

Paramagnetic Oxygen Analyzers Models MG8G, MG8E



Paramagnetic Oxygen Analyzer (General Purpose Type)

MG8G

Paramagnetic Oxygen Analyzer (Flameproof Type)

MG8E

Bulletin 11P03A01-01E

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Paramagnetic oxygen analyzers of new structures based on our long and field-proven experience

MG8G (General Purpose Type) / MG8E (Flameproof Type)

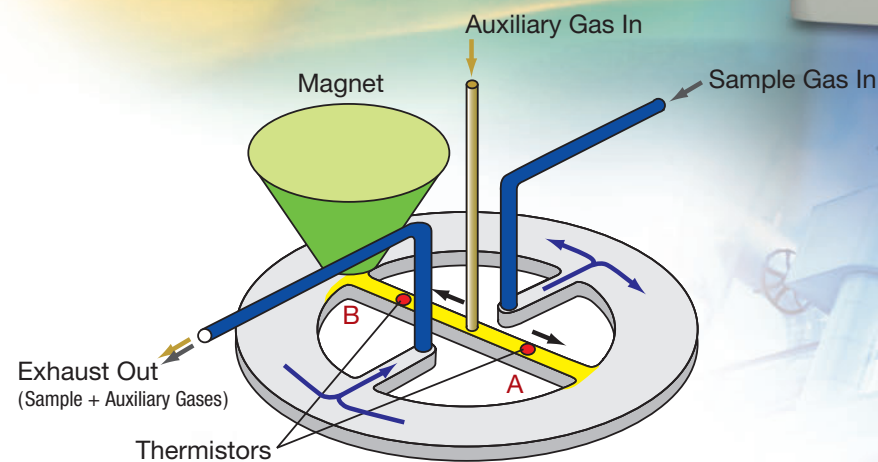
Advanced paramagnetic oxygen analyzer with fast response and various functions

Using a new magnetic flow ratio method, the MG8G and MG8E paramagnetic oxygen analyzers achieve higher performance compared to conventional analyzers. The analyzers are capable of measuring the concentration of oxygen in flammable gas mixtures in a low range with high precision, which cannot be done by a zirconia oxygen analyzer. With appropriate sampling systems, they can also be used for measurement in process gases with high temperature, high pressure, high dust content and/or high humidity. Providing excellent reliability and ease of use, the MG8G and MG8E analyzers are one of the Yokogawa's solutions that utilize accumulated know-how and reflect user needs.



Measurement Principle

Flow Schematic of Paramagnetic Oxygen Sensor Cell



A sample gas is introduced from the sample gas inlet and divided into two streams in the ring-shaped sensor cell. An auxiliary gas is introduced from the auxiliary gas inlet and divided into two streams, A and B. Each stream meets the sample gas in the ring-shaped path and where stream B meets the sample gas, a magnetic field is created by a magnet. Two thermistors are installed in streams A and B, respectively, to determine the flow rates.

When a sample gas contains oxygen, the oxygen is drawn into the magnetic field, thereby decreasing the flow rate of auxiliary gas in stream B. The difference in flow rates

of two streams, A and B, which is caused by the effect of flow restriction in stream B, is proportional to the oxygen concentration of the sample gas. The flow rates are determined by the thermistors and converted into electrical signals, the difference of which is computed as an oxygen signal.

This method provides fast response and resistance to vibration and shock. Furthermore, as the thermistors do not come in contact with sample gas, stable measurement is achieved over a long period of time without the effects of contamination and corrosion.

Features

Long-life Sensor Regardless of Process Gas Conditions

Sensors come in contact with clean auxiliary gas (N₂) but not with process gas. This allows for long-term stable measurements without the effects of contamination or corrosive gases in process.

Construction with No Moving Parts

Provides high resistance to vibration and shock. Also, stainless steel (JIS SUS316) wetted parts have excellent durability.

Interference Gas Compensation

Since flammable gases (such as H₂) possess magnetic properties (with lower magnetic susceptibility compared to oxygen), the coexistence of these gases can cause errors in paramagnetic oxygen measurement. The MG8G/MG8E compensates for the effects of background gas (one background gas or a gas mixture with constant mixture ratio) using the difference in gas densities.

High Sensitivity And Fast Response

MG8E is capable of measuring oxygen in a low range of 0-1 vol% O₂. Fast response (90% response within 3 seconds) is achieved by using thermistors that have high sensitivity and fast response, to directly detect changes in flow rates of auxiliary gases.

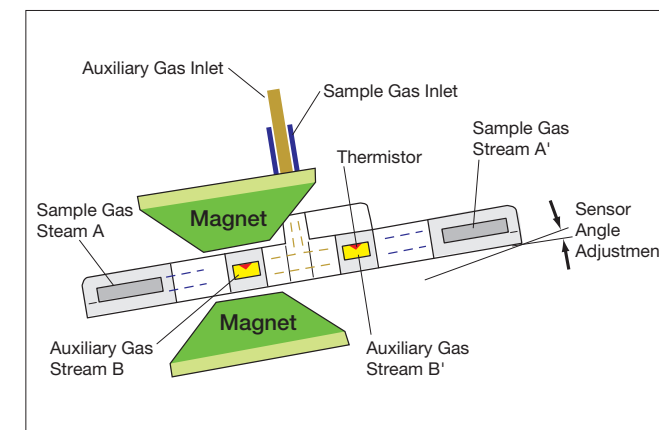
One-Touch Calibration/Labor-Saving Automatic Calibration

One-touch calibration is done by entering the specified oxygen concentration values of zero and span gases into the analyzer, introducing the calibration gas, and simply pressing the calibration key. Alternatively, automatic calibration mode can be used. Outputs for the operation of solenoid valves in zero, span and sample gas lines are provided as standard.

Multiple Self-Diagnosis Function

Detects cell error, analog error, temperature error, etc. and provides error information by error code for prompt remedial action. Contact output for low auxiliary gas pressure alarm is also available (MG8E).

Interference Gas Compensation (MG8G/MG8E)

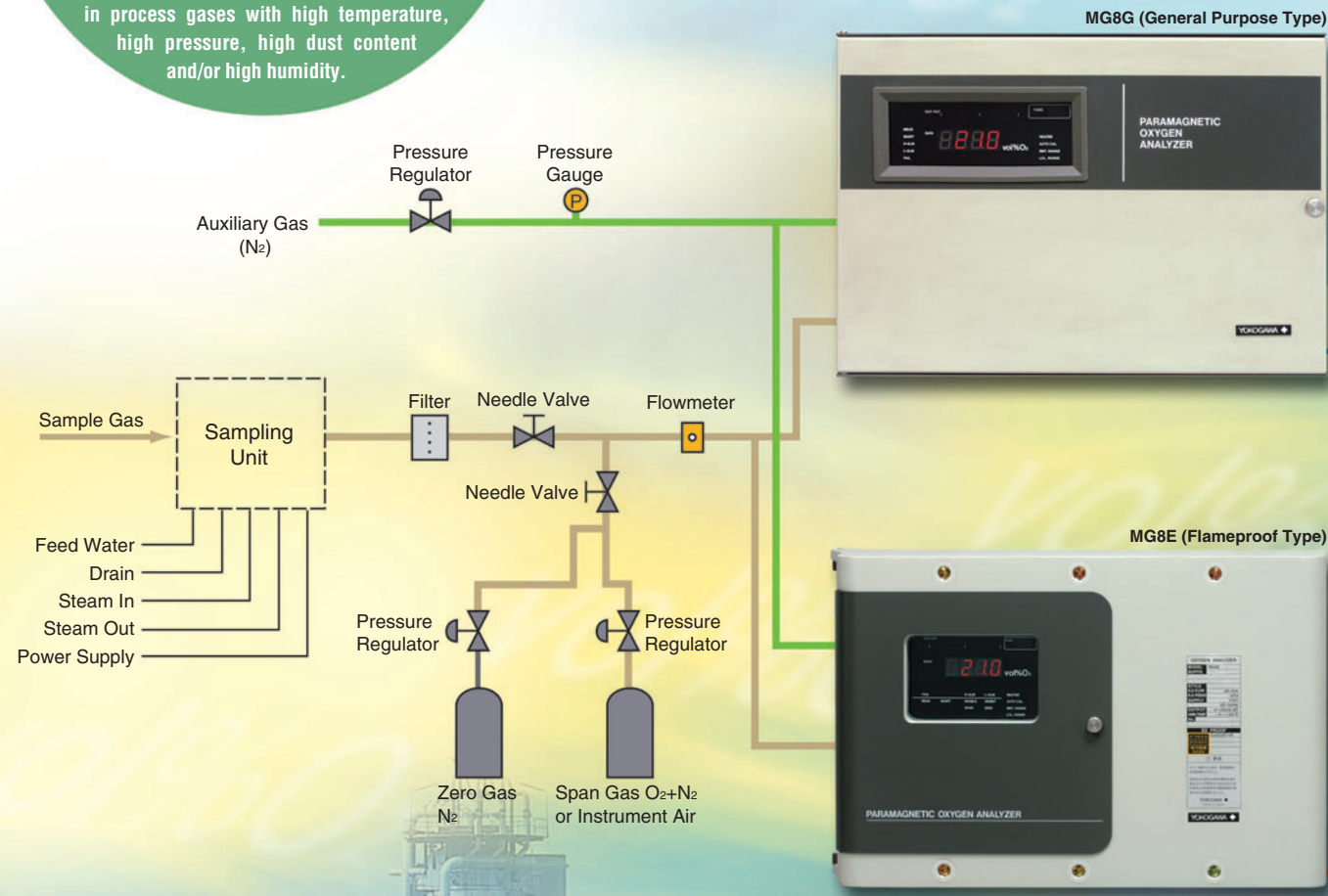


The MG8G/MG8E paramagnetic oxygen analyzers utilize the paramagnetic property of oxygen (the oxygen is drawn into a magnetic field) to measure the concentration of oxygen. However, gases other than oxygen have a little magnetism, although their magnetism is very low compared to oxygen. In actual measurement, background gas having magnetic susceptibilities may cause interference, affecting a measurement result.

For example, if carbon dioxide (CO₂) which has a lower magnetic susceptibility than nitrogen (N₂), is passed through the cell, the analyzer will read a negative value. If the cell is tilted as shown in the figure, the flow rate of the auxiliary gas toward stream B' will increase due to the higher density of CO₂. This will change the flow ratio, thereby canceling out the negative deviation. A change in the auxiliary gas flow ratio due to the magnetic susceptibility of background gas is cancelled out by a change in the auxiliary gas flow ratio due to the density difference which is generated by changing the cell angle. Thus, the interference can be compensated for.

Applications and System Configurations

The MG8G and MG8E analyzers are widely used for preventing the danger of explosion of flammable gases, controlling the partial pressure of oxygen in contact reaction processes, and monitoring the oxygen concentration of inert gases in anaerobic processes. With appropriate sampling system, the MG8G/MG8E can also be used in process gases with high temperature, high pressure, high dust content and/or high humidity.



Applications

Heating furnace	Oil/ Petrochemical
Catalyst regeneration tower	
Ethylene cracking furnace	
Electrolysis plant	Chemical
Ethylene oxide plant	
Reducing furnace	
Ammonia plant	
Silicon manufacturing plant	Iron & Steel
Air separator	
Pulverized coal injection system for blast furnace	
Coke dry quenching (CDQ) plant	
Hot-blast furnace	
Converter	Nonferrous metal
Bright annealing furnace	
Annealing furnace	
Non-oxidizing furnace	Machinery
Heating furnace	
Plating furnace	Ceramic
Cupola	
Cement kiln	Others
Incinerator	
Sludge incinerator	
Activated sludge plant	
Hyperbaric oxygenation equipment	
Fuel cell	

Typical Sampling Cabinet for MG8E



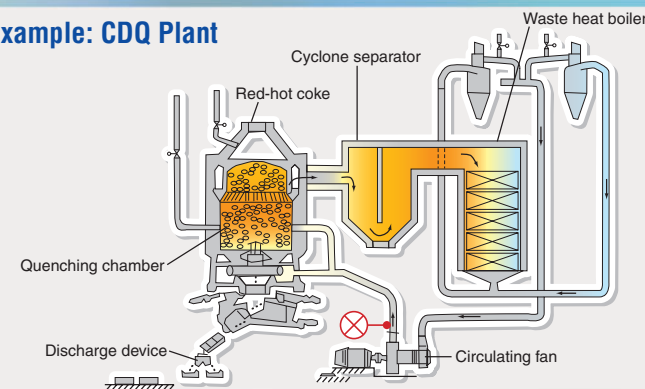
Features

- Fast response and high stability**
 - 90% response within 3 seconds
 - Interference gas compensation
 - Atmospheric pressure compensation
- Excellent maintainability**
 - One-touch calibration
 - Self-diagnosis function
 - Large, easy-to-read display
- High reliability**
 - Long life sensor regardless of process gas conditions
 - Construction with no moving parts provides vibration and shock resistance
 - Stainless steel (JIS SUS316) wetted parts
 - Flameproof construction: Exd II BT4

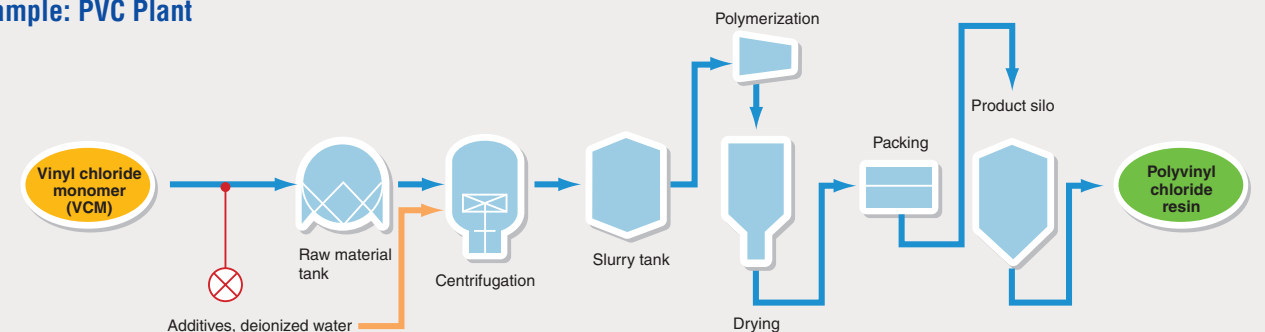
Typical Applications

- Combustion control for boilers, control for various heating and combustion furnaces
- Trace oxygen measurement in various manufacturing processes
- Explosion prevention at various plants
- Quality control of utility gas

Example: CDQ Plant



Example: PVC Plant



Standard Specifications

Model	MG8G
Measurement object	Oxygen concentration in gaseous mixture
Measurement system	Paramagnetic system
Measuring range	0-5 to 0-25 vol%O ₂ 3 ranges can be programmed arbitrarily within the above specified range.
Display	4-digit LED
Indication	Oxygen concentration (vol%) normally Temperature of constant temperature chamber (°C), cell output (mV) on demand Parameters; calibration gas concentration, output ranges 1/2/3, Hi/Lo alarms, automatic calibration settings
Self-diagnosis	Sensor unit error, Constant temperature chamber error, Analog error, Memory error, Calibration coefficient error
Analog output signal	4 to 20 mA DC, maximum load resistance 550 Ω
Contact output	Contact rating; 3 A at 250 V AC or 30 V DC, dry contacts Fail; 1 point, open or closed when error occurs, user configurable Contact is activated when sensor unit error, constant temperature chamber error, analog error, memory error, or calibration coefficient error (when automatic or semiautomatic calibration is enabled) occurs Maintenance status; 1 point, closed during maintenance Range answerback or high/low alarm; 2 points, normally deenergized (open) Range answerback or high/low alarm contact output, user selectable
Operate solenoid valve	3 points, Switching between zero and span calibration gas and measured gas. Maximum load; AC 1A
Contact input	Input specification; Contact ON: 200 Ω or less, Contact OFF: 100 kΩ or greater Remote range switching; 2 points, Output ranges 1 to 3 can be switched by external contact signal. Calibration start; 1 point, calibration start command by external contact signal.
Calibration method	(1) Automatic calibration at set intervals by internal timer (2) Semiautomatic calibration started by external contact input (3) Manual calibration in the field
Calibration gas	Zero gas; N ₂ gas Span gas; dry air (instrument air O ₂ : 20.95 vol%) or standard gas with an oxygen concentration of 80 to 100% of span value (balance N ₂)
Auxiliary gas pressure	N ₂ , 180 kPa (approx. 35 ml/min)
Measurement gas condition	Flow; 200ml/min±10 %, The gas flow rate may be less than 200 ml/min depending on the composition of the measurement gas. Temperature; 0 to 50°C Humidity; No moisture condensation in the flow path or the sensor.
Warm-up time	Approx. 2.5 hours
Ambient temperature	-5 to 55 °C
Power supply	100 - 115 V AC 50/60 Hz or 200 - 240 VAC 50/60 Hz
Power consumption	100 to 115 V AC; Max. 110 VA, normally approx. 25 VA 200 to 240 V AC; Max. 125 VA, normally approx. 35 VA
Installation	Indoors, panel or wall mounting
Construction	Dustproof, non-flameproof type
Dimensions	406 (W) x 288 (H) x 216 (D) mm
Weight	Approx. 18 kg

Characteristics

Repeatability	±1% or less of span
Linearity	±1% or less of span
Response time	90% response within 3 seconds
Zero drift	±1.5% or less of span/week
Span drift	±2% or less of span/week
Temperature drift	±1.5% or less of span/10 °C

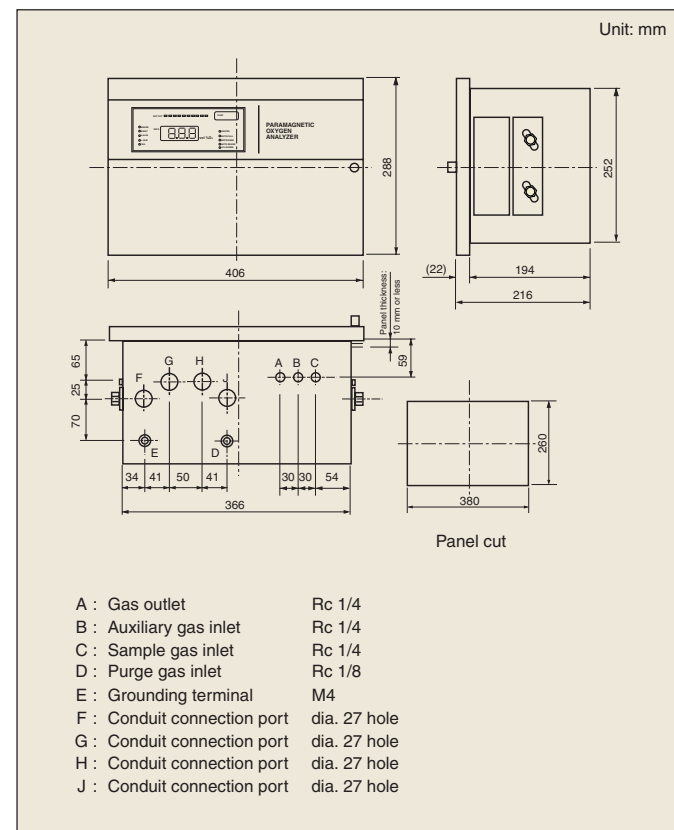
For details, refer to General Specifications, GS 11P03A03-01E.

Model and Suffix Codes

MG8G Paramagnetic Oxygen Analyzer (General Purpose)

Model	Suffix Code	Option Code	Specification
MG8G	-----	-----	Paramagnetic oxygen analyzer
Measurement range	-M	-----	0 - 5 to 25 vol% O ₂
Wetted material	A	-----	SUS316, Fluorine-contained rubber
Power supply	-2	-----	200 - 240V AC, 50/60Hz
	-5	-----	100 - 115V AC, 50/60Hz
Auxiliary gas	-W	-----	N ₂ gas
Flow rate of auxiliary gas	L	-----	Standard (35 ml /min)
Language	-J	-----	Japanese
	-E	-----	English
Auto calibration	-C	-----	Available
Style code	*C	-----	Style *C

External Dimensions



Standard Specifications

Model	MG8E
Measurement object	Oxygen concentration in gaseous mixture
Measurement system	Paramagnetic system
Measuring range	0-1 to 0-25 vol%O ₂ 3 ranges can be programmed arbitrarily within the above specified range.
Display	4-digit LED
Indication	Oxygen concentration (vol%) normally Temperature of constant temperature chamber (°C), cell output (mV) on demand Parameters; calibration gas concentration, output ranges 1/2/3, Hi/Lo alarms, automatic calibration settings
Self-diagnosis	Sensor unit error, Constant temperature chamber error, Analog error, Memory error, Calibration coefficient error
Analog output signal	4 to 20 mA DC, maximum load resistance 550 Ω
Contact output	Contact rating; 3 A at 250 V AC or 30 V DC, dry contacts Fail; 1 point, open or closed when error occurs, user configurable Contact is activated when sensor unit error, constant temperature chamber error, analog error, memory error, or calibration coefficient error (when automatic or semiautomatic calibration is enabled) occurs Low auxiliary gas pressure alarm; 1 point, closed when pressure drops Factory default low limit pressure; 300 kPa Maintenance status; 1 point, closed during maintenance Range answerback or high/low alarm; 2 points, normally deenergized (open) Range answerback or high/low alarm contact output, user selectable
Output to operate solenoid valve	3points Switching between zero and span calibration gas, and measured gas. Maximum load : AC 1 A.
Contact input	Input specification ; Contact ON ; 200 Ω or less, Contact OFF ; 100 kΩ or greater Remote range switching ; 2 points, Output ranges 1 to 3 can be switched by external contact signal. Calibration start ; 1 point, calibration start command by external contact signal
Calibration method	(1) Automatic calibration at set intervals by internal timer (2) Semiautomatic calibration started by external contact input (3) Manual calibration in the field
Calibration gas	Zero gas; N ₂ gas Span gas; dry air (instrument air O ₂ : 20.95 vol%) or standard gas with an oxygen concentration of 80 to 100% of span value (balance N ₂)
Auxiliary gas	N ₂ , gas, 350 to 500 kPa
Measurement gas condition	Gas Flow ; Setting range ; 300 to 800 ml/min (standard 600 ml/min) Allowable range : ±10 % of a set value Pressure ; Approx. 7 kPa (approx. 700 mmH ₂ O) in Analyzer inlet Temperature ; 0 to 50°C Humidity ; No moisture condensation in the flow path or the sensor
Warm-up time	Approx. 2.5 hours
Installation conditions	Ambient temperature ; -5 to 50°C Humidity; 10-95 %RH (Nocondensing) Vibration; 5 to 9 Hz : Vibration amplitude; 1.5mm or less 9 to 150 Hz: Acceleration; 2 m/s ² or less
Power supply	100 to 115 V AC±10 %, 50 or 60 Hz
Power consumption	Approx. 170 VA max., approx. 25 VA normally
Installation	Indoors, panel or wall mounting
Construction	Flameproof (Exd II BT4)
Dimensions	440 (W) x 370 (H) x 325 (D) mm
Weight	Approx. 38 kg

Characteristics

Repeatability	±1% or less of span
Linearity	±1% or less of span
Response time	90% response within 3 seconds
Zero drift	±1% or less of span/week (0-5 to 0-25 vol%O ₂)
Span drift	±1% or less of span/week (0-5 to 0-25 vol%O ₂)

For details, refer to General Specifications, GS 11P03A05-01E.

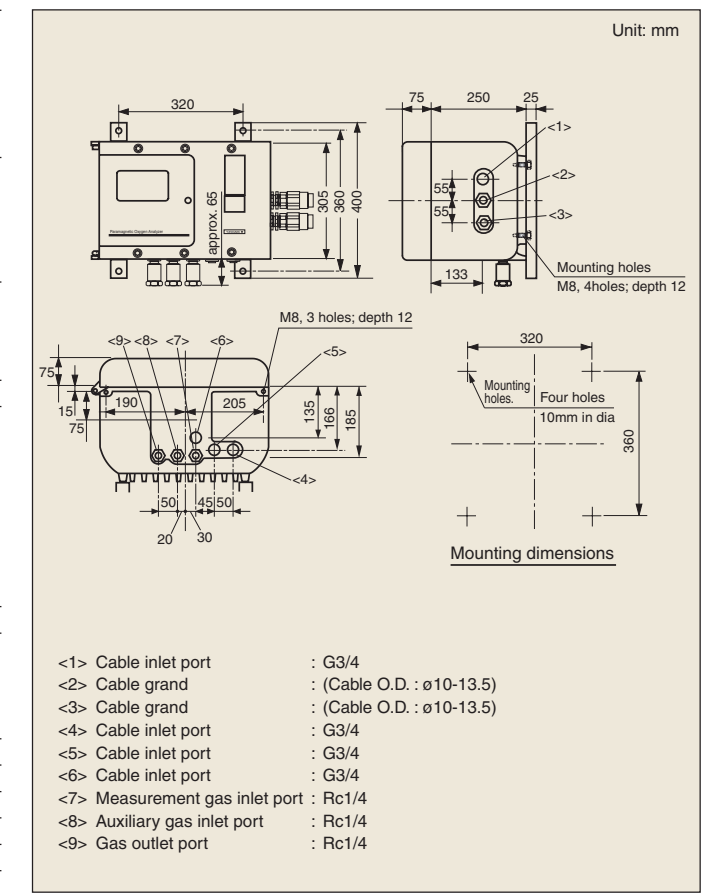
Model and Suffix Codes

MG8E Paramagnetic Oxygen Analyzer (Flameproof)

[Style:S3]

Model	Suffix Code	Option Code	Specification
MG8E	-----	-----	Paramagnetic oxygen analyzer
Measurement range	-1	-----	0 - 1 to 25 vol% O ₂
	-2	-----	0 - 2 to 25 vol% O ₂
	-5	-----	0 - 5 to 25 vol% O ₂
Cell material	A	-----	Standard
	B	-----	Organic solvent resistant
Auxiliary gas	W	-----	N ₂ gas
Flow rate of auxiliary gas	N	-----	35 ml/min
	H	-----	55ml/min, when sample gas contains H ₂ gas of 3% or greater and O ₂ in He
Power supply	5	-----	100 - 115V AC, 50 / 60 Hz
Language	-J	-----	Japanese
	-E	-----	English
Option		/B1	Balance gas: CO ₂ (20%)+N ₂

External Dimensions



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