T106 Pellistor

Operation Manual

TOCSIN 102, 103 & TOC-30 SERIES PELLISTOR OPERATION MANUAL

REFERS TO MODELS 5131401ATEX, 5137001, TOC-30A-PHC and TOC-31A-PHC

For Full Information please refer to JB3 ATEX junction box manual for a full description

INVESTORS IN PEOPLE

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THIS GUIDE

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 106 based flammable 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.

IGD are available to answer question using our on-line ticketing system available through our website.

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.

TOCSIN 102

ANALOGUE OR ADDRESSABLE PELLISTOR FLAMMABLE GAS DETECTOR

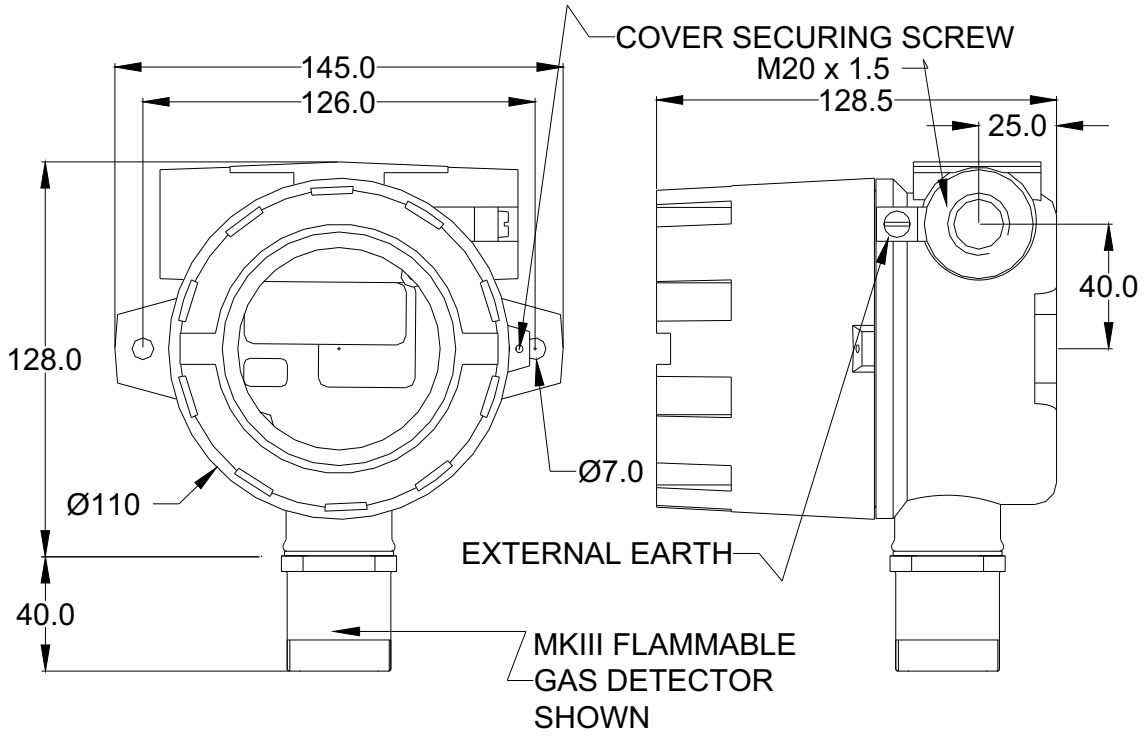
The Tocsin 102 and 103 series Pellistors are flammable gas detectors based on well proven catalytic principles. The units can be used either as conventional 3 wire 4-20mA transmitters or as 4 wire addressable modules capable of integration onto an IGD data highway. Either option allows integration with Tocsin 625, 640, 700 and 920 series control panels.

Pellistors are capable of detecting all flammable gases but are usually made sensitive to the particular target gas during calibration. It is therefore important that detectors are correctly installed and calibrated for correct operation.

Siting of the detector should also be carefully considered to take into account air flows, site geometry and the characteristics of the target gas. This instruction manual is intended fo ruse by competent persons who can either demonstrate previous experience and training with gas detection systems or have completed training courses at Oliver IGD Limited. Performance of the system will be a function of how well the system is installed and calibrated.

Oliver IGD Limited can help advise on the correct siting and calibration of gas detectors.

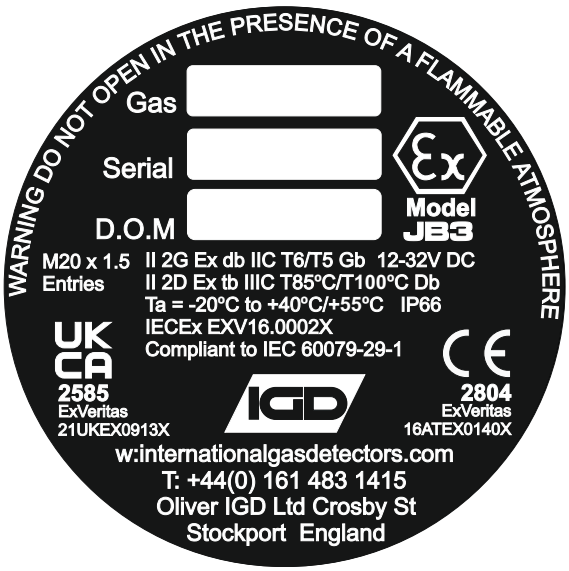
ATEX CERTIFIED MODELS



For Full Information please refer to JB3 ATEX junction box manual for a full description

ATEX Versions 5131401ATEX

MARKINGS AND APPLICABLE STANDARDS



The housing must be grounded to a minimum 20A ground.
If the JB3 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 without the cover correctly screwed in place.

JB3

INSTALLATION INSTRUCTIONS

The following information is provided to enable safe installation and operation of the Model JB3 Junction Box.

The junction box can be fitted with either two or three wire flammable gas sensor.

It is vitally important for correct and safe operation that appropriate cable types and sizes are used and all earth bonding points observed. It is also important to observe all instructions for entry terminations. Failure to follow these instructions may result in a system which may be dangerous or fail to operate correctly.

It is imperative to use cabling which suits the environment in which the JB3 and its sensor is to be used. The following is intended as a guide.

Use

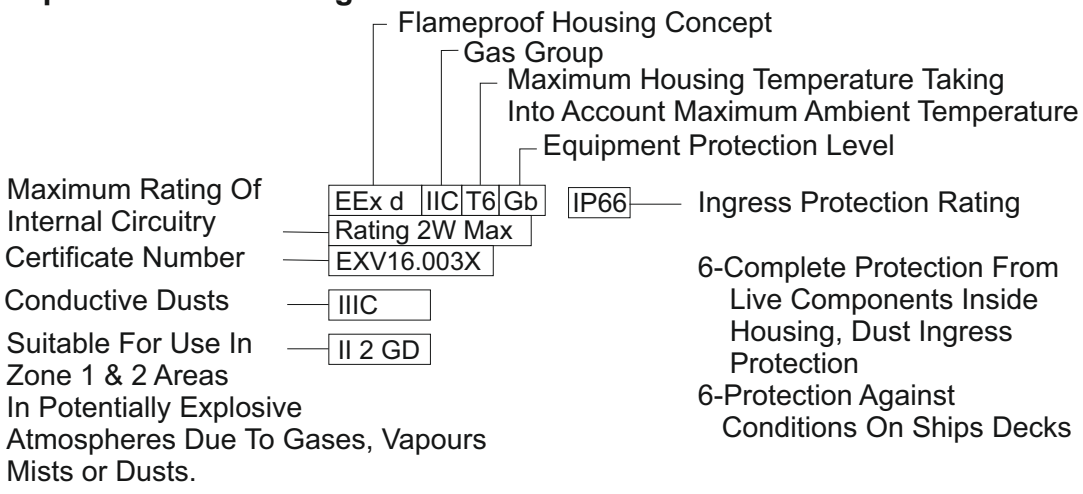
Pirelli LSX/FP type cable for office/light commercial un-zoned installations

Steel Wire Armoured or CY cable for medium/heavy industrial un-zoned installations

SWA or Mineral Insulated Pyro cable for all hazardous area zoned installations.

Note in all cases the JB3 Housing must be earthed and used in conjunction with correctly zoned cable glands and sealing for safe operation in a hazardous area.

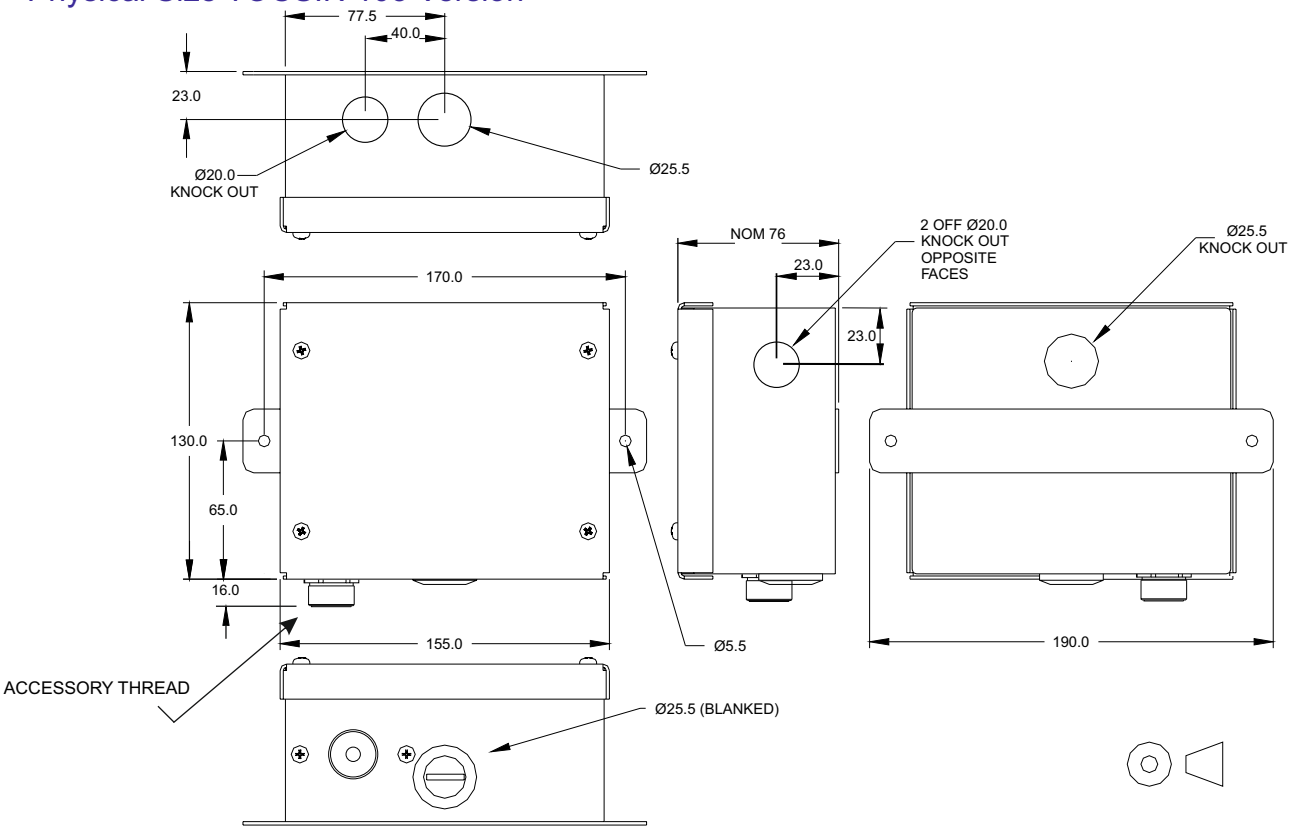
Explanation of Markings



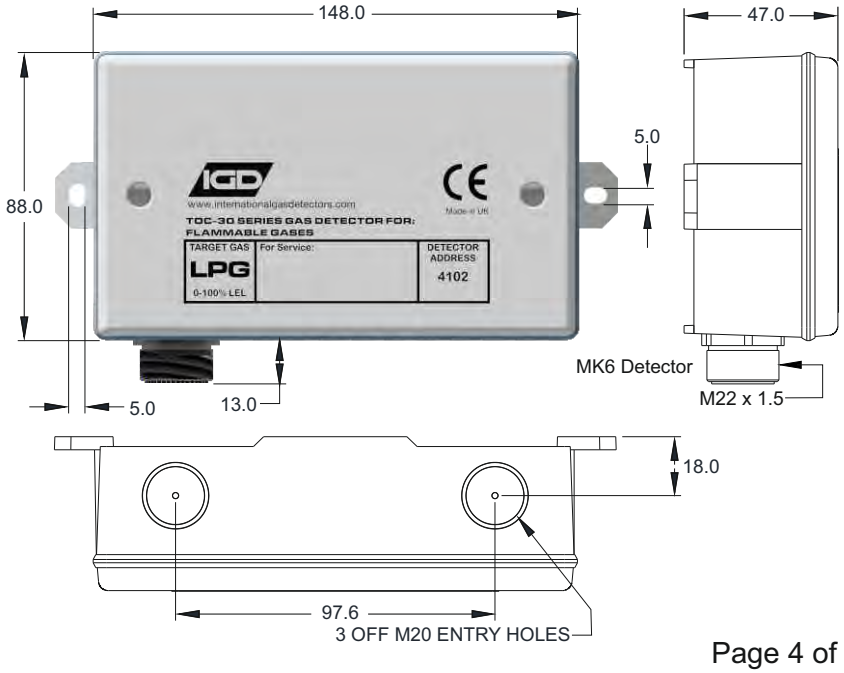
Non ATEX versions with MK6 detectors, Mounting Details

The non-ATEX version, 103 series flammable gas detector is typically fitted in areas that do not require a flameproof gas detector approval. Typical applications would be boiler rooms, school laboratories, commercial kitchens etc. Cabling should have a suitable level of protection for the area into which the detector is fitted and be of a screened type such as CY style cable or FP200 style cable. Cable glands should provide a positive seal to limit ingress from dust and moisture.

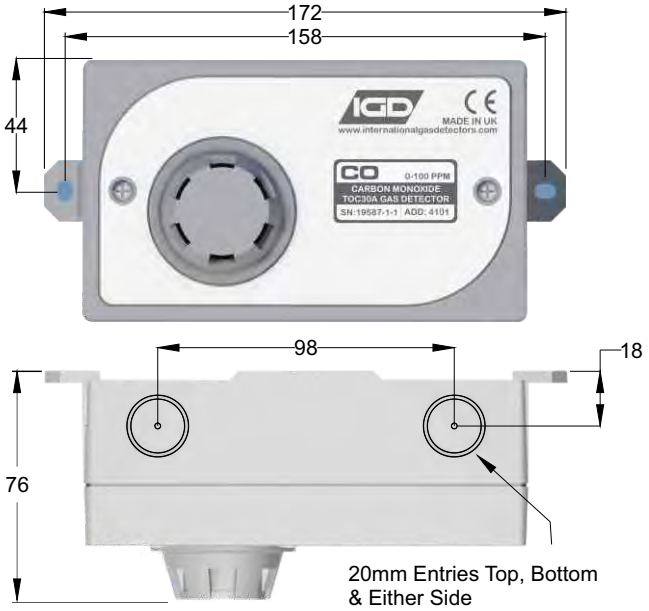
Physical Size TOCSIN 103 Version



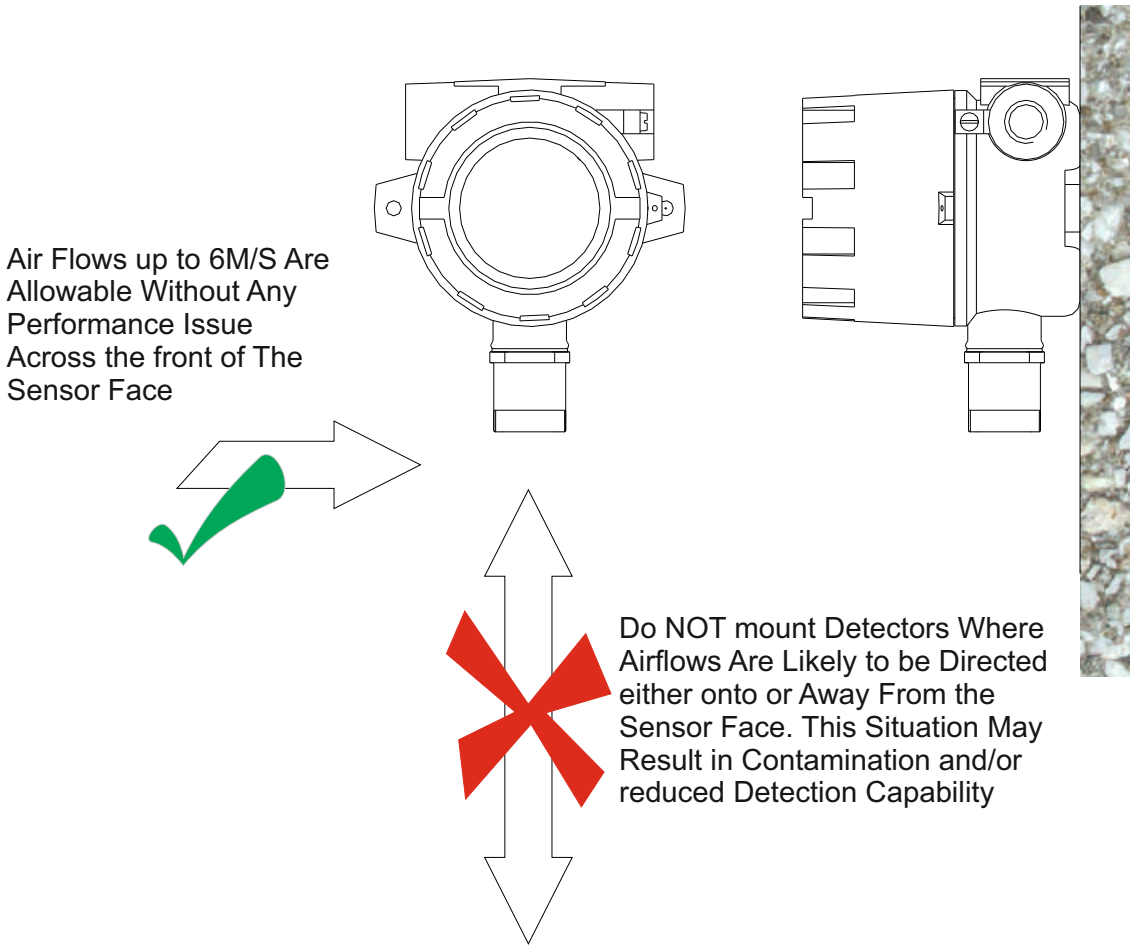
Physical Size TOC-31A Version



Physical Size TOC-31A Version



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



A Pellistor consists of a very fine coil of platinum wire, embedded within a ceramic pellet. On the surface of the pellet is a layer of a high surface area noble metal, which, when hot, acts as a catalyst to promote exothermic oxidation of flammable gases. In operation, the pellet and so the catalyst layer is heated by passing a current through the underlying coil. In the presence of a flammable gas or vapour, the hot catalyst allows oxidation to occur in a similar chemical reaction to combustion. Just as in combustion, the reaction releases heat, which causes the temperature of the catalyst together with its underlying pellet and coil to rise. This rise in temperature results in a change in the electrical resistance of the coil, and it is this change in electrical resistance which constitutes the signal from the sensor. Pellistors are always manufactured in pairs, the active catalysed element being supplied with an electrically matched element which contains no catalyst and is treated to ensure no flammable gas will oxidise on its surface. This "compensator" element is used as a reference resistance to which the sensor's signal is compared, to remove the effects of environmental factors other than the presence of a flammable gas. The advantage of using this technique when detecting flammable gases for safety purposes is that it measures flammability directly.

In the event of exposure to gas beyond the measuring range. Allow to stabilise in clean air or use instrument air at 0.5L/Min for 4 hours. If reading is greater then 5% LEL after this period replace otherwise re-zero and calibrate

Pellistor Poisons

Certain substances are known to have a detrimental effect on Pellistor sensors. There are two mechanisms by which this can occur:

Poisoning

Some compounds will decompose on the catalyst and form a solid barrier over the catalyst surface. This action is cumulative and prolonged exposure will result in an irreversible decrease in sensitivity. Typical poisons are organic lead and silicon compounds.

Inhibition

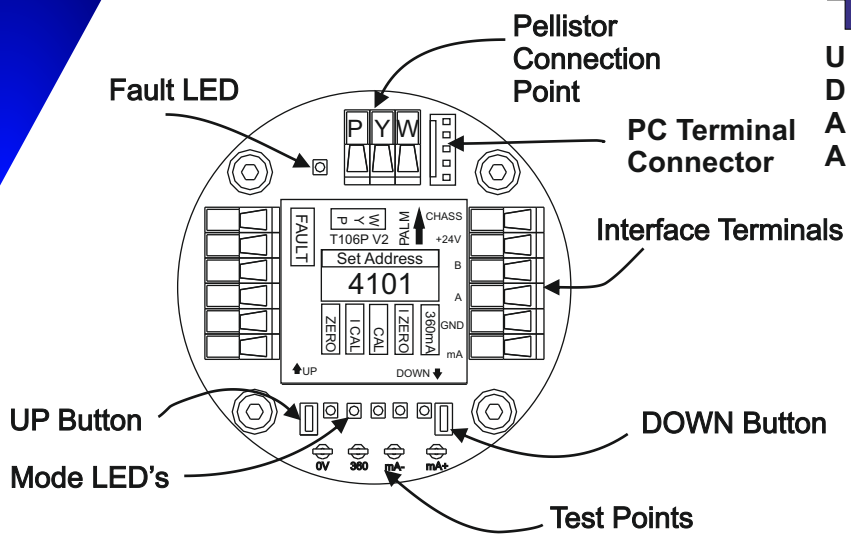
Certain other compounds, especially H2S and halogenated hydrocarbons, are absorbed or form compounds that are absorbed by the catalyst. This absorption is so strong that reaction sites in the catalyst can become blocked and normal reactions are inhibited. The resultant loss of sensitivity is temporary and in most cases a sensor will recover after a period of operation in clean air.

Most compounds fall into one of these two categories, although some will exhibit both mechanisms to greater or lesser extent. In applications where either poisoning or inhibition are likely to be present, MK8's should be protected from exposure to any compounds to which they do not specifically exhibit resistance.

Note that MK8 pellistors are extremely resistant to such poisons and inhibitors. A unique feature of the MK8 is its ability to recover most of their response after exposure to silicones.

TOCSIN 106P

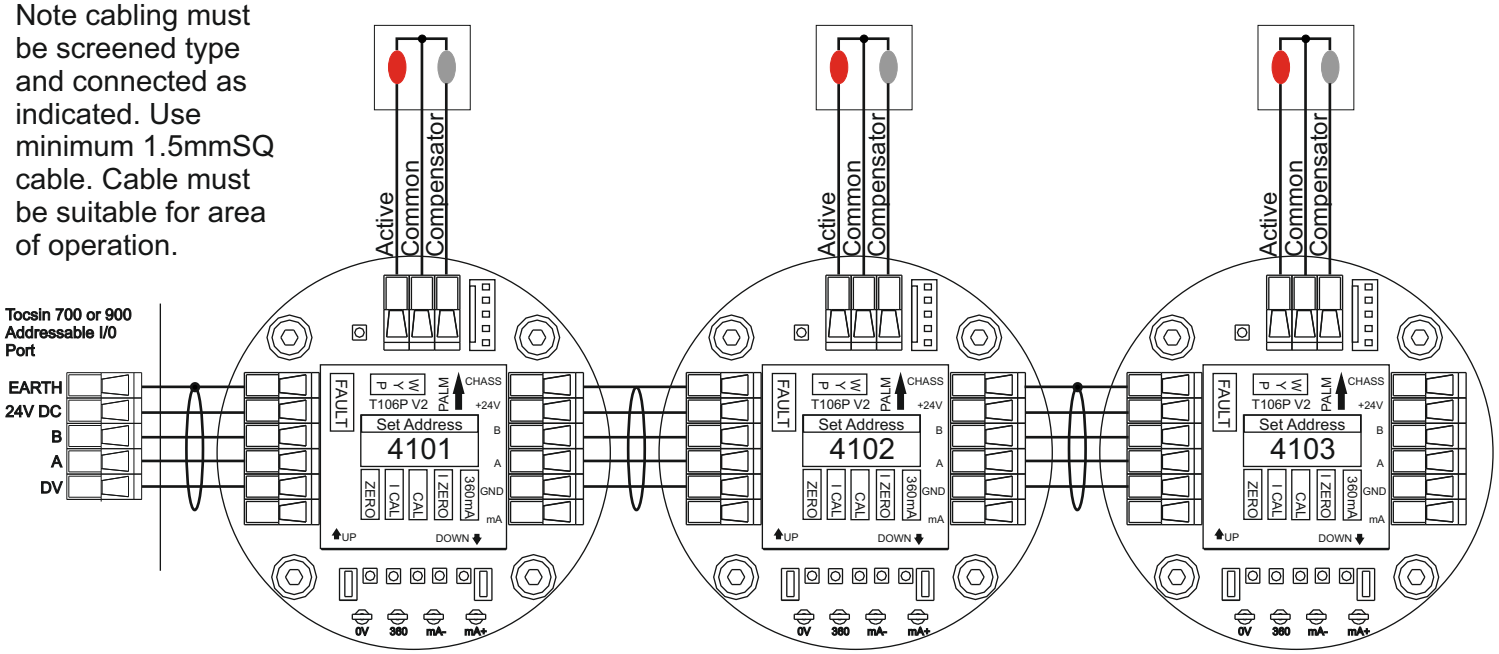
UNIVERSAL PELLISTOR DRIVE PCB ANALOGUE OR ADDRESSABLE OUTPUT



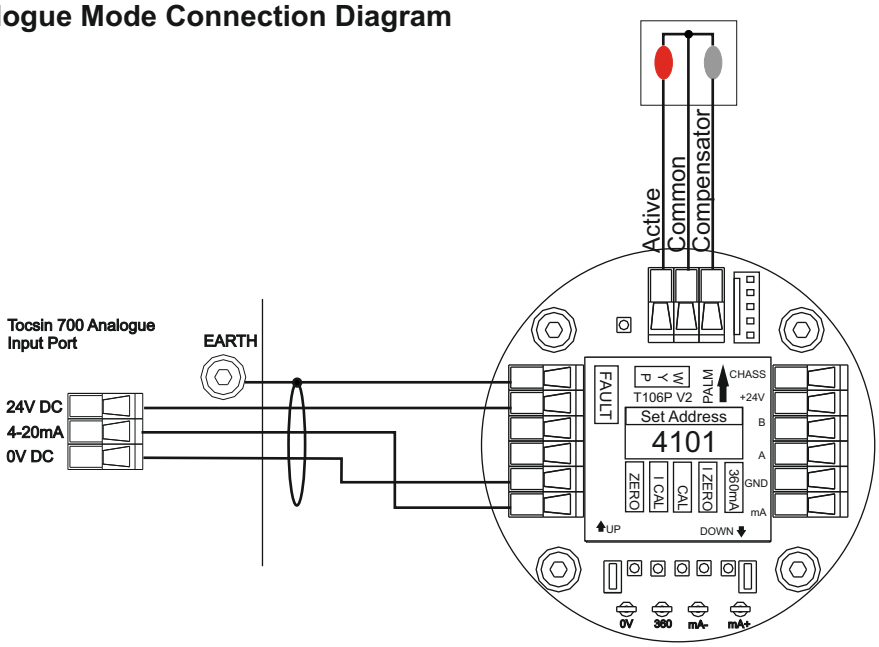
The Oliver IGD universal pellistor drive PCB is designed to take input from a standard pellistor and give either a linear 4-20mA current source output or digital RS485 addressable output.
Status LED's are provided to indicate mode of operation and correct operation through the internal fault detection systems.
Please note that a known calibration gas will be required to calibrate the unit.

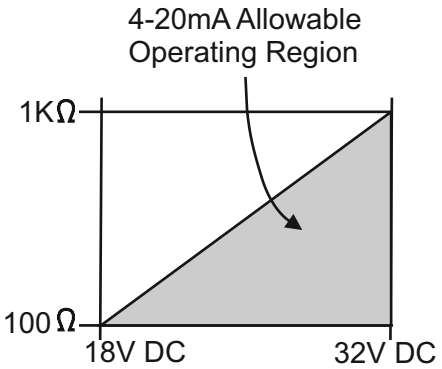
Addressable Mode Connection Diagram

Note cabling must be screened type and connected as indicated. Use minimum 1.5mmSQ cable. Cable must be suitable for area of operation.



Analogue Mode Connection Diagram

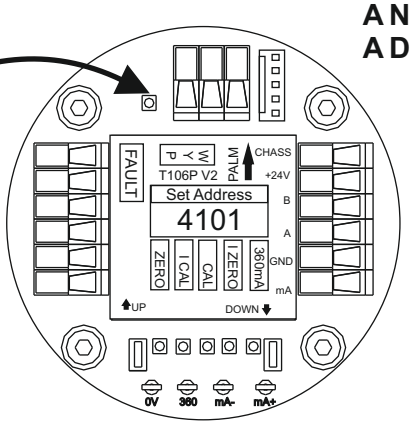




TOCSIN 106P

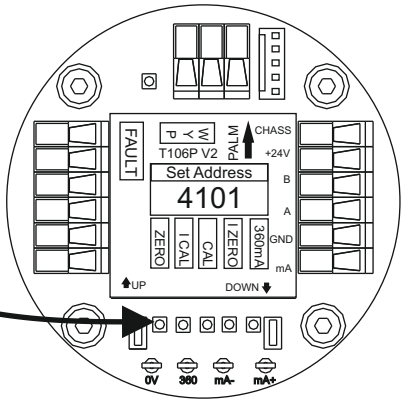
UNIVERSAL PELLISTOR DRIVE PCB ANALOGUE OR ADDRESSABLE OUTPUT

With power applied the FAULT LED will flash quickly to indicate the software version then flash more slowly(once per second) during warm up (60 Seconds). Warm up can be bypassed by pressing either button. In normal operation the FAULT LED will be off.



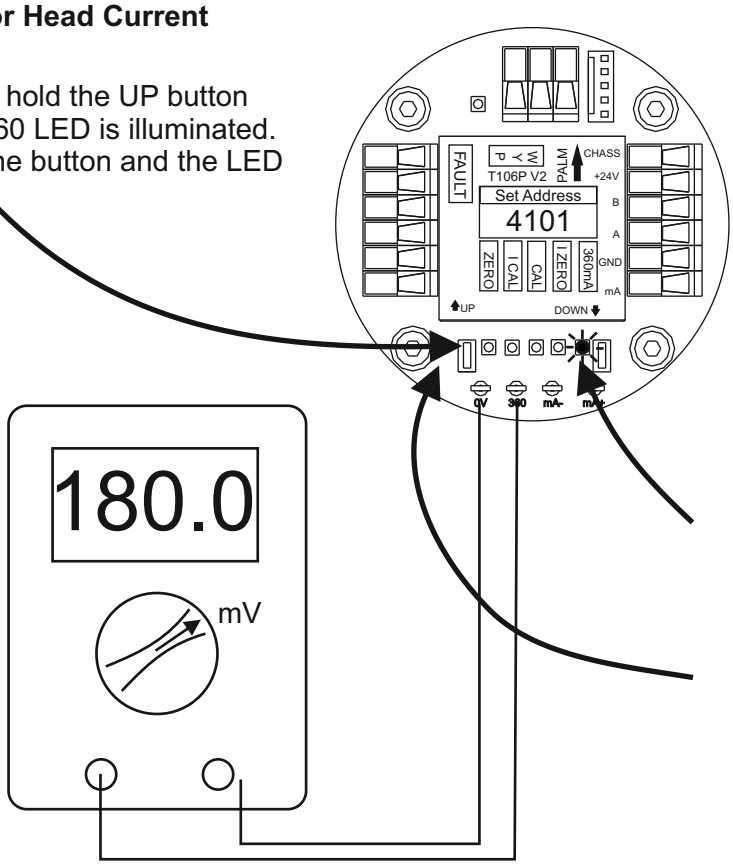
Addressable Operation After Warm Up

After warm up the fault LED should be off AND ZERO led on. If valid serial commands are received by the 103P then the ZERO LED will flash as commands are transmitted.



Setting Pellistor Head Current

Press and hold the UP button until the 360 LED is illuminated. Release the button and the LED will flash.



With the LED flashing connect a multimeter as indicated to read the pellistor head current. Note the meter will read half the head drive current. Use the UP - DOWN buttons to increase or decrease the set point. (Fault LED flashes on every button press.)

For MK3 and MK5 IGD pellistors set to 180mV.+/- 2mV.

For MK6 and Type B IGD Pellistors set to 85mV +/-3mV

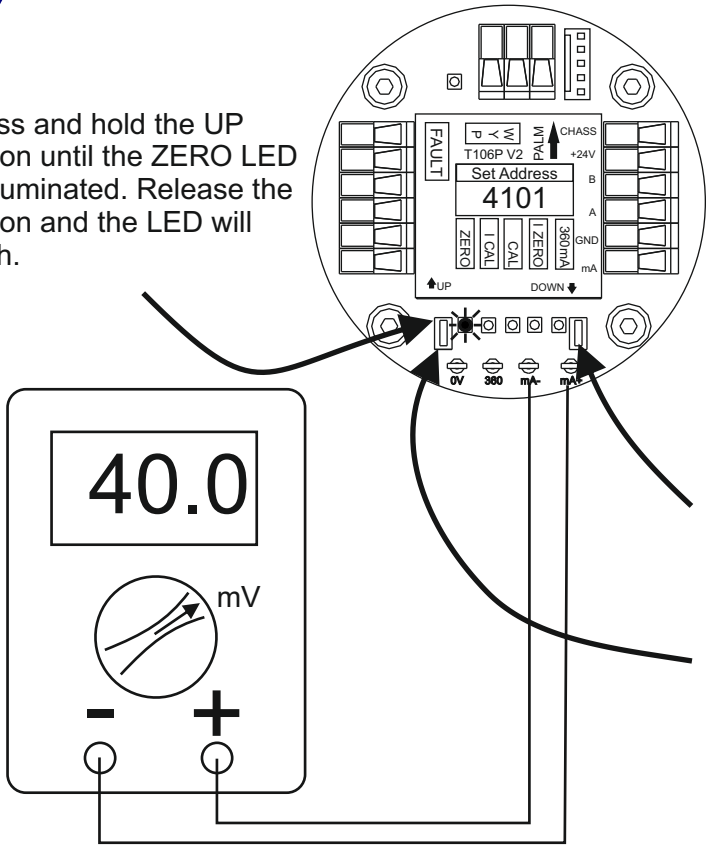
Note the preset head operating point will be indicated on the 106 label

Press and hold either button until the LED goes off to return to normal operation.

TOCSIN 106P

UNIVERSAL PELLISTOR DRIVE PCB ANALOGUE OR ADDRESSABLE OUTPUT

Press and hold the UP button until the ZERO LED is illuminated. Release the button and the LED will flash.



With the LED flashing connect a multimeter as indicated to read the zero mA output. Note: T106P switches an internal resistor between mA and GND to enable local mA measurements for addressable and analogue units.

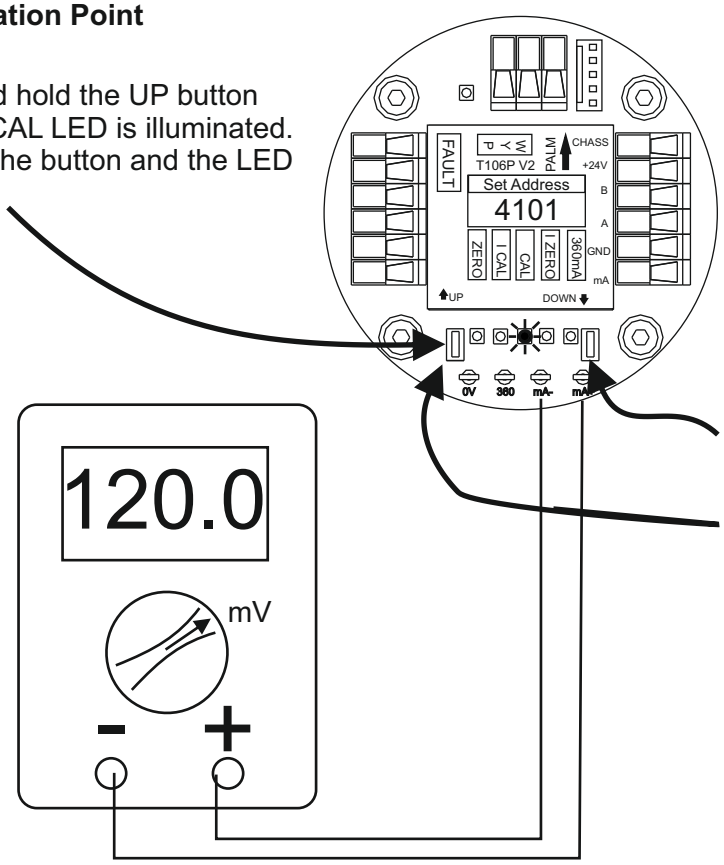
Use the UP - DOWN buttons to increase or decrease the set point.

Note that 4mA (zero) is indicated on the meter as 40.0mV +/- 1mV.

Press and hold either button until the LED goes off to return to normal operation.

Setting Calibration Point

Press and hold the UP button until the CAL LED is illuminated. Release the button and the LED will flash.



With the LED flashing connect a multimeter as indicated to read the CAL mA output.
Use the UP - DOWN buttons to increase or decrease the set point.

Note that 12mA (mid scale or 50% LEL) is indicated on the meter as 120.0mV +/-1mV

Press and hold either button until the LED goes off to return to normal operation.

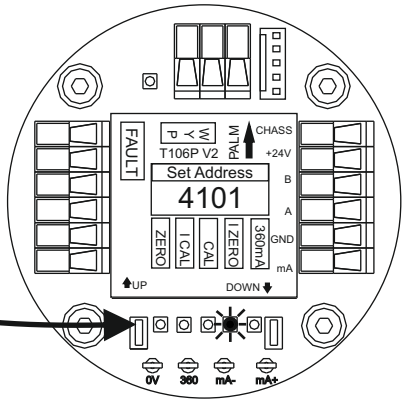
Note: Known calibration gas must be flowed to the detector head at the correct flow rate during calibration. If in doubt check with the pellistor manufacturer.
For IGD Pellistors use 0.5-1L/min

These two options relate to early versions pre 2015

OPTION 3 I ZERO (INSTANTANEOUS ZERO)

Setting Instantaneous Zero

Press and hold the UP button until the I ZERO LED is illuminated. Release the button and the LED will flash.



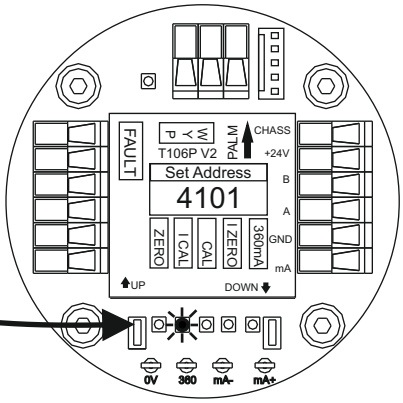
Ensure zero gas has been flowing passed head for enough time for the reading to stabilise (minimum of 60 seconds). Press and hold either button until LED goes off, then release.
LED's will then flash in turn for 5 seconds during zero. The unit will then automatically return to normal operation.

Notes:1. The internal zero pot is also adjusted, this is needed if a new pellistor is fitted.
2.The cal needs to be re-checked (due to possible changes in zero pot.)

OPTION 4 I CAL (INSTANTANEOUS CAL)

Setting Instantaneous Cal

Press and hold the UP button until the I CAL LED is illuminated. Release the button and the LED will flash.



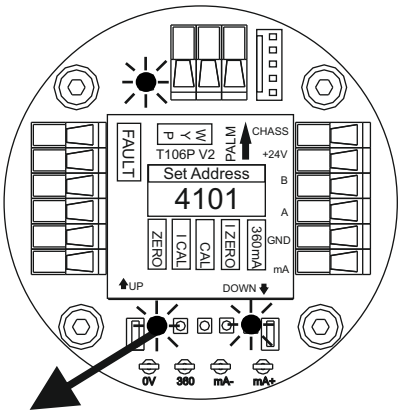
Ensure cal gas has been flowing passed head for enough time for the reading to stabilise (minimum of 60 seconds). Press and hold either button until LED goes off, then release.
LED's will then flash in turn for 5 seconds during zero. The unit will then automatically return to normal operation.

Notes: 1. The calibration gas used has to be the same as the last calibration.
2.The internal gain pot is also adjusted, this is needed if a new pellistor is fitted.
3.The zero needs to be re-checked (due to possible changes in gain pot.)

Setting The Unit Address

TOCSIN 106P

UNIVERSAL PELLISTOR DRIVE PCB ANALOGUE OR ADDRESSABLE OUTPUT



Press and hold the DOWN button until the FAULT LED is illuminated. Release the button and fault LED will flash and the address currently set will be illuminated on the bottom three LED's.

Use the UP and DOWN buttons to alter the address set as indicated in the table below.
Press and hold either button until the fault LED goes off to return to normal operation.

Address Combinations Which Can Be Set without Using An IGD Configuration Terminal

ZERO	I ZERO	CAL	I CAL	360mA	
					4100
☀					4101
	☀				4102
☀	☀				4103
		☀			4104
☀		☀			4105
	☀	☀			4106
☀	☀	☀			4107
			☀		4108
☀			☀		4109
	☀		☀		4110
☀	☀		☀		4111
		☀	☀		4112
☀		☀	☀		4113
	☀	☀	☀		4114
☀	☀	☀	☀		4115

ZERO	I ZERO	CAL	I CAL	360mA	
				☀	4116
☀				☀	4117
	☀			☀	4118
☀	☀			☀	4119
		☀		☀	4120
☀		☀		☀	4121
	☀	☀		☀	4122
☀	☀	☀		☀	4123
			☀	☀	4124
☀			☀	☀	4125
	☀		☀	☀	4126
☀	☀		☀	☀	4127
		☀	☀	☀	4128
☀		☀	☀	☀	4129
	☀	☀	☀	☀	4130
☀	☀	☀	☀	☀	4131
1	2	4	8	16	

It is possible to set other address combinations by connecting the unit to an IGD configuration terminal. This should only be undertaken by trained technicians and is beyond the scope of this manual.

RESPONSE TO FLAMMABLE GASES

TOCSIN 106P

Below is a table FOR MK6, MK3,MK7 and 8 pellistor responses to various flammable gases. The table assumes the sensor is measuring on the 0-100% LEL scale and assumes that the response to methane = 100%.

Note that the LEL data can be different in different countries. In Europe, the LEL's used are defined in the IEC standard IEC80079-20-1, whilst in the USA and various other areas, LELs are generally taken from the US Bureau of Mines Bulletin Document 627.

Technically, both are correct; the reason for the differences being that the measurements made for IEC80079-20-1 are with the gas in motion, whilst the US Bureau of Mines Bulletin Document 627 assumes the gas is not moving. For convenience, relative responses are given according to BOTH standards below.

Gas	Formula	LEL Europe (IEC80079-20-1)	Relative response (%)	LEL (USA) (USBoM 627)	Relative response (%)
Methane	**CH_4**	**4.4**	**100**	**5**	**100**
Acetone	$(CH_3)_2CO$	2.5	22	2.6	20
Ethanol	C_2H_5OH	3.1	27	3.3	26
Ethyl acetate	$C_2H_5COOCH_3$	2	22	2.2	21
Ethylene	C_2H_4	2.3	56	2.7	58
Hydrogen	H_2	4	97	4	85
Iso-propanol	$CH_3CH(OH)CH_3$	2	19	2.2	18
Methanol	CH_3OH	6	46	6.7	46
n-Butane	C_4H_{10}	1.4	47	1.8	53
n-Heptane	C_7H_{16}	0.85	40	1.05	43
n-Hexane	C_6H_{14}	1	42	1.2	44
n-Pentane	C_5H_{12}	1.1	41	1.4	46
Propane	C_3H_8	1.7	54	2.1	59
Toluene	$C_6H_5CH_3$	1	24	1.2	25
Propylene	$CH_3\text{-}CH{=}CH_2$	2	74	2.4	78
Cyclo-hexane	C_6H_{12}	1	44	1.3	50
Cyclo-pentane	C_5H_{10}	1.4	63	1.5	59
Iso-butane	C_4H_{10}	1.3	46	1.8	56
Iso-octane	C_8H_{18}	0.7	36	not given	32
n-octane	$CH_3(CH_2)_6CH_3$	0.8	40	0.95	42
Styrene	$C_6H_5CH{=}CH_2$	1	14	1.1	14
Xylene	$C_6H_4(CH_3)_2$	1	26	1.1	25
Carbon monoxide	CO	10.9	42	12.5	42
Ammonia	NH_3	15	68	15	60

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

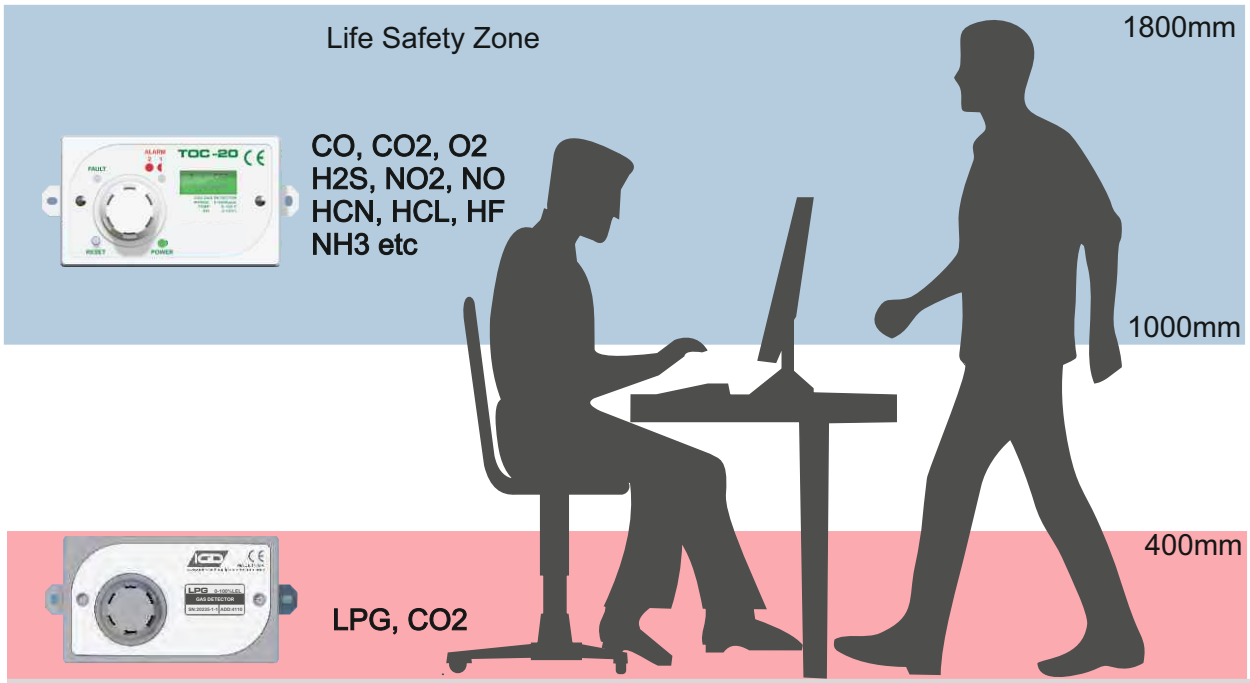
Note that in many cases both life safety and plant protection sensors may be appropriate on a site. For example a plant using liquid helium may have plant protection sensors at high level to ventilate roof spaces in the event of leaks. However in the event of ventilation failure Helium could accumulate 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.

Consider ceiling divisions, follow rules for smoke detectors

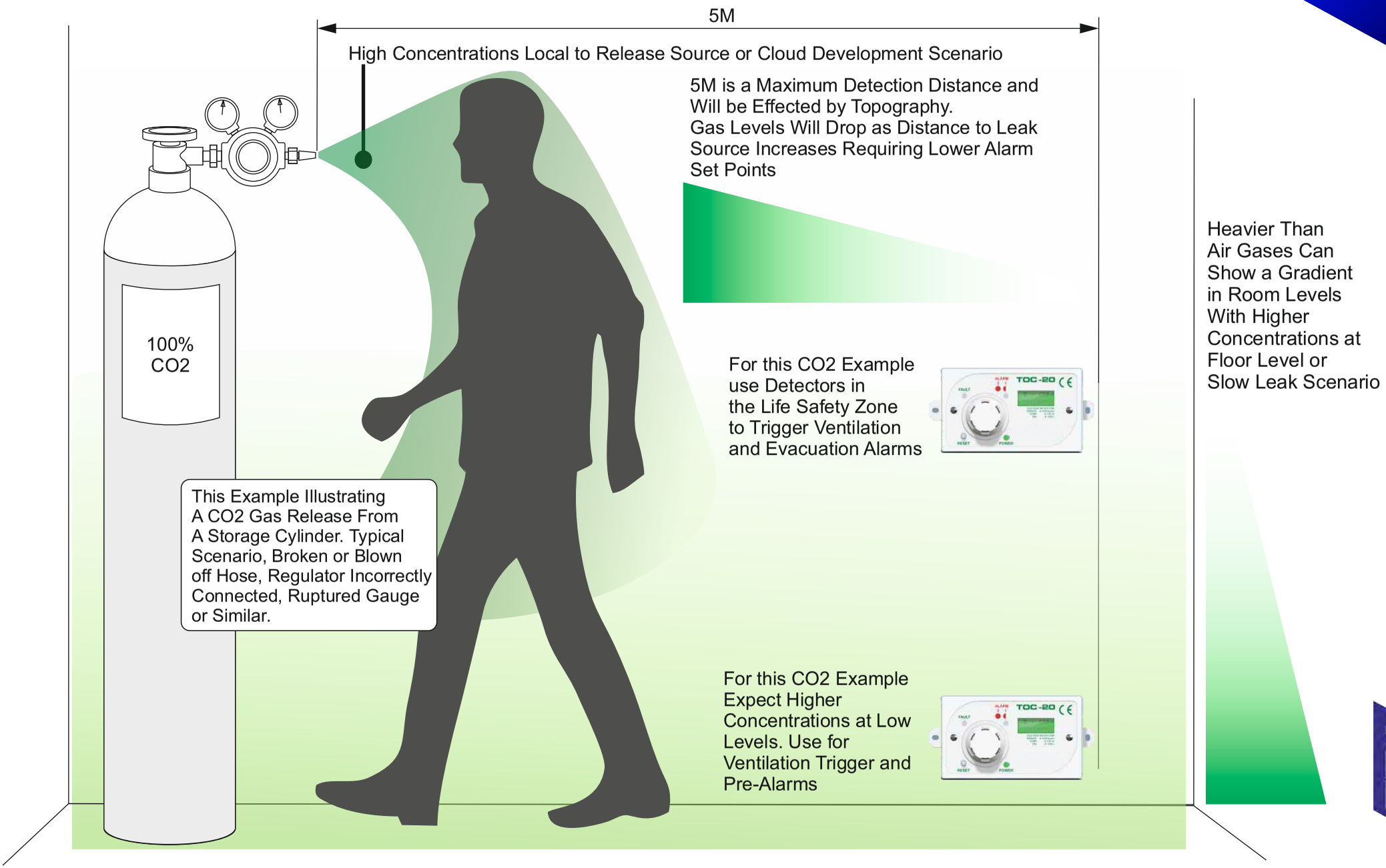
Lighter than air gases, detectors placed at highest ceiling points
Consider fitting collector cones at lower level for gas bottle stores boiler plant and gas meters (see separate application note).

Methane, Helium, Hydrogen, Ammonia etc



Consider fitting splash/dust guards to protect low level sensors

Consider sensors in under floor areas/voids/drains where heavier than air gases are present


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

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

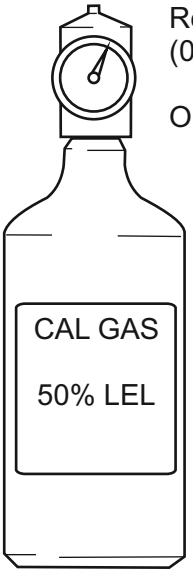
Calibration gas kits are available from IGD.

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