TOCSIN 102PID

INSTALLATION AND USER INSTRUCTIONS

EEx d IIC T6

CE 0518

Ex II 2 D G

Sira 02ATEX1271X

Oliver IGD Limited **V1.0**

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PERFORMANCE

		Low Range	High Range
Target gases	VOCs with ionisation potentials < 10.6eV		
Minimum detection level	(ppb isobutylene)	5	100
Linear range	(ppm isobutylene)(5% deviation)	50	300
Overrange	(ppm isobutylene)	50	6,000
Sensitivity	(linear range) (mV / ppm Isobutylene)	> 20	> 0.6
Full stabilisation time	(minutes to 100ppb)	20	20
Warm up time	(seconds) time to full operation	5	5
Response time (t_{90})	(seconds) diffusion mode		<25

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

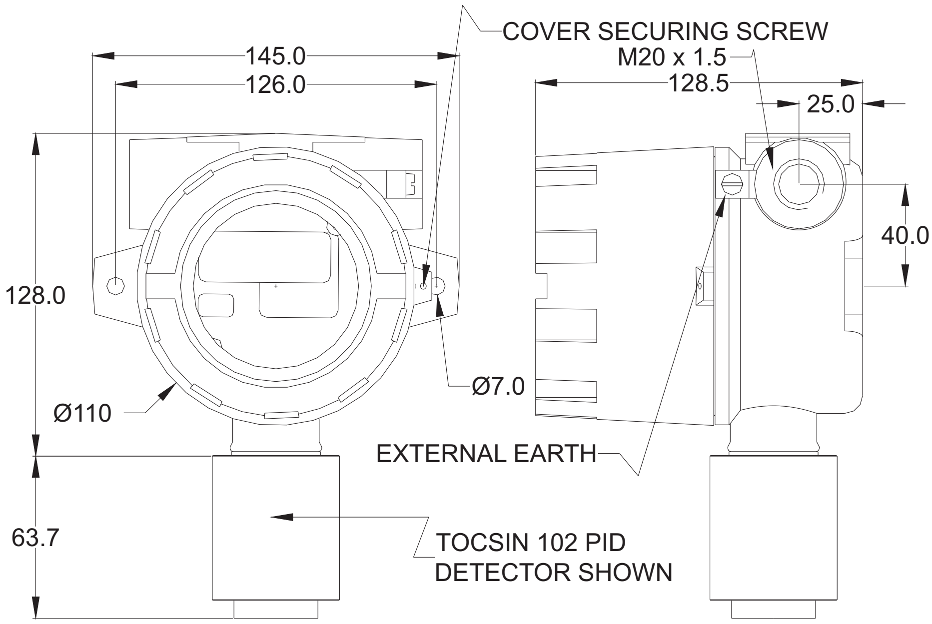
ENVIRONMENTAL

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	SIRA02ATEX1271X EEXd 2C T6 2 II GD a
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)



OLIVER IGD

EC Declaration of Conformity
Oliver IGD affirm under our sole responsibility that the following electrical equipment manufactured by us fulfills the requirements of the:
ATEX Directive 94/9/EC,
EMC directive 2004/108/EC
LVD directive 2006/95/EC.

Oliver Ref	T102ECDEC
Product Description	Tocsin 102 2 or 3 wire 4-20mA Gas Detector Head or Camera
Date of First Application	JULY 2007
Approval to Type	ISO9001:2000 Quality system and ATEX Quality Module
ATEX Marking	Ex II 2 GD Ex d IIC T6 +55°C
EC Type Certificate Notified Body Name, Number and Address	Sira 02ATEX1271X Sira 0539 Rake Lane, Eccleston Chester. UK
Manufactured By	Oliver IGD Limited, 4a Pepper Road, Stockport, SK7 5BW England.
Standards Applied	BS EN 61000-4-6 2009 BS EN 61000-4-2 2009 BS EN 60079-1 2004 inc corr 1 BS EN 60079-0 2006 BS EN 61241-0 2006 BS EN 61241-1

Oliver IGD Limited operate an ISO9001:2000 Quality System which incorporates the requirements of the ATEX directive.

Signed

Andrew Collier.
Managing Director

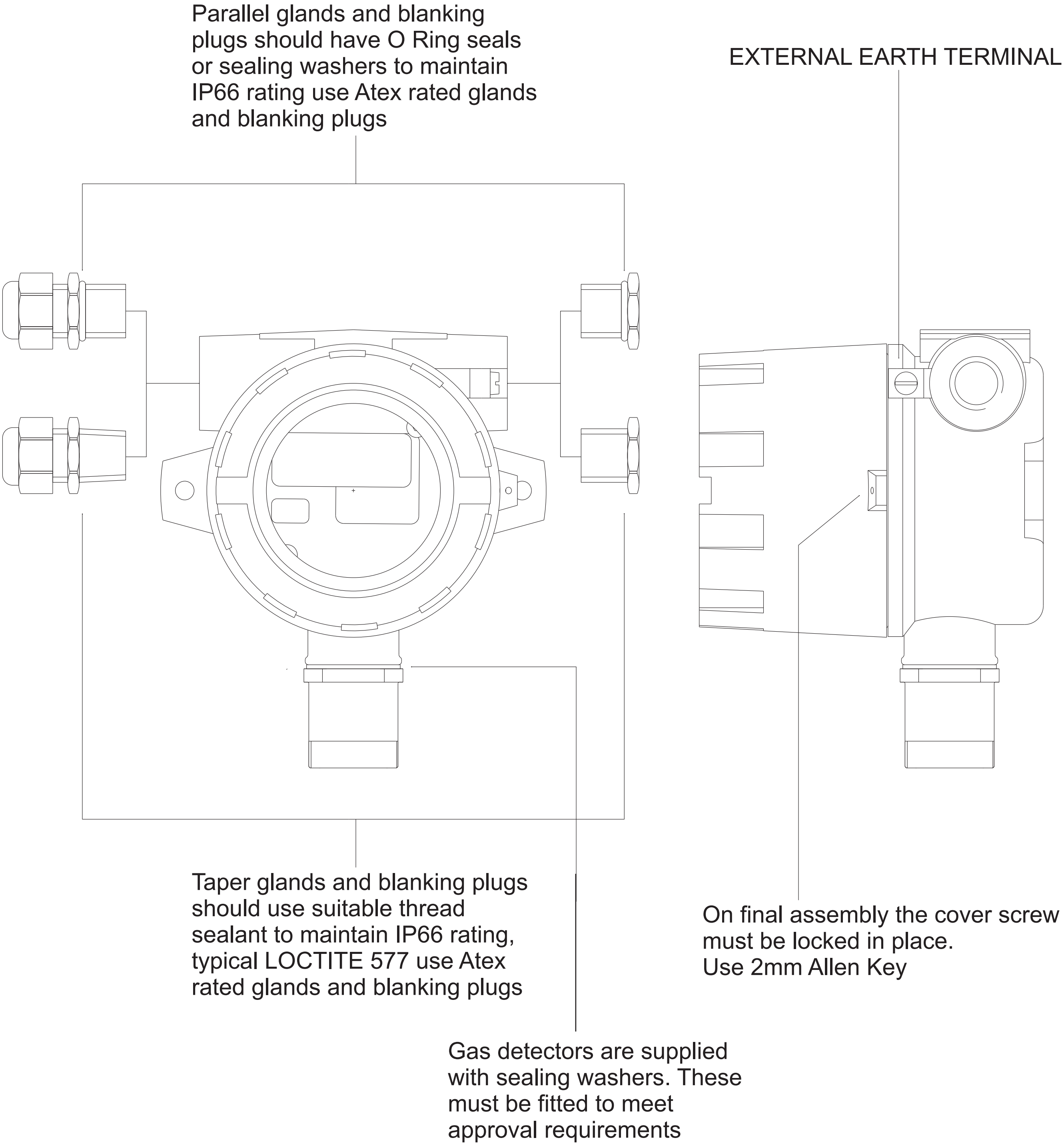
75 Years In Gas Detection
PIONEERS
30 Years In Gas Analysis

Registered in England No. 1044944

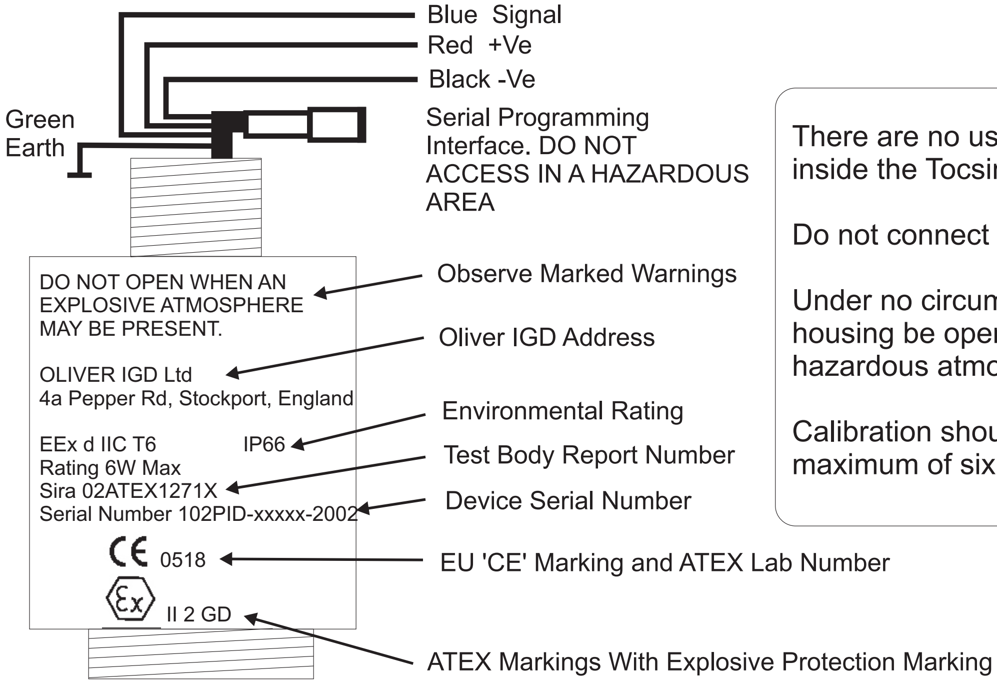
ISO 9001 sira UKAS QUALITY MANAGEMENT

CUSTOMER SEALING AND EARTHING RESPONSABILITIES

The Tocsin 102PID is designed for use in Zone 1 and Zone 2 hazardous areas and is ATEX 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. The Tocsin 102PID must be installed using a junction box which is suitable for the zone into which the equipment is being installed. Suitable junction boxes are available from Oliver IGD Limited. A typical example is indicated.



TOCSIN 102PID 4-20mA 3 Wire VOC Gas Transmitter Fitting and Markings.



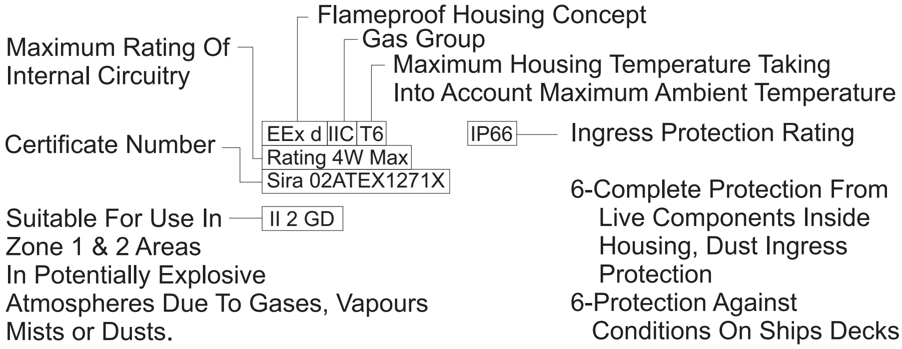
There are no user serviceable components inside the Tocsin 102.

Do not connect to portable equipment

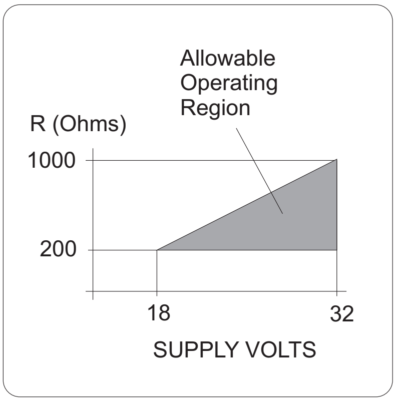
Under no circumstances should the housing be opened in a potentially hazardous atmosphere.

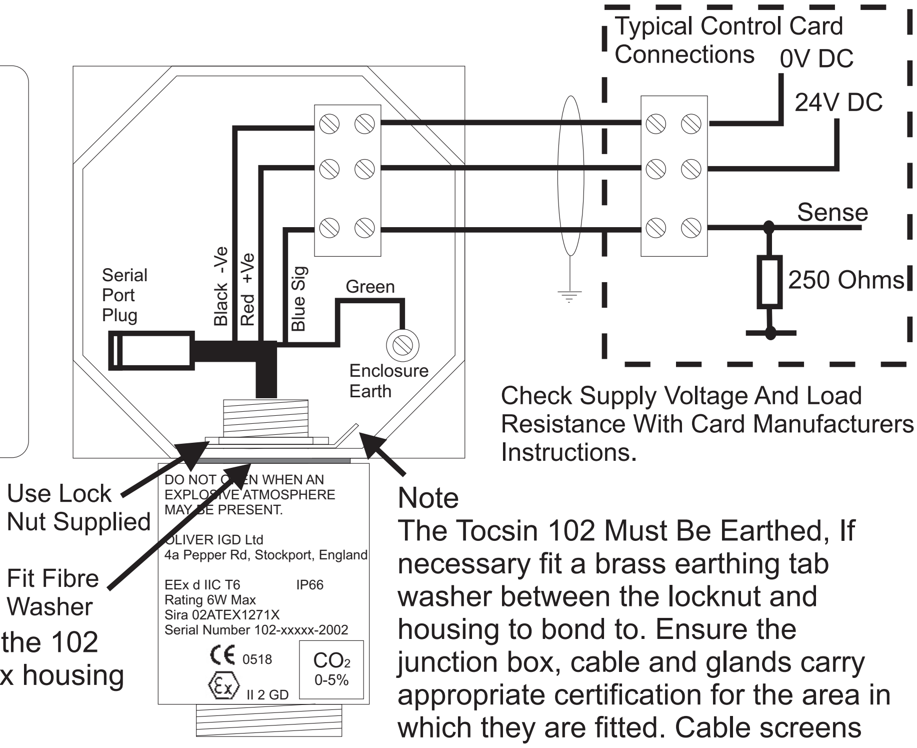
Calibration should be undertaken at a maximum of six monthly intervals.

Explanation of Markings



Fitting, Instructions





Check Supply Voltage And Load Resistance With Card Manufacturers Instructions.

Do not overtighten the 102 into the junction box housing

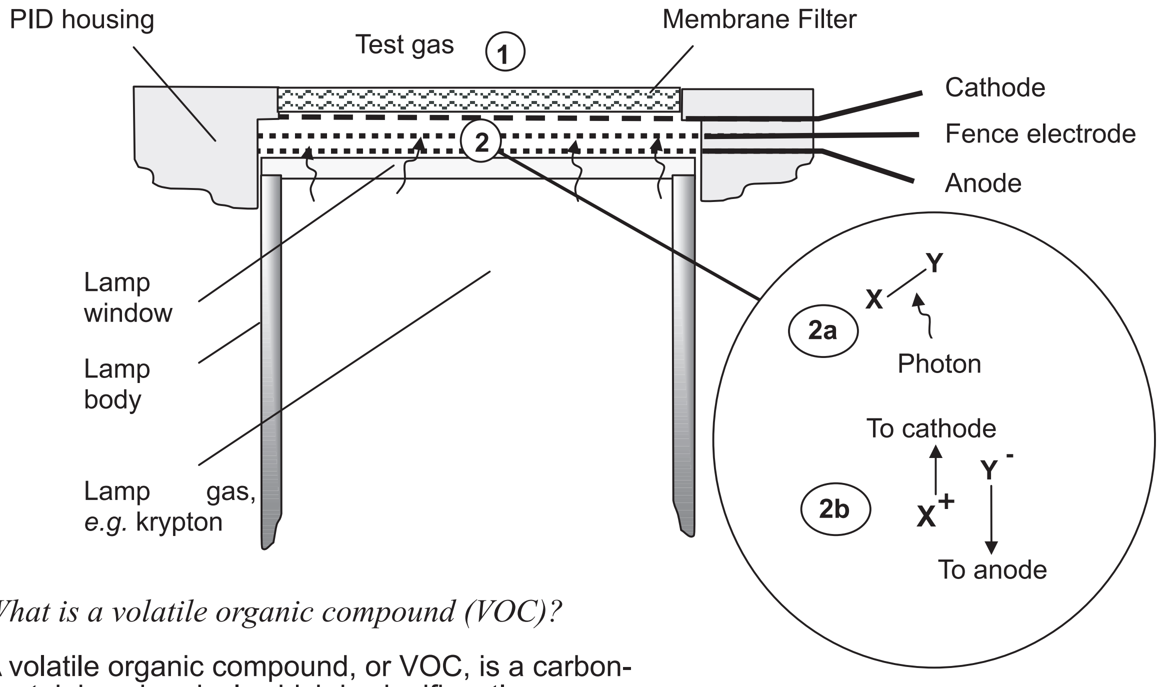
Note

The Tocsin 102 Must Be Earthed, If necessary fit a brass earthing tab washer between the locknut and housing to bond to. Ensure the junction box, cable and glands carry appropriate certification for the area in which they are fitted. Cable screens

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 low range version of the Tocsin 102 PID (measuring at ppb levels) includes a third fence electrode (patented) to ensure that the amplified current does not include significant contributions due to other current sources such as water condensation on the chamber walls.

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. For full details refer to the PID section of the configurator manual.
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.



What is a volatile organic compound (VOC)?

A volatile organic compound, or VOC, is a carbon-containing chemical, which is significantly or completely vaporised at ambient temperatures.

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 °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.

Which lamp is best?

The choice of lamp depends on target gases, selectivity requirements and lamp lifetime considerations. Where possible the krypton lamp is used for the high sensitivities it delivers.

Xenon lamp (9.6 eV)

Many aromatics and unsaturated VOC's compounds containing at least 6 carbon atoms ('C6') or more are detected. Sometimes it is an advantage to use the xenon lamp to ensure more selective detection of such compounds.

Krypton lamp (10.6 eV)

Some C2, and most C3, C4+ VOC's are detected. Exceptions usually contain chlorine, fluorine or bromine. For guidance, you can expect the following to be detected with Krypton-PID:

- All hydrocarbons, whose chemical names end in the letters **–ane**, **–ene** or **–yne**, *except* methane, ethane, propane, and acetylene, and also *except* if the name includes '**chloro**', '**fluoro**' or '**bromo**':
- All alcohol's, whose chemical names end in **–ol**, except methanol, or frequently if the name includes '**chloro**', '**fluoro**' or '**bromo**'
- All aldehydes, whose names end in **aldehyde**, except formaldehyde, or sometimes if the name includes '**chloro**', '**fluoro**' or '**bromo**'
- All ketones, whose chemical names end in **–one**, except rarely if the name includes '**chloro**', '**fluoro**' or '**bromo**'
- All esters, whose names end in **–ate**, except rarely if the name includes '**chloro**', '**fluoro**' or '**bromo**'
- All amines, sulfides

Argon lamp (11.7 eV)

All VOC's detectable with the kryton lamp, *plus* acetylene, methanol, formaldehyde and about 80% of VOC's whose chemical names include '**fluoro**', '**chloro**' and '**bromo**'. However, this lamp has a very short lifetime because the UV window is made from Lithium Fluoride, which is prone to degradation.

What is a response factor?

The sensitivity of PID varies according to the type of lamp used (krypton, argon or xenon) and the VOC detected. A response factor is a number, which relates the PID response to a particular VOC, to the PID response to the calibration gas, usually isobutylene. If the response of a PID to a particular VOC were eight times *smaller* than it is for the same concentration of isobutylene, then the *response factor* would be 8. Similarly, if the *response factor* for a particular VOC is 0.5, the PID response is *twice* that for isobutylene at the same concentration.

Example:

- A sensor is calibrated using isobutylene and found to have a sensitivity of 2-mV ppm^{-1}.
- If the sensor is exposed to 100-ppm isobutylene the output will be 200 mV.
- Toluene is known to generate **twice** the response of isobutylene.
- If the sensor is exposed to 100-ppm toluene the output will be 400 mV.
- In order to correct the response it is multiplied by the **response factor for toluene** of 0.5.

If response factors are programmed into an instrument, you are able to specify a volatile compound, and the instrument will internally compensate for the response factor corresponding to that volatile, and display and record the corrected volatile concentration.'

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Are there other ways to measure VOC's?

PID's show excellent sensitivity, a large dynamic range and allow ppb-low ppm measurement of VOC's in a background of higher inorganic gas concentrations. But there are other technologies to measure VOC's:

Flame Ionisation Detectors (FID)

Very similar to PID's, FID's are frequently used in laboratories for detecting VOC's eluted from a gas chromatograph. FID's like PID's are not selective, indeed all organic compounds including methane are selected, and FID's can be very sensitive and linear. But FID's require a hydrogen source, are bulky and more expensive. FID's are good in the lab or for fixed sites, but are not currently a viable alternative in portable VOC monitoring.

Portable GC/MS

This traditional laboratory analytical instrument is seeing its way into the field with mixed results. With micro machined silicon (MEMS), portable MS and portable GC may still become a real alternative, but the cost is prohibitive. Sinc e GC/MS can only cycle through a measurement, it is not a continuous monitor, but measures about once every few minutes. It does have the advantage of being selective - it is not a broad band analyser. Size, cost, need for a vacuum pump and maintenance requirements make this only an alternative when all else fails.

Thermal Desorption or Tedlar sampling bags

For retrospective analysis of all VOC's adsorbed in soil samples, other solids, liquids and gases, the ASTM recommends using sorbent tubes or Tedlar sampling bags. Samples are then sent to the lab for thermal desorption of the sorbent tubes and then analysis using GC/MS, traditionally. This is the best technique when surveying a specific problem, but clearly does not provide protection in real time. Also, these are averaged measurements, expensive and not point/time-specific.

Electrochemical sensors

You can measure many VOC's with electrochemical cells, with resolution from 10 to 200 ppb. These are low cost, low power, and compact sensors. Oliver IGD offers the ETO sensor for VOC applications. Both PID's and electrochemical cells are broad band sensors, but with a different profile - PID's will measure more VOC's than the ETO, and with much greater sensitivity. If you wish to measure a VOC with electrochemical cells, then you should optimise the electrochemical sensor for the target VOC: each VOC will require a different ideal bias voltage for best sensitivity. Not an easy task. Electrochemical cells respond in about 25 seconds, vs. 3-4 seconds for PID's.

Metal Oxide Semiconductor sensors (MOS)

Metal oxide sensors will also measure VOC's; they are compact, low cost and similar power to PID's. MOS sensors suffer from humidity sensitivity, non-linear response and long term drift. They also respond to inorganic gases, so you should not use them if you are trying to measure low concentrations of VOC's where gases such as NO, NO_2 or CO are present in higher concentrations. Unfortunately, it is all too easy to get false positive and false negatives when using MOS technology. If you want to use MOS, then request confirmation of long term stability, and humidity sensitivity. If you want high sensitivity, particularly to VOC's not measured by PID (*i.e.* many CFC's), but don't care about accuracy and cross sensitivity, MOS sensors may provide a possible solution.

Colorimetric ("Stain") tubes

Well-established technology for sampling for specific VOC's, colorimetric tubes have been around for decades, supplied chiefly by Draeger or Kitegawa. They have the advantage of low one-off cost and some specificity, but the disadvantages include disposal of chemical waste (the disposable tubes often contain toxic chemicals), poor accuracy, human interpretation of the colour change, sampling problems and non-continuous measurements: they should not be used to protect, only to qualitatively sample.

Calibration Factors

Oliver IGD PID's are calibrated using isobutylene, but the PID is a broadband VOC detector, with a sensitivity that differs for each VOC. If you know what VOC you are measuring, then the table below will allow you to calculate the concentration for your specific VOC. Remember, these are approximate values, so for best accuracy you should calibrate with the relevant VOC.

The table includes six columns:

1 **Gas/ VOC** The most common name for the VOC. If you can not find the name of your VOC of concern, then email us at sales@oliver-igd.co.uk and we will help.
2 **CAS No.** You can find the VOC using the CAS No.: ask your supplier.
3 **Formula** To assist in identifying the VOC.
4 **Relative Response/ Correction Factor (CF)** also called the **Response Factor (RF).** Multiply the displayed concentration by the Relative Response/ CF/ RF to calculate the actual concentration of the VOC.
5 **Relative sensitivity (%)** This is the inverse of the correction factor, specifying the percent response of the VOC, relative to isobutylene. If less than 100%, then the VOC is less responsive than isobutylene; if the relative sensitivity is greater than 100%, then the VOC is more responsive than isobutylene. Relative sensitivity (%) is specified the same way as cross-sensitivity for toxic gas sensors.
6 **Minimum Detection Level (MDL)** Also called **Minimum Detectable Quantity (MDQ).** Typical lowest concentration that can be detected. The PID-AH has greater sensitivity than the PID-A1, so the MDL for the PID-AH will be much less than the MDL for the PID-A1.

The Relative Response/ CF/ RF is measured in dry air; high humidity will reduce this factor by 30% to 50%, so the CF/ RF should be increased in high humidities.

VOC response

The PID can not measure all VOC's or gases. Two types of VOC's are not measured:
ZR: No response. The 10.6 eV lamp does not ionise the VOC and the VOC can not be measured.
NV: The vapour pressure of the VOC at 20 °C is less than a few ppm, so this Semi-Volatile Organic Compound (SVOC) can not be measured.

Occasionally you will be measuring a mixture of VOC's. If the total concentration is within the linear range of your PID, then it is reasonable to assume that the concentrations are additive without interference between the different VOC's. Remember that if you are measuring a combination of VOC's, then accurate measurement of one of these VOC's will be difficult; without careful data analysis, you will get only a CF averaged measurement *. Be cautious when reporting actual VOC concentration if you know that there may be several VOC's present.

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.

The correction factor for a gas mix containing PID detectable gases A, B, C… with response factors RF (A), RF (B), RF(C), in relative proportions a: b: c… is given by:

$$CF (mix) = 1 / [(a/CF (A) + b/CF (B) + c/CF(C)…]$$

Accuracy of the Table

This table is for indication only. Table accuracy is 1 to 2 digits only, so when calculating concentration for a specific VOC, specify to 1 or 2 digits only.

For best accuracy, calibrate using the specific VOC.

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Acetaldehyde	75-07-0	C2H4O	4.9	21	25	480
Acetic Acid	64-17-7	C2H4O2	36.2	3	180	3615
Acetic Anhydride	108-24-7	C4H6O3	4.0	25	20	400
Acetone	67-64-1	C3H6O	0.7	140	5	70
Acetonitrile	75-05-8	CH3CN	ZR			
Acetylene	74-86-2	C2H2	ZR			
Acrolein	107-02-8	C3H4O	4.0	25	20	400
Acrylic Acid	79-10-7	C3H4O2	2.7	36	15	275
Acrylonitrile	107-13-1	C3H3N	ZR			
Allyl alcohol	107-18-6	C3H6O	2.1	48	10	200
Allyl chloride	107-05-1	C3H5Cl	4.5	22	20	450
Ammonia	7664-41-7	H3N	8.5	12	40	850
Amyl acetate, n-	628-63-7	C7H14O2	1.8	56	10	180
Amyl alcohol	71-41-0	C5H12O	3.2	31	15	320
Aniline	62-53-3	C6H7N	0.5	200	3	50
Anisole	100-66-3	C7H8O	0.5	211	2	50
Arsine	7784-42-1	AsH3	2.5	40	15	250
Asphalt, petroleum fumes	8052-42-4		1.0	100	5	100
Benzaldehyde	100-52-7	C7H6O	0.9	117	5	85
Benzene	71-43-2	C6H6	0.5	200	3	50
Benzenethiol	108-98-5	C6H5SH	0.7	143	4	70
Benzonitrile	100-47-0	C7H5N	0.7	141	4	70
Benzyl alcohol	100-51-6	C7H8O	1.3	80	6	125
Benzyl chloride	100-44-7	C7H7Cl	0.6	182	3	55
Benzyl formate	104-57-4	C8H8O2	0.8	130	5	77
Biphenyl	92-52-4	C12H10	0.4	250	2	40
Bis(2,3-epoxypropyl) ether	2238-07-5	C6H10O3	3.0	33	15	300
Boron trifluoride	7637 07 2	BF3	ZR			
Bromine	7726-95-6	Br2	20.0	5	100	2000
Bromine pentafluoride	7789-30-2	BrF5	ZR			
Bromobenzene	108-86-1	C6H5Br	0.7	143	4	70
Bromochloromethane	74-97-5	CH2ClBr	ZR			
Bromoethane	74-96-4	C2H5Br	5.0	20	25	500
Bromoethyl methyl ether, 2-	6482-24-2	C3H7OBr	2.5	40	15	250
Bromoform	75-25-2	CHBr3	2.8	36	15	280
Bromopropane, 1-	106-94-5	C3H7Br	1.3	77	7	130
Bromotrifluoromethane	75-63-8	CF3Br	ZR			
Butadiene	106-99-0	C4H6	0.8	120	4	80
Butadiene diepoxide, 1,3-	1464-53-5	C4H6O2	4.0	25	20	400
Butane, n-	106-97-8	C4H10	46.3	2	230	4600
Butanol, 1-	71-36-3	C4H10O	4.0	25	20	400
Buten-3-ol, 1-	598-32-3	C4H8O	1.2	87	6	115
Butene, 1-	106-98-9	C4H8	1.3	77	7	130
Butoxyethanol, 2-	111-76-2	C6H14O2	1.1	91	6	110
Butyl acetate, n-	123-86-4	C6H12O2	2.4	41	10	240
Butyl acrylate, n-	141-32-2	C7H12O2	1.5	67	8	150
Butyl lactate	138-22-7	C7H14O3	2.5	40	15	250
Butyl mercaptan	109-79-5	C4H10S	0.5	185	3	50
Butylamine, 2-	513-49-5	C4H11N	0.9	111	5	90
Butylamine, n-	109-73-9	C4H11N	1.0	100	5	100
Camphene	565-00-4	C10H16	0.5	222	2	45
Carbon dioxide	124-38-9	CO2	ZR			

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Carbon disulfide	75-15-0	CS2	1.4	71	7	140
Carbon monoxide	630-08-0	CO	ZR			
Carbon tetrabromide	558-13-4	CBr4	3.0	33	15	300
Carbon tetrachloride	56-23-5	CCl4	ZR			
Carbonyl sulphide	463-58-1	COS	ZR			
Carvone, R-	6485-40-1	C10H14O	1.0	100	5	100
Chlorine	7782-50-5	Cl2	ZR			
Chlorine dioxide	10049-04-4	ClO2	1.0	100	5	100
Chlorine trifluoride	7790-91-2	ClF3	ZR			
Chloro-1,1,1,2-tetrafluoroethane	2837-89-0	C2HClF4	ZR			
Chloro-1,1,1-trifluoroethane, 2-	75-88-7	C2H2ClF3	ZR			
Chloro-1,1,2,2-tetrafluoroethane	354-25-6	C2HClF4	ZR			
Chloro-1,1,2-trifluoroethane, 1-	421-04-5	C2H2ClF3	ZR			
Chloro-1,1-difluoroethane, 1-	75-68-3	C2H3ClF2	ZR			
Chloro-1,1-difluoroethane, 1-	75-68-3	C2H3ClF2	ZR			
Chloro-1,1-difluoroethane, 2-	338-65-8	C2H3ClF2	ZR			
Chloro-1,2,2-trifluoroethane	431-07-2	C2H2ClF3	ZR			
Chloro-1,3-butadiene, 2-	126-99-8	C4H5Cl	3.2	30	16	320
Chloro-1-fluoroethane, 1-	1615-75-4	C2H4ClF	ZR			
Chloro-2-fluoroethane, 1-	762-50-5	C2H4ClF	ZR			
Chloroacetaldehyde	107-20-0	C2H3OCl	ZR			
Chlorobenzene	108-90-7	C6H5Cl	0.5	220	2	50
Chlorodifluoromethane	75-45-6	CHClF2	ZR			
Chloroethane	75-00-3	C2H5Cl	ZR			
Chloroethanol 2-	107-07-3	C2H5ClO	10.0	10	50	1000
Chloroethyl methyl ether, 2-	627-42-9	C3H7ClO	2.6	40	13	250
Chlorofluoromethane	593-70-4	CH2ClF	ZR			
Chloroform	67-66-3	CHCl3	ZR			
Chloromethane	74-87-3	CH3Cl	ZR			
Chloropentafluoroethane	76-15-3	C2ClF5	ZR			
Chlorotoluene, o-	95-49-8	C7H7Cl	0.5	220	2	50
Chlorotoluene, p-	108-41-8	C7H7Cl	0.5	200	3	50
Chlorotrifluoroethylene	79-38-9	C2ClF3	1.0	100	5	100
Chlorotrifluoromethane	75-72-9	CClF3	ZR			
Citral	5392-40-5	C10H16O	1.0	100	5	100
Citronellol	26489-01-0	C10H20O	1.0	100	5	100
Cresol, m-	108-39-4	C7H8O	1.1	95	5	105
Cresol, o-	95-48-7	C7H8O	1.1	95	5	105
Cresol, p-	106-44-5	C7H8O	1.1	95	5	105
Crotonaldehyde	4170-30-3	C4H6O	1.0	100	5	100
Cumene	98-82-8	C9H12	0.6	170	3	60
Cyanamide	420-04-2	CH2N2	ZR			
Cyanogen bromide	506-68-3	CNBr	ZR			
Cyanogen chloride	506-77-4	CNCl	ZR			
Cyclohexane	110-82-7	C6H12	1.3	77	7	130
Cyclohexanol	108-93-0	C6H12O	2.9	34	15	300
Cyclohexanone	108-94-1	C6H10O	1.1	91	6	110
Cyclohexene	110-83-8	C6H10	0.8	133	5	75
Cyclohexylamine	108-91-8	C6H13N	1.0	102	5	100
Cyclopentane	287-92-3	C5H10	4.0	25	20	400
Decane, n-	124-18-5	C10H22	1.0	96	5	100
Diacetone alcohol	123-42-2	C6H12O2	0.8	125	5	80
Dibenzoyl peroxide	94-36-0	C14H10O4	0.8	125	5	80

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Diborane	19287-45-7	B2H6	ZR			
Dibromochloromethane	124-48-1	CHBr2Cl	10.0	10	50	1000
Dibromodifluoromethane	75-61-6	CF2Br2	ZR			
Dibromoethane 1,2-	106-93-4	C2H4Br2	2.0	50	10	200
Dibromotetrafluoroethane , 1,2-	124-73-2	C2F4Br2	ZR			
Dibutyl hydrogen phosphate	107-66-4	HC8H18 PO4	4.0	25	20	400
Dichloro-1,1,1-trifluoroethane, 2,2-	306-83-2	C2HCl2F3	ZR			
Dichloro-1,1-difluoroethane, 1,2-	1649-08-7	C2H2Cl2F2	ZR			
Dichloro-1,2,2-trifluoroethane, 1,2-	354-23-4	C2HCl2F3	ZR			
Dichloro-1,2-difluoroethane, 1,2-	631-06-1	C2H2Cl2F2	ZR			
Dichloro-1-fluoroethane, 1,1-	1717-00-6	C2H3Cl2F	ZR			
Dichloro-1-fluoroethane, 1,1-	1717-00-6	C2H3Cl2F	ZR			
Dichloro-1-fluoroethane, 1,2-	430-57-9	C2H3Cl2F	ZR			
Dichloro-1-propene, 2,3-	78-88-6	C3H4Cl2	1.4	70	7	140
Dichloro-2,2,-difluoroethane, 1,1-	79-35-6	C2H2Cl2F2	ZR			
Dichloroacetylene	7572-29-4	C2Cl2	5.0	20	25	500
Dichlorobenzene o-	95-50-1	C6H4Cl2	0.5	200	3	50
Dichlorodifluoromethane	75-71-8	CCl2F2	ZR			
Dichloroethane 1,2-	107-06-2	C2H4Cl2	ZR			
Dichloroethane, 1,1-	75-34-3	C2H4Cl2	ZR			
Dichloroethene, 1,1-	75-35-4	C2H2Cl2	1.0	105	5	100
Dichloroethene, cis-1,2-	156-59-2	C2H2Cl2	0.8	125	4	80
Dichloroethene, trans-1,2-	540-59-0	C2H2Cl2	0.7	143	4	70
Dichloroethylene 1,2-	540-59-0	C2H2Cl2	0.8	133	4	75
Dichlorofluoromethane	75-43-4	CHFCl2	ZR			
Dichloromethane	75-09-2	CH2Cl2	39.0	3	200	3900
Dichloropropane, 1,2-	78-87-5	C3H6Cl2	ZR			
Dichlorotetrafluoroethane, 1,1-	374-07-2	C2Cl2F4	ZR			
Dichlorotetrafluoroethane, 1,2-	76-14-2	C2Cl2F4	ZR			
Dicyclopentadiene	77-73-6	C10H12	0.9	110	5	90
Diesel Fuel	68334-30-5		0.8	130	4	75
Diethyl ether	60-29-7	C4H10O	0.9	110	4	90
Diethyl maleate	141-05-9	C8H12O4	2.0	50	10	200
Diethyl phthalate	84-66-2	C12H14O4	1.0	100	5	100
Diethyl sulphate	64-67-5	C4H10SO4	3.0	33	15	300
Diethyl sulphide	352-93-2	C4H10S	0.6	180	3	50
Diethylamine	109-89-7	C4H11N	1.0	100	5	100
Diethylaminoethanol, 2-	100-37-8	C6H15ON	2.7	40	15	270
Diethylaminopropylamine, 3-	104-78-9	C7H18N2	1.0	100	5	100
Difluoroethane, 1,1-	75-37-6	C2H4F2	ZR			
Difluoroethane, 1,2-	624-72-6	C2H4F2	ZR			
Difluoromethane	75-10-5	CH2F2	ZR			
Dihydrogen selenide	7783 07 5	H2Se	1.0	100	5	100
Dihydroxybenzene, 1,2	120-80-9	C6H6O2	1.0	100	5	100
Dihydroxybenzene, 1,3	108-46-3	C6H6O2	1.0	100	5	100
Diisobutylene	107-39-1	C8H16	0.6	156	3	60
Diisopropyl ether	108-20-3	C6H14O	0.7	150	3	70
Diisopropylamine	108-18-9	C6H15N	0.7	140	4	70

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Diketene	674-82-8	C4H4O2	2.2	45	11	220
Dimethoxymethane	109-87-5	C3H8O2	1.4	71	7	140
Dimethyl cyclohexane, 1,2-	583-57-3	C8H16	1.1	95	5	105
Dimethyl disulphide	624-92-0	C2H6S2	0.2	435	1	23
Dimethyl ether	115-10-6	C2H6O	1.3	80	7	130
Dimethyl phthalate	131-11-3	C10H10O4	1.0	100	5	100
Dimethyl sulphate	77-78-1	C2H6O4S	ZR			
Dimethyl sulphide	75-18-3	C2H6S	0.5	200	3	50
Dimethylacetamide N,N-	127-19-5	C4H9NO	1.3	75	7	130
Dimethylamine	124-40-3	C2H7N	1.4	70	7	140
Dimethylaminoethanol	108-01-0	C4H11NO	1.5	70	8	150
Dimethylaniline, NN-	121-69-7	C8H11N	0.6	167	3	60
Dimethylbutyl acetate	108-84-9	C8H16O2	1.6	60	8	160
Dimethylethylamine, NN-	598-56-1	C4H11N	0.8	125	4	80
Dimethylformamide	68-12-2	C3H7NO	0.9	110	5	90
Dimethylheptan-4-one, 2,6-	108-83-8	C9H18O	0.8	125	4	80
Dimethylhydrazine, 1,1-	57-14-7	C2H8N2	1.0	100	5	100
Dinitrobenzene, m-	99-65-0	C6H4N2O4	3.0	33	15	300
Dinitrobenzene, o-	528-29-0	C6H4N2O4	ZR			
Dinitrobenzene, p-	100-25-4	C6H4N2O4	5.0	20	25	500
Dinonyl phthalate	84-76-4	C26H42O4	1.0	100	5	100
Dioxane 1,2-		C4H8O2	1.5	67	8	150
Dioxane 1,4-	123-91-1	C4H8O2	1.5	67	8	150
Dipentene	138-86-3	C10H16	0.9	110	5	90
Diphenyl ether	101-84-8	C12H10O	0.8	125	4	80
Disulphur decafluoride	5714-22-7	S2F10	ZR			
Disulphur dichloride	10025-67-9	S2Cl2	3.0	33	15	300
Di-tert-butyl-p-cresol	2409-55-4	C11H16O	1.0	100	5	100
Divinylbenzene	1321-74-0	C10H10	0.4	250	2	40
Dodecanol	112-53-8	C12H26O	0.9	110	5	90
Enflurane	13838-16-9	C4H2F5ClO	ZR			
Epichlorohydrin	106-89-8	C3H5ClO	8.0	15	40	800
Epoxypropyl isopropyl ether, 2,3-	4016-14-2	C6H12O2	1.1	90	5	110
Ethane	74-84-0	C2H6	ZR			
Ethanol	64-17-5	C2H6O	8.7	10	45	870
Ethanolamine	141-43-5	C2H7NO	3.0	33	15	300
Ethoxy-2-propanol, 1-	1569-02-4	C5H10O2	2.0	50	10	200
Ethoxyethanol, 2-	110-80-5	C4H10O2	29.8	3	150	3000
Ethoxyethyl acetate, 2-	111-15-9	C6H12O3	3.0	33	15	300
Ethyl (S)-(-)-lactate	97-64-3	C5H10O3	3.0	33	15	300
Ethyl acetate	141-78-6	C4H8O2	3.6	28	20	360
Ethyl acrylate	140-88-5	C5H8O2	2.0	50	10	200
Ethyl amine	75-04-7	C2H7N	1.0	100	5	100
Ethyl benzene	100-41-4	C8H10	0.5	185	3	50
Ethyl butyrate	105-54-4	C6H12O2	1.0	105	5	100
Ethyl chloroformate	541-41-3	C3H5O2Cl	80	1	400	8300
Ethyl cyanoacrylate	7085-85-0	C6H7O2N	1.5	67	8	150
Ethyl decanoate	110-38-3	C12H24O2	1.8	56	10	180
Ethyl formate	109-94-4	C3H6O2	30	3	150	3000
Ethyl hexanoate	123-66-0	C8H16O2	2.6	38	15	260
Ethyl hexanol, 2-	105-76-7	C8H18O	1.5	67	8	150
Ethyl hexyl acrylate, 2-	103-11-7	C11H20O2	1.0	100	5	100
Ethyl mercaptan	75-08-1	C2H6S	0.7	145	3	70

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Ethyl octanoate	106-32-1	C10H20O2	2.3	40	12	230
Ethylene	74-85-1	C2H4	8.0	13	40	800
Ethylene dinitrate	628-96-6	C2H4O6N2	ZR			
Ethylene glycol	107-21-1	C2H6O2	20.0	5	100	2000
Ethylene oxide	75-21-8	C2H4O	15.0	7	75	1500
Ferrocene	102-54-5	C10H10Fe	0.8	125	4	80
Fluorine	7782-41-4	F2	ZR			
Fluoroethane	353-33-6	C2H5F	ZR			
Fluoromethane	593-53-3	CH3F	ZR			
Formaldehyde	50-00-0	CH2O	ZR			
Formamide	75-12-7	CH3ON	2.0	50	10	200
Formic acid	64-18-6	CH2O2	ZR			
Furfural	98-01-1	C5H4O2	1.4	70	7	140
Furfuryl alcohol	98-00-0	C5H6O2	2.0	50	10	200
Gasoline vapors	8006-61-9		1.1	95	5	105
Gasoline vapors	8006-61-9		0.8	125	4	80
Gasoline vapors 92 octane	8006-61-9		0.8	125	4	80
Germane	7782-65-2	GeH4	10.0	10	50	1000
Glutaraldehyde	111-30-8	C5H8O2	0.9	111	5	90
Halothane	151-67-7	CF3CHBrCl	ZR			
Helium		He	ZR			
Heptan-2-one	110-43-0	C7H14O	0.7	140	4	70
Heptan-3-one	106-35-4	C7H14O	0.8	133	4	75
Heptane n-	142-82-5	C7H16	2.1	50	10	200
Hexachloroethane	67-72-1	C2Cl6	ZR			
Hexafluoroethane	76-16-4	C2F6	ZR			
Hexamethyldisilazane, 1,1,1,3,3,3-.	999-97-3	C6H19NSi2	1.0	100	5	100
Hexamethyldisiloxane.	107-46-0	C6H18OSi2	0.3	350	1	30
Hexan-2-one	591-78-6	C6H12O	0.8	125	4	80
Hexane n-	110-54-3	C6H14	4.2	25	20	420
Hexene, 1-	592-41-6	C6H12	0.9	110	5	90
Hydrazine	302-01-2	H4N2	3.0	33	15	300
Hydrazoic acid	7782-79-8	HN3	ZR			
Hydrogen	1333-74-0	H2	ZR			
Hydrogen bromide	10035-10-6	HBr	ZR			
Hydrogen chloride	7647-01-0	HCl	ZR			
Hydrogen cyanide	74-90-8	HCN	ZR			
Hydrogen fluoride	7664-39-3	HF	ZR			
Hydrogen peroxide	7722-84-1	H2O2	4.0	25	20	400
Hydrogen sulfide	7783-06-4	H2S	4.0	25	20	400
Hydroquinone	123-31-9	C6H6O2	0.8	125	4	80
Hydroxypropyl acrylate 2-	999-61-1	C6H10O3	1.5	67	8	150
Iminodi(ethylamine) 2,2-	111-40-0	C4H13N3	0.9	110	5	90
Iminodiethanol 2,2'-	111-42-2	C4H11NO2	1.6	60	8	160
Indene	95-13-6	C9H8	0.5	220	2	50
Iodine	7553-56-2	I2	0.2	667	1	15
Iodoform	75-47-8	CHI3	1.5	67	8	150
Iodomethane	74-88-4	CH3I	0.4	250	2	40
Isoamyl acetate	123-92-2	C7H14O2	1.6	60	8	160
Isobutane	75-28-5	C4H10	8.0	15	40	800
Isobutanol	78-83-1	C4H10O	3.5	30	20	350
Isobutyl acetate	110-19-0	C6H12O2	2.3	45	10	230

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Isobutyl acrylate	106-63-8	C7H12O2	1.3	80	7	130
Isobutylene	115-11-7	C4H8	1.0	100	5	100
Isobutyraldehyde	78-84-2	C4H8O	1.2	80	6	120
Isocyanates, all			NV			
Isodecanol	25339-17-7	C10H22O	0.9	110	5	90
Isoflurane	26675-46-7	C3H2ClF5O	ZR			
Isononanol	2452-97-9	C9H20O	1.5	67	8	150
Isooctane	565-75-3	C8H18	1.1	90	5	100
Isooctanol	26952-21-6	C8H18O	1.7	60	9	170
Isopentane	78-78-4	C5H12	6.0	20	30	600
Isophorone	78-59-1	C9H14O	0.8	133	4	75
Isoprene	78-79-5	C5H8	0.7	140	3	70
Isopropanol	67-63-0	C3H8O	4.4	20	22	440
Isopropyl acetate	108-21-4	C5H10O2	2.2	50	10	220
Isopropyl chloroformate	108-23-6	C4H7O2Cl	1.6	60	8	160
Jet Fuel JP-4			0.8	133	4	75
Jet Fuel JP-5			0.7	150	3	60
Jet Fuel JP-8			0.7	150	3	60
Kerosene	8008-20-6		0.8	120	4	90
Ketene	463-51-4	C2H2O	3.0	33	15	300
Liquefied petroleum gas	68476-85-7		ZR			
Maleic anhydride	108-31-6	C4H2O3	2.0	50	10	200
Mercaptoacetic acid	68-11-1	C2H4O2S	1.0	100	5	100
Mercury	7439-97-6	Hg	NV			
Mercury alkyls			NV			
Mesitylene	108-67-8	C9H12	0.3	300	2	30
Methacrylic acid	79-41-4	C4H6O2	2.3	40	12	230
Methacrylonitrile	126-98-7	C4H5N	5.0	20	25	500
Methane	74-82-8	CH4	ZR			
Methanol	67-56-1	CH4O	200	1	1000	20000
Methoxyethanol, 2-	109-86-4	C3H8O2	2.7	40	15	270
Methoxyethoxyethanol, 2-	111-77-3	C5H12O3	1.4	70	7	140
Methoxymethylethoxy-2-propanol	34590-94-8	C7H16O3	1.3	80	7	130
Methoxypropan-2-ol	107-98-2	C4H10O2	3.0	33	15	300
Methoxypropyl acetate	108-65-6	C6H12O3	1.2	80	6	120
Methyl acetate	79-20-9	C3H6O2	5.2	20	25	500
Methyl acrylate	96-33-3	C4H6O2	3.4	30	17	340
Methyl bromide	74-83-9	CH3Br	1.9	50	10	190
Methyl cyanoacrylate	137-05-3	C5H5O2N	5.0	20	25	500
Methyl ethyl ketone	78-93-3	C4H8O	0.8	130	4	80
Methyl ethyl ketone peroxides	1338-23-4	C8H18O2	0.8	125	4	80
Methyl formate	107-31-3	C2H4O2	ZR			
Methyl isobutyl ketone	108-10-1	C6H12O	0.8	125	4	80
Methyl isocyanate	624-83-9	C2H3NO	ZR			
Methyl isothiocyanate	556-61-6	C2H3NS	0.6	167	3	60
Methyl mercaptan	74-93-1	CH4S	0.7	140	4	70
Methyl methacrylate	80-62-6	C5H8O2	1.6	60	8	160
Methyl propyl ketone	107-87-9	C5H10O	0.8	130	4	80
Methyl salicylate	119-36-8	C8H8O3	1.2	80	6	120
Methyl sulphide	75-18-3	C2H6S	0.5	200	3	50
Methyl t-butyl ether	1634-04-4	C5H12O	0.8	125	4	80
Methyl-2-propen-1-ol, 2-	51-42-8	C4H8O	1.1	90	5	100

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Methyl-2-pyrrolidinone, N-	872-50-4	C5H9NO	0.9	110	5	90
Methyl-4,6-dinitrophenol, 2-	534-52-1	C7H6N2O5	3.0	33	15	300
Methyl-5-hepten-2-one, 6-	110-93-0	C8H14O	0.8	125	4	80
Methylamine	74-89-5	CH5N	1.4	70	7	140
Methylbutan-1-ol, 3-	123-51-3	C5H12O	3.4	30	17	340
Methylcyclohexane	108-87-2	C7H14	1.1	90	6	110
Methylcyclohexanol, 4-	589-91-3	C7H14O	2.4	40	12	240
Methylcyclohexanone 2-	583-60-8	C7H12O	1.0	100	5	100
Methylheptan-3-one, 5-	541-85-5	C8H16O	0.8	133	4	75
Methylhexan-2-one, 5-	110-12-3	C7H14O	0.8	133	4	75
Methylhydrazine	60-34-4	CH6N2	1.3	80	7	130
Methyl-N-2,4, 6-tetranitroaniline, N-	479-45-8	C7H5N5O8	3.0	33	15	300
Methylpent-3-en-2-one, 4-	141-79-7	C6H10O	0.7	140	4	70
Methylpentan-2-ol, 4-	108-11-2	C6H14O	2.8	40	14	280
Methylpentane-2,4-diol, 2-	107-41-5	C6H14O2	4.0	25	20	400
Methylpropan-2-ol, 2-	75-65-0	C4H10O	3.5	30	18	350
Methylstyrene	25013-15-4	C9H10	0.5	200	3	50
Mineral oil	8042-47-5		0.8	125	4	80
Mineral spirits	64475-85-0		0.8	125	4	80
Naphthalene	91-20-3	C10H8	0.4	230	2	45
Nitric oxide	10102-43-9	NO	8.0	15	40	800
Nitroaniline 4-	100-01-6	C6H6N2O2	0.8	125	4	80
Nitrobenzene	98-95-3	C6H5NO2	1.7	60	10	170
Nitroethane	79-24-3	C2H5NO2	ZR			
Nitrogen dioxide	10102-44-0	NO2	10.0	10	50	1000
Nitrogen trichloride	10025-85-1	NCl3	1.0	100	5	100
Nitrogen trifluoride	7783-54-2	NF3	ZR			
Nitromethane	75-52-5	CH3NO2	ZR			
Nitropropane, 1-	108-03-2	C3H7NO2	ZR			
Nitropropane, 2-	79-46-9	C3H7NO2	ZR			
Nitrous oxide	10024-97-2	N2O	ZR			
Nonane, n-	111-84-2	C9H20	1.3	80	6	130
Norbornadiene, 2,5-	121-46-0	C7H8	0.6	167	3	60
Octachloronaphthalene	2234-13-1	C10Cl8	1.0	100	5	100
Octane, n-	111-65-9	C8H18	1.6	60	8	160
Octene, 1-	111-66-0	C8H16	0.7	140	3	70
Oxalic acid	144-62-7	C2H2O4	ZR			
Oxalonitrile	460-19-5	C2N2	ZR			
Oxydiethanol 2,2-	111-46-6	C4H10O3	4.0	25	20	400
Oxygen		O2	ZR			
Ozone	10028-15-6	O3	ZR			
Paraffin wax, fume	8002-74-2		1.0	100	5	100
Paraffins, normal	64771-72-8		1.0	105	5	100
Pentacarbonyl iron	13463-40-6	FeC5O5	1.0	100	5	100
Pentachloroethane	76-01-7	C2HCl5	ZR			
Pentachlorofluoroethane	354-56-3	C2Cl5F	ZR			
Pentafluoroethane	354-33-6	C2HF5	ZR			
Pentan-2-one	107-87-9	C5H10O	0.8	125	4	80
Pentan-3-one	96-22-0	C5H10O	0.8	125	4	80
Pentandione, 2,4-	123-54-6	C5H8O2	0.8	133	4	75
Pentane, n-	109-66-0	C5H12	7.9	15	40	800
Peracetic acid	79-21-0	C2H4O3	2.0	50	10	200

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Perchloryl fluoride	7616-94-6	Cl03F	ZR			
Perfluoropropane	76-19-7	C3F8	ZR			
Petroleum ether			0.9	110	5	90
Phenol	108-95-2	C6H6O	1.2	85	6	120
Phenyl propene, 2-	98-83-9	C9H10	0.4	230	2	45
Phenyl-2,3-epoxypropyl ether	122-60-1	C9H10O2	0.8	125	4	80
Phenylenediamine, p-	106-50-3	C6H8N2	0.6	167	3	60
Phosgene	75-44-5	COCl2	ZR			
Phosphine	7803-51-2	PH3	2.0	50	10	200
Picoline, 3-	108-99-6	C6H7N	0.9	110	5	90
Pinene, alpha	80-56-8	C10H16	0.3	315	2	30
Pinene, beta	127-91-3	C10H16	0.3	315	2	30
Piperidine	110-89-4	C5H11N	0.9	110	5	90
Piperylene	504-60-9	C5H8	0.7	150	3	67
Prop-2-yn-1-ol	107-19-7	C3H4O	1.3	80	7	130
Propan-1-ol	71-23-8	C3H8O	4.8	20	25	480
Propane	74-98-6	C3H8	ZR			
Propane-1,2-diol, total	57-55-6	C3H8O2	10.0	10	50	1000
Propene	115-07-1	C3H6	1.4	70	7	140
Propionaldehyde	123-38-6	C3H6O	1.7	60	8	169
Propionic acid	79-09-4	C3H6O2	8.0	15	40	800
Propyl acetate, n-	109-60-4	C5H10O2	2.5	40	13	250
Propylene dinitrate	6423-43-4	C3H6N2O6	ZR			
Propylene oxide	75-56-9	C3H6O	7.0	15	35	700
Propyleneimine	75-55-8	C3H7N	1.3	80	7	130
Pyridine	110-86-1	C5H5N	0.8	133	4	75
Pyridylamine 2-	504-29-0	C5H6N2	0.8	125	4	80
Silane	7803-62-5	SiH4	ZR			
Sodium fluoroacetate	62-74-8	C2H2O2FNa	ZR			
Styrene	100-42-5	C8H8	0.4	230	2	50
Sulphur dioxide	7446-09-5	SO2	ZR			
Sulphur hexafluoride	2551-62-4	SF6	ZR			
Sulphur tetrafluoride	7783-60-0	SF4	ZR			
Sulphuric acid	7664-93-9	H2SO4	ZR			
Sulphuryl fluoride	2699-79-8	SO2F2	ZR			
Terphenyls		C18H14	0.6	167	3	60
Terpinolene	586-62-9	C10H16	0.5	210	2	50
Tert-butanol	75-65-0	C4H10O	2.6	40	15	260
Tetrabromoethane, 1,1,2,2-	79-27-6	C2H2Br4	2.0	50	10	200
Tetracarbonylnickel	13463-39-3	NiC4O4	1.0	100	5	100
Tetrachloro-1,2-difluoroethane, 1,1,2,2-	76-12-0	C2Cl4F2	ZR			
Tetrachloro-1-fluoroethane, 1,1,2,2-	354-14-3	C2HCl4F	ZR			
Tetrachloro-2,2-difluoroethane, 1,1,1,2-	76-11-9	C2Cl4F2	ZR			
Tetrachloro-2-fluoroethane, 1,1,1,2-	354-11-0	C2HCl4F	ZR			
Tetrachloroethane, 1,1,1,2-	630-20-6	C2H2Cl4	ZR			
Tetrachloroethane, 1,1,2,2-	79-34-5	C2H2Cl4	ZR			
Tetrachloroethylene	127-18-4	C2Cl4	0.7	140	4	70
Tetrachloronaphthalenes, all isomers	20020-02-4	C10H4Cl4	1.0	100	5	100
Tetraethyl orthosilicate	78-10-4	C8H20O4Si	2.0	50	10	200
Tetraethyllead	78-00-2	C8H20Pb	ZR			

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Tetrafluoroethane, 1,1,1,2-	811-97-2	C2H2F4	ZR			
Tetrafluoroethane, 1,1,2,2-	359-35-3	C2H2F4	ZR			
Tetrafluoroethylene	116-14-3	C2F4	1.0	100	5	100
Tetrafluoromethane	75-73-0	CF4	ZR			
Tetrahydrofuran	109-99-9	C4H8O	1.6	65	8	150
Tetramethyl orthosilicate	681-84-5	C4H12O4Si	ZR			
Tetramethyl succinonitrile	3333-52-6	C8H12N2	1.0	100	5	100
Therminol			1.0	100	5	100
Thionyl chloride	7719-09-7	SOCl2	ZR			
Toluene	108-88-3	C7H8	0.5	200	3	50
Toluene-2,4-diisocyanate	584-84-9	C9H6N2O2	1.6	60	8	160
Toluenesulphonyl chloride, p-	98-59-9	C7H7SO2 Cl	3.0	33	15	300
Toluidine, o-	95-53-4	C7H9N	0.5	200	3	50
Tributyl phosphate	126-73-8	C12H27O4P	5.0	20	25	500
Tributylamine	102-82-9	C12H27N	1.0	100	5	100
Trichloro-1,1-difluoroethane, 1,2,2-	354-21-2	C2HCl3F2	ZR			
Trichloro-1,2-difluoroethane, 1,1,2-	354-15-4	C2HCl3F2	ZR			
Trichloro-2,2-difluoroethane, 1,1,1-	354-12-1	C2HCl3F2	ZR			
Trichloro-2-fluoroethane, 1,1,2-	359-28-4	C2H2Cl3F	ZR			
Trichlorobenzene 1,2,4-	120-82-1	C6H3Cl3	0.6	180	3	50
Trichloroethane, 1,1,1-	71-55-6	C2H3Cl3	ZR			
Trichloroethane, 1,1,2-	79-00-5	C2H3Cl3	ZR			
Trichloroethylene	79-01-6	C2HCl3	0.7	150	3	65
Trichlorofluoromethane	75-69-4	CCl3F	ZR			
Trichloronitromethane	76-06-2	CCl3NO2	ZR			
Trichlorophenoxyacetic acid, 2,4,5-	93-76-5	C8H5O3Cl 3	1.0	100	5	100
Trichloropropane 1,2,3-	96-18-4	C3H5Cl3	ZR			
Trichlorotrifluoroethane, 1,1,1-	354-58-5	C2Cl3F3	ZR			
Trichlorotrifluoroethane, 1,1,2-	76-13-1	C2Cl3F3	ZR			
Triethylamine	121-44-8	C6H15N	0.9	110	5	90
Trifluoroethane, 1,1,1-	420-46-2	C2H3F3	ZR			
Trifluoroethane, 1,1,2-	430-66-0	C2H3F3	ZR			
Trifluoroethanol, 2,2,2-	75-89-8	C2H3F3O	ZR			
Trifluoromethane	75-46-7	CHF3	ZR			
Trimethylamine	53-50-3	C3H9N	0.5	200	3	50
Trimethylbenzene mixtures		C9H12	0.3	300	2	35
Trimethylbenzene, 1,3,5-	108-67-8	C9H12	0.3	300	2	35
Trinitrotoluene 2,4,6-	118-96-7	C7H5N3O6	ZR			
Turpentine	8006-64-2	C10H16	0.6	167	3	60
TVOC			1.0	100	5	100
Undecane, n-	1120-21-4	C11H24	0.9	110	5	100
Vinyl acetate	108-05-2	C4H6O2	1.1	90	6	110
Vinyl bromide	593-60-2	C2H3Br	1.0	100	5	100
Vinyl chloride	75-01-4	C2H3Cl	2.1	50	10	200
Vinyl-2-pyrrolidinone, 1-	88-12-0	C6H9NO	0.9	110	5	90
Xylene mixed isomers	1330-20-7	C8H10	0.4	230	2	40

Gas/ VOC	CAS No.	Formula	Relative response	Relative sensitivity (%)	Typical MDL Low Range (ppb)	Typical MDL High Range (ppb)
Xylene, m-	108-38-3	C8H10	0.4	230	2	50
Xylene, o-	95-47-6	C8H10	0.6	167	3	60
Xylene, p-	106-42-3	C8H10	0.6	180	3	50
Xylidine, all	1300-73-8	C8H11N	0.7	140	4	70

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 a 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, 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.

When do I replace the PID lamp?

A PID lamp will last a long time, typically a few thousand hours. Lamps are warranted for six months; replacement bulbs are available and are not expensive to replace. The sensitivity of the PID is approximately in direct proportion to the lamp light intensity, so as the bulb ages and loses intensity; the response to a particular, low gas concentration becomes noisier. Note the PC configurator software allows for lamp duty cycles to extend lamp life, this software can also be used for calibration and diagnostics

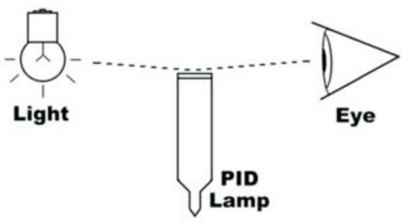
Removing the electrode stack and lamp (with unit powered down)

Always use the Electrode Stack Removal Tool; any other tools may damage your PID and invalidate your warranty

a. Gently remove the sensor from equipment.
b. Place the PID, pellet side down, onto a clean surface.
c. Locate electrode stack removal tool into the two slots on the sides of the PID and squeeze together until electrode stack and lamp are released.
d. Lift carefully the PID body away from the pellet and lamp.
e. Occasionally the lamp may be temporarily lodged in the cell and will need to be freed carefully with tweezers.
f. Occasionally the small spring behind the lamp will come out when the lamp is removed from the sensor. Simply replace it into the sensor house.

Cleaning the PID Lamp

Inspection of the lamp may reveal a layer of contamination on the detection window that presents itself as a 'blue hue.' To check for contamination, hold the lamp in front of a light source and look across the window surface



Only clean the lamp using our recommended lamp cleaning kit and detailed instructions. To avoid contaminating the sensor and affecting accuracy, do not touch the lamp window with bare fingers. You may touch the body of the lamp with clean fingers.

PID lamp cleaning kit PID-CK

The vial of cleaning compound contains alumina (CAS Number 1344-28-1) as a very fine powder. A full material safety data sheet MSDS is available on request
Key safety issues are identified below:

Hazard identification:
May cause irritation of respiratory tract and eyes.

Storage:

- Keep container closed to prevent water adsorption and contamination.

Handling:

- Do not breathe in the powder. Avoid contact with skin, eyes and clothing
- Wear suitable protective clothing
- Follow industrial hygiene practices: Wash face and hands thoroughly with soap and water after use and before eating, drinking, smoking or applying cosmetics.
- The powder carries a TVL(TWA) limit of 10 mg/m^3

Use of PID lamp cleaning kit 5981601

1. Open the container of alumina polishing compound. With a clean cotton bud, collect a small amount of the powder.
2. Use this cotton bud to polish the PID lamp window. Use a circular action, applying light pressure to clean the lamp window. Do not touch the lamp window with fingers.
3. Continue polishing until an audible "squeaking" is made by the cotton bud moving over the window surface. (usually within 15 seconds)
4. Remove the residual powder from the lamp window with a clean cotton bud. Care must be taken not to touch the tips of cotton buds that are to be used to clean the lamps as this may contaminate them with finger oil.
5. Ensure the lamp is completely dry and any visible signs of contamination are removed before refitting.

Discarding the PID electrode stack

Discard the contaminated electrode stack. The electrode stack does not have any toxic components, but if it has been contaminated by toxic materials, then show due care when disposing.

Re-fitting the PID electrode stack and lamp

Warning! Never refit a damaged lamp

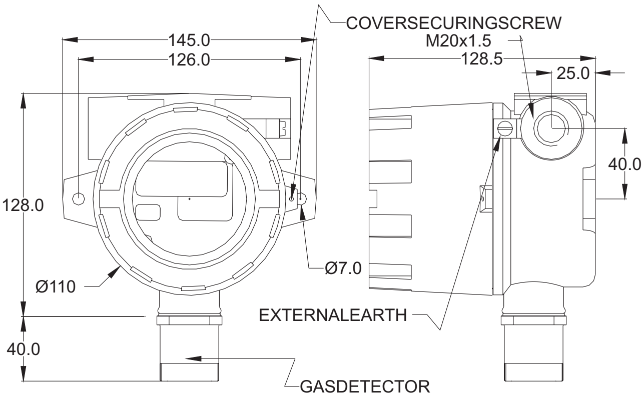
1. Place the lamp inside the O-ring seal in the pellet as illustrated. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the pellet's front electrode. The lamp should be freely supported by the O-ring.
2. Continuing to hold the pellet between forefinger and thumb, carefully insert the lamp into recess in the sensor ensuring that the lamp remains in position. Press the pellet firmly, to ensure that the pellet wing clips are engaged, and the top faces of the pellet and sensor house are flush.
3. Refit the sensor into the sensing equipment.
4. Re-calibrate the gas detector in accordance with manufacturer's instructions.

Ordering spare components

If you need spare components, then quote the order code below:

10.6eV lamp	5921401
Electrode stack	5921901
Electrode stack removal tool	5981801
Lamp cleaning kit	5981601
Lamp spring	5981701

Accessories and Complementary Products



EEXd Junction Boxes Ref 5045802

Tocsin 903 Single Channel EEXd Controller with Display.
Refer to seperate data sheet for full option list and part numbers.

Basic unit with 4-20mA Output
Options for:
Relay Alarm Outputs
Addressable Interface
HART Interface

Pitot Duct Adaptor P/N5139002

Dynamic Duct Adaptor P/N5999201

Type 4 Duct Adaptor P/N5133701

Type 3 Duct Adaptor P/N5133801

Splash/Dust Guard P/N401451

Calibration Gas Adaptor P/N401101