



FXCESO2-1001
January 8, 2019

Type2 Oxygen probe system for Nexus NXF4000 and PPC4000



Intended for Industrial Applications with NXF4000 & PPC4000



1. INTRODUCTION

This document is intended to be additional information to that contained in the standard Nexus Installation and Commissioning Bulletins NXF-4001 and PPC-4001. This document details the wiring configurations for the Type2 Oxygen probe system. The Type2 component system is intended for industrial applications, where the ambient temperature around the probe could exceed 85C (185F).

The Type2 probe system employs a probe controller and trim interface, model FXO2TRIM-1, with probe models FXCESO2-8, FXCESO2-16, and FXCESO2-30. A cable set, 59-612-33, is recommended for wiring the trim interface to the probe.

The Type 2 probe is designed to be powered directly from the NXF/PPC4000 controller. Using Modbus connectivity, the type 2 probe is able to communicate with the controller and provided pertinent operational information about the probe: O2 concentration, ambient temperature, stack temperature, sensor status, heater status, warnings, and fault codes.

1.1 ORDERING INFORMATION

PART NUMBER	DESCRIPTION
FXCESO2-8	Oxygen Probe assembly, insertion length 8" (215mm), calibration port
FXCESO2-16	Oxygen Probe assembly, insertion length 16" (406mm), calibration port
FXCESO2-30	Oxygen Probe assembly, insertion length 30" (757mm), calibration port
FXO2TRIM-1	Oxygen Probe interface module with sensor interface and 4-20mA inputs
59-612-33	Cable set for connecting Oxygen Probe to FXO2TRIM-1 Interface module, 33ft (10m) length
59-565	Cable, 1 twisted pair, 2 power wires, used for connecting Oxygen Probe to NXF4000 or PPC4000 control. Specify length in feet
FXIATS-140	Ambient Temperature Sensor, -40F to 140F (-40C to 60C), 4-20mA
LA220427	Weld flange kit for Oxygen Probe. Includes gasket and cover

1.2 APPROVALS

PART NUMBER	CE	UL Listed	AGA	SIL-3
FXCESO2-8	X	X	X	X
FXCESO2-16	X	X	X	X
FXCESO2-30	X	X	X	X
FXO2TRIM-1	X	X	X	X
FXIATS-140	X	X		



2. Specification

2.1 FXO2TRIM-1 Oxygen Probe Interface

Supply voltage (MODBUS)	24 VDC \pm 15%
Power consumption	Approximately 10 VA
Ambient temperature range	32F to 140F (0 to 60 °C)
Protection category	IP65.
Unit dimensions	6.29 x 4.3 x 2.9 in (160 x 110 x 75 mm)
Weight	1.32 lbs (0.6 kg)
Interface to NXF4000 or PPC4000 series.	Fireye specific MODBUS.
Interface to oxygen probe.	Proprietary.
Oxygen sensor heater supply.	14 Vac nominal
Oxygen sensor temperature set point.	1500 °F (820 °C)
Oxygen measurement accuracy	\pm 1% of value.
Auxiliary Inputs:	
Type	4– 20mA.
Input impedance	220 Ω
Pre-assignment	O ₂ , CO
Flue gas temperature input:	
Type	Type-K thermocouple.
Measurement range	32 -1000 °F (0 – 540 °C)
Flue temperature accuracy	\pm 2 °C



2.2 FXCESO2-x Flue Gas Temperature and Oxygen Probe

Protection category	IP20.
Maximum flue temperature	1112 °F (600 °C)
Oxygen Measurement:	
Type	Zirconia oxide cell,
Range	1 – 21% Oxygen.
Response.	5s
Time constant.	Less than 15s for 63% change.
Flue Gas Temperature Measurement	Type K thermocouple
Calibration:	
Reference gas concentration	Ambient air at 20.9% O ₂
Recommended calibration gas concentration	3% O ₂ in Nitrogen
Reference and Calibration gas flow rate	350 cc/min
Filter and flame arrestor	4 – 7 micron sintered stainless steel.
Filter pressure drop	50 – 100 mm water gauge.
Filter replacement pressure	150 mm water gauge.
Unit Weight	2.5 – 4.5 kg (type dependent) 5.5 – 9.9 lb (type dependant)



WARNING!!!



The equipment described in this manual is capable of causing property damage, severe injury, or death. It is the responsibility of the owner or operator to ensure that the equipment described is installed, operated and commissioned in compliance with the requirements of all national and local codes. The manufacturer of this equipment accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, commissioning or adjustment of the equipment. There are no user serviceable parts.

Installation, commissioning or adjustment of this product MUST be carried out by suitably trained engineer or personnel qualified by training and experience. Boiler operation, maintenance, and troubleshooting in association with this equipment shall only be conducted by trained personnel. Persons troubleshooting lockouts or resetting the control must respond properly to troubleshooting error codes as described in this bulletin or associated product bulletin.

2.3 Mechanicals

Model	Dimension A	Dimension B	Weight
FXCESO2-8	6.8" (173mm)	8.5" (215mm)	5.3lb (2.4kg)
FXCESO2-16	14.3" (362mm)	16" (406mm)	6.4lb (2.9kg)
FXCESO2-30	28.2" (716mm)	31.4" (757mm)	7.9lb (3.6kb)

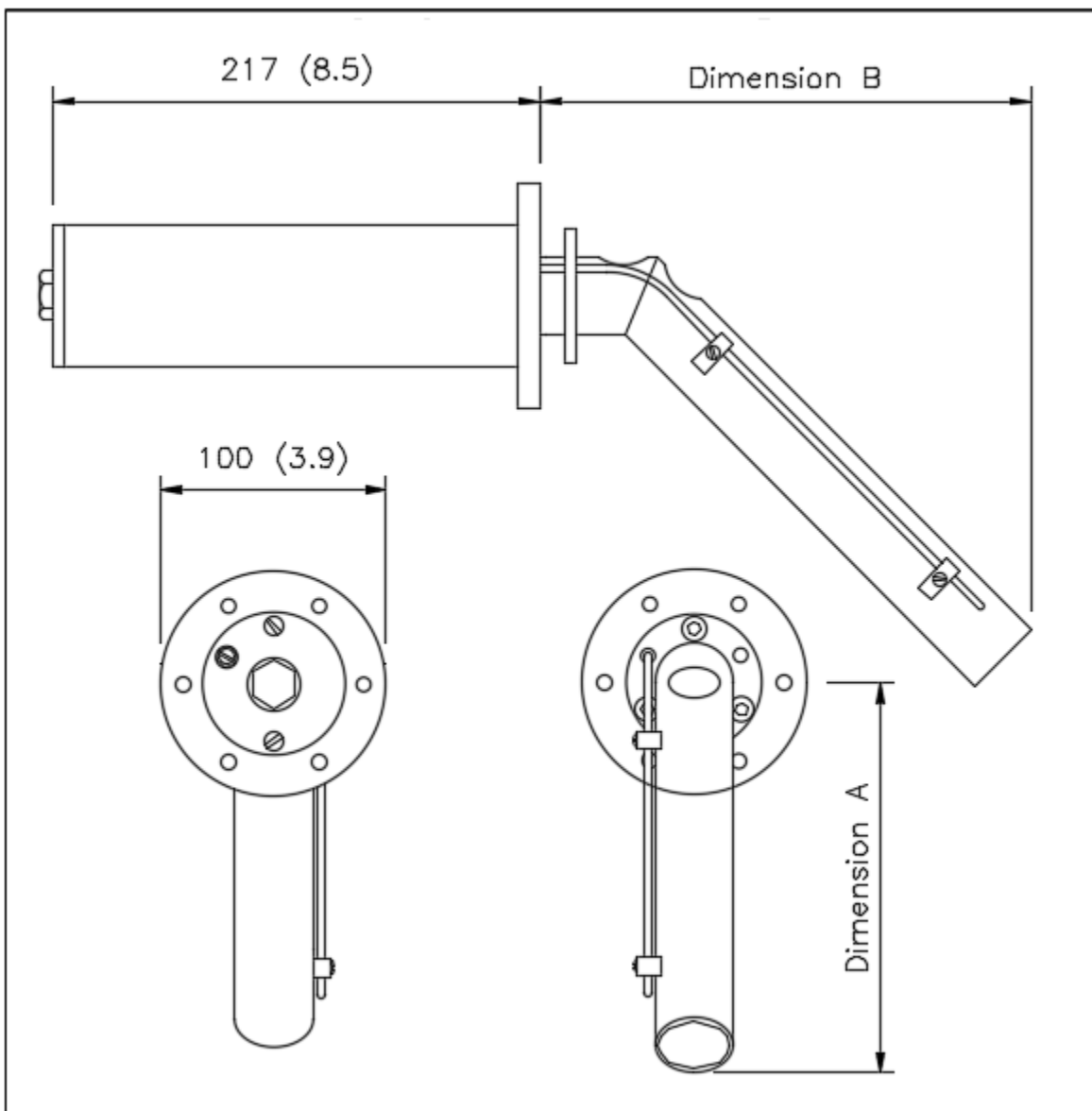
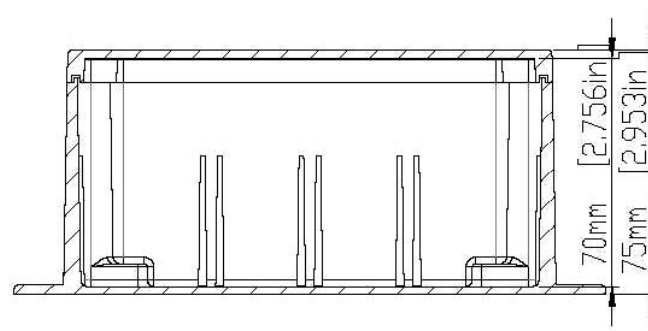
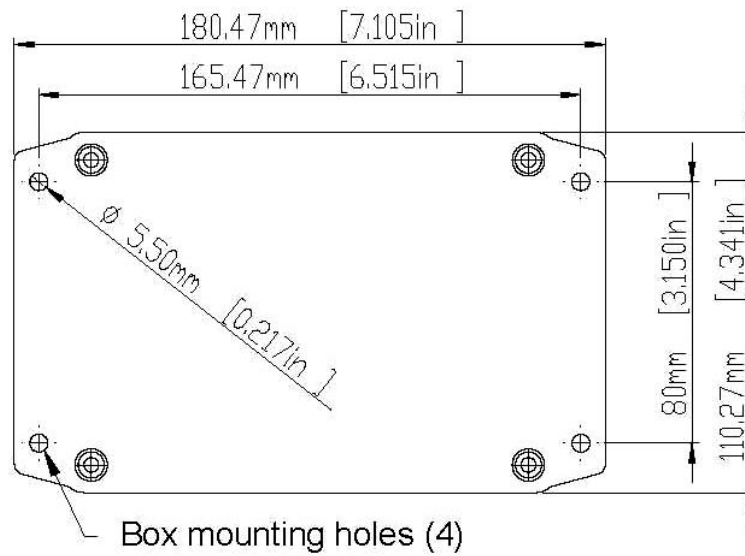


Figure 1: FXCESO2 Dimensions



Tolerances : $\pm 0.3\text{mm}$ ($\pm 0.012\text{in}$)

Figure 2: FXO2TRIM-1 Dimensions



3. Installation and Wiring

3.1 INSTALLATION

This section contains basic installation information concerning the FXCESO2-x probe and the FXO2TRIM-1 interface module.

When Installing This Product:

- Safe, reliable and proper operations of this product requires the use of the specified type shielded cable.
- Read these instructions carefully and ensure you fully understand the product requirements. Failure to follow them could damage the product or cause a hazardous condition.
- Check the ratings given in these instructions to ensure the product is suitable for your application.
- After installation is complete, check the product operation is as described in these instructions



CAUTION

- Disconnect the power supply before beginning installation to prevent electrical shock, equipment and/or control damage. More than one power supply disconnect may be involved.
- Wiring must comply with all applicable codes, ordinances and regulations.
- Loads connected to the Burner control must not exceed those listed in the specifications as given in this manual.
- All external components connected to the control must be approved for the specific purpose for which they are used.

3.1.1 Mounting the Oxygen Probe

The FXCESO2 oxygen probe is available in three different lengths to accommodate flue sizes from 12" to 160" (300mm to 4000mm). Probe should be mounted using the recommended LA220427 flange kit. The probe offers fast, accurate response and good reliability when mounted in accordance with the guidelines in this section.

The O2 probe mounts in the stack using mounting flange kit LA220427. The probe must be mounted in a manner that ensures that the flue gases pass into the gas tube at its open end and out of the tube at the flange end. Furthermore, if possible, the flange should be vertical with the gas tube angled downwards to ensure that particulates do not build up within the sample tube. Probe mounting with the flange horizontal is acceptable. Inverted probe mounting is not acceptable.

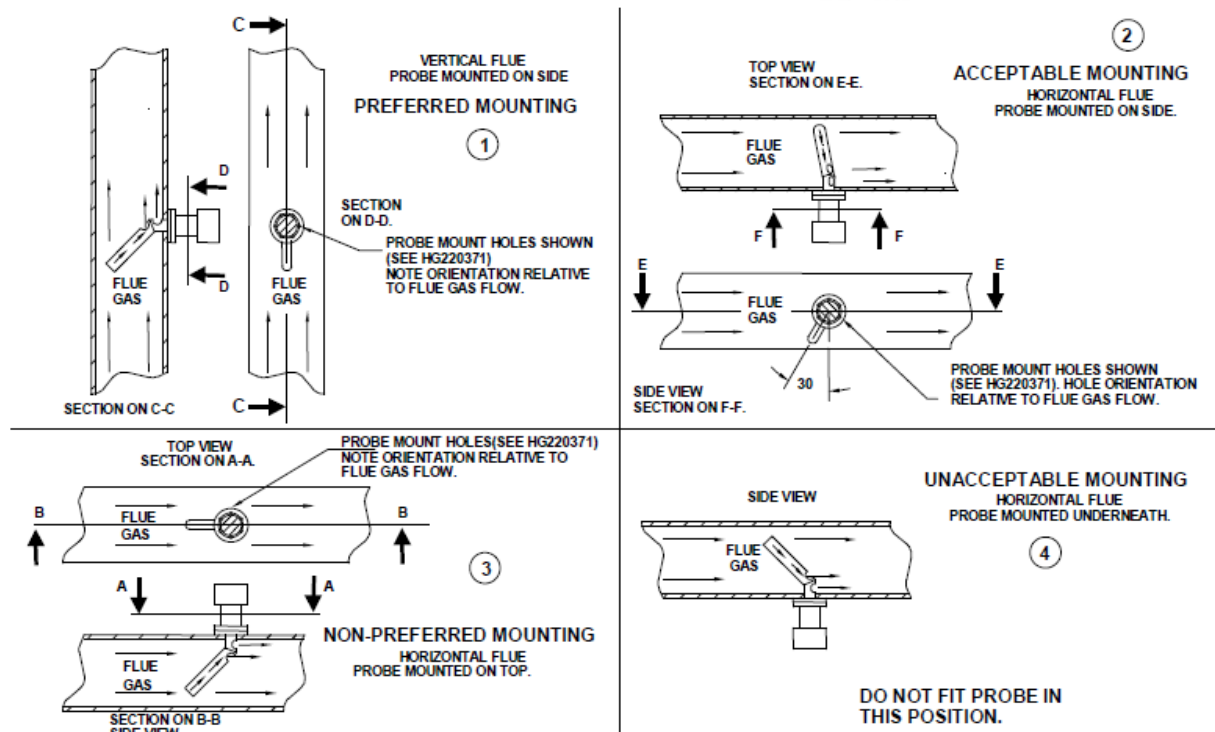


Figure 3: Mounting recommendations

The centerline of the mounted flange (shown on the drawing) should correspond to the gas flow direction.

6 stainless steel M6 x 20mm socket cap screws are provided for probe attachment.

The probe flange temperature must be maintained at the temperature of the flue wall by repacking or adding lagging, which may have been removed to mount the probe. Sulfate condensation will occur if the flue wall of an oil fired boiler falls below approximately 130°C. The sulfate problem does not occur in gas-fired installations, but vapor may cause problems due to condensation if the temperature of the flue gas falls below 100°C.

The maximum flue gas temperature is 1112°F (600°C).

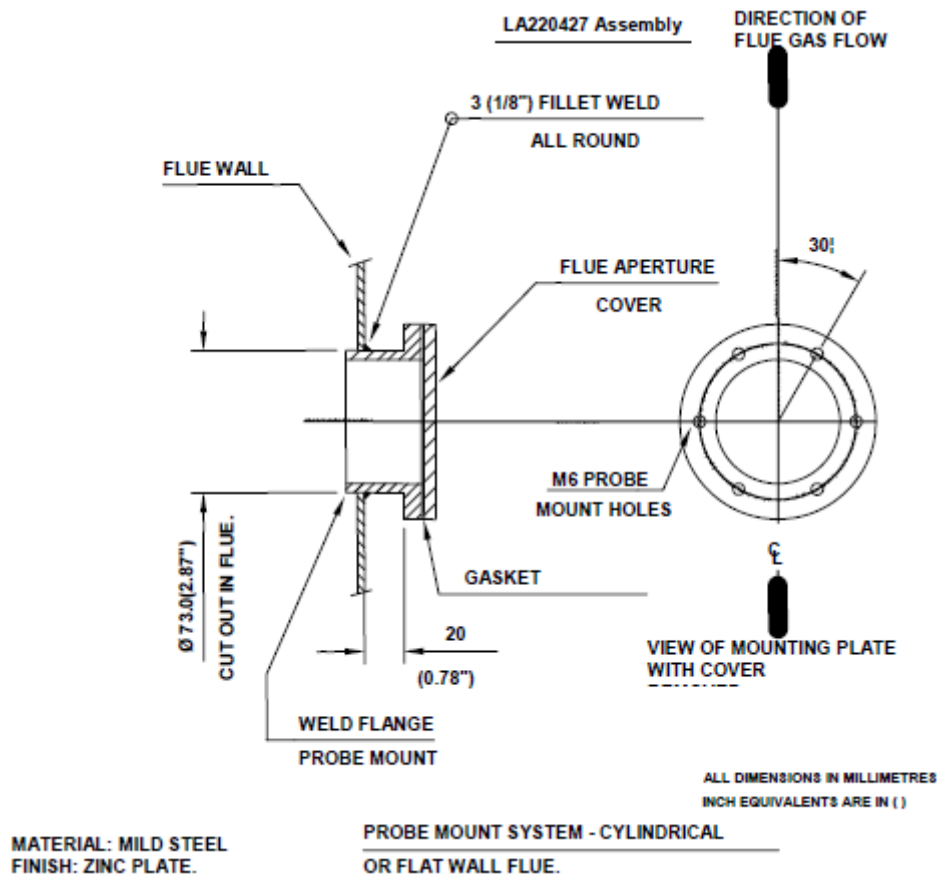


Figure 4: Mounting Flange

3.1.2 Mounting the Oxygen Probe interface Unit

The optional oxygen probe interface unit is designed to be fitted either within a control cabinet or without a control cabinet; the unit has a protection level of NEMA4 (IP65) providing suitable conduit glands are used. The interface unit can be mounted in any altitude and clearances should be maintained around the conduit entries to the unit to allow sufficient space for wiring. The ambient operating temperature range is 0 to 60°C (32 to 140°F). The unit **MUST** be grounded (earthed) to maintain electrical safety and ensure reliable operation.

The following drawing gives the dimensional information and the details required to fix the interface to a wall or panel surface. Please refer to Figure 2 on Page 6.

3.2 WIRING



CAUTION

- Read this document in conjunction with the product bulletin **NXF4000 & PPC4000**
- Disconnect the power supply before beginning installation to prevent electrical shock, equipment and/or control damage. More than one power supply disconnect may be involved.
- Wiring must comply with all applicable codes, ordinances and regulations.
- This equipment **MUST NOT** be directly connected to any part of a SELV circuit.

WIRING INSTALLATION MUST BE CARRIED OUT BY A COMPETENT ELECTRICIAN AND IS SUBJECT TO N.E.C. WIRING REGULATIONS AND/OR LOCAL STANDARDS, WHICH MAY PREVAIL.

HAZARDOUS VOLTAGES MUST BE ISOLATED BEFORE SERVICE WORK IS CARRIED OUT.

The main controller **MUST** be mounted within a 'burner cabinet' or similar panel and **MUST** be earthed to the overall enclosure to ensure safe and reliable operation using the largest cross-sectional area green/yellow earth wire available. **Do not use a green/yellow conductor for any purpose other than earth.** The metal body of all other component parts **MUST** be connected to earth using a green/yellow conductor.

To comply with EMC requirements, the controller and any optional units must be wired using the specified cable sizes, and screen connections, observing any maximum cable length limitations. Cabinet designers **MUST** ensure that Line voltage and Extra Low Voltage (ELV) cables are segregated within the burner cabinet, distribution panels and conduits.

The manufacturer of this equipment recommends the use of bootlace ferrules on all wire ends, as a "best practice".

**Bootlace
Ferrules**





Secure all cables carried in conduit at both ends using a suitable anchorage method in the cabinet.

Connect all signal cable 'braid' screens to earth using the screen termination clamps provided on the controller. Connect all cable screens to earth at the controller only, unless stated otherwise in this section.

The equipment described in this manual has been tested for compliance to the UL & CE directives listed in the approvals section. However, once connected to a burner and other associated control devices, it is the responsibility of the installer to ensure the complete installation meets the requirements of UL, CE or other local codes/directives relevant to the particular installation.

3.3 FXO2TRIM-1 terminal designation and wiring requirements

3.3.1 Wire specification and interconnection.

The electrical connection between the Nexus series controller to the FXO2TRIM-1 unit should be by a 4-conductor wire (Fireeye P/N: 59-565). Use the twisted pair for Modbus communications and the red & black wire for +24V and RTN. Connect the 'drain' wire at the designated termination point on the FXO2TRIM-1 interface module. The probe end cap is removable with a 20mm flexible conduit fitting to enable the interconnection wiring to be easily detached without re-wiring.

Incorrect connection or application of excess voltage will damage or destroy the devices being connected.

The electrical cable specification for connections between the FXO2TRIM-1 and FXCESO2-x probe must be as follows:

Cable function	Specification
Cell heater and O ₂ measurement.	Max Voltage in use 14V d.c. <ul style="list-style-type: none">• 6-core cable with each core 16/0.2mm (20 AWG) and with overall braided screen. Cable covered in PVC sheath.• Resistance per core 40 milliohms/metre.• Maximum working voltage 440V rms.• <u>Maximum length between the probe and controller is 10m (33ft).</u>
Flue gas temperature measurement.	Max Voltage in use 5V d.c. <ul style="list-style-type: none">• Type 'K' compensating cable.• 2-core PVC insulated cable with 7/0.2mm (24awg) conductors, covered in overall PVC sheath.

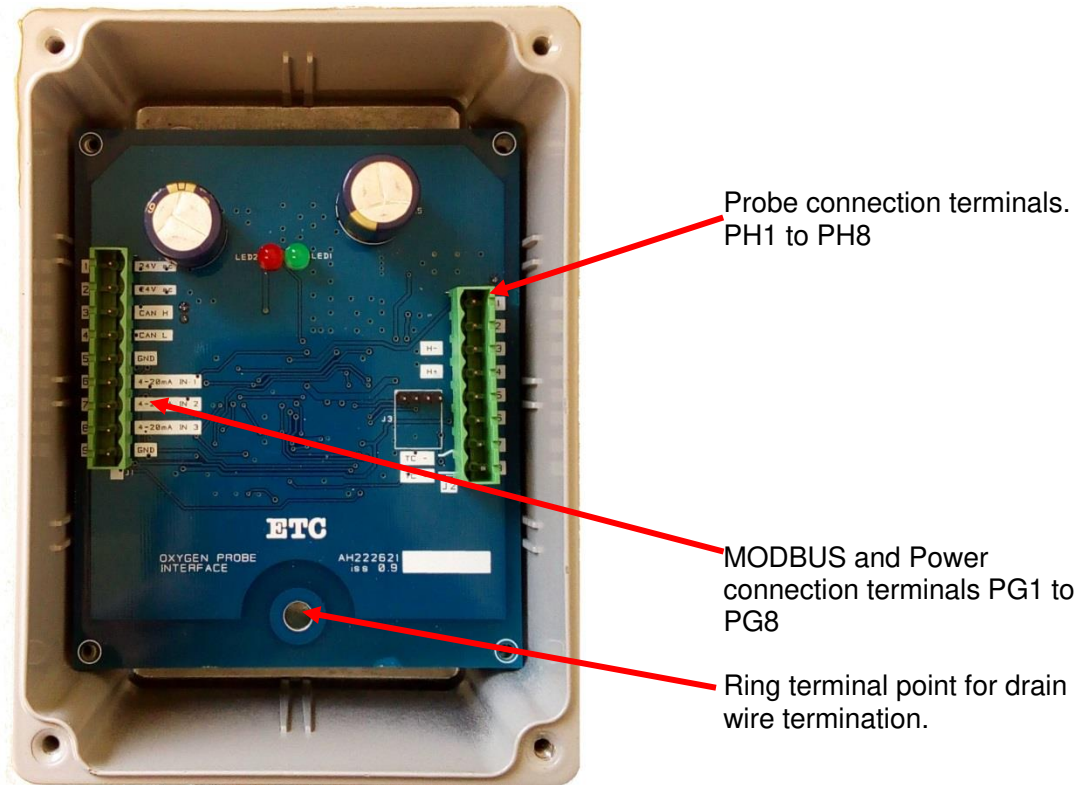


3.3.2 Terminal connections and layout.

Terminal No.	Module	Function	Voltage Rating
PG1	Control Interface	+24VDC Supply	+24V (15% tol.)
PG2	Control Interface	+24VDC Return	
PG3	Control Interface	Modbus A	0-5V
PG4	Control Interface	Modbus B	0-5V
PG5	Control Interface	GND (4-20mA input 0V)	0V
PG6	Control Interface	4-20mA Input 1	0-5V
PG7	Control Interface	4-20mA Input 2	0-5V
PG8	Control Interface	4-20mA Input 3	0-5V
PG9	Control Interface	GND (4-20mA input 0V)	0V
PH1	O2 Probe Interface	Probe 1 (Black)	0-14V
PH2	O2 Probe Interface	Probe 2 (Red)	0-14V
PH3	O2 Probe Interface	Probe 3 (Yellow)	0-14V
PH4	O2 Probe Interface	Probe 4 (Green)	0-14V
PH5	O2 Probe Interface	Probe 5 (Blue)	0-14V
PH6	O2 Probe Interface	Probe 6 (White)	0-14V
PH7	O2 Probe Interface	Flue gas thermocouple White	0-5V
PH8	O2 Probe Interface	Flue gas thermocouple Green	0-5V

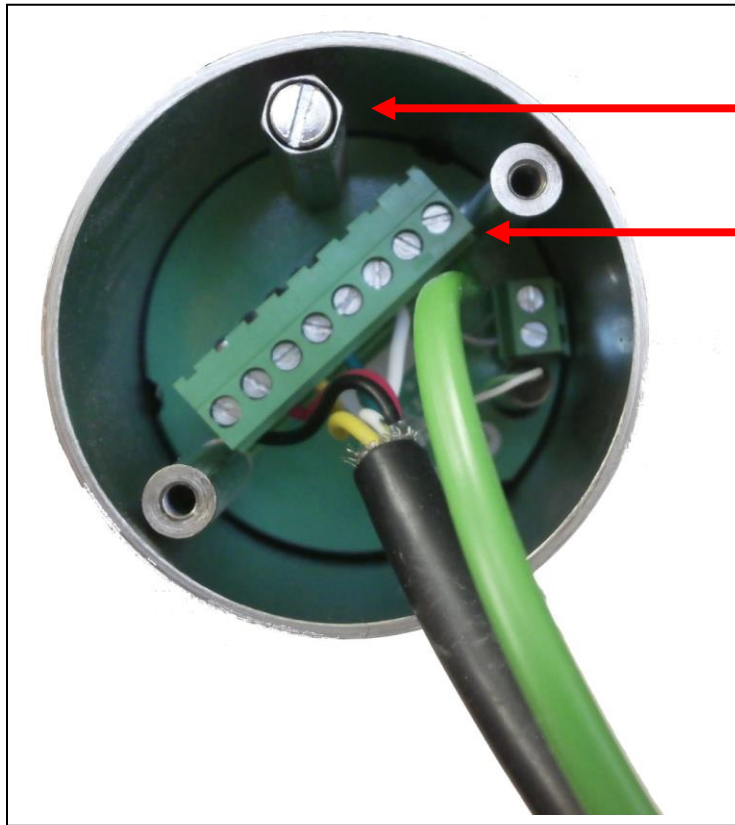
The connection scheme between the FXO2TRIM-1 and FXCESO2-x is by direct connection, terminal1 to 1, 2 to 2 and so on up to terminal 8. See the reference to PH above.

Internal view of FXO2TRIM-1



Cable entries on this face

View of FXCESO2-x Oxygen probe terminals.



NOTE: There is no screen termination point. The screen in the 6-way cable must be cut short to the PVC outer cover.



4. Calibration process

It is important to calibrate the O2 Probe periodically in order to achieve accurate oxygen measurement and maintain optimum combustion efficiency. Calibration of the probe can be accomplished by the following steps:

Note: Systems with multiple boilers with common flue gas outlet should be managed properly to avoid "fouling" of the probe with stack gases generated by adjacent boilers in operation.

1. Start a burner cycle.
2. At the pre-purge stage, place the burner control in "check mode" by utilizing the available RUN/CHECK slide switch or button located on the display. When in check mode, the burner control will stay in the pre-purge state indefinitely. Alternatively, a digital input could be configured to activate the 'PURGE HOLD' feature.
3. Keep system in pre-purge for at least 5 minutes in order to purge all traces of burnt/unburnt fuel. This purge time is needed to create the free-air (20.95% oxygen concentration) condition that is expected in order for the probe to calibrate properly. Extended purge time may be required for larger systems.
4. After 5 minutes (or more) of purge time, go to the PPC4000 or NXF4000 display (NXD410 or Touchscreen) and navigate to the O2 SETUP menu.
5. Initiate the O2 probe calibration by executing the CALIBRATE NOW option. Calibration time is About 30 seconds.
6. Observe the O2 reading after calibration to make sure that the O2 readout is about (20.8% \pm 0.1%).
7. Upon successful calibration, deactivate check mode or purge hold to allow the system to continue normal burner sequence.



5. Fault code

See PPC-4001 or NXF-4001 bulletin for information concerning O2 fault codes.

NOTICE

When Fireeye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps and photo-cells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.



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