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Product Data Sheet
PDS 103-670.A01
October, 2006

Heated NO/NO_x Analyzer Module Wet Chemiluminescence Detection (WCLD)

- Heated sample handling module for hot/ wet gas samples
- Eliminates loss of NO_2 in sample condensate
- Built-in Peltier cooler removes moisture after NO_2 conversion
- Thermoelectrically cooled solid state detector ensures high stability
- Automated ozonator shut-off on loss of air pressure
- Remote control and automatic calibration capabilities
- On-line diagnostics
- Efficient, interferent-free vitreous carbon NO_2 converter



Emerson's Rosemount Analytical NGA Wet Chemiluminescence Detection Analyzer Module (WCLD) is the industry's first modular analyzer designed to meet stringent environmental regulations on NO_x emissions. The loss of NO_2 due to solubility in sample condensate typically encountered in standard sample handling systems has been eliminated. The WCLD's heated sample conversion module is designed to accept a hot/ wet gas sample directly from the source. External sample handling requirements are therefore minimized.

The WCLD is an extremely versatile instrument due to the heated sample conversion module. Applications such as internal combustion engine emissions (ICEE), continuous emissions monitoring systems (CEMS) and NO_x scrubber efficiency monitoring among others can all benefit from increased accuracy and simplified sample handling requirements associated with the WCLD.

The NGA WCLD Analyzer Module is a self-contained unit complete with sample conversion, detection and associated electronics. The modular design allows for easy system integration, expandability and flexibility. The WCLD Module may be a "stand alone" instrument with the addition of our Input/Output (I/O) Module and Platform or it can be integrated into a sophisticated multicomponent analysis network.

What makes the NGA Analyzer family unique is the modular approach combined with an advanced digital communication network (LON). The network allows identification of and interaction with other analyzer modules in the analytical system. All pertinent analyzer outputs and diagnostic information is carried on the network to a centralized display panel on the platform or to a remote PC. Because of this distinctive feature, the WCLD Analyzer Module may either be incorporated into a panel/rack or it can be placed near the sample source up to a mile away, thereby further reducing sample handling requirements.

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FEATURES

The WCLD analyzer module is designed to meet stringent U.S. Environmental Protection Agency requirements for NO_x monitoring. Increased accuracy is achieved over conventional NO_x analyzers by converting water soluble NO_2 to NO in a heated sample conversion module. This hot NO_2 to NO conversion eliminates the loss of NO_2 in sample condensate. Moisture is then removed from the sample gas before analysis in order to eliminate water interference with the chemiluminescence reaction.

The WCLD analysis system consists of three separate but interconnected modules:

- Sample Conversion Module – accepts hot/wet sample gas and converts NO_2 to NO in a heated oven compartment. The vitreous carbon NO_2 converter provides high conversion efficiency and minimizes interferent effects. The oven also contains sample handling components to control sample pressure, bypass flowrate and NO/NO_x mode switching. A thermoelectric cooler then removes condensibles from the sample gas.
- Chemiluminescence Detection Module – measures concentration of NO in the conditioned sample gas. The module houses the chemiluminescence reaction chamber, thermoelectrically cooled detector, ozone generator and associated electronics.
- Platform – performs control unit functions with operator interface. Analog/digital outputs, alarm contacts and digital inputs are available on the Input/Output (I/O) module located inside the platform. One platform can interface with several other NGA analyzer modules like CO, O_2 and hydrocarbons, thereby significantly reducing installation and operating expenses.

Many new refinements have been added to the WCLD to enhance overall performance. A new solid state (silicon photodiode) detector provides unsurpassed stability and low maintenance. A two-stage Peltier cooler maintains thermal stability inside the detector assembly to minimize signal to noise ratio. An internal ozone generator supplies the steady source of ozone required for the chemiluminescence reaction. A pressure switch automatically turns the ozonator off in the event of loss of air pressure to prevent the possibility of corrosion. A back pressure regulator ensures steady sample pressure in the reaction chamber resulting in an ideal chemiluminescence reaction.

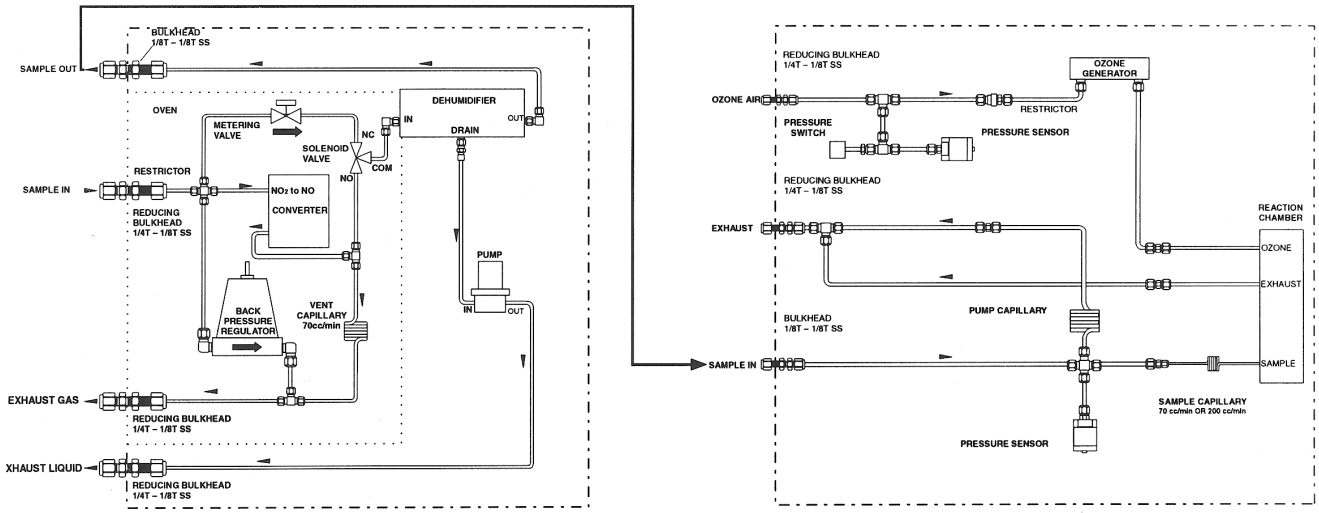
The WCLD analyzer is equipped with four user-selectable ranges and auto ranging capability. The analyzer can also be equipped with an auto calibration cycle. The digital communication network (LON) allows diagnostics to be monitored while analyzers are in service to anticipate service requirements and minimize downtime. Information like detector temperature, duty cycle, peak-peak noise, converter temperature and power supply voltages, are carried on the network between the analyzers and a remote platform or PC. In addition to complete analyzer operation on the network, I/Os are available in the platform providing analog outputs and external control of analyzer functions.

TYPICAL APPLICATIONS

The NGA WCLD analyzer can be used for a variety of applications. Typical applications include:

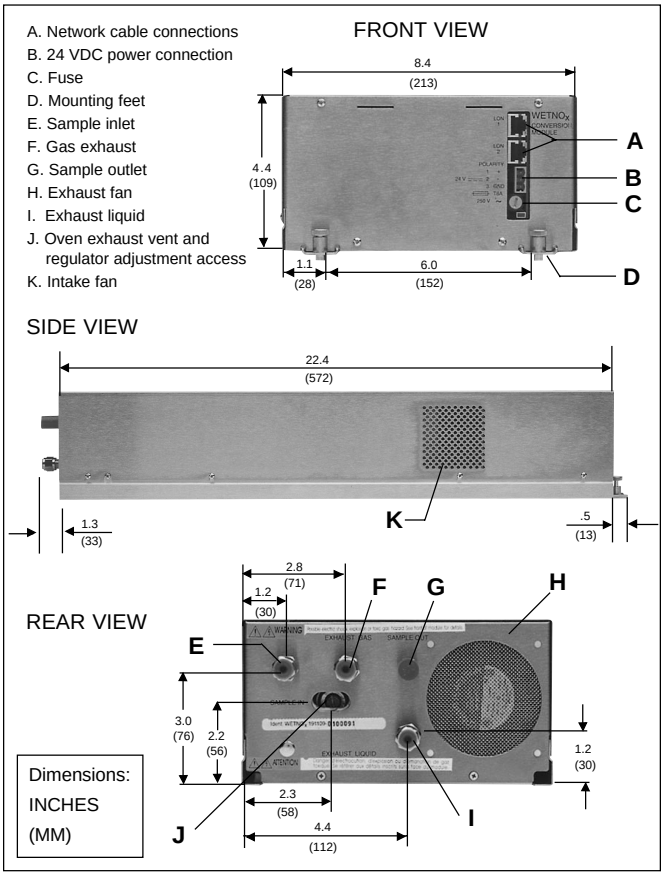
- NO/NO_x emissions from combustion of fossil fuels in:
  - Vehicle engine exhaust (Meets EPA regulations for heavy duty gasoline and diesel engine testing per 40CFR, Part 86)
  - Incinerators
  - Boilers
  - Gas appliances
  - Turbine exhaust
- Nitric acid plant emissions
- Selective catalytic reduction (SCR) process control and efficiency monitoring
- NO emissions from landfill decomposition

FLOW DIAGRAM FOR WCLD MODULES

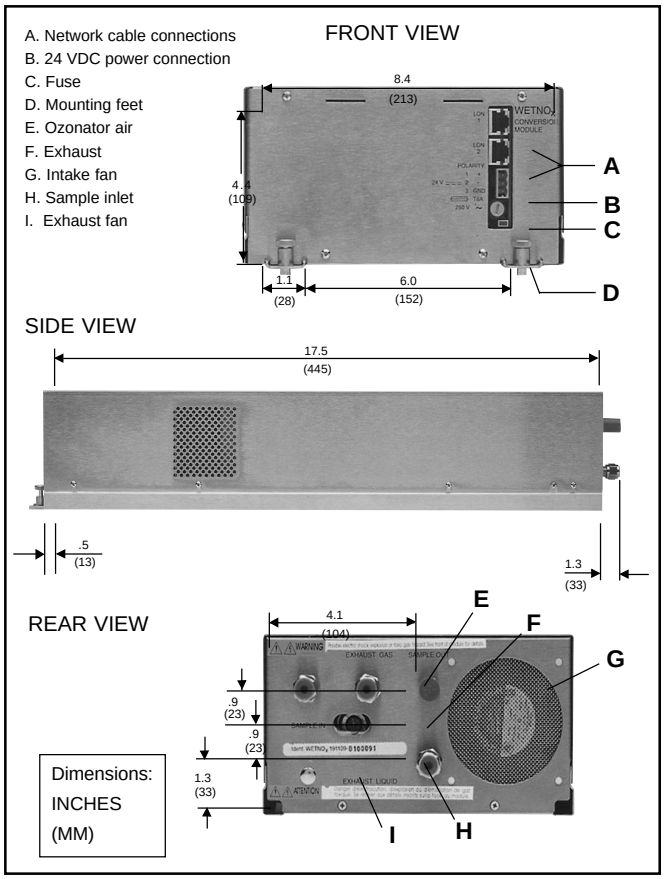


Conversion Module ***Detection Module***

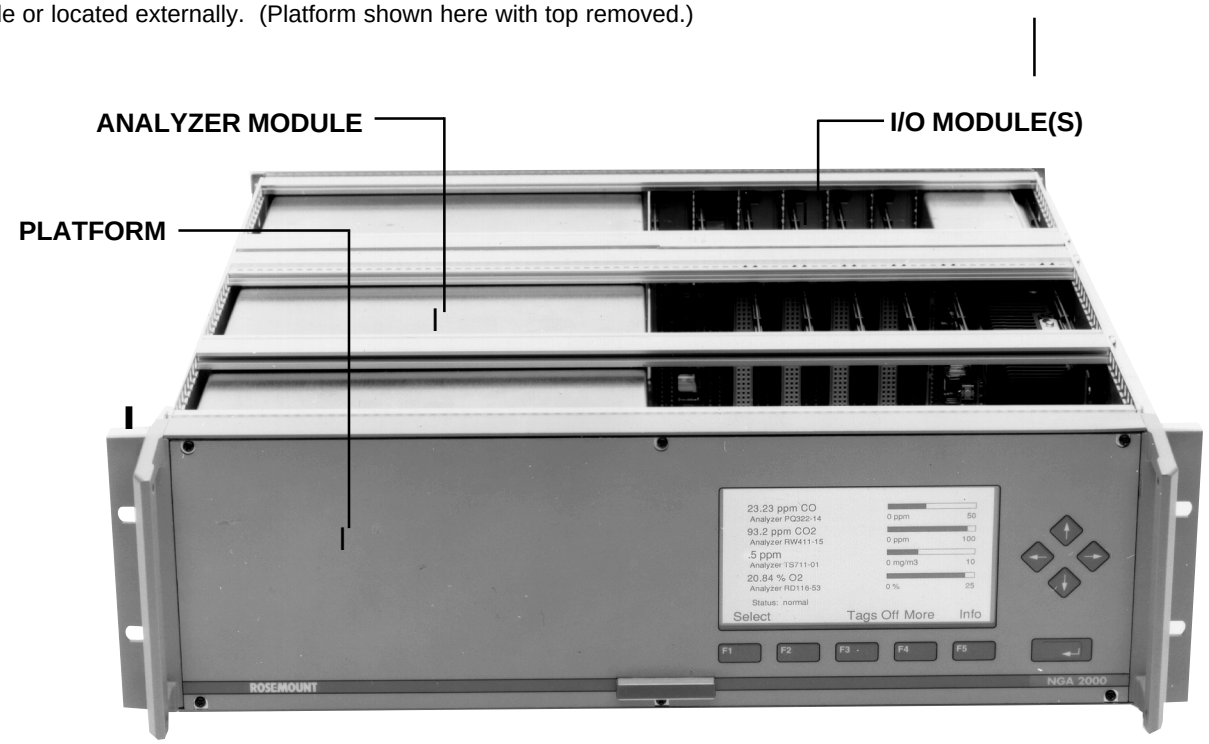
OUTLINE AND MOUNTING DIMENSIONS CONVERSION MODULE



OUTLINE AND MOUNTING DIMENSIONS DETECTION MODULE



Platform with Internal Analyzer Module Several analyzer modules may be integrated with a single platform, either mounted inside or located externally. (Platform shown here with top removed.)



PRINCIPLE OF OPERATION

The key benefit of the NGA WCLD Analyzer Module is prevention of the loss of nitrogen dioxide (NO_2) in sample condensate. This is achieved by bringing sample gas into the conversion module through a heated oven. The oven houses the vitreous carbon converter which is heated between 350°- 400°C. The converter reduces NO_2 in the sample to nitric oxide (NO). The vitrous carbon material achieves conversion efficiency of over 95% with limited interferent effects. Any NO initially present in the sample passes through the converter unchanged. A back pressure regulator and metering valve are used to control the sample pressure and flow rate. A thermoelectric cooler removes moisture from the sample stream immediately following the oven. A peristaltic pump drains all moisture removed from the sample gas.

Dry sample gas then enters the detection module. The detection module houses the ozone generator, the chemiluminescence reaction chamber and the solid state photodiode detector. The reaction chamber operates at atmospheric pressure, thus eliminating the need for a bulky vacuum pump. The chemiluminescence reaction involves following reactions:

$$NO + O_3 = NO_2^* + O_2 \text{ ..... (1)}$$

$$NO_2^* = NO_2 + hV \text{ (red light) ..... (2)}$$

In reaction (1), nitric oxide (NO) and ozone (O_3) readily react to form nitrogen dioxide (NO_2^*) in an electrically excited state. In reaction (2), the excited NO_2^* immediately reverts to the ground state, emitting photons (red light). This light is measured by the photodiode detector. The intensity of the red light is directly proportional to NO concentration in the sample. Measurement stability and low noise levels are achieved by thermoelectrically cooling the photodiode detector.

It is possible to measure NO concentration specifically instead of the combined NO/NO_2 or NO_x concentration as described above. Selection of NO mode on the platform automatically removes the vitreous carbon converter from the sample path. Without the converter, NO_2 in the sample gas is not converted to NO and will not participate in the chemiluminescence reaction. Therefore, only the NO concentration will be measured.

CONVERSION MODULE

General Specifications

Measurement Species: NO, NO_x

Ranges: 0 to 10 ppm through 0 to 10,000 ppm; 500 ppm NO_2 maximum

Delay Time: 5 seconds, maximum (does not include response time of detection module)

Ambient Temperature: 50°F to 104°F (10°C to 40°C)

Power: 24 VDC ± 5%. 192 Watts

For the following parameters, the conversion module will not degrade the performance of the companion detection module:

- Repeatability
- Minimum detectable level
- Noise
- Linearity
- Response time
- Drift
- Effect of temperature

Sample Requirements

Temperature: 158°F (70°C) or less

Flow Rate: 750 to 2000 cc/min.

Pressure: 5 to 9 psig (344 to 620 hPa)

Particles: Filtered to < 2 microns

Moisture: Less than 15% water vapor by volume, no entrained liquid

Materials in Contact with Sample: Stainless Steel, glass, Teflon*, Kynar**

Physical Specifications

Case Classification: General purpose for installation in weather-protected area

Compliance: CSA-NRTL/C, RWTÜV, CE, C-TICK, NAMUR EMC

Maximum Separation: 1 mile (1600M) analyzer module to platform

Dimensions: 4.4" H x 8.4" W x 22.4" D (109mm H x 213mm W x 572mm D)

Weight: 23.5 lbs. (10.7 kg)

Mounting: Custom-installed in a panel (not used in a platform)

Gas Connections:

Sample In: 1/4" O.D. tube fitting, Stainless Steel

Exhaust Gas: 1/4" O.D. tube fitting, Stainless Steel

Sample Out: 1/8" O.D. tube fitting, Stainless Steel

Exhaust Liquid: 1/4" O.D. tube fitting, Stainless Steel

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DETECTION MODULE

General Specifications

Measurement Species: NO

Ranges: 0 to 10 ppm through 0 to 10,000 ppm NO with four (4) fullscale user selectable output ranges

Repeatability: ± 0.5% of fullscale
(at constant temperature)

Minimum Detectable Level: 0.1 ppm

Noise: < 1% of fullscale, peak to peak

Linearity: ± 1% of fullscale

Response Time: < 1 sec. for 90% of fullscale for ranges of 25 ppm or greater

< 3 sec. for 90% of fullscale for ranges of less than 25 ppm

(Does not include delay time introduced by conversion module)

Drift: (at constant temperature)

Zero – ± 1% of fullscale/24 hours, < 2% of fullscale/week

Span – ±1% of fullscale/24 hours, < 3% of fullscale/week

Effect of Temperature: < 2% of fullscale (over any 10°C ambient temperature variation interval for a rate of change no greater than 10°C/hour)

Ambient Temperature: 50° to 104°F (10° to 40°C)

Power: 24 VDC ± 5%, 70W

Ripple and noise: < 100 mVpp

Load regulations: < ± 1%

Sample Requirements

Temperature: 32° to 131°F (0°C to 55°C)

Flow Rate: Approximately 400 cc/min.

Pressure: 7 psig (± 2 psig), 482 hPa (± 138 hPa)

Particles: Filtered to < 2 microns

Dewpoint: 10°F (5.5°C) below ambient temperature, no entrained liquid

Materials in contact with Sample: Stainless steel, Teflon*, Kynar**

Ozonator Gas: USP breathing grade, dry air or oxygen;

Flow rate: 1 L/min.

Pressure: 10 to 15 psig (688 hPa to 1033 hPa)

Physical Specifications

Case Classification: General purpose for installation in weather-protected area

Compliance: CSA-NRTL/C, RWTÜV, CE, C-TICK, NAMUR EMC

Maximum Separation: 1 mile (1600m) analyzer module to platform

Dimensions: 4.4" H x 8.4" W x 17.5" D (109mm H x 213mm W x 445mm D)

Weight: 18 lbs. (8.1 kg)

Mounting: Inside a platform (19" rack-mountable) or custom-installed in a panel

Gas Connections

Ozone Air: 1/4" O.D. tube fitting, brass

Exhaust: 1/4" O.D. tube fitting, Stainless Steel

Sample: 1/8 O.D. tube fitting, Stainless Steel

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ORDERING INFORMATION

Model	Description
WCLD	Process Wet NOx Converter and Chemiluminescence Analyzer (WCLD)

Level 1	Language
0	English
1	German
2	French

Level 2	Software
2	Software 2.21
3	Software 3.3.x
6	Software 3.6.x
7	Software 3.7.x (till September 2005)
9	Actual Standard Software 3.9.x
A	Software 2.3

Level 3	Configuration
A1	Calibrated Low Ranges: 0-10, 0-25, 0-100, 0-250 ppm
A2	Calibrated Low Ranges: 0-10, 0-30, 0-100, 0-300 ppm
A3	Calibrated Low Ranges: 0-10, 0-50, 0-100, 0-500 ppm
H1	Calibrated High Ranges: 0-250, 0-1000, 0-2500, 0-10000 ppm
H2	Calibrated High Ranges: 0-300, 0-1000, 0-3000, 0-10000 ppm
H3	Calibrated High Ranges: 0-500, 0-1000, 0-5000, 0-10000 ppm
XX	Special (consult factory)

Level 4	Materials
1	With sample restrictor – for bypass flow control
2	Without sample restrictor

Level 5	Flow Path
0	None Required
4	PS, 10 A, 24 VDC, for cabinet mounting on supporting rails TS35
5	PS, 10 A, 230 VAC, 24 VDC, table-top version
6	PS, 10 A, 230 VAC, 24 VDC, rear panel rack-mount
7	PS, 10 A, 120 VAC, 24 VDC, table-top
8	PS, 10 A, 120 VAC, 24 VDC, rear panel rack-mount
A	PS, 5 A, 24 VDC, for cabinet mounting on supporting rails TS35
B	PS, 5 A, 230 VAC, 24 VDC, table-top version
C	PS, 5 A, 230 VAC, 24 VDC, rear panel rack-mount
D	PS, 5 A, 120 VAC, 24 VDC, table-top
E	PS, 5 A, 120 VAC, 24 VDC, rear panel rack-mount

Level 6	Special
0	None Required
5	Connection of AM with table-top/rack PS, 1 m
6	Connection of AM with table-top/rack PS, 2 m
7	Connection of AM with cabinet PS, 1.5 m

Level 7	External Power Supply
0	None Required
4	PS, 10 A, 24 VDC, for cabinet mounting on supporting rails TS35
5	PS, 10 A, 230 VAC, 24 VDC, table-top version
6	PS, 10 A, 230 VAC, 24 VDC, rear panel rack-mount
7	PS, 10 A, 120 VAC, 24 VDC, table-top
8	PS, 10 A, 120 VAC, 24 VDC, rear panel rack-mount
F	PS, 20 A, 120 VAC, 24 VDC, for cabinet mounting on supporting rails
G	PS, 20 A, 120 VAC, 24 VDC, for cabinet mounting on supporting rails

Level 8	Power Supply Cable	
	0	None Required
	5	Connection of AM with table-top/rack PS, 1 m
	6	Connection of AM with table-top/rack PS, 2 m
	7	Connection of AM with cabinet PS, 1.5 m

Option Notes	
Level 3:	Option: A1, A2, A3, H1, H2, H3 Ranges indicated within the configuration identifier are standard. Non-standard ranges within the identifier can be changed by the user or factory calibrated for an additional charge. Indicate an "X" in the last position and specify ranges.
Level 5:	Option: 0 A power supply for WCLD (Detection AM) required. 10 A Power supply for WNOx (Conversion AM) required
Level 7:	Option: 0 Cabinet Power Supply, 10 A, manual switch: 120 VAC or 230 VAC Power Supply, 20 A, Cabinet mount: BxHxT=227 mm x 125 mm x 103 mm Power Supply, Rack-mount: 3 HU, B=141.9 mm

Accessories	
Part Number	**Description**
748313	Manual W-CLD

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