HORIBA
Process & Environmental

Explosion-proof INFRARED ANALYZER
EIA-51d/51p
TIA-51d/51p

Explosion-proof THERMAL CONDUCTIVITY ANALYZER
TCA-51d/51p

Explosion-proof MAGNETOPNEUMATIC OXYGEN ANALYZER
MPA-51d/51p

Explosion-proof PARAMAGNETIC OXYGEN ANALYZER
PMA-51d

Advanced technologies that provide safety. An explosion-proof gas analyzer is born.

The 51 series advanced explosion-proof analyzers include HORIBA's extensive experience and specialized know-how to provide the safety, reliability, and accuracy you demand in analyzing flammable gases or operating in explosive environments. To realize the highest levels of safety and operability, the 51 series offers an intuitive interface with a clearly visible display. The analyzers' long term reliability and your confidence are ensured by full compatibility with IEC 60079 standards. The extensive line-up for the 51 series covers a wide range of applications including infrared gas analyzers for general-purpose processes and models for use with oxygen and hydrogen. The HORIBA 51 series meets your gas analysis needs in environments where safety, reliability, and accuracy are always your priorities.

EIA-51d/51p

TIA-51d/51p

TCA-51d/51p

MPA-51d/51p

PMA-51d

New designs and unique concepts define the next generation of standards

Focused on functionality

- ***Meets diverse gas analysis requirements***
- ***Offers a clearly visible and easy-to-operate user interface***
- ***Compatible with IEC 60079 standards and communication functions***

Hydrogen explosion-proof models

Building on the HORIBA legacy of safety, reliability, and accuracy of the 31 series, the new 51 series enhances explosion-proof specs to the level of ⅡB + H_2.

Flameproof enclosures

Ex d ⅡB+H_2 T4

- Temperature class T4: 135℃ (Max surface temperature)
- Group of electrical apparatus ⅡB+H_2: Apply to flammable gases of group ⅡB and H_2
- Type of explosion d: Flame proof enclosures
- According to standard (IEC 60079)

Pressurized apparatus

Ex px Ⅱ T4 X

- Specific conditions.*
- Temperature class
  T4: 135℃ (Max surface temperature)
- Group of electrical apparatus
  Ⅱ: Apply to flammable gases of group Ⅱ
- Type of protection
  px: Pressurized apparatus, Type px
- According to standard (IEC 60079)

Ex pxd ⅡC T4 X

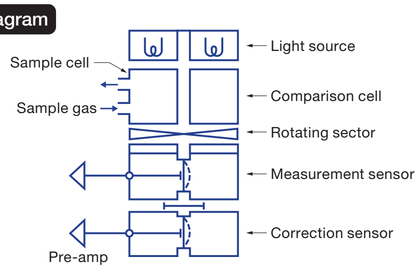
- Specific conditions.*
- Temperature class
  T4: 135℃ (Max surface temperature)
- Group of electrical apparatus
  ⅡC: Apply to flammable gases of group ⅡC
- Type of protection
  px: Pressurized apparatus, Type px (apparatus)
  d: Flame proof enclosures (sensor)
- According to standard (IEC 60079)

*The apparatus pressurized internally is 50 Pa higher than measuring gas pressure.

EIA-51d/51p·TIA-51d/51p

■Non-dispersive infrared (NDIR) analyzer (interference correction type)

Conceptual diagram



Measurement principle

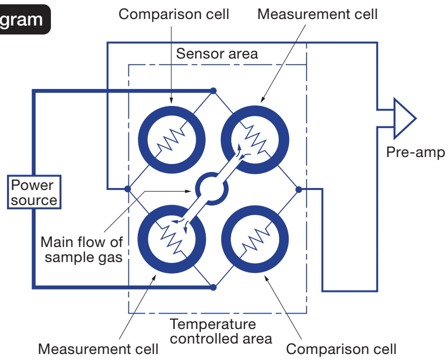
"Interference correction" is an original method based on NDIR analysis that ensures extremely high accuracy even in the case of samples containing large amounts of interfering compounds.
The interference correction combines a measurement sensor with a correction sensor positioned in parallel in the same optical path. This significantly reduces the effects of:

- interfering gases in the sample gas;
- vibrations and other external disturbances; and
- drift resulting from deterioration of the light source and cell components.

TCA-51d/51p

■Heat conductivity type

Conceptual diagram



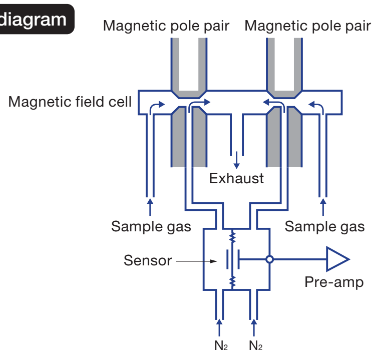
Measurement principle

Gas concentration is measured using the differences in heat conductivity unique to specific gases. The sensor area forms a Wheatstone bridge using measurement cells and comparison cells containing hot wires made from platinum and other materials. The sample gas flows into the measurement cell as a result of diffusion, and a base gas (generally nitrogen or air) is sealed inside the comparison cell.
The hot wires are heated by a constant current. If the sample gas contains a gas with a heat conductivity differing from that of the standard gas in the comparison cell, then the temperature of the hot wires on the measurement side changes, and this in turn changes the resistance depending on the composition of the sample gas. This change in resistance is converted into a concentration signal for the gas being measured, based on the change in the unbalanced voltage of the Wheatstone bridge.

MPA-51d/51p

■Magnetic pressure analyzer (pressure sensor / magnetic force type)

Conceptual diagram



Measurement principle

Because oxygen has extremely strong paramagnetic characteristics, if there is any oxygen in a heterogeneous magnetic field, then the oxygen is drawn toward the stronger magnetic field, and the pressure in that area changes (increases).
The change in pressure is represented by the following formula.

$\varDelta p=1/2H^2$ x X x C

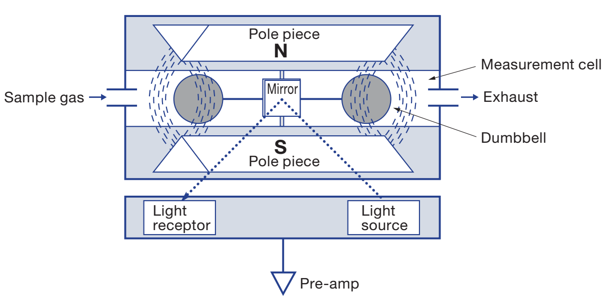
$\varDelta p$: change in pressure; H: Strength of magnetic field; X: Magnetic susceptibility of paramagnetic gas; C: Temperature of paramagnetic gas

This pressure increase is drawn out of the magnetic field using a non-magnetic comparison gas (nitrogen), and the pressure change is detected by a sensor and converted into an electrical signal. The electromagnets are excited alternately to derive and transmit a stable signal, which is processed as an alternating signal. For this reason, if there is no oxygen in the sample gas, the signal is zero, so there is no zero drift, and the signal remains extremely stable over long periods of time. Furthermore, the output is linear in reference to the oxygen concentration, so concentration can be measured across a very broad range.

PMA-51d

■Magnetic dumbbell (dumbbell-shaped magnet type)

Conceptual diagram



Measurement principle

Because oxygen has extremely strong paramagnetic characteristics, if there is any oxygen in a heterogeneous magnetic field, then the oxygen is drawn toward the stronger magnetic field.
In the sensor area, a glass dumbbell with a mirror attached is hung horizontally using platinum wires. When oxygen passes through the sensor area, the dumbbell is pushed out by the magnetic field effects described above.
The change in pressure is represented by the following formula.

F= (X1 - X2) x V x H

F: Force acting on the dumbbell; X1: Magnetic susceptibility of the dumbbell; X2: Magnetic susceptibility of the surrounding gas; V: Volume of the test body; H: Strength of the magnetic field

As the dumbbell rotates, the position of the reflected light reaching the photocell (the light receptor) changes. Reverse torque is then added to the dumbbell through a feedback system to return the dumbbell to its original position.
Because this torque is linear in reference to the oxygen concentration, the torque value is output as the oxygen concentration.

■Specification

Model			EIA-51d	EIA-51p	TIA-51d	TIA-51p
Type of protection			Exd II B+H_2T4	Expx II T4X	Exd II B+H_2T4	Expx II T4X
Frameproof enclosures			●		●	
Pressureized apparatus				●		●
Measurement method			NDIR			
Component			CO, CO_2, CH_4, etc.*1			
Measurement range	Minimum range		0 to 0.11 vol% (Depends on the component)		0 to 50 ppm (Depends on the component)	
	Maximam range		0 to 100 vol% (Depends on the component)		0 to 2000 ppm (Depends on the component)	
	Optional		100-90 to 50 vol% (Depends on the component)		0-20 to within less than 50 ppm (Depends on the component)	—
Range Ratio			—		—	
Performance	Repeatability	Standard range	Zero : ±0.5% of full scale Span : ±0.5% of full scale		Zero : ±0.5% of full scale Span : ±0.5% of full scale	
		Optional range	Zero : ±0.5% of full scale Span : ±0.5% of full scale		Zero : ±1.0% of full scale Span : ±1.0% of full scale	
	Linearity		±1.0% of full scale			
	Drift*2	Standard range	Zero : ±2.0% of full scale/week Span : ±2.0% of full scale/week			
		Optional range	Varies by specification			
	Response time (from in let of analyzer)				T90 within 20 seconds T90 within 40 seconds (TIA optional range)	
Sample gas Condition	Gas composition	Flameproof enclosures	O_2 : 21% or less, no mist, no dust The hazardous must be equivalent or less with electrical apparatus group II B, gas and vapor-air mixture corresponding to tempe			
		Pressurized apparatus	O_2 : 21% or less, no mist, no dust The ignition temperature must be equivalent or less with electrical apparatus of gas and vapor-air mixture corresponding to temperature code T4.			
	Pressure		Over 1.98 kPa			
	Flow rate		Approx. 500 mL/min.			
	Temperature		Ambient temperature			
	Exhaust		Atmosphere pressure			
Materials in contract with sample gas			SUS304, SUS316, FKM, CaF_2, Au, etc.			
Calibration method			Standard : Manual correction, Option : Automatic correction			
Analog output			DC 4 to 20 mA (DC 0 to 16 mA/0 to 20 mA, DC0 to 1 V/0 to 5 V/1 to 5 V/0 to 10 V optional), 1 ch			
	Alarm setting		Arbitrary setting is available with span range from -10% to +110% of output for current and voltage. Negative output values set t			
Contact Input-output (option)			6 channels			
Digital connection (option)	Interface		RS-485			
	Protocol		Modbus-RTU			
	Communication speed		Selected from 19200 bps/9600 bps/4800 bps/2400 bps/1200 bps			
Environment conditions	Location		Indoors			
	Operational Temperature		-5 to 40 ℃ (away from direct sunlight and radiant heat)			
	Humidity		90% or less			
	Vibration		Avoid large vibration sources (less than 100 Hz; 0.3 m/s^2)			
Utility	Protective gas for Pressurized apparatus composition		Gas composition : N_2, Gas pressure : 196 to 690 kPa, Gas flow late : 10 L/min. (when purging), 500 mL/min. (when operating) De			

*1 Consult HORIBA for measurement of the other components. *2 Guaranteed at normal ambient temp. ±5℃

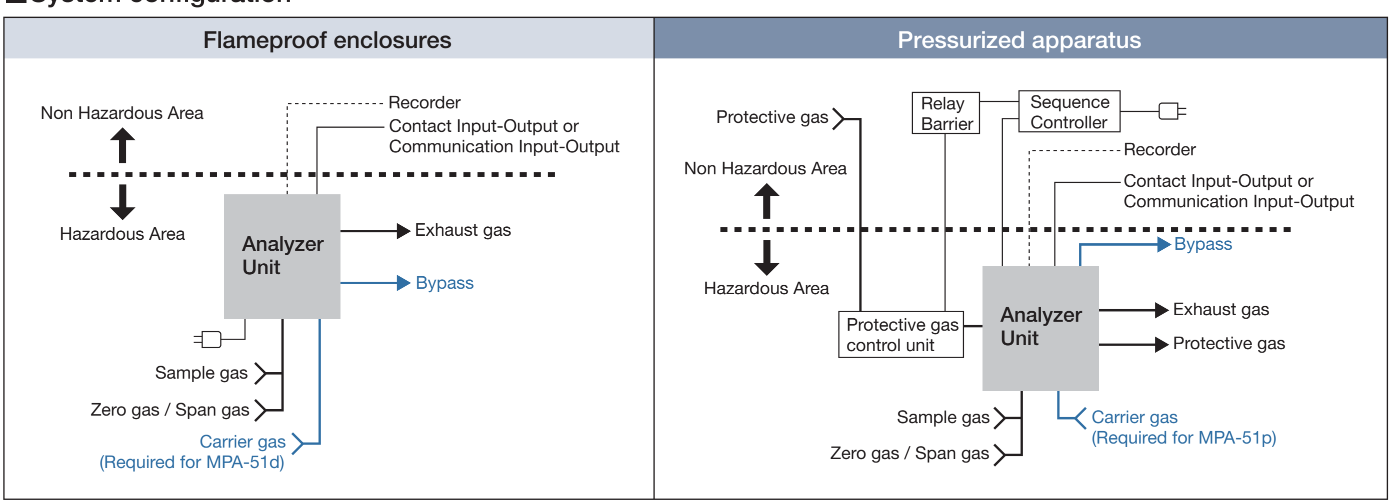
■Recommended Measuring Ranges

	EIA-51d/51p		TIA-51d/51p	
	Min. Range	Max. Range	Min. Range	Max. Range
CO	0 to 0.21%	0 to 100%	0 to 50 ppm	0 to 2000 ppm
CO_2	0 to 0.11%	0 to 100%	0 to 50 ppm	0 to 1000 ppm
CH_4	0 to 0.21%	0 to 100%	0 to 50 ppm	0 to 2000 ppm
C_3H_8	0 to 0.051%	0 to 100%	0 to 50 ppm	0 to 500 ppm
NO	0 to 0.21%	0 to 100%	0 to 100 ppm	0 to 2000 ppm
SO_2	0 to 0.051%	0 to 100%	0 to 100 ppm	0 to 500 ppm

Consult HORIBA for applications other than those listed avobe.

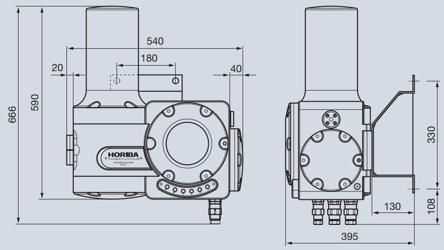
TCA-51d	TCA-51p	MPA-51d	MPA-51p	PMA-51d
Exd II B+H_2T4	Expxd II T4X	Exd II B+H_2T4	Expx II T4X	Exd II B+H_2T4
●		●		●
	●		●	
Thermal conductivity		Magnetopneumatic		Paramagnetic
H_2		O_2		
0 to 10 vol%		0 to 5 vol%		
0 to 100 vol%		0 to 25 vol%		
0-1 to within less than 10 vol%	100-90 to 50 vol%	0-1 to within less than 5 vol%		—
—		Max.1:25 Max.4 range		Max.1: 5
Zero : ±1.0% of full scale		Zero : ±0.5% of full scale		Zero : ±0.1 vol% O_2
Span : ±1.0% of full scale		Span : ±0.5% of full scale		Span : ±0.1 vol% O_2
Zero : ±1.0% of full scale		Zero : ±1.0% of full scale		—
Span : ±1.0% of full scale		Span : ±1.0% of full scale		
		Zero : ±1.0% of full scale/week		Zero : ±0.05 vol% O_2 /week
		Span : ±2.0% of full scale/week		Span : ±0.05 vol% O_2 /week
Varies by specification		Zero : ±1.0% of full scale/week		Varies by specification
		Span : ±3.0% of full scale/week		
T90 within 20 seconds				
rature code T4, and Hydrogen-air mixture.				
O_2 : 21% or less, no mist, no dust The hazardous must be equivalent or less with electrical apparatus of group II C gas and vapor-air mixture corresponding to temperature code T4.		O_2 : 21% or less, no mist, no dust The ignition temperature must be quivalent or less with electrical apparatus of gas and vapor-air mixture corresponding to temperature code T4.		
		14.7 to 24.5 kPa		Over 1.98 kPa
		Approx . 1.5L/min		Approx . 300mL/min
SUS304, SUS316, FKM, glass, SiO_2, Au		SUS304, SUS316, FKM		SUS304, SUS316, Pt, glass, FKM
o zero.				
w Point : -30°C Saturated or less				

■System configuration



■Dimensional Outlines unit: mm

EIA-51d/51p



TIA-51d/51p