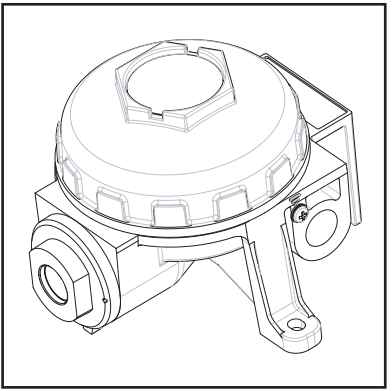
Xgard

Gas Detectors



Installation, operating and maintenance instructions

M07249
May 2004

CROWCON
Gas Detection You Can Trust

Safety information

- **Xgard** gas detectors must be installed, operated and maintained in strict accordance with these instructions, warnings, label information, and within the limitations stated.
- The lid on flameproof versions of **Xgard** must be kept tightly closed until power to the detector is isolated otherwise ignition of a flammable atmosphere can occur. Before removing the cover for maintenance or calibration purposes, ensure the surrounding atmosphere is free of flammable gases or vapours.
- **Xgard** detectors are designed to detect gases or vapours in air, and not inert or oxygen deficient atmospheres. **Xgard** oxygen detectors can measure in oxygen deficient atmospheres.
- Electrochemical cells used in toxic and oxygen versions of **Xgard** contain small volumes of corrosive electrolyte. Care should be observed when replacing cells to ensure that the electrolyte does not come into contact with skin or eyes.
- Maintenance and calibration operations must only be performed by qualified service personnel.
- Only genuine Crowcon replacement parts must be used, substitute components may invalidate the certification and warranty of the detector.
- **Xgard** detectors must be protected from extreme vibration, and direct sunlight in hot environments as this may cause the temperature of the detector to rise above its specified limits and cause premature failure.
- This equipment must not be used in a Carbon Disulphide atmosphere.

Hazardous area classifications:

Zone 0: An area classified as Zone 0 will have ignitable concentrations of flammable gases, vapours or liquids either continuously present or present for long periods of time under normal operating conditions. Intrinsically Safe (Exia) detectors are suitable for use in Zone 0, provided they are connected via a suitable zener barrier or galvanic isolator.

Zone 1: An area classified as Zone 1 is likely to have ignitable concentrations of flammable gases, vapours or liquids present under normal operating conditions. Flameproof (Exd) detectors are suitable for use in Zone 1. Intrinsically Safe (Exia) detectors are suitable for use in Zone 1, provided they are connected via a suitable zener barrier or galvanic isolator.

Zone 2: An area classified as Zone 2 is not likely to have ignitable concentrations of flammable gases, vapours or liquids present under normal operating conditions. Flameproof (Exd) detectors are suitable for use in Zone 2. Intrinsically Safe (Exia) detectors are suitable for use in Zone 2, provided they are connected via a suitable zener barrier or galvanic isolator.

Notes:

In North America 'Divisions' are used to categorise risk where:

Division 1 is equivalent to Zone 0 or 1

Division 2 is equivalent to Zone 2

Under European ATEX rules hazardous area equipment has been re-defined under 'equipment categories' where:

Equipment Category 1 is suitable for Zone 0

Equipment Category 2 is suitable for Zone 1

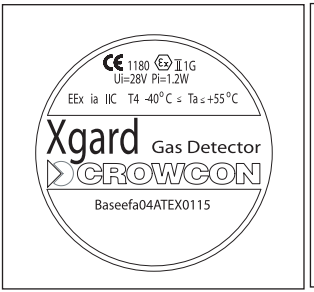
Equipment Category 3 is suitable for Zone 2

Product overview

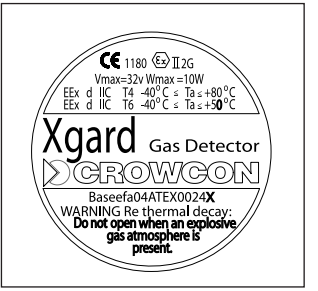
Xgard are a family of gas detectors for monitoring a very wide range of toxic and flammable gases and oxygen. **Xgard** are available as either Intrinsically Safe (Exia) or Flameproof (Exd) detectors, dependant upon sensor type and customer preference. Intrinsically Safe versions are suitable for use in Zone 0, 1 or 2 hazardous areas when used with a suitable Zener barrier or galvanic isolator. Flameproof versions are suitable for use in Zone 1 or 2 hazardous areas.

Please refer to the certification label on the detector junction box to identify the type of certification that relates to the product supplied. Hazardous area definitions are shown in the Hazardous area classifications section on page 3.

Note: if no certification label is fitted to the junction box, the detector is not certified for use in hazardous areas.



Intrinsically safe certification label



Flameproof certification label

Diagram 1: ***Xgard*** *certification labels*

Each type of **Xgard** detector is identified by a label fitted on the junction box body. Please quote the 'model number', 'gas range' and 'sensor type' when contacting Crowcon for advice or spares.

This manual covers all versions of **Xgard**, care should be taken to ensure that the correct section is referenced according to the type of detector used. The **Xgard** detector type is detailed on the product label. The **Xgard** range is as shown:

Type 1: Intrinsically safe toxic and oxygen gas detector

Type 2: Flameproof toxic and oxygen gas detector

Type 3: Flameproof flammable gas detector

Type 4: Flameproof high temperature flammable gas detector

Type 5: Flameproof flammable gas detector with 4-20mA output

Type 6: Flameproof thermal conductivity type gas detector

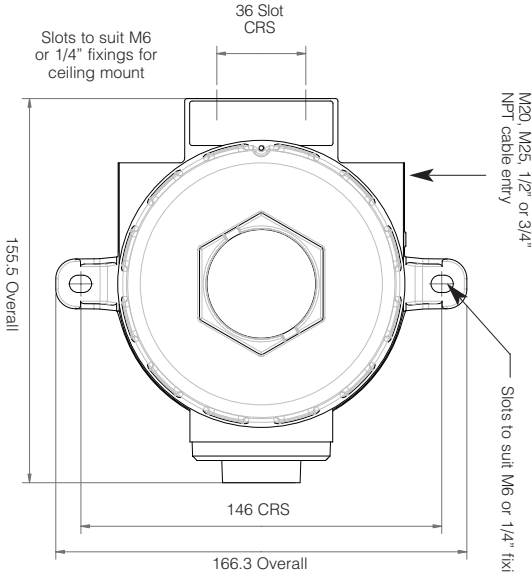
Type 7: Flameproof Sulphistor hydrogen sulphide gas detector

Product description

Xgard comprises of a universal assembly to accommodate the full range of toxic, flammable and oxygen gas sensors. The assembly comprises five main parts; the junction box, junction box lid, amplifier/terminal PCB, sensor PCB and sensor retainer. These are shown in exploded form in Diagram 3.

A cover is fitted over the amplifier PCB to provide protection when the junction box is opened. This cover is designed to allow access to all cable terminals, test points and potentiometers without the need for removal. The modular sensor retainer is supplied without an insert for I.S. versions, and with a sinter assembly for Flameproof versions.

The junction box is manufactured from marine grade aluminium with a durable polyester coating (stainless steel option is available), and is used for both Flameproof and Intrinsically Safe versions. The junction box is supplied with 1 x M20, M25, ½" or ¾"NPT cable gland entry, on the right hand side for customer use. The junction box is suitable for fixing on the wall or ceiling using M6 fixings. Cable gland adaptors are available if required (see Spare parts and accessories section).



All dimensions in millimetres

Diagram 2: ***Xgard*** *dimensioned view*

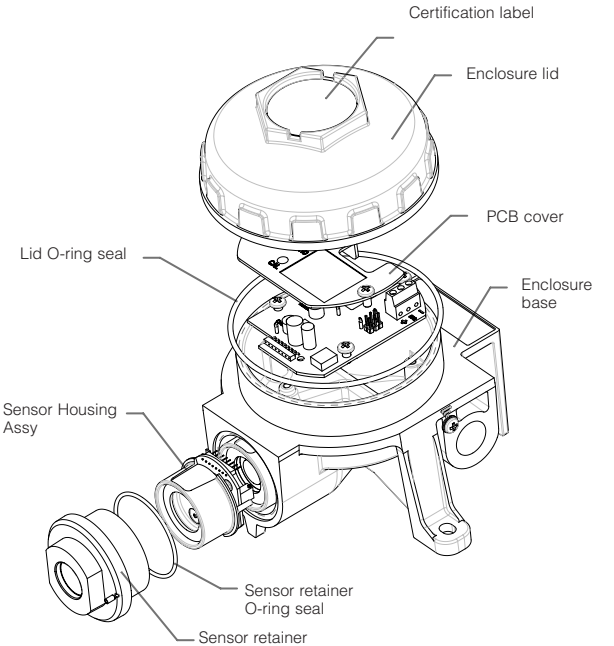


*Diagram 3: **Xgard** exploded view*

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1.1 Intrinsically safe toxic and oxygen gas detector

This version of **Xgard** is an Intrinsically safe loop-powered (current-sink) 4-20mA toxic or oxygen gas detector, designed to detect a wide range of gases when fitted with the appropriate electrochemical sensor. The detector is certified Ex II 1 G EEx ia IIC T4, and is suitable for use in Zone 0, Zone 1 and Zone 2 hazardous areas when used with a suitable Zener barrier or galvanic isolator.

Electrical connections to the detector are made via the terminal block on the amplifier PCB shown below. The amplifier provides power to the sensor, and converts the sensor signal into a 4-20mA signal for connection to a control panel.

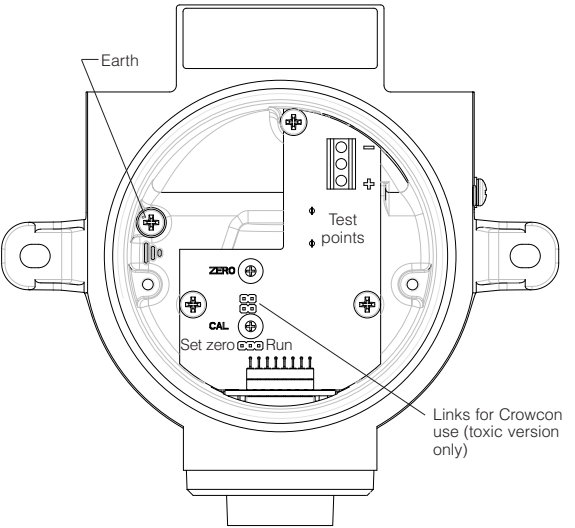


*Diagram 4: **Xgard** Type 1 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 0, Zone 1 and Zone 2 hazardous areas, and is certified Ⓔx II 1 G EEx ia IIC T4 when used with a suitable Zener barrier or galvanic isolator. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level and Crowcon recommend the use of a collector cone **(Part No. C01051)** and accessory adaptor **(Part No. M04666)**.
- To detect heavier than air gases, detectors should be mounted at low level.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a Spray Deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666).**
- Mounting of oxygen detectors requires knowledge of the gas displacing the oxygen. For example, carbon dioxide is heavier than air and collects in low lying areas. It will displace oxygen and so detectors should be placed at low level.
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, ammonia is normally lighter than air, but if released from a cooling system, the gas may fall rather than rise.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of 2-core screened cable with a minimum cross-sectional area of 0.5mm^2 (20awg). Suitable weatherproof cable glands must be used. Intrinsically Safe cables should be identified by some means, for example coloured blue. Alternative cabling techniques such as steel conduit may be acceptable provided appropriate standards are met.

Xgard requires a dc supply of 8-30 volts and is loop powered (if mounted in a hazardous area, do not apply a voltage higher than the maximum rating of the Zener barrier, typically 28 volts). Ensure there is a minimum of 8 volts at the detector, taking into account the voltage drop due to cable resistance, the Zener barrier (if fitted) and the sense resistance of the control panel to which it is connected.

For example, a nominal dc supply at the control panel of 24 volts has a guaranteed minimum supply of 19.5 volts. The circuit may demand up to 20 mA. Given a sense resistor in the control panel of 232 Ohms the maximum voltage drop allowed due to cable resistance is 6.8 volts. The maximum loop resistance allowed is 340 Ohms (approx.).

A 1.5 mm^2 cable will typically allow cable runs up to 14 km. Table 1 below shows the maximum cable distances given typical cable parameters.

C.S.A.		Resistance (Ohms per km)		Max. Distance (km)	Max. Distance with 330 Ω Zener barrier km
mm^2	Awg	Cable	Loop		
1.0	17	18.1	36.2	9.4	0.35
1.5	15	12.1	24.2	14	0.5
2.5	13	7.4	14.8	23	0.85

Table 1: Maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5 mm^2 (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the amplifier PCB in the junction box. The terminals are marked '+' and '-' and correct polarity should be observed when connecting the detector to control equipment. This version of **Xgard** is a 4-20 mA current sink device, and requires a dc supply of 8-30 volts.

Note: The junction box and cable screen must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops and maintain I. S. certification.

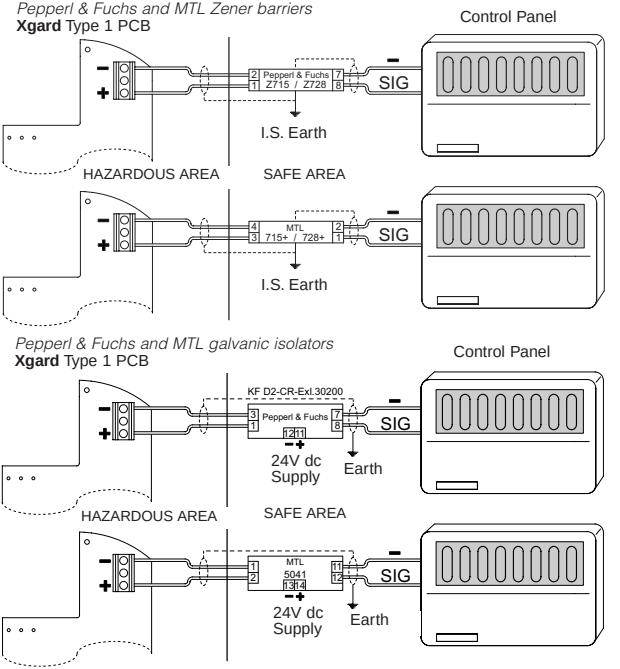


*Diagram 5: **Xgard** Type 1 electrical connections*

WARNING

Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1a Commissioning procedure – toxic types only

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 5.
3. Apply power to the detector and ensure the minimum supply voltage of 8 V dc is present at the '+' and '-' terminals of the detector.
4. Leave the detector to stabilise for at least 1 hour, dependant upon sensor type.
5. Connect a digital volt meter (DVM) to the test points on the amplifier PCB.

   Note: At the test points, Zero will read 40 mV = 4 mA.

   Full scale deflection will read 200 mV = 20 mA.

   Zeroing the detector
6. Ensure you are clean air. Adjust the 'ZERO' pot on the amplifier (which is accessible via a hole in the PCB cover) until the DVM reads 40 mV. Check that the control equipment display reads zero.

   Calibrating the detector
7. Apply calibration gas (concentration should be at least 50% of sensor full-scale) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor (**Part No. C03005**). Contact Crowcon for the supply of calibration gas.
8. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the 'CAL' pot until the DVM reads the appropriate reading. To calculate the reading use the formula and example below:

$$\left(\frac{160}{\text{Range}} \times \text{Gas} \right) + 40 = \text{mV setting}$$

Example: calibrating a 0-250 ppm carbon monoxide sensor using 150 ppm gas.

$$\left(\frac{160}{250} \times 150 \right) + 40 = 136 \text{ mV}$$

9. If the control equipment display requires adjustment consult the operating manual for the equipment.
10. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
11. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
12. The detector is now operational.

3.1b Commissioning procedure – oxygen type only

1. Follow steps 1 to 5 given in 3.1a above.

Zeroing the detector

2. Remove the amplifier PCB cover and move the LINK on the amplifier board from 'RUN' to 'SET ZERO'. Adjust the 'ZERO' pot on the amplifier until the DVM reads 40 mV. Check that the control equipment display reads zero.

Calibrating the detector

3. With normal clean air present at the detector, replace the LINK to 'RUN' on the amplifier board, adjust the 'CAL' pot until the DVM reads 174 mV, (20.9% O_2). Leave the LINK in 'RUN' position and re-fit the PCB cover.
4. If the control equipment display requires adjustment consult the operating manual for the equipment.
5. Follow steps 11 and 12 given in 3.1a above. The detector is now operational.

3.2 Routine maintenance

The operational life of the sensors depends on the application, frequency and amount of gas being seen. Under normal conditions (6 monthly calibration with periodic exposure to CAL gas) the life expectancy of the toxic sensors is 2-3 years. Oxygen sensors must be replaced every two years.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1 above. The calibration frequency should be increased in environments subject to extreme heat and/or dust, and where gas is frequently present.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer.
6. Follow the Commissioning Procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Operating voltage	8–30 V dc
Output	4-20mA Sink (loop powered)
Fault signal	< 3mA
Operating temperature	-20 to +50°C (-4 to +122°F) dependant upon sensor type
Humidity	0–90% RH, non condensing
Degree of protection	IP65, IP66 (when fitted with a weatherproof cap)
Explosion protection	Intrinsically Safe
Approval code	ATEX ⟨Ex⟩ II 1 G EEx ia IIC T4 Tamb = -40 to 55°C UL Class I, Division 1, Groups A, B, C & D
Safety certificate no.	ATEX Baseefa04ATEX0115
Standards	EN50014, EN50020, UL913
Zones	Certified for use in Zone 0, Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups A, B, C, D)
EMC	EN50270

1.1 Flameproof toxic and oxygen gas detector

This version of **Xgard** is a Flameproof loop-powered (current-sink) 4-20mA toxic or oxygen gas detector, designed to detect a wide range of gases when fitted with the appropriate electrochemical sensor. The detector is certified Ⓔx II 2 G EExd IIC T6, and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the amplifier PCB shown below. The amplifier provides power to the sensor, and converts the sensor signal into a 4-20mA signal for connection to a control panel.

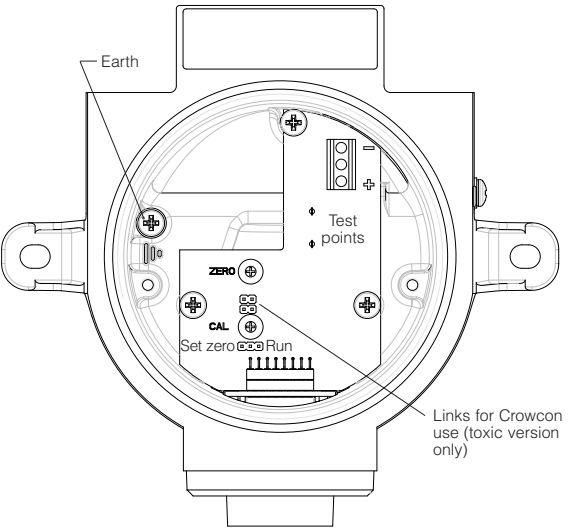


*Diagram 6: **Xgard** Type 2 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified Ⓔx II 2 G EExd IIC T6. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level and Crowcon recommend the use of a collector cone **(Part No. C01051)** and accessory adaptor **(Part No. M04666)**.
- To detect heavier than air gases, detectors should be mounted at low level.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a Spray Deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666).**
- Mounting of oxygen detectors requires knowledge of the gas displacing the oxygen. For example, carbon dioxide is heavier than air and collects in low lying areas. It will displace oxygen and so detectors should be placed at low level.
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, ammonia is normally lighter than air, but if released from a cooling system, the gas may fall rather than rise.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

Xgard requires a dc supply of 8-30 volts and is loop powered. Ensure there is a minimum of 8 volts at the detector, taking into account the voltage drop due to cable resistance and the sense resistance of the control panel to which it is connected.

For example, a nominal dc supply at the control panel of 24 volts has a guaranteed minimum supply of 19.5 volts. The circuit may demand up to 20 mA. Given a sense resistor in the control panel of 232 Ohms the maximum voltage drop allowed due to cable resistance is 6.8 volts. The maximum loop resistance allowed is 340 Ohms (approx.).

A 1.5 mm^2 cable will typically allow cable runs up to 14 km. Table 2 below shows the maximum cable distances given typical cable parameters.

C.S.A.		Resistance (Ohms per km)		Max. Distance (km)
mm^2	Awg	Cable	Loop	
1.0	17	18.1	36.2	9.4
1.5	15	12.1	24.2	14
2.5	13	7.4	14.8	23

Table 2: Maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5 mm^2 (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the amplifier PCB in the junction box. The terminals are marked '+' and '-' and correct polarity should be observed when connecting the detector to control equipment. This version of **Xgard** is a 4-20 mA current sink device, and requires a dc supply of 8-30 volts.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

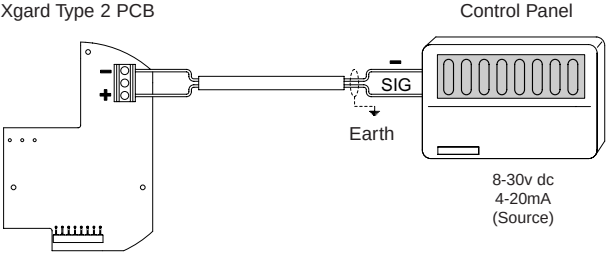


*Diagram 7: **Xgard** Type 2 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1a Commissioning procedure – toxic types only

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 7.
3. Apply power to the detector and ensure the minimum supply voltage of 8 V dc is present at the '+' and '-' terminals of the detector.
4. Leave the detector to stabilise for at least 1 hour, dependant upon sensor type.
5. Connect a digital volt meter (DVM) to the test points on the amplifier PCB.

   Note: At the test points, Zero will read 40 mV = 4 mA.

   Full scale deflection will read 200 mV = 20 mA.

Zeroing the detector

6. Ensure you are clean air. Adjust the 'ZERO' pot on the amplifier (which is accessible via a hole in the PCB cover) until the DVM reads 40 mV. Check that the control equipment display reads zero.

Calibrating the detector

7. Apply calibration gas (concentration should be at least 50% of sensor full-scale) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor (**Part No. C03005**). Contact Crowcon for the supply of calibration gas.
8. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the 'CAL' pot until the DVM reads the appropriate reading. To calculate the reading use the formula and example below:

$$\left(\frac{160}{\text{Range}} \times \text{Gas} \right) + 40 = \text{mV setting}$$

Example: calibrating a 0-250 ppm carbon monoxide sensor using 150 ppm gas.

$$\left(\frac{160}{250} \times 150 \right) + 40 = 136 \text{ mV}$$

9. If the control equipment display requires adjustment consult the operating manual for the equipment.
10. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
11. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
12. The detector is now operational.

3.1b Commissioning procedure – oxygen type only

1. Follow steps 1 to 5 given in 3.1a above.

Zeroing the detector

2. Remove the amplifier PCB cover and move the LINK on the amplifier board from 'RUN' to 'SET ZERO'. Adjust the 'ZERO' pot on the amplifier until the DVM reads 40 mV. Check that the control equipment display reads zero.

Calibrating the detector

3. With normal clean air present at the detector, replace the LINK to 'RUN' on the amplifier board, adjust the 'CAL' pot until the DVM reads 174 mV, (20.9% O_2). Leave the LINK in 'RUN' position and re-fit the PCB cover.
4. If the control equipment display requires adjustment consult the operating manual for the equipment.
5. Follow steps 11 and 12 given in 3.1a above. The detector is now operational.

3.2 Routine maintenance

The operational life of the sensors depends on the application, frequency and amount of gas being seen. Under normal conditions (6 monthly calibration with periodic exposure to CAL gas) the life expectancy of the toxic sensors is 2-3 years. Oxygen sensors must be replaced every two years.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1 above. The calibration frequency should be increased in environments subject to extreme heat and/or dust, and where gas is frequently present.

The sinter should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors, or sinters extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer having first inspected the sinter to make sure that it has not become contaminated. Contaminated items should be replaced (see Spare Parts section for replacement part numbers), as any blockages may result in slow sensor response to gas, and reduced sensitivity.
6. Follow the Commissioning Procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating
	316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs)
	Stainless Steel: 3kg (6.6lbs) approx.
Operating voltage	8–30 V dc
Output	4-20mA Sink (loop powered)
Fault signal	< 3mA
Operating temperature	-20 to +50°C (-4 to +122°F) dependant upon sensor type
Humidity	0–90% RH, non condensing
Degree of protection	IP65, IP66 (when fitted with a weatherproof cap)
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T6 Tamb = -40 to 50°C UL Class I, Division 1, Groups B, C & D
Safety certificate no.	ATEX Baseefa04ATEX0024X
Standards	EN50014, EN50018, UL1203
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups B, C, D)
EMC	EN50270

1.1 Flameproof flammable gas detector

This version of **Xgard** is a Flameproof gas detector, designed to detect flammable gas present in ambient air, at concentrations not exceeding the Lower Explosive Limit (LEL) of the target gas for which it is calibrated. **Xgard** Type 3 operates using pellistors as part of a 3-wire Wheatstone Bridge (WB) circuit, and must be connected to a suitable control card.

The detector is certified Ⓔx II 2 G EExd IIC T6 for operation up to 50°C (120°F), Ⓔx II 2 G EExd IIC T4 for operation up to 80°C (176°F), and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the PCB shown below.

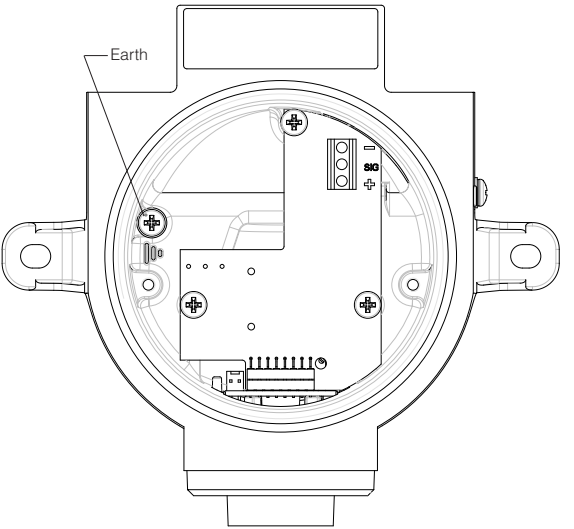


*Diagram 8: **Xgard** Type 3 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified Ⓔx II 2 G EExd IIC T6 for operation up to 50°C (122°F), Ⓔx II 2 G EExd IIC T4 for operation up to 80°C (176°F). Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level and Crowcon recommend the use of a collector cone **(Part No. C01051)** and accessory adaptor **(Part No. M04666)**.
- To detect heavier than air gases, detectors should be mounted at low level.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a Spray Deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666).**
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, butane is normally heavier than air, but if released from a process which is at an elevated temperature and/or pressure, the gas may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

Maximum permissible cable lengths depend on the cable resistance and sensor being used. It is important that the correct bridge voltage be applied to the detector. This will vary depending on the part number of the sensor fitted (see 'Sensor type' on the label fitted to the junction box). Table 3 below summarises the bridge voltage requirements for different sensor types.

Sensor Part No.	Pellistor Type	Bridge Volts (Vdc)	Comment
S011251/S	300P	2.0	Standard for CH_4
S011509/S	VQ21T	2.0	Alternative for CH_4
S011506/S	VQ8	2.5	Lead resistant for leaded petrol
S011712/S	VQ25	2.0	For halogens
S011487/S	VQ41	2.0	For Jet fuel
S011489/S	VQ41	2.0	For Ammonia

Table 3: Sensor options, please contact Crowcon for advice on alternative gases or vapours.

The following cable lengths are calculated assuming a 300mA constant current drive, with a minimum supply of 18 volts dc from the control equipment:

C.S.A.		Resistance (Ohms per km)		Max. Distance (km)	Max. Distance (km)
mm²	Awg	Cable	Loop	2.0 volt pellistors	2.5 volt pellistors
1.0	17	18.1	36.2	1.47	1.42
1.5	15	12.1	24.2	2.2	2.13
2.5	13	7.4	14.8	3.6	3.5

Table 4: maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5mm² (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the PCB in the junction box. The terminals are marked '+', 'sig' and '-' and correct polarity should be observed when connecting the detector to control equipment. This version of **Xgard** operates as part of a 3-wire mV Wheatstone bridge circuit and must be connected to a suitable control card.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

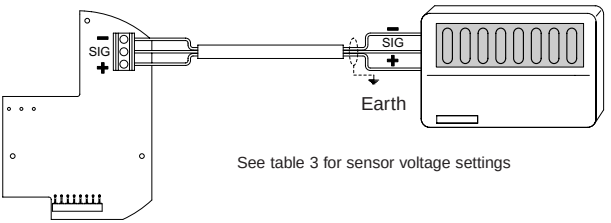


*Diagram 9: **Xgard** Type 3 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1 Commissioning procedure

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 9.
3. Measure the voltage across the '+' and '-' terminals and adjust according to the type of pellistor fitted (see Table 3).
4. Leave the detector to stabilise for at least 1 hour.
5. Balance the WB circuit at the control panel if necessary. Refer to the control equipment instruction manual.

Zeroing the detector

6. Ensure you are clean air. Adjust the control equipment to read zero.

Calibrating the detector

7. Apply calibration gas (concentration should be 50% LEL) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor (**Part No. C03005**). Contact Crowcon for the supply of calibration gas.
8. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the control equipment to read 50% LEL.
9. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
10. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
11. The detector is now operational.

3.2 Routine maintenance

Pellistors can suffer from loss of sensitivity when there is a presence of poisons or inhibitors such as silicones, sulphides, chlorine, lead or halogenated hydrocarbons. Crowcon use poison resistant pellistors to maximise the operational life of **Xgard**. In applications where such compounds are continuously present we recommend the use of Crowcon's fixed point infrared flammable gas detectors, which are immune to such poisons and inhibitors. Please contact Crowcon for further details.

The operational life of the pellistors depends on the application and amount of gas to which the pellistor has been exposed. Under normal conditions (6 monthly calibration with periodic exposure to CAL gas) the life expectancy is 3-5 years.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1.

The sinter should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors, or sinters extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer having first inspected the sinter to make sure that it has not become contaminated. Contaminated items should be replaced (see Spare Parts section for replacement part numbers), as any blockages may result in slow sensor response to gas, and reduced sensitivity.
6. Follow the Commissioning Procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Electrical output	3-wire mV bridge. Typically 12-15mV per % LEL CH_4
Operating temperature	-40 to +80°C (-40 to +176°F)
Humidity	0–99% RH, non condensing
Degree of protection	IP55, IP66 (when fitted with a weatherproof cap)
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T6 Tamb = -40 to 50°C ATEX ⟨Ex⟩ II 2 G EExd IIC T4 Tamb = -40 to +80°C UL Class I, Division 1, Groups B, C & D
Safety certificate no.	ATEX Baseefa04ATEX0024X
Standards	EN50014, EN50018, UL1203
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups B, C, D)
EMC	EN50270

1.1 Flameproof high temperature flammable gas detector

This version of **Xgard** is a Flameproof high temperature(150°C / 302°F) gas detector, designed to detect flammable gas present in ambient air, at concentrations not exceeding the Lower Explosive Limit (LEL) of the target gas for which it is calibrated. **Xgard** Type 4 operates using pellistors as part of a 3-wire Wheatstone Bridge (WB) circuit, and must be connected to a suitable control card. The detector is certified Ⓔx II 2 G EExd IIC T3, and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the PCB shown below.

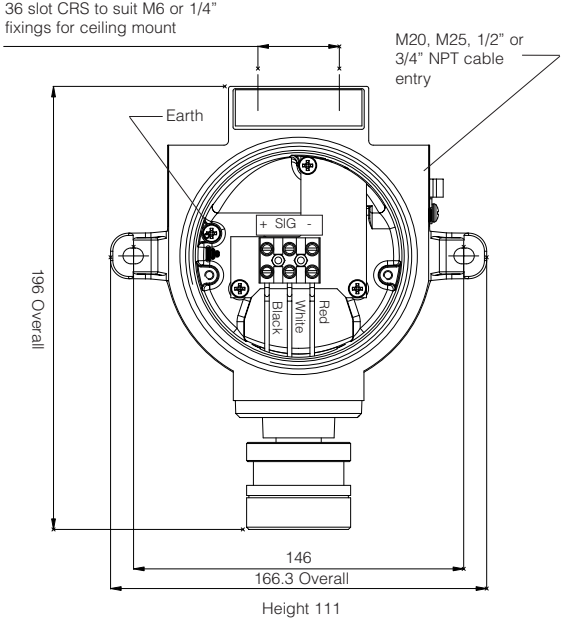


*Diagram 10: **Xgard** Type 4 dimensioned view (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified ⟨Ex⟩ II 2 G EExd IIC T3. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level.
- To detect heavier than air gases, detectors should be mounted at low level.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding.
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, butane is normally heavier than air, but if released from a process which is at an elevated temperature and/or pressure, the gas may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met. The cable selected must be suitable for use in temperatures of up to 150°C (302°F).

Maximum permissible cable lengths depend on the cable resistance and sensor being used. It is important that the correct bridge voltage be applied to the detector. This will vary depending on the part number of the sensor fitted (see 'Sensor type' on the label fitted to the junction box). Table 5 below summarises the bridge voltage requirements for different sensor types.

VQ600H Detector Part No.	Pellistor Type	Bridge Volts (Vdc)	Comment
C01883	VQ21T	2.0	Poison resistant
C01884	VQ41	2.0	Fuel vapours/ammonia

Table 5: Bridge voltage settings

The following cable lengths are calculated assuming a 300mA constant current drive, with a minimum supply of 18 volts dc from the control equipment:

C.S.A.		Resistance (Ohms per km)		Max. Distance (km)	Max. Distance (km)
mm^2	Awg	Cable	Loop	2.0 volt pellistors	2.5 volt pellistors
1.0	17	18.1	36.2	1.47	1.42
1.5	15	12.1	24.2	2.2	2.13
2.5	13	7.4	14.8	3.6	3.5

Table 6: maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5mm^2 (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the PCB in the junction box. The terminals are marked '+', 'sig' and '-' and correct polarity should be observed when connecting the detector to control equipment. This version of **Xgard** operates as part of a 3-wire mV Wheatstone bridge circuit and must be connected to a suitable control card.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

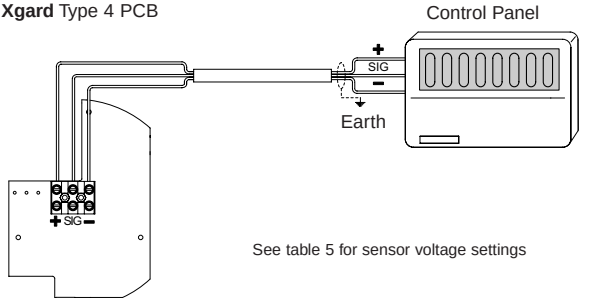


*Diagram 11: **Xgard** Type 4 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1 Commissioning procedure

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 11.
3. Measure the voltage across the '+' and '-' terminals and adjust according to the type of pellistor fitted (see Table 5).
4. Leave the detector to stabilise for at least 1 hour.
5. Balance the WB circuit at the control panel if necessary. Refer to the control equipment instruction manual.

Zeroing the detector

6. Ensure you are clean air. Adjust the control equipment to read zero.

Calibrating the detector

7. Apply calibration gas (concentration should be 50% LEL) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor (**Part No. C01886**). Contact Crowcon for the supply of calibration gas.
8. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the control equipment to read 50% LEL.
9. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
10. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
11. The detector is now operational.

3.2 Routine maintenance

Pellistors can suffer from loss of sensitivity when there is a presence of poisons or inhibitors such as silicones, sulphides, chlorine, lead or halogenated hydrocarbons. Crowcon use poison resistant pellistors to maximise the operational life of **Xgard**. In applications where such compounds are continuously present we recommend the use of Crowcon's fixed point infrared flammable gas detectors, which are immune to such poisons and inhibitors. Please contact Crowcon for further details.

The operational life of the pellistors depends on the application and amount of gas to which the pellistor has been exposed. Under normal conditions (6 monthly calibration with periodic exposure to CAL gas) the life expectancy is 3-5 years.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1.

Xgard Type 4 uses a VQ600H high temperature detector, which incorporates a sinter. The VQ600H detector has no user servicable parts, thus the complete unit must be replaced if it fails to calibrate during routine tests.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors extremely simple. **Xgard** Type 4 uses a VQ600H high temperature detector, which must be replaced as a whole.

A detailed view of **Xgard** Type 4 is given in Diagram 10.

The following procedure may be followed when servicing a **Xgard** Type 4.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3 Remove the PCB cover.
4. Loosen the terminals retaining the VQ600H detector wires.
5. Unscrew the VQ600H detector.
6. Fit the replacement detector taking care to ensure the wires do not become twisted. Ensure the new detector is securely tightened.
7. Re-connect the detector wires as shown in Diagram 10.
8 Re-fit the PCB cover.
9. Follow the commissioning procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	195 x 166 x 111 mm (7.6 x 6.5 x 4.3 inches)
Weight	Alloy: 1.5kg (3.3 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Electrical output	3-wire mV bridge. Typically 10mV per % LEL CH_4 (Minimum)
Operating temperature	-20 to +150°C (-4 to +302°F)
Humidity	0–99% RH, non condensing
Degree of protection	IP54
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T3 Tamb -20°C to +150°C FM Class I, Division 1, Groups B, C & D
Safety certificate no. Junction Box VQ600H detector	 Baseefa04ATEX0024X BAS01ATEX2110X
Standards Junction Box VQ600H detector	 EN50014, EN50018, UL1203 EN50014, EN50018, FM:3600, 3615
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (FM groups B,C,D)
EMC	EN50270

1.1 Flameproof flammable gas detector

This version of **Xgard** is a Flameproof gas detector, designed to detect flammable gas present in ambient air, at concentrations not exceeding the Lower Explosive Limit (LEL) of the target gas for which it is calibrated. **Xgard** Type 5 is powered by 24vDC (nominally) and provides a 4-20mA signal (sink or source) proportional to the gas concentration. The detector is certified Ⓔx II 2 G EExd IIC T6, and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the PCB shown below.

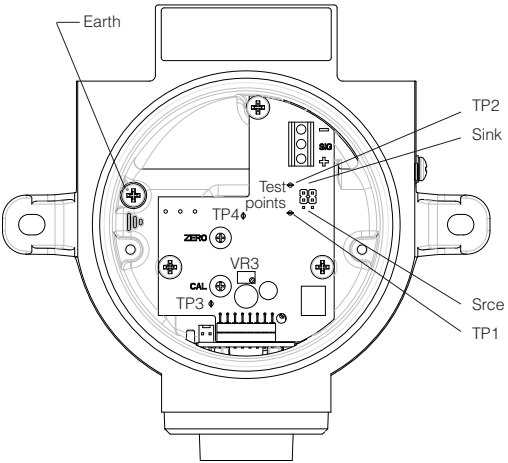


*Diagram 12: **Xgard** Type 5 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified Ⓔx II 2 G EExd IIC T6. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level and Crowcon recommend the use of a collector cone **(Part No. C01051)** and accessory adaptor **(Part No. M04666)**.
- To detect heavier than air gases, detectors should be mounted at low level.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a Spray Deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666).**
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, butane is normally heavier than air, but if released from a process which is at an elevated temperature and/or pressure, the gas may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

Xgard Type 5 requires a dc supply of 10-30 volts, at up to 100mA. Ensure there is a minimum of 10 volts at the detector, taking into account the voltage drop due to cable resistance. For example, a nominal dc supply at the control panel of 24 volts has a guaranteed minimum supply of 18 volts. The maximum voltage drop is therefore 8 volts. **Xgard** Type 5 can demand up to 100mA and so the maximum loop resistance allowed is 80 Ohms.

A 1.5mm^2 cable will typically allow cable runs up to 3.3km. Table 7 below shows the maximum cable distances given typical cable parameters.

C.S.A.		*Resistance (Ohms per km)*		*Max. Distance*
mm^2	**Awg**	**Cable**	**Loop**	***(km)***
1.0	17	18.1	36.2	2.2
1.5	15	12.1	24.2	3.3
2.5	13	7.4	14.8	5.4

Table 7: maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5mm^2 (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the PCB in the junction box. The terminals are marked '+', 'sig' and '-' and correct polarity should be observed when connecting the detector to control equipment. **Xgard** Type 5 is factory set as a 'current sink' device unless otherwise specified when ordering. To reset to 'current source', open the junction box and move the two links on the amplifier PCB from the 'sink position to the 'srce' position, as shown in Diagram 12.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

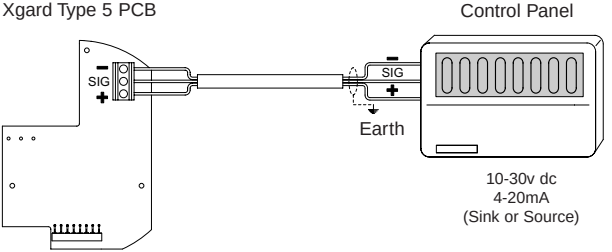


*Diagram 13: **Xgard** Type 5 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1 Commissioning procedure

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct, as shown in Diagram 13.
3. Measure the voltage across the '+' and '-' terminals and check a minimum supply of 10V d.c. is present.
4. Leave the detector to stabilise for at least 1 hour.
5. Before calibration of the detector can commence, the pellistors must be balanced. To do this remove the PCB cover, and connect a digital volt meter (DVM) to the test points marked 'TP3' and 'TP4' on the amplifier PCB, as shown in Diagram 12). The DVM should be set to the dc mV range, and the potentiometer marked 'VR3' should be adjusted until the DVM reads 0.00mV. The PCB cover can now be replaced.
6. To zero the detector, reconnect the DVM to the test points marked 'TP1' and 'TP2' on the amplifier PCB, as shown in Diagram 12.

   Note: At the test points, Zero will read 40 mV = 4 mA.

   Full scale deflection (100% LEL) will read 200 mV = 20 mA. There is a current clamp of 25mA on the 4-20mA output.

   Zeroing the detector
7. **Ensure you are clean air**. Adjust the 'ZERO' pot on the amplifier (which is accessible via a hole in the PCB cover) until the DVM reads 40 mV. Check that the control equipment display reads zero.

   Calibrating the detector
8. Apply calibration gas (concentration should be 50% LEL) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor (**Part No. C03005**). Contact Crowcon for the supply of calibration gas.
9. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the 'CAL' pot until the DVM reads the appropriate reading (ie 120mV = 12mA = 50% LEL). If the concentration of the calibration gas used is not 50% LEL, the following formula can be used to calculate the reading:

$$\left(\frac{160}{\text{Range}} \times \text{Gas} \right) + 40 = \text{mV setting}$$

Example: calibrating using 25% LEL test gas

$$\left(\frac{160}{100} \times 25 \right) + 40 = 80 \text{ mV}$$

10. If the control equipment display requires adjustment consult the operating manual for the equipment.
11. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
12. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
13. The detector is now operational.

3.2 Routine maintenance

Pellistors can suffer from loss of sensitivity when there is a presence of poisons or inhibitors such as silicones, sulphides, chlorine, lead or halogenated hydrocarbons. Crowcon use poison resistant pellistors to maximise the operational life of **Xgard**. In applications where such compounds are continuously present we recommend the use of Crowcon's fixed point infrared flammable gas detectors, which are immune to such poisons and inhibitors. Please contact Crowcon for further details.

The operational life of the pellistors depends on the application and amount of gas to which the pellistor has been exposed. Under normal conditions (6 monthly calibration with periodic exposure to CAL gas) the life expectancy is 3-5 years.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1.

The sinter should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors, or sinters extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer having first inspected the sinter to make sure that it has not become contaminated. Contaminated items should be replaced (see Spare Parts section for replacement part numbers), as any blockages may result in slow sensor response to gas, and reduced sensitivity.
6. Follow the Commissioning Procedure given in 3.1.

Sensor Part No.	Pellistor Type	Bridge Volts (Vdc)	Comment
S011251/S	300P	2.0	Standard for CH_4
S011509/S	VQ21T	2.0	Alternative for CH_4
S011506/S	VQ8	2.5	Lead resistant for leaded petrol
S011712/S	VQ25	2.0	For halogens
S011487/S	VQ41	2.0	For Jet fuel
S011489/S	VQ41	2.0	For Ammonia

Table 8: Sensor options, please contact Crowcon for advice on alternative gases or vapours.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Operating voltage	10-30V dc
Current consumption	100mA @ 10V 50mA @ 24V
Output	4-20mA Sink or Source (Selected by Links)
Fault signal	< 3mA
Maximum cable loop resistance	80 Ohms @ 18V (power) +ve terminal 450 Ohms @ 18V (signal) sig terminal Relative to -ve terminal (common)
Operating temperature	-40 to +55°C (-40 to +131°F)
Humidity	0–99% RH, non condensing
Degree of protection	IP65, IP66 (when fitted with a weatherproof cap)
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T6 Tamb -40°C to 50°C ATEX ⟨Ex⟩ II 2 G EExd IIC T4 Tamb -40°C to 80°C UL Class I, Division 1, Groups B, C & D
Safety certificate no.	Baseefa04ATEX0024X
Standards	EN50014, EN50018, UL1203
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups B,C,D)
EMC	EN50270

1.1 Flameproof thermal conductivity type gas detector

This version of **Xgard** is a Flameproof thermal conductivity type gas detector, designed to monitor binary gas mixtures (such as hydrogen in nitrogen, methane in carbon dioxide) in % volume concentrations. The detector relies on there being a substantial difference in the thermal conductivity properties of the gases in the mixture being monitored. Precautions should be taken to ensure that humidity in the gas mixture is kept to a minimum, and the operating temperature remains stable, otherwise the sensor readings may be affected. For a list of gas mixtures that can be detected using **Xgard** Type 6 please contact Crowcon. **Xgard** Type 6 is powered by 24vDC (nominally) and provides a 4-20mA signal (sink or source) proportional to the gas concentration. The detector is certified Ex II 2 G EExd IIC T6, and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the PCB shown below.

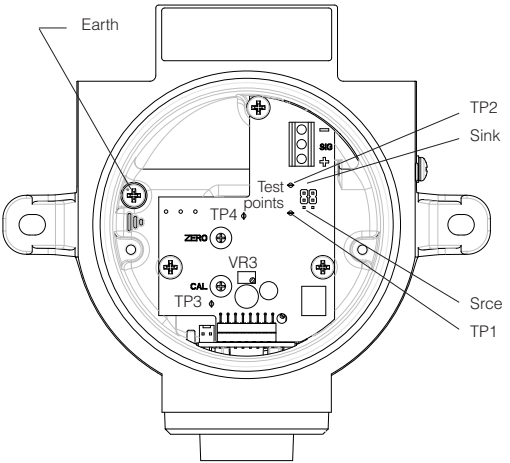


*Diagram 14: **Xgard** Type 6 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified ⟨Ex⟩ II 2 G EExd IIC T6. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

The detector should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, detectors should be mounted at high level and Crowcon recommend the use of a collector cone **(Part No. C01051)** and accessory adaptor **(Part No. M04666)**.
- To detect heavier than air gases, detectors should be mounted at low level.
- If the detector is to be used to monitor gas in a sample line rather than ambient conditions, a flow adaptor is available for 6mm (1/4") o/d pipe **(Part No. C01339)**. Crowcon recommend a flow rate of 0.5 - 1 litre/minute, and the sample gas must be suitably filtered to remove dust and moisture.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a Spray Deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666).**
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. For example, butane is normally heavier than air, but if released from a process which is at an elevated temperature and/or pressure, the gas may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

Xgard Type 6 requires a dc supply of 10-30 volts, at up to 100mA. Ensure there is a minimum of 10 volts at the detector, taking into account the voltage drop due to cable resistance. For example, a nominal dc supply at the control panel of 24 volts has a guaranteed minimum supply of 18 volts. The maximum voltage drop is therefore 8 volts. **Xgard** Type 6 can demand up to 100mA and so the maximum loop resistance allowed is 80 Ohms.

A 1.5mm^2 cable will typically allow cable runs up to 3.3km. Table 9 below shows the maximum cable distances given typical cable parameters.

C.S.A.		*Resistance (Ohms per km)*		*Max. Distance*
mm^2	**Awg**	**Cable**	**Loop**	***(km)***
1.0	17	18.1	36.2	2.2
1.5	15	12.1	24.2	3.3
2.5	13	7.4	14.8	5.4

Table 9: maximum cable distances for typical cables

The acceptable cross sectional area of cable used is 0.5 to 2.5mm^2 (20 to 13awg). **The table is provided for guidance only, actual cable parameters for each application should be used to calculate maximum cable distances.**

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the PCB in the junction box. The terminals are marked '+', 'sig' and '-' and correct polarity should be observed when connecting the detector to control equipment. **Xgard** Type 6 is factory set as a 'current sink' device unless otherwise specified when ordering. To reset to 'current source', open the junction box and move the two links on the amplifier PCB from the 'sink' position to the 'srce' position, as shown in Diagram 14.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

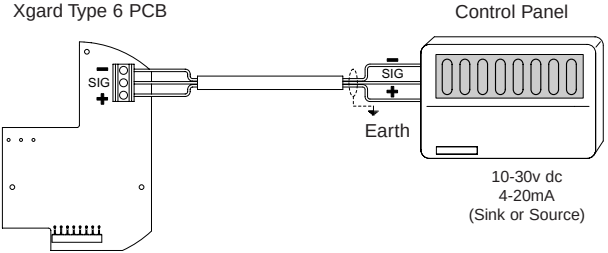


*Diagram 15: **Xgard** Type 6 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1 Commissioning procedure

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 15.
3. Measure the voltage across the '+' and '-' terminals and check a minimum supply of 10V d.c. is present.
4. Leave the detector to stabilise for at least 1 hour.
5. Before calibration of the detector can commence, the thermal conductivity sensor must be balanced. To do this remove the PCB cover, and connect a digital volt meter (DVM) to the test points marked 'TP3' and 'TP4' on the amplifier PCB, as shown in Diagram 14. The DVM should be set to the dc mV range.

   Check the detector label for details of the background gas. This is normally air, carbon dioxide, nitrogen or argon. Apply a sample of the background gas (100% volume concentration) to the sensor at a flow rate of 0.5 – 1 litre/minute via a flow adaptor **(Part No. C03005)**. If the background gas is air, the sensor may simply be exposed to ambient **clean** air. The potentiometer marked 'VR3' should be adjusted until the DVM reads 0.00mV. The PCB cover can now be replaced.
6. Reconnect the DVM to the test points marked 'TP1' and 'TP2' on the amplifier PCB, as shown in Diagram 14.

   Note: At the test points, Zero will read 40 mV = 4 mA.

   Full scale deflection will read 200 mV = 20 mA. There is a current clamp of 25mA on the 4-20mA output.

   Zeroing the detector
7. Check the detector label for details of the background gas. This is normally air, carbon dioxide, nitrogen or argon. Apply a sample of the background gas (100% volume concentration) to the sensor at a flow rate of 0.5 – 1 litre/minute via a flow adaptor **(Part No. C03005)**. If the background gas is air, the sensor may simply be exposed to ambient **clean** air. Adjust the 'ZERO' pot on the amplifier (which is accessible via a hole in the PCB cover) until the DVM reads 40 mV. Check that the

control equipment display reads zero.

Calibrating the detector

8. Apply calibration gas (which should either be 100% volume target gas, or be a representative mix of the required range, for example 60% CH_4 / 40% CO_2) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor **(Part No. C03005)**. Contact Crowcon for the supply of calibration gas.
9. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the 'CAL' pot until the DVM reads the appropriate reading (200mV if 100% volume target gas is used). Use the following formula to calculate the DVM reading if the target gas concentration in the calibration gas is lower than 100% volume:

$$\left(\frac{160}{\text{Range}} \times \text{Gas} \right) + 40 = \text{mV setting}$$

Where the 'Range' is the maximum value of the target gas, and 'Gas' is the concentration of the target gas in the calibration mixture.

Example: calibrating a detector to measure 0-100% volume methane in carbon dioxide, using 60% CH_4 / 40% CO_2 calibration gas:

$$\left(\frac{160}{100} \times 60 \right) + 40 = 136 \text{ mV}$$

10. If the control equipment display requires adjustment consult the operating manual for the equipment.
11. .Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
12. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
13. The detector is now operational.

Note: **Xgard** Type 6 will only measure reliably when exposed to a gas mixture for which it is calibrated. If, for example, a detector is calibrated for a CH_4 / CO_2 mixture, but exposed to air, erroneous signals will be produced.

3.2 Routine maintenance

The operational life of the sensor depends on the application for which it is being used. It is expected that a thermal conductivity sensor will work satisfactorily for up to 5 years in ideal conditions. Sensors are prone to damage by vibration and shock, so measures should be taken to ensure that the detector is not affected by these influences.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1.

The sinter should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors, or sinters extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer having first inspected the sinter to make sure that it has not become contaminated. Contaminated items should be replaced (see Spare Parts section for replacement part numbers), as any blockages may result in slow sensor response to gas, and reduced sensitivity.
6. Follow the Commissioning Procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Operating voltage	10-30V dc
Current consumption	100mA @ 10V 50mA @ 24V
Output	4-20mA Sink or Source (Selected by Links)
Fault signal	< 3mA
Maximum cable loop resistance	80 Ohms @ 18V (power) +ve terminal 450 Ohms @ 18V (signal) sig terminal Relative to -ve terminal (common)
Operating temperature	+10 to +55°C (50 to +131°F)
Humidity	0–90% RH, non condensing
Degree of protection	IP65, IP66 (when fitted with a weatherproof cap)
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T6 Tamb -40°C to 50°C ATEX ⟨Ex⟩ II 2 G EExd IIC T4 Tamb -40°C to 80°C UL Class I, Division 1, Groups B, C & D
Safety certificate no.	Baseefa04ATEX0024X
Standards	EN50014, EN50018, UL1203
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups B, C, D)
EMC	EN50270

1.1 Flameproof hydrogen sulphide gas detector

This version of **Xgard** is a Flameproof Sulphistor type gas detector, designed to detect hydrogen sulphide gas present in ambient air, in the range 0-100ppm.

Xgard Type 7 is available in two versions: a 4-20mA version for connection to general control systems, and a mV bridge version which must be connected to a dedicated control card such as the DI 4-11, DI-850, DI-860, and DI-800UN (contact Crowcon for details). To identify the type of detector supplied, refer to the junction box label.

As with all gas sensors, the Sulphistor is cross-sensitive to some substances other than the gas which it is designed to detect. The major cross-sensitivity arises from alcohols, which are often found in paints, degreasing fluids, paint strippers and also in some oils used for mud lubrication in oil production operations. Care should be exercised when operating **Xgard** Type 7 in areas where such substances may be present.

The detector is certified ⟨Ex⟩ II 2 G EExd IIC T6, and is suitable for use in Zone 1 and Zone 2 hazardous areas.

Electrical connections to the detector are made via the terminal block on the PCB shown below.

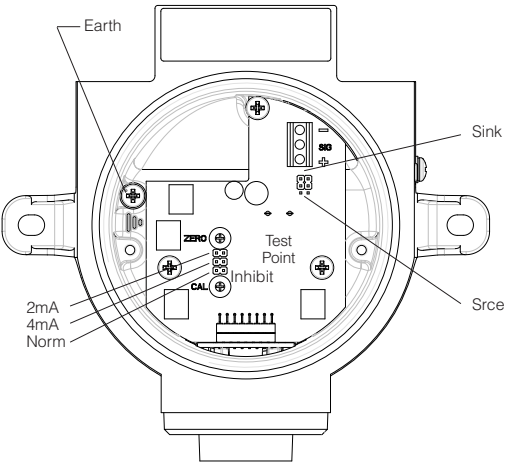


*Diagram 16: **Xgard** Type 7 PCB layout (Shown with PCB cover removed).*

WARNING
This detector is designed for use in Zone 1 and Zone 2 hazardous areas, and is certified Ⓔx II 2 G EExd IIC T6. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.
For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.

2.1 Location

Hydrogen sulphide is a highly toxic gas with a density slightly greater than air, and will therefore tend to settle low down in still air conditions. However, it also diffuses readily into air and does not behave like a vapour such as propane which will form pools. Since the toxic risk from hydrogen sulphide is by ingestion through the mouth and nose, it is recommended that detectors are mounted at head height.

The following points should also be noted when locating **Xgard** Type 7:

- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors Crowcon recommend the use of a spray deflector **(Part No. C01052)** and accessory adaptor **(Part No. M04666)**.
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount detectors in ventilation ducts if appropriate.
- Consider the process conditions. Gas released from a process which is at an elevated temperature or pressure may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion, the plant processing equipment as well as safety and engineering issues. **The agreement reached on the locations of sensors should be recorded.** Crowcon would be pleased to assist in the selection and siting of gas detectors.

2.2 Mounting

Xgard should be installed at the designated location with the sensor pointing down. This ensures that dust or water will not collect on the sensor and stop gas entering the cell. The mounting detail is shown in Diagram 2. Care should be taken when installing the detector to avoid damaging the painted surface of the junction box and sensor retainer.

2.3 Cabling requirement

Cabling to **Xgard** must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the detector.

Crowcon recommend the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

Xgard Type 7 4-20mA Version requires a dc supply of 10-30 volts, at up to 350mA. Ensure there is a minimum of 10V at the detector, taking into account the voltage drop due to cable resistance.

For example, a nominal dc supply at the control panel of 24 volts has a guaranteed minimum supply of 18 volts. The maximum voltage drop is therefore 8 volts. **Xgard** Type 7 can demand up to 350mA and so the maximum loop resistance allowed is 22 Ohms. A 1.5 mm^2 cable will typically allow cable runs up to 900m. Table 10 below shows the maximum cable distances given typical cable parameters.

Xgard Type 7 mV Bridge Version must only be connected to a suitable dedicated control card such as the DI 4-11, DI-850, DI-860, and DI-800UN. The supply voltage must be set to 6.5V dc, measured between the detector '+' and '-' terminals (care should be taken to ensure correct polarity, as incorrect connection will damage the sensor). The sensor can demand up to 400mA and so the maximum loop resistance allowed is 21 Ohms (assuming a supply of 18 volts). A 1.5 mm^2 cable will typically allow cable runs up to 900m. Table 10 below the shows maximum cable distances given typical cable parameters.

C.S.A.		*Resistance (Ohms per km)*		*Max. Distance*
mm^2	**Awg**	**Cable**	**Loop**	***(km)***
1.0	17	18.1	36.2	0.6
1.5	15	12.1	24.2	0.9
2.5	13	7.4	14.8	1.5

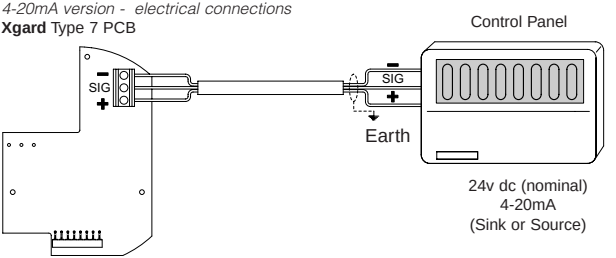
Table 10: maximum cable distances for typical cables (4-20mA and mV bridge versions)

2.4 Electrical connections

All connections are made via the screw terminal block mounted on the PCB in the junction box. The terminals are marked '+', 'sig' and '-' and correct polarity should be observed when connecting the detector to control equipment. **Xgard** Type 7 is factory set as a 'current sink' device unless otherwise specified when ordering. To reset to 'current source', open the junction box and move the two links on the amplifier PCB from the 'sink position to the 'srce' position, as shown in Diagram 16.

Note: The junction box and cable armour must be earthed at the control panel to limit the effects of radio frequency interference. Ensure the earth connection is provided in a safe area only, so as to avoid earth loops.

4-20mA version - electrical connections
Xgard Type 7 PCB



mV bridge version - electrical connections
Xgard Type 7 PCB

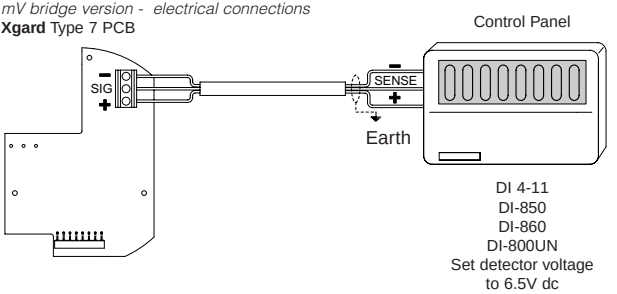


*Diagram 17: **Xgard** Type 7 electrical connections*

WARNING
Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the detector or junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.1a Commissioning procedure 4-20mA Version

Note: the amplifier PCB for this version is fitted with inhibit links (see Diagram 16) to clamp the output signal to either 2mA or 4mA. With the movable link in the 'NORM' position the 4-20mA output signal tracks the gas reading. It is recommended that the link be set to either the '2mA' or '4mA' position before applying power to the detector, to prevent false alarms on the control equipment during commissioning. The link MUST be reset to the 'NORM' position when calibration is completed.

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 17.
3. Measure the voltage across the '+' and '-' terminals and check a minimum supply of 10V dc is present.
4. Leave the sensor to stabilise for at least 24 hours before attempting to zero or calibrate.
5. Connect a digital volt meter (DVM) to the test points on the amplifier PCB, as shown in Diagram 16.

   Note: At the test points, Zero will read 40 mV = 4 mA.

   Full scale deflection (100ppm gas) will read 200 mV = 20 mA. There is a current clamp of 27mA on the 4-20mA output.

Zeroing the detector

6. Ensure the detector is in clean air with no H_2S present. Adjust the 'ZERO' pot on the amplifier (which is accessible via a hole in the PCB cover) until the DVM reads 40 mV. Check that the control equipment display reads zero.

Calibrating the detector

7. Apply calibration gas (which should be 25ppm H_2S in air) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor **(Part No. C03005)**. Contact Crowcon for the supply of calibration gas.

8. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the 'CAL' pot until the DVM reads the appropriate reading (80mV for 25ppm gas). If the concentration of the calibration gas is not 25ppm, use the following formula to calculate the DVM reading:

$$\left(\frac{160}{\text{Range}} \times \text{Gas} \right) + 40 = \text{mV setting}$$

Where the 'Range' is the full scale gas level (ie 100ppm), and 'Gas' is the concentration in the calibration mixture.

Example: calibrating using 50ppm H_2S in air calibration gas:

$$\left(\frac{160}{100} \times 50 \right) + 40 = 120 \text{ mV}$$

9. If the control equipment display requires adjustment consult the operating manual for the equipment (note that an output signal proportional to the gas reading will only be produced when the link is in the 'NORM' position).
10. Remove the gas and allow the sensor to completely settle before re-checking the zero setting. Re-set the inhibit link to 'NORM'.
11. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
12. The detector is now operational.

3.1b Commissioning procedure mV Bridge Version

This detector must only be used with a suitable control card (e.g. DI 4-11, DI-850, DI-860, DI-800UN). Refer to the control card instructions for full details of how to zero and calibrate. It is strongly recommended that the 'head volts' potentiometer on the control card is set to minimum before connecting the detector.

1. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
2. Check that all electrical connections have been made and are correct as per Diagram 17.
3. Measure the voltage across the '+' and '-' terminals adjust the control card until a supply of 6.5V dc is present.
4. Leave the sensor to stabilise for at least 24 hours before attempting to zero or calibrate.

Zeroing the detector

5. Ensure the detector is in clean air with no H_2S present. Adjust the control card to read zero.

Calibrating the detector

6. Apply calibration gas (which should be 25ppm H_2S in air) to the detector at a flow rate of 0.5 - 1 litre/minute via a flow adaptor **(Part No. C03005)**. Contact Crowcon for the supply of calibration gas.
7. Allow the gas reading to stabilise (usually 30 to 60 seconds) and adjust the control card to read 25ppm.
8. Remove the gas and allow the sensor to completely settle before re-checking the zero setting.
9. Close the junction box of the detector ensuring that the lid is securely tightened, and the grub-screw is secured.
10. The detector is now operational.

3.2 Routine maintenance

The operational life of the sensor depends on the application for which it is being used. It is expected that a Sulphistor sensor will work satisfactorily for up to 5 years in ideal conditions.

Site practices will dictate the frequency with which detectors are tested. Crowcon would recommend that detectors be gas tested at least every 6 months and re-calibrated as necessary. To re-calibrate a detector follow the steps given in 3.1. The calibration frequency should be increased in environments subject to extreme heat and/or dust, and where gas is frequently present.

The sinter should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor.

When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product. See the 'Spare parts and accessories' section for the part numbers of replacement O-rings.

3.3 Sensor replacement/servicing of detectors

Xgard uses a modular design, which makes replacement of sensors, or sinters extremely simple. Replacement sensors are supplied fitted to a sensor PCB to allow simple plug-in installation. An exploded view of **Xgard** is given in Diagram 3. The following procedure may be followed when servicing a **Xgard** detector.

WARNING
This work should be carried out by Crowcon or an approved service centre unless suitable training has been received.

1. Switch off and isolate power to the detector requiring attention.
2. Open the junction box of the detector by unscrewing the lid in an anti-clockwise direction (having loosened the retaining grub-screw first).
3. Unscrew the sensor retainer and remove the sensor and sensor PCB.
4. Fit the replacement sensor (having checked that the part number matches that stated on the detector junction box label), taking care to align the locating pins correctly with the slots in the junction box.
5. Re-fit the sensor retainer having first inspected the sinter to make sure that it has not become contaminated. Contaminated items should be replaced (see Spare Parts section for replacement part numbers), as any blockages may result in slow sensor response to gas, and reduced sensitivity.
6. Follow the Commissioning Procedure given in 3.1.

Junction box material	A356 marine grade alloy with polyester powder coating 316 Stainless Steel (optional)
Dimensions	156 x 166 x 111 mm (6.1 x 6.5 x 4.3 inches)
Weight	Alloy: 1kg (2.2 lbs) Stainless Steel: 3kg (6.6lbs) approx.
Operating voltage	mA version: 10-30V dc mV version: 6.5V dc +/- 0.2V dc
Current consumption	350mA @ 10V, 150mA @ 24V
Output	mA version: 4-20mA Sink or Source (Selected by Links) Fault Signal < 3mA mV version: 200mV version @ 10ppm, 400mV @ 100ppm Logarithmic scale
Maximum cable loop resistance (mA version)	22 Ohms @ 18V (power) +ve terminal 450 Ohms @ 18V (signal) sig terminal Relative to -ve terminal (common)
Maximum cable loop resistance (mV version)	21 Ohms @ 18V (power) +ve terminal
Operating temperature	-20 to +65°C (-4 to +149°F) mV version -20 to +55°C (-4 to +131°F) mA version
Humidity	0–99% RH, non condensing
Degree of protection	IP65, IP66 (when fitted with a weatherproof cap)
Explosion protection	Flameproof
Approval code	ATEX ⟨Ex⟩ II 2 G EExd IIC T6 Tamb = -40 to 50°C ATEX ⟨Ex⟩ II 2 G EExd IIC T4 Tamb = -40 to +80°C UL Class I, Division 1, Groups B, C & D

Safety certificate no.	Baseefa04ATEX0024X
Standards	EN50014, EN50018, UL1203
Zones	Certified for use in Zone 1 or Zone 2 (see hazardous area classifications section)
Gas groups	IIA, IIB, IIC (UL groups B,C,D)
EMC	EN50270

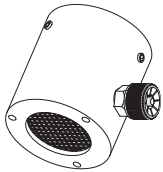
Spare parts and accessories

Please refer to the Sensor Type section on the main junction box label for the correct replacement sensor part number.

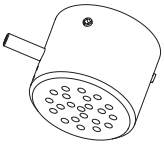
Description Part	Number	Xgard Type
M20 to 1/2" NPTF adaptor	M02125	All Types
M20 to 3/4" NPTF adaptor	M02281	All Types
Calibration adaptor	C03005	All Types*
Calibration cap	C01886	Type 4 only
Accessory adaptor	M04666	All Types*
Weatherproof cap	C01442	All Types*
Collector cone	C01051	All Types*
Spray deflector	C01052	All Types*
Flow adaptor (for sampling applications)	C01339	All Types*
Duct mounting kit	M01844	All Types
Sensor retainer	M01840	Type 1 only
Sensor retainer c/w sinter	M01814	Types 2-7
Sensor retainer O-ring	M04828	All Types
Junction box lid O-ring	M04829	All Types
Amplifier PCB (toxic)	S011328	Types 1 and 2
Amplifier PCB (oxygen)	S011240	Types 1 and 2
Amplifier PCB (flammable, bridge)	S011477	Type 3
Amplifier PCB (flammable, high temperature)	S011720	Type 4
Amplifier PCB (flammable, 4-20 mA)	S011242	Types 5 and 6
Amplifier PCB (Sulphistor 4-20mA)	S011244	Type 7
Amplifier PCB (Sulphistor mV)	S011467	Type 7
PCB Cover	M04770	All Types
Z715 Zener barrier for 12v control systems	C03316	Type 1
Z728 Zener barrier for 24v control systems	C03317	Type 1
Galvanic isolator	C03322	Type 1

* Except Type 4

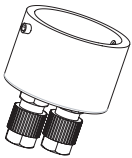
Accessory adaptor



Spray deflector



Weatherproof cap



Flow adaptor

Collector cone

Appendix: Sensor limitations

The sensors used in **Xgard** have limitations common to all such gas sensors, and users should be aware of the points listed below. Crowcon can advise on particular situations and suggest alternative sensors if the instrument is likely to experience extreme conditions.

- Electrochemical sensor performance changes at extremes of temperature; consult Crowcon if the detector will be exposed to ambient temperatures below -20°C or above +40°C (-4 and 104°F).
- Extreme levels of humidity can also cause problems. The sensors are rated for an (average) ambient of 15-90% R.H. However they are used from the tropics to deserts to tundra without this normally presenting a problem.
- Water, contaminants or paint should not be allowed to impede the sensor, as this will prevent gas diffusion. Detectors should be mounted with the sensor pointing down to help prevent this.
- Persistent exposure to certain compounds may contaminate the sensors. Calibration checks should be performed in accordance with the instructions for each detector type to ensure that the sensor is working correctly.
- Persistent exposure to high levels of toxic or flammable gas will shorten the life of the sensor. If the high level gas is corrosive (e.g. hydrogen sulphide) damage may occur over time to metal components.
- Sensors may be cross sensitive to other gases. If unsure, contact Crowcon or your local agent.

There are no rules which dictate the siting and location of detectors, however considerable guidance is available from BS EN50073:1999 'Guide for Selection, Installation, Use and Maintenance of Apparatus for the Detection and Measurement of Combustible Gases or Oxygen'. Similar international codes of practice may be used where applicable. In addition certain regulatory bodies publish specifications giving minimum gas detection requirements for specific applications.

The detector should be mounted where the gas is most likely to be present.

Warranty

This equipment leaves our works fully tested and calibrated. If, within a period of one year from the date of purchase, it is proved to be defective by reason of faulty workmanship or material we undertake, at our option, either to repair or replace it, free of charge, subject to the conditions below.

1 If the purchaser wishes to make any claim for repair or replacement under this guarantee, he shall contact our Customer Care department and obtain a claim number using the contact information detailed below. The purchaser should then return the complete instrument to us at his risk, adequately packed and carriage paid, and include a note of the complaint along with the allotted claim number. The guarantee will be rendered invalid if the instrument is found to have been altered, modified, dismantled, or tampered with.

2 We accept no liability for consequential or indirect loss or damage howsoever arising (including any loss or damage arising out of the use of the instrument) and all liability in respect of any third party is expressly excluded.

3 The guarantee does not cover the accuracy of calibration after the system has been put into use.

4 The guarantee does not include the cosmetic finish of the product, and is dependant upon installation and maintenance of the product in accordance with the procedures set out in the Installation, Operating and Maintenance Instructions.

5 Our liability in respect of defective equipment shall be limited to the obligations set out in the guarantee and any further warranty, condition or statement, express or implied statutory or otherwise as to the merchantable quality of our equipment or its fitness for any particular purpose is excluded except as prohibited by statute. This guarantee shall not affect a customer's statutory rights.

6 Detectors that are returned to Crowcon as faulty, and are subsequently found to be fault-free may be subject to a small handling charge to cover inspection and return shipping costs.

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