User Guide

Vaisala CARBOCAP® Handheld Carbon Dioxide
Meter

GM70

VAISALA

Table of contents

List of figures

List of tables

1. About this document

1.1 Version information

This document provides detailed instructions for installing, operating, and maintaining Vaisala CARBOCAP® Handheld Carbon Dioxide Meter GM70.

Document code	Date	Description
M010139EN-H	April 2021	This manual. Document template and content organization update. Added information about MI70 battery and device status icons and the calibration reminder setting. Updated information about data transfer with MI70 Link and stabilization time in adjustment instructions. Specifications and spare part information updated. Removed references to discontinued products GMT220, GMM220, GMK220, GMW115, and GMW20.
M010139EN-G	April 2012	Previous version. New error codes added. General updates implemented.

1.2 Related manuals

Document code	Name
M210292EN	*Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD20 User's Guide*
M210450EN	*Vaisala Field Check Adapter 26150GM Quick Reference Guide*
M210514EN	*Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 User's Guide*
M211501EN	*Vaisala CARBOCAP® Carbon Dioxide Probe GMP231 User Guide*
M211659EN	*Vaisala CARBOCAP® Carbon Dioxide, Temperature, and Humidity Transmitter Series GMW90 User's Guide*
M211799EN	*Vaisala CARBOCAP® Carbon Dioxide Probe GMP251 User Guide*
M211897EN	*Vaisala CARBOCAP® Carbon Dioxide Probe GMP252 User Guide*

1.3 Documentation conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions 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 highlights important information on using the product.

Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

Indicates that you need to take some notes during the task.

1.4 Trademarks

Vaisala® and CARBOCAP® are registered trademarks of Vaisala Oyj.

Windows® is either a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

All other product or company names that may be mentioned in this publication are trade names, trademarks, or registered trademarks of their respective owners.

2. **Product overview**

2.1 Introduction to GM70

Vaisala CARBOCAP® Handheld Carbon Dioxide Meter GM70 measures volume concentration of CO_2 gas and displays the result in the units of ppm or %. The exceptional stability and reliability performance of GM70 comes from the advanced silicon based Vaisala CARBOCAP® sensor.

2.1.1 Basic features of GM70

- Numerical and graphical multilingual displays
- Data logging possibility
- A tool for checking the reading of fixed CO_2 transmitters
- A tool for adjusting Vaisala GMP220 series probes
- Possibility for an analog output (voltage signal 0 ... 1 V)
- Sampling methods: diffusion sampling (GMH70 handle) or pump-aspirated sampling (GM70PUMP), alternatively
- Multiprobe operation; any combination of 2 Vaisala DM70, GM70, HM70, and MM70 series probes can be used, for example, for simultaneous CO_2 and dew point measurements
- The optional, ready-to-use MI70 Link Microsoft Windows® software, which allows an easy way to handle measurement data using a USB instrument cable or an RS-232 serial communication cable.

Using GM70 with Vaisala carbon dioxide probes and transmitters is discussed in the respective User Guides, available at www.vaisala.com.

More information

‣ Related manuals (page 7)

2.1.2 Interchangeable probes

By selecting the right GMP220 series probe you can choose the measuring range that best fits your application. The measuring ranges vary from 0 ... 10 000 ppm to 0 ... 20 % concentrations of CO_2. To change the measuring range, you only have to change the probe.

More information

‣ Probes (page 11)
‣ GM70 specifications (page 50)

2.2 Parts description
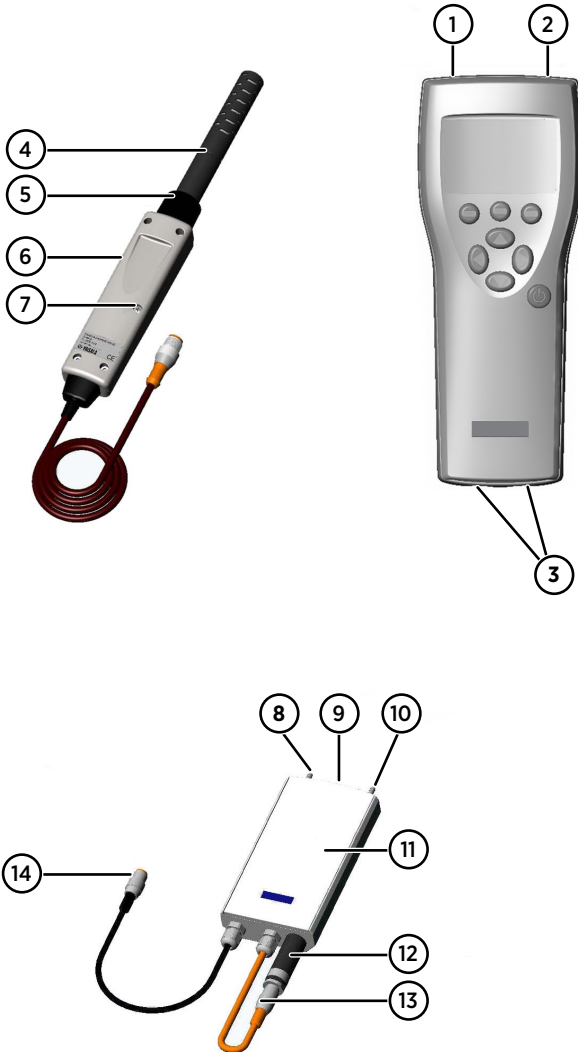
Figure 1   GM70 parts

1   MI70 indicator
2   Charger socket
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 the MI70 indicator

2.3 Probes

The GMP220 series probes can be used with GM70. The table below lists the measuring ranges that can be selected for the probes.

Table 3   GMP221 and GMP222 measuring ranges

Probe	CO_2 measuring ranges
GMP221	• 0 … 2 % • 0 … 30 % • 0 … 5 % • 0 … 10 % • 0 … 20 %
GMP222	• 0 … 2000 ppm • 0 … 3000 ppm • 0 … 5000 ppm • 0 … 7000 ppm • 0 … 10000 ppm

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.

2.4 GM70PUMP for aspirated sampling

The GM70 aspiration pump consists of a pump and a measurement chamber for CO_2 measurements. GM70PUMP is designed for checking of fixed CO_2 transmitters and for sampling from locations difficult to access. GM70PUMP is connected to an MI70 indicator which displays the measurement result. The pump system is powered through the MI70 indicator.

2.5 Safety

The Vaisala CARBOCAP® Handheld Carbon Dioxide Meter GM70 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precaution:

> ⚠️ **CAUTION!** Do not modify the unit or use it in ways not described in the documentation. Improper modification or use may lead to safety hazards, equipment damage, failure to perform according to specification, or decreased equipment lifetime.

2.5.1 ESD protection

Electrostatic Discharge (ESD) can damage 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 in the equipment housing.

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

3. MI70 indicator

3.1 MI70 indicator parts
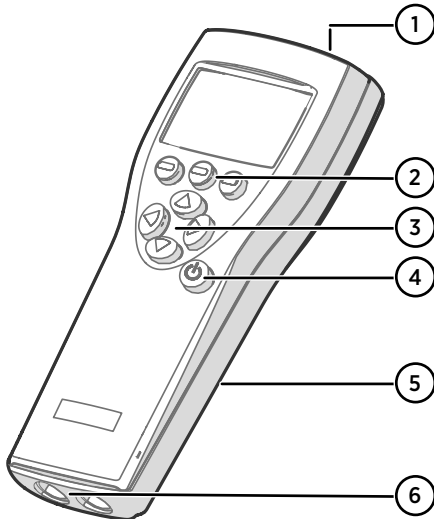
Figure 2   MI70 indicator parts

1   Charger socket
2   Function key shortcut buttons ⊖. The functions change according to what you are doing with the indicator.
3   Arrow buttons:

▲   Move up in a menu
▼   Move down in a menu
▶   Enter a sub-menu
◀   Return to previous menu level

4   Power On/Off button
5   Battery compartment at the back of the indicator
6   2 ports with M12 4-pin female connectors for connecting probes and instruments. The ports are labeled I and II.

To open menus, press an arrow button and then press the shortcut buttons. To activate a function shown above the shortcut button, press the shortcut button. To navigate in the menus, press the arrow buttons.

3.2 Installing and recharging MI70 batteries

ℹ️ Vaisala recommends using the rechargeable battery pack (item code 26755) with GM70, instead of alkaline batteries.

If you are using **alkaline** batteries, unscrew the back plate of the indicator and insert the batteries. Do not attempt to recharge standard alkaline batteries.

If you ordered MI70 with a **rechargeable** battery, it is already in place as shipped from the factory. The delivered batteries have been pre-charged.

To recharge the rechargeable battery:

▶ 1. Plug in the charger connector to the MI70 indicator. The socket is located at the top of the indicator, covered by a rubber seal.

2. Connect the charger to a wall socket. An animated battery icon in the left corner of the display indicates that the battery is charging. The recharge duration (typically 4 ... 5 h) depends on the charge level of the battery.

> A new battery takes approximately 3 charging cycles to reach its maximum capacity.

> Do not store the batteries empty. Empty batteries may not charge after an extended storage period.

3.2.1 MI70 battery status information

The status of the MI70 battery is shown by the battery icon in the upper left corner of the display. Possible statuses are listed in the following table.

Table 4   MI70 battery status indicator

Battery status indicator graphic	Description

	Battery status icon. The icon can show the following info:
	
	• 0 ... 8 bars, no animation:
	  • batteries are in use, a charger is not connected
	  • if a charger is connected: non-rechargeable batteries installed
	  • if a charger is connected: waiting for the battery temperature to settle between 0 ... +40 °C (+32 ... +104 °F)
	  • if a charger is connected and the icon remains at 8/8 bars: the battery is full
	• Animated battery status icon: battery is charging (or recovering after emptying out completely). The charging animation is shown also when the indicator is powered off.
	• Battery icon not present: batteries are not installed

	An empty battery icon with an X over it means that the battery cannot be recharged and must be replaced. If the indicator is powered on, a notification about not being able to charge the battery is shown on the MI70 screen. You can order replacement batteries from Vaisala (item code 26755).

> To keep the rechargeable MI70 battery in good working condition, recharge MI70 monthly if the indicator is not in use.

3.3 MI70 first start-up settings

When taking MI70 into use for the first time, configure the basic settings (language, date, and time) as instructed below.

▶

1. Press the **Power On/Off** button in MI70 to switch the indicator on.

2. Press any of the arrow buttons and open the menu by pressing ⊖ **Open**.

3. Select **Settings** using the ⊙ ⊙ buttons and press ⊙.

4. Select **User interface** and press ⊙.

5. Select **Language** and press ⊖ **Set**.

6. Select the language using the ⊙ ⊙ buttons. Confirm the selection by pressing ⊖ **Select**.

   The language selection can be changed later in the user interface settings of MI70.

7. To set the date, return to the **Settings** menu by pressing ⊙.

8. Select **Date** and press ⊖ **Set**. Change the date using the ⊙ ⊙ buttons. To confirm the selection, press ⊖ **Select**.
   To select an alternative date format, select **Date format** and press **Set**. You can select from 3 alternative formats. Press **Select** to confirm the selection.

9. To set the time, return to the **Settings** menu by pressing ⊙

10. Select **Time** and press ⊖ **Set**. Change the time by using the arrow buttons. Confirm the selection by pressing ⊖ **OK**. As a default, the time format is based on the 24-hour clock. If you want to use the 12-hour clock, select **12-hour clock** and press ⊖ **On**.

11. To ensure the best possible accuracy, set the actual pressure and temperature values to 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 the 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 the arrow buttons. Press **+/-** to change the sign of the value. Press ⊖ **OK** to save the value.

12. To return to the basic display, press ⊖ **Exit**.

3.4 Changing the rechargeable battery pack

✕

• New rechargeable battery pack
• Medium-sized flat head screwdriver

In case you are installing a rechargeable battery pack in the MI70 indicator and you have a device with alkaline batteries, remove the metal contact from the probe port end of the battery compartment before installing the battery pack.

▶ 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 carefully pulling it up from the wires.

3. Connect the black connector of the new battery pack. Make sure the position of the connector is as shown in the following figure (red and black wires are on the upper edge of the connector). Do not push the connector with conducting material.
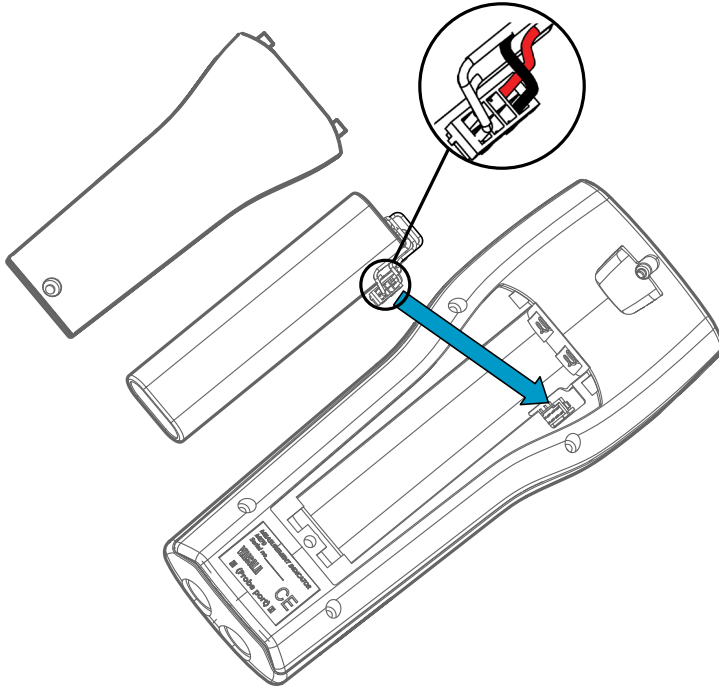
4. Place the battery pack in the compartment.

5. Close the back plate and tighten the screw.

6. Recharge the indicator before use.

4. Measuring carbon dioxide

4.1 Overview

This chapter consists of instructions on how to carry out carbon dioxide measurements.

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 GM70. The acceptable pressure value range is 700 ... 1300 hPa.

Before measurements ensure that the air pressure and temperature settings are correct. Set the correct settings as instructed in Setting actual pressure value and unit (page 26).

4.2 Taking measurements (diffusion sampling with GMH70 handle)

When using the MI70 indicator for the first time, see MI70 first start-up settings (page 15) before proceeding to take measurements.

To take measurements using the GMH70 handle:

1. Connect the probe cable to the MI70 indicator's connector port.
2. Switch MI70 on by pressing the **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 GM70.
4. Install the probe to the measuring position. Avoid exhaling near the probe as this increases the CO_2 concentration.
5. The MI70 basic display opens. Allow the reading to stabilize.

CAUTION! Handle the probe carefully. Strong impact or falling may damage the probe.
If you need to disconnect the probe, first press the **Power ON/OFF** button to switch the MI70 indicator off. This ensures that all settings and data are saved properly.

4.3 Taking measurements (pump-aspirated sampling with GM70PUMP)

> **i** When using the pump-aspirated system it is recommended to power the system by using the charger socket connected to a wall socket.

> **i** Only one pump-aspirated system can be connected to MI70 at a time.

To use GM70PUMP for pump-aspirated sampling:

▶   1. Connect one end of the sampling tube to the gas inlet (marked with IN), if using a tube.

2. Connect the black cable of GM70PUMP to the MI70 indicator's connector port.

3. Plug in the charger socket of MI70 and connect the charger socket to a wall socket.

4. Connect the GMP220 series probe to the probe connector of GM70PUMP.

5. Insert the probe in the measuring chamber. Note that to have a tight installation, the 2 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 3 (page 19)). 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. Switch on the MI70 indicator.

8. Switch on GM70PUMP.

9. The basic display opens. 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 GM70.
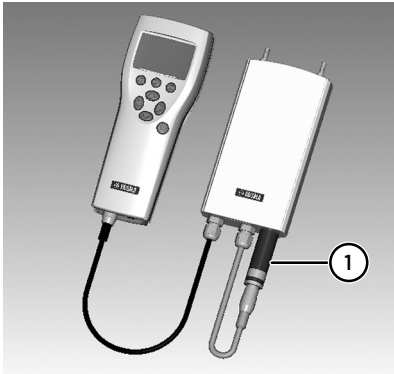

Figure 3   Correct connection of GM70PUMP

1   For a tight connection, match the 2 O-rings together with the smooth probe surface.

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

4.4 Measuring multiple parameters simultaneously

MI70 is a generic indicator that can be used with Vaisala interchangeable dew point (DM70 series), humidity (HM70 series), carbon dioxide (GM70 series), and moisture in oil (MM70 series) probes. Two different types of probes can be connected to MI70 simultaneously.

▶ 1. Switch off the MI70 indicator.

2. Connect the 2 probes to the connector ports (port I and II) on the bottom of the indicator.

3. Switch on MI70.

4. Check that the environment settings of the probes in port I and II are the same if you are taking measurements from the same condition. In this case, select ⊖ **Yes** when MI70 prompts you to check the environment settings.

5. When measuring humidity and CO_2 simultaneously, you can use the HMP70 probe's temperature data to compensate the CO_2 measurement.

   a. Select temperature (**T**) and press ⊖ **Set**.

   b. MI70 asks if you want to link the measured T value to environment parameter: to link, press ⊖ **Link** and then press ⊖ **Exit**.

6. The reading of the probe in port I is now displayed on the upper row(s) and the reading of the probe in port II on the lower row(s) of the MI70 display.

Figure 4   Display example with carbon dioxide and temperature and humidity probes connected simultaneously

7. To achieve the most accurate measurements, set the actual temperature value measured with the temperature and humidity probe to GM70.

5. Displays and menus

5.1 Basic display
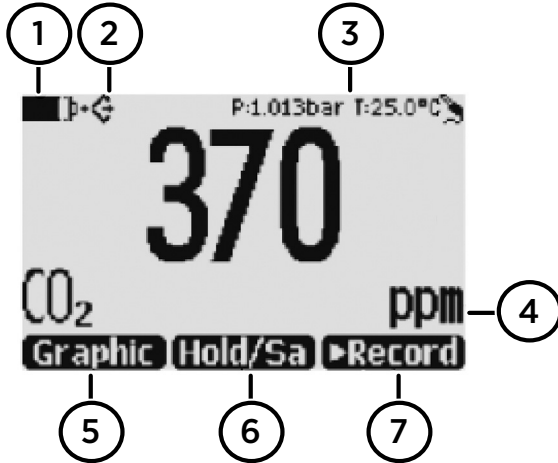

Figure 5   GM70 basic display

1   Battery indicator. Shows the current status (charge) of the battery.
2   Icon that indicates that GM70 is communicating with a PC. If the PC cable is not
     connected, this icon is not shown.
3   Pressure and temperature settings.
4   Selected parameters (ppm or %).
5   Function key **Graphic** shows the readings as a curve.
6   Function key **Hold/Save** freezes the display and you can save the reading in MI70 memory.
7   Function key **Record** is a shortcut to the **Recording/Viewing** menu.

You can change the default function key shortcuts (**Graphic**, **Hold/Save**, **Record**) to other
menus or functions in **Main menu > Settings > User interface > Program shortcut keys**.

5.2 Graphical display

The graphical display shows you the measurements as a curve (the curve of the uppermost
parameter shown in the basic display). From the curve you can examine the data trend and
history of the last minutes.

To open the graphical display, select **Graphic** in the basic display or select **Main menu >
Display > Graphic history > Show**.

To get the statistical info on the graph area (minimum, maximum, and average values), press **Info**.

To get the curve of the other selected parameters, press **Next**. To get the curves of all the parameters, press **Next** until the text **All** appears, and then select **All**.

To zoom in and out, press the up/down arrow buttons.

To move back and forward in the timeline, use the left/right arrow buttons.

5.3 Main menu

In the main menu, you can configure the MI70 settings and basic display options, view information about the probe, access recordings and clear the memory, set alarms, start adjustments, and use the analog output option of the MI70 indicator.

To open the main menu and navigate in the menus:

1. Go to the basic display.
2. Press any arrow button, then select ⊖ **Open** (must be pressed within 5 seconds or the indicator returns to the basic display).
3. Move in the menus using the ▲ ▼ buttons.
4. Select an item with the ▶ button.
5. To return to the previous level, press ◀.

6. To return to normal operation, press ⊖ **Exit**.

Figure 6   GM70 menus
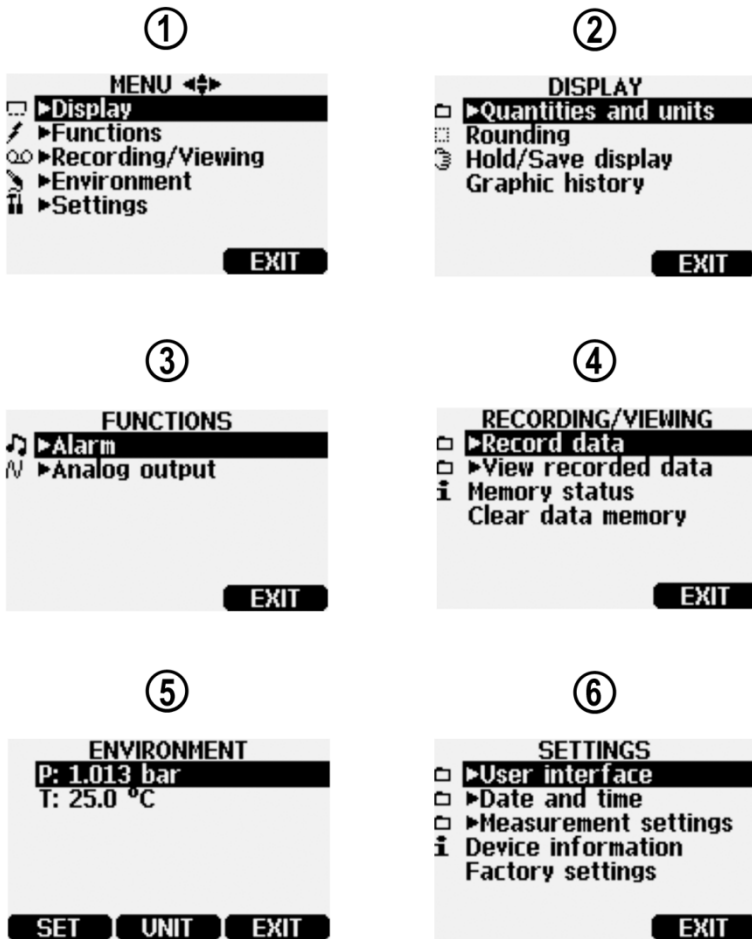
1   Main menu
2   Display menu
3   Functions menu
4   Recording/Viewing menu
5   Environment menu
6   Settings menu

5.4 MI70 status icons

Icons that inform you about the status of MI70 (for example, battery status and alarm notification) are shown on the upper left corner of the display. Multiple icons can be shown simultaneously.

Table 5   MI70 status icons

Icon	Description

	Battery status icon. The icon can show the following info:
	
	• 0 ... 8 bars, no animation:
	  • batteries are in use, a charger is not connected
	  • if a charger is connected: non-rechargeable batteries installed
	  • if a charger is connected: waiting for the battery temperature to settle between 0 ... +40 °C (+32 ... +104 °F)
	  • if a charger is connected and the icon remains at 8/8 bars: the battery is full
	• Animated battery status icon: battery is charging (or recovering after emptying out completely). The charging animation is shown also when the indicator is powered off.
	• Battery icon not present: batteries are not installed

	The battery can no longer be charged and must be replaced. If the indicator is powered on, a notification about not being able to charge the battery is shown on the MI70 screen. You can order replacement batteries from Vaisala (item code 26755).
	Recording icon. Shows that the measurements are being recorded. The bar shows for how long the recording will continue (a set time limit or until the memory runs out). The recording icon and bar are shown also when the indicator is powered off.
	Calibration reminder icon. Appears when a calibration reminder has been set to inform that a user-defined interval has passed and calibration is due.
	Analog output icon. Shown when the analog output mode is in use.
	PC connection icon. Shown when the indicator is connected to a PC with a cable.
	Alarm icon. Shown when the measurement has reached a user-defined alarm limit.

More information

6. Settings

6.1 Setting actual pressure value and unit

Figure 7   Environment menu

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 GM70. The acceptable pressure range is 700 ... 1300 hPa. Pressure is given in the units of hPa or bar.

To configure the pressure value:

1. Open the menu by pressing ▶ ⊖ **Open**.
2. Select **Environment** and press ▶.
3. Select pressure value, press ⊖ **Unit** and then press ⊖ **Set**.
4. Set the pressure value with the arrow keys and press ⊖ **OK** to save the value.
5. To change the unit, press ⊖ **Unit**. The default unit is hPa.
6. To return to the basic display, press ⊖ **Exit**.

6.2 Setting actual temperature value and unit

For achieving the most accurate measurements, the actual temperature value should be set to GM70. The acceptable temperature range is -20 ... +60 ºC (-4 ... +140 ºF).

1. Open the menu by pressing ▶ ⊖ **Open**.
2. Select **Environment** and press ▶.
3. Select temperature value and press ⊖ **Set**.
4. Set the temperature value with the arrow keys and press ⊖ **OK** to save the value.
5. To change the unit, press ⊖ **Unit**. The default unit is ºC.

6. To return to the basic display, press ⊖ **Exit**.

> ℹ️ If you are using HMP75 or some other humidity probe, the temperature information can be linked to compensate the CO_2 reading of GM70. For more information on simultaneous measurements, see Measuring multiple parameters simultaneously (page 19).

6.3 Display settings
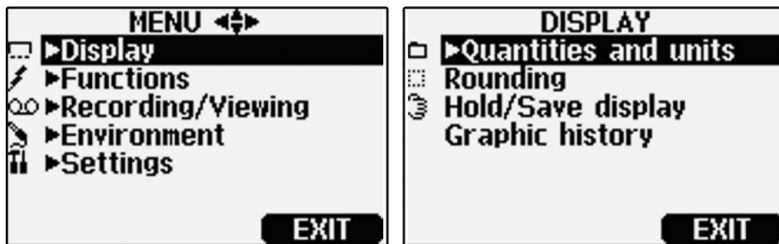
Figure 8   Display setting menus

6.3.1 Selecting parameters and units

> ℹ️ In the MI70 user interface, measurement parameters are referred to as quantities.

The unit of the parameter 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 by pressing ▶ ⊖ **Open**.

2. Select **Display** and press ▶.

3. Select **Quantities and units** and then press ▶.

4. To select a parameter, move on the desired parameter using the arrow buttons and then press ⊖ **Select**.

5. To change the unit, move on the desired parameter using the arrow buttons and then press ⊖ **Unit**.

6. To hide a parameter, move on the desired parameter using the arrow buttons and then press ⊖ **Hide**.

7. To return to the basic display, press ⊖ **Exit**.

8. If you want to check the environment settings, press ⊖ **Yes**. Otherwise press ⊖ **No**.

> **i** Measurement units (ppm and %) express the CO_2 concentration by gas volume.
> **1% CO_2 = 10 000 ppm CO_2**

6.3.2 Rounding

When using % units, you can select a 2 or 3-decimal display by using the **Rounding** options. As a default, rounding is turned off (= a 3-decimal display is in use).

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Display** and then press ▶.

3. Select **Rounding**.

4. To turn rounding on, press ⊖ **On**. To turn rounding off, press ⊖ **Off**.

5. To return to the basic display, press ⊖ **Exit**.

> **i** Rounding does not affect the measurement accuracy defined in the device specifications.

6.3.3 Holding and saving the display

With the **Hold/Save** function, you can freeze a certain display reading. This reading can be saved in the MI70 memory and it will be available even after MI70 is disconnected from the transmitter.

▶ 1. In the basic display, select **Hold/Save**. Alternatively, select **Main menu > Display > Hold/ Save display > Hold**.

2. Press **Save**.

3. To view the saved display, go to basic display and select **Record > View recorded data**. Alternatively, select **Main menu > Recording/Viewing > View recorded data**.
   A list of saved displays and data recordings appears. The icons on the left of the date and time indicate whether the file is a saved display or a longer recording of data:

   Saved display

   Data recording

4. Select the saved display based on date and time by pressing the right arrow button.
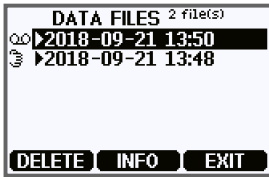
6.4 User interface settings
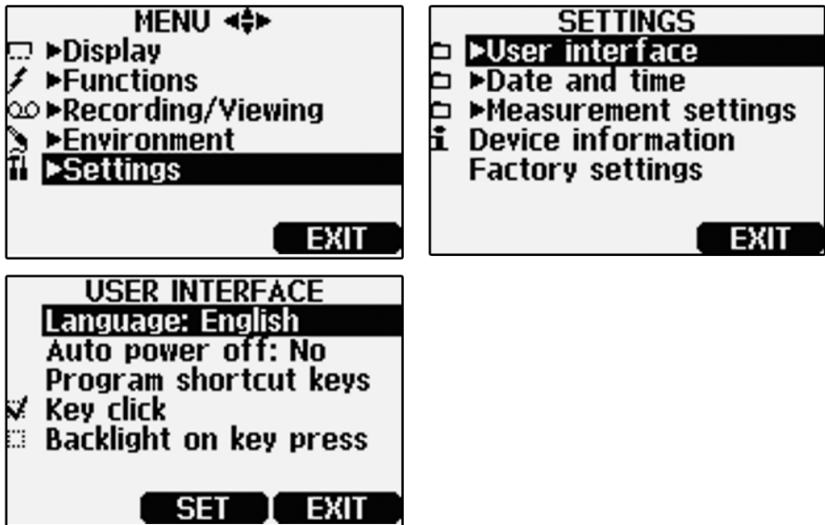
Figure 9   User interface settings menus

6.4.1 Selecting language

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

1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and then press ▶.

3. Select **User interface** and then press ▶.

4. Select **Language** and press ⊖ **Set**.

5. Choose the correct language and press ⊖ **Select**.

6. To return to the basic display, press ⊖ **Exit**.

6.4.2 Correcting language selection

▶ 1. Return to the basic display by pressing the rightmost ⊖ button until the basic display appears.

2. Go to the **Language selection menu** by pressing first ▶ and then the ⊖ button in the middle.

3. Then press ▲, then ▶, then ▶ again, and finally press the ⊖ button in the middle.

4. Reselect the language.

6.4.3 Configuring automatic power off

As a default, MI70 powers off after 15 minutes of inactivity. This also saves battery. The inactivity setting can be changed to 60 minutes or completely turned off.

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **User interface** and press ▶.

4. Select **Auto power off** and press ⊖ **Set**.

5. Choose an inactivity time option and press ⊖ **Select**.

6. To return to the basic display, press ⊖ **Exit**.

6.4.4 Programming shortcut keys

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **User interface** and press ▶.

4. Select **Program shortcut keys** and press ⊖ **Start**.

5. Press the shortcut key you want to change, for example, **Hold/Save**.

6. If you want to replace **Hold/Save** with the pressure **(P)** function, select **Environment > P** with the arrow buttons and then press ⊖ **Select**. To confirm your selection, press **Yes**. Otherwise press **No** and continue from step 4.

7. To return to the basic display, press ⊖ **Exit**.
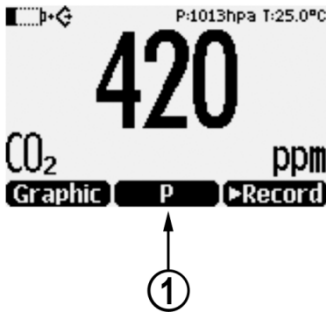
Figure 10   Hold/Save replaced by Pressure (P) shortcut

1   Hold/Save shortcut key replaced by P

6.4.5 Configuring button tones and backlight

To turn on or off the backlight or the sound effects for the buttons:

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **User interface** and press ▶.

4. To turn the sound effect on or off, select **Key Click** and press ⊖ **On/Off**.

5. To turn the backlight on or off, select **Backlight on key press** and press ⊖ **On/Off**.

6. To return to the basic display, press ⊖ **Exit**.

6.5 Date and time

As a default, the time format is based on the 24-hour clock. Also a 12-hour clock can be used.

The default date format is day.month.year, for example, 25.4.2020. The date format can be changed to month.day.year. or year.month.day.

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **Date and time** and press ▶.

4. For the desired date, select **Date** and then press ⊖ **Set**. Use the arrow buttons to change the date. Confirm the selection by pressing ⊖ **Select**. To change the date format, select an option and press ⊖ **Select**.

5. For the desired time, select **Time** and press ⊖ **Set**. Use the arrow buttons to change the time. To confirm the selection, press ⊖ **OK**. To change the time format, select **12-hour clock** and press ⊖ **On/Off**.

6. To return to the basic display, press ⊖ **Exit**.

6.6 Setting calibration reminder

You can set a calibration reminder to notify when calibration is due. Choose an interval of 3, 6, 12, or 24 months. By default, the reminder is off.
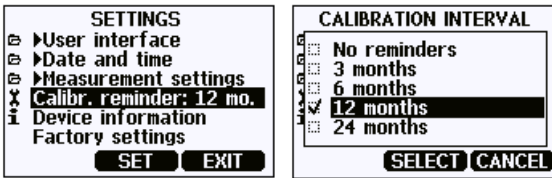
Figure 11   Calibration reminder menu

> ℹ️ Make sure the MI70 date and time settings are correct when using the calibration reminder.

1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **Calibr. reminder** and press ⊖ **Set**.

4. Choose a reminder interval option and press ⊖ **Select**.

5. To return to the basic display, press ⊖ **Exit**.

6.7 Device information
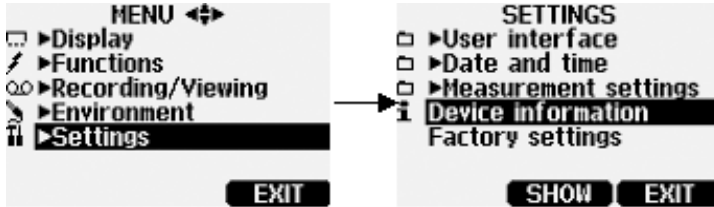
Figure 12   Device information menu

To view basic information about the indicator and probe:

1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Settings** and press ▶.

3. Select **Device information** and press ⊖ **Show**.

4. The first display gives information on the MI70 indicator. For details on the probe, press ⊖ **More**.

5. To return to the basic display, press ⊖ **Exit**.
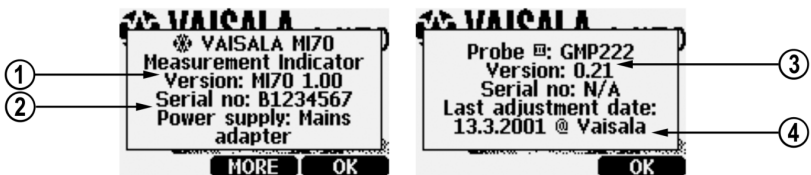
Figure 13   Indicator and probe information

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)

6.8 Factory settings

Factory calibration of the probe cannot be reverted if adjustment is made (see Calibration and adjustment by user (page 41)).

1. Open the menu by pressing ⏵ ⊖ **Open**.

2. Select **Settings** and press ⏵.

3. Select **Factory Settings** and press ⊖ **Revert**. To confirm the selection, press ⊖ **Yes**. MI70 powers off automatically.

> ℹ️ When MI70 is switched on after a factory reset, the language, date, and time settings must be set again in the user interface settings.

6.9 Other functions

6.9.1 Setting an alarm

> ℹ️ In the MI70 user interface, measurement parameters are referred to as quantities.

Two alarm levels can be set. Alarming state is OFF in between the set points. Alarming state is ON when CO_2 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 an alarm is triggered, the indicator beeps and the display backlight blinks. The alarm is triggered when the measured value is not between the alarm limits, that is, the permitted area. The alarm level(s) can be set for only 1 parameter at a time.

Figure 14   Other settings menu

1. Open the menus by pressing ⏵ ⊖ **Open**.

2. Select **Functions** and press ⏵.

3. Select **Alarm** and press ⏵.

4. Select **Quantity** and press ⊖ **Set** to select the parameter.

5. Select the parameter and press ⊖ **Select**. Only 1 active parameter can be selected at a time. To change which parameters are active, go to **Menu > Display > Quantities and units**.

6. Select the first limit and and press ⊖ **Set** (if the alarm function is on, turn it off). Use the arrow buttons to set the alarm level. To select the sign for the alarm level, press the ⊖ +/- button. To save the settings, press ⊖ **OK**.

7. Select the second limit and follow the instructions in step 6. The alarm is triggered when either the upper or lower limit is exceeded.

8. To activate the alarm and to return to the basic display, select **Alarm On/Off** and press ⊖ **On**. The note icon ♫ appears in the upper left corner of the display.

9. When the alarm level is reached, you can stop the alarm by pressing ⊖ **OK**. To reactivate the alarm, press ⊖ **Yes**. To discard the alarm, press ⊖ **No**.

> ℹ The alarm does not work when the device is powered off.

6.9.2 Selecting and scaling analog output

To get analog measurement data, an analog signal cable is needed (Vaisala item code 27168ZZ).

One scalable voltage signal channel 0 ... 1.0 V 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.
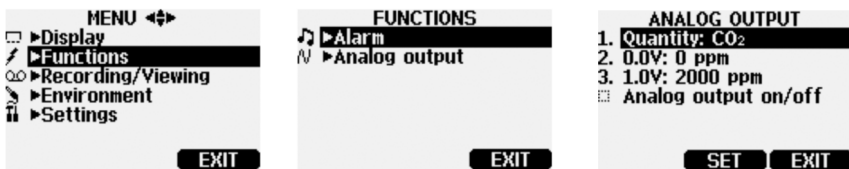
Figure 15   Selecting analog output

▶ 1. Connect the signal cable connector of the analog output to the base connector of the MI70 indicator. Connect the screw terminal block as follows:

Wire	Connect to
Brown wire	Common wire (−)
Yellow-green wire	Signal (+)

2. Open the menu by pressing ▶ ⊖ **Open**.

3. Select **Functions** and press ▶.

4. Select **Analog output** and press ▶.

5. To set the value for the 0.0 V output signal, select **0.0 V** and press ⊖ **Set**. If the analog output is on, turn it off. Set the low value using the arrow buttons. To select the sign for the value, press ⊖ +-. To confirm the setting, press ⊖ **OK**.

6. To set the value for the 1.0 V output signal, select **1.0 V** and press ⊖ **Set**. Set the high value using the arrow buttons. To select the sign for the value, press ⊖ +-. To confirm the setting, press ⊖ **OK**.

7. To activate the analog output and to return to the basic display, select **Analog output on/off** and ⊖ **On**. The wave icon ᐯ appears in the upper left corner of the basic display.

8. To deactivate analog output, go to **Menu > Functions > Analog output - Analog output on/off** and press ⊖ **Off**.

6.10 Recording and viewing data

6.10.1 Recording data

With MI70, you can record transmitter measurement data over a certain period at chosen intervals. These recordings are saved in the MI70 memory and are available even after MI70 is disconnected from the transmitter. To start recording, select the **Record** function key in the basic display, or navigate to the recording menu: **Main menu > Recording/Viewing > Record data**.
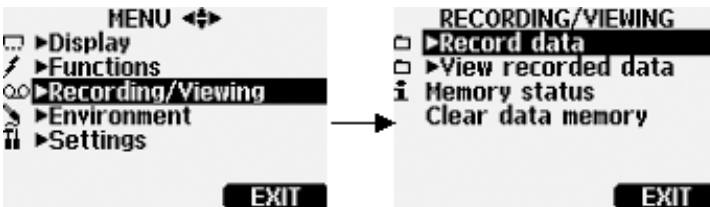
Figure 16   Recording/Viewing menu

6.10.2 Viewing recorded data

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Recording/Viewing** and press ⊖.

3. Select **View recorded data** and press ▶.

4. Select the file you want to view and press ▶. The files are identified according to the starting date and time of recording.

5. To go to the graphical view, press ⊖ **Graph**. To view the recording time stamps, press ⊖ **Times**. To return to the recording values, press ⊖ **Values**.

6. To return to the basic display, press ⊖ **Exit**.

6.10.3 Checking MI70 memory status

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Recording/Viewing** and press ▶.

3. To view the amount of memory that is in use and the estimated free space left, select **Memory status** and press ⊖ **Show**.

4. To return to the basic display, press ⊖ **OK** and ⊖ **Exit**.

> ℹ The estimate of available free space is calculated for the current number of active parameters. If you change the displayed parameters, the estimate will change accordingly.

6.10.4 Clearing data memory

▶ 1. Open the menu by pressing ▶ ⊖ **Open**.

2. Select **Recording/Viewing** and press ▶.

3. Select **Clear data memory** and press ⊖ **Clear**. To confirm the deletion, press ⊖ **Yes**.

4. To return to the basic display, press ⊖ **Exit**.

6.10.5 Transferring recorded data to PC with MI70 Link

Recorded data can be transferred to a PC using the MI70 Link program that allows examining the recorded data easily in the Microsoft Windows® environment and processing it further on a spreadsheet program such as Microsoft Excel®. Both logged and real-time measurement data can be transferred.

PC data transfer requires the MI70 Link Windows® software and a Vaisala USB cable (item code 219687). An RS-232 serial connection cable can also be used. The MI70 Link software is available from the Vaisala website: www.vaisala.com/mi70link.

> ℹ Make sure the MI70 indicator is powered off before setting up a connection between the MI70 and your PC.

To set up an MI70 Link connection:

▶   1. Install the MI70 Link software according to the instructions on the installation wizard.
        Do not connect the USB cable to your PC during installation.

     2. When the installation has completed, connect the USB cable to the USB port on your PC.
        Windows detects the new cable, and starts automatically using the driver installed with
        MI70 Link.

     3. Connect the other end of the USB cable to the MI70 indicator.

     4. Switch on MI70.

     5. You can now access the readings from the PC with MI70 Link. If MI70 Link cannot discover
        the instrument, check the following:
        • The device is powered on
        • The cable is properly connected
        • Another application has not reserved the connection.

> ℹ️   Before downloading data files to your PC, first save a copy of the files in MI70 Link
        if you need to keep the data for later use. The files are not automatically backed
        up in MI70 or MI70 Link.

7. Field checking fixed transmitters

For instructions on using GM70 to check and adjust GMW90 series transmitters, see the *GMW90 User Guide* at www.vaisala.com/gmw90.

7.1 Field checking GMD20 series transmitters (diffusion sampling)

You can check the reading of a GMD20 series transmitter by using GM70 as a reference. Both readings can be seen on the GM70 display simultaneously when using the connection cable GMA70 (optional accessory: for ordering information, see Spare parts and accessories (page 55)).

To carry out a field check:

1. Connect 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 transmitter component board.

3. Switch 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 breathing towards the probe as this alters the CO_2 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 Vaisala to be adjusted. For contact information, see Technical support (page 57).

7.2 Field checking GMD20 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 GM70's display simultaneously when using the connection cable GMA70 (optional accessory: for ordering information, see Spare parts and accessories (page 55)).

To carry out a field check of GMD20 series transmitters:

▶ 1. Connect the GMA70 cable between MI70 indicator's connector port and the **SERIAL COM** pins in the component board of the GMD20 series 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 GM70PUMP.

3. Connect the other end of the tube to the sampling port located in the middle of the GMD20 transmitter's component board (protected with a yellow cap).

4. Insert the calibrated GMP220 series probe to the measuring chamber of GM70PUMP.

5. Turn on the MI70 indicator and GM70PUMP.

6. Compare the readings. In case there is need for an adjustment, send the transmitter to Vaisala to be adjusted. For contact information, see Technical support (page 57).

> ℹ️ Do not breathe towards the transmitter when checking the readings.

8. Calibration and adjustment of GMP220 series probes

> ℹ️ For instructions on using the MI70 indicator with GMP251 and GMP252 probes, see the probes' User Guides at www.vaisala.com/gmp251 and www.vaisala.com/gmp252.

8.1 Calibration overview

In this manual, the term *calibration* means comparing detector's reading to a reference concentration. *Adjusting*, which is usually done after calibration, means changing the reading of the detector to correspond to the reference concentration.

> ℹ️ After adjustment, the original calibration certificate shipped with the product is no longer valid.

8.1.1 Calibration interval

GM70 is fully calibrated and adjusted as shipped from factory. The recommended calibration interval is 2 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.

8.1.2 Factory calibration and adjustment

It is recommended to send the GMP220 series probes to a Vaisala Service Center for accurate calibration and adjustment.

For contact information, see www.vaisala.com/support.

8.2 Calibration and adjustment by user

GM70 can be calibrated and fine control adjustment can be carried out by the user. Note that this adjustment does not correspond to an accurate factory adjustment. Making a 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 can no longer revert to factory settings after making a user adjustment.

> ℹ️ Adjustments cannot be done with GM70PUMP.

Adjustment is carried out:

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

To open the adjustment mode, you need to press the adjustment button (see Figure 17 (page 42)) 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.

Figure 17   Location of adjustment button

1   Adjustment button (covered by a detachable screw).

8.2.1 Adjustment with reference gases

For the adjustment procedure with gases, you need the probe that is going 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 in) inner diameter. For information on available accessories and ordering, see Spare parts and accessories (page 55).

Reference gases

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

- If adjustment is done by using 1 reference gas (1-point adjustment), the concentration of the gas must be near to the concentration values in which the device is used.

> ℹ️ When adjustment is done only in 1 point, this results in high accuracy only near to the adjustment point, not necessarily over the whole measurement range.

- When using 2 reference gases (2-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 0 gas can be N_2 gas with a purity of N5.0 (or better). The high-end gas can be mixture of CO_2 and N_2 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.

8.2.2 Making a 2-point adjustment

⚠️ **CAUTION!** Make sure to check the following when carrying out the adjustment:

- Give the correct reference concentrations in the correct units
- Wait until the reading has fully stabilized before accepting the reading.

⚠️ **CAUTION!** Reverting to factory settings is not possible after the adjustment.

ℹ️ The difference between the 2 references must be at least 20 % of the measuring range of the probe.

ℹ️ See also *Field Check Adapter 26150GM Quick Reference Guide* (M210450EN), available at www.vaisala.com/gm70.

▶ 1. Insert the probe into the field check adapter until the perforated filter is covered ((1) in Figure 18 (page 43)).

Figure 18   Field check adapter

2. Connect the tubing to the bottom port of the adapter ((2) in Figure 18 (page 43)).

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 wait until the reading has fully stabilized.

5. Take out the screw from the GM70 probe handle to expose the adjustment button (see). Press the button with a small screwdriver. When pressing the button, the indicator turns to adjusting mode.

6. Press ⊖ **OK** to confirm that you are making an adjustment.

7. Select **CO2** and press ⊖ **Select**.

8. Press ⊖ **Yes** to give the ambient pressure and temperature values. To continue adjusting, press ⊖ **Exit**.

9. The adjustment mode is now active. Press ⊖ **Graph** to confirm that the readings have stabilized. Go back and press ⊖ **Adjust** to select the adjustment method.

10. Select **2-point adjustment** and press ⊖ **Select**. Press ⊖ **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 ⊖ **OK**.

> This step completes the low-end adjustment: 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 wait until the reading has fully stabilized.

14. Press ⊖ **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_2 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 ⊖ **OK**.

16. Confirm the adjustment by pressing ⊖ **Yes**. If you press ⊖ **No**, you return to the adjustment mode display and changes are canceled.

17. The adjustment is complete. Press ⊖ **Back** and ⊖ **Exit** to return to the basic display.

18. Shut off the gas flow.

19. Replace the screw onto the adjusting button.

8.2.3 Making a 1-point adjustment

> ⚠️ **CAUTION!** Make sure to check the following when carrying out the adjustment:
> - Give the correct reference concentrations in the correct units
> - Wait until the reading has fully stabilized before accepting the reading.

> ⚠️ **CAUTION!** Reverting to factory settings is not possible after the adjustment.

> ℹ️ See also *Field Check Adapter 26150GM Quick Reference Guide* (M210450EN), available at www.vaisala.com/gm70.

▶ 1. Insert the probe into the feld 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 fow meter, the pressure regulator and further to the reference gas bottle. The side port of the adapter is left open for gas outfow.

4. Let the low end reference gas fow and stabilize with a fow rate of about 0.6 l/min. Follow the reading of GM70 and wait until the reading has fully stabilized.

5. Take out the screw from the GM70 probe handle to expose the adjustment button (see Figure 17 (page 42)). Press the button with a small screwdriver. When pressing the button, the indicator turns to adjusting mode.

6. Press ⊖ **OK** to confrm that you are making an adjustment.

7. Select **CO2** and press ⊖ **Select**.

8. Press ⊖ **Yes** to give the ambient pressure and temperature values. To continue adjusting, press ⊖ **Exit**.

9. The adjustment mode is now active. Press ⊖ **Graph** to confrm that the readings have stabilized. Go back and press ⊖ **Adjust** to select the adjustment method.

10. Select **1-point adjustment** and press ⊖ **Select**. Press ⊖ **Ready** when the value has stabilized.

11. Give the reference concentration value by using the arrow buttons and press ⊖ **OK**.

> 💡 For example, if you are using pure nitrogen, enter value 0 ppm. For other reference gases, the analyzed CO_2 concentration is typically printed on the bottle: use that value. Take care that you give the correct value in correct units, as you cannot revert the earlier values after accepting the new values.

12. Confirm the adjustment by pressing ⊖ **Yes**. If you press ⊖ **No**, you return to the adjustment mode display and changes are canceled.

13. The adjustment is complete. Press ⊖ **Back** and ⊖ **Exit** to return to the basic display.

14. Shut off the gas flow.

15. Replace the screw onto the adjusting button.

8.2.4 Making an adjustment with 2 probes

You need to have 2 probe handles and 2 probes: 1 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.

To make the adjustment:

▶ 1. Switch on GM70.

2. Take the probe you want to adjust. Unscrew the probe handle screw to expose the adjustment button (see). Press the button with a small screwdriver. When pressing the button, the indicator switches to adjusting mode.

3. Select **CO2** and press ⊖ **Select**.

4. Press ⊖ **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 ⊖ **Exit**.

5. The adjustment mode is now active. Press ⊖ **Graph** to confirm that the readings have stabilized. Go back and press ⊖ **Adjust** to select the adjustment method.

6. Select **To same as CO2**, press ⊖ **Select** and then ⊖ **Yes**.

7. The adjustment is complete. Press ⊖ **Back** and ⊖ **Exit** to return to the basic display.

8. Replace the screw onto the adjusting button.

9. Maintenance

9.1 Changing the probe

To change the probe:

▶ 1. Switch off GM70.

2. Detach the probe as follows:
   - 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. Switch on GM70.

Figure 19   Detaching the probe

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

9.2 Changing the probe filter

Replacement filters can be ordered from Vaisala. For ordering information, see Spare parts and accessories (page 55).

▶ 1. Remove the plastic grid by pulling it out.

2. Remove the filter paper.

3. Insert a new filter paper and plastic grid.

9.3 Cleaning

▶ 1. 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 button openings.

9.4 Error messages

Table 6   GM70 error messages

Error message	Interpretation and action
Difference too big	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.
	Contact Vaisala (see Technical support (page 57)).
Value too high	The reference concentration can be at the highest 110 % of the maximum value of the probe's measuring range.
	Make the adjustment using a lower reference gas concentration.
Lower value too high	The lower reference gas concentration must be less than 20 % of the maximum value of the probe's measuring range.
	Make the adjustment using a lower reference gas concentration.
Higher value too high	The higher reference gas concentration can be at the highest 110 % of the maximum value of the probe's measuring range.
	Make the adjustment using a lower reference gas concentration.
Values too close	The difference between the reference concentrations must be at minimum 20 % of the maximum value of the probe's measuring range.
	Make the adjustment using correct reference gas concentrations (see above).
CO_2 value too high	The measured CO_2 concentration is too high for the measurement range of the probe, or the calibration is not properly done. The screen goes blank.
	Move the probe to a location with less CO_2 or recalibrate.
Probe error: Reboot	This error can occur when changing the probe while power is on.
	Switch off power and connect the probe properly, then switch on power.

Error message	Interpretation and action
Probe error	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.
Adapter error	Switch off power and check that the probe is connected properly (see the instructions for handling a *Probe error* message. In case of continuous error, contact Vaisala. See Technical support (page 57).

10. Technical specifications

10.1 GM70 specifications

Table 7 GMP220 probe measurement performance

Property	Description/Value
Response time (63 %)	GMP221 probe: 20 s GMP222 probe: 30 s
Warm-up time	30 s (15 min to full specification) 30 min to full specification with GM70PUMP
Sensor type	CARBOCAP®
Measurement ranges	
High concentrations of CO_2, short probe (GMP221)	0 … 2 %, 0 … 3 %, 0 … 5 %, 0 … 10 %, 0 … 20 %
Low concentrations of CO_2, long probe (GMP222)	0 … 2000 ppm, 0 … 3000 ppm, 0 … 5000 ppm, 0 … 7000 ppm, 0 … 10 000 ppm
Accuracy (at 25 °C and 1013 hPa) [1]	
GMP221 probe	±(1.5 % of range + 2 % of reading) [2]
GMP222 probe	±(1.5 % of range + 2 % of reading)
Temperature dependence, typical	−0.3 % of reading/°C
Pressure dependence, typical	+0.15 % of reading/hPa
Long-term stability	< ±5 %FS / 2 years
Measurement environment	
Operating temperature	−20 … +60 °C (−4 … +140 °F) +15 … +40 °C (+59 … +104 °F) with GM70PUMP
Relative humidity	0 … 100 %RH, non-condensing
Operating pressure	700 … 1300 hPa
Flow range (diffusion sampling)	0 … 10 m/s

1) Including repeatability, non-linearity and calibration uncertainty.
2) Applies to concentrations above 2 % of full scale.

Table 8   GMP220, GMH70, and GM70PUMP mechanical specifications

Property	Description/Value
Probe cable length	1.9 m (6.2 ft)
IP rating	
GMH70 handle	IP65: Dust-tight. Protected from water jets from any direction.
GM70PUMP	IP54: Limited protection against dust. Protected from water splashes from any direction.
Housing material	
GMP221 and GMP222 probe	PC plastic
GMH70 handle	ABS/PC blend
GM70PUMP	Aluminum casing
Weight	
GMH70 with GMP221/GMP222 probe	230 g (8 oz)
GM70PUMP with GMP221/GMP222 probe	700 g (25 oz)
Storage	
Storage temperature	−30 ... +70 °C (−22 ... +158 °F)
Storage humidity	0 ... 100 %RH, non-condensing

Table 9   GM70 compliance

Property	Description/Value
EMC compatibility	EN 61326-1:1997 + Am1:1998 + Am2:2001, Electrical equipment for measurement, control and laboratory use - EMC requirements; generic environment

10.2 MI70 specifications

Table 10   MI70 measurement indicator

Property	Description/Value
Operating environment	
Operating temperature	−10 ... +40 °C (+14 ... +104 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Property	Description/Value
Storage temperature	−40 ... +70 °C (-40 ... +158 °F)
Inputs and outputs	
Max. no of probes	2
PC interface	MI70 Link software with USB or serial port cable
Power supply	Rechargeable NiMH battery pack with AC adapter or 4 × AA size alkalines, type IEC LR6
Analog output: [1]	
Scale	0 ... 1 V DC
Output resolution	0.6 mV
Accuracy	0.2 % full scale
Temperature dependence	0.002 %/˚C (0.01 %/˚F) full scale
Minimum load resistor	10 kΩ to ground
Mechanical specifications	
Housing classification	IP54: Limited protection against dust. Protected from water splashes from any direction.
Housing materials	ABS/PC blend
Weight	400 g (14 oz)
Compatibility	
EMC compliance	EN 61326-1, portable equipment
Other	
Menu languages	English, Chinese, Spanish, Russian, French, Japanese, German, Swedish, Finnish
Display	LCD with backlight
	Graphic trend display of any parameter
	Character height up to 16 mm (0.63 in)
Alarm	Audible alarm function
Data logging capacity	2700 real time data points
Logging interval	1 s to 12 h
Logging duration	1 min ... memory full
Resolution	0.01 %RH, 0.01 °C/°F, 0.01 hPa, 0.01 a_w, 10 ppm / 0.01 %CO_2

1)   *The specifications apply only when analog output is enabled for the handheld meter.*

Table 11   MI70 battery operation time

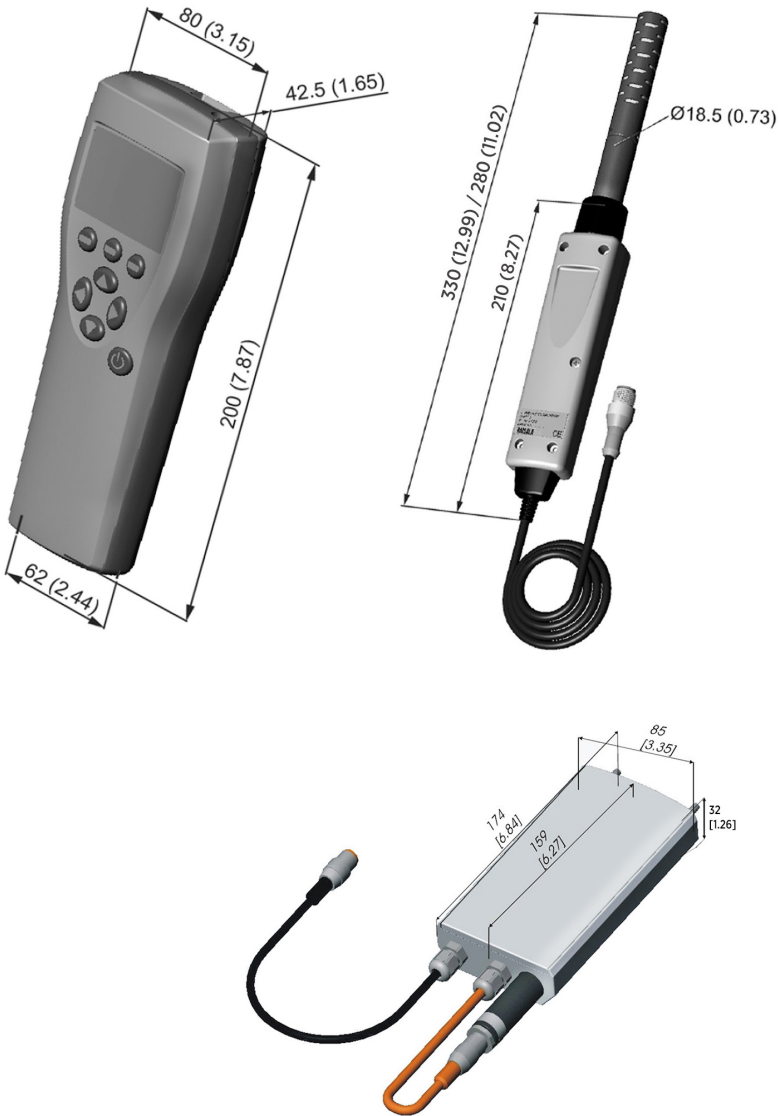| Property	Value/Description
Typical charging time	4 hours
Operation times	
Continuous use (with handle)	Better than 8 h at +20 ˚C (+68 °F)
Continuous use (with pump)	Better than 5 h at +20 ˚C (+68 °F) without load
Data logging use (one probe)	Up to 30 days depending on logging interval

10.3 Dimensions

Figure 20   GM70 dimensions in mm (in)

10.4 Spare parts and accessories

ℹ️ Information on spare parts, accessories, and calibration products is available online at www.vaisala.com and store.vaisala.com.

Table 12   GM70 spare parts and accessories

Description	Item code
AC adapters	
Euro AC adapter	MI70EUROADAPTER
UK AC adapter	MI70UKADAPTER
US AC adapter	MI70USADAPTER
AUS AC adapter	MI70AUSADAPTER
MI70 All adapter	MI70ALLADAPTER
Cables	
Analog output signal cable	27168ZZ
Connection cable for fixed CO_2 instruments GMT220, GMM220, GMD20, and GMW20 series	GMA70
Connection cable for GMP343 series	DRW216050SP
Connection cable for GMW90 series	219980SP
Connection cable for GMP250 series	CBL210472
Probe extension cable (10 m (33 ft))	213107SP
Flat cable for GMP220 series probes, M12/8-pin	238651
Carrying cases	
Weatherproof carrying case	MI70CASE3
Soft carrying case for diffusion handle and probe	MI70SOFTCASE
Probe accessories	
Replacement probe GMP221	GMP221 (define options in order form)
Replacement probe GMP222	GMP222 (define options in order form)
Others	
Measurement indicator	MI70
USB PC connection cable (for use with MI70 Link software) [1]	219687

Description	Item code
Rechargeable battery for MI70	26755
Calibration adapter for GMP220 series probes	26150GM
Nafion™ membrane tubing	212807GM
Aspiration pump for GM70	GM70PUMP
GM70 replacement handle	GMH70

1)   *Vaisala MI70 Link software for Windows is available at www.vaisala.com/mi70link.*

Maintenance and calibration services

Vaisala offers comprehensive customer care throughout the life cycle of our measurement instruments and systems. Our factory services are provided worldwide with fast deliveries. For more information, see www.vaisala.com/calibration.

- Vaisala Online Store at store.vaisala.com is available for most countries. You can browse the offering by product model and order the right accessories, spare parts, or maintenance and calibration services.
- To contact your local maintenance and calibration expert, see www.vaisala.com/contactus.

Technical support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.
Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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