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**Zirconium Oxide Probe
for oxygen measurement
Series ZO2-3I/E
Model ZO2-3I-C060**

INSTRUCTION FOR USE
ISTR_M_ZO2-3I-C060_E_01_--



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General Index

1. General description and operating principle	4
2. Installation and precautions.....	5
3. Power supply and electrical connections	6
4. Function of the LEDS	7
5. Configuration mode.....	7
5.1 Not available procedure	8
5.2 Output range 4-20mA selection procedure	8
5.3 Output current setup procedure.....	8
6. Quick guide	9
7. Maintenance	10
8. Trimmer calibration in ambient air	10
8. Technical data	11
9. How to order.....	11
10. Dimensioned drawings.....	12

1. General description and operating principle

The ZO2-3I/E Zirconium Oxide probe performs direct and continuous measurement of residual oxygen percentage in flue gas.

Typically, the probe is used for optimization of the combustion process of boilers with a modulating burner. Through the fine setting of combustion air, commonly called "trim" oxygen, it is possible to keep the proper air/flue ratio during combustion process.

In this way, the probe reduces pollution and ensures energy saving with a greater safety in the conduct of boiler.

The probe ZO2-3I/E is also used for norm compliance to regulations and often is combined with other instruments of Ascon TecnoLogic S.r.l for measurement and continuous monitoring of flue gases temperature and carbon monoxide.

Equipped with electronic control, generates directly a linear 4...20 mA output with active or passive output selectable by jumpers.

The electronic card offers the management of sensor and the built in heater, the setting of range, the calibration and adjustment of output signal.

The use of probe is possible for plants fueled by natural gas. For other fuels (however low sulfur content) the use must be evaluated with our technical department.

For some fuels, it is necessary a cleaning system with timer and air tools 2/3 bar for about 10 seconds.

The frequency depends on the type of fuel and the operation of the plant.

The probe is available in 4 versions:

Model	In-situ	Extractive¹	Integrated electronic	External electronic²
ZO2-3I	X		X	
ZO2-3E	X			X
ZO2-3E-C100		X		X
ZO2-3I-C-060		X	X	

NOTE

1: For harsh environments where high temperatures and/or vibrations can damage on-board electronic

2: Under critical process conditions

2. Installation and precautions

Perform the installation as per the following steps:

- Install the probe upright as close as possible at the sampling point
- Connect the sampling tube and exhaust gas tube, contemplating to add components for the sampling and treatment sample gas, as pump, filter, flowmeter etc.
- Make electrical connections (see Ch. 3)
- Turn on and wait 15 minutes to allow the probe heater to reach the operating temperature

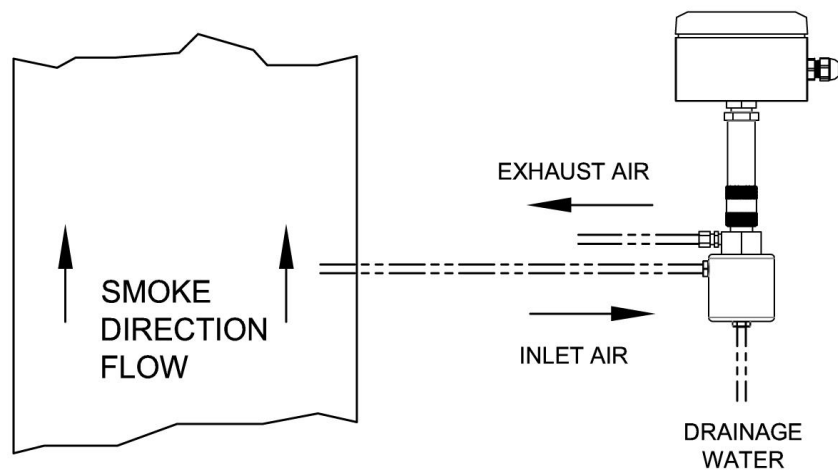


Figure 1

3. Power supply and electrical connections

The electronic of the probe ZO2-3I-C060 appears as in figure 2 below.
The sensor is already wired to the probe while the remaining connections are at the expense of the technician.

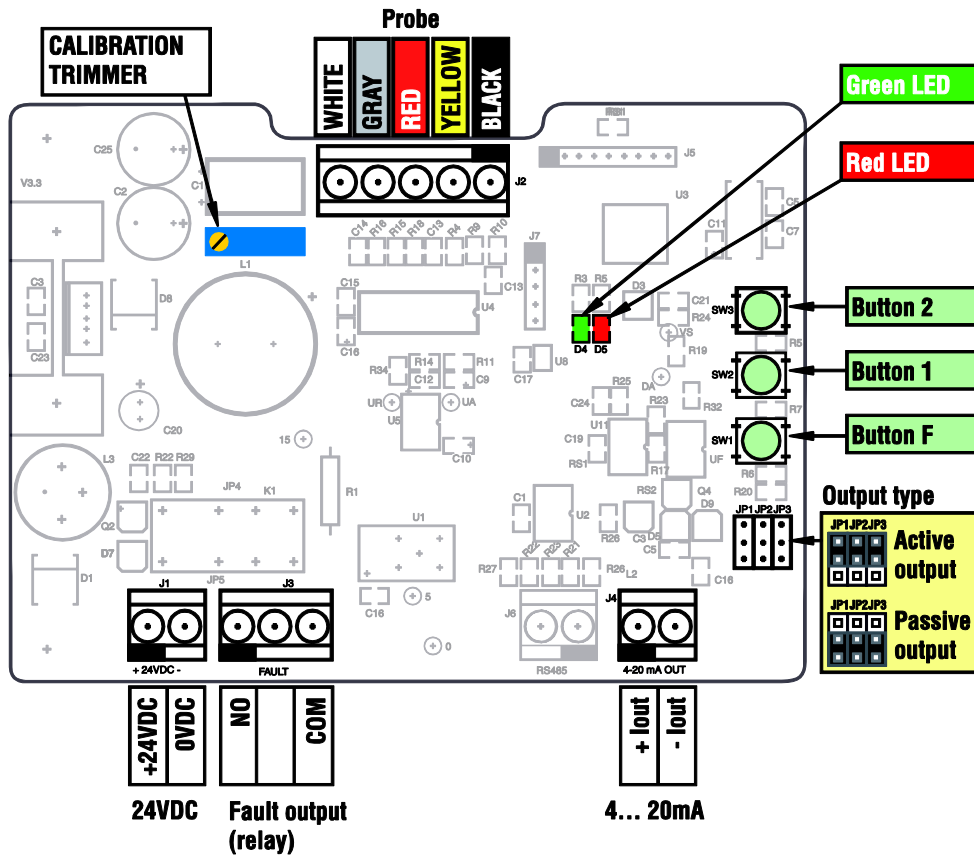


Figure 2

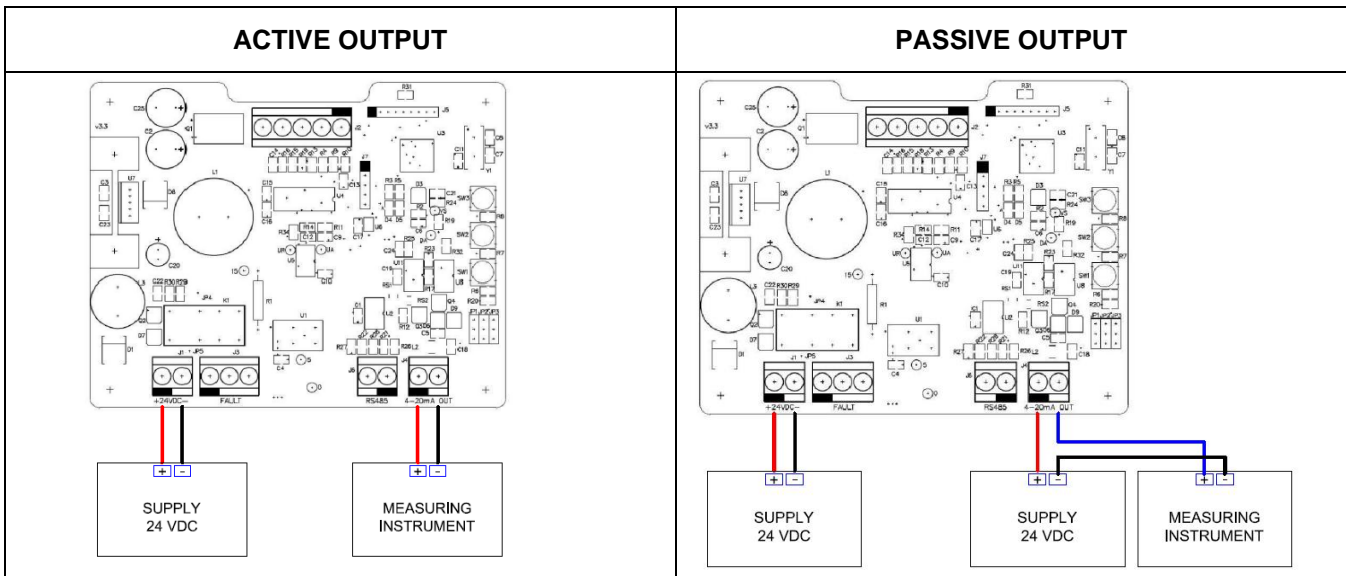


Figure 3

Warning

In the passive configuration, the power supply of current loop CAN NOT BE the same of power of the card.
In particular, the two negative poles of the two power supplies must not be placed in common for no modify the correct operation of the card.

4. Function of the LEDS

GREEN LED

The green led is switched on during normal board operation.

With card in *configuration mode*, (as described under chapter 5) the led will flash briefly each press of keys 1 and 2 to confirm the execution of the command.

RED LED

The red led is switched off during normal normal board operation.

With card in *configuration mode*, the led will flash briefly indicating the active mode.

The lighting of this led indicates a fault in the system. At same time the led lights up, the fault relay switches by closing the NO contact and the output current is set to 2 mA.

In fault condition, the red led emits a different number of flashes depending on the type of fault:

1 Flash: Temperature regulation fault or sensor in heating phase. During this phase, the reading of the measurement of oxygen is not significant

2 Flashes: Oxygen measurement below the minimum threshold (0.3%)

3 Flashes: Sensor fault or sensor disconnected. Power supply below the minimum limit of operation

5. Configuration mode

Pressing the F key for 2 seconds, the card access to the *configuration mode*.

There are 3 ways of configurations possible, as indicated by the number of flashes of the red led (1, 2 or 3).

To switch from one mode to another, release and then press the F key for 2 seconds.

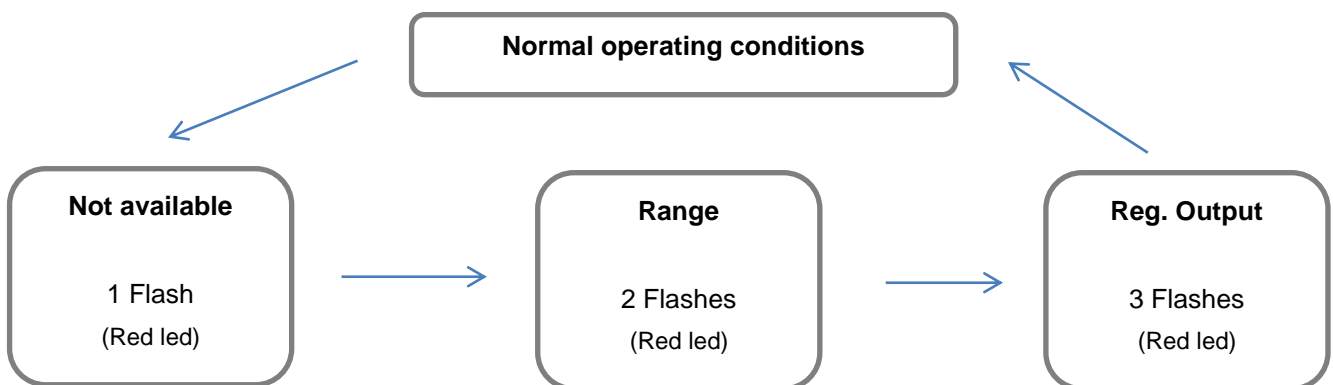


Figure 4

To come out of *configuration mode*, simply press the F key for 2 seconds from mode *Reg. Output*, or wait for about 15 seconds and the transition will happen automatically.

5.1 Not available procedure

5.2 Output range 4-20mA selection procedure

It is possible to set the board for two default output ranges:

- $I_{out} = 4 - 20\text{mA}$ \Leftrightarrow $O_2 = 0...20.9\%$
- $I_{out} = 4 - 20\text{mA}$ \Leftrightarrow $O_2 = 0...25.0\%$

To set the desired range:

- Access into mode *Range* pushing the F key for 2 seconds and checking that the red led emits 2 short blinks each second
- Push key 1 to set the range 0...20.9%
- Push key 2 to set range 0...25%

5.3 Output current setup procedure

With this procedure, it is possible to compensate for any errors in measurement of the output current. The maximum adjustment is $\pm 1\text{mA}$ achieved in step of approximately $10\mu\text{A}$.

- Access into mode *Reg. Output* pushing the F key for 2 seconds and checking that the red led emits 3 short blinks each second
- Push key 1 to increase the output current
- Push key 2 to decrease the output current

NOTE: The function of the keys is reversed in the case of passive output

6. Quick guide

FUNCTION OF THE LEDS (Ch. 4)

GREEN LED switched on during normal operation of the card

RED LED switched on in case of failure

Possible causes:

1 Flash: Temperature regulation fault or temperature sensor in the heating phase. During this phase the reading of the measurement of oxygen is not significant.

2 Flashes: Oxygen measurement below the minimum threshold (0.3%)

3 Flashes: Sensor fault or probe not connected. Supply voltage below the minimum limit of operation.

CONFIGURATION MODE (Ch. 5)

Pressing the F key for 2 seconds to shift into menu items

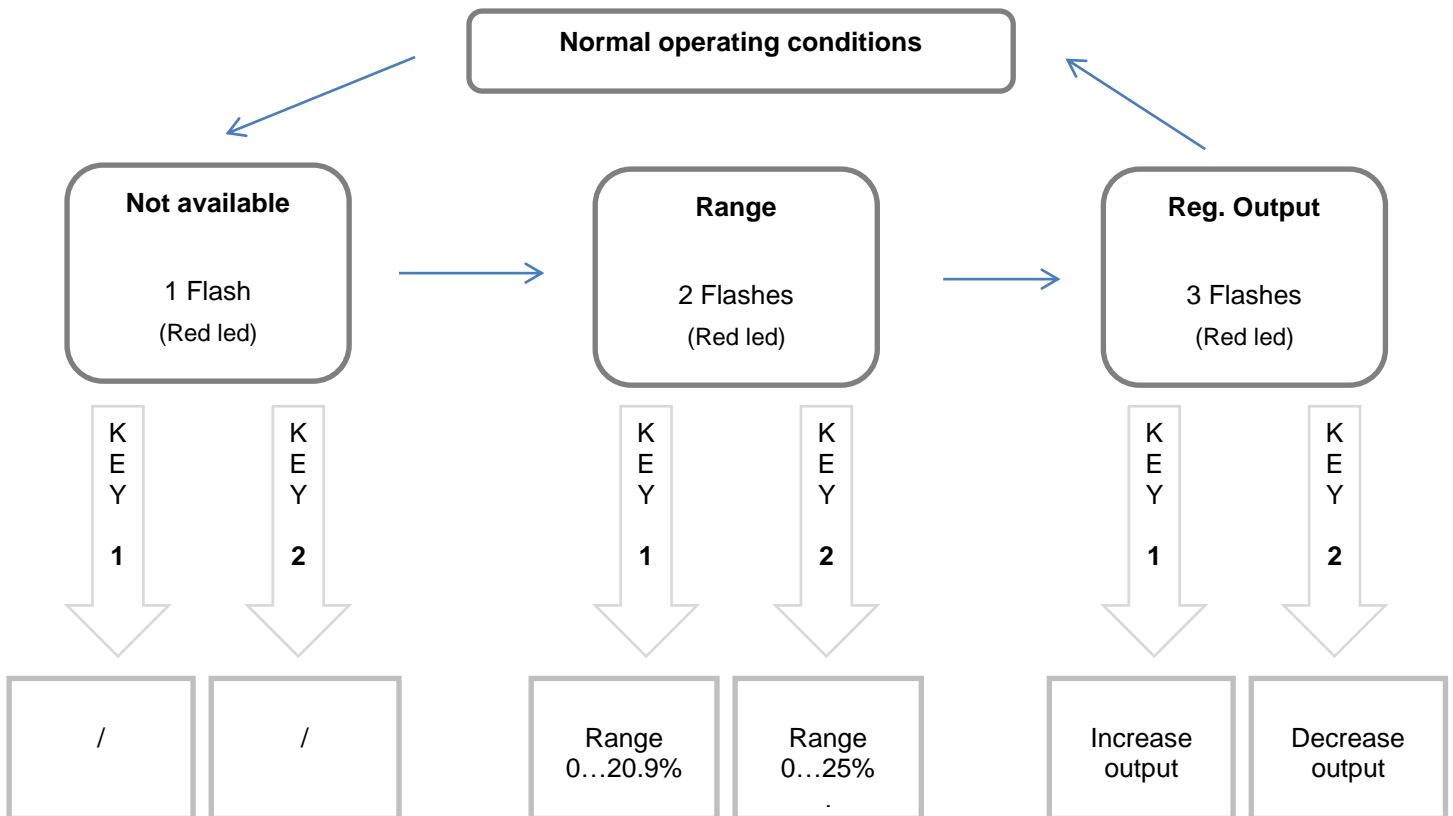


Figure 5

7. Maintenance

In normal applications, the probe does not require any maintenance.

However, in some cases, periodic cleaning is suggested to prevent unburnt combustion deposits which can affect the circulation of flue gases inside probe and even obstruct the inlet and outlet holes.

To clean the probe, proceed as follows:

Connect a instruments air dry and disoiled with a relative pressure of **2-3 bar for 10 seconds** to the exhaust air hole (fig. 1 page 5)

If necessary, repeat the operation.

During cleaning phase of probe, it is necessary to exclude monitoring or controlling instruments connected.

In general, for application in enviroments with high dust content or whit solid fuels, it is necessary to establish a system of timed cleaning.

In these cases, the frequency of cleaning depends on the type of process. It is therefore necessary to identify, in each case, the proper balance between cleaning and measurement continuity.

8. Trimmer calibration in ambient air

The following calibration procedure must be performed with maximum range of 12 months.

It is necessary to repeat this process each time the card is connected to a new sensor.

To perform this procedure:

- Connect the output signal 4...20mA to electronics (display, PLC, recorder, etc.)
- Ventilate the probe to ensure ambient air on sensor
- Correct the output value operating on the calibration trimmer (see fig. 4, pag 8) up to full scale set 20.9 %O₂ or 25 %O₂ (see Cap. 5.2)

IMPORTANT

For accurate calibration, it is necessary to perform the calibration procedure only after reaching a steady state of thermal equilibrium of the probe, usually after about 20 minutes of operation. It is therefore not recommended to perform the calibration procedure in the first minutes after turning on the system PCB + sensor.

8. Technical data

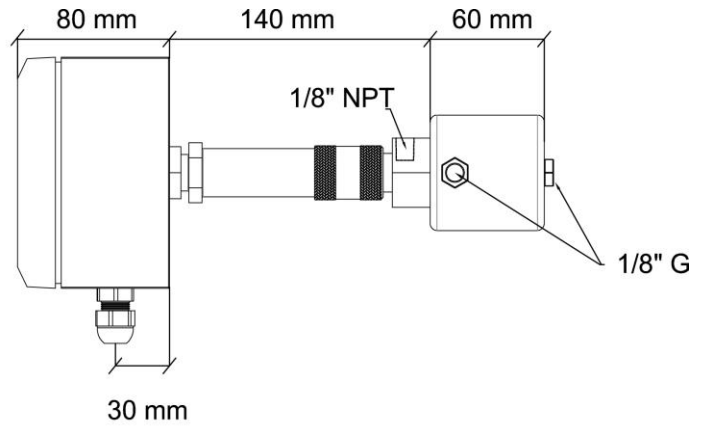
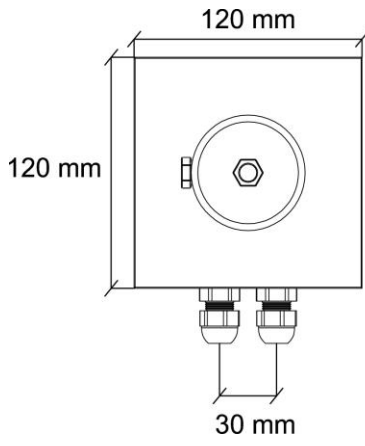
Measurement type		Direct and continuous oxygen measurement with expansion cylinder
Sensor		Heated zirconium oxide ZrO ₂
Max flue gases temperature	600°C	
Probe material	AISI 316	Stainless Steel AISI 316
Process connection		Complete of expansion cylinder
Inleat air Drainage water Exhaust air		Thread 1/8" G Thread 1/8" G Thread 1/8" NPT
Head protection	IP 66	
Ambient temperature	-20°C... + 55°C	
Weight	2-3 kg	
Power supply	24VDC ±5%	
Max current consumption	1.2 A	
Output	4... 20mA	Active or passive output, non isolated
O ₂ % Measuring range	0.3... 25%	
Accuracy	±1%f.s.	In the range 1.4...20.9 % O ₂
Output range 4-20mA	0... 20.9% 0... 25%	Adjustable with keys
Response time	<5 sec	
Heating up time	15 minutes	Standard heating time
Sensor heating up time	<15s	Automatic temperature control
Calibration	20.9%	Trimmer calibration in ambient air
Calibration interval	12 months	
Error indicator	Relay SPDT NC+NO	Red led on card in case of: -Oxygen % <0.3% -Probe disconnected - Probe failure - Heater failure - Power supply failure
Pluggable screw connectors		Supply 0...24V Output 4...20mA Fault signal contacts Sensor wiring (5 wires)
Operation interface		2 LEDS (green and red) and 3 keys

9. How to order

CODE	DESCRIPTION
	Probe for oxygen measurement
ZO2-3I-C-060	Extractive, integrated electronic, equipped by expansion cylinder

10. Dimensioned drawings

ZO2-3I-C060





WARNING!

In order that a probe failure or malfunction does not create dangerous situations for persons, things and animals, please remember that the plant has to be equipped with suitable safety devices.

The product is under warranty for 12 months except for parts subject to fair wear and tear.

The sensor, in particular, is considered within the parts subject to fair wear and tear. Its lifetime depends on working conditions. The expected sensor's lifetime is affected by elements such as humidity, particulates, corrosive substances and also by the exposition time to such elements.

The warranty term is ex works our factory (Vigevano, PV, Italy).

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