LABORATORY PRODUCTS CATALOG: 2004 - 2005

ABTECH Scientific, Inc. -- Chemical and biological sensor devices, instruments, and sensor systems.
SENSING FOR LIFE™

Introduction

ABTECH was founded in 1987 to research, develop and commercialize chemical and biological sensor technology for bioanalytical laboratory, industrial and environmental monitoring, biotechnology process monitoring, and biomedical diagnostics applications. Today ABTECH, a test and measurement biotechnology company, delivers sensor devices, sensing instruments, and sensing systems to all of these sensor end-use markets. At ABTECH we see our purpose and our strength as our ability to work closely with our customers, to understand their test and measurement needs, and to address these needs with appropriate sensing technologies keeping in mind the highest of quality, service, and economy. Our commitment to the needs of the life science and biotechnology communities is reflected in our motto "***Sensing for Life***".

Our corporate activities are divided into two business groups, **the Laboratory Products Group** and the **Advanced Products Group**. The activities of the Laboratory Products Group is reflected in the products offered in this catalog. This is a direct sale business with some limited marketing, distribution, and sale through the catalog businesses of other instrument companies. The Advanced Products Group works principally with corporate customers to develop chemical and biological sensing products to meet their emerging market needs. An example of the activities of the latter include our BioSenSys? Multi-analyte Environmental Workstation for biosensor-based immunodiagnostic assays of environmental pollutants.

In addition, our modern research and quality control laboratories allows us to undertake research, product development, and manufacture of custom products to meet your emerging sensor needs.

We invite you to make comments and suggestions on ways in which this catalog may be improved and made more helpful to you. Products in this catalog, such as the IME LC liquid flow-cell sensor, have been suggested by you, our customers. We are happy to respond to your product suggestions. Please continue to bring to our attention any products you would like to see presented by ABTECH.

Anthony Guiseppi-Elie, Sc.D.
President and Scientific Director

How to Place an Order

URL: **http://www.abtechsci.com**
By Phone to: **+ 1 804 783 7829**
By Fax. to: **+ 1 804 783 7830**
e-mail: **sales@abtechsci.com**

To insure prompt and accurate delivery, be sure to include the following information when placing an order:

Product number with appropriate additional product codes.
- Product description
- Quantity and/or size desired
- Your Purchase Order (P.O.) number
- Your "Ship to" address
- Your "Bill to" address
- The name, phone number and email address of a contact person.

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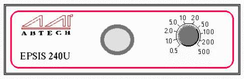
✍ EPSIS? - Electroactive Polymer Sensor Interrogation System



Model EPSIS 240 II US
Model EPSIS 240 II CS

EPSIS is the first of its kind sensor interrogation system designed specifically for research and applications-specific product development of chemical and biological sensors based on electroconductive polymer sensor technology. EPSIS is based on a patented analytical method that combines potentiometric, potentiostatic, and superior pulsed DC chronocoulometric capabilities in one unit. These electrochemical capabilities are sequentially combined to provide a powerful and versatile detection and measurement scheme that is unique to electroconductive polymer transducers. The result is a conductimetric response that detects, measures, and reports changes in electrical conductivity as electroconductive transducers respond to specific analytes to which they have been rendered chemically or biologically specific.

Principle of Operation

Electroactive polymers such as, *polypyrrole, polyaniline, and poly(3-hexylthiophene)* display very dramatic changes in electrical (electronic) conductivity upon oxidation or reduction. The oxidation/reduction reactions of these polymers may be driven by an impressed electrode potential or by the chemical potential energy of a chemical oxidizing or reducing agent. The resulting electrical conductivity of these chemically sensitive polymers is precisely governed by the state of charge or extent of oxidation/reduction of the polymer. These features identify electroactive polymers as transducer-active materials well suited to chemical and biological sensor applications. EPSIS is based on the simple principle that the amount of current (or charge) traversing a fixed dimension of electroconductive polymer film may be modulated by the chemical potential energy (concentration) of an analyte with which it is in intimate contact and to which it has been rendered specific. EPSIS uses this chemoresistance principle and exploits the very large changes in electrical impedance which accompanies the mediated oxidation/reduction of electroactive polymers fabricated on interdigitated microsensor electrodes.

EPSIS uses a patented analytical method which first evaluates the integrity of the electroconductive polymer device, initializes it to a user specified extent of charge to establish a known and reproducible starting electrical conductivity, then interrogates it with non-pertubating, small amplitude, short duration pulses to reveal time dependent changes in electronic conductivity as the device responds to an analyte. Sensor responses may be kinetic when the rate of change in electrical conductivity is monitored or equilibrium when the extent of change in electrical conductivity is monitored.

EPSIS Applications in Chemical and Biological Sensor Development

EPSIS in chemical sensors uses various agents to confer specificity, including: macrocyclic agents and other binding compounds, metal occlusions, and inorganic catalysts. In its two-electrode mode EPSIS may also be used to evaluate polymer-vapor interactions in the development of electronic noses. The biological specificity of biosensor devices is conferred by the use of immobilized co-factors, enzymes, antibodies, enzyme-antibody conjugates, stabilized receptors, and DNA fragments.

EPSIS Applications in Materials Science

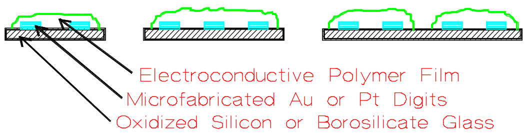
EPSIS? is also used in the study of the electrical properties of various novel electroactive polymer films. Studies such as the potential dependence of the electrical conductivity, the ensuing open circuit or poise potential as a function of impressed polarization potential, electrical conductivity as a function of counter anion type and concentration, and dynamic conductivity changes arising from various environmental factors.

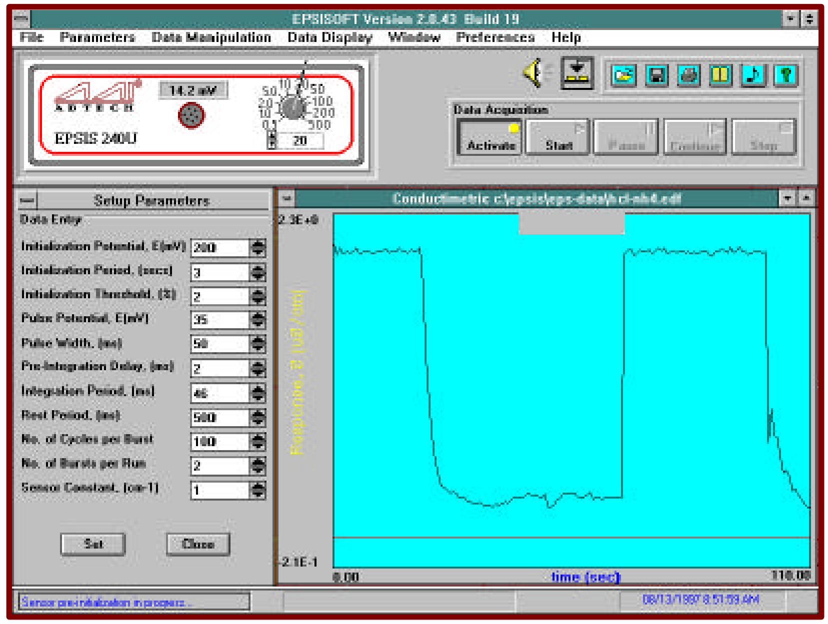
EPSIS System

EPSIS consists of the EPSIS 240II U analog sensor interrogation unit, a 12-bit A/D interface card and operations manual, as well as EPSISOFT? - dedicated instrument control, data acquisition, and analysis software implemented on a Pentium 200 MHz PC compatible computer. In addition, EPSIS is supplied with an IME 1550-CD-Au-P sensor device, a Sensor Simulation Cell with Ag?/AgCl, 3MCl$^-$ reference electrode, a shielded front panel sensor input cable, a shielded rear interface ribbon cable, and an EPSIS Operation Manual.

EPME Transducers for EPSIS

Electroactive Polymer Microsensor Electrodes (EPMEs) serve as the sensing element or chemically sensitive transducer device for EPSIS. The Model 1050 Series of EPMEs are microsensor devices composed of interdigitated microsensor electrode arrays of gold or platinum fabricated on an insulating glass or oxidized silicon substrate. The devices are supplied with a fully contiguous layer of PPy, PAn, or PTh and may be obtained with free surface groups of either $-NH_2$ or -SH for the immobilization of biospecific agents. These devices are well suited to broad applications in materials science, micro-electrochemistry, and sensor development.





Summary Technical Specifications

Chemoresistance Range	10 ? to 2 M?
Chemoresistance Resolution	+/- 0.3 %
Potential Range	-2,048 to +2,048 mV
Potential Resolution	+/- 1 mV
Ten (10) User-selectable Current Measuring Scales	0.5 to 500 ? A/V
Response Time	2 ? s
A/D Converter	12 bit resolution
Gain	1, 10, 100, 500
A/D Converter Throughput (speed)	45 KHz (22 ? s) 2.5 KHz (400 ? s)
Compliance Voltage	+/- 12 V at 10 mA
Maximum Current	10 mA
Weight, EPSIS 240U Analog Unit	1.6 Kg (2 lbs 4 ozs)
Dimensions, EPSIS 240U	14 cm W x 4 cm H x 19.5 cm D

Sensor Interrogation Parameters

Initialization Period:	1 - 60,000 ms
Voltage Pulse Height:	-2048 to +2048 mV
Voltage Pulse Width:	1 to 30,000 ms
Pulse Delay or Rest Period	1 to 30,000 ms
Pulse Pre-integration Delay	1 to 30,000 ms
Current Integration Period	1 to 30,000 ms
No. of Pulse Cycles per Run	1 to 9990
Pre-initialization Potential Reading	-2048 to +2048 mV
Sensor Rest Potential Recording	-2048 to +2048 mV
Sensor Response Ranges	nC to mC

Data Analysis and Graphic Presentation

Conductimetric Sensor Response *vs* Time Curve
Dual Sensor Response of ANA Signal and REF Signal
Sensor Response Rate Measurement (Slope dR/dt)
Savitsky-Golay Smoothing (3 point)
Single Point Cursor Readout
Zoom Expansion and Reduction
Response Curve Subtraction
Multi-curve Plotting
Full Printer and Plotter Support
Bin -> ASCII Data Conversion

To Order:

EPSIS 240II US

Sensor Interrogation Unit	EPSIS 240U
A/D Interface Card	DT825
Device Cable Connector	CC245
Interface Ribbon Cable Connector	ICV025

EPSIS 240II CS

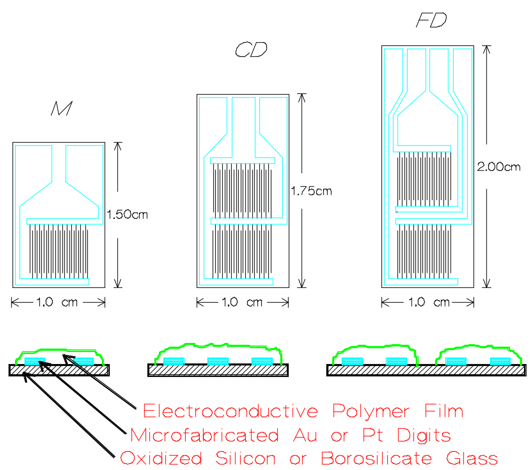
All of the above, plus	
PC Pentium 200 MHz Computer	PC200

EPSISOFT Ver 2.0

✍ EPMEs - Electroactive Polymer Microsensor Electrodes

Model EPME 1050 - *Polypyrrole*
Model EPME 1050 - *Polyaniline*
Model EPME 1050 - *Poly(3-hexylthiophene)*

EPMEs comprise fully contiguous and specifically adhered thin films of electroconductive polymers fabricated on inert interdigitated microsensor electrode array devices (IMEs). These devices serve as chemically sensitive, solid-state transducers in various gas/vapor, chemical and biological sensor systems, such as EPSIS.



EPMEs are your direct means for the simultaneous measurement of the electrical conductivity (conductimetric sensor), electrode potential (potentiometric sensor), and current (amperometric sensor) of thin, electroconductive polymer films on IME devices. With the associated Electroactive Polymer Sensor Interrogation System (EPSIS 240 CS), you are provided with the computerized sensor interrogation and data acquisition hardware for the simultaneous study of the electrochemical and electrical characteristics of the electroactive polymer films - electroconductive polymer sensor technology.

? ***Polypyrrole***, ***polyaniline***, and ***poly(3-hexylthiophene)*** films are fabricated by electropolymerization or spin coating onto the IME devices. Three IME device configurations are available; Monolith (M), Combined Differential (CD), and Full Differential (FD). These inert arrays are also available in two metals; Gold and Platinum. The EPME is supplied in the form of a fully packaged (P) electrode with leadwires attached and encapsulated using a chemically resistant epoxy resin to seal the device in a delrin electrode body.

? **In chemical and biosensor research and development -** The high sensitivity of these organic, polymeric, semiconducting films to changes in redox state, along with the solid state construction and small device size, make these devices ideally suited for research and development of chemical and biosensor applications and for gas/vapor senosrs used in electronic noses.

? **In materials science -** These array microelectrodes make excellent devices for the concurrent study of the electroactivity, electrical conductivity, and optical absorption/transmission properties of electroactive polymer thin films.

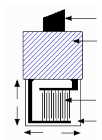
To order:

Electroactive Polymer Microsensor Electrodes (EPMEs)	**Gold**	**Platinum**
Monolithic-Polyaniline	EPME 1050-M-Au-P-PAn	EPME 1050-M-Pt-P-PAn
Monolithic-Polypyrrole	EPME 1050-M-Au-P-PPy	EPME 1050-M-Pt-P-PPy
Monolithic-Poly(3-hexylthiophene)	EPME 1050-M-Au-P-PTh	EPME 1050-M-Pt-P-PTh
Combined Differential-Polyaniline	EPME 1050-CD-Au-P-Pan	EPME 1050-CD-Pt-P-PAn
Combined Differential-Polypyrrole	EPME 1050-CD-Au-P-PPy	EPME 1050-CD-Pt-P-PPy
Combined Differential-Poly(3-hexylthiophene)	EPME 1050-CD-Au-P-PTh	EPME 1050-CD-Pt-P-PTh
Fully Differential-Polyaniline	EPME 1050-FD-Au-P-PAn	EPME 1050-FD-Pt-P-PAn
Fully Differential-Polypyrrole	EPME 1050-FD-Au-P-PPy	EPME 1050-FD-Pt-P-PPy
Fully Differential-Poly(3-hexylthiophene)	EPME 1050-FD-Au-P-PTh	EPME 1050-FD-Pt-P-PTh

EPME Transducers possessing free carboxylic acid (-COOH), primary amine (-NH_2), primary alcohol (-OH), or free sulfhydryl (thiol) (-SH) groups for the specific attachment and immobilization of biologically active polypeptides, enzymes, antibodies, enzyme-linked antibodies, DNA fragments, etc. may also be obtained under a joint product development contract.

Orders and Inquiries: **sales@abtechsci.com; +1 (804) 783 7829**
Fax.: +1 (804) 783 7830

✍ IMEs - Interdigitated Microsensor Electrodes



Model IME 1550 (15 ?) Series
Model IME 1050 (10 ?) Series
Model IME 0550 (10 ?) Series

✍ **Interdigitated Microsensor Electrodes (IMEs)** are inert, array microelectrodes formed from patterned noble metals sputter deposited on an insulating substrate chip. These devices are designed for the simultaneous interrogation of the electrical, electrochemical, and optical properties of thin polymeric films and coatings, for applications in microelectrochemistry, for electrical/electrochemical impedance spectroscopy, and for chemical and biological sensor development.

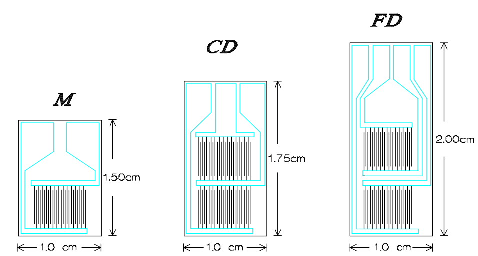
- ? **Microfabricated** from magnetron sputtered gold or platinum, these devices occur in three configurations; Monolith (M), Combined Differential (CD) and Full Differential (FD), and as packaged (with attached leadwires and encapsulated) or un-packaged die.

- ? **IME chips** of gold or platinum are available with 5 ?m, 10 ?m, or 15 ?m line and space dimensions of defined cell constant values.

- ? **Investigate** the chemoresistive responses of transducer-active, polymeric films in the same electrode configuration, the same test environment, and on the same sample film.

- ? **In research and product development**, these devices are widely used for conductimetric[1], chemoresistive chemical and biological sensors using electrically conducting (electroactive) polymers[2], for impedance spectroscopy of organic thin films and coatings[3], for impedance sensors based on Langmuir-Blodgett films[4], for studying the environmental effects on polymer thin films, and in modern micro-electrochemistry[5].

- ? **Develop** these devices into products where the application requires a compact, durable and versatile chemical or biological chemoresistive sensor of low cost.

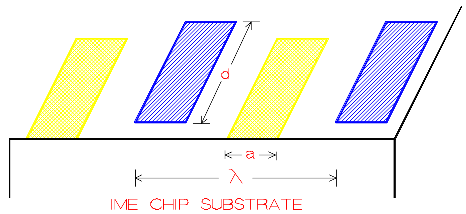


To Order:

		GOLD	PLATINUM
IME 1550 SERIES		**GOLD**	**PLATINUM**
	Monolithic-un-packaged	IME Au-1550-M-U	IME Pt-1550-M-U
	Monolithic-packaged	IME Au-1550-M-P	IME Pt-1550-M-P
	Combined Differential-un-packaged	IME Au-1550-CD-U	IME Pt-1550-CD-U
	Combined Differential-packaged	IME Au-1550-CD-P	IME Pt-1550-CD-P
	Full Differential-un-packaged	IME Au-1550-FD-U	IME Pt-1550-FD-U
	Full Differential-packaged	IME Au-1550-FD-P	IME Pt-1550-FD-P
IME 1050 SERIES		**GOLD**	**PLATINUM**
	Monolithic-un-packaged	IME Au-1050-M-U	IME Pt-1050-M-U
	Monolithic-packaged	IME Au-1050-M-P	IME Pt-10550-M-P
	Combined Differential-un-packaged	IME Au-1050-CD-U	IME Pt-1050-CD-U
	Combined Differential-packaged	IME Au-1050-CD-P	IME Pt-1050-CD-P
	Full Differential-un-packaged	IME Au-1050-FD-U	IME Pt-1050-FD-U
	Full Differential-packaged	IME Au-1050-FD-P	IME Pt-1050-FD-P
IME 0550 SERIES		**GOLD**	**PLATINUM**
	Monolithic-un-packaged	IME Au-0550-M-U	IME Pt-0550-M-U
	Monolithic-packaged	IME Au-0550-M-P	IME Pt-0550-M-P
	Combined Differential-un-packaged	IME Au-0550-CD-U	IME Pt-0550-CD-U
	Combined Differential-packaged	IME Au-0550-CD-P	IME Pt-0550-CD-P
	Full Differential-un-packaged	IME Au-0550-FD-U	IME Pt-0550-FD-U
	Full Differential-packaged	IME Au-0550-FD-P	IME Pt-0550-FD-P

IME devices possessing free carboxylic acid (-COOH), primary amine (-NH_2), primary alcohol (-OH), or free sulfhydryl (thiol) (-SH) groups for the specific attachment and immobilization of biologically active polypeptides, enzymes, antibodies, enzyme-linked antibodies, DNA fragments, etc. may also be obtained under a joint product development contract.

Summary Technical Specifications



Substrate:	Schott D263 Borosilicate Glass		
	Dielectric Constant, ?$_r$, at 1 MHz		6.7
	Dielectric Loss Angle, tan ?, at 1 MHz		61 x 10^{-4}
	Electrical Resistivity (50 Hz) (250?C)		1.6 x 10^{8} ? cm
	Coefficient of Linear Thermal Expansion, ? $_{20-300}$,		7.2 x 10^{-6} K^{-1}
	Refractive Index at 20?C, n_e (? = 546.1 nm)		1.5249
Metallization:	100 Å Ti / 1000 Å Au or Pt		
Digit length, d, (?m):	4,985 ?m		
No. of digit pairs, N:	50		
Digit Width, a, (?m):	15 ?m	10 ?m	05 ?m
Interdigit Space, a, (?m):	15 ?m	10 ?m	05 ?m
Spatial Periodicity, ?, (?m)	60 ?m	40 ?m	20 ?m
Zaretsky[6,7] Meander Length, M, (cm)	24.93	24.93	24.93
Center Line or Serpentine Length (cm)	49.65	49.55	49.45
Cell Constant[8] (cm^{-1})	0.040	0.040	0.040
IME Chip Dimensions (*l* x *w* x *t*)	Un-packaged Die		Packaged Electrode*
Monolithic, M	1.25 x 1.00 x 0.05 cm		12.3 x 1.38 x 0.7 cm
Combined Differential, CD	1.75 x 1.00 x 0.05 cm		12.8 x 1.38 x 0.7 cm
Full Differential, FD	2.00 x 1.00 x 0.05 cm		13.2 x 1.38 x 0.7 cm
*Electrode Body:	Delrin		
*Encapsulant:	Epoxy		
*Leadwires:	Color coded, 30AWG stranded copper, shielded, and PVC jacketed.		

References and Notes

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3. **Norman F. Sheppard, Jr.**, David J. Mears, and Anthony Guiseppi-Elie "Model of a Conductimetric Urea Biosensor" *Biosensors and Bioelectronics* (**1996**), Vol. 11(10) 967 - 979.

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8. The Zaretsky convention defines; M = N∡d

9. Sheppard, N. F.; Tucker, R. C.; Wu, C. "Electrical Conductivity Measurements Using Microfabricated Interdigitated Electrodes" *Anal. Chem.* **1993**, *65*, 1199.

✍ PMEs - Planar Metal Electrodes
Model PME-Au
Model PME-Pt

PMEs are uniform thin films of gold or platinum on a plane insulating substrate plate. PMEs are fabricated from magnetron sputtered gold or platinum (1,000Å) over titanium (100Å) (adhesion metal) on an electronics grade borosilicate glass substrate. PMEs have plate dimensions of 1.0 cm (w) x 1.8 cm (l) x 0.05 cm (t) (Model 118) OR 2.0 cm (w) x 1.8 cm (l) x 0.05 cm (t) (Model 218). The Model PME 118 is also available packaged in a 12 cm (l) x 0.635 cm (1/4") O.D. delrin electrode body as well as a free standing, unpackaged plate.

Applications in research and development include:

? Electropolymerization and electrochemical characterization of electroactive polymer films.

? Spectroscopy of thin polymer films and coatings - Grazing Incidence FTIR, Photoelectron Spectroscopy (XPS), Spectroscopic Ellipsometry, Atomic Force Microscopy (AFM).

? Surface modification and derivatization schemes for the specific immobilization of bioactive, catalytic and other molecular recognition/discrimination agents used in chemical and biosensor devices based on electroactive polymer sensor technology.

? Films may be applied to the PME plate by dip coating, spin casting, spray painting, brush painting, spontaneous self assembly, macromolecular adsorption, or by electropolymerization.

? PMEs of gold are particularly useful for studying monolayer adsorption and spontaneous self assembly of alkanethiol (R-SH) monolayers.

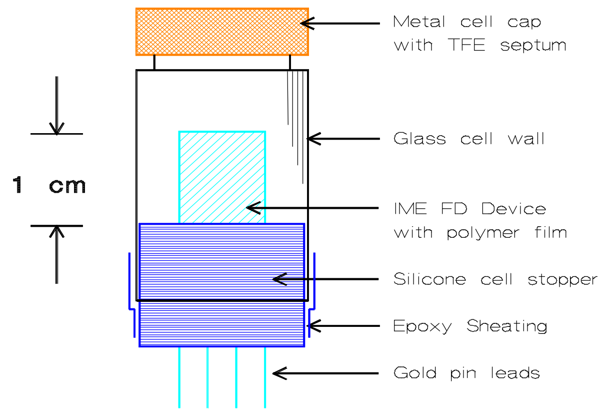
To order:

Planar Metal Electrodes (PMEs)	Gold	Platinum
Planar Metal Electrode, 1 cm x 1.8 cm x 0.05 cm - unpackaged	PME Au 118	PME Pt 118
Planar Metal Electrode, 1 cm x 1.8 cm x 0.05 cm - packaged	PME Au 118-P	PME Pt 118-P
Planar Metal Electrode, 2 cm x 1.8 cm x 0.05 cm - unpackaged	PME Au 218	PME Pt 218

Planar Metal Electrodes (PMEs) may also be obtained in custom dimensions to meet your unique research needs. Consult your Applications Development professional.

Planar Metal Electrodes (PMEs) may also be obtained with custom surface chemistries of free carboxylic acid (-COOH), free primary amine (-NH_2), free primary alcohol (-OH), or free sulfhydryl (thiol) (-SH) groups for the specific attachment and immobilization of biologically active polypeptides, enzymes, antibodies, enzyme-linked antibodies, DNA fragments, etc. Consult your Applications Development professional.

✍ CEC - Controlled Environment Cell
Model CEC 1010
Model CEC 1050



The Controlled Environment Cell is used for performing AC electrical impedance and DC conductance experiments under controlled gas/vapor environment conditions. The design is similar to that used in the laboratory of Prof. Mark Wrighton at MIT to study the electrical impedance changes in electropolymerized polyaniline films upon exposure to varying humidities. This design has also been used by scientists at ICI Chemicals to study acid-base interactions (by electrical impedance spectroscopy (0.1 mHz - 60 KHz)) of various probe vapors (water, acetone, chloroform, methanol) with ultra thin polymer coatings.

The CEC design consists of an Interdigitated Microsensor Electrode array (IME or IDA) microfabricated from Au or Pt on a borosilicate glass chip. The IME chip has equal lines and spaces that are each 10 ?m wide and may be gold or platinum. The number of lines or digits on each bus may be 10 (hence Model 1010) or 50 (hence Model 1050). Two such IMEs are provided on each chip. Electrical connection to the chip is made via pin-out headers that are wire bonded at bonding pads on the chip and encapsulated in a chemically resistant epoxy resin. The IME chip may be coated with your particular coating by dip coating, air brush spray coating, L-B film deposition, brush painting, or by electropolymerization. Spin coating is best performed on an unpackaged chip which will require wire bonding and encapsulation by the end user.

The coated IME is inserted into the cavity of a specially designed silicone rubber mold/stopper such that the array chip passes through a slit in the base of the cavity and the pin-out header projects out at the top of the cavity. The mold/stopper is then inserted into the 1" diameter opening formed by the cut base of a GC sample tube. Once inserted, a 1" length of heat shrinkable tubing that is internally lined with a heat curable epoxy resin is installed on the outside of the mold/stopper and over the edge of the glass tube. This provides a leak proof and protective seal for the CEC assembly. Depending upon the nature of your work, an additional coating of chemically resistant epoxy may be applied to the inside of the CEC around the base of the IME chip. This provides additional leak proofing and isolates the silicone rubber from the test environment. Finally, the GC crimp cap is installed creating a sealed, leak-proof, and controllable environment around the coating-bearing IME chip. The septum used in the GC crimp cap may be rubber or TFE.

To order:

Controlled Environment Cell	**Gold**	**Platinum**
Controlled Environment Cell	CEC 1010 FD - Au	CEC 1010 FD - Pt
Controlled Environment Cell	CEC 1050 FD - Au	CEC 1050 FD - Pt

✍ IME LC Electrochemical and Conductance Sensor

Model IME 1010.3 FD

For BAS Model LC-44 HPLC Flow Cell
For EG&G PAR Model 400 Electrochemical HPLC Detector

Electrochemical detection (ECD) in LC and HPLC applications offers very high selectivity based on the redox properties of the analyte to be measured and very high sensitivity -- down to picogram levels for its limit of detection. A wide variety of ionic and non-ionic compounds may be readily detected by ECD, thus making ECD a highly versatile detection technique. Similarly, conductance detection is integral to Ion Chromatography (IC) and Flow Injection Analysis (FIA) where conductance changes in the range from 0.1 ?S to 10 mS may be measured.

The IME 1010.3 FD LC Sensor from ABTECH Scientific, is one more innovation in the application of combined electrochemical detection and conductance measurement to analytical problems in science and industry. The precisely microfabricated digits of gold or platinum replaces the familiar carbon paste and bulk metal disc electrodes in LC detection.

Design

Four (4) separate working electrodes are microfabricated on the single LC Sensor Chip. These working electrodes are combined into two (one pair of electrodes each) interdigitated microsensor array electrodes (IMEs or IDAs). Each IME pair consists of 10 opposing digits (lines) with each digit being 10 ?m wide and 2,990 ?m long. Opposing digits are separated by a 10 ?m space. This produces a centerline serpentine length that is ca. 57 cm long.

Microfabricated from magnetron sputtered gold or platinum on a chemically resistant borosilicate glass, the metallization consists of 100 Å of Ti/W for adhesion promotion and a 1,000 Å overlay of gold or platinum.

Interrogation Methods

The IME 1010.3 FD LC sensor may be operated by Pulsed Amperometry or Cyclic Voltammetry. In addition, the very close electrode separation (10 ?m.) and the long centerline meander length (ca. 57 cm) allows the use of AC Impedance and Discontinuous Small Amplitude Pulse (EPSIS) analytical methodologies.

Applications

Electrochemical detection may be used in ultra-trace level biochemical analyses, in the analysis of various pharmaceutical compounds, in the detection and monitoring of environmental pollutants, and in "at-line" chemical and biological process monitoring. Conductance measurements may be used in Ion Chromatography.

The IME 1010.3 FD LC sensor is also used in materials science research of electroactive polymers films. Polymer films that are spun cast, electropolymerized or coated onto the LC sensor may be analyzed by AC Impedance, DC pulse amperometry or using EPSIS (The Electroactive Polymer Sensor Interrogation System) in a flowing stream. Changes in electrical impedance or conductivity of the film could then be monitored in response to various ionic analytes, or redox active analytes.

A further facility provided by the IME 1010.3 FD LC is the relative ease with which the sensor may be chemically modified and functionalized for the specific attachment or immobilization of bioactive molecules. The digits may be modified by platinization, amalgam formation, alkane thiols, or by electropolymerization of electroactive polymers. The interdigit space may likewise be modified using well established silane chemistries and derivatized by immobilized enzyme, antibodies, or enzyme-linked antibodies

To Order:

IME LC Sensor	IME LC 1010.3 FD

✍ Oxygen Sensor
Model OS-418

The AAI-ABTECH oxygen sensor is a miniature, Clark-type amperometric sensor suited to measuring static as well as dynamically changing oxygen levels in aqueous and physiologic fluids.

Principle of Operation and Sensor Design

The oxygen sensor consists of a pair of miniaturized electrodes immersed in a drop of electrolyte and separated from the test environment by a replaceable oxygen permeable membrane. An outer Ag°/AgCl anode surrounds an internal platinized platinum cathode. The 5 mil (0.005") diameter high purity platinum wire cathode is fused into a glass sheathing that fills the lumen of the outer silver body. The oxygen permeable membrane is placed over the tip of the electrode assembly and secured with an O-ring. With the membrane and O-ring in place the sensor diameter is 4.5 mm (0.177"). The sensor may be housed in an black delrin body that exposes only the membrane covered tip of the sensor to the test solution. A constant voltage applied between both electrodes produces a current directly related to the oxygen electrolytically discharged at the cathode. The steady state discharge rate is dependent upon diffusion of oxygen across the membrane and is thus indirectly proportional to the extra-membrane concentration of dissolved oxygen.

Oxygen Sensor Package

1 Oxygen Sensor
5 O-rings
1 Sheet of 0.001" Polyethylene Membrane
1 Membrane Installation Tool (white)
1 Sensor Housing (two parts) (black)
1 Oxygen Sensor Operations Manual

General Sensor Specifications

Sensor Length	4.182 cm
Sensor Housing Length	2.5 cm
Sensor Diameter	0.318 cm
Sensor Housing Diameter	0.787 cm
Connector	Modified Amphenol Sub-Minax P/N 27.9

Technical Specifications

Sensitivity	0 - 150 mmHg
Time Constant or Response Rate (0 - 63% of response)	4 sec
Bias Voltage	-0.7 V
Current Response for ambient pO_2	18 nA
Thermal Drift	4 %/°C

Requirements

? Requires Sensor Cable Model SC9BNC (sold separately).
Model SC9BNC is a flexible coaxial cable with a female Sub-Minax connector on one end (to the OS-418 oxygen sensor) and a BNC connector on the other to the OSI-2 instrument.

? Requires Oxygen Sensor Instrument Model OSI-1 (single channel) or Model OSI-2 (dual channel) (sold separately).
Model OSI-1 is a single channel oxygen sensor interrogation system for use with the Model OS-418 oxygen sensor.

? For best results, the OS-418 requires thermal regulation of test solution and electrode to avoid thermal drift.

? Requires initial calibration.

To Order:

Miniature Oxygen Sensor	OS-418
Sensor Input Cable (Sub-Minax to Sub-Minax)	SC9
Instrument Output Cable (BNC to spade)	IC9-BNC-s
Instrument Output Cable (BNC to Banana jack)	IC9-BNC-b

✍ Oxygen Sensor Instrument
Model OSI-2

The AAI-ABTECH oxygen sensor instrument is a dual channel sensor instrument. Each channel is a combined potentiostat (produces a constant potential) and low current amplifiers (measures and amplifies small currents) that interrogates the Clark-type amperometric oxygen sensor, amplifies, displays, and records the sensor's current response.

Key Instrument Features:
The Oxygen Sensor Instrument Model OSI-2 is designed to work with the Model OS-418 oxygen sensor. The OSI-2 features:

? 3½ digit digital display of oxygen tension.
? Analog output of 0 - 1.999 V with adjustable gain.
? 100% suppression of current offset.
? Low noise and low drift.
? Sensor quick connect via BNC connector.

Model OSI-2 Dual Channel Amplifier.
The Model OSI-2 is a dual channel amplifier that simultaneously accepts input from two separate oxygen sensors. The instrument is identical to two single channel instruments but has the added feature of being optionally arranged in a subtraction or difference mode. Thus the difference in oxygen tension between two sensors may be directly displayed. A front panel selector switch allows the user to display the value from either oxygen sensor or the difference between sensors.

The OSI-2 uses solid state circuitry to apply a constant, low drift bias voltage of -0.7 V to the platinized platinum electrode of the Model OS-418 oxygen sensor. The resulting current is measured and amplified. The Model OSI-2 is also equipped with three independently adjustable analog outputs that may be directed to chart recorders and/or computer data acquisition systems. With built in sensor output offset zeroing capability, the Model OSI-2 may electronically subtract any background response (e.g. under zero oxygen conditions during calibration).

General Instrument Specifications

	Model OSI-2
Weight (kg)	1.6
Dimensions (mm)	262 x 219 x 106
Voltage	110 VAC, 60Hz

Technical Specifications

	Model OSI-2
Bias Voltage	-0.7 V
Input Current Rating	10 ?A max
Sensor Input Current	18 nA
Output Voltage	1.999 V

Requirements

? Recommends Oxygen Sensor Model OS-418.

? Requires Sensor Input Cable Model SC9BNC (sold separately).
Model SC9BNC is a flexible coaxial cable with a female Sub-Minax connector on one end (to OS-418 oxygen sensor) and a BNC connector on the other to the OSI-2 instrument.

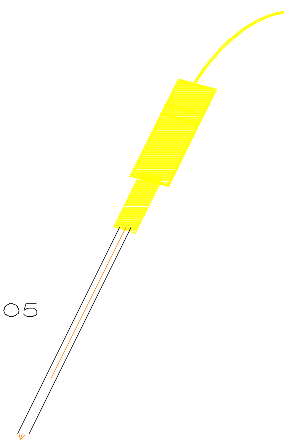
? Requires instrument output cable IC9-BNC (sold separately).
Model IC9-BNC is a coaxial instrument output cable with a BNC connector on one end (toward the OSI-2 instrument) and either a spade connector or banana jack on the other (toward your recorder).

To Order:

Model OSI-2 - Two Channel Oxygen Sensor Instrument	OSI-2
Instrument Output Cable (BNC to spade)	IC9-BNC-s
Instrument Output Cable (BNC to Banana jack)	IC9-BNC-b

✍ CPE 905 - Miniature Combination pH Electrode

The CPE 905 is a miniature combination pH electrode with internal Ag?/AgCl, 3M Cl^- reference element. It is fabricated from a miniaturized pH sensitive glass bulb which is internally junctioned with a chloridized, high-purity silver wire immersed in a contacting solution of 3M potassium chloride that is saturated with silver chloride. The electrode is a compact 6 cm long with a narrow 2.5 mm O.D. glass barrel and 1.2 mm O.D. pH sensitive tip. Each CPE 905 has a 100?l reference solution capacity and a very slow 5?l/day flow rate. Electrodes are outfitted with BNC connectors that fit most pH Meters and each is supplied with 25 ml reference filling solution, a filling capilliary, and an instruction sheet.



Electrode Body	Black Delrin
Total Length	9.5 cm
Lead Length	1 m
Electrode Body O.D.	2.5 mm
Electrode Tip O.D.	1.2 mm
Immersion Depth	2 mm
Response Time	10 sec
Temperature Range	-4?C - 75?C
pH Range	0 - 14

Applications in research and development include:

? As a pH sensitive electrode in any miniature electrochemical cell.
? pH measurements of small sample volumes as in chemical and biosensor assay development.

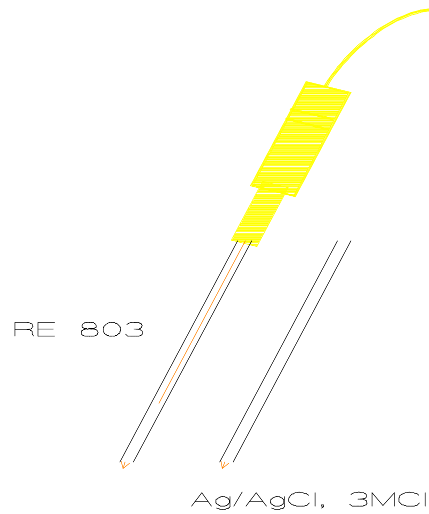
To order:

Miniature Combination pH Electrode

Miniature Combination pH Electrode	CPE 905-X

✍ RE 803 - Miniature Reference Electrode, Ag?/AgCl, 3M Cl$^-$

The RE 803 is a miniature Ag?/AgCl, 3M Cl$^-$ reference electrode. It is fabricated from chloridized, high-purity silver wire immersed in a contacting solution of 3M potassium chloride that is saturated with silver chloride. The electrode is a compact 6 cm long with a narrow 2.5 mm O.D. glass barrel. Two glass barrels are provided. The first has a fine 1.0 mm O.D. glass fiber tip and the second has a fine 2.0 mm O.D. tip of fritted ceramic. Each barrel has a 100?l electrolyte capacity and a very slow 1.7 ?l/day flow rate (glass fiber tip) and 5?l/day flow rate (fritted tip). Electrodes are outfitted with U.S. Standard pin-type connectors and each is supplied with 25 ml filling solution, a filling capilliary, and an instruction sheet.



Mini Reference Electrode

Electrode Body	Black Delrin
Total Length	9.5 cm
Lead Length	1 m
Electrode Barrel O.D.	2.5 mm
Electrode Tip O.D.	1.0 mm
Immersion Depth	Surface Contact
Response Time	5 sec
Temperature Range	-4?C - 75?C
Reference Junction	Fiber and/or Frit

Applications in research and development include:

? As a reference electrode in any three-electrode miniature electrochemical cell.
? As the reference junction with any pH measuring electrode, ion-selective electrode, or electroactive polymer microsensor electrode.
? As the reference junction in any two-electrode potentiometric measurement.

To order:

Miniature Reference Electrode

Miniature Reference Electrode, Ag?/AgCl, 3M Cl$^-$	RE 803-X

✍ Application Notes

AAI-ABTECH has developed several application notes that provide technical support for your research and product development efforts in the area of chemical and biosensor technology. Application Notes are provided at a minor publication charge to our customers who purchase other AAI-ABTECH products in this catalog.

Application Notes on Interdigitated Microsensor Electrodes:

IME1 - Interdigitated Microsensor Electrodes: Applications and References.
IME2 - Conductimetric Urea Biosensor Formed From Interdigitated Microsensor Electrodes.

Application Notes on Biosensors and EPSIS:

BA1 **-** Biosensor Brief **-** Introduction to Biosensors.
BA2 **-** Biosensor-based Assays Using EPSIS? .

Abstracts, Patents, and Papers Related to Electroconductive Polymer Sensor Technology.

To order:

Application Notes on Interdigitated Microsensor Electrodes:	**NOTE No.**
Interdigitated Microsensor Electrodes: Applications and References.	IME 1
Conductimetric Urea Biosensor Formed From Interdigitated Microsensor Electrodes.	IME 2
Application Notes on Biosensors and EPSIS:	
Biosensor Brief - Introduction to Biosensors.	BA 1
Biosensor-based Assays Using EPSIS? .	BA 2
Abstracts, Patents, and Papers Related to Electroconductive Polymer Sensor Technology.	APP

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