

SIMRAD GD10PE IR GAS DETECTOR

Operating Manual

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1. PRODUCT DESCRIPTION

1.1 General description

The Simrad GD10PE Gas Detector is an extended point detector for monitoring low gas concentration in potentially hazardous and/or poisonous environments. The GD10PE is based on infrared absorption and uses the latest developments in analogue and microprocessor technology. Solid state design improves reliability, long-term stability and accuracy in continuous measurement of gas concentration in ambient air.

Compared with catalytic sensors, the GD10PE has the following advantages:

Presence of oxygen is not required for correct measurement, which makes the GD10PE suitable even in an inert gas atmosphere.

No possibility of poisoning of the detector since no chemical reaction occurs, i.e. silicon vapours and H₂S have no effect on the detector or the measurement.

The gas flow rate has no influence on accuracy.

There are no saturation effects which could lead to false measurements.

The detector has a continuous self-test function, and reports dirty optics and fault conditions to the control system.

Total system costs can be dramatically reduced with the GD10PE:

High reliability results in low test frequency and no calibration costs.

Voting systems designed to reduce false alarms are not required, which reduces the number of detectors by up to 66 %.

1.2 Construction

A complete GD10PE Gas Detector consists of the following:

An external gas measuring path where gas is measured by monitoring absorption of IR radiation. An optional weather protection enclosure is mounted around the measuring path to protect the optical surfaces from rain and dust if the detector is installed as a stand-alone unit and not in a duct.

An optoelectronic unit, which generates IR radiation to the gas measuring path, measures the reflected IR radiation from the gas measuring path and calculates the gas concentration. This unit is enclosed by an EExd certified housing.

A terminal compartment with cable entry and mini-terminals for electrical connection. The compartment is protected by a cover and is EExe certified.

1.3 Application areas

The GD10PE is designed for critical applications involving large volumes of air with high velocity. Typical applications include the monitoring of air intakes for HVAC systems in living quarters or generators, and monitoring for potential gas leakages in areas with high temperatures in gasturbine packages.

GD10PE is designed for installation in air ducts and for mounting through walls and bulkheads in places such as pump rooms. The GD10PE can also be used as a more traditional point detector in places where the properties of the GD10PE is required, such as low ppm level detection.

For retrofit applications, a bridge interface is available allowing the detector to be connected directly to catalytic systems, using the existing cabling and control modules.

GD10PE is an ideal replacement for existing catalytic devices that up to now have been the only alternative in areas with high temperatures.

The GD10PE is housed in a compact stainless steel enclosure, which is certified flame-proof, meeting the requirements of EN 50018.

1.4 Technical data (0-20% LEL methane, 5 sec. response time)

Specification for other types on request

GENERAL

Detection method	IR-absorption, dual wavelength, dual path
Detection range, standard	0-20% LEL (0-1% Vol.) methane
Gas detected	Hydrocarbons
Life time stability	Better than $\pm 7\%$ of full scale reading
Accuracy, standard	Better than $\pm 5\%$ of full scale between 0-50 % reading Better than $\pm 7\%$ of full scale between 50-100 % reading

Response time, standard.	<u>Detector</u>	<u>100%LEL</u>	<u>20%LEL</u>
	<u>Reading:</u>	<u>test gas:</u>	<u>test gas:</u>
	4%LEL	0.6 sec.	1 sec.
	10%LEL	0.9 sec.	2.5 sec.
	18%LEL	1.3 sec.	6 sec.

Start-up time	Less than 60 sec.
Self-test	Continuous
Calibration	Factory set
Warranty	5 years full warranty

OUTPUT SIGNAL:

- Standard	Current source 4-20 mA, max. load impedance 500 Ω
- Option	Current sink 4 - 20 mA

Detector warnings:

- | | |
|----------------------|--|
| - Early clean optics | Dirt accumulation on windows (gas measurements interrupted by following signal: 1 mA for 3 sec. at 5 min. intervals) |
| - Clean optics | Dirt accumulation on windows (1 mA) |
| - Detector failure | Internal malfunction in the sensor (0 mA) |

ELECTRICAL:

- | | |
|-----------------------|--------------------------------|
| - Power supply | 24 V DC, range 18-32 V DC |
| - Power consumption | Approx. 3.5 W |
| - Start-up current | 0.3 A for 0.3 sec. |
| Electrical connection | 3 wires (M20 EExe cable gland) |

TEMPERATURE RANGE:

- | | |
|------------------------|------------------------|
| - Storage | -40 °C to +70 °C |
| - Operating | -20 °C to +60 °C |
| - Operating (option) | -40 °C to +60 °C |
| - Probe inside duct | up to + 85 °C |
| - Humidity (operation) | 99 % RH non-condensing |

EXPLOSION PROOF HOUSING:

- | | |
|----------------------|---------------------|
| Main compartment | EExd IIC T5-T6 |
| Terminal compartment | EExe |
| Protection category | IP66/IP67 DIN 40050 |

ENCLOSURE:

- | | |
|----------------------------------|------------------------------------|
| Housing material | Stainless steel SIS2343 (ASTM 316) |
| Weight, incl. Weather Protection | Approx. 6.5 kg |

ACCESSORIES:

- Duct Mounting Brackets

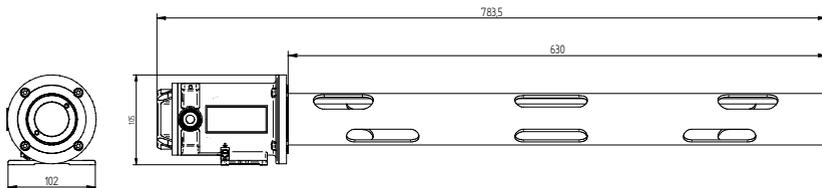


Figure 1-1 GD10PE, outline dimensions (mm)

1.5 Certification and standards

The GD10PE has been certified according to Atex Directive 94/9/EC, EMC Directive 89/336/EEC Article 4 and requirements laid down by the following standards:

EN50014/IEC 60079-0	Electrical apparatus for potentially explosive atmospheres.General requirements.
EN 50018/IEC 60079-1	Electrical apparatus for potentially explosive atmospheres. Flame-proof enclosure “d”.
EN 50019/IEC 60079-7	Electrical apparatus for potentially explosive atmospheres. Increased safety “e”.
EN 50081-1	Electromagnetic compatibility - Generic emission standard. Part 1: Residential, commercial and light industry.
EN 50082-2	Electromagnetic compatibility - Generic immunity standard. Part 2: Industrial environment.

1.6 Certificates

- Atex Certificate: Nemko 01 ATEX 282

1.7 Product identification label

	GD10PE	20% LEL CH ₄	Measuring Range
		5s SOURCE	Type of Gas
	II 2 G EEx de IIC T6 (Ta -40°C to +65°C)	Electrical performance temp:	Type of mA Output
		Ta -20°C to +45°C	Type of Response
Nemko 01ATEX282 Reg.No		Prod.Year S.No	

Figure 1-2 Product identification label

2. INSTALLATION

2.1 Mounting the GD10PE

2.1.1 Location

The detector should be mounted in such a way that the longitudinal axis of the detector is horizontal. This will prevent accumulation of water and dust on the optics. Further, the detector should be oriented in such a way that the air slots are aligned with the air flow direction to allow maximum free flow through the optical path.

NOTE: The area in which the detector may be mounted must be in accordance with the certification of the detector and in accordance with the standards of the appropriate authority in the country concerned.

Choice of mounting area:

- The detector should be mounted where gas leakage is most likely to occur.
- The detector should be mounted in a place where maintenance, i.e. cleaning of the optics, is easily performed.
- The detector may be mounted in areas where no oxygen is present.
- The detector should NOT be mounted where it could be exposed to water drenching or contamination from dirt or chemicals.

2.1.2 Ventilation duct or pipe mounting

Use the recommended mounting equipment and mounting guidelines given in figures 2.1 to 2.2.

NOTE: Avoid direct light on lens and mirror.

The detector should be mounted in straight parts of the duct or pipe with undisturbed airflow. Avoid areas with possible turbulent flow e.g. immediately after sharp bends or junctions.

The detector can be fixed at one or both ends. One-sided mounting is NOT possible with the Guide Support Kit.

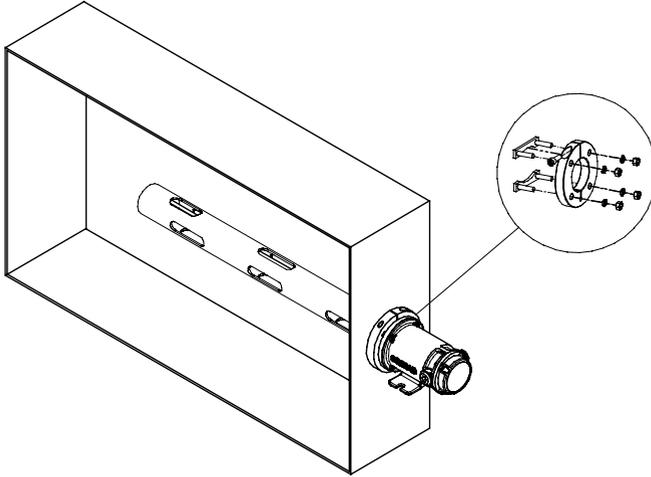


Figure 2-1 One-sided duct mounting using Mounting Flange Kit.

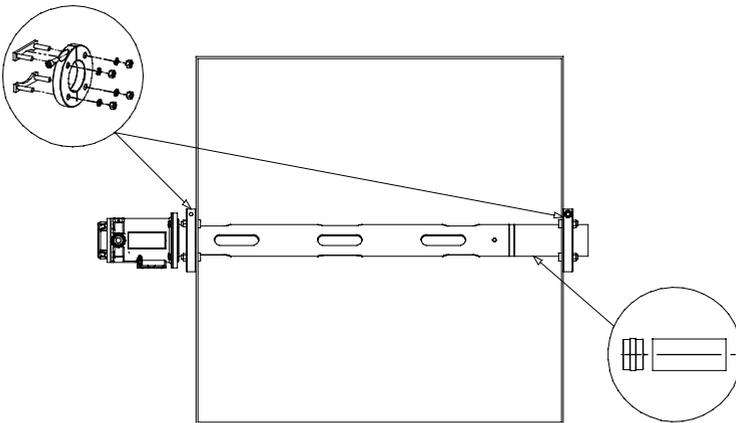


Figure 2-2 Dual side duct mounting using two Flange Mounting Kits and Extension Kit

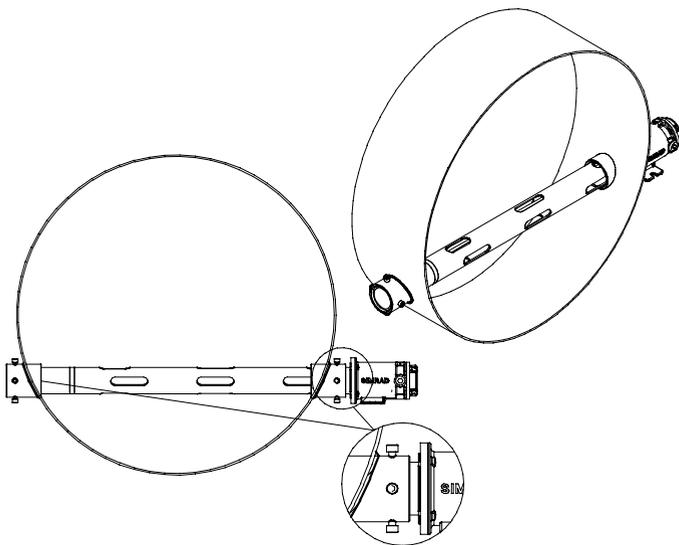


Figure 2-3 Circular duct mounting using Guide Support Kits and Extension Kit.

Other installation configurations: The Flange Mounting Kit can easily be used on a circular pipe or duct segment if a plane plate piece is fitted prior to mounting the detector. Simrad also recommend a similar approach if reinforcement of the mounting area (due to very thin duct walls) is required.

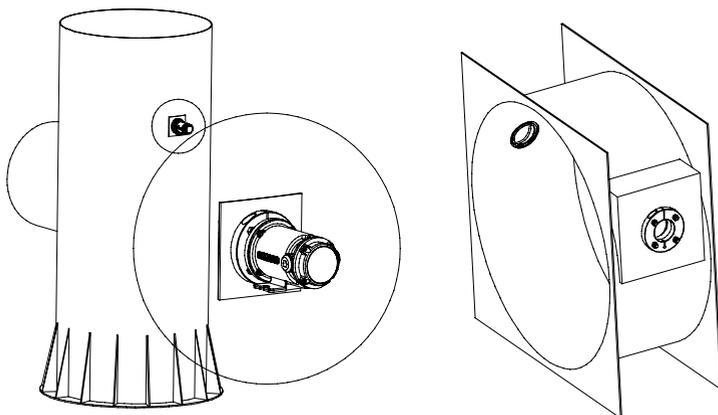


Figure 2-4 Mounting Flange Kit used on circular duct segments.

2.1.3 Mounting Kit details

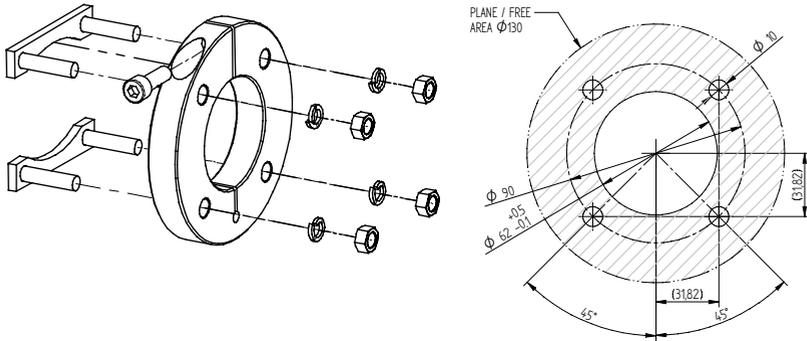


Figure 2-5 Exploded view, Duct Mount Flange Kit with recommended installation bore dimensions.

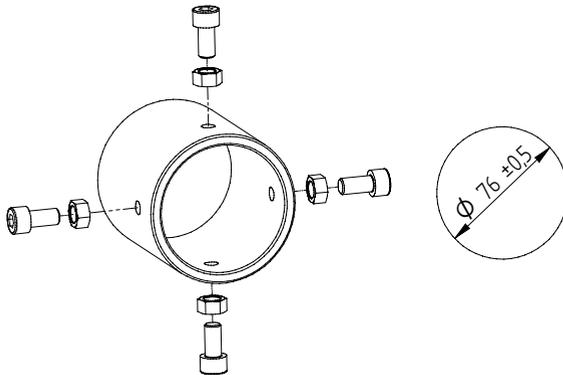


Figure 2-6 Exploded view, Guide Support Kit, with recommended installation bore dimension. Welding required.

2.2 Electrical connections

2.2.1 Terminal compartment

The terminal compartment is accessible by removing the rear terminal cover. (Loosen the four M5 screws.) Refer to Figure 2.7.

The terminal compartment, including the 5 mini-terminals for electrical connection, is shown in Figure 2.7 below.

The installation wiring enters the terminal compartment via a single M20 EExe cable gland, which can be mounted on either side of the compartment. The unused entry is blanked with an EExe cover.

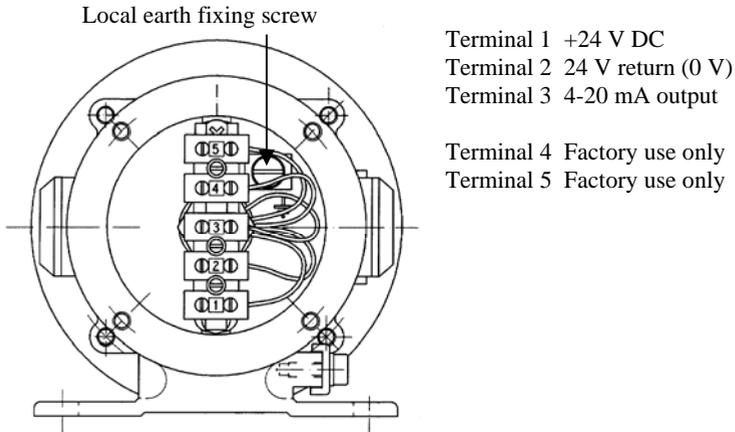


Figure 2-7 Terminal compartment

2.2.2 Output cable connections

The detector has two output modes:

- Current source 4-20 mA (standard)
- Current sink 4 - 20 mA (option)

The mode is factory set, and shown on the identification plate of the detector.

2.2.2.1 3-wire output cable connection

The cable connections are as follows:

Terminal No 1: +24V DC

Terminal No 2: 0 V DC (24 V and signal return)

Terminal No 3: Signal output

The shield of the cable should be connected to instrument earth in the central control module, and left unterminated at the detector. Do not connect clean earth conductors to the local earthing screw.

2.2.2.2 Retrofit wiring

The GD10PE Gas Detector has been designed to be fully interchangeable with existing catalytic sensors, using the same 3-wire cable and the same bridge input control modules. This application requires the Bridge Interface to be employed as shown in Figure 2.8 below.

The Bridge Interface converts the standard 4 - 20 mA active current output from the GD10PE to a bridge signal input, which is a typical standard for several control modules in use today. The Bridge Interface operates on a standard 24V DC supply. The complete Bridge Interface assembly is contained in a plastic housing, which clips onto a standard DIN mounting rail. This allows several channels to be interfaced in a space-saving way.

NOTE: As signal levels, polarity, loading, stability and fault testing differ between manufacturers of catalytic modules, Simrad Optronics must be contacted for correct setting of variables in the Bridge Interface.

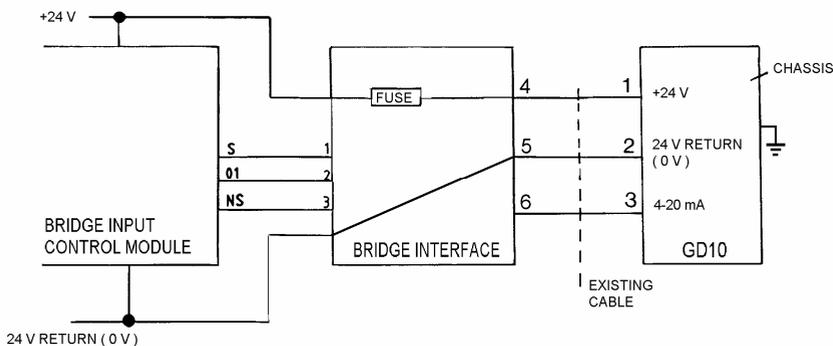


Figure 2-8 Bridge interface installation

2.2.2.3 Recommended cable types

The cable selected for interfacing the control equipment should be approved for use in the actual area.

It is recommended to use shielded cables.

Cables should be of a fine multi-strand type with a cross-section between 0.5 mm^2 and 1.5 mm^2 .

The cable enters the terminal compartment via an EExe cable gland. Several options of gland fittings are available.

2.2.2.4 Initial wiring checks

After wiring as detailed above, and before applying power, ensure that:

- +24V DC is connected to terminal 1
- 0 V DC is connected to terminal 2
- Signal output is connected to terminal 3

3. OPERATION

3.1 Start-up procedure

Ensure that system wiring and control system are in working order before switching on power to the detector.

The detector will then perform self-test and internal signal adjustments lasting for approx. 60 seconds and switch to measuring mode.

The output signal from the detector during this period is shown in Figure 3.1 below (current output of the GD10PE standard version). Signal output before 60 seconds is 0 mA, and signal output after 60 seconds is 4 mA (if no gas is present).

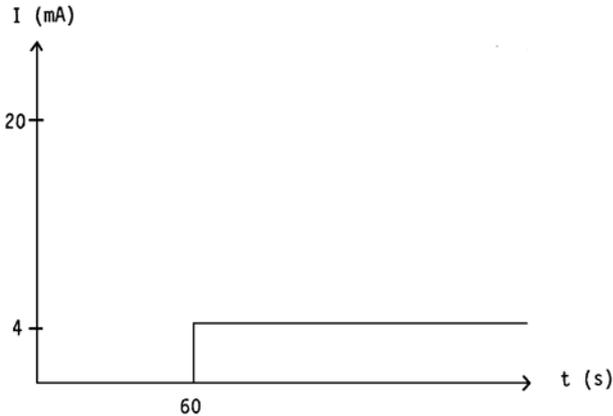


Figure 3-1 Signal output during start-up period

4. MAINTENANCE

NOTE: The GD10PE has no user adjustable parts. It is not recommended to open the GD10PE, as this will change the internal atmosphere, and the initial calibration could be affected.

NOTE: Opening the GD10PE voids all warranty offered at time of sale.

4.1 General

The GD10PE has been designed to require a minimum of maintenance. The only necessary maintenance is to inspect visually that the detector measuring path is not covered.

4.2 Cleaning of optical window and mirror

If the optical window and mirror have to be cleaned, use a soft, clean tissue to rub off the contamination. The window and mirror are made of sapphire, which is highly resistant to scratching. Make sure that the whole optical surface is clean.

NOTE: For difficult contaminants the mirror and lens can be cleaned with an equal-part mixture of isopropyl alcohol and water. Do not perform any testing of the sensor before this solution has dried and residues have been wiped away

4.3 Functional test

The GD10PE has been designed for long-term stability, and in order to retain the high reliability of the GD10PE it is only necessary to monitor the detector's zero point and error messages from the detector.

In order to perform functional test of the detector a test gas can be applied through the 6 mm gas test nozzle. Read the detector output signal at the detector, or through the gas detection system.

The functional test can be performed without doing any changes from normal operating conditions.

- Using 100 % l_{el} Propane as test gas:
Duct air velocity, up to 10 m/s. Apply test gas with a flow of 20 - 30 l/min. for at least 10 sec. The detector output should be 20 mA.
- Using 100 % l_{el} Methane as test gas:
Duct air velocity, up to 10 m/s. Apply test gas with a flow of 20 - 30 l/min. for at least 10 sec. The detector output should be more than 7 mA

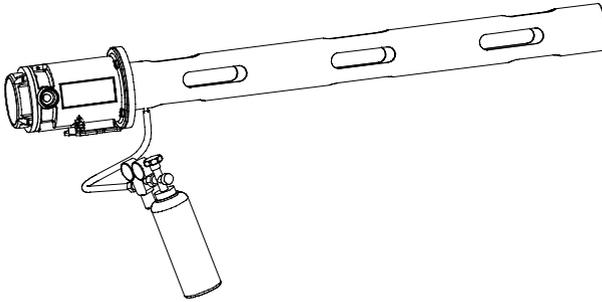


Figure 4-1 Set-up of functional test

4.4 Calibration test

- Ensure that optical surfaces are clean.
- Mount the Sample Flow Housing.
- Apply a certified test gas to the gas test nozzle, preferably 10 % lcl Methane, as shown in Fig 4.2.
- Gas flow should be approx. 3 litres/minute, wait approx. 5 min. to ensure that correct gas concentration is obtained in the Sample Flow Housing.
- Read the detector output signal at the detector, or through the gas detection system.

NOTE: Use the same type of gas as the detector has been calibrated for.

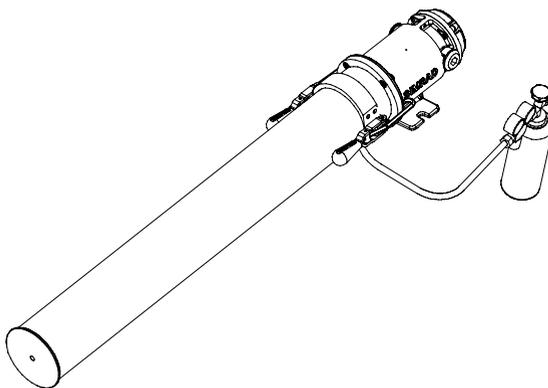


Figure 4-2 Set-up of calibration test

4.5 Failure indications

The internal microprocessor performs continuous self-testing of optical and electronic functions.

If a fatal error should occur in the electronics or optics, the processor will generate a 0 mA output signal, indicating sensor failure.

The detector should then be checked according to Figure 4.3 on the next page. Do not return the instrument to Simrad Optronics for repair if this test has not been performed.

If the IR energy in the optical path is reduced to 50-70% of its original value, the output signal will go down to 1mA for 3 seconds at 5 minutes interval.

If the IR energy is further reduced, the output signal will go down to 1mA. In this condition the detector will not detect gas.

If the optics are contaminated, wipe the optics with a clean cloth and mild detergent according to instructions in para. 4.2. The optics must be cleaned even if they appear not to be contaminated.

NOTE: Avoid direct light on lens and mirror if testing without the Weather Protection.

NOTE: Ensure that no gas is present in the measuring chamber when testing.

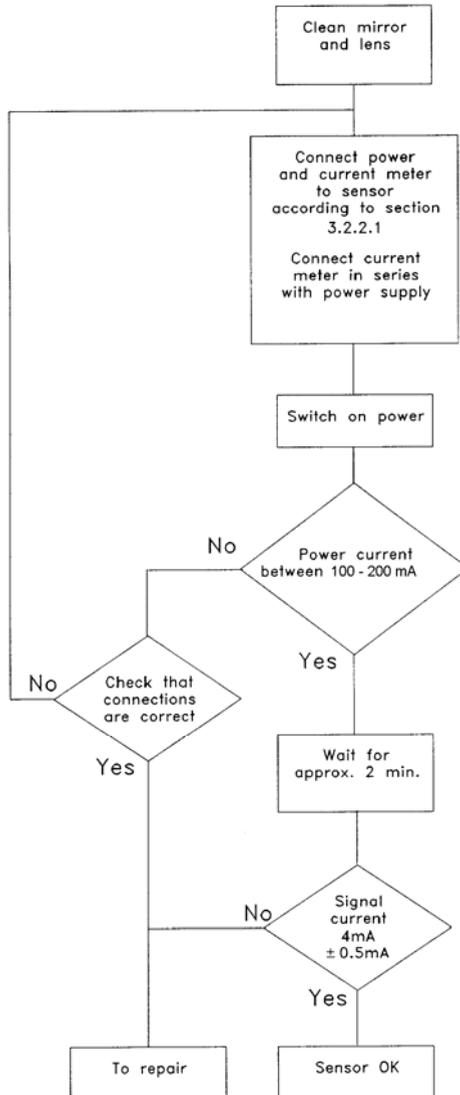


Figure 4-3 Test procedure

5. TECHNICAL DESCRIPTION

5.1 Introduction

The GD10PE Gas Detector from Simrad Optronics is an extended point detector for monitoring low gas concentration in potentially hazardous and/or poisonous environments.. A high-stability, solid-state infrared radiation source combined with the latest developments in optical and electronic design have led to the realisation of a compact, accurate and cost-effective instrument able to monitor explosion dangers in real-world environments.

5.2 The GD10PE concept

The concept is based on measurement of infrared radiation passing through a volume of gas. The GD10PE employs a dual beam, dual wavelength measuring principle with separate optical detectors for maximum stability and reliability.

Since different types of gas have unique absorption spectra, they can easily be identified by proper selection of an infrared wavelength at which absorption is measured. Radiation at another wavelength measures the overall transmission through the optical system and the air volume. By comparing the transmission at the two wavelengths, the gas concentration in the air is determined. Having chosen a wavelength which is characteristic of one type of gas, other types of gas will not cause false alarms.

Using a solid-state IR source instead of a lamp ensures high reliability and long-term stability with no regular maintenance or calibration required during equipment lifetime.

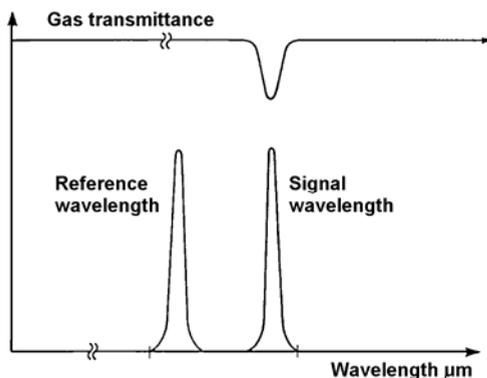


Figure 5-1 Transmittance as a function of wavelength

Refer to Figure 5.2 below.

Radiation from two infrared sources passes through two narrowband filters selecting a measuring wavelength and a reference wavelength. The sources are electronically chopped. Radiation is divided by a beam splitter into an internal and external path. The internal path is viewed by the compensation detector, and the external path is viewed by the measuring (main) detector. The compensation detector monitors and compensates for drift in sources or detectors. The main detector monitors the external measuring path and detects whether the selected gas is present.

The four signals, two from the compensation detector and two from the main detector, are amplified, digitised and fed to the microprocessor. The signals are used by the microprocessor to calculate the gas concentration. The gas response is then linearized and presented as either a voltage, a current or a digital output signal. Internal signals are compared with test limits to monitor electronics and optical parts. If values outside the test limits are found, specific error messages are given.

Optical filter characteristics remain constant over time, and drift in the other components is monitored and compensated by the dual wavelength, dual path concept. This means that the zero and gas span factory calibration will remain stable regardless of component drift, and that the detector needs no manual recalibration after factory calibration.

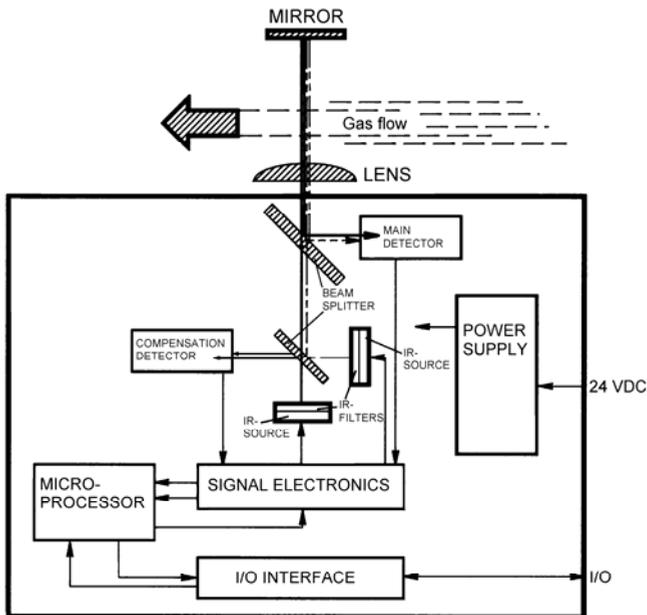


Figure 5-2 Block diagram, GD10PE

5.3 Performance characteristics

5.3.1 Gas data

The GD10PE standard version is factory calibrated and linearized with methane gas in the 0-20 % LEL range. Calibration/linearization to other gases or concentrations can also be done.

Accurate measurements can only be achieved by having the detector calibrated for the gas it is intended to measure.

A GD10PE calibrated for methane has a higher sensitivity to most of the other hydrocarbon gases than to methane. This means that explosion danger from other HC-gases will always be detected by the GD10PE.

Because of tolerances in the infrared filters, readings of other gases than methane will not be exact when the detector is calibrated to 20% LEL methane.

Converting % LEL to % v/v is based on ISO10156, Second edition 1996-02-15: "Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets".

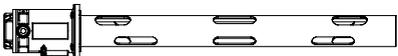
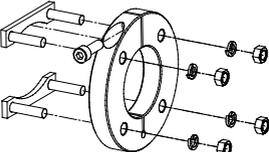
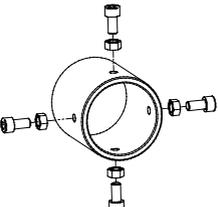
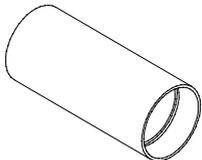
The GD10PE is designed for normal atmosphere pressure variation, but it is certified for pressure limits from 86 to 108 kPa.

5.3.2 Cross interference to other gases

Hydrocarbon gases such as methane, ethane, propane and butane are absorbing at a signal wavelength of 3.3 μm . These gases do not interfere at the reference wavelength at 3.0 μm . If the atmosphere to be monitored contains gases such as acetylene that absorb at the reference wavelength of 3.0 μm , misleading measurements may be obtained depending on the interfering gas concentration. In such cases, contact Simrad Optronic for information. A modified GD10PE using another reference wavelength will eliminate these problems.

Water vapour, carbon dioxide, oxygen, nitrogen and other gases, which are present in normal air will not influence the measurements.

6. ORDERING INFORMATION

Sketch	Description	Simrad Part Number
	GD10PE	Source: 128-814264.8 Sink: 128-814608.6
	G10PE-H	Source: 128-814242.4
	Mounting Flange 1 Assembly	499-814435.4
	Guide Support Assembly	499-814434.7
	Nipple, Coupling Machined	599-814198.8
	Tube Extended Machined	599-814287.9

6.1 Spare Parts list

Designation	Simrad Part Number
Cover Assy	499-810869.8



Simrad reg. no. 850-814800