



Operating instructions

VARIOTEC® 660

Gas measuring device • Gas leak detector



VARIOTEC® 660



Fig. 1: **VARIOTEC 660**

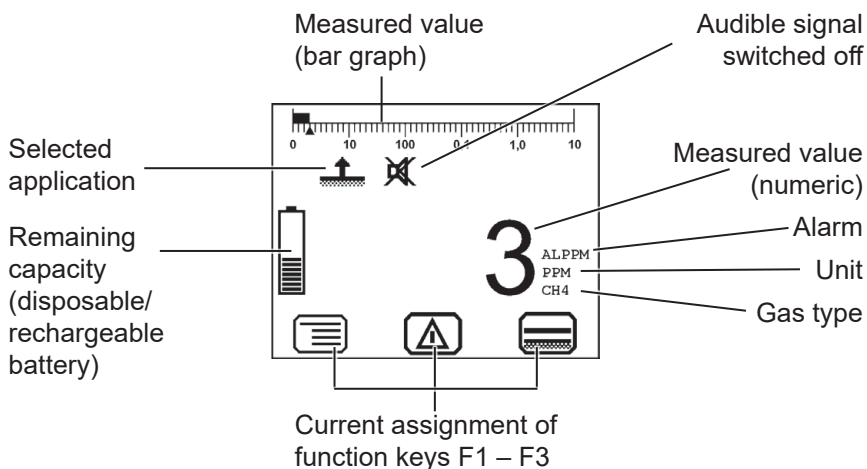


Fig. 2: Display in measuring mode – **Inspection above ground** application

Display symbols

General



menu



OK



Cancel



Buzzer off



Take sample



Save



Clear



Remaining capacity
(disposable battery/
rechargeable battery)



Fault



Device inspection due



Tab (jump to next input
field)



Set zero point



Purge



Stop measurement



Information



Open stored comment
Open stored inspector

Applications



inspection above ground



Plants



Measuring in bar holes



Ethane analysis



Structure



Gas measuring

Illustration of warnings in this document



DANGER!

Risk of personal injury. Will result in serious injury or death.



WARNING!

Risk of personal injury. Could result in serious injury or death.



CAUTION!

Risk of personal injury. Could result in injury or pose a risk to health.

NOTICE!

Risk of damage to property.

1	Introduction	1
1.1	Information about this document.....	1
1.2	Purpose	1
1.3	Intended use	2
1.4	Improper use	2
1.5	Qualification of users.....	2
2	Safety information.....	4
2.1	General safety information	4
2.2	Product-specific safety information	4
3	Product description	7
3.1	Overview	7
3.2	Features	7
3.2.1	Sensors	7
3.2.2	Controls.....	8
3.2.2.1	ON/OFF key	8
3.2.2.2	Function keys F1, F2, F3	8
3.2.2.3	Jog dial.....	8
3.2.3	Visual and audible signals.....	9
3.2.3.1	Overview	9
3.2.3.2	Alarms	9
3.2.4	Gas input and filter	10
3.2.5	TG8 bag	10
3.3	Applications	11
3.3.1	Allocation of tasks to applications	12
3.3.2	Inspection above ground	13
3.3.3	Plants	14
3.3.4	Measuring in bar holes.....	15
3.3.5	Ethane analysis (optional).....	17
3.3.5.1	General information on ethane analysis.....	17
3.3.5.2	Requirements.....	18
3.3.5.3	Displayed measurement values	18
3.3.6	Structure.....	20
3.3.7	Gas measuring.....	21
3.4	Differences between measuring mode and settings mode	22
3.5	Measuring mode	22
3.5.1	Menu in measuring mode (overview).....	22
3.5.2	Menu items.....	23
3.5.2.1	Zero point.....	23
3.5.2.2	Inspection above ground, Plants, Measuring in bar holes, Ethane analysis, Structure, Gas measuring	24

3.5.2.3	Settings	24
3.5.2.4	Start/stop/save a measurement	24
3.5.2.5	Protocols	25
3.5.2.6	Device inspection	25
3.5.2.7	Gas type	26
3.5.2.8	Device information	26
3.6	Settings	26
3.6.1	Settings menu (overview).....	27
3.6.2	Settings protected by PIN code.....	27
3.6.3	Menu items.....	28
3.6.3.1	Adjustment	28
3.6.3.2	System	29
3.6.3.3	Alarms	31
3.6.3.4	Date/time.....	31
3.6.3.5	Memory	31
4	Operation	33
4.1	Switching on the device	33
4.2	Switching off the device.....	36
4.3	Navigating	36
4.3.1	Switching from measuring mode to the menu	36
4.3.2	Opening an item in a menu	36
4.3.2.1	Opening an item using the menu	36
4.3.2.2	Opening a menu item using a function key	37
4.3.3	Going back up a menu level.....	37
4.3.3.1	Exiting a menu item using the menu	37
4.3.3.2	Exiting a menu item using a function key.....	37
4.4	Switching application.....	37
4.4.1	Switching to a different application using the menu	38
4.4.2	Switching to a different application using a function key	38
4.5	Opening settings	38
4.6	Setting zero point (manual zero point setting).....	39
4.7	Starting/stopping a measurement	39
4.7.1	Starting a measurement.....	40
4.7.2	Stopping a measurement.....	40
4.8	Saving a measurement	40
4.9	Carrying out an ethane analysis.....	41
4.9.1	Starting an ethane analysis.....	42
4.9.2	Evaluating an ethane analysis	43
4.9.3	Purging the detector.....	46
4.9.3.1	Frequency	46
4.9.3.2	Purging the detector after cancelling an ethane analysis ..	46

4.9.3.3	Purging the detector if contaminated	47
4.10	Leak test of probes and probe hoses	47
4.10.1	Frequency	47
4.10.2	Special features of certain probes	47
4.10.3	Checking the leak-tightness	48
4.11	Filter check and filter change	49
4.11.1	Frequency	49
4.11.2	Checking the filter for contamination and changing the filter	49
4.12	Testing the pump	50
5	Power supply	51
5.1	Overview	51
5.2	Suitable disposable/rechargeable batteries	51
5.3	Alarm at undervoltage	52
5.4	Operation with rechargeable batteries	53
5.4.1	Charging the batteries	53
5.4.1.1	Charging batteries without prior discharging	55
5.4.1.2	Charging batteries after prior discharging	55
5.4.2	Battery maintenance	55
5.5	Replacing the batteries	56
6	Maintenance	57
6.1	Overview	57
6.2	Suitable environment	57
6.3	Device inspection (overview)	57
6.3.1	Options for carrying out the procedure	58
6.3.2	Frequency and due date	58
6.3.3	Test gases for the device inspection	59
6.3.4	Requirements for performing a device inspection	60
6.4	Integrated device inspection	60
6.4.1	Features	61
6.4.2	Subtests	62
6.4.2.1	Special features of the General status subtest	62
6.4.3	Switching the device inspection on/off	63
6.4.4	Starting the device inspection	64
6.4.5	Saving the device inspection	64
6.4.6	Testing the general status	65
6.4.7	Checking the indication accuracy when clean air is supplied (zero point)	66
6.4.8	Performing a bump test	67
6.4.8.1	Performing a bump test in the Inspection above ground application	67

6.4.8.2	Performing a bump test in the Ethane analysis application	68
6.4.9	Checking the indication accuracy when a test gas is supplied (sensitivity).....	70
6.4.10	Failed subtests – causes and corrective action	71
6.5	Adjustment	72
6.5.1	Frequency	72
6.5.2	Test gases for the adjustment	73
6.5.3	Requirements for performing an adjustment.....	73
6.5.4	Performing the adjustment	74
6.5.4.1	Adjusting the zero point.....	75
6.5.4.2	Adjusting the sensitivity.....	75
6.6	Maintenance.....	76
7	Troubleshooting	77
8	Appendix.....	79
8.1	Technical data and permitted operating conditions	79
8.1.1	Device	79
8.1.2	Sensors	81
8.1.2.1	Infrared sensors (IR)	82
8.1.2.2	Thermal conductivity sensor (TC)	82
8.1.2.3	Gas-sensitive semiconductor (SC).....	84
8.1.3	Ethane detector.....	85
8.2	Alarms	86
8.2.1	Features	86
8.2.2	Alarm thresholds (factory settings).....	86
8.3	Device inspection limits	87
8.4	Memory capacity	87
8.5	Type examination	88
8.5.1	Explosion protection test.....	88
8.6	Identification plate	89
8.7	Care	90
8.8	Accessories and consumables.....	91
8.9	Advice on disposal	92
8.10	Legal basis	93
8.11	Declaration of conformity	93
8.12	Abbreviations	94
8.13	Technical terms	94
9	Index.....	96

1 Introduction

1.1 Information about this document

This document is a component part of the product.

- Read the document before putting the product into operation.
- Keep the document within easy reach.
- Pass this document on to any subsequent owners.
- Unless otherwise specified, the information in this document refers to the product as delivered (factory settings) and applies to all product variants.
- The product is described with all device features. Not all of the functions described may be available on the product you are using. Please contact the SEWERIN sales department for further information.
- Contradictory national legal regulations take precedence over the information in this document.
- Hermann Sewerin GmbH is also referred to as SEWERIN hereafter.

Right of reproduction

No part of this document may be edited, duplicated or circulated in any form without the express consent of Hermann Sewerin GmbH.

Registered trademarks

Registered trademarks are generally not indicated in this document.

1.2 Purpose

The **VARIOTEC 660** is a portable measuring device for various applications in gas pipe network inspection.

The device can be used, for example, to measure the concentration of methane and hydrogen in mixtures of methane-rich gas (natural gas) and hydrogen. The device is suitable for measuring gases from the second and fifth gas families according to /1/.

The device may be used to measure the following gases:

- Methane CH_4
- Hydrogen H_2
- for ethane analysis: methane CH_4 , ethane C_2H_6 , propane C_3H_8

1.3 Intended use

The device is designed for professional use in industry and commerce.

The device must only be used for the applications specified in section 1.2.

The device can be used at operating temperatures up to 40 °C (104 °F). However, high temperatures can reduce the lifetime of the sensors, disposable batteries and rechargeable batteries.

1.4 Improper use

The device must not be used for:

- gas analysis of technical processes
(including in biogas plants and on landfills)
- determining the purity of hydrogen obtained by electrolysis
- monitoring liquids
- measuring toxic and corrosive gases
- measuring gas mixtures with a high propane content

1.5 Qualification of users

The appropriate specialist knowledge is required for using this device. In addition, certain activities performed with or on the device may only be carried out by qualified persons.

A distinction is made between the following user groups:

Trained person

- Trained persons know the external structure, functions and operating instructions of the devices.
- Trained persons can detect defects or changes to the device.

- Trained persons may perform device inspections. They can evaluate the results.

Specialist (device inspector)

- Specialists have received professional training and thus have fundamental knowledge of the measuring principles used in gas concentration measuring devices.
- Specialists are experienced users and therefore have sufficient knowledge of the use of gas concentration measuring devices.
- Specialists are permitted to perform device inspections and adjustments. They can evaluate the results.

Competent person

SEWERIN service personnel and people trained by SEWERIN are competent persons.

- Competent persons have knowledge of the applicable regulations and guidelines as well as the tasks and functions of gas concentration measuring devices.
- Competent persons can evaluate whether the condition of devices renders them safe to operate and can perform the necessary operations without supervision.
- Competent persons are appointed by their company in writing. Their responsibilities are defined when they are appointed. They are authorised by the manufacturer.
- Competent persons must receive regular training.
- Competent persons are permitted to perform device inspections, adjustments and maintenance.

2 Safety information

2.1 General safety information

This product was manufactured in keeping with all binding legal and safety regulations.

The product is safe to operate when used in accordance with the instructions provided. However, when handling the product, there may be risks to persons and property. For this reason, observe the following safety information without fail.

- Observe all the applicable safety standards and accident prevention regulations.
- Use the product only as intended.
- Do not make any changes or modifications to the product unless these have been expressly approved by Hermann Sewerin GmbH.
- Only use accessories and consumables approved by Hermann Sewerin GmbH.
- Always observe the permitted operating and storage temperatures.
- Handle the product carefully and safely, both during transport and when working.
- Do not use the product if it is damaged or faulty.
- Protect the ports and sockets against dirt, and electrical ports in particular against moisture.

2.2 Product-specific safety information

- Switch on the device only in clean air.
- Only use probe hoses with a hydrophobic filter.
Exception: If the probe has a built-in hydrophobic filter, the hose does not require another filter.
- When the device has suffered an impact (such as being accidentally dropped):
 - Then perform a device inspection.

Safety information for explosion protection

The device is suitable for use in explosive environments. Please note the following exceptions:

- Do not operate the device in oxygen-enriched atmospheres, otherwise the device will not be explosion-proof.
- When measuring natural gas/hydrogen mixtures with more than 30% hydrogen:
 - always use the device with the **TG8** bag.
- The device must not be stored or operated in explosive environments if there is a chance of strong electrostatic charges occurring (e.g. from fast-moving particles, hydraulically propelled liquids, pneumatically extracted dust or materials, in electrostatic coating processes).
- Only use the USB port outside of explosive atmospheres.

Certain activities with the device must be performed outside of an explosive environment. The corresponding warnings can be found in these operating instructions in the descriptions of actions.

Safety information for maintenance

- Perform device inspection and adjustment only in well ventilated rooms or outdoors.
- Handle test gases in a professional manner.

Safety information for sensors

- Have sensors replaced by SEWERIN Service when their service life has expired.
- SEWERIN recommends: Perform a device inspection when the device has been exposed to gas concentrations above the end of measuring range.

Very high concentrations of flammable gases can damage the gas-sensitive semiconductor.

- Avoid gas concentrations above 2.2% vol. CH₄ or 2.0% vol. H₂ in the **Inspection above ground, Plants** and **Structure** applications.

Safety information for specific environments

Substances containing silicone and silicone vapours can contaminate the sensors.

- Do not allow the device to come into contact with substances containing silicone.
- Use the device only in a silicone-free environment.

The device complies with the requirements of Directive 2014/30/EU (EMC). When using the product close to devices with radio transmitters:

- Comply with the information in the operating instructions for the devices regarding emission of interference.

3 Product description

3.1 Overview

For an overview including the part names, see the front cover (fig. 1).

3.2 Features

3.2.1 Sensors

The device features the following sensors:

- gas-sensitive semiconductor (SC)
- thermal conductivity sensor (TC)
- infrared sensor (IR)

The device can be optionally fitted with a detector for ethane analysis to help you safely distinguish between natural gas and swamp gas.

Application	Gas	Measuring range	Sensors
Inspection above ground	CH ₄	0 ppm – 2.2% vol.	SC, TC
	H ₂	0 ppm – 2.0% vol.	SC, TC
Plants	CH ₄	0 ppm – 2.2% vol.	SC, TC
	H ₂	0 ppm – 2.0% vol.	SC, TC
Measuring in bar holes	CH ₄	0.0 – 100% vol.	IR
	H ₂	0 – 100% vol.	IR, TC
Structure	CH ₄	0 ppm – 2.2% vol.	SC, TC
	H ₂	0 ppm – 2.0% vol.	SC, TC
Gas measuring	CH ₄	0.0 – 100% vol.	IR
	H ₂	0 – 100% vol.	IR, TC
Ethane analysis	C _x H _y	0 ppm – 1.2% vol.	SC

Correlation between gas-sensitive semiconductor and thermal conductivity sensor

The gas-sensitive semiconductor (SC) features special preventive protection in the **Inspection above ground**, **Plants** and **Structure** applications. The sensor switches off automatically at high gas

concentrations and the thermal conductivity sensor (TC) takes the measurement alone. If the gas concentration drops to a certain value, the SC switches back on.

3.2.2 Controls

The device has the following controls:

- ON/OFF key
- Function keys F1, F2, F3
- Jog dial

3.2.2.1 ON/OFF key

The function of the ON/OFF key never changes.

Pressing the ON/OFF key performs an action.

Key	Actions
	● Switch on device ● Switch off device

3.2.2.2 Function keys F1, F2, F3

The functions of the function keys depend on the program status. The current key assignment is displayed by symbols at the bottom of the display.

Information about the possible key assignments can be found in the front cover (display symbols).

If no symbol is displayed, the function key has no function assigned to it in the respective program status.

Function keys are pressed to perform an action.

3.2.2.3 Jog dial

Turning or pressing the jog dial performs an action, depending on the desired function.

Operation	Actions
Turn	• select: menu items, values, characters, list entries etc.
Press	• confirm/apply: menu items, values, characters, list entries etc. • open: submenu levels, protocols etc.

3.2.3 Visual and audible signals

3.2.3.1 Overview

The device features two alarms:

- Signal light on top of device (visual signal)
- Buzzer on side of device (audible signal)

The signals indicate alarms and faults. The device also emits signals when it is switched on and off.

3.2.3.2 Alarms

The device issues a warning when the measured value exceeds certain limit values (alarm thresholds) in the **Inspection above ground, Plants** and **Structure** applications. The device emits both audible and visual signals.

Information on the characteristics of the alarms and the alarm thresholds in the factory settings can be found in section 8.2.

Audible signal



When this symbol appears on the display, the audible alarm signal can be switched off.

When an audible signal has been switched off, it cannot be switched back on while the concentration level remains above the alarm threshold.



When the alarm's audible signal is switched off, this symbol appears in the top left corner of the display. The symbol disappears automatically as soon as the concentration level falls below the alarm threshold.

Concentration-dependent signal

The alarm is triggered above the ALPPM alarm threshold and depends on the concentration in the **Plants** and **Structure** applications.

- The signals intensify as the concentration increases.
- As the concentration decreases, the signals diminish again.

3.2.4 Gas input and filter

The test gas or ambient air is drawn in using the pump via the gas inlet.

In certain applications and in certain measuring situations, accessories are connected to the gas input, for example:

- Test gas hose of the **SPE VOL** test set
- conditioner

for humidifying the gas that is sucked in

The gas that is sucked in flows through the dust filter directly behind the gas input.

The dust filter traps solid particles, especially dust, thus preventing contaminants from entering the device and reaching the sensitive sensors.

The filter must be changed regularly. Information on how and when to change the filter can be found in section 4.11.

3.2.5 TG8 bag

The device comes with the **TG8** bag. The bag is made of leather and prevents electrostatic charge in the device. The device must be used with the **TG8** bag when measuring natural gas/hydrogen mixtures with more than 30% hydrogen.

3.3 Applications

The device is suitable for the following applications:

Application	VARIOTEC 660
Inspection above ground	×
Plants	×
Measuring in bar holes	×
Structure	×
Gas measuring	×
Ethane analysis	○

× standard ○ optional

3.3.1 Allocation of tasks to applications

The table is designed to help you decide which application to choose for which task (as per /2/).

Location	Task	Application
Buried gas pipes	Measuring very low gas concentrations above: - the ground - the gas pipe - possible leakage points	Inspection above ground 
	Distinguishing between natural gas and swamp gas	Ethane analysis 
- Freely accessible gas pipes - Plants	- Measuring very low gas concentrations - Locating the source of gas - Finding leaks	Plants 
In the ground	Measuring the gas concentration to: - determine the gas dispersion (detection limit) - classify leaks - locate a probable gas escape (repair point) - prevent possible dangers	Measuring in bar holes 
Indoors (installations, cavities, buildings, containers, etc.).	- Measuring very low gas concentrations - Locating the source of gas - Finding leaks at internal connections	Structure 
- Gas pipes - Gas systems - etc.	- Measuring the gas concentration - Purging to demonstrate purity or absence of gas, e.g. when commissioning/decommissioning gas systems	Gas measuring 

3.3.2 Inspection above ground

In the **Inspection above ground** application, the device measures the set gas (methane or hydrogen).

Area of use

- Measuring minimal gas concentrations above the ground, the gas pipe or possible leakage points

Symbol



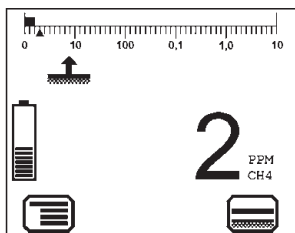
Unit

- ppm
- % vol.

Measuring range

- Methane CH₄ 0 ppm – 2.2% vol.
- Hydrogen H₂ 0 ppm – 2.0% vol.

Measurement data display



- Digit, e.g. 2 ppm CH₄
- Bar graph with quasi-logarithmic scale

Fig. 3: Measuring mode – **Inspection above ground** application

3.3.3 Plants

In the **Plants** application, the device measures the set gas (methane or hydrogen).

Area of use

- Measuring minimal gas concentrations in freely accessible gas pipes and systems (e.g. gas pipes on bridges, above-ground inverted siphons, biogas plants)
- Locating the source of gas
- Finding leaks

Symbol



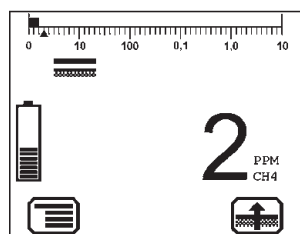
Unit

- ppm
- % vol.

Measuring range

- Methane CH_4 0 ppm – 2.2% vol.
- Hydrogen H_2 0 ppm – 2.0% vol.

Measurement data display



- Digit, e.g. 2 ppm CH_4
- Bar graph with quasi-logarithmic scale

Fig. 4: Measuring mode – **Plants** application

3.3.4 Measuring in bar holes

In the **Measuring in bar holes** application, the device simultaneously measures methane and hydrogen gases.

Area of use

- Measuring gas dispersal in the ground
- Locating the possible leakage point and classifying the leak

Symbol



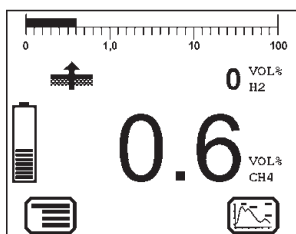
Unit

- % vol.

Measuring range

- Methane CH₄ 0.0 – 100% vol.
- Hydrogen H₂ 0 – 100% vol.

Measurement data display



- Digit, e.g.
0.6% vol. CH₄ (set gas)
0% vol. H₂
- Bar graph with quasi-logarithmic scale (for set gas)

Fig. 5: Measuring mode – **Measuring in bar holes** application

The measured value of the set gas is displayed as a large number and also shown in the bar graph. The measured value of the non-set gas is displayed as a small number (above the measured value of the set gas).

In gas samples with at least 2% vol. detectable hydrocarbons, the device distinguishes between (pure) methane and gas mixtures. The differentiation limit may be significantly higher than 2% vol. of the detectable hydrocarbons.

The composition of the natural gas is the determining factor.

Above the differentiation limit:

- In the case of methane, CH_4 is shown with the measured value.
- For gas mixtures of different hydrocarbons, C_xH_y is shown with the measured value.

3.3.5 Ethane analysis (optional)

The **Ethane analysis** application tests a gas sample for methane, ethane and propane .

Note:

Information about carrying out the ethane analysis can be found in section 4.9.

Area of use

- Distinguishing between natural gas and swamp gas

Symbol



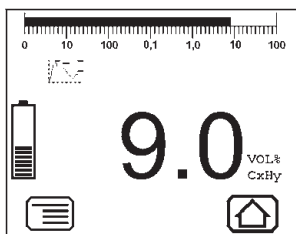
Unit

- ppm

Measuring range

- Hydrocarbons C_xH_y 0 – 12000 ppm

Measurement data display



- Digit, e.g. 9.0% vol. C_xH_y
- Bar graph with quasi-logarithmic scale

Fig. 6: Measuring mode – **Ethane analysis** application

3.3.5.1 General information on ethane analysis

Ethane analysis is used to demonstrate the presence of natural gas and to distinguish between natural gas and swamp gas.

This analysis utilises the fact that natural gas contains ethane, but swamp gas does not. Thus, if ethane is detected, it can be concluded that natural gas is present.

In ethane analysis, the gas sample is taken in a bar hole and diluted with clean air.

Note:

Ask the network operator about the composition of natural gas. Request an analysis certificate.

For ethane analysis, the device must be set to methane CH₄.

3.3.5.2 Requirements

The ethane analysis only works if the gas sample exhibits a specific concentration.

The device checks the concentration at the start of the analysis and prevents the analysis being carried out if the concentration is too low.

Gas sample concentration	Analysis is ...	Device response
> 1% vol.	Definitely possible	Analysis can be carried out
1% vol. – 0.5% vol.	Technically possible	Analysis can be carried out, but the following message appears: Ethane analysis critical
< 0.5% vol.	Not possible	Analysis cannot be carried out because Take sample symbol is not displayed

3.3.5.3 Displayed measurement values

In measuring mode, the device displays the actual concentrations of the gas components (fig. 6).

During the analysis, the device automatically dilutes the gas sample to 1% vol. to ensure optimal use of the gas-sensitive semiconductor. This means

- The concentration ratios of all components of the gas sample are retained.
- The maximum concentration of a gas component is 1% vol., even if the actual concentration in the gas sample is higher. In the chart, the maximum peak may be cut off (Fig. 16, pictured right).

3.3.6 Structure

In the **Structure** application, the device measures the set gas (methane or hydrogen).

Area of use

- Measuring minimal gas concentrations in structures.
- Locating the source of gas

Symbol



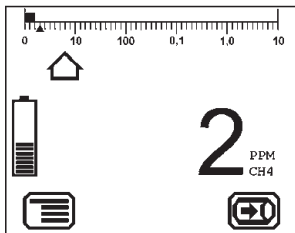
Unit

- ppm
- % vol.

Measuring range

- Methane CH_4 0 ppm – 2.2% vol.
- Hydrogen H_2 0 ppm – 2.0% vol.

Measurement data display



- Digit, e.g. 2 ppm CH_4
- Bar graph with quasi-logarithmic scale

Fig. 7: Measuring mode – **Structure** application

3.3.7 Gas measuring

In the **Gas measuring** application, the device simultaneously measures methane and hydrogen.

Area of use

- Demonstrating gas purity / absence of gas in gas pipes

Symbol



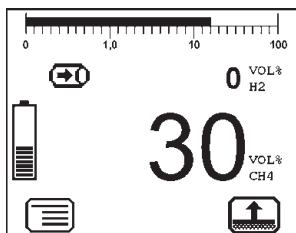
Unit

- % vol.

Measuring range

- Methane CH_4 0.0 – 100% vol.
- Hydrogen H_2 0 – 100% vol.

Measurement data display



- Digit, e.g.
30% vol. CH_4 (set gas)
0% vol. H_2
- Bar graph with quasi-logarithmic scale (for set gas)

Fig. 8: Measuring mode – **Gas measuring** application

The measured value of the set gas is displayed as a large number and shown in the bar graph. The measured value for the non-set gas is displayed above the large number.

In gas samples with at least 2% vol. detectable hydrocarbons, the device distinguishes between (pure) methane and gas mixtures. The differentiation limit may be significantly higher than 2% vol. of the detectable hydrocarbons. The composition of the natural gas is the determining factor.

Above the differentiation limit:

- In the case of methane, CH₄ is shown with the measured value.
- For gas mixtures of different hydrocarbons, C_xH_y is shown with the measured value.

3.4 Differences between measuring mode and settings mode

The device is operated in two modes:

- **Measuring mode**

Measurements are taken in measuring mode. All functions needed to take measurements can be accessed from one menu (fig. 9).

- **Settings**

The device settings can be changed in the settings (fig. 10). Information about the device can also be retrieved. Measurements cannot be taken in the settings.

Settings are accessed via the menu in measuring mode.

3.5 Measuring mode

When switched on, the device is automatically in measuring mode. The current measurements are displayed in measuring mode. You can switch from measuring mode to the menu.

3.5.1 Menu in measuring mode (overview)

In the menu the user can:

- Perform actions
- Perform settings
- View information

Zero point
Inspection above ground
Plants
Measuring in bar holes
Ethane analysis
Structure
Gas measuring
Settings
Start measurement
Protocol
Purge
Device inspection
Gas type
Device information
Exit

Fig. 9: Menu in measuring mode

The number and names of the menu items may differ from the illustration in fig. 9. Which menu items are actually available depends on the program status and certain settings. For example:

- Once you have started a measurement **Start measurement** in the menu becomes **Stop measurement**. In the **Measuring in bar holes** application, this menu item is called **Save measurement**.
- **Protocols** only appears in the menu if at least one protocol has been saved.
- **Purging** only appears in the menu in the **Ethane analysis** application.
- **Functional test** only appears in the menu if the device inspection is enabled.

3.5.2 Menu items

3.5.2.1 Zero point

The zero point can be manually set under **Zero point**. This is only necessary if the displayed measured values differ from the values in clean air after the warm-up time.

Gas	Content in clean air	Correct zero point on device
CH ₄	0% vol.	0.0% vol.
H ₂	0% vol.	0% vol.

The manual zero point setting is not saved. The zero point can be adjusted as often as zero point deviations occur.

3.5.2.2 Inspection above ground, Plants, Measuring in bar holes, Ethane analysis, Structure, Gas measuring

When the name of an application is selected from the menu, the device switches from the current application to the selected application.

3.5.2.3 Settings

You can change the device settings and access information about the device under **Settings** (section 3.6).

3.5.2.4 Start/stop/save a measurement

Depending on the application, measurements will have to be saved or started and then stopped. This applies to all applications except ethane analysis.

Application	Measurement	
	start/stop	save
Inspection above ground	x	
Plants	x	
Measuring in bar holes		x
Structure	x	
Gas measuring	x	

Difference between starting/stopping and saving

Selecting **Start measurement** followed by **Stop measurement** records a measurement plot.

Selecting **Save measurement** saves an individual measurement, namely the current one.

Up to 40 measurements can be saved.

The measurement values can be saved with or without a comment. Comments entered once are saved automatically. The list of saved comments can contain a maximum of 10 entries (ring memory).



Once the first comment has been entered, the **Open saved comments** function will become available.

The saved measurements can be read out on a computer using **GasCom** software. The software is available at www.sewerin.com.

3.5.2.5 Protocols

You can retrieve or clear protocols of saved data under **Protocols**. When saved, the protocols are assigned to different protocol types.

The following protocol types are available:

- Ethane analysis
- Device inspection
- Measurements

Protocol name

The protocol name is made up of the date of saving and time. If a comment has been saved, it will also appear in the protocol name.

Clear

Protocols can only be cleared individually.

You can find information on how to clear all protocols of one protocol type in section 3.6.3.5.

3.5.2.6 Device inspection

Device inspections can be started under **Device inspection**.

Functional test only appears in the menu if the integrated device inspection is enabled. The integrated device inspection is enabled in the factory settings.

Information on how to disable and enable the device inspection can be found in section 6.4.3.

Further information on device inspections can be found in section 6.3 and section 6.4.

3.5.2.7 Gas type

Once switched on, the device is ready for use with the preset gas. In measuring mode, the gas can be changed temporarily under **Gas type**. The temporary change of gas is not saved.

The options are:

- **CH4**
- **H2**

Note:

If the **Device inspection due** symbol appears after changing the gas, the device inspection must be carried out immediately.

For information on changing the preset gas, see section 3.6.3.2.

3.5.2.8 Device information

The following device information is shown under **Device information**:

- Firmware: version, date
- Service: date of the last service, date of the next service

3.6 Settings

The following settings and actions can be performed on the device:

- **Adjustment**
- **System**
- **Alarms**
- **Date/time**
- **Memory**
- **Back**

3.6.1 Settings menu (overview)

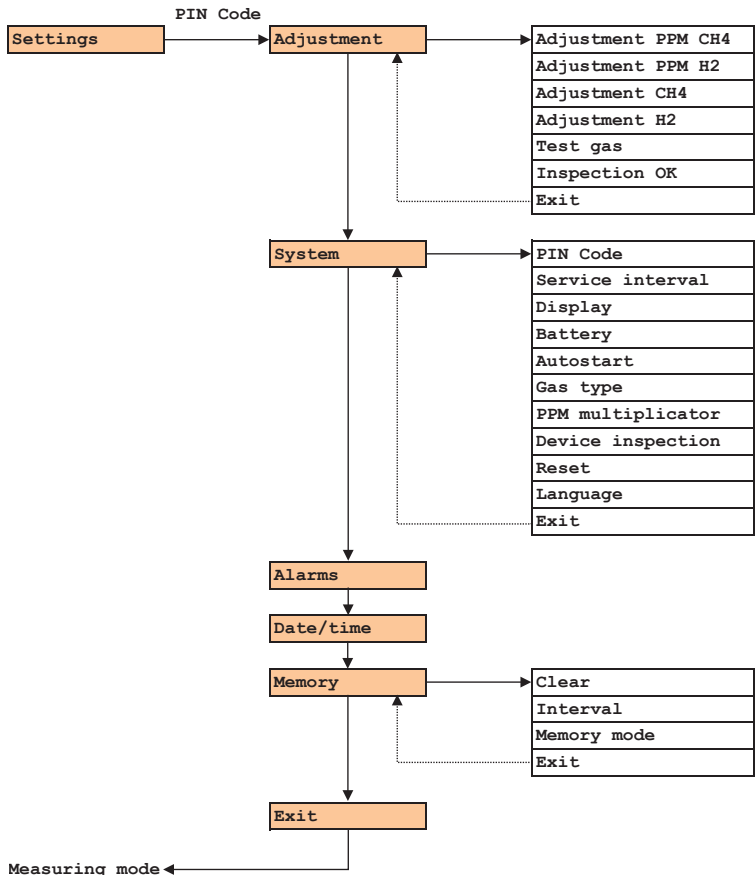


Fig. 10: **Settings** menu

3.6.2 Settings protected by PIN code

The settings on the device are protected by PIN code.

The device is delivered with the PIN code "0001". The PIN code can be changed.

SEWERIN recommends: Change the PIN code after initial start-up, so that only authorised persons have access to the settings.

3.6.3 Menu items

3.6.3.1 Adjustment

The device's sensors can be calibrated under **Adjustment**.

Further information about carrying out the adjustment can be found in section 6.5.

Adjustment PPM CH4

Used to adjust the gas-sensitive semiconductor for methane in the ppm range.

- Applications:
- Inspection above ground
 - Plants
 - Structure
 - Ethane analysis

Adjustment PPM H2

Used to adjust the gas-sensitive semiconductor for hydrogen in the ppm range.

- Applications:
- Inspection above ground
 - Plants
 - Structure

Adjustment CH4

Used to adjust the infrared sensor and the thermal conductivity sensor for methane in the % vol. range.

- Applications:
- Inspection above ground
 - Plants
 - Measuring in bar holes
 - Structure
 - Gas measuring

Adjustment H2

Used to adjust the thermal conductivity sensor for hydrogen in the % vol. range.

Applications:

- Inspection above ground
- Plants
- Measuring in bar holes
- Structure
- Gas measuring

Test gas concentration

Displays the concentration of the test gases used for the adjustment.

The concentration levels cannot be changed.

Inspection OK

Confirms the device is in proper working order. This extends the service interval.

3.6.3.2 System

General information and specifications for operation are set under **System** in the menu.

PIN code

Changes the PIN code.

The PIN code protects the settings from changes made by unauthorised persons.

With the digits "0000" the settings are not protected by PIN code.

If you lose the PIN code, you must contact SEWERIN Service.

Service interval

Sets a time interval for maintenance of the device. You can also activate the automatic switch-off function which prevents the device from being used once the set interval has passed.

Display

Used to set how long the display remains illuminated after any key is pressed as well as the display contrast.

Battery

Used to set the type of disposable/rechargeable battery used.

NOTICE! Damage possible due to device overheating

If the battery type is not correctly set, the device can overheat.

– Always enter the correct battery type.

Autostart

Sets the application displayed when the device is switched on.

Gas type

Used to set the gas that is automatically used after switching on.

The options are:

- CH4
- H2

PPM multiplier

Set the amplification factor for the lower ppm range.

Measurement x factor = displayed measurement

Application: ● Inspection above ground

The options are:

- 100% | 120% | 150% | 200%

Device inspection

Used to switch the integrated device inspection on or off.

Reset

Used to reset the device settings to the factory settings.

Language

Sets the language.

3.6.3.3 Alarms

Sets the alarm thresholds.

- No alarm is triggered in the **Measuring in bar holes** and **Gas measuring** applications.
- The **ALEOS** alarm cannot be adjusted. It always occurs at the end of the measuring range.

Further information about the alarms can be found in section 3.2.3.2 and section 8.2.

ALPPM

Used to set the alarm for methane and hydrogen.

The alarm threshold is identical for both gases.

- Applications:
- Inspection above ground
 - Plants
 - Structure

3.6.3.4 Date/time

Used to set the time, day, month and year. There are two formats available for the date.

The options are:

- **DD.MM.YYYY**
- **YYYY-MM-DD**

3.6.3.5 Memory

Memory is used to specify how measurement data and protocols are handled.

Clear

Used to clear protocols.

- The different protocol types must each be cleared separately.
- All protocols in one protocol type are cleared at once.

You can find information on clearing individual protocols in section 3.5.2.5.

Interval

Sets the interval at which measurement data is automatically saved during the recording of a measurement plot.

The options are:

- **1 | 2 | 5 | 10 | 20 | 60 seconds**

Memory mode

Used to set the type of memory.

The options are:

- **Ring memory**
- **Stack memory**

4 Operation

4.1 Switching on the device



CAUTION!

Risk due to contaminated ambient air

If the device is switched on in a contaminated environment¹, incorrect measurement values may be displayed in measuring mode.

- Switch on the device only in clean air.
-

Each switch-on process is linked to activation of the buzzer, signal light and display. This allows the user to check the following device functions:

Buzzer:	Is the audible signal working?
Signal light:	Is the visual signal working?
Display:	Can incorrect pixels be seen in the inverse display?

When the device is ready for use at the end of the startup process, the display shows the preset application in **Autostart**.



WARNING!

Risk to life if device functions are faulty or missing

Checking the device functions at switch-on is necessary for the safety of the user.

- Monitor the device carefully during the switch-on process.
 - Cancel the switch-on process if the check of any one of the device functions is unsuccessful.
-

¹ e.g. contamination with flammable hydrocarbons.

Procedure

The ambient air is clean.

When measuring natural gas/hydrogen mixtures with more than 30% hydrogen: The device is in the **TG8** bag.

1. Hold down the ON/OFF key until the device reports with a visual and audible signal.
 - A sequence of start images appears (fig. 11)
 - For the preset application, the gases including their measuring ranges and the alarm thresholds are displayed (fig. 12)
 - The device switches to measuring mode. The sensors are warmed up. The measured values flash.

If a gas-sensitive semiconductor is used in the preset application, the following message appears during warm-up: **Add fresh air**. The message serves as a reminder that the ambient air must be clean.
2. Wait until the measured values are stable.

The device is now ready for use (fig. 13).
3. If necessary:
 - Perform all device inspections that are due.



Fig. 11: Sequence of start images during switch-on process

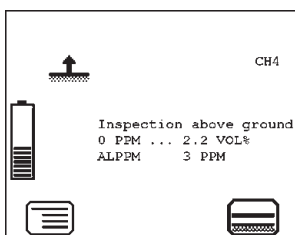


Fig. 12: Displays the preset application with measuring range and alarm thresholds (*here: Inspection above ground*)

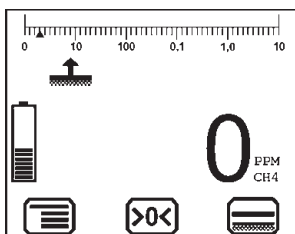


Fig. 13: Device ready for use with the preset application (*here:Inspection above ground*)

4.2 Switching off the device

Switching off the device takes a few seconds.

Procedure

- Press and hold the ON/OFF key until the device turns off.

4.3 Navigating

4.3.1 Switching from measuring mode to the menu

Procedure

The device is in measuring mode. The display shows the **Menu** symbol above function key F1.

- Press F1. The device switches to the top menu level.

4.3.2 Opening an item in a menu

Menu items can always be opened via the menu. In some program statuses, it is also possible to open menu items using the function keys.

4.3.2.1 Opening an item using the menu

Procedure

The device is in measuring mode. A menu or menu item is open.

1. Use the jog dial to select the desired item from the submenu.
2. Press **OK**.

4.3.2.2 Opening a menu item using a function key

Procedure

The device is in measuring mode. The display shows the symbol of the desired menu item above a function key.

- Press the function key that corresponds to the symbol of the menu item.

4.3.3 Going back up a menu level

You can always exit menus or menu items via the menu to go back up a menu level. In most program statuses, there is also the option to exit menu items using the F3 function key.

4.3.3.1 Exiting a menu item using the menu

Procedure

The device is in measuring mode. A menu or menu item is open.

- Select **Exit** from the menu.

4.3.3.2 Exiting a menu item using a function key

Procedure

The device is in measuring mode. A menu or menu item is open.
The display shows the **Esc** symbol above function key F3.

- Press **Esc**.

4.4 Switching application

The description of applications can be found in section 3.3.2 ff.

Note:

You may only switch application when the device is drawing in clean air.

In measuring mode the application currently selected is indicated by the symbol at the top left of the display. There are two ways to change the application.

4.4.1 Switching to a different application using the menu

Procedure

The device is in measuring mode.

1. Make sure the device is drawing in clean air.
2. Press **Menu**.
3. Select the desired application and press **OK**. The application changes.

4.4.2 Switching to a different application using a function key

Procedure

The device is in measuring mode. The display shows the symbol of an application above function key F3.

1. Make sure the device is drawing in clean air.
2. Press function key F3. The device switches to the next application.
3. Repeat the process until the desired application appears.

4.5 Opening settings

Procedure

The device is in measuring mode.

1. Press **Menu**.
2. Choose **Settings** and press **OK**.
3. Enter the PIN code from left to right. The active digit is displayed with a black background.

Digit	Change	Confirm
1st digit	Turn the jog dial	Press the jog dial
2nd digit		Press the jog dial
3rd digit		Press the jog dial
4th digit		

If the PIN code has been entered correctly, the **Settings** menu will appear once the last digit has been confirmed (fig. 18). Otherwise the device will revert to measuring mode.

4.6 Setting zero point (manual zero point setting)

Procedure

The device was switched on in clean air. The device is in measuring mode.

1. Make sure the device is drawing in clean air.
2. Press **Menu**.
3. Select **Zero point** and press **OK**. The values are automatically adjusted. The device returns again to measuring mode.

The **Setting zero point** function can also be accessed using the relevant symbol in the **Inspection above ground**, **Plants** and **Structure** applications.

4.7 Starting/stopping a measurement

A measurement plot can be recorded in the **Inspection above ground**, **Plants**, **Gas measuring** applications. The measurement must be started for this to happen. To end the recording of the measurement plot, the measurement must be stopped. The measurement is saved when it is stopped.

Note:

Measurements cannot be cancelled once begun. The only way to cancel a measurement is to stop it.

4.7.1 Starting a measurement

Procedure

The device is in measuring mode.

1. Press **Menu**.
2. Select **Start measurement** and press **OK**. This starts the measurement plot recording.

4.7.2 Stopping a measurement

Procedure

The device is in measuring mode. The measurement has been started.

1. Press **Menu**.
2. Select **Stop measurement** and press **OK**.
3. Answer **Yes** to the warning prompt.
4. If a comment is to be saved with the measurement:
 - a) Enter a comment. Select the characters required using the jog dial. Confirm each character using the jog dial.

OR

Select a comment from a list. To do this, press **View saved comments**. The list of saved comments will appear. Select the relevant comment. Apply the comment with **OK**.

- b) Confirm your entry/selection with **OK**.

To save a measurement without a comment:

- Press **OK**.

The measurement is saved as a protocol. The device returns to measuring mode.

4.8 Saving a measurement

Individual measured values can be saved in the **Measuring in bar holes** application.

Note:

Measurements do not stop and start in the **Measuring in bar holes** application.

Procedure

The device is in measuring mode.

1. Press **Menu**.
2. Select **Save measurement** and press **OK**.
3. If a comment is to be saved with the measurement:
 - a) Enter a comment. Select the characters required using the jog dial. Confirm each character using the jog dial.
OR
Select a comment from a list. To do this, press **View saved comments**. The list of saved comments will appear. Select the relevant comment. Apply the comment with **OK**.
 - b) Confirm your entry/selection with **OK**.

To save a measurement without a comment:

- Press **OK**.

The measurement is saved as a protocol. The device returns to measuring mode.

4.9 Carrying out an ethane analysis

Note:

Always carry out 2–3 measurements in the same location to obtain reliable results.

4.9.1 Starting an ethane analysis

NOTICE! Risk of damaging the sensor

The ethane detector can be damaged by impure or humid air.

- Make sure the device only draws in clean and dry air.
-

Note:

An ethane analysis takes approximately 4 minutes. If the analysis is cancelled, the detector must be purged. This purge cycle also takes approx. 4 minutes.

Procedure

The device is set to CH₄. The device is in measuring mode.

1. Make sure the device is drawing in clean air.
2. Switch to the **Ethane analysis** application.
3. The ethane analysis is generally performed on a bar hole. Use the localisation probe and a probe hose.
 - a) Insert the probe into the bar hole.
 - b) Connect the probe hose to the device.

As soon as the measurement value satisfies specific conditions (gas concentration >1% vol., stable measurement value), the **Take sample** symbol appears.

4. Press **Take sample**. The following message appears: **Analysis takes approx. 4 min.**
5. Confirm the **Take sample?** prompt by pressing **OK**. The gas sample is taken.

The following message appears: **Add fresh air.**

6. Add clean air.
 - a) To do so, remove the probe hose from the device.
 - b) Move away from the bar hole. Note the direction of the wind.

As soon as the gas concentration drops below 50 ppm, the analysis of the gas sample taken starts automatically. The gas sample analysis is plotted on the display (fig. 14).

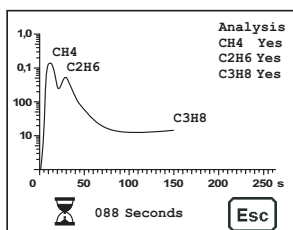


Fig. 14: Illustration of an analysis in progress

When the analysis is complete, the **Save** symbol appears.

7. Press **Save**.

8. If necessary enter a **Comment** for the analysis.

a) Select the characters required using the jog dial. Confirm each character using the jog dial.

OR

– Press **Open saved comments**. A list of the saved comments will appear.

– Select the relevant comment. Apply the comment with **OK**.

b) Confirm your entry/selection with **OK**.

OR

Press **Esc** if you do not wish to enter a comment.

9. Confirm the entry with **OK**. The comment is saved together with the protocol name (date, time).

4.9.2 Evaluating an ethane analysis

Fully completed ethane analyses are saved as protocols. These can be accessed and cleared at any time.

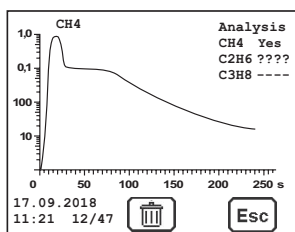


Fig. 15: Ethane analysis protocol

A protocol contains the following information about the gas sample:

- Analysis of the gas components:

CH_4 Yes

C_2H_6 ????

C_3H_8 ----

- Curve; peaks of the gas components definitely present in the sample are labelled: CH_4
- Date and time the protocol was saved
- Protocol number: 12/47, i.e. 12th protocol of 47 protocols in total

The symbols next to the analysed gas components are defined as follows:

Symbol	Gas component is ...
Yes	Definitely present
????	Possibly present
----	Not present

Ideally, the result of the ethane analysis is a curve with at least one clear, steep peak (fig. 16, pictured left). However, occasionally, the analysis does not provide a clear determination of the gas components present (fig. 16, pictured right). In such cases, you must decide whether the analysis quality is sufficient.

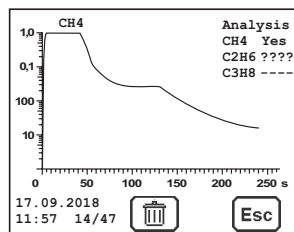
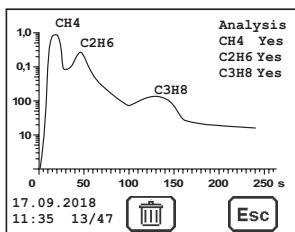


Fig. 16: Quality assessment of an ethane analysis;
left: good quality, right: poor quality

Criteria for determining the quality: good analysis quality

- Methane is definitely present.
- Methane concentration is approx. 1% vol.
- Peaks of the gas components present are clearly recognisable.

Criteria for determining the quality: the presence of natural gas

- good analysis quality
- Ethane is definitely present.

Ethane analyses of poor quality

Note:

Never use poor-quality ethane analyses to demonstrate the presence of natural gas.

Poor-quality ethane analyses can exhibit the following features, for example:

- Curve does not contain any clear peaks (smooth concentration plot)

Reason: Residual gases from previous analyses have accumulated.

Corrective Purge with test gas, e.g.:

action: • 1% vol. CH₄ in synthetic air

OR

 • 100 ppm C₂H₆ with 1% vol. CH₄ in synthetic air

- Curve and symbols provide contradictory information about gas components

Reason: Extremely high or low temperatures (optimal working temperature: 20°C (68 °F))

4.9.3 Purging the detector

The detector for ethane analysis must be kept clean at all times to prevent distortion of measurement results. When the device is in use, however, higher hydrocarbons (e.g. propane, butane) can accumulate in the detector and contaminate it.

Note:

Each purge cycle takes approximately 4 minutes. A new ethane analysis can only be started when the purge cycle has been completed.

4.9.3.1 Frequency

The detector is automatically purged after every ethane analysis. Additional purging of the detector is required in these situations:

- Cancelled ethane analysis

If an ethane analysis is cancelled, the message **Purging required** and the **Take sample** symbol appear automatically.

- Detector contamination suspected

4.9.3.2 Purging the detector after cancelling an ethane analysis

The detector must be purged following the cancellation of an ethane analysis.

Procedure

An ethane analysis has been cancelled. The display shows the **Take sample** symbol.

1. Press **Take sample**.

The purge cycle starts automatically as soon as the gas concentration drops below 50 ppm.

2. Wait until the purge cycle is complete.

The time remaining until the end of the purge cycle is displayed.

4.9.3.3 Purging the detector if contaminated

If you suspect the detector might be dirty, purge the detector separately.

Procedure

The device is in measuring mode. The device is set to CH₄.

1. Make sure the device is drawing in clean air.
2. Switch to the **Ethane analysis** application.
3. Press **Menu**.
4. Select **Purge** and press **OK**.

The **Take sample** symbol and the following message appear:
Purging required

5. Press **Take sample**.

The purge cycle starts automatically as soon as the gas concentration drops below 50 ppm.

6. Wait until the purge cycle is complete.

The time remaining until the end of the purge cycle is displayed.

After the purge cycle is complete, the device will switch to measuring mode.

4.10 Leak test of probes and probe hoses

If the device is used with probes, the leak-tightness of the gas path and the probes or probe hoses must be checked regularly.

The gas path at the gas inlet is sealed off for the test. The device must respond to this with an error message.

4.10.1 Frequency

The leak test must be performed at least quarterly.

4.10.2 Special features of certain probes

Flexible hand probe

Before the test, the filter cap must be unscrewed and the filter removed.

If the filter does not exhibit any visible contamination, it can be reinserted after the test. The original orientation must be maintained.

Carpet probe, bell probe

The carpet probe and the bell probe are also tested as part of bump tests /2/. The description in section 4.10.3 therefore does not apply to these probes.

4.10.3 Checking the leak-tightness

Note:

Note section 4.10.2 which describes special features when testing the following probes: Flexible hand probe, carpet probe, bell probe

Procedure

A probe or a probe hose is connected to the device. The device is in measuring mode.

1. Seal the probe or the probe hose at the open opening, e.g. with your finger.

The gas path is leak-tight if the following error message appears after a maximum of 10 seconds: **Probe/filter pump error**.

2. Unblock the sealed opening again.

The leak test is complete.

4.11 Filter check and filter change

The dust filter must undergo regular visual inspection for contamination. Dirty dust filters must be replaced.

4.11.1 Frequency

How often the filter needs to be changed depends greatly on how often the device is used and the ambient conditions during use.

The filter needs to be changed in the case of:

- visible contamination
- mechanical damage
- contact with water

If none of these events occurs, the filter must be changed after 12 months at the latest.

4.11.2 Checking the filter for contamination and changing the filter

NOTICE! Risk of contamination

New filters, i.e. filters not yet used, must be handled carefully to prevent mechanical damage.

Filters must not come into contact with grease.

- Ensure your hands are clean when changing the filters.
-

The dust filter is located behind the gas input.

Procedure

The device is switched off.

1. Unscrew the gas input.
2. Remove the dust filter.
3. Check that there is no dirt in the dust filter.

If the filter is dirty:

- Dispose of the dirty filter. Use a new filter.

If the filter is not dirty, it can continue to be used.

4. Insert the dust filter into the gas input.

If the existing filter continues to be used:

- Insert the filter in the same direction as it was previously used.

5. Screw the gas input back on.

4.12 Testing the pump

The pump function is tested with a simple leak check.

The test is part of the device inspection, but can also be carried out separately.

Procedure

The device is in measuring mode.

1. Seal off the gas input, e.g. using your finger.

The pump is working correctly if the following error message appears after a maximum of 10 seconds: **Probe/filter pump error**.

If the error message does not appear:

- The pump may be faulty. Contact SEWERIN Service.

2. Uncover the gas input again.

After approximately 5 seconds, the error message should disappear again.

If the error message does not disappear after approximately 5 seconds, there may be a fault.

- Check the gas input for foreign objects and dirt.
- Check the dust filter for dirt and moisture.
- Contact SEWERIN Service.

5 Power supply

5.1 Overview

The device can be operated using:

- Disposable batteries (not rechargeable)
- NiMH batteries (rechargeable)

Each device requires four (rechargeable) batteries. The battery compartment is on the back of the device.

Only approved batteries (rechargeable or disposable) may be used. The device comes with NiMh rechargeable batteries.



WARNING! Risk of explosion due to leaking batteries

Leaking electrolytes can shorten the creepage distance and air gap between the poles. This may mean that the batteries no longer meet the required standards.

- Replace leaking batteries immediately.
 - Clean the battery compartment (and if necessary the device) before inserting the new disposable/rechargeable batteries.
-

5.2 Suitable disposable/rechargeable batteries



WARNING! Risk of explosion due to unsuitable batteries

To ensure that the device remains explosion-proof only certain disposable/rechargeable batteries may be used (/6/).

- Only use disposable/rechargeable batteries other than those supplied by SEWERIN if they comply with the specifications contained in /3/.
-

The following battery types are suitable for use in the device:

Feature	Disposable battery	Rechargeable battery
Type:	alkaline	NiMH
Format, size:	Mignon AA LR6 (/4/)	Mignon AA HR6 (/5/)
Capacity:		2,000 – 2,500 mAh
Creepage distance and air gap between the poles (/3/):	≥ 0.5 mm (0.0197 in)	≥ 0.5 mm (0.0197 in)
Other requirements:		– quick charging (I > 1.25 A) – suitable up to the upper limit of the operating temperature (40°C (104 °F))

5.3 Alarm at undervoltage

If the remaining capacity of the disposable/rechargeable batteries falls below a certain level, then the device will issue two levels of warnings.

1st level

Situation:	Batteries almost exhausted
Warnings:	visual: – The Remaining capacity symbol flashes audible: – signal is emitted (one-off)
Remaining operating time:	approx. 15 min

2nd level

Situation:	Battery exhausted
Warnings:	visual: – no display except the Remaining capacity symbol audible: – a continuous signal is emitted
Remaining operating time:	none (the device switches off)

5.4 Operation with rechargeable batteries

The operating time of the device depends on the battery capacity. Batteries that have been used in the device for some time may have a lower battery capacity compared to new batteries.

5.4.1 Charging the batteries

A device powered with rechargeable batteries can be charged. The batteries remain in the device for charging.

Note:

When attempting to charge a device powered with a disposable battery, the following message appears: **Charging aborted**.

Charging options

The device can be charged via:

- Connection for power supply

OR

- **TG8** docking station

Charging process depending on the initial state of the device

The device can be charged:

- when switched-off

The charging process starts after the device is connected to the power supply.

OR

- when switched on

After connecting the device to the power supply, the batteries are first discharged. Discharging the batteries serves as battery maintenance. Once the device has been discharged, it will automatically switch to charging mode.

Accessories required

A power source is required to connect the device or **TG8** docking station:

- **M4** AC/DC adapter

OR

- **M4** vehicle cable (for charging in a vehicle)

Information about charging

- The device or docking station must not be directly connected to a 24-V on-board power supply in the vehicle. The voltage is too high for the charging process.
- Temperatures from 10 to 25 °C (50 to 77 °F) are ideal for charging.
- Several **TG8** docking stations must not be connected in series (cascaded).



DANGER! Risk of explosion from sparks

High charging currents occur when batteries are being charged. The mains adapter is not explosion proof.

– Only ever charge the device outside of explosive areas.

5.4.1.1 Charging batteries without prior discharging

Procedure

The device is switched off.

1. Optional:
 - Place the device into the docking station.
2. Connect the device or docking station to a power source using a cable. The batteries will start to charge.

5.4.1.2 Charging batteries after prior discharging

A full charge takes approximately 11 hours. The batteries are first discharged (approx. 8 hours) and then charged (approx. 3 hours). The exact duration depends on the current capacity of the rechargeable batteries used.

Procedure

The device is switched on.

1. Optional:
 - Place the device into the docking station.
2. Connect the device or docking station to a power source using a cable. The batteries are first discharged, then charged.

5.4.2 Battery maintenance

Rechargeable batteries lose charge even when the device is not in use. Batteries that are regularly charged may have a longer life.

SEWERIN recommends the following when the device is not in use: Recharge the batteries approximately every 1-3 months. Turn on the device before charging so that the batteries are discharged first.

Information about charging the rechargeable batteries can be found in section 5.4.1.

5.5 Replacing the batteries



DANGER! Risk of explosion from sparks

The device is not explosion proof when the housing is open.

- Only ever open the battery compartment outside of explosive areas.
-

Note:

Always use (rechargeable) batteries that are identical in terms of type, capacity, condition (new or used) and manufacturer at any one time.

Accessories required

To open the battery compartment you will need:

- 2.5 Allen key (included)

Procedure

The device is switched off.

1. Loosen the two screws securing the battery compartment. Remove the screws by repeatedly turning them alternately a short way; this ensures that the battery compartment does not twist.
2. Lift out the battery compartment.
3. Remove and replace the batteries (disposable or rechargeable). Ensure that the batteries are inserted with the correct polarity.
4. Replace the battery compartment so it fits neatly into place and secure firmly with the screws.
5. The next time you switch on the device, you will first be asked which battery type is in use. Enter the correct battery type.

If it takes longer than 120 seconds to replace the batteries, the date and time will have to be reset the next time you switch on the device.

6 Maintenance

6.1 Overview

The maintenance of the device consists of the following activities:

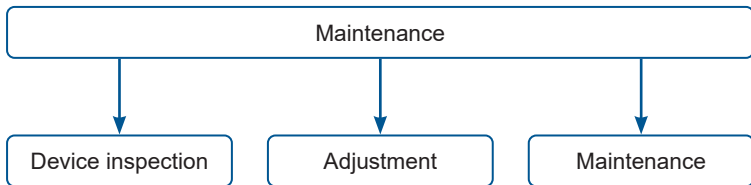


Fig. 17: Servicing activities

The frequency and performers of the individual activities vary. For more information, please refer to the next sections.

All maintenance activities must be documented.

Note:

In addition, these operating instructions describe only the device inspection and adjustment in detail, as maintenance may only be performed by specialists.

6.2 Suitable environment

Device inspection and adjustment must be performed in an environment with clean air. This means that the ambient air must be free of hydrocarbons and toxic gases.

6.3 Device inspection (overview)

The device inspection can be carried out by trained persons, specialists and experts.

Device inspections ensure the device is working properly.

The probes and probe hoses used with the device must also be visually inspected at each device inspection.

6.3.1 Options for carrying out the procedure

The following options are available for carrying out the device inspection:

- free
- integrated

Free device inspection

The user performs the device inspection on his own initiative and responsibility. The user protocols the results (e.g. on paper).

Integrated device inspection

The device guides the user through the required subtests. The subtests must be selected manually.

The device reminds the user of the due device inspections with a symbol.

Performed device inspections can be saved in the device and read out later on a computer using the GasCom software.

The following subtests are not part of the integrated device inspection and must therefore be carried out separately:

- Visual inspection of probes and probe hoses for damage
- Filter check (section 4.11)

6.3.2 Frequency and due date

Frequency

The frequency of device inspections depends on the application and the national regulations.

Frequency	Application
daily before and after use (/)	• Inspection above ground
weekly	• Plants • Structure
every 4 months	• Measuring in bar holes • Gas measuring • Ethane analysis

Due date

When the integrated device inspection is switched on, the device reminds you of due dates for device inspections.



If a device inspection is due, the **Device inspection due** symbol appears.

The symbol will remain on the display until the integrated functional device inspection for the selected application has been successfully completed. If the device inspection has been completed but the device failed on some points, the symbol will remain visible.

6.3.3 Test gases for the device inspection

The following test gases can be used for the device inspection:

Application (group)	Subtest	Recommended test gases
Inspection above ground	Test gas PPM CH4	10 ppm CH ₄ ^{*)}
	Test gas PPM H2	10 ppm H ₂ ^{*)}
Bar holes/ measuring	Test gas CH4	100% vol. CH ₄
	Test gas H2	100% vol. H ₂
Structure/Plants	Test gas CH4	1% vol. CH ₄ ^{*)}
	Test gas H2	1% vol. H ₂ ^{*)}
Ethane analysis	Test gas	100 ppm C ₂ H ₆ in 1% vol. CH ₄ (balance: synthetic air)

^{*)} in synthetic air

Notes:

- Use of test gases not provided by SEWERIN can cause interference.
 - The concentration of the test gas used must match the specified test gas concentration.
-

6.3.4 Requirements for performing a device inspection

The following requirements must be met for performing a device inspection:

- The device is switched on in clean air.
- The device continues to draw in clean air after it is switched on.
- The sensors are warmed up. The measured value is no longer flashing.

In the **Inspection above ground, Plants** and **Structure** applications: The device has been run in for at least 5 minutes.

- The necessary accessories are available.
- The intended test gas is suitable for the application being tested.

Using a conditioner

In the **Inspection above ground, Plants** and **Structure** applications, the device inspection must only be carried out with conditioner. Either a separate conditioner or a test set with an integrated conditioner can be used. Separate conditioners must be connected to the device before it is run in.

6.4 Integrated device inspection

Depending on the application, the integrated device inspection either checks the indication accuracy or performs a bump test.

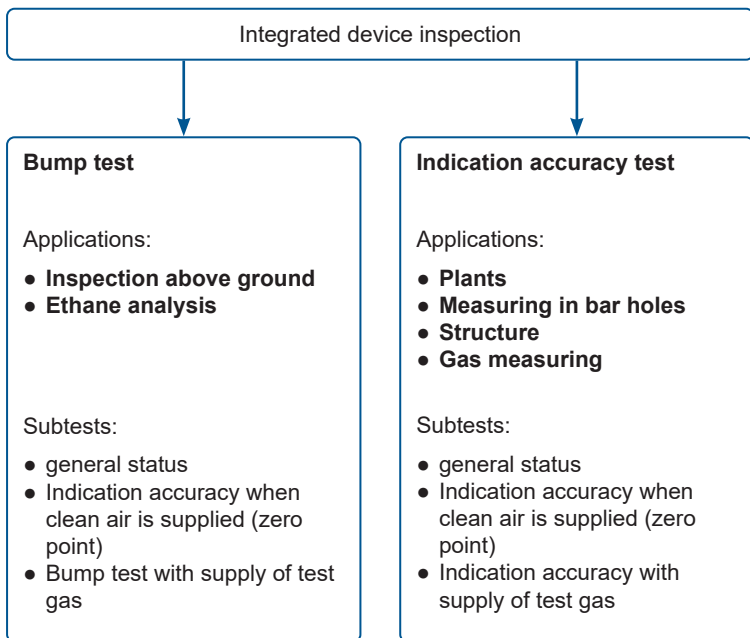


Fig. 18: Integrated device inspection depending on the application

6.4.1 Features

- The device inspection must be performed separately for each application.

When applications are grouped together (e.g. **Bar holes/measuring**), the device inspection must be carried out for the group.

- Device inspections due or subtests can be carried out in any order.
- You can repeat the subtests as often as you wish provided you have not yet concluded the device inspection.
- Device inspections can be saved.

Up to 40 device inspections can be saved.

The following information can be saved along with the device inspection:

- Inspector (e.g. inspector's name or initials)

- Password to protect the protocol from being accessed by unauthorised people

Inspectors entered once are saved automatically. A maximum of 10 inspectors can be saved on the list (ring memory).



Once the first inspector has been entered, the **Open stored inspectors** function will become available.

The protocols of saved device inspections can be accessed at any time on the device and read out on a computer using **GasCom** software. The software is available at www.sewerin.com.

6.4.2 Subtests

The following subtests are part of a device inspection:

- **General status**

- Assessment of the device's external general condition (visual inspection).
- Test whether the signals work.
- Test whether the device detects a pump error.

- **Indication accuracy when clean air is supplied**

- Check whether the zero point is within the permitted tolerances.

- **Indication accuracy/bump test when test gas is supplied**

In the **Plants, Measuring in bar holes, Structure, Gas measuring** applications:

- Check whether the indication accuracy lies within the permissible tolerances.

In the **Inspection above ground, Ethane analysis** applications:

- Check whether the display is working and whether alarms are triggered (bump test).

6.4.2.1 Special features of the General status subtest

During the integrated device inspection, the device specifies the testing of the signals and the pump. The battery charge status and the working condition of the controls are also automatically tested.

However, a complete check of the general status also includes a visual inspection of the housing, probes, probe hoses and dust filters.

- Housing, probes, probe hoses
 - Are the parts free from external damage?
- Filter
 - Is the dust filter dirty?

SEWERIN recommends: Perform the visual inspections before switching on the device, or at least before starting the device inspection.

6.4.3 Switching the device inspection on/off

The integrated device inspection is enabled in the factory settings. The integrated device inspection can be switched off.

Note:

If the integrated device inspection is switched off, the device inspection must be performed manually and documented on paper.

Procedure

The device is in measuring mode.

1. Press **Menu**.
2. Open **Settings**.
3. Choose **system** and press **OK**.
4. Choose **Device inspection** and press **OK**.
5. Select **No** to disable the integrated device inspection.
OR
Select **Yes** to enable the integrated device inspection.
6. Press **OK**.
7. Switch back to measuring mode. To do this, exit the submenus by pressing **Exit** or **Esc**.

6.4.4 Starting the device inspection

Procedure

The conditions for a device inspection are met (section 6.5.3).
The device is in measuring mode.

- 1. Press **Menu**.
- 2. Choose **Device inspection** and press **OK**.
The **Device inspection** menu appears (fig. 19).
- 3. Select an application and press **OK**.
The **Dev. Test ...** menu appears.
- 4. Perform all subtests.

Information about the subtests can be found in the following sections:

- Testing the general status section 6.4.6
 - Checking the indication accuracy when clean air is supplied (zero point) section 6.4.7
 - Checking the indication accuracy when a test gas is supplied (sensitivity) section 6.4.9
- OR
- Performing a bump test section 6.4.8

Inspection above ground
Bar holes/measuring
Structure/Plants
Ethane analysis

Fig. 19: **Device inspection** menu

6.4.5 Saving the device inspection

Procedure

All the subtests of a device inspection have been performed.
The display shows the **Save** symbol.

- 1. Press **Save**.

2. If you want to save the protocol with the name of the inspector:
 - a) Enter the name of the inspector. Select the characters required using the jog dial. Confirm each character using the jog dial.
OR
Select the inspector's name from a list. To do this press **Access saved inspectors**. The list of saved inspectors will appear. Select the desired inspector. Apply the inspector with **OK**.
 - b) Confirm your entry/selection with **OK**.
Press **Esc** if you do not wish to enter an inspector for the device inspection.
3. If the protocol is to be password-protected:
 - a) Enter a password. Select the characters required using the jog dial. Confirm each character using the jog dial.
 - b) Confirm the entry with **OK**.
Press **Esc** if you do not wish to enter a password for the device inspection.
The device inspection is saved as a protocol. An overview with the device inspection results is displayed.
Successfully tested gases are marked with **OK**. Untested gases are marked with ----.
4. Confirm the overview by pressing **OK**. The device switches to measuring mode.

6.4.6 Testing the general status

The general status test is part of the device inspection.

Note:

Note the specific details when checking the general status (section 6.4.2.1).

Procedure

The device inspection has been started (section 6.4.4). The display shows the **Dev. Test...** menu for the selected application.

1. Select **General status** and press **OK**. The device emits visual and audible signals.
2. Check the signals.
 - Can the audible signal be heard?
 - Is the visual signal visible?
3. Check the pump function (section 4.12).
4. If not yet carried out:
 - Check the housing, probes, probe hoses and dust filters for visible defects.
5. If there are no defects:
 - Confirm the **General status OK?** prompt with **Yes**. **General status OK** appears on the display.

This concludes the **General status** subtest.

6.4.7 Checking the indication accuracy when clean air is supplied (zero point)

The indication accuracy with supply of clean air test is part of the device inspection. It checks whether the zero point is within the permitted tolerances.

Procedure

The device inspection has been started (section 6.4.4). The display shows the **Dev. Test...** menu for the selected application.

1. Make sure the device is drawing in clean air.
2. Select **Fresh air** and press **OK**.
3. Wait until the measured values are stable. The following message appears: **Status: OK**
4. Press **OK**. **OK** appears on the display.

This concludes the **Fresh air** subtest.

6.4.8 Performing a bump test

A bump test is performed as part of the device inspection in the following applications:

- **Inspection above ground**
- **Ethane analysis**

6.4.8.1 Performing a bump test in the Inspection above ground application

This subtest checks whether the display is working and whether alarms are triggered.

The bump test must be carried out with the probe accessories connected, in accordance with legal requirements. /.

Note:

During the bump test in the **Inspection above ground** application, some steps may only be taken after a specified time has elapsed and must then be carried out within a certain time. Therefore, prepare for each bump test thoroughly.

- Familiarise yourself with the procedure beforehand.
 - Prepare the necessary accessories.
-

Accessories required

The following accessories are required for the bump test in the **Inspection above ground** application:

- Test gas

Information about the test gases to be used can be found in section 6.3.3.

- **SPE ppm** test set (conditioner integrated)

OR

SPE VOL test set and additionally a separate conditioner

- Carpet probe or bell probe
- Test plate

Procedure

The device inspection has been started (section 6.4.4). The display shows the **Inspection above ground dev. test** menu.

1. Make sure the device is drawing in clean air.
2. Connect the test plate to the **SPE ppm** test set.
3. Connect the probe to the device.
4. Select the menu item to be tested (**Test gas PPM CH4** or **Test gas PPM H2**) and press **OK**. The display shows instructions.
5. Check whether the test gas concentration specified by the device matches the test gas you intend to use.
 - To do this press **Information**.
6. Press **OK**. The following message appears: **Release test gas in**
7. After the specified time has elapsed:
 - Add the test gas using the test set.The following message appears: **Connect probe in**
8. After the specified time has elapsed:
 - Place the probe on the test plate.The measurement starts.
9. If the following message appears: **Status: OK**
 - Stop the test gas supply.
10. Press **OK**.
11. Repeat the steps for the other test gas.

Once the test for all gases is complete, the entire bump test is finished.

6.4.8.2 Performing a bump test in the Ethane analysis application

This subtest checks whether the display is working and whether alarms are triggered.

The bump test is similar in procedure to an ethane analysis and therefore also takes approximately 4 minutes.

Accessories required

The following accessories are required for the bump test in the **Ethane analysis** application:

- Test gas

Information about the test gases to be used can be found in section 6.3.3.

- Test set

Procedure

The device inspection has been started (section 6.4.4). The display shows the **Ethane analysis dev. test** menu.

1. Make sure the device is drawing in clean air.
2. Select **Test gas** and press **OK**.
3. Wait until the measurement is stable.
4. Connect the test set.
5. Add the test gas using the test set.
6. Wait until the measurement is stable. The **Take sample** symbol appears.
7. Press **Take sample**. The following message appears: **Analysis takes approx. 4 min.**
8. Confirm the **Take sample?** prompt by pressing **OK**. The gas sample is taken.
9. If the following message appears: **Add fresh air.**
 - a) Stop the test gas supply.
 - b) Add clean air. To do this, disconnect the test set from the device.
10. Wait until the measurement is stable.

As soon as the gas concentration drops below 50 ppm, the analysis of the gas sample taken starts automatically. The gas sample analysis is plotted on the display (fig. 14).

If the **test gas OK** message appears, the bump test completed.

6.4.9 Checking the indication accuracy when a test gas is supplied (sensitivity)

The indication accuracy is tested as part of a device inspection in the following applications:

- **Plants**
- **Measuring in bar holes**
- **Structure**
- **Gas measuring**

This subtest checks whether the indication accuracy lies within the permissible tolerances.

All test gases specified in the device must be tested in the **Measuring in bar holes** and **Gas measuring** applications.

Accessories required

The following accessories are required for testing the indication accuracy:

- Test gas

Information about the test gases to be used can be found in section 6.3.3.

- **SPE ppm** test set (conditioner integrated)

OR

SPE VOL test set and additionally a separate conditioner

The conditioner is only required for testing the indication accuracy in the **Plants** and **Structure** applications.

Procedure

The device inspection has been started (section 6.4.4). The display shows the **Dev. Test...** menu for the selected application.

1. Make sure the device is drawing in clean air.
2. Select the menu item to be checked (e.g. **Test gas CH4**, **Test gas H2**, ...) and press **OK**.
3. Check whether the test gas concentration specified by the device matches the test gas you intend to use.
 - To do this press **Information**.

4. Connect the test set.
5. Add the test gas using the test set.
6. Wait until the measured values are stable. The following message appears: **Status: OK**
7. Press **OK**.
8. Stop the test gas supply.
The device switches back to the **Dev. test...** menu. The following message appears: **Test gas ... OK**
9. Repeat the steps for the other test gases, if applicable.
Once the test for all gases is complete, the entire indication accuracy test is finished.

6.4.10 Failed subtests – causes and corrective action

Status: OK - message does not appear or appears late

- Applies to: Testing the indication accuracy with a supply of clean air

If the **Status: OK** message does not appear within a reasonable amount of time, the air inflow does not correspond to the limit values stored in the device.

– Move the device somewhere else and repeat the subtest.

If the message still does not appear when the subtest is repeated, the device must be re-adjusted (section 6.5).

Test gas... not OK

If a **Test gas...** subtest is failed, the following message appears:
Test gas... not OK

- Applies to: Indication accuracy test with supply of test gas

Cause	Corrective action
Connections not sealed, e.g. between test set and device	– Repeat subtest, checking the seal on the connections
Measurement values outside the specified limit values	– Adjust device

- Applies to: Bump test in the **Inspection above ground** application

Cause	Corrective action
The ambient air was not clean when the zero point was set	1. Reset zero point 2. Repeat subtest
Subtest test performed without conditioner	– Repeat subtest with conditioner

6.5 Adjustment

The adjustment can be carried out by specialists and experts.

The sensors and the corresponding gases are set by means of adjustment. To this end, the zero point needs to be adjusted, followed by the sensitivity to the reference values.

6.5.1 Frequency

It is mandatory to perform an adjustment in the following cases:

- Measurement values outside the specified limit values
- Device inspection failed

Only the affected gases need to be adjusted, not the entire device.

6.5.2 Test gases for the adjustment

The following test gases can be used for adjustment:

Gas	Suitable test gases for Zero point	Sensitivity
CH ₄	Fresh air (clean air)	• 10 ppm CH₄^{*)} • 100 ppm CH₄^{*)} • 1000 ppm CH₄^{*)} • 1.0% vol. CH₄^{*)} • 100% vol. CH₄
H ₂	Fresh air (clean air)	• 10 ppm H₂^{*)} • 100 ppm H₂^{*)} • 1000 ppm H₂^{*)} • 1% vol. H₂^{*)} • 100% vol. H₂

^{*)} in synthetic air

If more than one test gas can be used to adjust a gas, it does not have to be adjusted with all test gases. However, adjusting with more than one test gas increases the measurement quality.

Every gas must be adjusted separately,

Notes:

- Use of test gases not provided by SEWERIN can cause interference.
 - The concentration of the test gas used must match the specified test gas concentration.
-

6.5.3 Requirements for performing an adjustment

The following requirements must be met for performing an adjustment:

- The device is switched on in clean air.
- The device continues to draw in clean air after it is switched on.
SEWERIN recommends: Perform the adjustment in well ventilated rooms or in the open air.

- The sensors are warmed up. The measured value is no longer flashing. The device has been run in for at least 5 minutes.
- The necessary accessories are available.
- The specified test gas is suitable for the adjustment.

Using a conditioner

In the **Inspection above ground**, **Plants** and **Structure** applications, the adjustment must only be carried out with conditioner. Either a separate conditioner or a test set with an integrated conditioner can be used. Separate conditioners must be connected to the device before it is run in.

6.5.4 Performing the adjustment

The zero point and sensitivity are adjusted following the same procedure for all gases.



You can find information on the adjustment of the various gases (for example, test gas and accessories required, date of last adjustment) under **Information**.

The symbol appears after the corresponding **Adjustment ...** menu item has been selected.

Note:

For each measuring range always adjust the zero point first, followed by the sensitivity.

Accessories required

The following accessories are required for an adjustment:

- Test gas

Information about the test gases to be used can be found in section 6.5.2.

- **SPE ppm** test set (conditioner integrated)

OR

SPE VOL test set and additionally a separate conditioner

The conditioner is only required for adjustment in the **Inspection above ground**, **Plants**, **Structure** applications.

6.5.4.1 Adjusting the zero point

The zero point is adjusted following the same procedure for all gases.

Procedure

The conditions for an adjustment are met (section 6.5.3). The device is in measuring mode.

1. Make sure that clean air is being drawn in.
2. Press **Menu**.
3. Open **Settings**.
4. Select **Adjustment** and press **OK**.
5. Select the desired adjustment (e.g. **Adjustment CH4**) and press **OK**.
6. Wait at least 1 minute. The measurement must be stable.
7. Select **Zero point** and press **OK**.

This adjusts the zero point. The reading shows zero (0.00% vol. / 0 ppm).

6.5.4.2 Adjusting the sensitivity

The sensitivity is adjusted following the same procedure for all gases.

Note:

When adjusting the sensitivity, never use a carbon dioxide filter.

Procedure

The zero point has been adjusted. The display shows the **Adjustment...** menu for the gas whose zero point was previously adjusted.

1. Connect the test set.
2. Select the sensitivity to be adjusted (e.g. **100 VOL% CH4**).
3. Add the test gas using the test set.

4. Wait at least 1 minute. The measurement must be stable.
5. Press **OK**. The device is adjusted. The reading shows the specified value (e.g. 100% vol. CH₄).
6. Stop the test gas supply.
7. Repeat the steps for other test gases if applicable.
8. Switch back to measuring mode. To do this, exit the submenus by pressing **Exit** or **Esc**.

6.6 Maintenance

Maintenance may only be performed by competent persons.

The device must undergo maintenance once a year.

- Send the device to SEWERIN Service for maintenance.
- If there is a service contract, the device can be serviced by the mobile service.

The inspection sticker on the device confirms the last maintenance and shows the next due date.



Fig. 20: Inspection sticker

7 Troubleshooting

Error messages

Error messages are displayed in the order in which they occur. Up to five errors can be displayed.

Error messages continue to be displayed until the error is corrected.

Error code	Error message	Corrective action
8	Error 8 No calibration PPM sensor adjustment	– Adjusting the device (adjustment PPM CH4, adjustment PPM H2)
9	Error 9 No calibration IR/PX sensor adjustment	– Adjusting the device (adjustment CH4, adjustment H2)
10	Error 10 Adjustment failed Test gas	– Checking the test gas concentration
52	Error 52 XFLASH SEWERIN Service	– Contact SEWERIN Service
59	Error 59 Error unknown SEWERIN Service	– Contact SEWERIN Service
60	Error 60 PX sensor SEWERIN Service	– Contact SEWERIN Service
62	Error 62 IR sensor SEWERIN Service	– Contact SEWERIN Service
80	Error 80 Error unknown SEWERIN Service	– Contact SEWERIN Service
100	Error 100 Pump error Probe/filter	– Check all filters, probes and hose connections for porosity and dirt
200	Error 200 I2C HOST – IR SEWERIN Service	– Contact SEWERIN Service
201	Error 201 I2C HOST – EC SEWERIN Service	– Contact SEWERIN Service

Error code	Error message	Corrective action
202	Error 202 I2C HOST – EX SEWERIN Service	– Contact SEWERIN Service

8 Appendix

8.1 Technical data and permitted operating conditions

8.1.1 Device

Series

Type/model	065 40
------------	--------

Certificates

Certificate	explosion protection test • EU type examination certificate: TÜV 07 ATEX 553353 X
Marking	II 2G Ex db eb ib IIC T4 Gb

Device data

Dimensions (W × D × H)	approx. 148 × 57 × 205 mm (5.83 × 2.24 × 8.07 in) approx. 148 × 57 × 253 mm (5.83 × 2.24 × 9.96 in) with supporting bracket
Weight	approx. 1000 g (35 oz)
Material	housing: polycarbonate

Features

Display	monochrome, 320 × 240 pixels
Buzzer	• frequency: 2.4 kHz • volume: 80 dB (A) / 1 m (3.28 ft)
Signal light	red
Pump	• vacuum: > 250 mbar • volume flow: typically 50 l/h ±20 l/h ◦ inspection above ground, measuring in bar holes, gas measuring, plants applications: approx. 50 l/h ◦ structure, Warning applications: approx. 40 l/h ◦ ethane analysis application during sampling: approx. 50 l/h • pump error (F100) depending on volume flow: ◦ ≤ 20 l/h F100 certain ◦ > 20 l/h – ≤ 35 l/h F100 possible
Interface	USB 2.0 Type B
Memory	8 MB
Controls	• ON/OFF key • 3 function keys • Jog dial
Sensors	• SC for CH₄, H₂ • IR for CH₄ • TC for H₂
Filter	replaceable dust filter

Operating conditions

Operating temperature	-20 – 40 °C (-4 – 104 °F)
Humidity	5 – 90 % r.h., non-condensing
Atmospheric pressure	800 – 1100 hPa
Pressure at gas input	max. 100 mbar
Protection rating	IP54
Position of use	any

Storage conditions

Storage temperature	-25 – 60 °C (-13 °F – 140 °F) temperatures above 40 °C (104 °F) reduce the lifespan of the sensors
Humidity	5 – 90 % r.h., non-condensing
Atmospheric pressure	800 – 1100 hPa

Power supply

Power supply	4 cells, type Mignon AA, optionally: • rechargeable batteries: NiMH • disposable batteries: alkaline
Operating time, typical	min. 7 h
Charging time	approx. 3 h (full charge), depending on capacity
Charging temperature	0 – 35 °C (32 – 95 °F)
Charging voltage	12 V DC (max. 1 A)

Data transmission

Communication	USB 2.0 Type B
---------------	----------------

Gas types

Default	• CH₄ • H₂
---------	--

8.1.2 Sensors

Note:

Probes increase the stated response times.

8.1.2.1 Infrared sensors (IR)

Methane CH₄ (Measuring in bar holes, Gas measuring applications)

Type	infrared sensor (IR)
Measuring range	0 – 100% vol.
Indication range	0 – 120% vol.
Resolution	0 – 10% vol. 0.1% vol. 10 – 100% vol. 1% vol.
Response times	100% vol.: $t_{90} < 10$ s
Warm-up time	< 30 s
Temperature range	-20 – 40 °C (-4 – 104 °F)
Measuring error	- CH₄: ±5% of the measured value, minimum 1% vol. - C_xH_y: > ±5% of the measured value, minimum 1% vol.
Interference, known	all hydrocarbons
Lifetime, expected	5 years
Test gases	- zero point: clean air - CH₄: 1.0% vol. in synth. air 100% vol.

8.1.2.2 Thermal conductivity sensor (TC)

Hydrogen H₂ (Measuring in bar holes, Gas measuring applications)

Type	thermal conductivity (TC) sensor with hydrocarbon compensation
Measuring range	0 – 100% vol.
Indication range	-5 – 120% vol.
Resolution	1% vol.
Response times	100% vol. H ₂ : $t_{90} < 10$ s
Warm-up time	< 90 s
Temperature range	-20 – 40 °C (-4 – 104 °F)
Measuring error	±3% vol.
Interference, known	- all gases with a different thermal conductivity - at 20 °C (68 °F): 10% vol. CO₂ -1 – 0% vol.
Lifetime, expected	5 years
Test gases	- zero point: clean air - H₂: 100% vol.

Methane CH₄, hydrogen H₂ (Inspection above ground, Plants, Structure applications)

Type	thermal conductivity sensor (TC)
Measuring range	• CH₄: 0 – 2.2% vol. • H₂: 0 – 2.0% vol.
Indication range	-5 – 10% vol.
Resolution	0.1% vol.
Response times	• CH₄: 2.2% vol.: $t_{90} < 10$ s • H₂: 2.0% vol.: $t_{90} < 10$ s
Warm-up time	< 30 s
Temperature range	-20 – 40 °C (-4 – 104 °F)
Measuring error	• CH₄: ±25% of measured value, minimum 0.3% vol. • H₂: ±20% of measured value, minimum 0.2% vol.
Interference, known	• all gases with a different thermal conductivity at 20 °C (68 °F), typically: • gas type CH₄: ◦ 1% vol. H₂ < 4.5% vol. ◦ 1% vol. C₃H₈ < 0.6% vol. • gas type H₂: ◦ 1% vol. CH₄ < 1.0% vol. ◦ 1% vol. C₃H₈ < 1.2% vol.
Lifetime, expected	5 years
Test gases	• zero point: clean air • CH₄: ◦ 1.0% vol. in synth. air ◦ 100% vol. • H₂: 100% vol.

8.1.2.3 Gas-sensitive semiconductor (SC)

Methane CH₄, hydrogen H₂ (Inspection above ground, Plants, Structure applications)

Type	gas-sensitive semiconductor (SC)
Measuring range	0 – 1% vol.
Indication range	0 – 1.5% vol.
Resolution	• 0 – 10 ppm 1 ppm • 10 – 100 ppm 2 ppm • 100 – 999 ppm 20 ppm • 0.1 – 0.5% vol. 0.02% vol. (200 ppm) • 0.5 – 1.0% vol. 0 – 1% vol.
Response times	when adding test gas directly at the gas input: • CH₄: ◦ 10 ppm: t₉₀ < 7 s ◦ 1000 ppm: t₉₀ < 8 s • H₂: ◦ 10 ppm: t₉₀ < 5 s ◦ 1000 ppm: t₉₀ < 6 s
Warm-up time	approx. 1 min
Temperature range	-20 – 40 °C (-4 – 104 °F)
Measuring error	• CH₄: ±30% of measured value • H₂: ±30% of measured value
Interference, known	• all hydrocarbons • water vapour, CO, CO₂ at 20 °C (68 °F), typically: • gas type CH₄: ◦ 100 ppm H₂ < 100 ppm ◦ 100 ppm C₃H₈ < 80 ppm ◦ Water vapour (< 80% r.h.) < 1 ppm ◦ 40 ppm CO < 15 ppm ◦ 2% vol. CO₂ < 25 ppm • gas type H₂: ◦ 100 ppm CH₄ < 120 ppm ◦ 100 ppm C₃H₈ < 100 ppm ◦ Water vapour (< 80% r.h.) < 1 ppm ◦ 40 ppm CO < 10 ppm ◦ 2% vol. CO₂ < 20 ppm
Lifetime, expected	4 years

Test gases	use the conditioner for all test gases! • zero point: clean air • CH₄: ◦ 10 ppm in synth. air ◦ 100 ppm in synth. air ◦ 1000 ppm in synth. air ◦ 1.0% vol. in synth. air • H₂: ◦ 10 ppm in synth. air ◦ 100 ppm in synth. air ◦ 1000 ppm in synth. air ◦ 1.0% vol. in synth. air
------------	---

8.1.3 Ethane detector

Type	gas chromatograph
Gases, separable	CH ₄ , C ₂ H ₆ , C ₃ H ₈
Sensor, used	gas-sensitive semiconductor
Measuring range	0 – 12000 ppm
Separating capacity	25 ppm
Resolution	1 ppm
Measurement time	4 min
Warm-up time	approx. 1 min
Measuring error	±30%
Lifetime, expected	5 years
Test gases	test gas concentration: • zero point: clean air • gas mixture 1% vol. CH₄ / 100 ppm C₂H₆ in synth. air

8.2 Alarms

8.2.1 Features

ALPPM

Type:	warning of gas concentration in ppm range
Adjustable:	yes – setting range: 3 – 500 ppm – increment 1 ppm
Latching:	no
Trigger:	ALPPM alarm threshold exceeded
Indicators:	– audible signal – visual signal – ALPPM notification on display
Deactivation option:	– possible for audible signal when ALPPM alarm threshold is exceeded
Reset:	automatic when level falls below ALPPM alarm threshold

ALEOS

Type:	end of measuring range
Adjustable:	no
Latching:	no
Trigger:	end of measuring range
Indicators:	– audible signal – visual signal – ALEOS notification on display – Reading flashes
Deactivation option:	no
Reset:	– automatic when level falls below ALEOS alarm threshold – by switching off the device

8.2.2 Alarm thresholds (factory settings)

Gas	ALPPM	ALEOS
CH ₄	3 ppm	2.2% vol.
H ₂		2.0% vol.

8.3 Device inspection limits

Inspection above ground

Gas	Zero point	Sensitivity
CH ₄	0 ±2 ppm	≥8 ppm in 10s
H ₂	0 ±2 ppm	≥8 ppm in 10s

Plants, Structure

Gas	Zero point		Sensitivity	
	Specification	Deviation	Specification	Deviation
CH ₄	0 ppm	±2 ppm	1.00% vol.	±3% vol.
H ₂	0 ppm	±2 ppm	1.00% vol.	±3% vol.

Measuring in bar holes, Gas measuring

Gas	Zero point		Sensitivity	
	Specification	Deviation	Specification	Deviation
CH ₄	0.0% vol.	±0.3% vol.	100% vol.	±2% vol.
H ₂	0% vol.	±2% vol.	100% vol.	±5% vol.

8.4 Memory capacity

The total memory capacity of the device is divided up as follows:

Protocol type	Maximum number of storable protocols
Device inspection	40
Measurement	
• Inspection above ground, Plants, Structure, Gas measuring	40 (for all 4 applications)
• Measuring in bar holes	40
• Ethane analysis	40

There is a choice of two memory modes (section 3.6.3.5). The selected memory mode applies for all protocol types.

Measurements

Note:

A file is saved after each **Start measurement – Stop measurement** cycle, regardless of whether the memory capacity is exhausted.

Each file has a maximum memory capacity of 1800 data records. This means that a file can record data for 30 min (0.5 h) at a save interval of 1 second. After this, data recording continues automatically in the next file.

Save interval	Save time for 1 file (1800 data records)	Save time for 40 files (max. memory capacity)
1 s	0.5 h	20 h
2 s	1 h	40 h
5 s	2.5 h	100 h
10 s	5 h	200 h
20 s	10 h	400 h

Factory settings in **bold**

8.5 Type examination

8.5.1 Explosion protection test

The device is assigned to the following explosion-proof groups:

Explosion-proof group	For the following atmospheres	When using the device
II 2G Ex db eb ib IIB T4 Gb	• Methane CH₄ • Propane C₃H₈ • Butane C₄H₁₀	without TG8 bag
II 2G Ex db eb ib IIC T4 Gb	• Methane CH₄ • Propane C₃H₈ • Butane C₄H₁₀ • Hydrogen H₂	with TG8 bag

EU type examination certificate¹: TÜV 07 ATEX 553353 X

¹ For specific testing conditions, see EU type examination certificate.

8.6 Identification plate

The identification plate is located on the back of the device.

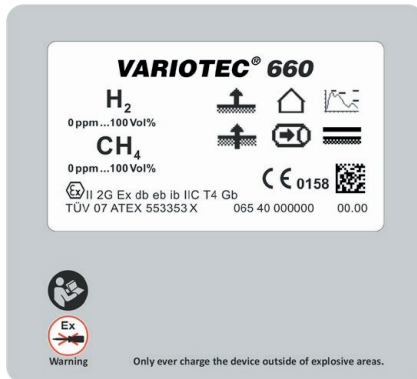


Fig. 21: **Variotec 660** identification plate

The identification plate contains the following information:

- measurable gases and their measuring ranges
- Product name
- Applications
- QR code for serial number
- Production date (MM.YY)
- CE mark
- Serial number
- Ex marking

Symbols

-  CE mark
-  Explosion protection logos
-  Follow the operating instructions.
-  Only ever open the battery compartment outside of explosive areas.

8.7 Care

All that is necessary to care for the device is to wipe it down with a damp cloth.

NOTICE! Damage to property from unsuitable cleaning agents

Unsuitable cleaning agents can chemically corrode the housing surface. Fumes from solvents and substances containing silicone can get into the device and damage the sensors.

- Never use solvents, petrol, cockpit sprays containing silicone or similar substances to clean the device.
-

8.8 Accessories and consumables

Below is a selection of accessories and consumables. SEWERIN sales will be happy to provide you with information on other accessories and consumables.

Accessories

Part	Order number
Docking station TG8	LP11-10001
AC/DC adapter M4	LD10-10001
Vehicle cable M4, 12 V= portable	ZL07-10100
Vehicle cable M4, 12 V= installed	ZL07-10000
Vehicle cable M4, 24 V= portable	ZL09-10000
"Vario" carrying system	3209-0012
Case TG8-RÜ	ZD29-10000
Carpet probe PRO	ZS01-12000
Bell probe D80	ZS05-10500
Localisation probe 345 mm	ZS03-10300
Flexible hand probe	ZS32-10000
Telescopic hand probe	ZS43-10000
Telescopic probe SeGAS GRP	ZS31-20000
Probe hose	ZS25-10000 (e.g.)
Test set SPE VOL	PP01-90101
Test set SPE DUO	PP01-60001
Test case kit PPM	ZP03-12001
Test plate	ZP06-10000

Consumables

Part	Order number
Dust filter	2499-0020
Hydrophobic filter (for probe hoses)	2491-0050
Hose filter	2499-0010
Special filter element	2499-0005
Rechargeable NiMH battery	1354-0009
Disposable alkaline battery	1353-0001
Test gas 10 ppm CH ₄ in synth. air*	ZT24-10000
Test gas 1000 ppm CH ₄ in synth. air*	ZT29-10001
Test gas 1.0% vol. CH ₄ in synth. air*	ZT04-10001
Test gas 100% vol. CH ₄ *	ZT20-10000
Test gas 10 ppm H ₂ in synth. air*	ZT53-10000
Test gas 1000 ppm H ₂ in synth. air*	ZT46-10000
Test gas 1.0% vol. H ₂ in synth. air*	ZT17-10000
Test gas 100% vol. H ₂ .	ZT54-10000
Test gas 100 ppm C ₂ H ₆ / 1% vol. CH ₄ in synth. air*	ZT43-10000

* Test gas can 1 ltr, pressure approx. 12 bar

8.9 Advice on disposal

The European Waste Catalogue (EWC) governs the disposal of appliances and accessories.

Description of waste	Allocated EWC waste code
Device	16 02 13
Test gas can	16 05 05
Disposable battery, rechargeable battery	16 06 05

End-of-life equipment

Used equipment can be returned to Hermann Sewerin GmbH. We will arrange for the equipment to be disposed of appropriately by certified specialist contractors free of charge.

8.10 Legal basis

The following standards and regulations as well as European Directives form the basis for working with the device.

- /1/ DVGW G 260 (2021)
- /2/ Gas quality
- /3/ Available for download at: www.dvgw.de **
- /4/ DVGW G 465-4-2 (2025)
- /5/ Equipment Technology for Inspection of Gas Pipelines and Gas Systems - Part 2: Handheld gas concentration measuring devices
- /6/ Available for download at: www.dvgw.de ***
- /7/ EN 60079-7
- /8/ EN 60086-1
- /9/ EN 61951-2
- /10/ 2014/34/EU

8.11 Declaration of conformity

Hermann Sewerin GmbH hereby declares that the **VARIOTEC 660** fulfils the requirements of the following directive(s):

- 2011/65/EU
- 2014/30/EU
- 2014/34/EU

Gütersloh, 2026-08-17



Benjamin Sewerin (Managing Director)

The complete declaration of conformity can be found at www.sewerin.com.

8.12 Abbreviations

ALEOS	Alarm at end of measuring range (end of scale)
ALPPM	Alarm in ppm range
SC	Gas-sensitive semiconductor
IR	Infrared sensor
NiMH	Nickel metal hydride
ppm	parts per million
LEL	Lower Explosion Limit
% vol.	Percentage of a gas in a gas mixture based on the volume
TC	Thermal conductivity sensor

8.13 Technical terms

Bump test

Uses a test gas to check whether the display is working and whether alarms are triggered.

Indication accuracy test

Uses a test gas to check whether the displayed values are within the permitted tolerances.

Ring memory

Type of data storage in the device. If the available storage space is full, the oldest file is automatically overwritten by the current file.

Clean air

Air that is free from hydrocarbons and toxic gases.

Serial number

A fixed 11-digit number sequence for uniquely identifying a device. The serial number is made up of the type (3 digits), model (2 digits) and device number (6 digits).

Stack memory

Type of data storage in the device. If the available storage space is full, you are prompted to confirm whether the oldest file should be overwritten by the current file.

9 Index

A

- Accessories 91
- Adjusting the Sensitivity 75
- Adjustment 28, 72
 - adjustment CH4 28
 - adjustment H2 29
 - adjustment PPM CH4 28
 - adjustment PPM H2 28
 - conditioner 74
 - frequency 72
 - performing 74
 - requirements 73
 - sensitivity 75
 - test gases 73
 - zero point 75
- Alarm 9, 31, 86
 - undervoltage 52
- Alarm thresholds 86
- Application 11
 - allocation of tasks 12
 - ethane analysis 17
 - gas measuring 21
 - measuring in bar holes 15
 - plants 14
 - replacing 37
 - selecting 37
 - structure 20
- Audible signal 9

B

- Bag 10
- Bump test
 - ethane analysis 68
 - inspection above ground 67
 - performing 67

C

- Care 90
- Clear 31
- Competent person 3
- Concentration-dependent signal 10
- Conditioner 60, 74
- Consumables 92
- Controls 8

D

- Date 31
- Device
 - cleaning 90
 - switching off 36
 - switching on 33
- Device information 26
- Device inspection 25, 30, 57
 - conditioner 60
 - due date 59
 - features 61
 - free device inspection 58
 - frequency 58
 - general status 62
 - integrated 58, 60
 - limits 87
 - options 58
 - requirements 60
 - saving 64
 - starting 64
 - subtests 62
 - switching off 63
 - switching on 63
 - test gases 59
- Device inspector 3
- Display 30
- Disposable battery 30
 - replacing 56
 - setting the type 30
 - suitable 51
- Disposal 92
- Dust filter 10

E

- Error messages 77
- Ethane analysis 17
 - evaluating 43
 - good analysis quality 45
 - measurement values 18
 - performing 42
 - poor quality 45
 - presence of natural gas 45
 - quality 45
 - requirement 18
 - starting 42

Explosion protection test 88

F

Filter 10
 checking for contamination 49
 replacing 49
Filter check 49
 frequency 49
Function keys 8

G

Gas input 10
Gas measuring (application) 21
Gas type 26, 30
General status 62
 testing 65

I

Indication accuracy
 sensitivity 70
 with clean air 66
 with test gas 70
 zero point 66
Infrared sensor 82
Inspection above ground 13
Inspection OK 29

J

Jog dial 8

L

Language 31
Leak test 47, 48
 frequency 47
 special features of certain probes 47

M

Maintenance 57, 76
 suitable environment 57
Measurement
 saving 24, 40
 starting 24, 39
 stopping 24, 39
Measuring in bar holes 15

Measuring mode 22, 39
 menu 22
 switching to the menu 36
Memory 31, 87
Memory mode 32
Menu
 settings 27
Menu item
 exiting 37
 opening 36

N

Navigating 36

O

ON/OFF key 8
Operation 33

P

PIN code 29
Plants 14, 20
Power supply 51
PPM multiplier 30
Probe
 check the leak-tightness 47
Protocol name 25
Protocols 25
 clear 25
Purging the detector 46
 after cancelling an ethane analysis 46
 frequency 46
 in case of contamination 47

R

Rechargeable battery
 charging 53
 charging while the device is switched
 off 55
 charging while the device is switched
 on 55
 maintaining 55
 replacing 56
 setting the type 30
 suitable 51
Reset 30
Ring memory 32

S

- Semiconductor sensor 84
- Sensors 7, 81
- Service interval 29
- Settings 22, 24, 26
 - menu 27
 - opening 38
 - PIN code 27
- Signal
 - audible 9
 - concentration-dependent 10
 - visual 9
- Specialist 3
- Stack memory 32
- Status: OK 71
- Structure 20
- Subtests 62
 - failed 71
- System 29

T

- Test gas concentration 29
- Test gases
 - for adjustment 73
 - for the device inspection 59
- Test gas... not OK 71
- Testing the pump 50
- Thermal conductivity sensor 7
- Time 31
- Trained person 2

U

- Undervoltage 52
- Use, intended 1

Z

- Zero point 23
 - adjusting 75
 - set manually 39

Hermann Sewerin GmbH

Robert-Bosch-Straße 3
33334 Gütersloh, Germany
Tel.: +49 5241 934-0
www.sewerin.com
info@sewerin.com

SEWERIN IBERIA S.L.

Centro de Negocios Eisenhower
Avenida Sur del Aeropuerto
de Barajas 28, Planta 2
28042 Madrid, España
Tel.: +34 91 74807-57
www.sewerin.es
info@sewerin.es

Sewerin Sp. z o.o.

ul. Twórcza 79L/1
03-289 Warszawa, Polska
Tel.: +48 22 675 09 69
www.sewerin.pl
info@sewerin.pl

SEWERIN SARL

17, rue Ampère – BP 211
67727 Hoerd Cedex, France
Tél. : +33 3 88 68 15 15
www.sewerin.fr
sewerin@sewerin.fr

Sewerin Portugal, Lda

Avenida dos Congressos da
Oposição Democrática, 65D, 1º K
3800-365 Aveiro, Portugal
Tlf.: +351 234 133 740
www.sewerin.pt
info@sewerin.pt

Sewerin Ltd.

Hitchin
Hertfordshire, UK
Phone: +44 1462-634363
www.sewerin.co.uk
info@sewerin.co.uk