PLATINUM IR SENSOR USER MANUAL

Certified (Ex'd)

Low Power Certified (Ex'd)

Non-Certified

Low Power Non-Certified

SIL1 Certified (Ex'd)

Low Power SIL1 Certified (Ex'd)

SIL1 Non-Certified

Low Power SIL1 Non-Certified

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Contents

Platinum Sensor

Description

Dynament infrared sensors operate by using the NDIR principle to monitor the presence of the target gas. The sensor contains a long life tungsten filament infrared light source, an optical cavity into which gas diffuses, temperature compensated pyroelectric infrared detectors, an integral semiconductor temperature sensor and electronics to process the signals from the pyroelectric detector .

Basic operation

The sensor has an infrared lamp that is switched on and off. This results in the pyroelectric device producing a sinusoidal signal for both the detector and reference devices.

The detector sinusoidal signal reduces in size as the target gas enters the sensor, the reference signal is unchanged.

The gas concentration is calculated by measuring the difference in the ratio of the detector and reference signals in zero gas and with gas. The reference signal is used to compensate the gas readings for effects like temperature and lamp ageing.

Overview of Available Options

Option	LP2	LP	RP	HP
	8mA/24mW	15mA/45mW	80mA/240mW	140mA/420mW
Non-certified (Safe Area)	✓	✓	✓	✓
Ex'd Certified (Hazardous Area Zones 1 & 2)	✓	✓	✓	✓
SIL1 Certified (EN50271)		✓	✓	✓
3-Pin (Analogue)	✓	✓	✓	✓
4-Pin (Digital)	✓	✓	✓	✓
5-Pin (Analogue & Digital)	✓	✓	✓	✓
Voltage Output	✓	✓	✓	✓
Bridge Output		✓	✓	✓
Positive Polarity	✓	✓	✓	✓
Negative Polarity		✓	✓	✓
XTR (-40...+75C)	✓	✓	✓	✓

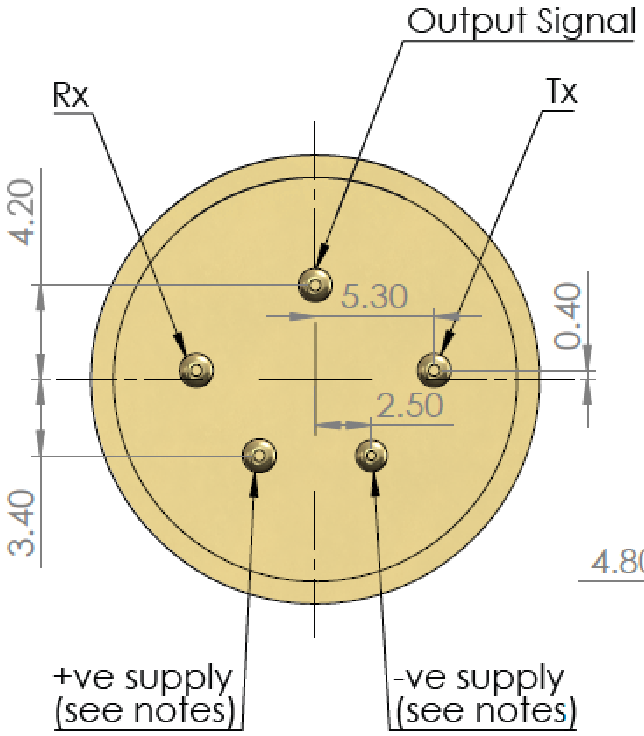
Target gases

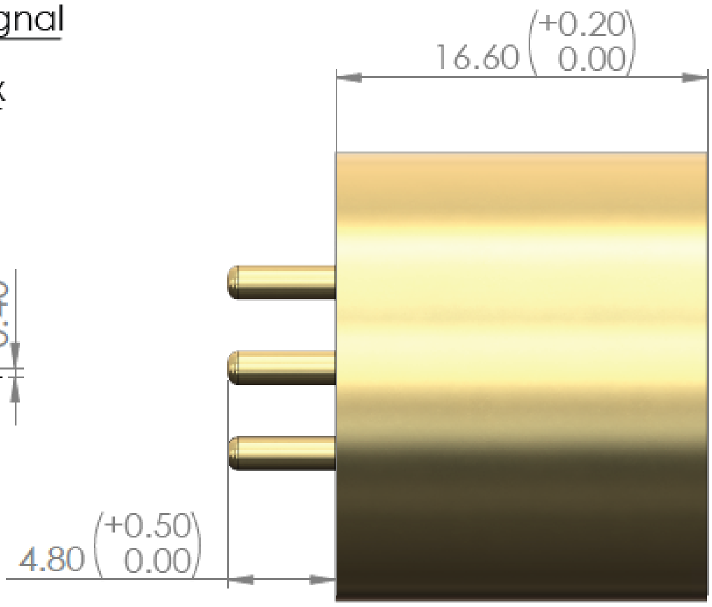
Refer to sensor technical datasheets.

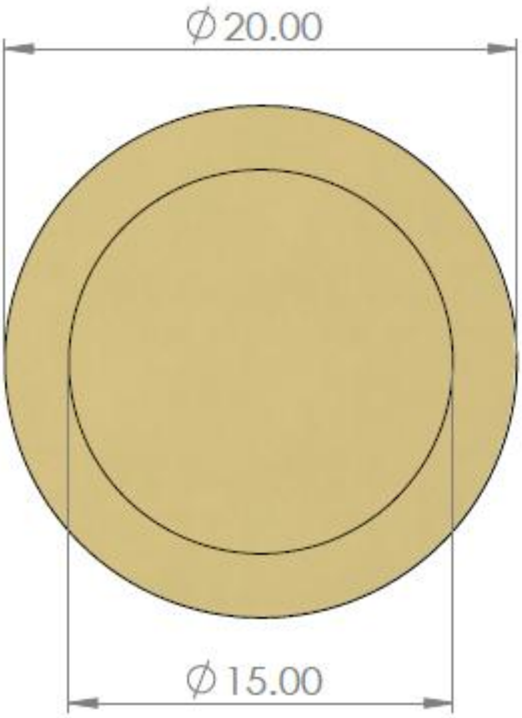
Power Cycling

The sensor is designed for continuous powered operation. Repeated short-interval power cycling (for example, powering the unit for brief measurement periods followed by shutdown) may reduce the service life of internal non-volatile memory components.

Operation in this manner is outside the intended use of the product and any resulting damage is not covered under warranty.







Notes
Tolerance: +/- 0.15 unless otherwise stated.

Recommended PCB socket Wearnes Cambion Ltd code 450-3326-01-06-00

Use anti-static precautions when handling.

Do not cut pins.

Do not solder directly to pins.

The labelling adds up to 0.2mm to the outer diameter and up to 0.2mm to the overall height.

All dimensions are in millimetres.
Pins viewed from underside.
Diameter of pins = 1.5mm (+/- 0.05)
Tx & Rx communication connections are available as either pads or pins

Sealing

The Platinum sensor is not designed to be hermetically sealed. We do not recommend that the sensor is used as an active part of a seal.

Shelf Life, Storage & Extended Storage

Shelf Life

Dynament infrared (NDIR) gas sensors are solid-state devices incorporating optical, electronic and pyroelectric components. Unlike electrochemical sensors, they do not contain consumable electrolytes or reactive chemicals and therefore do not have a defined expiry date when stored under recommended conditions.

No fixed shelf-life limitation is assigned to Dynament infrared sensor products.

Storage

Sensors should be stored:

- In their original sealed packaging as supplied by Dynament
- Within the storage temperature range specified in the applicable product data sheet
- In a clean, dry environment free from corrosive gases and condensation

Extended Storage

Where a sensor is installed more than twelve (12) months after the original date of shipment, Dynament recommends that calibration is verified prior to commissioning to ensure conformity with published performance specifications.

This statement applies to all Dynament infrared gas sensor variants unless otherwise specified in an individual product data sheet.

Sensor Ex'd Certification

The Platinum Sensor housing is available in two formats:

1) Ex'd
2) Non-Ex'd

Ex'd versions of the Platinum IR sensor use the Ex'd method of protection to comply with European ATEX Certification, International IECEx Certification and North American Certification. The limitations shall be based on the standard's guidelines.

! It is the responsibility of the end user to provide a suitable method of protection for the non-Ex'd versions of the sensor when the sensor is to be operated in a potentially hazardous area. !

European 'Ex' ATEX Certification Data

	Sensor Types	Sensor Types	Sensor Types	Sensor Types
*** Refers to the sensor type suffix e.g. P, DP, LP etc.	! All certified versions prefixed MSH2-***	All certified versions prefixed MSH2ia-***	All certified versions prefixed MSH-***	All certified versions prefixed MSHia-***
Approval body	FTZU	FTZU	SIRA	SIRA
Certificate Number	FTZU 14 ATEX 0213U	FTZU 14 ATEX 0213U	SIRA 04ATEX1357U (Ex & EN50271 / SIL1)	SIRA 04ATEX1357U (Ex & EN50271 / SIL1)
Test Standards	EN60079-0:2012+A11:2013	EN60079-0:2012+A11:2013	EN60079-0:2012+A11:2013	EN60079-0:2012+A11:2013
	EN 60079-1:2014	EN 60079-1:2014	EN60079-1:2014	EN60079-1:2014
	EN 60079-11:2012	EN 60079-11:2012	EN60079-11:2012	EN60079-11:2012
	EN 50303:2000	EN 50303:2000	EN60079-26:2015	EN60079-26:2015
			EN 50271:2010 (except Type MSH)	EN 50271:2010 (except Type MSHia)
Certification Codes	I M2 Ex db I Mb	I M1 Ex db ia I Ma	I M2 Ex db I Mb	I M1 Ex db+ia I Ma
	II 2 G Ex db IIC Gb	II 2 G Ex db IIC Gb	II 2 G Ex db IIC Gb	II 2 G Ex db IIC Gb
Input parameters	0.8W max, 30V max.	Ui=6V dc, Pi=0.8W	0.8W max, 30V max.	Ui=6V dc, Pi=0.8W
Operating temperature	-20 to +60 deg. C	-20 to +60 deg. C	-20 to +60 deg. C	-20 to +60 deg. C
Note	! Input parameters are defined for certification purposes only. Refer to the individual sensor data sheet 'Specification' tables for the sensor operating voltage and temperature range. !			

International IECEx Certification

	Sensor Types	Sensor Types	Sensor Types	Sensor Types
*** Refers to the sensor type suffix e.g. P, DP, LP etc.	All certified versions prefixed MSH2-***	All certified versions prefixed MSH2ia-***	All certified versions prefixed MSH-***	All certified versions prefixed MSHia-***
Approval body	FTZU	FTZU	SIRA	SIRA
Certificate Number	IECEx FTZU 15.0002U	IECEx FTZU 15.0002U	IECEx SIR 05.0053U	IECEx SIR 05.0053U
Test Standards	IEC 60079-0:2011	IEC 60079-0:2011	IEC 60079-0:2011	IEC 60079-0:2011
	IEC 60079-1:2014-6	IEC 60079-1:2014-6	IEC 60079-1:2014-6	IEC 60079-1:2014-6
	IEC 60079-11:2011	IEC 60079-11:2011	IEC 60079-26:2014-10	IEC 60079-26:2014-10
Certification Codes	Ex db I Mb	Ex db ia I Ma***	Ex db I Mb	Ex db+ia 1Ma
	Ex db IIC Gb	Ex db IIC Gb	Ex db IIC Gb	Ex db IIC Gb
Input parameters	0.8W max, 30V max.	Ui=6V dc, Pi=0.8W	0.8W max, 30V max.	Ui=6V dc, Pi=0.8W
Operating temperature	-20 to +60 deg. C	-20 to +60 deg. C	-20 to +60 deg. C	-20 to +60 deg. C
Note	**Input parameters are defined for certification purposes only. Refer to the individual sensor data sheet 'Specification' tables for the sensor operating voltage and temperature range.**			

North American Certification

	Sensor Types	Sensor Types
*** Refers to the sensor type suffix e.g. P, DP, LP etc.	All UL certified versions prefixed MSH- *** or MSH2-***	All UL certified versions prefixed MSHia- *** or MSH2ia-***
Approval Body	Underwriters Laboratory Inc.	Underwriters Laboratory Inc.
File Reference	E336365	E336365
Test Standards	UL 60079-0, 4th Edition	UL913, 7th Edition
	UL 60079-1, 6th Edition	UL 60079-0, 4th Edition
	CAN/CSA-C22.2 No. 60079-0-1-7	UL 60079-11, 2nd Edition
	CAN/CSA-22.2 No. 60079-1, Part 1, 1st Edition	CAN/CSA-C22.2 No. 157-92
Hazardous Locations	Class 1, Zone 1, AEx d IIC and Ex d IIC	Class I, II, III, Division 1 Class 1, Zone 0, AEx a IIC, T4 with 60 deg. C ambient
Input / Entity Parameters	0.8W max, 30V max.	Ui=6V dc, Pi=0.8W, Ci=4.105uF, Li=0 mH

CERTIFICATION DETAILS		
European ATEX Certification	**Sensor types** **MSH-P, MSH-PS**	**Sensor types** **MSHia-P, MSHia-PS**
Approval body	**SIRA**	
Certificate Number	**SIRA 04ATEX1357U (Ex & EN50271 / SIL1)**	
Test Standards	**EN60079-0:2012+A11:2013, EN60079-1:2014,** **EN60079-11:2012, EN60079-26:2015** **EN 50271:2010**	
Certification Codes	**I M2 Ex db I Mb** **II 2 G Ex db IIC Gb**	**I M1 Ex db+ia I Ma** **II 2 G Ex db IIC Gb**
Input parameters	**0.8W max, 30V max.** **(See footnote)**	**Ui=6V dc, Pi=0.8W** **(See footnote)**
Operating temperature	**-20°C to +60°C (See footnote)**	
International IECEx Certification	**Sensor types** **MSH-P, MSH-PS**	**Sensor types** **MSHia-P, MSHia-PS**
Approval body	**SIRA**	
Certificate Number	**IECEx SIR 05.0053U**	
Test Standards	**IEC 60079-0:2011** **IEC60079-1:2014** **IEC 60079-11:2011** **EN 60079-26:2014**	
Certification Codes	**Ex db I and/or Ex db IIC**	**Ma Ex db+ia I and/or** **Gb Ex db IIC**
Input parameters	**0.8W max, 30V max.**	**Ui=6V dc, Pi=0.8W**
Operating temperature	**-20°C to +60°C (See footnote)**	
North American Certification	**Sensor type MSH-P**	**Sensor type MSHia-P**
Approval body	**Underwriters Laboratory Inc.**	**Underwriters Laboratory Inc.**
File Reference	**E336365**	**E336365**
Test Standards	**UL 60079 – 0, 4th Edition** **UL 60079 - 1, 6th Edition** **CAN/CSA-C22.2 No. 60079-0-1-7** **CAN/CSA-C22.2 No. 60079-1** **part 1, 1st Edition**	**UL913 7th, Edition** **UL 60079 – 0, 4th, Edition** **UL 60079 – 11, 2nd , Edition** **CAN/CSA-C22.2 No. 157-92**
Hazardous Locations	**Class 1, Zone 1, AEx d IIC and Ex d IIC Hazardous Locations**	**Class I, II, III, Division 1** **Class 1, Zone 0, AEx ia IIC, T4 with 60°C ambient**
Input/Entity parameters	**0.8W max, 30V max.**	**Ui=6V dc, Pi=0.8W, Ci=4.105µF, Li=0 mH**

Input parameters are defined for certification purposes only, refer to the "Specification" table for the sensor operating voltage and temperature range.

CERTIFICATION DETAILS		
European ATEX Certification	**Sensor types** **MSH2-LP, MSH2-LS**	**Sensor types** **MSH2ia-LP, MSH2ia-LS**
Approval body	**FTZU**	**FTZU**
Certificate Number	**FTZU 14 ATEX 0213U** **(See footnote 2)**	**FTZU 14 ATEX 0213U** **(See footnote 2)**
Test Standards	**EN 60079-0:2012+A11:2013** **EN 60079-1:2014** **EN 60079-11:2012** **EN 50303:2000**	**EN 60079-0:2012+A11:2013** **EN 60079-1:2014** **EN 60079-11:2012** **EN 50303:2000**
Certification Codes	**I M2 Ex db I Mb** **II 2 G Ex db IIC Gb**	**I M1 Ex db ia I Ma** **II 2 G Ex db IIC Gb**
Input parameters	**0.8W max, 30V max.** **(See footnote)**	**Ui=6V dc, Pi=0.8W** **(See footnote)**
Operating temperature	**-20°C to +60°C (See footnote 1)**	
International IECEx Certification	**Sensor types** **MSH2-LP, MSH2-LS**	**Sensor types** **MSH2ia-LP, MSH2ia-LS**
Approval body	**FTZU**	**FTZU**
Certificate Number	**IECEx FTZU 15.0002U** **(See footnote 2)**	**IECEx FTZU 15.0002U** **(See footnote 2)**
Test Standards	**IEC60079-0:2011, Edition 6** **IEC60079-1:2007-04, Edition 6**	**IEC60079-0:2011, Edition 6** **IEC60079-1:2007-04, Edition 6** **IEC60079-11:2011, Edition 6**
Certification Codes	**Ex d I Mb Ex db IIC Gb**	**Ex d ia I Ma Ex db IIC Gb**
Input parameters	**0.8W max, 30V max.**	**Ui=6V dc, Pi=0.8W**
Operating temperature	**-20°C to +60°C (See footnote 1)**	
North American Certification	**Sensor type MSH2-LP**	**Sensor type MSH2ia-LP**
Approval body	**Underwriters Laboratory Inc.**	**Underwriters Laboratory Inc.**
File Reference	**E336365**	**E336365**
Test Standards	**UL 60079 – 0, 4th Edition** **UL 60079 - 1, 6th Edition** **CAN/CSA-C22.2 No. 60079-0-1-7** **CAN/CSA-C22.2 No. 60079-1** **part 1, 1st Edition**	**UL913 7th, Edition** **UL 60079 – 0, 4th, Edition** **UL 60079 – 11, 2nd , Edition** **CAN/CSA-C22.2 No. 157-92**
Hazardous Locations	**Class 1, Zone 1, AEx d IIC and Ex d IIC Hazardous Locations**	**Class I, II, III, Division 1** **Class 1, Zone 0, AEx ia IIC, T4 with 60°C ambient**
Input/Entity parameters	**0.8W max, 30V max.**	**Ui=6V dc, Pi=0.8W,** **Ci=4.105µF, Li=0 mH**

Note1 Input parameters are defined for certification purposes only, refer to the "Specification" table for the sensor operating voltage and temperature range.

Note 2 SIL Certificate number for all variants is SIRA FSP 14002/01

Ex'd certified regular power and high power sensors

SPECIAL CONDITIONS FOR SAFE USE FOR ALL DYNAMENT CERTIFIED SENSORS TYPES MSH-XXX, MSHia-PXXX AND MSH-PXXX

It is a requirement of the IECEx & ATEX EC Type Examination Certification for all certified versions of the standard range of sensors types MSH-XXX and Premier sensors types MSH-PXXX that the following "Special Conditions for Safe Use" be made known to the end user of the product.

CERTIFICATE No.'s SIRA 04ATEX1357U, IECEx SIR 05.0053U, CSAE 22UKEX1379U

SPECIAL CONDITIONS FOR SAFE USE

1) The sensors have been assessed as suitable for use within an ambient temperature range of -20°C to +60°C, whilst producing a maximum external surface rise of 45 K in normal operation.
2) The devices shall be effectively protected from impact.
3) These devices are intended for use at atmospheric pressure and shall not be used in pressures exceeding 1.1 bar.
4) The connection pins shall be protected from dust and moisture by an enclosure with an Ingress Protection rating of at least IP 54 in accordance to EN/IEC 60079-0.
5) The devices shall not be installed or removed when an explosive gas atmosphere is present.
6) The sensor may be supplied with a metallic closing disc around the connection pins. This may need to be considered with respect to creepage and clearance distance when the device is incorporated into equipment.
7) The Type MSHia *** and Type MSHia-P *** shall be supplied by an intrinsically safe supply coded Ex ia with a maximum output voltage of 6.0 Vd.c. and a maximum output power of 0.8 W.

The following conditions apply when the Types MSH-P* and MSHia-P *** Gas Sensors are used as a SIL 1 safety related device as defined in EN 50271:2018**

1) The user shall comply with the requirements given in the manufacturer's user documentation regarding all relevant functional safety aspects such as application of use, installation out of hazardous areas, operation, maintenance, proof tests, maximum ratings, environmental conditions, and repair.

2) Selection of this equipment for use in safety functions, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing all the manufacturer's conditions and recommendations in the user documentation.

3) The safety related device must be functioning and powered independently of any control devices required for operation.

4) The recommended proof test interval for the safety functions is 1 year.

5) All information associated with any field failures of this product should be collected under a dependability management process (e.g., IEC 60300-3-2) and reported to the manufacturer.

6) The IR Platinum Series are only approved for software version (V7.17.00u B18).

7) The certified products series shall only be configured using Dynament "Status Scientifics' PC application v3.4.0 or later".

8) The serial communication bus shall only be used with the protocol developed by Dynament Ltd to exercise the safety function.

SPECIAL CONDITIONS FOR SAFE USE FOR DYNAMENT

CERTIFIED SENSORS TYPES MSH2 * AND MSH2ia *****

The following instructions apply to Gas Sensors covered by certificate numbers **FTZU 14 ATEX 0213 U and IECEx FTZU 15.0002U**

The "***" contained within the type number MSH2 *** or MSH2ia *** is used to define the specific sensor variant.

THE FOLLOWING SPECIAL CONDITIONS FOR SAFE USE APPLY:

1) The sensors have been assessed as suitable for use within an ambient temperature range of -20ºC to +60 ºC, whilst producing a maximum external surface rise of 45K in normal operation.

2) The devices shall be effectively protected from impact.

3) These devices are intended for use at atmospheric pressure and should not be used in pressures exceeding 1.1 bar.

4) Unless subsequently protected by concepts that render the following conditions unnecessary:

a) The connection pins shall be protected from dust and moisture by an enclosure with an Ingress Protection rating of at least IP54.

b) The devices should not be installed/removed when an explosive gas atmosphere is present.

5) The sensor may be supplied with a metallic closing disc around the connection pins. This shall be considered with respect to creepage and clearance distance when the device is incorporated into equipment.

6) Type MSH2ia *** sensors shall be supplied by an intrinsically safe supply Ex ia with a maximum output voltage of 6.0 V and a maximum output power of 0.8W.

ADDITIONAL INFORMATION

1 Assembling and dismantling: - The sensor is supplied fully assembled. No dismantling is required, or possible. The sensor must not be unplugged when in use in a potentially explosive atmosphere.

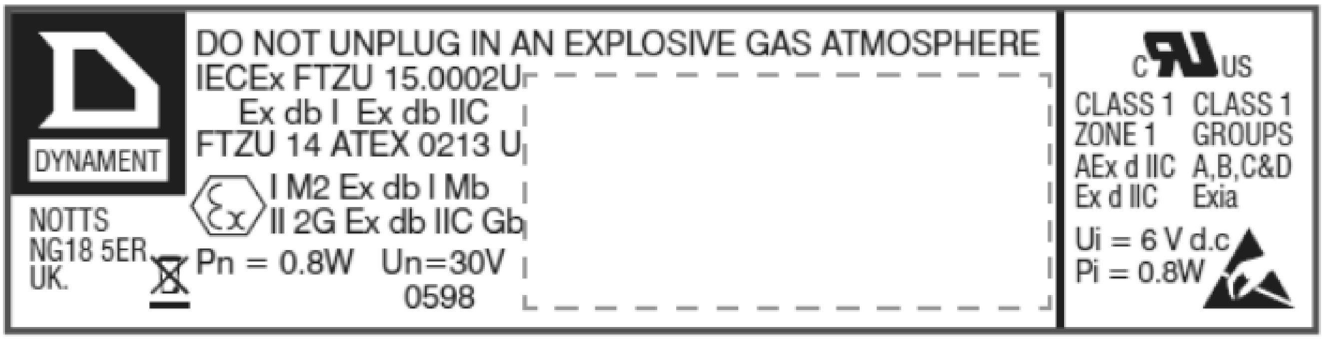
2 Maintenance: - The user should ensure that the sensor opening is kept free from blockages such as a build up of dust or dirt that would otherwise restrict gas flow.

3 Servicing: - The sensor does not require servicing, only maintenance as described above..

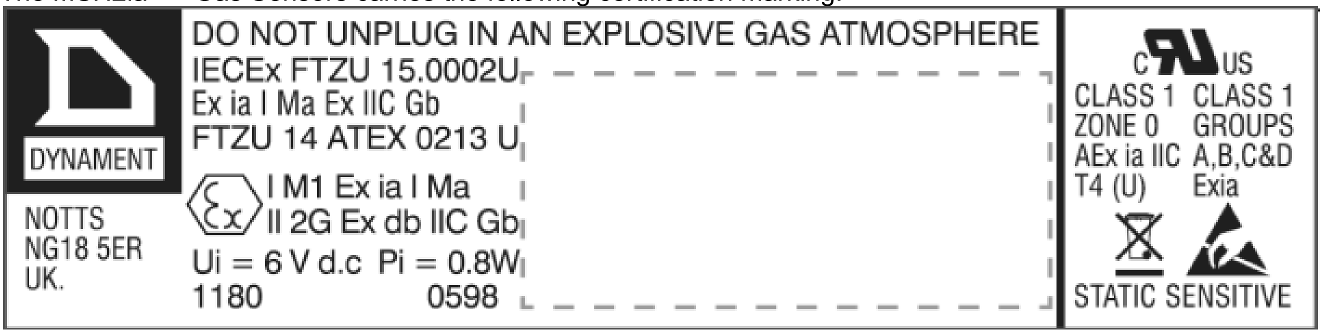
4 Emergency repairs: - The sensor is not an item to which emergency repairs can be made.

5 Adjustment: - Gas calibrations and changes to the configuration are possible on certain variants, refer to the relevant data sheets published at www.dynament.com

6 The MSH2 *** Gas Sensors carries the following certification marking:



The MSH2ia *** Gas Sensors carries the following certification marking:



Power Supply

The sensor power supply rise time must be less than 50 mS to ensure correct operation. Operation outside the range of 3 – 5 V dc will result in either fault indication, or the sensor will not function correctly.

Sensor warm-up

Analogue output behaviour:
When power is first applied to the sensor, the voltage at the output pin is held at a pre-determined level. The default setting for this start-up value is the "zero gas" value for bridge output sensors and 0.2V for voltage output sensors. This condition is maintained for a default "warm-up" time of 45 seconds, after this time the output voltage represents the calculated gas value. Sensors can take up to 1 minute to indicate the correct gas reading.

Digital output behaviour:
When power is first applied to the sensor, the digital output is held at -250% of the full scale for the duration of the "warm-up" time.

Note: Both the voltage at the output pin during the "warm-up" time, and the duration of the "warm-up" time can be pre-programmed to alternative values at the time of ordering sensors.

Serial Communications

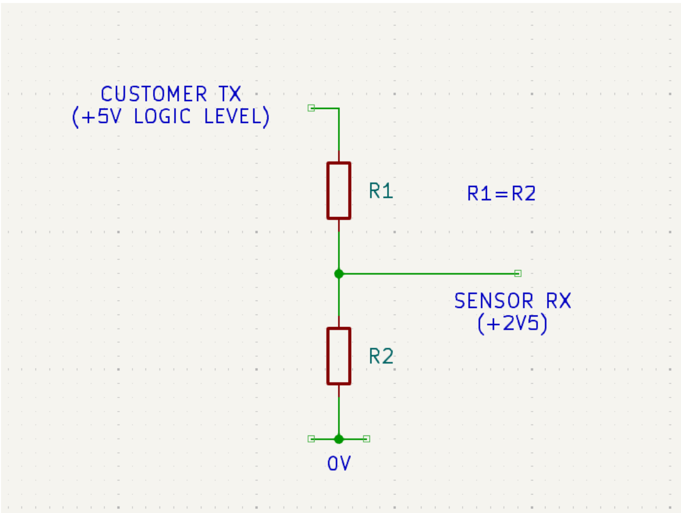
The digital communication pins "RX" and "TX" operate at a nominal 2.8V logic level. When interfacing to external circuitry that uses a higher voltage level it is necessary to ensure that the voltage signals are within range of the sensor's Rx and Tx.

The Rx and Tx voltage limits are as follows:

RX: Input 'High' minimum voltage (VIH) = 2.24V
RX: Input 'Low' maximum voltage (VIL) = 0.56V

TX: Output 'High' minimum voltage (VOH) = 2.1
TX: Output 'Low' maximum voltage (VOL) = 0.6V

To interface to systems that use 5V logic levels, use the voltage divider circuit outlined in the diagram below to ensure the inputs are not overloaded. Suggested values for R1 and R2 are 4K7Ω.

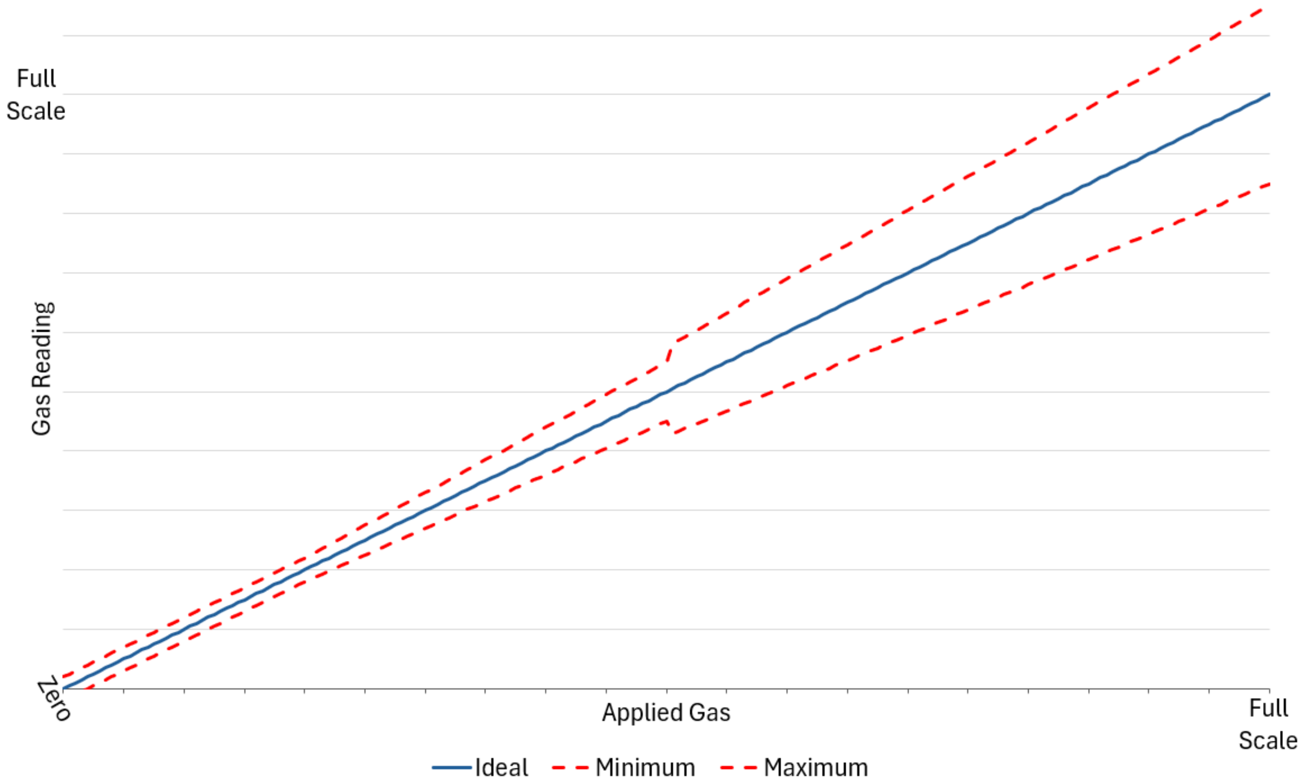


Contact Dynament Ltd for details of the required protocol (TDS0045)

Temperature transients and gas flow rates

The Platinum series sensor employs a pyroelectric detector, the output from which can be disrupted by sudden changes in temperature. If there is an excessive change in the ambient temperature, gas sample temperature or flow rate, then the output signal will be momentarily frozen. Correct operation is restored when the effects of the transient have settled. Rates of change in the ambient temperature should be restricted to 2°C/minute and gas flow rates kept below 600 cc/minute.

Sensors are available in the range -20°C…+50°C (Standard Temperature) or -40°C…+75°C (Extended Temperature (XTR)). The graph below shows typical characteristics.



See individual sensor technical datasheets for detailed specifications.

Analogue output

The analogue output of the sensor is directly proportional to the measured gas level. The analogue output can be configured to be a straightforward voltage or a bridge type configuration. This configuration is carried out during manufacture and thus cannot be changed afterwards.

Voltage

The default configuration for the voltage analogue output is 0.4 to 2.0V for zero gas to FSD. The user can select the output for zero gas to be in the range of 0.1V to 0.5V and for FSD in the range of 1.5 to 2.7V (2.5V for LP2). This is shown in the following diagram.

The table below shows the analogue output for a sensor that is configured to:
Zero = 0.4V, FSD = 2.0V FSD = 100% v/v.

Condition	Digital Output (%)	Analogue Output (V)
Target Gas	0	0.40
Target Gas	10	0.56
Target Gas	20	0.72
Target Gas	30	0.88
Target Gas	40	1.04
Target Gas	50	1.20
Target Gas	60	1.36
Target Gas	70	1.52
Target Gas	80	1.68
Target Gas	90	1.84
Target Gas	100	2.00
Negative Gas Reading	-10	0.24
Negative Gas Reading	-20	0.08
Negative Gas Reading	-200	0.00
Fault Mode	-250	0.00

The following formula can be used to derive the gas concentration from the voltage output:

$$\text{Gas Measurement} = \frac{\text{(Voltage Reading-DAC Zero) x Full scale range}}{\text{Full scale voltage - Zero voltage}}$$

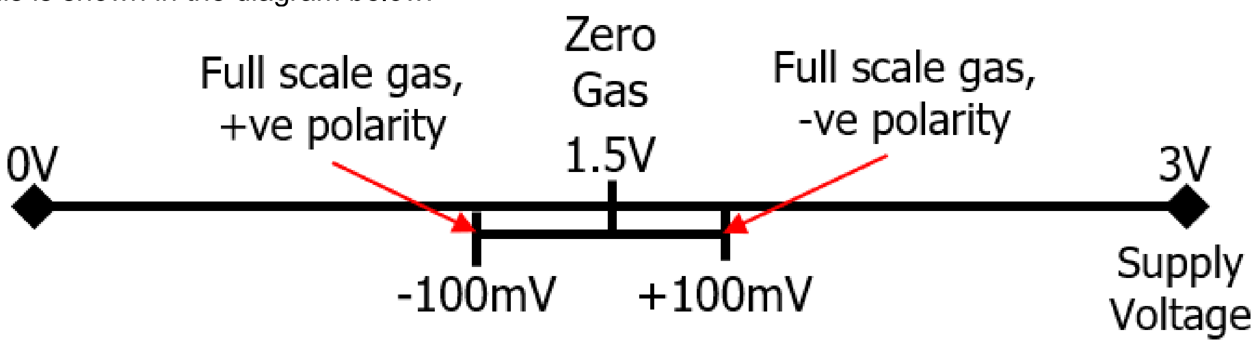
Following worked example for Zero = 0.4V, FSD = 2.0V FSD = 100% v/v.

$$\text{50\% gas} = \frac{(1.2V - 0.4V) \times 100}{2V - 0.4V}$$

Bridge

The bridge output configuration is typically used as a pellistor replacement and is configured to be ½ of a Wheatstone bridge. At zero gas, the analogue output is configured to ½ of the supply voltage with the output changing directly in proportion with gas by 100 mV. Negative polarity sensors default to rising with gas, whilst positive polarity sensors default to falling with gas.

This is shown in the diagram below.



Condition	Digital Output (%)	5V Supply 0.1V Rising	3 Supply 0.1V Rising	5V Supply 0.1V Falling	3 Supply 0.1V Falling	5V Supply 0.2V Rising	3 Supply 0.2V Rising	5V Supply 0.2V Falling	3 Supply 0.2V Falling
Target Gas	0	2.50	1.50	2.50	1.50	2.50	1.50	2.50	1.50
Target Gas	10	2.51	1.51	2.49	1.49	2.52	1.52	2.48	1.48
Target Gas	20	2.52	1.52	2.48	1.48	2.54	1.54	2.46	1.46
Target Gas	30	2.53	1.53	2.47	1.47	2.56	1.56	2.44	1.44
Target Gas	40	2.54	1.54	2.46	1.46	2.58	1.58	2.42	1.42
Target Gas	50	2.55	1.55	2.45	1.45	2.60	1.60	2.40	1.40
Target Gas	60	2.56	1.56	2.44	1.44	2.62	1.62	2.38	1.38
Target Gas	70	2.57	1.57	2.43	1.43	2.64	1.64	2.36	1.36
Target Gas	80	2.58	1.58	2.42	1.42	2.66	1.66	2.34	1.34
Target Gas	90	2.59	1.59	2.41	1.41	2.68	1.68	2.32	1.32
Target Gas	100	2.60	1.60	2.40	1.40	2.70	1.70	2.30	1.30
Negative Gas Reading	-10	2.49	1.49	2.51	1.51	2.48	1.48	2.52	1.52
Negative Gas Reading	-20	2.48	1.48	2.52	1.52	2.46	1.46	2.54	1.54
Negative Gas Reading	-200	2.30	1.30	2.70	1.70	2.10	1.10	2.90	1.90
Fault Mode	-250	2.25	1.25	2.75	1.75	2.00	1.00	3.00	2.00

The following formula can be used to derive the gas concentration from the voltage output.

$$\text{Gas Measurement} = \frac{\text{(Half supply voltage - Voltage Reading) x Full scale range}}{\text{Voltage drop/rise for full scale}}$$

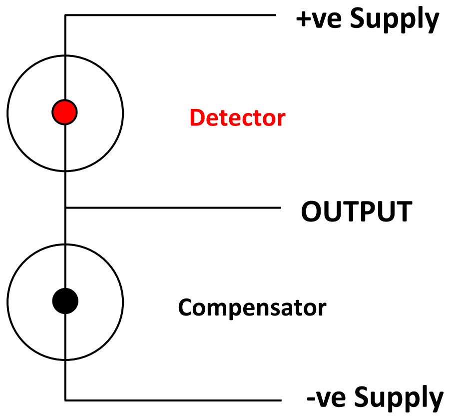
Following worked example for 3V supply voltage, 100% v/v measurement range and 100mV falling.

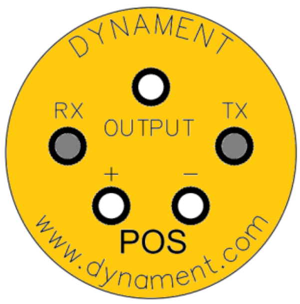
$$\text{50\% gas} = \frac{(1.50V - 1.45V) \times 100}{0.1V}$$

Catalytic (Pellistor) sensor emulation

The Platinum sensor in bridge output configuration has been designed to be a direct drop-in replacement for catalytic sensors. Catalytic (pellistor) sensors are used in a Wheatstone bridge type circuit where the detector and reference beads can be in one of two positions.

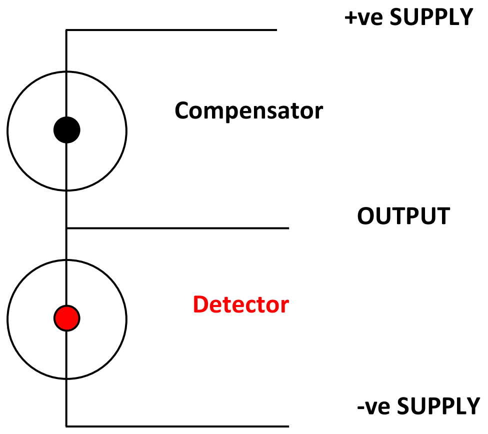
The diagrams below illustrate which Infrared sensor type should be used.

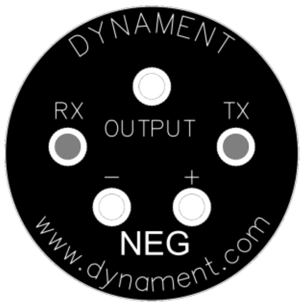




Platinum Positive Polarity Option

Use when the compensator pin of the existing pellistor is connected to the negative of the pellistor bridge supply.





Platinum Negative Polarity Option

Use when the detector pin of the existing pellistor is connected to the negative of the pellistor bridge supply.

Zero Suppression

The sensor can be configured to 'hide' positive and negative reading at the zero-gas reading. If the values are set to zero, then the output always reflect the calculated readings.

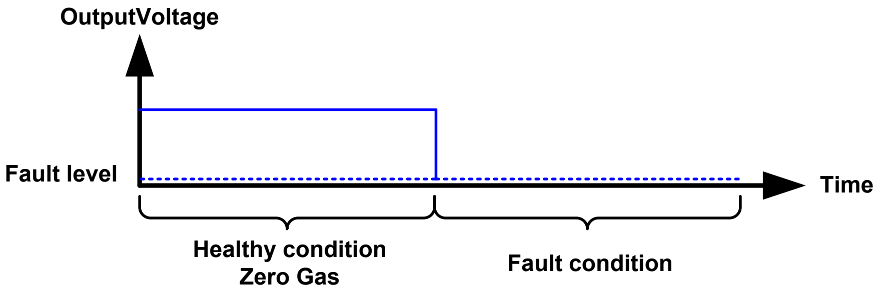
Positive and negative values are expressed as a percentage of the FSD setting. The limits are 0 to 5%, thus for a 0 to 5% v/v methane sensor this equates to 0 to 0.25% v/v gas reading.

Fault indication

The analogue output is driven to the fault level when an internal fault is detected. This is shown in the following diagrams.

Voltage output

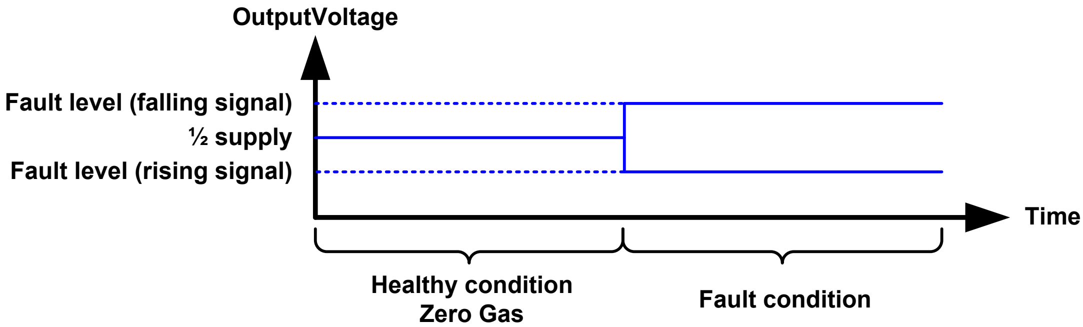
The voltage output is held at 0V when fault mode is triggered.



Bridge output

The bridge output is driven to a level depending upon the sensor configuration. See table in bridge section.

The following diagram shows the output for a sensor that is configured for an FSD of 100 mV.



Serial Data

The gas readings in the live data are set to -250% of the full-scale during fault conditions.
The status flags are set according to the actual fault.

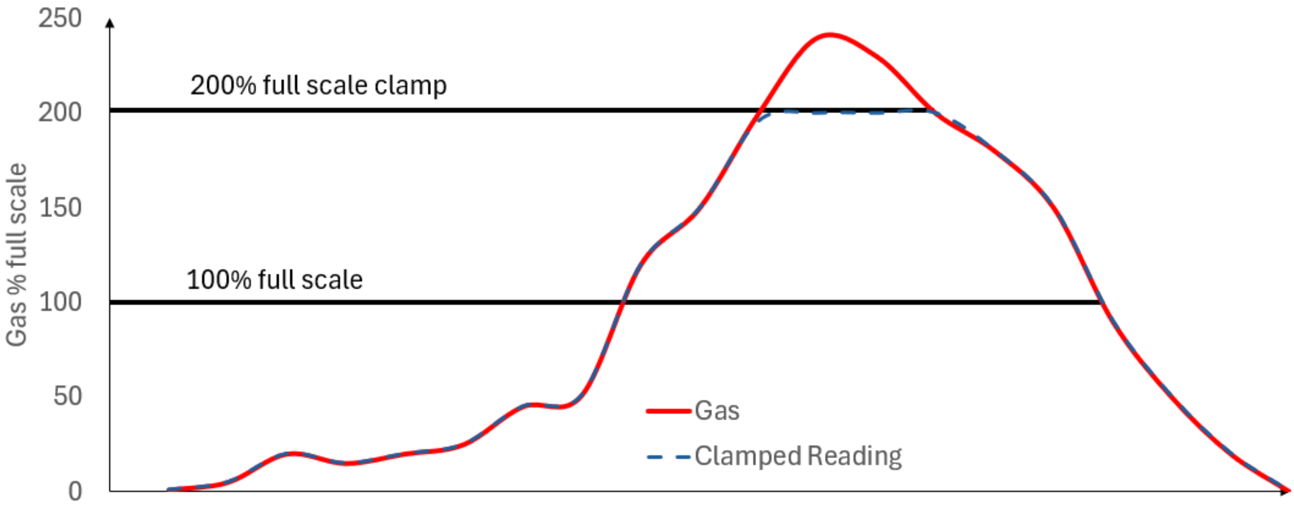
Refer to the latest TDS0045 document available by contacting Dynament.

Over-range conditions

The sensor can be configured to clamp its output reading at 100%, 125%, 150% and 200% of the selected range.

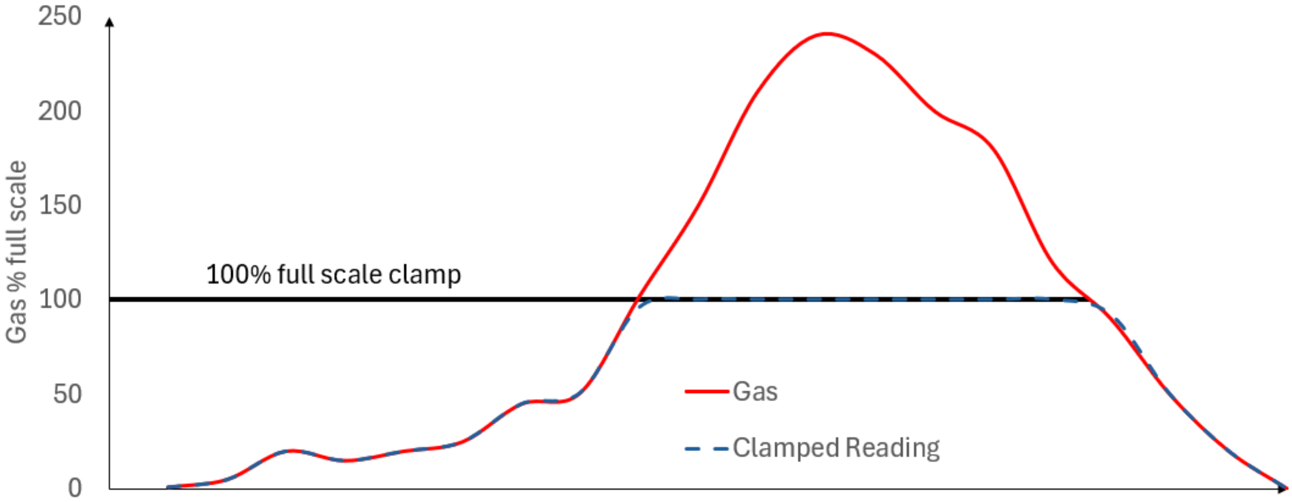
Selecting a clamp value above the sensor range can be used to get an indication of approximately how high the gas level is.

The following diagram shows the clamping action at 200%, readings above 200% are held at 200%:



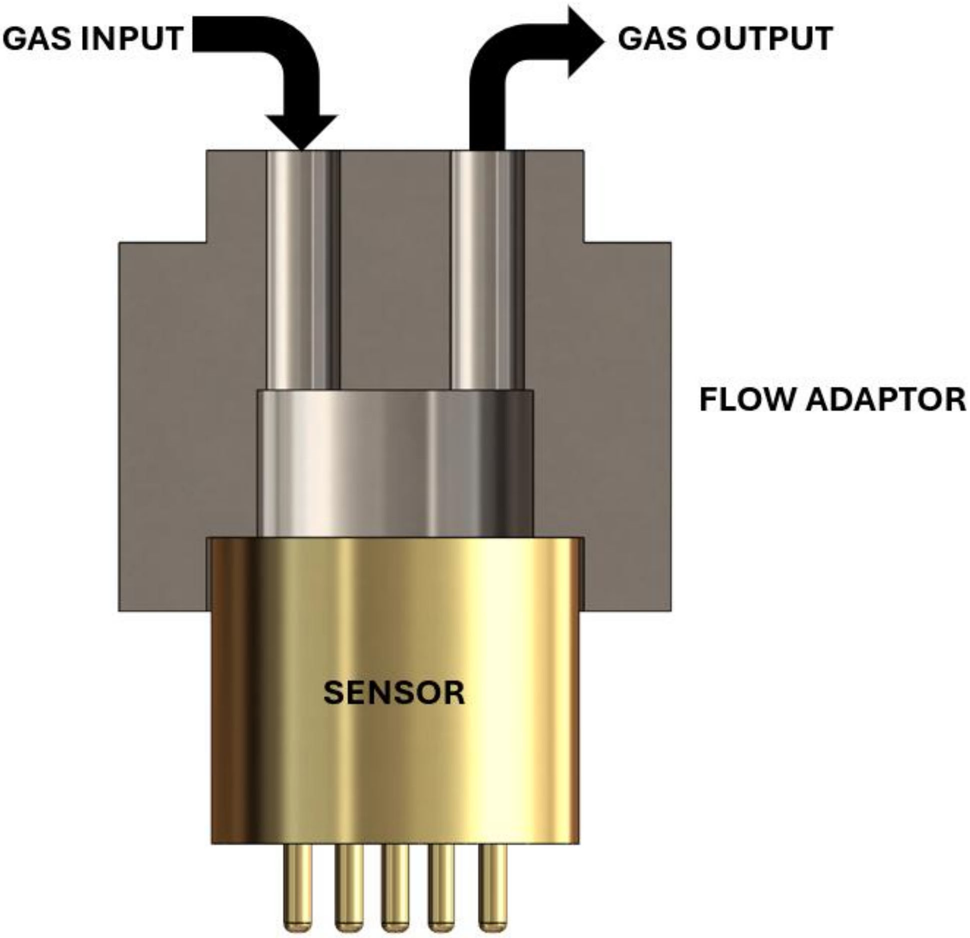
! Note: the accuracy of the output can only be held to the specifications stated on the technical datasheets up to 100% of the measurement range. !

The following diagram shows the same signals clamped at 100%, readings above 100% are held at 100%:



Flow Considerations

The sensor operates in diffusion mode and as such care must be taken not to pressurize the sensor during gas sampling. The flow rate should be between 200 and 600 cc/min.



Note: Avoid rapid changes in flow rate. Excessive flow rates may cause temporary signal noise and ‘freeze’ the gas reading updates until the flow rate is reduced.

Applying pressure to the sensor will result in inaccurate readings.

Make sure the output side of the sampling adaptor is not restricted and vents freely to atmosphere.

! If using a potentially hazardous gas, comply with local regulations regarding the safe exhaust of the gas. !

! The maximum interval of 12 months between calibration checks is required to maintain certification to SIL1, see the SIL1 section !

Dynament recommends a maximum interval of 12 months between calibration checks. A small amount of zero drift can be accomodated by re-zeroing the gas detector against the sensor. The degree of drift that is acceptable should be determined by the user. Note that the subsequent change in gas reading will be greater than the change in zero reading. If the sensor requires either a "***Zero***" or "***Span***" adjustment, there are two methods that can be used:

1. By using the "Premier Configuration Unit"
   When used in conjunction with dedicated PC software, this device uses the data communication pins on the sensor to provide a means of calibration.

2. By using the data communications pins and software written in accordance with the communications protocol supplied by Dynament. "TDS0045".

In all cases ensure that the sensor has been powered long enough for the temperature to have stabilised before starting the calibration. This time will vary in accordance with the way in which the sensor is mounted.

! Note 1: a zero calibration must always be carried out before a span calibration.

Note 2: the linearity will be impaired if the sensor's zero offset is repeatedly nulled-out at the instrument, as opposed to performing a true sensor-zero. !

Zero

Always perform a ***Zero*** operation before a ***Span*** operation, in most cases once the zero has been restored the span value will also be restored. Ensure the sensor is in a zero-gas environment before using the ***Zero*** command.

- Carbon dioxide sensors cannot be zeroed in air due to the background levels of CO_2 present. These sensors must be zeroed whilst being exposed to 100% nitrogen.
- Ambient air can be used to ***Zero*** hydrocarbon sensors provided that it is known that there is no target gas present.
- Use a flow rate of between 200 cc/min and 600 cc/min. Allow sufficient time for the sensor to be purged. Some sensor types can take longer than others to reach a stable zero condition with no target gas left within the sensor. For example, it can take at least 10 minutes to remove all the CO_2 from a ppm range CO_2 sensor.
- The ***Zero*** command can be used repeatedly until there is no further change in the observed zero value.

Span

The default gas concentration for a **Span** operation is listed below.

Gas range	Ideal Calibration Gas Level
0-5% vol. CO_2	5% vol. CO_2
0-5000ppm CO_2	5000ppm CO_2
0-100% vol. CO_2	50% vol. CO_2
0-5% vol. CH_4	2.5% vol. CH_4
0-100% vol. CH_4	100% vol. CH_4
0-2% vol. C_3H_8	1.1% vol. C_3H_8
0-100% vol. C_3H_8	100% vol. C_3H_8
0-1% vol. N_2O	1% vol. N_2O
0-1000ppm N_2O	1000ppm N_2O

This will provide the optimum linearity over the full operating range. If the best accuracy is required at a specific gas level, for example 25% of full scale value, then a Span operation can be performed using this value instead of the reccomended value; only sensors with calibrations according to the reccomended gas level can be held to the specifications on the technical datasheet.

Note than when using the "Manual Calibration" feature, the span gas concentration must match the value specified within the sensors calibration gas field. This can be found on the calibration certificate for each sensor.

N2O Sensor

It is recommended that the N2O sensor receives a zero calibration every 2-3 months in order to mainatin accuraccy.

General Notes

Use a flow rate of between 200 cc/min and 600 cc/min. Allow sufficient time for the gas to completely purge ambient air from the sensor before finalising any calibration operation.

The calibration commands can be used repeatedly until there is no further change in the observed gas value.

Contact Dynament for further support.

Vibration

The Platinum sensor has been tested for vibration effects giving satisfactory results. The certificate number is ET2597, issued by Ferranti Technologies.

FERRANTI TECHNOLOGIES

UKAS TESTING 0499

CERTIFICATE OF TEST

CERTIFICATE NUMBER ET2574

Approved by: ____________ P.M. Taylor (Technical Manager (UKAS))

Date of issue: 02 April 2012 Issue N° 1 Page 1 of 4

UKAS Testing Accreditation Number 0499

Issued by: Environmental Test Laboratory, Ferranti Technologies Ltd, Waterhead, Oldham, OL4 3JA
Telephone 0161 624 0281, Fax 0161 624 5244

Tests marked 'Not UKAS Accredited' in this Certificate are not included in the UKAS accreditation schedule for our laboratory. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Customer Name:	Dynament Ltd
Customer Address:	Premier House The Village South Normanton Derbyshire DE55 2DS
Order Number:	40802
Test Item Received:	13th March 2012
Test Date:	13th and 20th March 2012

Test Item Description:

Gas Detection Sensor, 24 off, part number CO2/NC/B/N, serial numbers:

B1301N19, B1301N54 – B1301N65, B1301N67, B1301N68, B1301N70 – B1301N78

Test Performed:

A total of 24 Gas Detection Sensors, mounted onto a test bed provided by the customer and clamped onto FTLs' vibration system were initially subjected to swept sinusoidal vibration in accordance with BS60079-29-1:2007 Paragraph 5.4.13 (Procedure 1) and generally in accordance with BSEN60068-2-6:2008. Test conditions were then varied at the customers request as detailed below.
The test items were monitored during vibration by the customer representative. All tests were performed at ambient temperature.

4100-0038-06

Registered Office: Cairo House, Waterhead, Oldham OL4 3JA, England.
Registered in England Number 2968071

EMC

The Platinum sensor has been tested for EMC effects giving satisfactory results. The certificate numbers are 11377TR1.pdf and 11378TR1.pdf, issued by York EMC Services Ltd.

Note: The user must provide a suitable enclosure and carry out an EMC test on the complete instrument to comply with the EMC directive.

York EMC Services

Test Report (pdf copy)

EMC Testing of

Platinum Infrared Gas Sensor with screen not connected to 0V

For Dynament Ltd

Document number 11378/TR/1

Project number C1453

Author: ....
Mr D Horry
EMC Technician

Checked: ....
M Render
Senior Engineer

Approved: ....
M Render
Senior Engineer

Issue	Description	Issue by	Date
1	**Issue one**	**DH**	**8th April 2014**

UKAS TESTING 1574
Instrumentation, Consultancy and Research, Training
A BIS designated Notified Body No 1892
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E: enquiry@yorkemc.co.uk
www.yorkemc.co.uk
Registered in England and Wales
Company Reg No. 6148589
VAT Reg No. GB 947 2055 41

Test Report (pdf copy)

EMC Testing of

Platinum Infrared Gas Sensor with screen connected to 0V

For Dynament Ltd

Document number 11377/TR/1

Project number C1453

Author: ....

Mr D Horry

EMC Technician

Checked: ....

M Render

Senior Engineer

Approved: ....

M Render

Senior Engineer

Issue	Description	Issue by	Date
1	**Issue one**	DH	**8th April 2014**

UKAS TESTING 1574

Instrumentation, Consultancy and Research, Training

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VAT Reg No. GB 647 2055 41

Pressure Dependency

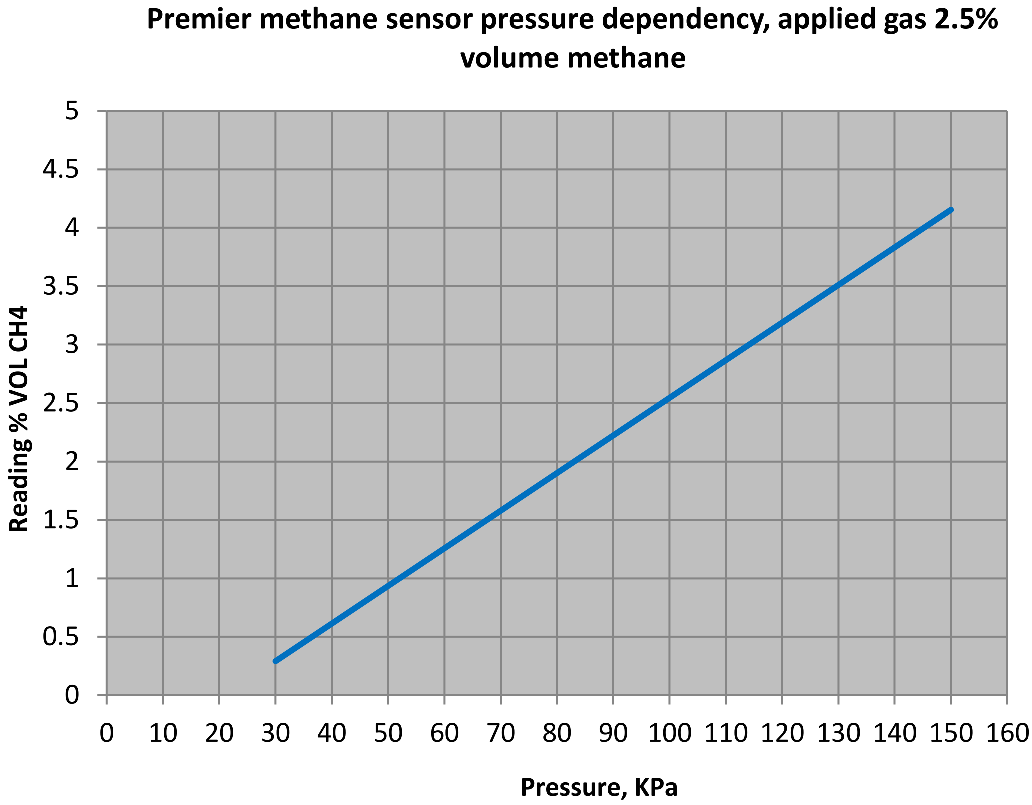
NDIR sensors exhibit a dependency on the pressure conditions under which they operate. The principle of operation is based upon the absorption of infrared energy by molecules of the target gas within the sensor light path. As the gas pressure in increased, the number of molecules within the sensor is increased. This leads to increased absorption, and so the calculated gas reading is increased. The opposite effect is true when the gas pressure is reduced.

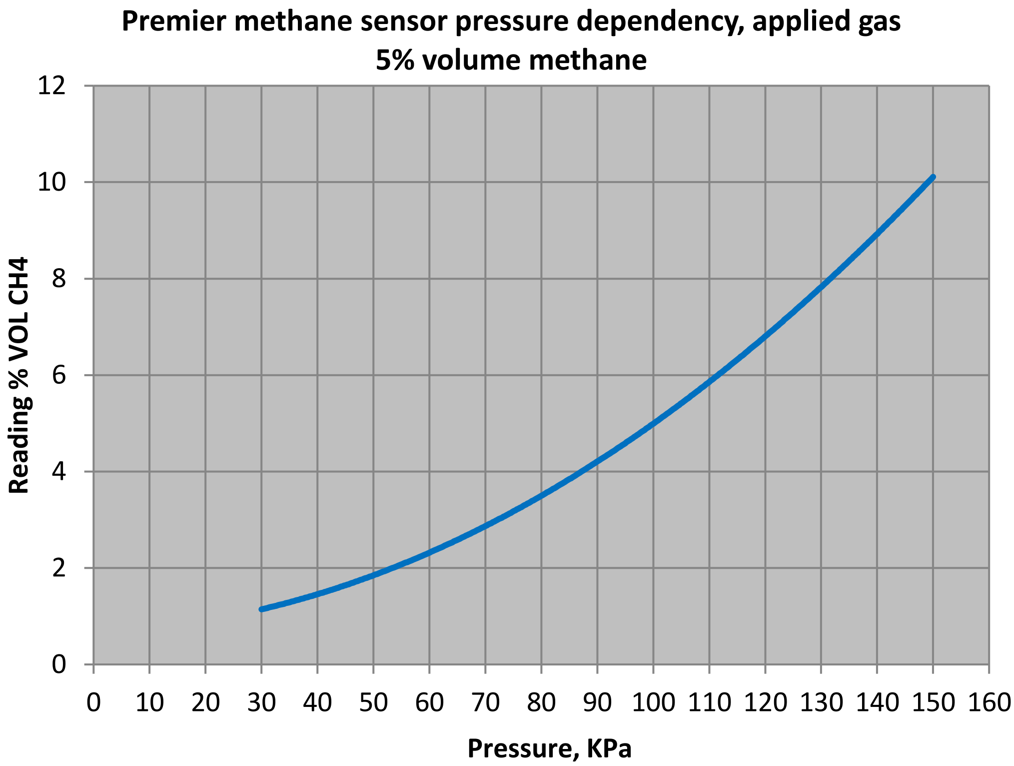
Premier sensors are pre-calibrated at normal atmospheric pressure, and the accuracy of the reading will be adequate in most instances without the need for pressure compensation.

In cases where the sensors are operated at pressures significantly different from their original calibration pressure, for example high altitudes, the sensors should be re-calibrated to restore accuracy. Alternatively, a compensation factor can be applied to the reading based on the pressure within the sensor. For example, when the sensor is used in process-monitoring applications at either elevated or reduced pressures, a pressure transducer can be incorporated into the gas flow and its output value can be used to determine the degree of compensation to be applied.

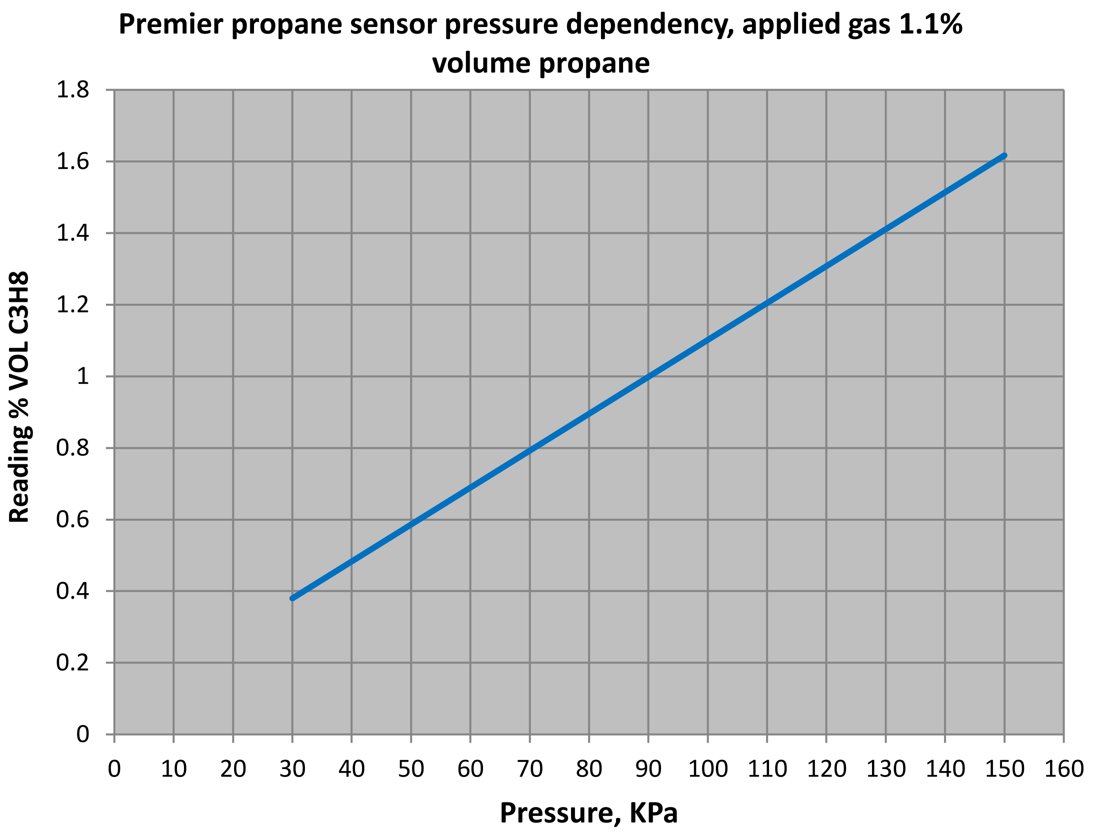
The following graphs provide a guide to pressure compensation. It is important to note that the pressure/reading relationships defined by the accompanying graphs are only valid for the specific gas concentrations shown.

The following pages show examples where the sensors have been calibrated at 100 kPa.

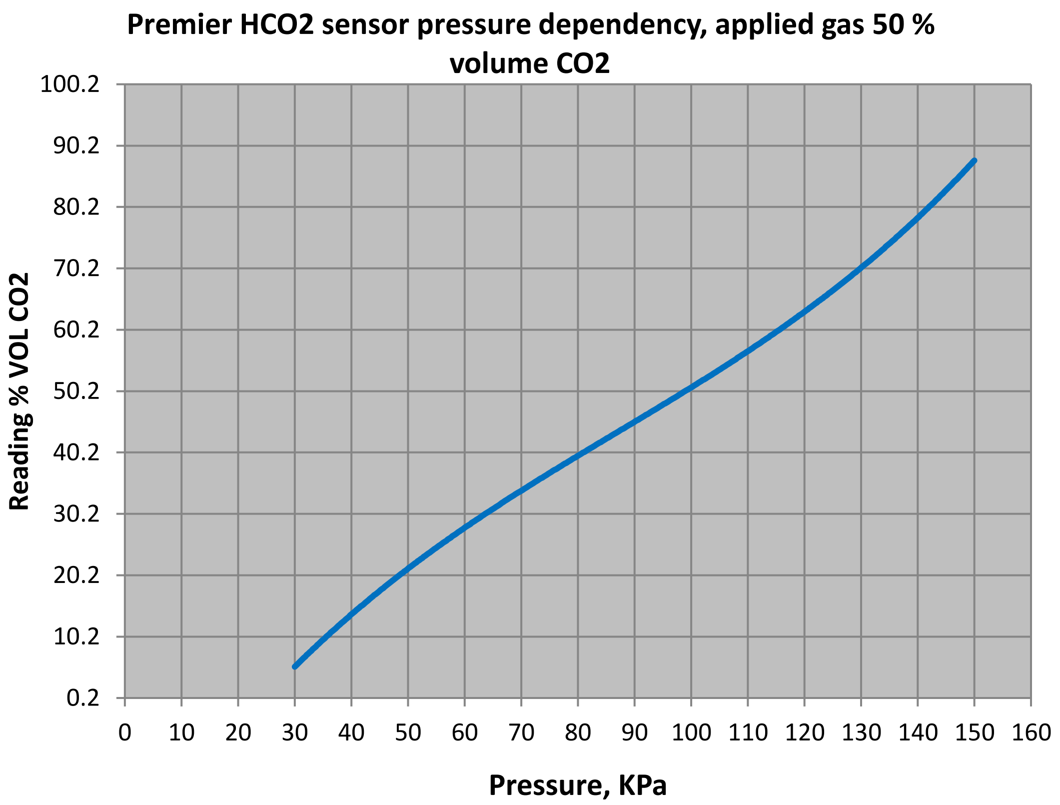

Premier methane sensor pressure dependency, applied gas 2.5% volume methane
Reading % VOL CH4
Pressure, KPa
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

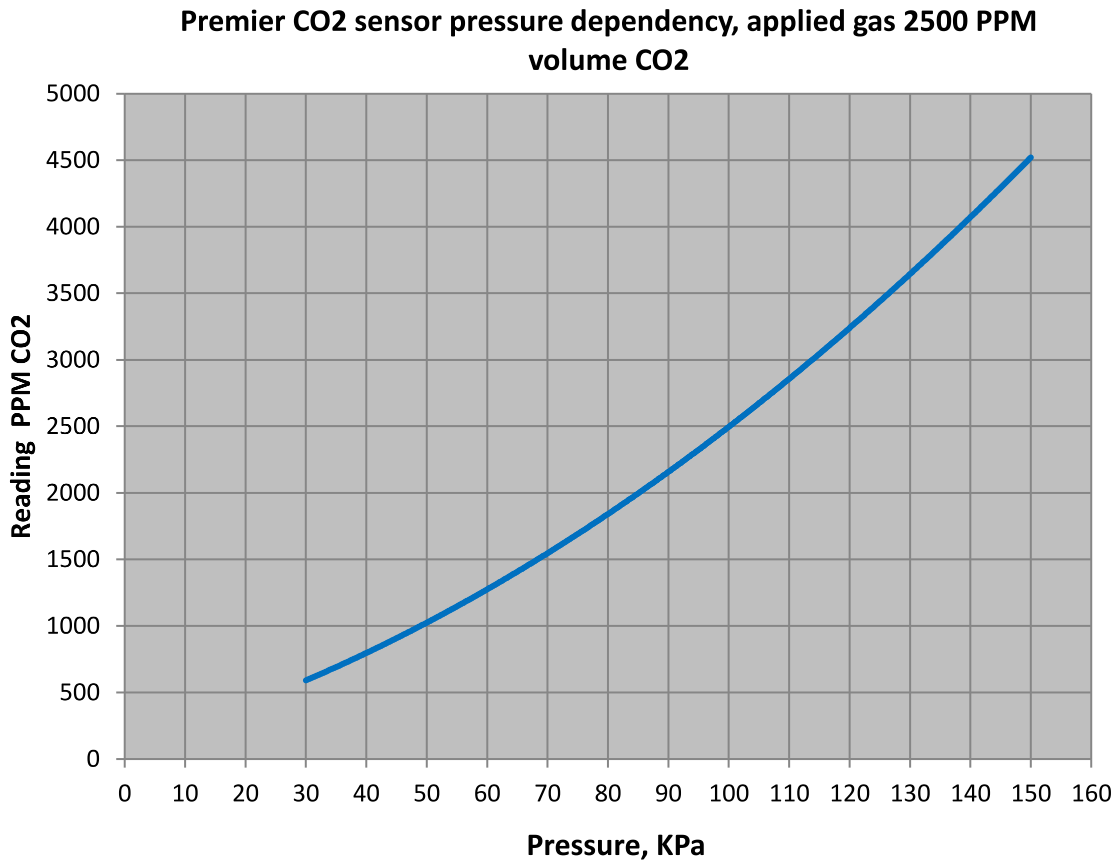

Premier methane sensor pressure dependency, applied gas 5% volume methane
Reading % VOL CH4
Pressure, KPa
0
2
4
6
8
10
12
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

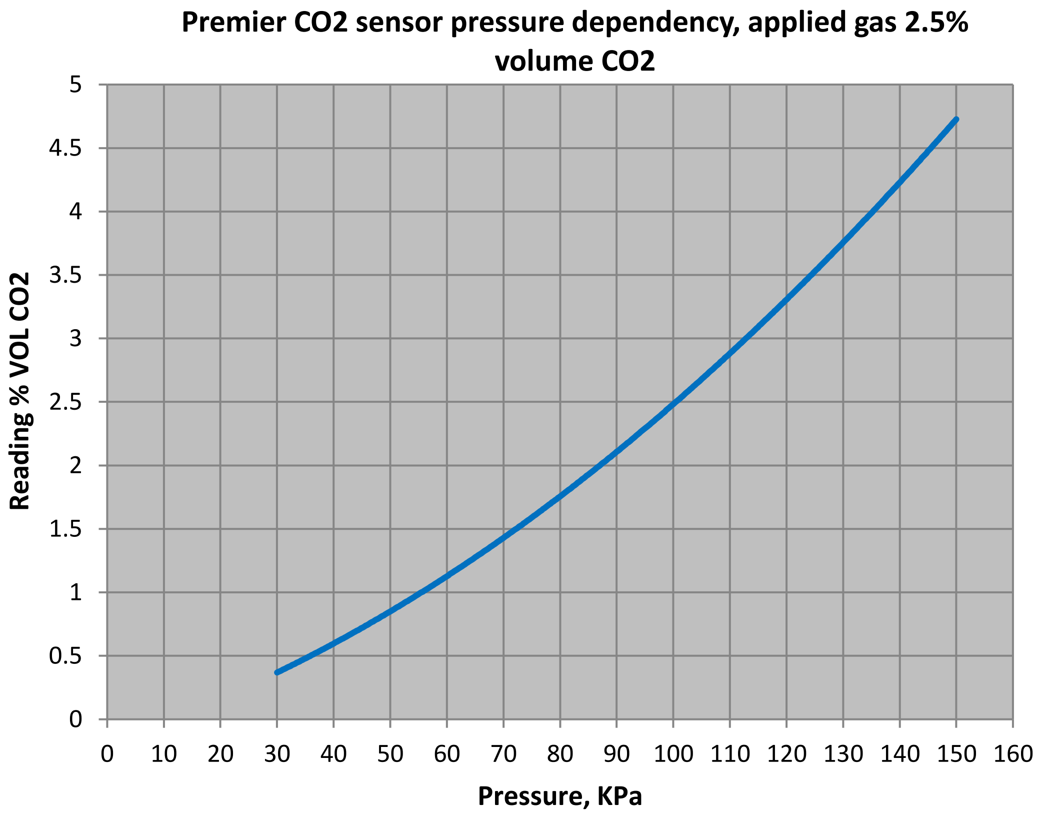
Propane Pressure Dependency



High Range Carbon Dioxide Pressure Dependency




Premier CO2 sensor pressure dependency, applied gas 2500 PPM volume CO2
Reading PPM CO2
Pressure, KPa
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160


Premier CO2 sensor pressure dependency, applied gas 2.5% volume CO2
Reading % VOL CO2
Pressure, KPa
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

Contamination Mitigation, Corrosive Gas & Maintenance

Steps must be taken to mitigate contaminants entering the optical path to maintain accuracy and extend sensor lifetime.

Contamination Mitigation

The sensor optics will become obscured if dust or liquid droplets enter the sensor, resulting in incorrect readings being given and potentially causing the sensor to become responsive to humidity.

The sensor can be supplied with a PTFE filter to reduce the effects of dust or liquid droplets entering the sensor.

When a sensor is used with a PTFE filter in dusty or wet environments, it is recommended that the sensor is checked at regular intervals to verify that the PTFE filter has not become clogged. The frequency of checks will depend upon the actual conditions and must be assessed by the user.

Corrosive Gas

The sensor must be protected from corrosive gas to prevent damage to the sensor optics which could affect the performance.

Mitigation for corrosive gas will vary depending on the nature of the gas. It is the user's responsibility to assess the gas present in the application and implement appropriate mitigation.

Maintenance

Dynament NDIR sensors, like any other sensors, require regular maintenance in terms of inspection to prevent a build up of dust or dirt or any other form of contamination which might prevent gas from entering the sensor or affect the optical arrangement.

Maintenance should include cleaning of the housing within which the sensor is mounted; a good design will afford some level of protection for the bare sensor.

Handling precautions

- Do not solder directly to the sensor pins.
- Do not apply any mechanical pressure.
- Do not expose to corrosive gases.
- Observe antistatic handling precautions.

Safety Integrity Level

The Platinum sensor has been designed to achieve SIL1.
Certificate No. Sira 04ATEX1357U (Ex'd sensor)
Certificate No. Sira FSP 14002/00 (Non-Ex'd sensor)

Safety Function:

To measure the concentration of gas by means of analogue and /or digital outputs so that:

Analogue output (SF): Output voltage < 0.2V or >2.5V reserved for revealed failures
Digital output (SF): < -200% and/or > 200% of gas concentration reserved for revealed failures
Output voltage ≥0.4V and ≤2.4V are for normal operating conditions
Digital output (SF): >-200% and < 200% of gas concentration for normal operating conditions

Notes:

For bridge type sensors configuration powered by 5V to 3V, the output Voltage Vo is configurable as defined in this equation:

Output Voltage (Vo) = (Zero * Supply Voltage) + (Sensitivity * (Gas Level / FSD))

Where, zero is = 0.5 (0.4 to 0.6), Supply Voltage (5V to 3V), Sensitivity (±0.1V to ±0.2V), Gas Level (any value between -200% to +200%), FSD (5% v/v)

(Sensitivity : 100mV)

a) 5V supply: Output voltage < 2.3V or >2.7 reserved for revealed failures and
Output voltage ≥2.3V and ≤2.3 are for normal operating conditions

b) 3V supply: Output voltage < 1.3V or >1.7 reserved for revealed failures
Output voltage ≥1.3V and ≤2.7 are for normal operating conditions

(Sensitivity : 200mV)

a) 5V supply: Output voltage < 2.1V or >2.9 reserved for revealed failures and
Output voltage ≥2.1V and ≤2.9 are for normal operating conditions

b) 3V supply: Output voltage < 1.1V or >1.9 reserved for revealed failures
Output voltage ≥1.1V and ≤1.9 are for normal operating conditions

Digital outputs (SF) conditions unchanged, their outputs as described above.

Summary of Clauses 2/7.4.2 and 2/7.4.4		**Single Channel**	**Dual Channel**	**Verdict**
Architectural constraints		**HFT=0**	**HFT=0**	**Type B**
Safe Failure Fraction (SFF)		**66%**	**67%**	**SIL 1**
Random hardware failures:[h^{-1}] (dangerous)	λ_{DD} λ_{DU}	1.70E-07 9.20E-08	1.56E-07 8.81E-08	
Random hardware failures:[h^{-1}] (safe)	λ_{SD} λ_{SU}	3.61E-09 7.59E-09	2.05E-09 2.19E-08	
Diagnostic Coverage (DC)		64%	64%	
Probability of failure on demand @ proof test interval = 8760 Hrs Mean time to restoration = 8 Hrs		4.05E-04	3.88E-04	SIL 3
Frequency of a Dangerous failure (High Demand – PFH) [h^{-1}]		9.20E-08	8.81E-08	
Hardware safety integrity compliance		Route 1_H		
Systematic safety integrity compliance (HW)		Route 1_S		
Systematic safety integrity compliance (SW)		EN50271		
Systematic Capability (SC1, SC2, SC3, SC4)		SC1		
Overall SIL-capability achieved		SIL 1 due to Architectural constraints (SFF).		

A yearly proof test must be carried out by the end user to validate the safety function.
If the sensor is out of specification, then contact Dynament.

! **SIL1 certified sensors are not suitable for use with 4800 baud rate.** !

Decommissioning

The sensors should be disposed of in accordance with local disposal requirements.

Warranty

All Dynament Platinum sensors carry a ***five***-year warranty against defects in materials and workmanship. The warranty is invalidated if the sensors are used under conditions other than those specified in the relevant data sheet.

Particular attention should be paid to the following criteria:

- **Observe the correct supply polarity**
- **Do not exceed the maximum rated supply voltage of 5V**
- **Do not solder directly to the sensor pins**
- **Do not expose the sensor to corrosive gases such as hydrogen sulphide**
- **Do not allow condensation to take place within the sensor**
- **Do not apply any mechanical pressure**