

BT. 13.04.03 ASC/E

Control and monitoring combustion systems with zirconium oxide probe **ascomb** series

- Zirconium oxide probe Z02 line
- Indicator, monitor and controller OXI, OXM, OXR line
- Complete systems line SI

Based on the measurement of oxygen content in the flue gases by means the zirconium oxide probe, the systems grant a continuous control of the combustion. The following advantages are available:

- **Energy saving**
- **Normatives compliance**
- Reduction of pollution
- Low cost
- Quick installation and low maintenance
- Financial benefits and avoidance of excessive climate levy.



Energy saving through the control of combustion

Starting from combustion theory...

The characteristics curves of combustion are represented in fig. 1. From this can be seen the relationship between the higher efficiency values and the minimum pollution. This area is called optimise zone of combustion. In this area is the correct fuel and air ratio. This situation grants a limited air excess avoiding any dangerous and expensive oxygen defect situation. Based on the fact the boiler load requires different oxygen quantities, the fuel air ratio changes as shown in fig. 2.

The oxygen content on the flue gases in the chimney, represents the significant parameter of the combustion process.

The continuous measurement of this value, enables a manual or automatic intervention on the burner setting in order to reset to the optimum air/fuel ratio.

Fig. 2 - %O₂ correction curve as function of boiler load

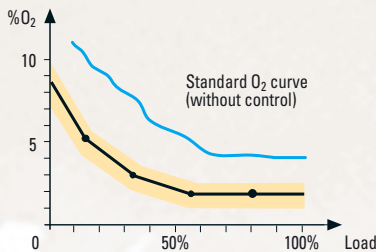


Fig. 1 - Characteristics curves of combustion

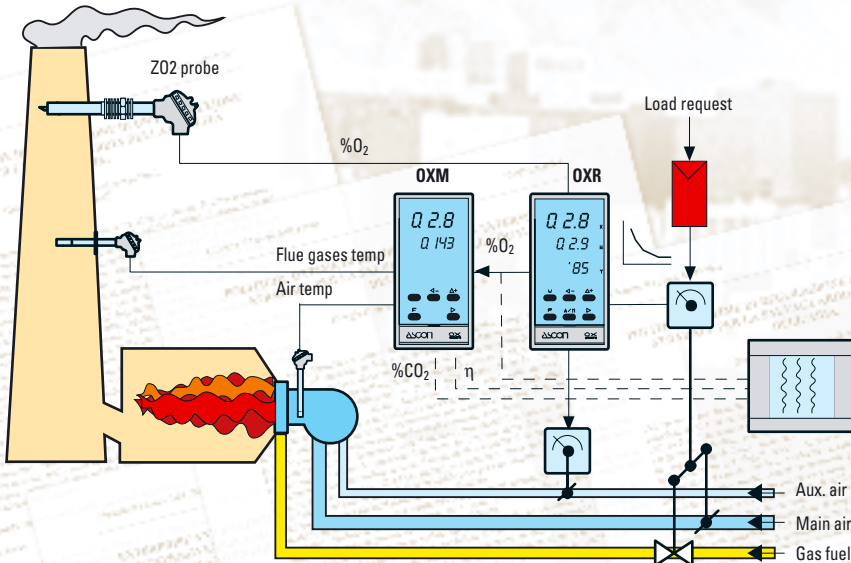
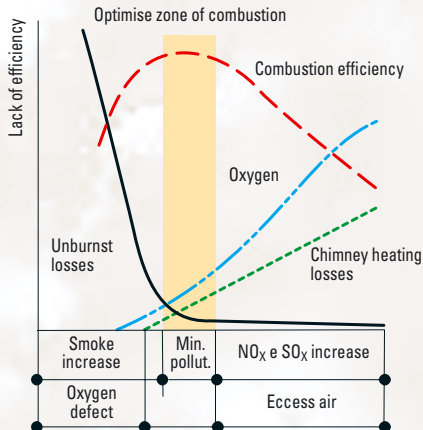


Fig. 3 - Example of typical combustion control system

...to ASCOMB systems.

The ASCOMB systems (see fig. 3) perform the combustion control using a zirconium oxide probe directly inserted in the stack.

This probe ensure a continuous, swift and accurate read-out of the oxygen content in the flue gases.

Thanks to a wide range of components it is possible obtain different system for indication calculation and control purposes.

Monitoring for normatives compliance

Over the years various standard on regulation for civil and industrial installation have been applied. The oxygen content on the flue gases has always been an important reference parameter. This is exactly what ASCOMB systems measure for combustion control.

Starting from this point and integrating it with other parameters like flue gas temperature and/or carbon monoxide (see BT. 13.05.03 ZCI) it is possible perform monitoring system in the majority of the cases.

ASCOMB systems where and how

Where

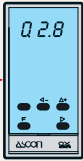
The application possibilities of ASCOMB systems are many both in civil and industrial sectors.

Civil: schools, prisons, hospitals, shopping centres, condominiums, sky-scrappers etc.

Industrial: Power station and boilers for steam production.

How

ASCOMB system building-up: starting from the Z02 probe and the related power supply unit model AZO-AI06 combines the most suitable electronics.



OXI
Indicator oxygen percentage

Boiler power
Low

Burner
2 stage/modulating



OXM
Monitor for calculation of the main combustion variables

Medium/high 2 stage/modulating



OXR
Control of oxygen content in the flue gases with respect to the boiler load

Medium/high Modulating

The basic system can be also integrated with other components like air/flue gases temperature (mandatory for OXM), recording and/or data acquisition through a SCADA, carbon monoxide measurement and so on.

SIS line ASCOMB systems

They are already assembled turn-keys solutions. It is possible to choose the solution in a range of standard systems or create a custom one. The advantages are:

- one ordering code
- simpler installation
- quicker start-up
- easier and faster after-sales assistance.

Some examples of SIS line

	Cabinet	Z02 probe	AZOAI06 power supply	OXI	OXM	OXR	fgT probe	airT probe	Recorder	CO analyzer
Indication										
Oxygen	1	1	1	1						
Oxygen + recording	1	1	1	1					1	
Oxygen + flue gases temp (fgT)	1	1	1	1			1			
Oxygen + fgT + recording	1	1	1	1			1		1	
Monitoring										
Oxygen + fgT + recording	1	1	1		1		1	1	1	
Oxygen + fgT + CO + recording	1	1	1		1		1	1	1	1
Control										
O ₂ Control	1	1	1			1	1	1		
O ₂ Control + fgT + recording		1	1	1			1	1	1	1
O ₂ Control + fgT + recording	1	1	1		1	1	1	1	1	



Z02-100-300-500-700-C100 and AZO-AL06

Z02 zirconium oxide probe and AZO-AL06 power supply unit

Zirconium oxide probe for continuous, swift and accurate measurement of the oxygen content in the flue gases up to 600 °C.

A free air reference circuit is not required because one part of the sensor is in contact with the ambient air present in the connection head.

An internal heater maintains the sensor at a constant temperature of 600 °C. The power is provided by the AZO-AL06 power supply unit which grants:

- protection from the high level of absorption, typical during the initial heating phase

- voltage correction required by the probe directly on its head connection terminals, integrated “sense” system
- switching technology for a minimum heating dissipation inside the panel.

Z02 for “in-situ” measurement

Z02-C100 for extractive measurement method

Probe models: Z02 for “in-situ” measurement, length: 100, 300, 500, 700 mm (other lengths on demand)
Z02-C100 for extractive measurement method, length 100 mm

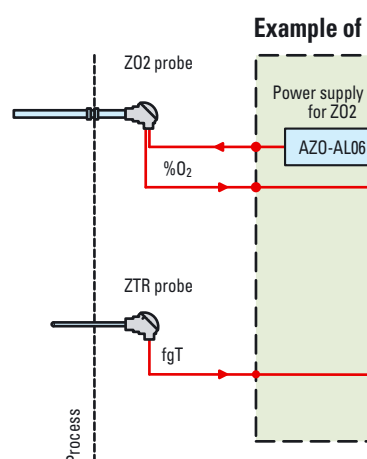
Sensor:	electrically heated Zirconium oxide by means external AZO-AL06 power supply
Flue gas temperature :	up to 600 °C
Output:	logarithmic mV signal (4/20mA by means OX line instruments)
Range:	0.3..20.9 %O ₂
Accuracy:	3% (between 0.5... 10% O ₂)
Warm-up time:	minimum 15 minutes, standard 45 minutes
Construction:	Sheath: AISI316, connection head: painted alluminium DIN B, protection: IP67
Process connection:	compression nipple 1” NPT M
Ambient temperature :	-20... +70 °C
Calibration interval:	1 year (with Methan fuel and flue gases temperature < 350 °C)
Mounting position:	Adjustable, at right angle to the gases flow direction
Connection:	2 + 2 wires 1.5 mm ² min. for the heater 2 shielded and twisted wires 0.5 mm ² for sensor output
Weight:	2 kg max.

Model:	AZO-AL06
Power supply:	100...240 Vac ±10%; 47/63 Hz
Efficiency:	75% (typical value at max. load)
Output Voltage / Current:	12 Vdc/20 A max.
Ambient temperature:	0... 50°C
Mounting:	with fixing clamp
Connection:	M3 screwed terminals
EMC:	CE compliant



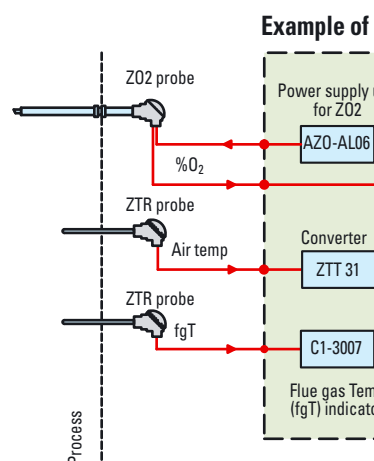
OXI

Oxygen indicator in 48x96 DIN size with acquisition and linearisation capability of the logarithmic signal coming from the Z02 probe. As alternative a 4/20mA linearized signal (range 0... 20.9%) is available. In combination with the Z02 probe and its AZO power supply it establishes the basic system to monitor the combustion by means the oxygen measurement in the flue gases. More complex system can be obtained adding flue gases temp measurement and data recording or data acquisition through a SCADA.



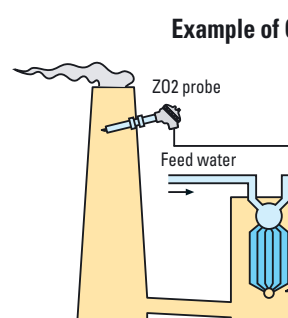
OXM

Oxygen monitor in 48x96 DIN size with acquisition and linearisation capability of the logarithmic signal coming from the Z02 probe. As alternative a 4/20mA linearized signal (range 0... 20.9%) is available. In combination with the Z02 probe, its AZO power supply, air and flue gases temp. probes, it establishes a real combustion monitor. The following variables can be calculated: η (efficiency), λ (air excess) and $\%CO_2$ (carbon dioxide). More complex system can be obtained adding recorder, the OXR controller and, when requested by the normatives, the ZCO carbon monoxide analyzer (see BT.13.02.03 ZCI).

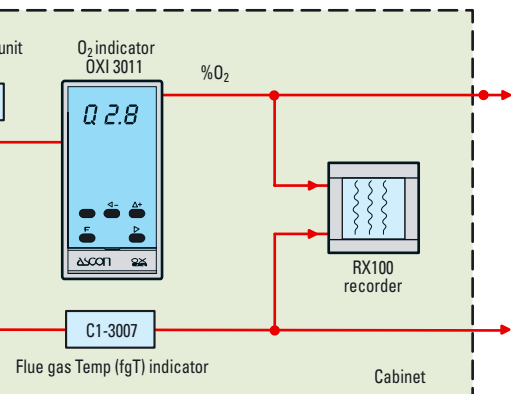


OXR

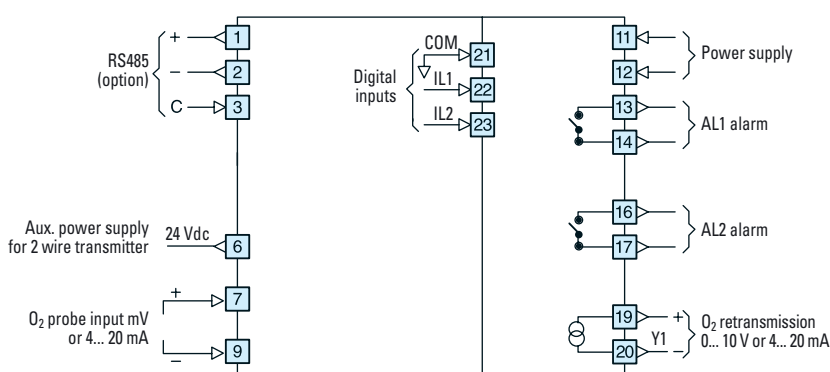
Oxygen "Trim" controller in 48x96 DIN size with acquisition and linearisation capability of the logarithmic signal coming from the Z02 probe. As alternative a 4/20mA linearized signal (range 0... 20.9%) is available. Its target is optimization of the air/fuel ratio acting on the adjustment of the air quantity requested by the master controller (load). The optimization is related to the oxygen content in the flue gases. This enable to save fuel consumption. It is possible to select, up to 2 curves of 4 segments (depending on fuel characteristics) to perform a corrective action during the load changing.



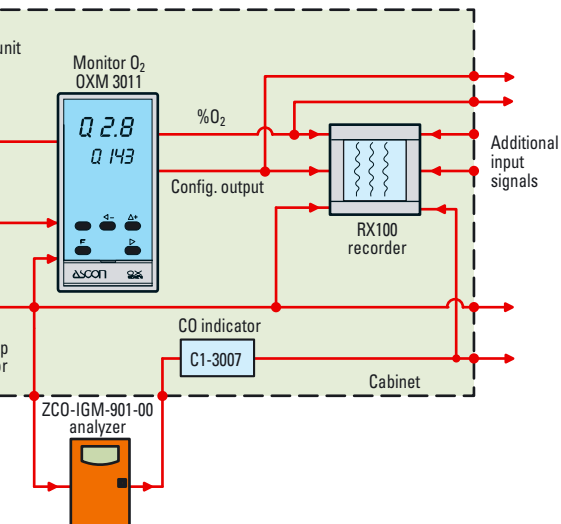
OXI indicator application



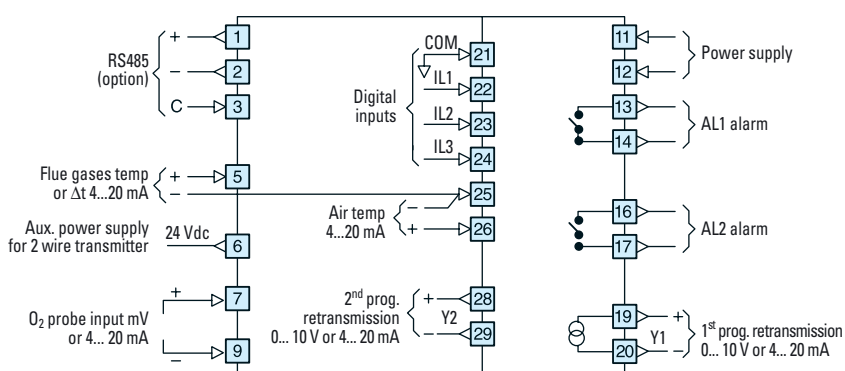
OXI wiring



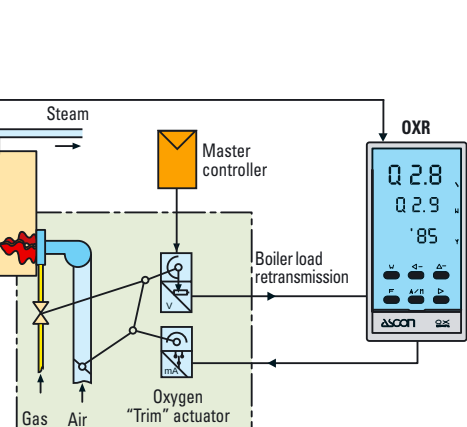
OXM monitor application



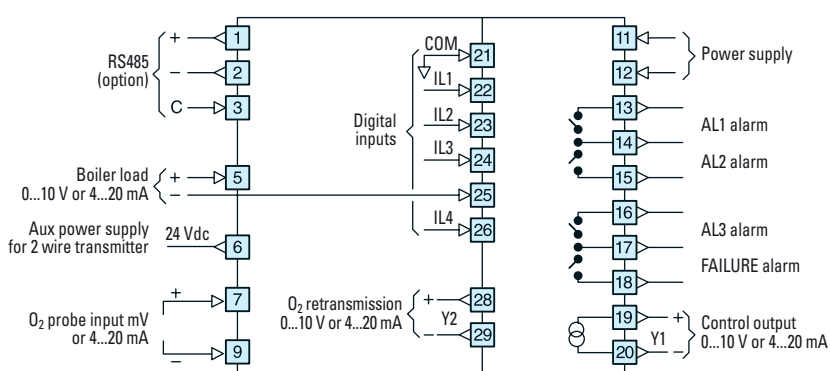
OXM wiring



OXR controller application

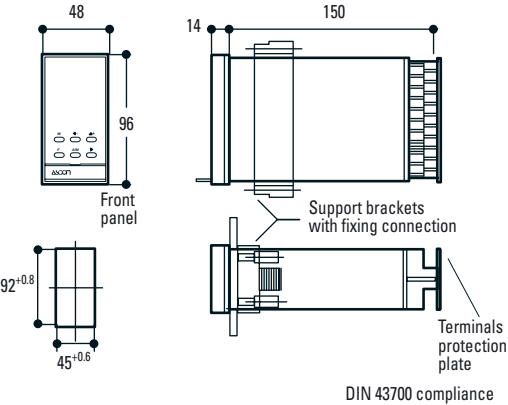


OXR wiring

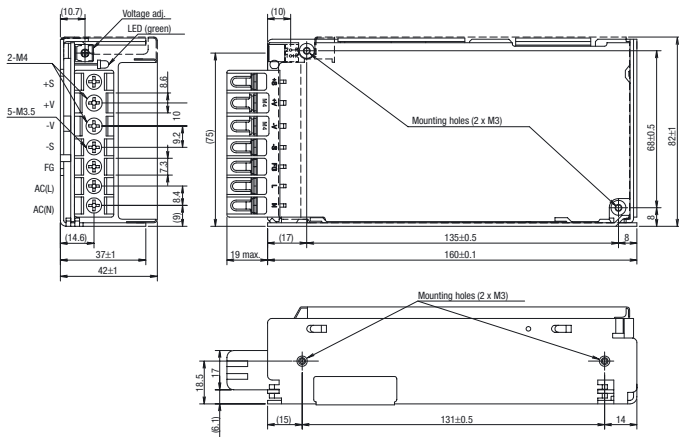


Overall dimensions and wiring

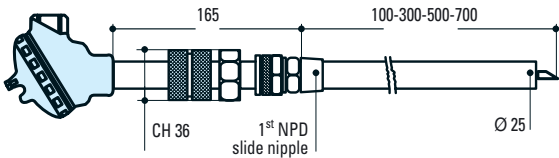
OXI-OXM-OXR instruments



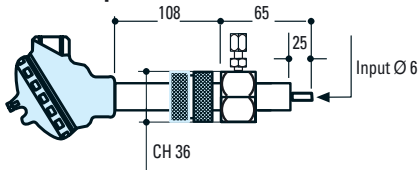
AZO-AL06 auxiliary power supply



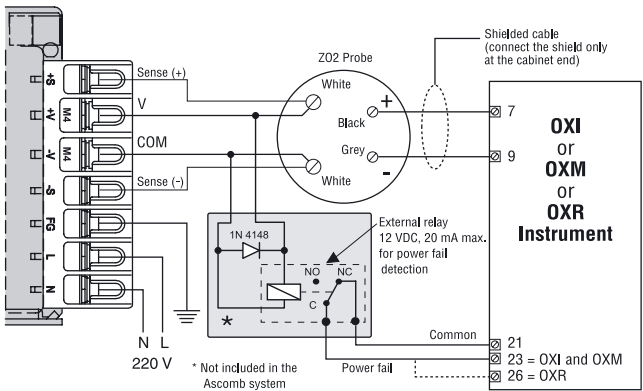
Z02 probe



Z02-C100 probe



Wiring



Technical data	OXI	OXM	OXR
Main analog input	mV from the Z02 probe (0.2 % ±1 digit) or 4... 20 mA linearised with range 0.0... 20.9%		
Auxiliary analog inputs		2 x 4... 20 mA from air and flue gas temperature	4... 20 mA boiler load
Main analog output	4... 20 mA/0... 10 V for O ₂ %	4... 20 mA/0... 10 V settable for: O ₂ %, fgT, Air temp, CO ₂ %, η, λ	4... 20 mA/0... 10 V control output
Auxiliary analog output			4... 20 mA/0... 10 V for O ₂ %
Digital inputs and related functions:	2 digital inputs: Hold and Fail	3 digital inputs: Hold, Fail, fuel switching	4 config. digital outputs: Hold, Fail, fuel switching, SP mem., Auto/man
Alarm output:	2 NO relay, 250 Vac/5 A configurable		3 NO relay, 250 Vac/5 A config. 1 NO relay, 250 Vac/5 A Failure
Serial comm.s (option):	RS485 (2 wire) Modbus, Jbus, BaudRate 9600 max.		
Power supply:	100... 240 Vac, 50/60 Hz or 16... 28 Vac, 50/60Hz and 20...30 Vdc		
Power consumption:	4 VA		
Ambient temperature:	0... 50 °C		
Ambient Humidity:	35... 85 % RH		
EMC:	IEC801-2, 801-3, 801-4: Level 4		
Mounting:	Front panel		
Front panel protection:	IP 54 Standard (IP65 with optional kit)		
Dimensions:	48 x 96 x 150 mm		

Ordering code

Oxygen indicator 48x96 DIN	OXI-	A	B	C	D	/999
Combustion monitor 48x96 DIN	OXM-					
Oxygen "TRIM" controller 48x96 DIN	OXR-					
Power supply						
Serial communications						
Y1 output						
Y2 output						

Power Supply	I	M	R	A
230 Vac	✓	✓	✓	3
24 Vac/Vdc	✓	✓	✓	5
Serial Communications				B
Not provided	✓	✓	✓	0
Rs485 Modbus	✓	✓	✓	3
Output Y1				C
4...20 mA	✓	✓	✓	1
0...10 V	✓	✓	✓	2
Output Y2				D
N.P.	✓	✓	✓	0
4... 20 mA		✓	✓	1
0... 10 V		✓	✓	2
Oxigen probe	Z02-	☐	☐	☐
Lunghezza 100		1	0	0
Lunghezza 300		3	0	0
Lunghezza 500		5	0	0
Lunghezza 700		7	0	0
Power supply unit				
AZO-AL05				