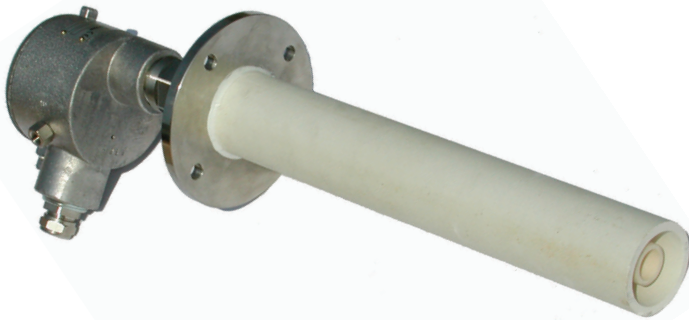




*Gas Analysers & Integrated Systems  
for Process Gas Analysis*

## Zirconia In Situ O<sub>2</sub> Analyser

# 6801



For process temperatures  
from 600 °C to 1200 °C  
(special applications up to 1500 °C)

### **Main Applications**

- Combustion efficiency control in every type of ovens and furnaces
- Civil, industrial and hospital waste incinerators
- Cremators
- Flue gas
- Pre heating furnaces
- Soaking pits
- Annealing furnaces
- Glass melters
- In general, control of residual Oxygen in every combustion process (within the specified temperature limits) operating with either positive or negative pressure.

### **Features**

- Real in situ measurement with the sensor placed on the tip of the probe
- Direct insertion into the chimney
- Available version for hazardous area Zone 1
- Selected materials to resist the attack of corrosive substances that may develop in the process
- Extremely fast response time and excellent stability
- Possibility to perform periodical calibration directly in situ, without dismantle the probe from process
- Low installation and maintenance costs
- Sensor, TC and protection easily replaceable in field

# In Situ Analyser 6801

## General Information

The high temperature Zirconia in situ Oxygen analyser model 6801 is an instrument designed for the analysis of combustion gases. It measures the residual concentration of Oxygen in the fumes produced by combustion processes, that is the quantity of residual Oxygen after the complete oxidation of the fuel.

It can perfectly operate for long periods, it's reliable, accurate and has a high speed of response to process changes.

## Construction

One of the 6801 main feature is the extreme simplicity and functionality of the very few structure components, result of a long applicative experience.

The construction materials have been carefully selected to guarantee resistance at high temperatures and to the attack of acid and aggressive substances and to withstand with cycling oxidizing and reducing conditions, thus allowing its use in combustion processes involving the widest variety of products, from gas to fuel oil, to coal or in incinerators and cremators.

## Installation tube

The probe can be directly installed into the process chamber, but in combustion chambers with great amount of dust or with particular combustion products, it's suggested the use of the ceramic installation tube (flanged) in order to protect the probe and make the installation easier.

The protective tubes guarantee a longer sensor life and allow a more accurate measurement eliminating external particulates which may attack the sensor and avoiding that sensor contacts false air coming from the bricks of the duct wall in case of plants working in negative pressure condition. As a correct installation is fundamental for this kind of analysers, custom solutions are available.

## Very easy maintenance

All components are extremely rugged easily replaceable. Sensor assembly, thermocouple and alumina protective tube can be easily disconnected for a low cost maintenance or replacement.

## A really in situ measure

Many self-defined in situ analysers really use a semi-extractive system in which the gas is sucked from the duct (typically by an ejector) and sent to the probe head where the sensor is located. In case of processes with a huge load of dusts and particulate (very frequent condition), this system is critical as there is high risk to plug the inner circuit with consequent loss of the measure.

At the contrary, the model 6801 is really in situ analyser as the sensor is on the tip of the instrument, protected by a filter, and contacts the process gas only by diffusion. No sucking means no risk of plugging. In this way the measure is extremely reliable and maintenance costs are lowered.

## Probe head

The probe head consists in a "junction box" to the signal terminals coming from the electrolytic cell and from the thermocouple. The electrical connections can be made with normal conductors without particular limits of length of sensor and standard thermocouple type B. For other types of thermocouples (available as option) it is absolutely necessary to use suitable compensated cables.

Take particular care of temperature at probe head, which cannot exceed 130°C; otherwise it is necessary to cool either the probe head or the flange assembly.

## ATEX

The probe is also available ATEX version, suitable to be installed in hazardous area classified Zone 1 in accordance to European Directive 94/9/EC (ATEX)

# Specifications...

## ...Performance

### Accuracy:

± 5% of reading or 0.05% O<sub>2</sub> (whichever is worst) including linearity.

5% of reading for ppm ranges.

### Zero drift:

± 2 mV after 12 months in normal combustion conditions.

### Resolution:

0.01 % O<sub>2</sub>

### Repeatability:

± 1% of reading (short term).

### Response Time:

less than 1 second to reach 95% of a step variation (with 1 lit./min. flow rate).

## ...Physical

### Probe head protection:

IP 65 (water and dust tight)

### Weight::

about 1,5 ÷ 2.5 Kg (depending on probe length ). Installation tube not included.

### Wiring connections:

N°2 cable glands for cables with diameter up to 10 mm and inner terminal boards.

### Pneumatic connections:

Reference air and calibration gas inlets 1/8" NPT-F

## ...Operative

### Sensor output:

E.M.F. function of O<sub>2</sub> concentration.

### TC output:

E.M.F. function of temperature

### M701 control unit output:

menu selectable output range maintaining on the display a **resolution of 0.1 ppm** and a visualization up to 25% O<sub>2</sub>, with isolated linear 4-20 mA output.

### Standard Thermocouple:

type B (Pt 6 Rh - Pt 30 Rh).

Others in alternative (types S - K - R)

### Ambient Requirements:

Relative Humidity: 90% maximum

Probe temperature: 600 ÷ 1200°C (special applications up to 1500°C)

Probe head temperature: max. 130°C

### Calibration Gas:

Zero (high end of the scale): compressed air (dry and clean)

Span (low end of the scale): mixture with known concentration of O<sub>2</sub> in N<sub>2</sub> (at 1500 ÷ 2000 cc/min. flow rate)

# Measuring Principle

The measuring principle on which the analysis is based is linked to the use of Zirconium oxide which, at high temperatures, can behave like a solid state electrolyte, developing an electromotive force on two electrodes placed in contact with different O<sub>2</sub> concentrations (partial pressures), proportional to the temperature in Kelvin degrees (°K) and the logarithm of the ratio between the two pressures PO<sub>2</sub>' and PO<sub>2</sub>" in accordance with Nernst's well-know ratio:

$$E = RT/nF(\text{Lg } PO_2' / PO_2'')$$

where: R = Perfect gas constant (8,31 Joule/degree bulk)  
F = Faraday's constant  
T = Absolute temperature in °Kelvin  
n = 4

# M701 Control Unit



## Description

The M701 model is a smart instrument which elaborates the signals coming from the Zirconia probes (both high and low temperature type), providing for the computing and displaying of the Oxygen value in % or parts per million following the Nernst's law.

The instrument has been designed to re-transmit the 4-20 mA signal according to the set range and may be connected to a PC or an external printer in order to have a chronological tabulation of both measures and alarms.

When probe is process heated, O<sub>2</sub> % is transmitted above 600°C.

In case of malfunction, the instrument will automatically provide for the supervision of the probe. Optional RS232C output can directly drive a printer with selectable timing and baud rate. Isolated current output is standard.

## Mounting

The unit can be housed in a compact Noryl DIN case for panel mounting (standard), in a IP 65 case with clear front door for wall mounting or in explosion proof housing for mounting in classified area.

## Single or dual alarm

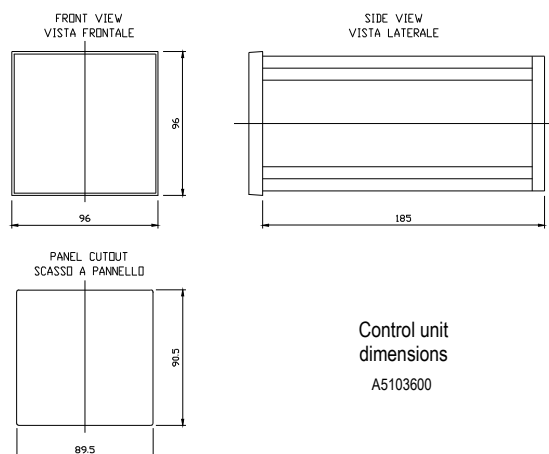
A single alarm (high or low) or dual alarms (1 high and 1 low, 2 high or 2 low) can be provided as option. Each alarm consists of: 1) a keyboard configurable alarm threshold; 2) a LED, which is lit when an alarm is detected; 3) a relay contact that can be used to actuate an external signal or to start a shutdown process device.

## Display

It provides a continuous readout indication of the requested variable in engineering units (e.g. %), of alarms set point and alarms condition.

## Control unit main elements

- 4 digits display for %O<sub>2</sub> or other variables visualization.
- Two Led for alarms status indication.
- One led for instrument programming status indication.
- Two increase—decrease push buttons.
- One F key for display selection.
- One A key to enter into programming.



# Technical Specifications

## Inputs

Input signals: 1 for self-heated probe, 2 for process-heated probe; 3 for process-heated probe and auxiliary external thermocouple (same type).

Scanning time: 0,6 seconds

Conversion type: double ramp

Resolution: 1/20000

Response time: 1 second typical

Input's impedance: 100 Mohm typical

Isolation between channels: none

## Alarms

Contact rating: N.O./N.C. 1 A @ 250 Vac (define the alarm contact condition -soldering type- at order)

Set: programmable on 100% of range

Relay status: normally triggered / not triggered

Number of alarms: 2 on concentration, 1 on temperature t1, 1 on temperature t2

Hysteresis: 5 / 1 / .5 / .1% of range

Delay: 10 / 5 / 1 / .1 seconds

Alarm scanning: ON/OFF programmable

Threshold: high or low to be selected at order; field adjustable by soldering jumpers.

## Serial interface

Standard: RS 232 C

Check lines: CTS

Speed: 9600, 4800, 2400, 1200, 600, 300 baud/sec.

Parity: even, odd, none

Isolation: 1500 V

## Power Supply:

220/110 Vac; 50/60 Hz; 5 VA

## Diagnostics

TC out of order: err1 message on display

Broken CJ: err2 message on display

Anomalous conditions: OFL message on display

## Analogical output

Output: 4-20 mA isolated proportional to 100% of range on maximum load of 500 Ω

Total Range (over range): 3.6 - 24 mA

Resolution: 1/3800

Isolation: 1500 V

Uploading time: 1 second

## Temperature ranges

TC type K, R, S, B (keyboard selectable)

°C ranges

Tc K from 0 to 1370 °C

Tc R from 0 to 1700 °C

Tc S from 0 to 1760 °C

Tc B from 200 to 1820 °C

°F ranges

Tc K from 32 to 2498 °F

Tc R from 32 to 3092 °F

Tc S from 32 to 3200 °F

Tc R from 392 to 3300 °F

## Printing messages

Periodical printing: programmable in hours, min.

Alarm printing: automatic printing

Printing message: year, month, day, hours, minutes, % O<sub>2</sub>, temperature, alarm 1 status, alarm 2 status

## Probe resistance

Range: from 0 to 99.9 Kohm

Reading: from keyboard in off-line conditions

## Ambient requirements

Working temperature: 0 ÷ +50 °C

Storage temperature: -10 ÷ +75 °C

Humidity: 10 ÷ 90% without condense

## Physical specification

Dimensions: 96 x 96 x 185 mm.

Weight: about 0,5 Kg.

Mounting: panel cut out

## Clock

Clock type: Gregorian

Back-up: by means of lithium battery

Battery life: 1 year in case of power supply absence.

Accuracy: 1 second/month

## Explosion-proof housing

Protection mode:

II 2 GD EEx d IIC T6 IP65 T85°C T<sub>amb</sub> -20 ÷ +60°C

for hazardous area ZONE 1 / ZONE 21



## Installation:

Wall or panel

Adjustable without opening the housing

3 Gk 3/4" holes



## IP65 housing

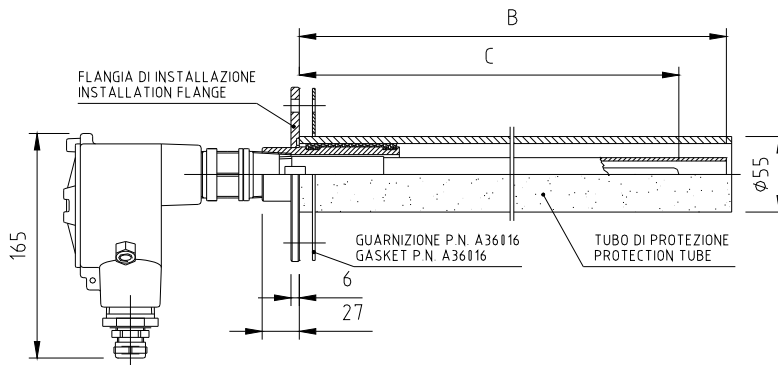
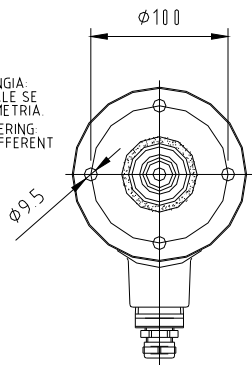
Installation:

Wall or panel

Clear front door

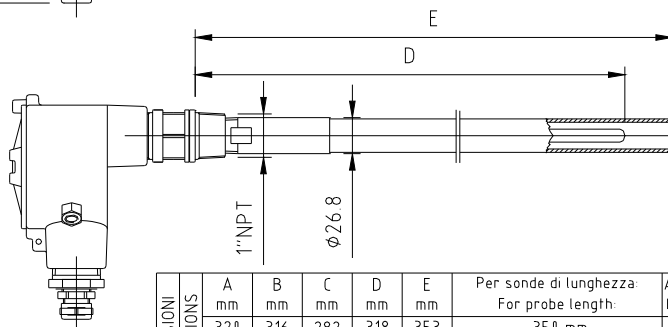
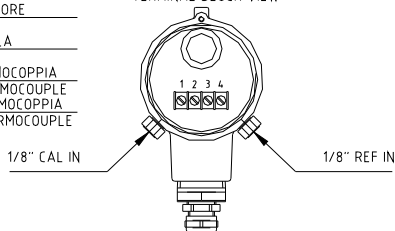
# Dimensional Specifications

NOTA PER ORDINE FLANGIA-  
ORDINARE COME SPECIALE SE  
CON DIFFERENTE FOROMETRIA  
NOTE FOR FLANGE ORDERING  
ORDER HOW SPEC. IF DIFFERENT  
HOLES POSITIONING.



- ① POSITIVO SENSORE  
POSITIVE CELL
- ② NEGATIVO CELL  
NEGATIVE CELL
- ③ POSITIVO TERMOCOPIA  
POSITIVE THERMOCOUPLE
- ④ NEGATIVO TERMOCOPIA  
NEGATIVE THERMOCOUPLE

-VISTA MORSETTIERA  
-TERMINAL BLOCK VIEW



DIMENSIONI	A	B	C	D	E	Per sonde di lunghezza: For probe length:	Assieme tubo di install Installation tube ass'y
	320	316	282	318	353	350 mm	p/n: A42032
	450	441	402	438	478	500 mm	p/n: A42033
	620	616	582	618	653	650 mm	p/n: A42034
	840	835	780	818	873	800 mm	p/n: A42050

## Installation and Calibration

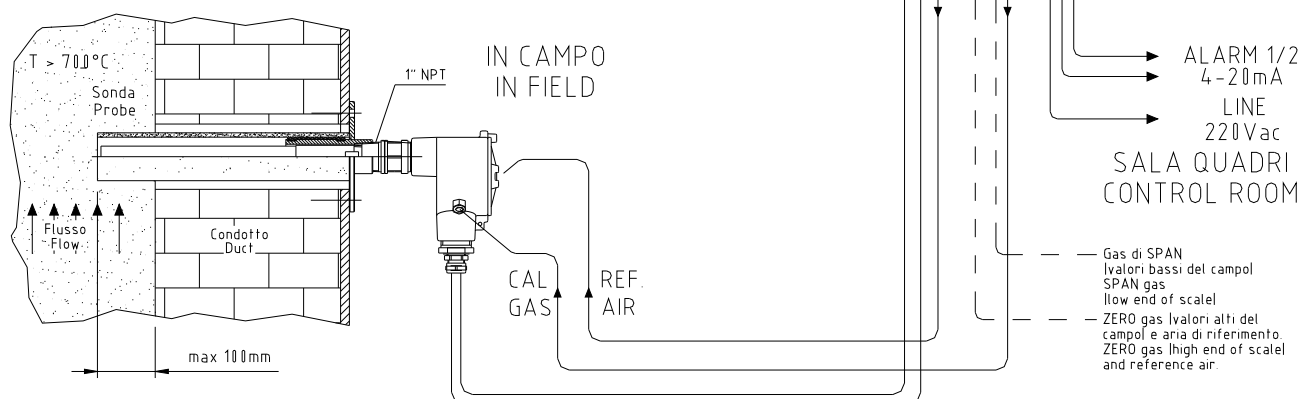
### Easy installation and calibration

The instrument consists of a probe designed to be directly installed into a smokestack as easily as a thermocouple.

It's requested the connection to a continuous reference air flow as normally done for instruments of this type.

It can be easily checked and calibrated in field, through normal air or a mixture with known oxygen content. No special connecting cables required.

In the probe head two standard 1/8" NPT-F inlets are provided to operate connections to the reference flow and to a mixture with known oxygen content (or Air) for in situ calibration.



## Ordering 6801



### Suffix A - Probe immersion length <sup>a)</sup>

003	350 mm
005	500 mm
006	650 mm
008	800 mm
999	On specification

### Suffix B- Thermocouple type

1	TC type B
2	TC type S
9	On specification

### Suffix C – Control unit

00	Not used <sup>b)</sup>
01	M701 control unit <sup>c)</sup>
99	On specification

### Suffix D - Installation tube

00	Not used
35	Tube for probe L = 350 mm
50	Tube for probe L = 500 mm
65	Tube for probe L = 650 mm
80	Tube for probe L = 800 mm
99	On specification

### Suffix E - Probe configuration

01	Standard for safe area
02	Version for hazardous area classified Zone 1 <sup>d)</sup>

### Suffix F – Options for hazardous area <sup>d)</sup>

000	None
940	Couple intrinsically safe barriers to be mounted in safe area
950	Couple of intrinsically safe barriers in explosion proof housing
960	Couple of intrinsically safe barriers in explosion proof housing connected to control unit in explosion proof housing
999	On specification

### Notes:

- <sup>a)</sup> Nominal immersion lengths. Refer to diagrams for detailed dimensional specification.
- <sup>b)</sup> The analyser can be selected without control unit only in case it's a spare part.
- <sup>c)</sup> Refer to M701 control unit ordering information for further monitor configurations.
- <sup>d)</sup> Contact ADEV technical office

## Ordering M701



### Suffix A - Line voltage

2	230 V 50/60 Hz
4	115 V 50/60 Hz

### Suffix B - Type of sensor combined with

1	High temperature probe model 6801
2	High temperature probe model 6801 + external TC
3	Fix temperature sensor (7873, M7873, 8864, 8870)
9	On specification

### Suffix C - Range

Menu A and B are alternative. As one full scale is selected at order, it will be possible to turn to another full scale (in filed) belonging to the same menu.

#### Menu A:

001	0-25 %
002	0-10 %
003	0-5 %
004	0-2 %
005	0-1 %
006	0-1000 ppm
007	0-100 ppm
008	0-50 % freely selectable

#### Menu B:

198	98-100 %
195	95-100 %
190	90-100 %
180	80-100 %
150	50-100 %
110	10-100 %
100	0-100 %
999	On specification

### Suffix D1 - Alarm threshold

0	None
1	1 low alarm
2	1 high alarm
3	1 high alarm + 1 low alarm
4	2 low alarms
5	2 high alarms
9	On specification

### Suffix D2 - TC alarms (only with suffix B = 2)

0	None
1	High alarm on internal TC + High alarm on external TC
2	Low alarm on internal TC + Low alarm on external TC
3	Low alarm on internal TC + High alarm on external TC
4	High alarm on internal TC + Low alarm on external TC
9	On specification

### Suffix E – Alarm contacts

0	None
1	Closed in alarm condition
2	Open in alarm condition

### Suffix F - Serial output

0	NO
1	RS 232 C + internal clock

### Suffix G– Control unit configuration

1	Provided loose for mounting in a cut out 89,5 x 90,5 mm
2	Mounted in IP65 housing
3	Mounted in EEx-d housing
9	On specification



**Conformity to European Normative**

In accordance to Low Voltage directive 2006/95/EC

In accordance to EMC directive 2004/108/EC:

- EN 61000-6-2
- EN 61000-6-3
- EN 50270

In accordance to directive ATEX 94/9/EC



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