

*Conford Electronics*

# PRO<sub>2</sub> Sensor (IHT)

## Installation and Users Manual

V 1.1c

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## Warnings and Cautions



**ONLY QUALIFIED PERSONNEL WHO THOROUGHLY UNDERSTAND THE OPERATION OF THIS EQUIPMENT AND ANY ASSOCIATED MACHINERY SHOULD INSTALL, START-UP OR ATTEMPT MAINTENANCE OF THIS EQUIPMENT. NON-COMPLIANCE WITH THIS WARNING MAY RESULT IN PERSONAL INJURY AND/OR EQUIPMENT DAMAGE**

**NEVER WORK ON ANY CONTROL EQUIPMENT WITHOUT FIRST ISOLATING ALL POWER SUPPLIES FROM THE EQUIPMENT.**



### **WARNING**

#### **CAUTION**

This equipment was tested before it left our factory. However, before installation and start-up, inspect all equipment for transit damage, loose parts, packing materials etc. Due consideration must be given to environmental conditions of installation for safe and reliable operation.



#### **STATIC ELECTRICITY**

This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product



EMC & Safety tested to relevant BS EN Standards



#### **CAUTION**

The user must be aware that, if this equipment is used in a manner not specified by Conford Electronics, the protection provided by the equipment may be impaired



#### **INSTALLATION**

This equipment is designed for indoor use only Installation category II Pollution Degree 2 in accordance with IEC 664



#### **CAUTION**

Oxygen sensor body may be hot, even when boiler is off



#### **CAUTION**

Do not bypass IHT unit by connecting cable directly to the oxygen sensor. This will result in damage to the equipment. The IHT unit should on no account be removed from the PRO<sub>2</sub>Sensor; these are a calibrated, matched pair.

# ***PRO<sub>2</sub>Sensor (IHT)***

## ***General***

Measuring depleted Oxygen levels in the flue gas has long been recognised as one of the best measures of combustion conditions and is an essential pre-requisite to reducing fuel costs and improving environmental performance of new and existing industrial boiler plant. The **Conford Electronics PRO<sub>2</sub>Sensor (IHT)** combines field proven PRO<sub>2</sub>Sensor technology with an intelligent In-head transmitter (IHT) to provide a low cost and easily installed oxygen monitoring system. The design eliminates the need for an external signal-conditioning unit (normally housed in a separate panel). This enables a direct connection to the sensor thus providing optimum EMC immunity, high signal integrity, and low cost installation and servicing.

The IHT unit is coupled directly to a high stability zirconium oxygen sensor cell and converts the output to an industry standard process signal (4-20mA).

## ***Energy efficiency and the environment***

The optimum air to fuel ratio is critical to efficient energy conversion and to minimising noxious emissions from boiler plant. Burning less fuel also means producing less CO<sub>2</sub>. Hysteresis, linkage wear, cable and control failures are some of the typical causes of significant fuel wastage, and hence poor environmental performance.

## ***Safety***

Maintaining the correct air to fuel ratio reduces the risk of flame impingement and resultant failure of boiler tubes. Combustion efficiency tests carried out when the boiler is routinely serviced do not protect against interim faults developing, or catastrophic component failure with the risk of a serious explosive incident.

## ***Plant performance, outages and damage***

Poor combustion accelerates the formation of carbon deposits on the heat transfer surfaces, reducing boiler efficiency. These deposits can also cause thermal stress, which may result in costly boiler repairs and unscheduled outages. Continuous monitoring of oxygen levels can therefore greatly reduce maintenance costs.

## ***Installation***



All electrical work to be carried out by qualified personnel in accordance with Local wiring regulations

### ***General***

The **Conford Electronics PRO<sub>2</sub> Sensor (IHT)** installation kit includes a DIN rail mountable pre-set dc power supply (required for its internal heater), probe assembly, flue flange, gasket and cable assemblies pre conduited for ease of installation.

The flue flange is welded to the boiler flue as detailed below. A flue gas sampling probe is screwed into the flange ensuring correct orientation, and locked in place with a locknut. This part of the installation is permanent. The O<sub>2</sub> sensor assembly bolts on to the probe body, remote from the flue, (this considerably eases maintenance).

The In-head transmitter (IHT) is directly mounted to, and should not be separated from, the sensor. The 4-20mA signal output is scaled to 0.1% - 20.9% O<sub>2</sub>.

The power supply is DIN rail mountable, generally positioned in the burner panel. (wired as per drawing.)

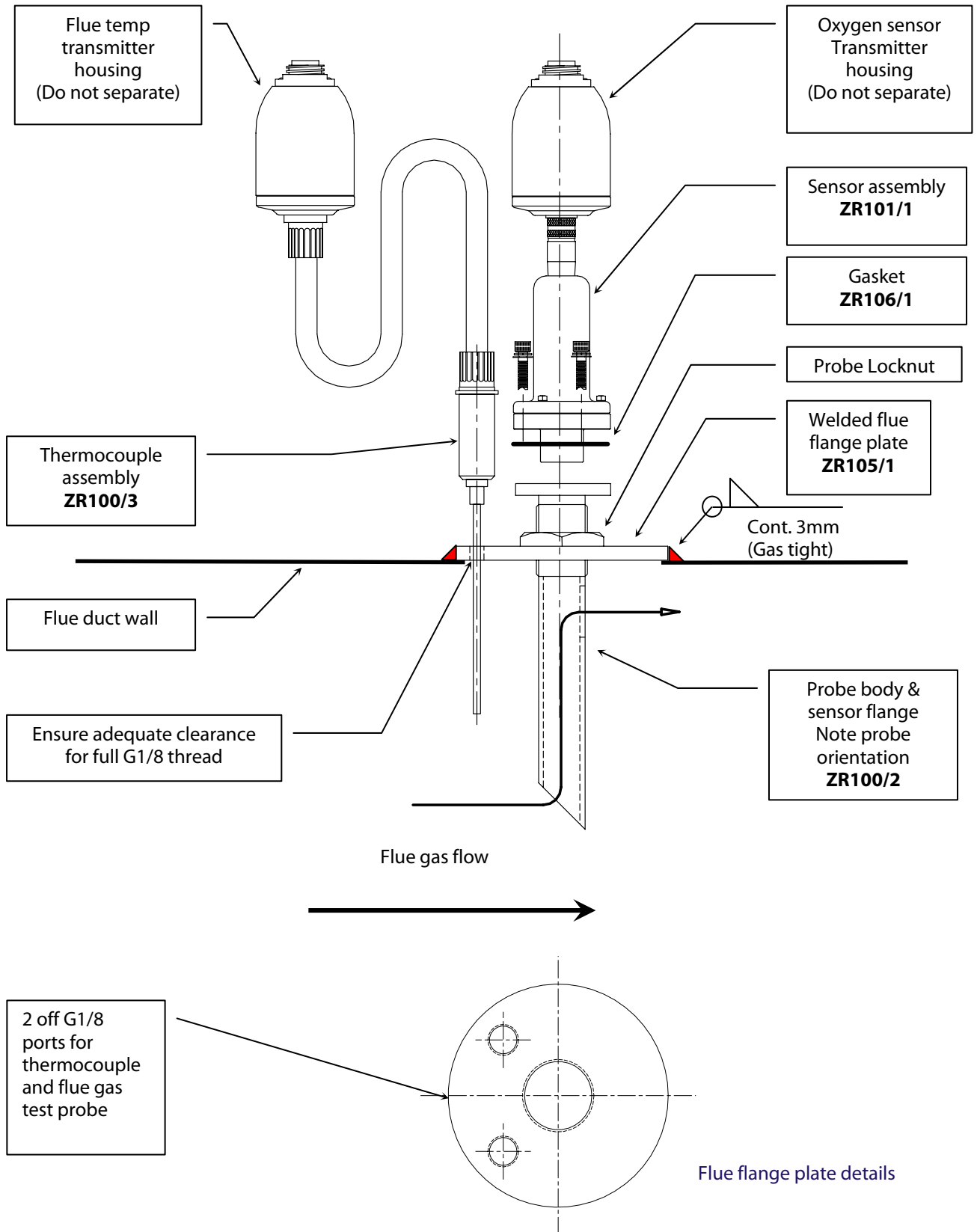
### ***Fitting the flange and probe body in the duct***

The oxygen sensors will be normally located in the flue duct immediately after the point where the flue gasses exit the boiler. The flue flange should be welded on to the top surface of the duct, taking care not to overheat and deform the flange. The probe body should be mounted as detailed below. The duct should be insulated to avoid radiant heat damaging the cabling if flue gas temperatures in excess of 250°C are anticipated.

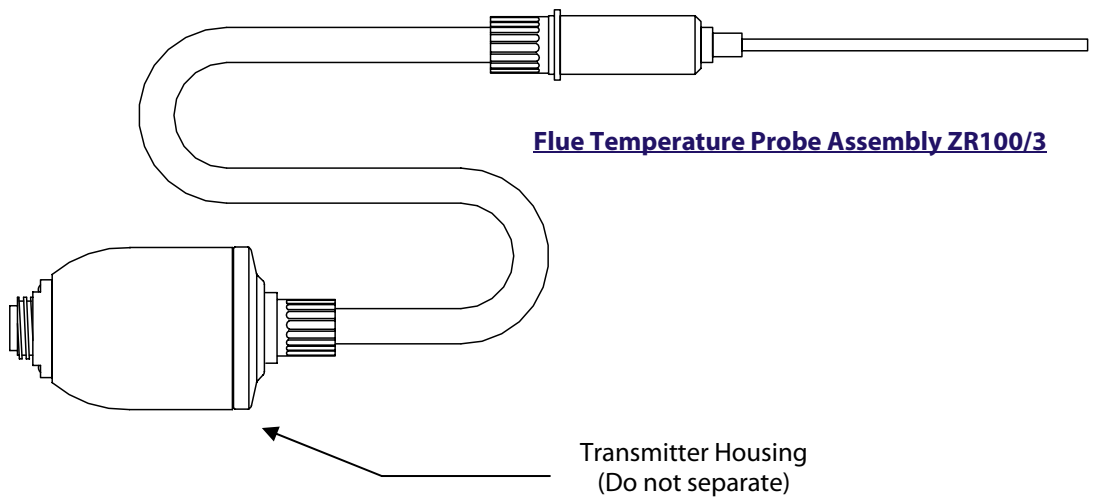
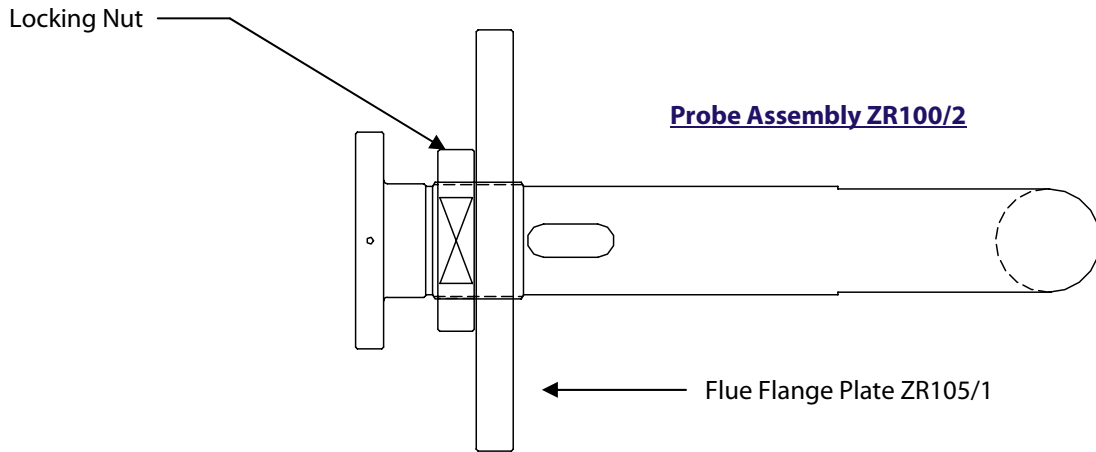
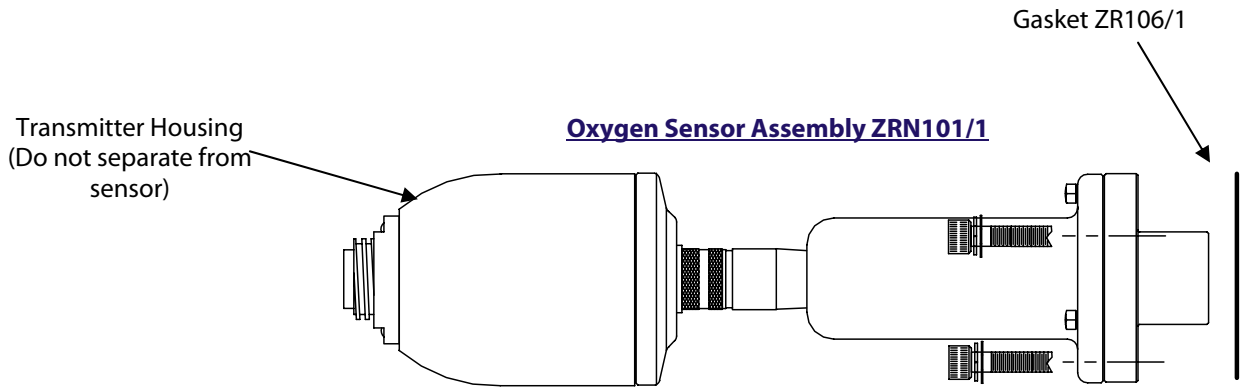
When welding the flue flange to the duct wall, the threads should be protected with temporary blanking plugs available from Conford Electronics.

The probe body is to be screwed in and locked with the locknut provided, ensuring the correct orientation as shown overleaf. The oxygen sensor assembly is then mounted on the sensor-mounting flange with gasket, 3 off M6x25 setscrews and lockwashers provided.

***Mechanical installation***



**Mechanical assembly**



### **Electrical installation**

Pre conduited 10m cable sets fitted with IP66 plug and socket terminations are supplied with the **Conford Electronics PRO<sub>2</sub> Sensor (IHT)** and should be installed as per the wiring installation diagram.

### **Mains connection**

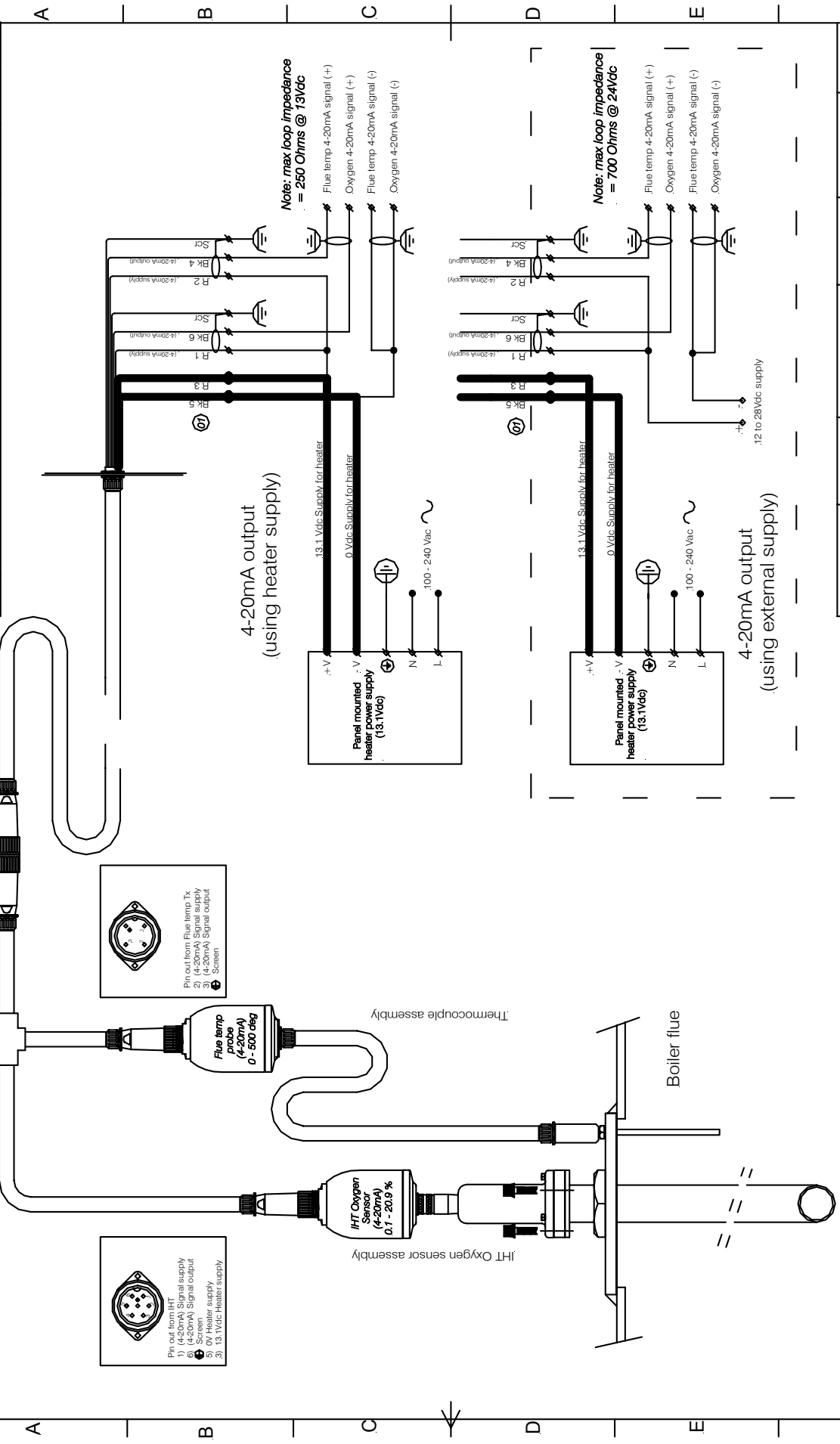
The power supply should be installed with a double pole, thermal magnetic circuit breaker. It should meet the relevant requirements of IEC 947-1 and IEC 947-3. The circuit breaker should be marked to indicate it as the disconnecting device for the PRO<sub>2</sub>Sensor, and should be located as close as possible to the supply (typically this would be in the boiler control panel). The protective earth of the power supply must be connected to the main protective earth.

**Note.** No signalling wiring should be allowed to run parallel with any mains cabling, unless separated by at least 300mm. Where signalling and mains have to cross, this should be done at right angles.

See wiring diagram (over) for details.



|       |   |        |           |         |
|-------|---|--------|-----------|---------|
| RevNo | Revision note   | Date   | Signature | Checked |
| 01    | BK5 was 28, R3 was 29, BK6 was 33, R1 was 35, R2 was 36, BK4 was 34 | 6/2/01 | SP        |         |



|  |            |                    |                     |          |       |
|--|------------|--------------------|---------------------|----------|-------|
| Designed by  | Checked by | Approved by - date | Filename            | Date     | Scale |
| JG   | PM         | 10/1/00            | IHT Electrical Inst | 18/12/99 | NTS   |
| <b>Conford Electronics</b><br><b>Conford, Liphook</b><br><b>Hampshire GU30 7QW</b>         |            |                    |                     |          |       |
| <b>Electrical installation PRO2Sensor (IHT) &amp; Flue temp</b><br><b>Installation dwg</b> |            |                    |                     | Sheet    | 1/1   |
|  |            |                    |                     | Edition  | 1     |
|  |            |                    |                     | 8        |       |

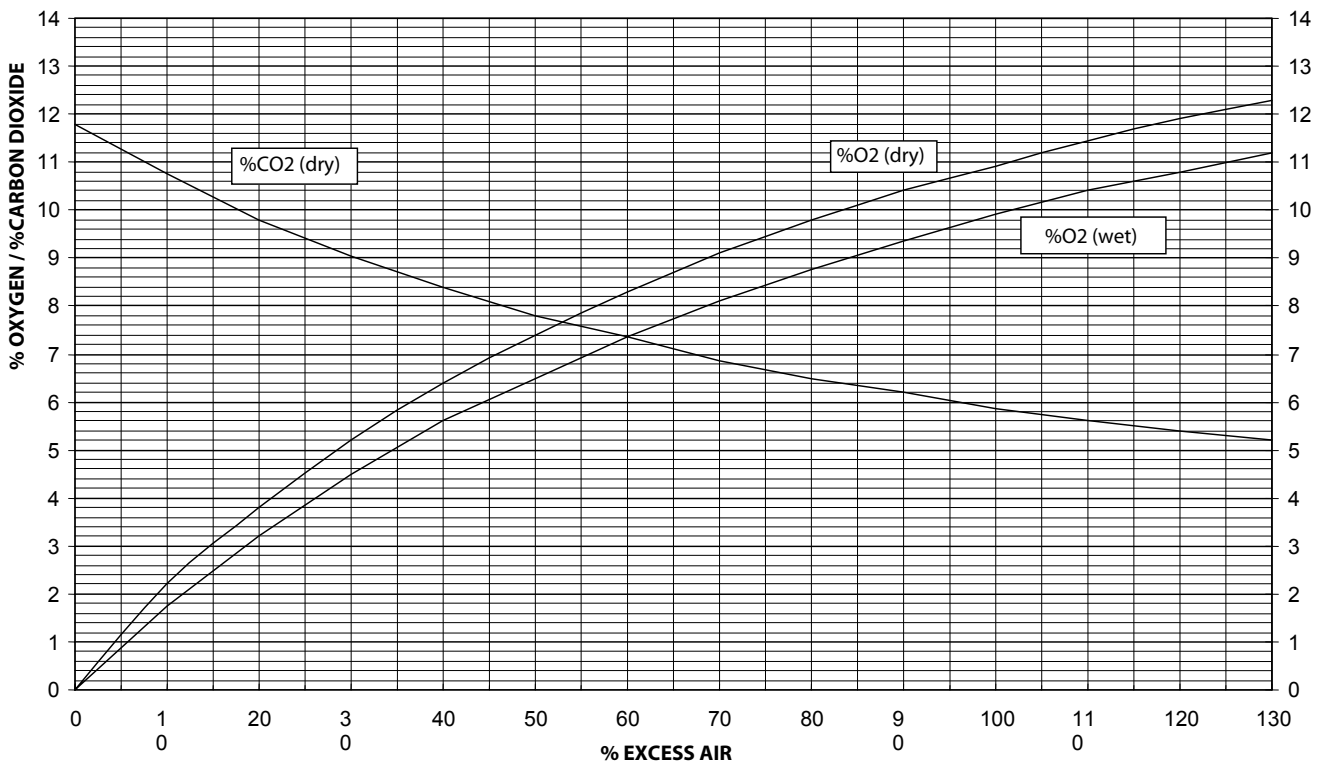
### Calibration check

In common with all process monitoring and control equipment, the calibration of the PRO<sub>2</sub>Sensor should be checked after installation with a calibrated combustion analyser. Using the test port provided in the flue flange, O<sub>2</sub> levels should be checked against the values displayed at both low and high burner firing rates once the boiler and sensor have got to normal operating temperature.

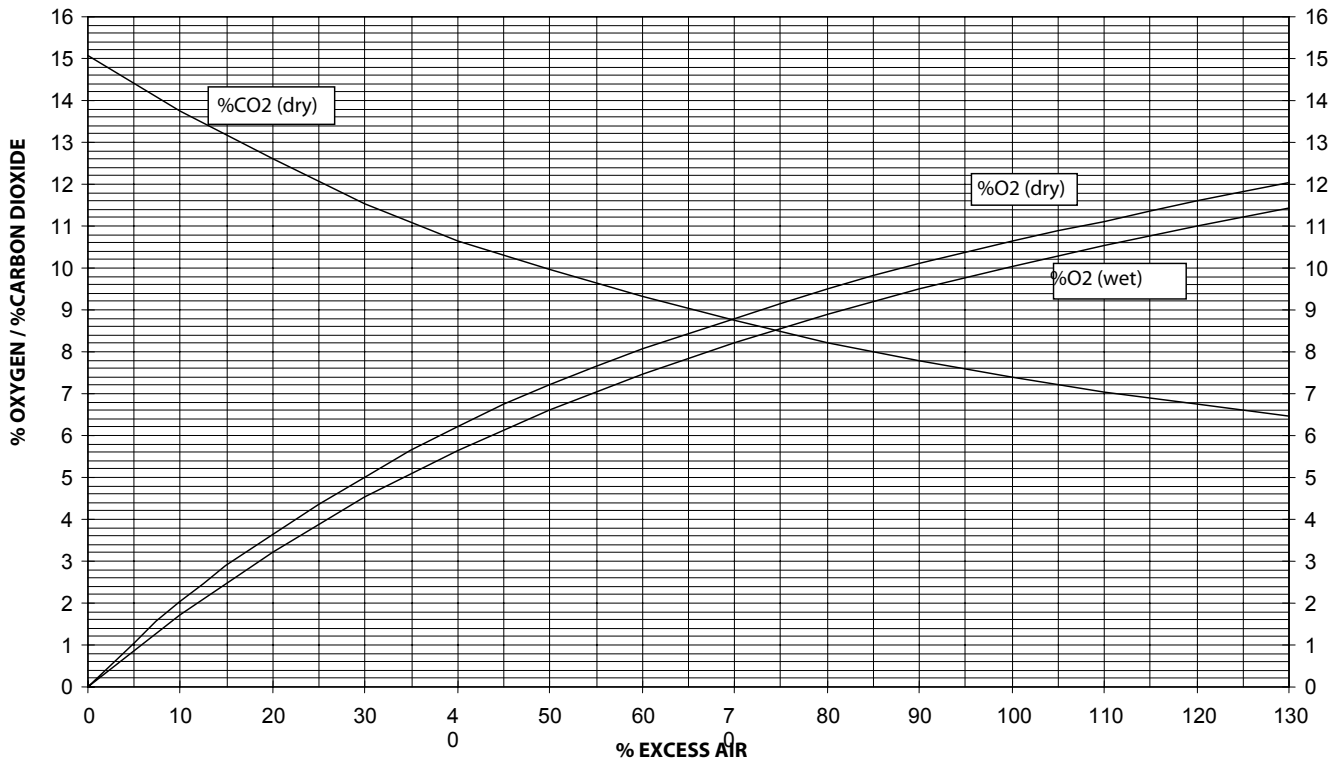
**Note:** The PRO<sub>2</sub>Sensor sensor reads the “wet” oxygen level and that most portable flue gas analysers read the “dry” oxygen level. This will result in slightly differing measured values, the “wet” measurement being typically ½ to 1% less than the “dry” reading portable instrument, - dependent upon fuel type.

Refer to the appropriate graph below

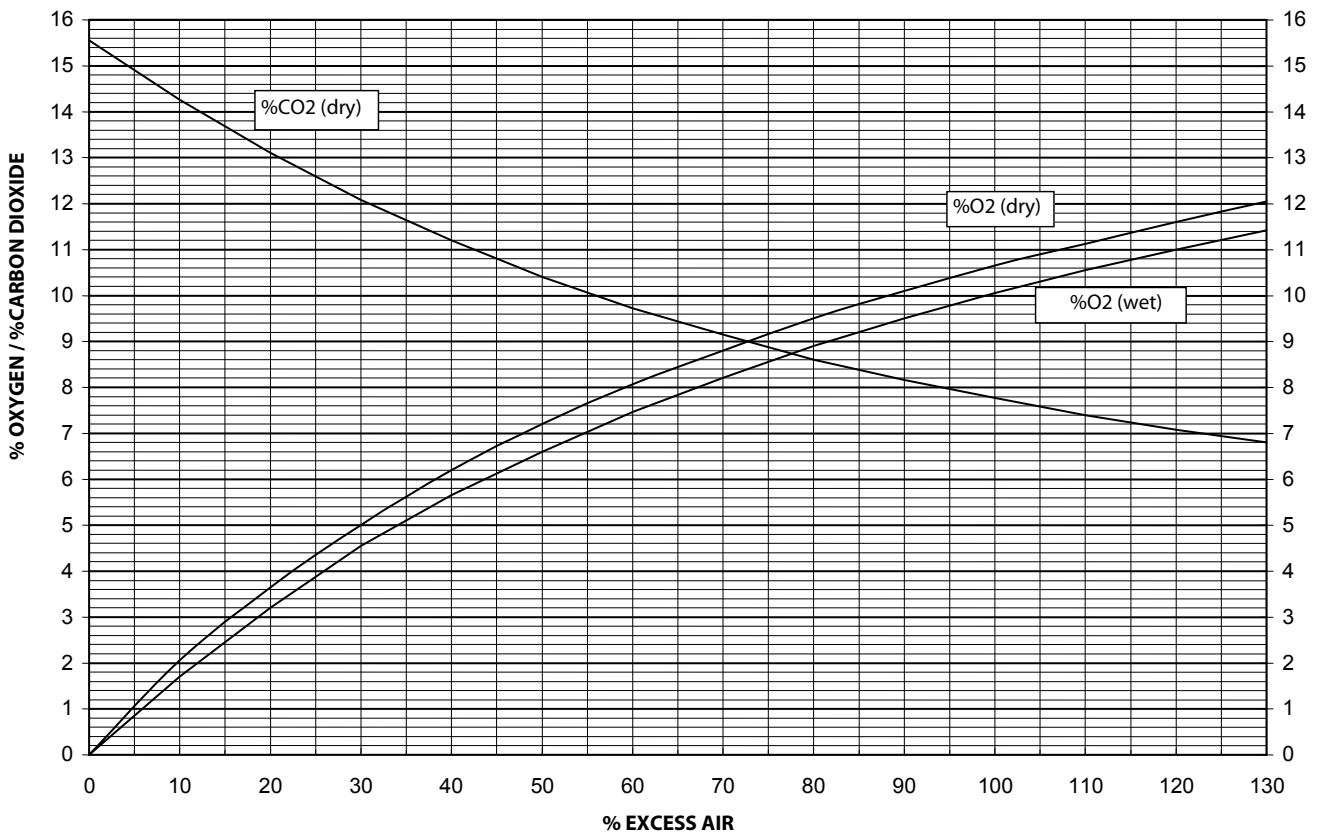
### **NORTH SEA GAS**



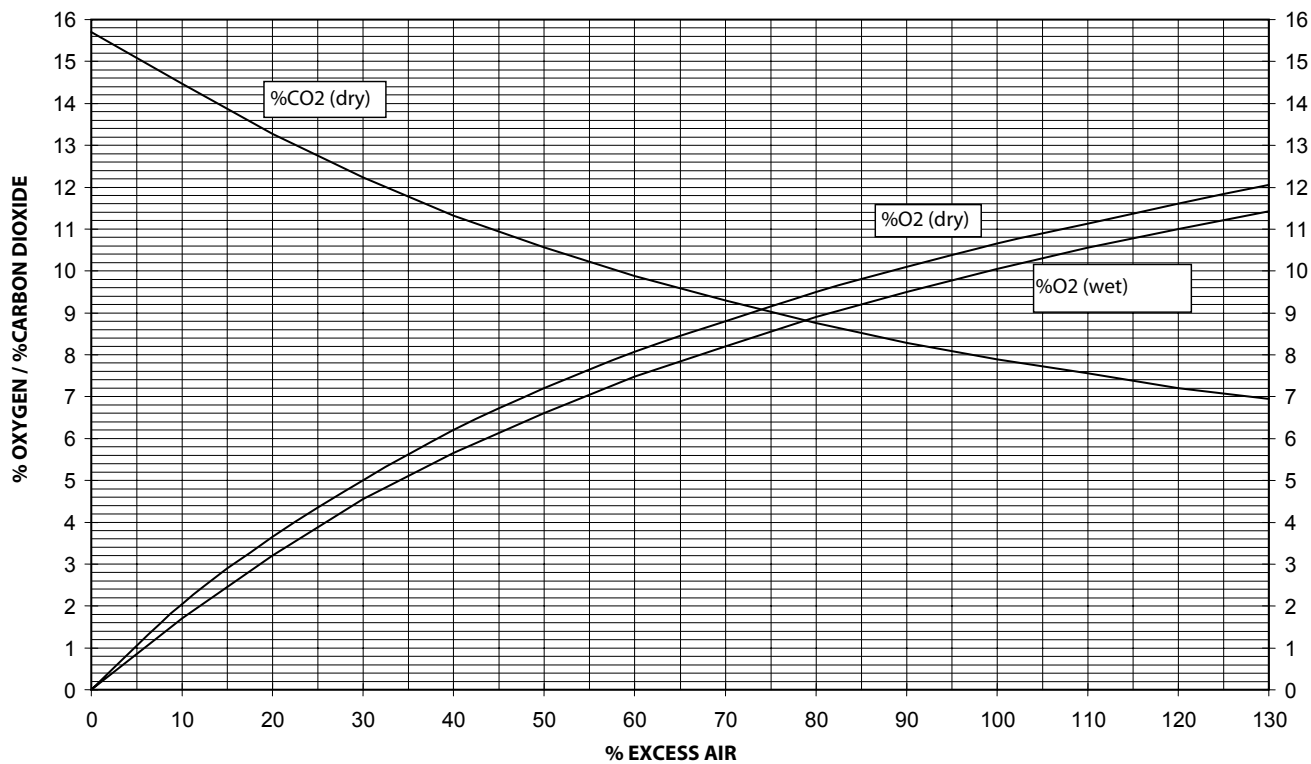
## GAS OIL



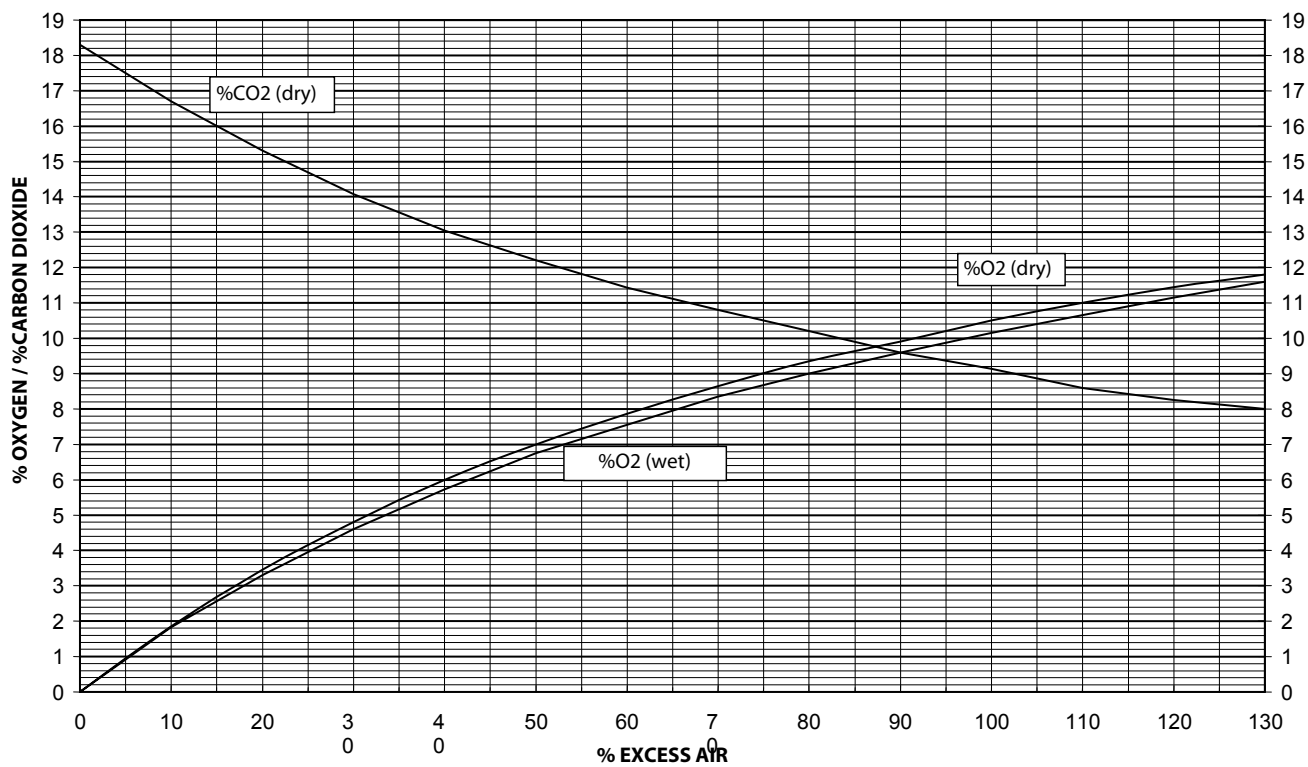
## MEDIUM & LIGHT OIL



## HEAVY OIL

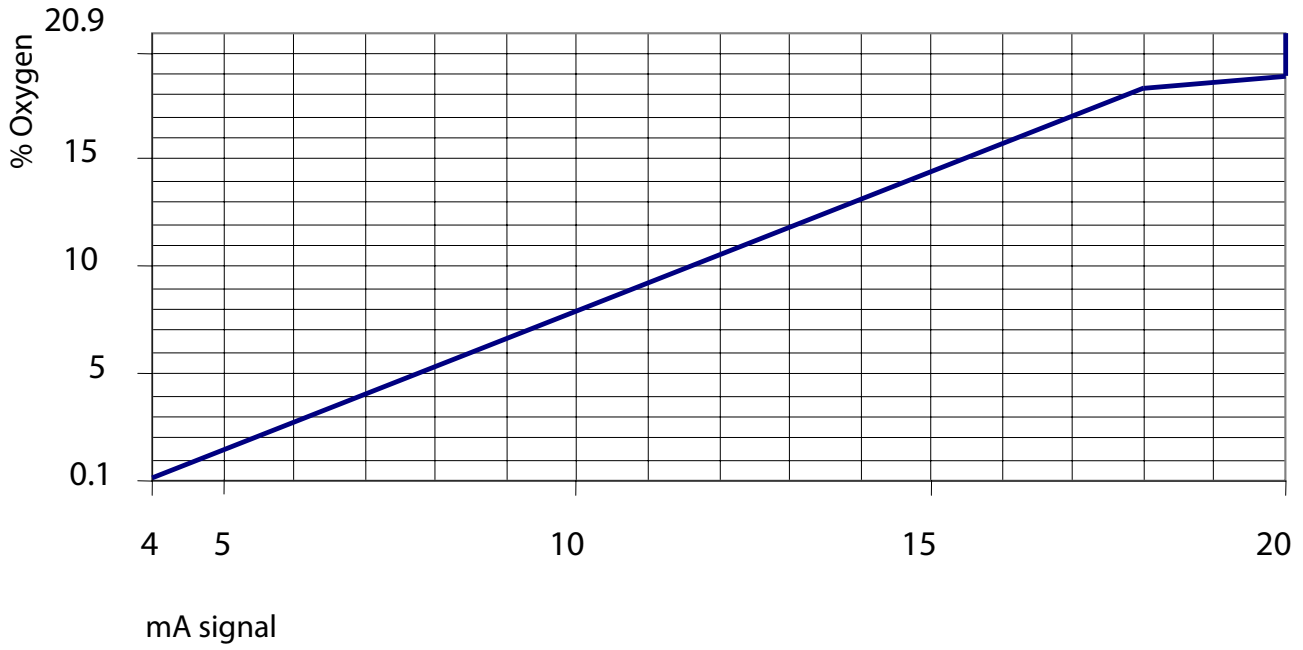


## COAL

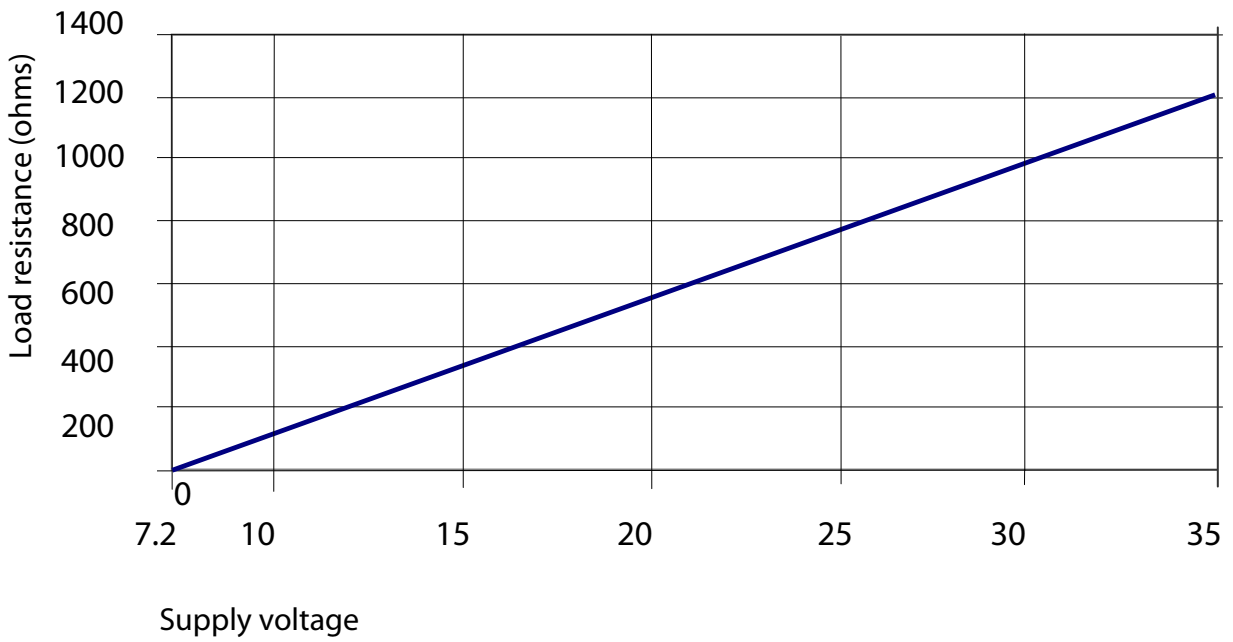


Sensor characteristic charts

*IHT mA Output*



*IHT 4-20 mA characteristics*



## Maintenance



As with any safety equipment, it is essential for the satisfactory, long-term operation of the system that a comprehensive maintenance agreement is in place.

The **Conford Electronics PRO<sub>2</sub> Sensor (IHT)** has been developed specifically for ease of maintenance. Many of the components are recyclable, and the service exchange units, pre-calibrated, set a new benchmark for ease of servicing and low cost of ownership.

Zirconium oxygen sensors have a finite life, it is recommended that they are checked for accuracy and response time every 3 months. The life span is dependent on fuel type used and contaminants present in the flue gas. (Nominally this can be considered to be 12 to 24 months in natural gas) Replacement is necessary when ambient oxygen levels are reading 19% or less, or the response time for the sensor becomes excessive. A low cost service exchange facility is available from Conford Electronics.

The sensor is resistant to residue-free gaseous hydrocarbons and light fuel oil in line with DIN 51 603 when used as fuel. During its total lifetime the sensor is resistant to aggressive exhaust gases like CO, CO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub> and low temperature carbonisation gas. A reduced lifetime can occur if the sensor is subjected to lead, phosphor, oxides of silicone, halogens, halogen acids or high concentrations of sulphur.

A stainless steel sintered disk provides additional sensor protection from particulate, sulphur and other contaminants substantially improving the effective life of the zirconia sensor.

## **Technical specification**

### ***PRO<sub>2</sub>Sensor (IHT)***

- O<sub>2</sub> Sensor type Zirconium  
(Protected with a sintered stainless steel filter)
- Range 0.1% - 20.9%
- Accuracy +/- 5% of reading
- IP Rated IP20 (sensor) IP65 (transmitter)
- Housing Stainless Steel / Aluminium
- Weight 1.2kg
- Connection Amphenol C16-1 Plug
- Dimensions 320 x 62mm (max)
- Heater supply nom. 1.4A @13.1V DC
- Output 4-20 mA (0.1% - 20.9% O<sub>2</sub>)  
Galvanically isolated  
Polarity protected
- Supply 7-35V DC (Load resistance  $\leq (V_{\text{supply}} - 7.2) / 0.023 (\Omega)$ )
- Isolation 1500V AC for 60 Sec's
- Air humidity 0-90% RH (non condensing)
- Flue gas temperature 500°C sustained; 600°C max (200 hour cumulative)
- Ambient temperature -40°C to 85°C
- EMC Emissions EN50081-1  
Immunity EN50082-2
- Safety EN61010-1

### ***Flue gas temperature***

- Flue gas temperature 4-20 mA (0-500°C)

### ***Power supply***

- Input 100 – 240V AC @ 50/60Hz
- Nominal max power 50VA
- Output 13.1V DC (regulated) Din rail mounted
- Dimensions 129 x 98 x 38mm

### ***Options***

- Digital display Pre configured to allow custom alarm thresholds:  
Relay output  
250V AC @ 5A / 12V DC @1A  
Open collector output  
48V DC @ 0.5A (NPN)
- Probes Compact probe 165 x 62mm (max)

## ***Parts List***

| <b><i>Description</i></b>                                     | <b><i>Part Number</i></b> |
|---|---------------------------|
| Power Supply Unit   | PR500/12                  |
| <b><i>PRO<sub>2</sub>Sensor (IHT) assembly including:</i></b> |                           |
| 165mm S/S probe   | ZR1000                    |
| S/S probe locking nut   |                           |
| Flange Plate  |                           |
| Flue Temperature Probe assembly                               |                           |
| Gasket  |                           |
| 3 x M6 S/S Socket head cap screw                              |                           |
| 3 x M6 Plain washer   |                           |
| 3 x M6 Split washer   |                           |
| G1/8 Blanking plug  |                           |
| 0.3m Y cable assy   |                           |
| 10m cable assy  |                           |
| PRO <sub>2</sub> Sensor (IHT) manual                          |                           |
| <b><i>Options and accessories</i></b>                         |                           |
| Flange plate blanking plug                                    | ZR105/2                   |
| Digital display /alarm module                                 | -                         |
| <b><i>Spares</i></b>  |                           |
| Replacement PRO <sub>2</sub> Sensor (IHT)                     | ZR101/1                   |
| Replacement flue temperature probe                            | ZR100/3                   |
| 165mm S/S probe   | ZR100/2/165               |
| 300mm S/S probe   | ZR100/2/300               |
| G1/8 Sampling port blanking plug                              | B800                      |