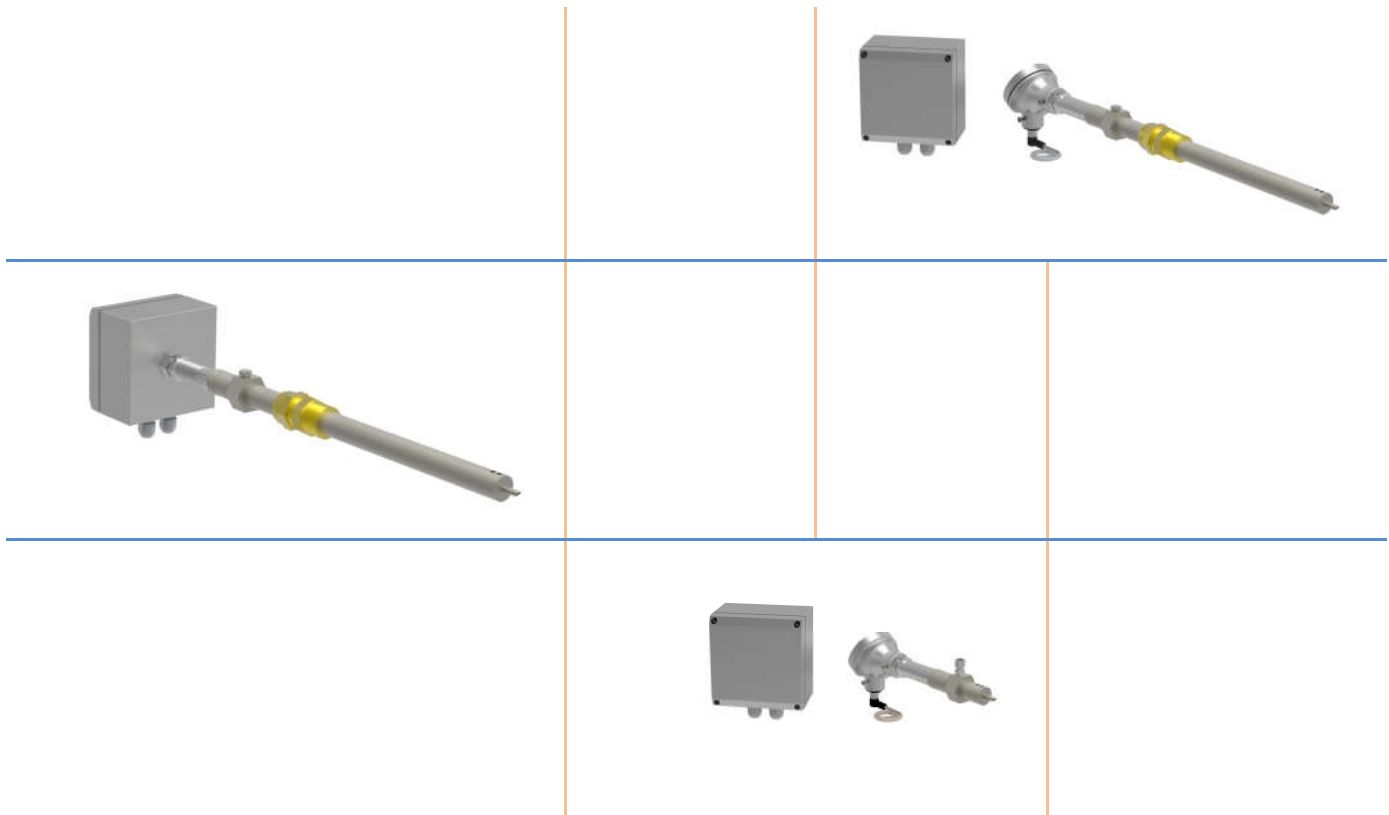# ASCON TECNOLOGIC

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**Zirconium Oxide Probe
for oxygen measurement
in flue gas
Series ZO2-3I/E**

INSTRUCTION FOR USE
ISTR_M_ZO2-3I-E-EC100_E_01_--

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General Index

1. General description and operating principle

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

Typically, the probe is used for optimization of combustion process of boilers with a modulating burner.
Through the fine setting of combustion air, commonly called "trim"oxygen, it is possibile 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 compliace 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, directly generates 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 type of fuel and operation of plant.

The probe is available in 3 versions:

Model	In-situ	Extractive[1]	Integrated electronic	External electronic[2]
ZO2-3I	X		X	
ZO2-3E	X			X
ZO2-3E-C100		X		X

NOTE

1: For harsh environments where high temperatures and/or vibrations can damage on-board electronics
2: Under critical process conditions

2. Installation and precautions

2.1 Installation and precautions ZO2-3I in-situ with integrated electronic

Perform the installation as per the following steps:

- Install probe where combustion gas flow is most likely to be homogeneous and has the least turbulence
- Place probe perpendicular to the smoke direction flow and tilted about 15-20° (see figure 1)
- Insert probe in central area of the duct (as shown in figure 1) and then lock the probe in position by tightening the fixing nipples
- Make electrical connections (see Ch. 3)
- Turn on and wait 15 minutes to allow the probe heater to reach the operating temperature

NOTE
In order to avoid condensation of the sensor, it is necessary to leave the probe heater switched on during the shut-down periods.

Figure 1

2.2 Installation and precautions ZO2-3E in-situ with external electronic

Perform the installation as per the following steps:

- Install probe where combustion gas flow is most likely to be homogeneous and has the least turbulence
- Place probe perpendicular to the smoke direction flow and tilted about 15-20° (see figure 2)
- Insert the probe in the central area of the duct (as shown in figure 2) and then lock the probe in position by tightening the fixing nipples
- Set the remote case with electronics in right place (length of cable supplied 3 mt.)
- Connect probe to remote case with the supplied cable
- Make electrical connections (see Ch. 3)
- Turn on and wait 15 minutes to allow the probe heater to reach the operating temperature

NOTE
Do not use other cables. The calibration of the probe depends on the type and length of cable.
In order to avoid condensation of the sensor, it is necessary to leave the probe heater switched on during the shut-down periods.
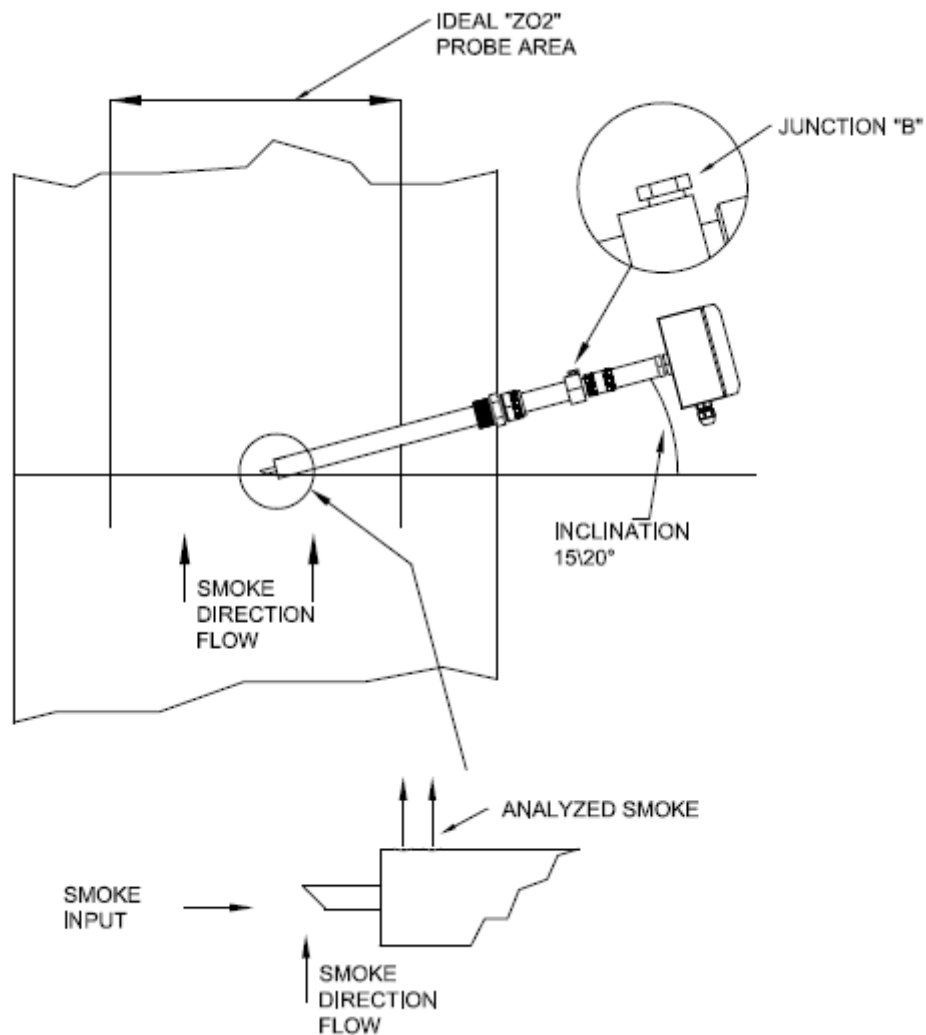

Figure 2

2.3 Installation and precautions ZO2-E-C100 extractive with external electronic

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.
- Set the remote case with electronics in right place (length of cable supplied 3 mt.)
- Connect probe to remote case with the supplied cable
- Make electrical connections (see Ch. 3)
- Turn on and wait 15 minutes to allow the probe heater to reach the operating temperature

NOTE
Do not use other cables. The calibration of the probe depends on the type and length of cable.
In order to avoid condensation of the sensor, it is necessary to leave the probe heater switched on during the shut-down periods.
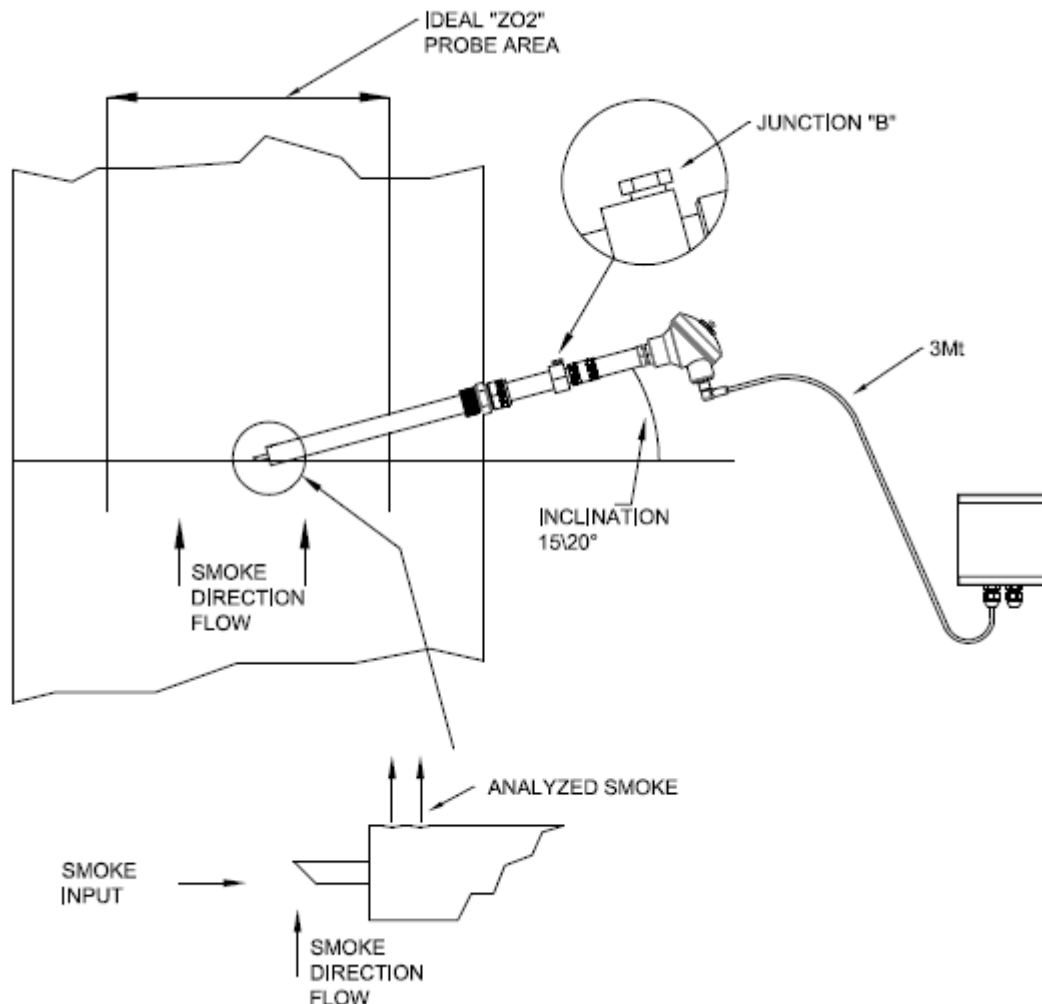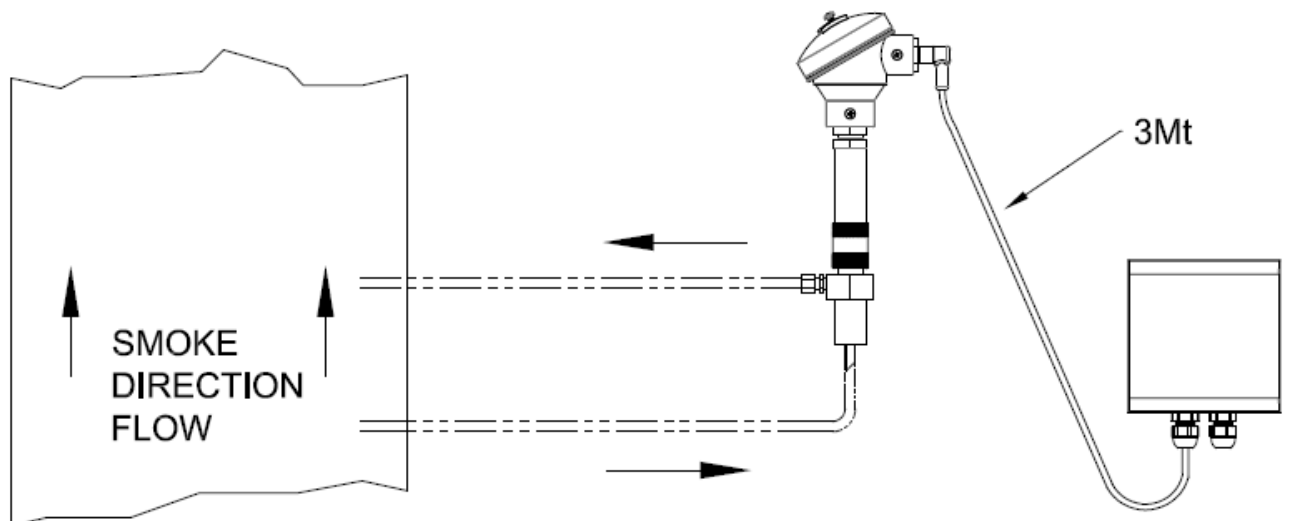

Figure 3

3. Power supply and electrical connections

The electronic of probe ZO2-3I/E appears as in figure 4 below.
The sensor is already wired to probe while the remaining connections are at the expense of the technician.
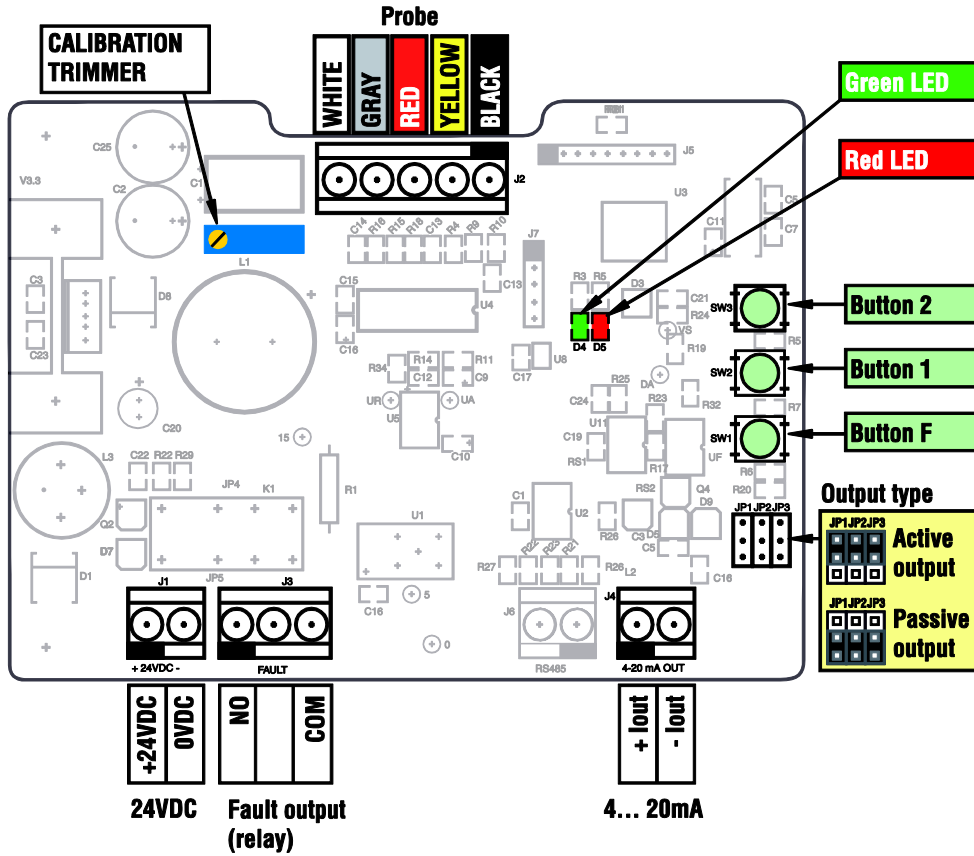
Figure 4
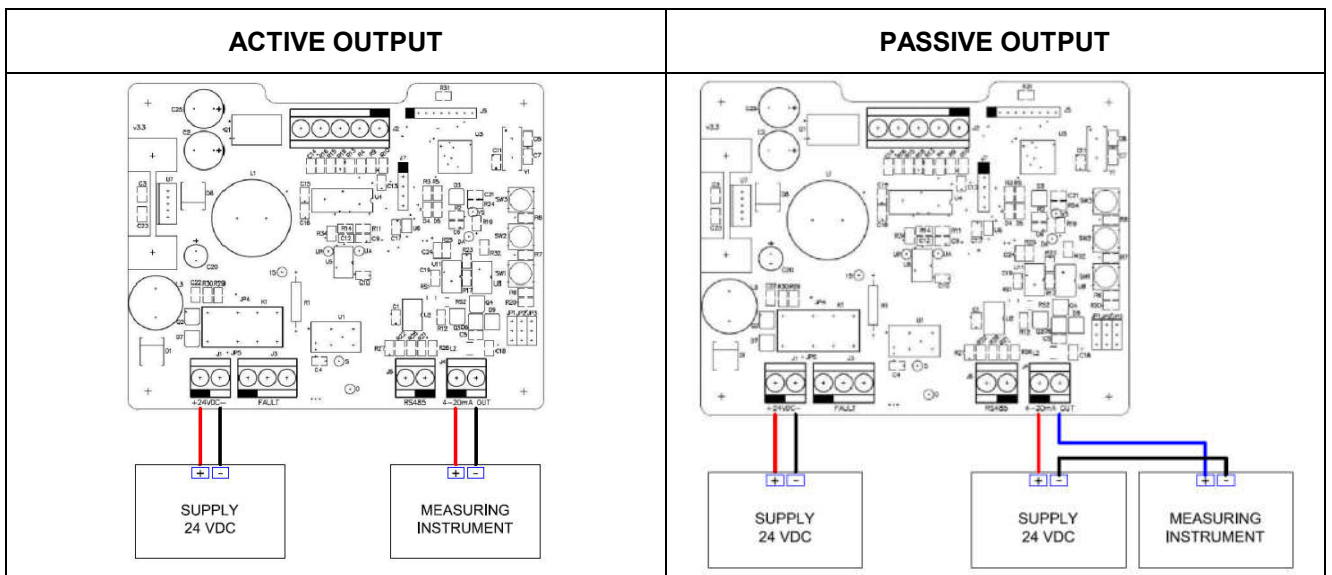
Figure 5

Warning

In passive configuration, the power supply current loop <u>CAN NOT</u> be the same that powers the board.
In particular, the two negative terminals of the two power supplies must not be placed in common, in order to have the board functioning properly.

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 minimun 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 possible configurations, 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.
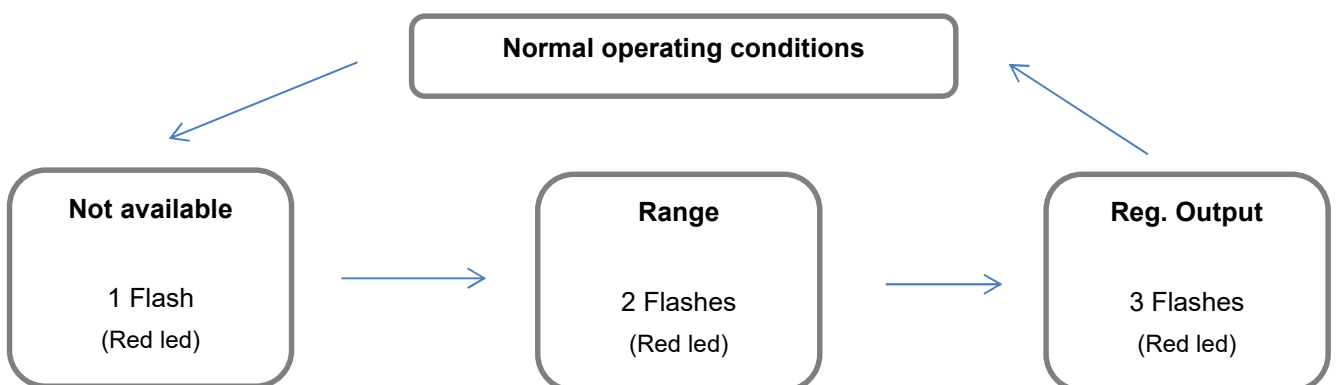

Figure 6

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:

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

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

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 ±1mA achieved in step of approximately 10µA.

- 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

| **Normal operating conditions** |

Not available	**Range**	**Reg. Output**
1 Flash	2 Flashes	3 Flashes
(Red led)	(Red led)	(Red led)

KEY 1	KEY 2	KEY 1	KEY 2	KEY 1	KEY 2
/	/	Range 0…20.9%	Range 0…25%.	Increase output	Decrease output

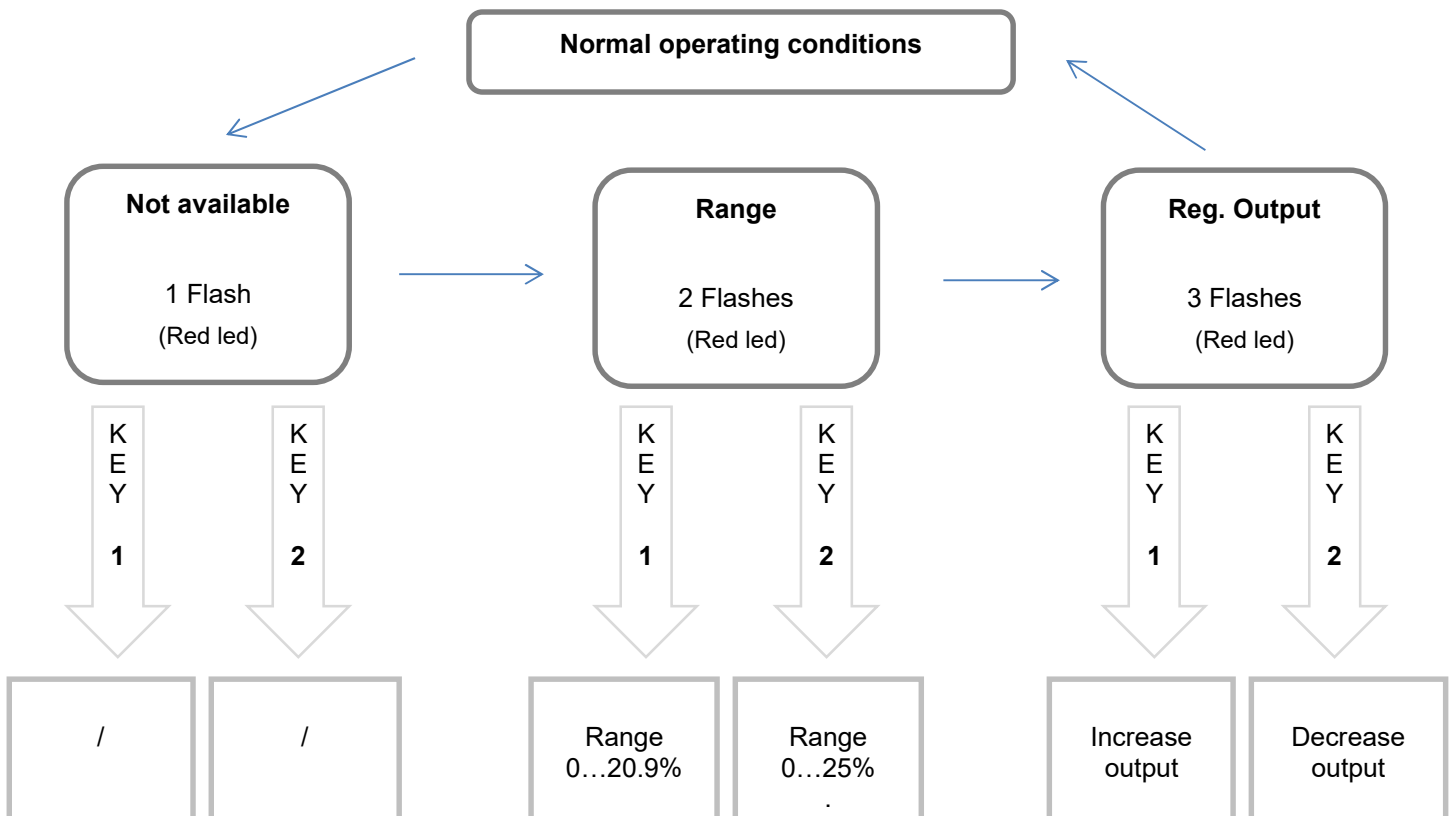Figure 7

7. Maintenance

With fuels different from natural gas, 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:

1. Connect a <u>instruments air (dry and disoiled)</u> to the **B** connection fitting 1/8" NPT (see figures pages 5/6), with a relative pressure **of 2-3 bar for 10 seconds**.
2. Complete the cleaning procedure by removing the instruments air and by closing the **B** connection fitting with the plug.

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 estabilish 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 cleanling 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)

<u>IMPORTANT</u>
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.

9. Procedure for setting instruments of the OX series

The instruments Ascon Tecnologic of OX serie can acquire:

- Mv signal not linearized of probe **ZO2** (old model)
- 4/20 Ma signal linearized proportional to range **0…20.9 %O2** of probe **ZO2-3I/E**

Therefore, it is necessary configure adequately the instruments according to the probe.
For complete procedure, it is necessary refer to the instrument manual OX.
The following summarizes the correct parameterization:

Setting of parameter **CON**

- Pushing key **F** until **CON**
- Pushing twice key **ENTER**
- Insert password **3333**

Set up:

- **2**000 for input 4/20 Ma linearized by probe **ZO2-3I**
- Confirm with **ENTER**

Or:

- **0**000 for input with Mv not linearized by probe **ZO2**
- Confirm with **ENTER**

NOTE

If you are using the probe ZO2-3I/E in place of the previous ZO2 (old model) with the instruments OX, delete, if necessary, the logic input "Failure" (remote sensing relative to the power supply model AZO-AL0x)

In this case, proceed as follows

OXI remove electrical connections to terminals 21-23   IL2

OXM remove electrical connections to terminals 21-23   IL2

OXR remove electrical connections to terminals 21-26   IL4

10. Technical data

|		
Measurement type		Direct and continuous oxygen content measurement in wet flue gas
Sensor		Heated zirconium oxide ZrO2
Max Flue gases temp.	600°C	
Probe material	AISI 316	Stainless Steel AISI 316
Process connection	1" NPT	With 1" NPT sliding nipple
Purge air/calibration	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
O2% Measuring range	0.3… 25%	
Accuracy	±1% f.s.	In range 1.4…20.9% O2
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 mounths	
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		Power supply 0…24V Output 4…20mA Failure contacts Probe cabling (5 wires)
Operator interface		2 LEDS (green and red) + 3 keys
Remote probe connection for extractive models ZO2-3E, ZO2-3E-C100		With supplied cable (3 mt.)

11. How to order

| CODE	DESCRIPTION Probe for measurement of oxygen content in wet flue gas
ZO2-3I-300	In-situ, integrated electronic, L=300 mm
ZO2-3I-500	In-situ, integrated electronic, L=500 mm
ZO2-3E-300	In-situ, external electronic , L=300 mm
ZO2-3E-500	In-situ, external electronic, L=500 mm
ZO2-3E-C100	Extractive, external electronic, L=100 mm

12. Dimensioned drawings

ZO2-3I-300/500
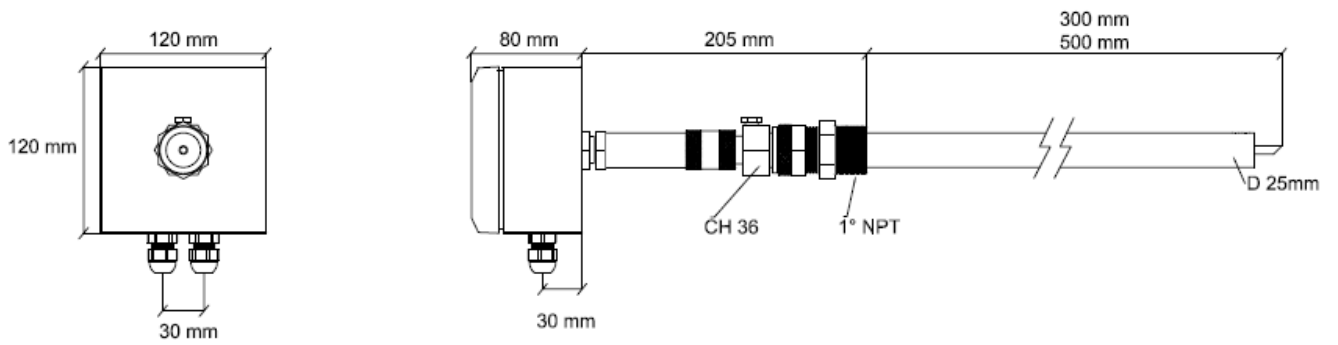
ZO2-3E-300/500
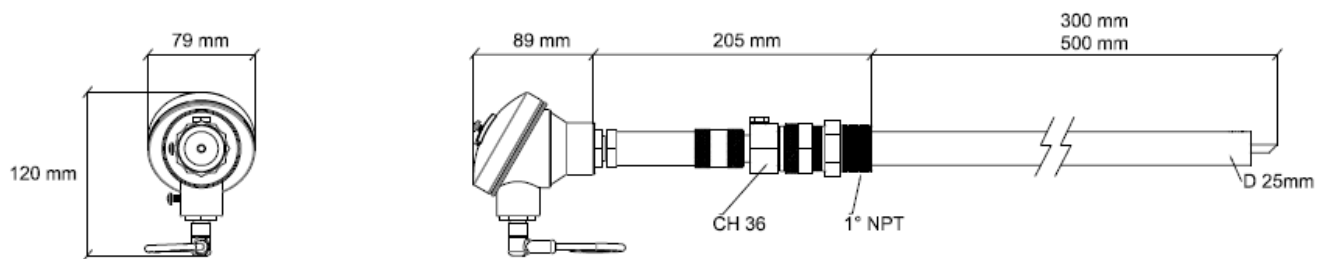
ZO2-3E-C100
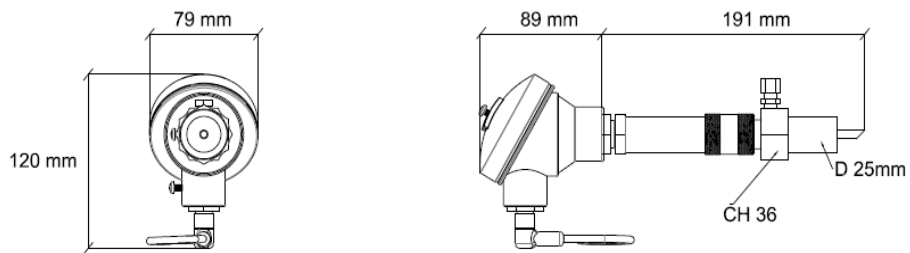
Remote case for ZO2-3E-300/500 e ZO2-3E-C100

15
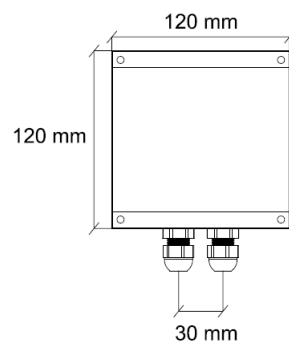
WARNING!

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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