A Badger Meter® Brand

Water Quality Monitor

Q46D Dissolved Oxygen Monitor

OVERVIEW

Dissolved oxygen monitoring is critical to stable operation of biological processes in wastewater treatment plants. Whether it be fine bubble aeration, coarse bubble aeration, surface aeration or brush aerators, maintaining the proper D.O. level produces better results. The Q46D Dissolved Oxygen monitor is ideal for control applications where reliable performance is required 365 days a year.

Dissolved oxygen monitoring is critical for aeration system process control. Optimization of the biological process, whether it is removal of organic material, nitrification or nitrification/ denitrification, depends on maintaining proper D.O. levels. Controlling air flow to within the optimal range eliminates excess aeration, which translates into significant energy savings.

The Model Q46D monitor is designed to provide reliable oxygen measurement and help reduce operating costs. Two types of sensing technologies are available for use with the Q46D system: membraned electrochemical and optical (fluorescence). Both sensors provide reliable long-term performance with minimal maintenance. No hardware modifications are required to change from one sensor type to the other. The monitor can be configured for AC or DC power supplies, and a portable battery-powered unit is available to meet a variety of monitoring needs.

When process conditions require frequent sensor cleaning, our unique Q-Blast Auto-Cleaner can be used to keep the system operating nearly maintenance free. This time-proven system has been instrumental in providing years of worry-free operation.

FEATURES

- **Sensor Options**. Choice of using either optical or galvanic membraned sensors. Electronics handle either sensor option without adjustments or special programming.
- **Auto-Cleaning**. Automatic "Air Blast" sensor cleaning system available for reducing maintenance in applications where sensor fouling is a problem.
- **Cal Check**. Automatic calibration check at the end of an auto-clean cycle ensures sensor is clean and responding to changing oxygen concentration.
- **AC or DC Power Options**. Power options include universal 90…260V AC or 12…24V DC.
- **Analog Output Options**. Two isolated 4…20 mA outputs are standard, with an option for a third output if required. Default setting provides analog outputs for D.O. and temperature.
- **PID Output**. Standard PID control function assignable to one analog output.
- **Digital Communications**. Five digital communication protocols are available: Profibus DP, Modbus RTU, Modbus TCP/IP, Ethernet IP, Datalogger.

- **Relay Outputs**. Three SPDT relays are standard, with relay functions programmable for alarm, control or trouble indication. An additional three internal low-power relays provide control of the automatic sensor cleaning function.
- **Flexible Mountin**g. NEMA 4X (IP66) enclosure is suitable for wall, pipe or panel mounting.
- **Clear Display**. Backlit large LCD display provides clear visibility in any lighting conditions. A scrolling second line on the display provides additional information and programming prompts.

AUTOMATIC SENSOR CLEANING

While both sensor types are capable of providing reliable dissolved oxygen readings, neither functions reliably unless the face of the sensor is kept clean.

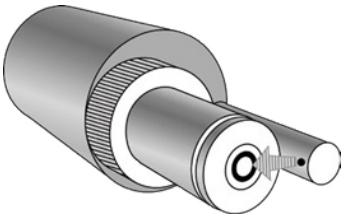

Figure 1: Sensor cleaning

Over time, the treatment process deposits a biologically active film onto the surface of the sensor that impedes the transfer of oxygen. This build up can cause sluggish response to changing oxygen concentrations and inaccurate oxygen values. The removal of this film and other solids that may adhere to the sensor is critical to the integrity of the oxygen readings. Sensor cleaning can be performed manually, but it is time consuming and often neglected when other maintenance needs take precedence.

Badger Meter

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Product Data Sheet

Q-Blast

Our Q-Blast option provides the ideal answer for automatic dissolved oxygen sensor cleaning. Employing a unique "air-blast" cleaning method, sensors can be cleaned as often as necessary without operator attention. Pulses of pressurized air delivered through a nozzle at the tip of the sensor remove accumulated solids from critical sensing surfaces, resulting in accurate and reliable measurements.

The Q-Blast Auto-Clean assembly is housed in a NEMA 4X enclosure suitable for indoor or outdoor use. The system includes an integral compressor and air pulse control components, with a power supply for the entire air supply system incorporated into the design. A simple connection to the Q46D monitor provides the sequencing for the system and allows the operator to select cleaning frequencies as often as once every hour to as little as once every 999 hours. To provide performance in extreme cold conditions, a thermostatically controlled heater is included in the assembly, allowing operation down to –40° F (–40° C).

Figure 2: Q-Blast Auto-Clean system with integral air-blast

OPTICAL SENSOR

The optical D.O. sensor operates on a light-based principle called "fluorescence," which is a type of luminescence. Certain chemical compounds absorb one type of light energy and then emit a different type of light energy. This light emission is called luminescence.

The active portion of the sensor has a metal-based compound embedded in a structural matrix. A light source inside the sensor illuminates this compound that absorbs light at a specific wavelength. The compound then emits light at a different wavelength, which is picked up by a photodetector within the sensor. As oxygen diffuses into the active sensor material, it interacts with the light absorbing compound and interferes with the emission reaction. This interaction, called quenching, causes the light absorbing material to release energy in a form other than light. The degree of quenching is proportional to the concentration of dissolved oxygen. The quenching reaction is reversible, which allows this sensor to measure increasing and decreasing concentrations of oxygen.

Figure 3: Auto-Clean optical sensor

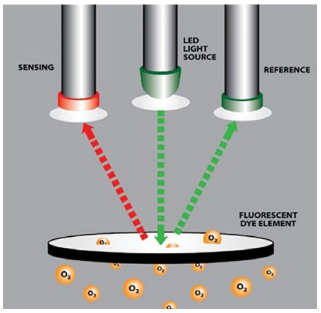

Figure 4: Sensor operation

Optical Sensor Reduces Maintenance

Optical sensors do not have internal electrolyte, so maintenance of this type of sensor is limited to changing the optical element. Over time, the element loses the ability to absorb light due to a process called "bleaching." With some sensors, this process is greatly accelerated when exposed to direct sunlight and causes irreversible damage to the sensor element.

Our optical sensor element is designed to last several years in normal operation. The sensor design allows for exposure to direct sunlight without damaging the sensor element.

Optical Sensor Specifications

Range	0…40 ppm
Wetted Materials	PVC
Optical Element	Replacement disk, 2…5 year life
Cable Length	30 ft (9.2 m) standard 200 ft (61 m) max. with junction box

Response Time	90% in 3 minutes
Operating Temperature	23…122° F (–5…50° C)
Size	2.4 in. D × 5.5 in. L (6.1 cm × 14 cm)
Weight	2 lb (0.9 kg)

GALVANIC MEMBRANED SENSOR

Membraned type D.O. sensors have been used for D.O. monitoring and control for over 40 years and have proven to be consistently accurate and reliable. Properly designed, a membraned sensor provides continuous service for a year or more without maintenance of any kind.

Galvanic oxygen sensors function in much the same way as a battery. The sensing elements consist of platinum cathode and lead anode, with a durable Teflon membrane isolating the sensor system from the liquid being measured. See *Figure 6*. Oxygen diffuses through the membrane and is reduced to hydroxide ion on the surface of the cathode. This reaction generates current between the platinum and lead electrodes, which is proportional to oxygen concentration. An RTD temperature element measures water temperature and corrects the sensor signal for its effect. The result is a D.O. measurement that is accurate over an operating range of 23…122° F (–5…50°C).

Both standard and auto-clean sensors use the same rebuildable D.O. cartridge. A durable 5-mil membrane makes sure that these sensors perform reliably in the most demanding applications, and a 2-mil membrane is available if faster response is needed. Modular design allows easy removal of the cartridge for service, eliminating the need for membrane changes out on the aeration tank. Spare cartridges can be prepared on the bench and quickly swapped to minimize downtime when service is required. Better yet, sensor cartridges can be rebuilt at very little cost. The D.O. cartridge holders for both types of sensors contain a preamplifier potted in the holder assembly. This preamp reduces the potential for electrical interference with sensor signals and allows sensor cables to be extended long distances without signal loss. For applications where measurements need to be made in a closed system, a flow-type D.O. sensor is also available with a number of options for flow cells to meet specific applications.

Figure 5: Standard D.O. sensor

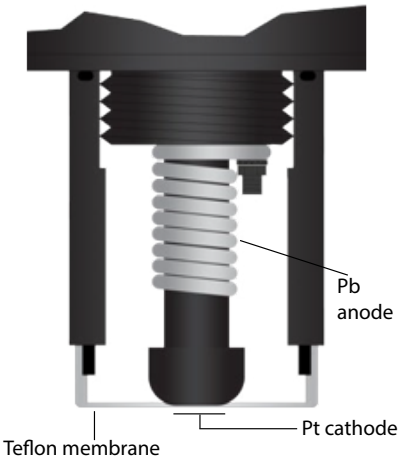

Figure 6: Galvanic oxygen sensor

SPECIFICATIONS

Galvanic Sensor

Range	0…40 ppm
Wetted Materials	Noryl, PVC & 316 SS
Membrane/Response	5 mil - 90% in 3 minutes (standard); 2 mil - 90% in 1 minute (optional)
Cable Length	30 ft (9.2 m) standard; 1000 ft (307 m) max. with junction box
Operating Temperature	23…122° F (–5…50° C)
Size (Auto-Clean)	2.4 in. D × 5.5 in. L (6.1 cm × 14 cm)
Weight	2 lb (0.9 kg)
Size (Standard)	1.8 in. D × 6 in. L (4.6 cm × 15.2 cm)

Electronic Monitor

Display Range	0…40.00 ppm (or mg/L); 0…200% saturation
Accuracy	0.5% of selected range or 0.01 ppm
Repeatability	0.3% of selected range or 0.01 ppm
Non-Linearity	0.1% of selected range
Temperature Drift	0.01% of span/°C
Power	90…260V AC, 50/60 Hz, 10VA max.; 12…24V DC, 500 mA max.
Analog Outputs	Two isolated 4…20 mA, 500 Ω load max. (3rd output optional)
Relays	Three SPDT, 6A @ 250V AC, 5A @ 24V DC
Display	4 digit, 0.75 in. numeric LCD with 12 character second line, LED backlight
Enclosure	NEMA 4X (IP66) Polycarbonate, V-0 flammability
Operating Temperature	–4…140° F (–20…60° C)
Weight	4 lb (1.8 kg); Auto-Clean version: 18 lb (8.1 kg)
Sensor Options	Optical fluorescence quenching or membrane-covered galvanic (flow type or submersible)

ORDERING INFORMATION

QE-A-B-C-D-E Dissolved Oxygen Monitor

Suffix A - Power
1 - 100…240V AC, ±10%, 50/60 Hz
2 - 12…24V DC, requires 300 mA
3 - 100…240V AC, 50/60 Hz with Auto-Clean assembly
4 - 12V DC, with Auto-Clean assembly (requires 1.0 A)
Suffix B - Sensor Type
WW - None
D1 - Submersible sensor with 15 ft cable
D2 - Submersible sensor with 30 ft cable
D3 - Auto-Clean sensor with air nozzle and 30 ft cable
D4 - Auto-Clean sensor with air nozzle and 60 ft cable
D5 - Flow type membraned sensor with 25 ft interface cable
D6 - Optical sensor with cleaner nozzle and 30 ft cable

Suffix C - Membrane Type
1 - 5 MIL (Standard)
2 - 2 MIL
3 - None
Suffix D - Digital Output
1 - None
2 - Profibus-DP
3 - Modbus-RTU
4 - Ethernet/IP
5 - Modbus TCP/IP
6 - Datalogger
Suffix E - System Assembly
6 - Q-Blast mounting plate - VAC
7 - Q-Blast mounting plate - VDC
X - Not applicable

ACCESSORIES

00-0628	Submersion mounting bracket kit for standard sensors
00-0629	Mounting kit for Auto-Clean sensor with rag shedder
07-0100	Junction box, NEMA 4X
31-0038	7-conductor optical sensor cable, 300 ft max.
31-0001	5-conductor sensor interconnect cable (max. 1000 ft)
00-0624	Mounting bracket kit for Auto-Clean sensor
45-0043	Pipe adapter for Auto-Clean sensor
05-0094	Panel mount bracket kit
47-0005	2 in. U-bolt, 304SS
00-1637	Q-Blast assembly with Power J-Box and mounting rails
00-0625	1-1/2 in. flow tee assembly
00-0043	Constant-head flow cell
00-1522	Sealed flow cell

Notes

1. All systems with membraned sensors are supplied with one package of membranes, one 120 cc bottle of electrolyte and one spare parts kit.
2. Pipe mount requires two 2 inch U-bolts (47-0005).
3. If Option D6 is selected under Suffix B, Option 3 under Suffix C must be selected.