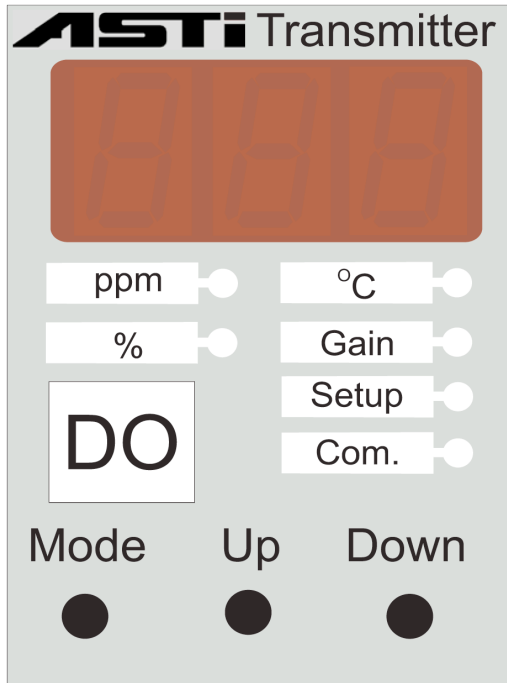


3TX-DO Dissolved Oxygen Controller, Transmitter & Datalogger



- Rugged & cost-effective solution for continuous measurement of dissolved oxygen in tough process applications such as abrasive slurries, high levels of organic & biological content, high turbidity likely to foul luminescent type DO sensors
- Simple, easy to use 3TX-DO & 3TX-DO-X transmitters have all critical features for continuous field measurement such as:
 - Display and output dissolved oxygen levels in ppm and percent (%) saturation units plus temperature in °C via both analog 4-20mA and optional RS485 MODbus RTU
 - Calibrations and process readings are automatically corrected for temperature, air pressure and salinity
- Measure from 0-4 to 0-40.0ppm (0-40% to 0-400% saturation) or 0-6 to 0-60.0ppm (0-60% to 0-600% saturation) as special order
- Fixed 0.01 mV & 0.01ppm resolution anywhere in the range
- For galvanic dissolved oxygen sensors with true zero and mV per DO ppm response with internal temperature compensation For measurements operating from 0 to +50 °C (+32 to +122 °F)
- Modular 3TX series allows any mix of modules for pH, ORP, ISE, DO & conductivity measurement and/or control field use

KEY FEATURES & BENEFITS

Wide range of installation schemes to interface your process:

- ¾" NPT inline use with convertible type configuration
1" NPT inline with twist lock quick disconnect bayonet style
- ¾" & 1" NPT immersion use standard or else fully submersible when used with immersion tube and/or waterproofing option
- Sanitary tri-clover for food, dairy, beverage & pharmaceutical
- HOT-TAP valve retractable assemblies for locations where a slip stream bypass or submersible installation is not possible
- Galvanic DO sensor require **no zero adjustment of any kind**
- Gain calibration performed with sensor dry in air; 3TX-DO has correct calibration value stored at any temperature & pressure
 - Adjustment for gain is completely automatic so that **no look-up tables and no solutions are required to calibrate galvanic DO sensors with the 3TX-DO!**
- Due to unique electrolyte chemistry and design combined with rugged high stability thick membrane technology for minimal calibration, cleaning & rebuilding of the industrial DO cell.
- Available for DO sensors without preamplifiers (3TX-DO) as well as DO sensors with integral preamplifiers (3TX-DO-X)



AST-DO-UNIVERSAL dissolved oxygen sensor in convertible configuration; Close-up on DO cell



SPECIFICATIONS: 3TX-DO(-X) 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)
Typical Applications for the AST-DO-UNIVERSAL Galvanic Dissolved Oxygen Sensors:	Industrial & mining abrasive slurries as well as any solution with high turbidity. Ideal for high sulfide containing media since the AST-DO-UNIVERSAL sensor is insensitive to hydrogen sulfide gas. Any measurement where rugged process conditions may exist.
Concentration Range Standard:	0.0 to 40.0 ppm or 0 to 400% saturation is the standard full range
Concentration Range Special:	0.0 to 60.0 ppm or 0 to 600% saturation ranges available as a special order option
Resolution:	0.01mV and 0.01 ppm absolute anywhere in the range
Output Scaling:	Minimum 10% of full range for both analog current loop & MODbus. The 4mA & 20mA setpoints can be arbitrarily defined and are fully reversible
Lowest Displayed Limit of Detection:	0.01 ppm (Recommended for applications that are typically 0.10ppm or higher)
Sample pH Range:	Typically 2 to 12 (Inquire for other pH levels outside of this range)
Sample Temperature Range:	0 to +50 °C (+32 to +122 °F)
Pressure Range:	Typical inline installations are 10 psig or less; Submersible to 50 meters (165 feet)
Sample Flow Requirements:	Continuous flow, Minimum 1cm per second for stable readings
AST-DO-UNIVERSAL Industrial Galvanic Dissolved Oxygen Sensor Specifications:	Membrane covered galvanic cell generates an internally temperature compensated mV signal linear to dissolved oxygen in air or liquid. Typical response is 1 to 5 mV per ppm as is determined from dry in air slope (span) calibration. Measurement range is 0-600% saturation.
Special Features:	3TX-DO(-X) corrects for temperature, pressure and salinity effects on % saturation in calibration and measurement modes; More details are provided on the following pages
Display:	Bright 3-digit red LED display visible in sunlight
Power Supply:	CSA/UL/CE Universal 100 to 240 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 CSA/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 galvanic dissolved oxygen measurement systems, the 3TX-DO-X transmitter model supports preamplifiers for use in particularly noisy environments or to avoid opening the analyzer enclosure. The 3TX-DO-X transmitters when used with the AST-DO-UNIVERSAL sensors in the with integral preamplifier configuration supports the Q7M/Q7F NEMA 6P rated quick disconnect snap connectors for ease of installation and maintenance at cable lengths up to 100 meters (330 feet). End of cable terminations can be bridged for with integral preamplifier configurations.

3TX-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).

3TX-DAT Data Logging Option: MODbus 3TX-DAT datalogger can support simultaneously datalogging from any 3TX module with MODbus output (3TX-pH, 3TX-ISE, 3TX-DO, 3TX-CON and 3TX-TOT) at frequencies from every second to every hour. Configuration of 3TX-DAT datalogger and downloading of data done via freely supplied mating Windows PC software which also allows for visualization and workup of the information.

3TX-TOT Option: pH compensation module computes total ammonia (NH₃ + NH₄⁺) using the free ammonium ion activity, pH, and temperature from the respective measurement modules' bridged outputs. The 3TX-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. **THE 3TX-TOT IS REQUIRED AT pH ABOVE 7.5 TO PROPERLY PERFORM AMMONIUM ISE MEASUREMENTS AT MOST TEMPERATURES.**

Modbus Option: Available as RS-485 output option for measurement module or by adding 3TX-TOT module at any time. Free of charge Windows Graphing & Datalogging software supplied with all 3TX measurement modules purchased with MODbus output option or 3TX-TOT.

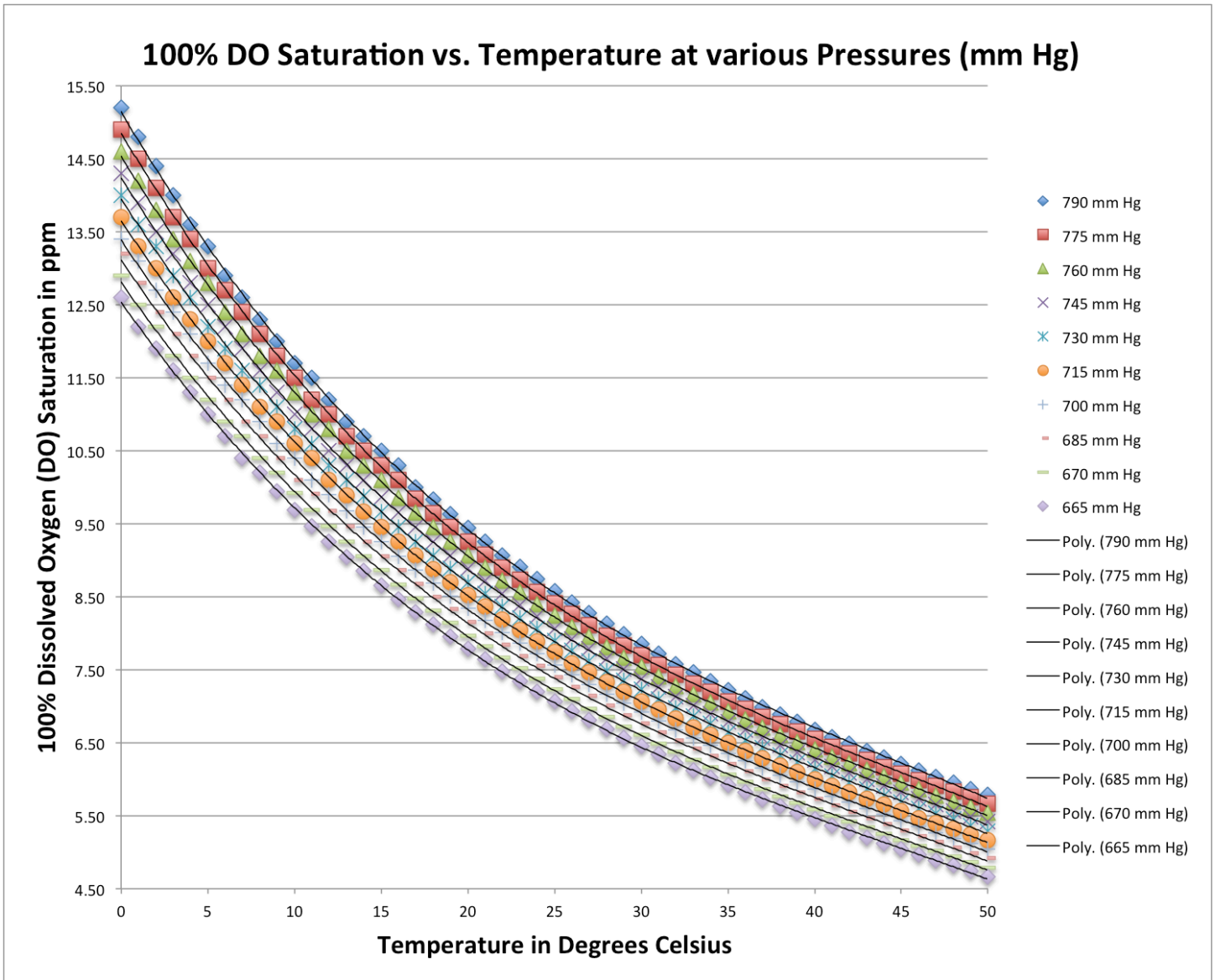
Enclosure Options: NEMA 4X Enclosures (CSA/UL Listed) for 2, 3, 4, 6, or 7 modules for Wall, Panel or Pipe Field Mounting or 35mm Din-Rail Only

Power Options: Universal 100 to 240 VAC 50/60 Hz power supply or 3-wire 24VDC operation (not 2-wire loop power) with a dedicated power supply.

Last Revised July 11, 2016

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

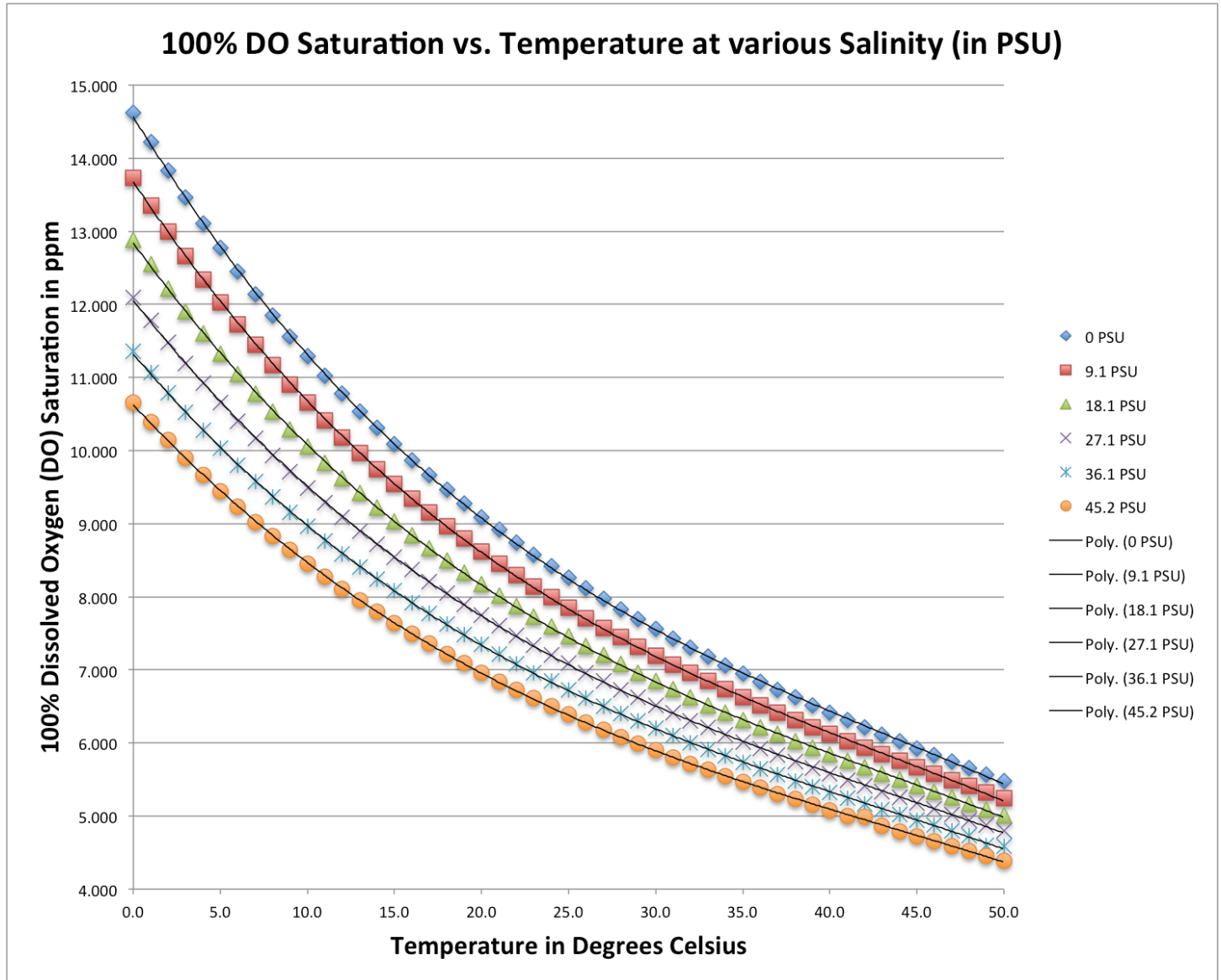
The 3TX-DO(-X) has preprogrammed the correct 100% dissolved oxygen saturation levels valid at any temperature and pressure. This is important for two main purposes: 1) to ensure accurate calibration of the sensor which is performed dry in air and 2) when the percent (%) saturation is displayed and output for purposes of monitoring and control. The graph below demonstrate 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 3TX-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 3TX-DO(-X) 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 applications 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 any temperature, pressure or salinity.



This salinity correction is only required as a 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 (PPT) units can be entered into the 3TX-DO transmitter to perform this correction. The value of the salinity can be determined by a handheld salinity meter or else monitoring continuously using a 3TX-CON conductivity transmitter from which one can readily convert into common salinity units.