



Electrode

A collector or emitter of electric charge as in a semi-conducting device; a form of transducer usually paired with an indicator to transform sensed values into information legible to the human eye.

About pH Electrodes

Basic Theory and Application of pH Measurement

pH refers to the power or exponent of hydrogen where 'p' stands for power and 'H' is the symbol of the element Hydrogen.

pH is defined as the negative logarithm of the molar concentration of the active hydrogen ions, $pH = -\log H^+$.

pH provides a convenient way to compare the relative acidity or alkalinity of a sample at a given temperature. For example, pure water has a neutral pH of 7, where the activities of hydrogen and hydroxide ions are equal. If the activity of hydrogen ion is greater than that of hydroxide ion the sample is described as acidic. In general, as the level of hydrogen ion activity increases, the pH decreases. A pH below 7 is known as acidic. On the contrary, as the level of hydrogen ion activity decreases, the pH increases. A pH above 7 is known as alkaline or basic.

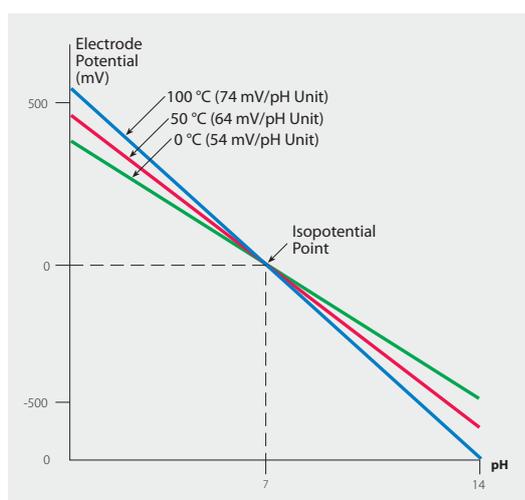
Use of Electrodes for pH Measurement

pH measurement is usually done with the use of a combination electrode. The combination electrode is an electrode system formed by a glass sensing half-cell and an internal reference half-cell. As the reference junction acts as the medium of conductor between the reference electrolyte and the sample to be measured, it must allow free movement of electrons through the junction and into the sample. A potential develops on the membrane surface when a pH electrode comes into contact with a sample and its value varies with the pH of the sample. This variation in potential is measured in mV by a meter and is converted to direct pH values.

Slope

The 'slope' is the voltage produced per pH. In theory, the value is 59.16 mV per pH at 25 °C. Practically, the value ranges between 50 and 58 mV.

Influence of Temperature on pH Measurement



Temperature variations can affect pH. However at a certain pH, usually 7, temperature will not have an effect on the potential of the system. This is known as the 'isopotential point'.

If automatic compensation is not practical, the following equation can be used to determine error:

$$\text{Magnitude of error} = 0.003 \text{ pH}/^{\circ}\text{C}/\text{pH unit from pH 7}$$

Note: The temperature compensation here refers to electrode related temperature variation and not solution related variations.

Selection Criteria

Eutech combination electrodes offer the convenience of having the reference and measuring electrodes combined in a single housing. They are offered in a variety of configurations to suit most laboratory and field application needs.

Electrode Construction



Glass Body

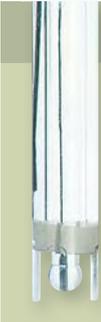
- Glass withstands high temperature of 100 °C or more.
- Resistant to corrosive materials and solvents.
- Brittle.
- Ideal for laboratory use and is easy to clean.



Plastic Body

- Not recommended for usage at temperature above 80 °C.
- Moderate resistance to highly corrosive materials and solvents.
- Durable and withstands rough handling.
- Ideal for field use.

Single Vs Double Junction



Single Junction

- Ideal for general purpose applications.
- Ag^+ ions are in contact with junction and this can cause chemical interaction with sulphur. Not suitable for biological samples or tris buffers.



Double Junction

- Prevents interference between the inner fill solution and sample.
- Electrolyte is free of Ag^+ ions. Suitable for use with biological samples.
- Can be used in place of calomel reference electrodes.

Internal Reference Types

| Calomel Reference (Hg/Hg₂Cl₂) |

Calomel reference electrodes can give potentials accurate to within 0.01 millivolt. The repeatability and potential stability of such electrodes are superior to those of the Ag/AgCl electrode, although only at a constant and relatively low temperature. Calomel is subject to a constant and relatively low temperature fluctuation with a temperature limitation of 80 °C. Calomel is recommended for clinical measurement; for samples containing protein, tris buffers; and for high purity water applications.

| Silver/Silver Chloride Reference (Ag/AgCl) |

Ag/AgCl reference electrodes are largely hysteresis-free and can be used at a higher temperature with lower temperature coefficients. Ag/AgCl is the best general purpose reference with a wide temperature range (-5 to 110 °C).

| Double Junction |

A double junction reference is constructed with an Ag/AgCl inner chamber and a chemically compatible reference solution in the outer chamber. It is recommended for samples containing organic compounds, proteins, heavy metals; and other compounds that interact with silver, such as bromides, iodides, cyanides and sulfides.

Refillable Vs Sealed Design

	<p>Refillable Design</p> <p>Refill hole allows reference electrolyte replenishment.</p> <p>Can be used many times over.</p> <p>Needs refilling when fill solution is low.</p>
	<p>Sealed Design</p> <p>No refill hole. The reference electrolyte is usually a gel.</p> <p>Replacement of the electrode is necessary when it gets contaminated.</p> <p>Virtually no maintenance is required.</p>

Reference Construction

| Refillable Reference Cell |

Selected for high accuracy, stability, and longer electrode life. Refillable types sacrifice convenience and ease of maintenance.

Patented Twist-Cap Design

Unlike conventional designs which use rubber sleeves, Eutech's 620 series refillable electrodes feature a patented refill-hole with twist-cap design – easy-to-use and leak-proof. Refilling of reference electrolyte is hassle-free and quick with no wastage.



Twist-open the cap to expose the refilling hole



Pour in reference electrolyte with the refilling bottle



Twist-close the cap

| Sealed Reference Cell |

Sealed gel-filed reference electrodes are designed for convenience where minimal maintenance is required. Slightly lower accuracy and shorter life must be taken into account.

Types of Reference Junctions



Annular Junction
Fast electrode response.



Porous HDPE Junction
Low electrolyte flow, hence more durable.



Flushable Junction
Cleanses by pumping out electrolyte to remove residue, thus eliminates clogging problems in viscous samples.



Open Pore Junction
About 200 times larger than ceramic junctions, ensures increased electrolyte flow for stable junction potential.

Reference Junctions

Some glass combination electrodes feature an anti-fouling annular ceramic junction. The annular junction is formulated with a special ceramic which encircles the glass bulb. Numerous pores in the ceramic provide lower resistance and more stable pH readings. The plastic body combination electrodes come standard with a porous HDPE pin junction. Sleeve junction provides the highest flow rate for difficult samples.

General Purpose Vs Specialty Applications

Most electrodes come in different stem lengths and diameters for specific applications.



General Purpose Applications
Usually measures 120 mm (length) by 12 mm (diameter) and can be used for general applications.



Specialty Applications
Effective for specific applications. For instance the spear tip sensor can be used for the direct pH testing of semi-solids and soft materials. Sleeve type electrode ensures high electrolyte flow so it is ideal for low ionic strength and viscous sample measurements. On the other hand, a flat surface tip electrode is used for flat samples like paper or cloth. Micro-stem electrode fits into thin stem NMR tubes or small vessels. For harsh use, a durable tough bulb electrode that is resistant to breakage is recommended.



About ISE Electrodes

Introduction to Ion Selective Electrodes (ISE)

The ISE functions in the same principle as the pH electrode. The pH electrode is the most commonly used ISE that measures the activity of hydrogen activity in a solution. Ion Selective Electrodes (ISE) respond to ionic activity or concentration in a liquid because of the characteristics of the electrode's sensing membrane. Ideally, the ISE develops an electrical potential which is proportional to the activity or concentration of the ion for which the membrane is selective. For example, the fluoride electrode can be used to directly sense fluoride ion in drinking water.

Eutech offers a wide selection of ISEs for the measurement of ammonia, bromide, cadmium, calcium, carbon dioxide, carbonate, chloride, copper, cyanide, fluoride, iodide, lead, nitrate, potassium, silver, sulfide and sodium.

Direct Analysis with Ionic Strength Adjustment

In the direct analysis method, a sample concentration is determined by measuring the electrode potential and comparing to those obtained in standard solutions. Normally, an Ionic Strength Adjustor (ISA) and/or pH adjustor must be added to both the samples and the standards. This helps in that the closer the standard solution matrix is to the sample matrix, the more valid is the analysis. A number of standard solutions are used to standardize a pH/ORP/ion meter, or to construct a calibration curve (by plotting the electrode's output in mV versus the log of the concentration). The sample concentration is then read from the meter or the calibration curve.

The advantages of the direct method of analysis are:

1. Many samples (particularly those with relatively simple ionic backgrounds) can be quickly measured after a single calibration procedure
2. The technique is valid over a wide range of concentrations
3. Sample volume values are not required, and may also vary over a wide range

Calibrating and Ionic Strength Adjuster solutions (ISA) in 480 ml bottles are available for the various ions measured. Please refer to the accompanying instruction sheet of each Eutech ISE.

Other methods of measurement that may need the use of ISA are the known addition, known subtraction, analyte addition and analyte subtraction methods that are applicable with the colour touchscreen research-grade CyberScan series 6000 bench meters. For specific application methods, please refer to the accompanying instruction manuals of the bench meters.

Types of ISE Constructions

Eutech carries ISEs with the following three types of sensing elements.

Membrane/Solid State – The solid, polished crystalline membrane of the solid state ion selective electrode is prepared from either a single or mixture of compounds. Measurement of the potential is taken across this membrane.

Gas Sensing – In general, the sensing element of the gas sensing electrode is made of a Teflon® membrane. The gas permeates through the

membrane and changes the pH of the KCl filling solution. The change in pH is directly proportional to the concentration of ions present.

Glass Bulb – Glass body ion selective electrodes are constructed similar to a pH electrode since they have a glass bulb that is sensitive to the species in question.

ISEs are also available in single and double junction constructions. While the single junction electrodes are suitable for clean water applications, the double junction electrodes are designed for harsher applications such as solutions with heavy metals and organic materials.

Calibrating and Ionic Strength Adjuster solutions (ISA) in 480 ml bottles are available. Contact your nearest distributor for more information.



Use and Care of Electrodes

Maintenance and Storage of pH Electrodes

Electrodes are delicate measuring instruments that require proper care and maintenance to produce accurate and reliable results, and to prolong useful life.

Always keep the pH electrode moist when not in use for a period of time, by using an electrode storage solution or a pH 7 buffer as storage media to soak the electrode. DO NOT store the electrode in distilled or deionised water as this will cause ions to leach out of the glass bulb and reference electrolyte, causing slow and sluggish response.

Electrodes may be shipped with either protective caps or in electrode soaking bottles to prevent cracking or scratching, and to keep the glass bulbs moist. Remove the electrode gently from the storage bottle and rinse it with distilled water before use. For long-term storage, always keep the electrode in the bottle, filled with sufficient storage solution to cover the bulb. Replenish the bottle as needed.

Handling

The electrode should be rinsed thoroughly between sample measurements and calibrations with distilled or deionised water. Blot the electrode dry to gently dislodge excess water. Use a lint-free wiping paper as rubbing causes the electrode to be charged electrostatically. Never use polymer or plastic body electrodes in samples containing organic solvents.

Refillable Electrodes

The filling solution in refillable electrodes should be filled up to, but not past, the refill hole. Make sure that the refill hole is open when measuring to ensure that the fill solution flows properly through the reference junction.



Warranty
Eutech Instruments warrants its electrodes to be free from manufacturing defects for 6 months (unless otherwise specified).

Rejuvenation and Reconditioning of Electrodes

As electrodes age, their efficiency is reduced. Symptoms include sluggish or erratic readings. This aging is usually caused either by contamination of the glass membrane, or by blockage of the liquid junction reference. Below are a few remedial procedures to improve the performance of such electrodes.

Unblocking Reference Junction

A blocked or clogged reference junction attributes to about 80 % of all pH measurement difficulties; resulting in extremely slow response, off-scale readings and electrically noisy measurements. Procedures for unblocking the junction depend on the type of reference junction electrode in use:

- **Gel-Filled Electrodes**

Soak the electrode in warm water (about 60 °C) for 5 to 10 minutes to re-establish contact. Or place the electrode in warm saturated KCl solution (60 °C) and allow both electrode and solution to cool down to room temperature.

- **Liquid-Filled Electrodes**

Sleeve and Annular Junction – Drain the electrode, rinse the cavity with distilled water and refill it with fresh electrolyte. For sleeve-type electrodes, rotate the sleeve to re-establish flow if necessary.

- **Ceramic Junction**

For Calomel Types Only – Soak the electrode in warm water for about 10 minutes, and check for electrolyte flow. Alternatively, soak the electrode tip in concentrated HCl for 5 to 10 minutes (use adequate ventilation and precautionary measures when performing this task). Rinse the electrode, then check for electrolyte flow again.

For Silver/Silver Chloride Types Only – Soak the electrode in warm saturated KCl solution (60 °C) for about 10 minutes, and check for electrolyte flow. Alternatively, soak the electrode tip in concentrated ammonium hydroxide for 5 to 10 minutes (use adequate ventilation and precautionary measures when performing this task). Rinse the electrode, then check for electrolyte flow.

For Ceramic Junctions Only – If the junction remains clogged, gently sand the junction area (be careful not to touch the glass bulb), and check for electrolyte flow.

Cleaning Glass pH Membrane

Dirty glass membranes are usually indicated by beads of water forming on the bulb when rinsing with distilled water. The bulb can be cleaned as follows:-

- **For Protein** – Soak in fresh protein removal solution ECDPCBT for 30 minutes, rinse thoroughly before use.
- **For Inorganic Deposits** – Wash with EDTA, ammonia or acids
- **For Grease and Similar Films** – Wash with acetone, methanol, etc.

Reconditioning Glass pH Membrane

Prolonged use, excessive alkaline immersion, or high temperature operation will cause surface leaching of the membrane glass; resulting in erratic or sluggish response which cannot be remedied by clearing the electrode. Immerse the electrode tip into 0.1N HCl for less than 5 minutes, and rinse with water. Then immerse the electrode tip into 0.1N KOH for 5 minutes, and rinse thoroughly with water. Check for electrode's performance. If the problem persists, repeat the steps but note that frequent HCl/KOH treatment can shorten the electrode life.

	ECFC7252101B 01X099412	ECFC72521R01B 01X099413	ECFC72522R01B 01X099414	ECFG7350401B 93X218814	ECCOMBI03M 01X234601
pH Electrodes					
					
Parameter	pH	pH	pH	pH	pH/Conductivity/ Temperature
Range	1 to 13 pH	1 to 13 pH	1 to 13 pH	1 to 13 pH	1 to 13 pH / 0 to 20 mS/cm
Temp. Range	0 to 80 °C	0 to 80 °C	0 to 80 °C	0 to 100 °C	0 to 80 °C
Liquid Junction Type	Porous HDPE pin	Porous HDPE pin	Porous HDPE pin	Annular	Porous HDPE pin
Internal Reference Type	Ag/AgCl	Ag/AgCl	Ag/AgCl	Ag/AgCl	Ag/AgCl
Sealed/Refillable	Sealed	Refillable	Refillable	Refillable	Sealed
Reference Junction	Single	Single	Double	Single	Single
Refilling Reference Electrolyte	–	ECRE001	ECRE002	ECRE001	–
Dimensions (Shaft)	90 x 12 mm	90 x 12 mm	90 x 12 mm	130 x 12 mm	155 x 55 mm
Cable Length	1 m	1 m	1 m	1 m	3 m
Connector	BNC	BNC	BNC	BNC	6-pin
Description	General purpose plastic-body gel-filled pH electrode	General purpose plastic-body pH combination electrode. Comes with 10 ml refilling electrolyte	General purpose plastic-body pH combination electrode. Comes with 10 ml refilling electrolyte	General purpose glass-body pH electrode, annular ceramic reference junction with protective sensor guard. Comes with 10 ml refilling electrolyte	Combined pH electrode and 2-pin stainless steel conductivity electrode with 15 cm ABS guard
Used With	All pH meters with BNC input connector	All pH meters with BNC input connector	All pH meters with BNC input connector	All pH meters with BNC input connector	CyberScan PC 10

	EC620130 01X218972	ECDA9350603B 93X218879	ECFC7252201B 01X099417	ECFC7252203B 01X417010
pH Electrodes				
Parameter	pH	pH	pH	pH
Range	1 to 14 pH	1 to 14 pH	1 to 13 pH	1 to 13 pH
Temp. Range	0 to 80 °C	0 to 50 °C	0 to 80 °C	0 to 80 °C
Liquid Junction Type	Open pore	Annular ceramic	Porous HDPE pin	Porous HDPE pin
Internal Reference Type	Ag/AgCl	Ag/AgCl	Ag/AgCl	Ag/AgCl
Sealed/Refillable	Refillable	Sealed	Sealed	Sealed
Reference Junction	Double	Single	Double	Double
Refilling Reference Electrolyte	EC636430	–	–	–
Dimensions (Shaft)	140 x 12 mm	151 x 26 mm	90 x 12 mm	90 x 12 mm
Cable Length	1 m	3 m	1 m	3 m
Connector	BNC	BNC	BNC	BNC
Description	General purpose glass-body pH electrode. Comes with 10 ml refilling electrolyte	Submersible ABS-body gel-filled electrode	General purpose plastic-body gel-filled pH combination electrode	General purpose plastic-body gel-filled pH combination electrode
Used With	All pH meters with BNC input connector	All pH meters with BNC input connector	All pH meters with BNC input connector	All pH meters with BNC input connector

	ECFC7960101B 01X256612	ECFC79601R01B 01X254014	ECFC7960201B 01X256613	ECFC79602R01B 01X256621
Oxidation Reduction Potential (ORP) Electrodes				
Parameter	Oxidation Reduction Potential (ORP)	Oxidation Reduction Potential (ORP)	Oxidation Reduction Potential (ORP)	Oxidation Reduction Potential (ORP)
Range	-1000 to 1000 mV	-1000 to 1000 mV	-1000 to 1000 mV	-1000 to 1000 mV
Temp. Range	0 to 80 °C	0 to 80 °C	0 to 80 °C	0 to 80 °C
Sensor Type	Platinum pin	Platinum pin	Platinum pin	Platinum pin
Internal Reference Type	Ag/AgCl	Ag/AgCl	Ag/AgCl	Ag/AgCl
Sealed/Refillable	Sealed	Refillable	Sealed	Refillable
Reference Junction	Single	Single	Double	Double
Refilling Reference Electrolyte	–	ECRE001	–	ECRE002
Dimensions (Shaft)	90 x 12 mm	90 x 12 mm	90 x 12 mm	90 x 12 mm
Cable Length	1 m	1 m	1 m	1 m
Connector	BNC	BNC	BNC	BNC
Description	General purpose plastic-body gel-filled ORP electrode	General purpose plastic-body ORP electrode. Comes with 10 ml refilling electrolyte	General purpose plastic-body gel-filled ORP electrode	General purpose plastic-body ORP electrode. Comes with 10 ml refilling electrolyte
Used With	All ORP meters with BNC input connector	All ORP meters with BNC input connector	All ORP meters with BNC input connector	All ORP meters with BNC input connector



	ECCONSEN91B 01X244701	ECCONSEN91J 01X244721	EC620165 93X219046	ECCONSEN91W 01X244702	ECCONSEN9203J 01X244723	
Conductivity Electrodes						
	Parameter	Conductivity/Temperature	Conductivity/Temperature	Conductivity/Temperature	Conductivity/Temperature	
	Range	0 to 150 mS/cm	0 to 150 mS/cm	0 to 500 mS/cm	0 to 150 mS/cm	0 to 350 mS/cm
	Cell	2	2	4	2	4
	Cell Constant	K = 1.0	K = 1.0	K = 1.0	K = 1.0	K = 0.530
Cell Material	Stainless steel rings, PBT and ultem-body	Stainless steel rings, PBT and ultem-body	Platinum cell on glass with epoxy-body	Stainless steel rings, PBT and ultem-body	Graphite with epoxy-body	
ATC	Yes	Yes	Yes	Yes	Yes	
Dimensions (Shaft)	144 x 16 mm	144 x 16 mm	100 x 12 mm	144 x 16 mm	120 x 12 mm	
Cable Length	1 m	1 m	1 m	1 m	3 m	
Connector	BNC and phono plug	8-pin	8-pin DIN	6-pin	8-pin	
Used With	EcoScan CON 6 / TDS 6 / Salt 6	CyberScan COND 610 / COND 600 / CD 650 / PC 650 / PCD 650	CyberScan CON 1500 / CON 6000 / PC 6000 / PC 6500 / PCD 6500	CyberScan CON 510 / CON 400 / CON 410 / PC 300 / PC 510 / CON 11 / CON 110	CyberScan COND 610 / COND 600 / CD 650 / PC 650 / PCD 650	

	ECDO6HANDY 01X233913	ECDO6HANDY3M 01X233916	ECDOHANDY8M 01X239606	EC620SSP 01X295704	ECDOHANDYNEW 01X239601
Dissolved Oxygen (DO) Electrodes					
					
Parameter	% Saturation of Oxygen, Dissolved Oxygen (DO)	% Saturation of Oxygen, Dissolved Oxygen (DO)	% Saturation of Oxygen, Dissolved Oxygen (DO)	% Saturation of Oxygen, Dissolved Oxygen (DO)	% Saturation of Oxygen, Dissolved Oxygen (DO)
Type	Galvanic	Galvanic	Galvanic	BOD amperometric	Galvanic
Range	0 to 20 mg/L	0 to 20 mg/L	0 to 20 mg/L	0 to 20 mg/L	0 to 20 mg/L
Temp. Range	0 to 50 °C	0 to 50 °C	0 to 50 °C	15 to 35 °C	0 to 50 °C
Response Time	1 min to reach 95 % of final reading	1 min to reach 95 % of final reading	40 sec to reach 93 % of final reading	30 sec to reach 90 % of final reading	40 sec to reach 93 % of final reading
Minimum Sample Flow	2 inch / sec	2 inch / sec	2 inch / sec	Self-stirring	2 inch / sec
Maximum Pressure	7.5 bar	7.5 bar	7.5 bar	Lab use only	7.5 bar
ATC	Yes	Yes	Yes	Yes	Yes
Dimensions (Shaft)	78 x 16.5 mm	78 x 16.5 mm	150 x 25 mm	62 x 12 mm	150 x 25 mm
Cable Length	0.9 m	3 m	7.6 m	0.9 m	3 m
Connector	BNC & phono plug	BNC & phono plug	6-pin	8-pin DIN	6-pin
Description	Galvanic Dissolved Oxygen electrode, epoxy body, Noryl cap/HDPE membrane, ATC. Comes with 2 assembled membrane cap housing, 1 refilling electrolyte & 1 scouring pad	Galvanic Dissolved Oxygen electrode, ATC. Comes with 2 assembled membrane cap housing, 1 refilling electrolyte & 1 scouring pad	Galvanic Dissolved Oxygen electrode, ATC. Comes with 1 assembled membrane cap housing, 1 refilling electrolyte & 1 scouring pad	Polarographic Dissolved Oxygen/BOD electrode with self-stirring mechanism	Galvanic Dissolved Oxygen electrode, ATC. Comes with 1 assembled membrane cap housing, 1 refilling electrolyte & 1 scouring pad
Used With	EcoScan DO 6	EcoScan DO 6	CyberScan DO 600 / DO 300 / DO 110 / PD 650 / PCD 650	CyberScan DO 1500 / DO 6000 / PCD 6500	CyberScan DO 600 / DO 300 / DO 110 / PD 650 / PCD 650



	ECPH5TEM01P 01X021804	ECPH5TEMB01P 01X210303	ECPHWPTM01J 01X021818	ECPHWPTM01W 01X021807	EC62019 01X306504	ECPHWPTM03J 01X021818
ATC Probes						
Parameter	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature
Temp. Range	0 to 100 °C	0 to 100 °C	0 to 100 °C			
Material	Stainless steel 304	Stainless steel 304	Stainless steel 304	Stainless steel 304	Stainless steel 304	Stainless steel 304
Dimensions (Shaft)	84 x 3 mm	117 x 3 mm	84 x 3 mm	84 x 3 mm	117 x 3 mm	84 x 3 mm
Dimensions (Handle)	85 x 12 mm	85 x 12 mm	75 x 12 mm	75 x 12 mm	75 x 12 mm	75 x 12 mm
Cable Length	1 m	1 m	1 m	1 m	1 m	3 m
Connector	2.5 mm phono plug	2.5 mm phono plug	8-pin	6-pin	2.5 mm phono plug	8-pin
Used With	CyberScan pH 110 / pH 11, EcoScan Ion 6 / pH 6 / pH 5	CyberScan pH 2100 / pH 1100 / Ion 510 / pH 510	CyberScan pH 620 / pH 610 / pH 600	CyberScan pH 310 / pH 300 / PC 300 / PC 510	CyberScan pH 6500 / pH 6000 / pH 1500 / CON 1500 / PC 6000 / PC 6500 / PCD 6500	CyberScan PCD 650 / PC 650 / PD 650 / pH 600 / pH 610 / pH 620

	ECTEM5TEM01P 01X021811	ECTEM6TEM01R 01X021814	ECTPGLPJ01M 01X220001	ECTPGLPK01M 01X220101	ECTPPENJ01M 01X220002	ECTPPENK01M 01X220102
Temperature Probes						
						
Parameter	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature
Range	0 to 125 °C	-50 to 150 °C	-50 to 700 °C	-50 to 700 °C	-50 to 700 °C	-50 to 700 °C
Meter	Thermistor	RTD	Type J	Type K	Type J	Type K
Dimensions (Shaft)	117 x 3 mm	117 x 3 mm	200 x 3 mm	200 x 3 mm	120 x 3.2 mm	120 x 3.2 mm
Cable Length	1 m	1 m	1 m	1 m	1 m	1 m
Connector	¼ inch phono plug	3-pin	Miniature plug	Miniature plug	Miniature plug	Miniature plug
Description	100 K thermistor Temperature probe, ungrounded, SS304	3 wire RTD Pt 100 Temperature probe, ungrounded, SS304 (max. temp. 150 °C)	General purpose probe (for immersion into liquids), ungrounded	General purpose probe (for immersion into liquids), ungrounded	Penetration probe (for penetrating meat, plastic & semi-soft materials), ungrounded	Penetration probe (for penetrating meat, plastic & semi-soft materials), ungrounded
Used With	EcoScan Temp 5	EcoScan Temp 6	EcoScan Temp JKT	EcoScan Temp JKT	EcoScan Temp JKT	EcoScan Temp JKT

Ion Selective Electrodes (ISE)

Eutech offers a large selection of Ion Selective Electrodes (ISE) to suit a wide variety of applications. Each electrode has a typical response time of 20 to 30 seconds which varies with solution concentration. Gas sensing electrodes also include replacement membranes. Eutech offers three electrode types: Membrane/Solid State, Gas Sensing, or Glass Bulb.

Choose from single junction or double junction electrodes: Single junction for clean water applications; Double junction electrodes for testing dirty water and solutions with heavy metals or organics.

All electrodes are refillable and include 15 ml of electrolyte, filling pipette and instructions. Solid state electrodes also include polishing strips.



ISE General Application Guide

ISE Applications	Concentration Range	Temperature / pH Range	Interferences	Electrode	Standard 0.1M	Standard 100 ppm	Standard 1000 ppm	Ion Strength Adjuster
Ammonia NH₃ – High Purity Power Station Water, Fish Tanks, Sea Water, Waste Water, Plating Baths, Air/Stack Gases and Biological Samples Type: Gas Sensing	(17,000 to 0.001 ppm) 1.0 to 5 x 10 ⁻⁶ M	0 to 50 °C / Above pH 11	Volatile Amines	ECNH30101B	ECSCSAA1BT	ECSCSAA2BT	ECSCSAA3BT	ECISAAA1BT
Ammonium NH₄⁺ – Boiler Feed Water, Natural Water and Fertilizers Type: Polymer Membrane	(18,000 to 0.01 ppm) 1.0 to 5 x 10 ⁻⁶ M	0 to 50 °C / pH 4 to pH 10	K ⁺	ECNH40301B	ECSCSAM1BT	ECSCSAM2BT	ECSCSAM3BT	ECISAAM1BT
Bromide Br⁻ – Water, Wine, Soil, Plant Tissue, Blood and Clinical Analysis Type: Solid State	(79,000 to 0.4 ppm) 1.0 to 5 x 10 ⁻⁶ M	0 to 50 °C / pH 2 to pH 14	S ²⁻ , I ⁻ , CN ⁻ , High Cl ⁻ and NH ₃ Levels	ECBRO0301B	ECSCSBR1BT	ECSCSBR2BT	-	ECISABR1BT
Cadmium Cd²⁺ – Plating Baths Type: Solid State	(11,200 to 0.01 ppm) 0.1 to 1 x 10 ⁻⁷ M	0 to 80 °C / pH 2 to pH 12	Ag ⁺ , Hg ²⁺ , Cu ²⁺ , High Pb ²⁺ and Fe ²⁺ Levels	ECCD0301B	ECSCSCD1BT	ECSCSCD2BT	-	ECISACD1BT
Calcium Ca²⁺ – Water Softening Systems, Boiler Feed Water, Drinking/Mineral Water, Clinical Analysis and Food Applications Type: Polymer Membrane	(40,000 to 0.2 ppm) 1.0 to 5 x 10 ⁻⁶ M	0 to 50 °C / pH 3 to pH 10	Pb ²⁺ , Hg ²⁺ , Cu ²⁺ , Ni ²⁺ , Fe ²⁺ , Mg ²⁺ , Zn ²⁺ , Ba ²⁺ , K ²⁺ , K ⁺ , Na ⁺	ECCAL0201B	ECSCSCA1BT	ECSCSCA2BT	ECSCSCA3BT	ECISACA1BT
Carbon Dioxide CO₂ and Carbonate CO₃²⁻ – Soft Drinks/Carbonated Beverages, Wine, Beer, Fermentation Processes, Bacterial Cultures Type: Gas Sensing	(440 to 0.4 ppm) 1 x 10 ⁻² to 1 x 10 ⁻⁴ M	0 to 50 °C / pH 4.8 to pH 5.2	Volatile Weak Acids	ECCO20101B	ECSCSCO1BT	ECSCSCO2BT	ECSCSCO3BT	ECISACO1BT
Chloride Cl⁻ – River/Tap Water, Plant Tissue, Soils, Boiler Feed Water, Clinical Analysis, Sweat, Urine, Cement, Plating Baths and Food Samples Type: Solid State	(35,500 to 1.8 ppm) 1.0 to 5 x 10 ⁻⁵ M	0 to 80 °C / pH 2 to pH 12	S ²⁻ , I ⁻ , CN ⁻ , Br, OH ⁻ , NH ₃ , S ₂ O ₃ ²⁻	ECCL00301B	ECSCSCL1BT	ECSCSCL2BT	ECSCSCL3BT	ECISACL1BT
Copper Cu²⁺ – Plating Baths and Water Type: Solid State	(6350 to 6.4 x 10 ⁻⁴ ppm) 0.1 to 1 x 10 ⁻⁸ M	0 to 80 °C / pH 2 to pH 12	Ag ⁺ , Hg ²⁺ , High Cl ⁻ , Br, Fe ²⁺ and Cd ²⁺ Levels	ECCU0301B	ECSCSCU1BT	ECSCSCU2BT	-	ECISACU1BT
Cyanide CN⁻ – Plating Baths, Waste Water and Plant Tissue Type: Solid State	(260 to 0.13 ppm) 5 x 10 ⁻⁶ to 10 ⁻² M	0 to 80 °C / pH 11 to pH 13	S ²⁻ , I ⁻ , Br, Cl ⁻	ECCN0301B	-	-	-	-
Fluoride F⁻ – Drinking/Natural Water, Waste Water, Air/Stack Gases, Acids, Sea Water Minerals, Soils, Food, Biological Fluids, Toothpaste/Mouth Wash, Coal, Carbonated Beverages and Bone Type: Solid State	0.02 ppm to Saturated (10 ⁻⁶ to Saturated)	0 to 80 °C / pH 5 to pH 8	OH ⁻	ECFO0301B	ECSCSFL1BT	ECSCSFL2BT	ECSCSFL3BT	ECISAF1BT
Iodide I⁻ – Milk, Feeds, Plants and Pharmaceuticals Type: Solid State	(127,000 to 6 x 10 ⁻³ ppm) 5 x 10 ⁻⁸ to 1.0 M	0 to 80 °C / pH 0 to pH 14	S ²⁻ , CN ⁻ , Br, Cl ⁻ , NH ₃ , S ₂ O ₃ ²⁻	ECIO0301B	ECSCSIO1BT	ECSCSIO2BT	-	ECISAIO1BT
Lead Pb²⁺ – Plating Baths and Organic Compounds Type: Solid State	(20,7000 to 0.2 ppm) 10 ⁻⁶ to 10 ⁻¹ M	0 to 80 °C / pH 3 to pH 8	Ag ²⁺ , Hg ²⁺ , Cu ²⁺ , High Cd ²⁺ and Fe ²⁺ Levels	ECPB0301B	ECSCSPB1BT	ECSCSPB2BT	-	ECISAPB1BT
Nitrate NO₃⁻ – Surface/Drinking Water, Sewage Effluent, Soil Extracts, Fertilizers, Plant Tissue, Meat, Potatoes, Spinach, Beets, Baby Food Type: Polymer Membrane	(62,000 to 0.5 ppm) 7 x 10 ⁻⁶ to 1.0 M	0 to 50 °C / pH 2.5 to pH 11	ClO ₄ ⁻ , I ⁻ , CN ⁻ , BF ₄ ⁻	ECNO0301B	ECSCSNT1BT	ECSCSNT2BT	ECSCSNT3BT	ECISANT1BT
Potassium K⁺ – Waste Water, River/Tap Water, Clinical Analysis, Saliva, Serum, Fertilizers, Soils and Wines Type: Polymer Membrane	(39,000 to 0.04 ppm) 10 ⁻⁶ to 1.0 M	0 to 50 °C / pH 2 to pH 12	Cs ⁺ , NH ₄ ⁺ , Tl ⁺ , H ⁺ , Ag ⁺ , Li ⁺ , Na ⁺ , Tris 1 ⁺	ECK0301B	ECSCSKO1BT	ECSCSKO2BT	-	ECISAKO1BT
Silver/Sulfide Ag⁺/S²⁻ – Sewage Effluent, Soils, Sediments, Plating Baths and Photographic Fixing Solution Type: Solid State	(107,900 to 0.01 ppm) 10 ⁻⁷ to 1.0 M (Ag ⁺ , S ²⁻)	0 to 80 °C / pH 2 to pH 12	Hg ²⁺	ECAGS0301B	ECSCSSS1BT	ECSCSSS2BT	-	ECISASS1BT
Sodium Na⁺ – Steam Condensates in Power Plants, Clinical Analysis, Serum, Foods, Wine, Glass, Sea Water, Swimming Pools, Fish Farms and Aquariums Type: Glass Bulb	(23,000 to 0.2 ppm) 10 ⁻⁶ M to Saturated	0 to 80 °C / pH 5 to pH 12	H ⁺ , K ⁺ , Li ⁺ , Ag ⁺ , NH ₄ ⁺ , Rb ⁺ , Cs ⁺ , Tl ⁺	ECNA0201B	ECSCSLNA1BT	ECSCSLNA2BT	ECSCSLNA3BT	ECISALNA1BT