EQUIPMENT AND SERVICE COMPANY, INCORPORATED Dissolved Oxygen Measurement General Brochure

# FX-300-DO Dissolved Oxygen Transmitter & Controller



FOXCROFT

- Many of those who monitor the environment, as well as municipal and industrial wastewater treatment plants, are devoting more money and ongoing expense to the measurement of dissolved oxygen due to the high costs of both the transmitters and sensors.
- Simple, low-cost & easy to use FX-300-DO transmitter has all features that are needed such as:
  - Display and output dissolved oxygen in ppm and % saturation units plus temperature in °C with analog 4-20mA and optional RS485 Modbus
  - Calibrations and process readings corrected for temperature, air pressure and salinity
- Compact sensor measures from 0-20 ppm (limit 0.1 ppm) in water with naturally occurring oxygen levels.
- Submersible sensor measures from 0-4ppm to 0-4oppm with 0.01ppm resolution anywhere in the range
- DO transmitter & sensors rated to 0-50 °C (0-122 °F)
- Modular FX-300 series allows for any mix of FX-300 modules for pH, ORP, ISE, DO & Conductivity in one enclosure.

### **KEY FEATURES & BENEFITS**

- FX-300-DO is a proven membrane covered self-polarizing style galvanic cell that generates a low-impedance millivolt electrical signal proportional to the oxygen pressure it senses.
- Extremely low initial commissioning cost and residual cost of ownership. For most applications included materials are sufficient to perform measurement for 3 to 5 years time.
- Commissioning costs are often less than 1/3 that of optical sensor systems. The cost of ownership for FX300-DO sensors is often less than 1/5 the cost of optical sensors
- With galvanic type DO sensors there is a true zero and so no zero adjustment is ever needed
- Gain calibration performed with sensor dry in air; FX-300-DO has correct calibration value stored at any temperature & pressure
  - ✓ Adjust the display in the gain mode and you are done.
    No look-up tables and no solutions required to calibrate your DO sensor with the FX-300-DO!
- Due to unique electrolyte chemistry and design combined with rugged membrane technology, the calibration, cleaning and replacement needs are quite minimal and easy to perform.





Compact FX300-DO 21.5 mm dia. X 160 mm long Submersible, Inline or Tank Mounting



SPECIFICATIONS: FX-300-DO Dissolved Oxygen Analyzer/Transmitter/Controller	
Measurement Type and Purpose:	Galvanic (active self-polarizing) dissolved oxygen sensor to measure DO levels in aqueous media, internally self temperature compensating (even without integrated TC element)
Application Range: (Submersible Probe)	Environmental monitoring of water quality in rivers, lakes and well and other natural water sources, compliance for health and safety applications; municipal secondary and tertiary wastewater treatment; industrial wastewater treatment; aquaculture and fish applications
Displayed Concentration Range:	o.o to 40.0 ppm or 0 to 400% Saturation
Resolution:	0.01 ppm anywhere in the range
Output Scaling:	Output scalable to 10% of full range (min 4ppm or 40% Saturation) for Analog & MODbus The 4mA & 20mA set points can be arbitrarily defined and are fully reversible
Lowest Displayed Limit of Detection:	0.01 ppm
Sample pH Range:	Typically 2 to 12 (Inquire for other pH levels outside of this range)
Sample Temperature Range:	o to 50 °C (32 to 122 °F)
Pressure Range:	Typical installations 10 psig or less; Submersible to 50 meters (165 feet)
Sample Flow Requirements:	Continuous flow, Minimum 1cm per second for stable readings
DO Sensor Specifications:	Membrane Covered Galvanic Cell generates mV potential linear to the dissolved oxygen ppm in air or liquid; Internally temperature compensated; Response of 2mV to 6mV per ppm
Special Features:	FX-300-DO automatically corrects for temperature, pressure and salinity effects on % saturation in calibration and measurement (both for display & output); More details on following pages
Display:	Bright 3-digit red LED display visible in sunlight
Power Supply:	CSA/UL/CE Universal 115/230 VAC power supply, consumption 60mA max per module
Signal Output:	Scalable 4-20 mA; DO ppm, % Saturation & Temperature all sent on optional RS485 MODbus
Instrument Mounting & Dimensions:	Wall, Pipe or Panel Mounting for 2, 3, 4, 6 or 7 modules per enclosure (NEMA 4X & UL)

#### Module Description & Options:

**Transmitter Modules:** In addition to dissolved oxygen, modules are available for pH, ORP, mV, Temperature, Conductivity and Ion Selective (ISE) measurements including Fluoride, Ammonia, Nitrite, Nitrate & Calcium among others. All analog outputs have built-in trim calibration support, including both offset and span adjustments. Calibration of temperature element is available for all measurement modules via 1-point offset adjustment.

**Preamplifier Support:** Unlike many low cost systems, the FX-300-pH and FX-300-ISE transmitter series supports optional external preamplifiers for noisy environments or to avoid opening the analyzer enclosure for sensor service, and to minimize sensor replacement costs (no long cables need be pulled).

**FX-300-REL Option:** Alarm and relay controller module provides (2) each 5 Amp contact relays and controller that is fully configurable by the user for control mode and variables for each control algorithm. Control modes include: 1) Alarm functions only; 2) On/Off control with a user-configurable dead band; 3) Time proportional control; and 4) Proportional frequency control (variable pulse controller).

**FX-300-DAT Data Logging Option:** MODbus FX-300-DAT data logger can support simultaneously data logging from any FX-300 module with MODbus output (FX-300-pH, FX-300-ISE, FX-300-DO, FX-300-CON and FX-300-TOT) at frequencies from every second to every hour. Configuration of FX-300-DAT data logger and downloading of data done via free Windows PC software.

**FX-300-TOT Option:** pH compensation module computes total ISE using the free ion activity, pH, and temperature from the respective measurement modules' bridged outputs. The FX-300-TOT module includes a scalable 4-20mA output for total ammonia result and RS485 Modbus communications for all inputs and outputs. By using the bridged output for totalizing, you retain the use of free ion and pH 4-20mA outputs.

**Modbus Option:** Available as RS-485 output option for measurement module or by adding FX-300-TOT module at any time. Free of charge Windows Graphing & Data logging software supplied with all FX-300 modules purchased with MODbus output option or FX-300-TOT.

Enclosure: Molded fiberglass NEMA 4X windowed enclosures for Wall, Panel or Pipe Mounting, 7" x 7" or 9" x 11"

Power Options: Universal 115/230 VAC power supply or 3-wire 24VDC operation (not 2-wire loop power) with a dedicated power supply.

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## Automatic Calculation of Theoretical 100% Dissolved Oxygen Saturation At any Temperature & Pressure for Accurate Calibration & Measurement

The FX-300-DO has preprogrammed the correct 100% dissolved oxygen saturation levels valid at any temperature and pressure. This is important for two main purposes: 1) to ensure accurate calibration of the sensor which is performed dry in air and 2) when the percent (%) saturation is displayed and output for purposes of monitoring and control. The graph below demonstrates the impact of both temperature and pressure on the dissolved oxygen (DO) ppm levels that constitute 100% saturation condition.



For the calibration function, either the field condition should be 100% relative humidity for best accuracy or else the sensor should be suspended dry in air but over a water source to simulate locally the 100% relative humidity condition. The water molecule in air (humidity) is then saturated with oxygen in manner that can be fully described by the ambient temperature and pressure as shown above. When placed into service, the galvanic DO sensor will measure the ppm levels at the installation depth. To convert this measured ppm value into percent (%) saturation the FX-300-DO transmitter uses the stored curve visualization above.



## Automatic Calculation of Theoretical 100% Dissolved Oxygen Saturation At any Temperature & Pressure for Accurate Calibration & Measurement

The FX-300-DO has preprogrammed the correct 100% dissolved oxygen saturation levels valid at not only any temperature and pressure but also corrected for salinity. This is important for application where not only fresh water will be present but also for brackish and salt water sources in variable amounts. The graph below demonstrates the impact of salinity on the dissolved oxygen (DO) ppm levels that constitute 100% saturation condition at the nominal 760mm pressure condition. For simplicity of visualization just one set of curves is shown although the analyzer can perform this compensation at any temperature, pressure or salinity.



This salinity correction is only required for correction to the computation of the % saturation from the measured DO ppm levels for the inline measurement. Since the calibration is done dry in air, salinity correction is not required for this part of operation. Since the impact of salinity is considerable as shown in the graph above, it must be corrected carefully at any level of salinity and temperature. The salinity value in standard PSU units can be entered into the FX-300-DO transmitter to perform this correction. The value of the salinity can be determined by a handheld salinity meter or else monitored continuously using a FX-300-CON conductivity transmitter from which you can readily convert into these common salinity units.