

Optical Oxygen Analyzer

Overview

The optical oxygen analyzer is based on luminescence quenching of a sensor dye. The dye is excited with excitation light, and the properties of the resulting luminescence are measured in the near-infrared region. The presence of molecular oxygen quenches the luminescence, changing its intensity and lifetime in a fully reversible manner. This principle is very robust. It shows virtually no interferences to other gases (except Cl₂ and NO₂), has a very low drift, and the sensor is fully solid-state. It does not deplete over time, unlike galvanic oxygen sensors with their limited shelf life. Optics and electronics are hermetically sealed from the measured gas. For typical indoor environmental conditions, a 10-year operating life is expected. The Optical oxygen analyzer comes with a factory calibration. If required, the user can perform a simple 1-point calibration at ambient air. The optical oxygen analyzer features **MZD BaroSense™ Technology** and built-in temperature compensation. No additional signal conditioning is required. A mounting thread allows easy installation.



Features

- High-accuracy measurement
- Low drift
- Factory calibrated
- Long life
- Fast response ($t_{63} < 2s$)
- Temperature compensation
- **MZD BaroSense™ Technology**
- Stainless steel sintered filtration (membrane filtration optional)

Potential Applications

- Reactor/Centrifuge
- Chemicals/Biopharmaceuticals industry
- Pharmaceuticals industry
- Fine chemicals industry
- Exhaust gas measurement
- Inert gas processing chambers (glove boxes)
- Metal heat treatment/welding
- Monitoring fruit ripening and transport
- Oxygen concentrators

Optical Oxygen Analyzer

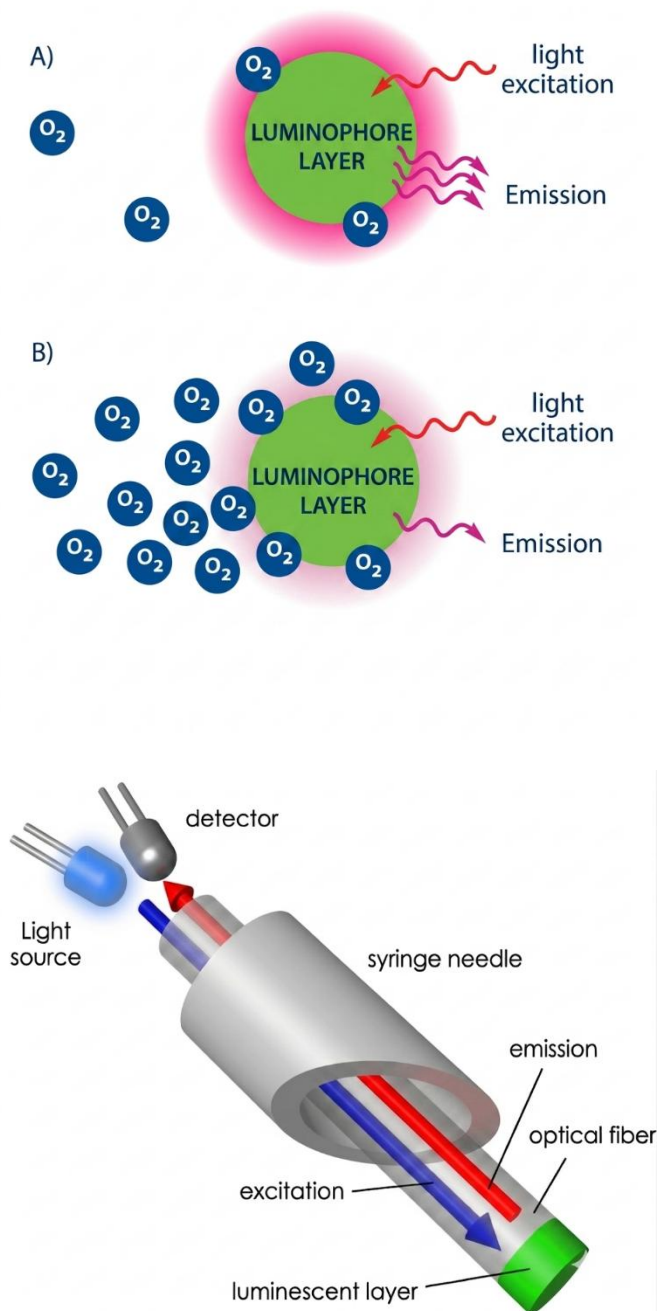
Oxygen Measuring Principle

This optical technology relies on an indicator material that is highly sensitive to oxygen and exhibits exceptional luminescence brightness. The measurement principle is based on the luminescence quenching effect: collisions between oxygen molecules and the indicator material—immobilized at the tip or on the surface of the sensor probe—reduce the luminescence intensity, with the magnitude of this reduction depending on the oxygen concentration.

The indicator material can be excited by visible light and emits a luminescence signal in the near-infrared region that correlates with the oxygen concentration. This optical sensing method is characterized by high precision, high reliability, low power consumption, minimal cross-sensitivity, and rapid response times.

Compared to similar products, this oxygen-sensitive indicator material offers significantly higher luminescence brightness; the excitation duration required for a single oxygen measurement can be reduced from the typical 100 milliseconds to approximately 10 milliseconds, thereby substantially lowering the light dosage within the measurement system. Furthermore, the material's excellent luminescence efficiency allows for a thinner sensing matrix layer, resulting in a faster response speed for the oxygen sensor.

The measurement principle employs a sinusoidally modulated excitation light source, generating a phase-shifted sinusoidal emission signal in the near-infrared range. The optical oxygen analyzer converts the measured phase shift into an oxygen concentration value using the Stern-Volmer equation.



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Features

❖ Quick and convenient

The navigation menu contains 6 languages, which can be operated easily.

❖ Process safety

4.3" or 7" large size color LCD touch screen, convenient and safe touch operation and debugging

Large size screen with red flashing alarm, clearly visible from long distances and in dark areas

Alarm immediately, save the process

❖ Alarm event record

Real-time data curve display

Record function for up to 6,000 alarms

❖ Expert calibration function

Multi-point calibration function up to 9 point

❖ Powerful self-diagnosis function

Built-in flow monitoring

Built-in heartbeat monitoring function and watchdog

Monitor the status of analyzer and sensors, and promptly remind customers to take necessary maintenance

High-standard hardware and software security and password protection

❖ Powerful control function

High(low) limit control function

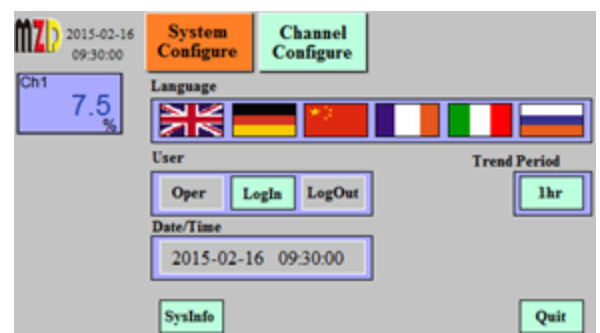
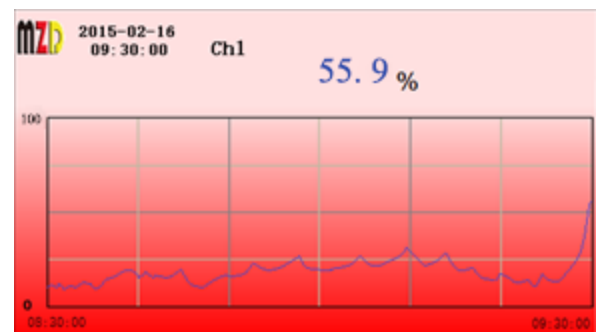
Optional: Timer control(automatic cleaning) function

Optional: analog PID control function

Optional: PWM control function

❖ Flexible fieldbus communication functions for IOT4.0

Optional fieldbus MODBUS, HART, Foundation Fieldbus FF, PROFIBUS PA, PROFIBUS DP, etc.



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Parameters

Measuring principle	Optical (Luminescence Quenching)			
Display	4.3" or 7" industrial color touch screen			
Language	Multi-Language (English, German, Chinese, French, Italian, Russian or Customized)			
Range	0~100% O ₂			
Accuracy*	2.5% MV			
Resolution*	0.01%			
Detection limit	0.01% O ₂ (100ppm)			
Response time (t ₆₃)	<2 sec.			
Drift	typ. <1% O ₂ /year **			
Sample gas temperature	10 ~ 40°C			
Process pressure(Max.)	3Bar			
Sample gas flow	30NI/h (recommend)			
Max. number of measurements	>500 million ***			
Lifetime	typ. >5 years ***			
Warm-up time	3 min (reduced accuracy during warm-up)			
Analog Output(Galvanic)	4~20mA, maximum load 500Ω			
Relay Output(Galvanic)	Relay(2A, 230V AC freely set alarm), System alarm			
Diagnosis function	Flow monitoring, Sensor and analyzer self-diagnosis, Heartbeat monitoring			
Event Logger	Internal Flash, up to 6,000 alarm records			
Control function	Optional Timer control function, PID, PWM			
Calibration	Expert calibration function, Multi-point calibration function up to 9 point			
Communication	RS485 MODBUS RTU, HART, Foundation Fieldbus FF, PROFIBUS PA, PROFIBUS DP, MODBUS TCP/IP, etc			
Power	80~264V AC, 1A or 19~28V DC, 3A			
Electrical protection	EMI/RFI CEI-EN55011-05/99			
Ambient Temperature	10~40°C			
Storage and transport temperature	-10~60°C			
Ambient Humidity	0~90%RH			
Diameter of connecting pipe	6mm			
Wall-mounted	4.3" touchscreen	Steel, Gray	300*300*220mm	IP65
	1.8" color LCD	Aluminum, Gray	300*280*195 mm	IP65, Exd IICT4
Laboratory Desktop	7" touchscreen	Aluminum, Black	250*144*184mm	IP40
Portable	7" touchscreen	ABS, Yellow	420*325*180mm	IP67
19" Rack(1~6Channels)	7" touchscreen	Aluminum, natural-coloured	483*133*238mm	IP40

* given for factory calibration. Units of %O₂ given for 1013 mbar ambient air pressure.

** at 21% O₂, 25° C, 1013 mbar ambient gas pressure, protected from direct sunlight. The drift can be significantly increased after the exposure to elevated temperature >60° C or to specific chemicals (refer to section 3).

*** at 21% O₂, 25° C, 1013 mbar ambient gas pressure, protected from direct sunlight.

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Overview

The Optical oxygen analyzer is cost-effective and suitable for stable and continuous measurement of the percentage oxygen content of most gases.

Application

- Reactor/Centrifuge
- Chemicals/Biopharmaceuticals/Pharmaceuticals industry
- Fine chemicals industry
- Exhaust gas measurement
- Inert gas processing chambers (glove boxes)
- Metal heat treatment/welding
- Monitoring fruit ripening and transport
- Oxygen concentrators



Measuring principle	Optical (Luminescence Quenching)
Display	1.8"color LCD,160*128 pixel, English menu, Status LED Light(NAMUR NE107)
Keypad	Magnetic keypad
Range	0~100% O ₂
Accuracy*	2.5% MV.(10°C~40°C) or 5% MV.(-10°C~60°C,<1% O ₂ 为 10%MV.)
Resolution*	0.01%
Detection limit	0.01% O ₂ (100ppm)
Response time (t63)	<2 sec.
Drift	typ. <1% O ₂ /year **
Max. number of measurements	>500 million ***
Lifetime	typ. >5 years ***
Warm-up time	3 min (reduced accuracy during warm-up)
Analog Output(Galvanic)	4~20mA, maximum load 500Ω
Relay Output(Galvanic)	2 Relay(2A, 230V AC/DC freely set), 1 Relay(System alarm)
Communication	RS485 (MODBUS RTU Slave)
Power	19 ~ 28V DC Power, 0.5A
Ambient Temperature	-10~60°C(recommend 10°C~40°C)
Process pressure(Max.)	3Bar
Sample gas flow	30NI/h (recommend)
Process Connection	NPT1/2" thread or KF40 flange
Housing Material	Aluminium alloy, Stainless steel
Size	Φ110*240*107 mm
Weight	1.5Kg
Explosion-proof	Ex d IICT4 optional (300*280*195 mm, 14Kg)

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CROSS-SENSITIVITY AND CHEMICAL

The following table shows the compatibility and possible cross sensitivities to some important chemical substances at a given concentration range. An "X" under "OK" indicates compatibility. "Cross-Sensitivity" indicates that the oxygen measurement is influenced by this substance. "Damage" indicates that this substance might physically damage the Optical oxygen analyzer (marked in red).

Substance	Concentration	OK	Cross-Sensitivity	Damage	Comment
Moisture	0~100%	X			
CH ₄	<20%	X			
Cl ₂			X	X	
CO	<20%	X			
CO ₂	<20%	X			
H ₂ S	<1%	X			
NO	<1%	X			1.
NO ₂			X	X	2.
N ₂ O	<1%	X			
Inorganic acid/sbases	<1%	X			
Methanol, Ethanol, Isopropanol, formic Acid, Acetic Acid	<0.1%v	X			3.
Methanol, Ethanol, Isopropanol, Formic Acid, Acetic Acid	>0.1%v		X		4.
Ethylene oxide			X		5.
Other volatile organic compounds			(X)	(X)	6.

Comments:

1. NO may form NO₂ in presence of oxygen.
2. Ca. 5-10 times more sensitive to NO₂ than to oxygen. Slow degradation over time.
3. 0.1%v in gas corresponds approximately to the vapor pressure above a 0.5-1% solution in water at 25°C.
4. Recalibration after conditioning at constant substance levels might be possible.
5. Exposure to EtO (e.g. for sterilization) will cause increased drift. Recalibration after exposure is possible.
6. Can result in erroneous oxygen readings and significantly enhanced drift. Interference depends on the compound. Substances with high vapor pressure or high reactivity are expected to be more problematic.

Note:

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