Operating Instructions

SEWERIN
Protecting Water, Gas and Life.

VARIOTEC®
480/460/450/400 EX

01.09.2025 a – 106606 – en

Fig. 1: **VARIOTEC 480 EX** device overview

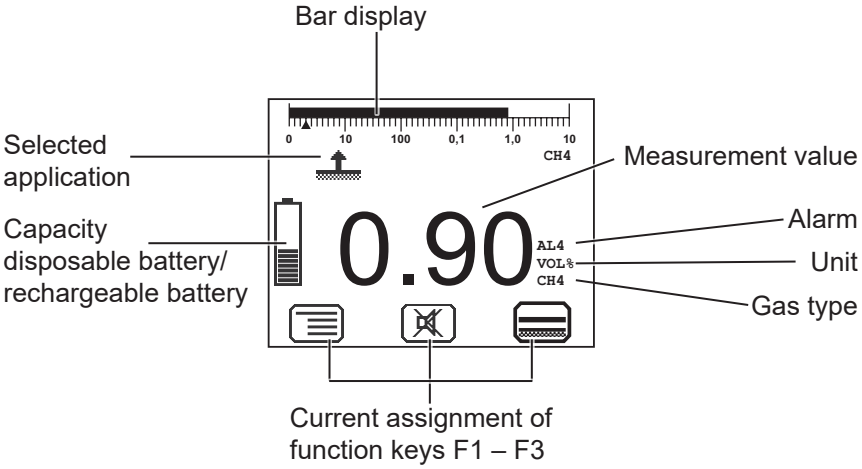


Fig. 2: **VARIOTEC 480 EX** display

Display symbols

General

Menu

OK

Cancel

Buzzer off

Take sample

Save

Delete

Capacity disposable battery/rechargeable battery

Fault

Carry out device inspection

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

Warning %LEL

Warning ExTox

Information about this document

The warnings and notes in this document mean the following:

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

WARNING!
Risk of personal injury. Can result in serious injury or death.

CAUTION!
Risk of personal injury. Can result in injury or a risk to health.

Notice!
Risk of damage to property.

Note:
Tips and important information.

Numbered lists (numbers, letters) are used for:

- Instructions that must be followed in a certain order

Lists with bullet points (point, dash) are used for:

- Lists
- Instructions that only involve one step

Numbers between forward slashes /.../ refer to the referenced documents.

1 General 1
1.1 Warranty 1
1.2 Purpose 2
1.3 Intended use 3
1.4 General safety information 4
1.5 Allocation of tasks to applications 5

2 Features 6
2.1 Visual and audible signals 6
2.2 Sensors 8
2.3 Explosion protection 9
2.3.1 Passive explosion protection 9
2.3.2 Active explosion protection 10

3 Operation 11
3.1 General information on operation 11
3.1.1 Keys and jog dial 11
3.1.2 Selecting/exiting menus and menu items 11
3.1.3 Switching the device on 12
3.1.4 Selecting/changing the application 14
3.1.5 Differences between measuring mode and settings mode 15
3.2 Measuring mode 15
3.2.1 Accessing the menu (measuring mode menu structure) 16
3.2.2 Zero point 17
3.2.3 Inspection above ground 18
3.2.4 Plants 19
3.2.5 Measuring in bar holes 20
3.2.6 Ethane analysis 20
3.2.6.1 General information on ethane analysis 22
3.2.6.2 Purging the detector 23
3.2.6.3 Carrying out an ethane analysis 24
3.2.6.4 Evaluating an ethane analysis 26
3.2.7 Structure 29
3.2.8 Gas measuring 30
3.2.9 Warning %LEL 31
3.2.10 Warning ExTox 32
3.2.11 Settings 33
3.2.12 Start/stop/save a measurement 33
3.2.13 Protocols 35

3.2.14 Device inspection 36
3.2.15 Gas type CxHy 36
3.2.16 Device information 37
3.3 Settings 37
3.3.1 Opening settings 37
3.3.2 Settings menu structure 39
3.3.3 Adjustment 40
3.3.4 System 41
3.3.5 Alarms 43
3.3.6 Date/time 44
3.3.7 Memory 44

4 Power supply 45

4.1 Suitable disposable/rechargeable battery types 45
4.2 Operation with rechargeable batteries 46
4.2.1 Charging 47
4.2.2 Rechargeable battery maintenance 48
4.3 Battery alarm 48
4.4 Replacing disposable/rechargeable batteries 49

5 Maintenance 50

5.1 Device inspection 50
5.1.1 General information on the device inspection 50
5.1.1.1 Scope 50
5.1.1.2 Frequency 51
5.1.1.3 Documentation 52
5.1.1.4 Integrated device inspection 52
5.1.1.5 Order 53
5.1.1.6 Test gases for the device inspection 53
5.1.2 Performing the device inspection 55
5.1.2.1 Accessing the device inspection 55
5.1.2.2 Concluding the device inspection 56
5.1.3 Testing the general status 57
5.1.3.1 Housing 57
5.1.3.2 Signals 58
5.1.3.3 Probe 58
5.1.3.4 Filter 58
5.1.3.5 Pump 58
5.1.4 Testing indication accuracy with supply of fresh air 59
5.1.5 Testing indication accuracy with supply of test gas 59

5.2 Adjustment 61
5.2.1 Scope 61
5.2.2 Test gases for the adjustment 62
5.2.3 Special features of adjustment with gas mixture 63
5.2.4 Preparation 63
5.2.5 Performing the adjustment 64
5.2.5.1 Adjusting the zero point 64
5.2.5.2 Adjusting the sensitivity 65
5.2.6 Carrying out an oxygen adjustment 66
5.2.6.1 Adjusting the zero point for oxygen 66
5.2.6.2 Adjusting the sensitivity for oxygen 67
5.3 Servicing 67

6 Faults 68

7 Appendix 69

7.1 Specifications and permitted operating conditions 69
7.2 Alarms 72
7.2.1 Features 72
7.2.2 Occupational exposure limits (OEL) and excess factors (STEL and LTEL) 75
7.2.3 Alarm thresholds (factory settings) 75
7.2.4 Setting ranges for gas types 76
7.3 Limit values for the device inspection 76
7.4 Memory capacity 77
7.5 Sensors 78
7.5.1 Catalytic combustion sensor (CC) 78
7.5.2 Thermal conductivity sensor (TC) 79
7.5.3 Electrochemical sensors (EC) 80
7.5.3.1 Oxygen O_2 80
7.5.3.2 Carbon monoxide CO 81
7.5.4 Gas-sensitive semiconductor (SC) 82
7.6 Ethane detector 83
7.7 Technical information 84
7.7.1 Sensitivity of the catalytic combustion sensor 84
7.7.2 Identification sticker (back of device) 84
7.7.3 Cleaning 84
7.7.4 Electrostatic charge 85
7.8 Accessories and consumables 85

7.9 Declaration of conformity 86
7.10 Inspection protocol 87
7.11 Advice on disposal 89
7.12 Terminology and abbreviations 90
7.13 Referenced documents 91

8 Index 92

1 General

1.1 Warranty

The following instructions must be complied with in order for any warranty to be applicable regarding functionality and safe operation of this equipment. This product must only be commissioned by qualified professionals who are familiar with the legal requirements (Germany: DVGW).

- Read these operating instructions prior to operating the product.
- Use the product only as intended.
- Maintenance and repairs must only be carried out by qualified staff from Hermann Sewerin GmbH (SEWERIN for short) or by persons trained by SEWERIN. Only spare parts approved by SEWERIN may be used when performing repairs.
- Use only suitable battery types. otherwise the device will not be explosion-proof.
- Changes or modifications must not be made to this product without approval from SEWERIN.
- Use only SEWERIN accessories for the product.

SEWERIN shall not be liable for damages resulting from the non-observance of this information. The warranty conditions of the General Terms and Conditions (AGB) of Hermann Sewerin GmbH are not affected by this information.

In addition to the warnings and other information in these Operating Instructions, always observe the generally applicable safety and accident prevention regulations.

The manufacturer reserves the right to make technical changes.

1.2 Purpose

The **VARIOTEC 480 EX** and the models **460 EX**, **450 EX** and **400 EX** are hand-held measuring devices which can be used for all gas pipeline testing applications.

The devices are designed for professional industrial use and require the necessary specialist knowledge for working in gas pipelines. Sample applications are described in /3/.

Models **480 EX** and **460 EX** can be optionally fitted with a detector for ethane analysis to help you safely distinguish between natural gas and swamp gas.

All devices can also be individually fitted with electrochemical sensors.

Catalytic combustion sensors operate on the catalytic combustion principle. Thermal conductivity sensors measure the specific conductivity of gases. Electrochemical sensors operate on the electrochemical cell principle. The gas-sensitive semiconductor reacts to changes in conductivity brought about by reducible gases.

Note:
These operating instructions describe the **VARIOTEC 480 EX** with all additional equipment (firmware version 2.XXX). All descriptions refer to the device as delivered (factory settings) and apply to all device versions. The manufacturer reserves the right to make changes.

1.3 Intended use

This device is intended for professional residential and commercial use, in small firms and commercial operations and in industry. The appropriate specialist knowledge is required to operate the device.

The device may only be used to measure the following gases (depending on the device model and additional equipment):

- Methane CH_4/propane C_3H_8/butane C_4H_{10}
- Oxygen O_2
- Carbon monoxide CO

The device must **not** be used for:

- Gas analysis of technical processes
- Monitoring liquids

The device can be used up to a temperature of 40 ºC (104 °F). However, high temperatures reduce the lifetime of the sensors and rechargeable batteries.

If a device with an electrochemical sensor is exposed to gas concentrations above the measuring range limit, this can reduce the lifetime of the sensor.

1.4 General safety information

- The device has been tested to ensure that it is explosion-proof in accordance with European standards (CENELEC).
- The device must only be switched on with fresh air.
- Do not use this device in oxygen-enriched atmospheres, otherwise it will not be explosion-proof.
- Only probe hoses with a hydrophobic filter may be used.

  Exception:

  If the probe has a built-in hydrophobic filter, the hose does not require any other filters.
- The device must only be tested and adjusted with test gases in well ventilated rooms or in the open air. Test gases must be handled in a professional manner.
- Handle the product carefully and safely, both during transport and operation.
- Do not use the product if it is damaged or faulty.
- Always carry out a device inspection (see section 5.1) after the device has suffered an impact (for example, if dropped accidentally).
- Always carry out a device inspection (see section 5.1) after the device has been exposed to gas concentrations above the measuring range limit of the LEL range.
- The device complies with the limits of the EMC directive. Always observe the information in the manuals of (mobile) radio equipment when using the device close to (mobile) radio equipment.

Note:
Follow the advice regarding explosion protection (see section 2.3).

1.5 Allocation of tasks to applications

The table is designed to help you decide which application to choose for which activity (in accordance with /3/).

Location	Activity	Application
Gas lines, gas systems, …	• Measuring the gas concentration – Purging (to demonstrate purity or absence of gas, e.g. when commissioning/decommissioning gas systems)	Gas measuring
Buried gas lines	• Measuring very low gas concentrations: – Ground – Gas line – Possible leakage points	Inspection above ground
	• Distinguishing between natural gas and swamp gas	Ethane analysis
Gas lines, gas systems, …in houses, enclosed spaces and shafts	• Warning against explosive gas concentrations through work area monitoring	Warning %LEL
	• Warning against explosive and toxic gases through work area monitoring	Warning ExTox
In the ground	• Measuring the gas concentration to: – Determining gas dispersion (detection limit) – Classify leaks – Locating a probable gas escape (repair point) – Preventing possible dangers	Measuring in bar holes
Poorly accessible gas pipes, systems	• Measuring very low gas concentrations • Locating the source of gas • Finding leaks	Plants
In the house	• Measuring very low gas concentrations • Locating the source of gas • Finding leaks at internal connections	Structure

2 Features

The device comes in four models:

VARIOTEC 480 EX

VARIOTEC 460 EX

VARIOTEC 450 EX

VARIOTEC 400 EX

The models are suitable for the following applications:

Application	480 EX	460 EX	450 EX	400 EX
Inspection above ground	×	×		×
Plants	×	×		
Measuring in bar holes O_2	× ○	× ○	× ○	
Ethane analysis	○	○		
Structure CO	× ○	× ○		
Gas measuring	×	×	×	
Warning %LEL	×		×	
Warning ExTox CO O_2	× ○ ○		× ○ ○	

× standard ○ optional

2.1 Visual and audible signals

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.

If this symbol appears on the display, the audible 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.

This symbol appears at the top left of the display as soon as the audible signal has been switched off. It disappears automatically if the level falls below the alarm threshold.

Operating signal

When using the **Warning %LEL** and **Warning ExTox** applications, the device emits a visual and audible signal at regular intervals. This indicates that the device is working properly.

Alarm

The device can monitor several gases at the same time. If the measured gas concentration of one or more gases exceeds specified limit values (alarm thresholds) the device gives a warning. It emits both audible and visual signals, which are clearly different from the operating signal.

WARNING! Risk to life from dangerous gas concentrations

The **AL1**, **AL2** and **AL3** alarms always indicate danger. The **AL4** alarm may indicate danger.

- Take all necessary measures for your own safety and the safety of others immediately.

There is detailed information on alarms in section 7.2.

2.2 Sensors

The device features four types of sensor:

- Gas-sensitive semiconductor (SC)
- Catalytic combustion sensor (CC)
- Thermal conductivity sensor (TC)
- Electrochemical sensor (EC)

Application	Gas	Measuring range	Sensors
Inspection above ground	CH_4	0 ppm – 10% vol. *	SC, TC
Plants	CH_4	0 ppm – 100% vol.	SC, TC
Measuring in bar holes	CH_4	0.0 – 100% vol.	TC
	O_2	0 – 25% vol.	EC
Ethane analysis	CH_4	---	Gas chromatograph, SC, TC
	C_2H_6		
	C_3H_8		
Structure	CH_4	0 ppm – 100% vol.	SC, TC
	CO	0 – 500 ppm	EC
Gas measuring	CH_4	0.0 – 100% vol.	TC
Warning %LEL and warning ExTox	CH_4	0 – 100% LEL	CC
	O_2	0 – 25% vol.	EC
	CO	0 – 500 ppm	EC

* VARIOTEC 400 EX: 1 ppm – 1.0% vol., because there is no TC

2.3 Explosion protection

2.3.1 Passive explosion protection

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

Explosion-proof group	For the following atmospheres	When using
II 2G Ex db eb ib IIB T4 Gb	– Methane CH_4 – Propane C_3H_8 – Butane C_4H_{10} – Carbon monoxide CO	Device **without** carrying bag TG8
II 2G Ex db eb ib IIC T4 Gb	– Methane CH_4 – Propane C_3H_8 – Butane C_4H_{10} – Carbon monoxide CO – Hydrogen H_2	Device **with** carrying bag TG8

EU type examination certificate[1]: TÜV 07 ATEX 553353 X

DANGER! Risk of explosion from sparks

- Only ever open the battery compartment outside of explosive areas.
- Only ever charge the device outside of explosive areas.
- Only use the USB port outside of explosive areas.
- Use only suitable battery types.
- When working with hydrogen, always use the TG8 carrying bag for the device.

[1] For special test conditions, see EU type examination certificate.

2.3.2 Active explosion protection

The functional safety test applies to:

Applications:	Warning %LEL Warning ExTox	
Gas types:	Measuring range:	
– Methane CH_4	0 – 100% LEL	
– Propane C_3H_8	0 – 100% LEL	
Gases:	Measuring range:	As per:
– Oxygen O_2	0 – 25 % O_2	/7/
– Carbon monoxide CO	0 – 500 ppm CO	/5/
Tested accessories:	– Test set SPE VOL – Flexible hand probe, 1 m (3.28 ft) – Floating probe 2 m (6.56 ft) / 6 m (19.68 ft)	

Type examination

Testing institute:	DEKRA Testing and Certification GmbH
Certificates:	PFG 08 G 002 X N1 BVS 09 ATEX G 001 X N1

The following points were not part of the type examination:

- Saving measurement data (see section 3.2.12)
- Saving protocols from the integrated device inspection (see section 5.1.1.4)
- Disposable alkaline batteries for the power supply (see section 4.1)

3 Operation

3.1 General information on operation

3.1.1 Keys and jog dial

The ON/OFF key is the only control on the device that does not change its function.

When switched on, the device is operated using the jog dial and function keys to navigate the display.

Control	Action	Function
ON/OFF key	Press	● Switches the device on ● Switches the device off
Function keys F1, F2, F3	Press	● Variable ● As indicated on the display at the bottom of the screen ● Function keys may also have no function assigned in some cases
Jog dial	Turn	● Selects functions, settings, measurement data, etc. ● Modifies values
	Press	● Opens the next program level (for example, menu item, function, measurement data, selectable values) ● Accepts values

3.1.2 Selecting/exiting menus and menu items

Functions, applications and settings etc. are selected via the main menu (for short: **Menu**). This **menu** has submenus and menu items. Refer to section 3.2.1 for information on accessing the menu.

Selecting submenus/menu items

Submenus and menu items are selected and opened using the jog dial and/or the function keys.

In measuring mode the name of the selected application is indicated by the symbol at the top left of the display. You can find detailed information on selecting and switching applications in section 3.1.4.

Exiting menus/menu items

There are generally two ways to exit open menus/menu items and return to the next level up:

- Press **Esc**
- Select **Back** from the menu

3.1.3 Switching the device on

Note:
Always switch the device on with fresh air.

1. Press the ON/OFF key. The device switches on.

   The switching on process involves an internal check.

Process	Test purpose
Buzzer Sounds an audible signal.	Is the audible signal working?
Signal light Displays a visual signal.	Is the visual signal working?
Display Display inverted.	Are there pixels missing from the display?

   The start screen appears on the display.

Fig. 3: Start screen

Display:
- Device type:
  VARIOTEC 480 EX
- User:
  Frank Smith
  City Council
  Leakage Delivery
- Firmware version: V2.000
- Date and time
- Capacity disposable battery/ rechargeable battery

The splash screen for the application set under **Autostart** appears (see section 3.3.4).

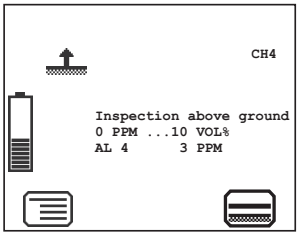


Fig. 4: Splash screen for Inspection above ground application

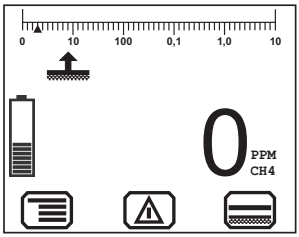
Display:
- Gas type: CH_4
- Application as symbol (top left) and text:
  Inspection above ground
- Measuring range:
  0 ppm ... 10 % vol.
- Alarm threshold:
  AL4, 3 ppm
- Symbol for next application that can be selected via function key F3: Measuring in bar holes

The device switches to measuring mode. The device warms up. The reading flashes.

While the device is warming up, the prompt **Add fresh air!** is displayed as a reminder.

2. Make sure the device is actually drawing in fresh air. Change its location if necessary.
3. Wait until the reading stops flashing.

   The device is ready for use.



Display:
– Current reading: zero when device is switched on with fresh air

Fig. 5: Inspection above ground measuring mode

WARNING! Risk to life from using miscalibrated or faulty devices

Gas warning devices must be regularly checked before use.

- Carry out a device inspection each day before starting work.

3.1.4 Selecting/changing the application

WARNING! Risk to life from using miscalibrated or faulty devices

If the device is used as a gas warning instrument (**Warning %LEL** and **Warning ExTox** applications), it must be regularly checked before use.

- Carry out a device inspection each day before starting work.

Note:

You may only switch applications when the device is drawing in fresh air.

The current application is indicated by the symbol at the top left of the display. The symbol at the bottom right shows the next application that can be selected via function key **F3**. You can

specify which application is activated first when the device is switched on in the **Settings** under **System** (see section 3.3.4).

- Press **Menu**. Select the menu item for the application you want to use.

  OR

  a) Press function key **F3**. The device switches to the next application.

  b) Repeat until the symbol for the application you want to use appears at the top left.

3.1.5 Differences between measuring mode and settings mode

The device is operated in two modes:

- **Measuring mode** (see section 3.2)

  Measurements are taken in measuring mode. All functions needed to take readings can be accessed from one menu.

- **Settings** (see section 3.3)

  The device settings can be changed in settings mode. Information about the device can also be retrieved. Measurements cannot be taken in settings mode.

  Settings are accessed via the menu in measuring mode. The settings are access-protected by a PIN code.

WARNING!
Risk to life due to absence of alarm
The device only issues alarms in measuring mode. As soon you open the menu, alarms are no longer triggered.
- Only adjust settings in areas where there is no risk of explosion and where there is no toxic or low-oxygen atmosphere.

3.2 Measuring mode

When switched on the device is in measuring mode. In measuring mode, the current readings are always displayed (Fig. 5). Depending on the application, the measurement will have to be saved or started and then stopped (see section 3.2.12).

WARNING!
Risk to life from operating signal failure
When the device is used as a gas warning device (**Warning %LEL** and **Warning ExTox** applications), an operating signal must always sound in measuring mode. If the operating signal does not sound, the device is not safe to operate.

- Stop using the device immediately.
- Leave explosive areas or areas with a toxic or low-oxygen atmosphere immediately.

3.2.1 Accessing the menu (measuring mode menu structure)

In measuring mode **F1** can be used to access the **Menu**.

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

Fig. 6: **Menu** with submenus (menu items)

Once you have started a measurement **Start measurement** in the menu becomes **Stop measurement**. In some applications this menu item is called **Save measurement**.

You can find detailed information on starting, stopping and saving measurements in section 3.2.12.

Protocol is only visible in the menu if at least one protocol is saved.

Purging only appears in the menu in the ethane analysis application.

Gas type CxHy only appears in the menu if the device is equipped for at least one further gas type apart from methane CH_4.

3.2.2 Zero point

The zero point can be manually set under **Zero point** in the menu. This is only necessary if the displayed fresh air measurement is not zero after the end of the warm-up period.

Gas	Content in fresh air	Correct zero point on device
CH_4	0% vol.	0.0% vol.
CO	0 ppm	0 ppm
O_2	20.9% vol.	20.9% vol.

The manual zero point setting is not saved. The zero point can be corrected by adjustment as often as zero point deviations occur (see section 5.2).

Requirements for correct setting of the zero point

- Device has been switched on with fresh air.
- Device continues to draw in fresh air.

Setting zero point (manual zero point setting)

1. Press **Menu**.
2. Select **Zero point** menu item. The values are automatically adjusted. The device returns 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.

3.2.3 Inspection above ground

The measuring mode can be changed for the **Inspection above ground** application via this menu item.

Area of use

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

Symbol

Unit

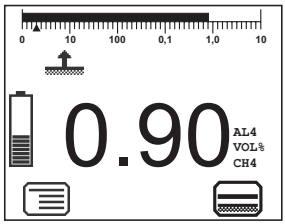
– ppm (parts per million)
– % vol.

Measuring range

Gas-sensitive semiconductor 0 to 10,000 ppm

Thermal conductivity sensor 1 to 10% vol.

Measurement data display



– Digit, for example, 0.90% vol. CH_4
– Bar graph with quasi-logarithmic scale

Fig. 7: Inspection above ground measuring mode

3.2.4 Plants

The measuring mode can be changed for the **Plants** application via this menu item.

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

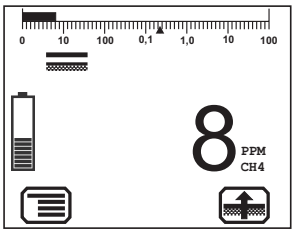
– ppm (parts per million)
– % vol.

Measuring range

Gas-sensitive semiconductor 0 to 10,000 ppm

Thermal conductivity sensor 0.1 to 100% vol.

Measurement data display



– Digit, for example, 8 ppm CH_4
– Bar graph with quasi-logarithmic scale

Fig. 8: Plants measuring mode

3.2.5 Measuring in bar holes

The measuring mode can be changed for the **Measuring in bar holes** application via this menu item.

Area of use

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

Symbol

Unit

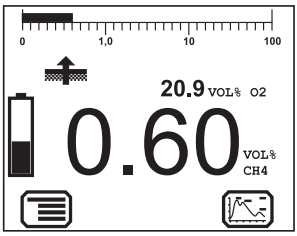
– % vol.

Measuring range

Thermal conductivity sensor 0.0 to 100% vol.

Electrochemical sensor
(oxygen O_2) 0.0 to 25.0% vol.

Measurement data display



– Digit, for example,
  20.9% vol. O_2
  0.60% vol. CH_4
– Bar display with quasi-logarithmic scale (for CH_4)

Fig. 9: Measuring in bar holes measuring mode

3.2.6 Ethane analysis

Selecting **Ethane analysis** from the menu opens an overview of the gases that can be detected. The device automatically returns to measuring mode.

Note:
The ethane analysis cannot be started with the **Ethane analysis** menu item.
Information about carrying out the ethane analysis can be found in section 3.2.6.3.

Area of use

– Distinguishing between natural gas and swamp gas

Symbol

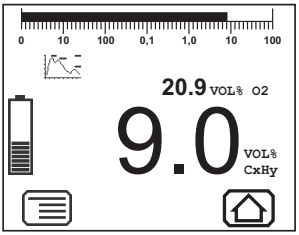
Unit

– ppm (parts per million)
– % vol.

Measuring range

Thermal conductivity sensor	0.0 to 100% vol.
Electrochemical sensor (oxygen O_2)	0.0 to 25.0% vol.
Gas chromatograph/ gassensitive semiconductor	1 ppm to 1.2% vol.

Measurement data display



– Digit, for example,
  20.9% vol. O_2
  9.0% vol. C_XH_Y
– Bar display with quasi-logarithmic scale (for C_xH_y)

Fig. 10: Ethane analysis measuring mode

3.2.6.1 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.

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

Ethane can definitely be detected in natural gas at a minimum concentration of 1% vol. If the concentration of ethane in natural gas is less than 0.5% vol., the gas cannot be detected. If the concentration falls between these two values, the analysis can be carried out, but the result must be assessed subsequently.

During the ethane analysis, the gas sample is always analysed for the presence of the following three gases:

- Methane CH_4
- Ethane C_2H_6
- Propane C_3H_8

Requirement

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 **Ethane analysis critical** note appears
< 0.5% vol.	Not possible	Analysis cannot be carried out because **Take sample** symbol is not displayed

Displayed measurement values

In **measuring mode**, the device displays the actual concentrations (fig. 10).

During the **analysis**, the device automatically dilutes the gas sample to 1% vol. to ensure optimal utilisation of the semiconductor sensor. 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 mode of curve, the maximum peak may be cut off as necessary (fig. 13 right).

Number of measurements

Always carry out 2–3 measurements in the same location to obtain certain results. Observe the information on evaluation in section 3.2.6.3.

3.2.6.2 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.

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

Note:
The purge always takes 4 minutes. A new ethane analysis can only be started when the purge cycle has been completed.

The device is in measuring mode.

1. Only when detector contamination is suspected:
   a) Press **Menu**.
   b) Select the **Purging** menu item. The message **Purging required** and the **Take sample** symbol appear.

NOTICE! Risk of damaging the sensor
The ethane detector will be damaged if the air supply is contaminated or moist
- Always add clean, dry fresh air.

---

2. Make sure the device is drawing in fresh air.
3. Press **Take sample**.

   The purge cycle starts automatically as soon as the gas concentration drops below 50 ppm. The time remaining until the end of the purge cycle is displayed.

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

3.2.6.3 Carrying out an ethane analysis

The device is in measuring mode.

1. Make sure the device is drawing in fresh air.
2. Change 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**. A message appears.

Note:
An ethane analysis takes approximately 4 minutes. After **Esc** is used to cancel the analysis, the detector must be purged (see section 3.2.6.2). This purge cycle also takes 4 minutes.

---

5. Confirm the **Take sample?** prompt by pressing **OK**. The gas sample is taken.

   The **Add fresh air** note appears.

6. Add fresh 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.

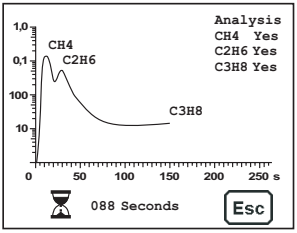


Fig. 11: Mode of curve of an analysis in progress

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

7. Press **Save**.

8. If necessary enter a **Comment** on the analysis.
   a) Select the characters required using the jog dial. Confirm each character using the jog dial.

      OR

      − Press **Open stored comments**. A list of the stored comments will appear.
      − Select the desired comment. Open the comment with **OK**.

   b) Then confirm your entry/selection with **OK**.

      OR

      Press **Esc** if you do not wish to enter a comment.
9. Confirm your entry with **OK**. The comment is saved together with the protocol name (date, time).

3.2.6.4 Evaluating an ethane analysis

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

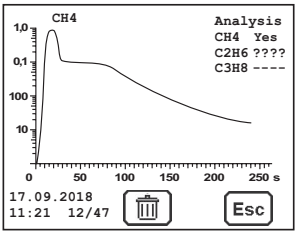


Fig. 12: Ethane analysis protocol

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. 13 left). However, occasionally, the analysis does not provide a clear determination of the gas components present (Fig. 13 right). In such cases, you must decide whether the analysis quality is sufficient.

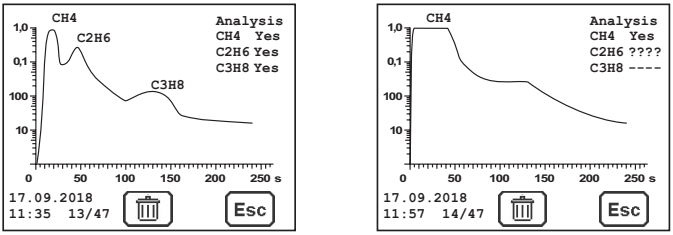


Fig. 13: Quality assessment of an ethane analysis; Left: good quality, Right: poor quality

Criteria for determining good analysis quality

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

Criteria for determining the presence of natural gas

- Good analysis quality (see above)
- Ethane is definitely present.

Ethane analyses of insufficient 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 action: Purge with test gas, for example:
  – 1% vol. CH_4 in synthetic air
  OR
  – 100 ppm C_2H_6 with 1% vol. CH_4 in synthetic air

- Curve and symbols (**Analysis**) provide contradictory information about gas components

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

3.2.7 Structure

The measuring mode can be changed for the **Structure** application via this menu item.

Area of use

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

Symbol

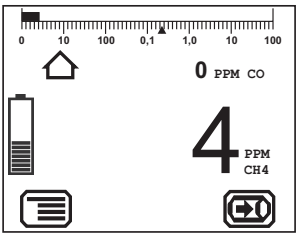
Unit

– ppm (parts per million)
– % vol.

Measuring range

Gas-sensitive semiconductor	0 to 10,000 ppm
Thermal conductivity sensor	0.1 to 100% vol.
Electrochemical sensor (carbon monoxide CO)	0 to 500 ppm

Measurement data display



– Digit, for example,
  0 ppm CO
  4 ppm CH_4
– Bar display with quasi-logarithmic scale (for CH_4)

Fig. 14: Structure measuring mode

3.2.8 Gas measuring

The measuring mode can be changed for the **Gas measuring** application via this menu item.

WARNING!
Risk to life due to absence of alarm
The device does not sound an alarm in the gas measuring application.
- Before switching application, please make sure there are no ignition sources close by.
- Do not smoke.
- Be extremely careful.

Area of use

– Demonstrating gas purity / absence of gas in gas pipes

Symbol

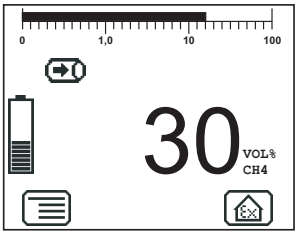
Unit

– % vol.

Measuring range

Thermal conductivity sensor 0.0 to 100% vol.

Measurement data display



– Digit, for example, 30% vol. CH_4
– Bar graph with quasi-logarithmic scale

Fig. 15: Gas measuring mode

3.2.9 Warning %LEL

The measuring mode can be changed for the **Warning %LEL** application via this menu item.

WARNING!
Risk to life from operating signal failure
If the operating signal does not sound, the device is not safe to operate.
- Stop using the device immediately.
- Leave explosive areas or areas with a toxic or low-oxygen atmosphere immediately.

Area of use

– Testing work environments where explosion is possible, e.g. when working on gas pipes or gas systems

Symbol

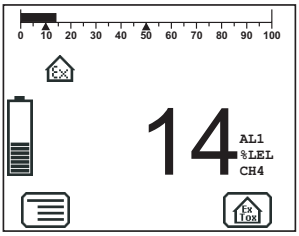
Unit

– % LEL or % vol.

Measuring range (methane CH_4)

Catalytic combustion sensor 0 to 100% LEL or
0.00 to 4.40% vol.

Measurement data display



– Digit, for example, 14% LEL CH_4
– Bar display with linear scale, alarm thresholds marked AL1 and AL2

Fig. 16: Warning %LEL measuring mode

3.2.10 Warning ExTox

The measuring mode can be changed for the **Warning ExTox** application via this menu item.

WARNING!
Risk to life from operating signal failure
If the operating signal does not sound, the device is not safe to operate.
- Stop using the device immediately.
- Leave explosive areas or areas with a toxic or low-oxygen atmosphere immediately.

Area of use

– Warning of explosive and toxic gas concentrations as well as lack of oxygen

Symbol

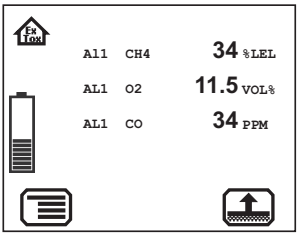
Unit

– % LEL (methane CH_4)
– % vol. (oxygen O_2)
– ppm (carbon monoxide CO)

Measuring range (methane CH4)

Catalytic combustion sensor 0 to 100% LEL

Measurement data display



– Digit, for example,
34% LEL CH_4
11.5% vol. O_2
34 ppm CO

Fig. 17: Warning ExTox measuring mode

CAUTION!
Health risk due to late alarm
If you change the device from the **Warning ExTox** application to another application, data that could initiate an STEL or LTEL alarm is reset to zero.
- Only switch from **Warning ExTox** to another application once you have left the work area being monitored.

3.2.11 Settings

You can change the device settings and access information about the device under **Settings** in the menu (see section 3.3).

3.2.12 Start/stop/save a measurement

Depending on the application, measurements will have to be saved or started and then stopped. The ethane analysis is an exception (see section 3.2.6.3).

Application	Measurement	
	start/stop	save
Inspection above ground	×	
Plants		×
Measuring in bar holes		×
Structure	×	
Gas measuring		×
Warning %LEL	×	
Warning ExTox	×	

Difference between starting/stopping and saving

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

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

Note:
Measurements cannot be cancelled. The only way to cancel a measurement is to stop it.

Up to 80 measurements can be saved.

The measurement values can be saved with or without a comment. Comment entries are saved automatically (ring memory with max. 10 entries).

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

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

Starting a measurement

1. Press **Menu**.
2. Select **Start measurement** from the menu. This starts the measurement plot recording.

The measurement plot recording must always be concluded with **Stop measurement**.

Stopping a measurement

1. Press **Stop measurement**.

   OR

   a) Press **Menu**.

   b) Select **Stop measurement** from the menu.
2. Answer **Yes** to the warning prompt.
3. Enter a **comment** for the measurement.

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

   OR

   − Press **Open stored comments**. A list of the stored comments will appear.

   − Select the desired comment. Open the comment with **OK**.

b) Then confirm your entry/selection with **OK**.

OR

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

The measurement is saved as a protocol. The protocol name is formed from the date, time and comment.

Saving a measurement

1. Press **Menu**.
2. Select **Save measurement** from the menu.
3. Enter a **comment** for the measurement.
   a) Select the characters required using the jog dial. Confirm each character using the jog dial.

   OR

   − Press **Open stored comments**. A list of the stored comments will appear.

   − Select the desired comment. Open the comment with **OK**.

   b) Then confirm your entry/selection with **OK**.

   OR

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

   The measurement is saved as a protocol. The protocol name is formed from the date, time and comment.

3.2.13 Protocols

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

The following protocol types are available:

- Ethane analysis
- Device inspection
- Measurements

Protocols can only be cleared individually.

You can find information on how to clear all protocols of one protocol type in section 3.3.7.

3.2.14 Device inspection

The **device inspection** can be used to check the general status and the indication accuracies. **Device inspection** only appears in the menu when the integrated device inspection is switched on.

Note:
The integrated device inspection is switched off in the factory settings. More detailed information about the device inspection can be found in section 5.1.

The frequency of the device inspection depends on the application (see section 5.1.1.2).

If the integrated device inspection is switched on, the device will remind you to perform a device inspection.

The **Device inspection** symbol will appear when the inspection is due. It is visible in the display until the complete integrated device inspection has been carried out successfully.

3.2.15 Gas type CxHy

You can temporarily change the gas type under the **Gas type C**x**H**y menu item, provided the device is designed for other gas types. Gas types available for selection:

- Methane CH_4
- Propane C_3H_8
- Butane C_4H_{10}

The temporary gas type change is not saved. If you need to set a different default gas type, you can do this in the **Settings** menu item under **System**.

3.2.16 Device information

The following device information is shown under **Device information** in the menu:

- Installed electrochemical sensors: Gas, installation date, warranted/expected lifetime
- Firmware: version, date
- Service: date of the last service, date of the next service

3.3 Settings

The following menus and menu items are included under Settings:

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

You can find information on selecting and exiting menus and menu items in section 3.1.2.

3.3.1 Opening settings

1. Press **Menu**.

WARNING!
Risk to life due to absence of alarm
The device only issues alarms in measuring mode. As soon you open the menu, alarms are no longer triggered.
- Only adjust settings in areas where there is no risk of explosion and where there is no toxic or low-oxygen atmosphere.

---

2. Select **Settings** from the menu.

   Access is protected by a PIN code. The **default setting** is always **PIN code 0001**.

Note:
You can change the PIN code at any time.
SEWERIN recommends setting a different PIN code after initial start-up so that only authorised personnel have access to the settings.

3. Enter the PIN code from left to right. The active digit is always displayed with a black background.

Digit	To change	To 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.

Adjustment
System
Alarms
Date/time
Memory
Exit

Fig. 18: **Setting**s menu

3.3.2 Settings menu structure

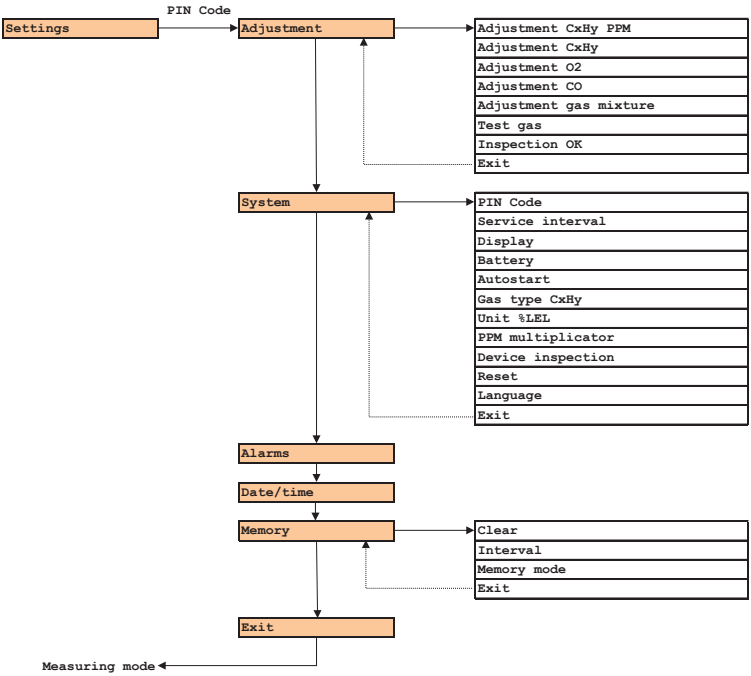


Fig. 19: **Settings** menu structure for **VARIOTEC 480 EX** (gas type: methane)

Note:
The number and names of available menu items depend on the device model and optional additional equipment.

3.3.3 Adjustment

The Adjustment menu is used to set the sensors.

WARNING! Danger of death due to incorrect adjustment

Incorrect adjustment can lead to incorrect measurement results. This means that the user may not be warned about dangerous gas concentrations in time.

- Only specialist technicians may perform adjustments.
- Adjustments must be made in well ventilated rooms or in the open air.

A detailed description of adjustment along with important information is provided in section 5.2.

Adjustment CxHy ppm

Used to adjust the gas-sensitive semiconductor for gas type C_xH_y (methane CH_4, propane C_3H_8, butane C_4H_{10}) in the ppm range.

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

Adjustment CxHy

Used to adjust the catalytic combustion and thermal conductivity sensors for gas type C_xH_y (methane CH_4, propane C_3H_8, butane C_4H_{10}) in the % vol. range / LEL range.

Applications:
- Inspection above ground
- Measuring in bar holes
- Ethane analysis
- Plants
- Structure
- Gas measuring
- Warning %LEL
- Warning ExTox

Adjustment O2

Used to adjust the electrochemical sensor for oxygen O_2 in the % vol. range.

Applications:
- Measuring in bar holes
- Ethane analysis
- Warning ExTox

Adjustment CO

Used to adjust the electrochemical sensor for carbon monoxide CO in the ppm range.

Application:
- Warning ExTox

Gas mixture adjustment

Used to adjust the catalytic combustion and electrochemical sensors for all components of the test gas (gas mixture).

Applications:
- Warning %LEL
- Warning ExTox

Test gas concentration

Used to adjust the concentration of the test gases used.

Inspection OK

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

3.3.4 System

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

PIN code

Used to change or reset the PIN code.

Note:
If you lose the PIN code, you must contact SEWERIN Service.
If the PIN code is set to **0000**, you will not be asked to enter it. The settings can then be accessed by anyone.

Service interval

Specifies the regular inspections/maintenance required for the device. You can also activate the automatic switch-off function 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 that is automatically activated when the device is switched on.

Gas type CxHy

Sets the gas type (methane CH_4, propane C_3H_8, butane C_4H_{10}) which is automatically used when the device is switched on.

Unit %LEL

Used to set the unit of measurement. Only applies to **Warning %LEL** and **Warning ExTox** applications.

PPM multiplicator

Set the amplification factor for the lower ppm range.

Measurement x factor = displayed measurement

Application: – Inspection above ground

Device inspection

Used to switch the integrated device inspection on or off.

Factory settings

Used to reset the device settings to the factory settings.

Language

Sets the language.

3.3.5 Alarms

Sets the alarm thresholds for the gas types and gases.

Alarm **AL3** cannot be set. It always occurs at the end of the measuring range.

There is detailed information on alarms in section 7.2.

AL1 alarm

Used to set the pre-alarm.

Applications:
- Plants
- Structure
- Warning %LEL
- Warning ExTox

AL2 alarm

Used to set the main alarm.

Applications:
- Plants
- Structure
- Warning %LEL
- Warning ExTox

AL4 alarm

Used to set the alarm threshold in excess of significant gas concentrations which indicate a gas leak.

Application: – Inspection above ground

3.3.6 Date/time

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

3.3.7 Memory

The Memory menu 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 3.2.13.

Interval

Sets the interval at which measurement data is automatically saved.

Memory mode

Switches between ring memory and stack memory.

4 Power supply

This device can be operated using:

- Disposable (non-rechargeable) alkaline batteries
- Rechargeable NiMH batteries

The device comes with nickel metal hydride rechargeable batteries. The corresponding settings are stored.

WARNING! Risk of explosion from leaking batteries
Leaking electrolyte can reduce the creepage distance and air gaps 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.

4.1 Suitable disposable/rechargeable battery types

WARNING! Risk of explosion due to unsuitable batteries
To ensure that the device remains explosion-proof in accordance with /16/, only certain disposable/rechargeable batteries may be used.

- Only use batteries supplied by SEWERIN. Other disposable/rechargeable batteries, which have not been supplied by SEWERIN, may only be used if they meet the requirements of /8/.
- In each battery compartment use only batteries that are identical with respect to type (disposable or rechargeable), capacity and manufacturer.

Disposable battery requirements

- Disposable alkaline batteries
- Size: AA, type: LR6 as per /11/
- The creepage distance and air gap between the poles must not be less than 0.5 mm (0.0197 in) in accordance with /8/.

Rechargeable battery requirements

- NiMH rechargeable batteries
- Size: AA, type: HR6 as per /13/
- The creepage distance and air gap between the poles must not be less than 0.5 mm (0.0197 in) in accordance with /8/.
- The rechargeable batteries must be fast charging (I > 1.25 A) and remain within the temperature range.

Note:
A device operated with disposable alkaline batteries cannot be charged. A note to this effect is shown on the display.

4.2 Operation with rechargeable batteries

The operating time of the device depends on the battery capacity.

If the device is not used or not kept in the docking station, the batteries will lose their charge due to self-discharge. The self-discharge intensity depends on the battery type.

4.2.1 Charging

The device can be charged via:

- Connection for power supply
- Docking station TG8

DANGER! Risk of explosion from sparks
High charging amperage occurs when charging batteries. The mains adapter is not explosion proof.

- Only ever charge the device outside of explosive areas.

For charging you will need either:

- AC/DC adapter M4
- Vehicle cable M4

Please note the following points:

- 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).

4.2.2 Rechargeable battery maintenance

If the device is not used for a long period of time, it is advisable to fully discharge the battery before recharging it again.

A full discharging and recharging process takes approx. 11 hours (8 hours to discharge + 3 hours to recharge). The duration depends on the capacity of the rechargeable batteries used.

DANGER! Risk of explosion from sparks
High charging amperage occurs when charging batteries.
The mains adapter is not explosion proof.
- Only ever charge the device outside of explosive areas.

- Connect the device (switched on) to the power supply via the side connection

  OR

  Place the device (switched on) into the docking station.

  The rechargeable batteries will be fully discharged. Once the device has been discharged, it will automatically switch to charging mode.

4.3 Battery alarm

As soon as the remaining capacity of the batteries gets low, a battery alarm will go off:

Level 1: Battery almost empty
- – **Battery capacity** symbol flashes
- – Audible signal (one-off)
- – Operating signal doubles
- – Remaining operating time: approx. 15 min

Level 2: Battery empty
- – Blank display apart from **Battery capacity** symbol
- – Continuous audible signal
- – Measuring mode unavailable
- – Device shuts off

4.4 Replacing disposable/rechargeable 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.

A 2.5 mm Allen key (supplied) is required to open the battery compartment on the back of the device.

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 the disposable/rechargeable batteries and insert new ones. 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. When you switch the device back on again, you will 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 the device on. All the other data will be saved.

5 Maintenance

In accordance with the legal regulations, device maintenance comprises the following elements:

- Device inspection including test of indication accuracy
- Adjustment
- Servicing

All inspections must be documented. The documentation must be retained for at least one year.

WARNING! Risk to life from using miscalibrated or faulty devices

If the device is used as a gas warning instrument (**Warning %LEL** and **Warning ExTox** applications), it must be regularly checked before use.

- Carry out a device inspection each day before starting work (as per /1/, /2/, /6/, /10/).

5.1 Device inspection

5.1.1 General information on the device inspection

5.1.1.1 Scope

The device inspection includes the following tests:

- Analysis of the general status
- Test of the indication accuracy with supply of fresh air
- Test of the indication accuracy with supply of test gas

5.1.1.2 Frequency

The frequency of the device inspection depends on the application.

Application	When to test	Legal basis
Inspection above ground	Before starting work and if out of use for long periods	/3/
Plants	Weekly to every six months	/3/
Measuring in bar holes		
Structure		
Gas measuring		
Warning %LEL	Every day before starting work	/2/, /10/
Warning ExTox		/1/, /2/, /6/, /10/
Ethane analysis	Quarterly	

If the integrated device inspection is switched on, the device will remind you to perform a device inspection.

The applications are grouped together for the device inspection. The device inspection must be performed separately for each group.

Devices with multiple gas types

For devices that are designed for multiple gas types, the device inspection must be carried out for the gas type currently being used. The device inspection can also be carried out for other available gas types.

Note:
If the device inspection symbol appears after changing the gas type, the device inspection must always be carried out immediately.

5.1.1.3 Documentation

The device inspection procedure must be documented. There are two ways of doing this:

- On paper
- Saved electronically supported by the device (**integrated device inspection**)

Only the integrated device inspection is described in these operating instructions.

Note:
If the integrated device inspection is switched off, the device inspection must be documented on paper.

5.1.1.4 Integrated device inspection

The integrated device inspection is accessed via the **menu** (fig. 6).

The results of the device inspection are stored in the device as a protocol.

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

The **Perform device inspection** symbol appears when a device inspection is due. It is visible in the display until the complete integrated device inspection has been carried out successfully for the selected application. If the device inspection was completed but the device failed on some points, the symbol will remain visible.

The integrated device inspection is switched off in the factory settings. The integrated device inspection has to be switched on (once only) before it can be performed.

Switching on the integrated device inspection

1. Press **Menu**.
2. Select **Settings**.
3. Enter your **PIN code**.
4. Select **System**.
5. Select **Device inspection**.
6. Select **Yes**.
7. Apply the setting with **OK**.
8. Exit the **settings** with **Back**.

5.1.1.5 Order

You can carry out the device inspections and the associated tests for the applications (groups) that are due to be inspected in any order you wish. You can repeat the tests as often as you wish provided you have not yet concluded the device inspection for a group.

5.1.1.6 Test gases for the device inspection

The following variables depend on the application:

- Number of tests with test gas
- Test gases to be used

The following test gases can be used to check the indication accuracy when supplying test gas:

Application (group)	Test	Recommended test gases
Inspection above ground	Test gas 10 ppm in 10 seconds	10 ppm CH_4*)
Bar holes/ measuring	Test gas CH_4	100% vol. CH_4
	Test gas C_3H_8	100% vol. C_3H_8
Structure/plants	Test gas CH_4	1% vol. CH_4*)
	Test gas CO	40 ppm CO*)
	Test gas C_3H_8	1% vol. C_3H_8*)

Application (group)	Test	Recommended test gases
Warning	Gas mixture	ExTox IR
	Test gas C_3H_8	1% vol. C_3H_8 *)
	Test gas C_4H_{10}	1% vol. C_4H_{10} *)
Ethane analysis	Test gas 50/100 PPM C_2H_6	100 ppm C_2H_6 in 1% vol. CH_4 (balance: synthetic air)

*) in synthetic air

If a test can be carried out either with a gas mixture or with an individual gas, SEWERIN recommends you use the gas mixture.

If a gas mixture is used, but the device is equipped for other gas types and gases which are not contained in the gas mixture, these must be additionally tested with the relevant individual gas.

Note:
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.

Changing the test gas concentration

If no test gas with the specified concentrations is available for the test, the values can be changed according to the test gas used under **Test gas concentration** in the adjustment menu (see section 3.3.3).

5.1.2 Performing the device inspection

5.1.2.1 Accessing the device inspection

The device is in measuring mode.

1. Press **Device inspection**.

   OR

   a) Press **Menu**.

   b) Select **Device inspection** from the menu.

   The **Device inspection** menu appears.

Inspection above ground
Bar holes/measuring
Houses/Spaces
Warning
Ethane analysis

Fig. 20: **Device inspection** menu

2. Selecting an application (group).

   The **Dev. Test ...** menu appears.

3. Select a test (under **General status**, **Fresh air**, **Test gas …**).

Note:
The number and names of the available menu items depend on the device features.

---

4. Carry out the test.

   For detailed information, refer to the following sections:

   - General status section 5.1.3
   - Fresh air section 5.1.4
   - Test gas … section 5.1.5

5.1.2.2 Concluding the device inspection

After all the tests have been carried out as described in section 5.1.3 to section 5.1.5, the **Save** symbol will appear in the display.

An integrated device inspection is concluded by saving it. Up to 40 device inspections can be saved. The following information can be stored along with the device inspection:

- Inspector (e.g. inspector's name or initials)
- Password to protect the protocol from being accessed by unauthorised people

Inspector entries are saved automatically (ring memory with max. 10 entries).

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

1. Press **Save**.
2. Enter the name of the **inspector**.
   a) Select the characters required using the jog dial. Confirm each character using the jog dial.

      OR

      − Press **Open stored inspectors**. A list of the stored inspectors will appear.

      − Select the desired inspector. Open the inspector with **OK**.

   b) Then confirm your entry/selection with **OK**.

      OR

      Press **Esc** if you do not wish to enter an inspector for the device inspection.
3. Enter a **password**.
   a) Select the characters required using the jog dial. Confirm each character using the jog dial.

   b) Then confirm your entry with **OK**.

      OR

      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.

This overview includes a list of all gas types for which the device is configured. Gas types for which the indication accuracy was successfully tested in the device inspection are flagged with **OK**. Gas types that are available but have not been tested are flagged with **----**.

4. Confirm the overview by pressing **OK**. The device returns to measuring mode.

5.1.3 Testing the general status

The general status test is part of the device inspection (see section 5.1.1.1). It is based on estimations by the user. The following must be tested:

- Housing
- Signals
- Probe
- Filter
- Pump

The battery charge status and the working condition of the controls are automatically tested during the integrated device inspection.

The device inspection has been opened.

1. Select **General status** from the **Dev. Test ...** menu.
2. Test all associated subitems as described in section 5.1.3.1 to section 5.1.3.5.
3. Confirm the prompt **General status OK?** by pressing **Yes** if **all** subitems show no faults during testing. **General status OK** appears on the display.

This concludes the **General status** test.

5.1.3.1 Housing

- Is the housing free from external damage?

5.1.3.2 Signals

During the integrated device inspection the signals are emitted at short intervals.

- Can the audible signal be heard?
- Is the visual signal visible?

5.1.3.3 Probe

Probes are accessories. They only need to be tested if they are likely to be used in the course of the working day.

- Are the probes free from external damage?

Probe hoses are tested with a simple leak check.

1. Connect the probe hose to the gas input.
2. Seal the free end of the probe hose.

   An error message should appear after approx. 10 seconds. This indicates that the probe hose is in good condition.

5.1.3.4 Filter

The fine dust filter is located behind the gas input. It is tested by means of a visual inspection.

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

   As soon as there are any signs of deposits, the filter must be replaced. If you do not replace the filter, you must reinsert it exactly as you found it.

5.1.3.5 Pump

The pump function is tested with a simple leak check.

1. Seal the gas input.

   After a maximum of 10 seconds an error message should appear. This indicates that the pump is working correctly.

   If the error message does not appear, the pump may be faulty. The device must be tested by SEWERIN Service.

2. Release the gas input again.

   After approximately 5 seconds, the error message should disappear again. Otherwise there is an error (see Section 6).

5.1.4 Testing indication accuracy with supply of fresh air

The indication accuracy with supply of fresh air test is part of the device inspection (see section 5.1.1.1).

The device inspection has been opened.

1. Make sure that only fresh air is being drawn in.
2. Select **Fresh air** from the **Dev. Test ...** menu.
3. Wait until the displayed readings are stable. A **Status: OK** message will appear.
4. Press **OK** to confirm. **Fresh air OK** will appear on the display.

This concludes the **Fresh air** test.

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 (see section 7.3). Move the device somewhere else and repeat the test.

If the **Status: OK** message still does not appear when the test is repeated, the device must be re-adjusted (see section 5.2).

5.1.5 Testing indication accuracy with supply of test gas

The indication accuracy with supply of test gas test is part of the device inspection.

All test gases specified in the device must be tested. The number of specified test gases depends on the model and the optional additional equipment.

The following resources are needed for the test:

- Test gas (e.g. gas mixture)

  Information on test gases for the device inspection can be found in section 5.1.1.6.

- Test set for the supply of test gas (e.g. **SPE VOL**)

Note:
Details of how to use the test set can be found in the accompanying operating instructions.

The procedure for testing with a gas mixture and individual gas is the same.

The device inspection has been opened.

1. On the **Dev. Test …** menu, select the menu item to be tested (e.g. **Gas mixture**, **Test gas C3H8**, etc.).
2. Check whether the test gas concentration specified by the device matches the test gas you intend to use. To do this press **Information**.

Note:
When testing the indication accuracy for **Inspection above ground** using **test gas 10 ppm in 10 seconds** it is not possible to check the test gas concentration. Instead, a message will appear explaining what steps need to be carried out.

3. Add the test gas
4. Wait until the displayed readings are stable. A **Status: OK** message will appear.
5. Press **OK** to confirm.
6. Stop the test gas supply.

   The device switches back to the **Dev. test…** menu. A **Test gas … OK** message will appear.
7. Repeat for further test gases if applicable.

Once all tests have been successfully completed, the complete test of the indication accuracy with supply of test gas is also complete.

Test gas test unsuccessful

If a **Test gas …** test was not carried out successfully, the message **Test gas not OK** appears.

A test may be unsuccessful for the following reasons:

Cause	Corrective action
Connections leaking	Repeat check, checking the seal on the connections
Measurement values outside the specified limit values (see section 7.3)	Adjustment required (see section 5.2)

5.2 Adjustment

WARNING! Danger of death due to incorrect adjustment

Incorrect adjustment can lead to incorrect measurement results. This means that the user may not be warned about dangerous gas concentrations in time.

- Only specialist technicians may perform adjustments.
- Adjustments must be made in well ventilated rooms or in the open air.

5.2.1 Scope

Adjustments must be made separately for each measuring range.

- Zero point
- Sensitivity

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

Only gases for which the readings are outside the predefined limits need to be adjusted during the adjustment process (see section 7.3).

5.2.2 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	• Gas mixture • 10 ppm CH_4 *) • 100 ppm CH_4 *) • 1000 ppm CH_4 *) • 1.0% vol. CH_4 *) • 2.2% vol. CH_4 *) • 100% vol. CH_4
C_3H_8	• Fresh air	• 1% vol. C_3H_8 *) • 100% vol. C_3H_8
C_4H_{10}	• Fresh air	• 1% vol. C_4H_{10} *)
CO	• Fresh air	• Gas mixture • 40 ppm CO
O_2	• Gas mixture (free from O_2) • 100% vol. CH_4	• Fresh air

*) 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, except for adjustment with a gas mixture (see section 5.2.3).

Replacement test gases are suitable for adjustment even though they do not contain the gas to be tested, although the adjustment error can be up to -15% or +30%.

Fresh air contains 20.9% vol. O_2 and is therefore used with oxygen to adjust the sensitivity.

Propane C_3H_8 and butane C_4H_{10} can only be adjusted with individual gas.

Note:
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.

5.2.3 Special features of adjustment with gas mixture

If you are using a SEWERIN gas mixture as the test gas, the following gases can be adjusted **in a single step** via **Gas mixture adjustment**:

- Methane CH_4
- Oxygen O_2
- Carbon monoxide CO

SEWERIN recommends a test gas with 2.2% vol. CH_4, 2.0% vol. CO_2, 40 ppm CO and 17.5% vol. O_2.

Zero point

The **zero point** is adjusted under **Fresh air** in the menu. The following parameters are adjusted in a single step:

- Zero points of CH_4 and CO
- Sensitivity of O_2

Sensitivity

The **sensitivity** is adjusted under **Gas mixture** in the menu. The following parameters are adjusted in a single step:

- Sensitivities of CH_4, CO_2 and CO

5.2.4 Preparation

Carrying out an adjustment always takes some time. Leave yourself plenty of time to prepare the necessary steps of the procedure.

- Have all necessary tools available.
- Let the device run for several minutes,to guarantee that the temperature is correct, for example.

Note:
When adjusting the gas-sensitive semiconductor (**Inspection above ground** and **Structure/Plants** groups), you must apply a **conditioner**.

- SEWERIN recommends applying separate conditioners for methane CH_4 on the one hand and propane C_3H_8/butane C_4H_{10} on the other.
- The conditioner must already be connected during the running-in period.

5.2.5 Performing the adjustment

The zero point and sensitivity are adjusted following the same procedure for all gases. The adjustment of **oxygen** is an **exception**. For this reason it is described separately (see section 5.2.6).

You can access detailed information on the adjustment of the various gases (for example, test gas concentration, installation date of the sensor, or date of the last adjustment) under **Information**.

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

5.2.5.1 Adjusting the zero point

For all gases except oxygen O_2, the zero point is adjusted following the same procedure.

1. Make sure that only fresh air is being drawn in.
2. Open **Settings**.
3. Select **Adjustment** menu item.
4. Select the desired adjustment (for example, **Adjustment CH4, Adjustment gas mixture**).
5. Wait at least 1 minute. The displayed reading must be stable.

Note:
For **Adjustment gas mixture**, **all** values must be stable. The time required for this can vary depending on the specific gas.

6. From the menu select the method you wish to use to adjust the zero point.
   - e.g. for **Adjustment CH4**: **Zero point**
   - e.g. for **Adjustment gas mixture**: **Fresh air**
7. Press **OK** to confirm.

   This adjusts the zero point. The reading shows zero (0.00% vol. / 0 ppm). (Except for **Adjustment gas mixture** menu item: the value for oxygen O_2 is 20.9% vol.)

5.2.5.2 Adjusting the sensitivity

For all gases except oxygen O_2, the sensitivity is adjusted following the same procedure.

The following resources are needed for adjusting the sensitivity:

- Test gas

  Information on test gases for adjustment can be found in section 5.2.2.
- Test set for the supply of test gas (e.g. **SPE VOL**)

Note:
Details of how to use the test set can be found in the accompanying operating instructions.

---

1. Connect the device to the test set.
2. Open **Settings**.
3. Select **Adjustment** menu item.
4. Select the desired adjustment (for example, **Adjustment CH4, Adjustment gas mixture**).
5. Select the menu item that specifies the sensitivity to be tested.
   - e.g. for **Adjustment CH4**: **2.20% VOL CH4**
   - e.g. for **Adjustment gas mixture**: **Gas mixture**

   Do not confirm with OK yet.
6. Press and hold the release button on the test set. The test gas is added. **Do not let go of the release button**.
7. Wait at least 1 minute. The displayed reading must be stable.

Note:
For **Adjustment gas mixture**, **all** values must be stable. The time required for this can vary depending on the specific gas.

8. Press **OK** to confirm. The device is adjusted. The reading shows the specified value (for example, 2.20% vol. CH_4).
9. Let go of the release button on the test set.

5.2.6 Carrying out an oxygen adjustment

As oxygen is a component of fresh air, the procedure for adjusting oxygen is different from the procedure for all other gases.

5.2.6.1 Adjusting the zero point for oxygen

The zero point for oxygen must be adjusted using a gas which contains no oxygen and does not damage the sensor.

The following resources are needed for adjusting the zero point of oxygen:

- Test gas

  Information on test gases for adjustment can be found in section 5.2.2.
- Test set for the supply of test gas (e.g. **SPE VOL**)

Note:
Details of how to use the test set can be found in the accompanying operating instructions.

1. Connect the device to the test set.
2. Open **Settings**.
3. Select **Adjustment** menu item.
4. Select **Adjustment O2** menu item.
5. Select **Zero point** menu item. **Do not confirm with OK yet**.
6. Press and hold the release button on the test set. The test gas is added. **Do not let go of the release button**.

7. Wait at least 1 minute. The displayed reading must be stable.
8. Press **OK** to confirm. The device is adjusted. The reading shows zero (0.0% vol.).
9. Let go of the release button on the test set.

5.2.6.2 Adjusting the sensitivity for oxygen

The sensitivity for oxygen is adjusted with fresh air.

1. Make sure that only fresh air is being drawn in.
2. Open **Settings**.
3. Select **Adjustment** menu item.
4. Select **Adjustment O2** menu item.
5. Wait until the displayed reading is stable. (The reading may still flash.)
6. Select **20.9 % VOL. (fresh air)** from the menu (select and confirm with **OK**). This adjusts the sensitivity. The reading shows 20.9% vol.

5.3 Servicing

Maintenance and repair work to the device must only be carried out by qualified SEWERIN staff or by persons trained by SEWERIN.

- Send the device to SEWERIN for repairs and for annual maintenance.

Note:
If there is a service agreement in place, the device can be serviced by the mobile maintenance service.

The inspection plate on the device shows confirmation of the last maintenance and the next scheduled maintenance.

Fig. 21: Inspection plate

6 Faults

If a fault occurs during operation, an error message will appear on the screen.

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.

Overview of possible error messages

Error code	Error message on the display	Error correction
8	No calibration PPM sensor adjustment	**Adjustment CxHy ppm** required
9	No calibration IR/PX sensor adjustment	Adjustment required (**adjustment CxHy** or **adjustment gas mixture**)
10	Adjustment failed Test gas	Check test gas concentration
11	Zero point Adjustment required	Adjustment required
52	XFLASH SEWERIN Service	Error can only be corrected by SEWERIN Service
59	Error unknown SEWERIN Service	Error can only be corrected by SEWERIN Service
60	PX sensor	Error can only be corrected by SEWERIN Service
61	PX sensor	Error can only be corrected by SEWERIN Service
100	Pump error Probe/filter	Check all filters, probes and hose connections for porosity and dirt
200	I2C HOST – IR SEWERIN Service	Error can only be corrected by SEWERIN Service
201	I2C HOST – EC SEWERIN Service	Error can only be corrected by SEWERIN Service
202	I2C HOST – EX SEWERIN Service	Error can only be corrected by SEWERIN Service

7 Appendix

7.1 Specifications and permitted operating conditions

Series

Type/model	• VARIOTEC 480 EX: 065 01 • VARIOTEC 460 EX: 065 11 • VARIOTEC 450 EX: 065 31 • VARIOTEC 400 EX: 065 21

Certificates

Certificate	TÜV 07 ATEX 553353 X • II 2G Ex db eb ib IIB T4 Gb basic device without leather bag for: ◦ CH_4, C_3H_8, C_4H_{10}, C_9H_{20}, CO • II 2G Ex db eb ib IIC T4 Gb basic device with leather bag for: ◦ CH_4, C_3H_8, C_4H_{10}, C_9H_{20}, CO, H_2 VARIOTEC 480/450 EX additionally: BVS 09 ATEX G 001 X, PFG 08 G 002 X • applies to Warning LEL and Warning ExTox applications for CH_4, C_3H_8, O_2, CO

Device data

Dimensions (W × D × H)	approx. 148 × 57 × 205 mm (5.83 x 2.24 x 8.07 in) approx. 148 × 57 × 253 mm (5.83 x 2.24 x 9.96 in) with supporting bracket
Weight	approx. 1000 g (35 oz), depending on equipment

Features

Display	monochrome, 320 x 240 pixel
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 • pump error (F100) depending on volume flow: ◦ ≤ 20 l/h F100 certain ◦ > 20 l/h – ≤ 35 l/h F100 possible
Interface	USB
Memory	8 MB
Controls	• ON/OFF key • 3 function keys • jog dial
Sensors	VARIOTEC 480 EX • SC for flammable gases (CH_4, C_3H_8, C_4H_{10}) • CC for flammable gases (CH_4, C_3H_8, C_4H_{10}) • TC for all gases optional: • EC for O_2, CO VARIOTEC 460 EX • SC for flammable gases (CH_4, C_3H_8, C_4H_{10}) • TC for all gases optional: • EC for O_2, CO VARIOTEC 450 EX • CC for flammable gases (CH_4, C_3H_8, C_4H_{10}) • TC for all gases optional: • EC for O_2, CO VARIOTEC 400 EX • SC for flammable gases (CH_4, C_3H_8, C_4H_{10})

Operating conditions*

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

*Optional sensors can affect the operating conditions of the device.

Storage conditions

Storage temperature	-25 – 60ºC (-13 °F – 140 °F) temperatures above 40°C (104 °F) reduce the service life of the sensors

Power supply

Power supply	4 cells, type Mignon AA, optionally: • rechargeable batteries: NiMH • disposable batteries: Alkaline
Operating time, typical	at least 8 h
Charging time	approx. 3 h (complete charge), depending on capacity
Charging temperature	0 – 35 ºC (32 – 95 °F)
Charging voltage	12 V DC (max. 1 A)

Data transmission

Communication	USB

Gas types

Default	CH_4
Optional	C_3H_8 • VT 480/460/450: % vol. • VT 480/460/400: ppm • VT 450: % LEL C_4H_{10} • VT 480/460/400: ppm • VT 450: % LEL

7.2 Alarms

WARNING! Risk to life from dangerous gas concentrations

The **AL1**, **AL2** and **AL3** alarms always indicate danger. The **AL4** alarm may indicate danger.

- Take all necessary measures for your own safety and the safety of others immediately.

The type of action depends on the situation. In the event of a pre-alarm, it may be sufficient to ventilate thoroughly. In the event of a main alarm, it may be necessary to leave the danger zone immediately.

7.2.1 Features

AL1

Type:	Pre-alarm
Adjustable:	Yes
Latching:	No
Trigger:	Alarm threshold AL1 exceeded
Indicator:	– Audible signal – Visual signal – **AL1** notification on display
Acknowledgement:	– Possible for audible signal when alarm threshold AL1 is exceeded
Reset:	– Automatic when level falls below alarm threshold AL1

Exception for **oxygen**: alarm AL1 is triggered when the level falls below alarm threshold AL1.

AL2

Type:	Main alarm
Adjustable:	Yes
Latching:	Yes
Trigger:	AL2 alarm threshold exceeded
Indicator:	– Audible signal – Visual signal – **AL2** notification on display
Acknowledgement:	– Possible for audible signal when alarm threshold AL2 is exceeded – Possible overall after level falls below alarm threshold AL2
Reset:	– By acknowledgement after level falls below alarm threshold AL2 – By switching device off

Exception for **oxygen**: alarm AL2 is not latching.

AL3

Type:	End of measuring range
Adjustable:	No
Latching:	Yes
Trigger:	AL3 alarm threshold exceeded
Indicator:	– Audible signal – Visual signal – **AL3** notification on display – Reading flashes
Acknowledgement:	– Possible after level falls below alarm threshold AL2
Reset:	– By acknowledgement after level falls below alarm threshold AL2 – By switching device off

AL4

Type:	Warning of gas concentration in ppm range
Adjustable:	Yes
Latching:	No
Trigger:	Alarm threshold AL4 exceeded
Indicator:	– Audible signal – Visual signal – AL4 notification on display
Acknowledgement:	– Possible for audible signal when alarm threshold AL4 is exceeded
Reset:	– Automatically when level falls below alarm threshold AL4

STEL

Type:	Main alarm (Short Time Exposure Limit)
Adjustable:	No
Latching:	Yes
Trigger:	Sum of the concentrations of a gas is greater than the product of the OEL and the excess factor over the averaging time
Indicator:	– Audible signal – Visual signal – **STEL** notification on display
Acknowledgement:	– Not possible
Reset:	– By changing to another application – By switching device off

LTEL

Type:	Main alarm (Long Time Exposure Limit)
Adjustable:	No
Latching:	Yes
Trigger:	Sum of the concentrations of a gas is greater than the OEL over the averaging time
Indicator:	– Audible signal – Visual signal – **LTEL** notification on display
Acknowledgement:	– Not possible
Reset:	– By changing to another application – By switching device off

7.2.2 Occupational exposure limits (OEL) and excess factors (STEL and LTEL)

The short-time exposure limit (STEL) is calculated by multiplying the OEL by the excess factor over an averaging time of 15 minutes, as per /15/.

The long-time exposure limit (LTEL) is obtained from the OEL over an averaging period of 8 hours, as per /15/.

Gas	OEL	Excess factor
CO	30 ppm	1

7.2.3 Alarm thresholds (factory settings)

Gas	AL1	AL2	AL3	AL4	STEL	LTEL
CH_4	10% LEL	50% LEL	100% LEL	3 ppm	—	—
C_3H_8	10% LEL	50% LEL	100% LEL	3 ppm	—	—
C_4H_{10}	10% LEL	50% LEL	100% LEL	3 ppm	—	—
O_2	18.0% vol.	23.0% vol.	25% vol.	—	—	—
CO	30 ppm	60 ppm	500 ppm	—	60 ppm	30 ppm

7.2.4 Setting ranges for gas types

LEL values are specified as per /12/ and /14/.

The setting for AL1 must not exceed the setting for AL2.

Gas type		AL1	AL2
All C_xH_y in % LEL	Threshold	**10% LEL**	**50% LEL**
CH_4	Threshold	**0.45% vol.**	**2.20% vol.**
	Setting range	0.20 – 2.60% vol.	0.25 – 2.65% vol.
	Increment	0.05% vol.	0.05% vol.
C_3H_8	Threshold	**0.17% vol.**	**0.86% vol.**
	Setting range	0.08 – 1.00% vol.	0.10 – 1.02% vol.
	Increment	0.02% vol.	0.02% vol.
C_4H_{10}	Threshold	**0.14% vol.**	**0.7% vol.**
	Setting range	0.08 – 0.82% vol.	0.10 – 0.84% vol.
	Increment	0.02% vol.	0.02% vol.
O_2	Threshold	**18.0% vol.**	**23.0% vol.**
	Setting range	0.5 – 20.5% vol.	21.2 – 25.0% vol.
	Increment	0.1% vol.	0.1% vol.
CO	Threshold	**30 ppm**	**60 ppm**
	Setting range	5 – 499 ppm	6 – 500 ppm
	Increment	1 ppm	1 ppm

Factory settings in **bold**

7.3 Limit values for the device inspection

Gas	Zero point		Sensitivity	
	Specification	Deviation	Specification	Deviation
CH_4	0.00% vol.	±0.15% vol.	2.20% vol.	±0.20% vol.
C_3H_8	0.00% vol.	±0.12% vol.	1.00% vol.	±0.16% vol.
C_4H_{10}	0.00% vol.	±0.12% vol.	1.00% vol.	±0.16% vol.
O_2	0% vol.	±0.5% vol.	20.9% vol.	±0.5% vol.
CO	0 ppm	±3 ppm	40 ppm	±3 ppm

7.4 Memory capacity

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

Protocol type	Maximum number of storable protocols
Ethane analysis	40
Device inspection	40
Measurement	160

There is a choice of two memory modes (see section 3.3.7). 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 80 files (max. memory capacity)
1 s	0.5 h	40 h
2 s	1 h	80 h
5 s	2.5 h	200 h
10 s	5 h	400 h
20 s	10 h	800 h

Factory settings in **bold**

7.5 Sensors

Note:
Probes increase the stated response times.

7.5.1 Catalytic combustion sensor (CC)

Methane CH_4, propane C_3H_8, butane C_4H_{10}

Type	catalytic combustion sensor
Use	VARIOTEC 480/450 EX
Measuring range	0 – 100% LEL
Resolution	• CH_4: 0,05% vol. • C_3H_8, C_4H_{10} : 0,02% vol.
Response times	• CH_4: t_{50} < 5 s t_{90} < 14 s • C_3H_8, C_4H_{10}: t_{50} < 6 s t_{90} < 11 s
Warm-up time	up to 90 s
Temperature range	-20 – 40 ºC (-4 – 104 °F)
Measuring error	according to EN 60079-29-1 • CH_4: ±1% LEL (short-term stability) ±4% LEL (long-term stability) • C_3H_8: ±1% LEL (short-term stability) ±2% LEL (long-term stability)
Interference, known	all flammable gases
Lifetime, expected	5 years
Adjustment	test gas concentration: • zero point: hydrocarbon-free, clean airt • CH_4: 2.20% vol. in synth. air, utilisable 1.00 – 4.00% vol. • C_3H_8: 1.00% vol. in synth. air, utilisable 0.85 – 1.50% vol. • C_4H_{10}: 1.00% vol. in synth. air, utilisable 0.50 – 1.30% vol.

7.5.2 Thermal conductivity sensor (TC)

Methane CH_4, propane C_3H_8

Type	thermal conductivity sensor
Use	VARIOTEC 480/460/450 EX
Measuring range	0 – 100% vol.
Resolution	• 0 – 9,9% vol.: 0,1% vol. • 10 – 100% vol.: 1% vol.
Response times	• CH_4: t_{50} < 9 s t_{90} < 17 s • C_3H_8: t_{50} < 11 s t_{90} < 22 s
Warm-up time	up to 90 s
Temperature range	-20 – 40 ºC (-4 – 104 °F)
Measuring error	according to EN 60079-29-1 • CH_4, C_3H_8: ±3% vol.
Interference, known	all gases with a different thermal conductivity
Lifetime, expected	5 years
Adjustment	test gas concentration: • zero point: hydrocarbon-free, clean air • CH_4: 100% vol., utilisable 20 – 100% vol. • C_3H_8: 100% vol., utilisable 20 – 100% vol.

7.5.3 Electrochemical sensors (EC)

7.5.3.1 Oxygen O_2

Type	electrochemical sensor
Use	VARIOTEC 480/460/450 EX
Measuring range	0 – 25% vol.
Resolution	0,1% vol.
Response times	t_{90} < 15 s
Warm-up time	up to 90 s
Temperature range	-20 – 40 ºC (-4 – 104 °F)
Measuring error	±3%, minimum ±0.3% vol. (±3 digit)
Drift	< 2% within 3 months
Interference, known	none
Humidity	5 – 90% r.h., non-condensing • short term: 0% r.h
Lifetime, expected	3 years
Adjustment	test gas concentration: • zero pointt: ◦ oxygen-free air ◦ 100% vol. N_2 ◦ 100% vol. CH_4 • O_2: 20,9% vol., e.g. clean air

7.5.3.2 Carbon monoxide CO

Type	electrochemical sensor
Use	VARIOTEC 480/450 EX
Measuring range	0 – 500 ppm • lower limit: ◦ 0 – 100 ppm: 4 ppm ◦ > 100 ppm: 11 ppm
Resolution	1 ppm
Response times	t_{90} < 30 s
Decay times	t_{10} ≤ 25 s
Warm-up time	up to 90 s
Temperature range	-20 – 40 ºC (-4 – 104 °F)
Measuring error	• ±3%, minimum ±3 ppm (±3 digit) • long-term stability as per EN 45544 ◦ Test gas: ≤ 4% of measured value ◦ zero point (fresh air): ≤ 1 ppm
Drift	< 10% within 6 months
Zero point deviation	• 0 – 100 ppm: 3 ppm • > 100 ppm: 13 ppm
Interference, known	at 20 ºC (68 °F) • C_2H_2 100 ppm: approx. 90 ppm CO • C_2H_4 100 ppm: approx. 96 ppm CO • Cl_2 15 ppm: approx. 1 ppm CO • H_2 200 ppm: approx. 30 ppm CO • H_2S 50 ppm: approx. 1 ppm CO • NH_3 50 ppm: approx. 0 ppm CO • NO 50 ppm: approx. 15 ppm CO • SO_2 20 ppm: approx.. 0 ppm CO
Humidity	15 – 90% r.h., non-condensing • short term: 0% r.h
Lifetime, expected	3 years
Adjustment	test gas concentration: • zero point: clean air • CO: 40 ppm, , utilisable 10 – 150 ppm

7.5.4 Gas-sensitive semiconductor (SC)

Methane CH_4, propane C_3H_8

Type	gas-sensitive semiconductor
Use	VARIOTEC 480/460/400 EX
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 • 0,10 – 1,0% vol.: 0,02% vol. (200 ppm)
Response times	CH_4: t_{90} < 7 s
Warm-up time	approx. 1 min
Measuring error	±30%
Interference, known	all flammable gases
Lifetime, expected	5 years
Adjustment	test gas concentration: • test gas concentration: • zero point: hydrocarbon-free, clean air • CH_4: ◦ 10 ppm ◦ 100 ppm ◦ 1000 ppm ◦ 1,0% vol. • C_3H_8: ◦ 10 ppm ◦ 100 ppm ◦ 1000 ppm ◦ 1,0% vol.

7.6 Ethane detector

Type	gas chromatograph
Use	VARIOTEC 480/460 EX
Gases, separable	CH_4, C_2H_6, C_3H_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	gas mixture: 1% vol. CH_4 / 100 ppm C_2H_6 in synth. air

7.7 Technical information

7.7.1 Sensitivity of the catalytic combustion sensor

Oxygen-deficient atmospheres can reduce the sensitivity of the catalytic combustion sensor (sensor suffocation).

Gaseous constituents of silicones, oils and phosphate esters for example have a damaging effect on the sensor. They permanently reduce the sensitivity.

Contamination of the measurement environment with halogens, burnt neoprene, PVC or trichloroethene for example also lowers the sensitivity of the sensors, but they can be regenerated.

7.7.2 Identification sticker (back of device)

The symbols on the sticker mean the following:

Only ever open the battery compartment outside of explosive areas.

Read the operating instructions.

7.7.3 Cleaning

The device must only be cleaned with a damp cloth.

NOTICE! Possible 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.

7.7.4 Electrostatic charge

Avoid electrostatically charging the device. Electrostatically unearthed objects (e.g. including metallic housing without an earth connection) are not protected against applied charges (e.g. through dust or dispersed flows).

DANGER! Risk of explosion from sparks

When working with hydrogen, electrostatic charging can occur.

- When working with hydrogen, always use the TG8 carrying bag.

7.8 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
Carrying bag TG8	3204-0040
Case TG8-RÜ	ZD29-10000
Compact case TG8	ZD31-10000
Carpet probe PRO	ZS01-12000
Bell probe D80	ZS05-10500
Localisation probe 345 mm	ZS03-10300
Flexible hand probe	ZS32-10000
Floating probe	ZS21-10100
Probe hose	ZS25-10000 (e.g.)
Test set SPE VOL	PP01-90101
Test set SPE ppm	PP01-40101
Test set SPE DUO	PP01-60001
Test case kit PPM	ZP03-12001
Test plate	ZP06-10000

Consumables

Part	Order number
Fine dust filter	2499-0020
Hydrophobic filter	2491-0050
Special filter element	2499-0005
Rechargeable NiMH battery	1354-0009
Disposable alkaline battery	1353-0001
Test gas (2.2% vol. CH_4, 2.0% vol. CO_2, 40 ppm CO and 17.5% vol. O_2), test gas can 1 l, pressure approx. 12 bar	ZT32-10000
Test gas 10 ppm CH_4 in synthetic air, test gas can 1 l, pressure approx. 12 bar	ZT24-10000

Other accessories and consumables are available for the product. Please contact our SEWERIN sales department for further information.

7.9 Declaration of conformity

Hermann Sewerin GmbH hereby declares that the **VARIOTEC® 480/460/450/400 EX** fulfils the requirements of the following guidelines:

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

Gütersloh, 2025-09-01

Benjamin Sewerin (CEO)

The complete declarations of conformity can be found online.

7.10 Inspection protocol

Sample inspection protocol for inspection with gas mixture.

TEST PROTOCOL **Gas mixture** ***Variotec® 480 EX***

Serial no. (e.g.: 065 01 00480)

SEWERIN

01.08.2020

1.0	**General status**										
1.1	– Perfect condition (e.g.: Y / N)										
1.2	– Fine dust filter correct (e.g.: Y / N)										
1.3	– Capacity disposable battery/ rechargeable battery (e.g.: ¼)										

2.0	**Pump check**										
2.1	– Pump error F100 in seal										

3.0	**Inspection above ground**										
3.1	Zero point – Display with fresh air										
3.2	Test gas 10 ppm CH_4 – Display ≥ 8 ppm in 10 seconds										

4.0	**Structure/Plants**										
4.1	Zero point – Display with fresh air										
4.2	Test gas 1.00 % vol. CH_4 – Display 0.80 – 1.20 % vol.										

5.0	**Warning %LEL / Warning ExTox (test gas: fresh air)**										
5.1	Zero point CH_4 – Display -3 – +3 % LEL or – Display -0.15 – +0.15 % vol.										
5.2	Fresh air O_2 (20.9 % vol.) – Display 20.4 – 21.4 % vol.										
5.3	Zero point CO – Display -3 – +3 ppm										

6.0	**Warning %LEL / Warning ExTox (test gas: gas mixture)**										
6.1	CH_4 (2.20 % vol.) – Display 45 – 55 % LEL or – Display 2.00 – 2.40 % vol.										
6.2	O_2 (17.5 % vol.) – Display 17.0 – +18.0 % vol.										
6.3	CO (40 ppm) – Display 37 – 43 ppm										
6.4	Visual alarm (e.g.: Y / N)										
6.5	Audible alarm (e.g.: Y / N)										

7.0	Bar holes/measuring										
7.1	Zero point CH_4 – Display -1.0 – +1.0 % vol.										
7.2	Test gas 100 % vol. CH_4 – Display 98 – 102 % vol.										

8.0	Ethane analysis										
8.1	Test gas 100 ppm C_2H_6, 1 % vol. CH_4 – CH_4: Yes, C_2H_6: Yes, C_3H_8: No										

9.0	Comments – Housing damaged – Adjustment, repair – Inspection at factory – Or similar										

10.0	Inspection										
	– Day										
	– Month										
	– Year										
	– Signature										

7.11 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.

7.12 Terminology and abbreviations

% vol.	● Percentage of a gas in a gas mixture based on the volume
AL	● Alarm
CC	● Catalytic combustion sensor
CENELEC	● European Committee for Electrotechnical Standardization
EC	● Electrochemical sensor
Gas type	● Hydrocarbon C_xH_y which can be measured with a SC, TC or CC ● One of the available gas types must always be set at a given time, as it is not possible to measure more than one gas type at the same time.
LEL	● Lower Explosion Limit
LTEL	● Long time exposure limit
NiMH	● Nickel metal hydride
OEL	● Occupational exposure limit
ppm	● Parts per million
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.
SC	● Gas-sensitive semiconductor
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.
STEL	● Short time exposure limit
TC	● Thermal conductivity sensor

7.13 Referenced documents

The following standards, guidelines and regulations are referred to in these operating instructions:

/1/ BG RCI (German Social Accident Insurance Institution for the raw materials and chemical industry) Leaflet T 021 (DGUV Information 213-056)
Gas Warning Devices for Toxic Gases/Vapours and Oxygen – Use and Operation. Available for download at: www.brgci.de

/2/ BG RCI (German Social Accident Insurance Institution for the raw materials and chemical industry) Leaflet T 023 (DGUV Information 213-057) Gas Warning Devices for Explosion Protection – Use and Operation. Available for download at: www.brgci.de

/3/ DVGW G 465-4 (M) (2019) Equipment technology for the inspection of gas pipelines and gas systems.
Available for download at: www.dvgw.de

/4/ EN 45544

/5/ EN 45544-2

/6/ EN 45544-4

/7/ EN 50104:2010

/8/ EN 60079-7:2007

/9/ EN 60079-29-1

/10/ EN 60079-29-2

/11/ EN 60086-1

/12/ EN 61779-1

/13/ EN 61951-2

/14/ IEC 60079-20

/15/ TRGS 900: 2006 Technical Regulations for Hazardous Substances: Occupational Exposure Limits.
Available for download at: www.baua.de

/16/ 2014/34/EU

8 Index

A

Accessories 85
Adjustment 40, 61
  CO 41
  CxHy 40
  CxHy ppm 40
  gas mixture 41
  O2 41
  of oxygen 66
  performing 64
  preparation 63
  scope 61
  sensitivity 65
  with gas mixture 63
  zero point 64
Adjustment menu 40
Alarm 7, 43, 72
  setting ranges for gas types 76
Alarm thresholds 75
Application 6
  associated task 5
  selecting 14
  switching 14
Autostart 42

B

Battery alarm 48

C

Cleaning 84
Comment 34
Conditioner 64
Consumables 86

D

Date 44
Delete 44
Device
  models 6
  switching off 11
  switching on 11
Device information 37
Device inspection 36, 43, 50
  accessing 55
  concluding 56
  documentation 52
  frequency 51
  integrated 52
  limits 76
  order 53
  performing 55
  scope 50
  switching on 53
Display 42
Display contrast 42
Display illumination 42
Disposable battery 42
  replacing 49
  requirements 46
  setting the type 42
Disposal 89

E

Electrostatic charge 85
Error message 68
Ethane analysis 20
  evaluating 26
  measurement values 23
  number of measurements 23
  performing 24
  print quality 27
  requirement 22
Excess factor 75
Explosion protection
  active 10
  passive 9

F

Factory settings 43
Faults 68
Filter 58
Fine dust filter 58
Function key 11

G

Gas measuring 30
Gas mixture 63
Gas type CXHY 42
General status 57

H

Housing 57

I

Identification plate 84
Indication accuracy
  with fresh air 59
  with test gas 59
Inspection above ground 18
Inspection OK 41
Interval 44

J

Jog dial 11

K

Keys 11

L

Language 43
LTEL 75

M

Main menu *see* Menu
Maintenance 50
Measurement
  saving 33, 35
  starting 33, 34
  stopping 33, 34
Measuring in bar holes 20
Measuring mode 15
  menu structure 16
Memory 44, 77
Memory mode 44
Menu 11, 16
  accessing 16
  exiting 12
  selecting 12
Menu item
  exiting 12
  selecting 12
Menu structure 16, 39

O

Occupational exposure limit 75
OEL 75
Operating signal 7
Operation 11
Oxygen 66

P

PIN code 37, 41
Plants 19
Power supply 45
PPM multiplicator 43
Probe 58
Protocols 35
Pump 58

R

Rechargeable battery 46
  charging 47
  maintenance 48
  replacing 49
  requirements 46
  self-discharge 46
  setting the type 42
Ring memory 44

S

Sensitivity
  adjusting 65, 67
Sensor 8, 78
  catalytic combustion 8, 78, 84
  electrochemical 8, 80
  gas-sensitive semiconductor 8, 82
  installation date 37
  thermal conductivity 8, 79
Service interval 42
Servicing 67
Settings 15, 33, 37
  menu structure 39
  opening 37
Signal 58
  audible 6
  visual 6
Stack memory 44
STEL 75
Structure 29
System 41

T

Test gas
  adjustment 62
  for the device inspection 53
Test gas concentration 41
  changing 54
Time 44

U

Unit
  setting 42
Use
  intended 3

W

Warning ExTox 32
Warning %LEL 31

Z

Zero point 17
  adjusting 64, 66

Hermann Sewerin GmbH
Robert-Bosch-Straße 3
33334 Gütersloh, Germany
Tel.: +49 5241 934-0
Fax: +49 5241 934-444
www.sewerin.com
info@sewerin.com

SEWERIN SARL
17, rue Ampère – BP 211
67727 Hoerdt Cedex, France
Tél. : +33 3 88 68 15 15
Fax : +33 3 88 68 11 77
www.sewerin.fr
sewerin@sewerin.fr

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
Fax: +34 91 74807-58
www.sewerin.com
info@sewerin.es

Sewerin Portugal, Lda
Avenida dos Congressos da
Oposição Democrática, 65D, 1º K
3800-365 Aveiro, Portugal
Tlf.: +351 234 133 740
Fax.: +351 234 024 446
www.sewerin.com
info@sewerin.pt

Sewerin Sp. z o.o.
ul. Twórcza 79L/1
03-289 Warszawa, Polska
Tel.: +48 22 675 09 69
Tel. kom.: +48 501 879 444
www.sewerin.com
info@sewerin.pl

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