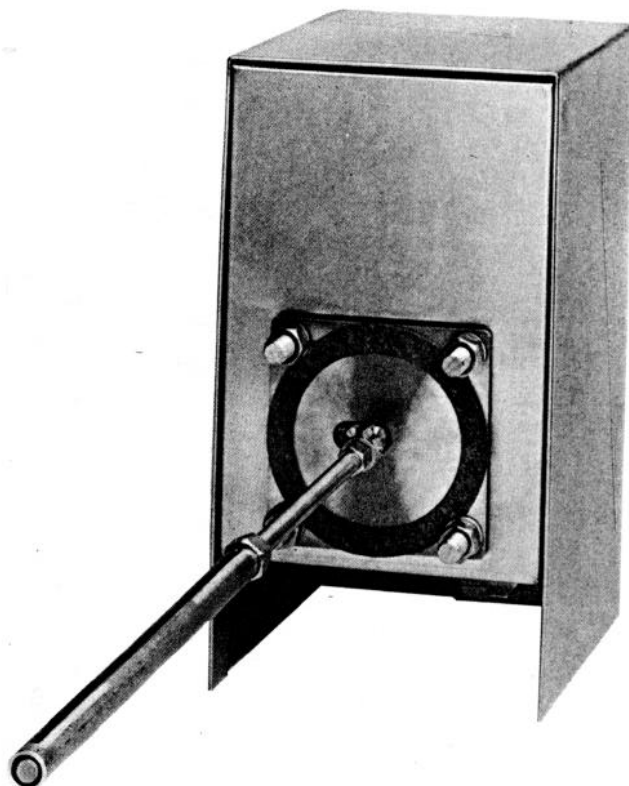


Oxygen Detector

QGO30...



FM740



QGO30... oxygen detector complete
with AGO30.011 flue gas collector

The QGO30... is used for continuous measurement of the residual oxygen content of dirt-laden and aggressive flue gases and in industrial combustion plant when burning heavy oil, coal, wood or waste.

Application

The QGO30... oxygen detector measures the oxygen content of dirt-laden and aggressive flue gases. Used in conjunction with the units of the RPO... range, it serves for the supervision and regulation of the combustion process. The QGO30... has been designed for use with flue gases of heavy oil, coal, wood, waste and in industrial process plant with flue gas temperatures up to 1900°C and flue gas velocities of 0.1 ... 20m/s. There are two versions available:

- QGO30.000A27 with flue gas collector type AGO30.01... for flue gas temperatures up to 450°C
- QGO30.001A27 with flue gas collector type AGO30.02... for flue gas temperatures up to 1900°C

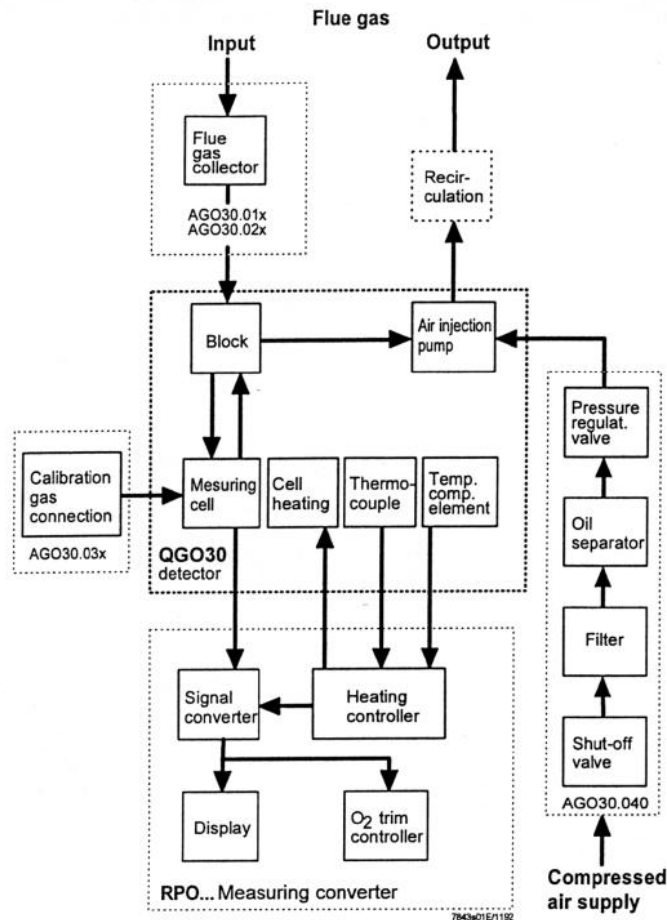
The QGO30... must always be used in connection with the respective flue gas collector type AGO30...

Ordering

- | | |
|---|---------------------|
| Oxygen detector: | |
| - Basic version with flue gas recirculation, for flue gas temperatures up to 450°C | QGO30.000A27 |
| - As above, but without flue gas recirculation, for flue gas temperatures up to 1900°C | QGO30.001A27 |
| Flue gas collectors made from stainless steel (< 450°C), complete with filter | |
| - Length = 500mm | AGO30.011 |
| - Length = 800mm | AGO30.012 |
| Flue gas collectors made from ceramics (<1900°C) | |
| - Length = 500mm | AGO30.021 |
| - Length = 1000mm | AGO30.022 |
| Calibration gas connection with blanking plug | AGO30.030 |
| As above, with ball valve | AGO30.031 |
| As above, with 230V electric valve | AGO30.032A27 |
| Compressed air connection set consisting of: 230V shut-off valve, oil separator, manometer, and pressure reducing valve | AGO30.040A27 |
| Spare measuring cell | AGO30.000 |
| Measuring converter (including oxygen trim control with control function for 2-stage burner) | RPO20.000A27 |
| Measuring converter (including oxygen trim control with control function for modulating burner) | RPO25.000A27 |

Functions

With the help of the flue gas collector and an air injection pump, the flue gases are drawn from the flueway and are then routed past the detector's measuring cell. A difference in oxygen concentration between the flue gas and the reference gas at the measuring cell produces a voltage which is used as a signal for the RPO... control unit. The following block diagram shows the interplay of functions.



With the help of compressed air (0.5 bar), the air injection pump generates the necessary vacuum to suck off the flue gases. Due to this vacuum, the flue gases pass through the block. From the main flow, due to thermal convection, a part flow is diverted to the measuring cell after which it rejoins the main flow. Compressed air and flue gas together return to the stack (only with type QGO30.000A27).

The measuring cell consists of zirconium dioxide (ZrO_2). As ZrO_2 becomes oxygen-conductive at high temperatures, a difference between the O_2 concentrations inside and outside the measuring cell causes oxygen ions to diffuse, thereby generating an electrical voltage. This voltage, the so-called Nernst voltage V_N , is acquired by porous platinum electrodes on the inner and outer sides of the measuring cell. To ensure correct functioning of the measuring cell, a heating coil keeps the cell at a constant working temperature of $700^\circ C$. The inside of the measuring cell, which is hermetically sealed against the ingress of the flue gases, communicates with the outside air which is used as a reference value (20.9 % O_2) when making measurements.

The Nernst voltage V_N is a function of the difference in oxygen content and the temperature of the measuring cell, as expressed by the following formula:

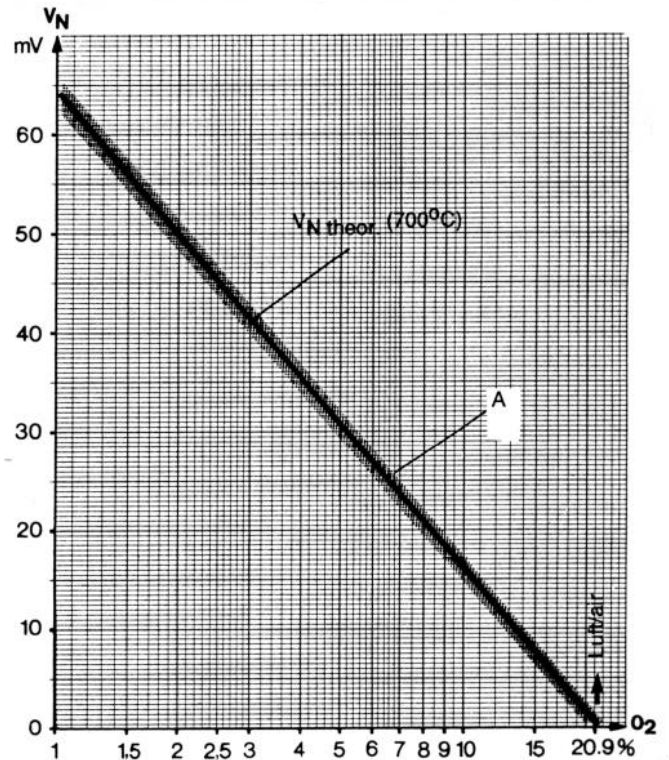
$$V_N = \frac{R \cdot T}{4F} \ln \frac{(O_2)_{Ref}}{(O_2)} \quad (mV)$$

where:

$$\frac{R \cdot T}{4F} = 20.9mV \text{ at } 700^\circ C$$

According to the above formula, the Nernst voltage with an O_2 concentration of 1% in the flue gas is 64 mV.

A	Tolerance band
V_N	Nernst voltage
R	Gas constant (8.3J/K)
T	Absolute temperature of measuring cell (973 K)
F	Faraday constant (96 486 Clb)
ln	Natural logarithm
$(O_2)_{Ref}$	Oxygen content (Vol.-%) inside the measuring cell (reference gas)
(O_2)	Oxygen content (Vol.-%) of flue gas



Design Features

The QGO30... consists of a thermally completely insulated housing with a connecting flange for fitting to the flueway, a removable cover and a flue gas collector, which is mounted later.

On the **mounting side** are:

- Flange, gasket, and fixing screws for fitting the QGO30... to the stack
- Outlet for recirculation of the flue gases (only with QGO30.000A27)
- Connection for flue gas collector with special thread and bracket for mounting the collector. Two types of flue gas collectors are available:

- Flue gas collector made from stainless steel complete with filter (type AGO30.01...)
The flue gases are drawn from the stack through a slot of 250 mm length located on the collector's downstream side.
- Flue gas collector made from ceramics (type AGO30.02...)
The flue gases are drawn from the stack at a single spot.

Under the housing of the QGO30..., that is, under the equally insulated cover, are:

- The heated air injection pump and the heated block. Heating is required to prevent condensation
- The flue gas recirculation (only with the QGO30.000A27)
- The interchangeable, finger-shaped measuring cell, made of zirconium dioxide (ZrO_2 , stabilized with 8% Y_2O_3)
- The cell's heating, thermocouple, and temperature compensation element

At the bottom of the housing are:

- 10-pin socket for the electrical connections
- Connection (DN 1/8" internally threaded) for compressed air
- Connection (DN 1/8" internally threaded) for calibration gas (type AGO30.030; on request only). This allows manual or automatic entry of a specific calibration gas

All parts of the detector are made from stainless steel.

Planning Guide

For its operation, the air injection pump requires oil- and dust-free compressed air of about 0.5 bar. For this reason, appropriate separators and filters are to be installed (refer to "Ordering").

The air injection pump, which is used to pass the flue gases to the measuring cell, shall be activated only when required to prevent dirt from being drawn unnecessarily through the filter and into the detector.

It must be ensured that both detector and RPO... measuring converter are under voltage also when the burner is shut down.

Mounting Guide

To mount the QGO30..., a DN100 PN6 opening is required on site. **The detector must always be mounted vertically** so that the marking on the cover will not be upside down.

Various types of flue gas collectors are available, depending on the stack diameter and the flue gas temperature (refer to "Ordering"). The flue gas collector must be carefully fitted to the QGO30..., as explained in the Mounting Instructions M7873, prior to mounting the detector onto the stack.

Never use a cold detector in the flueway when the burner is running. It must be made certain there are no wiring errors because such errors could destroy the electronic circuit of the RPO... control unit.

Commissioning Guide

Due to temperature differences between the inner and the outer electrode, thermo-voltages are generated during the heating up phase, leading to falsification of the measured oxygen level during that period of time. For this reason, the measuring system (QGO20 and RPO...) must be switched on at least 4 hours before starting up the burner. Also, if the plant is shut down for short periods of time (say 1 to 2 days), it is recommended not to switch the detector off.

Maintenance Guide

In the case of very dirty flue gases, it is recommended to remove the QGO30... at regular intervals (say once a year) to clean the flue gas collector with compressed air.

In industrial applications with ceramic collectors with no filter, and in the case the QGO30.001A27 is used without flue gas recirculation, dirt deposits can be removed with a steel brush.

Replacing the measuring cell:

If the measuring cell is faulty or has aged prematurely, it can be replaced by a new one (refer to Mounting Instructions M7843).

Technical Data

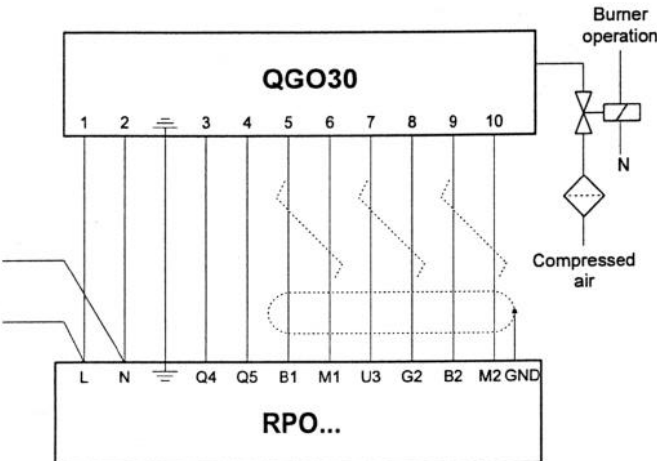
Measuring system	zirconium dioxide cell as oxygen ion conductor
Required working temperature of measuring cell	700°C ±50°C
Operating voltage of measuring cell heater	AC 230 V ±15%
Frequency	50...60 Hz ±6%
Measuring range	0.1...20.9% O ₂
Perm. ambient temperature:	
- Operation	-20°...+80°C
- Transport and storage	-25°...+80°C
Power consumption	135 W (170 W max.)
Protection standard	IP42
Net weight of QGO30	12.6 kg
Weight of AGO30... flue gas collector	0.7 kg
Mounting orientation	vertical
Perm. flue gas velocity in the stack	0.1 ... 20 m/s
AGO30.01... flue gas collector	VA 4 stainless steel 450°C max.
AGO30.02... flue gas collector	Alox type 710 ceramics 1900°C max.
Connection for compressed air (and calibration gas)	DN 1/8" (internally threaded)
Max. line length to the RPO...	50 m

Electrical Connections

The electrical installation must comply with local standards and regulations and must be undertaken by personnel specifically trained for this type of installation. The maximum line length between the QGO30... and the RPO... is 50 m.

Wiring Diagram

For the low voltage side, a screened 6-core cable is required. The wires should be twisted in pairs. The screening must be connected to terminal GND of the RPO... The minimum cross-sectional area is 0.25 mm².

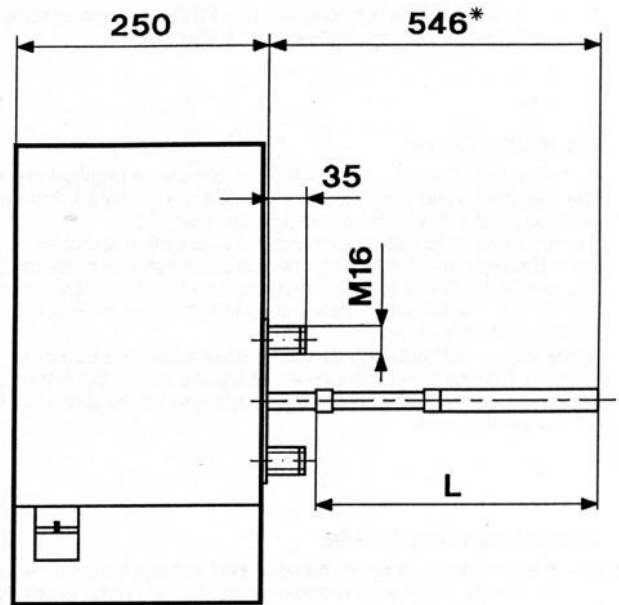
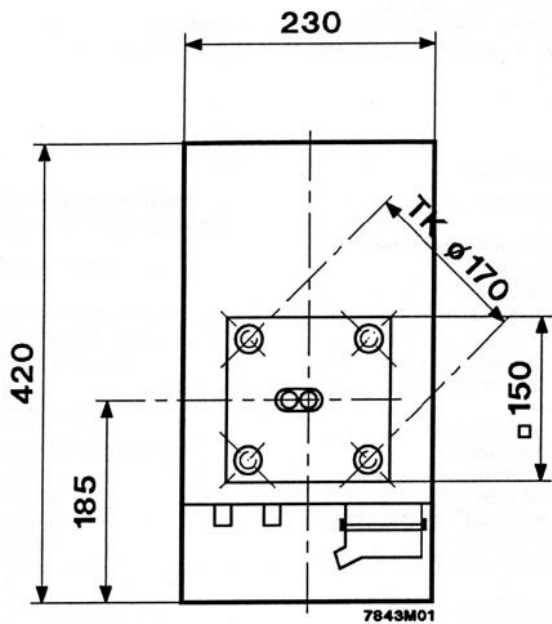


Terminal designations on the QGO30...

↓	Terminal designation on the RPO...			
5	B1 (+)	Nernst voltage of measuring cell (V _N)	} Screened 6-core cable, twisted in pairs, ≥ 0.5 mm ²	
6	M1 (-)			
9	B2 (+)	Thermocouple voltage		
10	M2 (-)			
7	U3 (+)	Compensation Thermocouple reference point	} Cable 2 x 1.5 mm ²	
8	G2 (-)			
	GND	Ground (screen)		
3	Q4	Detector heating (AC 230 V)	} Cable 2 x 1.5 mm ²	
4	Q5	Detector heating (AC 230 V)		
1	L	Phase Neutral Earth	} Cable 3 x 1.5 mm ²	
2	N			
	Q	Operating voltage Signal "not ready" Signal "ready"	} Wire 0.6 mm ² min	
	Q1 Q2			
	X1 (+)	Output signal — 0...10 V = 0...10% O ₂		
	M			

Dimensions

Dimensions in mm



*With AGO30.011 / AGO30.021

L = 500 mm with AGO30.011/ AGO30.021
L = 800 mm with AGO30.012
L = 1000 mm with AGO30.022