NO, NO_2, NO_x Monitor

The Model 400 Nitric Oxide Monitor™ is designed for the measurement of atmospheric nitric oxide (NO) in the range 2-2,000 ppb with a precision of ±2 ppb. Combination of the Model 400 NO Monitor and Model 401 NO_2 Converter allows measurement of NO_x as well and NO_2 by difference ($NO_2 = NO_x - NO$). The Model 400 shares many of the unique features of the Model 202 and 205 Ozone Monitors, including small size and weight, low power requirement, and absolute calibration.

Theory of Operation: Our recently patented technology for the Model 400 is based on the quantitative reaction of nitric oxide (NO) with ozone (O_3):

$$NO + O_3 \rightarrow NO_2 + O_2 + h\nu$$

This reaction has long been used as a gas phase titration for the measurement of either NO or O_3 in laboratory kinetics experiments, and the reaction is stoichiometric; i.e., one O_3 molecule is consumed for every NO molecule oxidized to NO_2 in the reaction. In the Model 400, a small concentration of ozone (3-5 ppm) is added to the gas sample stream and the resulting decrease in concentration of ozone is measured by the absolute method of UV absorption in a dual beam arrangement that cancels any contribution from ambient ozone. By providing adequate time for the reaction to go to completion, the decrease in ozone concentration is equal to the original concentration of NO in the gas stream.

The $NO + O_3$ reaction is the same reaction used in conventional chemiluminescence analyzers. Instead of measuring the change in ozone concentration, chemiluminescence detects the small amount of light produced in the reaction. Chemiluminescence instruments are highly sensitive and have a very fast response time, but require frequent calibration using a gas standard. Although less sensitive than chemiluminescence instruments, the Model 400 NO Monitor has the advantages of portability and an absolute calibration.

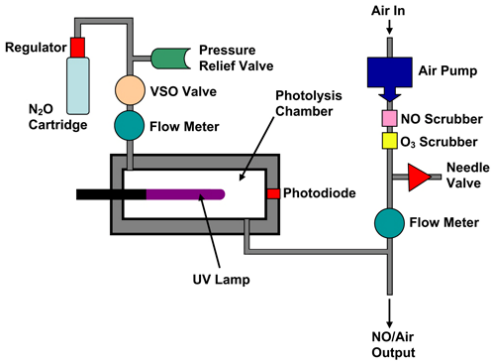
Model 400 Specifications:

Measurement Principle	Quantitative depletion of ozone, UV absorbance
Analytical Range	0-2,000 ppbv
Precision and Accuracy	Greater of 2.0 ppbv or 3%
Measurement Interval	10 s
Nominal Flow Rate	1 L/min
Data Storage	14,336 lines internal; optional flash memory card
Data Outputs	RS232, LCD Display
Power Requirements	12 V dc or 120/240 V ac, 11 Watt
Size	3.5 x 8.3 x 11.6 in (9 x 21 x 30 cm)
Weight	6.4 lb (2.6 kg)

NO Calibration Source

The Model 408 NO Calibration Source™ is a highly portable source of nitric oxide in the range 0-1000 ppb. The Model 408 may be used to calibrate any nitric oxide monitor, including those based on chemiluminescence. It produces nitric oxide in NO-scrubbed ambient air by photolysis of nitrous oxide provided by small N_2O cartridges. The calibration gas is supplied at an output flow rate of 3 L/min, and the instrument may be programmed to output a series of up to 10 ozone concentration steps with a chosen time interval.

Theory of Operation: The Nitric Oxide Calibration Source makes use of a low pressure mercury lamp to photolyze nitrous oxide (N_2O) and produce NO in a patent-pending process using the apparatus shown below:



The vacuum UV emission lines of mercury near 185 nm are absorbed by N_2O to produce electronically excited oxygen atoms, O ($^1D_2$). A large fraction of these highly energetic oxygen atoms react with N_2O to form NO:

$$N_2O + h\nu \rightarrow N_2 + O(^1D_2)$$
$$O(^1D_2) + N_2O \rightarrow 2\ NO$$

$$\text{Net: } 2\ N_2O + h\nu \rightarrow N_2 + 2\ NO$$

The concentration of NO produced in a flowing stream of air depends on the intensity of the photolysis lamp, the concentration of N_2O (determined by pressure and temperature), and the residence time in the photolysis cell (determined by volumetric flow rate and cell volume). By holding these parameters constant, it is possible to produce a flow of air containing a constant concentration of NO, and the concentration of NO produced can be varied by varying the lamp intensity.

2B Technologies

www.twobtech.com

Since 1998, 2B Tech has invented, designed and manufactured small, light weight, low power, portable instruments for highly precise and accurate measurements of air pollutants.

Products:

Ozone Monitors
- Models 106-L, M, H
- Models 202 and 205

Ozone Calibration Source
- Model 306

NO, NO_2, NO_x Monitor
- Model 400 NO Monitor
- Model 401 NO_2 Converter

NO Calibration Source
- Model 408

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