

Rosemount Instruments

Rosemount Instruments Ltd
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Fax (403) 465-0440

February 9, 1996

Mr. Eric Madson
Royal Oak Mines Inc.
PO Bag 3000 Stn Main
Yellowknife NT X1A 2M2

Dear Eric:

SUBJECT: Budgetary Pricing for AFE

As discussed in our telephone conversation January 15, 1996, Royal Oak Mines is considering the acquisition of a SO₂ Continuous Emissions Monitoring System (CEMS) for its Giant Mine Roaster Stack. It is understood that the mine has been in operation for some 50 years, and its future is somewhat uncertain, therefore capital outlay is of concern. As requested, the following prices are budgetary, and can be attached to your AFE.

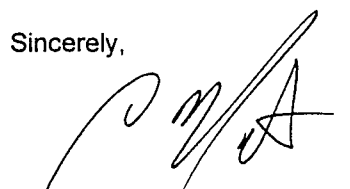
On September 22, 1995, Rosemount submitted a proposal to Dave Anthony at Royal Oak Mines for a SO₂ CEMS. The CEMS package consists of a Rosemount SO₂ analyzer with the appropriate sample handling system (SHS) for the specifications Rosemount received from Dave Anthony. The total cost of the hardware package was approximately \$50,000.00 Canadian. In addition to this hardware package, commissioning assistance and training can also be offered at a cost of approximately \$10,000.00 to \$20,000.00 Canadian. In order to clarify this price, Rosemount will need to know the extent of training required by Royal Oak. Some questions that need to be answered are; will the training be in Edmonton or on-site, what is the extent of commissioning assistance available from Royal Oak, and the details of installation/commissioning responsibilities between Rosemount and Royal Oak personnel? If desired, Rosemount can provide a system complete with hardware, training, commissioning assistance and support.

CEMS systems provide the facility operators with a continuous indication of plant performance, and environmental emissions. This information is invaluable when dealing with government agencies and/or the general public. Rosemount CEMS are designed to be low maintenance, user-friendly, and very accurate.

Once your budget has been approved and the details of installation and training have been agreed to, Rosemount will be happy to provide a firm quote to Royal Oak and give a presentation on the analyzer, SHS, commissioning and training details. We discussed mid-March, 1996 as a possible date for a CEMS presentation.

If you have any questions or comments, please do not hesitate to contact myself at (403) 951-2860, or your account representative, Darcy Yakichuk, at (403) 990-6417.

Sincerely,



Christopher T. Martin, C.E.T.
Analytical Sales Specialist

CTM:mrr

FISHER-ROSEMOUNT

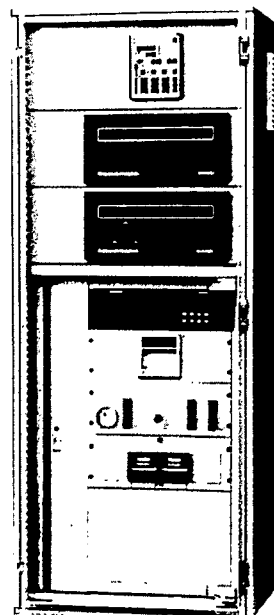
Continuous Emissions Monitoring (CEMS) Package

- Packaged approach to measuring one, two, or three gases plus opacity
- Measurement options: O₂, CO, CO₂, SO₂, NO_x, NH₃, THC, Opacity
- Field proven Rosemount Analytical analyzer technologies
- Fully pre-engineered; designed for maximum uptime
- Self diagnostics
- Manufactured under ISO 9001 certified quality standards
- Optional installation, startup, certification, and on-going service programs available

WORLD CLASS TECHNOLOGY FROM YOUR ONLY SINGLE SOURCE CEMS SUPPLIER

Rosemount Analytical offers a cost-effective, pre-engineered Continuous Emissions Monitoring (CEMS) package for those applications where one, two, or three gases, and possibly opacity, must be monitored for U.S. EPA compliance purposes.

The GMP 1000 CEMS package provides the same field-proven Rosemount Analytical analyzer technologies coupled to the most ruggedly constructed and dependable sample extraction and conditioning systems in the industry. The GMP 1000 package is backed by the SINGLE SOURCE capability of Rosemount Analytical so you can depend on the best and most comprehensive support services for CEMS in the industry. Optional services can include installation, startup, certification testing, in-house training and on-going maintenance contracts. Or, you can choose to purchase the pre-engineered, stand-alone GMP 1000 package for cost effective, dependable continuous emissions monitoring.



THE GMP 1000 PACKAGE

The basic GMP 1000 Package includes:

- Rosemount Analytical analyzers
- Heated sample probe.
- Temperature controllers for both probe and heated sample line.
- Thermoelectric sample conditioner containing integral pre-cooler, sample pump, condensate removal system, and water intrusion monitor for sample pump shutdown in the unlikely event of a conditioner failure; provides unsurpassed analyzer protection.
- Local/remote calibration capability for diagnostic testing of analyzers, and compliance with the EPA's 40 CFR 60, Appendix F and 40 CFR 75.
- Calibration drift and pollutant exceedence alarms.
- "Fast Loop" and analyzer flow control.
- Optional HVAC and/or probe blowback for enhanced performance over a wider range of applications.

ROSEMOUNT[®] ANALYTICAL

FISHER-ROSEMOUNT[™] Managing The Process Better[™]

ORDERING INFORMATION (Continued)

Code	Model 4200 Strip Chart Recorder
00	No recorder
01	1 pen recorder
02	2 pen recorder
03	3 pen recorder
04	4 pen recorder
05	5 pen recorder
06	6 pen recorder

Code	Heated Sample Line
000	None
XXX	Length of line required.

Maximum length is 300 ft (90 m). Specify in feet. Example: 50 ft = 050

75 ft = 075

150 ft = 150

(Contd)	02	050
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- NOTES:**
- One instruction manual is included.
 - Customer outputs will be raw analyzer signals for all manual calibration configurations. Customer outputs will be calibration corrected analyzer signals for all automatic calibration configurations. Auto cal with diluent correction will include the diluent corrected outputs.
Ex: Two gas, manual cal system = two customer outputs (Raw analyzer signals)
Two gas, auto cal with diluent correction = three customer outputs
(Two cal corrected analyzer outputs and one diluent corrected output)
 - Isolated signals can be any or all of the above standard customer outputs. Please specify which outputs the customer requires isolated and price accordingly.
 - Model 880A NDIR Analyzer
 - Model 951C Chemiluminescence Analyzer
 - Model 755R Paramagnetic Oxygen Analyzer
 - Model 951A Chemiluminescence Analyzer
 - Model ETL 9100 Etalon Analyzer. SO₂ Applications operating below 400 ppm must use the ETL 9100 Etalon Analyzer.
 - OXA 1000 Zirconium Oxide Oxygen Analyzer: for use in all gas monitoring applications except where excess combustibles (>1%) are present.
 - Model ETL 9200 Etalon Series Ammonia Analyzer
 - Model 755 Paramagnetic Oxygen Analyzer
 - HVAC includes as a minimum 4000 BTU/hr A/C & 750 W heater, temperature range good for 0°F to 110°F (-17.8°C to 43.3°C).
 - Model 4200 Strip Chart Recorder does not include any recorder options and is configured for standard analyzer output trending only. Hourly averages can be done in recorder for an additional charge. Consult factory for special applications. Please specify which analyzer outputs, diluent corrected outputs, or hourly averages need to be recorded if a recorder is purchased (6 maximum recorded signals).

STARTUP, TRAINING, AND GUARANTEED CERTIFICATION

This option provides the following services:

Two (2) days on site startup and checkout of the GMP 1000.

One (1) day training for up to six (6) people in the operation and maintenance of the GMP 1000. This training is to be scheduled during the same visit as startup.

Participation by a Rosemount Analytical Inc. (RAI) representative at a pre-certification meeting. This meeting is to be arranged by the client. The meeting shall include at a minimum the client, the RAI representative, a representative of the stack testing team, and a representative of the regulatory agency having jurisdiction over the facility. This meeting will discuss and confirm the procedures to be utilized during the actual certification testing.

NOTE: If during this pre-certification meeting any modifications to the GMP 1000 are required by the agency, such modifications are the client's responsibility. RAI will provide a quotation covering any requested modification.

Certification testing by an independent stack testing team of RAI's choice with supervision provided by RAI. During this visit RAI will instruct the client's personnel in the procedures to be followed during the certification period.

Preparation and submittal (to the client) of a complete written report covering the certification of the GMP 1000.

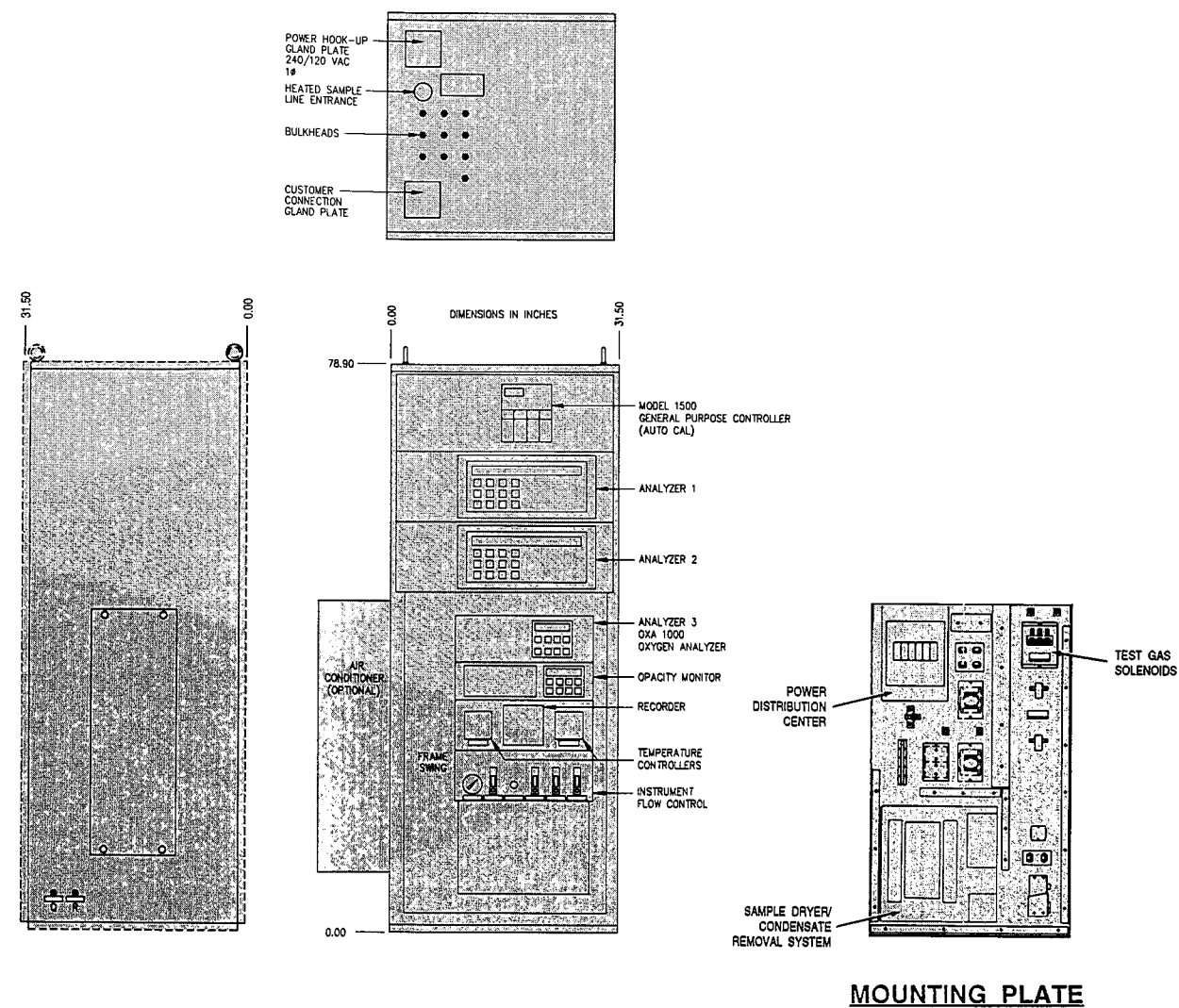
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DIMENSIONAL DRAWINGS

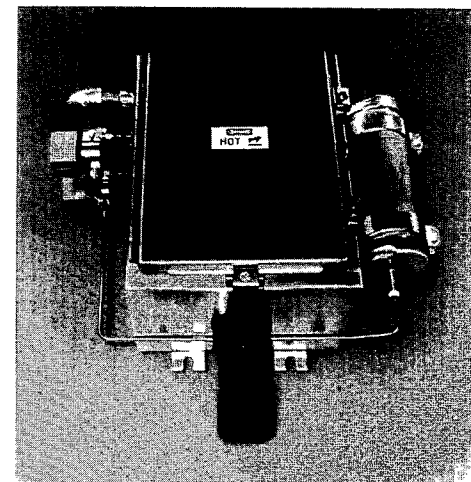


SP 110 GAS SAMPLING PROBE

The Model SP 110 Gas Sampling Probe from Rosemount Analytical extracts a representative sample from a gas stream for analysis. The probe's external filter reduces particulate in the sample, eliminating blockage of the heated sample line. An optional backpurge feature is designed to rapidly clean the filter and sample tube, reducing maintenance.

Sample probe problems are typically caused by corrosive condensate. The SP 110 Probe and sample line are heated, maintaining an elevated sample temperature to prevent condensation.

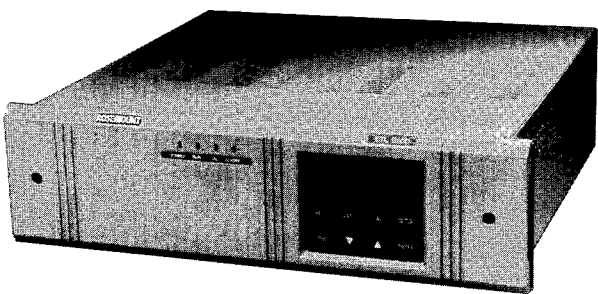
The SP 110 Gas Sampling Probe can extract a representative sample in temperatures up to 1850°F (1010°C).



ROSEMOUNT ANALYTICAL GMP 1000 ANALYZERS (Continued)

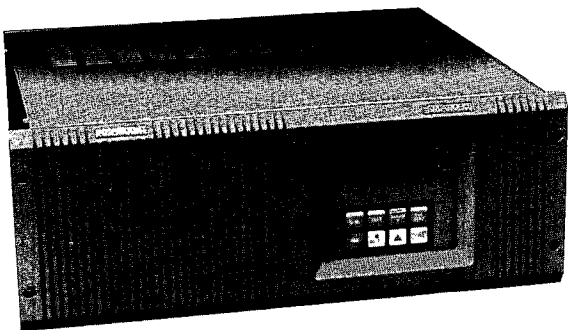
SO₂ MONITORING USING PATENTED ETALON TECHNOLOGY

The ETL 9100 Low ppm Sulfur Dioxide (SO₂) Analyzer from Rosemount utilizes electro-optic Etalon technology to measure SO₂ in the ultraviolet spectral region. Utilizing an Etalon crystal, the analyzer provides ±1% full scale accuracy by rejecting interference from other gases. The ETL 9100 has a wide dynamic dual range, with a minimum range of 0-10 ppm and an autoranging capability up to 2000 ppm. The solid-state instrument has NO MOVING PARTS, increasing reliability and reducing maintenance. The ETL 9100 digitally processes the input signal, ensuring accuracy even under extreme ambient temperature swings.



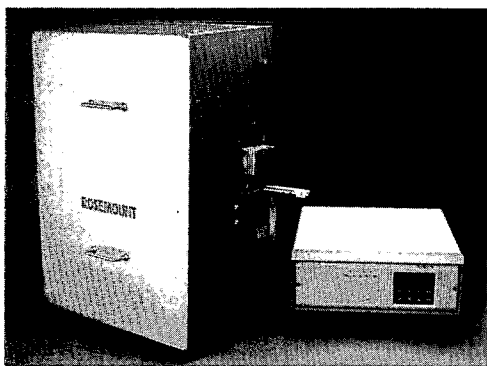
EXTRACTIVE ZIRCONIUM OXIDE OXYGEN ANALYSIS

The Rosemount Analytical OXA 1000 Oxygen Analyzer measures oxygen concentrations in non-combustible or low-level combustible gas samples. The analyzer utilizes industry-standard zirconium oxide sensor technology to provide dry analysis of process oxygen content. The OXA 1000 has NO MOVING PARTS, and requires minimum maintenance and calibration. Standard measurement ranges are 0-25% with linear output or 0.25%-25% with logarithmic output. The analyzer offers a field selectable 0-20 mA or 4-20 mA output signal and the microprocessor-based electronics proved self-diagnostic capabilities.



LOW PPM NH₃ MEASUREMENTS

The ETL 9200 Etalon Series Ammonia (NH₃) Analyzer provides low ppm measurements of NH₃. The analyzer uses a rugged ultraviolet spectrometer to reliably and accurately detect ammonia in process or stack gases. It uses a close-coupled, stack-mounted analyzer to monitor NH₃ for regulatory compliance. Utilizing Rosemount's patented electro-optic Etalon technology, the ETL 9200 analyzer rejects interfering gases and provides a direct, real-time ammonia measurement for greater accuracy. The analyzer is programmable in 1 ppm increments from 0-10 ppm up to 0-200 ppm.



SPECIFICATIONS ①

GMP 1000 SPECIFICATIONS

Dimensions:	78.9"H x 31.5"W x 31.5"D (2000 mm H x 800 mm W x 800 mm D)
Enclosure:	NEMA 12
Weight:	approximately 500 lbs (227 kg)
Sample Moisture:	up to 40% moisture
Sample Temperature:	less than 1800°F (982°C)
Sample Pressure:	-5 to 15 in. (-127 to 381 mm) H ₂ O
Sample Flow Rate:	5 L/min from sample probe to conditioning drier. Sample then splits to bypass — providing field selectable flow rate to analyzer(s) from 0.5 - 2 L/m

Ambient Temperature Range:	45° to 85°F (7° to 29°C) for use in controlled environment 0° to 110°F (7° to 43°C) with optional HVAC
Ambient Humidity:	0 to 90%, non-condensing
Response Time:	Variable. Time lag for sample transport from probe to analyzer is dependent upon distance. Approximately 0.2 sec/ft.
Power Requirements:	110/220 Vac ±10%, 60 Hz ±1.5 Hz, single phase
Power Consumption:	approximately 6 kVA with 100 ft (30 m) of sample line

① Specifications subject to change without notification. Our policy is one of continuous product improvement, and we reserve the right to change specifications.

SPECIFICATIONS (Continued) ①

GMP 1000 SPECIFICATIONS (Continued)

Contact Inputs:	Manual Cal - control of all test gas solenoid valves (dry contacts) Auto Cal - dry contact inputs rated 24 Vdc, 2.5 mA for remote cal initiate and remote cal inhibit	Contact Outputs:	Manual Cal - form A dry contacts rated 2A at 28 Vdc, system fault, system in calibration Auto Cal - form A dry contacts rated 2A at 28 Vdc, system fault, auto cal fault, system in calibration
Analog Outputs:	Manual Cal - standard analyzers provided with 0-5 Vdc outputs Auto Cal - standard analyzers provided with 0-5 Vdc outputs. Auto cal feature retransmits this signal as 4-20 mA dc signal to customer connection terminal strip		

MODEL 880A INFRARED ANALYZER

Precision:	1% of full scale	Materials in Contact with Sample:	
Noise:	1% of full scale	Windows:	Sapphire, quartz, Intran™
Zero Drift*:	±1% of full scale per 24 hours	Cells:	Gold-plated Pyrex™ or stainless steel
Span Drift*:	±1% of full scale per 24 hours	Tubing:	FEP Teflon™
Response Time (Electronic):	Variable, 90% of full scale in 0.5 sec to 20 sec field selectable	Fittings:	316 stainless steel
		O-Rings:	Viton-A™
		Sample Flow Rate:	Nominal 500 to 1,000 cc/min.
		Sample Pressure:	Max. 10 psig (69 kPa) (higher pressures used in pressurized cell applications)
		Linearization:	Keypad entered coefficients or linearizing 1, 2, or all 3 ranges

* Performance specifications based on ambient temperature shifts of less than 20°F (11°C) per hour.

Pyrex is a registered trademark of Corning Glass Works
Viton is a registered trademark of E.I. duPont de Nemours & Co.

MODEL 755R SPECIFICATIONS

Oxygen Ranges:	0 to 5%, 0 to 10%; 0 to 25%; 0 to 50%; 0 to 100% oxygen
Response Time:	(90% Full scale) factory set for 20 seconds
Zero Drift:	±1% Full scale per 24 hours provided ambient temperature does not change by more than 20°F (11.1°C) ±2.5% Full scale per 24 hours with ambient temperature change over entire range Same as zero drift
Span Drift:	Same as zero drift
Operating Pressure Limits:	Maximum 10 psig (69 kPa) Minimum 500 mm Hg absolute
Materials in Contact with Sample Gas:	316 ss, glass, titanium, Paliney No. 7™, epoxy resin, Viton A™, platinum, nickel and magnesium fluoride

OPM 2000A OPACITY MONITOR

ENVIRONMENTAL		OPERATIONAL	
Flue Gas		Accuracy:	±1%
Temperature:	Maximum 1000°F (538°C)	Resolution:	<0.1% opacity
Flue Gas Pressure:	Maximum 10 in. (254 mm) WC with supplied blowers	Response Time:	<10 seconds
Light Source:	Gas filled incandescent bulb. Expected life greater than 30,000 hours	Calibration Error:	<2% opacity
		Zero Drift:	<2% opacity in three months
		Calibration Drift:	<2% opacity in three months
TRANSCEIVER AND RETROREFLECTOR		Auto Lamp	
Enclosure Type:	Moisture-proof, designed for NEMA 4 (IP56) environments	Compensation:	Included
		Signal Averaging:	13 selectable averages: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60, and 0.25 minutes
AIR LENS ASSEMBLY		Automatic Calibration	
Dimensions:	Diameter 11 in. (280 mm) Length 6 in. (150 mm) Weight 18 lbs (8 kg)	Verification:	User-selectable, 1 to 1440 minutes
Blower Motor:	Maximum volume 40.0 cfm @ 10 in. H ₂ O	Analog Outputs:	Two to four linear isolated outputs, 4-20 mA or 0-20 mA 900 ohms (user definable)
		Contact Outputs:	8 SPST relays, including four selectable alarms
		Output Ranges:	Measurement ranges are continuously adjustable (field adjustable)

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SPECIFICATIONS (Continued) ①

MODEL ETL 9100 ETALON SERIES SO₂ ANALYZER

Dual range:	Adjustable in 1 ppm increments	Front panel:	Membrane keypad with 4 line LCD display and LED status indicators.
Low range:	0-30 ppm	Auto range:	0-1000 ppm FS
	↓		↓
	0-1000 ppm		0-2000 ppm FS
Response time:	3 seconds		
Accuracy:	±1% of FS range	Outputs	
Minimum detectable:	1% of FS range	Analog:	0-10V or 0-20 mA or 4-20 mA (isolated)
Calibration:	External gas source, manual calibration, or automatic calibration (optional).	Alarms:	3 relays; range, level, trouble relays rated for 1 amp 250 Vac.
		Electrical:	90-127 Vac or 200-240 Vac, 50/60 Hz
		Temperature:	32° to 113°F (0° to 45°C)
		Humidity:	20-85% non-condensing

MODEL OXA 1000 OXYGEN ANALYZER ②

Standard measurement ranges:	Measures O ₂ from 0-25% with linear output or 0.25-25% with logarithmic output. Field selected 0-20mA dc or 4-20 mA dc. Maximum load 600 ohms.	Calibration gas mixture:	O ₂ /N ₂ , minimum 1% O ₂
Current output:	0.1% O ₂ or ±3% of reading, whichever is greater using Rosemount test gases.	Calibration gas flow rate:	5 scfh
Accuracy:	10 seconds	Alarm set point:	0-25% O ₂
Speed of response:	Keyboard selectable, three ranges: percent, to the 1/10th of one percent, and to the 1/100th of one percent.	Alarm action:	High/Low/Off
Display precision:		Supply voltage:	115/220 Vac at 50/60 Hz
Sample specifications:		Power consumption:	250 watts maximum, 75 watts nominal
Temperature:	50° to 1300°F (10° to 740°C)	Environmental Specifications	
Operating pressure limit:	10 in. (254 mm) H ₂ O	Location:	Non-hazardous, weather protected area
Sample flow rate:	5 scfh	Ambient temperature reading:	40° to 120°F (5° to 50°C)
Material in contact with sample:	316L Stainless Steel	Humidity:	95% relative humidity maximum
		Analyzer housing:	NEMA 1
		Mounting:	Standard rack mount, 19 in. (483 mm)
		Approximate shipping weight:	25 lbs (11 kg)

MODEL ETL 9200 ETALON SERIES NH₃ ANALYZER

CONTROL MODULE		ANALYSIS MODULE	
Dual range:	Adjustable in 1 ppm increments up to 200 ppm	Calibration:	External gas source 20 scfh at 5 to 15 psig (34 to 103 kPa). Zero and span gases have dedicated entries located on side panel.
Low range:	0-10 ppm	Electrical:	90-127 Vac only. Total power consumption less than 800 watts.
Auto range:	0-200 ppm FS	Air:	Air with less than 40 ppm total hydrocarbons (THC) for vortex cooler. Eductor requires 60 to 100 psig (414 to 689 kPa) air at 10 scfm.
Accuracy:	±1% of FS range	Maximum dew point:	15°F (-26°C)
Minimum detectable:	1% of FS range	Ambient temperature:	-40° to 140°F (-40° to 60°C)
Calibration:	External gas source, manual calibration, or automatic calibration (optional).	Approximate shipping weight:	80 lbs (36.28 kg)
Front panel:	Membrane keypad with 4 line LCD display and LED status indicators.	Installation:	Stack mounted NEMA 4 enclosure. Mounting flange 4 in. (102 mm) 150 ANSI type.
Outputs			
Analog:	0-10V or 0-20 mA or 4-20 mA (isolated)		
Alarms:	3 relays; range, level, trouble relays rated for 1 amp 250 Vac.		
Electrical:	90-127 Vac or 200-240 Vac, 50/60 Hz		
Temperature:	32° to 113°F (0° to 40°C)		
Humidity:	20-85% non-condensing		
Approximate shipping weight:	20 lbs (9.07 kg)		
Installation:	19 in. (483 mm) rack mount, one enclosure (3U High) or stand-alone, indoors.		

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② All static performance characteristics are with operating variables constant.

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(Cont'd)	02	050
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- NOTES:**
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STARTUP, TRAINING, AND GUARANTEED CERTIFICATION

This option provides the following services:

- Two (2) days on site startup and checkout of the GMP 1000.
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Preparation and submittal (to the client) of a complete written report covering the certification of the GMP 1000.

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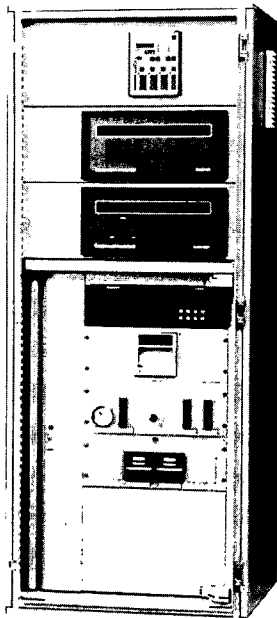
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FISHER-ROSEMOUNT™ Managing The Process Better.™

GMP 1000

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Supersedes Product Data PD 103-101,
Pages 1-8, dated November, 1994

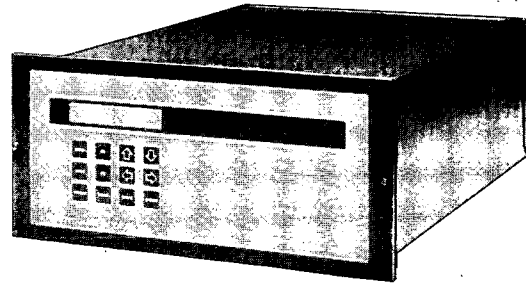
ROSEMOUNT ANALYTICAL GMP 1000 ANALYZERS

GAS ANALYSIS USING INFRARED SPECTROSCOPY

The GMP 1000 measures seven gases using the Rosemount Analytical Model 880A Infrared Analyzer. The Model 880A is a microprocessor-based instrument which uses the proven Luft detector for measuring a wide range of stack gases. Ease of operation and calibration, programmable linearizing coefficients, field retrofitable configurations, selectable speed of response and field proven reliability are just a few of its many standard features.

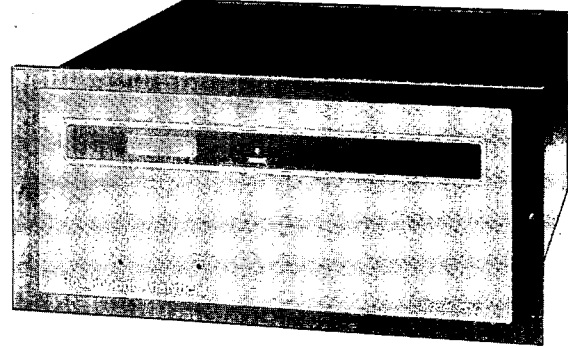
Model 880A Applications:

- 0-100 ppm CO
- 0-800 ppm SO₂
- 0-1000 ppm CO
- 0-4000 ppm SO₂
- 0-10000 ppm CO
- 0-5% CO₂
- 0-20% CO₂



PARAMAGNETIC OXYGEN ANALYSIS

The Rosemount Analytical Model 755R Series Analyzer measures oxygen in stack gases using a field-proven paramagnetic technique. This reliable analyzer allows the GMP 1000 package to measure oxygen (as a diluent gas) in ranges varying from 0 to 1 percent to 0 to 100 percent oxygen full scale.

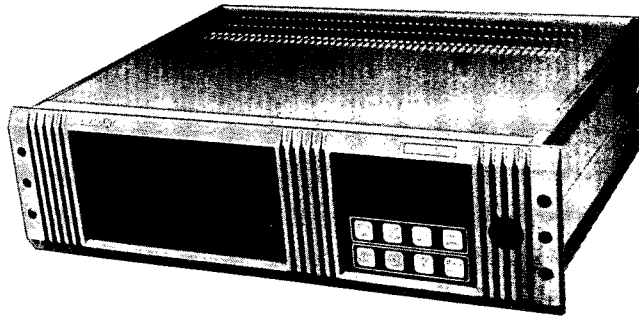


NO_x MEASUREMENT

The Rosemount Analytical Model 951 Series Analyzers use the chemiluminescent detection technique to monitor Nitrogen Oxides (NO_x) in stack gases for emissions monitoring. The 951 Series offers a wide selection of full scale ranges from 10 to 10,000 ppm.

STATE-OF-THE-ART OPACITY MONITORING

The Rosemount Analytical OPM 2000A Opacity Monitor is a transmissometer instrument designed to meet all EPA 40 CFR, Part 60, Appendix B Performance Specifications. It is the only opacity monitor on the market to utilize a single source, single detector, double pass principle of measurement with no moving parts. Measurement ranges are continuously adjustable (field adjustable).



ORDERING INFORMATION

GMP 1000	CEMS Model GMP 1000	Complete Shipping Weight: 1000 lbs (454 kg)									
Code		Number of Gases (Includes Sample Probe and Conditioning System) ¹									
1		One									
2		Two									
3		Three									
Code		Automatic Calibration									
1		Manual Calibration PER ANALYZER									
2		Automatic Calibration									
3		Automatic Calibration with Diluent Correction									
Code		Outputs ²									
0		Non-isolated PER OUTPUT									
X		Isolated (X = # of Outputs, 5 max.)									
Code		Analyzer 1									
10		³ CO: 0 - 100 ppm									
11		0 - 1000 ppm									
12		0 - 10000 ppm									
20		³ CO ₂ : 0 - 5%									
21		0 - 20%									
30		SO ₂ : ⁷ 0 - 30 Thru 0 - 400 ppm									
31		³ 0 - 800 ppm									
32		³ 0 - 4000 ppm									
50		⁴ NO _x : 0 - 10, 25, 100, 250 ppm									
51		⁵ NO/NO _x : 0 - 10, 25, 100, 250, 1000, 2500, 10000									
60		⁵ O ₂ : 0 - 5, 10, 25, 50%									
61		⁵ 0 - 5, 10, 25, 50%									
90		⁹ NH ₃ : 0 - 10 ppm thru 0 - 200 ppm									
99		Other									
Code		Analyzer 2									
00		Single gas package									
XX		Follow designation for Analyzer 1 above									
Code		Analyzer 3									
00		Single gas package									
60		¹⁰ O ₂ : 0 - 5, 10, 25, 50%									
61		⁸ O ₂ : 0 - 5, 10, 25, 50%									
Code		Cabinet									
10		NEMA 12									
11		NEMA 12 w/HVAC ¹¹									
21		NEMA 4 w/HVAC ¹¹									
31		NEMA 4X w/HVAC ¹¹									
Code		OPM 2000A Opacity Monitor									
0		None									
1		OPM 2000A included									
Code		Probe Blowback									
0		None									
1		Supplied									
GMP 1000	2	2	2	50	61	00	21	0	1	Continued	EXAMPLE