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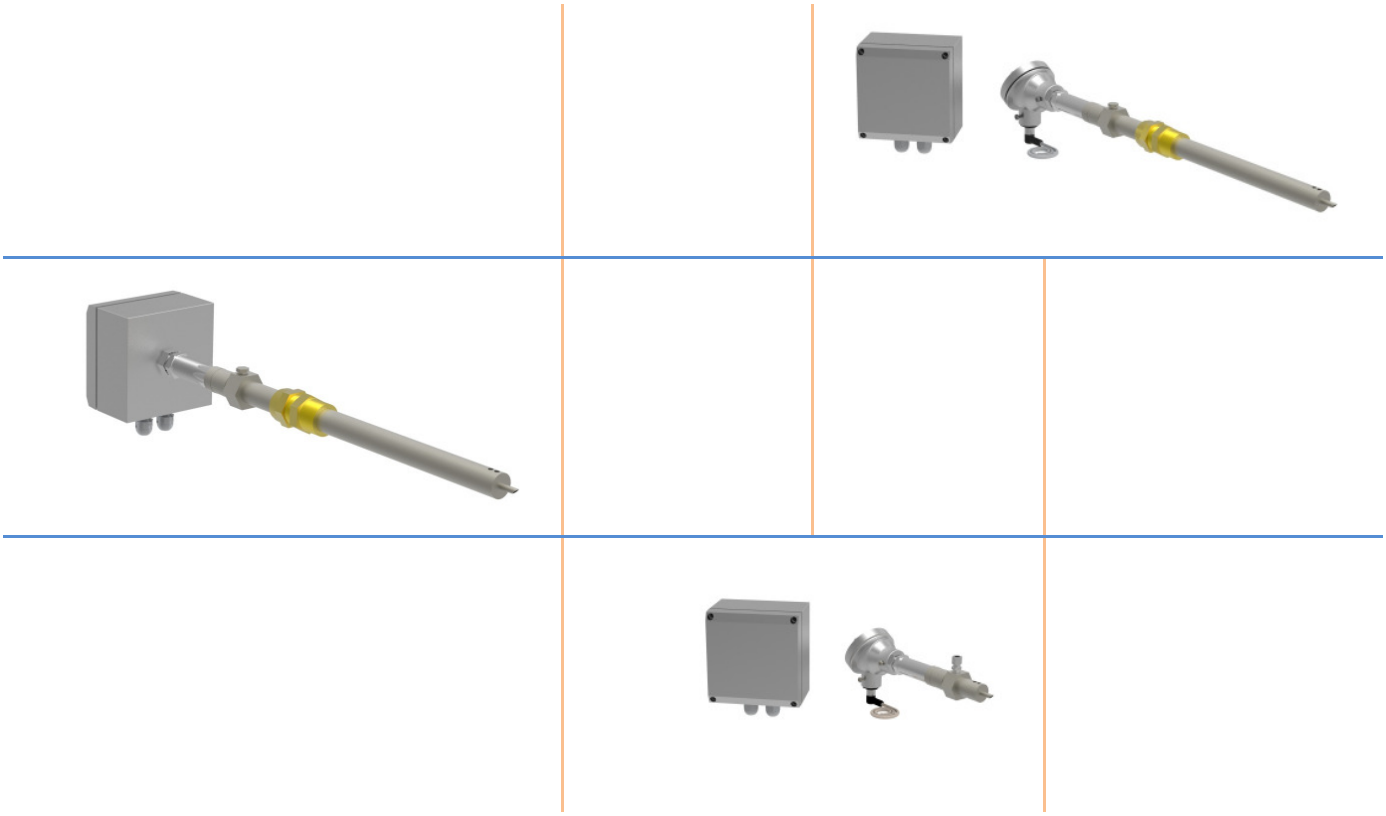
Zirconium Oxide Probe for oxygen measurement in flue gas Series ZO2-I/E

INSTRUCTION FOR USE
ISTR-MZO2-I-E-EC100-EN-01



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General Index

1. General description and operating principle

The ZO2-I/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-I/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, 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 3 versions:

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

NOTE

1: Within 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-I

Perform the installation as per the following steps:

- Install probe where the 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

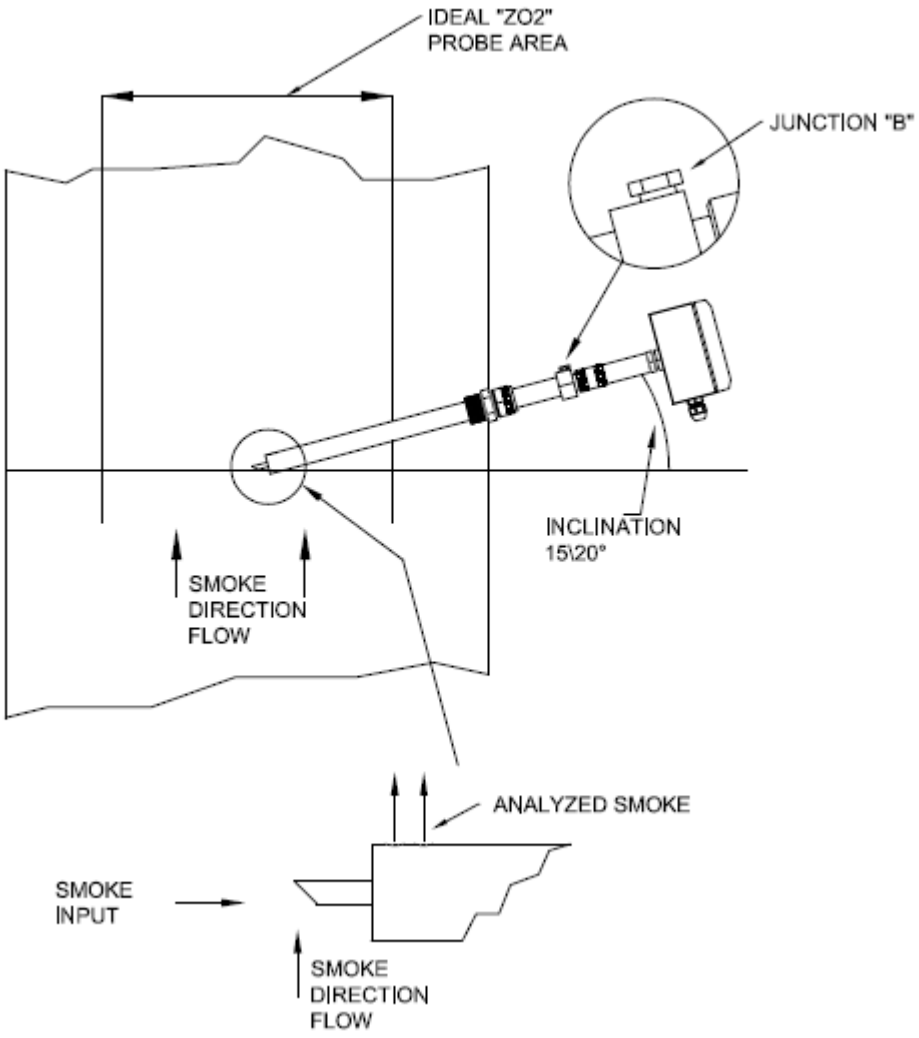


Figure 1

2.2 Installation and precautions ZO2-E

Perform the installation as per the following steps:

- Install probe where the 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.

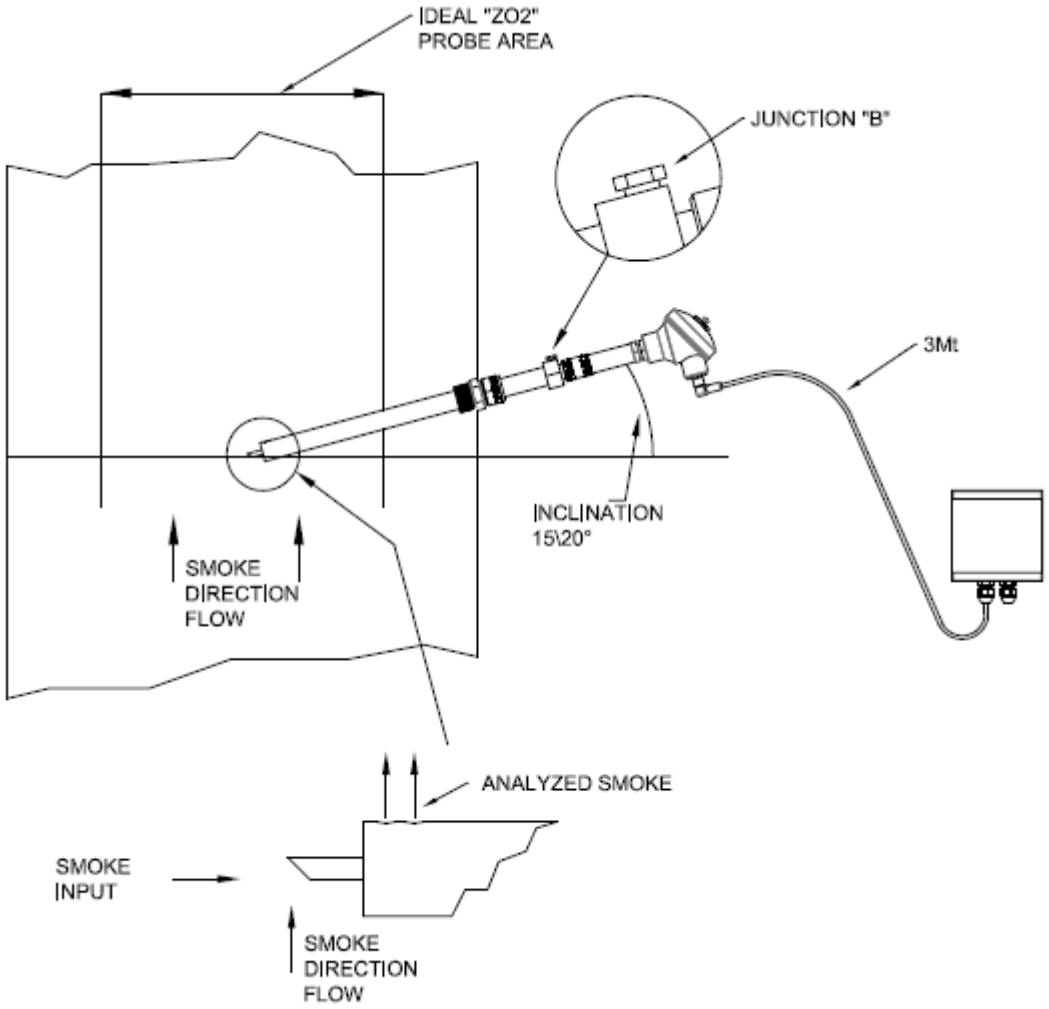


Figure 2

2.3 Installation and precautions ZO2-E-C100

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.

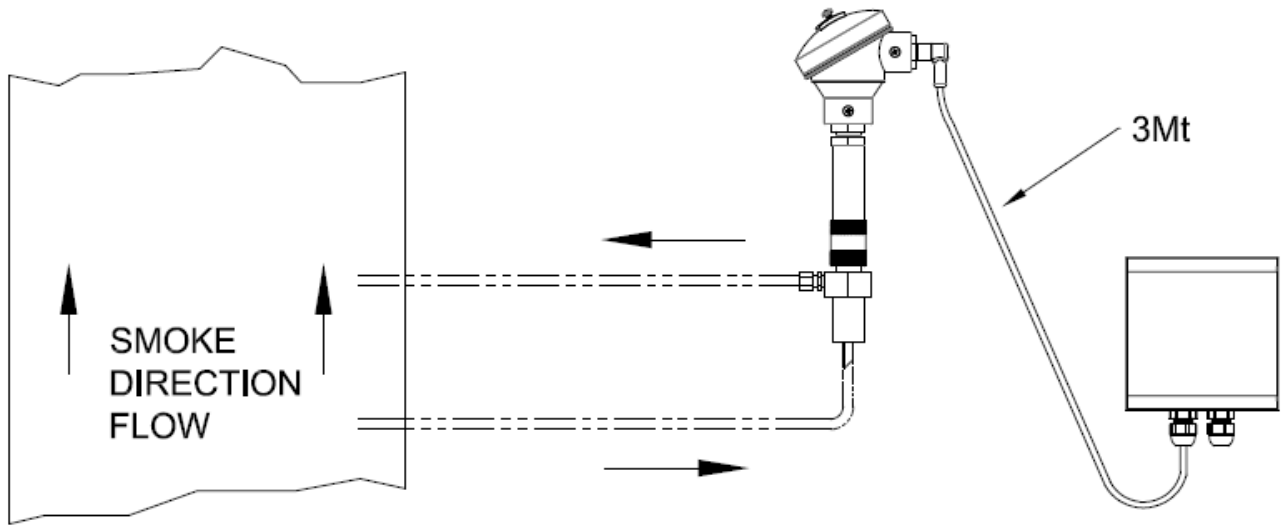


Figure 3

3. Power supply and electrical connections

The electronic of the probe ZO2-I/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.

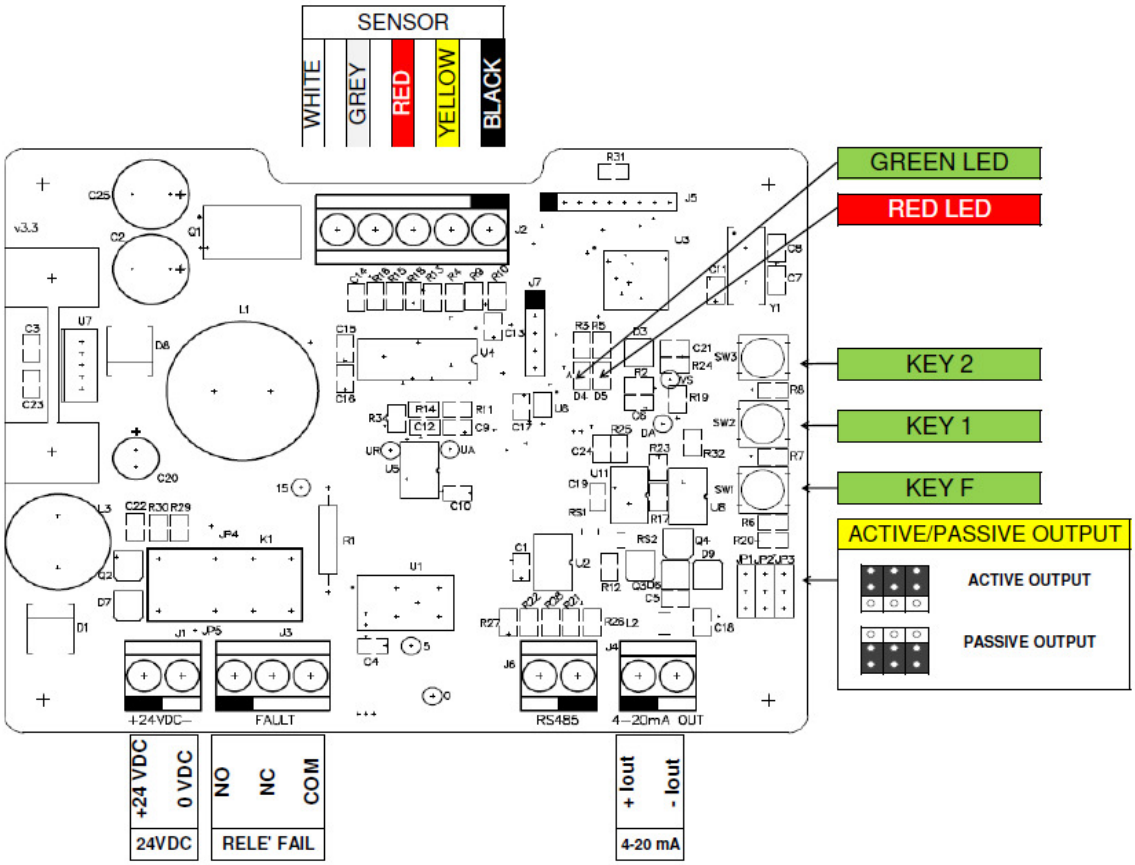


Figure 4

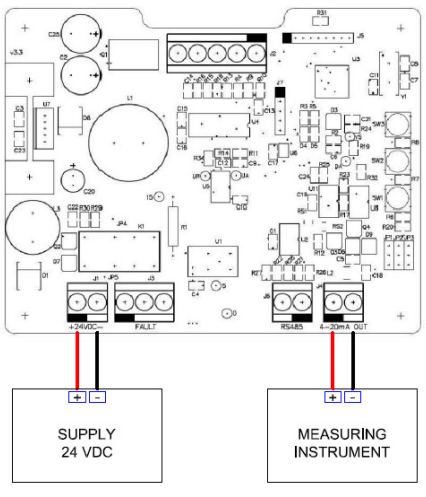
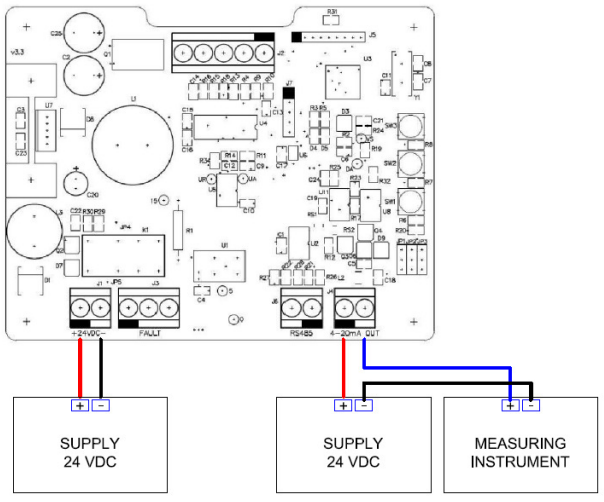
ACTIVE OUTPUT	PASSIVE OUTPUT
	

Figure 5

Attention:
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 operation of the card.
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 operation of the card.
With card in *configuration mode*, the led will flash briefly

The stable lighting of this led indicates a fault in the system.
The possible causes of failure are:

1. Sensor warming. Immediately after turning on the card, the red led is switched on to indicate the heating phase of the probe. During this stage, the reading of the measurement of oxygen is not significant

2. Supply voltage below the minimum limit

3. Sensor fault probe or sensor disconnected

At the same time the led lights up, the fault relay contacts switch by closing the NO contact and the output current is set to 2 mA.

5. Configuration mode

Pressing the "F" key for 2 seconds, access to *configuration mode.*
There are 3 possible configurations, indicated by the number of flashes of the red led (1, 2 or 3).

To switch between modes, release and then press the "F" key for 2 seconds.

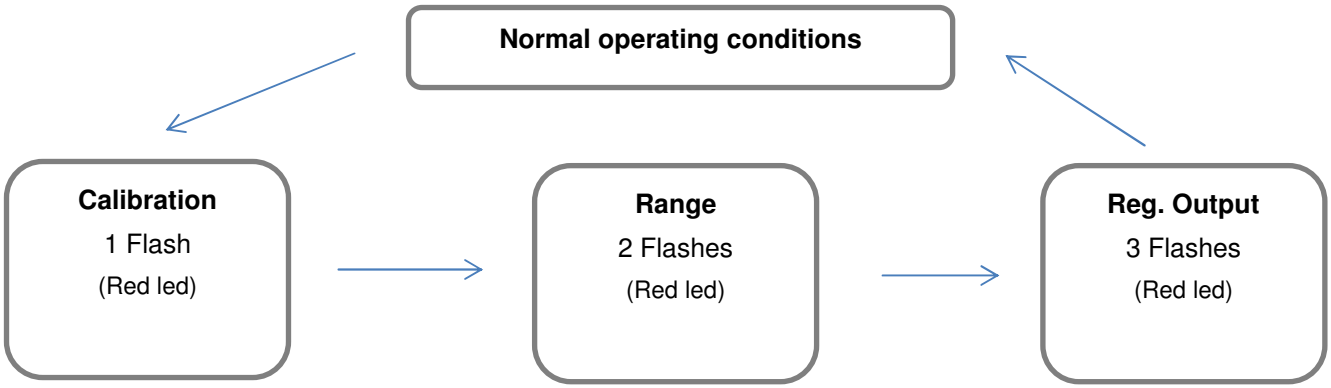


Figure 6

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 Two-point calibration procedure

The recommended interval calibration of zero and span is 12 months.
The procedure shall be carried out with the following sequence:

- Access into mode *Calibration* pushing the "F" key for 2 seconds and checking that the red led emits 1 short blink each second
- Connect the sensor to the air or to a cylinder with 20.9% of O2 in nitrogen
- Push key 1
- Connect the sensor to a cylinder with 1% concentration of O2 in nitrogen
- Push key 2

IMPORTANT: For accurate calibration, it is necessary to perform calibration procedure only after the achievement of a state of thermal equilibrium obtainable normally after about 15 minutes of working. Therefore, it is not recommended to perform the calibration procedure in the first minutes after ignition of system.

5.2 Selection output range 4-20mA procedure

It's possible to set two default output range:

- I_{out} = 4 - 20mA ⇔ O_2 = 0 – 20.9%
- I_{out} = 4 - 20mA ⇔ O_2 = 0 – 25.00%

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 Setting output current procedure

With this procedure, you can adjust the output current of about ±1mA in step of 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:

- sensor warming or failure to the heater
- supply voltage below the minimum limit
- sensor failure or sensor not connected

CONFIGURATION MODE (Ch. 5)

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

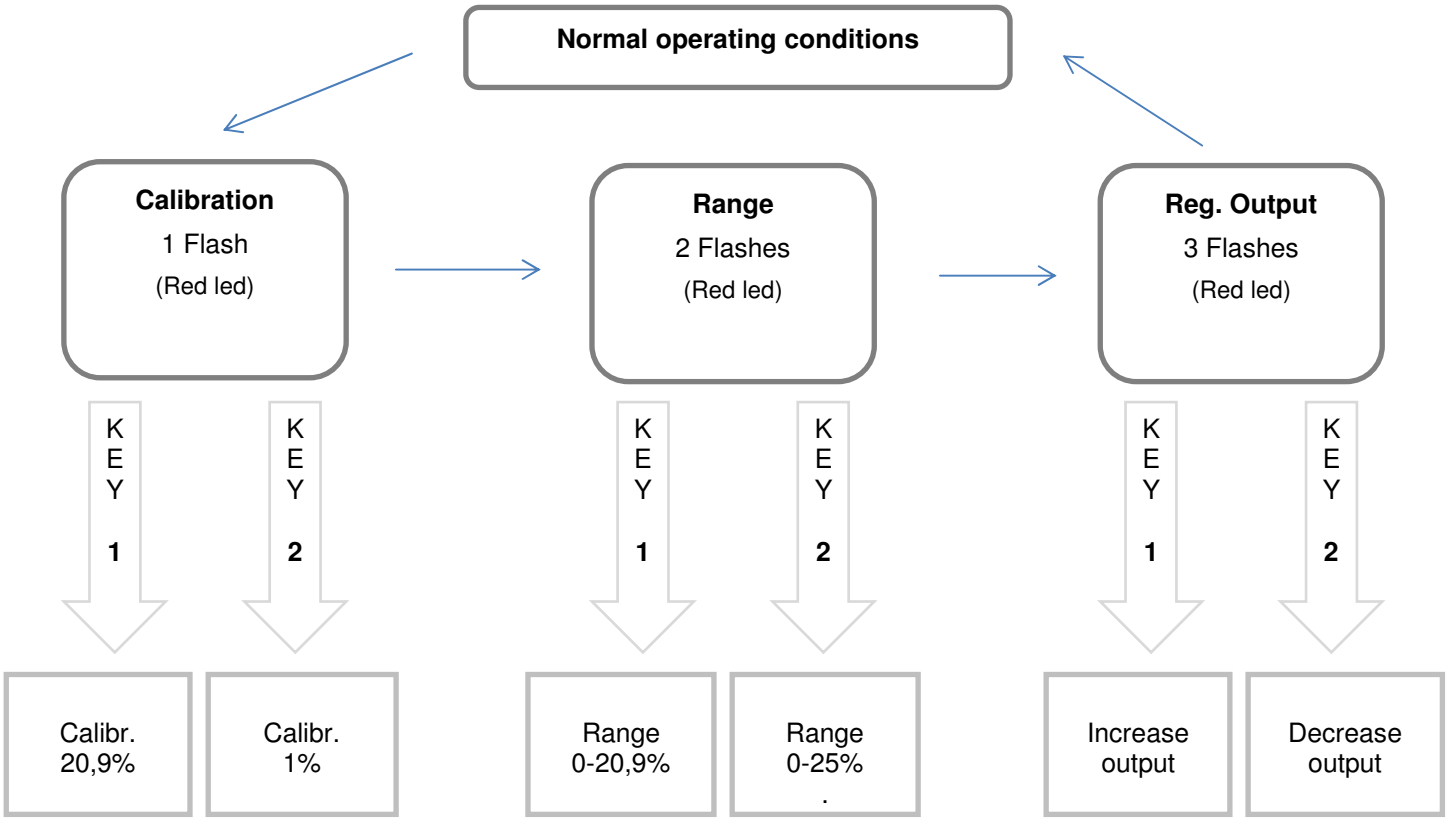


Figure 7

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 the probe and even obstruct the inlet and outlet holes.
To clean the probe, proceed as follows:

1. Connect a instruments air (dry and disoiled) to the “B”connection fitting (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 the 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. Procedure for setting the instruments of the OX series

The instruments Ascon Tecnologic of the OX series can acquire:

- mV signal not linearized of probe **ZO2** (old model)
- 4/20 mA signal linearized proportional to range **0-20,9%** of probe **ZO2-I/E**

Therefore, it is necessary configure adequately the instruments according to the probe.
For the complete procedure, 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:

- "**2000**" for input 4/20 mA linearized by probe **ZO2-I**
- Confirm with "**ENTER**"

Or:

- "**0000**" for input with mV not linearized by probe **ZO2**
- Confirm with "**ENTER**"

NOTE:

If you are using the probe ZO2-I/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

9. Technical data

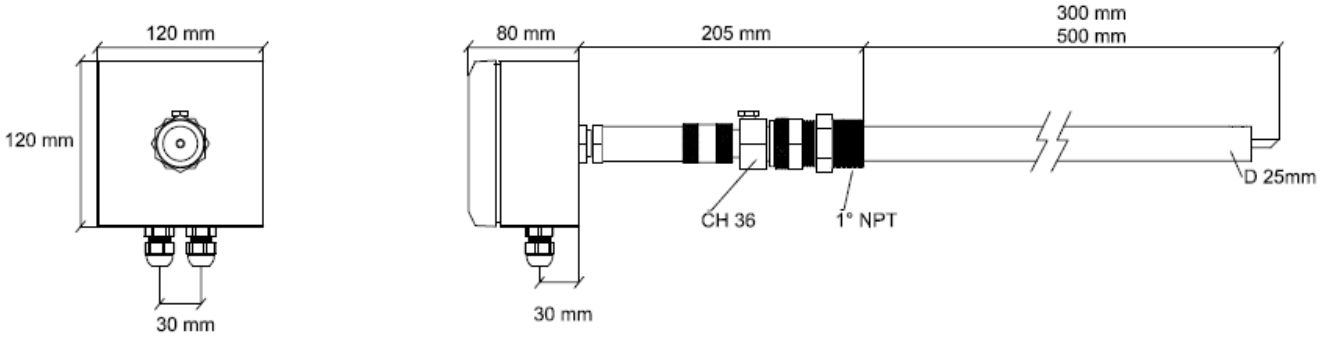
Measurement type		Direct and continuous oxygen content measurement in wet flue gas
Sensor		Heated zirconium oxide ZrO2
Max. Heater	600°C	
Probe material	AISI 316	Stainless Steel AISI 316
Process connection	1" NPT	With 1" NPT sliding nipple
Head protection	IP 66	
Ambient temperature	-20°C… + 55°C	
Weight	2-3 kg	
Supply	24VDC ±5%	
Max power absorption	1.2 A	
Output	4… 20mA	Active or passive output, non isolated
O2% Measuring range	0,3… 25%	
Accuracy	±2%	
Output range 4-20mA	0… 20.9% 0… 25%	Adjustable with keys
Response time	<5 sec	
Heating up time	15 minutes	
Calibration 2-points	1…20.9%	Procedure of calibration with keys
Calibration intervals	12 mounths	
Error indicator	Relay DPST NC+NO	Red led on card in case of: % of O2 <0.3% probe disconnettion probe anomaly heater anomaly supply voltage anomaly
Sensor heating up time	<15s	Automatic temperature control
Pluggable screw connectors		Supply 0…24V Output 4…20mA Fault signal contacts Sensor wiring (5 wires)
Operation interface		Red led, green led and 3 keys
Remote probe connection		With supplied cable (3 mt.)

10. How to order

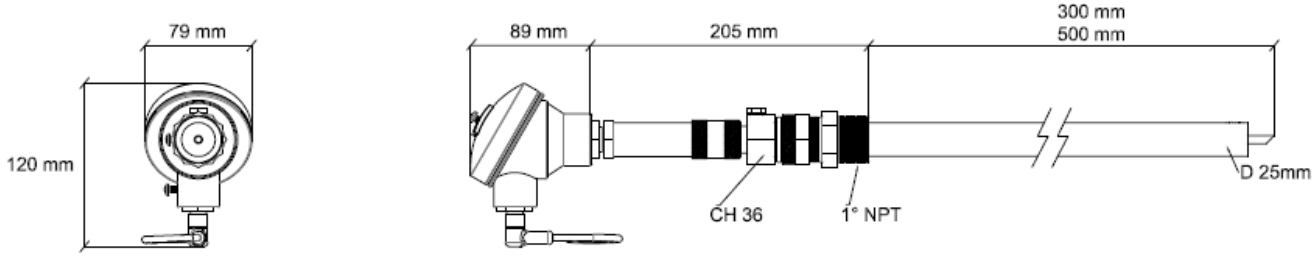
CODE	**DESCRIPTION** Probe for measurement of the oxygen content in wet flue gas
ZO2-I-300	In-situ, integrated electronics, L=300 mm
ZO2-I-500	In-situ, integrated electronics, L=500 mm
ZO2-E-300	In-situ, external electronics , L=300 mm
ZO2-E-500	In-situ, external electronics, L=500 mm
ZO2-E-C100	Extractive,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

11. Dimensioned drawings

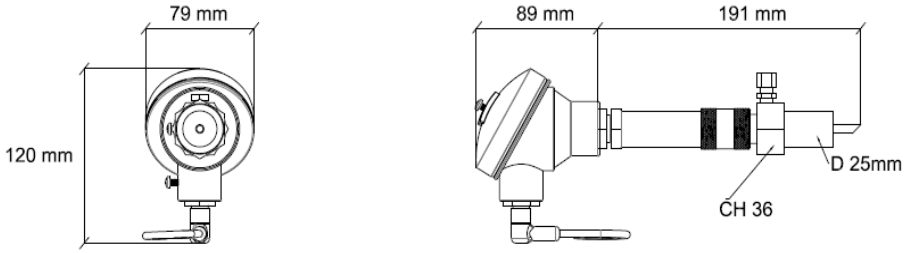
ZO2-I-300/500



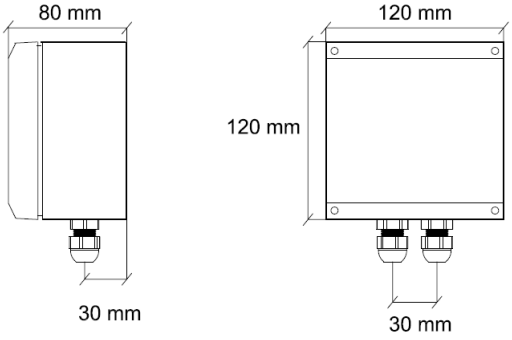
ZO2-E-300/500



ZO2-E-C100



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



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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