

# G600 Series

## Operation Manual



**GfG Instrumentation**

Worldwide Manufacturer of Gas Detection Solutions



# TABLE OF CONTENTS

1. Description .....	3
2. Principle of measurement .....	4
2.1 Catalytic combustion .....	4
2.2 Thermal conductivity.....	4
3. Construction of the instrument.....	5
4. Use of the instrument .....	8
4.1 Commissioning .....	8
4.1.1 Control of the operational voltage.....	8
4.1.2 Checking the mechanical zero.....	9
4.1.3 Checking the electrical zero.....	9
4.2 Modes of operation .....	10
4.2.1 Measurement range 0 to 100% volume .....	11
Pump mode .....	11
4.2.2 Measurement in the range of 0 to 5% volume (0 to 100% LEL respectively) .....	12
Diffusion mode.....	12
Pump mode .....	13
4.2.3 Micro range approximately 0 to 8,000 ppm (G 634 only) .....	13
Pump mode .....	14
4.3 Alarm.....	14
4.4 Display error / sensor poisons.....	15
Oxygen deficiency.....	15
Sensor poisons (catalytic combustion sensors) .....	15
4.5 Distinction between methane (natural gas/town gas) and propane/butane (technical gas) .....	16
5. Technical data .....	18
6. Test and approvals .....	20
7. Maintenance.....	20
7.1 Charging of battery black .....	21
7.2 Calibration and adjustment .....	23
7.2.1 Calibration of the mechanical zero.....	24
7.2.3 Sensitivity calibration .....	26
7.3 Gas alarm thresholds.....	28
7.4 Grit and fine dust filter.....	29
7.5 Pump control.....	30
7.6 Maintenance schedule .....	31
8. Malfunctions .....	33
9. Accessories .....	34
10. Ordering information .....	36
Accessories .....	37

## 1. Description

The EXOTECTOR® measures and monitors mixtures of combustible gases and vapors in air below the LEL range. An additional range makes it possible to measure methane in the range of up to 100 % volume.

The different gases and ranges tested are:

<u>Gas</u>	<u>Range</u>
Methane	0 to 5% CH <sub>4</sub> , 0 to 100% LEL, and 0 to 100 % volume
Propane	0 to 100% LEL
Nonane	0 to 100% LEL

The second range 0 to 100 % volume

Makes it possible to measure gas concentrations above the LEL e.g. such as required by gas suppliers, fire brigades, or when searching for leakages in gas pipelines or when bleeding gas pipelines.

A third range 0 to 8,000 ppm (micro range, G 634 P) is suitable for leak detection when gas concentrations are very low.

A large rotary switch, which is easy to use is situated on the front of the device. This serves to turn the EXOTECTOR on and off and to select the measurement range. The EXOTECTOR has an adjustable alarm threshold in the range 0 to 5 % volume (0 to 100 % LEL respectively).

If the gas concentration exceeds the set alarm threshold, the device emits an alarm. In the case of an alarm the large red alarm lamp is activated and in addition the acoustic alarm signal emits a piercing sound. The gas alarm is alternatively latched or not latched. If the alarm is latched, it can only be reset below the alarm threshold. If battery voltage is insufficient, an alarm is also raised. The small size, the easy handling and the combination of 2 respectively 3 ranges make the EXOTECTOR extremely suitable for a variety of applications.

Due to its rechargeable NiCd accumulator the device can monitor the ambient air for combustible gases and vapors for more than 10 hours in diffusion mode.

The EXOTECTOR is equipped with a high-performance electric gas pump which allows measurements to be made in inaccessible areas such as containers and manholes using sampling lines and telescopic probes.

## **2. Principle of measurement**

### **2.1 Catalytic combustion**

In the ranges

0 to 5 % volume (0 to 100 % LEL resp.)

0 to 8000 ppm (micro range, G 634 P)

the EXOTECTOR operates according to the principle of catalytic combustion.

The inflammable mixture of combustible gas and vapor in air diffuses through a flame arrestor into the combustion chamber or it is supplied by the sampling pump. In the combustion chamber there are an active sensor (detector) and an inactive sensor (compensator). The gas and vapor mixture is burnt at the preheated active sensor. The temperature increase due to combustion results in a proportional change in the electrical resistance, unbalancing the measurement bridge circuit. The bridge signal is amplified and is used for indication and alarm. If various combustible gases and vapors are present in the gas sample, e.g. methane and propane, they are measured and indicated as one gas by the EXOTECTOR.

### **2.2 Thermal conductivity**

For the measurement of high gas concentrations in the range: 0 to 100 % volume the EXOTECTOR operates according to the measurement principle of thermal conductivity. For this method of measurement the different thermal conductivities

of gases are used. In the combustion chamber of the EXOTECTOR are, in addition to the catalytic combustion sensor, two thermal conductivity sensors. The first sensor is in a sealed air-filled chamber (reference sensor) while the second sensor (signal sensor) comes into contact with the gas to be measured by means of diffusion or using the pump.

The signal and the reference sensors are both heated to working temperature. According to the thermal conductivity of the gas the signal sensor is either cooled down or heated up and compared to the reference sensor, which does not come into contact with the gas, and the difference is indicated by the EXOTECTOR (e.g. the thermal conductivity of methane and hydrogen is positive).

The thermal conductivity sensor integrated in the EXOTECTOR has been specially developed by GfG and has special features.

Gases like methane and hydrogen for example have a positive conductivity when compared to air and thus result in a positive signal (reading) on the EXOTECTOR

However, gases like propane, butane, and ethane etc., which (according to their thermal conductivities) have a negative thermal conductivity signal in comparison to air, are also shown as positive by the EXOTECTOR. Therefore, they do not lead to a reduction of the measurement reading. The negative signal behavior of carbon dioxide ( $\text{CO}_2$ ) has also been markedly reduced compared to other sensors (e.g. 50 % volume  $\text{CH}_4$  + 10 % volume  $\text{CO}_2$  in air result in a reading of 48 - 49 % volume  $\text{CH}_4$ ).

### **3. Construction of the instrument**

Figure 1 shows the EXOTECTOR G 634 and the individual parts for the use of the instrument.

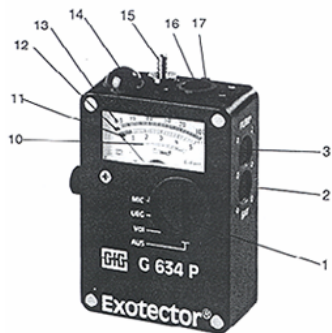


Figure 1

1. Measurement range selection switch
  - Off: instrument is not in use
  - % volume: Instrument is operating in the range 0 to 100 % volume
  - LEL: Instrument is operating in the range 0 to 5 % volume (0 to 100 % LEL respectively)
  - Micro Instrument is operating in the micro range (0 to 8,000 ppm)
2. Dual function switch
  - Switch for battery charge level
  - Alarm reset
3. Sampling pump switch
4. Charging socket
5. Adjustment potentiometers for maintenance
  - Z.P-LEL - zero point potentiometer 0 to 5 % volume (0 to 100 % LEL respectively)
  - Z.P-% volume - zero point potentiometer 0 to 100 % volume
  - Cal-LEL - Span potentiometer 0 to 5 % volume (0 to 100 % LEL respectively)
  - Cal-% volume - span potentiometer 0 to 100 % volume
6. Zero point potentiometer for the micro range
7. Adjustment screw for the mechanical zero
8. Display
9. Battery charge range
10. Range: 0 to 8,000 ppm (micro)
11. Range: 0 to 5 % volume (0 to 100 % LEL respectively.)
12. Range: 0 to 100 % volume
13. Operation LED
14. Alarm LED
15. Intake for sampling line
16. Measurement chamber intake for diffusion mode
17. Measurement chamber cover cap



## 4. Use of the instrument

### 4.1 Commissioning

Commissioning should be done in an atmosphere free of interfering gases.

#### 4.1.1 Control of the operational voltage

Be sure to check the charge level of the integrated NiCd-accumulator before and after use of the EXOTECTOR (see figure 2)



Figure 2

- Switch the measurement range selection switch to the % volume or LEL position
- Green operation LED lights up
- Press the charge control/reset switch



Figure 3

- \* the indicator should move to the right in the battery control range
- \* full and more - the battery is fully charged (picture 3)



Figure 4

- \* the indicator is in the middle of the green battery control range - the battery is charged to 50-60 % (picture 4)

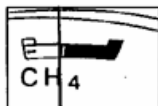


Figure 5

- \* the indicator is at the beginning of the green battery control range - the battery is charged to 20 % (picture 5)

The indicator is in the yellow battery range - the battery must be recharged.

#### 4.1.2 Checking the mechanical zero

The indicator of the measuring instrument must be in the zero tolerance field near the zero mark when off.

#### 4.1.3 Checking the electrical zero

- Switch the range switch to the position 0 to 100 % volume the indicator should move into the zero tolerance range within 15 seconds
- Switch the range switch to the position 0 to 5 % volume (0 to 100 % LEL respectively)

The indicator should move into the zero tolerance range within 15 seconds.

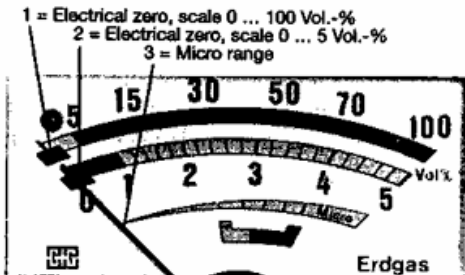


Figure 6: Scale graduation

If the instrument operates as indicated above, it is ready for use. If this is not the case, the instrument is not ready for use and must be inspected.

#### 4.2 Modes of operation

According to the type of model the EXOTECTOR provides up to 3 measurement ranges:

- Range: 0 to 100 % volume (G 624, G 634)
- Range: 0 to 5 % volume (0 to 100 % LEL respectively) (G 624 P, G 634 P)
- Range: 0 to ca. 8000 ppm (micro) (G 634 P)

In addition to this, the gas sample reaches the sensor either by means of diffusion or by means of the integrated gas sampling pump. Usually, we recommend (the local conditions and the company regulations must be observed), especially before entering manholes, sewers, or hazardous areas, to begin with measurements in the highest possible range and working down to low range. Furthermore, the integrated gas sampling pump makes it possible to take samples by means of a telescopic

suction probe or sampling lines before entering hazardous areas.

#### **4.2.1 Measurement range 0 to 100% volume**

Due to the switching sequence of the EXOTECTOR it is necessary to always start with the measurement range 0 to 100 % volume. The reasons for this result on one hand from the safety philosophy (see chapter 4.2) and on the other hand the catalytic combustion sensor is protected from high gas concentrations and thus the life span of the sensor is increased.

The measurement range 0 to 100 % volume is mainly used for the detection of gas before entering manholes and sewers or hazardous areas, the search for leakages in underground gas pipelines, the measurement of high gas concentrations when filling gas tanks and pipelines with gas.

In practice, these measurement functions are nearly always executed by means of the electrical gas sampling pump in connection with adequate sampling lines and telescopic suction probes.

#### **Pump mode**

For the exact measurement of high gas concentrations in pump mode it is recommended to close the diffusion opening by means of the cover cap.

- Turn range switch to position 0 to 100 % volume
- Short acoustic and visible operational alarm

Press pump switch - the gas sampling pump is activated supplying the gas sample to the sensors.

During pump mode the thermal conductivity sensor is continuously in operation allowing changes in the gas concentration to be read immediately from the meter. If sampling tubes and telescopic sampling probes are used, the

suction time (tp) required by the pump to supply the gas to the sensor must be taken into consideration.

- The suction time for 1 m sampling line and telescopic suction probe (1.36 or 1.92 m) can be up to 15 seconds tp.
- Extending the sampling line always means increasing the suction time by approx. 4 seconds per meter.
- If measurement is finished, the pump switch must be released and the range switch must be turned to the position OFF.

In order to protect the sensors in the pump mode from the suction of dust, humidity, and water we recommend to use a special filter.

If the gas concentration is lower than 5 % volume (0 to 100 % LEL respectively), measurement must be continued in the range of 0 to 5 % volume (0 to 100 % LEL respectively).

#### **4.2.2 Measurement in the range of 0 to 5% volume (0 to 100% LEL respectively)**

##### **Diffusion mode**

If the EXOTECTOR is used in diffusion mode for continuous monitoring of gas hazards, the cover cap (picture 1, pos. 17) must be removed from the diffusion opening.

The EXOTECTOR must be switched on in fresh air before being used for the measurement of inflammable gases.

- Turn range switch from position 0 to 100 % volume to 0 to 5 % volume (0 to 100 % LEL respectively)

Thus, it is guaranteed that the latched alarm also reacts, if the gas concentration exceeds the LEL. It is not allowed to turn the alarm signal off, if high gas concentrations are present.

The EXOTECTOR monitors the ambient air for combustible gases and vapors for approx. 10 hours, if the battery is fully charged.

## **Pump mode**

Same procedure as in diffusion mode.

- Press pump key

The gas sampling pump operates and supplies the gas sample to the sensor. In order to complete the measurement, release the pump key. The other instructions given in chapter 4.2.1 pump mode still remain valid.

### **4.2.3 Micro range approximately 0 to 8,000 ppm (G 634 only)**

The micro range is used for the measurement of lowest gas and vapor concentrations in the ppm range. In the pump mode the micro range makes it possible to detect leakages e.g. in gas pipelines and flanges, but in the diffusion mode it can also be used for personal monitoring of combustible gases and vapors. The range 0 to 8,000 ppm is not scaled. Using the regulating switch for the adjustment in the micro range a fine tuning can be made before each measurement. The fine tuning does not change the set alarm threshold. If gas concentrations exceed the set alarm threshold, the EXOTECTOR raises an acoustic and visible alarm.

#### **Diffusion mode**

- Turn range switch from position 0 to 5 % volume (0 to 100 % LEL) to micro range.
- If necessary, execute fine tuning of the zero point with the zero point regulating switch. In that case, the position of the instrument (vertical, 45° or horizontal) must be taken into account, because in the micro range a change of position can have a slight effect on the measurement range pointer.

The EXOTECTOR monitors the ambient air for lowest concentrations of combustible gases and vapors for approximately 10 hours.

## **Pump mode**

- Same procedure as in diffusion mode
- Press pump key - the gas sampling pump operates supplying the gas sample to the sensor.

Due to the suction of gas by means of a powerful electrical gas sampling pump slight oscillations of the range indicator may be caused by the cooling of the sensor and the influence of the position.

The other instructions given in chapter 4.2.1 Pump mode still remain valid.

## **4.3 Alarm**

**If an alarm is raised, the large red alarm-LED lights up and a permanent acoustic alarm is emitted.**

### **Gas alarm**

The EXOTECTOR has an adjustable alarm threshold in the range 0 to 5 % volume (0 to 100 % LEL respectively). The alarm threshold is factory set at 20 % LEL (methane LEL = 5 %, alarm threshold 1 % volume\*). An acoustic and optical alarm is emitted if the gas concentration exceeds the alarm threshold.

This is valid for both measurement ranges: - 0 to 5 % volume (0 to 100 % LEL respectively) - micro range approx. 0 to 8,000 ppm  
Depending on the type of device the alarm is latching or not latching. If the alarm is latching, the dual function switch (figure 1, point 2) is to be pressed shortly for alarm reset.

### **Battery alarm**

The battery charge level of the EXOTECTOR is continuously monitored. If the charging voltage reaches the discharge level, an acoustic and optical alarm is emitted. The battery alarm cannot be turned off.

If battery alarm is raised, the EXOTECTOR can be used for another 10 minutes approximately. After 10 minutes the measured

values are no longer reliable. The battery capacity can be checked at any time by pressing the switch for the battery charge level. If battery alarm is raised, it is recommended to switch the EXOTECTOR off and to recharge the battery.

#### **4.4 Display error / sensor poisons**

##### **Oxygen deficiency**

It is to be taken into consideration that the accurate measurement of gas and/or vapor concentrations in both measurement ranges below 5 % volume (100 % LEL respectively) cannot be carried out exactly, if the oxygen concentration is at the same time less than 5 % volume. In this case the catalytic combustion sensor does not have the required oxygen for the "catalytic combustion". In practice, this measurement task is very rare e.g. it is used for the inerting of pipelines and containers. Under these circumstances, it is recommended to carry out the measurement with another measuring principle such as thermal conductivity - range 0 to 100 % volume or to use a bypass for the suction of air and to effect the measurement according to the principle of catalytic combustion.

##### **Sensor poisons (catalytic combustion sensors)**

Certain substances known as sensor or catalyst poisons affect the sensor in its signal behavior. The "sensitivity" that means the ability of the sensor to release signals is reduced. These substances are for example sulphur, lead or silicium compounds. In addition, the halogenated hydrocarbons must be mentioned because they have a corrosive effect on the sensor. Usually, these substances are rarely found and in small concentrations only.

If these substances occur more often, calibration, that means examination of the sensitivity of the sensor must be carried out before and after each measurement (see 7.2.3). In addition, as a preventive measure we recommend to take the gas sample by



means of an electrical pump and a sampling line and to put a carbon filter into the intake (e.g. a charcoal filter tube), if silicide compounds are present in the gas sample.

This carbon filter retains the silicide compounds, but does not retain methane, hydrogen, and other gases. It must be taken into consideration that propane and butane for example are absorbed by the carbon filter. Therefore, a lower reading has to be taken into account.

#### **4.5 Distinction between methane (natural gas/town gas) and propane/butane (technical gas)**

In manholes and sewers methane (natural gas) as well as propane/butane (technical gas) can be found. It is not possible to distinguish between the gases only by means of the display of the EXOTECTOR. However, the GfG charcoal filter tube makes it possible to distinguish between methane and propane/butane. The distinction is possible because the GfG charcoal filter tube retains propane and butane in concentrations up to approx. 15 % volume, but methane (natural gas) is practically not retained at all.

#### **Instructions for Use**

The definition of the type of gas can be made as follows: first, the GfG charcoal filter tube must be prepared. For this, the tips of the tubes must be removed by means of the enclosed file.

- The first measurement is to be carried out by means of the electrical pump as usual without using the charcoal filter tube
- For the second measurement the open GfG charcoal filter tube is to be inserted into the sampling line and then a
- Second gas sample has to be taken through the filter tube and the sampling line.

Typical reading for gas concentrations in the LEL range:

- If the reading does not change, only methane is present in the gas sample.
- If the reading decreases, a propane/butane/methane mixture is present.
- If the reading shows "0", only propane or butane are present. The GfG charcoal filter tubes are not suited for multiple use.

## 5. Technical data

<b>Range:</b>	0 to 1 00 % volume 0 to 5 % volume (0 to 100 % LEL respectively) 0 to 8,000 ppm (micro range)
<b>Measuring principle:</b>	0 to 1 00 % volume - thermal conductivity, 0 to 5 % volume (0 to 100 % LEL respectively), and 0 to 8,000 ppm - catalytic combustion
<b>Display:</b>	Analog meter
<b>Scale graduation:</b>	- Range 0 to 8,000 ppm yellow field - Range 0 to 5 % volume (0 to 1 00 % LEL respectively.) 0 to 1 % volume green field 1 to 5 % volume yellow field - range to 100 % volume 0 to 5 % volume yellow field 5 to 15 % volume red field 15 to 100 % volume yellow field
<b>Display accuracy:</b>	- Range 0 to 8,000 ppm Leakage detection, quantitative indication only < 4 % of full scale 0 to 5 % volume - Range (0 to 100 % volume respectively) < 2 % of full scale - Range 0 to 100 % (under normal conditions) volume respectively) Range 0 to 100 % volume
<b>Reading accuracy:</b>	- Range Better +/- 0.2 % volume 0 to 5 % volume - Range Approximately 1.0 % volume 0 to 100 % volume
<b>Operating temperature:</b>	-20° C to < + 55° C

<b>Storage temperature:</b>	-40° C to + 600° C recommended + 5 to 25° C
<b>Approved temperature range:</b>	20° C to < + 55° C (approval)
<b>Humidity range:</b>	- Can be used within the range of 35 % to 95 % r.h.
<b>Gas sampling:</b>	- Diffusion - Diaphragm pump (approximately 0.5 l/minutes)
<b>Response time:</b> (20 % of full scale)	- $t_{20}$ :- diffusion approx. 5.5 s for methane - (20 % of full scale) pump 0 to 100 % LEL approximately 4.5 seconds 0 to 100 % volume approximately 2.5 seconds for methane
<b>Response time:</b>	- $t_{90}$ : - diffusion (90 % of full scale) approximately 48 seconds for methane - Pump 0 to 100 % LEL approximately 8.5 seconds 0 to 100 % volume approximately 6.5 seconds for methane
<b>Alarm thresholds:</b>	One alarm threshold, adjustable within 0.3 to 5 % volume, latching or not latching (factory-set at 1 % volume / 20 % LEL)
<b>Alarm:</b>	
- <b>Optical</b>	1 large red LED, permanent light
- <b>Acoustic</b>	Piezoelectric alarm, continuous tone
<b>Power supply:</b>	Rechargeable NiCd accumulator
<b>Operating time:</b>	With a fully charged battery approx. 10 hours without alarm and use of the pump

<b>Voltage control of the accumulator:</b>	By means of a push button, acoustic, and optical alarm in case of discharged battery
<b>Housing material:</b>	Polyamide, antistatic, impact proof, surface resistance < 10 <sup>0</sup> Ohm
<b>Dimensions:</b>	90 x 130 x 45 mm
<b>Weight:</b>	Approximately 800 gram
<b>Class of protection:</b>	(EX is G5)
<b>BVS-Approval:</b>	T 6725

## 6. Test and approvals

The EXOTECTOR type G 624, G 634 has been ex-approved.

The construction of the intrinsically-safe electrical device EXOTECTOR has been approved for use in potentially explosive areas by the certificate of the BVS.

Approval (EX) i,s G5

BVS-No.: T 6725

The display accuracy and the test for use in practice according to ZH 1 08 and ZH 108.1 respectively. have been approved.

## 7. Maintenance

The EXOTECTOR does not need special maintenance. Nevertheless, depending on the conditions of use, the battery block must be charged regularly and the electrical pump and the zero point must be checked at regular intervals.

In addition, the device must be calibrated at regular intervals, for this calibration the GfG service is at your disposal. We recommend a maintenance contract with an interim inspection every six months and an annual basic inspection.

## **7.1 Charging of battery block**

Depending on the mode of operation, the capacity of a fully charged battery block (NiCd-accumulator) is sufficient for continuous use of approximately 10 hours. If measurements are carried out by means of the electrical gas pump or if an alarm is raised, the operational time is reduced due to higher energy consumption. Insufficient battery capacity is indicated by an acoustic and visible alarm. It is possible to check the actual capacity of the battery block at any time.

The operating voltage check must be carried out as follows: turn the measurement range switch to % volume or LEL position press the charge level/reset switch the indicator in the battery control range must move to right side full scale and more

- The battery is fully charged (picture 3) the indicator is in the middle of the green battery control range
- The battery is charged to 50-60 % (picture 4)
- The indicator is at the beginning of the green battery control range
- The battery is charged to 20 % (picture 5)
- The indicator is in the yellow battery range
- The battery must be recharged

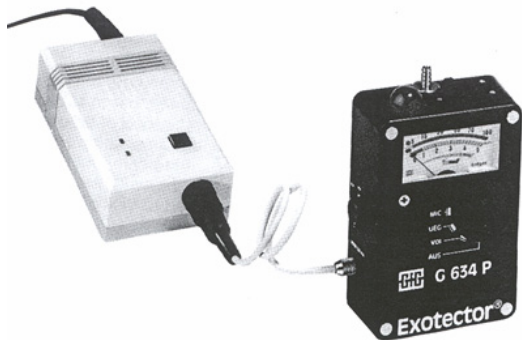


Figure 7: charging of the EXOTECTOR with the universal charger

CHARGING of the battery block must be carried out as follows:

- Measurement range switch in position "OFF".
- Connect plug of the charger to the mains supply.
- Put charging plug of the charger or the universal charger into the charging socket of the EXOTECTOR.
- The yellow operation LED of the charger lights up, the EXOTECTOR is recharged for about 8 hours.
- After approximately 8 hours the universal charger switches over to trickle charge. Thus, an overcharge of the NiCd-accumulator is impossible. The green LED of the charger lights up.

If the EXOTECTOR is not used for a longer period of time, the EXOTECTOR can be connected to the universal charger in the charging mode trickle charge. Thus, the EXOTECTOR is always ready for operation.

If the battery block is always charged in trickle charge mode, it should be discharged once a month but at least once every three months to ensure its proper functioning and a long life-span. If battery blocks are older than three years, their possibly

reduced capacity can be increased by carrying out the described charging/discharging cycle two or three times in succession. If the device was only used for a short period of time (one or two hours), in order to maintain the long lifespan of the NiCd-accumulator it is recommended, not to carry out the normal full charging every time. By pressing the switch at the universal charger the charger can be switched to trickle charge mode at every time within the 8 hours.

It must be observed that a discharged battery block can only be recharged partially in the charging mode trickle charge, but not fully recharged. This is on purpose and is achieved by the impulse trickle charge which is especially used in the GfG universal charger.

The NiCd-accumulators cannot be overcharged.

If the NiCd-accumulators are treated properly, a lifespan of 3-5 years and more can be achieved.

## **7.2 Calibration and adjustment**

All calibration and adjustment works must be carried out by trained personnel. In general, these works are carried out by the GfG service or by authorized persons.

The calibration interval chosen must ensure that the deviation does not exceed 5 % LEL. Even in the case of deviations of less than 5 % LEL, the calibration intervals should not exceed 16 weeks.

Calibration means the ascertainment of a measuring deviation of the device using a test gas. Adjustment means the setting to the lowest possible measuring deviation.

The test should be carried out as follows:

- Position of mechanical zero point, adjustment if necessary
- Charging status of the battery, recharging if necessary



- Display using zero gas, adjustment of electrical zero if necessary
- Display using standard test gas 0 to 5 % volume / 0 to 100 % LEL, adjustment if necessary
- Display using standard test gas 0 to 100 % volume, adjustment if necessary
- Alarm release using an alarm test gas, adjustment if necessary
- Checking adjustment time

### **Position of use**

In order to get a high measurement accuracy, the EXOTECTOR should be calibrated in its normal position of use. The EXOTECTOR as a handheld device is mainly held in the position 0 to 150, this position should be chosen for calibration and adjustment proceedings.

Nevertheless, regardless of the chosen position of use for maintenance, the EXOTECTOR measures and warns in every other position of use with the indicated accuracy.

#### **7.2.1 Calibration of the mechanical zero**

The EXOTECTOR must be switched off and the indicator of the measurement device must be on the zero point line of the scale. If the deviation is more than one indicator breadth, the mechanical zero point must be adjusted. This is carried out by using the delivered screw driver, turning the "adjustment screw-mechanical zero" of the switched-off device until the indicator of the instrument is identical with the zero point line of the scale.

If this adjustment is not carried out, the deviation affects the measurement result and the alarm threshold deviates in proportion to the mechanically misadjusted range.

Like the mechanical zero point the electrical zero point is identical to the zero point of the scale. The electrical zero point calibration has to be carried out as follows:

- Turn the range key to the position 0 to 100 % volume
- The indicator must move into the zero tolerance area within 30 seconds.
- If the indicator exceeds the zero tolerance area, the measurement chamber must be purged with fresh air for 1 minute in order to remove possibly present residual gases from the measurement chamber.
- If the indicator is still not in the zero tolerance area after the measurement chamber has been purged. The electrical zero-point must be adjusted.
- The adjustment potentiometers are situated on the left side of the device. The indicator must be moved to the zero point line by turning the potentiometer screw "N. P. volume" with a screw - driver.
- After the zero point calibration of the thermal conductivity range 0 to 100 % volume has been completed, the zero point calibration of the catalytic combustion range 0 to 5 % volume. 100 % LEL respectively) can be done in the same order. For this purpose, the range 0 to 5 % volume (0 to 100 % LEL respectively) must be switched on and the zero point can be adjusted with the adjustment potentiometer "N. P. - LEL".
- The zero point calibration of the "micro range" (EXOTECTOR G 634 P) is done by means of the big adjustment switch on the outside of the device. If the fine adjustment range is not sufficient, a screwdriver can be used for the adjustment of the potentiometer "N. P. -LEL". If the potentiometer "N . P. LEL" in the "micro range" has been changed during the adjustment of the zero point, a complete adjustment of the device in the range 0 to 5 % / 0 to 100 % LEL respectively is necessary.

- After the zero calibrations of the different ranges have been completed, the device must be switched off. Now the zero calibration has been completed.

### 7.2.3 Sensitivity calibration

- Select suitable test gas in air. The concentration of the selected test gas must exceed the adjusted alarm threshold. Thus, the acoustic alarm and the optical alarm can be checked at the same time.

Range	Test gas*	Reference gas*	Display
0 to 5 % volume methane	2 % volume methane		2% volume methane
		0.4 % volume propane	1.05 % volume methane
0 to 100 % volume methane	100 % volume methane		100 % volume methane
0 to 100 LEL-% methane	0.4 % volume propane		24% LEL propane
	2 % volume methane		40% LEL methane
		0.4 % volume propane	22% LEL methane
0...100% LEL n-nonane	0.56 % volume n-nonane (at = 25°C)		80% LEL n-nonane
		2 % volume methane	75% LEL nonane

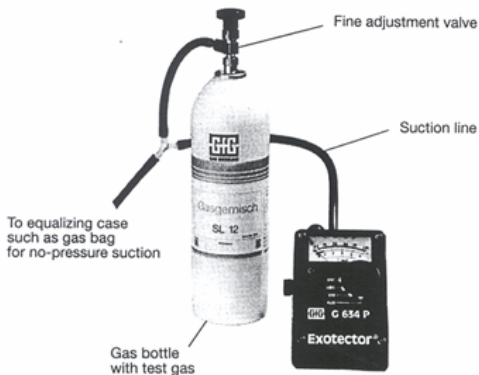


Figure 9: Sensitivity calibration

Switch on 0 to 5 % volume (0 to 100 % LEL) range. Select suitable test gas, e.g. 2 % volume methane in synthetic air.

Take in test gas from a gas bag via sampling line by using the

- Pump or press the test gas through the pump by means of a pressurized gas can with a volume flow of 0.5 l/minute In this case the gas pump does not need to be switched on.
- The indicator should show the gas concentration of the test gas within 20 seconds.
- If the device does not show the test gas concentration, the value must be adjusted at the sensitivity potentiometer "CAL.-LEL" by means of a screwdriver.

If the value cannot be adjusted by means of the sensitivity potentiometer, the sensor must be checked or possibly replaced. Replacement of the sensor must be completed by the GfG service.

Switch on 0 to 100 % volume

- Select suitable test gas, e.g. 100 % volume methane.
- Turn the range key to the measurement range 0 to 100 % volume, take in test gas via gas pump or via sampling line through the pumping set. The volume flow must be approx. 0.5 l/minutes.
- The indicator should show the test gas concentration within 20 seconds.

If the device does not show the test gas concentration, the value must be adjusted at the sensitivity potentiometer "CAL.-LEL" by means of a screwdriver.

If the value cannot be adjusted by means of the sensitivity potentiometer, the sensor must be replaced. Replacement of the sensor must be completed by the GfG service. The calibration is complete after the control and the sensitivity adjustment of the range 0 to 100 % volume (if necessary) have been carried out.

### **7.3 Gas alarm thresholds**

The EXOTECTOR has an adjustable alarm threshold in the range 0 to 5 % volume (0 to 100 % LEL respectively). The alarm threshold is factory-set at 1 % volume (20 % LEL respectively). If the gas concentration exceeds the alarm threshold, an acoustic and optical alarm is released. This is valid for the two ranges:

- 0 to 5 % volume (0 to 100 % LEL)
- Micro range 0 to 8,000 ppm

Depending on the type of device the alarm is either latching or volatile. The latching alarm can only be switched off below the set alarm threshold by pressing the reset switch/charge control switch shortly. If desired, the alarm threshold can be factory-set at another value by the GfG service.

There is no alarm threshold in the range 0 to 100 % volume. This is not an error but on purpose, because high gas concentrations are supposed to be present in the range 0 to 100 % volume.

#### 7.4 Grit and fine dust filter

There is a grit filter in the intake of the EXOTECTOR. The filter should be checked at least once a week or after it has been used in a dusty or dirty area. The dust filter protects the flow system and the pump from soiling to a great extent. The control and the possible exchange of the grit filter must be done as follows:

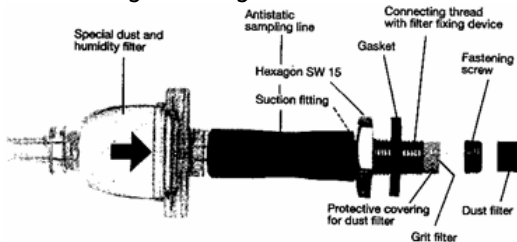


Figure 10

- The intake (picture 1, position 15) is unscrewed by means of an allen key (size 3).
- The grit filter is checked for dust. The filter must be replaced, if the color of the filter becomes darker.
- If the grit filter is very dirty, the subjacent sintered metal filter (fine dust filter) must be replaced. The sintered metal filter can be exchanged after the adjustment screw of the sintered metal filter has been removed.
- After having proceeded as described above, the different parts must be assembled in reverse order. It must be ensured that the bulging of the adjustment screw must show to the sintered metal.

## 7.5 Pump control

An exact measurement can only be accomplished if the gas pump works accurately and if the suction capacity is sufficient. A flow indicator (e.g. rotameter) and a vacuum meter are necessary for a proper control. The minimum pump capacity must be higher than 0.25 l/minutes and the suction capacity must come to 8,000 Pa (800 mm WS). The intake is connected with the testing instrument via a sampling line. The pump is activated when the measurement range is switched on and when the pump switch is pressed. The suction line must be checked if the pump capacity is too low. If the pump capacity is still too low after the dust filter has been replaced or cleaned, an inspection by the GfG service is necessary.

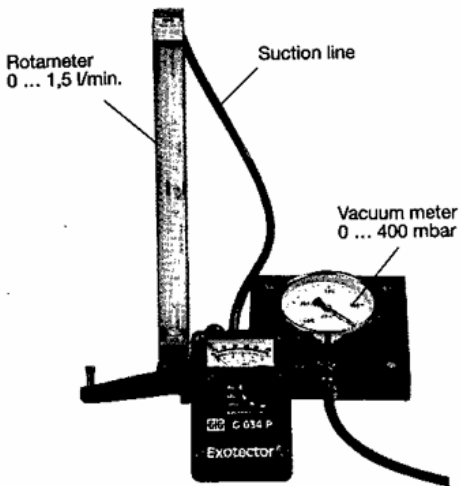


Figure 11

If there are no measurement devices available for checking the pump performance, a rough inspection can be carried out quickly.

- Switch the device on using the range switch
- Press pump switch
- Close intake
- You can hear the pump abating (or even stopping)
- Pump check is complete

## 7.6 Maintenance schedule

According to the conditions of use and the company regulations the shown maintenance schedule should be a suggestion for the inspections. Maintenance such as interim inspections and main inspections are to be completed regularly.

Check and control	before use	after use	after x weeks						
			1	2	4	16	27	52	
External condition	X 0	X			0		Z	H	
Position of mechanical zero	X 0	X			0		Z	H	
Charge level of the battery	X 0	X			0		Z	H	
Reading with zero gas micro	X 0	X			0		Z	H	
0...100 % LEL	X 0	X			0		Z	H	
0...100 Vol.-%	X 0	X			0		Z	H	
Reading with test gas micro									
0...100 % LEL	X 0	X				X 0	Z	H	
0...100 Vol.-%	X 0	X				X 0	Z	H	
Diffusion control					X	0	Z	H	
Pump mode									
W/min	X 0				X 0		Z	H	
Pa (mmWs)	X 0				X 0		Z	H	
Alarm signal release									
20 % LEL	X 0		X			X 0	Z	H	
battery	X 0		X			X 0	Z	H	
Suction line/scaling filter	X 0	X			X		Z	H	
sintered metal filter					X				
Adjustment time									
0...100 % LEL						X 0	Z	H	
0...100 Vol.-%						X 0	Z	H	

Symbols X: Check when used daily  
 0: Check when stored



- Z: Interim check/functional check by authorized person (includes all checks X/O)
- H: Annual main check/functional check by authorized person (includes all checks X/O an all other works).

The user is not allowed to open the device. In case of claims please contact GfG service.

## 8. Malfunctions

Failure	Cause	Clearing
The indicator does not move to the zero when the device is switched off	Mechanical zero point misadjusted	Adjust mechanical zero point line (see 7.2.1)
The indicator does not move to the zero tolerance field after it has been switched on	Electrical zero point misadjusted	<ol style="list-style-type: none"><li>1. Purge with fresh air</li><li>2. If the indicator still does not move to the zero tolerance field, the electrical zero must be adjusted (see 7.2.2)</li></ol>
After the device has been switched on in the range 0.5 % volume (0 to 100% LEL), the device raises an acoustic and optical alarm	Sampling line is still filled with gas	Purge the measurement chamber
	The indicator has moved to the alarm threshold and has raised the alarm (heating effect)	Press reset key and cancel the alarm
Pump does not work	Intake soiled	Exchange filter, check intake
	Faulty pump	Pump must be replaced by GfG service
The device raised an acoustic and optical alarm after having been switched on	Battery discharged	Recharge battery block (see 7.1)

Failure	Cause	Clearing
Display reads "zero" device is switched on, the indicator moves to the right or left limit stop	Zero-point misadjusted	Adjust zero-point (see 7.2.1)
	Faulty sensor or sensors	Measurement chamber must be replaced

## 9. Accessories

There are many accessories available for the EXOTECTOR.

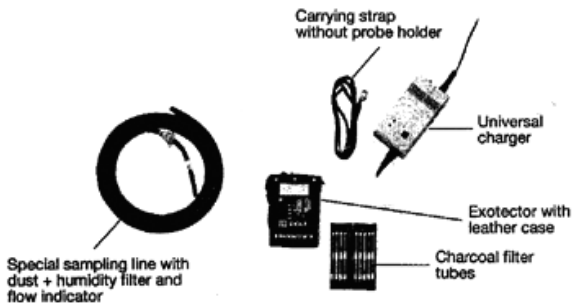


Figure 12

### Leather case

The leather case serves for transporting the device. It protects the device from shocks, impacts and soiling.

### Special sampling line

If measurements have to be taken at inaccessible places, the gas sample is taken by means of a special sampling line. The sampling line is made of special antistatic rubber. The sampling line always contains a built-in dust and humidity filter. The sampling line is also available with a flow indicator showing the perfect function of the pump by means of a green section. There is a 3 m sampling available as well as a 6 m sampling line.

### **Telescopic probe**

The telescopic probe allows to take samples at places which cannot be reached using a sampling line. The telescopic probe is made of corrosion resistant steel and has a probe top which makes the suction of liquid nearly impossible. There is a 1.36 m telescopic probe available as well as a 1.92 m telescopic probe.

### **Universal charger**

By means of the GfG universal charger NiCd-accumulators with a nominal charging capacity between 100 mAh and 2 Ah can be charged. The universal charger is suitable for charging all battery blocks contained in the gas measurement device of the GfG (pocket-size devices, handheld devices, and portable devices) except from the measurement devices Vabotector and GMA 052-T.

The charger works with a pulsed standard and with trickle charge. After about 8 hours the charger switches from standard charge to trickle charge automatically.

### **Filter**

**Grit filter:** A grit filter is situated in the intake of the EXOTECTOR. This filter protects the suction line and the electrical pump from dust and soiling. The functioning of the filter must be checked at regular intervals. If the filter does not work properly, it must be replaced.

**Fine dust filter:** Below the grit filter a sintered metal filter is situated in the EXOTECTOR. This filter must be cleaned in case of

severe soiling of the grit filter. In general, the filter is replaced by GfG service or authorized personnel.

### **Special dust and water filter**

There is a special dust and water filter in the sampling line. This filter protects the device from suction of water, humidity, and dust.

### **Charcoal filter tubes for the determination of methane or propane**

In manholes and sewers methane (natural gas) as well as propane (technical gas) can be found. It is not possible to distinguish between these gases by reading of the EXOTECTOR only.

The GfG charcoal filter tube makes it possible to distinguish between methane and propane/butane. The distinction is possible because the GfG charcoal filter tube retains propane and butane in concentrations up to 15 %, but methane (natural gas) is almost not retained. The charcoal filter tubes are available in a pack containing 9 filter tubes and an additional sampling line.

## **10. Ordering information**

### **Type of detector**

EXOTECTOR G 624 P

Two detection ranges

0 to 5 % volume and 0 to 100 volume-O/o or  
(to 100 % LEL and 0 to 100 % volume

EXOTECTOR G 634 P Three detection ranges

Micro (leak detection), 0 to 5 % volume and 0 to 100 %  
volume or

Micro (leak detection), 0 to 100 l/o LEL and 0 to 100 %  
volume

For part numbers please contact GfG Instrumentation.

The EXOTECTOR is available for numerous gases, e.g. methane, natural gas, town gas, hydrogen, propane, butane, nonane (fuel vapors), etc.

## **Accessories**

### # Description

1. Universal charger 220 W50HZ (standard and trickle charge)
2. 5-point charger 220 V or 110 V 200/20 mA (standard/trickle charge)
3. Universal charger for cars (12 V) (standard and trickle charge)
4. Universal charger 110 W60HZ (standard and trickle charge)
5. Universal charger in transport case (12 V)
6. Leather case for G 600 series
7. Telescopic probe CrNi steel 1.36 m, with connection adapter and 50 cm sampling line
8. Telescopic probe CrNi steel 1.92 m, with connection adapter and 50 cm sampling line
9. Spare connection adapter with 50 cm sampling line
10. Special sampling line 3 m, antistatic, with filter for particles and humidity
11. Special sampling line 3 m, antistatic, with filter for particles and humidity and flow indicator
12. Special sampling line 6 m, antistatic, with filter for particles and humidity
13. Special sampling line 6 m, antistatic, with filter for particles and humidity and flow indicator
14. Special water filter
15. Charcoal filter tube for distinction of methane or propane (pack of 9 each)





## **GfG Instrumentation**

1194 Oak Valley Drive, Suite 20  
Ann Arbor, Michigan 48108  
United States of America  
Phone: (800) 959-0329 or (734) 769-0573  
Fax (734) 769-1888  
E-mail: [info@gfg-inc.com](mailto:info@gfg-inc.com)  
Website: [www.gfg-inc.com](http://www.gfg-inc.com)