USER'S GUIDE

Vaisala HUMICAP® Hand-Held Moisture and Temperature in Oil Meter MM70

North America

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CHAPTER 1

GENERAL INFORMATION

About This Manual

This manual provides information for installing, operating, and maintaining the product.

Product Related Safety Precautions

The MM70 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 with a wrist strap and a resistive connection cord to the equipment chassis before touching the boards. When neither of the above is possible, at least 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 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.

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CHAPTER 2
PRODUCT OVERVIEW AND MECHANICS

Vaisala´s Hand-held MM70 Device

MM70 consists of two main units: MI70 indicator and MMP78 probe. MM70 Hand-held humidity meter incorporates Vaisala's advanced HUMICAP technology which enables reliable and high performance moisture in oil measurement.

Vaisala MM70 is delivered with a factory calibration certificate.

Structure of the MI70 Indicator
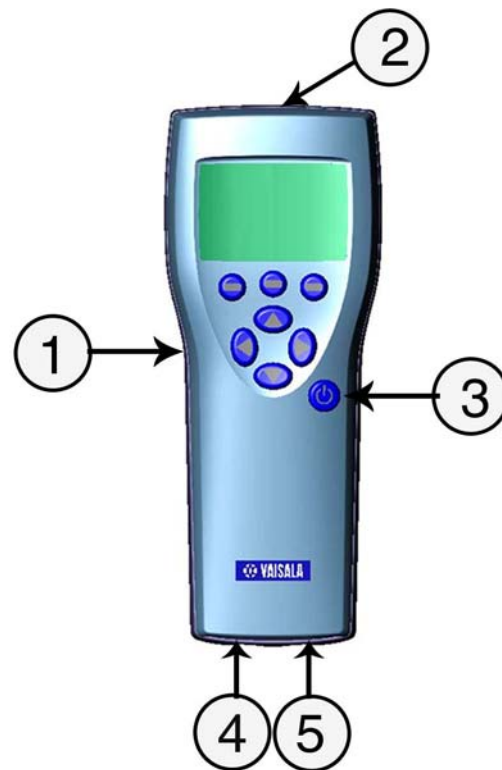
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Figure 1   MI Indicator

The following numbers refer to Figure 1 on page 10.

1   =   MI70 indicator
2   =   Recharger connector
3   =   Power On/Off key
4   =   Connector port for cable
5   =   Connector port for probe

Structure of the MMP78 Probe
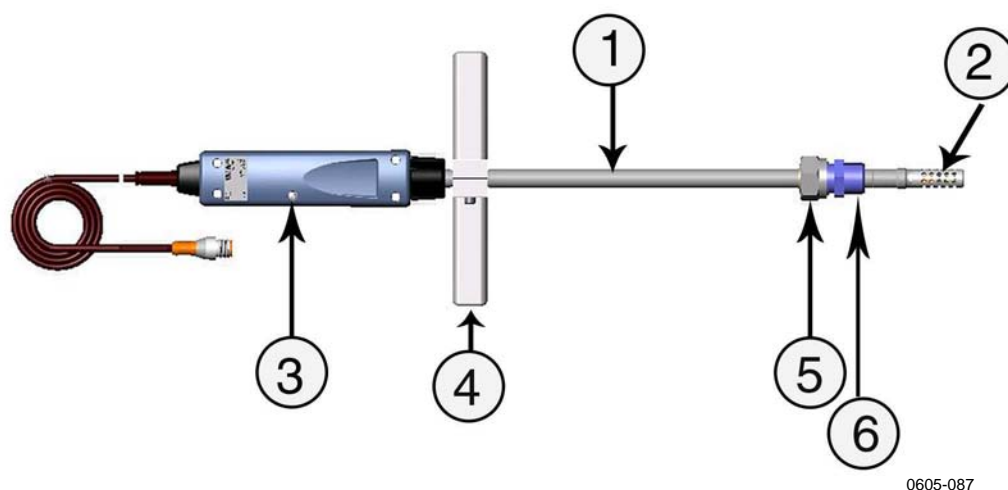
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Figure 2   MMP78 Probe

The following numbers refer to Figure 2 on page 11.

1   =   Probe MMP78. Rugged probe with a long stainless steel shaft.
2   =   Probe filter
3   =   Calibration button under the screw
4   =   Manual press tool
5   =   Clasp nut
6   =   Fitting body

Tools
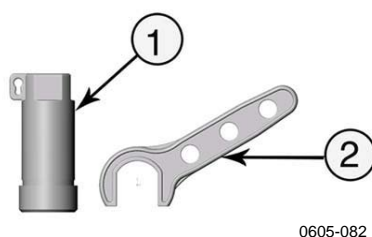
0605-082

Figure 3   Protecting Cap and Plastic Wrench

The following numbers refer to Figure 3 on page 11:

1   =   Protecting cap (including plastic wire for attaching the cap to the probe)
2   =   Plastic wrench

Display Parameters

- a_w: water activity
- T: temperature (°C/F)

Options

- carrying case for the indicator and the probe
- connection cables for the fixed transmitters: HMP228, MMT318, and MMT330.
- MI70 Link software kit. The software can be used for transferring recorded data to a PC using a serial line or a USB instrument cable. The MM70 readings can be easily monitored and examined direcly in a Windows environment on a PC display. The data can even be transferred further to a spreadsheet software (such as Microsoft Excel) for modification. The MI70 Link Software can be ordered from Vaisala. For more information, see section Options and Accessories Available on page 62.
- extension cable (10m)

CHAPTER 3

INSTALLATION AND MOUNTING OPTIONS

Installing and Recharging the Batteries

1. If you are using alkaline batteries, unscrew the back plate of the indicator and insert the alkalines. If MM70 is ordered with rechargeable battery, it is already in place as shipped from the factory.

2. Recharge the battery as follows: Plug in charger connector to the indicator. The plug is located at the top of the indicator, covered by rubber seal. Then connect the charger to wall socket. A battery symbol in the left corner of the display starts to roll.

3. It is not recommended to use MM70 during the first recharging. Later on MM70 can be used while recharging.

4. Duration of recharging depends on the charge level of the battery being 4 hours typical. The recommended first recharging time is 6 hours.

5. The battery is full when the battery symbol stops rolling.

6. Disconnect the charger.

Turning On the Device

1. Connect the probe to either one of the bottom connectors of the indicator. To ensure durable connection, screw the metal ring clockwise until it tightens up. (Respectively, when disconnecting the cable, first screw the metal ring counterclockwise until it loosens and then pull out the plug.)

2. Press the power on/off key.

3. Select the language by using the arrow up/down keys. Confirm by pressing the **SELECT** key. You can select the language later on, as well. For more information, see Selecting Language on page 27.

4. To change the date, select **Date** and press the **SET** key. Change the date by using any of the arrow keys: up/down/left/right. To confirm the date, press the **OK** key. The default date presentation format is: **year-month-date**. If you want to change the format, see Setting Date and Time on page 28.

5. To change the time, select **Time** and press the **SET** key. Change the time by using any of the arrow keys. To confirm the time, press the **OK** key. The default time presentation format is 24-hour clock. If you want to use 12-hour clock, select **12-hour clock**, and press the **On** key.

6. Press the **EXIT** key. To check and change the pressure setting, select **YES**. Otherwise select **NO**, basic display appears.

Installing the Probe

First select a place for the probe that simulates real conditions of the process. Oil should circulate freely around the sensor; a rapid oil flow is recommended. Install the probe directly into the circulation system and not into the oil reservoir because of deposition.It is recommended that the sensor head is installed directly in the process through the ball valve assembly. When the ball valve assembly is used, the pipe does not have to be emptied or shut down for installation or removal of the probe. Install the sensor head transversely against the direction of the process flow. Avoid installing into a bend in the pipe.

NOTE	Take care not to damage the pipe of the probe. If the pipe is damaged, the probe head is less tight and will not go through the clasp nut. Make sure that the filter is tightly fastened to protect the sensors..

Mounting the Probe for Pressurized Pipelines/Oils

Due to the sliding fit, the MMP78 is easy to install into and remove from the pressurized process. The probe is especially suitable for the

measurements in pipelines. The maximum installation pressure is 10 bar and the maximum operation pressure is 20 bar.

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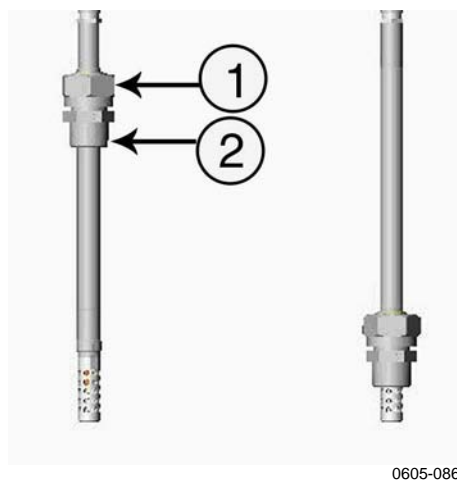
Figure 4   MMP78 Pipe Dimensions (in mm); 400 mm (adjustment range 340 mm)

The following numbers refer to Figure 4 on page 15.

1   =   Clasp nut, 27 mm hex nut)

2   =   Fitting body, 24 mm hex head

Tightening the Clasp Nut

1.   Adjust the probe to a suitable depth according to the type of installation and tighten the clasp nut first manually.

2.   Tighten the clasp nut first manually. Mark the fitting screw and the clasp nut. Tighten the nut a further 30 - 40° (ca.1/12" turn) with a plastic wrench. If you have a suitable torque spanner, tighten the nut to max 35±5 Nm (25±4 ft-lbs).

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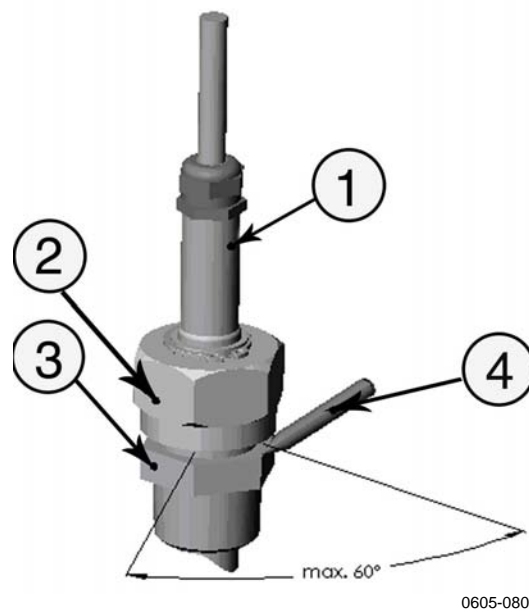
Figure 5   Tightening Clasp Nut

The following numbers refer to Figure 5 on page 16 above

1   =   Probe

2   =   Clasp nut

3   =   Fitting screw

4   =   Pen

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

When the probe is used in a pressurized processes the sensor head should preferebly be installed through a ball valve assembly.

```
fitting body
hex = 24 mm
tapered thread

sealing with:
1. LOCTITE®   No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock
the parts together. Therefore, use two fork spanners (hex 24 and
27 mm) for tightening and opening the clasp nut of the probe
                                                      0605-083
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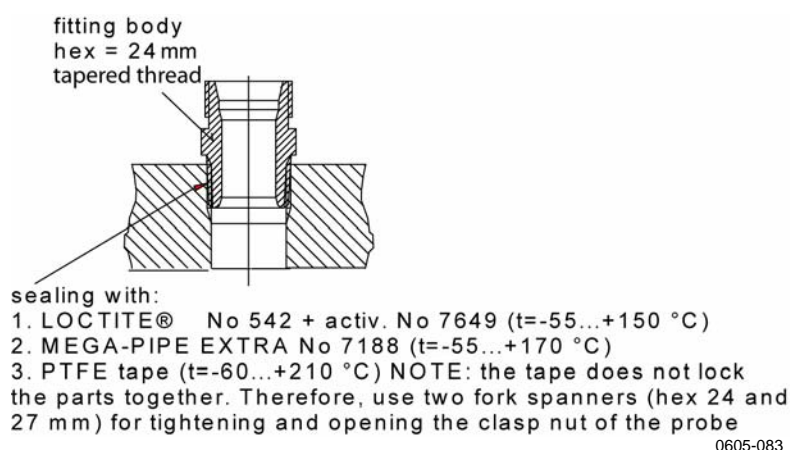
Figure 6   Sealing Thread Cutting for the Fitting Body

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

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.

Ball Valve Installation

The ball valve installation is preferred when connecting the probe to a pressurized process or pipeline. Use the Vaisala BALLVALVE-1 ball valve set or a 1/2" ball valve assembly with a ball hole of 14 mm or more. If you install the sensor head (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 tool 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.

3. Make sure that the temperature at the measurement point is equal to that of the process, otherwise the moisture reading may be incorrect.
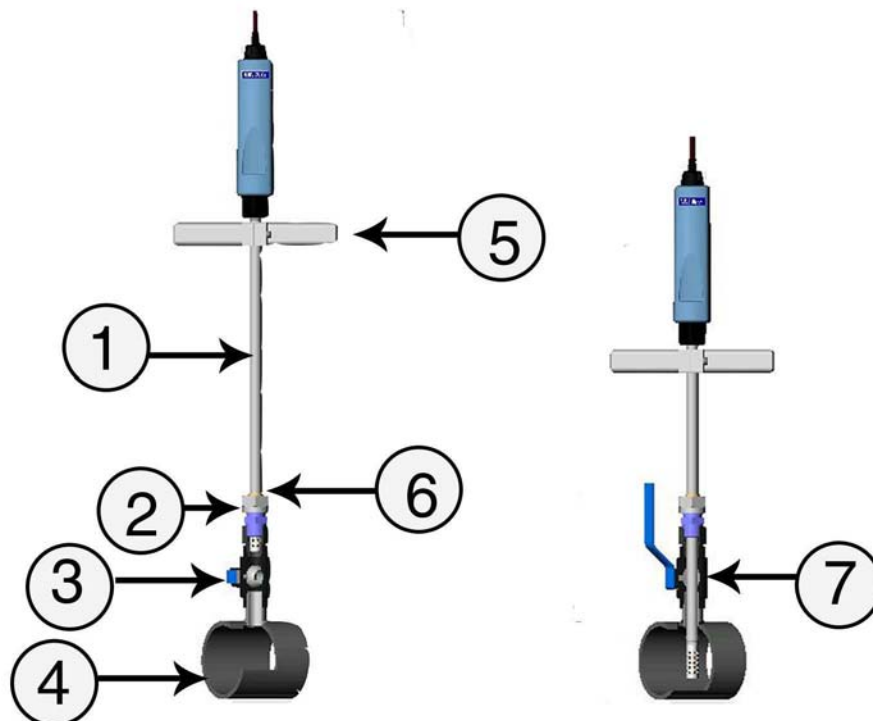
0605-085

Figure 7   Ball Valve Installation

The following numbes refer to Figure 7 on page 18 above.

1 = Probe

2 = Clasp nut. The probe slides easily in place when you first fix the clasp nut manually. Then complete the installation and make it stable by tightening the clasp nut with a plastic wrench. Do not overtighten the screw.

3 = Handle of the ball valve

4 = Process chamber/pipeline

5 = Manual press tool

6 = The groove on the probe indicates the upper adjustment limit

7 = Ball of the ball valve

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 for installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars.

Mounting the Probe for Direct Measurement (No Pressure)

1. Lift up the clasp nut, see picture below.

2. Install the probe into measuring position. When stopping the measurement, pull down the clasp nut to clean the probe or just wipe the probe with soft cloth.
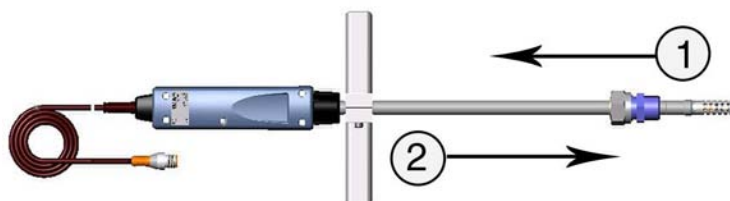
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Figure 8   Direct Mounting

The following numbers refer to Figure 8 on page 19 above:

1 = Lift up the clasp nut

2 = Pull down to clean the probe

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CHAPTER 4
MENU OPERATIONS AND SETTINGS

Function Keys and Menu Structure

Navigating in Menu

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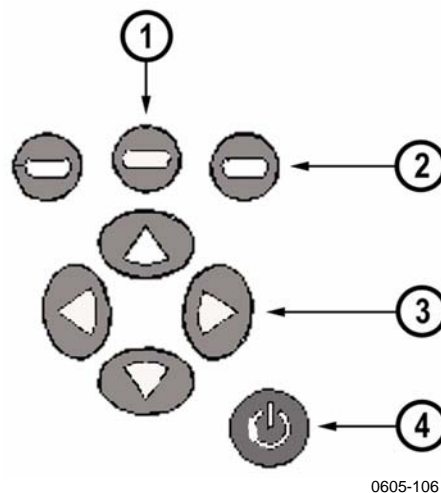
Figure 9   Keypad

The following numbers refer to Figure 9 on page 21 above:

1   =   To open the main menu, first press any of the arrow keys (3),
        then press the middlemost function key (1).

2   =   Function keys left/middle/right

3   =   Arrow keys up/down/left/right

4   =   Power On/Off key

- To turn the indicator on or off, press the power On/Off key.

- To open the main menu, press any of the arrow keys and then the middlemost function key in sequence.

- To move in a menu and select an option, press the up/down arrow keys. To enter sub-menu of selected option, press the right arrow key. To return to the previous menu level, press the left arrow key.

- To activate a function: Press a function key according to the guiding text below the key.

- To return to the basic display directly from any menu levels, press the function key **EXIT**.

Basic Display
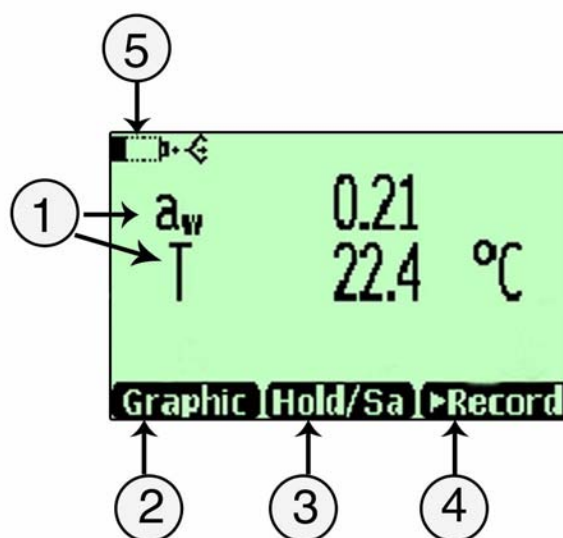
0709-119

Figure 10   Basic Display

The following numbers refer to Figure 10 on page 22 above.

1 = Selected quantities. You can select up to two quantities at a time, for example a_w: Water activity and T: Temperature (C/F).

2 = Function key **Graphic** changes display into curve mode.

3 = Function key **Hold/Save** freezes the display and you can save the reading into the memory.

4 = Function key **Record** is a quick access to the **Recording/Viewing** menu.

5 = Battery indicator. Shows current status (charge) of the battery.

Function keys are shortcuts to some functions or menus. Shortcuts for **Graphic**, **Hold/Save** and **Record** are preset at the factory. You can change these shortcuts by assigning the function keys to other functions or menus, as well. For more information on changing shortcuts, see Changing the Shorcut Keys on page28.

Graphical Display

Graphical display shows you the measurements in a form of curve. From the curve you can examine the data trend and history of the last minutes. Graphical display shows first the curve of the uppermost quantity shown in a basic display.

1. In the basic display, press the **Graphic** key. Alternatively you can open the **MENU**, and select **Display, Graphic history** with arrow keys. To view the graph, press the **SHOW** key.

2. Graphical display opens. For more information, see Graphical Display on page 23.

3. Press the **BACK** key to return to the previous menu level.

Main Menu

You can change settings and select functions in the menu.

1. Open the main menu by pressing any of the arrow keys.

2. Main menu consists of five menu groups: **Display**, **Functions**, **Recording/Viewing, Environment**, and **Settings**. Each group contains sub-menus and options of its own.

3. Move in the menus by using arrow up/down keys. Note that the basic display returns if you do not open anything in several seconds. If this happens, press any of the arrow keys to re-enter main menu.

4. Open a sub-menu with the right arrow key.

5. To return to the previous menu level, press the left arrow key.

6. To return to the basic display, press the **EXIT** key.

Settings

Display Settings
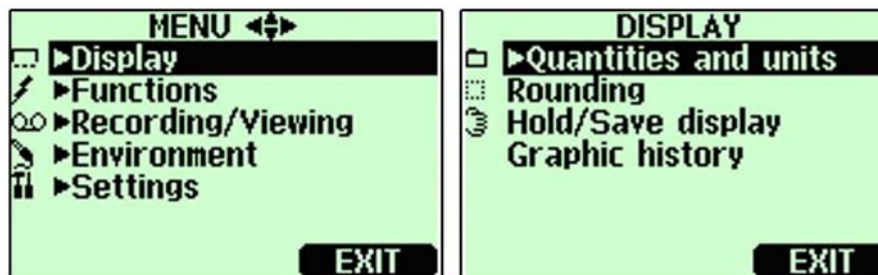
0605-102

Figure 11   **Display Setting Menus**

Quantities and Units

1.   Open the **MENU**. First press an arrow key, and then press the **OPEN** key.

2.   Select **Display**. Press the right arrow key.

3.   Select **Quantities and Units**. Press the right arrow key.

4.   Select the desired quantity with the up/down arrow keys and press the **SELECT** key.

5.   To change the unit, select the desired quantity with arrow keys and press the **UNIT** key.

6.   To hide a quantity, select the desired quantity with arrow keys and press the **HIDE** key.

7.   To return to the basic display, press the **EXIT** key.

8.   If you want to check environment settings, press the **YES** key (if requested), otherwise press the **NO** key.

Rounding

You can select one or two decimal display by using the **Rounding** function. The default setting is rounding off (=two decimal display).

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Display**. Press the right arrow key.

3. Select **Rounding**. Press the right arrow key.

4. To set rounding on (one decimal display), press the **ON** key. To set rounding off (two decimal display), press the **OFF** key.

5. To return to the basic display, press the **EXIT** key.

Hold/Save Display

Hold/Save function enables you to freeze a certain display reading. This reading can be saved into the memory.

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Display**. Press the right arrow key.

3. Select **Hold/Save**.

4. To freeze the display, press the **HOLD** key. The frozen measurement data is displayed.

5. To save the reading, press the **SAVE** key and then return to the basic display by pressing the **CANCEL** key.

6. You can save several readings with **HOLD-SAVE** function. The data points are indentified on the basis of the saving date and time. All the individual readings (data points) are stored in a same file marked with a Hand symbol. The file remains in the indicator memory even if the indicator is switched OFF.

7. To view the saved readings, press the function key, select **Record**, then select **View recorded data**, and press the right arrow key.

8. Select the file marked with the Hand symbol, press the right arrow key. Now you can see the saved data readings. Press the **TIMES** key to see the recording timestamps.

9. To return to the basic display, press the **EXIT** key.

Graphic History

Graphic history shows the data curve of the last hour. To see longer graphs, use the data recording function to save the data and then view it as a graph.

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Display**. Press the right arrow key.

3. Select **Graphic History**. To enter a graphical history display, press the **SHOW** key.

4. To get the statistical info on the graph area (minimum, maximum and mean values), press the **INFO** key.

5. To get the curve of the other selected quantities, press the **NEXT** key. To get the curves of the all quantities, press the **NEXT** key until the text **ALL** is displayed instead of **NEXT**. Then press the **ALL** key.

6. To zoom in the curve, press the up arrow key. To zoom out, press the down arrow key. To move the curve in horizontal directions, press the left/right arrow keys.

7. To return to the basic display, first press the **BACK** key, and then the **EXIT** key.

User Interface Settings

0605-117

Figure 12   User Interface Setting Menus

Selecting Language

You can select any of the following languages for a user interface language: English, German, French, Finnish, Spanish, Swedish, Chinese, Japanese or Russian.

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Settings**. Press the right arrow key.

3. Select **User Interface**. Press the right arrow key.

4. Select **Language**. Press the **SET** key.

5. Select the desired option. Press the **SELECT** key.

6. To return to the basic display, press the **EXIT** key.

If you accidentally select a wrong language, first return to the basic display by pressing the rightmost function key as many times as needed, then return to the language selection menu by pressing the following key string: First press the right arrow key, then the middlemost function key, the up arrow key, the right arrow key twice, and finally the middlemost function key.

Automatic Power Off

When shipped from factory, MM70 has a default setting which turns the power off automatically after 15 minutes of inactivity. This is to conserve the battery. In case you want to change the inactivity time setting to 5 or 30 minutes or turn off the function entirely, do as follows:

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Settings**. Press the right arrow key.

3. Select **User Interface**. Press the right arrow key.

4. Select **Auto Power off**. Press the **SET** key.

5. Select the desired option. Press the **SELECT** key.

6. To return to the basic display, press the **CANCEL** key and the **EXIT** key.

Changing the Shorcut Keys

As a default, the function keys are shortcuts to **Graphic**, **Hold/Save** and **Record** menus. The shortcuts can be changed to other locations to correspond your needs.
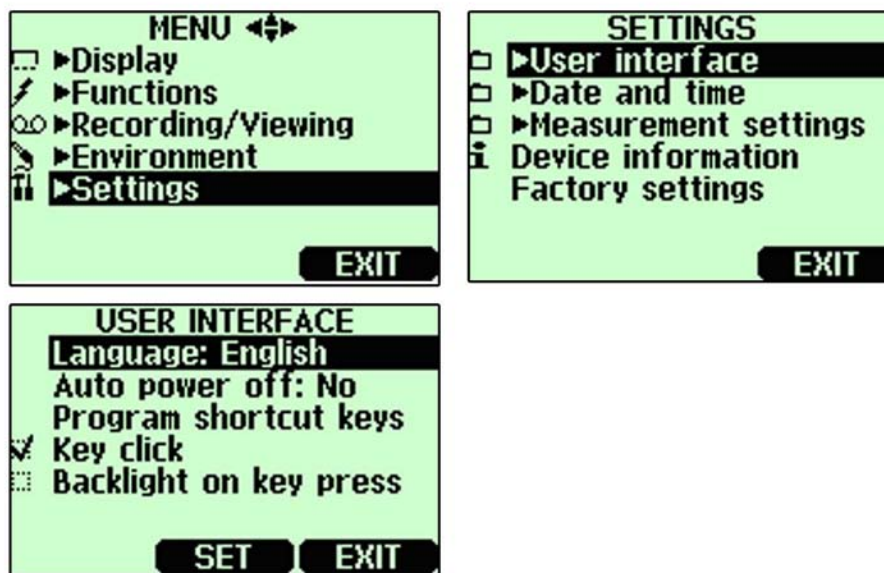
1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Settings**. Press the right arrow key.

3. Select **User Interface**, press the right arrow key.

4. Select **Program Shortcut Keys**, press the **START** key.

5. Press the shortcut key that you want to change. E.g. **Hold/Save**.

6. For example, if you want to replace the **Hold/Save** function with the **Alarm** function, press the middlemost function key, then select **Alarm** by using the arrow keys and press the **SELECT** key. Answer **YES** to confirm your selection. If you do not want to select **Alarm** after all, answer **NO** and continue from the step 4.

7. To return to the basic display, press the **EXIT** key.

Turning Key Click and Backlight On/Off

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Settings**. Press the right arrow key.

3. Select **User Interface**. Press the right arrow key..

4. To turn the key tones on/off, select Key Click and press the **ON/OFF** key.

5. To return to the basic display, press the **EXIT** key.

Setting Date and Time

To have correct date and time in recorded data files, set the date and the time as follows:

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Settings**. Press the right arrow key.

3.   Select **Date and Time**. Press the right arrow key.

4.   To change the date, select **Date** and press the **SET** key. Change the date by using arrow keys. To confirm the date, press the **OK** key. The default date presentation format is year-month-date, e.g. 2002-06-05. If you want to change the format, select **Date format**: **Y-M-D**, press the **SET** key, select either **D.M.Y** or **M/D/Y**, press the **SELECT** key.

5.   To change the time, select **Time** and press the **SET** key. Change the time by using arrow keys. To confirm the time, press the **OK** key. The default time presentation format is 24-hour clock. If you want to change the format, select **12-hour clock**. Press the **ON/OFF** key.

6.   To return to the basic display, press the **EXIT** key.

Device Information
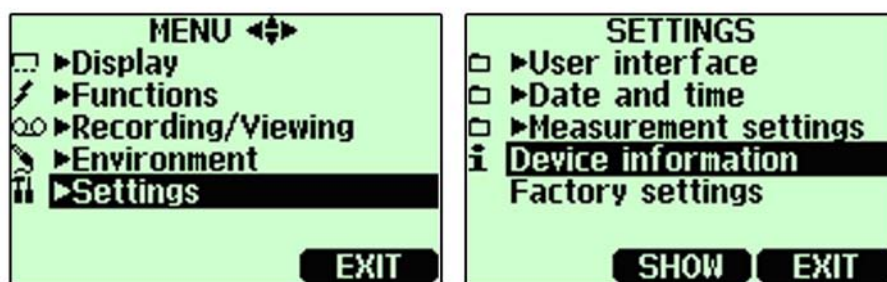
0605-098

Figure 13   Device Information Setting Menus

The basic information about the indicator and the probe is found as follows:

1.   Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2.   Select **Settings**. Press the right arrow key.

3.   Select **Device Information**. Press the **SHOW** key.

4.   Information on the MI70 Indicator is displayed. To enter Probe Information, press the **MORE** key.

5.   To return to the basic display, first press the **OK** key and then the **EXIT** key.

0605-099

Figure 14   Device Information Submenus

Restoring Factory Settings

Factory settings can be reverted to clear all changed settings and data memory of the indicator. Reverting factory settings does not effect on probe calibration.

1.   Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2.   Select **Settings**. Press the right arrow key.

3.   Select **Factory Settings**, press the **REVERT** key.

4.   Answer **YES** to confirm reverting.

5.   The power turns off automatically. When switching on again, the factory settings are reverted. You must set the language, date and time again. For more information, see Selecting Language on page 27 and Setting Date and Time on page 28.

Other Functions

Setting the Alarm Levels

0605-092

Figure 15   Alarm Function Menus

MM70 alarms by beeping and blinking the backlight. The alarm turns on when the measured value is not between the alarm limits (permitted area). Alarm level(s) can be set for only one quantity at a time. Set the alarm levels as follows:

1.   Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2.   Select **Functions**. Press the right arrow key.

3.   Select **Alarm**, press the right arrow key.

4.   Select **Quantity** and press the **SET** key to choose quantity.

5.   Select the desired quantity, press the **SELECT** key. (Only one quantity can be chosen at a time. Only active quantities can be selected. To change the active quantities, enter **MENU**, **Display**, **Quantities and units**).

6.   Select the first limit, press the **SET** key (if the alarm function is ON, take it OFF). Set the alarm level by using arrow keys. Press the **+/-** key to choose the sign of the alarm level. Press the **OK** key to save the setting.

7.   Select the second limit, then follow instructions in step 6. The alarm will go off when the upper limit is exceeded or when the lower limit is gone below. If you have only one limit, e.g. if you want to detect if the a_w reaches 0.9, set the upper limit to 0.9 and the lower limit so low that it never will be reached (for example 0). Thus, the MM70 will alert when RH rises above 0.9 a_w.

8.   Select **Alarm ON/OFF**, press the **ON** key to activate the alarm and return back to the basic display.

9.   A note symbol appears on the upper left corner.

10.   When the alarm level is reached, you can stop alarming by pressing   the **OK** key. To reactivate the alarm function, answer **YES**. To stop the alarm function completely, answer **NO**.

NOTE	The alarm is not in function when the device is turned off. Remember to turn off the automatic power off, see Automatic Power Off on page 27.

Selecting and Scaling the Analog Output
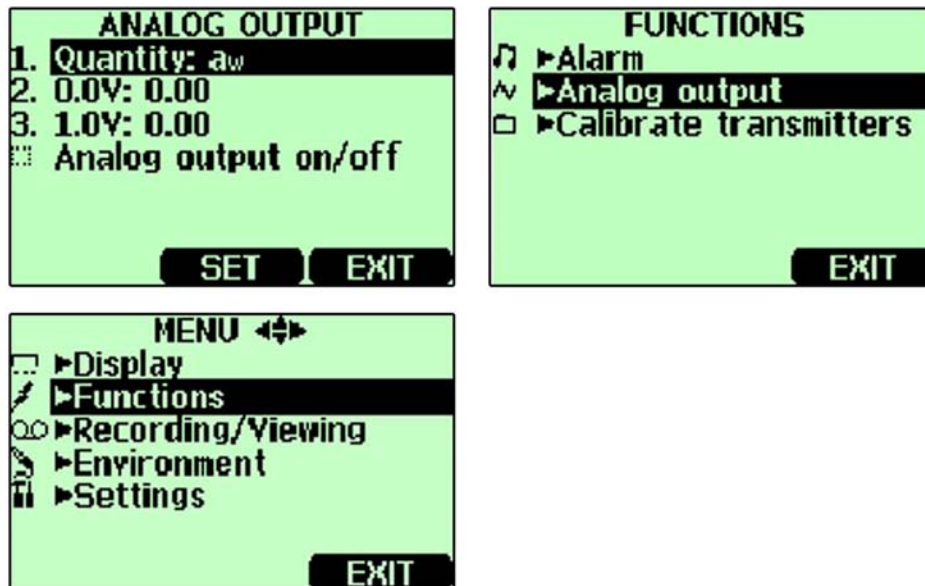
0605-093

Figure 16   Analog Output Menus

To get analog measurement data, you need the analog output signal cable, see section Options and Accessories Available on page 62. One voltage signal channel 0...1.0V can be scaled for the selected quantity.

1. Connect the analog output signal cable connector to the indicator base connector. Connect the screw terminal block as follows:

    - Brown wire: Common wire (-)

    - Yellow-green wire: Signal (+)

2. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

3. Select **Functions**. Press the right arrow key.

4. Select **Analog output**, press the right arrow key.

5. Select **Quantity** and press the **SET** key to choose quantity.

6. Select quantity, press the **SELECT** key. (Only one quantity can be chosen at a time. Only active quantities can be selected. To change the active quantities, enter **MENU**, **Display**, **Quantities and units**).

7. Select **0.0 V** to set the value for the 0.0 V output signal, press the **SET** key (if the analog output is ON, turn it OFF). Set the low value by using the arrow keys. Press the **+/-** key to choose the sign of the value. Press the **OK** key to save the setting.

8. Select **1.0 V** to set the value for the 1.0 V output signal, press the **SET** key. Set the high value by using the arrow keys. Press the **+/-** key to choose the sign of the value. Press the **OK** key to save the setting. Select **Analog output on/off**, press the **ON** key to activate the analog output and return to the basic display.

9. A wave sign appears on the upper left corner of the basic display.

10. To deactivate the analog output function, enter **MENU**; **Functions**, **Analog output**, **Analog output on/off** and press the **OFF** key.

Taking Measurements

When you start to use the MM70 for the first time, see Chapter 3, INSTALLATION AND MOUNTING OPTIONS , on page 13. Otherwise follow the instructions below.

1. Connect the probe to MI70 indicator.

2. Press the power On/Off key.

3. Install the probe to the measuring position. When measuring in pressurized processes, see the instructions in the Chapter 3 Mounting the Probe for Pressurized Pipelines/Oils on page 14.

4. The basic display opens, let the reading stabilize.

| **CAUTION** | If you need to disconnect the probe from the indicator, first press the power On/Off key to turn the indicator OFF. This ensures that all settings and data are saved properly. |

Measuring Other Parameters Simultaneously

The MI70 indicator is a generic indicator that can be used with Vaisala interchangeable humidity (HMP), dewpoint (DMP) and carbon dioxide (GMP) probes. Two different probes can be used simultaneously.

1. Turn off the device.

2. Connect the DMP70/GMP70/HMP70 probe to the other connector port in the bottom of the indicator.

3. Turn on the device.

4. Check that the pressure settings of the probes (port I and II) are the same, if you are taking measurements from the same condition.

5. The display shows now the reading of the port I probe in the upper row(s) and the reading of the port II in the lower row(s).

Recording Data

Recording
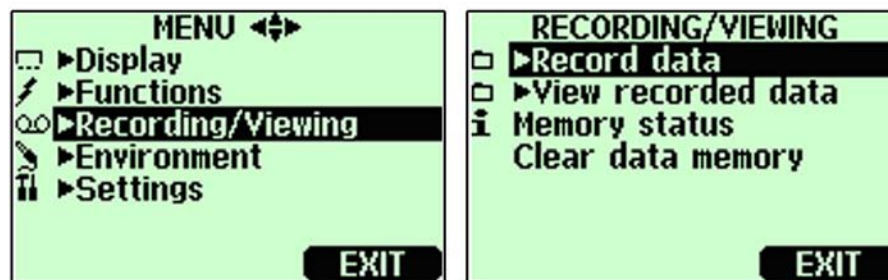
0605-113

Figure 17   Record and View Menu

1. Press the **RECORD** key. Alternatively open the **MENU**, select **Recording/Viewing**.

2. Select **Record data**, press the right arrow key.

3. To change interval, select **Interval** and press the **SET** key.

4. Select the measurement interval with the up/down arrow keys. Measurement intervals and maximum recording times are shown in the Table 1 on page 35.

5. Press the **SELECT** key.

6. To set recording duration, select **Duration** and press the **SET** key.

7. Select the recording duration (**1 min, 5 min, 15 min, 30 min, 1 h, 3 h, 12 h, 24 h, 7 days, 30 days, Memory full**). Make the selection with the arrow keys and finally press the **SELECT** key.

8. Start recording: Select **Start/Stop recording**, press the **START** key. If you choose **Memory full** option, you will see the maximum recording time on the display. You can also delete files in order to empty the memory. Press the **START** key again to accept maximum recording time.

9. You can switch the MM70 off during recording to save battery. Display message informs you that recording continues undisturbingly even when power is off. If the indicator is switched off during recording, the progress bar is shown on the display every 10 seconds (all the time, if charger is connected). This bar shows the amount of recorded data.

CAUTION	Do not disconnect the probe when the data recording is on, even if the indicator is off. This may cause loss of recorded data.

Table 1   Measurement Intervals and Max. Recording Times

Recording Interval	Maximum Recording Time (memory full)		
	1 Quantity	2 Quantities	3 Quantities
1 s	45 min	22 min	15 min
5 s	3 h	113 h	75 min
15 s	11 h	5 h	3 h
30 s	22 h	11 h	7 h
1 min	45 h	22 h	15 h
5 min	9 days	4 days	3 days
15 min	28 days	14 days	9 days
30 min	56 days	28 days	18 days
1 h	113 days	56 days	37 days
3 h	339 days	169 days	112 days
12 h	1359 days	678 days	451 days

Stopping Recording

1. To stop recording, press the function key. Select **Record**, **Record data** and press the right arrow key. Then select **Start/Stop recording** and finally press the **STOP** key. .

2. Now you can view the recorded file by pressing the **SHOW** key.

3. Select the measurement interval with the arrow keys. Measurement intervals and maximum recording times are shown in the Table 1 above.

4. You can save individual measurement data points with **Hold/Save** function. For more information, see section Hold/Save Display on page 25.

Viewing Recorded Data

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Recording/Viewing**. Press the right arrow key.

3. Select **View recorded data.** Press the right arrow key.

4. Select the file that you want to view, press the right arrow key. The files are identified according to the starting date and time of recording.

5. To view the graphical view, first press the **GRAPH** key, then press the **TIMES** until the recording time stamps are displayed. You can return to the recorded values by pressing the **VALUES** key.

6. To return to the basic display, press the **EXIT** key.

Checking the Memory Status

You can check how much there is free space in the memory.

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Recording/Viewing**. Press the right arrow key.

3. Select **Memory Status.** Press the **SHOW** key to view the amount of memory in use and the estimated free space left.

4. To return to the basic display, press the **OK** and **EXIT** keys.

Note that estimate of free space is calculated for current number of active quantities. If you change the displayed quantities, the estimate will change.

Deleting All Recorded Files

The data memory can be cleared as follows:

1. Open the **MENU**. First press the right arrow key, and then press the **OPEN** key.

2. Select **Recording/Viewing**. Press the right arrow key.

3. Select **Clear data memory.** Press the **CLEAR** key, and answer **YES** to confirm deletion of all recorded data files.

4. To return to the basic display, press the **EXIT** key.

Transferring Recorded Data to PC

The recorded data can be transferred to a PC using the MI70 Link program. The MI70 Link program can be ordered from Vaisala, see section Accessories on page 107. You can examine the recorded data easily in the Microsoft Windows® environment and transfer it further on a spreadsheet program, such as, Microsoft Excel® for modifications. Together with the USB instrument cable (optional accessory 219687) or the serial connection cable it is easy to transfer logged and real time measurement data from the MM70 to a PC.

When using the USB cable consider the following: the MI70 Link program contains the driver needed for the USB connection. For the system requirements and installation, see the back of the installation CD. Follow the installation instructions on the CD. Check that the USB cable is not connected. The MI70 Link Setup Wizard will install Vaisala MI70 Link on your computer. Installing the USB instrument driver can take a few minutes. After the installation is finished, connect the USB cable to the USB port on your PC. Windows will detect the new device, and use the driver automatically.

You can now start monitoring the MM70 readings in real time with a PC using the MI70 Link program. In case the MI70 Link cannot find the instrument, check the following:

- the MM70 is switched on

- the USB instrument cable/serial connection cable is properly connected to the USB/serial port of your PC

- another application has not reserved the connection

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CHAPTER 5

CALIBRATION AND ADJUSTMENT

General Notes about Calibration and Adjustment of Transmitters

Using MM70 in Checking and Adjusting

Vaisala´s HMP228, MMT318 and MMT330 series transmitters can be calibrated and adjusted by using MM70.

- In the field: Check and adjust a fixed transmitter´s reading against MM70´s calibrated reference probe.

- One or two point calibrations and adjustments can be done by using a MI70 indicator and Vaisala´s humidity calibrator HMK15.

Using Calibration Cables

For calibration and adjustment connect MM70 to fixed transmitter by using one of the following connection cables.

- 27159ZZ connection cable for HMP228 transmitters

- DRW216050 connection cable for MMT318 transmitters.

- 211339 connection cable for MMT330 transmitters.

Calibration and Adjustment of HMP228 Series Transmitters

You can check all the parameters a_w, T and RH, but only RH can be adjusted. You can calibrate your transmitter against a calibrated reference probe of MM70 or against a calibrator's reference humidity by using MI70 indicator in communication. Follow the first 12 steps and continue according to the chosen calibration method.

1. Connect the 27159ZZ-calibration cable to the **X5** connector of the HMP228-series transmitter (X5 connector = 6-pin connector on the left side of the motherboard).

2. Connect the other end of the calibration cable to either of the MM70´s connector port located on the bottom of the indicator, see Figure 1 on page 10.

3. Turn on the MM70.

4. Open the **MENU**. First press the right arrow key, then press the **OPEN** key.

5. Select **Functions**. Press the right arrow key.

6. Select **Calibrate transmitters**. Press the right arrow key.

7. Select **1.Baud rate** and **2.Serial format**. Press the **SET** key to change the serial settings. Serial settings of HMP228 and MM70 should be the same. (HMP228 factory serial settings: 4800, 7, even 1).

8. Select **3.Start calibration**, press the **START** key. If the serial settings of MM70 are not compatible with the settings of HMP228, or the cable connection is not working, ensure that the serial settings of HMP228 and the settings of MM70 are the same. Check the cable connection. Then retry connection in step 6.

9. After connection has been established, start the calibration/adjustment by pressing the **OK** key.

10. Select the quantity to check (a_w/T/RH) or to adjust (RH), press the **SELECT** key.

11. Check the environment settings of MM70 probe, if needed. Press the **YES** or **NO** key.

12. The first row shows the reading of the probe/transmitter connected to the port I, the second row shows the reading of the probe/transmitter connected to the port II. The third row RH is the difference between the readings of the ports.
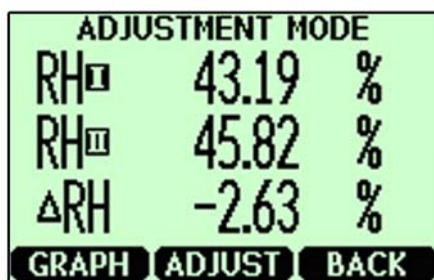
0605-091

Figure 18   Adjustment Mode

Relative Humidity Adjustment by Using a Calibrated Reference Probe

When using this adjustment method, start with the steps 1 through 12 on the previous page. Then proceed as follows:

1.   Ensure that the probes are located in the same conditions.

2.   Wait until the readings have stabilized. If the difference between the humidity readings is less than 2 % RH, there is no immediate need for adjustment.

3.   Adjust the transmitter reading to correspond a reading of the reference probe by pressing the **ADJUST** key.

4.   Select **To same as RH**$_{I/II}$. Press the **SELECT** key.

5.   Confirm by pressing the **YES** key.

6.   To return to the basic display, first press the **BACK** key, then the **EXIT** key twice.

1-point Relative Humidity Adjustment by Using a Calibrator

You can use Vaisala humidity calibrator HMK15 to achieve the reference humidities. MI70 indicator is working as a communicator in the calibration procedure. When using this adjustment method, start with the steps 1 through 12 on the previous page. Then proceed as follows:

1.   Insert the transmitter probe to the reference humidity.

2.   Press the **ADJUST** key.

3.   Select 1-point adjustment. Press the **SELECT** key.

4.   Wait until the reading is stabilized (takes about 30 minutes).
      You can follow the stabilization from the graph display, by
      pressing the **GRAPH** key.

5.   Press the **READY** key when the value is stabilized in the
      reference humidity.

6.   Enter the correct humidity value by using the arrow keys. Press
      the **OK** key.

7.   Confirm by pressing the **YES** key.

8.   To return to the basic display, first press the **BACK** key, then
      the **EXIT** key twice.

2-point Relative Humidity Adjustment by Using a Calibrator

You can use Vaisala humidity calibrator HMK15 in calibration and
adjustment. Note that the difference between the two reference
humidities should be at least 50%. MI70 indicator is working as a
communicator in the calibration procedure. When using this
adjustment method, start with the steps 1 through 12 in the section
Calibration and Adjustment of HMP228 Series Transmitters on page
40. Then proceed as follows:

1.   Insert the transmitter probe to the first reference humidity.

2.   Press the **ADJUST** key.

3.   Select 2-point adjustment. Press the **SELECT** key.

4.   Wait until the reading is stabilized (takes about 30 minutes).
      You can follow the stabilization from the graph display, by
      pressing the **GRAPH** key.

5.   Press the **READY** key when the value is stabilized in the first
      reference humidity.

6.   Enter the first referenc humidity value by using the arrow keys.
      Press the **OK** key.

7.   Insert the transmitter probe to the second reference humidity.

8.   Wait until the reading is stabilized (takes about 30 minutes or
      more). You can follow the stabilization from the graph display,
      by pressing the **GRAPH** key.

9.   Press the **READY** key when the value is stabilized in the second
      reference humidity.

10. Enter the second reference humidity value by using the arrow keys. Press the **OK** key.

11. Confirm by pressing the **YES** key.

12. To return to the basic display, first press the **BACK** key, then the **EXIT** key twice.

Calibration and Adjustment of MMT318 Transmitters

You can check and adjust MMT318 transmitter reading against a calibrated reference probe of MMP78 or against another reference condition by using MI70 indicator in communication. Follow the first 4 steps and continue according to the chosen calibration method.

1. Connect the DRW216050-calibration cable between the screw terminal connector of the MMT318 transmitter and the MI70 indicator.

2. Turn on MM70.

   - In case you use a MMP78 probe as a reference: The reading of the transmitter is shown on the first or middle row of the display, depending on the connector port to which the calibration cable is connected. Value of the port I is shown on the upper row of the display and the value of the port II on the lower row of the display. Difference of the readings is shown on the lowest row.

   - In case MI70 is used as an display, the reading of the MMT318 transmitter is shown on the display.

3. Remove the MMI318 transmitter unit from the mounting plate and press the adjustment key once. Now MI70 is starting the **Adjustment mode**.

4. Press the **OK** key to start adjustment.

Field Checking and Adjustment by Using a Calibrated Reference Probe

When using this adjustment method, start with the steps 1 through 4 in the section Calibration and Adjustment of MMT318 Transmitters on page 43. Then proceed as follows:

1. Select a_w, RH, T or H_2O (H_2O can only be checked, not adjusted). Press the **SELECT** key.

2. Check that the probes are located in equal conditions and wait until the readings are stabilized (can take 30 minutes or more). If you are near the probes, do not breathe towards them.

3. To continue adjusting, press the **ADJUST** key.

4. Select **To same as...** Press the **SELECT** key. (MI70 always recognizes the port to which the MMP70-series probe is connected.)

5. Confirm by pressing the **YES** key.

6. Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

7. Switch off the MI70 and detach the calibration cable.

1-point Adjustment by Using a Calibrator

When adjusting a transmitter only in one reference condition, take care that the reference condition represents well the measuring environment.

If you use humidity calibrator HMK15, use the adapter fitting (13.5 mm) on the measurement hole.

When using this adjustment method, start with the steps 1 through 4 in the section Calibration and Adjustment of MMT318 Transmitters on page 43. Then proceed as follows:

1. Select the quantity and press the **SELECT** key.

2. Remove the filter from the transmitter´s probe and insert the probe head into the reference condition.

3. To continue adjusting, press the **ADJUST** key.

4. Select **1-point adjustment**, press the **SELECT** key.

5. Press the **READY** key when the reading is stabilized in the reference condition (takes about 30 minutes or more). You can follow the stabilization from the graph display, by pressing the **GRAPH** key.

6. Enter correct reference value by using the arrow keys. Press the **OK** key.

7. Confirm by pressing the **YES** key.

8. Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

9. Detach the calibration cable.

2-point Adjustment by Using a Calibrator

If you use humidity calibrator HMK15, use the adapter fitting (13.5 mm) on the measurement hole.

When using this adjustment method, start with the steps 1 through 4 in the section Calibration and Adjustment of MMT318 Transmitters on page 43. Then proceed as follows:

1. Select the quantity and press the **SELECT** key.

2. Remove the filter from the transmitter´s probe and insert the probe head into the reference condition.

3. To continue adjusting, press the **ADJUST** key.

4. Select **2-point adjustment**, press the **SELECT** key.

5. Press the **READY** key when the reading is stabilized in the reference condition (takes about 30 minutes or more).

6. Enter correct reference value by using the arrow keys. Press the **OK** key.

7. Remove the probe and insert the probe head into the second reference condition. You can follow the stabilization from the graph display, by pressing the **GRAPH** key.

8. Press the **READY** key when the reading is stabilized in the second reference condition.

9. Enter the higher reference humidity value by using the arrow keys. Press the **OK** key.

10. Confirm the adjustment by pressing the **YES** key. (By pressing the NO key you will return to adjustment mode display and no changes are made.) Note that if the difference between two references is less than 50%, adjustment cannot be done.

11. Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

12. Detach the calibration cable.

Calibration and Adjustment of MMT330 Transmitters

You can check and adjust MMT330 transmitter reading against a calibrated reference probe of MMP78 or against another reference condition by using MI70 indicator in communication. Follow the first 4 steps and continue according to the chosen calibration method.

1. Connect the 211339-connection cable between the service port of the MMT330 transmitter and the bottom connector of the MI70 indicator. To ensure durable connection, screw the metal ring (located at the round end of the cable) clockwise until it tightens up. (Respectively, when disconnecting the cable, first screw the metal ring counterclockwise until it loosens and then pull out the plug.)

2. Turn on the indicator.

    -   In case you use a MMP78 probe as a reference: The reading of the transmitter is shown on the first or middle row of the display, depending on the connector port to which the calibration cable is connected. Value of the port I is shown on the upper row of the display and the value of the port II on the lower row of the display. Difference of the readings is shown on the lowest row.

    -   In case MI70 is used as an display (without its own probe), the reading of the MMT330 transmitter is shown on the display.

3. Remove the MMI330 transmitter unit from the mounting plate and press the adjustment key once. Adjustment key is located at the mother board of the transmitter. Now MI70 is starting the **Adjustment mode**.

4. Press the **OK** key to start adjustment.

Field Checking and Adjustment by Using a Calibrated Reference Probe

When using this adjustment method, start with the steps 1 through 4 in the section Calibration and Adjustment of MMT330 Transmitters on page 46. Then proceed as follows:

1. Select a_w, RH, T or H_2O (H_2O can only be checked, not adjusted). Press the **SELECT** key.

2. Check that the probes are located in equal conditions and wait until the readings are stabilized (can take 30 minutes or more). If you are near the probes, do not breathe towards them.

3. To continue adjusting, press the **ADJUST** key.

4. Select **To same as...**. Press the **SELECT** key. (MI70 always recognizes the port to which the MMP70-series probe is connected.)

5. Confirm by pressing the **YES** key.

6. Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

7. Switch off the MI70 and detach the calibration cable.

1-point Adjustment by Using a Calibrator

When adjusting a transmitter only in one reference condition, take care that the reference condition represents well the measuring environment.

When using this adjustment method, start with the steps 1 through 4 in the Calibration and Adjustment of MMT318 Transmitters on page 43. Then proceed as follows:

1. Select the quantity and press the **SELECT** key.

2. Remove the filter from the transmitter´s probe and insert the probe head into the reference condition.

3. To continue adjusting, press the **ADJUST** key.

4. Select **1-point adjustment**, press the **SELECT** key.

5. Press the **READY** key when the reading is stabilized in the reference condition (takes about 30 minutes or more). You can follow the stabilization from the graph display, by pressing the **GRAPH** key.

6. Enter correct reference value by using the arrow keys. Press the **OK** key.

7. Confirm by pressing the **YES** key.

8. Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

9. Detach the calibration cable.

2-point Adjustment by Using a Calibrator

When using this adjustment method, start with the steps 1 through 4 in the section Calibration and Adjustment of MMT330 Transmitters on page 46. Then proceed as follows:

1.   Select the quantity and press the **SELECT** key.

2.   Remove the filter from the transmitter´s probe and insert the probe head into the reference condition.

3.   To continue adjusting, press the **ADJUST** key.

4.   Select **2-point adjustment**, press the **SELECT** key.

5.   Press the **READY** key when the reading is stabilized in the reference condition (takes about 30 minutes or more).

6.   Enter correct reference value by using the arrow keys. Press the **OK** key.

7.   Remove the probe and insert the probe head into the second reference condition. You can follow the stabilization from the graph display, by pressing the **GRAPH** key.

8.   Press the **READY** key when the reading is stabilized in the second reference condition.

9.   Enter the higher reference value by using the arrow keys. Press the **OK** key.

10.   Confirm the adjustment by pressing the **YES** key. (By pressing the **NO** key you will return to adjustment mode display and no changes are made.) Note that if the difference between two references is less than 50%, adjustment cannot be done.

11.   Adjustment is done. To return to the basic display, first press the **BACK** key, then the **EXIT** key.

12.   Detach the calibration cable.

Calibration and Adjustment of MM70 Series Probes

General about Calibrations

The MM70 is fully calibrated as shipped from factory. Adjustment should be done if there is a reason to believe that device is not within the accuracy specifications. The recommended calibration interval is one year.

It is recommended to send the device to Vaisala Service Centre for calibration and adjustment, see contact information in section Vaisala Service Centers on page 57. Alternatively, user can calibrate and adjust MM70 by following the instructions below.

Preparations before the Calibration

Before calibration the used sensor should be cleaned with instrument air to blow out existing oil or gently first flush with hepthane (C7H16) and dry with instrument air. This is to decrease response time and to prevent contamination of the salt bath and change of the reference condition. See Chapter 6, MAINTENANCE, on page 55.

NOTE	It is important to clean the sensor before calibration as the dirty sensor can contamine the salt bath and change the reference condition.

When using Vaisala humidity calibrator HMK15, use the adapter fitting (13.5 mm hole). Before starting the adjustment mode, take out the screw vovering the calibration button (item 3 in Figure 2). See Figure 2 on page 11.

Relative Humidity Adjustment

Li-Cl-NaCl Automatic Adjustment

LiCl-NaCl automatic adjustment is a two-point adjustment in reference humidities of 11.3 % (LiCl) and 75 % (NaCl). You don't

have to feed the reference values, the MM70 displays the accurate value based on the measured temperature and the Greenspan table stored into the memory of the MM70. Make the adjustment as instructed in the section below (select **LiCl-NaCl autom.** on item 8 and follow the display instructions).

2-point Adjustment

Low humidity references 0 % (Nitrogen)/ 11.3 % (LiCl) and higher humidity references 75 % (NaCl)/ 97 % (K2SO4) are recommended for two-point adjustment. Ensure that the difference between the humidity references is more than 50 %.

1. When adjusting both relative humidity and temperature, please make the temperature adjustment first.

2. Check that the MM70 is switched on.

3. Take out the screw from the probe handle to expose the calibration button. Press the button with a small screwdriver. When pressing the button, indicator turns to adjusting mode.

4. Press the **OK** key to start the adjustment mode.

5. Select **RH**, press the **SELECT** key.

6. To check the environmental settings, press the **YES** key. To continue directly to adjustment mode, press the **NO** key.

7. Now the adjustment mode is on, press the **ADJUST** key to select the adjustment method.

8. Select **2-point adjustment**, press the **SELECT** key. Press the **OK** key to continue.

9. Set the probe to a lower reference relative humidity. If using HMK15 calibrator, use the adapter fitting (13.5 mm hole).

10. You can follow the stabilization from the graph display, by pressing the **GRAPH** key. When the reading is stabilized, press the **READY** key.

11. Enter value for the lower reference humidity by using the arrow keys. Press the **OK** key.

12. Set the probe to the higher reference humidity. You can follow the stabilization from the graph display, by pressing the **GRAPH** key. When the reading is stabilized, press the **READY** key.

13. Enter value for the higher reference humidity by using the arrow keys. Press the **OK** key.

14. Confirm the adjustment, press the **YES** key (by pressing the **NO** key you return to adjustment mode display and no changes are made). If the difference between two references is less than 50 %, adjustment can not be done.

15. Adjustment is done. To return to the basic display, first press the **BACK** key, then press the **EXIT** key.

16. Replace the screw onto calibration key.

You can attach a sticker on the calibration key screw to seal the calibration.

1-point Adjustment

Usually it is recommended to make an adjustment in two reference humidities. If adjustment is done by using one reference humidity (1-point adjustment), select the reference humidity so that it represents the measuring environment. Make the adjustment in one point as instructed in the previous section "2-point Adjustment" (select **1-point adjustment** and follow the display instructions).

Temperature Adjustment

Temperature adjustment in one or two points can be done if there is reason to believe that the adjustment is changed. If adjustment is done only in one point, reference condition shall represent the measuring environment.

1. Take out the screw covering the calibration button (in the probe handle).

2. Press the calibration key. For pressing, use tool with thin and sharp point, such as small screwdriver. When pressing the key, indicator turns to adjusting mode.

3. Select **T**, press the **SELECT** key.

4. Now the adjustment mode is on, press the **ADJUST** key to select the adjustment method: **1-point adjustment** or **2-point adjustment**.

1-point Adjustment

When using this adjustment method, start with the steps 1 through 4 in the previous section Temperature Adjustment on page 51. Then proceed as follows.

1. Select **1-point adjustment**, press the **SELECT** key.

2. Set the probe to a reference temperature. You can follow the stabilization from the graph display. Press the **READY** key when the reading is stabilized in the reference.

3. Enter value for reference temperature by using the arrow keys. Press the **OK** key.

4. Confirm the adjustment, press the **YES** key. (By pressing the **NO** key you will return to adjustment mode display and no changes are made.)

5. Calibration is done. To return to the basic display, first press the **BACK** key and then press the **EXIT** key.

2-point Adjustment

When using this adjustment method, start with the steps 1 through 4 in the previous section Temperature Adjustment on page 51. Then proceed as follows.

1. Select **2-point adjustment**, press the **SELECT** key.

2. Set the probe to a lower reference temperature. You can follow the stabilization from the graph display.

3. Press the **READY** key when the reading is stabilized.

4. Enter value for the lower reference temperature by using the arrow keys. Press the **OK** key.

5. Set the probe to the higher reference temperature. You can follow the stabilization from the graph display. Press the **READY** key when the reading is stabilized.

6. Enter value for the higher reference temperature by using the arrow keys. Press the **OK** key.

7. Confirm the adjustment, press the **YES** key. (By pressing the **NO** key you will return to adjustment mode display and no changes are made.) If the difference between two references is less than 30° C, adjustment cannot be made.

8. Calibration is done. To return to the basic display, first press the **BACK** key and then press the **EXIT** key.

Last Adjustment Date

To see the last adjustment date, select **Last adjustment date**. You can check this date also from the Device information. For more information, see section Device Information on page 29.

Error Messages

If MM70 displays an error message, first check that the sensor is connected properly and let the probe dry if there is condensed water in the probe.

In case of constant error, please contact Vaisala Service Center. For more information, see section Vaisala Service Centers on page 57.

Error Message Types

Eeprom read/write error

ADC malfunction

Operating voltage out of range

Analog voltage out of range

Temperature/humidity sensor open/short circuit

Temperature sensor current leak

Temperature/humidity measurement malfunction

Temperature value out of range
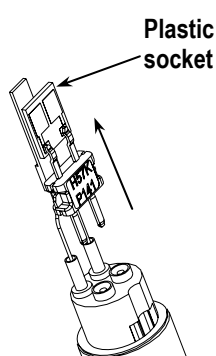
Relative humidity value out of range

Sensor not found

Amplifier chain malfunction

CHAPTER 6
MAINTENANCE

Changing the Filter and Sensor

Plastic socket

1. Screw out the filter from the probe head, see Figure 2 on page 11.

2. Remove the damaged sensor by pulling it out. Handle the sensor by the plastic socket.

3. Insert a new sensor.

4. Make a humidity calibration.

5. Screw a new filter on the probe head, take care to tighten the filter properly (5.1 Nm).

Cleaning the Sensor

Make sure to clean the sensor before calibration and storing the MMP78 probe. For cleaning of the probe you need instrument air and heptane liquid. Dry with instrument air to prevent oxidation of the sensor. The oxidation of 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.

Changing the Battery

A new rechargeable battery pack can be ordered from Vaisala. Change the battery pack as follows:

1. Open the back plate of the indicator by opening the screw of the back plate.

2. Remove the old battery pack. Detach the black connector by gently pulling it up from the wires.

3. Connect the black connector of the new battery pack, ensure that the position of the connector is as indicated in figure (red and black wires are on the upper edge of the connector). Do not push the connector with conducting material.

4. Place the battery pack, close the back plate and tighten the screw.

5. Change the battery pack before use. For more information, see section Installing and Recharging the Batteries on page 13.

In case you are installing battery pack and you have a device with alkaline batteries, remove the metal contact before installing the battery pack.
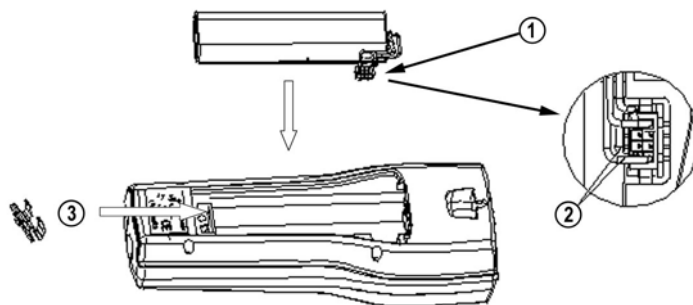
0505-239

Figure 19   Installing the Battery Pack

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CHAPTER 7
TECHNICAL SPECIFICATIONS

Measured Variables

Water Activity a_w

Measurement range	0...1 (-40...+60 C/-40 ...+140 F)
Accuracy	0.02(0...0.9)
	0.03(0.9...1.0)
Response time (90%) at +20 C in still oil (stainless steel filter)	10 min
Humidity sensor	HUMICAP

Temperature

Measurement range	-40...+100 C (-40 ...+212 F)
Typical accuracy at +20 C (+68 C)	0.1 C (0.18 F)
Typical temperature dependence of electronics	0.005 C/C (0.003 F/F)
Temperature sensor	Pt 100 RTD 1/3 Class B IEC 751

MMP78 Probe

Humidity sensor	HUMICAP
Temperature sensor	Pt 100 1/3 Class B IEC 751
Operating temperature range for electronics	-40...+60 C, -40...+140 F
Operating pressure range	0...20 bar
Standard sensor protection	Stainless steel grid
Housing classification	IP65 (NEMA 4)
Housing material	ABS/PC blend
Probe material	Stainless steel (AIS316L)
Probe cable length (between indicator and the probe handle)	1.9 m
Extension cable	10 m
Probe head diameter	12 mm (0.47 inch)
Weight (including protective cap and manual press tool)	520 g

MI70 Indicator

Operating temperature range	-10...+40 C
Operating humidity	0...100% RH, non-condensing
Menu languages	English, Finnish, French, German, Spanish, Swedish, Chinese, Japanese or Russian.
Display	LCD with backlight
	Graphic trend display of any quantity
	Character height up to 16 mm
Probe inputs	1 or 2
Power supply	Rechargeable NIMH battery pack with AC-POWER or 4 x AA size alkalines, type IEC LR6
Analog output	0...1 VDC
Output resolution	0.6 mV

Accuracy	0.2 % full scale
Temperature dependence	0.002 %/ C full scale
Minimum load resistor	10 kohm to ground
Data interface	RS232C (EIA-232)
Data logging capacity	900...2700 real time data points
Logging interval	1 s to 12 h
Logging duration	1 min...memory full
Alarm	Audible alarm function
Housing classification	IP54
Weight	400 g
Housing material	ABS/PC-blend

Battery Pack

Operating times in continuous use	48 h typical at +20 C (68 F)
data logging use	up to 30 days
Power consumption during charge	10 W max
Charging time	4 h

General Facts about the MM70 Hand-held Humidity and Temperature Meter

Storage temperature	-40...+70 C
Storage humidity range	0...100% Non-condensing

Electromagnetic Compatibility

Complies with the following standard: EN 61326-1:1997+Am 1:1998, Electrical equipment for measurement, control and laboratory use - EMC requirements: Portable test and measurement equipment.

Options and Accessories Available

Table 2   List of Options and Accessories

| Description	Order code
AC-Adapters	
Euro AC-adapter	MI70EUROADAPTER
UK AC-adapter	MI70UKADAPTER
US AC-adapter	MI70USADAPTER
AUS AC-adapter	MI70AUSADAPTER
Cables	
Analog output signal cable	27168ZZ
Connection cable for MMT318	DRW216050
Connection cable for HMP228	27159ZZ
Connection cable for MMT330	211339
Extension cable (10m)	213107SP
Carrying case	
Carrying case for two probes (MMP78, DMP74A/B)	MI70CASE2
Probe Accessories	
Stainless steel filter	HM47453SP
Protective cap	DRW215988SP
Others	
Measurement indicator	MI70
Manual press tool	HM36854SP
Plastic wrench	DRW216040SP
Calibration adapter for HMK15	211302
Fitting body ISO1/2	DRW212076SP
Fitting body NPT1/2	NPTFITBODASP
Thread adapter ISO1/2 to NPT1/2	210662SP
PC Connection tools	
MI70 Link software interface kit including a USB instrument cable for MI70	219687
MI70 Link software interface kit including a serial connection cable for MI70	MI70LINK

Dimensions in mm (inches)
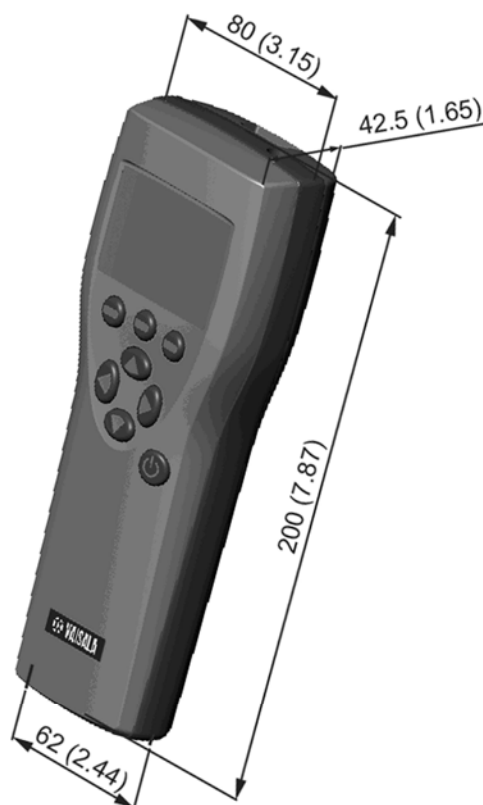
Figure 20   MI70 Indicator
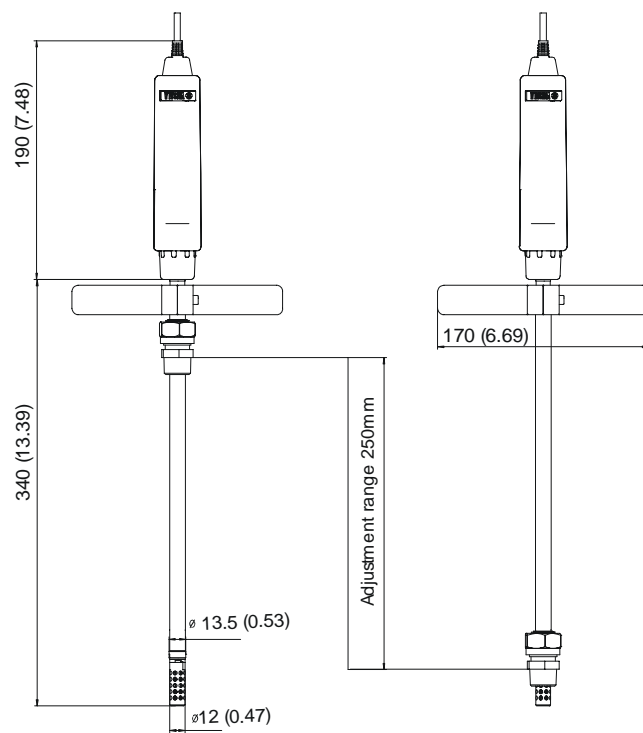
Figure 21   MMP78 Probe

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