

Ambient Air NO_x Analyser Model 447

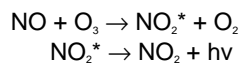
- Meets or exceeds all EPA performance specifications
- Single chamber design
- Excellent stability
- High sensitivity
- Displays NO/NO₂/NO_x
- 3 continuous outputs
- Adjustable cycling time

Application

Model 447 is an ambient air analyser for oxides of nitrogen, based on the proven chemiluminescence principle.

Principle of operation

Model 447 utilises the well established technique of chemiluminescence to measure oxides of nitrogen viz:



Nitric oxide present in the sample gas reacts with ozone generated within the analyser, producing nitrogen dioxide in an electronically excited state. This rapidly decays to ground state, emitting light in the process. This light output is detected by a photomultiplier tube, and its intensity is directly related to the concentration of NO in the sample.

The basic technique measures NO only; a catalytic or reactive convertor is used to reduce NO₂ in the sample gas to NO, allowing measurement of total NO_x.

Product description

Model 447 is a single chamber cyclic analyser, measuring NO and total NO_x sequentially, by alternately switching the NO₂ to NO convertor in and out of the flow system.

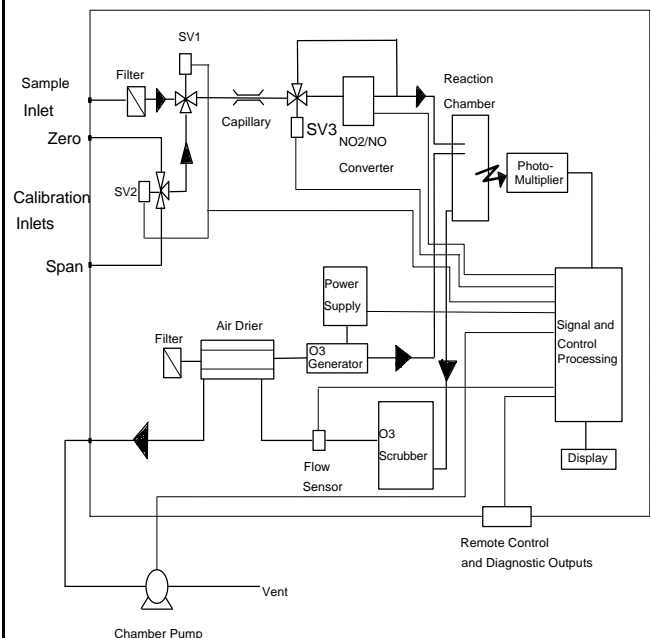
The chemiluminescence reaction takes place in a reaction chamber held at approximately 0.5bar negative by an external pump. The negative pressure draws both sample and ozonised air through flow control capillaries, regulating the flows into the reaction chamber.

Sample gas is filtered at the inlet with a teflon membrane filter; solenoid valves SV1, SV2 allow the introduction of zero and span gases for calibration. After the flow control capillary, solenoid valve SV3 switches the sample either through the convertor, (NO_x mode) or to bypass the convertor (NO mode), on an even split time basis, controlled by the analyser electronics.

Air supply for the ozonator is drawn through a permeation drier and optionally through an external chemical drier, prior to the high voltage discharge

ozonator. Ozonised air flows to the reactor chamber via a flow control capillary.

Exhaust gas from the chamber passes through a scrubber to remove unreacted ozone, a flow sensor for the flow alarm, and the shell of the permeation drier



where it acts as dry purge gas prior to a vent fitting connected to the pump. A vacuum gauge on the outlet of the reaction chamber monitors the reaction chamber pressure.

Calibration

The analyser is supplied with two front panel operated solenoid valves. These permit zero and span gases to be introduced into the analyser for calibration. As an option, the unit can be fitted with an internal span check permeation calibration (see over for details)

Specification

Analyser performance

Ranges available 0-1/2/5/10ppm (standard)
0-0.1/0.2/0.5/1.0ppm
(high sensitivity)

Measurement
Resolution 1ppb
Repeatability 1ppb
Linearity 1%fs
Noise <1ppb

Minimum detectable concentration 2ppb
Zero drift <1ppb/24hrs
Span drift 1%fs/24hrs
Rise time 2 mins 95%
Fall time 2 mins 95%
Cycle time 20 seconds

Output signals 0-1V DC

Sample requirements

One litre/minute of ambient air non condensing at the analyser operating temperature.

Power supply

Voltage 110V or 220/240V
50 Hz or 110V, 60Hz
All - 10% + 6%
Consumption 600 VA

Local displays Triple digital displays
for NO, NO₂, NO_x
concentrations

Vacuum gauge for sample pressure

Standard connections

These are 1/4" OD compression fittings and are used for:

- Sample in
- Vent
- Zero/span gas in

Environmental operating conditions

The analyser is designed for rack or bench mounting in a non hazardous area.

Temperature +15°C to +30°C
Humidity 95% max RH

Storage temperature

The analyser should be stored at a temperature within the range 0 to 45°C .

Dimensions and weight

	unpacked	packed
Height	222 mm	390 mm
Width	434 mm	620 mm
Depth	570 mm	790 mm
Weight	34.5kgs	39.5kgs

Options

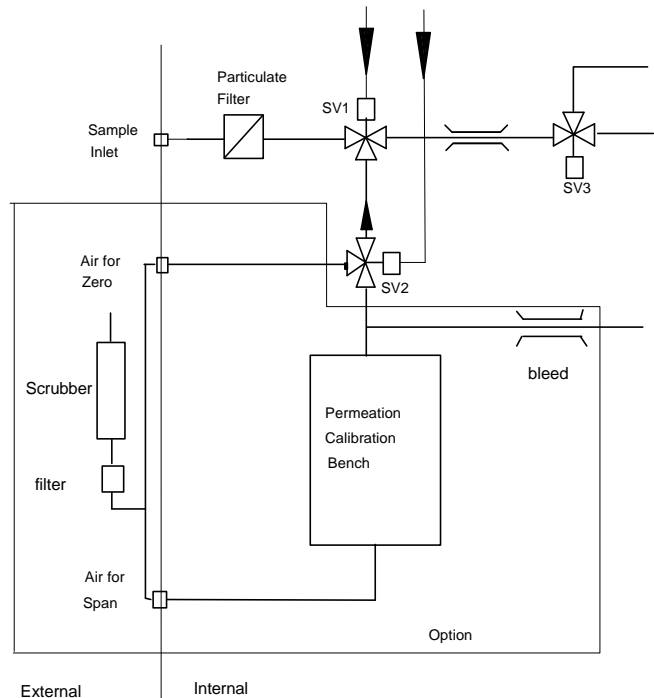
Cycle time.

For kerbside or roadside applications where the concentrations of NO₂ are changing rapidly, it may be desirable to cycle the NO_x -> NO₂ converter at a faster rate, to ensure that true NO₂ values are measured. A simple modification to the basic analyser allows a faster converter cycle time for such applications.

Internal permeation bench

In addition to the internal calibration switching valves fitted as standard, the analyser can be equipped with an internal span gas generation system, for routine calibration checks. Zero gas is generated by passing ambient air through a disposable scrubber; this effectively removes ambient trace NO_x levels to below 5ppb. In normal use the scrubber can be expected to last 3 months. Span gas is generated by means of a permeation device. This contains NO₂ held liquid under its own vapour pressure; a membrane releases NO₂ vapour by permeation at a mass emission rate dependent only on temperature. The device is maintained in a temperature controlled chamber. The NO₂ generated is diluted when required by scrubbed ambient air, drawn by the analyser sample pump. The small mass flow of emission of the device is therefore diluted to a concentration of NO₂ in air within the range of the analyser, allowing calibration checks to be carried out.

The span gas concentration from the permeation device is certified for each unit. Calibration accuracy is ±5%.



Schematic of Permeation Calibration Bench Option