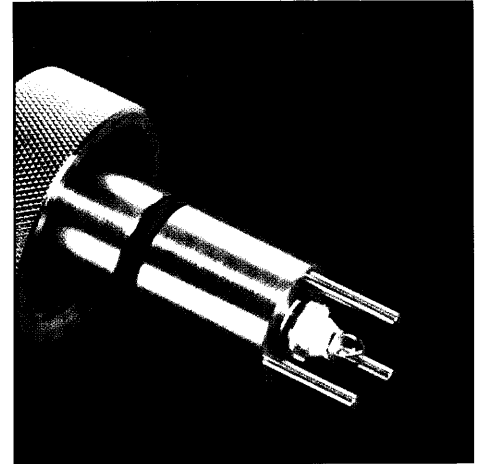


# Innovative Sensors, Inc.

ISI SOLUTIONS - Specialty Sensors for Difficult Applications

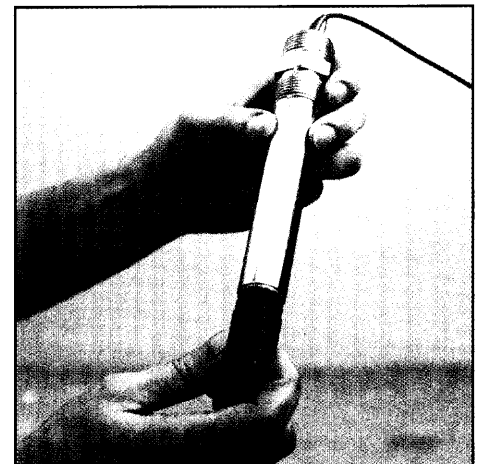
## Biotech Sensors

For measuring pH, DO<sub>2</sub>, ORP and other ions  
in fermentation processes.

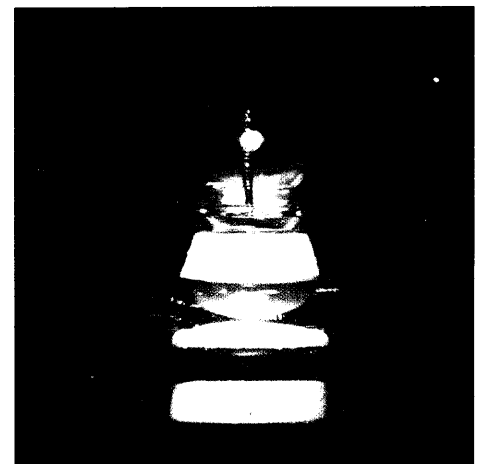


### ISI SOLUTIONS

A range of Specialty Sensors developed by  
Innovative Sensors, Inc., which has been designed  
to solve your measurement needs in difficult  
research and production applications.



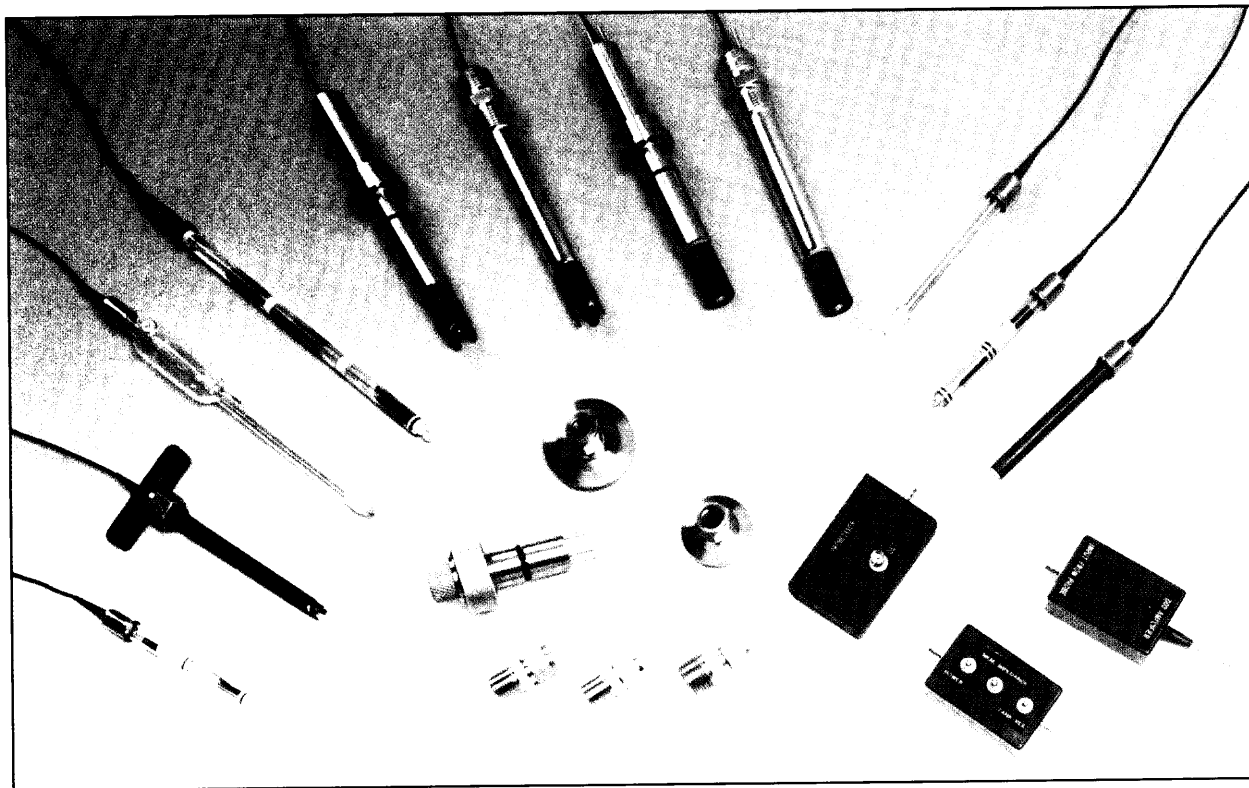
- Able to withstand severe temperature exposure
- Patented reference junction system to resist media fouling
- Wide range of mounting assemblies
- Specially formulated ion sensitive membranes
- User friendly designs for easy maintenance



## ISI Technology

ISI has always been, and remains, firmly committed to the research and development of new and imaginative sensor technologies. It is this commitment which has given birth to the "SOLUTIONS" product line.

These electrodes and sensors represent an industry developed solution for biotech and pharmaceutical measurement applications. All products have been designed and manufactured to withstand the severe in-situ conditions of fermentation vessels and bioreactors. Accessory items, including mounting glands, signal enhancers and test equipment provide comprehensive coverage of user needs.



**ISI SOLUTIONS:** The perfect choice today, the wisest choice tomorrow.

Key features and benefits are identified throughout this brochure using the icons listed below. These icons represent patented electrode technology which has been developed with both the application and user in mind. This technology is versatile and employed across a wide range of ISI products to address varying marketplace needs. Product confidence, quality and reliability are the results of these efforts.



Patented PLUNGER<sup>®</sup> pH electrode design. Over 300,000 installations. Ideal for vertical, horizontal or inverted use. Temperature cycle tested from -5°C to +145°C.



Proven, patented POROUS TEFLON<sup>®\*\*</sup> reference system. Over 1 million installations. Chemically inert, non-fouling, low resistance process connection.



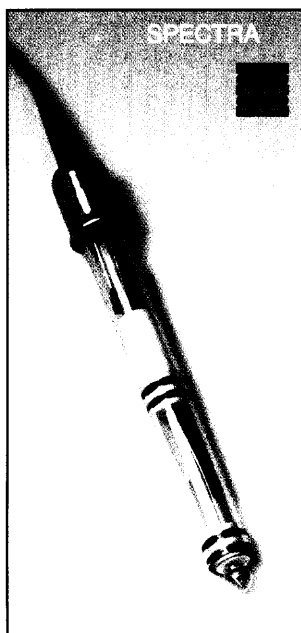
A unique approach to membrane replacement assures proper tensioning of the dissolved oxygen sensor with a simple twist of the wrist.<sup>\*\*\*</sup>



Newly developed triple junction reference cell offers increased speed of response while preventing electrode contamination.

## All Purpose 12mm Electrodes

These steam sterilizable electrodes are high quality, inexpensive and maintenance free. Chosen body materials include glass, PAS (Polyarylsulphone) and PPS (Ryton<sup>®</sup>) to cover user preference, all of which are ideally suited to the industry conditions. All products are rated to 135°C, and offer mounting flexibility when combined with various mounting glands (as detailed on page 6).

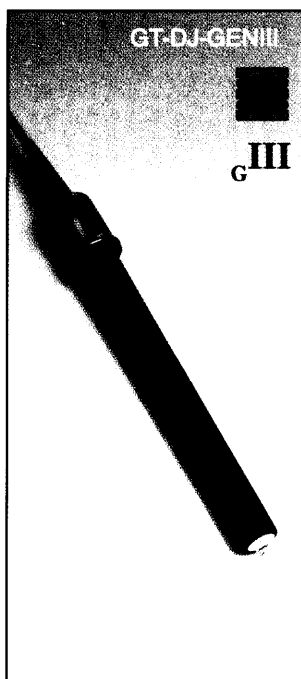
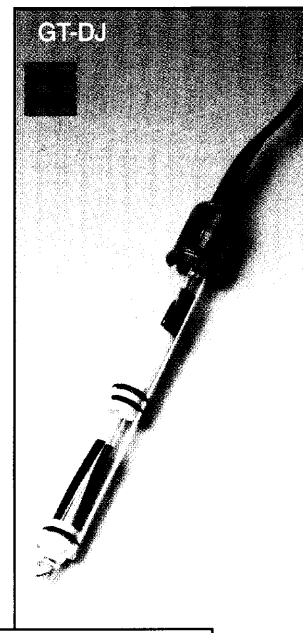
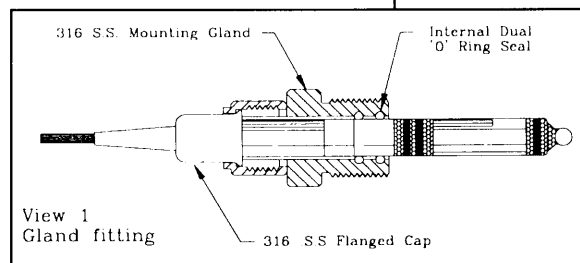


### SPECTRA

The SPECTRA pH electrode is housed in a durable thermoplastic (PAS) body and is rated for temperatures up to 135°C. The use of the double porous teflon<sup>®</sup> liquid junctions with matched viscosity electrolytes provides a reference cell which permits extended periods of pH measurements in the presence of sulfides or other silver complexing agents. The SPECTRA also incorporates pressure compensating devices to protect the electrode from extreme temperature induced pressure deviations.

### GT-DJ

The GT-DJ is ISI's most popular product. This electrode has a glass body, porous teflon<sup>®</sup> liquid junctions and a two chamber reference cell. The use of pressure compensating devices placed inside the reference electrolyte provides protection from extreme temperature induced pressure deviations. This electrode is rated for pressures up to 500psig @ 25°C when mounted with an ISI gland fitting (see inset). Designed specifically for in-situ sterilization, the GT-DJ is an ideal choice for many harsh, continuous process applications.



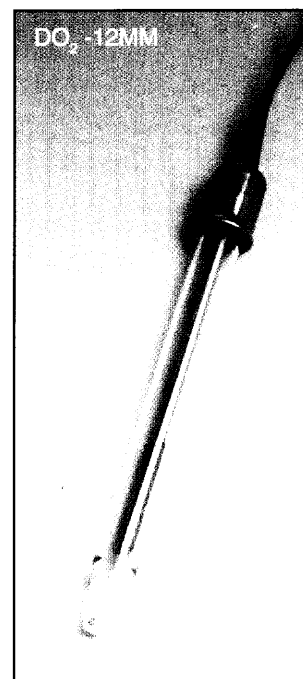
### GT-DJ-GENIII

This third generation design of the GT-DJ includes all the features of its predecessors while being housed in a robust, chemically resistant Ryton<sup>®</sup> body. In addition, this electrode incorporates GENIII reference technology.

A GENIII reference is a triple junction reference cell of varying electrolytes and configurations providing an unpenetrable barrier to protect the reference half-cell. This design will permit extended periods of pH measurements while used in the presence of sulphides or other silver complexing ions.

### DO<sub>2</sub>-12mm

This sealed, disposable, galvanic dissolved oxygen electrode is designed for continuous service in steam sterilizable fermentation applications. The high temperature durability and long term stability make it ideal for DO<sub>2</sub> measurements.



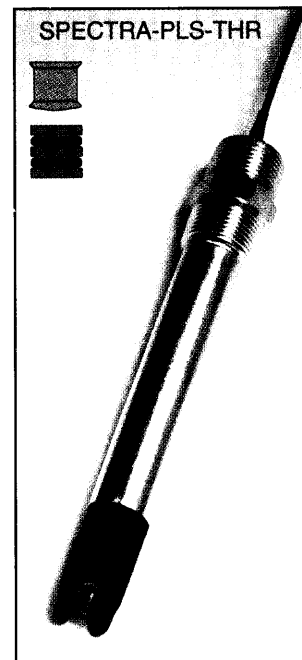
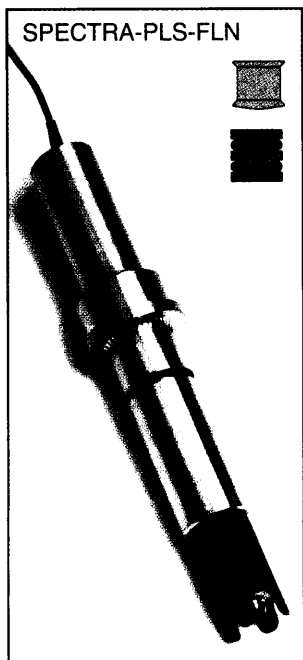
## Industrial Style pH and DO<sub>2</sub> Sensors

These industrial style fermentation sensors are designed for use in the most hostile production or laboratory reactors. Both pH and dissolved oxygen sensors are available. Housing configurations include the popular 25mm flange mount and 3/4" MNPT. Long life and low maintenance are two key benefits of these sensors.

### SPECTRA-PLUS-FLANGE SPECTRA-PLUS-THREAD

The SPECTRA-PLUS series is a larger version of the successful 12mm SPECTRA electrode. These industrial style, steam sterilizable pH sensors are specifically designed to tackle the toughest bioreactor or production fermentation applications. They are sealed, double junction, combination pH sensors featuring a large volume reference cell to assure a long service life. Specially formulated electrolytes and a low impedance glass membrane allow use in the broadest spectrum of pH applications. The patented porous teflon<sup>®</sup> liquid junction provides an inert reference contact which reduces media fouling.

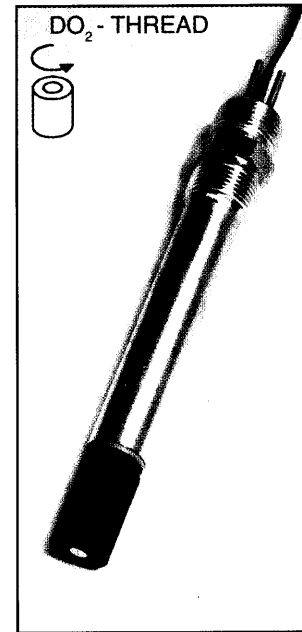
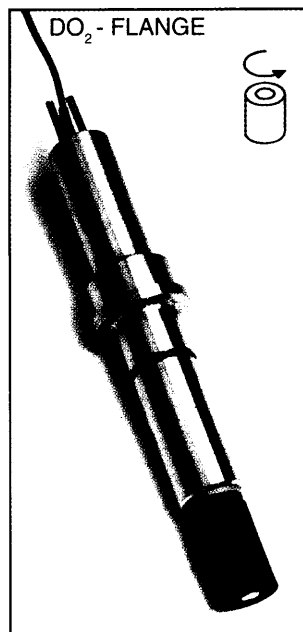
These sensors are constructed of a durable high temperature thermoplastic with 316 stainless steel jacket. Both 25mm flange or 3/4" MNPT housing configurations are available. Standard insertion lengths are 115mm (flange style) and 150mm (thread). Alternative lengths are available on request.



### DO<sub>2</sub> - FLANGE DO<sub>2</sub> - THREAD

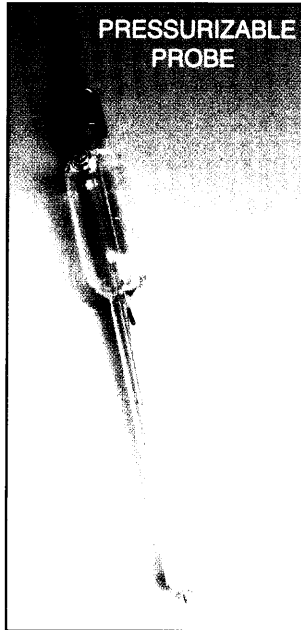
The ISI dissolved oxygen sensors<sup>®</sup> (patent no. 4,620,918) are designed to be robust, economical and "user friendly". Galvanic DO<sub>2</sub> sensors have been used in the fermentation industry for many years due to their ruggedness, high current output and long term stability. The ISI galvanic cell is composed of a coiled silver cathode, a large lead anode, a high boiling point propionate electrolyte and a Teflon<sup>®</sup> (PFA) membrane. The unique cathode design eliminates trapped gas bubbles which lead to erratic readings, while the large lead anode enables a long service life. The "bayonet" style replaceable membrane cap assures proper tensioning of the premounted membrane with a simple twist of the wrist (no tools required).

The inner bodies are manufactured from a state of the art thermoplastic that is dramatically less permeable to oxygen than conventional polymers. The outer body is a 316 stainless steel housing with either a 25mm flange or 3/4" MNPT pipe fitting for vessel mounting. Standard insertion lengths are 115mm (flange) and 150mm (thread). Special insertion lengths can be ordered to meet application requirements.



## Long Immersion and Specialty Sensors

The diversity of industrial applications coupled with the variety of mounting hardware encountered in measurement situations has led to a range of specialty sensors. ISI recognizes the popular pressurizable designs of the 1960's - 1990's and provides these fermentation configurations on an after market basis. Certain top and side entry fermentors require longer insertions which is addressed by the "LG-TJ (long glass, triple junction) probe". The SPECTRA-T has been added to complete this line.

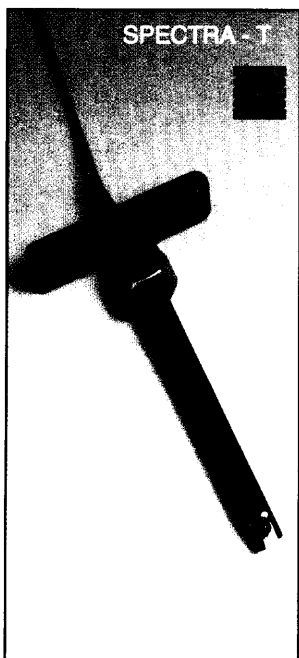
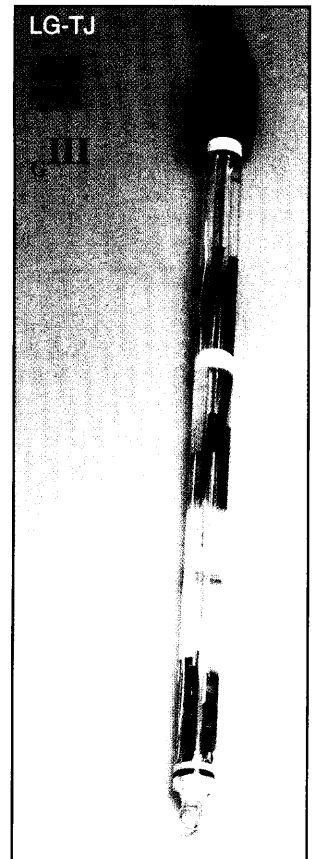


### PRESSURIZABLE ELECTRODES

Applications which involve pressurized electrode chambers may require this unique style glass probe. These custom ordered electrodes can withstand pressures to 87psi and temperatures up to 130°C. Commonly ordered insertion lengths include 120mm, 150mm, 200mm and 250mm. Please contact ISI to discuss specific requirements.

### LG-TJ

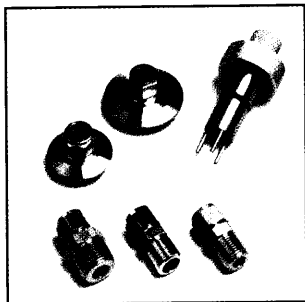
This combination pH electrode can be ordered to meet your unique mounting requirements. These electrodes are designed for top or side entry into large fermentation vessels or to be used with retractable hardware. The standard configuration includes a triple junction reference cell (GENIII), 225mm insertion length, high temperature pH glass, and is rated to 135°C. The molded cap allows for an optional PG13.5 mounting nut.



### SPECTRA-T

This combination pH sensor was developed as an extension of the popular SPECTRA sterilizable electrode. The "T" handle provides a more convenient method for removing the electrode after the process has been run. This is achieved by unscrewing the mounting cap and then pulling on the handle. The electrode is built directly into the durable PPS (Ryton®) housing which has a 120mm insertion. Double junction reference construction and high temperature electrolytes make this sensor ideal for sterilizable service.

## Accessory Items

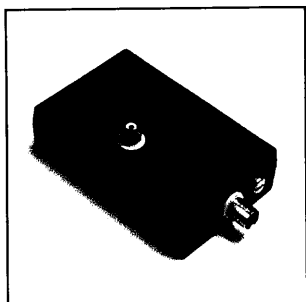
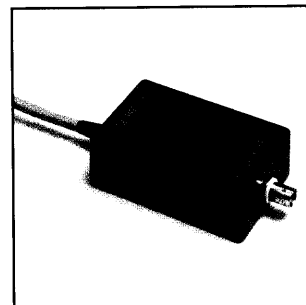


### Mounting Glands

A wide variety of mounting glands are offered to be used with the 12mm diameter electrodes. These fittings are manufactured of 316 stainless steel and are designed to simplify electrode installation while mounting into vessels. All fittings have dual front o-ring seals to minimize any cavities that would trap or carry over the process media. Threaded, sanitary and Ingold style fittings are available.

### DO<sub>2</sub> Polarographic Converter

Galvanic DO<sub>2</sub> electrodes offer many benefits over polarographic DO<sub>2</sub> electrodes. Lower sensor costs, lower maintenance costs and ease-of-use are a few. The DO<sub>2</sub> Polarographic Converter allows galvanic electrodes to be used with existing instrumentation. This device acts as a signal converter and is easily installed between the electrode and the instrument.

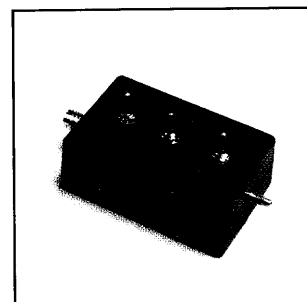


### Probe Saver™

The Probe-Saver™ interface module is an independent probe/electronic module that protects the electrode or sensor from harmful electronic conditions that shorten its life. A “ground loop” would be an example of such a condition. Installation of this device only requires three connections: input signal from the electrode, output signal to the instrument, and a solution ground to the process.

### DO<sub>2</sub> Test Box

The unique function of this box is to detect leakage across the membrane of a DO<sub>2</sub> sensor while in process. When a sensor is in use it will generate a DC current, thus giving an output to the test box. If leakage occurs the sensor's output will dissipate and the output to the test box will be driven high and display an output value that will warn the user of any membrane leakage problem. The normal readout instrument will not provide this function.



\* Patent No. 4,333,812








\*\* Patent No. 4,128,468

\*\*\* Patent No. 4,620,918



Teflon™ and Viton™ are registered trademarks of E.I. Du Pont de Nemours + Co.

Ryton™ is a registered trademark of Phillips 66 Co.

## Specifications

Product & Features	pH Range	Temperature Range	Pressure Range (psig)	Reference Cell	Wetted Materials	Cable & Connector
 GT-DJ	0 to 14 pH	-5°C to +135°C	500psig* @ 25 °C	Double Junction KNO <sub>3</sub> & KCl/AgCl	Teflon®, Glass membrane, Glass outer body, EPR	10' BNC
 GT-DJ-GENIII	0 to 14 pH	-5°C to +135°C	500psig* @ 25 °C	Triple Junction 3M KCl+KCl/AgCl	Teflon®, Glass membrane, PPS(Ryton®), EPR	10' BNC
 SPECTRA	0 to 14 pH	-5°C to +135°C	500psig* @ 25 °C	Double Junction KNO <sub>3</sub> & KCl/AgCl	Teflon®, Glass membrane, Polymer outer body, EPR	10' BNC
 SPECTRA-PLUS-THREAD	0 to 14 pH	-5°C to +135°C	100psig @ 25 °C	Double Junction KNO <sub>3</sub> & KCl/AgCl	Semi-Crystalline Resin, 316 Stainless Steel, Teflon®, EPR, Glass	20' BNC
 SPECTRA-PLUS-FLANGE	0 to 14 pH	-5°C to +135°C	100psig @ 25 °C	Double Junction KNO <sub>3</sub> & KCl/AgCl	Semi-Crystalline Resin, 316 Stainless Steel, Teflon®, EPR, Glass	20' BNC
 LG-TJ	0 to 14 pH	-5°C to +135°C	100psig @ 25 °C	Triple Junction 3M KCl+KCl/AgCl	Teflon®, Glass membrane, Glass outer body, EPR	10' BNC
<b>PRESSURIZABLE</b>	0 to 14 pH	-5°C to +135°C	100psig @ 25 °C	Single Junction KCl/AgCl	Ceramic, Glass membrane, Glass outer body	5' BNC
 SPECTRA-T	0 to 14 pH	-5°C to +135°C	150psig @ 25 °C	Double Junction KNO <sub>3</sub> & KCl/AgCl	Teflon®, Glass membrane, PPS(Ryton®), EPR	10' BNC

\*When mounted in an ISI Gland fitting

Product & Features	Operating Range	Temperature Range	Pressure Range (psig)	Output	Wetted Materials	Cable & Connector
<b>DO<sub>2</sub> -12mm</b>	0 to 40% Oxygen	-5°C to +135°C	0 to 50psig	15µA in air @ 25°C	Glass, Silicone, Teflon®	10' BNC
 DO <sub>2</sub> -FLANGE	0 to 40% Oxygen	-5°C to +135°C	0 to 50psig	15µA in air @ 25°C	Teflon®, Viton®, Semi-Crystalline Resin, 316 Stainless Steel	20' BNC
 DO <sub>2</sub> -THREAD	0 to 40% Oxygen	-5°C to +135°C	0 to 50psig	15µA in air @ 25°C	Teflon®, Viton®, Semi-Crystalline Resin, 316 Stainless Steel	20' BNC

### GLAND FITTINGS

Part Number	Description
<b>Z7500 (½")</b>	½" MNPT, 316 Stainless Steel, EPR O-Rings
<b>Z7501 (¾")</b>	¾" MNPT, 316 Stainless Steel, EPR O-Rings
<b>Z7503</b>	PG13.5 Threads, 316 Stainless Steel, EPR O-Rings
<b>Z7510</b>	25mm Port Gland, 316 Stainless Steel, Silicone O-Rings
<b>Z7520</b>	1" to 1½" Sanitary Flange, 316 Stainless Steel, Viton® O-Rings
<b>Z7521</b>	2" Sanitary Flange, 316 Stainless Steel, Viton® O-Rings
<b>Z7522</b>	3" Sanitary Flange, 316 Stainless Steel, Viton® O-Rings
<b>Z7523</b>	4" Sanitary Flange, 316 Stainless Steel, Viton® O-Rings

### ACCESSORIES

Part Number	Description	Power Supply	Notes
<b>Z5100</b>	DO <sub>2</sub> Polarographic Converter	Via Instrument	For use with galvanic electrodes
<b>Z5200</b>	Probe Saver	9v Battery	Requires solution ground
<b>Z5300</b>	DO <sub>2</sub> Test Box	Battery powered	Detects membrane leaks

# Ordering Information

## Direct Ordering:

**PML** Monitoring and Treatment;  
Systems for Industry.  
**Process Technology**

pmlprocess.com  
Tel: (905) 206-9514 Fax: (905) 282-9903

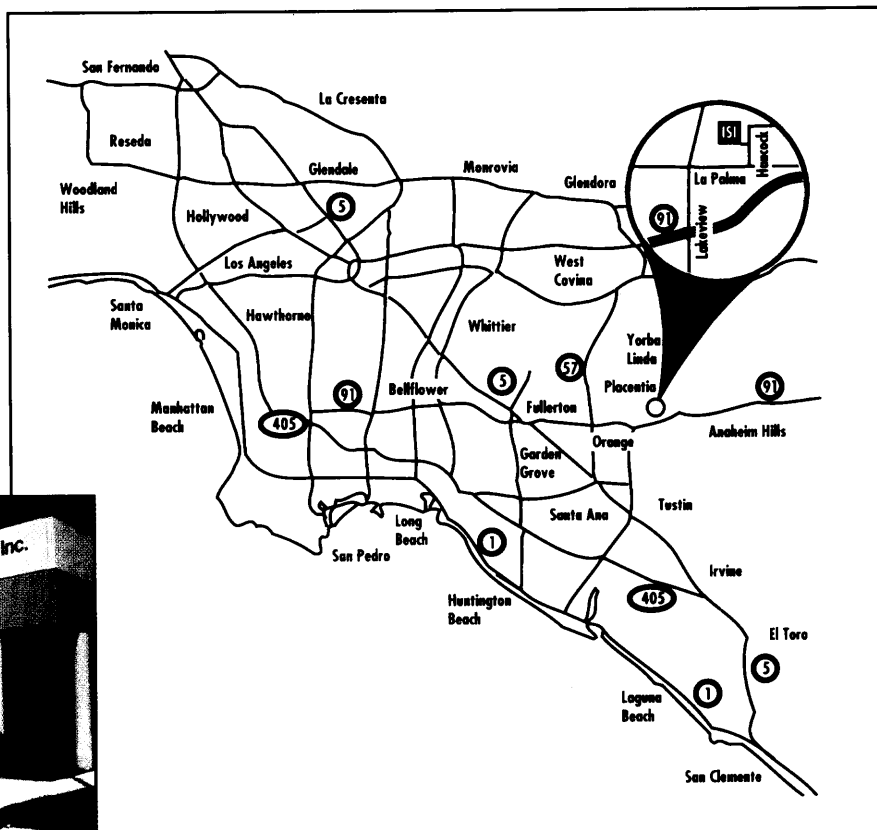
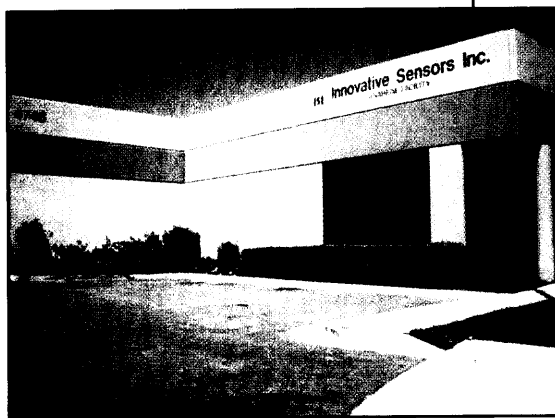
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USA Country Code: 010 1

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from Disneyland in beautiful  
Orange County.

You are welcome to stop  
by and visit our facility.



## Other Products:

“LABORATORY SOLUTIONS” and a selection of Schott-Geräte electrodes

“INDUSTRIAL SOLUTIONS” - Specialty Sensors for Difficult Applications

OEM Replacement Electrodes - incorporating 1990's features

Ion Selective Electrodes and Ion Measuring Devices - for Industrial and Laboratory Applications

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