Optical Oxygen Analyzer

Overview

The Optical oxygen analyzer based on luminescence quenching of a sensor dye. The dye is excited with red light, and the properties of the resulting luminescence are measured in the near infrared. The presence of molecular oxygen quenches the luminescence, changing its intensity and lifetime fully reversibly.

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 build in temperature compensation. No additional signal conditioning is necessary. A mounting thread allow easy installation.

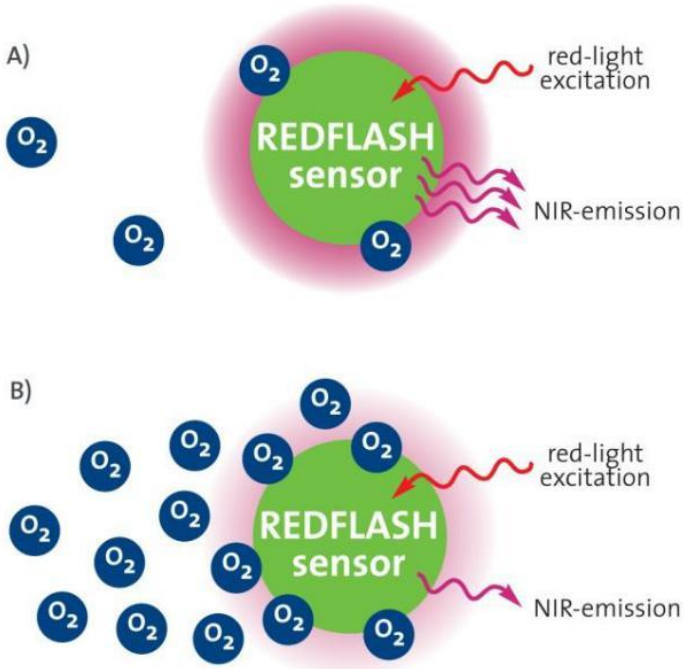
Features

- High-accuracy measurement
- Low drift
- Factory calibrated
- Long life
- Fast response (t63<2s)
- Temperature compensation
- Stainless steel sintered filtration (membrane filtration optional)

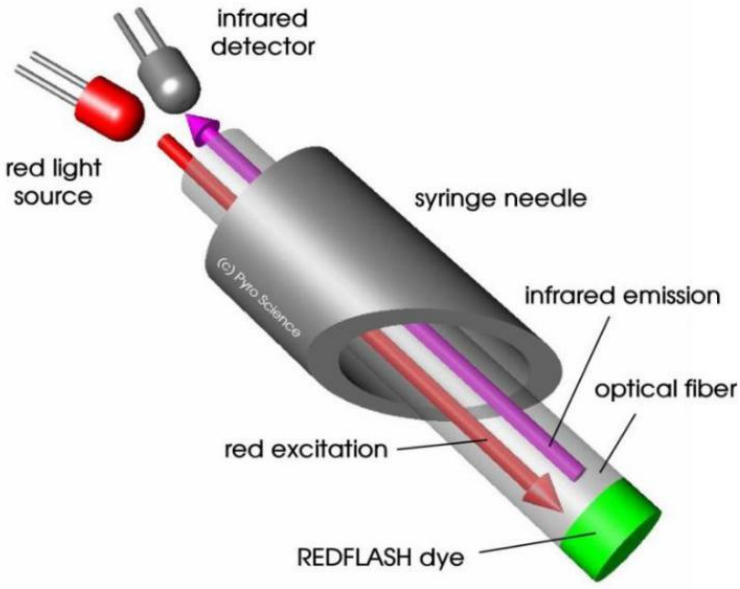
Potential Applications

- Inert gas processing chambers (glove boxes)
- Exhaust gas measurement
- Inert gas monitoring
- Monitoring fruit ripening and transport
- Oxygen concentrators
- Incubators
- Portable equipment

Optical Oxygen Analyzer



Principle: red light excited REDFLASH indicators show luminescence in the near infrared (NIR), which decreases with increasing oxygen (quenching effect).
A) high NIR emission at low oxygen and **B)** low NIR at high oxygen



Oxygen Measuring Principle

The new Optical technology is based on the unique oxygen-sensitive REDFLASH indicator showing excellent brightness. The measuring principle is based on the quenching of the REDFLASH indicator luminescence caused by collision between oxygen molecules and the REDFLASH indicator immobilized on the sensor tip or surface. The REDFLASH indicators are excitable with red light (more precisely: orange-red at a wavelength of 610-630 nm) and show an oxygen-dependent luminescence in the near infrared (NIR, 760-790 nm).

The Optical technology impresses by its high precision, high reliability, low power consumption, low cross-sensitivity, and fast response times. The red-light excitation significantly reduces interferences caused by autofluorescence and reduces stress in biological systems. The REDFLASH indicators show much higher luminescence brightness than competing products working with blue light excitation. Therefore, the duration of the red flash for a single oxygen measurement could be decreased from typically 100 ms to now typically 10 ms, significantly decreasing the light dose exposed to the measuring setup. Further, due to the excellent luminescence brightness of the REDFLASH indicator, the actual sensor matrix can be now prepared much thinner, leading to fast response times of the oxygen sensors.

The measuring principle is based on a sinusoidally modulated red excitation light. This results in a phase-shifted sinusoidally modulated emission in the NIR. Optical oxygen sensor measures this phase shift (termed "dphi" in the software). The phase shift is then converted into oxygen units based on the Stern-Vollmer-Theory.

Optical Oxygen Analyzer

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, safe 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

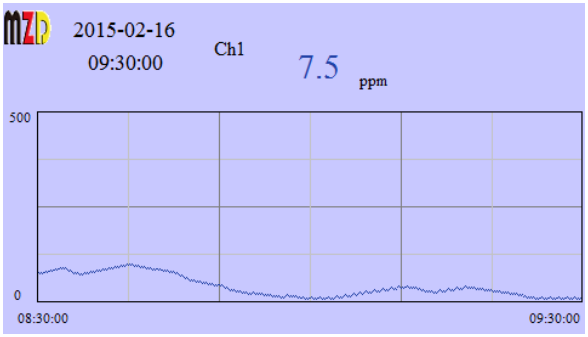
Optional: Timer control(automatic cleaning) function

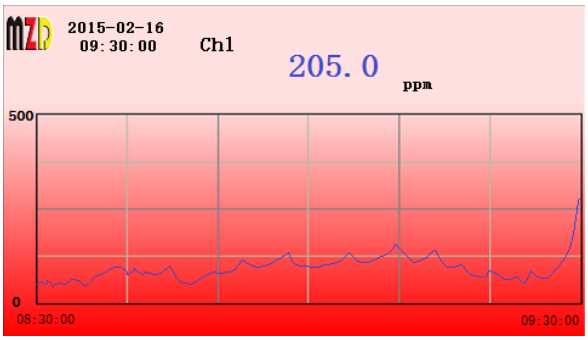
Optional: analog PID control function

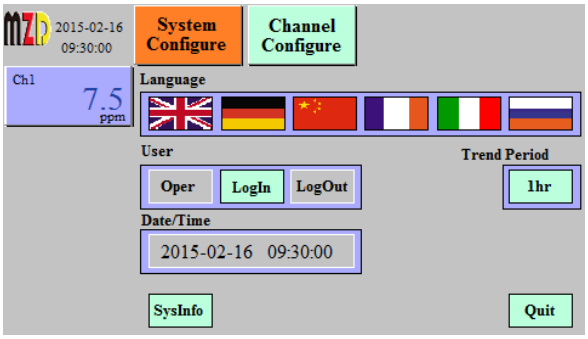
Optional: PWM control function

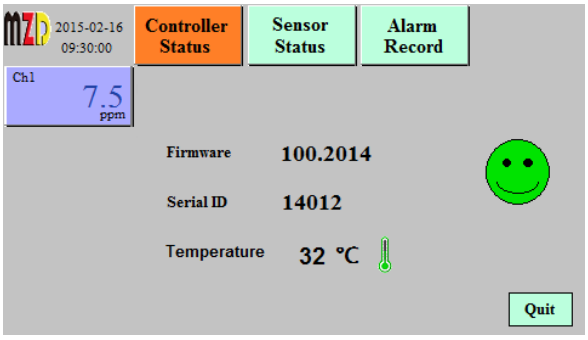
❖ **Flexible fieldbus communication functions for IOT4.0**

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









Optical Oxygen Analyzer

Parameters

Measuring principle	Optical			
Display	4.3”or 7" industrial color touch screen 1.8”color LCD,160*128 pixel, English menu, Status LED Ligh(NAMUR NE107), magnetic keypad			
Language	Multi-Language (English, German, Chinese, French,Italian, Russian or Customized)			
Range	0~100% O2			
Accuracy*	2.5% MV			
Resolution*	0.01%			
Detection limit	0.01% O2 (100ppm)			
Response time (t63)	<2 sec.			
Drift	typ. <1% O2/year **			
Sample gas temperature	10 ~ 40℃			
Process pressure(Max.)	3Bar			
Sample gas flow	30Nl/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℃			
Storage and transport temperature	-10~60℃			
Ambient Humidity	0~90%RH			
Diameter of connecting pipe	6mm			
Wall-mounted(1~2Channels)	4.3" color touchscreen	ABS,Gray RAL7045	213x185x84mm	IP65
	1.8”color LCD	Aluminum,Gray	230x200x157mm	IP65, Exd IICT4
Laboratory Desktop (1~2Channels)	7" color touchscreen	Aluminum,Black	250x144x184mm	IP40
Portable(1~2Channels)	7" color touchscreen	ABS,Yellow	420x325x180mm	IP67
19" Rack(1~6Channels)	7" color touchscreen	Aluminu,natural-coloured	483x133x238mm	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.

Optical Oxygen Analyzer

Overview

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

Application

- Microelectronics(OLED/capacitor/HID)
- Lithium battery
- University and research
- Glove Boxes
- Metal heat treatment/welding
- Chemicals/Pharmaceuticals
- Air Separation Unit

Measuring principle	Optical
Display	1.8”color LCD,160*128 pixel, English menu, Status LED Ligh(NAMUR NE107)
Keypad	Magnetic keypad
Range	0~100% O2
Accuracy*	2.5% MV.(10℃~40℃) or 5% MV.(-10℃~60℃,<1% O2 为 10%MV.)
Resolution*	0.01%
Detection limit	0.01% O2 (100ppm)
Response time (t63)	<2 sec.
Drift	typ. <1% O2/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℃(recommend 10℃~40℃)
Process pressure(Max.)	3Bar
Sample gas flow	30Nl/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

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_2S	<1%	X			
NO	<1%	X			1.
NO_2			X	X	2.
N_2O	<1%	X			
Inorganic acid/sbases	<1%	X			
Methanol, Ethanol, Isopropanol, ormic Acid, Acetic	<0.1%v	X			3.
Methanol, Ethanol, Isopropanol, Formic 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.

MZD Analytik GmbH
Enderstraße 94
01277 Dresden, Germany
Tel: +49-(0)351-850-710-10
Email: info@mzdd.de