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# USER'S GUIDE

## Vaisala CARBOCAP® Hand-Held Carbon Dioxide Meter GM70



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# CHAPTER 1

## GENERAL INFORMATION

This chapter provides general notes for the product.

### About This Manual

This manual provides information for installing, operating, and maintaining Vaisala CARBOCAP<sup>®</sup> Hand-Held Carbon Dioxide Meter GM70.

### 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.

### Safety

#### General Safety Considerations

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

**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.

## Product Related Safety Precautions

The Hand-Held Carbon Dioxide Meter GM70 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

**CAUTION**

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

## ESD Protection

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

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

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

## Recycling



Recycle all applicable material.



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

## Trademarks

Vaisala CARBOCAP® is a registered trademark of Vaisala.  
Microsoft®, Windows®, and Windows NT® are registered trademarks of Microsoft Corporation in the United States and/or other countries.

## 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.

## CHAPTER 2

# PRODUCT OVERVIEW

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

## Introduction to Vaisala CARBOCAP<sup>®</sup> Hand-Held Carbon Dioxide Meter GM70

The GM70 hand-held carbon dioxide meter measures volume concentration of CO<sub>2</sub> gas and displays the result in the units of ppm or percentage %. The exceptional stability and reliability performance of the GM70 comes from the advanced silicon based Vaisala CARBOCAP<sup>®</sup> sensor.

### Basic Features of the GM70

- Both numerical and graphical displays
- Data logging possibility
- Tool for checking the reading of fixed CO<sub>2</sub> transmitters
- Tool for adjusting Vaisala GM220 series probes
- Possibility for an analog output (voltage signal 0 ... 1 V)
- Optional ready-to-use Windows software enabling easy way to handle measurement data
- Sampling methods: diffusion sampling (GMH70 handle) or pump aspirated sampling (GM70PUMP), alternatively
- An optional, ready-to-use Microsoft Windows<sup>®</sup> software, which allows an easy way to handle measurement data using a serial line or a USB instrument cable

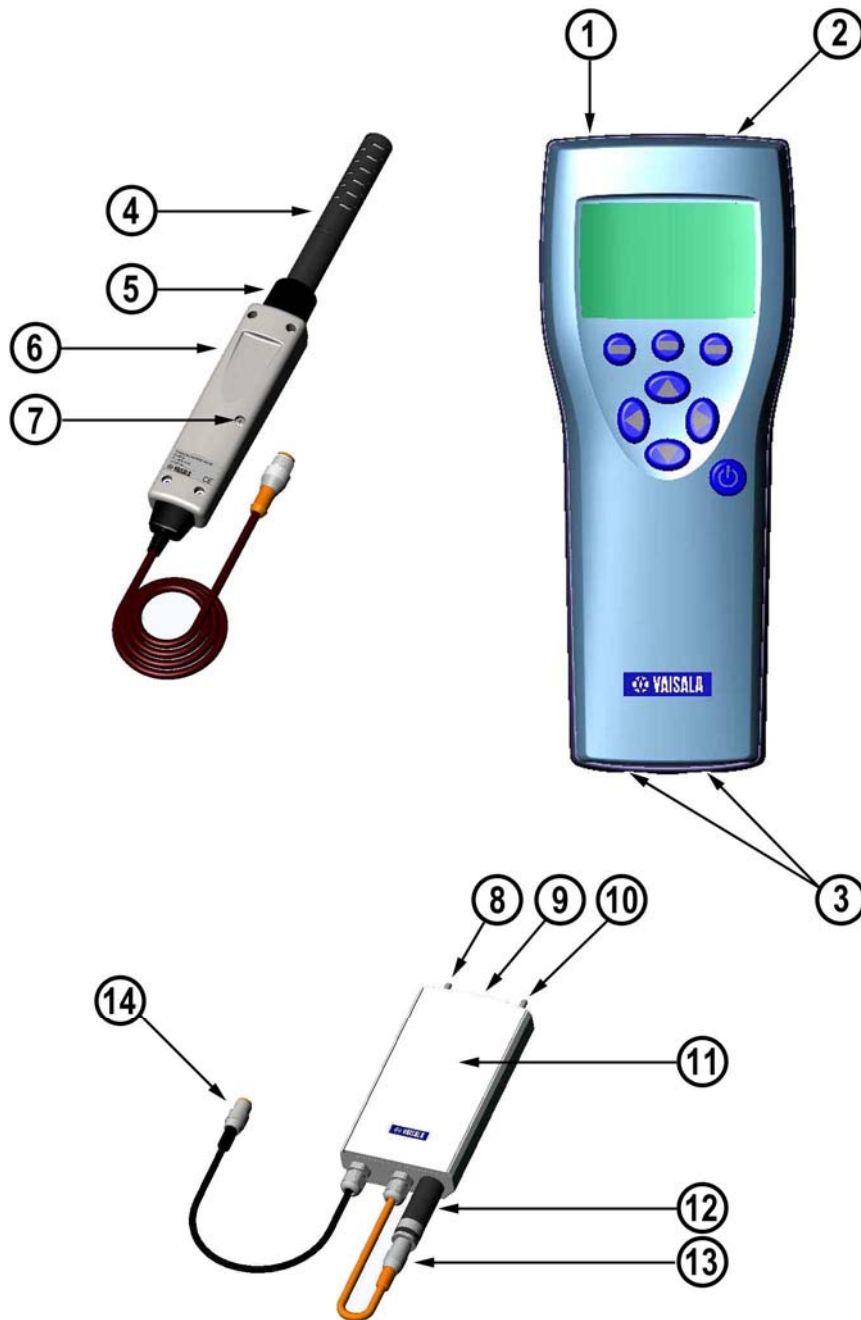
## Interchangeable Probes

By selecting the right probe you can choose the measuring range that best fits for your application. The calibrated measuring ranges varies from 0...2000 ppm to 0 ... 20% concentrations of CO<sub>2</sub>. Refer to Chapters 2 and 13 for more details. For changing the measuring range you only have to change the probe.

## Tool for Adjustments

For adjusting the GMT220 series transmitters the GM70 needs only the probes. GM70 adjusts and stores the adjusting information to the nonvolatile memory of the probes. This enables true interchangeability of the probes.

## Parts Description



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**Figure 1** GM70 Parts

The following numbers refer to Figure 1 on page 11 above:

- 1 = MI70 indicator
- 2 = Recharger connector

- 3 = Connector ports I and II for probes and cables
- 4 = Probe GMP221 or GMP222
- 5 = Probe fastener
- 6 = Handle GMH70
- 7 = Adjustment button
- 8 = Gas outlet
- 9 = ON/OFF switch
- 10 = Gas inlet
- 11 = Measuring chamber
- 12 = Probe GMP221 or GMP222
- 13 = Probe connector
- 14 = Connector to MI70 indicator

## Probes

Probes GMP221 and GMP222 can be used with the GM70. Table 1 presents the measuring ranges that can be selected for the probes.

**Table 1 GMP221 and GMP222 Measuring Ranges**

<b>Probe</b>	<b>Measuring Range</b>
GMP221	0 ... 2%, 0 ... 3%, 0 ... 5%, 0 ... 10%, 0 ... 20% CO <sub>2</sub>
GMP222	0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 5000 ppm, 0 ... 7000 ppm, 0 ... 10000 ppm

In order to obtain the best possible performance, it is recommended that the measurement range is chosen so that the actual concentrations to be measured are roughly in the middle of the measuring range.

## GM70PUMP for Aspirated Sampling

GM70 Aspiration pump consists of a pump and a measurement chamber for CO<sub>2</sub> measurements. GM70PUMP is designed for checking of fixed CO<sub>2</sub> transmitters and for sampling from locations difficult to access. GM70PUMP is connected to a MI70 indicator which displays the measurement result. Pump system is powered through the MI70 indicator.























## CHAPTER 3

# PREPARATIONS BEFORE USE

### Recharging the Batteries

1. If using alkalines, unscrew the back plate of the indicator and insert the alkalines. If the GM70 is ordered with a rechargeable battery pack, the battery pack is already in place as shipped from the factory.
2. Recharge the battery pack as follows: Plug in recharger to the recharger connector 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 the GM70 during the first recharging. Later on the GM70 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 to roll.
4. Disconnect the recharger.

## Turning On and Setting Language, Date, and Time

1. Connect the probe handle (or the connector from the GM70PUMP) to either of the connector ports of the indicator.
2. Press the  button.
3. Select the language by using   buttons. Confirm by pressing  SELECT.
4. The default date presentation format is: date.month.year. To change the date, select Date and press  SET. Change the date by using the     buttons. To confirm the date, press  OK. If you want to change the format, select *MD/Y* date format (month/date/year), press  ON.
5. The default time presentation format is 24-hour clock. To change the time, select Time and press  SET. Change the time by using arrow buttons. To confirm the time, press  OK. If you want to use 12-hour clock, select 12-hour clock, press  ON.
6. Press  EXIT. To check and change the environment settings, select YES. Otherwise select NO, basic display appears.
7. To ensure the best possible accuracy set the actual pressure and temperature values to the GM70 as follows:
  - Select the pressure setting (P: 1013 hPa, default), press  UNIT to select unit (hPa or bar), press  SET, set the pressure value by using arrow buttons. Press  OK to save the value.
  - Select the temperature setting (T: 25.0 C°, default), press  UNIT to select unit (°C or °F), press  SET, set the temperature value by using arrow buttons. Press +/- to change the sign of the value. Press  OK to save the value.
8. Press  EXIT to return to the basic display.

## CHAPTER 4

# MEASURING CARBON DIOXIDE


The results of carbon dioxide measurements are affected by the air pressure and the temperature of the measurement conditions. For achieving the most accurate measurements in high altitudes where the barometric pressure is clearly lower than in the sea level, the actual atmospheric pressure value should be set to the GM70. The acceptable pressure value range is 700 ... 1300 hPa.

**NOTE**

Before measurements ensure that the air pressure and temperature settings are correct. Set the correct settings as instructed on page 23.

## Taking Measurements (Diffusion Sampling)


See Chapter 3 Preparations Before Use on page 13 if you start the GM70 for the first time, otherwise follow the instructions below:

1. Connect the probe cable to the MI70 indicator's connector port.
2. Press  POWER ON/OFF button.
3. Wait for about 15 seconds to get the reading. For the most accurate readings wait for 15 minutes to reach the full operating state of the GM70.
4. Install the probe to the measuring position. Avoid exhaling near the probe as this increases the CO<sub>2</sub> concentration.
5. The basic display opens, allow the reading to stabilize.




**CAUTION**

Handle the probe carefully. Strong impact or falling can damage the probe.

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

## Taking Measurements (Pump Aspirated Sampling)

See Chapter 3 Preparations Before Use on page 13 if you start the GM70 for the first time, otherwise follow the instructions below:

1. Connect one end of the sampling tube to the gas inlet (marked with IN), in case of using a tube.
2. Connect the black cable of the GM70PUMP to the MI70 indicator's connector port.
3. Plug in the recharger connector of the MI70 and connect the recharger to wall socket.
4. Connect the GM220 probe to the probe connector of the GM70PUMP.
5. Insert the probe in the measuring chamber. Note that to have a tight installation, the two O-rings on the opening of the measuring chamber should not match together with the filter edge or the tapes on the probe (see figure). When operating the pump, especially when taking a sample from hot and humid conditions into room temperature, take care that no condensation forms on the probe.
6. Install the other end of the sampling tube to the sampling location.
7. Turn on the MI70 indicator by pressing the  button.
8. Turn on the GM70PUMP.
9. The basic display opens.
10. Wait for a few minutes to get a stabilized reading. For the most accurate readings wait for 15 minutes to reach the full operating state of the GM70.



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**Figure 2 Properly Connecting the GM70PUMP**

The following number refers to Figure 2 above:

- 1 = Match the 2 O-rings together with the smooth probe surface to have a tight connection!

**NOTE**

Only one pump aspirated system can be connected to the MI70 at a time.

**NOTE**

When using the pump aspirated system it is recommended to power the system by using the recharger connected to a wall socket.

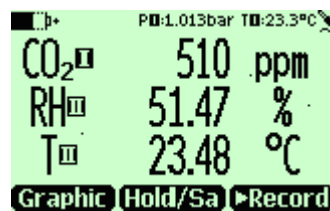
**NOTE**

The battery indicator of the MI70 display does NOT show the actual recharge level when the pump is in operation.

## Measuring Other Parameters Simultaneously

Connect Vaisala interchangeable dewpoint (DMP) or humidity (HMP) probe to the MI70 indicator's other connector port to have simultaneous humidity measurement.

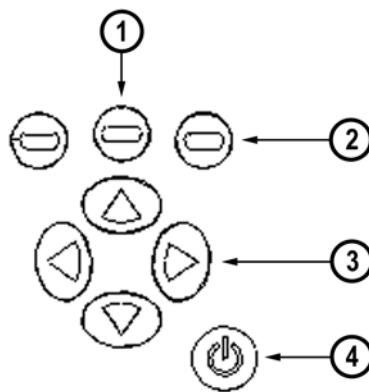
1. Connect the DMP70/HMP70 probe to the other connector port in the bottom of the indicator.
2. Turn on the MI70 device.
3. Check that the pressure settings of the probes (port I and II) are the same if you are taking measurements from the same condition. You can use the HMP70 probe's temperature data to compensate the CO<sub>2</sub> measurement. In this case, select YES when the MI70 asks you to check the environmental settings. Then select temperature T and press SET. Now the MI70 asks if you want to link the measured T value to environment parameter, press LINK and EXIT.
4. The display now shows the reading of the port I probe in the upper row(s) and the reading of the port II probe in the lower row(s).
5. For achieving the most accurate measurements, set the actual temperature value measured with the temperature and humidity probe to the GM70.



0505-223

**Figure 3** Example of the Display when the Carbon Dioxide, and the Temperature and Humidity Probe are Connected Simultaneously to the MI70 Indicator

## CHAPTER 5




**BUTTONS, DISPLAYS, AND MENUS****Buttons and Navigation**

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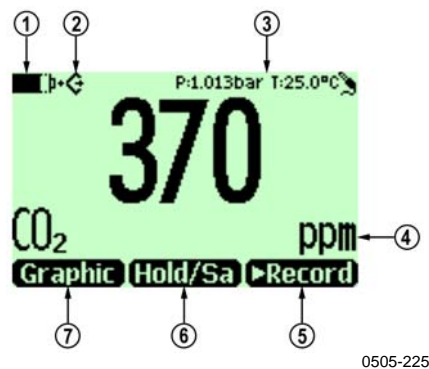
**Figure 4 MI70 Indicator Buttons**

The following numbers refer to Figure 4:

- 1 = To open a menu view:
  - Press an arrow button
  - Press this shortcut button
- 2 = Shortcut buttons
- 3 = Arrow buttons
- 4 = Power ON/OFF

-  Press down and hold the POWER ON/OFF button (1) until the indicator turns on/off.
-  Press the SHORTCUT buttons (2) to activate the function above the button.
-  Press any of the ARROW buttons (3) to open the path for the MENUS. In the MENUS you can navigate with the ARROW buttons.

## Basic Display



0505-225

**Figure 5 Basic Display**

1. Selected unit, ppm or %.
2. Shortcut button Graphic<sup>1</sup> changes display into the graphical trend mode.
3. Shortcut button Hold/Sa<sup>1</sup> freezes display and you may save the reading into the memory.
4. Shortcut button ► Record<sup>1</sup> takes you to the Recording/Viewing menu.
5. State of the battery.
6. Pressure and temperature settings.
7. Symbol which indicates that the GM70 is communicating with a PC. If the PC cable is not connected this symbol is not shown.

<sup>1</sup>Graphic, Hold/Sa and Record-functions above the shortcut buttons are set in the factory. You can however change them to refer other functions (see *Changing the Shortcut Keys* on page 28).

## Graphical Display

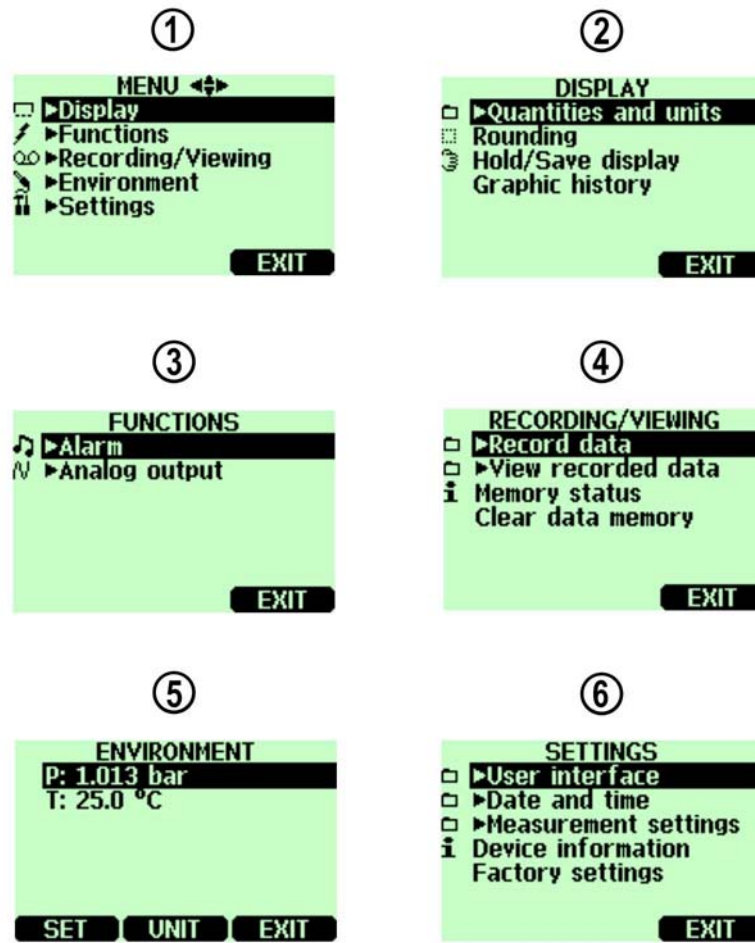
The graphical display shows you the measurements in the form of a curve. From the curve you can examine the data trend and the history data of the last minutes.

1. In the basic display, press  $\ominus$  Graphic or (alternatively open the MENU, select  $\blacktriangleright$  Recording/Viewing).
2. Graphical display opens. More information in section *Graphic History* on page 26.
3. Press  $\ominus$  BACK to return to the basic display.

## Menus

In the menus you can change settings and select functions.

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



0505-226

**Figure 6**      **Menus**

The following numbers refer to Figure 6 above:

- 1 = Main menu
- 2 = Display menu
- 3 = Functions menu
- 4 = Recording/Viewing menu
- 5 = Environment menu
- 6 = Settings menu

## CHAPTER 6

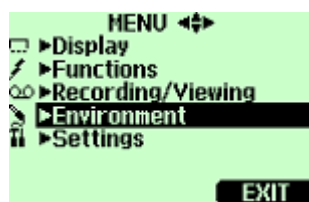
# SETTINGS

### Setting Actual Pressure Value and Unit

For achieving the most accurate measurements in high altitudes where the barometric pressure is clearly lower than in the sea level, the actual atmospheric pressure value should be set to the GM70. The acceptable pressure range is 700 ... 1300 hPa. Pressure is given in the units of hPa or bar.

Follow the instructions below:

1. Open the MENU, press OPEN.
2. Select Environment with press .
3. Select pressure value, press UNIT , press SET.
4. Set the pressure value by using buttons. Press OK to save the value.
5. Press UNIT to change the pressure unit. Default unit is hPa.
6. Press EXIT to return to the basic display.



0505-227

**Figure 7** Environment Menu



## Setting Actual Temperature Value and Unit

For achieving the most accurate measurements, the actual temperature value should be set to the GM70. The acceptable temperature range is -20...60°C.

Follow the instructions below:

1. Open the MENU, press OPEN.
2. Select Environment with press .
3. Select temperature value, press SET.
4. Set the temperature value by using buttons. Press OK to save the value.
5. Press UNIT to change the temperature unit. Default unit is °C.
6. Press EXIT to return to the basic display.

If you are using the HMP75 or other humidity probe, the temperature information can be linked to compensate the GM70's CO<sub>2</sub> reading.

## Display Settings



0505-228

Figure 8 Display Menu

## Display Units

The unit of the measurement can be selected between ppm and %. The default unit is ppm for measuring ranges with upper limit of 10 000 ppm or less. For measuring ranges with upper limit of 2...20%, the default unit is %.

1. Open the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Display, press  $\text{▶}$ .
3. Select  $\text{▶}$  Quantities and units, press  $\text{▶}$ .
4. To change the unit, press  $\ominus$  UNIT (ppm or %)
5. Press  $\ominus$  EXIT to return to the basic display.
6. Press  $\ominus$  YES, if you want to check the environment settings, otherwise press  $\ominus$  NO.

**NOTE**

Measurement units (ppm and %) express the CO<sub>2</sub> concentration by gas volume.

$$1\% \text{ CO}_2 = 10\,000 \text{ ppm CO}_2$$

## Rounding

When using % units, you can select two or three decimal display by using the Rounding function. The default setting is rounding off (= three decimal display).

1. Open the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Display, press  $\text{▶}$ .
3. Select Rounding.
4. Press  $\ominus$  ON to have rounding on (two decimal display). Press  $\ominus$  OFF to deactivate rounding (three 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 the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Display, press  $\text{▶}$ .
3. Select Hold/Save display.

4. Press  $\ominus$  HOLD to freeze the display. The frozen measurement data is displayed.
5. Press  $\ominus$  SAVE to save the reading and  $\ominus$  EXIT to return to the basic display.
6. You can save several readings with HOLD-SAVE function. The first saved reading is data point 1, the second saved reading is data point 2 etc. All the individual readings (data points) are stored in the same file marked with  $\text{⏏}$ . The file remains in the indicator memory even if the indicator is switched OFF.
7. To view the saved readings, press  $\ominus$   $\blacktriangleright$  Record, select  $\blacktriangleright$  View recorded data, press  $\text{⏏}$ .
8. Select the file marked with  $\text{⏏}$ , press  $\text{⏏}$ . Now you can see the saved data readings. Press  $\ominus$  TIMES to see the recording timestamps.
9. Press  $\ominus$  EXIT to return to the basic display.

## Graphic History

Graphic history shows you the data curve from the time the device was turned on.

1. Open the MENU, press  $\text{⏏}$   $\ominus$  OPEN.
2. Select  $\blacktriangleright$  Display, press  $\text{⏏}$ .
3. Select Graphic history, press  $\ominus$  SHOW to have a graphical history display.
4. To get the statistical info on the graph area (minimum, maximum and mean values), press  $\ominus$  INFO.
5. To get the curve of the other selected quantities, press  $\ominus$  NEXT. To get the curves of all the quantities, press  $\ominus$  NEXT until text ALL is shown, press  $\ominus$  ALL.
6. To zoom in on the curve, press the arrow button  $\text{⏏}$ . To zoom out, press the button  $\text{⏏}$ . To move the curve in horizontal directions, press the buttons  $\text{⏏}$   $\text{⏏}$ .
7. Press  $\ominus$  BACK and EXIT to return to the basic display.

## User Interface



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Figure 9 User Interface Settings Menus

## Selecting

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





1. Open the MENU, press  $\text{▶} \ominus$  OPEN.
2. Select  $\text{▶}$  Settings, press  $\text{▶}$ .
3. Select  $\text{▶}$  User interface, press  $\text{▶}$ .
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  $\ominus$  (right) as many times as required, then go to the language selection menu by pressing:  $\text{▶}$ ,  $\ominus$  (middle)  $\text{▶}$ ,  $\text{▶}$ ,  $\text{▶}$ ,  $\ominus$  (middle).

## Automatic Power Off








As shipped from the factory, the GM70 has a default setting which turns the power off automatically after 15 minutes of inactivity. This is to save the battery. In case you want to change the inactivity time setting to 60 minutes or turn off the automatic power off function, follow the instructions below:

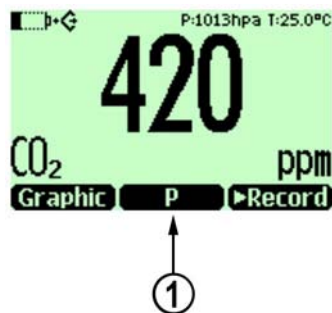
1. Open the MENU, press  $\text{▶} \ominus$  OPEN.
2. Select  $\text{▶}$  Settings, press  $\text{▶}$ .

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

By default the three shortcut keys refer to the functions Graphic, Hold/Save and Record. However the shortcut keys for the functions can be changed to meet 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, for example: Hold/Save.
6. If you want to replace Hold/Save with pressure setting function, select pressure setting by using arrow buttons, ► Environment→P, 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.










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**Figure 10** Changing the Shortcut Keys












The following number refers to Figure 10 above:

- 1 = Hold/Save-shortcut key replaced by pressure setting shortcut key P

## Key Click and Backlight On Key Press




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

## Setting Date and Time

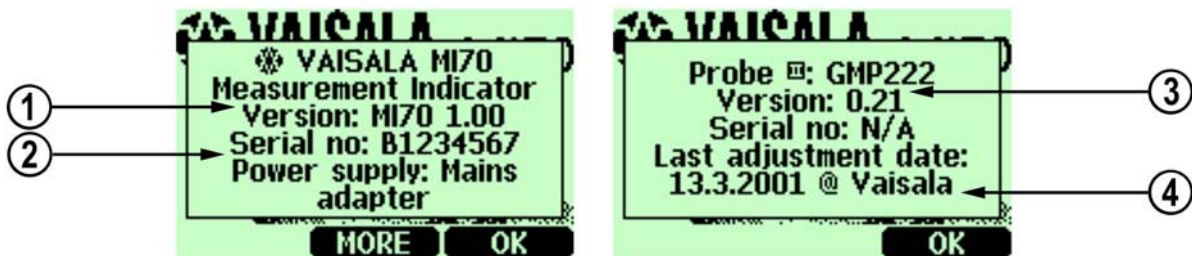
1. Open the MENU, press   OPEN.
2. Select ► Settings, press .
3. Select ► Date and time, press .
4. The default date presentation format is *year-month-date*. For example 2002-02-01. To change the date, select Date and press  SET. Change the date by using arrow buttons. To confirm the date, press  OK. If you want to change the format, select D.M.Y (*date.month.year*) or M/D/Y date format (*month/day/year*), press  ON/OFF.
5. The default time presentation format is 24-hour clock. To change the time, select Time and press  SET. Change the time by using arrow buttons. To confirm the time, press  OK. 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.



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**Figure 11 Device Information Displays**

The following numbers refer to Figure 11 above:

- 1 = Software version of the MI70 indicator
- 2 = Serial number of the MI70 indicator
- 3 = Software version of the probe
- 4 = Location of the last adjustment (alternatives: Vaisala, GM70, or GMK220)

## Reverting Factory Settings

Factory settings of the indicator only can be reverted to clear all changed settings and data memory of the indicator. Reverting factory settings of the indicator does not affect the probe calibration. Factory calibration of the probe cannot be reverted if adjustment is made (see *Chapter 10 Calibrating and Adjusting the Probes* on page 43).

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 need to set the language, date, and time again. See *Turning On and Setting Language, Date, and Time* on page 14.

## Other Settings



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Figure 12 Other Settings Menu

## Setting the Alarm Levels

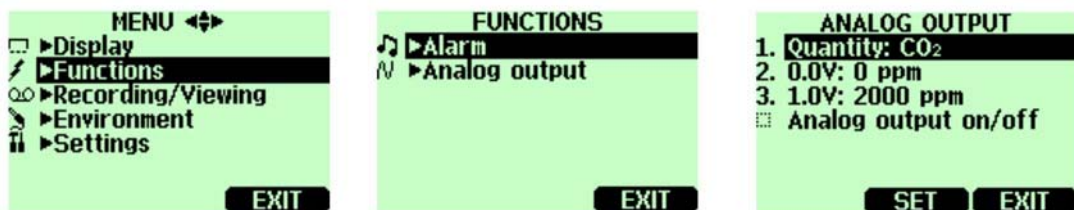
Two alarm levels can be set. Alarming state is OFF in between the set points. Alarming state is ON when CO<sub>2</sub> concentration is below level 1 or above alarm level 2. For example, if you want to set ON the alarm when concentration exceeds 1000 ppm, set the first level as 0 ppm and the second level as 1000 ppm. When alarming is ON, GM70 starts to beep and display backlight starts to blink.

1. Open the MENU, press  $\rightarrow$   $\ominus$  OPEN.
2. Select  $\blacktriangleright$  Settings, press  $\rightarrow$ .
3. Select  $\blacktriangleright$  Alarm, press  $\rightarrow$ .
4. Select the first limit, press  $\ominus$  (if the alarm function is ON, take it OFF). Set the alarm level by using arrow buttons. Press  $\ominus$  OK to save the setting.
5. If needed, select the second limit, and then follow instructions from item 6. The alarm will go off when the upper limit is exceeded or when lower limit is gone below.
6. Select Alarm ON/OFF, press  $\ominus$  ON to activate the alarm and return back to the basic display.
7. A note picture sign  $\text{M}$  appears on the upper left corner of the basic display.
8. 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.



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## CHAPTER 7

**ANALOG OUTPUT CONNECTION****Selecting and Scaling the Analog Output**


















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**Figure 13** Selecting Analog Output

To get analog measurement data you need an analog output signal cable, see list of accessories on page 62. One scalable voltage signal channel 0...1.0V is available. You can scale the output to any output range but it is recommended to have the scaling within the probe's measuring range to get accurate measurements.

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

<b>Brown wire:</b>	<b>common wire (-)</b>
<b>Yellow-green wire:</b>	<b>signal (+)</b>

2. Open the MENU, press   OPEN.
3. Select  Functions, press .
4. Select  Analog output, press .
5. Select 0.0V to set the value for the 0.0V output signal, press  SET (If the analog output is ON, take it OFF). Set the low value by using the arrow buttons. Press  OK to make the setting.
6. Select 1.0V to set the value for the 1.0V output signal, press  SET. Set the high value by using the arrow buttons. Press  +/- button to choose the sign of the value. Press  OK to make the setting.
7. Select Analog output on/off, press  ON to activate the analog output and return back to the basic display.
8. A wire picture sign  appears on the upper left corner of the basic display.
9. To deactivate the analog output function, go to MENU  Functions  Analog output  Analog output on/off and press  OFF.

## CHAPTER 8

# RECORDING DATA

## Recording




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**Figure 14** Recording Data

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

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

Measurement interval	Maximum recording duration (= memory full)
1 second	45 minutes
5 seconds	3 hours
15 seconds	11 hours
30 seconds	22 hours
1 minute	45 hours
5 minutes	9 days
15 minutes	28 days
30 minutes	56 days
1 hour	113 days
3 hours	339 days
12 hours	1359 days

5. Press  $\ominus$  SELECT.
6. To set the recording duration, select Duration, press  $\ominus$  SET.
7. Select the recording duration with the arrow buttons and press  $\ominus$  SELECT.
8. Start recording: select Start/Stop recording, press  $\ominus$  START. If you choose 'Memory full', you see the maximum recording time on the display. You can also delete files to free memory. Press  $\ominus$  START again to accept maximum recording time.
9. It is recommended to have power on during recording to get the most accurate measurements. In long lasting recordings, power the GM70 via the charging adapter. Ensure that the automatic power off function is deactivated. In battery use, you can switch off power during recording to save battery, but then the accuracy is not necessarily within accuracy specifications. A 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 the charging adapter is connected).

**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.

## Stop Recording

1. To stop recording, press shortcut  $\ominus \blacktriangleright$  Record, select  $\blacktriangleright$  Record data and press  $\ominus \blacktriangleright$ , select Start/Stop recording and press  $\ominus$  STOP.
2. Now you can go and view the recorded file by selecting  $\ominus$  SHOW.

You can save individual measurement data points with Hold/Save function described in page 25.

## Viewing Recorded Data

1. Open the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Recording/Viewing, press  $\text{▶}$ .
3. Select  $\text{▶}$  View recorded data, press  $\text{▶}$ .
4. Select the file you want to view, press  $\text{▶}$ . The files are identified according to the starting date and time of recording.
5. Press  $\ominus$  GRAPH to get the graphical view, press  $\ominus$  TIMES to get the recording timestamps (press  $\ominus$  VALUES to go back to the recording values).
6. Press  $\ominus$  EXIT to return to the basic display.

## Checking Memory Status

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

1. Open the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Recording/Viewing, press  $\text{▶}$ .
3. Select Memory status, press  $\ominus$  SHOW to see the amount of memory in use and the estimated free space.
4. To return to the basic display, press  $\ominus$  OK and  $\ominus$  EXIT.

## Deleting All Recorded Files

The data memory can be cleared as follows:

1. Open the MENU, press  $\text{▶}$   $\ominus$  OPEN.
2. Select  $\text{▶}$  Recording/Viewing, press  $\text{▶}$ .
3. Select Clear data memory, press  $\ominus$  CLEAR. Press  $\ominus$  YES to confirm deletion of all recorded data files.
4. To return to the basic display, press  $\ominus$  EXIT.

## Transferring Recorded Data to PC

The recorded data can be transferred to a PC by using the MI70 Link program.

The MI70 Link program can be ordered from Vaisala, see list of accessories on page 62. You can examine the recorded data easily in Microsoft Windows® environment and further transfer it into 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 GM70 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 GM70 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 GM70 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

## CHAPTER 9

# FIELD CHECKING OF FIXED TRANSMITTERS

### Field Checking of the Vaisala GMD/W20 Series Transmitters (Diffusion Sampling)



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**Figure 15** Location of the MI70 Connector Ports

The following number refers to Figure 15 above:

1 = Connectors for the GMA70 cable

Check the reading of a fixed transmitter by using the GM70 as a reference. Both readings can be seen on the GM70's display



simultaneously when using a connecting cable GMA70 (see the list of accessories).

1. Connect the end of the GMA70-cable to either of the GM70's connector ports located on the bottom of the indicator.
2. Connect the other end of the GMA70-cable to the SERIAL COM pin connector of the GM20 transmitter's motherboard.
3. Turn on the MI70 indicator.
4. Set the GM70 probe next to the transmitter to be checked. Ensure that the probes are located in the same conditions. Avoid exhaling towards the probe as this alters the CO<sub>2</sub> concentration and disturbs the readings.
5. The reading of the transmitter is shown on the first or middle row of the display, depending on which connector is used. Value of connector I is shown on the upper row of the display. Value of connector II is on the lower row of the display. The difference of the readings is shown on the lowest row.
6. Compare the readings. In case there is a need for an adjustment, send the transmitter to a Vaisala Service Center to be adjusted or make an adjustment by using a calibration software kit (19222GM).

## Field Checking of the Vaisala GMD/W20 Series Transmitters (Pump Aspirated Sampling)

The pump aspirated system feeds the same gas sample to both the reference probe and the transmitter to be checked. Both readings can be seen on the GM70's display simultaneously when using a connecting cable GMA70 (see the list of accessories).

1. Connect the GMA70 cable between the MI70 indicator's connector port and the SERIAL COM pins in the motherboard of the GM20 transmitter. If not using the GMA70 cable, check the transmitter reading from the transmitter output.
2. Connect one end of the sampling tube to the gas inlet (marked with IN) of the GM70PUMP.
3. Connect the other end of the tube.
4. GMD20: to the sampling port located in the middle of the GMD20's motherboard (protected with a yellow cap).
5. GMW20: to the sampling port located on the GMW20's motherboard (protected with a yellow cap).

6. Insert the calibrated GM220 probe to the measuring chamber of the GM70PUMP.
7. Turn on the MI70 indicator and the GM70PUMP.
8. Compare the readings. In case there is need for an adjustment, send the transmitter to a Vaisala Service Center to be adjusted or make an adjustment by using a calibration software kit (19222GM).

**NOTE**

Please do not breathe towards the transmitter when checking the readings.

## Field Checking of the GMT220 (Without a Display)

Follow the instructions below to check the operation of a GM220 series probe.

1. Check the display reading of the GM70.
2. Turn off the GM70.
3. Detach the GM70's probe as follows:
  - Loosen the plastic probe fastener (item 7, Figure 1) by unscrewing it about 5 turns.
  - Take a firm hold from the base of the probe and pull strongly until the probe comes loose.
4. Detach the GM220 probe from the transmitter base (open the cover, loosen the tightening screw and pull the probe out).
5. Insert the GM220 probe to the GM70 handle as deep as possible. Turn the probe inside the handle until you feel that a step in the probe connector snaps into the groove of the probe handle connector and locks the probe.
6. Tighten the probe fastener.
7. Turn on the GM70.
8. Compare the readings of the GM70 and the transmitter probe to be checked.
9. If there is need for an adjustment, please contact Vaisala Service Center or adjust the probe according to the instructions in *Chapter 10 Calibrating and Adjusting the Probes* on page 43.

You can also connect the GMA70 cable between the GMT220 and the GM70 as described in the previous section.

## CHAPTER 10

# CALIBRATING AND ADJUSTING THE PROBES

In this user's guide the term **calibration** means comparing detector's reading to a reference concentration. In **adjusting**, which is usually done after calibration, the reading of the detector is changed to correspond to the reference concentration.

After adjustment, the original calibration certificate shipped with the product is not valid anymore.

## Calibration Interval

The GM70 is fully calibrated and adjusted as shipped from factory. The recommended calibration interval is two years. However, calibration should always be done whenever there is reason to believe that the device is not within the accuracy specifications. The length of the suitable calibration interval may vary depending on the conditions and frequency of use.

## Factory Calibration and Adjustment

It is recommended to send the GM70 probe to Vaisala Service Centers for accurate calibration and adjustment, see contact information on page 56.

## Calibration and Adjustment by the User

The GM70 can be calibrated and fine control adjustment can be carried out by the user. Note that this adjustment does not correspond to the accurate factory adjustment. The user adjustment is recommended only if the reading error is less than 10% of the measuring range in the low-end and less than 20% of the measuring range in the high-end. The calibration report supplied with the product is not valid after the adjustment.

**CAUTION**

You cannot revert to factory settings after the user adjustment!

Adjustment is carried out

- by using reference gases and a field check adapter,
- by comparing two probes: the one to be adjusted and the other a calibrated probe.

**NOTE**

Adjustment cannot be done with the GM70PUMP.

To open the adjustment mode you need to press the adjustment button (Figure 16) located in the probe handle. The GMH70 handle does not meet the IP65 classification requirements after removal of the screw that covers the adjustment button.



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**Figure 16** Location of the Adjustment Button

The following number refers to Figure 16 above:

- 1 = Adjustment button (before adjusting, take out the screw which covers the button).

## Adjustment with Reference Gases

### Equipment Needed

For the adjustment procedure with gases, you need the probe to be adjusted, accurate reference gas(es), a pressure regulator, a flow meter, a field check adapter (can be ordered from Vaisala) and flexible tubing with 3 mm (1/8") inner diameter.

### Reference Gases

To achieve reliable results reference gases shall be traceable to appropriate standards (for example NIST).

- If adjustment is done by using one reference gas (one-point adjustment), concentration of the gas should be near to the concentration values in which the device is used.

**NOTE**

It must be noted that when adjustment is done only in one point, this results high accuracy only near to the adjustment point, not necessarily over the whole measurement range.

- When using two reference gases (two-point adjustment), the reference gas concentrations should represent the low-end and the high-end of the measuring range. The low-end concentration should be less than 20% of the measuring range of the probe. The zero gas can be N<sub>2</sub> gas with a purity of N5.0 (or better). The high-end gas can be mixture of CO<sub>2</sub> and N<sub>2</sub> with concentration near to the upper limit of the measuring range, being 110% of the range at maximum. Accuracy of the concentrations should be 1% (or better). Difference between the reference gas concentrations should be more than 20% of the measuring range.

### Two-Point Adjustment Procedure

**CAUTION**

Please take special care regarding the following when carrying out the adjustment:

- Check that you give the correct reference concentrations in the correct units.
- Check that the reading has really stabilized before accepting the reading.

You cannot revert the factory settings after the adjustment!

1. Insert the probe into the field check adapter until the perforated filter is covered.



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**Figure 17** Field Check Adapter

2. Connect the tubing to the bottom port of the adapter.
3. Connect the adapter with the tubing to the flow meter, the pressure regulator and further to the low-end reference gas bottle. The side port of the adapter is left open for gas outflow.
4. Let the low end reference gas flow and stabilize with a flow rate of about 0.6 l/min. Follow the reading of GM70, and after it has stabilized, wait for 6 more minutes.
5. Take out the screw from the GM70 probe handle to expose the adjustment button (see Figure 16, page 44). Press the button with a small screwdriver. When pressing the button, the indicator turns to adjusting mode.
6. Press  $\ominus$  OK to confirm the adjusting.
7. Select CO<sub>2</sub>, press  $\ominus$  SELECT.
8. Press  $\ominus$  YES to give the ambient pressure and temperature values. To continue adjusting press  $\ominus$  EXIT.
9. Now the adjustment mode is on. Press  $\ominus$  GRAPH to confirm that the readings have stabilized. Go back and press  $\ominus$  ADJUST to select the adjustment method.
10. Select 2-point adjustment, press  $\ominus$  SELECT. Press  $\ominus$  READY with the stabilized reading in the lower reference concentration.
11. Give the lower reference concentration value by using the arrow buttons (for example, if you are using pure nitrogen, enter value 0 ppm). Take care that you give the correct value in correct units, as you cannot revert the earlier values after accepting the new values. Press  $\ominus$  OK.

Next move on to the adjustment at the second (high-end) reference point.

12. Take out the tubing from the low-end gas bottle and connect it to the high-end gas bottle.
13. Let the high end reference gas flow and stabilize with a flow rate of 0.6 l/min. Follow the reading of GM70, and after it has stabilized, wait for 6 more minutes.
14. Press  $\ominus$  READY with the stabilized reading in the higher reference concentration.
15. Give the high-end reference concentration value by using the arrow buttons. The analyzed CO<sub>2</sub> concentration of the reference gas is typically printed on the bottle.

Take care that you give the correct value in correct units, as you cannot revert the earlier values after accepting the new values. Press  $\ominus$  OK.

16. Confirm the adjustment, press  $\ominus$  YES. By pressing  $\ominus$  NO you return to adjustment mode display. (If the difference between the two references is less than 20% of the measuring range of the probe, adjustment cannot be done).
17. Adjustment is complete. Press  $\ominus$  BACK-EXIT to return to the basic display.
18. Shut off the gas flow.
19. Replace the screw onto the adjusting button.

## One-Point Adjustment Procedure

### CAUTION

Please take special care regarding the following when carrying out the adjustment:

- Check that you give the correct reference concentrations in the correct units.
- Check that the reading has really stabilized before accepting the reading.

You cannot revert the factory settings after the adjustment!

1. Insert the probe into the field check adapter (as deep as possible, the perforated filter cover should be completely inside the adapter).
2. Connect the tubing to the bottom port of the adapter.



3. Connect the adapter with the tubing to the flow meter, the pressure regulator and further to the reference gas bottle. The side port of the adapter is left open for gas outflow.
4. Let the reference gas flow and stabilize with a flow rate of 0.6 l/min. Follow the reading of GM70, and after it has stabilized, wait for 6 more minutes.
5. Take out the screw from the GM70 probe handle to expose the adjustment button (see Figure 16, page 44). Press the button with a small screwdriver. When pressing the button, the indicator turns to adjusting mode.
6. Press  $\ominus$  OK to confirm the adjusting.
7. Select CO<sub>2</sub>, press  $\ominus$  SELECT.
8. Press  $\ominus$  YES to give the ambient pressure and temperature values. To continue adjusting press  $\ominus$  EXIT.
9. Now the adjustment mode is on. Press  $\ominus$  GRAPH to see when the readings have stabilized. Go back and press  $\ominus$  ADJUST to select the adjustment method.
10. Select 1-point adjustment, press  $\ominus$  SELECT. Press  $\ominus$  READY if the value has stabilized.
11. Give the reference concentration value by using the arrow buttons.

Examples: For a zero-point adjustment using pure nitrogen (N<sub>2</sub>) enter value 0 ppm.

For other reference gases, the analyzed CO<sub>2</sub> concentration is typically printed on the bottle. Use that value.

Take care that you give the correct value in correct unit, you cannot revert the earlier values after accepting the new values. Press  $\ominus$  OK.

12. Confirm the adjustment, press  $\ominus$  YES. By pressing  $\ominus$  NO you return to adjustment mode display.
13. Adjustment is complete. Press  $\ominus$  BACK-EXIT to return to the basic display.
14. Shut off the gas flow.
15. Replace the screw onto the adjusting button.

## Adjustment with Two Probes

You need to have two probe handles and two probes: one calibrated probe and the probe to be adjusted. It is recommended to carry out the adjustment in a stable environment and near the concentration values in which the device is used.

Connect the probes to connectors I and II in the bottom of the indicator.

1. Turn on the GM70.
2. Take the probe you want to adjust. Unscrew the probe handle screw to expose the adjustment button (see Figure 16, page 44). Press the button with a small screwdriver. When pressing the button, indicator turns to adjusting mode.
3. Select CO<sub>2</sub>, press  $\ominus$  SELECT.
4. Press  $\ominus$  YES to give the ambient pressure and temperature values. Remember to check that pressure and temperature values are the same with both probes. To continue adjusting press  $\ominus$  EXIT.
5. Now the adjustment mode is on. Press  $\ominus$  GRAPH to see when the readings have stabilized. Go back and press  $\ominus$  ADJUST to select the adjustment method.
6. Select To same as CO<sub>2</sub>, press  $\ominus$  SELECT and  $\ominus$  YES.
7. Adjustment is complete. Press  $\ominus$  BACK-EXIT to return to the basic display.
8. Replace the screw onto the adjusting button.

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## CHAPTER 11

# ERROR MESSAGES

**Table 2 Error Messages Table**

<b>Error Message</b>	<b>Interpretation and Action</b>
<b>Difference too big</b>	<p>The adjustment cannot be made if the difference between the measured concentration and the given value is more than 20% of the maximum value of the probe's measuring range. This message can be caused by a considerable high drifting error of the probe.</p> <p>Please, contact Vaisala or send the probe to Vaisala Service, see page 56.</p>
<b>Value too high</b>	<p>The reference concentration can be at the highest 110% of the maximum value of the probe's measuring range.</p> <p>Make the adjustment by using lower reference gas concentration.</p>
<b>Lower value too high</b>	<p>The lower reference gas concentration shall be less than 20% of the maximum value of the probe's measuring range.</p> <p>Make the adjustment by using lower reference gas concentration.</p>
<b>Higher value too high</b>	<p>The higher reference gas concentration shall be at highest 110% of the maximum value of the probe's measuring range.</p> <p>Make the adjustment by using lower reference gas concentration.</p>
<b>Values too close</b>	<p>The difference between the reference concentrations shall be at minimum 20% of the maximum value of the probe's measuring range.</p> <p>Make the adjustment by using correct reference gas concentrations, see above.</p>
<b>Probe error: Reboot</b>	<p>This error can occur when changing the probe while power is on. Switch off power and connect the probe properly. Switch on power.</p>
<b>Probe error</b>	<p>This error can occur when changing the probe while power is on. Switch off power and check that the probe is connected properly: unscrew the probe fastener. Insert the probe to the handle as deep as possible. Turn the probe inside the handle until you feel that a step in the probe connector snaps into the groove of the handle connector and locks the probe. Tighten the probe fastener. Switch on power.</p>
<b>Adapter error</b>	<p>Switch off power and check that the probe is connected properly, see the instructions of Probe error. In case of continuous error, contact Vaisala or send the probe to Vaisala Service, see page 56.</p>

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## CHAPTER 12

# MAINTENANCE

### Changing the Probe

1. Turn off the GM70.
2. Detach the probe as follows (see Figure 18 on page 54):
  - Loosen the plastic probe fastener by unscrewing it about 5 turns.
  - Take a firm hold from the base of the probe and pull strongly until the probe comes loose.
3. Insert a new probe to the handle as deep as possible. Turn the probe inside the handle until you feel that a step in the probe connector snaps into the groove of the probe handle connector and locks the probe.
4. Tighten the probe fastener.
5. Turn on the GM70.



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**Figure 18 Detaching the Probe**

The following refers to Figure 18 above:

- 1 = Unscrew the probe fastener (about 5 turns).
- 2 = Pull the probe out firmly.

## Changing the Probe Filter

Spare filters for the probe can be ordered from Vaisala, see list of accessories on page 62.

- 1. Remove the plastic grid by pulling it out.
- 2. Remove the filter paper.
- 3. Insert a new filter paper and plastic grid.

## Cleaning

Wipe the plastic parts of the device with a damp paper or towel. Mild washing agents can be used. Do not let water flow down to electronics through the buttonholes.

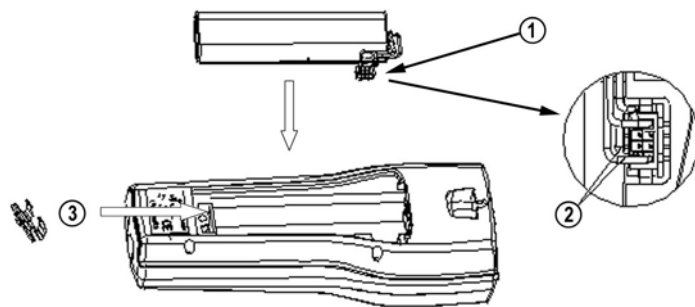
## Changing the Battery Pack

New rechargeable battery packs 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 4 (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 13.

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



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**Figure 19** Installing the Battery Pack



## Return Instructions

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

1. Read the section Warranty on page 8.
2. Contact a Vaisala Service Center or a local Vaisala representative. The latest contact information and instructions are available from [www.vaisala.com](http://www.vaisala.com). Addresses of the Service Centers are provided in section Vaisala Service Centers on page 57.

Please have the following information on hand:

- serial number of the unit
  - date and place of purchase or last calibration
  - description of the fault
  - circumstances in which the fault occurs/occurred
  - name and contact information of a technically competent person who can provide further information on the problem
3. Pack the faulty product in a strong box of adequate size, with proper cushioning material to avoid damage.
  4. Include the information specified in step 2 in the box with the faulty product. Also include a detailed return address.
  5. Ship the box to the address specified by your Vaisala contact.

# Vaisala Service Centers

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## CHAPTER 13

**TECHNICAL SPECIFICATIONS****GM70 Hand-Held Carbon Dioxide Meter****General****Table 3      General Specifications**

<b>Property</b>	<b>Description / Value</b>
Storage temperature	-30 ... +70°C
Storage humidity range	0 ... 100%RH non-condensing

**Electromagnetic Compatibility**

Complies with the following standard:

EN61326-1:1997+ Am1:1998 + Am2:2001, Electrical equipment for measurement, control and laboratory use - EMC requirements; Generic environment.

**GMP221/222 Probes****Table 4      Measuring Ranges**

<b>Probe</b>	<b>Measuring Ranges</b>
GMP221	0 ... 2%, 0 ... 3%, 0 ... 5%, 0 ... 10%, 0 ... 20%
GMP222	0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 5000 ppm, 0 ... 7000 ppm, 0 ... 10000 ppm

**Table 5 Accuracy Specifications**

Accuracy (including repeatability, non-linearity and calibration uncertainty) at 25°C and 1013 hPa.

<b>Probe</b>	<b>Accuracy</b>
GMP221 Accuracy specification applies for CO <sub>2</sub> concentrations above 2% of full scale	±[1.5% of range + 2% of reading]
GMP222	±[1.5% of range + 2% of reading]
<b>Property</b>	<b>Description / Value</b>
Temperature dependence, typical	-0.3% of reading / °C (reference 25°C/77°F)
Pressure dependence, typical	+0.15% of reading / hPa (reference 1013 hPa)
Long-term instability	<±5%FS / 2 years
Response time (63%)	20 seconds (GMP221) 30 seconds (GMP222)

**Table 6 Other Specifications**

<b>Property</b>	<b>Description / Value</b>
Warm-up time	30 seconds
with GM70PUMP	15 min full specification 30 min full specification
Operation temperature	-20 ... + 60°C
Operation pressure	700 ... 1300 hPa
Operation humidity	0 ... 100%RH non-condensing
Flow range (diffusion sampling)	0 ... 10 m/s
Probe material	PC
Probe cable length	1.9 m

## GMH70 Handle, GM70PUMP

**Table 7 General Specifications**

<b>Property</b>	<b>Description / Value</b>
<b>GMH70 Handle</b>	
GMH70 handle material	ABS/PC-blend
Probe fastener	Aluminium
Weight (with probe)	0.23 kg
Housing classification	IP65
<b>GM70PUMP</b>	
Pump casing	Anodized aluminium
Pump	0 ... 18 mbar differential pressure
Weight (with probe)	0.7 kg
Housing classification	IP54

## MI70 Indicator

### Indicator General

**Table 8** General Specifications

Property	Description / Value
Operating temperature range	-10 ... + 40°C
Operating humidity change	0 ... 100%RH non-condensing
Menu languages	English, German, French, Finnish, Spanish, Swedish, Chinese, Russian and Japanese.
Display	LCD with backlight Graphic trend display of any parameter Character height up to 16mm
Max number of probes	2
Power supply	Rechargeable NIMH battery pack with AC-adapter 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
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Logging interval	1 s to 12 h
Alarm	Audible alarm function
Housing classification	IP54
Weight	400 g
Housing material	ABS/PC-blend

### Battery Pack

**Table 9** Battery Pack Specifications

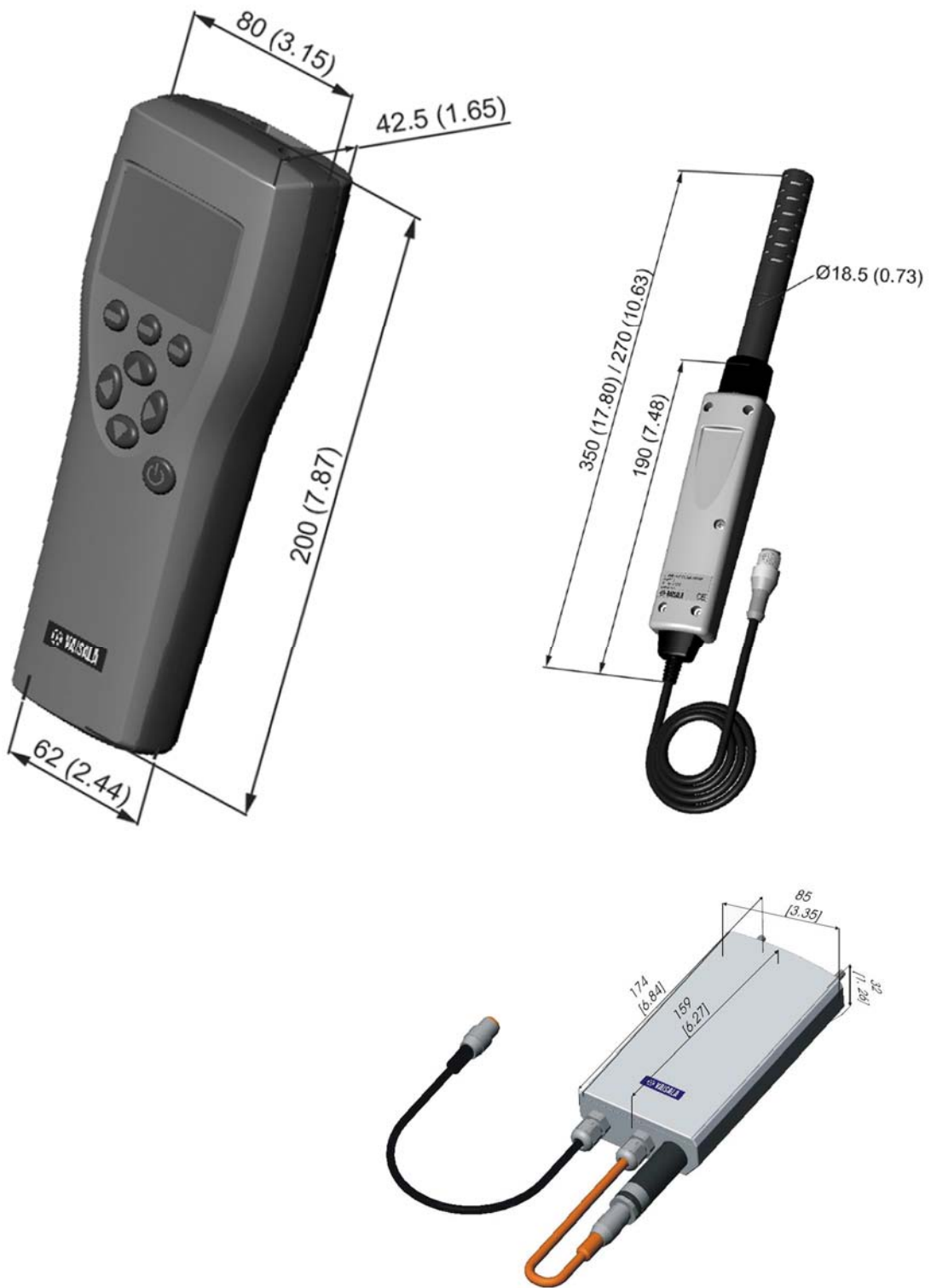
Property	Description / Value
Operation times continuous use (one probe)	better than 8 h at +20°C
data logging use (one probe)	up to a month, depending on logging interval
when pump is on	better than 5 h at +20°C without load
Power consumption during charge	10 W max
Charging time	4 hour typical

## Accessories

**Table 10 Accessories Table**

<b>Description</b>	<b>Order Code</b>
Euro AC-adapter	MI70EUROADAPTER
UK AC-adapter	MI70UKADAPTER
US AC-adapter	MI70USADAPTER
AUS AC-adapter	MI70AUSADAPTER
Measurement indicator (battery pack included)	MI70
Analog output signal (0 ... 1 VDC) cable	27168ZZ
Connection cable for fixed CO <sub>2</sub> instruments (GMT220, GMM220, GMD20 and GMW20)	GMA70
Carrying case	MI70CASE
Spare probe (use the order form to define measurement range)	GMP221, GMP222
Aspiration pump	GM70PUMP
Handle	GMH70
Spare filter for GMP221	25378GMSP
Spare filter for GMP222	25879GMSP
Calibration adapter	26150GM
Battery, NiMH 4.8 V	26755
Nafion Membrane tubing	212807GM
<b>PC Connection tools</b>	
MI70 Link software interface kit including a USB instrument cable for MI70	219687
MI70 Link software interface kit including a serial port cable for MI70	MI70LINK

## Dimensions in mm (inch)



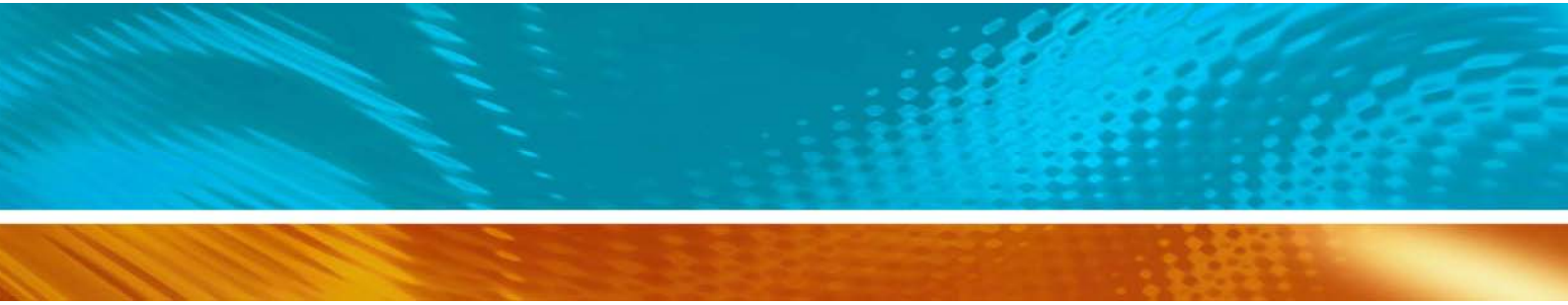
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**Figure 20** Dimensions









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