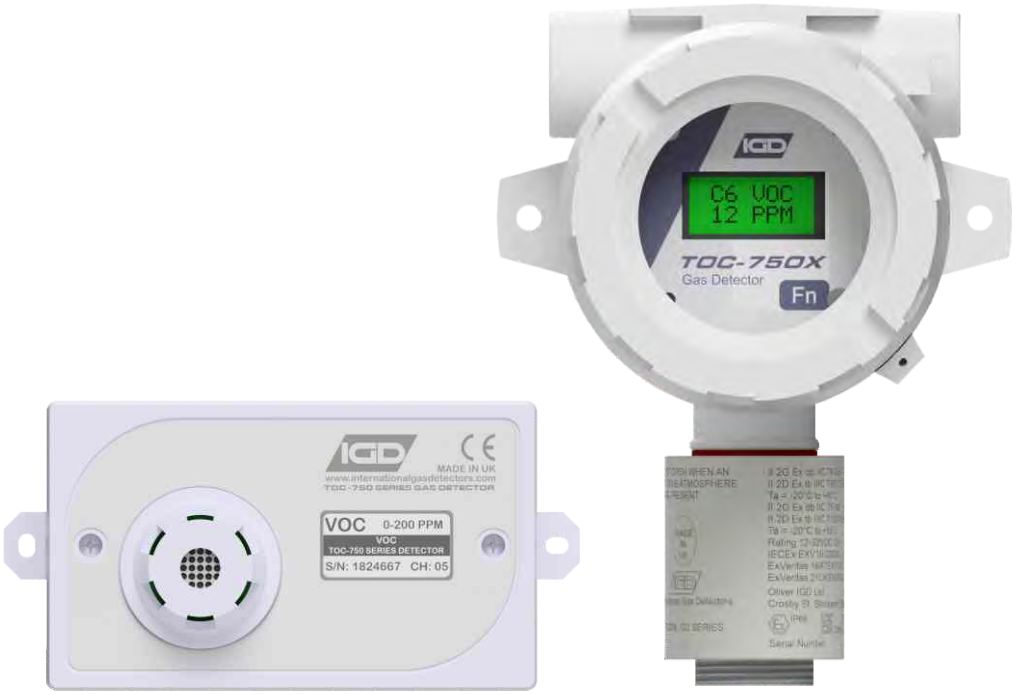
Operation Manual

Document Ref: SL-040 v4.5



SAFE AREA & ATEX FIXED PID DETECTORS INSTALLATION AND USER INSTRUCTIONS Version 4.5

(Read in conjunction with SL-031 Gas Correction Factor list
SL-016 Addressable system installers guide
SL-039 ATEX Controller
or safe area controller manual as applicable)

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INTRODUCTION

This guide is intended for the use of system specifiers, surveyors, designers and installers. The intention of this guide is to provide information for the correct installation of IGD's PID based VOC gas detectors. This guide indicates correct cabling practice, types of cabling which can be used and options available. This guide is not intended as a design or specification guide, these are available separately.

Note that System control panels, detector nodes, battery backup modules and power boosters are all supplied with their own manuals. Their general specifications and performances are available both in their individual manuals and published data sheets. This data is not reproduced in this guide.

Failure to follow this guide could compromise operation so please follow the enclosed information carefully.

Systems should be designed and installed by competent persons. A competent person being defined by the UK Health and Safety Executive as:

"A competent person is someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular help you need."

IGD's gas detection systems are capable of installation by electrical installation engineers. Design of a system is not covered in this guide and should be undertaken by a competent person. The design should include:

> The nature of the gas hazard and appropriate placement of detectors
> Clear indication to workers that a gas hazard exists and the action they must take
> Interaction between the gas detection system and other systems
> The necessary safe operating procedures that must be in place

IGD can provide help to design systems where help is required and can also provide training for surveyors, specifiers, designers and installers.

All Gas Detectors shipped from IGD are pre-calibrated. It is not always necessary to re-calibrate a newly installed system on site but it is recommended that commissioning is undertaken. Commissioning should be undertaken by persons trained to do so. Commissioning should ensure that the system performs and interfaces correctly to all connected devices, host systems and operates to the required cause and effect.

NOTE that ATEX equipment has specific requirements for cable protection and glanding to housings. These requirements are detailed in manuals for such equipment available through our website.

SPECIFICATIONS

PERFORMANCE

Target gases	VOCs with ionisation potentials < 10.6eV
Minimum detection level	(ppm isobutylene 0.5ppm
Warm up time	10 seconds time to full operation
Response time (t_{90})	<25 seconds diffusion mode
Range Options	0-50ppm Resolution 1ppm 0-100ppm Resolution 1ppm 0-200ppm Resolution 1ppm 0-2000ppm Resolution 10ppm 0-5000ppm Resolution 10ppm

ELECTRICAL

Power consumption	0.9W typical (at 24V DC)
Supply voltage	18 to 32VDC
Output signal	Linear 4-20mA Output for set range. RS232 Interface

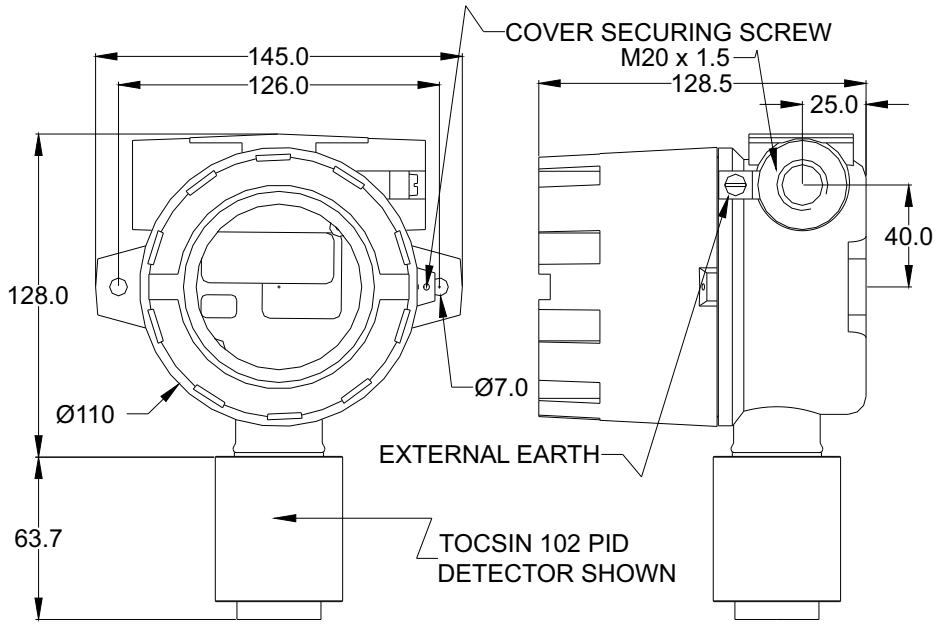
ENVIRONMENTAL

Temperature range	-10ºC to +55ºC
Temperature dependence	0°C to 40°C: 95% to 100% of signal at 25°C -20°C: 125% of signal at 25°C
Relative humidity range	0 to 95%rh, non-condensing
Humidity sensitvity	Near zero

KEY SPECIFICATIONS

Expected operating life	5 years (excluding replaceable lamp and electrode stack)
Approval	Ex Veritas **16 ATEX 0141X** II 2 G Ex db IIC T6 +55°C
Onboard filter	To remove liquids and particulates
Lamp replacement	User replaceable (10.6 eV)
Electrode stack	User replaceable
Position sensitivity	None
Weight	550 grams (detector excluding any junction box)

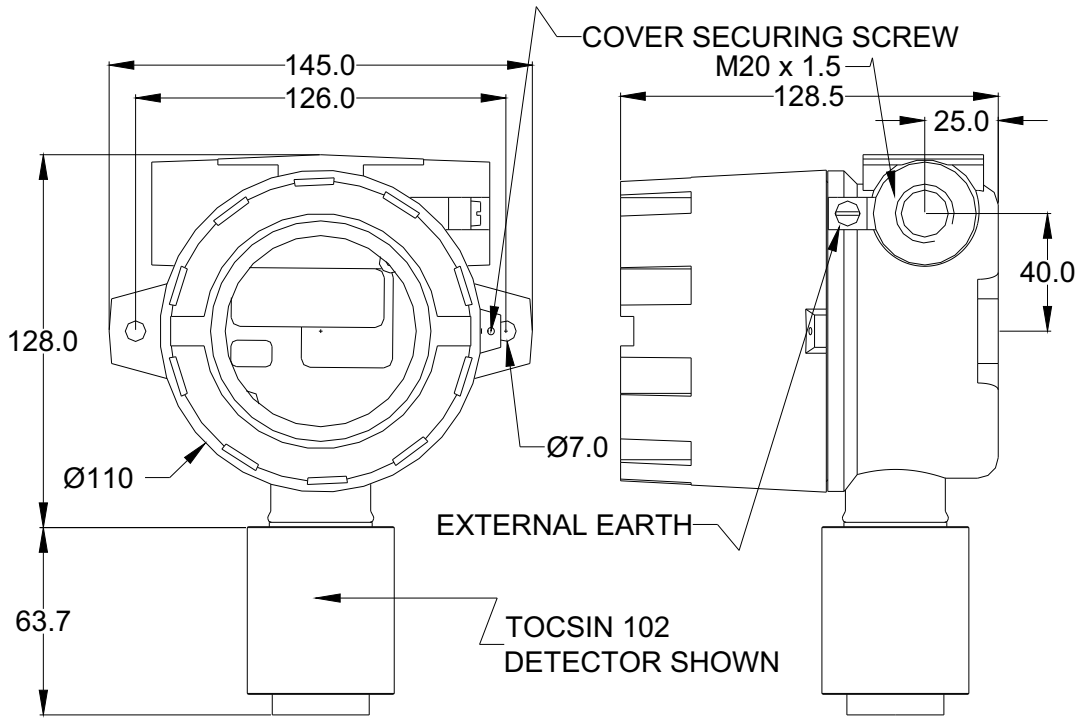
SIZE AND MOUNTING INFORMATION (OPTIONAL JUNCTION BOX/TOCSIN 903 SHOWN)



CERTIFICATION & SPECIFICATIONS

JB3/903

II 2G Ex db IIC T6/T5 Gb
II 2D Ex tb IIIC T85ºC/ T100ºC Db
Ta = -20ºC to +40ºC/+55ºC
IECEx EXV 16.0002X
ExVeritas 16 ATEX 0140X
ExVeritas 21UKEX0913X
IP66 M20 x 1.5 Entries 12-32V DC
Compliant to IEC 60079-29-1



Power	12 to 32V DC without Relay Option Typically 4W
Electrical Outputs	2 Wire Sentinel+™ Addressable I/O Digital Communication Linear over Detector Range.
JB Housing Material	Junction Box, Copper Free Aluminium Alloy Epoxy Coated Option for 316 Stainless Steel and Marine Paint Finishes
Sensor Housing Material	Sensor, Stainless Steel 316 S16
Explosion Protection	Junction Box, Ex d IIC T6 I I2 D G
Explosion Protection Sensor	Ex d IIC T6 I I2 D G
Housing Dimensions (mm)	110 Diameter x 127 High Plus Detector Option
Cable Entry	2 x M20 x 1.5 Cable Entries 1 x M20 x 1.5 Detector Entry

Storage Temperature	-20 Deg Celsius to +55 Deg C
Storage Humidity	20-90% RH Non-Condensing
Shelf Life	5 Years
Sealing	IP66*
Mounting	Wall Mount
Weight	1.5Kg
Measured Range	See Range Options
T90 Time	<60 seconds
T50 Time	<20 seconds
Pressure	80 to 120kPa
Humidity	0 to 90% RH non condensing
Temperature T5 Temperature T6	-20 to +55 Deg C -20 to +40 Deg C
Warm up Time	Set by controller, 15 minutes

* IP ratings do not imply that the equipment will detect gas during and after exposure to these conditions. Calibration and maintenance may be required more frequently and should be assessed based upon exposure.

ATEX Markings

Labelling for JB3 Versions

Permanent Print Direct to Front Face as Indicated

78mm Dia

Equipment Name

Labelling for 903 Versions

Material:
CPM-200 3M Silver / Grey
Polyester -40 to +150 Deg C
69mm x 38 mm

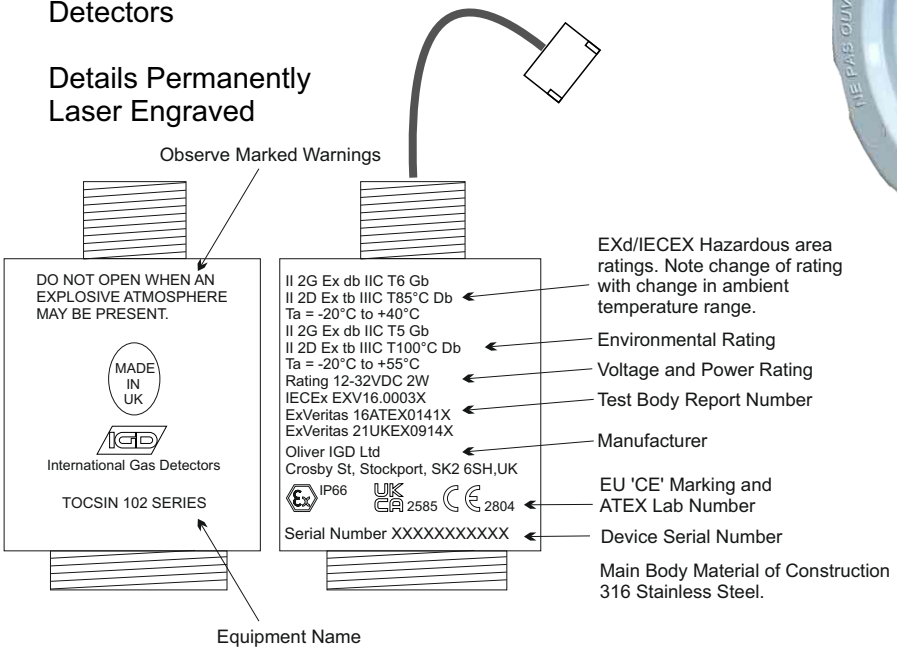
Equipment Name

Adhesive label applied to top surface of housing

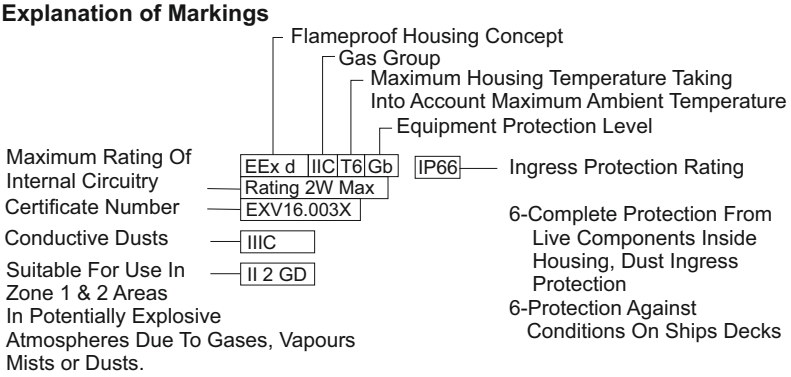
Refer to TOCSIN 903 manual for stand alone ATEX versions

Labelling for 102 Series Detectors

Details Permanently Laser Engraved



Explanation of Markings



The housings must be grounded to a minimum 20A ground.
If the JB3/903 is to be used in a zoned hazardous area ensure the certification marks on the side of the main housing match the zones certification requirements.
In such cases do not operate the JB3/903 without the cover correctly screwed in place.

NOTES

The following notes on equipment selection and installation are taken from applicable standards. They are not intended to replace adequate knowledge and skill on the part of those using them. Also any and all applicable local regulations should be considered when deciding on installation methods and materials.

Selection of cables

In accordance with EN 60079-14, cables connected to Ex d enclosures should satisfy one of the following:

- Have ALL the following characteristics:
  - Sheathed with thermoplastic, thermosetting or elastomeric material
  - Any bedding or sheathing must be extruded
  - Any fillers must be non-hygroscopic (meaning resistant to the absorption of moisture)

or;

- Mineral insulated & metal sheathed

or;

- Special cables, for example flat cables with appropriate glands

It is worth noting that many PVC sheathed and insulated cables do not satisfy these requirements.
Also if an armoured cable is used, then the gland should be of a type that clamps the armour, and provides a compression seal on the inner sheath.
For these purposes armoured can refer to armoured OR braided (SWA or SY), and should be clamped accordingly.
If using a fine braided cable with strands of less than 0.15mm, where the braid covers at least 70% of the surface of the cable, then compression sealing only on the outer sheath, is permitted. In such instances the braid should be brought into the enclosure, and handled accordingly.
Fire Proof cable, such as FP200 can be used with the recommended IGD gland. The aluminuim tape which forms the outer metal jacket can be clamped in the armour clamping ring.

Selection of cable glands

In accordance with EN 60079-14, cable glands used with Ex d enclosures should satisfy one of the following:

- Certified barrier glands

or;

- Cables and glands meeting ALL of the following:
  - Certified Ex d glands
  - Connected cable length is at least 3m
  - Cable having ALL the following characteristics:
    - Sheathed with thermoplastic, thermosetting or elastomeric material
    - Any bedding or sheathing must be extruded
    - Any fillers must be non-hygroscopic (meaning resistant to the absorption of moisture)

or;

- Certified Ex d bushing and Ex e junction box

or;

- Mineral insulated cable and suitable, certified glands

or;

- Other certified barrier device

It should be noted that the use of tapes, heat shrink or other devices to enlarge the diameter of the cables sheath to make the gland compression seal grip the cable, is explicitly forbidden.
To satisfy the above requirements we recommend using IGD part # 5922701, with at least 3m of cable left before the next gland, and a cable which complies with the above requirements.

Unused cable entries

It is critical to the safety integrity of the system that all unused cable entires MUST be fitted with a suiatbly certified Ex d stopping plug. We recommend using IGD part # 5880501.

Un-used cores of a multi-core cable

Any un-used cores in a multi-core cable must be either terminated to earth, or effectively isolated from other cores and terminations. We recommend terminating to the internal earth stud.

Maintenance

Whilst the maintenance of installations is the responsibility of the site operator, EN 60079-17 gives guidance on what should be checked and when. Included at the back of this manual is a chart based on that found in section 6 of EN 60079-17, for a Periodic Close Inspection. This chart is intended to be used by qualified personnel in conjunction with the EN 60079-17.

Commissioning

When commissioning a system for use in a zoned area, EN 60079-17:2014 4.3 mandates that, it shall be given an initial inspection. Included at the back of this manual is a chart based on that found in section 6 of EN 60079-17, for an Initial Detailed Inspection. This chart is intended to be used by qualified personnel in conjunction with the EN 60079-17.

Qualification of personnel

Personnel involved in installation and commissioning of equipment in Zoned areas should be suitably qualified. The qualifications required are detailed in various parts of the EN 60079 standard. Qualification can be purely internal or can involve a third party. It is the responsibility of each individual organisation to decide upon the most appropriate way to implement these requirements.
As well as the mandatory qualifications in the standard personnel must of received adequate training in the gas detection equipment. To comply with EN 60079 such training must be documented.
Installation, commissioning, maintenance and operation by unqualified personnel could lead to serious equipment malfunction and/or unsafe operation.

Installation location

It is important that the detector is mounted in accordance with EN 60079-14, clause 14.2 which states that flameproof joints must be a minimum distance away from solid obstacles, (eg structural steelwork) which is not part of the equipment.
Note that if the detector is mounted to a flat surface then the joints where the cables and detectors go into the housing are closer than the minimum, but this has been taken account of during testing and hence does not need to be considered.
For a IIA installation the minimum distance is 10mm, for a IIB it is 30mm and for IIC it is 40mm.

Earthing

Both internal and external earth studs are provided, and can be used as the installation requires. The external earth point provides a means for connecting the enclosure, which is considered to be an ‘exposed conductive part’, to the bonding system. There is no specific requirement in 60079 to run a separate earth bond to this stud, but we recommend that one is connected. This is inline with best practice and many local requirements, for example equipment going offshore from Aberdeen. The minimum size conductor for such bonds is 4mm² as per EN60079-14 clause 6.4.1.

To summarise, as a minimum we recommend that:

- The internal earth stud be used to:
  - ☐ Connect any unused cores
  - ☐ Connect any earth core internal to the cable
- The external earth stud be used to bond the enclosure to the any steel-work, on which the gas detector is mounted.

Greases and assembly compounds

EN 60079-14 allows for the use of grease when assembling flameproof joints, such as threaded cable glands, but stipulates that it must be, non-setting, non-metallic and non-combustible, and, in the case of cable entries, also that earth continuity must be maintained. We recommend conductive carbon grease such as IGD part # 5128701.

Special condition for safe use for ATEX housed detectors (X):

The enclosures can have a non-conductive coating applied and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

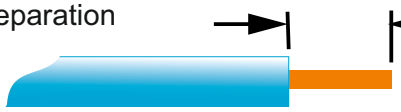
The flameproof joints employed in the equipment are not intended to be repaired

Equipment not intended to be installed in areas where corrosive vapour or gas may be present.

CABLE TYPES

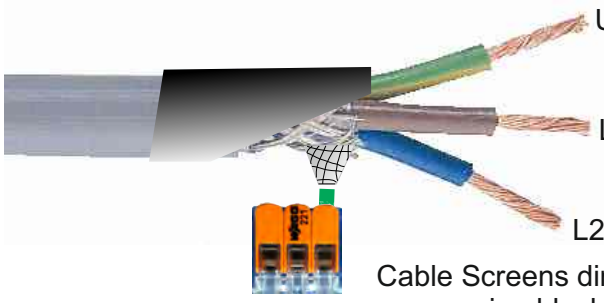
IGD's 2-Wire gas detection systems operate using screened cabling of appropriate cross sectional area. There are no specific requirements and our typical advised cable types are indicated below. Cable screens, either foil and drain wire, braid or armouring must be continuous between devices and grounded for effective operation. Ancillary devices such as stop buttons, beacons, sounders etc should commoned to the earth blocks provided as indicated below.

Recommended Cable Preparation



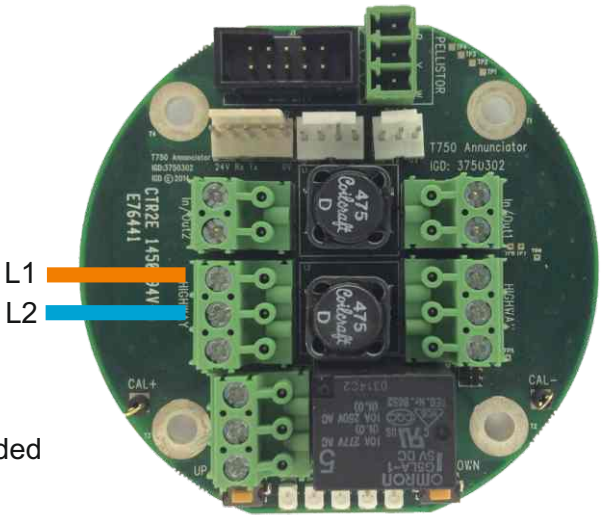
Strip Conductors 7mm Ensure No Stray Strands

CY Type cable has a braided screen which should be trimmed back to ensure no trimmed conductor ends up on sensitive PCB components, tracks or terminals where it may short. The screens of the incoming cables should be terminated to the floating terminal block provided to ensure screen continuity. Trim back any unused conductors and ensure the braid is insulated with heat shrink or insulation tape and/or sleeve.



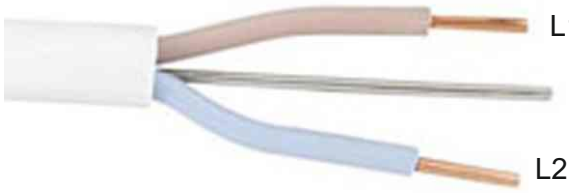
Cable Screens direct to commoning blocks provided

Internal Interface PCB TOC-750 Versions
Refer to TOCSIN 903 Manual for Stand Alone versions



FP Style Cable (Preferred Option)

FP style cable is fitted with a foil screen and drain wire. Generally this is easier to terminate than CY type cable. Trim back any unused cores and foil screen. Ensure the drain wire is insulated with suitable size sleeving and terminates to the cable screen terminal



SWA Style Cable

SWA style cables are usually only recommended for used with ATEX EXD housings where the universal cable glands ground the cable armour to the housing. This provides both an effective EMC screen and mechanical protection. Ensure unused conductors are trimmed back and isolated. If terminating to plastic enclosures fit 'pan handles' and terminate on the outside of the enclosure to ensure screen continuity

Note: AWG vs mm^2 Cable Sizes

2.5mm^2	13 AWG
1.5mm^2	15 AWG

International Gas Detectors
Innovative Gas Detection since 1917

Initial detailed inspection check-list to EN 60079-17:2014 Part 6. Table 1 Ex d & Ex tD

System name			
Inspection date		**Doc template #**	
Equipment type	**Ex d gas detector**	**Detector serial #**	
Site name			

	Check that:	**Y,N or N/A**	**Comments**
A	**General**		
1	Equipment is appropriate to the ELP/Zone requirements of the location		
2	Equipment group is correct		
3	Equipment temperature class is correct		
4	Equipment maximum surface temperature is correct		
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity		
6	Equipment circuit identification is correct		
7	Equipment circuit identification is available		
8	Enclosure glass parts and glass -to-metal sealing gaskets and/or compounds are satisfactory		
9	There is no damage or unauthorised modifications		
11	Bolts, cable entry devices (direct or indirect) and blanking elements are of the correct type and are complete and tight. Physical check		
12	Threaded covers on enclosures are of the correct type, are tight and secured. Physical check		
13	Joint surfaces are clean and undamaged and gaskets, if any, are satisfactory and correctly positioned		
14	Conditions of gaskets is satisfactory		
15	There is no evidence of ingress of water or dust in the enclosure in accordance with the IP rating		
17	Electrical connections are tight		
25	Breathing and draining devices are satisfactory		
26	Items 26 – 31 refer to motors and lighting so hence are not relevant and have been omitted		
B	**Installation – General**		
1	Type of cable is appropriate		
2	There is no obvious damage to cables		
3	Sealing of ducts, pipes and/or conduits is satisfactory		
4	Stopping boxes and cable boxes are correctly fitted		
5	Integrity of conduit system and interface with mixed system maintained		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory (for example connections are tight and conductors are satisfactory (for example connections are tight and conductors are of sufficient cross-section). Physical check.		
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory		
8	Automatic electrical protective devices are set correctly (auto reset not possible)		
9	Automatic electrical protective devices operate within permitted limits		
10	Specific conditions of use (if applicable) are complied with		
11	Cables not in use are correctly terminated		
12	Obstructions next to flameproof joints are in accordance with IEC 60079-14:2014 14.2. See explanatory note on Page 6 of the 903 manual		
14	Items 14-23 refer to heating systems and motors, hence they have been omitted		
C	**Environment**		
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors		
2	No undue accumulation of dust and dirt		
3	Electrical insulation is clean and dry		

Signature	Print name

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Periodic close inspection check-list to EN 60079-17:2014 Part 6. Table 1 Ex d & Ex tD

System name			
Inspection date		**Doc template #**	
Equipment type	**Ex d gas detector**	**Detector serial #**	
Site name			

	Check that:	**Y,N or N/A**	**Comments**
A	**General**		
1	Equipment is appropriate to the ELP/Zone requirements of the location		
2	Equipment group is correct		
3	Equipment temperature class is correct		
4	Equipment maximum surface temperature is correct		
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity		
7	Equipment circuit identification is available		
8	Enclosure glass parts and glass -to-metal sealing gaskets and/or compounds are satisfactory		
10	There is no evidence of unauthorised modifications		
11	Bolts, cable entry devices (direct or indirect) and blanking elements are of the correct type and are complete and tight. Physical check		
12	Threaded covers on enclosures are of the correct type, are tight and secured. Physical check		
25	Breathing and draining devices are satisfactory		
26	Items 26 – 31 refer to motors and lighting so hence are not relevant and have been omitted		
B	**Installation – General**		
2	There is no obvious damage to cables		
3	Sealing of ducts, pipes and/or conduits is satisfactory		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory (for example connections are tight and conductors are satisfactory (for example connections are tight and conductors are of sufficient cross-section). Visual check.		
12	Obstructions next to flameproof joints are in accordance with IEC 60079-14:2014 14.2. See explanatory note on Page 6 of the 903 manual		
14	Items 14-23 refer to heating systems and motors, hence they have been omitted		
C	**Environment**		
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors		
2	No undue accumulation of dust and dirt		
3	Electrical insulation is clean and dry		

Signature	Print name

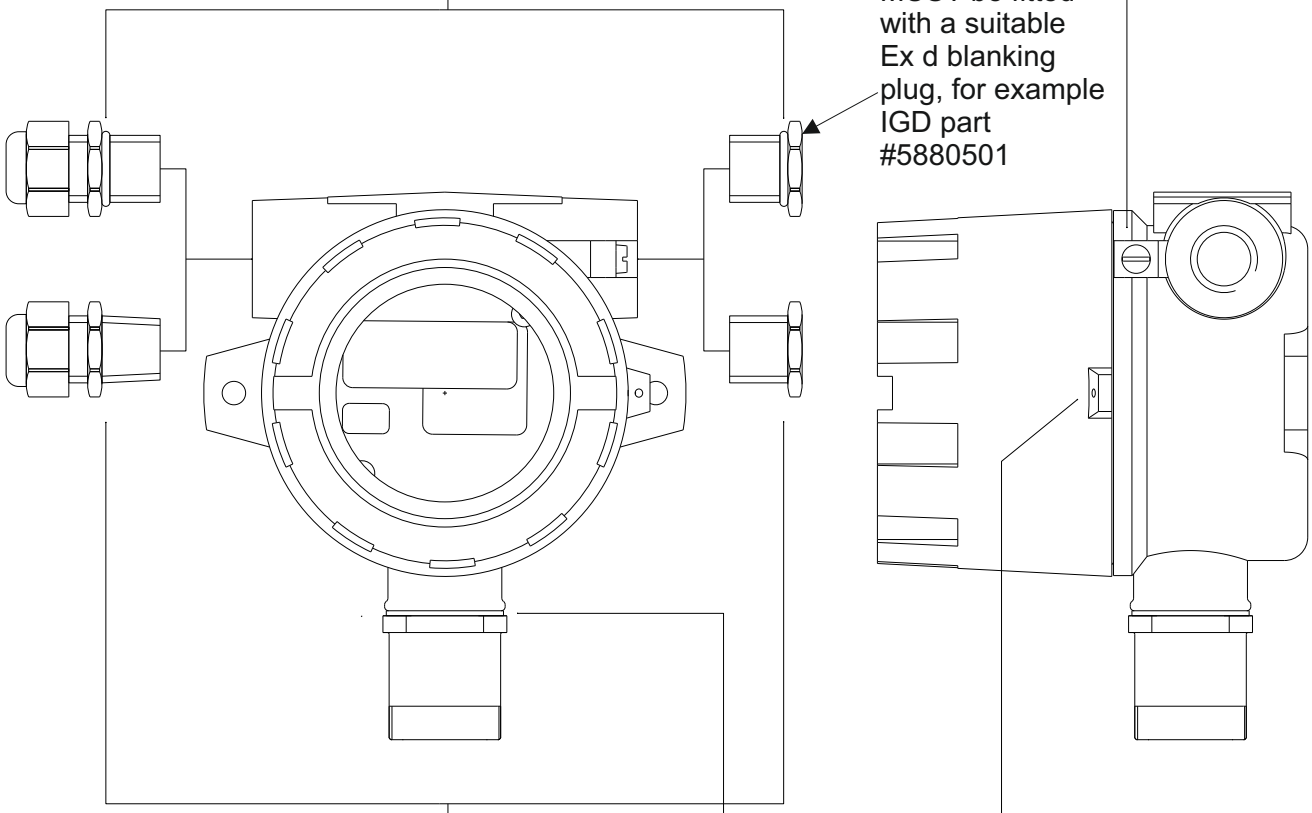
CUSTOMER SEALING AND EARTHING RESPONSABILITIES

The JB3 is designed for use in Zone 1 and Zone 2 hazardous areas and is ATEX & IECEx certified. To maintain compliance it is imperative the installer of the equipment observes the following installation guidelines. Failure to do so could compromise the protection concept of the equipment.

Parallel glands and blanking plugs should have O Ring seals or sealing washers to maintain IP66 rating use Atex rated glands and blanking plugs

EXTERNAL EARTH TERMINAL

ALL UNUSED cable entries MUST be fitted with a suitable Ex d blanking plug, for example IGD part #5880501



Taper glands and blanking plugs should use suitable grease to maintain IP66 rating, typical IGD part # 5128701.

Use suitably rated glands, for example IGD part # 5922701, and suitably rated blanking plugs, for example IGD part # 5880501.

Also see notes on page 5 & 6 of this manual.

On final assembly the cover screw must be locked in place.
Use 2mm Allen Key

Gas detectors are supplied with sealing washers. These must be fitted to meet approval requirements

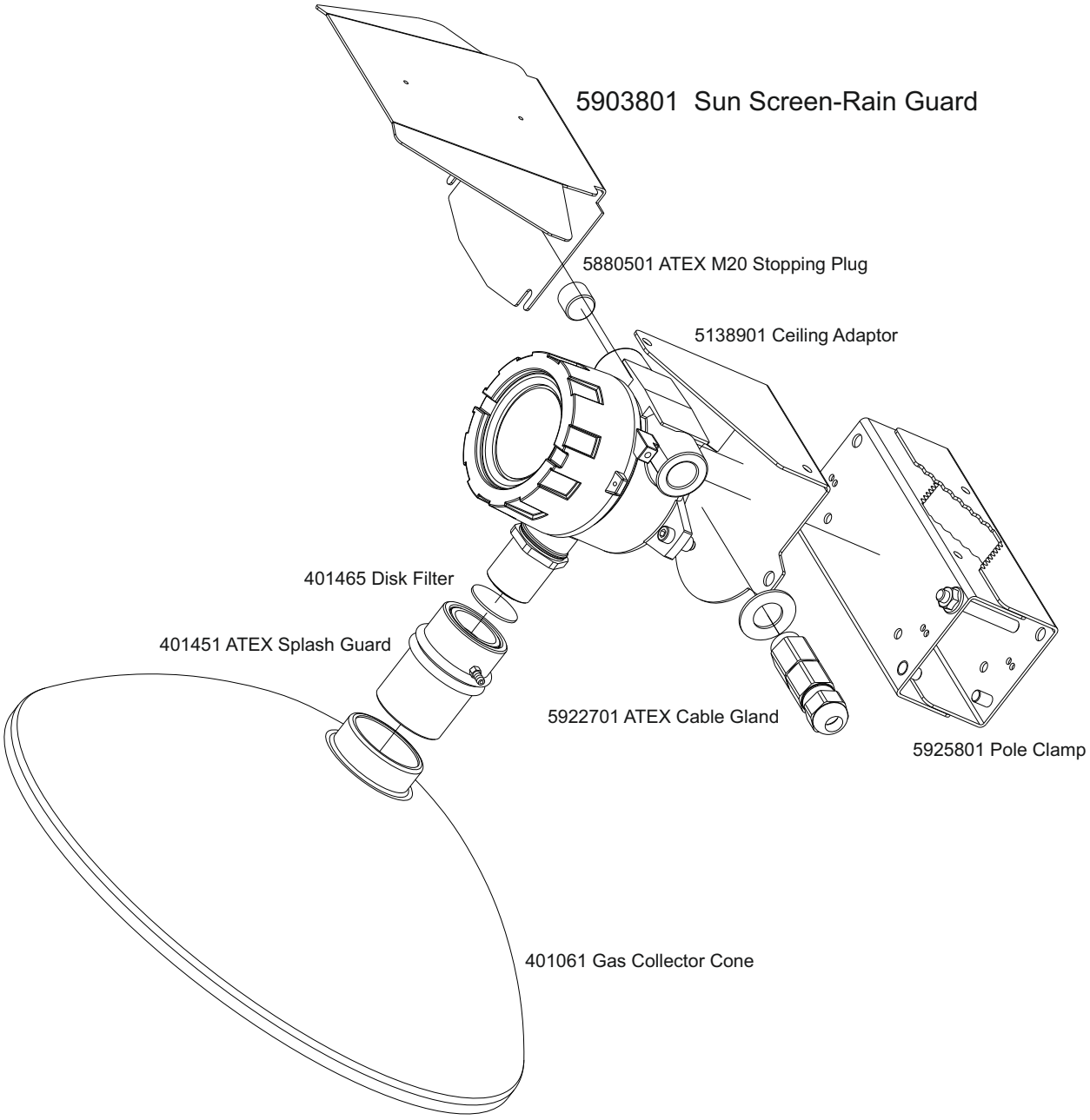
Two detectors may be ‘close coupled’ together using our potted feedthrough bushing. For example IGD part # 5903501

EXTERNAL EARTH	STRANDED CABLE USE	4.0mmSQ CSA	SOLID CORE CABLE USE	6.0mmSQ CSA
INTERNAL EARTH	STRANDED CABLE USE	1.5mmSQ CSA	SOLID CORE CABLE USE	2.5mmSQ CSA

WARNING

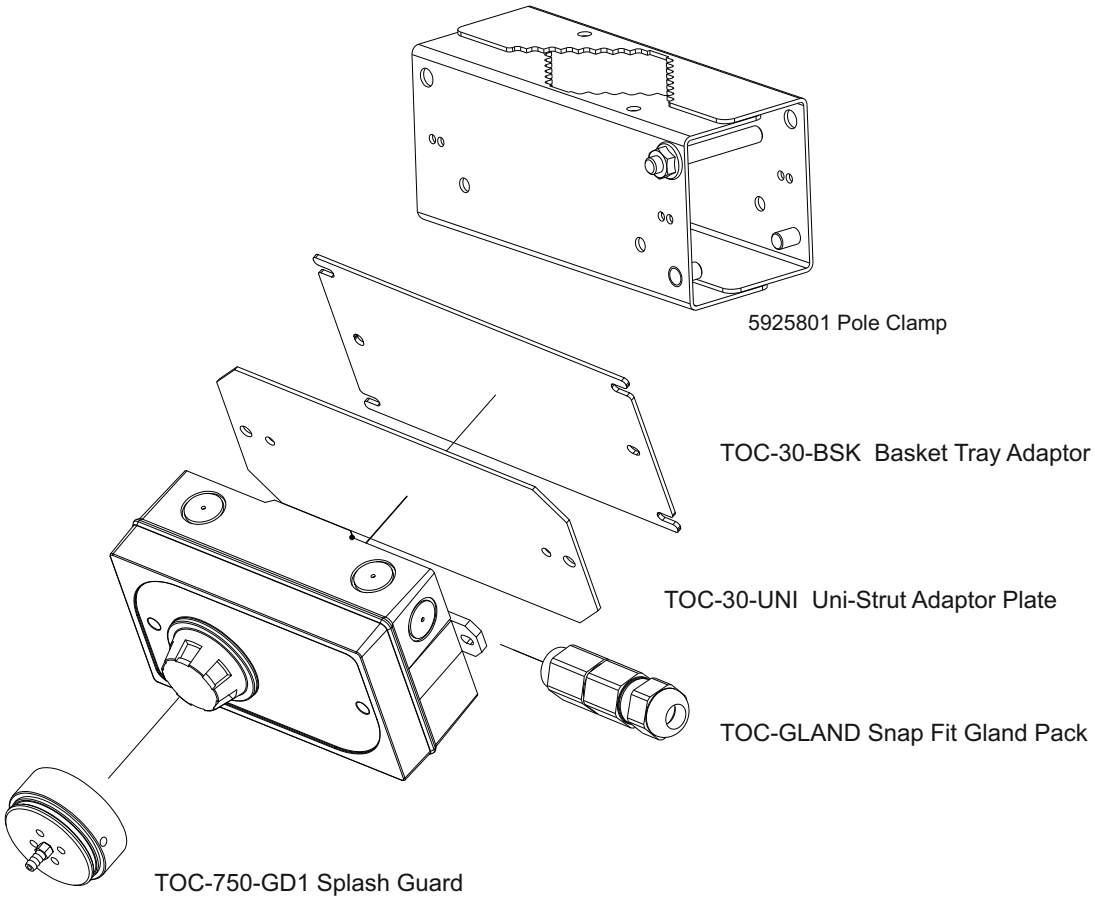
Glands and cable must be of a suitable type to match the zone of application of the equipment, see later notes in this manual

5922701	M20 Universal EX d Cable Gland
5880501	M20 Stopping Plug
5128701	Conductive Assembly Paste
5138901	Ceiling Adaptor
5903801	Sun Screen/Rain Guard
5925801	Pole Clamp
401451	102 Series Detector Splash Guard
401465	Optional Disk Filter

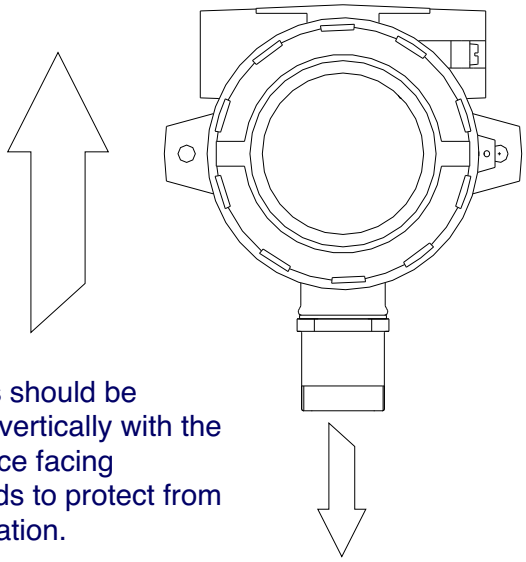


SAFE AREA ACCESSORIES

5925801	Pole Clamp
TOC-750-GD1	750 Series Detector Splash Guard
TOC-GLAND	Snap Fit Cable Gland (Pack of 4)
TOC-30-UNI	Uni-Strut Adaptor Plate
TOC-30-BSK	Basket Tray Adaptor



GENERAL MOUNTING POSITIONS ATEX (BS EN 60079-29-1)

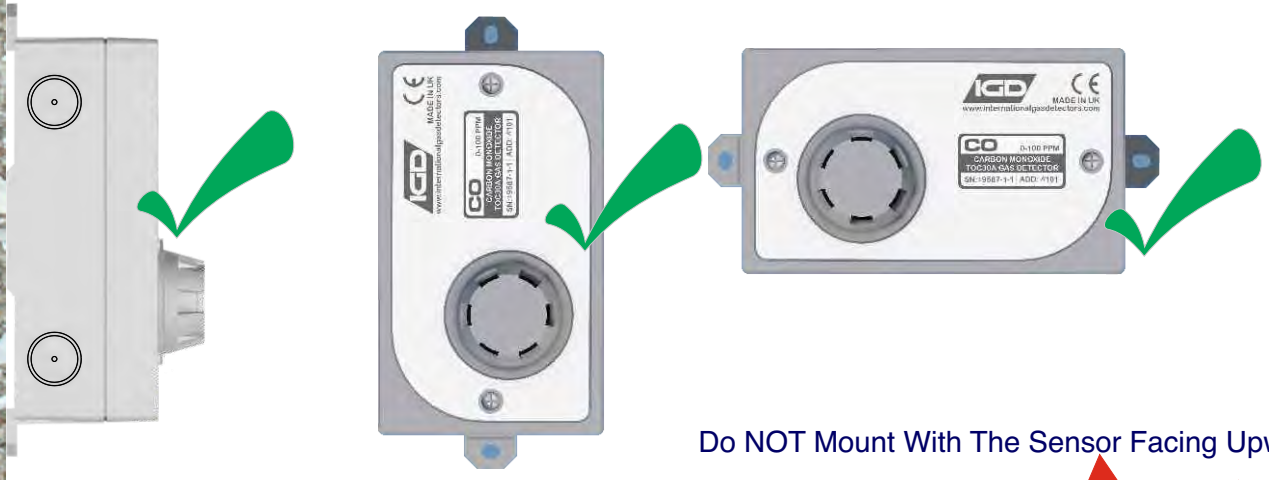


Detectors should be mounted vertically with the sensor face facing downwards to protect from contamination.

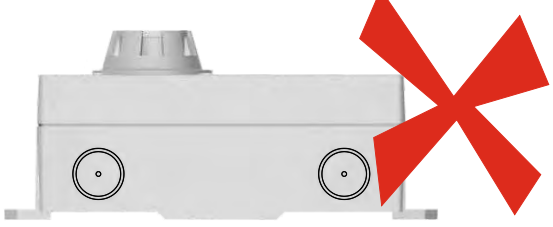
GENERAL MOUNTING POSITIONS SAFE AREA (BS EN 50194)

Sensor Facing Down

Sensor Mounted to Vertical Wall in Various Orientations

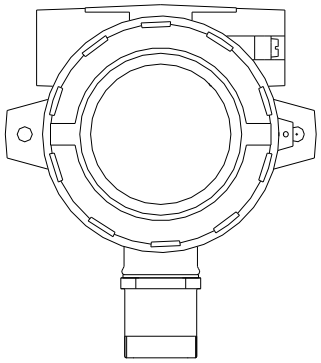


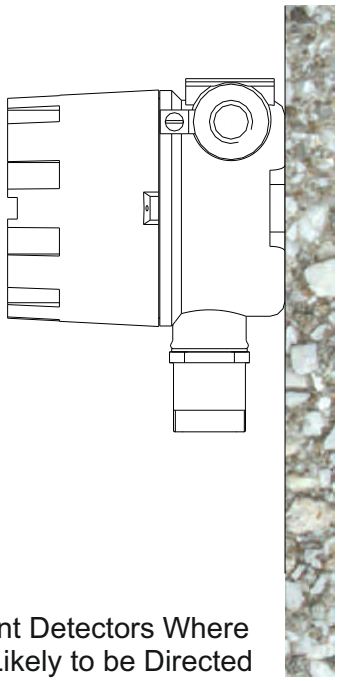
Do NOT Mount With The Sensor Facing Upwards

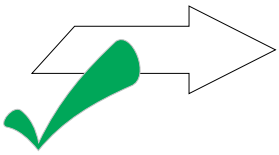


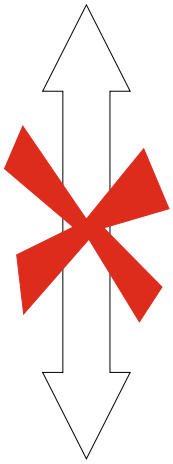
Detectors in Airflows Mounting Positions Atex (BS EN 60079-29-1)

Air Flows up to 6M/S Are Allowable Without Any Performance Issue Across the front of The Sensor Face





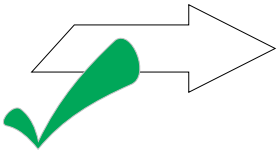




Do NOT mount Detectors Where Airflows Are Likely to be Directed either onto or Away From the Sensor Face. This Situation May Result in Contamination and/or reduced Detection Capability

Detectors in Airflows Mounting Positions Safe Area Versions

Air Flows up to 6M/S Are Allowable Without Any Performance Issue Across the front of The Sensor Face



SITING SYSTEM COMPONENTS

Control Panels

These should be located outside of the area protected by its connected gas detectors.

The control panel should be accessible such that in the event of an alarm the area can be evacuated and gas levels viewed from the controller.

Consider the use of mimic panels, HMI panels or GSM options available from IGD to provide additional remote indication/alarm

Audio-Visual alarms

As a general rule if there is gas detection fitted to an area then there should be an audio-visual alarm (beacon sounder) to alert personnel who may be in the same area. Typically these will be standard beacon sounders where the sounder can be silenced from the control panel once an alarm is accepted. Standard LED beacon sounder modules are available from IGD and can be run from addressable I/O points to minimise cabling. Another option is to fit IGD's range of annunciators.

Annunciators

Annunciators are addressable devices typically fitted at door entry points. They provide a clear audible visual alarm in the event of a gas alarm to warn persons from entering an area where a gas hazard could be present.

They offer many advantages over standard beacon sounders. They can be fitted to standard dado trunking systems; cannot be confused with other alarms; the displayed alarm message and flashing colour display is unambiguous; they can be fitted with slam switches.

Gas Collector Cones and splash Guards

Where detectors are located above gas plant such as boilers or meters in rooms with high ceilings then consider the use of gas collector cones. These are fitted to detectors sited just above gas plant to enhance the detectors capability to detect gas leaks (see separate application note)

For detectors fitted at low level, fitting splash guards may be appropriate to protect sensors from dust, rain splash, floor washing etc.

SITING GAS DETECTORS

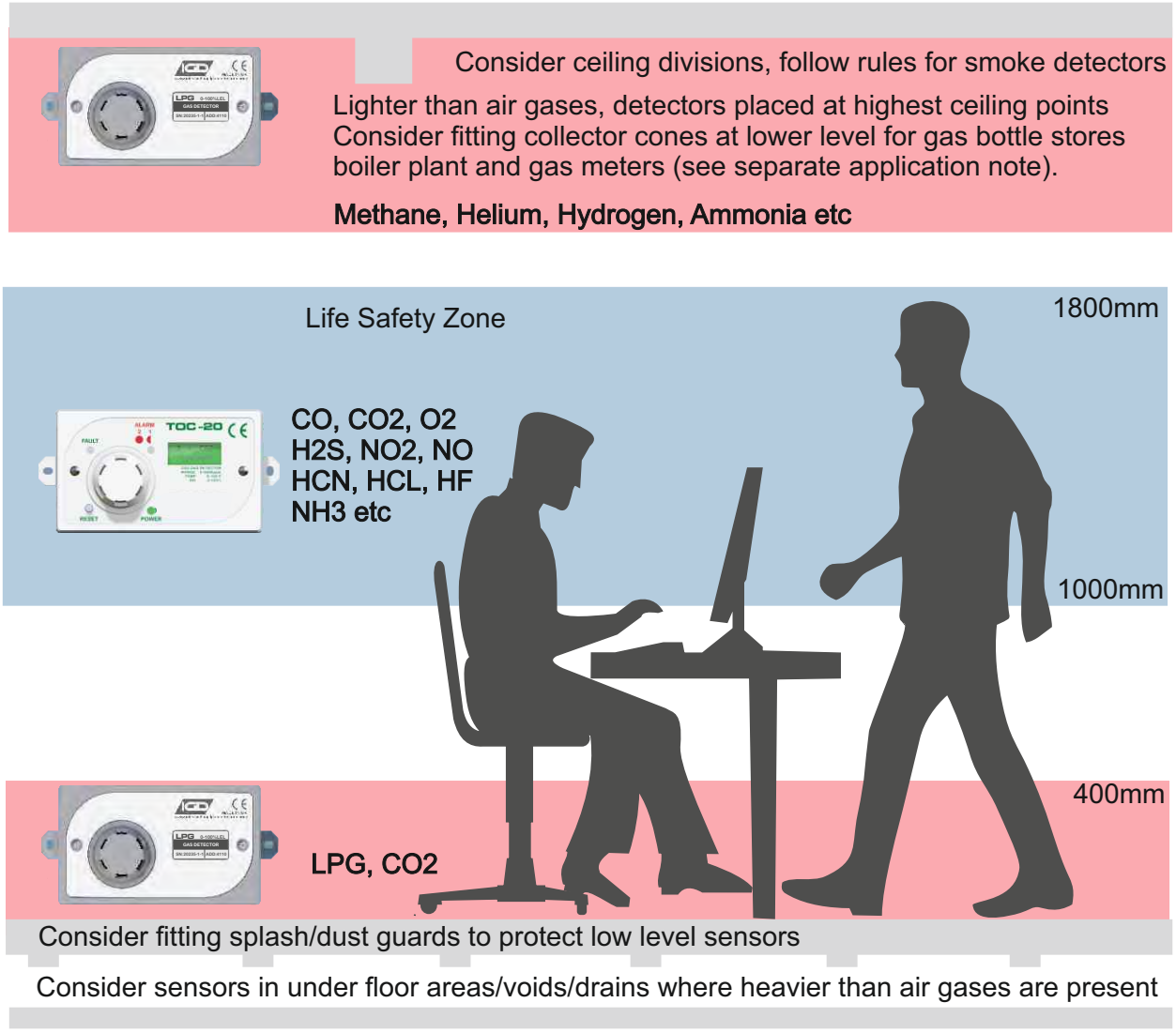
Gas detectors usually fall into two groups for placement

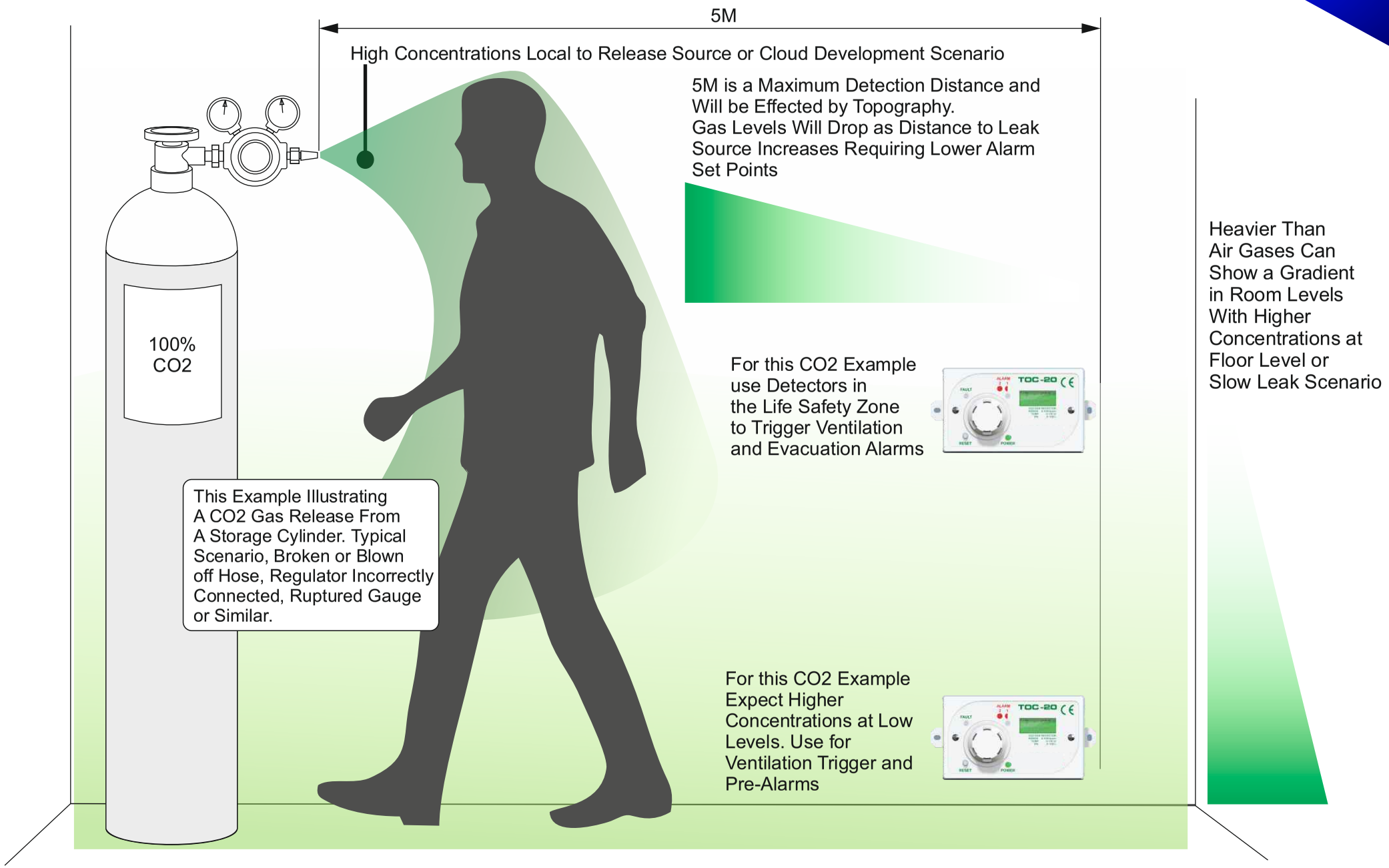
1. Plant Protection. Typically flammable gas detectors fall into this category. Aside from asphyxiation flammable gases are typically not directly toxic and so detectors are placed strategically where the gas is expected to accumulate based on its relative density to air (lighter or heavier)

2. Life Safety Systems. Here the concern is that a toxic or asphyxiant gas is directly hazardous to personnel and so the gas detection is placed based on the normal operating zone for the people present

Note that in many cases both life safety and plant protection sensors may be appropriate on a site. For example a plant using liquid helium may have plant protection sensors at high level to ventilate roof spaces in the event of leaks. However in the event of ventilation failure Helium could accumulate down towards the zone where personnel operate. In this case a second set of life safety sensors would be appropriate.

Each site should be surveyed and assessed on its own merits. This document presents general guidance only.



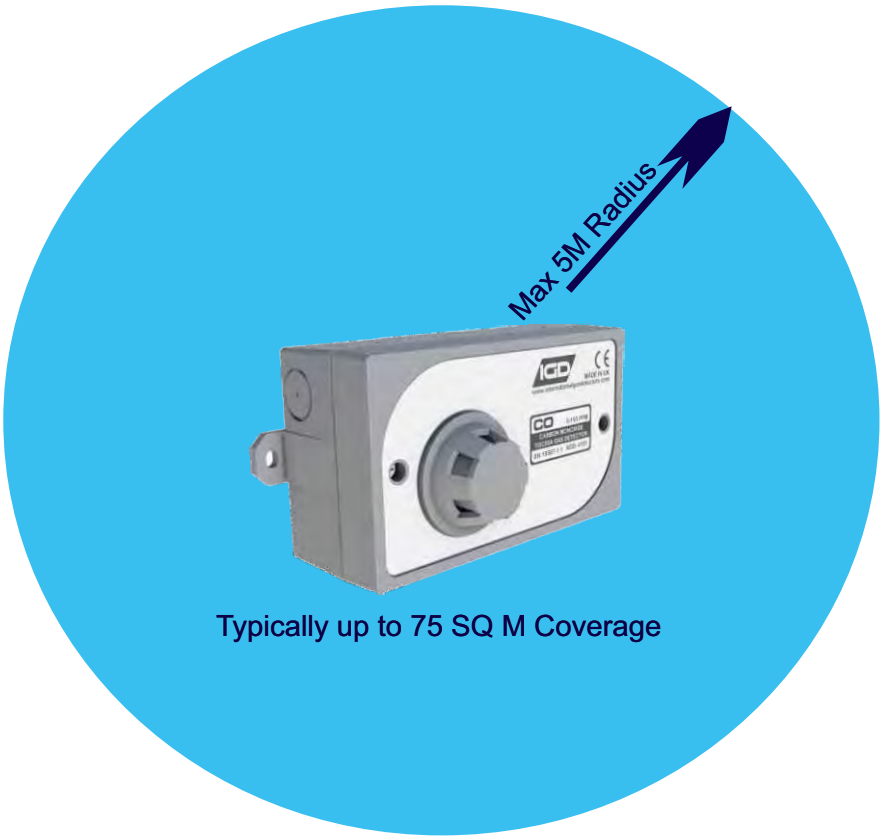

5M
High Concentrations Local to Release Source or Cloud Development Scenario
5M is a Maximum Detection Distance and Will be Effected by Topography.
Gas Levels Will Drop as Distance to Leak Source Increases Requiring Lower Alarm Set Points
100% CO2
This Example Illustrating A CO2 Gas Release From A Storage Cylinder. Typical Scenario, Broken or Blown off Hose, Regulator Incorrectly Connected, Ruptured Gauge or Similar.
For this CO2 Example use Detectors in the Life Safety Zone to Trigger Ventilation and Evacuation Alarms
TOC-20
For this CO2 Example Expect Higher Concentrations at Low Levels. Use for Ventilation Trigger and Pre-Alarms
TOC-20
Heavier Than Air Gases Can Show a Gradient in Room Levels With Higher Concentrations at Floor Level or Slow Leak Scenario

CRYOGENIC GAS DETECTION

Applications involving Cryogenically cooled gases such as liquid Nitrogen or Helium need careful consideration for gas detection. On initial release as cryogenically cooled gases can typically be at lower temperature and high density than their surroundings they will behave differently than when in their gaseous state. In such cases it should be considered if two sets of detection is required, one for the life safety zone and one for low level detection in the gases cooled state. Applications involving such gases are recommended to be surveyed.

AREA COVERAGE FOR GAS DETECTORS

In a similar manner to smoke detectors, a gas detector can provide up to 75SQ M area coverage based on a 5M radius of operation. There are many factors affecting this, geometry of a room, equipment in the area, gas characteristics, ventilation air flows etc. IGD can support throughout the survey, design and installation process to ensure the best possible result on site.



CALIBRATION & SERVICE REQUIREMENTS FOR GAS DETECTION SYSTEMS

All gas detection systems require regular checking and calibration to be in compliance with the UK factories act. The service and calibration period will be a function of the application based on environmental in service conditions. It is extremely important to ensure a service plan is in place for any gas detection system installed as part of a site safety system. IGD can work with operators to provide advice, service and spares to ensure an appropriate level of cover.

CALIBRATION

TOC-750X-PIDxx gas detectors are addressable devices compatible with the following control panels:

TOC-635 Series
TOC-650 Series
TOC-750 Series

Gas detectors require regular calibration. As with all such devices calibration periods are a function of the environment into which the detector is installed. A detector installed onto an offshore oil platform where it sees large temperature swings, vibration, salt spray etc will require a different calibration regime to the same detector installed into a closely controlled environment clean room. As a minimum calibration should be undertaken every 12 months with gas response checks (bump tests) every 6 months. Detectors MUST be bump tested to confirm correct operation if the measured range has been exceeded.

Only competent persons should undertake calibration. A competent person being defined by the UK Health and Safety Executive as:

A competent person is someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular help you need.

Installation, operation and calibration is detailed in the control panel product manual. User should reference IEC 60079-29-1 and its related standards.

To undertake calibration you will need as a minimum:

Either instrument grade air or Nitrogen
A suitable calibration gas
Correct calibration gas adaptor (#401101A)
Correct regulator to suit the gas bottles capable of delivering a fixed flow of 0.5L/Min

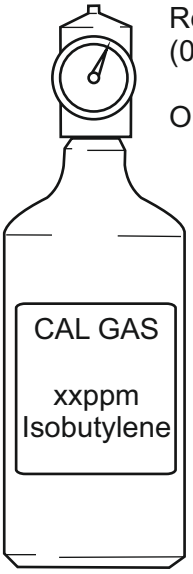
Calibration gas kits are available from IGD.

Calibration gases are ‘dry’ (zero humidity)

Gases must be flowed for a minimum of 60 seconds

Cal Gas Adaptor
Ensure it is correctly fitted

Hose delivers cal gas to the detector. Note a test gas applicator is usually required. In some cases weather protection guards or the detector itself may include a gas applicator port.



Regulator to deliver a fixed flowrate (0.5-1 L/min)

Oliver IGD P/N 5022001

Calibration gas.
Note: the concentration marked on the label. Ensure it is of the correct type for the detector being calibrated. The concentration should typically be 50 to 90% of the detector range.
Calibration gas should have a humidity between 0-90%RH
Refer to EN 600179-20-1 for gas concentration guidance.

Response time of the detector can be tested using a stopwatch to check the time for the detector to reach 90% of the applied calibration gas value from first application of the calibration gas.

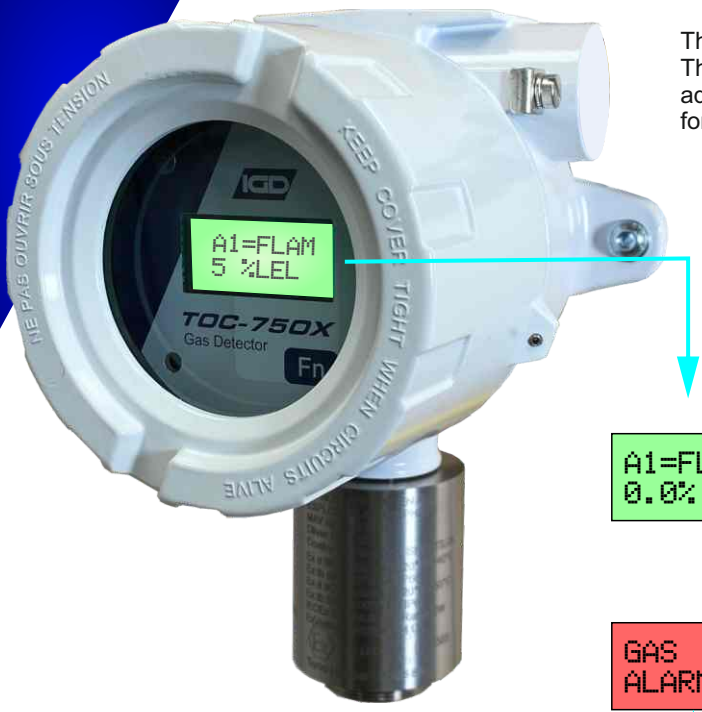
1. First zero and calibrate the detector.

2. Flow zero gas ensuring a stable zero

3. Fit the calibration gas bottle and time response to 90% of the bottle value.

Response time requirement to meet 60079-29-1 is less than 60 seconds and a T50 time in under 20 seconds

INDICATIONS



The following information refers to ATEX model TOC-750XD— The same indications are displayed on the control panels of addressably connected versions. Refer to control panel manual for full details.

Note there is no audible output on the TOC-750XD display version of the detector or the TOC-750X.

For both types the internal relay or I/O ports can be used to trigger local beacon sounders. If fitted these must carry a suitable approval for the zone of operation and be compatible electrically and match approval requirements.

For example and EXD IIC T6 rated beacon sounder could be directly connected either using the internal relay of I/O ports so long as its does not exceed 100mA@24V DC. Otherwise a separate supply is required. Please refer to the Installers Guide for more details.

A1=FLAM 0.0% LEL	Normal Operation Top Line of the Display Indicated Gas Type Bottom Line of the Display shows the Reading
GAS ALARM	Alarm Mode Display Changes to Red and Indicates Gas Alarm. Note Alarm Levels Are Set on and Indicated by the Connected Control Panel
OVER RANGE	Alarm Mode Beyond the Measured Range Display Alternates Between ‘Gas Alarm’ on a Red Background to Over Range on a Yellow/Amber Background. Mode Active When Above 110% of Range
UNDER RANGE	Under the Measured Range Display Alternates Between ‘Gas Alarm’ on a Red Background to Over Range on a Yellow/Amber Background
FAULT	Detector Fault Mode Display changes to Yellow/Amber Background and Indicates Fault. The fault Type and Details Can be Further Explored on the Connected Controller. In Short fault types: > Over Range > Under Range > Communication Error > Detector Fault

Refer to TOCSIN 903 manual for stand alone ATEX versions

Gas values indicated on the display are communicated digitally to the controller using IGD’s proprietary Sentinel+ © communications protocol.

Each detector on the system has its own unique address (see controller manual). Using Sentinel+© protocol the controller requests the detectors status and gas reading sequentially from each address on the system. The update cycle for all connected detectors is approx 1 second.

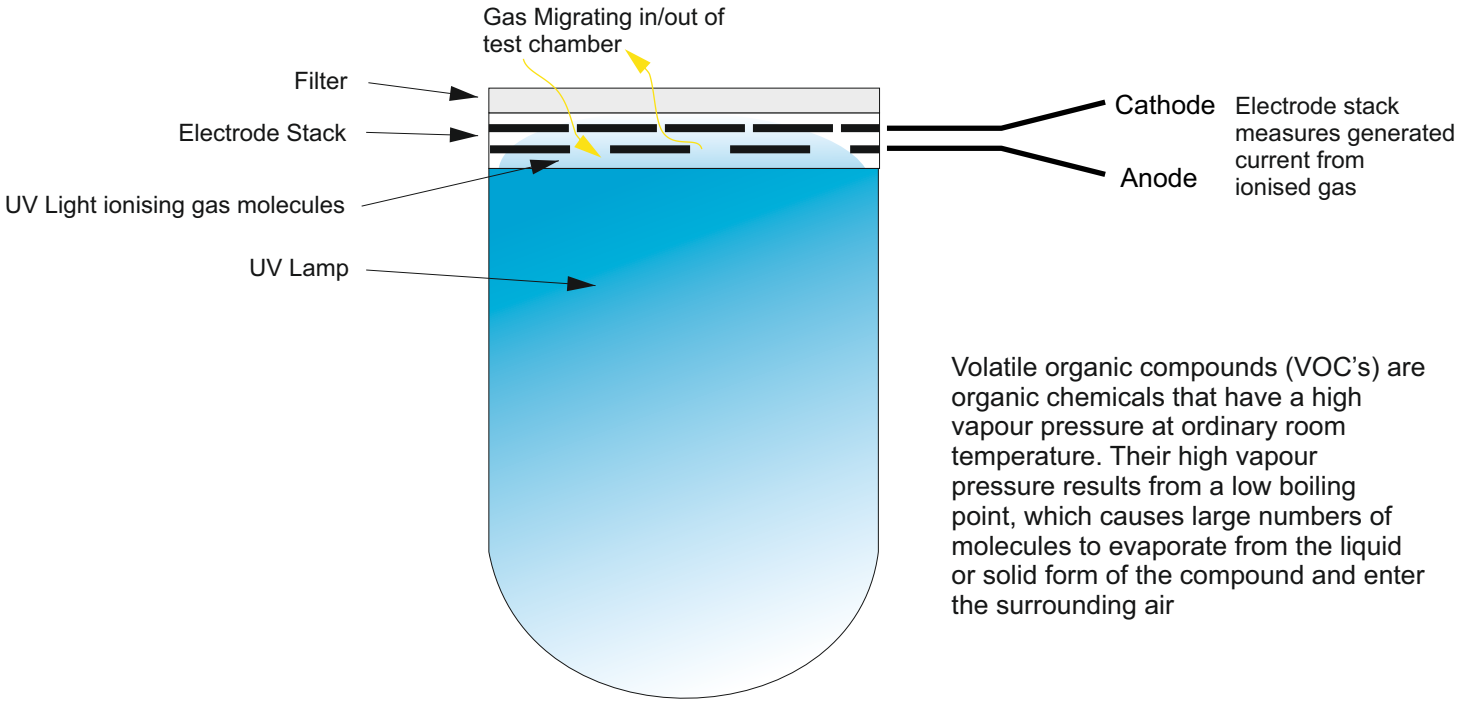
The PID Photo-Ionisation Detector

The Tocsin 102 PID detector measures volatile organic compounds (VOC's) in air by photo ionisation detection (PID), which is shown schematically below. Test gas (1) is presented to the membrane filter at the top of the photo ionisation cell and freely diffuses into and out of the underlying chamber formed by the filter, housing walls, and a UV lamp window. The lamp emits photons(shown by arrows) of high energy UV light, transmitted through the window. Photo ionisation occurs in the chamber when a photon is adsorbed by the molecule, generating two electrically charged ions, one positively charged, X_+, and one negatively charged Y_- (2a). An electric field, generated between the cathode and anode electrodes, attracts ions (2b). The resulting current, which is proportional to the concentration of the VOC, is measured and used to determine the gas concentration.

The UV lamp used in IGD's latest series PID detectors uses RF technology to energise the lamp and generate UV light. This represents a significant improvement in lamp technology over lamp systems that use inductive coupling. In these systems a metal ring inside the lamp couples inductively to energise the gas inside the lamp to generate UV light. The downside is that the metal ring 'sputters' inside the lamp and slowly contaminating the inside surface and degrading the lamp. IGD's RF system overcomes this life limitation providing a significant improvement. It should be noted that lamps and electrode stacks are consumables that will require replacement.

Note that the Oliver IGD Tocsin 102 PID is available in high range and low range models. If supplied as a stand alone unit then a standard linear 4-20mA output is provided along with a diagnostic port. This can be used in conjunction with Oliver IGD configurator software for service diagnostics and maintenance. This software can be used to set lamp duty cycles to extend lamp life. as standard units will be shipped with a 50% duty cycle set at 10 seconds. note that the duty cycle function is disabled once gas is detected and for 10 minutes after returning to zero.

A full range of splash guards, calibration adaptors, duct adaptors, samplers and service tools are available from Oliver IGD. In dirty environments always consider fitting splash guards to extend service intervals.



Volatile organic compounds (VOC's) are organic chemicals that have a high vapour pressure at ordinary room temperature. Their high vapour pressure results from a low boiling point, which causes large numbers of molecules to evaporate from the liquid or solid form of the compound and enter the surrounding air

What volatile organic compounds (VOC's) is sensed by PID?

Most VOC's can be detected by PID. Notable exceptions are low molecular weight hydrocarbons. Each VOC has a characteristic threshold energy of light (photon energy) which, when directed at the VOC, causes it to fragment into ions. This is called the *Ionisation Potential*, or IP. VOC's are ionised (and hence detected) if light of *photon energy* greater than the IP interacts with the gas sample. The peak photon energy generated in a detector depends on the PID lamp used: Xenon = 9.6 eV, Deuterium = 10.2 eV, Krypton = 10.6 eV or Argon = 11.7 eV. Hence, the use of an argon lamp leads to detection of the largest range of volatile compounds, while using a Xenon lamp can increase selectivity. Lamps of a particular type do not typically vary in spectral fingerprint, so relative responses to a particular gas, e.g. benzene, to a particular lamp, e.g. krypton, does not vary from lamp to lamp. However, the intensity of lamps does vary to some extent, leading to a difference in absolute response to the calibration gas.

Sufficient volatility of a compound is also essential for measurement by PID as with any other detector. A fairly large molecule such as alpha pinene, (a constituent of turpentine), saturates in air at about 5000 ppm at 20^{o}C; this is the maximum concentration at which the compound will usually be detected. Some compounds, for example, machine oils and agrochemicals - generate only a few ppm of vapour at ambient temperatures; it is more difficult to detect these compounds in air.

Krypton lamp (10.6 eV)

For general purpose use IGD PID's use a 10.6eV lamp. This provides the best balance of lamp life vs the variety of VOC's that can be detected. It must be noted that PID's are what IGD term a first responder. This means the PID will respond to a wide range of VOC's but cannot determine the exact VOC being detected. Generally the detectors are calibrated using Isobutylene, a stable safe and easy to obtain as a calibration gas VOC. IGD document SL-031 tabulates information to show the Correction Factor (CF) to other VOC's. This then allows the user either to use Isobutylene as the displayed VOC if there a range of VOC's on site or calibrate to read correctly for a specific VOC if there is just one.

For example if the PID is to monitor a toluene storage tank then the PID could be calibrated to read correctly for toluene as it's the only VOC of interest.

If however the application is a laboratory with many VOC's present then the PID is being used as a first responder. In this case it is more appropriate to leave the PID reading an Isobutylene calibration, using document SL-031 to determine appropriate alarm levels based on the materials present and their CF.

Calibration Factors

PID detectors from IGD are as standard shipped with a calibration for ISO-Butylene to match the shipped range.

PID's respond to a wide range of VOC's and hazardous gases. IGD can provide multiplication factors to convert the Iso-Butylene reading into a particular gas response reading. Contact IGD technical support with the gas of interest and IGD can advise the capability of the PID to monitor the substance in question and the multiplication factor.

For example a 0-200ppm Isobutylene calibrated PID can be used to monitor for Hydrogen Sulphide

The relative response (multiplier) for Hydrogen Sulphide is 4. This means H2S is 4 times less responsive so if the detector is being used to monitor H2S the reading as Isobutylene must be multiplied by 4 to be correct for H2S

IGD maintain a library of test results for PID response factors. This is continuously being updated. IGD technical support can provide data for your specific application.

Note that PID's respond to a wide range of gases and vapours and are not gas specific. Where a gas specific detector is available and suits the application, this should be used in preference. PID's are generally used as first responders where the target gas is reasonably specific to the area being monitored. This reduces the risk of alarms or readings from other VOC's which may not necessarily be of interest. IGD can help with application specific data.

Balance gas

The relative response is measured in laboratory air, with 20.9% oxygen, balance nitrogen. Some gases absorb UV light without causing any PID response (*e.g.* methane, ethane). In ambient atmospheres where these gases are present, the measured concentration of target gas will be less than is actually present. Methane absorbs UV strongly, so for accurate measurements in methane containing atmospheres, calibrate with a calibration gas containing the expected methane concentration. 50% LEL methane reduces the reading by up to 50%. Gases such as nitrogen and helium do not absorb UV and do not affect the relative response.

Notes

Maintenence

The electronics in the PID detector element and Tocsin 102PID are not accessible, being designed to be maintenance-free. Periodic sensor maintenance is required for the electrode stack and lamp.

When does my PID require maintenance?

Your PID lamp will need cleaning from time to time. How often? This depends on the environment you are measuring. If you are measuring indoor air quality with the low range, where the VOC concentrations are low and there are few particulates, then six monthly or even less frequent calibration may be adequate. However, if you are measuring high VOC concentrations with the highrange and particulates are present in high concentrations, then check calibration frequently and when the PID has lost sensitivity, clean the lamp and or change the stack as explained below.

You can tell when the PID needs cleaning:

- If the baseline is climbing after you zero the PID, then the electrode stack needs replacing.
- If the PID becomes sensitive to humidity, then the electrode stack needs replacing.
- If the baseline is unstable or shifts when you move the PID, then the electrode stack needs replacing.
- If sensitivity has dropped too much (note the change required when checking calibration), then the lamp needs cleaning.

When do I clean the PID lamp?

Cleaning of the PID lamp is recommended as a first action when presented with a PID that needs cleaning. Use the procedure described below. It is recommended that a cell be recalibrated after cleaning a lamp, especially if the cell has been used for a few months since the sensor was last used.

When do I replace the PID electrode stack?

The PID electrode stack can last the lifetime of the PID if used in clean environments, or may only last a month if used in heavily contaminated sites. The electrode stack is a disposable item, so always hold a spare electrode stack if you are working in a dirty environment. If the cell shows signs of contamination after the lamp window has been cleaned, or is known to have been subjected to severe contamination, then it should be replaced. Instructions for replacing the electrode stack are below. It is recommended that the PID be recalibrated after replacing the electrode stack.

SENSOR ACCESS

Gas detectors can give excellent service over many years. The expected life of a gas detector will be dependant on many factors.

Run time
Exposure to contaminants
Environmental factors (thermal shock, vibration and similar)
Sensor aging

Over time the response of a sensor will change so whilst it may still zero and calibrate the following may change:

Response times become slower
Response to gas diminishes meaning the sensor will become noisier
Drift may increase between calibrations

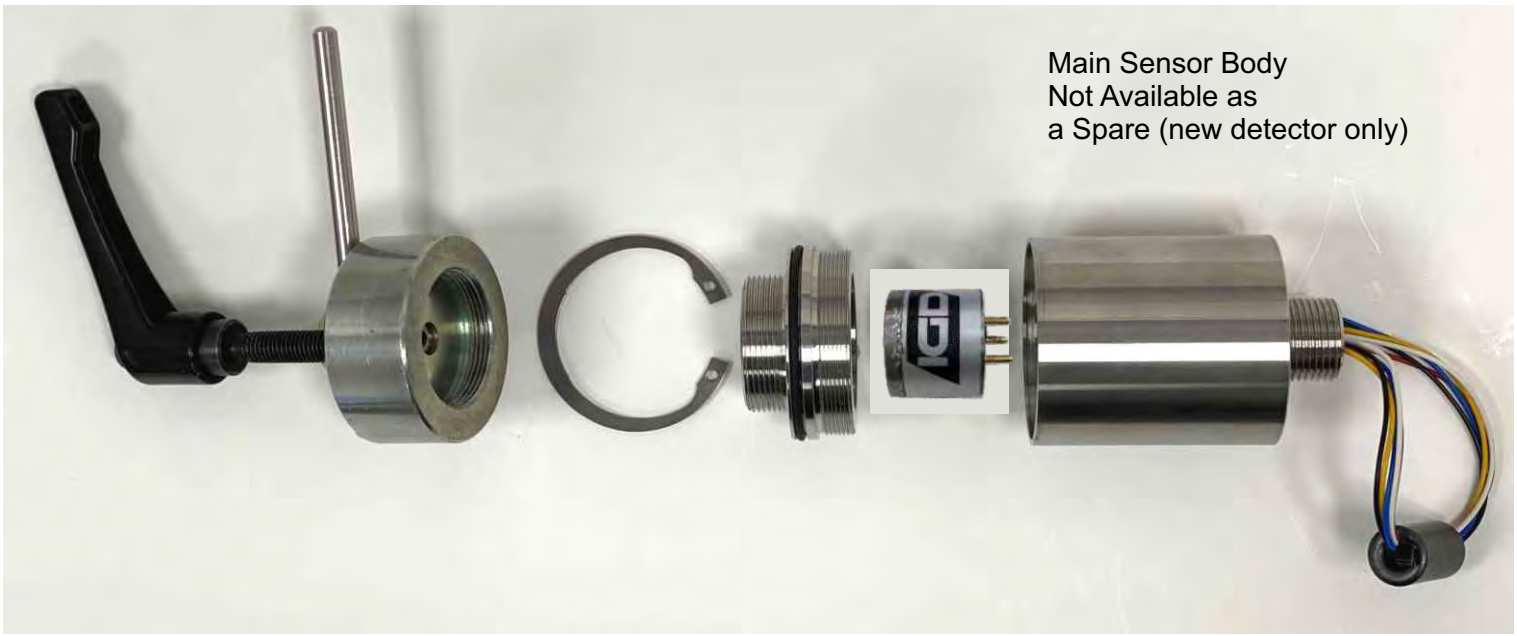
For these reasons the internal sensor module of the PID may need to be accessed for cleaning or for UV lamp or electrode stack replacement, or complete replacement

It is recommended to replace the protective sinter assembly at the same time ref 501019. This requires service tool ref 5121401.

Replacement should only be undertaken by suitably competent persons trained in the process.

Housings MUST NOT be opened in the hazardous area without first removing power.

Note that sensors will be susceptible to contaminants and should be handled in a clean area. Use nitrile or similar gloves to ensure sensors are not contaminated with dirt or hand creams when fitting. The sensor only plugs in one way and the assembly will require re-calibration after fitting. Allow 30 minutes for a sensor to fully stabilise before attempting calibration.



1. Use the sinter removal tool to gain access to the PID module. On safe area versions Access to the module requires the grey locking ring to be unscrewed from the rear of the detector front panel.

2. The PID module can be unplugged from the main stainless steel housing Wear neoprene or similar gloves to prevent contamination

3. IGD provide a PID service kit PN TOC-PID-SVC, it is recommended to use this kit.

4. Use a 3mm flat bladed screw driver fitted to the slot into the cap to pop off the cap on the PID (Fig 1)

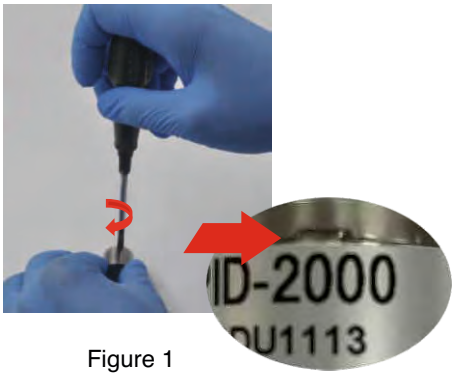


Figure 1

5. With the sensor cap removed use tweezers to remove the protection filter. This will need to be replaced on re-assembly replacement filters are IGD PN TOC-PID-FLT (Fig 2)

Note: as far as possible try to handle the PID parts as little as possible using the tweezers in preference to gloved hands.

Filter spare part number TOC-PID-FLT

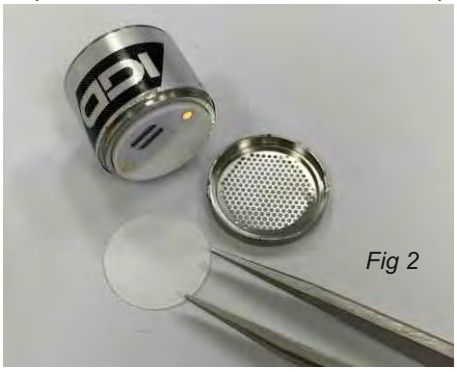


Fig 2

Fig 3

4. Carefully pull forward the electrode stack to disengage from the assembly

7. Use the Lamp removal tool to gently pop out the lamp. If you are not using the tool kit then a straightened paper clip can be used

Fig 5

Fig 4

8. Clean the UV lamp window surface by wiping with Gas Chromatograph (GC) grade methanol using lint free cotton swabs and moderate pressure.

After cleaning, hold the UV lamp up to the light at an angle to view if there is any remaining contamination, repeat cleaning to remove if necessary.

The cleanliness of the electrode stack can be checked using a suitable magnifying glass. Replace the electrode stack If necessary

Allow the lamp to thoroughly dry. Do not touch the surface of the lamp once it has been cleaned as to do so may affect sensitivity by contamination.

9. Reassembly in the reverse sequence:

Fit the UV lamp back into its pocket using tweezers and only touching the body of the lamp

Refit the electrode stack using tweezers

Place a new filter into the cap and place onto the sensor body

Use the refit tool to squeeze the cap back onto the sensor body. Only apply enough pressure until the cap pops into place (Fig 5)

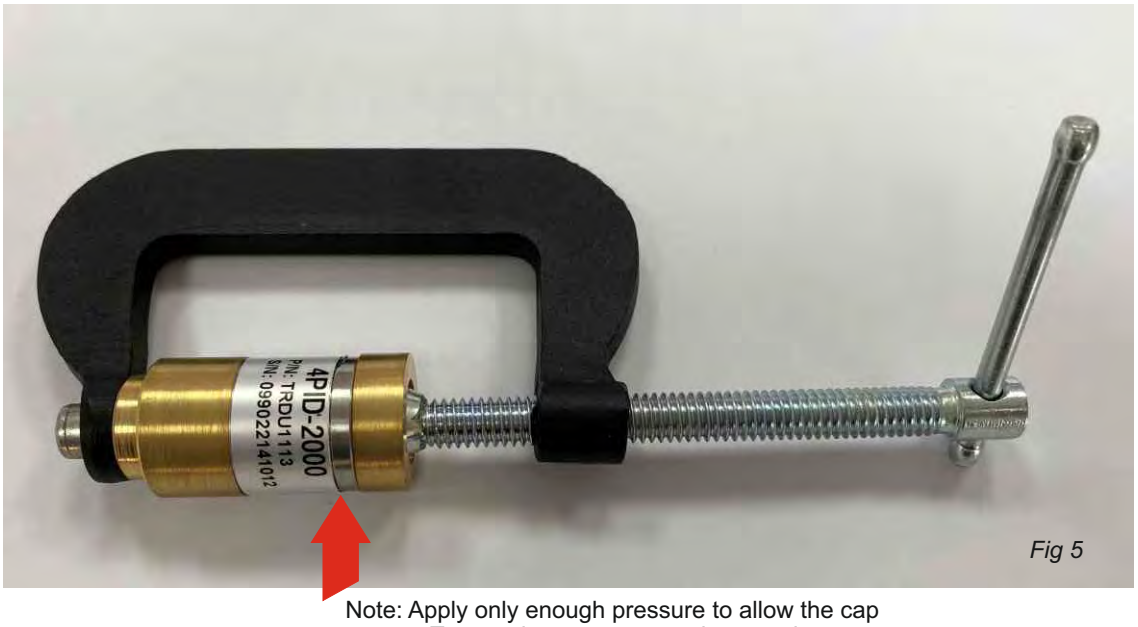


Fig 5

Note: Apply only enough pressure to allow the cap to seat. Too much pressure may damage the sensor. Not the orientation in the tool

10. The PID sensor module can now be re-fitted back into the 102 series stainless steel housing. Check the sinter housing O ring is in good condition, replace if necessary. Use the sinter removal tool to refit the sinter assembly. When correctly seated the circlip can then be re-fitted.

11. The sensor will now require re-calibration.

PID SPARE PARTS

Part ID	Description
TOC-PID-UV05	Replacement Lamp 50ppm
TOC-PID-UV01	Replacement Lamp 100ppm
TOC-PID-UV02	Replacement Lamp 200ppm
TOC-PID-UV20	Replacement Lamp 2000ppm
TOC-PID-UV50	Replacement Lamp 5000ppm
TOC-PID-ELEC	Replacement Electrode Stack
TOC-PID-FILT	Replacement Filter Pack

2-Wire Systems

Installers Guide

Document Ref: T550-INST V4.58

International Gas Detectors

2-WIRE SYSTEMS
Gas Detection Installers Guide

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