

USER`S GUIDE



Vaisala HUMICAP® Moisture and Temperature Transmitter for Oil MMT330



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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala HUMICAP[®] Moisture and Temperature Transmitter for Oil MMT330.

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING

Warning alerts you to a serious hazard. If you do not read and follow instructions very 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

Note highlights important information on using the product.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com

Product Related Safety Precautions

The Vaisala HUMICAP Moisture and Temperature Transmitter for Oil MMT330 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING

Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION

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

ESD Protection

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

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

Recycling



Recycle all applicable material.



Dispose of batteries and the unit according to statutory regulations.
Do not dispose of with regular household refuse.

Trademarks

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License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the

client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

- a. A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and
- b. the allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

- a. normal wear and tear or accident;
- b. misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;
- c. wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;
- d. modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;
- e. other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of MMT330.

Introduction to MMT330

The MMT330 transmitter is a microprocessor based instrument for the measurement of moisture in terms of water activity for example in the lubrication of circulation systems or in transformer oil. The transmitter incorporates a capacitive thin film sensor. The operation of the sensor is based on changes in its capacitance as the thin polymer film absorbs water molecules.

The transmitter can be configured in many ways. It can have either a blank cover or a cover with a local display and keypad with which the user can operate the transmitter. The power supply voltage can be selected from three alternatives. Two analogue output signals can be scaled and the measurement ranges changed within certain limits. The MMT330 transmitter can be supplied with two, five or ten metre sensor head cable.

The MMT330 also provides for accurate temperature measurement. It is an easy-to-install on-line transmitter which can be calibrated against traceable salt solutions.

Vaisala HUMICAP[®] Moisture and Temperature Transmitter for Oil MMT330 provides reliable moisture measurement in wide range of applications. Analog outputs can be chosen between current and voltage signals. Alternatively, digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected.

Basic Features and Options

- several probes for various applications
- user friendly display
- different probe mounting kits and probe cable lengths
- transmitter mounting kits for multiple installation purposes
- optional modules: isolated power supply, power supply module, RS-422/485-module, additional analog output module and relay module

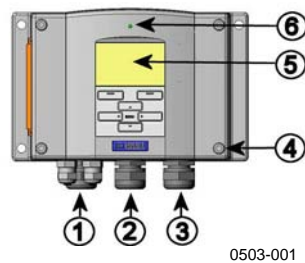
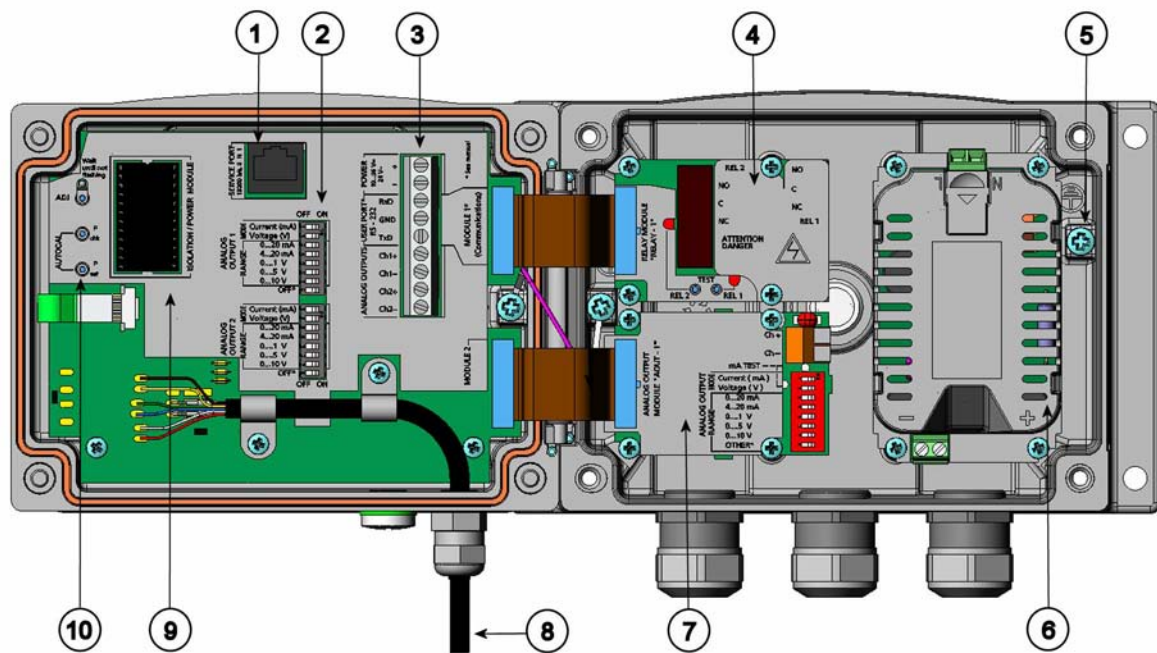


Figure 1 Transmitter Body

The following numbers refer to Figure 1 above:

- 1 = Signal + powering cable gland
- 2 = Cable gland for optional module
- 3 = Cable gland for optional module
- 4 = Cover screw (4 pcs)
- 5 = Display with keypad (optional)
- 6 = Cover LED



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Figure 2 Inside of Open Transmitter

The following numbers refer to Figure 2 above:

- 1 = Service port (RS-232)
- 2 = DIP switches for analog output settings
- 3 = Power supply and signal wiring screw terminals
- 4 = Relay/RS-422/485 module (optional)
- 5 = Grounding connector
- 6 = Power supply module (optional)
- 7 = Analog output relay module (optional)
- 8 = Humidity probe cable
- 9 = Output isolation module (optional)
- 10 = Adjustment buttons with indicator led. Purge is not available.

Probe Options



Figure 3 Probe Options

The following numbers refer to Figure 3 above:

- 1 = MMT332 for High-pressure Applications
- 2 = HMT337 Small pressure-tight probe
- 3 = HMT338 adjustable probe for pressurized pipelines (40 bar, ball valve)

Probe cable lengths are 2 m, 5 m and 10 m.

Typical Applications

Method Used for Measuring Moisture in Oil

The MMT330 transmitter measures water in oil in terms of water activity (aw) which can be determined as follows: water activity indicates the amount of oil in the scale of 0 - 1 aw. In this scale, 0 aw is an indication of completely water free oil and 1 aw an indication of oil fully saturated with water. Water is present in free form.

The most important feature which distinguishes the measurement of water activity (aw) from the traditional measurement of absolute water content (in ppm) is that the saturation point remains stable regardless of the oil type or the aging of oil, additives used etc. As water activity exceeds 0.9 aw in any system, there is a risk for segregation (especially if the temperature decreases). The water activity is used for alarming at the point of >0.9 aw that the risk for free water in the system is obvious. The most important advantages of this system are the fact that water activity is immune to the aging of oil and to additives, and that the MMT330 transmitter can be used for continuous on-line measurements. In addition, the MMT330 can be calibrated against salt solutions and no reference oils are needed.

Lubrication Oil in Paper Machines

Typically, a paper machine contains two or three separate lubrication systems. Usually, one is located at the wet end and the other at the dry end. There is a certain amount of free moisture constantly present which means that there is a risk of this moisture becoming into contact with the machine bearings. The most common reasons for the entrance of water are an inadequate sealing of the housing and cleaning with high pressure. However, accidental leakages from oil coolers and other equipment may also cause damage. In paper machines, the oil should absorb water while lubricating the bearings and then release this water when collected into the reservoir. It is to be noted that bearings should never be exposed to oils that have a high water content; this is especially important during standstill because the risk for corrosion process increases as the oil temperature decreases. It is essential to monitor the water content and keep it on a suitable level.

When measuring the water content of oil in paper machines, it would be useful to measure the water activity before an oil reservoir and from a pressure line flow. This way, the performance of dehumidifiers

can be kept under control to ensure that no free water reaches the bearings.

Transformer Oil

The determination of moisture in oil is an essential part of a comprehensive transformer maintenance program. Aging and deterioration increase the capacity of oil to absorb water. The primary interest in transformers is to measure the water not in oil but in the cellulosic insulation around the transformer windings. Heating and cooling have a considerable effect on moisture levels in oil. While temperature raises, the paper insulation of transformers tends to loose moisture which is absorbed by the oil surrounding it. Saturation level is thus a true indicator of moisture present. The MMT330 method provides for a reliable detection of the aging of oil and possible leakages.

Oil immersed transformers rely on the oil for cooling, protection from corrosion and as an important component of their insulation. Excessive moisture contents in oil causes accelerated ageing of the insulation materials and reduces their dielectric strength. In extreme cases this can result in arcing and short circuits within the windings. Accurate moisture measurements can also warn about leaks in the oil system, as water is absorbed from the surrounding air.

Heating and cooling of a transformer effect moisture levels in oil. This is due to the fact that the water solubility of oil is temperature dependent. In general, water solubility increases as temperature raises, see Figure 4 on page 17 below. Changes in temperature affect also on water desorption of the paper insulation around the transformer windings. Desorption of water from the insulation increases as temperature raises and the surrounded oil absorbs desorbed water. Moisture level in oil is thus a true indicator of moisture present in the paper insulation.

In addition, it must be noted that capacity of oil to absorb water depends both on the chemical structure of the oil and the additives.

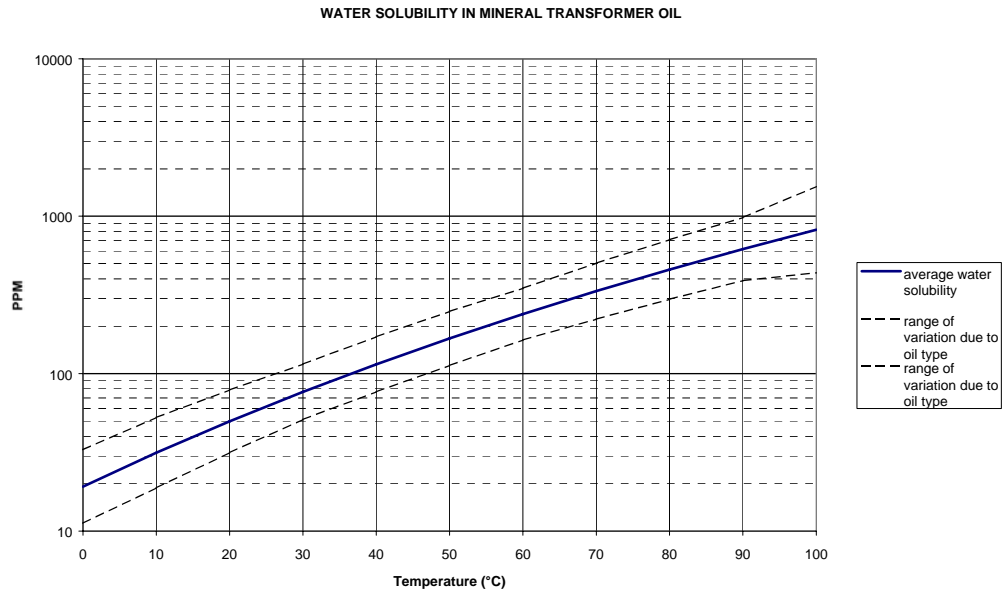


Figure 4 The Water Solubility of Transformer Oils versus Temperature

The margins show the range of variation of water solubility found in mineral oils.

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CHAPTER 3

INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Mounting the Housing

Standard Mounting

Mount the housing by fastening the transmitter to the wall with 4 screws, for example M6 (not provided).

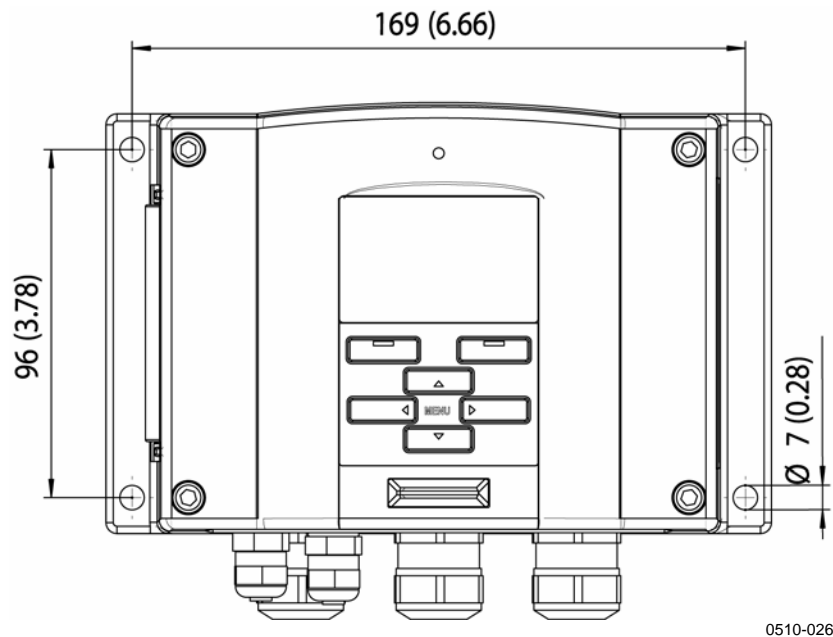


Figure 5 Standard Mounting Dimensions (in mm/inch)

Wall Mounting with Wall Mounting Kit

When mounting with wall mounting kit the mounting plate (Vaisala order code 214829) can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the transmitter before mounting.

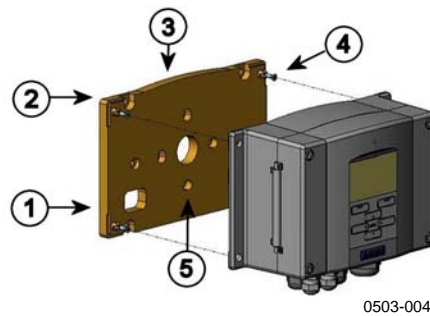
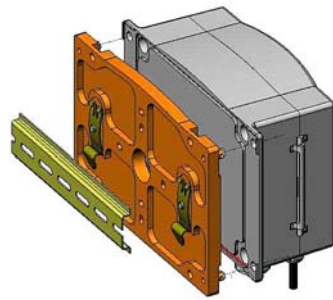


Figure 6 **Mounting with Wall Mounting Kit**

The following numbers refer to Figure 6 above:

- 1 = Plastic mounting plate
- 2 = Mount the plate to wall with 4 screws M6 (not provided)
- 3 = The arched side up
- 4 = Fasten MMT330 to the mounting plate with 4 fixing screws M3 (provided)
- 5 = Holes for wall/junction box mounting

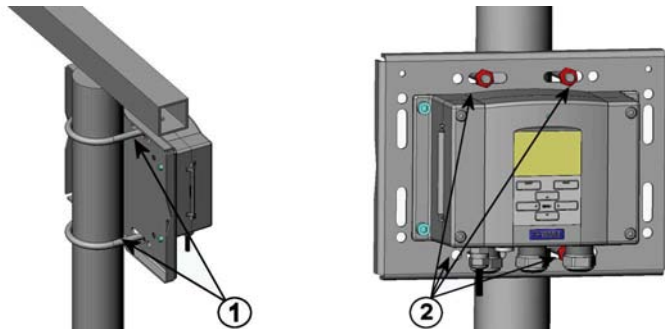


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Figure 8 Mounting with DIN Rail Installation Kit

Pole Installation with Installation Kit for Pole or Pipeline

Installation kit for pole or pipeline (Vaisala order code: 215108) includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upwards, see Figure 11 on page 23.



0503-006

Figure 9 Vertical Pole

The following numbers refer to Figure 9 above:

- 1 = Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles.
- 2 = Mounting nuts M8 (4 pcs)

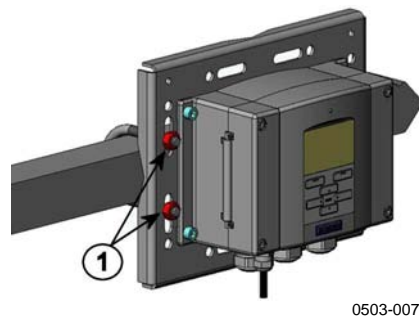


Figure 10 Horizontal Pole

The following number refers to Figure 10 above:

1 = Mounting nuts M8 (4 pcs)

Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.

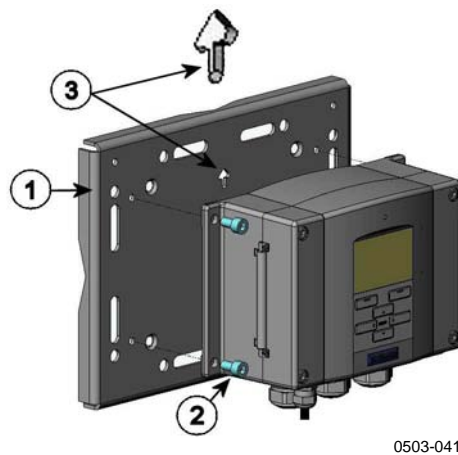
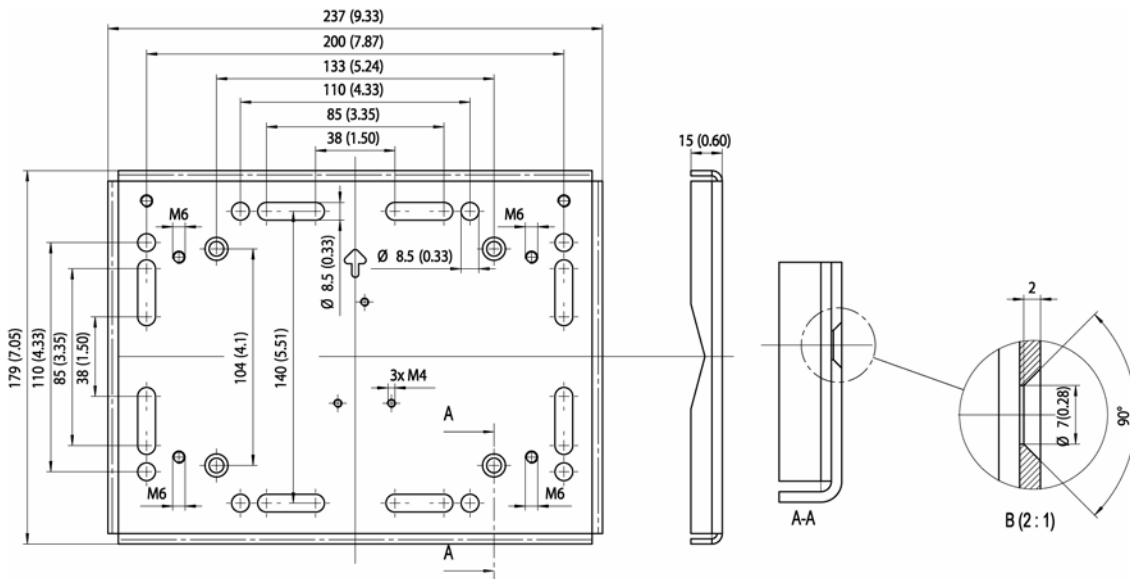


Figure 11 Mounting with Metal Wall Mounting Plate

The following numbers refer to Figure 11 above:

- 1 = Mount the plate to wall with 4 screws M8 (not provided)
- 2 = Fasten MMT330 to the mounting plate with 4 fixing screws M6 (provided)
- 3 = Note the position of the arrow when mounting. This side must be up when mounting.



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Figure 12 Dimensions of Metal Mounting Plate (mm/inch)

Mounting Rain Shield with Installation Kit



0503-008

Figure 13 Mounting Rain Shield with Installation Kit

The following numbers refer to Figure 13 above:

- 1 = Fasten the rain shield with installation kit (Vaisala order code: 215109) to the metal mounting plate with 2 (M6) mounting screws (provided).
- 2 = Fasten the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation).
- 3 = Fasten MMT330 to the mounting plate with 4 fixing screws (provided).

Wiring

Cable Bushings

A single electrical cable with a screen and three to ten wires is recommended for power and analog/serial connections. The cable diameter should be 8...11 mm. The number of cable bushings depends on the transmitter options. See the following recommendations for the cable bushings:

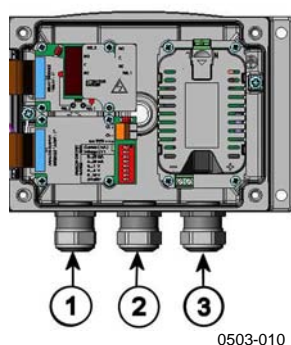


Figure 14 Cable Bushings

The following numbers refer to Figure 14 above:

- 1 = Cable for signal/powering Ø8 ... 11 mm
- 2 = Cable for optional module Ø8 ... 11 mm
- 3 = Cable for optional power supply module Ø8 ... 11 mm

NOTE

When there is high electric noise level (for example, near powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Fig. 1

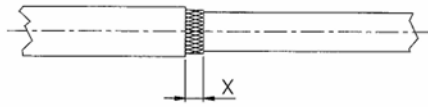


Fig. 2

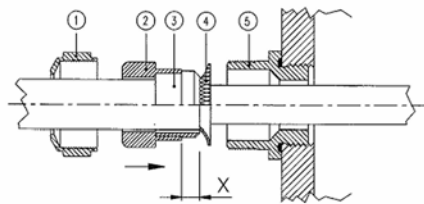
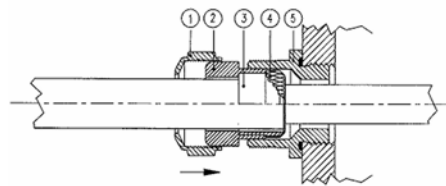


Fig. 3



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Figure 15 Grounding the Screen of Electrical Cable

1. Cut back outer sheath to desired length.
2. Cut back screen braiding or screen foil to dimension X (see figure 3).
3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.
4. Bend over the screen braiding or screen foil by about 90° (item 4).
5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.
6. Mount lower part (item 5) on the housing.
7. Push the seal with the contact socket of the gland and (item 2+3) flush into the lower part (item 5).
8. Screw the domed cap nut (item 1) onto the lower part (item 5).

Grounding the Transmitter Housing

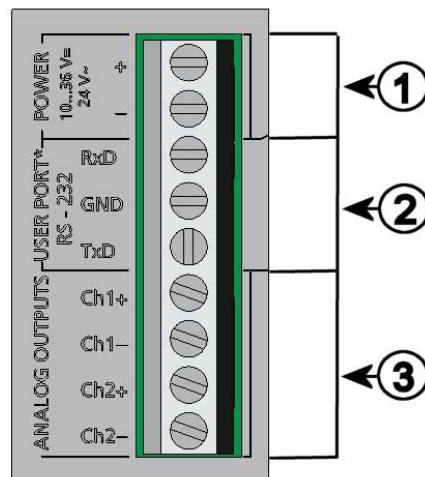
In case you need to ground the transmitter housing, the grounding connector is found inside the housing, see Figure 2 on page 13.

Note anyhow that the probe head is connected to the same potential as the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If it is needed to have galvanic isolation of the power supply line from the output signals, MMT330 can be ordered with optional output isolation module. This module prevents harmful grounding loops.

Signal and Power Supply Wiring

When connecting transmitter with 8-pin connector, see section 8-Pin Connector on page 50. When wiring the power supply module, see section Power Supply Module on page 38.



0506-028

Figure 16 Screw Terminal Block on Motherboard

The following numbers refer to Figure 16 above:

- 1 = Power supply terminals 10 ... 35 VDC, 24 VAC
- 2 = User port (RS-232 terminals)
- 3 = Analog signal terminals

WARNING

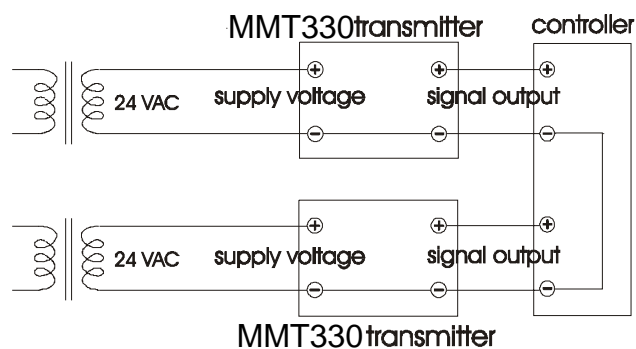
Make sure that you connect only de-energized wires.

1. Open the transmitter cover by taking out the four cover screws.
2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the transmitter; see the grounding instructions in the previous sections.
3. Connect the analog output cables to terminals: **Ch1 +, Ch1-, Ch2+, Ch2-**. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection refer to section Serial Line Communication on page 57.
4. When wiring RS-485 module, relay module or additional analog output module, see section RS-422/485 Interface on page 47 section Relays on page 45 and section Third Analog Output on page 43 on page
5. Connect the power supply wires to the connectors: **POWER 10...35V+ 24V~ (+) and (-)** terminals. If you are using 24 VAC power supply, see the note below before connecting the supply wires.
6. Turn on the power. The indicator led on the cover lit continuously during normal operation.
7. Close the cover and replace the cover screws. The transmitter is ready for use.

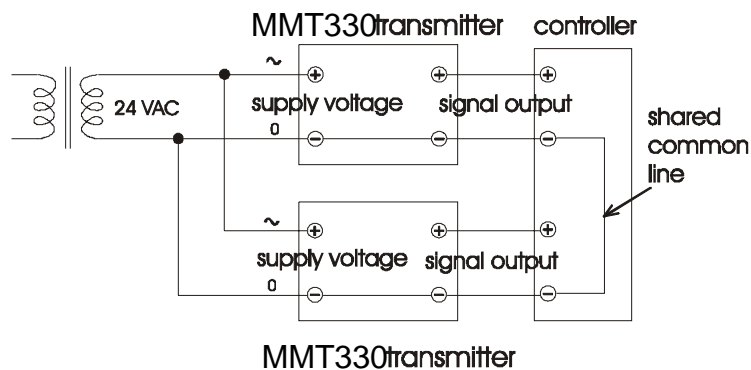
Connections to 24 VAC Power Supply

Separate floating supply for each transmitter is recommended (see upper Figure 17 on page 29 above.) If you have to connect several transmitters to one AC supply, the phase (~) must always be connected to (+) connector of each transmitter (see lower Figure 17 on page 29 below).

No common loop - RECOMMENDED!



Common loop formed - NOT recommended!



0510-025

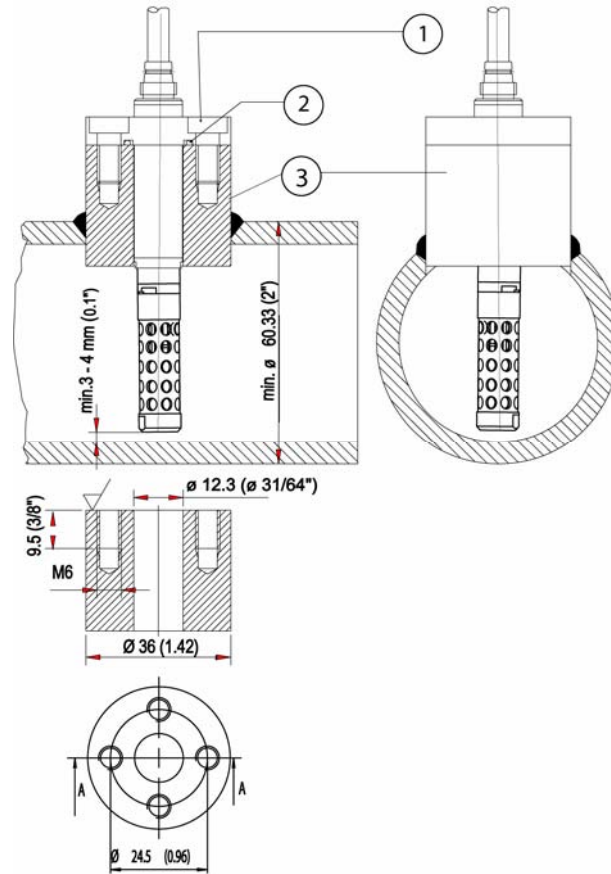
Figure 17 Connections to 24 VAC Power Supply

CAUTION

In case you have only one AC supply, never connect same wire to the + connector of a transmitter and to the - connector of another one. This will short-circuit the transformer.

MMT332 for High-pressure Applications

The MMT332 probe is a small pressure-tight probe equipped with installation flange. It is suitable for high-pressure applications; up to 250 bar.



0510-030

Figure 18 MMT332 Installation

The following numbers refer to Figure 18 above:

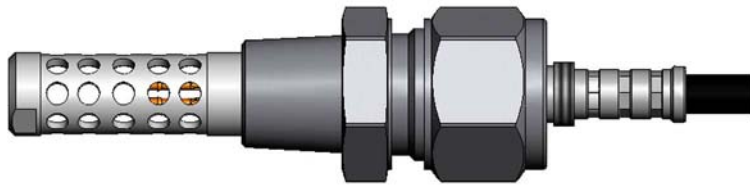
- 1 = Screw, 4 pcs, Hexacon socked head (provided)
- 2 = O-ring (provided)
- 3 = Threaded sleeve (not provided)

MMT 337 Small Pressure-tight Probe

The MMT337 is ideal for tight spaces with threaded connection. The small probe is installed using the threaded fitting bodies, see below.

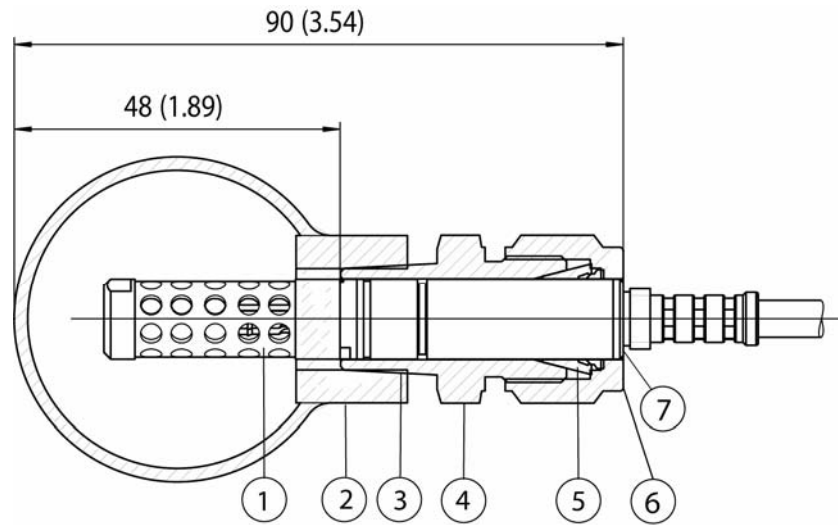
MMT337 Probe with Swagelok Connector for Tight-place Installations

Swagelok installation kit for the MMT337 probe includes Swagelok connector with ISO3/8" thread (Vaisala order code: SWG12ISO38) or NPT1/2" thread (Vaisala order code:SWG12NPT12).



0509-144

Figure 19 MMT337 Probe with Swagelok Installation Kit



0509-150

Figure 20 MMT337 Probe Installation to Pipeline with Swagelok Installation Kit

The following numbers refer to Figure 20 above:

- 1 = Probe
- 2 = Duct connector
- 3 = ISO3/8" or NPT1/2" thread
- 4 = Swagelok connector
- 5 = Ferrules
- 6 = Upper edge of the connector nut
- 7 = Upper edge of the probe

1. Preparing Installation. The connector options are the following:
 - a. R3/8" ISO (Swagelok code SS-12M0-1-6RTBT)
 - b. 1/2" NPT (Swagelok code SS-12M0-1-8BT)

Note that the connector inner diameters extend for Ø12 mm probe.

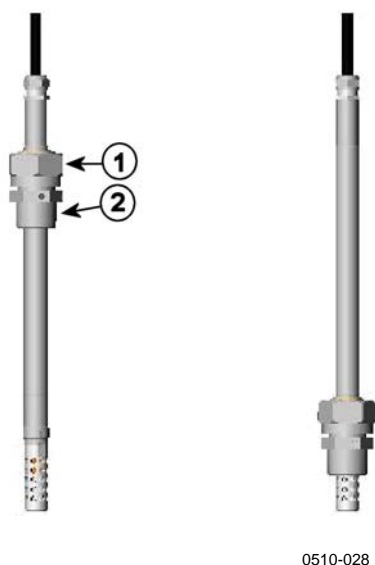
2. Probe position. Before the final tightening check that the upper edge of the connector nut is in line with the upper edge of the probe. Otherwise the sealing may not be gas tight.
3. Gas tight sealing
 - a. Turn the connector nut finger tight and draw a vertical mark on the nut and the fitting body.
 - b. Be sure that the probe position follows step 2.

- c. Tighten the connector nut with a wrench 1 and 1/4 turns ($360^\circ + 90^\circ$) with the help of marks you drew. The connector has now a gas tight connection to the probe. Excess tightening can damage the probe.
- d. Connector can be disconnected and re-installed. In re-installation first turn the connector nut finger tight and then with wrench 1/4 turn (90°).

Use teflon tape or thread sealant to seal the connection between the Swagelok connector and the process, see Figure 22 on page 34.

MMT338 for Pressurized Pipelines

Due to the sliding fit the MMT338 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. The probe is adjustable, with two length options. The installation is easy due to the ball valve installation kit, see below.



0510-028

Figure 21 MMT338 Probe

The following numbers refer to Figure 21 above:

- 1 = Clasp nut, 24 mm hex nut
- 2 = Fitting body, 27 mm hex head

The following two fitting body options are available:

- Fitting Body ISO1/2 solid structure
- Fitting Body NPT1/2 solid structure

Table 1 MMT338 Probe Dimensions

Probe type	Probe Dimension	Adjustment Range
Standard	178 mm	120 mm
Optional	400 mm	340 mm

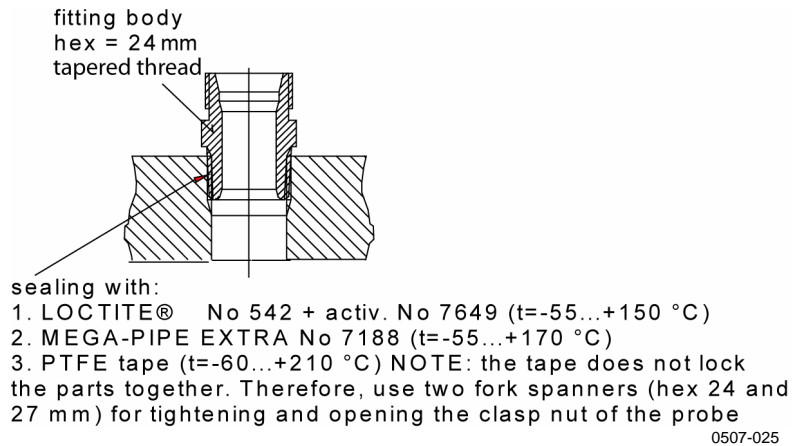


Figure 22 Sealing of Fitting Body into Process

Ball Valve Installation Kit for MMT338

The ball valve installation kit (Vaisala order code: BALLVALVE-1) is preferred when connecting the probe to a pressurized process or pipeline. Use the ball valve set or a 1/2" ball valve assembly with a ball hole of Ø14 mm or more. If you install the sensor head (Ø 12 mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). Use the manual press handle to press the sensor head into the pressurized (< 10 bar) process or pipeline.

1. Shut down the process if the process pressure is more than 10 bars. If the pressure is lower there is no need to shut down the process.
2. Make the installation according to the figure below. Install the sensor head transversely against the direction of the process flow.

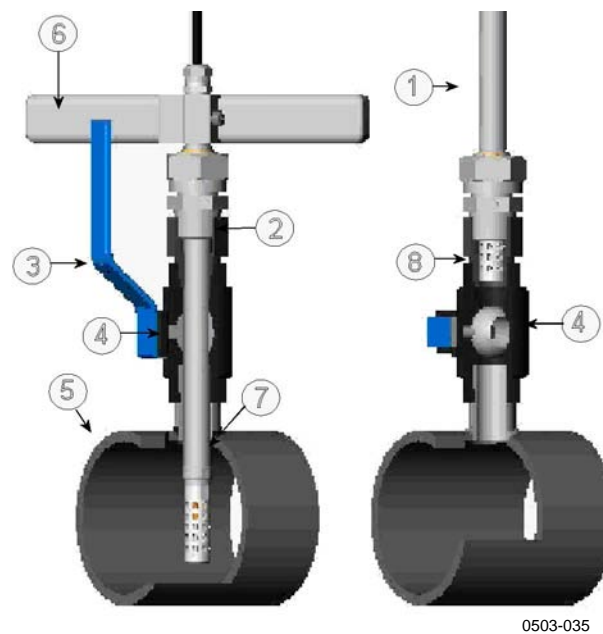


Figure 23 Installing the Sensor Head Through the MMT338 Ball Valve Assembly

The following numbers refer to Figure 23 above:

- 1 = Probe
- 2 = Tighten clasp nut first manually; probe is then sliding easily. Finally tighten with a fork spanner about 60° to have a stable installation. Do not overtighten this nut.
- 3 = Handle of the ball valve
- 4 = Ball of the ball valve
- 5 = Process chamber/pipeline
- 6 = Manual press handle
- 7 = The groove on the sensor head indicates the upper adjustment limit
- 8 = Filter

You can not close the valve if the groove (7) is not in sight. When installing the sensor head through the Ball Valve Assembly it is not necessary to empty or shut down the process for installing or removing the sensor head.

1. Mount the probe with the ball valve assembly closed; tighten the clasp nut manually. Add tape or other sealing according to instructions, see Figure 22 on page 34.
2. Open the ball valve assembly.

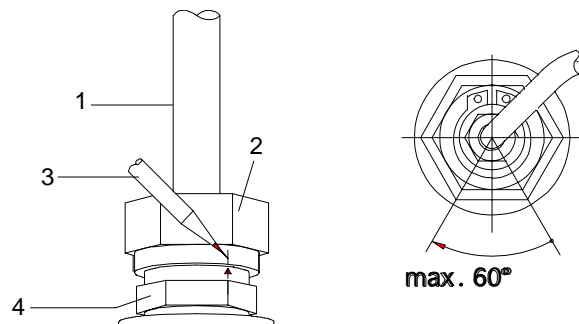
3. Push the probe head through the ball valve assembly into the process. If the pressure is high, use a manual press handle. Note that the sensor head must be pushed so deep that the filter is completely inside the process flow.
4. Tighten the clasp nut a further 50-60°.

NOTE

The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 40 bars.

Tightening the Clasp Nut

1. Adjust the probe to a suitable depth according to the type of installation.
2. Tighten the clasp nut first manually.
3. Mark the fitting body and the clasp nut.
4. Tighten the nut a further 50 -60° (ca. 1/6 turn) with a wrench. If you have suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs).



0511-109

Figure 24 Tightening the Clasp Nut

The following numbers refer to Figure 24 above:

- 1 = Probe
- 2 = Clasp nut
- 3 = Pen
- 4 = Fitting body

NOTE

Take care not to over tighten the clasp nut to avoid difficulties when opening it.

CAUTION

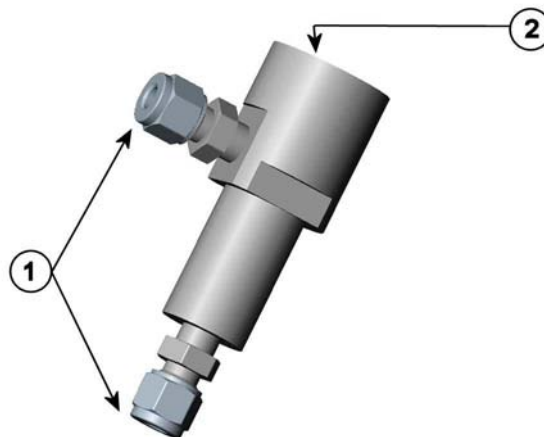
Take care not to damage the probe body. A damaged body makes the probe head less tight and may prevent it from going through the clasp nut.

CAUTION

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

Sampling Cell for MMT338

It may be necessary to use a sampling cell if the MMT338 probe cannot be installed directly into the process pipe. For example, if the pipe is too small for the probe. Then a by-pass sampling line may be feasible. Sampling Cell with Swagelok Connectors (Vaisala order code: DMT242SC2) is available as an optional accessory.



0511-108

Figure 25 Sampling Cell DMT242SC2

The following numbers refer to Figure 25 above:

- 1 = Male pipe weld connector Swagelok 1/4"
- 2 = G1/2"

Optional Modules

Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.

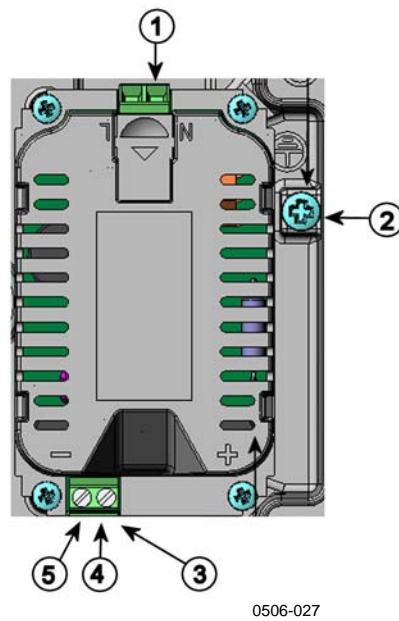


Figure 26 Power Supply Module

The following numbers refer to Figure 26 above:

- 1 = Connect AC (mains) voltage wires to these terminals
- 2 = Grounding terminal
- 3 = In case the module is not installed in the factory, connect wires from these terminals to the power supply 10...36V=24V~ terminals in the screwterminal of the mother board.
- 4 = +
- 5 = -

Installation

1. Disconnect the power and open the transmitter cover.
2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.
3. To attach the module fasten the power module to the bottom of the housing with four screws. See the position in Figure 2 on page 13.
4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals **POWER 10... 35 V 24V** on the motherboard of the transmitter.
5. Connect the AC mains voltage wires to the power supply module terminals marked with **N** and **L**.
6. Attach the grounding wire to the grounding terminal on the right-hand side of the transmitter.
7. Connect the power. The LED on the cover of the transmitter is lit continuously during normal operation.

WARNING

Do not detach the power supply module from the transmitter when the power is on.

WARNING

Do not connect the mains power to power supply module when it is not installed in the transmitter.

WARNING

Always connect protective ground terminal.

Warnings

Dieses Produkt entspricht der Niederspannungsrichtlinie (73/23 EWG).

- Das Netzmodul darf nur von einem dazu befugten Elektriker angeschlossen werden.
- Trennen Sie das Netzmodul nicht vom Messwertgeber, wenn der Strom eingeschaltet ist.
- Verbinden Sie das Netzmodul nur mit der Spannungsquelle, wenn es im Messwertgeber MMT330 montiert ist.
- Das Erdungskabel muss zum Schutz immer angeschlossen sein.

Ce produit est conforme à la Directive relative à la Basse Tension (73/23 EEC).

- Seul un électricien compétent est habilité à raccorder le module d'alimentation au secteur.
- Ne pas détacher le module d'alimentation du transmetteur lorsqu'il est en service.
- Ne pas raccorder le secteur au module d'alimentation lorsque celui-ci n'est pas installé dans le transmetteur MMT330.
- Toujours raccorder un bornier de protection à la terre.

Tämä tuote on pienjännitedirektiivin (73/23 EEC) mukainen.

- Vaihtovirtaliitäntään saa kytkeä tehonsyöttömoduuliin ainoastaan valtuutettu sähköasentaja
- Älä irrota tehonsyöttömoduulia lähettimestä, kun virta on kytkettynä.
- Älä kytke verkkovirtaa tehonsyöttömoduuliin, jos kyseistä moduulia ei ole asennettu MMT330 lähettimeen.
- Kytke aina maadoitusliittimet.

Denna produkt uppfyller kraven i direktivet om lågspänning (73/23 EEC).

- Nätanslutningen (växelströmsanslutningen) får bara anslutas till strömförsörjningsmodulen av en behörig elektriker.
- Ta inte loss strömförsörjningsmodulen från mätaren när strömmen är på.
- Anslut inte strömförsörjningsmodulen till nätet när den inte är installerad i MMT330-mätaren
- Anslut alltid en skyddande jordningsplint.

Questo prodotto é conforme alla Direttiva sul basso voltaggio (73/23 CEE).

- La conduttura elettrica può essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l'alimentazione elettrica dal trasmettitore quando é acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non é installato nel trasmettitore MMT330.
- Collegare sempre il morsetto protettivo a terra!

Dette produkt er i overensstemmelse med direktivet om lavspænding (73/23 EØS).

- Netstrømskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallatør
- Strømforsyningsmodulet må ikke løsghøres fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i MMT330- senderen
- Forbind altid den beskyttende jordklemme!

Dit product voldoet aan de eisen van de richtlijn 73/23 EEG (Laagspanningsrichtlijn).

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in een MMT330-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

Este producto cumple con la directiva de bajo voltaje (73/23 EEC).

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en el transmisor MMT330.
- Conecte siempre el terminal de protección de conexión a tierra.

See toode vastab madalpinge direktiivile (73/23 EEC).

- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse lülitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole MMT330-tüüpi saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!

Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek (73/23/EGK).

- A hálózati feszültséget csak feljogosított elektrotechnikus csatlakoztathatja a tápegységmodulra.
- A bekapcsolt távadóról ne csatolja le a tápegységmodult.
- Ne csatlakoztassa a hálózati feszültséget a tápegységmodulhoz, ha az nincs beépítve a MMT330 távadóba.
- Feltétlenül csatlakoztasson földelő védőkapcsot!

Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (73/23/EB).

- Elektros tinklą su energijos tiekimo modulių sujungti gali tik įgaliotas elektrikas.
- Niekada neišimkite energijos tiekimo modulio iš siūstuvo, kai maitinimas yra įjungtas.
- Jei energijos tiekimo modulis nėra įmontuotas MMT330 siūstuve, nejunkite jo į elektros tinklą.
- Visada prijunkite prie apsauginės įžeminimo jungties!

Šis produktas atbilst Zemsprieguma direktivai (73/23 EEC).

- Strāvas pieslēgumu var pieslēgt pie barošanas avota moduļa tikai autorizēts elektriks.
- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.
- Nepievienot strāvu barošanas avota modulim, ja tas nav uzstādēts MMT330 raidītājā
- Vienmēr pievienot aizsargājošu iezemētu terminālu !

Ten produkt spełnia wymogi Dyrektywy niskonapięciowej (73/23 EEC).

- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.
- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.
- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku MMT330.
- Zawsze należy podłączać zabezpieczający zacisk uziemiający!

Tento výrobek vyhovuje Směrnici pro nízké napětí (73/23 EEC).

- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.
- Neodpojujte napájecí modul od snímače při zapnutém napájení.
- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači MMT330.
- Vždy zapojte ochrannou zemnicí svorku!

Galvanic Isolation for Output

If galvanic isolation of the power supply line from the output signals is needed, MMT330 can be ordered with optional output isolation module. This module prevents harmful grounding loops.

NOTE

Output isolation module is not needed when using the power supply module.

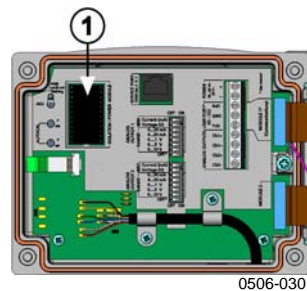


Figure 27 Galvanic Output Isolation Module

Number refers to Figure 27 above:

1 = Output isolation module

Third Analog Output

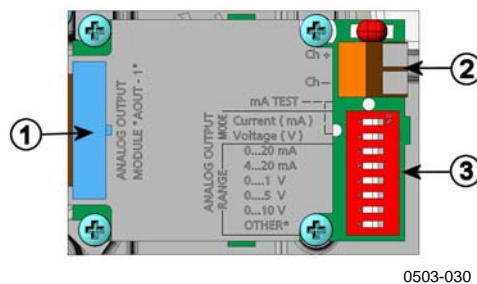


Figure 28 Third Analog Output

The following numbers refer to Figure 28 above:

- 1 = Flat cable pins
- 2 = Screw terminals for signal line
- 3 = DIP switches to select the output mode and range

Installation and Wiring

1. Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.
2. To attach the module, open the transmitter cover and fasten the analog output module to the bottom of the housing with four screws. See the position from the picture on page 11.
3. Connect the flat cable between the analog output module and the motherboard's pins MODULE 2.
4. Take out the protective plug from the cable gland and thread the wires.
5. Connect the wires to the screw terminals marked with **Ch+** and **Ch-** .
6. Select the current/voltage output by setting ON either of the switches 1 or 2.
7. Select the range by setting ON one of the switches 3...7.

NOTE

Only one of the switches 1 and 2 can be ON at a time.

Only one of the switches 3...7 can be ON at a time.

	OFF	ON	Selection
Channel 3 {	1		Current output selection, ON=Current output selected
	2		Voltage output selection, ON=Voltage output selected
	3		0...20 mA selection, ON= 0...20 mA selected
	4		4... 20 mA selection, ON= 4... 20 mA selected
	5		0...1 V selection, ON=0...1 V selected
	6		0...5 V selection, ON=0...5 V selected
	7		0...10 V selection, ON= 0...10 V selected.
	8		For service use only, keep always in OFF position.

8. Connect the power.
9. Select the quantity and scale the channel via the serial line or display/keypad, see section Analog Output Quantities on page 79. For testing the analog output, see Section Analog Output Tests on page 81. For fault indication setting, see section Analog Output Fault Indication Setting on page 82.

Relays

MMT330 can be equipped with one or two configurable relay modules. Each module contains two configurable relays. See the contact ratings in section Technical Specifications of Optional Modules on page 114.

Installation and Wiring

1. Disconnect the power and open the transmitter cover. In case the relay-module is installed in the factory, continue with step 5.
2. To attach the module fasten the relay module to the bottom of the housing with four screws. See the position in Figure 2 on page 13.
3. When the mains power is in use attach the grounding wire to the grounding terminal.
4. Connect the flat cable between the relay module and the **MODULE 1** or **MODULE 2** pins of the motherboard.
5. Take out the protective plug from the cable gland and thread the relay wires.
6. Connect the wires to the screw terminals: NO, C, NC.

Selecting the Activation State of the Relay

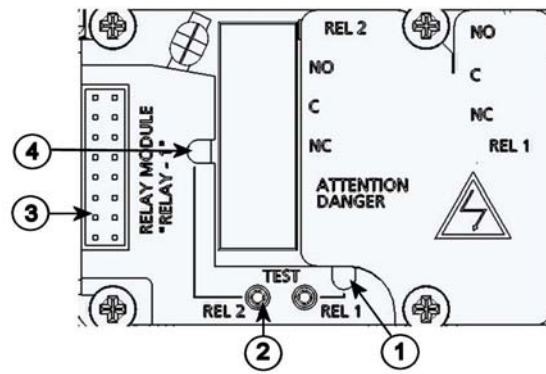
The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

NO Normally open
C Common relay
NC Normally closed

Relay NOT activated: C and NC outputs are closed, NO is open
Relay IS activated: C and NO outputs are closed, NC is open.
Connect the power and close the cover.

NOTE

For instructions on how to operate the relay (for example, select quantity for the relay output and set the relay setpoints) see section Operation of Relays on page 83.



0503-037

Figure 29 Relay Module

The following numbers refer to Figure 29 above:

- 1 = Indication led for the relay 1 or 3
- 2 = Relay test buttons
- 3 = Flat cable pins
- 4 = Indication led for relay 2 or 4

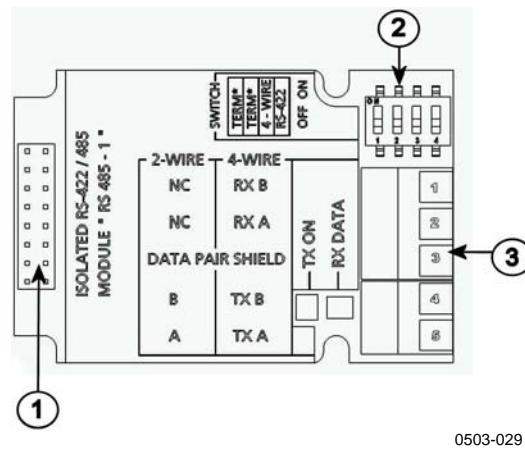
WARNING

The relay module may contain dangerous voltages even if the transmitter power has been disconnected. Before opening the transmitter you must switch off **both** the transmitter **and** the voltage connected to the relay terminals.

WARNING

Do not connect the mains power to relay unit without grounding the transmitter.

RS-422/485 Interface



0503-029

Figure 30 RS-485 Module

The following numbers refer to Figure 30 above:

- 1 = Flat cable pins
- 2 = Selection switches
- 3 = Screw terminals for wiring

Installation and Wiring

1. Disconnect the power. In case the RS-485-module is installed in the factory, continue with the item 4.
2. To attach the module, open the transmitter cover and fasten the RS-485 module to the bottom of the housing with four screws.
3. Connect the flat cable between the RS-485 module and the motherboard's pins **MODULE1 (Communications)**.
4. Pull the network wirings through the cable gland.
5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 2 on page 47:

Table 2 Connecting the Twisted Pair Wires to the Screw Terminals

Screw terminal	Data line (2-wire RS-485)	Data line (4-wire RS-485/422)
1	(not connected)	RxB
2	(not connected)	RxA
3	Data pair shield	Data pair shield
4	B	TxB
5	A	TxA

6. If you use RS-485 (or RS-422) to connect just one MMT330 to a master computer, enable the internal termination of MMT330 by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

If you are connecting many transmitters to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any transmitter without blocking the bus operation.

NOTE If you use the internal termination of the transmitter at the end of the RS-485 bus (instead of using separate terminators) removing that transmitter will block the bus operation.

7. Use the bus type (4-wire/2-wire) to select the selection switch 3. In 4-wire mode RS-485 master sends data to the MMT330 through terminals RxA and RxB and receives data from MMT330 through terminals TxA and TxB.

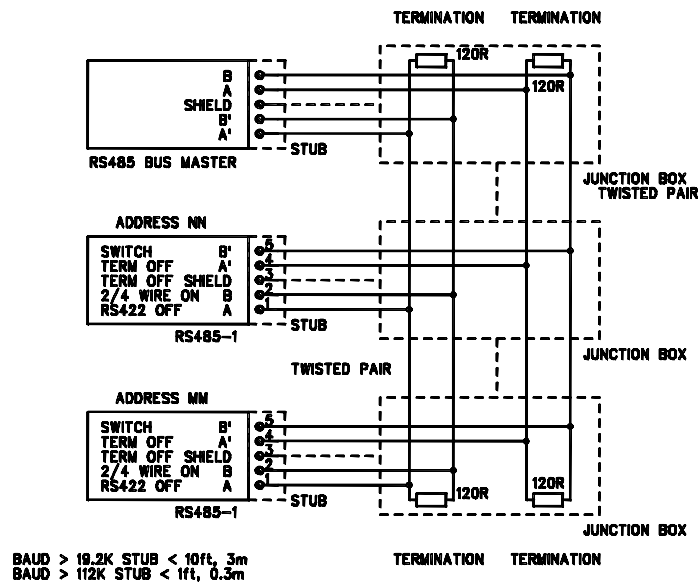


Figure 31 4-Wire RS-485 Bus

Table 3 4-Wire (Switch 3:On)

RS-485 master	Data	MMT330
TxA	→	RxA
TxB	→	RxB
RxA	←	TxA
RxB	←	TxB

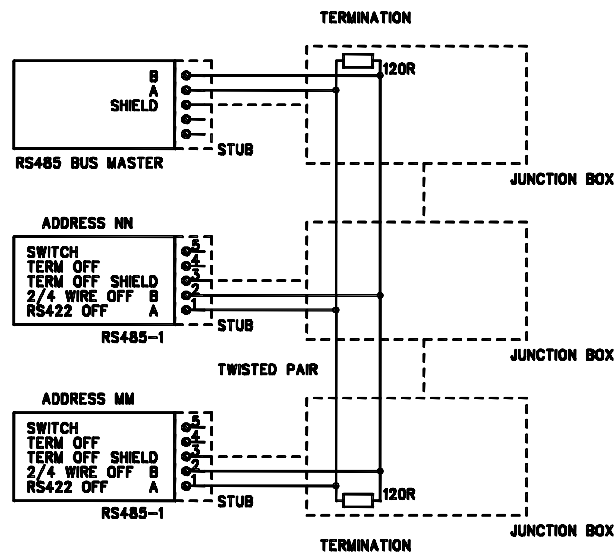
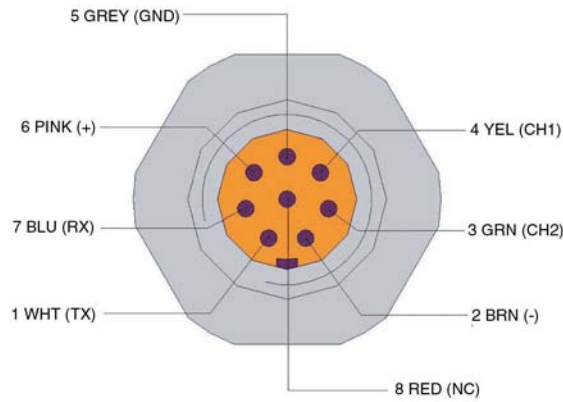


Table 4 2-Wire (Switch 3:Off)

RS-485 master	Data	MMT330
A	↔	A
B	↔	B

8. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).
9. Connect the power and close the cover.

8-Pin Connector



0503-026

Figure 32 Wiring of Optional 8-Pin Connector

Table 5 Wiring of 8-Pin Connector

PIN/Terminal	Wire	Serial Signal		Analog Signal
		RS-232 (EIA-232)	RS-485 (EIA-485)	
1	White	Data out TX	A -	-
2	Brown	(serial GND)	(serial GND)	Signal GND (for both channels)
3	Green	-	-	Ch 2+
4	Yellow	-	-	Ch 1 +
5	Grey	Supply -	Supply -	Supply -
6	Pink	Supply +	Supply +	Supply +
7	Blue	Data in RX	B -	-
8	Shield/Red	Cable shield	Cable shield	Cable shield

CHAPTER 4

OPERATION

This chapter contains information that is needed to operate this product.

Getting Started

Within a few seconds after power-up the led on the cover of the transmitter is lit continuously indicating normal operation. When using the optional display and turning the transmitter on the first time, the language selection menu window opens. Select the language with ▲▼ arrow buttons and press the SELECT button.

Display/Keypad (Optional)

Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1... 3 quantities for the numerical basic display (see section Changing Quantities and Units on page 65.)

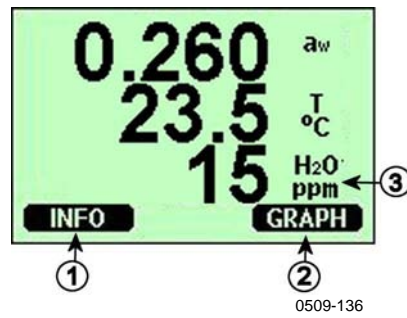


Figure 33 Basic Display

The following numbers refer to Figure 33 above:

- 1 = The Info shortcut button, see section Device Information on page 71.
- 2 = The Graph shortcut button, see section Graphic History on page 52.
- 3 = Quantities selected for display

NOTE

From any view, a four-second press on the right-hand function button takes you directly to the basic display.

Graphic History

The graphical display shows the data trend of the selected quantities, one at a time. The graph is updated automatically while measuring. Use the following functions in the graphical display:

- Press the **NEXT** button to have the trend graph and max/min graph in turns and browse through the quantities selected for display.
- Press the **EXIT** button to get back the basic display.

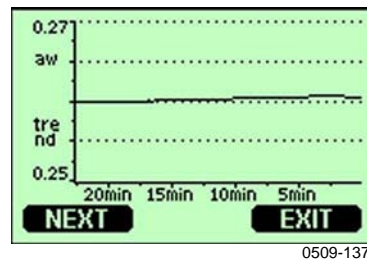


Figure 34 Graphical Display

Trend graph: Shows you a curve of average values. Each value is a calculated average over a period. See Table 6 on page 53.

Max/min graph: Shows you the minimum and maximum values in a form of curve. Each value is max/min over a time period. See Table 6 on page 53 below.

Table 6 Periods for Trend and Max/Min Calculations

Observation Period	Period for Trend/Max/Min Calculations (Resolution)
20 minutes	10 seconds
3 hours	90 seconds
1 day	12 minutes
10 days	2 hours
2 months	12 hours
1 year	3 days

- Press the ▲▼ arrow buttons to zoom in and out the time in the graph window.
- Press the ◀▶ arrow buttons to have the cursor mode where you can observe individual measuring points. Press an arrow button to move the cursor (vertical bar) along the time axis. The numerical value at the cursor position is shown at the left upper corner. Time from the present to the chosen moment is shown at the right upper corner.

Table 7 Graph Information Messages in Cursor Mode

Message	Interpretation
Power outage	Power failure (marked also with dashed vertical line)
No data	Quantity has not been selected for the display
Device failure	General device failure
T meas. failure	Temperature measurement/sensor failure
RH meas. failure	Moisture measurement/sensor failure
Adj. mode active	Adjustment mode active (data recorded in the adjustment mode is not displayed)

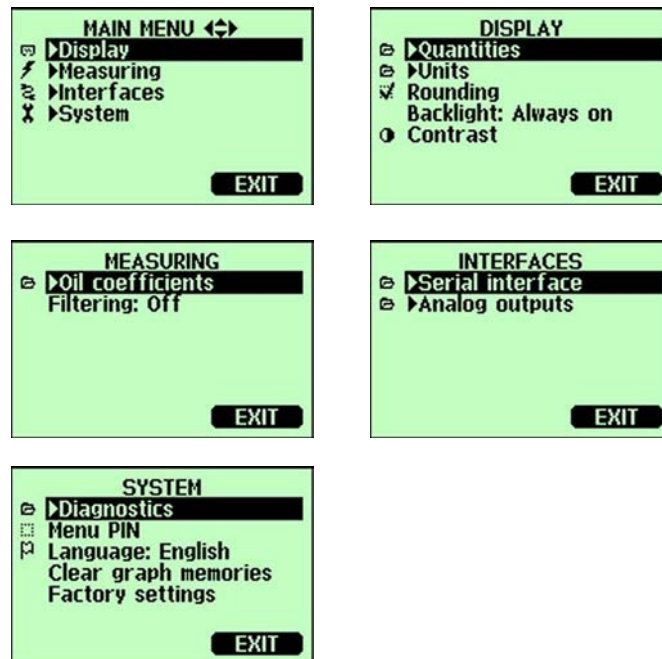
A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known.

Menus and Navigation

You can change settings and select functions in the menus.

1. Open the **MAIN MENU** by pressing any of the ▲▼◀▶ arrow buttons in the basic (numeric) display mode.

2. Move in the menus by using the ◀▶ arrow buttons.
3. Open a submenu with ▶ button.
4. Press ◀ to return to the previous level.
5. Function button **EXIT** returns you back to the basic display.



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Figure 35 Main Menu

Language Setting

1. Go back to the basic display by keeping the right-hand = button pressed for four seconds.
2. Open the **MAIN MENU** by pressing any of the ▲▼◀▶ buttons.
3. Select ▶**System** (the lowest row), press ▶ button.
4. Select **Language: ...** (the third row marked with a flag icon), press **SELECT** button (left-hand = button).
5. Select the menu language with ▲▼ buttons and press **SELECT** button (left-hand = button).
6. Press **EXIT** to return to the basic display.

Rounding Setting

Round off one decimal by using the Rounding function . The default setting is rounding on. Rounding has no effect on quantities without decimals.

1. Open the **MAIN MENU** by pressing any of the ▲▼◀▶ arrow buttons.
2. Select ►**Display** and confirm by pressing the ►arrow button.
3. Select **Rounding** and press **ON/OFF** button.
4. Press **EXIT** to return to the basic display.

Display Backlight Setting

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the **MAIN MENU** by pressing any of the ▲▼◀▶ arrow buttons.
2. Select ►**Display**, press the ►arrow button.
3. Select **Backlight**, press the **CHANGE** button.
4. Select **On/Off/Automatic**, press the **SELECT** button.
5. Press **EXIT** to return to the basic display.

Display Contrast Setting

1. Open the **MAIN MENU** by pressing any of the ▲▼◀▶ arrow buttons.
2. Select ►**Display**, press the ►arrow button.
3. Select **Contrast**, press the **ADJUST** button.
4. Adjust the contrast by pressing the ◀▶ arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

Keypad Lock (Keyguard)

This function locks the keypad and prevents unintentional key presses.

1. Keep pressing the left-hand function button for 4 seconds to lock the keypad (at any display).
2. To unlock the keypad, press the **OPEN** button for 4 seconds.

Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display and graphical view are available but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the **MAIN MENU** by pressing any of the **▲▼◀▶** arrow buttons.
2. Select **►System**, press the **►** arrow button.
3. Select **Menu PIN**, press the **ON** button.
4. Enter a PIN code by using the **▲▼** arrow buttons. Press **OK** to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.
5. Press **EXIT** to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by giving the PIN code and select **►System, Menu PIN**, press **OFF** button.

In case you have forgotten the PIN code, open the transmitter cover and press the **ADJ** button once. Wait for a few seconds and the adjustment menu opens. Select **Clear menu PIN**, press **— CLEAR**.

NOTE

You can also disable the keypad completely with serial command LOCK .

Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the **►** arrow button.
3. Select **Factory settings** and press the **REVERT** button to confirm your selection. Press the **YES** button to reset all settings to the factory defaults.

See section General Settings on page 65 for a description of the other menu options.

MI70 Link Program for Data Handling

The recorded data can be transferred to a PC by using MI70 Link program. You can examine the recorded data easily in Windows environment and transfer it further to a spreadsheet program (such as Microsoft Excel) or virtually to any Windows program in numeric or graphical format. MI70 Link program allows you also to monitor transmitter readings directly with a PC (real-time window function).

A software interface kit with MI70 Link program is available from Vaisala, see list of accessories in section Options and Accessories on page 116.

1. Connect the connection cable between the serial port of your PC and the Service Port of MMT330, see Figure 36 on page 57 below.
2. Check that the MMT330 is powered and start using the MI70 Link program.

Use a MI70 Link version 1.07, or a newer one, to be able to utilize all the functions of MMT330.

Serial Line Communication

Connect the serial interface by using either the user port or the service port.

For permanent interfacing to host system, use the user port. You can change the serial settings and operate in RUN, STOP and POLL modes.

For temporary RS-232 connections use the service port. Service port is always available with fixed serial settings.

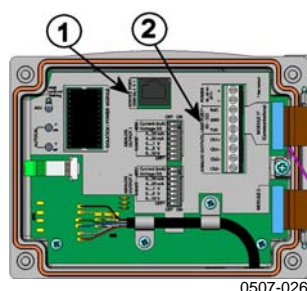


Figure 36 Service Port Connector and User Port Terminal on Mother Board

The following numbers refer to Figure 36 above:

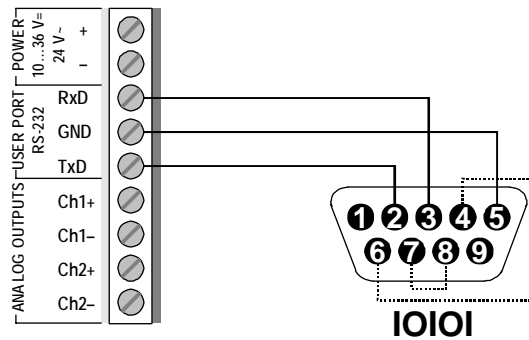
- 1 = Service port connector
- 2 = User port terminals

User Port Connection

Use suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port, see Figure 37 on page 58 below.

Table 8 Default Serial Communication Settings for the User Port

Parameter	Value
Bauds	4800
Parity	Even
Data bits	7
Stop bits	1
Flow control	None



0506-033

Figure 37 Connection Example Between PC Serial Port and User Port

Connections to pins 4,6,7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking.

NOTE

User port cannot be used when RS-485 module is connected.

Service Port Connection

1. Connect the serial interface cable (optional accessory, order code: 19446ZZ) between the serial port of your PC and the service port connector on the motherboard, see Figure 36 on page 57 above.

Table 9 Fixed Communication Settings for Service Port

Parameter	Value
Bauds	19200
Parity	No
Data bits	8

Parameter	Value
Stop bits	1
Flow control	None

- Open a terminal program and set the communication settings (see the following section for more detailed instructions).
- Power-up the MMT330.

After power-up the transmitter (in STOP-mode) outputs the software version and the command prompt.

```
MMT330/2.04
>
```

In RUN mode a measurement output starts immediately after power-up.

Terminal Program Settings

The following instructions show a connection example with HyperTerminal program (included in the Microsoft Windows).

Follow the instructions below to open a HyperTerminal program:

- Start HyperTerminal. To get help for starting HyperTerminal, click "Start", select "Help" to open Windows help, and search for "HyperTerminal".



Figure 38 Starting HyperTerminal Connection

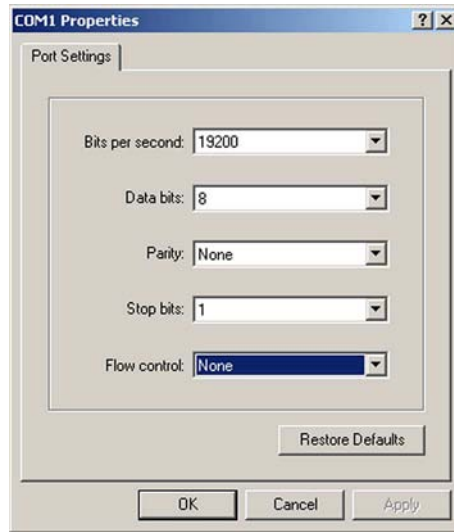
- In the "New Connection" window of the HyperTerminal, define a name for MMT330 serial connection, for example "MMT330". Click OK.
- In "Connect using" box, select the PC communications port where the serial cable is connected. (If your computer has only one COM port, it is called "COM1"). Click OK.



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Figure 39 Connecting to HyperTerminal

4. Set the port settings in the "Properties" window to match the settings of your MMT330 *user port/service port*. For MMT330, "Flow control" must always be set to "None". Finally click OK to start using the serial connection.



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Figure 40 HyperTerminal Serial Port Settings

5. Select "File" → "Save" in the HyperTerminal main window to save the serial port settings. To use the saved settings later, start HyperTerminal, click cancel in the "New Connection" window, and select "File" → "Open".

List of Serial Commands

The bold text in the brackets is the default setting. Enter commands by typing them on your computer and pressing the Enter key.

Measurement commands

R Start the continuous outputting
S Stop the continuous outputting
INTV [0...255 S/MIN/H] Set the continuous output interval (for RUN mode)

SEND [0...99] Output the reading once
SMODE [STOP/RUN/POLL] Set the serial interface
SERI [baud p d s] User port settings (default: 4800 E 7 1) baud: 300...115200
ADDR [0...99] Set the transmitter address (for POLL mode)
OPEN [0...99] Open temporarily connection to the POLL-mode device
CLOSE Close the connection (back to POLL mode)

Formatting commands

FORM Set the output format of SEND and R commands
TIME Set the time
DATE Set the date
FTIME [ON/OFF] Add time to output to SEND and R outputs
FDATE [ON/OFF] Add date to R and SEND outputs
UNIT Select the metric or non-metric output units

Data recording commands

DSEL Select data recording and display quantities.
PLAY [0...17] Output recorded data file
DIR Display recorded files
DELETE Delete the graph files
UNDELETE Recovers the deleted files

Calibration and adjustment commands

CRH Relative humidity calibration
CT Temperature calibration
FCRH Relative humidity calibration after sensor change
CTEXT Give the text to calibration information field
CDATE Set the calibration date

ACAL	Analog output calibration
Setting and testing the analog outputs	
AMODE	View the analog output modes
ASEL	Select the parameters for the analog outputs
ITEST	Test the analog outputs
AERR	Change the analog error output values
Setting and testing the relays	
RSEL	Set and view the relays
RTEST	Test the relays
Other commands	
?	Output the information about the device
??	Output the information about the device in POLL-state
ECHO [ON/OFF]	Turn the serial interface echo ON/OFF
FIND	All devices in POLL mode are sent their addresses
HELP	List the most common commands
ERRS	List present transmitter errors
FILT	Set the result filtering
VERS	Display the software version information
LOCK	Lock the menu/disable keypad
OIL	Set oil-specific parameters for ppm conversion

Getting Measurement Message from Serial Line

Enter the **R** command to start output of measurements. Enter the **S** command, press the Esc button or reset the transmitter to stop outputting. See command **SMODE** to change the default (power-up) operation mode.

Format the output by using the following commands:

- outputting interval can be changed with the **INTV** command.
- output message format can be changed with a command **FORM**.

- status of chemical purge and probe heating can be added with a command **FST**.
- date and time information can be added with commands **FDATE** and **FTIME**

Examples:

```
>r  
aw= 0.261 T= 23.8 'C H2O= 15 ppm  
>
```

Stopping Continuous Outputting

S

Use the S command to end the RUN mode. After this command all other commands can be used.

Outputting Reading Once

SEND

Use the SEND command to output the reading once in STOP mode.

The output format depends on which parameters the transmitter can output.

Examples:

```
>SEND  
aw= 0.261 T= 23.8 'C H2O= 15 ppm  
>
```

If there is an error in outputting the quantity, value is displayed with stars '*’.

The output mode can be changed with the commands: **FORM**, **FST**, **FDATE**, **TIME**.

Formatting Serial Line Message

TIME and DATE

To set time enter the **TIME** command. To set date enter the **DATE** command.

TIME

DATE

These time and date settings are shown on the timestamps of **PLAY** command. When you want to include time and date in the **R** and **SEND** commands, use the **FTIME** and **FDATE** commands.

Example:

```
>TIME
Current time is 04:12:39
Enter new time (hh:mm:ss) ? 12:24:00
>DATE
Current date is 2000-01-01
Enter new date (yyyy-mm-dd) ? 2005-10-22
>
```

NOTE

Time and date are cleared to 2000-01-01 00:00:00 at reset or at power failure.

FTIME and FDATE

FTIME and **FDATE** commands will enable/disable output of time and date to the serial line. To add time to **R** and **SEND** outputs enter:

FTIME [x]

To add date to **R** and **SEND** outputs enter:

FDATE [x]

where

x = ON or OFF

Example:

```
>send
aw= 0.277 T= 23.5 'C H2O= 16 ppm
>ftime on
Form. time : ON
>send
00:16:07 aw= 0.277 T= 23.5 'C H2O= 16 ppm
>fdate on
Form. date : ON
>send
2000-01-01 00:16:15 aw= 0.277 T= 23.5 'C H2O= 16
ppm
>
```

General Settings

Changing Quantities and Units

To change quantities and units use serial commands or the optional display/keypad. The MMT330 measures the following quantities:

- water activity (aw)
- temperature (T) (metric unit: °C, non metric unit:°F)
- ppm for transformer oil only (H₂O)

NOTE

Only the quantities selected when ordering the device can be selected as a display output quantity.

Using Display/Keypad

Use display/keypad to select the display output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Display**.
3. Press ► arrow button to select **Quantities**.
4. Select the quantity by using the ▲▼ arrow buttons. Confirm the selection by pressing **SELECT**. You can select 1 ... 3 display quantities at a time.
5. Press **EXIT** to return to the basic display.

To select display units:

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Display**.
3. Use the ▲▼ arrow buttons to select Units. Confirm the selection by pressing the right-hand arrow button.
4. Use the ▲▼ arrow buttons to select display units. Confirm the selection by pressing **CHANGE**. The unit changes from metric to non-metric or the other way round.
5. Press **EXIT** to return to the basic display.

NOTE

Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.

Using Serial Line

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**.

FORM [x]

where

x = Formatter string

Formatter string consists of quantities and modifiers. The MMT330 measures the following quantities:

- water activity (aw)
- temperature (T) (metric unit: °C, non metric unit:°F)
- ppm for transformer oil only (H₂O)

When selecting the quantity, use the abbreviations of the quantities. The modifiers are presented in Table 10 on page 66 below.

Table 10 The modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage-return
#n	Line feed
""	String constant
#xxx	Special character, code "xxx" (decimal), for example #027 for ESC
U5	Unit field and length (optional)

Example:

```
>form "aw=" 6.4 aw #t "t=" 6.2 t #r#n
>
```

```
>send
aw=      0.2644t=      25.50
>
```

```
>form "Oil ppm= " h2o " " u3 #r#n
>send
Oil ppm=      16.6 ppm
>
```

Command '**FORM /**' will return the default output format. The default output format depends on the device configuration.

```
>form /  
>send  
aw= 0.087 T= 24.0 'C  
>
```

UNIT

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

UNIT [x]

where

x = M or N

where

M = Metric units

N = Non-metric units

NOTE

This command changes both the serial output and display units to either metric or non-metric units. When you want to output both metric and non-metric units simultaneously on the serial line and display, select the display units later by using the display/keypad.

User Port Serial Settings

Using Display/Keypad

The communication settings for the user port can be changed via the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **Interfaces** and press the ► arrow button to confirm your selection.
3. Select **Serial interface** and press the ► arrow button to confirm your selection.
4. Select **Bit rate/Serial format/Comm. mode** by pressing the **CHANGE** button. Use the ▲ ▼ arrow buttons to select and press **SELECT** to confirm your selection.

5. If you selected RUN communication mode, select **RUN** interval for and press **SET** to confirm your selection.
6. Use the arrow buttons to set the measuring interval and the unit. Press **OK** to confirm your settings.
7. If you selected POLL communication mode, select **POLL** address and press **SET** to confirm your selection.
8. Use the arrow buttons to set the transmitter address. Press **OK** to confirm the setting.
9. Use the arrow buttons to select **ECHO**. Press **ON** to turn to it on. Press **OFF** to turn it off.
10. Press **EXIT** to return to the basic display.

The new user port settings set using the display/keypad are effective immediately.

Using Serial Line

SERI

Use the serial line command **SERI** [*b p d s*] to set communication settings for the user port.

SERI [*b p d s*]

where

- b** = Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- p** = Parity (n = none, e = even, o = odd)
- d** = Data bits (7 or 8)
- s** = Stop bits (1 or 2)

Example:

```
>SERI 600 N 8 1
600 N 8 1
>
```

You need to reset the transmitter to activate the new communication settings set with command SERI.

The settings can be changed one parameter at a time or all parameters at once:

```
>SERI O                changing parity only
4800 O 7 1
>SERI 600 N 8 1       changing all parameters
600 N 8 1
>
```

You can use the **SERI** command to change/view the user port settings even if you are currently connected to the service port.

SMODE

Use the command **SMODE** to set the user port start-up operating mode.

SMODE [xxxx]

where

xxx = STOP, RUN or POLL

Table 11 Selection of Output Modes

Mode	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	Use with RS-485 buses, see Operation of RS-485 Module on page 88.

Selected output mode will be activated after power outages.

INTV

Use the command **INTV** to set the outputting interval for the RUN mode.

INTV [xxx yyy]

where

xxx = Output interval (0 ... 255). 0: the fastest possible output rate.

yyy = Unit (s, min or h)

Example:

```
>INTV 10 min
Output intrv. : 10 min
>
```

ECHO

Use the command **ECHO** to set the user port echo. The command either enables or disables echo of characters received.

ECHO [x]

where

- x = ON (default) or
- = OFF

NOTE

You can use the SERI, SMODE, INTV and ECHO commands to change/view the user port settings even if you are currently connected to the service port.

Data Filtering

The averaging data filter calculates a average over a certain period of time. The lowest measurement noise is achieved with the extended filtering. There are three filtering levels available.

Table 12 Filtering Levels

Setting	Filtering level
OFF (default)	No filtering
ON	Standard = short filtering (approximately 15 s moving average)
EXTENDED	Extended filtering (default: approximately 1 min average)

Use display/keypad to set the filtering level.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Measuring** by pressing the ► arrow button.
3. Select **Filtering** and press **CHANGE** to confirm your selection.
4. Select **Off/Standard/Extended** and press **SELECT** to confirm your selection.
5. Press **EXIT** to return to the basic display.

FILT

Use the serial line command **FILT** [xxx] to set the filtering level.

FILT [xxx]

where

xxx = OFF, ON or EXT (default = ON)

Device Information

Use the display/keypad or the serial line to display the device information.

Press the **INFO** button in the basic display to see the following information:

- present or past unacknowledged errors, if any
- device information
- adjustment information fed by the user
- measuring settings
- serial interface information
- analog output information
- relay output information (when applicable)

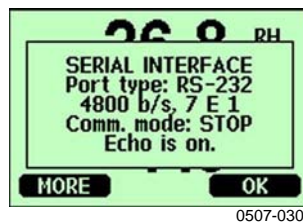


Figure 41 Device Information on Display

Proceed in the information views by pressing the **MORE** button as many times as you get the desired information. You can browse through the information displays also with arrow buttons. Press **OK** to return to the basic display.

?

Use the serial line command **?** to check the current transmitter configuration. Command **??** is similar but can also be used if the transmitter is in POLL mode.

Example:

```
>?
MMT330 / 2.04
Serial number : A3420002
Batch number  : A3210034
Adjust. date   : 2005-08-07
Adjust. info   : Pre-adjustment Vaisala/HEL
Date          : 2000-01-01
Time          : 02:32:27
Serial mode    : STOP
Baud P D S    : 4800 E 7 1
Output interval: 0 s
Address       : 0
Echo         : ON
Pressure      : 1013.25 hPa
Filter        : OFF
Ch1 output    : 4...20mA
Ch2 output    : 4...20mA
Ch3 output    : 4...20mA
Ch1 aw low   : 0.00
Ch1 aw high  : 1.00
Ch2 T low    : -40.00 'C
Ch2 T high   : 60.00 'C
Ch3 H2O low  : 0.00 ppm
Ch3 H2O high : 500.00 ppm
Module 1     : not installed
Module 2     : AOUT-1
>
```

HELP

Use the command **HELP** to list the commands.

Example:

```
>help
?          ACAL      ADDR      AERR      ASCL
ASEL      CDATE     CLOSE     CODE      CRH
CT        CTA       CTEXT    DATE      DELETE
DIR       DSEL     DSEND    ECHO      ERRS
FCRH      FDATE     FILT     FORM      FST
FTIME     HELP     INTV     ITEST    MODS
OPEN      PLAY     PRES     R         RESET
SEND      SERI     SMODE    TEST     TIME
UNDELETE  UNIT     VERS     XPRES
>
```

ERRS

Use the command **ERRS** to display transmitter error messages, see Table 15 on page 100.

Example:

```
>ERRS
No errors
>
```

VERS

Use the command **VERS** to display software version information.

Example:

```
>vers
MMT330 / 2.04
>
```

Resetting Transmitter By Using Serial Line

RESET

Resets the device. The user port switches to start-up output mode selected with command SMODE.

Locking Menu/Keypad by Using Serial Line

LOCK

Use the **LOCK** command to turn on the menu lock with 4-digit PIN code, for example 4444.

LOCK [x yyyy]

where

x = 1 (Menu locked)
 $yyyy$ = 4-digit PIN code

Example:

```
>lock 1 4444
Keyboard lock : 1 [4444]
>
```

Use the **LOCK** command to turn on the menu lock without PIN code access possibility.

LOCK [x]

where

x = 1 (Menu locked)

Example:

```
>lock 1
Keyboard lock : 1
>
```

Use the **LOCK** command to disable the keypad completely.

LOCK [x]

where

x = 2 (Keypad disabled)

Example:

```
>lock 2
Keyboard lock : 2
>
```

NOTE

Open the locks with the serial command LOCK 0 . You can open the menu lock also by using the keypad, if a PIN code has been set.

Data Recording

Data recording function is always on and collects data automatically into the memory of the device. Recorded data do not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial line or MI70 Link program.

Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to three quantities can be recorded at a time. See section Changing Quantities and Units on page 65 for instructions on how to select the display quantities with the keypad.

DSEL

Use the serial line command **DSEL** to select the quantities to be recorded if the transmitter is not equipped with display/keypad. The MMT330 measures the following quantities:

- water activity (aw)
- temperature (T) (metric unit: °C, non metric unit:°F)
- ppm for transformer oil only (H₂O)

DSEL [xxx]

where

xxx = Data recording quantity.

Example:

```
>dsel aw t
aw T
>
```

Enter the command without parameters and press **ENTER** to display current recording parameters.

View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 52 for details about graphical display.

You may also dump the logged data to the serial line in numeric form with the following commands.

DIR

Use the serial line and enter the **DIR** command to check the available files.

The device records six files (six observation periods) for each selected quantity. Thus, total amount of the files depends on the amount of the selected quantities being at minimum 6 and at maximum 18. See Table 6 on page 53.

Select, for example, three quantities (aw, T and H₂O). The last two columns illustrate software information that is not essential for the user.

Example:

```
>dir
0  aw  latest 20 minutes    00-01-01 02:12:49 135 020A
1  aw  latest 3 hours      99-12-31 23:12:49 135 025A
2  aw  latest 1 day        99-12-30 23:35:19 135 040C
3  aw  latest 10 days      99-12-20 20:35:19 135 0802
4  aw  latest 2 months     99-10-25 14:35:19 135 080C
5  aw  latest 1 year       98-11-22 02:35:19 135 1003
6  T   latest 20 minutes    00-01-01 02:12:49 135 020A
7  T   latest 3 hours      99-12-31 23:12:49 135 025A
8  T   latest 1 day        99-12-30 23:35:19 135 040C
9  T   latest 10 days      99-12-20 20:35:19 135 0802
10 T   latest 2 months     99-10-25 14:35:19 135 080C
11 T   latest 1 year       98-11-22 02:35:19 135 1003
12 H2O latest 20 minutes    00-01-01 02:12:49 135 020A
13 H2O latest 3 hours      99-12-31 23:12:49 135 025A
14 H2O latest 1 day        99-12-30 23:35:19 135 040C
15 H2O latest 10 days      99-12-20 20:35:19 135 0802
16 H2O latest 2 months     99-10-25 14:35:19 135 080C
17 H2O latest 1 year       98-11-22 02:35:19 135 1003
>
```

PLAY

Use the **PLAY** command to output the selected file to the serial line. Data in the output is <TAB> limited. This is compatible with most spreadsheet programs. Before giving the command, set the correct date and time with **TIME** and **DATE** commands, if needed.

PLAY [x]

where

x = 0 ... 17

Example:

```
>play 2
aw latest 1 day          05-10-22 21:17:58      135 040C
Date      Time      trend      min      max
yy-mm-dd hh:mm:ss
05-10-22 21:17:58 0.2701     0.2700   0.2705
05-10-22 21:29:58 0.2711     0.2702   0.2718
05-10-22 21:41:58 0.2708     0.2708   0.2710
05-10-22 21:53:58 0.2710     0.2702   0.2720
>
```

The <ESC> key can be used to interrupt the output listing.

The **PLAY** -1 command can be used to output all files.

NOTE

Output of large amounts of recorded data can take a long time. If you are using the user port, select the highest serial baud supported to reduce the time required for output.

Deleting the Recorded Files

Use the keypad/display to delete the recorded files. Note that the transmitter automatically overwrites the old data when the memory gets full, so manual deletion of the recorded files is not necessary.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Clear graph memories** by pressing the **CLEAR** button. Press the **YES** button to confirm the selection.

CAUTION

This function clears all the data history from the memory, all graphs included.

DELETE/UNDELETE

Use the serial line to delete or undelete data files. Use the **DELETE** command to delete all data files. Use the **UNDELETE** command to recover the deleted files.

NOTE

The **UNDELETE** command will only recover the part of the deleted data that has not been recorded over yet.

Analog Output Settings

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Third Analog Output on page 43.

Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches, see the position in Figure 2 on page 13 (DIP switches for analog output settings).

1. Select the current/voltage output, switch ON either of the switches, 1 or 2.
2. Select the range, switch ON one of the switches from 3 to 7.

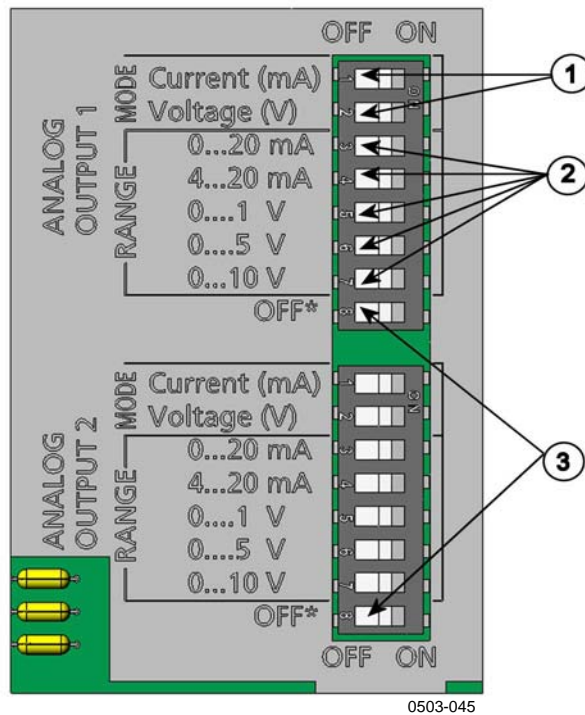


Figure 42 Current/Voltage Switches of Output Modules

The following numbers refer to Figure 42 above:

- 1 = Current/voltage selection output switches (from 1 to 2)
- 2 = Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.
- 3 = Switches for service use only. Keep in OFF position always.

NOTE Only one of the switches 1 or 2, must be ON at a time.
 Only one of the switches 3 to 7, must be ON at a time.

Example: 0 ... 5 V voltage output selected for channel 1 and 4...20 mA selected for channel 2.

	OFF	ON	Selection
1			Voltage output selected
2			
3			
4			0...5 V selected
5			
6			
7			
8			

1			Current output selected
2			4... 20 mA selected
3			
4			
5			
6			
7			
8			

NOTE If you have customized the error output setting (**AERR**), check that the set error values are still valid after changing the output mode/range, see section Analog Output Fault Indication Setting on page 82.

Analog Output Quantities

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog outputs** by pressing the ► arrow button.

4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select **Quantity** by pressing the ▲▼ arrow buttons. Confirm your selection by pressing **CHANGE**.
6. Select the quantity by using the arrow buttons. Press **SELECT** to confirm your selection.
7. Select **Scale, lower limit**, by pressing the ▲▼ arrow buttons. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
8. Select the upper limit by pressing the ▲▼ arrow buttons. Use the arrow buttons to set the upper limit value. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
9. Press **EXIT** to return to the basic display.

AMODE/ASEL

Use the serial line to select and scale the analog output quantities. Connect the transmitter to the PC. Open the terminal connection between your PC and the transmitter.

1. Check the analog output modes with the **AMODE** command.

Example:

```
>amode
Ch1 output      : 0...1V
Ch2 output      : 0...1V
>
```

2. Select and scale the quantities for the analog outputs with the command **ASEL**. Note that the optional quantities can be selected only if they have been selected when ordering the device.

ASEL [xxx yyy zzz]

where

xxx = Quantity of channel 1
yyy = Quantity of channel 2
zzz = Quantity of the optional analog output channel 3

Enter always all the quantities for all outputs. The MMT330 measures the following quantities:

- water activity (aw)
- temperature (T) (metric unit: °C, non metric unit:°F)
- ppm for transformer oil only (H₂O)

Use the command **ASEL** [xxx yyy] as shown in the example below when using a device with two analog outputs.

Example:

```
>asel aw t
Ch1 aw    low   : 0.00
Ch1 aw    high  : 1.00
Ch2 T     low   : -40.00 'C
Ch2 T     high  : 60.00 'C
>
```

Analog Output Tests

Use the display/keypad for testing to test the operation of the analog by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Diagnostics** by pressing the ► arrow button.
4. Select **Analog output tests** by pressing the ► arrow button.
5. Select one of the testing options **Force 0%/50%/100% of scale**. Press **TEST** to confirm your selection. All outputs are tested simultaneously. The actual output value depends on the selected range.
6. Press **OK** to stop testing. Press **EXIT** to return to the basic display.

ITEST

Use the serial line to test the operation of the analog outputs. Use the command **ITEST** to force the analog outputs to entered values. The set values remain valid until you enter the command **ITEST** without parameters or **RESET** the transmitter.

ITEST [aa.aaa bb.bbb]

where

aa.aaa = Current or voltage value to be set for channel 1 (mA or V)
bb.bbb = Current or voltage value to be set for channel 2 (mA or V)

Example:

```
>itest 20 5
Ch1 (aw ) : * 20.000 mA H'CCDA
Ch2 (T ) : * 5.000 mA H'34B9
>
```

Analog Output Fault Indication Setting

Factory default state for analog outputs during error condition is 0 V/ 0 mA. Please be careful when selecting the new error value. The error state of the transmitter should not cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog Outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select Fault indication. Press **SET** to confirm your selection. Enter the fault indication value by using the arrow buttons. Press **OK** to confirm your setting. This value is outputted if a transmitter error occurs.
6. Press **EXIT** to return to the basic display.

AERR

Use the serial line **AERR** command to change the error output.

AERR

Example:

```
>aerr
Ch1 error out : 0.000V ? 5.0
Ch2 error out : 0.000V ? 5.0
>
```

NOTE

The error output value must be within a valid range of the output mode.

NOTE

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

Operation of Relays

Quantity for Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints.

You can also set only one setpoint.

Hysteresis

Hysteresis function is to prevent the relay switching back and forth when the measured value is near to the setpoint values.

Relay is activated when the measured value passes the exact value of the setpoint. When returning and passing the setpoint again relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value.

Hysteresis should be smaller than difference of the setpoints.

Example: When the 'active above' value a_w is 0.6 and the hysteresis value is 0.05, relay activates when the a_w reaches 0.60. As the humidity decreases, relay releases at 0.55.

NOTE

If both setpoints are specified and "above" setpoint is lower than "below" setpoint, the hysteresis works in the opposite direction, that is, relay is **released** when the measured value passes the exact value of the setpoint.

Relay Indicating Transmitter Error Status

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

FAULT STATUS

Normal operation: relay active (C and NO outputs are closed)
 Not measuring state (error state or power off): relay released (C and NC outputs are closed)

ONLINE STATUS

Live measurement (data available): relay active (C and NO outputs are closed)
 No live data (for example: error state or adjustment mode): relay released (C and NC outputs are closed)

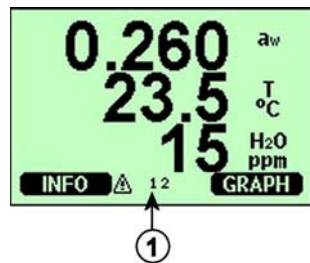
Enabling/Disabling Relays

You can deactivate the relay outputs for example for service purposes of your system.

Setting Relay Outputs

NOTE When having only one relay module installed, its relays are called 'relay 1' and 'relay 2'.

When having two relay modules, the relays of the the module connected to slot **MODULE 1** are called 'relay 1' and relay 2' and relays connected to slot **MODULE 2** are called 'relay 3' and 'relay 4'



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Figure 43 Relay Indicators on Display

The following number refers to Figure 43 above:

- 1 = Lists enabled relays. Activation state shown in black.
 Disabled relays are not shown.

Use the display/keypad to set the relay outputs.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces**, confirm by pressing the ► arrow button.
3. Select **Relay outputs**, confirm by pressing the ► arrow button.
4. Select **Relay 1/2/3/4**, confirm by pressing the ► arrow button.
5. Select the **Quantity**, confirm by pressing **Change**. Select the Quantity by using the arrow buttons. Confirm your selection by pressing **Select**.
6. Select **Act. above / Act. below**. Press **SET** to confirm your selection. (If asked, select **MODIFY** if you want to set the setpoint by using the arrow buttons. Select **REMOVE** if you want to remove the setpoint.)
7. Select **Hysteresis** by using the arrow buttons. Press **SET** to set the hysteresis. Press **OK**.
8. Select **Relay enable** by using the arrow buttons, press **ON/OFF** to enable/disable the relay.

RSEL

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. Enter the **RSEL** command.

RSEL [q1 q2 q3 q4]

where

- q1* = quantity for the relay 1 or Fault/Online
- q2* = quantity for the relay 2 or Fault/Online
- q3* = quantity for the relay 3 or Fault/Online
- q4* = quantity for the relay 4 or Fault/Online

Factory setting: all relays disabled.

The MMT330 measures the following quantities:

- water activity (aw)
- temperature (T) (metric unit: °C, non metric unit:°F)
- ppm for transformer oil only (H₂O)

Table 13 Quantities Measured by MMT330

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Water activity	aw		
Temperature (T)	T	°C	°F

Table 14 Optional Quantity

Quantity	Abbreviation	Metric Unit	Non Metric Unit
ppm for transformer oil only	H2O	ppm	ppm

Example of window limit switch: Selecting relay 1 to follow aw measurement and relay 2 to follow temperature measurement. Two relay setpoints are set for both relays.

```
rsl aw t
Rel1 aw above: 0.00 ? 0.3
Rel1 aw below: 0.00 ? 0.4
Rel1 aw hyst : 0.00 ? 0.02
Rel1 aw enabl: OFF ? on
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? 40
Rel2 T hyst : 0.00 'C ? 3
Rel2 T enabl: OFF ? on
>
```

- **Example of normal limit switch:** Selecting relay 1 to follow H₂O, relay 2 to follow temperature, relay 3 to follow online status and relay 4 to follow fault status.

```
rsl h2o t online fault
Rel1 H2O above: 0.00 ppm ?
Rel1 H2O below: 0.00 ppm ? 200
Rel1 H2O hyst : 0.00 ppm ? 10
Rel1 H2O enabl: ON ?
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? 60
Rel2 T hyst : 0.00 'C ? 2
Rel2 T enabl: ON ?
Rel3 ONLI above: -
Rel3 ONLI below: -
Rel3 ONLI hyst : -
Rel3 ONLI enabl: ON ?
Rel4 FAUL above: -
Rel4 FAUL below: -
Rel4 FAUL hyst : -
Rel4 FAUL enabl: ON ?
```


Example of using relay 1 as fault alarm: selecting relay 1 to follow the fault status and relay 2 to follow the temperature measurement.

```
>rsel fault t
Rel1 FAUL above: -
Rel1 FAUL below: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 T    above: 0.00 'C ? 30
Rel2 T    below: 0.00 'C ? -
Rel2 T    hyst : 0.00 'C ? 2
Rel2 T    enabl: OFF ? ON
>
```

Testing Operation Of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the **REL 1** or **REL 2** button to activate the corresponding relay.

Relay is activated:	led is lit
Relay is not activated:	led is not lit

RTEST

Use the serial line command **RTEST** to test the operation of the relays.

RTEST [x1 x2 x3 x4]

where

x = ON/OFF

Example: Activate and then release all four relays.

```
>rtest on on on on
ON ON ON ON
>
>rtest off off off off
OFF OFF OFF OFF
>
```

Enter the command **RTEST** without parameters to stop testing.

Operation of RS-485 Module

RS-485 interface enables communication between RS-485 network and MMT330 transmitter. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)

When selecting an RS-232-RS-485 converters for the network, avoid self powered converters as they don't necessarily support the needed power consumption.

Echo function shall be always disabled (OFF) when using the 2-wire connection. When using the 4-wire connection you can disable/enable the echo setting.

NOTE

User port on MMT330 main board cannot be used and connected when RS-485 module is connected. Service port is operating normally.

Networking Commands

Set the RS-422/485 interface by using the following commands. The other serial line commands are presented in section List of Serial Commands on page 61.

RS-485 configuration commands **SERI**; **ECHO**; **SMODE**; **INTV** and **ADDR** may be entered by using either the service port or RS-422/485 port. Also the optional display/keypad can be used, see section User Port Serial Settings on page 67.

SERI

Use the **SERI** command to input RS-485 bus settings.

SERI [*b p d s*]

where

- b* = bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- p* = parity (n = none, e = even, o = odd)
- d* = data bits (7 or 8)
- s* = stop bits (1 or 2)

ECHO

Use the **ECHO** command to enable/disable echo of characters received over the serial line.

ECHO [x]

where

x = ON/OFF (default = OFF)

When using 2-wire connection, echo must be always disabled.

SMODE

Use the **SMODE** command to set the default serial interface mode.

SMODE [xxxx]

where

xxxx = STOP, RUN or POLL

In STOP mode: measurements output only by command SEND, all commands can be used

In RUN mode: outputting automatically, only command S can be used to stop.

In POLL mode: measurements output only with command SEND [*addr*].

When several transmitters are connected to the same line, each transmitter must be entered an own address in the initial configuration, and POLL mode must be used.

INTV

Use the **INTV** command to set the RUN mode output interval.

INTV [n xxx]

where

n = 0 - 255

xxx = S, MIN or H

Sets the RUN mode output interval. The time interval is used only when the RUN mode is active. For example, the output interval is set to 10 minutes.

```
>INTV 10 min
Output intrv. : 10 min
>
```

Setting RUN output interval to zero enables the fastest possible output rate.

ADDR

Addresses are required only for POLL mode (see serial line command SMODE on page 69.) Use the **ADDR** command to input the RS-485 transmitter address.

OPEN [aa]

where

aa = address (0 ... 99) (default = 0)

Example: the transmitter is configured to address 99.

```
>ADDR
Address : 2 ? 99
>
```

SEND

Use the SEND command to output the reading once in POLL mode:

SEND [aa]

where

aa = address of the transmitter

OPEN

When all transmitters on the RS-485 bus are in POLL mode the **OPEN** command sets one transmitter temporarily to STOP mode so that other commands can be entered.

OPEN [aa]

where

aa = address of the transmitter (0 ... 99)

CLOSE

The **CLOSE** command switches the transmitter back to the POLL mode.

Example:

```
>OPEN 2 (opens the line to transmitter 2, other  
transmitters stay in POLL mode)  
>CRH (for example, calibration performed)  
...  
>CLOSE (line closed)
```

This page intentionally left blank.

CHAPTER 5

PPM CONVERSION

MMT330 ppm conversion for Transformer Oils

Traditionally, moisture in transformer oil is measured by using ppm-units. The ppm-output shows the average *mass concentration of water* in oil. Vaisala has this conversion readily available for mineral transformer oils.

The moisture and temperature transmitter MMT330 has an option for ppm-output provided that this has been notified as placing the order of the transmitter. Vaisala has this conversion readily available for mineral transformer oils.

Conversion Model with Average Coefficients

The conversion model of the MMT330 is based on the average water solubility behaviour of transformer oils. The ppm-output is calculated as follows:

$$ppm = aw \times 10^{((A/T+273.16)+B)}$$

Where:

aw = water activity

A,B = coefficients (average/oil-specific)

T = temperature (°C)

Generally, measurements with MMT330 give accuracy better than 10 % of the reading. If additional accuracy is needed, refer to the paragraph Conversion Model with Oil-specific Coefficients below.

Conversion Model with Oil-specific Coefficients

For additional accuracy, oil-specific conversion model can be used both for mineral and silicon based oils. An oil sample has to be sent to Vaisala for modelling. As a result, the specific coefficients (A and B, see formula 1) for the transformer oil are determined by Vaisala. For additional information, please contact Vaisala.

The determined coefficients of the transformer oil can be programmed to the MMT330 by Vaisala or by a user according to the instructions presented in this chapter.

NOTE

Conversion Model With Oil-specific Coefficients is always needed for **silicone based oils**.

Setting Oil Coefficients Using Serial Line

If the ppm conversion and oil-specific coefficients have been programmed at Vaisala, the user does not have to set the conversion co-efficients.

If a user has defined the coefficients or separately received from Vaisala the oil-specific coefficients A and B, related to his own oil type, the coefficients can be set to the software of MMT330 by using a serial bus or through an RS 485/422 serial module or through keypad/display.

OIL

Use the serial line command OIL to set oil-specific parameters for ppm conversion.

Example:

```
>OIL
Oil[0]           : -1662.6999 ?
Oil[1]           : 7.3694 ?
>
```


where

Oil [0] corresponds to parameter A

Oil [1] corresponds to parameter B

Using Display/Keypad

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Measuring** by pressing the ► arrow button.
3. Select **Oil coefficients** by pressing the ► arrow button.
4. Press **SET**. Set the upper value A by using the ▲ ▼ buttons. Confirm by pressing OK.
5. Use the ▼ button to choose B. Press **SET**. Set the lower value B by using the ▲ ▼ buttons. Confirm by pressing **OK**.
6. Press **EXIT** to return to the basic display.

Determination of Oil-Specific Coefficients

The equation of the Ppm calculation is:

$$\text{ppm} = \text{aw} * 10^{(B+A/T)}$$

With the following procedure the coefficients A and B can be defined for the equation:

$$\text{LOG}(\text{PPM}_{\text{sat}}) = B + A/T$$

Equipment needed:

- Apparatus for determining water content (for example, coulometric titrator and e.g. magnetic stirrer.)
- Oil test station:
 - a temperature test chamber
 - for example, a conical flask (1L) sealed by PTFE stopper with an inlet for a moisture probe
 - MMT330 by Vaisala
 - magnetic stirrer.

Procedure:

1. Define the water content of the oil sample with the titration. Use the oil moisture level that is close to real conditions in the process.
2. Measure the water activity of this sample with MMT330 at two temperatures that differ at least 20 °C. Follow the measurement stabilization illustrated by the graph.

NOTE The sample has to be sealed very carefully i.e. not to be in contact with ambient air, which would change the water content.

NOTE If the oil sample is very dry and the temperatures are close to each other, it may cause inaccuracy to the calculation model. In order to get the best possible performance it is recommended to use oil conditions that represent real conditions in application. Recommended values for sample are aw approx. 0.5 at 20 °C.

3. Define the correlation between aw, T and PPM (w/w) from the measured values. Calculate A and B according to the following example.

$$A = \frac{\text{LOG}(PPM_{sat}[T2]) - \text{LOG}(PPM_{sat}[T1])}{1/(T2) - 1/(T1)}$$

$$B = \text{LOG}(PPM_{sat}[T1]) - A/T1$$

Example:

measured water content 213 ppm

T (°C)	aw	ppm _{saturation}
24.1	0.478	213/0.478 = 445.6067
57.6	0.188	213/0.188 = 1132.979

$$A = (\text{LOG}(1132.98) - \text{LOG}(445.607)) / (1/(57.6) - 1/(24.1)) = -1189.4581$$

$$B = \text{LOG}(445.607) - (-1189.4581) / (24.1 + 273.16) = 6.6503583$$

Assumptions:

The isotherm of water activity versus water concentration is linear and the solubility curve has the form of the given equation.

CHAPTER 6

MAINTENANCE

This chapter provides information that is needed in basic maintenance of the product.

Periodic Maintenance

Cleaning

Clean the transmitter enclosure with a soft, lint-free cloth moistened with mild detergent.

Clean the sensor before storing the MMT330 probe and before calibration. For cleaning of the probe you need instrument air and heptane (C_7H_{16}) liquid. Dry with instrument air to prevent oxidation of the oil on the sensor. The oxidation of the oil on the sensor can cause extended response times or drifting.

1. Blow the probe head (with filter) with instrument air to remove the remains of the oil.
2. Immerse the probe head into heptane liquid and rinse out the oil (for 1 minute maximum).
3. Dry the probe head with instrument air. In case you are going to calibrate the probe, remove the filter and dry the sensor with instrument air. Check that the sensor looks clean.

Changing the Probe Filter

1. Unscrew the filter from the probe head.
2. Screw a new filter on the probe head. When using the stainless steel filter (for oil and fuel cell), take care to tighten the filter properly (recommended force 130 Ncm).

New filters can be ordered from Vaisala, see section Options and Accessories on page 116.

Changing the Sensor

The user can change HUMICAP180L sensors.

1. Unscrew the filter from the probe head. See the instructions in section Changing the Probe Filter on page 98.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. **DO NOT TOUCH THE SENSOR PLATE.**
3. After sensor change the humidity calibration must be made according to the instructions, see section Relative Humidity Adjustment After Sensor Change on page 106.
4. Screw a new filter on the probe head. When using the stainless steel filter, take care to tighten the filter properly (recommended force 130 Ncm).

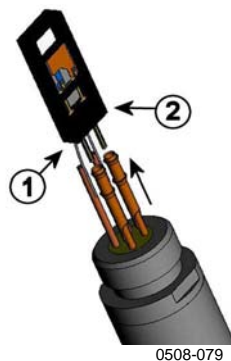


Figure 44 Changing the Sensor

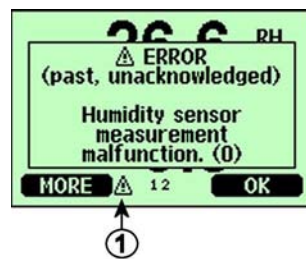
The following numbers refer to Figure 44 above:

- 1 = Pull out the sensor
- 2 = Plastic socket

Error States

In error state the quantity is not measured and the output is shown as follows:

- analog channel outputs 0 mA or 0 V (you can use the serial line command **AERR** or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 82.
- the serial port outputs stars (***)
- the cover LED is blinking
- optional display: error indicator is lit.



0508-036

Figure 45 Error Indicator and Error Message

The following number refers to Figure 45 above:

1 = Error Indicator

- The error indicator disappears when the error state is over and you have checked the error message. Press the **INFO** button to display the error message.

You can also check the error message via the serial interface by using the command **ERRS**. In case of constant error, please contact Vaisala, see Vaisala Service on page 121.

Table 15 Error Messages

Error Message	Action
Humidity sensor measurement malfunction.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
Humidity sensor short circuit	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
Humidity sensor open circuit	Check the integrity of the humidity probe and the probe cable.
Temperature sensor open circuit.	Check the integrity of the humidity probe and the probe cable.
Temperature sensor short circuit.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
Temperature measurement malfunction	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
Temperature sensor current leak.	Check the integrity of the humidity probe and the probe cables. Clean the probes from dirt, water, ice or other contaminants.
Internal ADC read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal EEPROM read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal EEPROM write error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Add-on module 1 (or 2) connection failure	Turn off the power and check the module connection. Turn on the power.
Device internal temperature out of range	Ensure that the operating temperature is within the valid range.
Operating voltage out of range	Ensure that the operating voltage is within the valid range.
Internal analog voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal system voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal ADC reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal analog output reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Configuration switches for analog output 1/2/3 set incorrectly	Check and re-set the switches, see Figure 42 on page 78 and Figure 28 on page 43.
EEPROM failure on add-on module 1 (or 2)	Disconnect the power and check the analog output module connection.
Communication module installed in incorrect add-on module slot	Disconnect the power and change the communication module to another module slot.
Unknown/incompatible module installed in add-on module slot 1(or 2)	Ensure that the module is compatible with the MMT330.

CHAPTER 7

CALIBRATION AND ADJUSTMENT

This chapter provides information that is needed in calibration and adjustment of the product.

The MMT330 is fully calibrated and adjusted as shipped from factory. The calibration interval depends on the application. It is recommended that calibration is done always when there is a reason to believe that the device is not within the accuracy specifications.

The user can calibrate the MMT330 or send it to Vaisala for calibration. Calibration and adjustment is carried out either by using the push-keys on the motherboard, through the serial port or with the optional display/keypad.

Before the calibration the used sensor should be cleaned with instrument air to blow out existing oil or gently first flush with heptane (C_7H_{16}) and dry with instrument air to decrease response time.

The cleaning must be done as the oily sensor can contaminate the salt bath and change the reference condition.

NOTE

It is important to clean the sensor before calibration as the oily sensor can contaminate the salt bath and change the reference condition.

Vaisala HUMICAP[®] hand-held moisture and temperature in Oil meter MM70 can also be used for calibration.

Cleaning the Sensor

Clean the sensor before storing the MMT338 probe and before calibration. For cleaning of the probe you need instrument air and heptane liquid. Dry with instrument air to prevent oxidation of the oil on the sensor. The oxidation of the oil on the sensor can cause extended response times or drifting.

1. Blow the probe head (with filter) with instrument air to remove the remains of the oil.
2. Immerse the probe head into heptane liquid and rinse out the oil.
3. Dry the probe head with instrument air. In case you are going to calibrate the probe, remove the filter and dry the sensor with instrument air. Check that the sensor looks clean.

Opening And Closing the Adjustment Mode

1. Open the transmitter cover. The buttons needed in adjustment are on the left-hand side of the motherboard.
2. Press the **ADJ** key to open the adjustment mode.
3. Press the **ADJ** key again to close the adjustment mode.

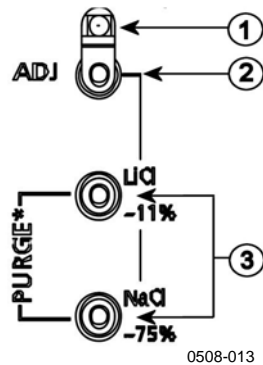


Figure 46 Adjustment and Purge Buttons

The following numbers refer to Figure 46 above:

- 1 = Indicator led
- 2 = Adjustment button
- 3 = Salt adjustment buttons. Note: purge is not available.

Adjustment menu is displayed only when **ADJ** button (on the motherboard inside the transmitter) is pressed.



0508-033

Figure 47 Adjustment Menu**Table 16** Indicator Led Functions

Indicator Led Function	Description
LED off	adjustment locked
LED on	adjustment available
LED blinking evenly	measurement not stabilized

Relative Humidity Adjustment

Using Push-Buttons

A simple push-button adjustment is carried out by using two relative humidity references: 11 % RH (LiCl) and 75 % RH (NaCl).

LiCl reference

1. Press the **ADJ** button (see Figure 46 on page 102) on the motherboard to open the adjustment mode. The indicator led starts flashing.
2. Remove the filter from the probe and insert the probe head into a measurement hole of the 11 % RH (LiCl) in the humidity calibrator HMK15. Use the adapter fitting for the MMT332, MMT337 and MMT338 probes.
3. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
4. When the indicator led is lit continuously press the button LiCl-11% to adjust the 11 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

NaCl reference

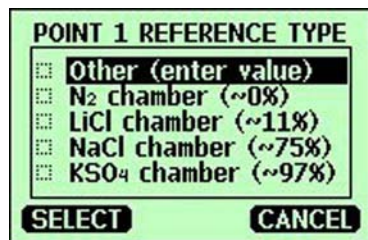
5. When adjusting in the second reference 75 % RH, press the **ADJ** button to open the adjustment mode. The indicator led starts flashing.

6. Insert the probe head into a measurement hole of the 75 % RH (NaCl) reference chamber of the humidity calibrator HMK15. Use the adapter fitting for the MMT332, MMT337 and MMT338 probes.
7. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
8. Press the button **NaCl 75 %** to adjust the 75 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

Using Display/Keypad

Note that the difference between the two humidity references must be at least 50% RH.

1. Press the **ADJ** button (opens the **ADJUSTMENT MENU**).
2. Select **Adjust RH measurement**, press ► button.
3. Select **1-point/ 2-point adjustment**, press. Press **START**.
4. Select the reference as guided by the display, press **SELECT**.



0507-013

Figure 48 Selecting Point 1 Reference Type

5. Remove the filter from the probe and insert the probe head into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15.) Use the adapter fitting for the MMT332, MMT337 and MMT338 probes
6. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
7. Press **READY** when stabilized. If you have chosen the **Other** reference value, enter now the reference value by using the arrow keys.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous items.

8. Answer **YES** to confirm the adjustment. Press **OK** to return to the adjustment menu.
9. Press **EXIT** to close the adjustment mode and return to the basic display. Before closing the adjustment mode, feed the adjustment information into the device, see section Feeding Adjustment Information on page 110.

Using Serial Line

Note that the difference between the two humidity references must be at least 50% RH.

1. Connect the MMT330 to a PC. See section Serial Line Communication on page 57. Open a terminal program.
2. Press the **ADJ** button.
3. Remove the filter from the probe and insert the probe head into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15). Use the adapter fitting for the MMT332, MMT337 and MMT338 probes.
4. Enter the **CRH** command and press **ENTER**.

CRH

5. Wait at least 30 minutes for the sensor to stabilize.
6. Type **C** and press **ENTER** a few times to check if the reading is stabilized.
7. When the reading is stabilized, give the reference humidity after the question mark and press **ENTER**.

```
>crh
```

```
RH :    11.25  Ref1 ? c
RH :    11.25  Ref1 ? c
RH :    11.25  Ref1 ? c
RH :    11.24  Ref1 ? c
RH :    11.24  Ref1 ? 11.3
Press any key when ready ...
```

8. Now the device is waiting for the high end reference. Insert the probe head into a measurement hole of the high end reference

chamber (for example,. NaCl: 75 % RH chamber in the humidity calibrator HMK15). Use the adapter fitting for the MMT332, MMT337 and MMT338 probes. Press any key when ready.

9. Let the probe stabilize for about 30 minutes. You can follow the stabilization by typing C and pressing **ENTER**.
10. When stabilized, type the high end reference value after the question mark and press **ENTER**.

```
>crh
RH : 11.25 Ref1 ? c
RH : 11.24 Ref1 ? c
RH : 11.24 Ref1 ? 11.3
Press any key when ready ...

RH : 75.45 Ref2 ? c
RH : 75.57 Ref2 ? c
RH : 75.55 Ref2 ? c
RH : 75.59 Ref2 ? 75.5
OK
>
```

11. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored. Enter the adjustment information (date and text) to the memory of the transmitter, see the commands **CTEXT** and **CDATE**.
12. Press the **ADJ** button on the motherboard to close the adjustment mode.
13. Take the probe out of the reference conditions and replace the filter.

Relative Humidity Adjustment After Sensor Change

Using Display/Keypad

When using the optional display/keypad, follow the instructions on Using Display/Keypad on page 104 but select **Adj. for new RH sensor** (instead of **1-point/ 2-point adjustment**).

Using Serial Line

After sensor change, carry out the procedure as described in previous sections. Just replace the **CRH** command with the **FCRH** command.

FCRH

Example:

```
>FCRH
RH   :   1.82 1. ref   ?   0
Press any key when ready...
RH   :   74.22   2. ref   ? 75
OK
>
```

The OK indicates that the calibration has succeeded.

Temperature Adjustment

Using Display/Keypad

1. Press the **ADJ** button on the motherboard to open the **ADJUSTMENT MENU**. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** key is pressed. Wait some time for the probe to reach ambient temperature.
2. Select **►Adjust T measurement**, press **►**key.
3. Select **1-point/ 2-point adjustment**, press. Press **START**.
4. Remove the filter from the probe and insert the probe head into the reference temperature.
5. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
6. Press **READY** when stabilized. Give the reference temperature by using the arrow keys.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous item. Please, note that the difference between the two temperature references must be at least 30 °C.

7. Press **OK**. Press **YES** to confirm the adjustment.

8. Press **OK** to return to the adjustment menu.
9. Press **EXIT** to close the adjustment mode and return to the basic display.

Using Serial Line

1. Press the **ADJ** key on the motherboard to open the adjustment mode.
2. Remove the probe filter and insert the probe head into the reference temperature.
3. Enter the command **CT** and press **ENTER**.

CT

4. Type **C** and press **ENTER** a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press **ENTER** three times.

When having another reference temperature (2-point calibration) press **ENTER** only twice and insert the probe to the second reference. When the reading is stabilized, give the second reference temperature after the question mark and press **ENTER**. Please, note that the difference between the two temperature references must be at least 30 °C.

Example (1-point adjustment):

```
>ct
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? 16.0
Press any key when ready ...
T : 16.06 Ref2 ?
OK
>
```

5. **OK** indicates that the calibration has succeeded. Give the calibration information (date and text) to the transmitter's memory, see the serial commands **CTEXT** and **CDATE**.
6. Press the **ADJ** button on the motherboard to close the adjustment mode.
7. Take the probe out of the reference conditions and replace the filter.

Analog Output Adjustment

In the analog output calibration the analog output is forced to the following values:

- current output: 2 mA and 18 mA
- voltage output: 10 % and 90 % of the range

Connect MMT330 to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

Using Display/Keypad

1. Press the **ADJ** button to open the **ADJUSTMENT MENU**.
2. Select **►Adjust analog outputs**, press **►**key.
3. Select the output to be adjusted **Adjust analog output 1/2**, press **START**.
4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK**.
5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK**.
6. Press **OK** to return to the adjustment menu.
7. Press **EXIT** to close the adjustment mode and to return to the basic display.

Using Serial Line

Enter the **ACAL** command and type the multimeter reading for each case. Continue by pressing **ENTER**.

ACAL

Example (current outputs):

```
>ACAL
Ch1 I1 (mA) ? 2.046
Ch1 I2 (mA) ? 18.087
Ch2 I1 (mA) ? 2.036
Ch2 I2 (mA) ? 18.071
>
```

Feeding Adjustment Information

This information is shown on the device information fields (see section Device Information on page 71.)

Using Display/Keypad

1. If you are not in the adjustment menu, press the **ADJ** button on the motherboard (opens the **ADJUSTMENT MENU**).
2. Select **►Adjustment info**, press the arrow **►** button.
3. Select **Date**, press **SET**. Give the date by using the arrow buttons. Press **OK**.
4. Select **i**, press **SET**. Enter information text including 17 characters at maximum by using the arrow buttons. Press **OK**.
5. Press **EXIT** to return to the basic display.

Using Serial Line

CTEXT

Use the CTEXT command to enter text to the adjustment information field.

Example:

```
>ctext
Adjust. info   : (not set) ? HMK15
>
```

CDATE

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

Example.

```
>cdate
Adjust. date   : (not set) ? 2004-05-21
>
```


CHAPTER 8

TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Measured Values

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

Performance

Temperature

Measurement range	
MMT342	-40...+180 °C (-40...+356 °F)
MMT347	-40...+180 °C (-40...+356 °F)
MMT348	-40...+180 °C (-40...+356 °F)
Accuracy at +20 °C (+68 °F)	± 0.2 °C

Operating Environment

Operating temperature for probes	same as measurement ranges
for transmitter body	-40...+60 °C (40...+140°F)
with display	0...+60 °C (+32...+140°F)
Pressure range for probes	See probe specifications
Complies with EMC standard	EN61326-1:1997+ Am1:1998 + Am2:2001 Industrial environment

Probe Specifications

MMT332

Pressure range	up to 250 bar / 3625 psia
Probe diameter	12 mm / 0.5 inch
Installation	
Flange	36 mm / 1.4 inch

MMT337

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

MMT338

Pressure range	0..40 bar / 0..580 psia
Mechanical durability	up to 40 bar /580 psia
Adjustable length	41..149/371 mm / 1.61..5.87/14.6 inch
Installation	
Fitting Body	R1/2" ISO
Fitting Body	NPT 1/2"
Ball Valve Set	BALLVALVE-1
Sampling Cell	DMT242SC2

Inputs and Outputs

Operating voltage	10...35 VDC, 24 VAC
with optional power supply module	100...240 VAC, 50/60 Hz
Power consumption @ 20 °C (U_{in} 24VDC)	
RS-232	max 25 mA
U_{out} 2 x 0...1V / 0...5V / 0...10V	max 25 mA
I_{out} 2 x 0...20 mA	max 60 mA
display and backlight	+ 20 mA
Analog outputs (2 standard, 3rd optional)	
current output	0...20 mA, 4...20 mA
voltage output	0...1 V, 0...5 V, 0...10 V
Accuracy of analog outputs at 20 °C	± 0.05 % full scale
Temperature dependence of the analog outputs	± 0.005 %/°C full scale
External loads	
current outputs	$R_L < 500$ ohm
0... 1V output	$R_L > 2$ kohm
0... 5V and 0... 10V outputs	$R_L > 10$ kohm
Max wire size	0.5 mm ² (AWG 20) stranded wires recommended
Digital outputs	RS-232, RS-485 (optional)
Relay outputs (optional)	0.5 A, 250 VAC, SPDT (optional)
Display	LCD with backlight, graphic trend display of any parameter
Display menu languages	English, French, Spanish, German, Japanese, Russian, Swedish, Finnish

Mechanics

Cable bushing	M20x1.5 for cable diameter 8...11mm/0.31..0.43"
Conduit fitting	1/2"NPT
Interface cable connector (optional)	M12 series 8-pin (male)
option 1	with plug (female) with 5 m / 16.4 ft black cable
option 2	with plug (female) with screw terminals
Probe cable diameter	5.5 mm
Probe cable lengths	2 m, 5 m or 10 m
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 65 (NEMA 4)

Technical Specifications of Optional Modules

Power Supply Module

Operating voltage	100...240 VAC 50/60 Hz
Connections	screw terminals for 0.5...2.5 mm ² wire (AWG 20...14)
Bushing	for 8...11 mm diameter cable
Operating temperature	-40...+60 °C (-40...+140 °F)
Storage temperature	-40...+70°C (-40...+158 °F)

Analog Output Module

Outputs	0...20 mA, 4...20 mA, 0...1 V, 0...5 V, 0...10 V
Operating temperature range	-40...+60 °C (-40...+140 °F)
Power consumption	
U_{out} 0...1 V	max 30 mA
U_{out} 0...5V/0...10V	max 30 mA
I_{out} 0... 20 mA	max 60 mA
External loads	
current outputs	$R_L < 500$ ohms
Max load + cable loop resistance	540 ohms
0...1 V	$R_L > 2000$ ohms
0...5 V and 0... 10 V	$R_L > 10\ 000$ ohms
Storage temperature range	-55...+80 °C (-67...+176 °F)
3-pole screw terminal	
Max wire size	1.5 mm ² (AWG16)

Relay Module

Operating temperature range	-40...+60 °C (-40...+140 °F)
Operating pressure range	500...1300 mHg
Power consumption @24 V	max 30 mA
Contacts SPDT (change over), for example, Contact arrangement Form C	
I _{max}	0.5 A 250 VAC
I _{max}	0.5 A 30 VDC
Safety standard for the relay component	IEC60950 UL1950
Storage temperature range	-55...+80 °C (-67...+176 °F)
3-pole screw terminal / relay	
Max wire size	2.5 mm ² (AWG14)

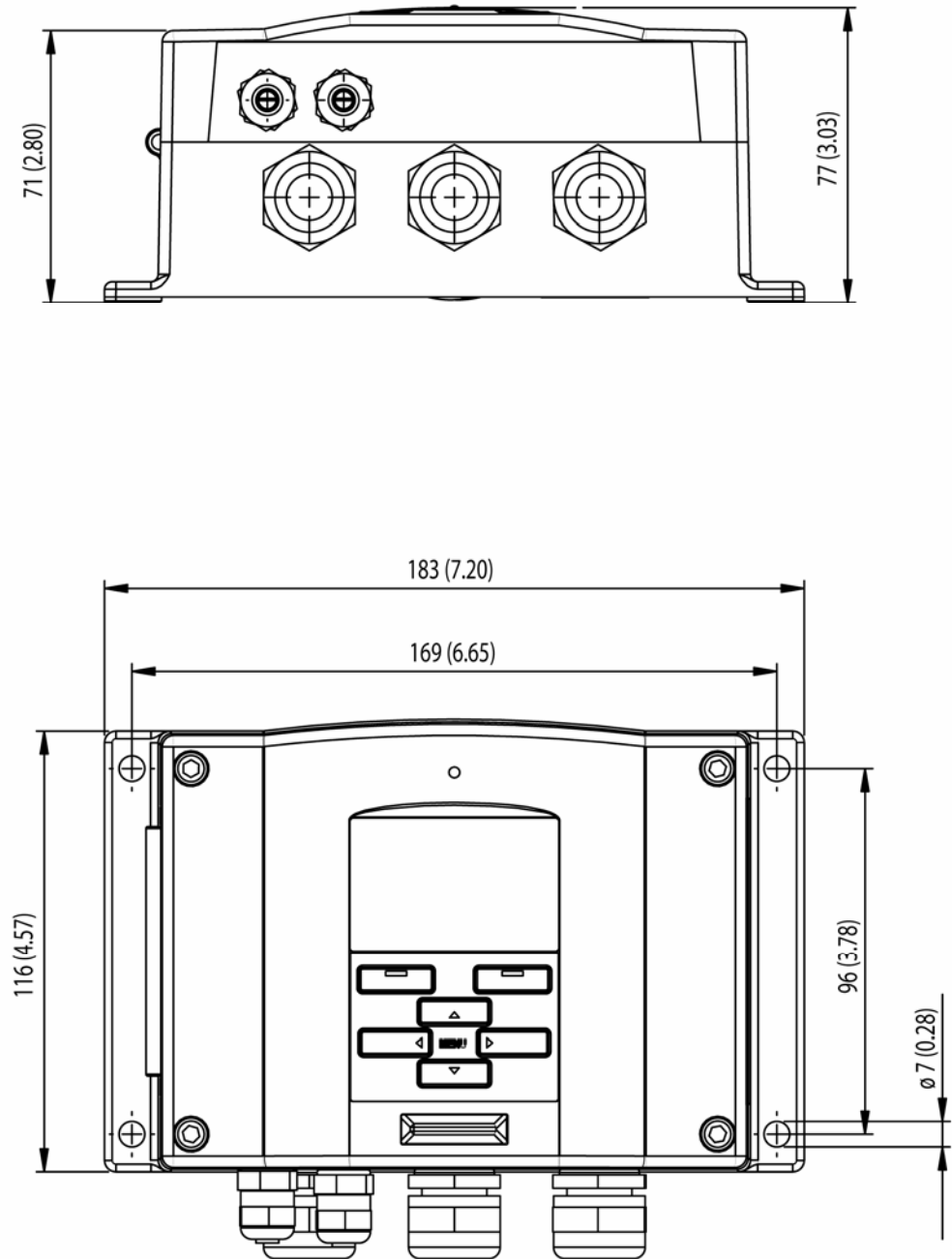
RS-485 Module

Operating temperature range	-40...+60 °C (-40...+140 °F)
Operating modes	2-wire (1-pair) half duplex 4-wire (2-pair) full duplex
Operating speed max	115.2 kbaud
Bus isolation	300VDC
Power consumption @ 24V	max 50 mA
External loads standard loads	32 RL > 10kohm
Storage temperature range	-55...+80 °C (-67...+176 °F)
Max wire size	1.5 mm ² (AWG16)

Options and Accessories

Description	Item code
MODULES	
Relay module	RELAY-1
Analog Output Module	AOUT-1
Isolated RS485 Module	RS485-1
Power Supply Module	POWER-1
Galvanic Isolation Module	DCDC-1
SENSORS	
HUMICAP180L2	HUMICAP180L2
PT100 Sensor	10429SP
FILTERS	
Stainless Steel Filter	HM47453SP
TRANSMITTER MOUNTING ACCESSORIES	
Wall Mounting Kit	214829
Installation Kit for Pole or Pipeline	215108
Rain Shield with Installation Kit	215109
DIN Rail Clips with Installation Plate	215094
PROBE MOUNTING ACCESSORIES	
MMT332	
5 pcs O-ring Set Size 14.1x1.6	216026
MMT337	
Swagelok for 12mm Probe 3/8" ISO Thread	SWG12ISO38
Swagelok for 12mm Probe 1/2" NPT Thread	SWG12NPT12
MMT338	
Fitting Body ISO1/2 Solid Structure	DRW212076SP
Fitting Body NPT1/2 Solid Structure	212810SP
Sampling Cell with Swagelok Connectors	DMT242SC2
Ball Valve ISO1/2 with Welding Joint	BALLVALVE-1
Manual Press	HM36854SP
CONNECTION CABLES	
Serial Interface Cable	19446ZZ
MI70 Connection Cable with RJ45 Connector	211339
OUTPUT CABLES FOR 8-PIN CONNECTOR	
Connection Cable 5m 8-pin M12 Female, Black	212142
Connector 8-pin M12 with Screw Terminals	212416
Male Connector 8-pin M12 with Cable and Adapter	214806SP
CABLE BUSHINGS	
Cable Gland M20x1.5 for 8...11mm Cable	214728SP
Cable Gland M20x1.5 for 11...14mm Cable	214729
Conduit Fitting M20x1.5 for NPT1/2 Conduit	214780SP
Dummy Plug M20x1.5	214672SP
WINDOWS SOFTWARE	
Software Interface Kit (MI70 Link + PC cable)	215005
OTHER	
Calibration Adapter for HMK15	211302SP

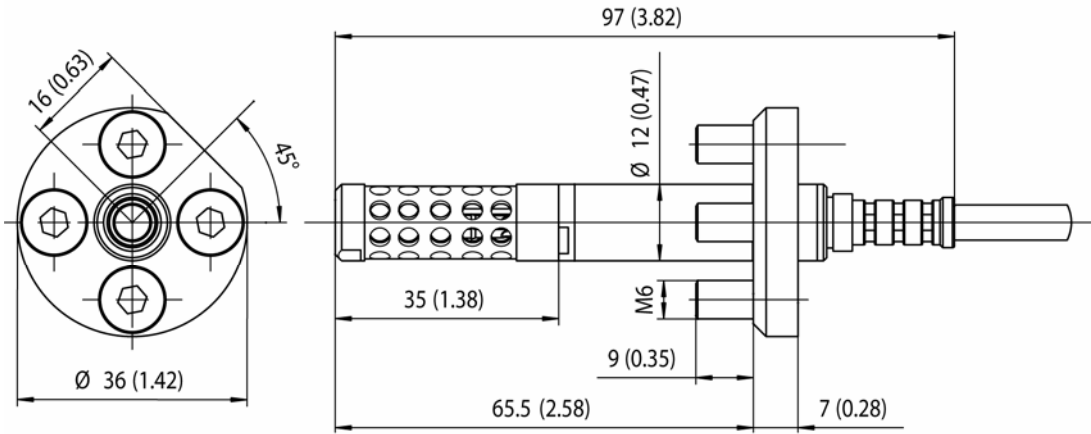
Dimensions (in mm)



0506-035

Figure 49 Transmitter Body Dimensions

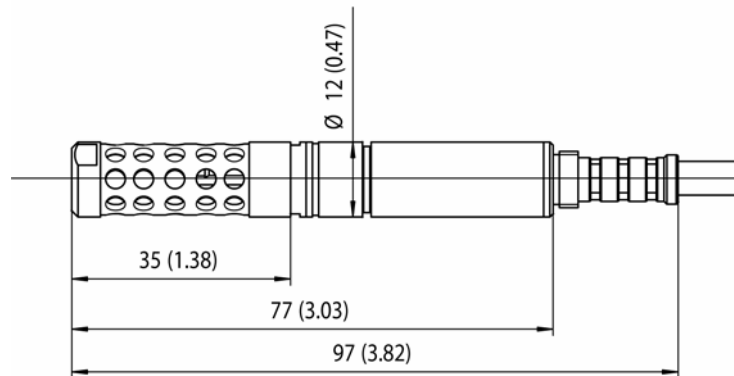
MMT332



0509-149

Figure 50 MMT332 Probe Dimensions

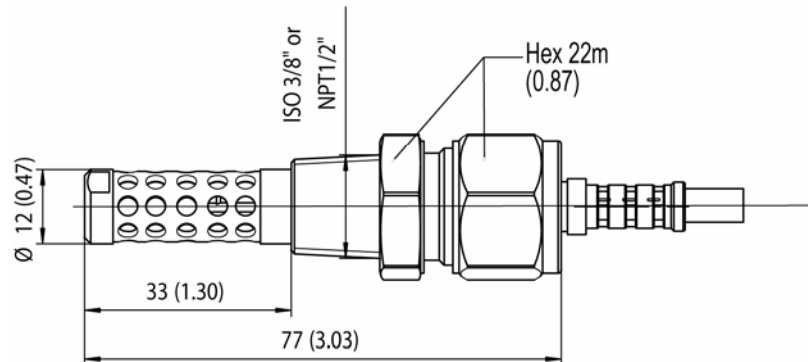
MMT337



0509-146

Figure 51 MMT337 Probe Dimensions

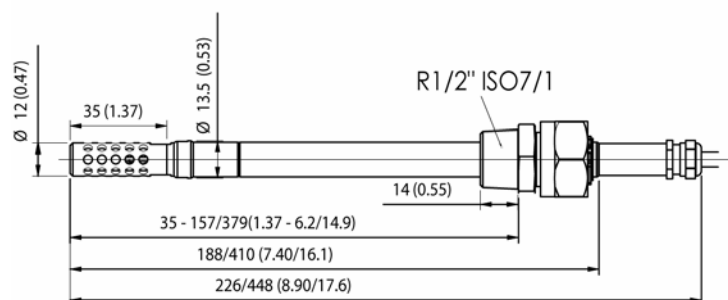
MMT337 with Swagelok Connector



0509-148

Figure 52 MMT337 Probe with Swagelok Connector, Dimensions

MMT338



0509-145

Figure 53 MMT338 Probe with RST-filter (Oil Filter), Dimensions

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail helpdesk@vaisala.com

Fax +358 9 8949 2790

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

Return Instructions

If the product needs repair, please follow the instructions below to speed up the process and avoid extra costs.

1. Read the warranty information.
2. Write a Problem Report with the name and contact information of a technically competent person who can provide further information on the problem.
3. On the Problem Report, please explain:
 - What failed (what worked / did not work)?
 - Where did it fail (location and environment)?
 - When did it fail (date, immediately / after a while / periodically / randomly)?
 - How many failed (only one defect / other same or similar defects / several failures in one unit)?
 - What was connected to the product and to which connectors?
 - Input power source type, voltage and list of other items (lighting, heaters, motors etc.) that were connected to the same power output.
 - What was done when the failure was noticed?

4. Include a detailed return address with your preferred shipping method on the Problem Report.
5. Pack the faulty product using an ESD protection bag of good quality with proper cushioning material in a strong box of adequate size. Please include the Problem Report in the same box.
6. Send the box to:
Vaisala Oyj
Contact person / Division
Vanha Nurmijärventie 21
FIN-01670 Vantaa
Finland

Vaisala Service

NORTH AMERICAN SERVICE CENTER

Vaisala Inc., 10-D Gill Street, Woburn, MA 01801-1068, USA.

Phone: +1 781 933 4500, Fax: +1 781 933 8029

E-mail: us-customersupport@vaisala.com

EUROPEAN SERVICE CENTER

Vaisala Instruments Service, Vanha Nurmijärventie 21 FIN-01670 Vantaa, FINLAND.

Phone: +358 9 8949 2658, Fax: +358 9 8949 2295

E-mail: instruments.service@vaisala.com

TOKYO SERVICE CENTER

Vaisala KK, 42 Kagurazaka 6-Chome, Shinjuku-Ku, Tokyo 162-0825, JAPAN.

Phone: +81 3 3266 9617, Fax: +81 3 3266 9655

E-mail: aftersales.asia@vaisala.com

BEIJING SERVICE CENTER

Vaisala China Ltd., Floor 2 EAS Building, No. 21 Xiao Yun Road, Dongsanhuan Beilu, Chaoyang District, Beijing, P.R. CHINA 100027.

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