OXIGRAF

Oxigraf Model O2E

Dust Explosion Oxygen Safety Monitor For Dense Phase Pneumatic Conveying Using Nitrogen as Inert Carrying Gas

- **Transport flakes and solids safely**
- **Reliable laser diode technology**
- **Fast response--seconds**
- **Sample flow sensing, automatic backflush**
- **Nitrogen purge for Class I Div 2 hazardous locations**
- **Pressure and temperature corrected sensor, insensitive to movement**
- **Autocalibration built in**
- **Low volume particle filter, 2 um ceramic, included**

Pneumatic conveying raises the possibility of dust explosion hazards. Dust explosions can occur over a range of dust density, in general from 100 g/m3 to 3 kg/m3. At low concentrations there is not enough fuel, and at high concentrations there is not enough oxygen.

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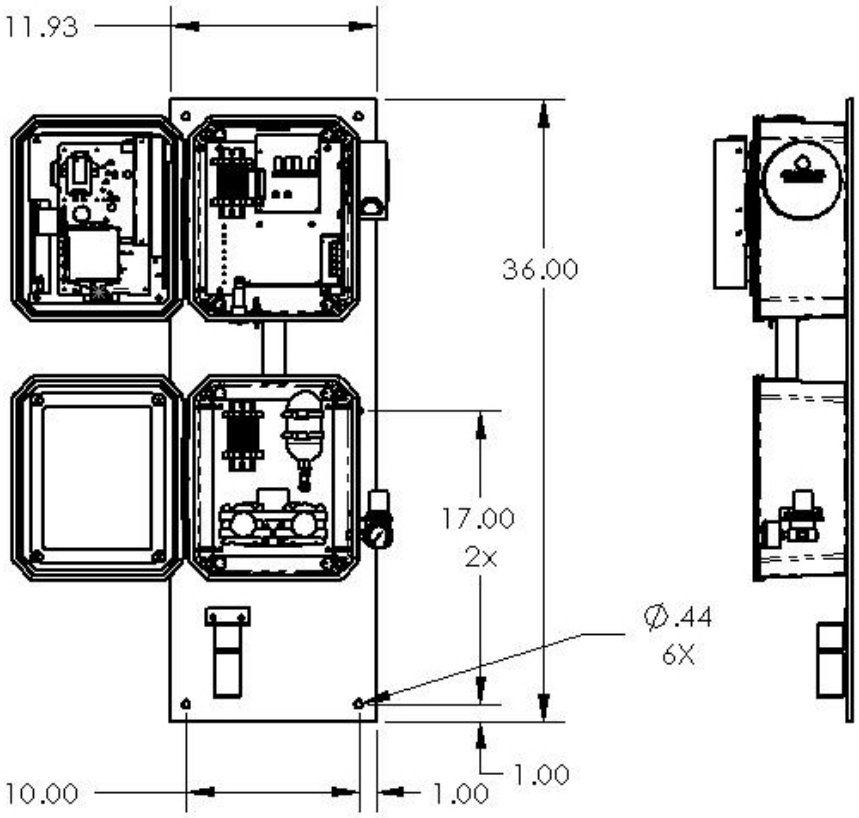
Reducing the oxygen concentration using nitrogen blanketing or nitrogen pneumatic transport systems depresses the upper explosion limit, increases the minimum ignition energy, and reduces the severity of the explosion by limiting the rate of combustion. Explosions can be completely suppressed if the oxygen concentration is low enough, with typical values of the limiting oxygen concentration (LOC) for organic dusts of 11%.
Here is a truly digital oxygen analyzer with analog and digital interfaces for control, display, and datalogging of either nitrogen blanketing of powder storage or of nitrogen content in recirculating pneumatic transport systems.

Schematic Drawing Oxigraf Model O2E:



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Tunable Diode Laser Spectroscopy.
The Oxigraf Model O2E is the next generation oxygen safety monitor. Laser diode absorption spectroscopy assures stable, long-life oxygen measurement: there are no electrochemical cells to replace or paramagnetic sensors to recalibrate. The laser diode, derived from high reliability telecommunications VCSEL (vertical cavity surface emitting laser) diode technology, is rated for more than 500,000 hours mean time to failure. The laser diode is thermally and electronically tuned to measure the absorption of oxygen at 763 nm, and also periodically measures the background to provide an automated zero. Pressure and temperature corrections are made to yield the correct oxygen concentration as the weather changes.

Temperature, Pressure, and Humidity.
Temperature and pressure corrections are important. The Oxigraf sensor is corrected to within ±0.2 % over pressure changes of 50% and temperature changes from 0 to 50 C˚. An oxygen sensor that only measures oxygen partial pressure instead of concentration, would report an oxygen variation of 2% with a 10% variation in barometric pressure. Humidity changes can also change the oxygen dilution caused by humidity, and the Oxigraf sensor is not corrected for humidity. A hot, wet day relative humidity of 50% at 37 C˚ (99 F˚) corresponds to an absolute humidity of 3.2%. Such a water vapor dilution causes a variation from the cold, dry air oxygen concentration of 20.9% to 20.2%, a change of 0.7%.

Fast Response.
Industrial processes need fast measurement of oxygen and timely update of operating conditions. The Oxigraf Safety Monitor responds in less than a second. The transit time of the gas sample through the sampling tube may be 1 second per meter of sampling tube. To respond within 5 seconds, a monitor with a 1 second response time would need to be placed within 4 meters of the potential hazard. Electrochemical sensors may require 20 or more seconds to respond to large, abrupt changes in oxygen concentration.

Sample Flow Monitor.
The Model O2E includes a sampling pump, hydrophobic filter, and flow sensor. Any flow blockage or pump failure is reported as a low flow fault Warning and initiates a back-flush sequence. The set point for flow restriction is user adjustable. Status of the flow is reported via the communication port, and a warning condition is triggered as well. Thus remote monitoring of the flow system is enabled.

Remote Display - Remote Maintenance
The Oxigraf Safety Monitor includes various communication outputs. A 4-20 mA current output may be programmed to relate oxygen concentration. The Horn- Strobe/Alarm relay may be enabled by a programmable combination of the two independent high/low alarm settings, the System OK/Fault or the operation Warning information. Up to five relays are available to denote System OK, various Warning states, two independent high/low alarms, and a general alarm.

Insensitivity to Movement.
The Oxigraf technology has no moving parts, in contrast to paramagnetic technology. Laser diode technology will have no false alarms due to equipment vibration and is transportable.

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Product Specifications Model O2E

Measurement Range	0 to 100% oxygen
Accuracy	±0.5%
Cross Sensitivity	±0.2% for any foreign gas
Response Time	<1 second at normal flow rate, additional low pass filtering programmable
Ambient Temperature	-10 to 50 deg C operating, -20 to 60 deg C storage.
Gas Inlet Temperature	-10 to 50 deg C
Gas Pressure	250 to 1150 mbar
Humidity	0 to 95% non-condensing
Warm-up Time	5 minutes
Display Resolution	0.1% O2
Analog Output	4 to 20 mA (max 750 ohm load), range programmable
Serial Outputs	RS232 (TXD, RXD, Ground), RS485 Modbus compatible
Relays	SPDT, 5 Amps max, 115 VAC or 24 VDC
	Alarm Relay programmable in 12 different Horn/Strobe modes
	Limit Relay A: Programmable low limit or high limit, failsafe on/off
	Limit Relay B: Programmable low limit or high limit, failsafe on/off
	Low Flow Warning Relay: Active if sample flow problem
	System OK Relay: Programmable failsafe on/off
Power	85 to 264 VAC, 40 Watts max
Display	16 x 2 character VFD, 8 mm character size
Keyboard	12 capacitive touch keys
Enclosure	NEMA 4X rated non-metallic boxes with Lexan windows, wall mounted.
	Outside dimensions: Height: 36 in, Width: 12.5 in, Depth: 7 in
	Weight: 35 pounds.
	Conduit connection: ¾ EMT x2 supplied by user.
Electrical Interface	Power: Terminal strip (85-264 VAC)
	4-20 mA: Terminal strip (+/-)
	RS232 Serial: Terminal strip (IN, OUT)
	RS485 Modbus: Terminal strip (+/- IN, +/- OUT)
	Relays: Terminal strip (N.O., Common, N.C.)
Pneumatic Interface.	A 2-stage pump draws a gas sample at a flow up to 5 l/min at atmospheric pressure. PTFE inlet filter blocks condensate: any condensate must gravity drain down to the source. Inlet/outlet tubing may be 1/16", 1/8", or 3/16" ID flexible tubing. Larger bore tubing will degrade time response. With ¼" OD tubing having a 0.193" ID, the time delay for drawing a sample over a 20' line is less than 7 seconds.
Field Replaceable.	Enclosure unbolts with four screws. Sensor door may be removed at hinge pins. Electrical connections are made to a terminal board. Pneumatic connections are slip fit or o-ring quick connects.

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