

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

USER'S GUIDE

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Table of Contents

CHAPTER 1	
GENERAL INFORMATION	4
Safety	4
Warranty	5
CHAPTER 2	
PRODUCT DESCRIPTION	6
Vaisala's Hand-held MM70	6
Display parameters	6
Options	6
CHAPTER 3	
PREPARATIONS BEFORE USE	8
Installing and recharging of batteries	8
Turning on the device	8
CHAPTER 4	
INSTALLING THE PROBE	10
Selecting a place for the probe	10
Mounting the probe for pressurized pipelines/oils	10
Mounting the probe for direct measurement (no pressure)	14
CHAPTER 5	
TAKING MEASUREMENTS	15
CHAPTER 6	
BUTTONS, DISPLAYS AND MENUS	16
Buttons and navigation	16
Basic display	17
Graphical display	17
Menus	18
CHAPTER 7	
SETTINGS	19
PPM-calculation	19
Display settings	21
Quantities and units	21
Rounding	21
Hold/Save display	22

Graphic history.....	22
User interface.....	23
Selecting language	23
Automatic power OFF.....	24
Changing the shortcut keys.....	24
Button click and backlight on button press	25
Setting date and time.....	25
Device information	26
Reverting factory settings	26
CHAPTER 8	
RECORDING DATA	27
Recording	27
Stopping recording.....	28
Viewing recorded data	28
Checking the memory status	29
Deleting all recorded files	29
MI70 Link program to transfer recorded data to PC	30
MI70 Link program for real time PC monitoring	30
CHAPTER 9	
OTHER FUNCTIONS.....	31
Setting the alarm levels	31
Selecting and scaling the analog output	32
CHAPTER 10	
CALIBRATION AND ADJUSTMENT OF TRANSMITTERS	34
MM70 in checking and adjusting	34
Calibration cables.....	34
Calibration of HMP228 series transmitters	35
Checking and adjusting the MMT318 transmitters	38
CHAPTER 11	
MEASURING OTHER PARAMETERS SIMULTANEOUSLY.....	41
CHAPTER 12	
CALIBRATION AND ADJUSTMENT OF MM70 SERIES PROBES	42
General about calibrations	42
Preparations before the calibration	42
Relative humidity adjustment.....	43
Temperature adjustment.....	45
Last adjustment date.....	46

CHAPTER 13	
ERROR MESSAGES.....	47

CHAPTER 14	
MAINTENANCE	48
Changing the filter and sensor	48
Clean the sensor before storing the MMP78 probe and before calibration	48
Changing the battery pack	49
Vaisala Service Centres.....	50

CHAPTER 15	
TECHNICAL SPECIFICATIONS.....	51
MMP78 Probe	52
MI70 Indicator	52
Options and Accessories	54
Dimensions in mm (inches).....	55

CHAPTER 1

GENERAL INFORMATION

Safety

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

WARNING

Warning alerts you to a potential 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

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 malfunction 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 DESCRIPTION

Vaisala's Hand-held MM70

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.

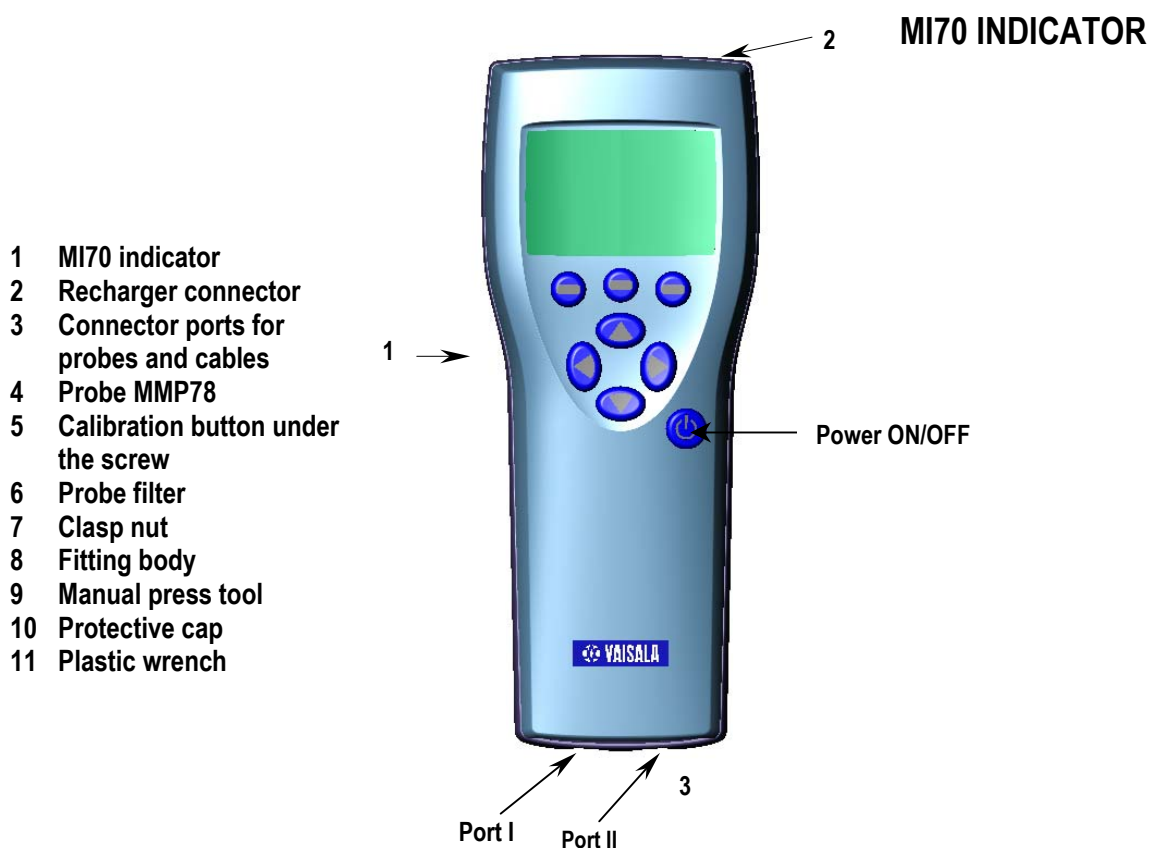
Vaisala MM70 is delivered with a factory calibration certificate.

Display parameters

- **a_w**: :water activity
- **T** :temperature (°C/°F)
- **H₂O** :mass concentration of water (ppm) (available only if selected when ordering)

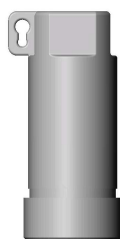
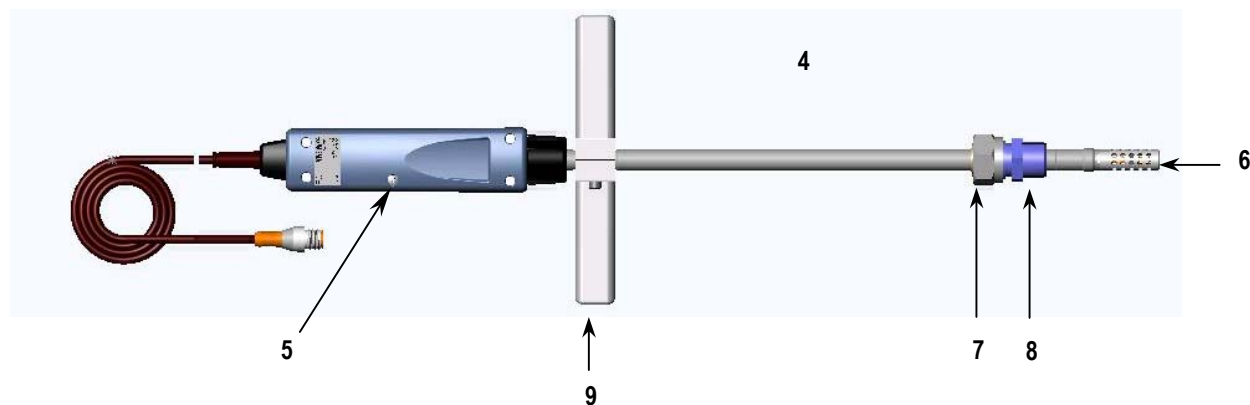
Options

- carrying case for the indicator and the probe
- connection cables for the fixed transmitters: HMP228 and MMT318
- MI70 Link software interface kit
- extension cable (10 m)

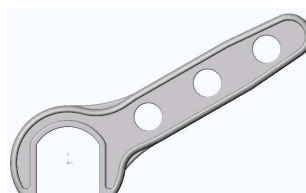


MMP78 PROBE

Rugged probe with a long stainless steel shaft.



10 Protecting cap
 (+ plastic wire for
 attaching the cap
 to the probe)



11 Plastic wrench





CHAPTER 3

PREPARATIONS BEFORE USE

Installing and recharging of 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 pack, it is already in place as shipped from the factory.
2. Recharge the battery pack as follows: Plug in recharger connector to the base of the indicator and connect the recharger to wall socket. A battery symbol in corner of display starts to roll.
 - It is not recommended to use MM70 during the first recharging. Later on MM70 can be used while recharging.
 - Duration of recharging depends on the charge level of the battery pack being 4 hours typical. The recommended first recharging time is 6 hours.
3. The battery pack is full when the battery symbol stops rolling.
4. Disconnect the recharger.

Turning on the device

1. Connect the probe to the either of the base connectors of the indicator.
2. Press  button.
3. Select the language by using   buttons. Confirm by pressing  **SELECT**. You can select the language later as well, see page 23.

4. To change the date, select **Date** and press \ominus **SET**. Change the date by using any of the \triangle ∇ \triangleright \triangleleft buttons. To confirm the date, press \ominus **OK**. The default date presentation format is: **year-month-date**. If you want to change the format, see page 25.
5. To change the time, select **Time** and press \ominus **SET**. Change the time by using arrow buttons. To confirm the time, press \ominus **OK**. The default time presentation format is 24-hour clock. If you want to use 12-hour clock, select **12-hour clock**, press \ominus **ON**.
6. Press \ominus **EXIT**. To check and change the pressure setting, select **YES**. Otherwise select **NO**, basic display appears.

CHAPTER 4

INSTALLING THE PROBE

Selecting a place for the probe

Select a place which gives a true picture 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.

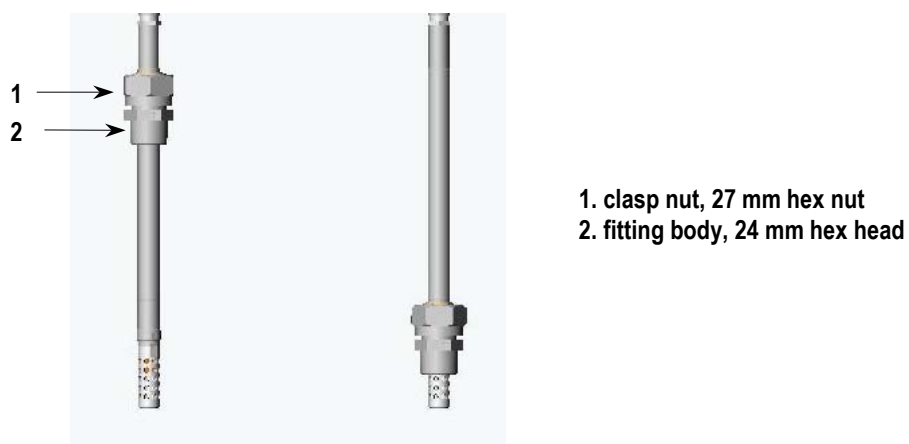
It is recommended that the sensor head is installed directly in the process through the ball valve assembly. When the ball valve assembly is used, the pipe does not have to be emptied or shut down for installation or removal of the probe. Install the sensor head transversely against the direction of 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

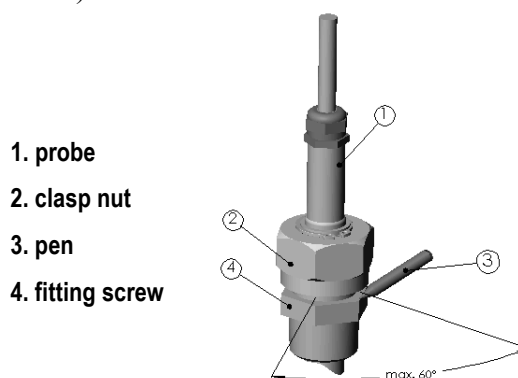
Due to the sliding fit, the MMP78 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. The maximum installation pressure is 10 bar and the maximum operation pressure is 20 bar.



MMP78 pipe dimensions (in mm); 400 mm (adjustment range 340 mm).

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.
3. Mark the fitting screw and the clasp nut.
4. 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).

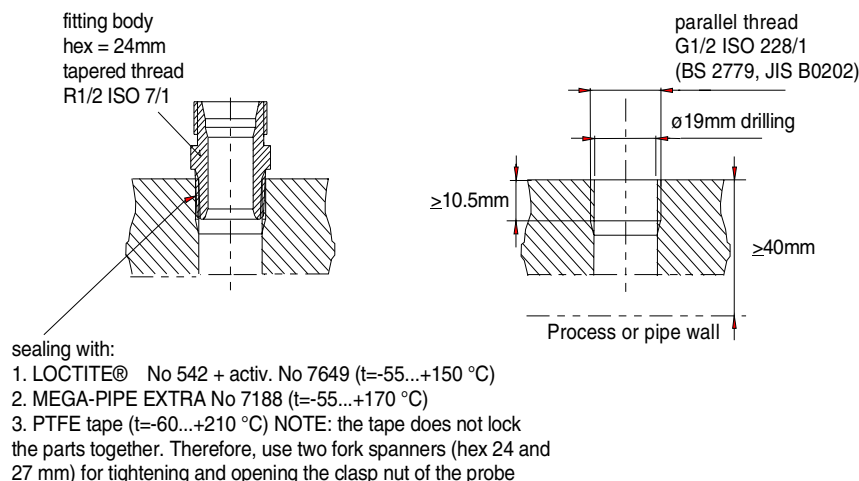


NOTE

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 preferably be installed through a ball valve assembly.

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 DMP248BVS 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 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.

1. probe

2. Tighten clasp nut first manually; probe is then sliding easily. Finally tighten with an plastic wrench about 30-40°, to have a stable installation, Note: do not overtighten this screw!

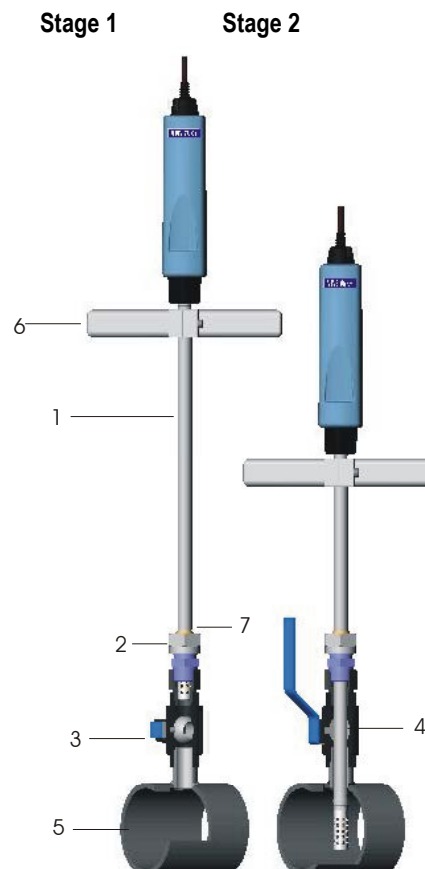
3. handle of the ball valve

4. ball of the ball valve

5. process chamber / pipeline

6. manual press tool

7. the groove on the probe indicates the upper adjustment limit

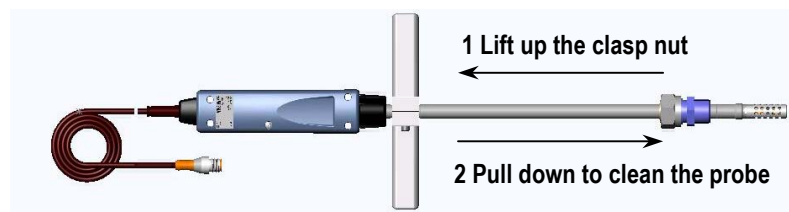


NOTE

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




CHAPTER 5

TAKING MEASUREMENTS

See Chapter 3 *Preparations before use* if you start the MM70 first time, otherwise follow instructions below.

1. Connect the probe to MI70-indicator.
2. Press  **POWER ON/OFF** button.
3. Install the probe to the measuring position. If measuring in pressurized processes, see the instructions on page 10.
4. The basic display opens, let the reading stabilize.

CAUTION

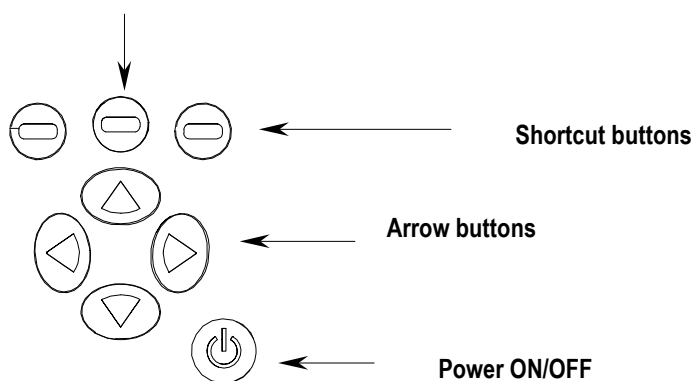
If you need to disconnect the probe from the indicator, first press  **POWER ON/OFF** button to turn the indicator OFF. This ensures that all settings and data are saved properly.




CHAPTER 6

BUTTONS, DISPLAYS AND MENUS

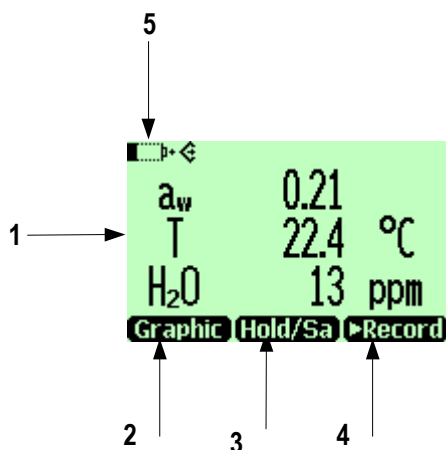
Buttons and navigation

To open a menu view
1. Press an arrow button
2. Press this shortcut button



-  Press down the **POWER ON/OFF** button until the indicator turns on/off.
-  Press the **SHORTCUT** buttons to activate the function shown above the button.
-  Press any of the **ARROW** buttons to open the **MENUS**. In the **MENUS** you can navigate with **ARROW** buttons.

Basic display



1. Selected quantities. Up to three of the quantities can be selected at a time.
 - **a_w** : water activity
 - **T** temperature (°C/°F)
 - **H₂O**: moistured oil/ dry oil volume (ppm)
2. Shortcut button **Graphic**¹ changes display into curve mode
3. Shortcut button **Hold/Sa**¹ freezes display and you may save the reading into the memory.
4. Shortcut button **▶Record**¹ takes you to the **Recording/Viewing** menu.
5. State of battery.

¹**Graphic**, **Hold/Sa** and **Record** -functions above the shortcut buttons are set in the factory. You can change them to refer other functions (see page 24).

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 firstly the curve of the uppermost quantity shown in a basic display.

1. In basic display, press **⊖ Graphic** or (alternatively open the **MENU**, select **▶Recording/Viewing**).
2. Graphical display opens. More information on page 22 **Graphic history**.
3. Press **⊖ BACK** to return to the basic display.

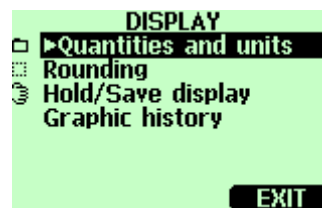
Menus

In the menus you can change settings and select the functions.

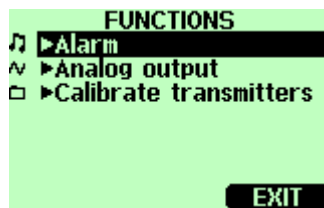
1. Open the main menu by pressing any of the \triangle ∇ \rightarrow \leftarrow buttons.
2. Press \ominus **OPEN** within 5 seconds. The basic display returns if you do not open the **MENU** shortly. If this happens, begin with the item 1 again.
3. Move in the menus by using \triangle ∇ buttons.
4. Select the item with \rightarrow button.
5. Press \leftarrow to return to the earlier level.
6. **EXIT** returns back to normal operation.



Main menu



Display menu



Functions menu



Recording/Viewing menu



Settings menu

CHAPTER 7

SETTINGS

PPM-calculation

In case you have a device with a ppm-output the ppm-value is available as one of the quantities. The calculation model is based on the average water solubility behaviour of transformer oils, as follows:

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

Where aw = water activity
 A, B = coefficients (average/oil specific)
 T = temperature (°C)

If additional accuracy is needed, refer to the paragraph Calculation Model with Oil Specific Coefficients.

Calculation Model with Oil Specific Coefficients

For additional accuracy, oil specific calculation 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) for the transformer oil are determined by Vaisala. Using these coefficients the accuracy of measurements is increased. The determination of specific coefficients shall be agreed with the Vaisala representative.

The determined coefficients of the transformer oil can be programmed to the MM70 by Vaisala or by a user according to the following instructions.

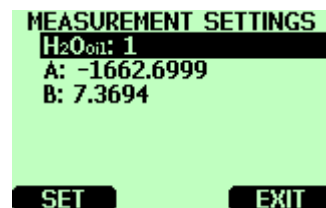
NOTE

Calculation Model With Oil Specific Coefficients is always needed for **silicone based oils**.

Feeding the coefficients to the MI70 memory

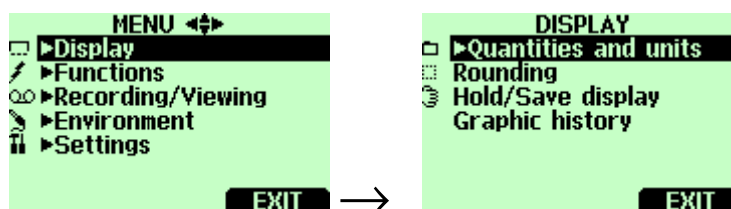
You can save in the memory specific coefficients for 4 different oils. As shipped from factory the average coefficients are set for the number 1 type (H_2O_{oil} : 1). Add your own coefficients as follows:

1. Open the **MENU**; press \rightarrow \ominus **OPEN**
2. Select **SETTINGS** and press \rightarrow .
3. Select **MEASUREMENT SETTINGS** and press \rightarrow .
4. If you want to keep the average coefficients under identification number 1 (set in the factory) press \ominus **SET** and give number 2 for the second oil type.
5. Select the A value (**A:0.0000**) and press \ominus **SET**.
6. Set the value A by using using \triangle ∇ \rightarrow \leftarrow buttons, press **OK**.
7. Select the B value (**B:0.0000**) and press \ominus **SET**.
8. Set the value B by using using \triangle ∇ \rightarrow \leftarrow buttons, press **OK**.
9. You may give coefficients for 4 different oils. Indentify the oil by numbering them (1...4). Select the first row (H_2O_{oil}) and set the identification number. Then feed the coefficients as shown above.
10. Press \ominus **EXIT** to return to the basic display.
11. Remember always select the correct oil type before measurements.



Oil
identification
number 1-4

Display settings



Quantities and units

All the quantities and units are shown in page 6.

1. Open the **MENU**; press \rightarrow \ominus **OPEN**.
2. Select **►Display**, press \rightarrow .
3. Select **►Quantities and units**, press \rightarrow .
4. To select a quantity, move on the quantity you want by using the arrow buttons, press \ominus **SELECT**.
5. To change the unit, move on the quantity you want by using the arrow buttons, then press \ominus **UNIT**.
6. To hide a quantity, move on the quantity you want to hide by using the arrow buttons, then press \ominus **HIDE**.
7. Press \ominus **EXIT** to return to the basic display.
8. If asked, press \ominus **YES**, if you want to check environment settings, otherwise press \ominus **NO**.

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**: press \rightarrow \ominus **OPEN**
2. Select the **►Display**, press \rightarrow
3. Select **Rounding**.
4. Press \ominus **ON** to have rounding on (one decimal display). Press \ominus **OFF** to deactivate rounding (two decimal display).
5. Press \ominus **EXIT** to return to the basic display.

Hold/Save display

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

1. Open **MENU**: press **OPEN**.
2. Select **►Display**, press .
3. Select **Hold/Save display**.
4. Press **HOLD** to freeze the display. The frozen measurement data is displayed.
5. Press **SAVE** to save the reading and **CANCEL** to return to the basic display.
6. You can save several readings with **HOLD-SAVE** function. The data points are identified on the basis of the saving date and time. All the individual readings (data points) are stored in a same file marked with . The file remains in the indicator memory even if the indicator is switched OFF.
7. To view the saved readings, press **►Record**, select **►View recorded data**, press .
8. Select the file marked with , press . Now you can see the saved data readings. Press **TIMES** to see the recording timestamps.
9. Press **EXIT** to return to the basic display.

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**: press **OPEN**.
2. Select **►Display**, press .
3. Select **Graphic history**, press **SHOW** to have a graphical history display.
4. To get the statistical info on the graph area (minimum, maximum and mean values), press **INFO**.

5. To get the curve of the other selected quantities, press \ominus NEXT. To get the curves of the all quantities, press \ominus NEXT until text ALL is shown instead of NEXT. Then press \ominus ALL.
6. To zoom in the curve, press the arrow button \triangle . To zoom out, press the button ∇ . To move the curve in horizontal directions, press the buttons \rightarrow \leftarrow .
7. Press \ominus BACK and EXIT to return to the basic display.

User interface



Selecting language

You can select any of the following languages as an user interface language: English, German, French, Finnish, Spanish or Swedish.

1. Open the MENU: press \rightarrow \ominus OPEN.
2. Select \blacktriangleright Settings, press \rightarrow .
3. Select \blacktriangleright User interface, press \rightarrow .
4. Select Language, press \ominus SET.
5. Select the language you want, press \ominus SELECT.
6. Press \ominus EXIT to return to the basic display.

If you accidentally select a wrong language, first go back to the basic display by pressing rightmost \ominus key as many times as required, then go to the language selection menu by pressing: \rightarrow , middle \ominus key \triangle , \rightarrow , \rightarrow , middle \ominus key.

Automatic power OFF

As 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 automatic power off function, follow the instructions.

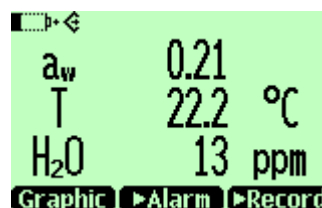
1. Open the **MENU**: press **OPEN**.
2. Select **►Settings**, press .
3. Select **►User interface**, press .
4. Select **Auto power off**, press **SET**.
5. Select the choice you want, press **SELECT**.
6. Press **EXIT** to return to the basic display.

Changing the shortcut keys








As a default, the three shortcut keys refer to the functions **Graphic**, **Hold/Save** and **►Record**. If needed, a shortcut for the functions can be changed to correspond to your needs.

1. Open the **MENU**: press **OPEN**.
2. Select **►Settings**, press .
3. Select **►User Interface**, press .
4. Select **Program shortcut keys**, press **START**.
5. Press the shortcut key you want to change, e.g. **Hold/Save**.
6. If you want to replace **Hold/Save** with alarm-function (as an example), select **Alarm** by using arrow buttons (**►Functions**), press **SELECT**. Answer **YES** to confirm your selection, otherwise answer **NO** and continue from item 4.
7. Press **EXIT** to return to the basic display.

Hold/Save -shortcut key replaced
by alarm function -shortcut key














Button click and backlight on button press

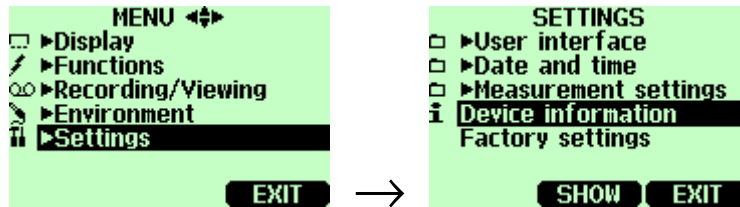
1. Open the **MENU**: press   **OPEN**.
2. Select **►Settings**, press .
3. Select **User interface**, press .
4. To turn OFF or ON sound effect while pressing the buttons, select **Key Click** and press  **ON/OFF**.
5. To turn OFF and ON backlight while pressing the buttons, select **Backlight on key press**  **ON/OFF**.
6. Press  **EXIT** to return to the basic display.

Setting date and time

To have correct date and time in recorded data files, set the date and time according to the following instructions.

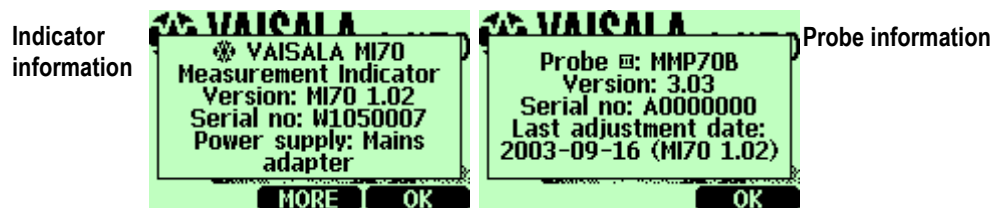
1. Open the **MENU**: press   **OPEN**.
2. Select **►Setting**, press .
3. Select **►Date and time**, press .
4. To change the date, select **Date** and press  **SET**. Change the date by using arrow buttons. To confirm the date, press  **OK**. The default date presentation format is *year-month-date*, e.g. 2002-06-05. If you want to change the format, select **Date format: Y-M-D**, press **SET** , select either **D.M.Y** or **M/D/Y**, press **SELECT**.
5. To change the time, select **Time** and press  **SET**. Change the time by using arrow buttons. To confirm the time, press  **OK**. The default time presentation format is 24-hour clock. If you want to change the format, select **12-hour clock**, press  **ON/OFF**.
6. Press  **EXIT**.

Device information



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

1. Open the **MENU**: press **OPEN**
2. Select **►Settings**, press .
3. Select **Device information**, press **SHOW**.
4. The first display gives the information on the MI70 indicator. Press **MORE** to get the information on the probe. Press **OK** and **EXIT** to return to the basic display.



Reverting factory settings

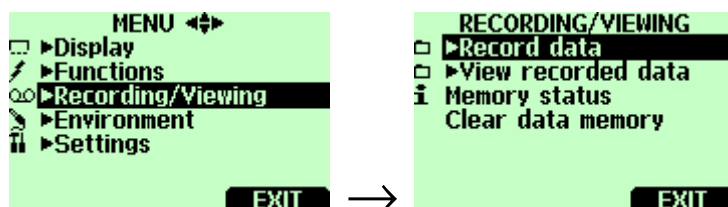
Factory settings can be reverted to clear all changed settings and data memory of the indicator. Reverting factory settings does not effect on probe calibration.

1. Open the **MENU**: press **OPEN**.
2. Select **►Settings**, press .
3. Select **Factory settings**, press **REVERT**. Press **YES** to confirm the reverting.
4. The power turns off automatically. When switching on again, the factory settings are reverted. You shall set the language, date and time again. See Chapter 3.

CHAPTER 8

RECORDING DATA


Recording



You can record measurement data and view the recorded data on the display.

1. Press the shortcut $\ominus \blacktriangleright$ **Record**, (alternatively open the **MENU**, select \blacktriangleright **Recording/Viewing**).
2. Select \blacktriangleright **Record data**, press \triangleright .
3. To change interval, select **Interval**, press \ominus **SET**.
4. Select the measurement interval with arrow buttons. Measurement intervals and the maximum recording times are shown in the table below.

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 min	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

5. Press \ominus **SELECT**.
6. To set the recording duration, select **Duration**, press \ominus **SET**.
7. Select the recording duration (1 min, 5 min, 15 min, 30 min, 1 h, 3 h, 12 h, 24 h, 7 d, 30 d, memory full) with arrow buttons and press \ominus **SELECT**.
8. Start recording: select **Start/Stop recording**, press \ominus **START**. If you chose 'Memory full', you see the maximum recording time on the display. You can also delete files in order to empty the memory. Press \ominus **START** again to accept maximum recording time.
9. You can switch the MM70 off during recording to save battery. Display message tells you that recording continues undisturbed 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.

Stopping recording

1. To stop recording press \ominus **►Record**, select **►Record data** and press \odot , select **Start/Stop recording** and press \ominus **STOP**.
 2. Now you can go and see the recorded file by selecting \ominus **SHOW**.
- You can save individual measurement data points with **Hold/Save** function described in page 22.

Viewing recorded data

1. Open the **MENU**: press \odot \ominus **OPEN**.
2. Select **►Recording/Viewing**, press \odot .
3. Select **►View recorded data**, press \odot .

4. Select the file you want to view, press . The files are identified according to the starting date and time of recording.
5. Press **GRAPH** to get the graphical view, press **TIMES** to get the recording timestamps (press **VALUES** to go back the recorded values).
6. Press **EXIT** to return to the basic display.

Checking the memory status

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

1. Open the **MENU**: press **OPEN**.
2. Select **►Recording/Viewing**, press .
3. Select **Memory status**, press **SHOW** to see the amount of memory in use and the estimated free space.
4. To return to the basic display, press **OK** and **EXIT**.

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

Deleting all recorded files

The data memory can be cleared as follows:

1. Open the **MENU**: press **OPEN**.
2. Select **►Recording/Viewing**, press .
3. Select **Clear data memory**, press **CLEAR**. Press **YES** to confirm deletion of all recorded data files.
4. To return to the basic display, press **EXIT**.

MI70 Link program to transfer recorded data to PC

The recorded data can be transferred to a PC by using MI70 Link program. MI70 Link program can be ordered from Vaisala, see list of accessories on page 54. You can examine the recorded data easily in Windows[®] environment and transfer it further to a spreadsheet program (such as Microsoft[®] Excel) to be modified.

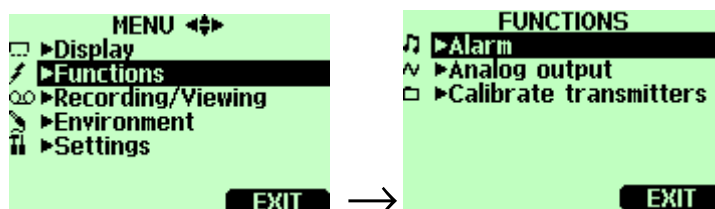
MI70 Link program for real time PC monitoring

You can monitor MM70 readings directly with a PC by using MI70 Link program. MI70 Link program can be ordered from Vaisala, see list of accessories on page 54.

CHAPTER 9

OTHER FUNCTIONS

Setting the alarm levels



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

1. Open the **MENU**: press **OPEN**.
2. Select **►Functions**, press .
3. Select **►Alarm**, press .
4. Select **Quantity** and press **SET** to choose a quantity.
5. Select quantity, press **SELECT**. (Only one quantity can be chosen at a time. Only active quantities can be selected. To change the active quantities, go to **MENU**→**►Display**→**►Quantities and units**).
6. Select the first limit, press **SET** (if the alarm function is ON, take it OFF). Set the alarm level by using arrow buttons. Press **+/-** button to choose the sign of the alarm level. Press **OK** to save the setting.
7. Select the second limit, then follow instructions in item 6. The alarm will go off when the upper limit is exceeded or when lower limit is gone below.

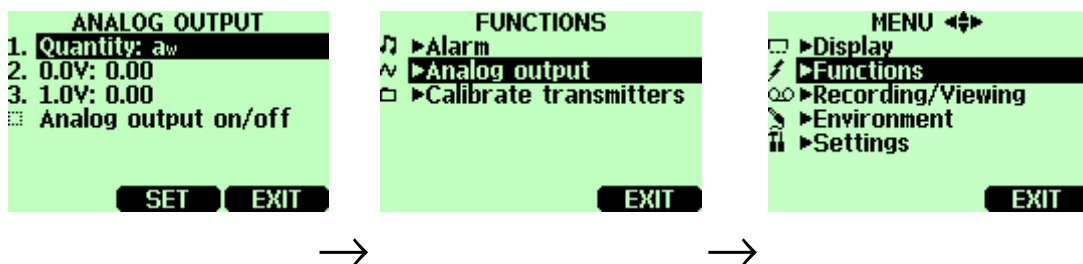
If you have only one limit, e.g. if you want to detect if the a_w reaches 0.9, set the upper limit to 0.9 and the lower limit so low that it never will be reached (for example 0). Thus, the MM70 will alert when RH rises above 0.9 a_w .

8. Select **Alarm ON/OFF**, press \ominus **ON** to activate the alarm and return back to the basic display.
9. A note picture sign 📌 appears on the upper left corner.
10. When the alarm level is reached, you can stop alarming by pressing \ominus **OK**. To reactivate the alarm function, answer \ominus **YES**. To stop the alarm function completely, answer \ominus **NO**.

NOTE

The alarm is not in function when the device is turned off. Remember to turn off the automatic power off, see page 24.

Selecting and scaling the analog output




To get analog measurement data, you need the analog output signal cable, see list of accessories on page 54. 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**: press ▶ \ominus **OPEN**.
3. Select **▶Functions**, press ▶ .
4. Select **▶Analog output**, press ▶ .
5. Select **Quantity** and press \ominus **SET** to choose a quantity.

6. Select **Quantity**, press \ominus **SELECT**. (One quantity can be chosen at a time. Only active quantities can be selected. To change the quantities, go to **MENU**→**Display**→**Quantities and units**).
7. Select **0.0 V** to set the value for the 0.0V output signal, press \ominus **SET**. (If the analog output is ON, take it OFF) Set the low value by using arrow buttons. Press \ominus **+/-** button to choose the sign of the value. Press \ominus **OK** to make the setting.
8. Select **1.0V** to set the value for the 1.0V output signal, press \ominus **SET**. Set the high value by using arrow buttons. Press \ominus **+/-** button to choose the sign of the value. Press \ominus **OK** to make the setting.
9. Select **Analog output on/off**, press \ominus **ON** to activate the analog output and return back to the basic display.
10. A wave picture sign  appears on the upper left corner of the basic display.
11. To deactivate the analog output function, go to **MENU**→**Functions**→**Analog output**→**Analog output on/off** and press \ominus **OFF**.

CHAPTER 10

CALIBRATION AND ADJUSTMENT OF TRANSMITTERS

MM70 in checking and adjusting

Vaisala's HMP228 and MMT318 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.

Calibration cables













↑
Connector ports for connection
cables

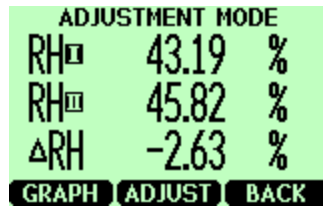
For calibration and adjustment connect MM70 to fixed transmitter by using one of the following connection cables:

- 27159ZZ connection cable for HMP228 transmitters
- DRW216050 connection cable for MMT318 transmitters

Calibration and adjustment of HMP228 series transmitters

You are able to 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 on page 34.
3. Turn on the MM70.
4. Open the **MENU**: press   **OPEN**.
5. Select **►Functions**, press .
6. Select **►Calibrate transmitters**, press .
7. Select **1.Baud rate** and **2.Serial format**. Press  **SET** to change the serial settings. Serial settings of HMP228 and MM70 shall be the same. (HMP228 factory serial settings: 4800, 7, even 1).
8. Select **3.Start calibration**, press  **START**. If the serial settings of MM70 are not compatible with the settings of HMP228, or the cable connection is not working check 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  **OK**.
10. Select the quantity to check (a_w / T / RH) or to adjust (RH), press  **SELECT**.
11. Check the environment settings of MM70 probe, if needed. Press  **YES** or  **NO**.
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 Δ RH is the difference between the readings of the ports.



Relative humidity adjustment by using a calibrated reference probe

Follow the steps from 1 to 12 and continue as follows:

13. Ensure that the probes are located in the same conditions.
14. 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.
15. Adjust the transmitter reading to correspond a reading of the reference probe by pressing \ominus ADJUST.
16. Select **To same as RH_{III}**. Press \ominus SELECT.
17. Confirm by pressing \ominus YES
18. Press \ominus BACK, \ominus EXIT, \ominus EXIT to return to the basic display.

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.

Follow the steps from 1 to 12 and continue as follows:

13. Insert the transmitter probe to the reference humidity
14. Press \ominus ADJUST
15. Select **1-point adjustment**. press \ominus SELECT

16. Wait until the reading is stabilized (takes about 30 minutes). You can follow the stabilization from the \ominus **GRAPH** display.
17. Press \ominus **READY** when the value is stabilized in the reference humidity.
18. Enter the correct humidity value by using the arrow buttons. Press \ominus **OK**.
19. Confirm by pressing \ominus **YES**
20. Press \ominus **BACK**, \ominus **EXIT**, \ominus **EXIT** to return to the basic display.

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 shall be at least 50 %. MI70 indicator is working as a communicator in the calibration procedure.

Follow the steps from 1 to 12 and continue as follows:

13. Insert the transmitter probe to the first reference humidity.
14. Press \ominus **ADJUST**
15. Select **2-point adjustment**. press \ominus **SELECT**
16. Wait until the reading is stabilized (takes about 30 minutes). You can follow the stabilization from the \ominus **GRAPH** display.
17. Press \ominus **READY** when the value is stabilized in the first reference humidity.
18. Enter the first reference humidity value by using the arrow buttons. Press \ominus **OK**.
19. Insert the transmitter probe to the second reference humidity.
20. Wait until the reading is stabilized (takes about 30 minutes or more). You can follow the stabilization from the \ominus **GRAPH** display.
21. Press \ominus **READY** when the value is stabilized in the second reference humidity.
22. Enter the second reference humidity value by using the arrow buttons. Press \ominus **OK**.
23. Confirm by pressing \ominus **YES**

24. Press \ominus BACK, \ominus EXIT, \ominus EXIT to return to the basic display.

Checking and adjusting the 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 in the lowest row.
 - In case MI70 is used as an display, the reading of the MMT318 transmitter is shown on a display.
3. Remove the MMT318 transmitter unit from the mounting plate and press the adjustment button once. Now MI70 is starting the **Adjustment mode**.
4. Press \ominus OK to start adjustment.

Field checking and adjustment by using a calibrated reference probe

Follow the steps from 1 to 4 and continue as follows:

5. Select a_w , RH ,T or H₂O (H₂O can be checked only) press \ominus SELECT.

6. 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.
7. Press \ominus **ADJUST** to continue adjusting.
8. Press **To same as..**, press \ominus **SELECT**. (MI70 recognizes always the port to which the MMP70-series probe is connected).
9. Confirm by pressing \ominus **YES**.
10. Adjustment is done. Press \ominus **BACK** and \ominus **EXIT** to return to the basic display.
11. 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, please take care that the reference condition represents well the measuring environment.

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

Follow the steps from 1 to 4 and continue as follows:

5. Select the quantity press \ominus **SELECT**.
6. Remove the filter from the transmitter's probe and insert the probe head into the reference condition.
7. Press \ominus **ADJUST** to continue adjusting.
8. Select **1-point adjustment**, press \ominus **SELECT**.
9. Press \ominus **READY** when the reading is stabilized in the reference condition (takes about 30 minutes or more). You can follow the stabilization from the \ominus **GRAPH** display.
10. Enter correct reference value by using the arrow buttons. Press \ominus **OK**.
11. Confirm by pressing \ominus **YES**.
12. Adjustment is done. Press \ominus **BACK** and \ominus **EXIT** to return to the basic display.
13. Detach the calibration cable.

2-point adjustment by using a calibrator

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

Follow the steps from 1 to 4 and continue as follows:

5. Select the quantity press \ominus **SELECT**.
6. Remove the filter from the transmitter's probe and insert the probe head into the first reference condition.
7. Press \ominus **ADJUST** to continue adjusting.
8. Select **2-point adjustment**, press \ominus **SELECT**.
9. Press \ominus **READY** when the reading is stabilized in the first reference condition (takes about 30 minutes or more).
10. Enter correct reference value by using the arrow buttons. Press \ominus **OK**.
11. Remove the probe and insert the probe head into the second reference condition. You can follow the stabilization from the \ominus **GRAPH** display (takes about 30 minutes or more).
12. Press \ominus **READY** when the reading is stabilized in the second reference condition.
13. Give the higher reference humidity value by using the arrow buttons. Press \ominus **OK**.
14. Confirm the adjustment, press \ominus **YES** (by pressing \ominus **NO** 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. Press \ominus **BACK** to exit the adjustment mode press \ominus **EXIT** to return to the basic display.
16. Detach the calibration cable.

CHAPTER 11

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).

CHAPTER 12

CALIBRATION AND ADJUSTMENT OF MM70 SERIES PROBES

General about calibrations

The MM70 is fully calibrated as shipped from factory. Adjustment shall 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 Centres for calibration and adjustment, see contact information on page 50. Alternatively, user can calibrate and adjust MM70 by following the instructions given in this chapter.

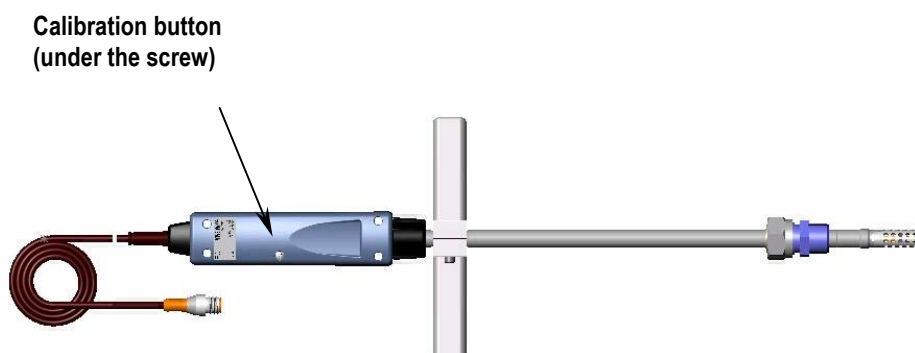
Preparations before the calibration

Before the calibration the used sensor should be cleaned with instrument air to blow out existing oil or gently first flush with heptane (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 page 48.

NOTE

It is important to clean the sensor before calibration as the dirty sensor can contaminate 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 covering the calibration button.



Relative humidity adjustment

LiCl-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 following section *2-point relative humidity adjustment* (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 **⊖ OK** to start the adjustment mode.
5. Select **RH**, press **⊖ SELECT**.
6. Press **⊖ YES** to check the environmental settings, to continue directly adjustment press **⊖ NO**.
7. Now the adjustment mode is on, press **⊖ ADJUST** to select the adjustment method.
8. Select **2-point adjustment**, press **⊖ SELECT**. Press **⊖ OK** to continue.
9. Set the probe to a lower reference relative humidity. If using HMK15 calibrator, use the adapter fitting (13.5 mm hole).
You can follow the stabilization from the **⊖ GRAPH** display. Press **⊖ READY** when the reading is stabilized.
10. Give the lower reference humidity value by using the arrow buttons. Press **⊖ OK**.
11. Set the probe to the higher reference humidity. Press **⊖ READY** when the reading is stabilized. You can follow the stabilization from the **⊖ GRAPH** display.
12. Give the higher reference relative humidity value by using the arrow buttons. Press **⊖ OK**.
13. Confirm the adjustment, press **⊖ YES** (by pressing **⊖ NO** 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.
14. Adjustment has been carried out. Press **⊖ BACK** to exit the adjustment mode press **⊖ EXIT** to return to the basic display.
15. Replace the screw onto calibration button.

You can attach a sticker on the calibration button 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 *Two-point relative humidity 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 button. For pressing, use tool with thin and sharp point, such as small screwdriver. When pressing the button, indicator turns to adjusting mode.
3. Select T, press \ominus **SELECT**.
4. Now the adjustment mode is on, press \ominus **ADJUST** to select the adjustment method: **1-point adjustment** or **2-point adjustment**.

1-point adjustment

Follow the steps from 1 to 4 and continue as follows:

5. Select **1-point adjustment**, press \ominus **SELECT**.
6. Set the probe to a reference temperature. You can follow the stabilization from the \ominus **GRAPH** display. Press \ominus **READY** when the reading is stabilized in the reference.
7. Give the reference temperature value by using the arrow buttons. Press \ominus **OK**.
8. Confirm the adjustment, press \ominus **YES**. (By pressing \ominus **NO** you return to adjustment mode display and no changes are made).
9. Calibration is carried out. Press \ominus **BACK** to exit the adjustment mode and \ominus **EXIT** to return to the basic display.

2-point adjustment

Follow the steps from 1 to 4 and continue as follows:

5. Select **2-point adjustment**. Press \ominus **SELECT** to continue.
6. Set the probe to a lower reference temperature. You can follow the stabilization from the \ominus **GRAPH** display.
7. Press \ominus **READY** when the reading is stabilized. Give the lower reference temperature by using the arrow buttons. Press \ominus **OK**.
8. Set the probe to the higher reference temperature. You can follow the stabilization from the \ominus **GRAPH** display. Press \ominus **READY** when the reading is stabilized.
9. Give the higher reference temperature by using the arrow buttons. Press \ominus **OK**.
10. Confirm the adjustment, press \ominus **YES**. (By pressing \ominus **NO** you return to adjustment mode display and no changes are made). If the difference between two references is less than 30 °C, adjustment can not be done.
11. Calibration is carried out. Press \ominus **BACK** to exit the adjustment mode and \ominus **EXIT** to return to the basic display.

Last adjustment date

To see the last adjustment date, select **Last adjustment date**. You can check this date also from the **Device information**, see page 26.

CHAPTER 13

ERROR MESSAGES

If MM70 displays an error message, check first 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 (see page 50).

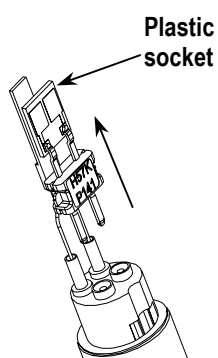
Error Messages

- 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 14

MAINTENANCE

Changing the filter and sensor



1. Screw out the filter from the probe head (figure on page 7).
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).

Clean the sensor before storing the MMP78 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 sensor. The oxidation of the sensor can cause extended response times or drifting.

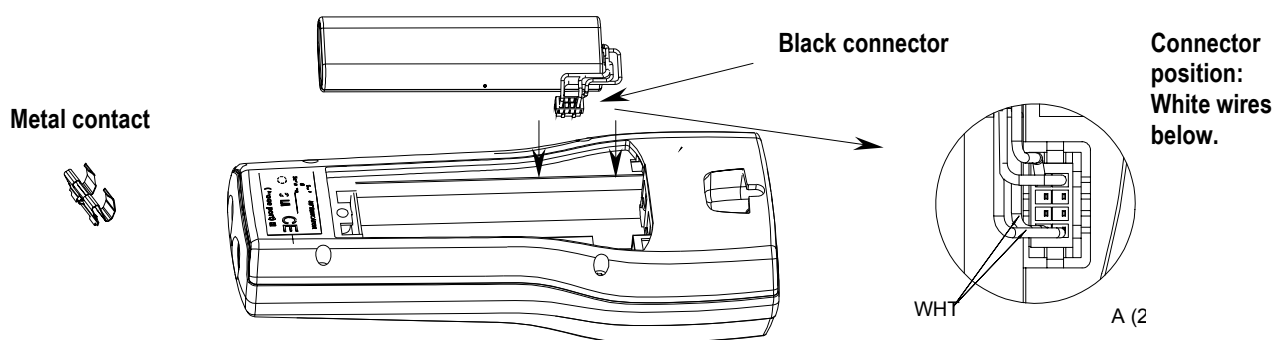
1. Blow the probe head (with filter) with instrument air to remove the remains of the oil.
2. Immerse the probe head into heptane liquid and rinse out the oil.
3. Dry the probe head with instrument air. In case you are going to calibrate the probe, remove the filter and dry the sensor with instrument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

Changing the battery pack

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 pulling up carefully 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. Charge the battery pack before use, see page 8.

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



Installing the battery

Vaisala Service Centres

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CHAPTER 15

TECHNICAL SPECIFICATIONS**Measured variables****Water activity a_w**

Measurement range 0...1 (@-40...+60 °C/ -40...+140 °F)

Accuracy (including nonlinearity and repeatability)

When calibrated against salt solutions (ASTM E104-85):

±0.02 (0...0.9)

±0.03 (0.9...1.0)

When calibrated against high-quality, certified humidity standards:

±0.01 (0...0.9)

±0.02 (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 °F) ±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	Pt100 IEC751 1/3 class B
Operating temperature range for electronics	-40...+60 °C, -40...+140 °F
Operation 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
Display	LCD with backlight Graphic trend display of any quantity Character height up to 16mm
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

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

General about the MM70 Hand held humidity and temperature meter

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

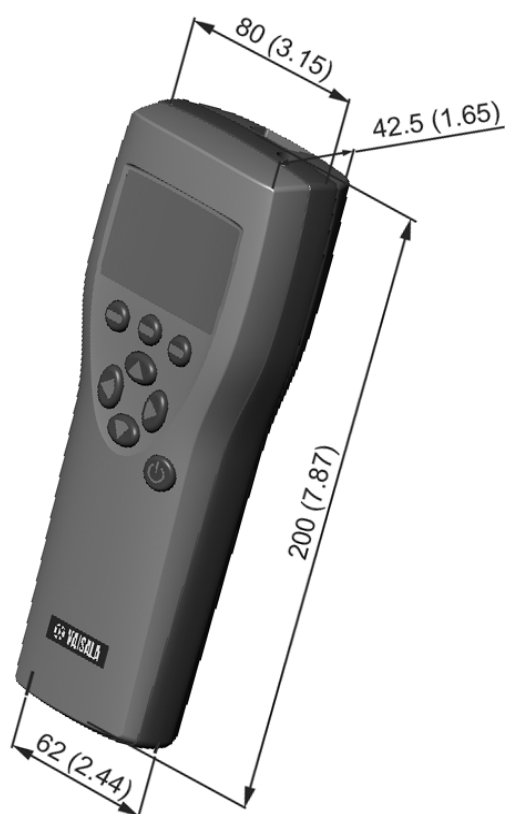
Electromagnetic compatibility

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.

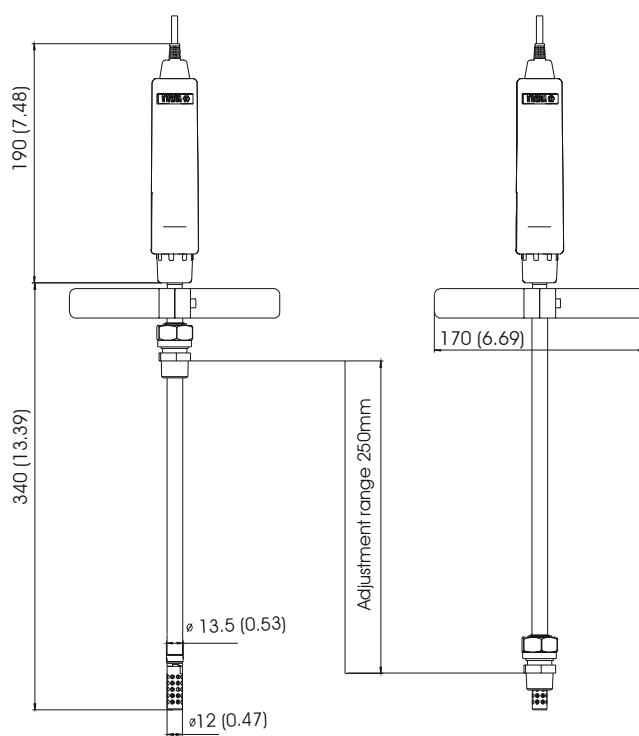
Options and Accessories

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
Extension cable (10 m)	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	DRW212076SP
Pressure fitting	210662SP
Ball valve set (+fitting body+blanking plug)	HMP228BVS
MI70 Link- software interface kit	MI70LINK

Dimensions in mm (inches)



MI70 Indicator



MMP78 probe