

# CAT Continuous Gas Analyzer Transmitter With Optional FOUNDATION™ fieldbus Communications

- Single, dual- or three-channel multi-component analyzer
- CSA-C/US and CENELEC-approved for Class I, Zone I, Group IIB+H<sub>2</sub> environments
- NEMA 4X / IP 66
- Supports NDIR, VIS, UV, paramagnetic O<sub>2</sub>, electrochemical O<sub>2</sub> and thermal conductivity detectors
- Integral touch pad provides access to setup and viewing screens without disassembly or shut-off
- Eliminates high-cost, environmentally-controlled shelters
- Improves process control by as much as 16:1
- Simple, fast and easy maintenance: internal analyzer can be removed and replaced quickly and easily
- Operates as a stand-alone analyzer or as part of an analyzer network
- -30 to 50°C (-22 to +122°F) ambient temperature option allows for continuous operation in nearly all climates
- Optional sample conditioning plate allows for a complete, stand-alone analyzer system
- Optional analog, digital and serial I/Os permit sophisticated PLC functionality
- High-performance microflow NDIR detector allows measurements as low as 0 to 10 ppm CO and 0 to 5 ppm CO<sub>2</sub>



## PRODUCT DESCRIPTION

Rosemount Analytical, the world leader in process gas analyzers, offers the CAT 200 multi-component, multi-technology continuous gas analyzer transmitter with explosion-proof packaging. The CAT 200 provides superior performance and has been designed for precise, continuous gas measurements in a variety of applications.

## FIELD MOUNTABLE HOUSING

The CAT 200 is housed in a Class I, Zone I (IIB) + H<sub>2</sub> approved transmitter-style enclosure that can be field-mounted in the harshest environmental conditions. The enclosure can be mounted near the process without requiring ambient controls or costly and space-consuming shelters. This feature greatly reduces installation and utility costs while vastly improving process efficiency.

## MULTI-MEASUREMENT CAPABILITY

The CAT 200 can continuously measure up to 3 components in a single analyzer using a combination of non-dispersive infrared (NDIR), ultraviolet (NDUV), visible (VIS) spectroscopy, paramagnetic or electrochemical oxygen and thermal conductivity sensors. This exceptional flexibility has been achieved by combining the most sophisticated gas detection sensor technology with close-coupled Digital Signal Processing (DSP).

## ANALYZER NETWORKS

The CAT 200 can network with up to 15 other CAT 200 or NGA 2000 analyzer module channels. The analyzer module is a blind analyzer unit, but retains all of the advanced CAT 200 design features. In addition to the operational benefits, the CAT 200 offers significant installation and maintenance savings not possible with conventional analyzers. The CAT 200 analyzer's unique network capability allows the user to easily route all of the field-mounted analyzer module inputs, outputs and diagnostics into one easily accessed central location.

## MEASUREMENTS

The CAT 200 brings together more than 40 years of development and process application expertise including the latest sensors, digital signal processing and software technologies. The CAT 200 can satisfy the most demanding single- or multi-component analysis requirements. More than 60 gas components can be measured including:

Carbon Monoxide (CO)	Oxygen (O <sub>2</sub> )
Carbon Dioxide (CO <sub>2</sub> )	Water (H <sub>2</sub> O)
Sulfur Dioxide (SO <sub>2</sub> )	Methane (CH <sub>4</sub> )
Nitrogen Dioxide (NO <sub>2</sub> )	Hydrogen (H <sub>2</sub> )
Ammonia (NH <sub>3</sub> )	Ethylene (C <sub>2</sub> H <sub>4</sub> )

## STANDARD TOUCHPAD CONTROL

The touchpad interface offers the user setup and control capabilities without needing to open the analyzer housing or shut off power. All analyzer key functions are accessible including auto calibration, limit alarms, range selection, diagnostic viewing and much more by simply pointing your finger at the appropriate function key accessible through the glass-covered touchpad interface.

## LOW AMBIENT TEMPERATURE CONTROL OPTION

A specially-designed temperature control system has been engineered into the CAT 200 housing, allowing the unit to operate at temperatures from -30 to +50°C. The system maintains a constant temperature internal to the CAT 200 regardless of the ambient temperatures. This control of the temperature assures accurate measurements.

## ADVANCED PLC FUNCTIONALITY OPTION

Using optional SIO and DIO I/O boards, the flexibility and diversity of the CAT can be expanded well above any other analyzer. These boards allow the user to selectively choose from more than 80 different signals and parameters including:

- Up to 8 programmable analog output channels: concentration, temperature, pressure, flow, calculator results
- Up to 3 relay contacts, programmable, e.g. acc. to NAMUR: unit failure, maintenance request, function control
- Serial interfaces: RS 232 or RS 485
- Up to 15 digital outputs and 6 digital inputs: zero and span Initiate and in progress, concentration alarm, flow alarm, range identification, etc.

## SAMPLE HANDLING/CONDITIONING OPTION

With the addition of a sample handling and conditioning system mounted to an integral plate, the CAT 200 becomes a complete stand-alone, in-field, transmitter-style analyzer system. The sample conditioning plate option is a small and efficiently designed system that is bolted directly onto the analyzer housing at the factory for a final one-piece system construction. This one-piece unit can then be easily mounted to the process pipe. Thus, this feature offers highly efficient and fast process monitoring installation at low cost. The sample conditioning system is designed by experienced Rosemount Analytical engineers who will tailor the sample handling system around your particular process parameters and required measurements.

## FOUNDATION™ FIELDBUS COMMUNICATIONS OPTIONS

FOUNDATION fieldbus offers the newest, most innovative field control architecture available. A two-wire digital communications protocol enables individual instruments to communicate together and be interoperable with other FOUNDATION fieldbus capable instruments. This communications data can carry vast amounts of information that is not accessible by using analog or digital devices – information not only about the process, but also about the equipment controlling it. See *the Emerson Process Management PlantWeb Brochure for details.*

## CAT DETECTOR METHODOLOGIES

### NDIR/UV/VIS Technology

The compact, optical bench can selectively measure multiple components by using a unique dual optical bench design. Depending on the application, any two combinations of NDIR/UV or VIS channels can be combined on a single chopper motor, dual bench assembly. Two different measuring principles exist depending on the application and configuration of the CAT 200.

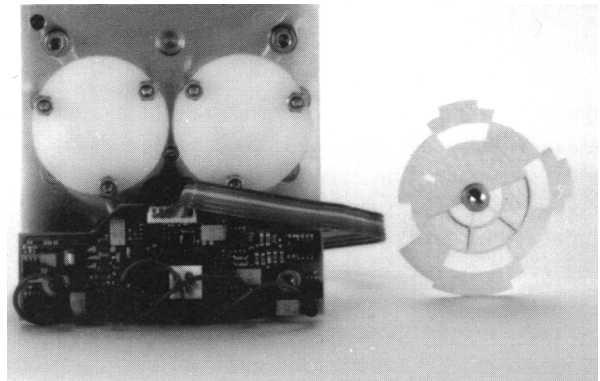
The NDIR micro-flow detector consists of two chambers: an absorption chamber and a compensation chamber. The chambers have an interconnected path in which an ultra-low flow filament sensor is mounted. During operation, a pulsating flow occurs between the two chambers that is dependent upon sample gas absorption, modulation by the chopper motor and the fill gas of the detector chambers. The micro-flow gas detector output is proportional to the measured gas concentration. The optical bench contains a unique eddy current drive chopper motor and source assembly. This design incorporates on-board "intelligence" to provide continuous "self test" diagnostics.

The brushless motor, long-life bearings and ultra-high rotation speed (120 Hz) ensure long-term reliability, stability and immunity from power and frequency variations. Incorporated into the chopper wheel assembly is the patented "Proof-Peak" automatic detector signal. This unique feature, operating at 30 times per second, continuously adjusts the detector signal. In addition to providing long-term stability, accuracy and drift-free operation, this feature facilitates very fast warm-up. Measuring in VIS/UV region avoids cross interferences that might occur using IR measurements for some gas mixtures and background components, providing the opportunity for enhanced selectivity and sensitivity.

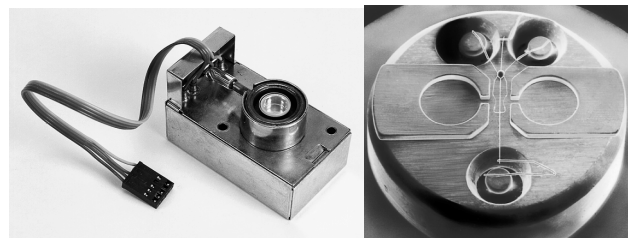
Other application-dependent options include a wide range of sample cell materials, optical filters and solid state detectors.

### ELECTROCHEMICAL O<sub>2</sub>

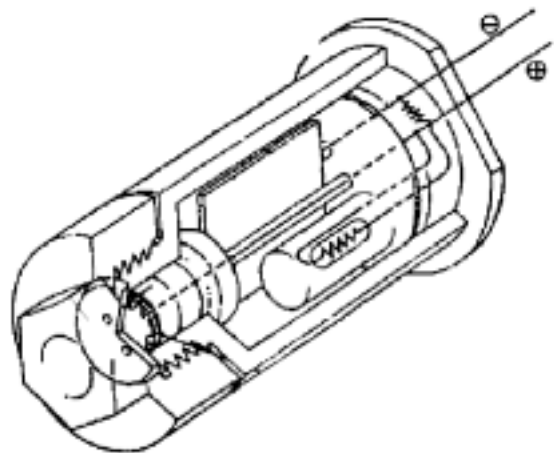
The determination of oxygen is based on a galvanic cell. When sample gas is passed over a selective gas diffusion membrane any oxygen present diffuses into an electrolyte. The oxygen is absorbed and is reduced to water. Lead oxide is developed at the anode. Electrons generated at the anode flow to the cathode of the cell producing a current that is proportional to the oxygen concentration. The principle offers a cost-effective analysis with negligible interference in standard applications, ease of maintenance and immunity from vibration.



**Chopper Motor/Source Assembly**



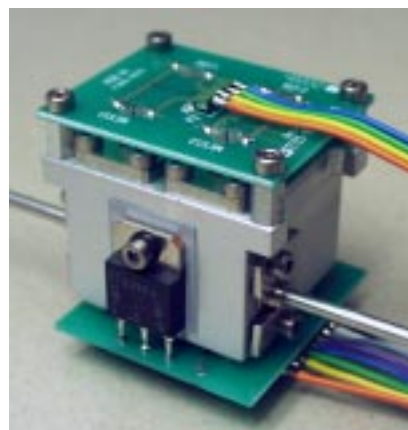
**Microflow Detector**



**Electrochemical Cell**

## THERMAL CONDUCTIVITY (H<sub>2</sub>, He, Ar)

Thermal conductivity (TC) measuring cells incorporate electrically heated wires with cooling rates that are influenced by the sample gas in the cell. The cell combines short response time with minimum interference which was achieved by the special design of the new TC cell. This cell contains two passages, each equipped with two thermal sensor devices. One passage is supplied with sample gas and the other is supplied with an optional reference gas or a closed loop. The cell is optimized to a certain response time band for increasing and decreasing concentrations (see detector specifications) with least dependence on sample flow rate. The TC is equipped with an electronic compensation system for handling multi-component mixtures. Disturbance can be compensated for with internal or external cross compensation of measured gas constituents.

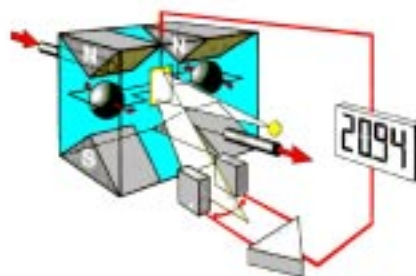


*Thermal Conductivity Measuring Cell*

## PARAMAGNETIC O<sub>2</sub>

Paramagnetic determination of oxygen is based on the measurement of the magnetic susceptibility of the sample gas. Oxygen is strongly paramagnetic, while other common gases are not. The detector used is compact, has fast response and a wide dynamic range. The long-life cell is corrosion-resistant, heated and may be easily cleaned. It has rugged self-tensioning suspension and is of welded non-glued construction.

Rosemount Analytical also provides solvent-resistant cells, corrosion-resistant cells or intrinsically safe cells for potentially explosive sample gas.



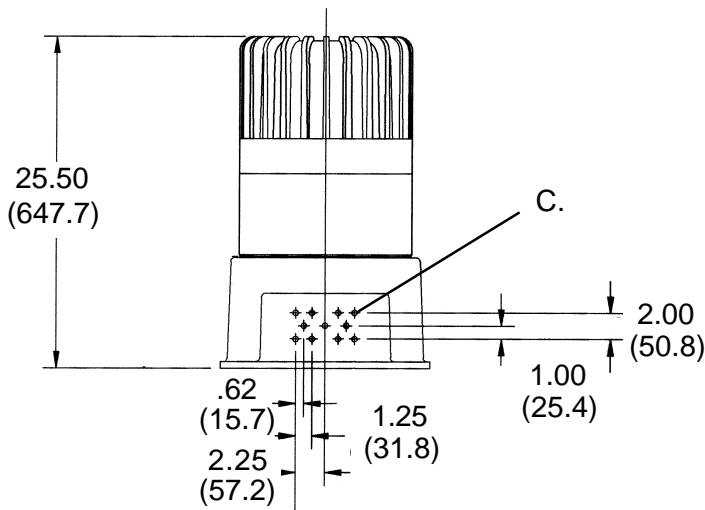
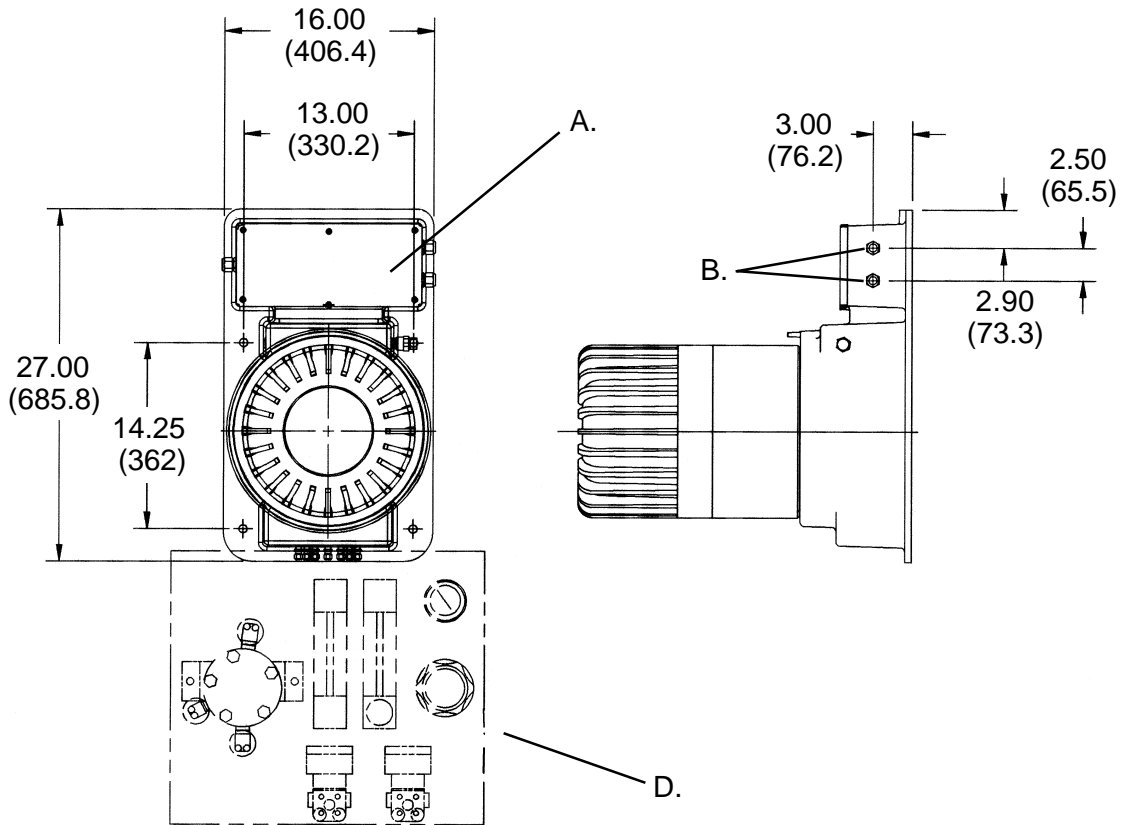
*Paramagnetic Detector Assembly*

## CAT VALUE COMPARISON

ITEM	1 Year Cost CAT	1 Year Cost Others
Dual-channel NDIR analyzer	\$17,000	\$20,000
Sample handling system	Internal	\$5,000
Shelter cost/analyzer	\$0	\$10,000
Annual shelter maintenance/analyzer	\$0	\$1,000
Shelter installation	\$0	\$5,000
Analyzer installation	\$900	\$250
Peripheral installation costs	\$5,000	\$10,000
Training costs	\$1,000	\$1,000
Plant air cost	\$0	\$788
Calibration gas cost	\$3,000	\$3,000
Installed sample line cost	\$50	\$1,000
<b>TOTALS</b>	<b>\$26,950</b>	<b>\$57,038</b>
<b>Savings PER CAT =</b>	<b>\$30,088</b>	

Due to possible combinations of process conditions, applications, stream compositions and installation criteria, the prices shown are intended for guidance only and as such do not constitute an "offer" or "formal contract."

# DIMENSIONAL DRAWING



- A. Increased safety junction box
- B. Analog and digital I/O ports (M16 x 1.5)
- C. Eleven gas connection ports (if required for application, flame arrestor(s) installed).
- D. Sample handling plate option. Size and arrangement subject to application.

Note: The increased safety junction box must be protected by fuse supply which has a breaking capacity adjusted to the short circuit of the equipment.

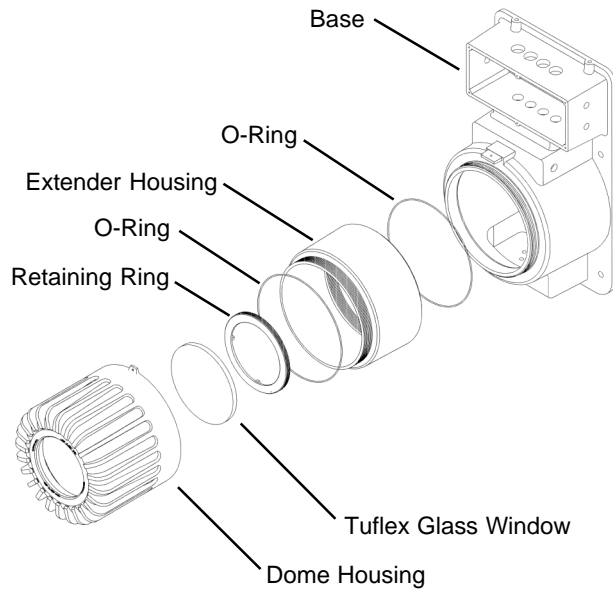
Dimensions are in inches (mm in parentheses)

Dimensional drawings are subject to change without notification.

## CAT 200 ENCLOSURE ASSEMBLY

The CAT 200 enclosure is comprised of three major sections:

- The base
- The extender housing
- The dome housing



The three sections are threaded together. To remove, turn counterclockwise and to replace turn clockwise.

## TYPICAL CAT APPLICATIONS

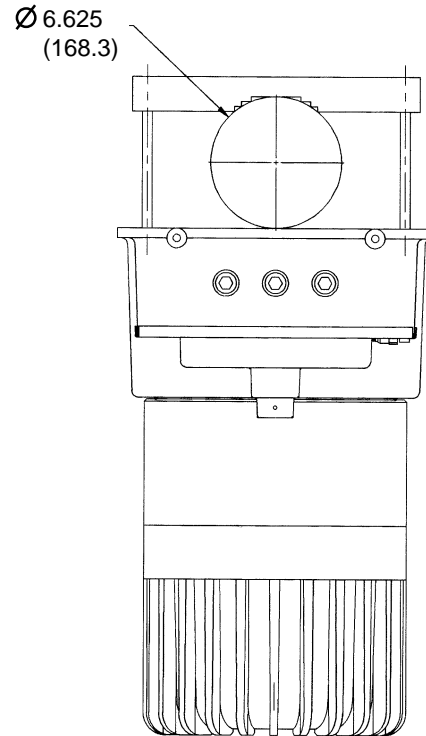
### • Petroleum Refinery

Light naphtha isomerization  
Catalytic reforming  
Fluidized catalytic cracking  
Sulfur recovery units  
CEMS

### • Petrochemical Complex

Sulfuric and nitric acid manufacturing  
Corrosive and toxic process gas monitoring  
Ethylene in demethanizer overhead CEMS

## PIPE MOUNTING DETAIL



Note: Dimensions are in inches (mm in parentheses)

### • Ammonia and Urea

H<sub>2</sub>, CO and CO<sub>2</sub> in synthesis gas

### • Metals

H<sub>2</sub> in endothermic furnace

### • Utility

H<sub>2</sub> cooling gas in turbine generators CEMS

## STANDARD CONFIGURATION PARAMETERS

Gas Components *		Minimum Ranges	Maximum Ranges
Carbon dioxide	CO <sub>2</sub>	0 - 5 ppm	0 - 100%
Carbon monoxide	CO	0 - 10 ppm	0 - 100%
Hexane	C <sub>6</sub> H <sub>14</sub>	0 - 300 ppm	0 - 9,000 ppm
Methane	CH <sub>4</sub>	0 - 300 ppm	0 - 100%
Propane	C <sub>3</sub> H <sub>8</sub>	0 - 1,000 ppm	0 - 100%
Oxygen, paramagnetic	O <sub>2</sub>	0 - 1%***	0 - 100%
Oxygen, electrochemical	O <sub>2</sub>	0 - 5%	0 - 25%
n-Butane	C <sub>4</sub> H <sub>10</sub>	0 - 800 ppm	0 - 100%
Ethylene	C <sub>2</sub> H <sub>4</sub>	0 - 400 ppm	0 - 100%
Water vapor **	H <sub>2</sub> O	0 - 1,000 ppm	0 - 3%
Hydrogen	H <sub>2</sub>	0 - 5%	0 - 100%
Helium	He	0 - 10%	0 - 100%
Argon	Ar	0 - 50%	0 - 100%
Sulfur dioxide	SO <sub>2</sub>	0 - 130 ppm	0 - 80%
Nitrogen monoxide	NO	0 - 250 ppm	0 - 100%
Nitrogen dioxide	NO <sub>2</sub>	0 - 250 ppm	0 - 1,000 ppm
Ammonia	NH <sub>3</sub>	0 - 100 ppm	0 - 100%
Nitrous oxide	N <sub>2</sub> O	0 - 200 ppm	0 - 2,000 ppm
Sulfur hexafluoride	SF <sub>6</sub>	0 - 20 ppm	0 - 2%

\* Other components and configurations on request

\*\* Dew point must not exceed ambient temperature

\*\*\* Non-standard specifications

## CAT 200 SPECIFICATIONS - GENERAL <sup>1</sup>

**Power:** Universal power supply 90 – 264 VAC, 50 – 60 Hz, ± 10% 180 watts maximum at start up. 380 watts with optional case heater

**Detectors:** NDIR/VIS/UV, PMD, EO<sub>2</sub>, TC

**Channels:** Up to four in one analyzer

**Mounting:** 4" or 6" pipe, rack-, wall- or floor-mount

**Area Classification:** NEMA 4X / IP 66  
**U.S.A.** Class I, Zone 1, AEx d e m IIB+H<sub>2</sub> T4X

**Canada** Ex d e m IIB+H<sub>2</sub> T4X

**Europe** Category 2, Zone 1, Group IIB+H<sub>2</sub>, T4

**Compliances:** NRTL/OSHA – Canadian Standards Association (CSA)  
European legislation: 0081 Ex II 2 G EEx d e m IIB +H<sub>2</sub> T4  
NAMUR (EMC)  
Australia/New Zealand – C-Tick (EMC)

### Ambient

**Temperature:** 0 to +50°C (+32 to +122°F)  
option: -30 to +50°C (-22 to 122°F)

**Relative Humidity:** 5 to 100%

**Inputs/Outputs:** SIO options

**Analog Outputs:** Up to 8 isolated 0(2) - 10 V, ≥ 2 K Ω, 0(4) - 20 mA (500 Ω, maximum load)

**3 Output Relays:** 30 VDC maximum, 1A, 30 W

**Serial:** RS485 multi-drop network or RS232 serial data  
FOUNDATION fieldbus - Non-Intrinsically Safe

**Inputs/Outputs:** DIO options

**Digital Outputs:** Up to 15: 5 - 30 VDC maximum, current 500 mA VDC

**Digital Inputs:** Up to 6: 5 - 30 VDC / 2.2 mA

**Instrument Weight:** 120 to 150 lbs. (55 to 70 kg)

<sup>1</sup> Specifications are subject to change without notification. Our policy is one of continuous improvement, and we reserve the right to change specifications.

<sup>2</sup> IP 66 and Optional Temperature Control Kit approvals in process.

# CAT 200 DETECTOR SPECIFICATIONS<sup>①</sup>

	NDIR/UV/VIS	O <sub>2</sub> Paramagnetic <sup>1</sup>	O <sub>2</sub> Electrochemical	Thermal Conductivity <sup>4</sup>	NDIR <sup>Ultra Low</sup> CO <sub>(0-10 ppm)</sub> CO <sub>2 (0-5 ppm)</sub>
Detection limit	≤1% <sup>2,3</sup>	≤1% <sup>2,3</sup>	≤1% <sup>2,3</sup>	≤2% <sup>2,3</sup>	≤0.2 ppm <sup>3</sup>
Linearity <sup>2,3</sup>	≤1%	≤1%	≤1%	≤1%	≤1%
Zero drift	≤2%/week <sup>2,3</sup>	≤2%/week <sup>2,3</sup>	≤2%/week <sup>2,3</sup>	≤2%/week <sup>2,3</sup>	≤±0.2 ppm/24hr. <sup>3</sup>
Span drift	≤0.5%/week <sup>2,3</sup>	≤1%/week <sup>2,3</sup>	≤1%/week <sup>2,3</sup>	≤1%/week <sup>2,3</sup>	≤±0.2 ppm/24hr. <sup>3</sup>
Repeatability <sup>2,3</sup>	≤1%	≤1%	≤1%	≤1%	≤1%
Response time	3s ≤t <sub>90</sub> ≤7s <sup>4</sup>	<4s	12s	5-20s	≤10s
Sample flow rate	.2-1.5 l/min.	.2-1.5 l/min.	.2-1.5 l/min.	.2-1.5 l/min.	.2 - 1.5 l/min.
Sample pressure	≤1500 hPa abs	Atm	≤1500 hPa abs	≤1500 hPa abs	≤1500 hPa abs
Influence of pressure Standard <sup>5</sup> Pressure comp. opt <sup>5</sup>	≤0.1%/hPa ≤0.01%/hPa	≤0.1%/hPa ≤0.01%/hPa	≤0.1%/hPa ≤0.01%/hPa	≤0.1%/hPa ≤0.01%/hPa	≤0.1%/hPa ≤0.01%/hPa
Influence of temperature On zero <sup>2</sup> On span <sup>2</sup> On span <sup>2,6</sup>	≤1% ≤5% <sup>7</sup> ≤1%	≤1% ≤1% ≤1%	≤1% ≤1% ≤1%	≤1% ≤2% ≤1%	≤±0.2 ppm/10 K <sup>1</sup> ≤±0.2 ppm/10 K <sup>1</sup> ≤2%
Sensor materials in contact with sample	Anodized aluminum stainless steel (gold coated), BaF <sub>2</sub> – CaF <sub>2</sub>	Stainless steel, platinum, glass, PTFE, PVDF, FPM, epoxy resin (solvent resistant: no FPM, no epoxy, but nickel, kalrez)	ABS, Teflon	Stainless steel, aluminum oxide, FPM, gold, glass	Gold plated stainless steel (aluminum), BaF <sub>2</sub> , CaF <sub>2</sub>
Warm-up time	15 to 50 min. <sup>4</sup>	50 min.	15 to 50 min.	50 min.	15 - 50 min. <sup>4</sup>

<sup>1</sup> Temperature change not greater than 10 K (°C) in 1 hour

<sup>2</sup> Related to fullscale, per 10 K (°C)

<sup>3</sup> At constant pressure and temperature

<sup>4</sup> Thermostat controlled cell 75°C (167°F)

<sup>5</sup> Related to measuring value

<sup>6</sup> With optional temperature stabilization

<sup>7</sup> Starting from 20°C (68°F) to +5°C (41°F) or +40°C (104°F)

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

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