



**TELEDYNE**  
ANALYTICAL INSTRUMENTS  
Everywhere you look™



(주)엠씨마스터스

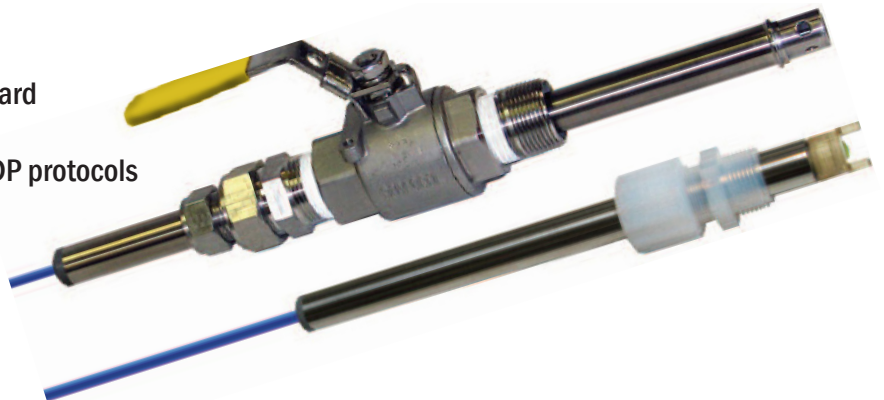
**MC Masters**  
Measurement & Control

# Model LXT-330 & LXT-380

## Universal Transmitter and Smart Sensors

### FEATURES:

- Measure pH, ORP, conductivity, resistivity, dissolved oxygen, specific ion (pION), turbidity or chlorine dioxide (ClO<sub>2</sub>)
- Intelligent sensors provide configuration and calibration parameters to the transmitter
- Microprocessor-based electronics with menu-driven functionality
- Luminescent LCD display with easy to view numerical and graphical representations
- 4-20mA and MODBUS RTU outputs as standard
- Universally accepted HART® 7 and Profibus DP protocols
- One or two sensors per transmitter



## LXT-330 / LXT-380 - Universal Transmitter and SP-3X Smart

The Teledyne Analytical Instruments Model LXT-330 Transmitter is a single or dual channel, universal, multi-parameter transmitter designed for the continuous online measurement of pH, ORP, pION, conductivity, resistivity, turbidity, chlorine dioxide (ClO<sub>2</sub>) or dissolved oxygen in a general purpose industrial environment.

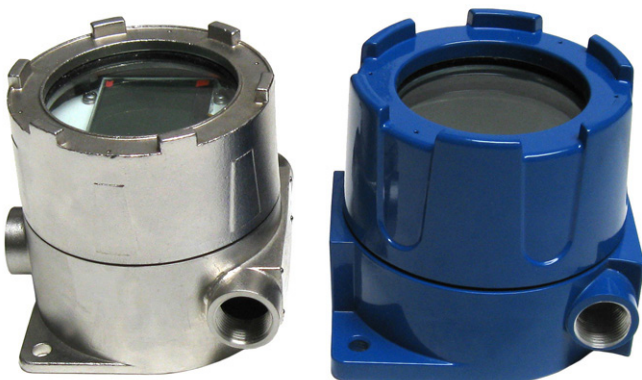
The LXT-330 Transmitter uses the TAI SP-3X series of sensors, which cover a wide range of analytical applications. The same LXT-330 can be used for any of the measurements, i.e. plug a conductivity sensor into an LXT-330 pH transmitter and it will automatically reconfigure into a conductivity transmitter. There is no longer any need to inventory multiple instrument types. The sensor type, identity, serial number and calibration registers are stored in the sensor's main memory, facilitated by two-way digital communication between the sensors and the transmitter. A converter option

is available to allow the use of non-digital sensors. The LXT-330 allows for single or dual sensors per transmitter.

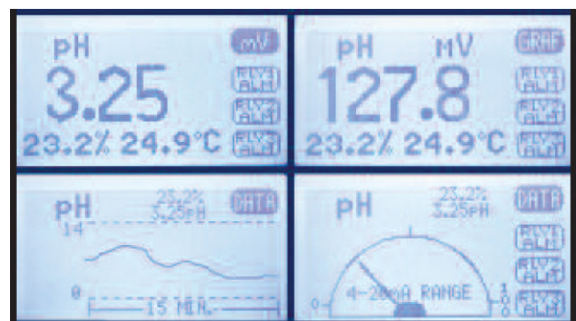
The Model LXT-330 Transmitter features a large, easily viewed LCD display with switchable screens including the main numeric screens, graphical screens showing a trending chart in a selectable format, and diagnostic data for troubleshooting. Three graphical styles are available: Trend Line, Bar Graph, or Gauge. Loop-powered instruments have black lettering on a grey background, while non-loop powered instruments have blue lettering on a white background when the LED backlight is on. Menu navigation is accomplished using membrane switch buttons with soft keys displaying the function associated with the button. Pressing any of the buttons twice within 2 seconds activates the soft key function menus. The primary menu selections are the Calibration, Configuration, Info and Simulate Menus.

The Model LXT-330 transmitter is available as a loop powered transmitter (standard), or an optional 24 VDC or 100/250 VAC powered transmitter. The loop powered transmitter has a 4-20 mA output or an optional HART® output. The line powered instruments have a 4-20 mA output and MODBUS RTU or HART® and can be ordered with a (3) Alarm Relay option. The relays can be configured as Alarm (set point) relays or Fault relays.

For hazardous area installations, the Model LXT-380 offers a Class I Div 1 (Zone 1) and Class I Div 2 (Zone 2) approved transmitter with NEMA-4 or NEMA-4X ingress protection. Magnetic switches allow for menu navigation and access to transmitter functions.



Model LXT-380 Explosion-Proof Transmitter



The SP-3X valve retractable sensor uses a 1" MNPT ball valve, 1"x 3/4" reducer and a 3/4" MNPT compression fitting as the process connection. Loosening the compression fitting allows the sensor to slide freely through the ball valve for either insertion into the process or retraction from the process. Once retracted, the ball valve can be closed and the sensor removed for maintenance or replacement without shutting down the process line.

### Pre-Calibrated Detachable Sensor Option

This detachable sensor has a rugged IP68 rated industrial connector. Just a simple quarter turn locks the cable connector in place. These pre-calibrated sensors can be easily installed in the field (see Page 6 for picture).

### pH and ORP Electrode Cartridges

The Model SP-3X Sensors use replaceable electrode cartridges to provide application specific solutions for the most demanding pH measurements. Available in either Radel (PES) or PEEK construction with full crown, double or single tine style pH bulb protection. Various pH glass formulations are available for general purpose, high temperature or aggressive chemical applications. These formulations are blown into spherical bulbs (best response), hemispherical bulbs (more durable) or a slightly radiused flat surface (easily cleaned) to address the process conditions. A platinum tip replaces the pH glass bulb on ORP electrodes. The reference electrodes have double or triple junction reference cells with porous Teflon® and ceramic junctions and various electrolytes. This vast array of possibilities will solve most application problems. We have refined this offering to three widely used electrodes for most installations. Consult our technical support staff for other unique electrode configurations.

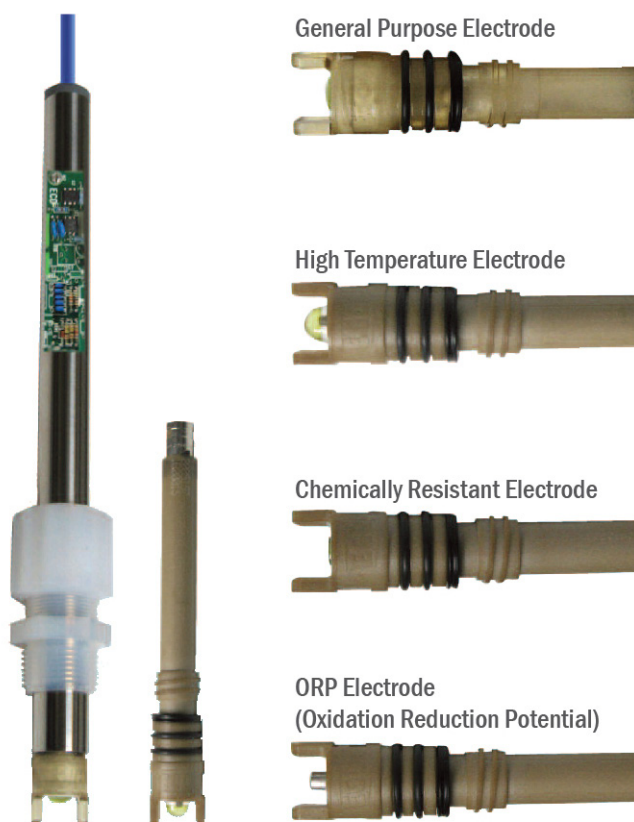
The General Purpose Electrode has a two tine Radel body, double junction reference and slightly radiused pH bulb. While suitable for higher temperatures, it is optimized for fast and stable readings in ambient temperature applications. Neutralizations, waste effluent monitoring, rinse applications and potable water are just a few of the suggested applications.

The High Temperature Electrode has a two tine PEEK body, triple junction reference and hemispherical pH bulb. This

electrode is designed for the process control or neutralization of most mineral acids and bases in applications up to 130°C. The triple junction design is resistant to sulfide ion poisoning making it ideal for use in petroleum refineries and metal processing plants.

The Chemically Resistant Electrode has a two tine PEEK body, double junction reference and slightly radiused pH bulb. The PEEK body is suitable for use in most aggressive solvents, oxidizing solutions and acids or bases. This electrode is optimized for a harsh chemical environment and is suitable for service up to 130°C. Suggested applications include chemical separations, solvent recovery in the CPI and pharmaceutical industries, chlorine production and flotation in mining.

This ORP (Oxidation Reduction Potential) Electrode has a two tine PEEK body, double junction reference and a platinum tip. This general purpose sensor can be used for monitoring the oxidant level of cooling towers, swimming pools, aquariums or the de-chlorination of waste water. Metal finishing and mining also provide applications such as cyanide destruction and monitoring chrome plating baths.



SP-3X Sensor and Sensor Cartridge



## Conductivity Measurements

Two technologies are used to measure conductivity - contacting conductivity, an impedance measurement made between two metal contacts in the solution, or toroidal conductivity, a non-contacting inductive measurement made between two coils inside the sensor inductively coupled through the solution's conductivity. Toroidal sensors excel in the higher conductivity ranges and where coating is a problem. The chemically resistant PVDF body

## Conductivity and Resistivity Sensors

The SP-3X Conductivity Sensors are capable of measuring ranges from 0-1  $\mu\text{S}$  to 0-50 mS. The sensor provides the inner contact for the measurement with the housing providing the other contact. User input to the transmitter optimizes the cell for the desired measurement range. Standard wetted materials are 316 Stainless Steel, PVDF (Kynar®), with Viton o-rings. A closed guard style is offered as standard for the SP-3X conductivity sensors.

## Toroidal Sensors (Non-Contacting)

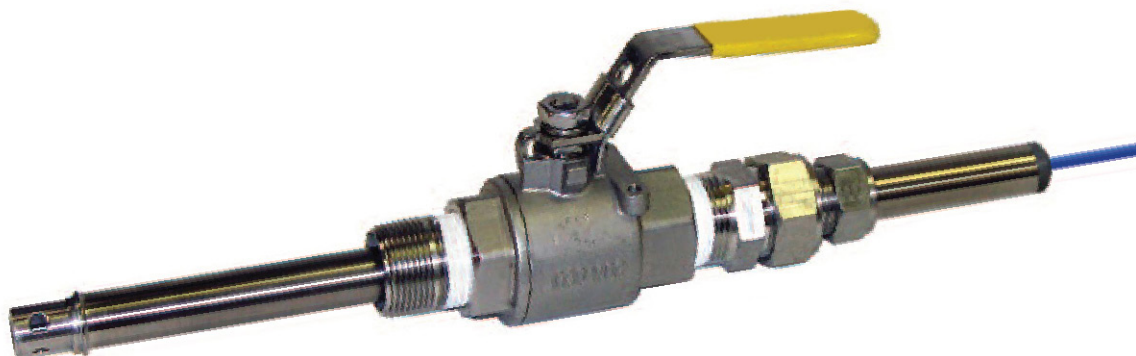
The SP-3X Toroidal Sensors have a  $\frac{3}{4}$ " diameter PVDF (Kynar®) body, not the stainless steel used for the other measurements. The sensors are sealed and there are no replaceable cartridges. These sensors are ideal for high conductivity solutions like percent concentration measurements or any application that coats or corrodes the standard contacting conductivity sensors. The toroidal sensor measurement range is from 50 mS to 1000 mS.

is excellent for corrosive environments. Contacting sensors can measure from very low to very high conductivities (resistivity measurements), but they are subject to coating and corrosion issues, where the toroidal sensor excels. The contacting conductivity SP-3X sensors come in three ranges: Low Range (1 $\mu\text{S}$  - 50 $\mu\text{S}$ ), High Range (50 $\mu\text{S}$  - 50mS) and Resistivity (0 - 20M $\Omega$ ). Inductive Toroidal Sensors measure from 50 mS to 1000 mS.

## High Temperature - High Pressure Sensors

The High Temperature- High Pressure sensor is designed for service to 230°C and 660 psig. These insertion style  $\frac{3}{4}$ " MNPT, 316 stainless steel sensors have PEEK insulators and are available with or without an integral signal conditioner. An aluminum junction box is mounted on the rear of the sensor that contains a terminal block and optional signal conditioner. The junction box is rated for Class I, Div I, Groups C & D, Class II, Groups E, F and G hazardous locations. The SP-3X S sensors are rated for service to 150°C and 225 psig and use Ryton®, Kynar® or Teflon® insulators. These stainless steel insertion sensors are available in  $\frac{3}{4}$ " MNPT or with various sanitary flanges.

Toroidal Sensors - (non-contacting)



Conductivity/Resistivity Sensor



Specific Ion (plon) Electrode Cartridges

## Specific Ion (plON) Sensors

Ion selective electrodes are not limited to laboratory use; some are suitable for continuous online measurement. TAI offers Specific Ion Electrode cartridges to measure ammonium, bromide, calcium, chloride, cupric, cyanide, fluoride, nitrate, potassium, silver, sodium and sulfide ions.

Specific Ion Electrodes measure the activity (concentration) of the ion in solution, the “free” ion, not a complexed version. Cyanide, fluoride and sulfide ions only exist in a specific pH range as free ions and outside this pH range some percentage of the total concentration is complexed as H(X) which is not seen by the sensor. These measurements can be pH compensated using the dual channel LXT-220 Controller with a pH sensor to determine the total ion concentration. Most plon sensors are subject to interfering ion errors. A positive interference is caused by similar ions in the solution. Consult with the factory on all new installations to determine the suitability of the measurement.

## Specific Ion (plon) Electrode Cartridges

Type	Measurement Range	pH Range	Temperature Range
Ammonium	0.05 - 18,000 ppm	2-10 pH	0° - 40°C
Bromide	1 - 80,000 ppm	2 - 12pH	0° - 50°C
Calcium	0.1 - 40,000 ppm	2.5 - 10 pH	0° - 40°C
Chloride	2 - 35,000 ppm	2 - 12 pH	0° - 50°C
Cyanide	0.1 - 260 ppm	11 - 13 pH	0° - 80°C
Cupric	1.0 ppb -6,300 ppm	2 - 6 pH	0° - 80°C
Fluoride	0.02 - 2,000 ppm	5 - 8 pH	0° - 80°C
Nitrate	0.1 - 1000 ppm	2 - 12 pH	0° - 40°C
Potassium	0.1 - 40,000 ppm	2 - 12 pH	0° - 40°C
Sodium	0.2 - 23,000 ppm	2 - 14 pH	0° - 80°C
Sulfide	0.01 - 32,000 ppm	11 - 14 pH	0° - 80°C
Silver	0.1 - 107,000 ppm	2 - 14 pH	0° - 80°C

## Dissolved Oxygen Electrode Cartridge

The TAI dissolved oxygen electrodes are galvanic cells with a lead anode, silver cathode and a 2 mil or 5 mil Teflon membrane. The cartridge is ready to use as received, there are no solutions or membranes to install before the electrode

can be used. The membrane is protected by a single one PEEK body allowing for easy cleaning. Designed for ppm level measurements it is ideal for environmental water measurements, aerobic waste treatment and digesters.

## Dissolved Oxygen Electrode Cartridge

Type	Measurement Range	Pressure Range	Temperature Range
Dissolved or Gaseous Oxygen (2 or 5 mil)	0 - 20 ppm (mg/L) 250% Saturation	0 - 50 psig	-5 to 80°C

### Turbidity Sensor

The turbidity sensor uses an optical method for determining turbidity; a directed light beam is scattered by suspended particles in the water. The amount of scattering depends on three variables: the amount of material in the water, the wavelength of light used, and the size and composition of the suspended particles.

The turbidity sensor uses a long-lived near infrared LED light source (880 nm) and the 90° scattered light method to assure accurate turbidity measurements under most conditions compliant with ISO 7027/ EN 27027 standards. The 90° scattered light detection method is the benchmark design for turbidity. This sensor offers high sensitivity at low levels of turbidity, a simple optical configuration, and a balanced sensitivity to all particle sizes. Three detectors monitor the light beam at an angle of 90°. The first sensor detector, the reference detector, compensates for changes in the LED light source caused by aging or other variations.

The second detector measures a short path length, best suited for high concentration measurements. The third detector measures the longer path length for lower expected concentrations. The turbidity signal is constantly adjusted versus the reference detector and the LXT-330 digital filter functions help to suppress interfering signals while the self monitoring diagnostics, assuring a highly reliable measurement for almost all operating conditions.

Teledyne's turbidity sensor design makes periodic cleaning easy. In most cases, this entails simply removing the sensor and wiping the optical surface with a soft cloth to remove any dirt or biofilms. An optional automated mechanical wiper is available to minimize manual cleaning as well as mitigate measurement problems associated with air bubbles. Air bubbles in the water can also reflect light and may interfere with the measurement.



SP-3X Turbidity Sensor



SP-3X Detactable Sensor

# LXT-330 / LXT-380 - Universal Transmitter and SP-3X Smart

## Chlorine Dioxide Sensor

Teledyne's chlorine dioxide (ClO<sub>2</sub>) sensor incorporates a flow control device and a chlorine dioxide sensor conveniently mounted on a PVC panel. Simply connect the sample and drain lines, power, and outputs and the sensor is ready to use. Calibration is easily accomplished by DPD comparison.

Chlorine Dioxide (ClO<sub>2</sub>) exists as a gas in solution and does not dissolve like other chlorine compounds. Therefore, chlorine dioxide not affected by the pH of the solution. ClO<sub>2</sub> is approximately 10 times more soluble than chlorine in water, but its extreme volatility allows it to be easily removed from dilute aqueous solutions with minimal aeration. In Teledyne's ClO<sub>2</sub> sensor, chlorine dioxide diffuses through the sensor's PTFE membrane and is reduced to chloride ions by the addition of electrons from the cathode. Silver from the anode is then oxidized to silver chloride. The electrons released from the gold cathode and the electrons

accepted on the silver anode result in a measured current flow proportional to the chlorine dioxide concentration in the medium.

Temperature affects the ClO<sub>2</sub> permeability of the PTFE membrane. The output of the sensor increases with rises in temperature about 4% / degC. The chlorine flow cell includes a temperature sensor, allowing the LXT-330 transmitter to perform automatic temperature compensation of the measurement.

Amperometric chlorine sensors are flow sensitive and the minimum required flow by the sensor is 0.5 ft /sec. The output is virtually flow independent above this minimum flow. A "constant head" flow control device (CFD) maintains the optimum flow over the sensor through a wide range of incoming sample flow rates.

MODEL LXT-330 OR MODEL LXT-380		TRANSMITTER PART NUMBER GUIDE			
Inputs	10 SP-3X Sensor, pH, ORP, pION, Conductivity, Resistivity, Turbidity, galvanic Dissolved Oxygen and Chlorine Dioxide				
	20 Optical DO and Amperometric ppb DO Sensors				
	30 Internal Digital Converter/Preamp (for use with S10 and S17 style sensors)				
	Power Supply	-0 Loop Powered Transmitter			
		-1 24 VDC Powered Transmitter			
		-2 100-240 VAC Powered Transmitter			
	Alarm Relays	0 No Relays			
		1 (3) formC 250 V 3A relays			
	Output	0 4-20 mA output and MODBUS RTU			
		1 HART®			
Mounting Hardware	-00 No Mounting Hardware				
	-01 Universal Mount				
	-02 Panel Mount				
	-03 Handrail Mount				
	-04 Sunshield Vertical Rail Mount				
-05 Sunshield Horizontal Rail Mount					
MODEL LXT-330	10	-0	0	1	-01

# LXT-330 / LXT-380 - Universal Transmitter and SP-3X Smart

## SP-3X Sensor Probe Specifications

pH Measurement Sensor	
Measurement Range	0-14 pH
Temperature Range	0 - 90° C (optional 0 - 140° C)
Pressure Range	0 - 100 psig @ 90° C (optional HP version: 0 - 300 psig @ 140° C)
Temperature Compensation	Automatic 0 - 100° C Accuracy $\pm 0.2^\circ$ C over the range 3K ohm RTD
ORP and Specific Ion Sensor	
Measurement Range	ORP: -2000 to +2000 mV plon: Sensor Specific, ppb, ppm & ppt
Temperature Range	ORP: 0 - 90° C, plON Sensor Specific
Pressure Range	0 - 100 psig @ 90° C
Temperature Compensation	Automatic 0 - 100° C Accuracy $\pm 0.2^\circ$ C 3K ohm RTD
Dissolved Oxygen Sensor	
Measurement Range	0-20 ppm, 0-150% SAT
Temperature Range	0 - 90° C
Pressure Range	0 - 65 psig @ 90° C
Temperature Compensation	Automatic 0 - 100° C Accuracy $\pm 0.2^\circ$ C over the range 3K ohm RTD
Conductivity/Resistivity Sensor	
Measurement Ranges	Low Range Sensor: 1 $\mu$ S to 50 $\mu$ S High Range Sensor: 50 $\mu$ S to 50 mS Resistivity: 0- 2 M $\Omega$ to 0-50 M $\Omega$
Temperature Range	-5 to 100° C (optional -5 to 150° C)
Pressure Range	0 - 100 psig (optional HP version: 0 - 300 psig)
Temperature Compensation	Automatic 0 - 100° C Accuracy $\pm 0.2^\circ$ C, 100K ohm thermistor
Toroidal Conductivity Sensor - KYNAR (PVDF) body material	
Measurement Range	0.5mS to 1000mS
Temperature Range	-5 to 100° C
Pressure Range	0 - 100 psig
Temperature Compensation	Automatic 0 - 100° C Accuracy $\pm 0.2^\circ$ C, 100K ohm thermistor
High Temperature Conductivity Sensor (316 SS and PEEK wetted materials)	
Measurement Range	1.0 $\mu$ S to 50mS
Temperature Range	0 to 150° C (optional 0 to 200° C)
Pressure Range	0 - 250 psig (optional HP version: 0 to 400 psig)
Temperature Compensation	Automatic 0 - 150° C Accuracy $\pm 0.2^\circ$ C, 10K ohm platinum RTD



# LXT-330 / LXT-380 - Universal Transmitter and SP-3X Smart

## SP-3X Sensor Probe Characteristics (continued)

Common Sensor Characteristics	
Dimensions	Insertion/Immersion: ¾"OD x 13¾" Length Valve Retractable: ¾" OD x 24"
Cable Length	Standard: 10 ft. Optional: Detachable cable connection
Housing Materials	Standard: 316 Stainless Steel Optional: Titanium, grade 2 Hastelloy C-22 (H), PVDF (K)
O-Ring Materials	Standard: Viton™ (VIT) Optional: Ethylene Propylene (EPR), Fluorosilicone (FSIL) Silicone (SIL) Kalrez™ (KLZ) CV75 (CV)
Shipping Weight	10": 2.5 lbs (1.2 kg) 17": 2.75 lbs (1.25 kg) VSS: 5.8 lbs (2.65 kg)
Process Connections	
Insertion/Immersion	¾" 316 SS gland fitting with nylon ferrule ¾" 316 SS gland fitting with Teflon™ ferrule ¾" 316 SS gland fitting with stainless steel ferrule ¾" Teflon™ gland fitting with Teflon™ ferrule 1" Teflon™ gland fitting for PVDF housing only
Valve Retractable	VSS: 1" 316 SS valve retraction assembly VKY: 1" PVDF valve retraction assembly

## Turbidity Sensor Specifications:

General	LXT-330
Measurement Range:	0-250 NTU to 0-4000 NTU, dual-ranges (must be within 4X)
Temperature Range:	0-50° C
Pressure Range:	6 bar @ 25°C, 1 bar @ 50°C
Sensor Cable:	Shielded 7-core cable, 7 meter (23 feet) or 15 meter (41 feet) lengths
Process Connection:	G1 Thread, 3/4" FNPT

## Chlorine Dioxide Sensor Specifications:

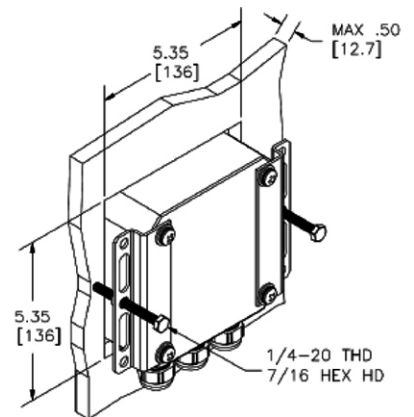
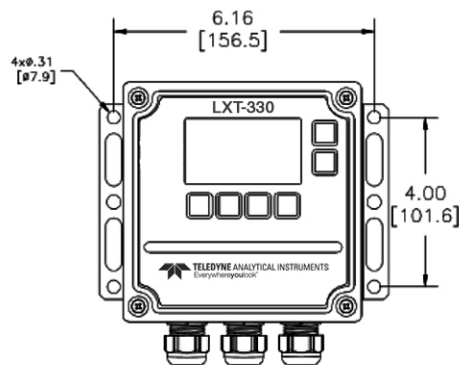
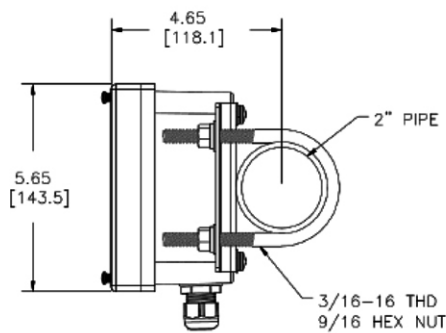
General	LXT-330
Measurement Range:	0.05 - 20.00 ppm (optional low range 0.01 - 5.00 ppm)
Temperature Range:	0 - 50°C
Response Time (T90):	120 seconds
Sample Flow:	38 - 300 L/hr (10-80 gal/hr)
Process Connection:	1/4" barbed fitting, Drain 3/4" barbed fitting

# LXT-330 / LXT-380 - Universal Transmitter and SP-3X Smart

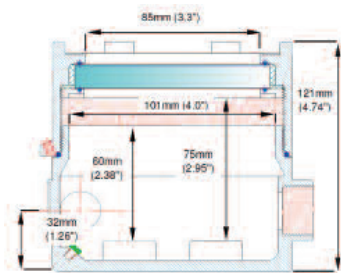
## Universal Transmitter Specifications:

General	LXT-330	LXT-380
Transmitter Type	General purpose	Fully explosion-proof (all approvals pending) ATEX: II 2 G D Ex d IIC Gb Ex tb Db IIIC IP68 Ta = -40C to 85C CSA: Class I, Div 1, Groups B, C, D Class II, Div 1, Groups E,F,G Class III, Div 1; Type 4X Ex d IIB+H2 IECEX: Ex d II C Gb Ex tb Db IIIC IP68 Ta = -40C to 85C
Enclosure	Beige Polycarbonate, NEMA 4X, weatherproof, ½ DIN 5.7"L x 5.7"W x 3.5"D (144 x 144 x 90 mm)	Epoxy Coated Aluminum (Cu-free) OR 316SS Electro-polished
Input Ranges	<p>pH: -1.00 – 15.00 pH</p> <p>ORP: -1500 - +1500 mV</p> <p>plON: 000.1 – 999.9 Units: ppb, ppm, parts per thousand; Auto Ranging</p> <p>Dissolved Oxygen: 000.1 – 999.9 Units: ppb, ppm, %SAT, mg/L; Auto Ranging</p> <p>Conductivity: 0.055 µS – 2.00S Units: µS, mS, S; Auto Ranging</p> <p>Resistivity: 0.001 - 20.00 megaohms</p> <p>Turbidity: 000.0 - 4000 NTU Units: NTU, FNU, mg/L, ppm, % Solids; Auto Ranging</p> <p>Temperature: 3 K-ohm TC, -30°C-140°C</p> <p>Chlorine dioxide: 0.01 to 20 ppm</p>	
Display	128 x 64 pixels (2.75" x 1.5") LCD, Black/Grey background on loop powered instruments, Blue/White background LED backlight on 100-250 VAC and 24 VDC powered instruments	
Ambient Temperature	-20 to 70°C	
Storage Temperature	-30 to 85°C	
Relative Humidity	0 – 90%	
Accuracy	<p>pH: 0.02 pH</p> <p>ORP: ± 1 mV</p> <p>plON: Specific for ion type</p> <p>Dissolved Oxygen: 0.1% of full scale</p> <p>Conductivity: 0.1% of full scale</p> <p>Resistivity: 0.1% of full scale</p> <p>Turbidity: 2% of reading</p> <p>Temperature: ± 0.3°C</p>	
Outputs	<p>Standard</p> <p>4-20mA output (fault condition 3.5 mA, 22 mA or 0 mA) MODBUS RTU (non loop-powered only)</p> <p>Optional</p> <p>HART® communications Alarm Relays Three (3) SPDT, form 1C, 250 VAC, 3 Amp resistive maximum relays, user configurable as Hi/Lo or Fault alarms</p>	
Power	<p>Standard</p> <p>Loop powered, 24 VDC (18-36 VDC), 600 Ω maximum load</p> <p>Optional</p> <p>24 VDC (18 – 36 VDC) power, 250 mW power 100-240 VAC, 50/60 Hz, 4 watts power</p>	
Weight	1.6 lbs. (0.75 kg)	5.5 lbs. (2.5 kg)

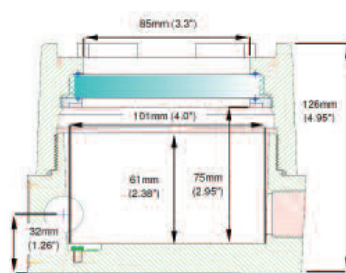
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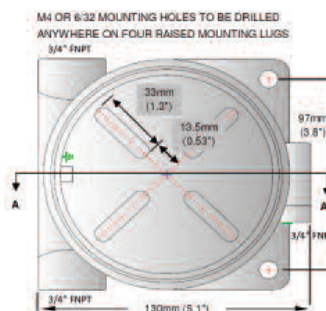
Model LXT-330 Mounting Dimensions



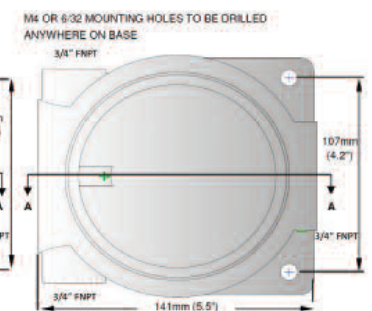
Dimensions:  
316 Stainless Steel



Epoxy Coated Aluminum  
(Copper-Free)



316 Stainless Steel



Epoxy Coated Aluminum  
(Copper-Free)

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### Warranty

Instrument is warranted for one year against defects in material or workmanship

**NOTE:** Specifications and features will vary with application. The above are established and validated during design, but are not to be construed as test criteria for every product. All specifications and features are subject to change without notice.

