



Analytical Sensors & Instruments Ltd.
Measuring Your SuccessSM

Ion Selective Electrodes



ION SELECTIVE ELECTRODE

Ion Selective Electrodes (ISE) are membrane electrodes that respond selectively to ions in the presence of others. These include probes that measure specific ions and gasses in solution. The use of Ion Selective Electrodes offers several advantages over other methods of analysis. First, the cost of initial setup to make analysis is relatively low. ISE determinations are not subject to interferences such as color in the sample. There are few matrix modifications needed to conduct these analyses. These advantages make them ideal for use in the laboratory, out in the field or in the plant where they are most popular. Analytical Sensors & Instruments has been manufacturing OEM Ion Selective Electrodes for 15 years. Our success has been accomplished thru constant research and communication with our customers. Call ASI today to find out what ISE would best meet your OEM requirements.

11 Series PVC Mono



The 11 Series Mono ISE features a replaceable PVC membrane sensing element that fits into a durable epoxy handle. Each sensing element has a brass pin connector and viton o-ring to ensure a tight seal and solid connection with the handle.

Specifications:

Construction: PVC/Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Module: 12 x 50



12 Series PVC FreshTip™



The FreshTip ISE is the new generation of durable, replaceable ISEs from ASI. With a simple to use refillable reference and replaceable sensing head (only on PVC Membrane), the FreshTip electrode is a revolutionary design.

Specifications:

Construction: PVC/Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 60mm

Module: 12 x 33



01 Series Solid State Mono



The 01 Series Solid State Mono ISE features a durable epoxy handle with each sensing element sealed in the handle. The solid state membrane is rugged and dependable, able to be regenerated thru cleaning of the sensing element.

Specifications:

Construction: PVC/Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Cable: Coax

03 Series Solid State FreshFil



The FreshFil ISE is the next generation refillable ISE from ASI. With a simple to use flushable junction the FreshFil electrode is a quality design. The FreshFil ISE combines reliability, durability and value.

Specifications:

Construction: Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Cable: Coax

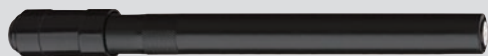
E M O D E L S

Sodium Electrode



The Glass Sodium electrode is the latest in ASI innovation. The fast response speed and accurate Sodium measurements provide the performance needed in routine testing. This electrode fits any pH/Ion/millivolt meter. Available in glass and plastic models.

35 Series Gas Sensing



The Gas Sensing ISE series are potentiometric, analytical devices that offer economical, rapid, precise measurements of ammonia, nitrogen oxide, oxygen and carbon dioxide. The Gas Sensing electrodes use convenient, pre-assembled membrane caps.

Specifications:

Construction: ABS

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Module: 12 x 126mm

43 Series PermaFil™



The PermaFil ISE is a gel filled, double junction, sealed, combination ISE. The PermaFil ISE eliminates the inconvenience and time consuming cleaning, flushing and maintenance of conventional refillable designs. When you are finished measuring, simply rinse, blot dry and refit the protective cap.

Specifications:

Construction: PVC/Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Cable: Coax

ISE Theory

How do they work or what is an Ion-Selective Electrode?

An Ion Selective Electrode measures the potential of a specific ion in solution. This potential is measured against a stable reference electrode of constant potential. The potential difference between the two electrodes will depend upon the activity of the specific ion in solution. This activity is related to the concentration of that specific ion, therefore allowing the end-user to make an analytical measurement of that specific ion.

How Does the mV Reading Correspond to the Concentration?

Standard solutions of known concentrations must be accurately prepared. These solutions are then measured with the pH/mV meter. The mV reading of each solution is noted and a graph of concentration vs. mV reading must be plotted. Now the unknown solution can be measured. The mV value of the unknown solution is then located on the graph and the corresponding solution concentration is determined.

Several types of sensing electrodes are commercially available. They are classified by the nature of the membrane material used to construct the electrode. It is this difference in membrane construction that makes an electrode selective for a particular ion.

1. Polymer Membrane Electrodes (Organic Ion Exchangers and Chelating Agents)

-- Polymer membrane electrodes consist of various ion-exchange materials incorporated into an inert matrix such as PVC, polyethylene or silicone rubber. After the membrane is formed, it is sealed to the end of a PVC tube. The potential developed at the membrane surface is related to the concentration of the species of interest. Electrodes of this type include potassium, calcium, chloride, fluoroborate, nitrate, perchlorate, potassium, and water hardness.

2. Solid State Electrodes (Insoluble Conductive Inorganic Salts)

-- Solid state electrodes utilize relatively insoluble inorganic salts in a membrane. Solid state electrodes exist in homogeneous or heterogeneous forms. In both types, potentials are developed at the membrane surface due to the ion-exchange process. Examples include silver/sulfide, lead, cupric, cyanide, thocyanate, chloride and fluoride.

3. Gas Sensing Electrodes

-- Gas sensing electrodes are available for the measurement of dissolved gas such as ammonia, carbon dioxide, nitrogen oxide, sulfur dioxide and Free Chlorine. These electrodes have a gas permeable membrane and an internal buffer solution. Due to the construction, gas sensing electrodes do not require an external reference electrode.

4. Glass Membrane Electrodes -- Glass membrane electrodes are formed by the doping of the silicon dioxide glass matrix with various chemicals. The most common of the glass membrane electrodes is the pH electrode. Glass membrane electrodes are also available for the measurement of sodium ions.

Reference Electrodes

ASI reference electrodes feature reliable, stable, drift free performance in a variety of sample types. The silver/silver-chloride models offer high stability and should be used for most sample types. The calomel model is ideal for use in Tris buffers or in the presence of organics, sulfides or samples, which will complex silver. The double junction varieties offer high stability, eliminating Ag^+ interference, and can be used with any ion selective electrodes. Glass versions tolerate cleaning with solvents after measuring foods, lubricants or oily, greasy samples. Epoxy models are rugged and are used in most routine ISE applications.

25 Series Reference



Specifications:

Reference Type: Ag/AgCl
Junction Type: Sleeve
Reference Solution: KCl, KNO_3 , LiCl, others available

Construction: Epoxy

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 32mm

Cable: Custom

12 Series Reference



Specifications:

Reference Type: Ag/AgCl
Junction Type: Ceramic Pin
Reference Solution: KCl, KNO_3 , LiCl, others available

Construction: Glass

Dimensions

Immersion: 12 x 120mm

Cap: 16 x 33mm

Cable: Custom

Ion Name	ION Species	Mono Part Number	PermaFil Part Number	FreshFil Part Number	FreshTip Part Number	Gas Sensing Part Number	Sensing Element
Ammonia	NH_3	- - -	- - -	- - -	- - -	NH35	Gas Sensing
Ammonium	NH_4^+	NH11	NH43	- - -	NH12	- - -	PVC Membrane
Bromide	Br^-	BR01	BR43	BR03	- - -	- - -	Solid State
Cadmium	Cd^{++}	CD01	CD43	CD03	- - -	- - -	Solid State
Calcium	Ca^{++}	CA11	CA43	- - -	CA12	- - -	PVC Membrane
Carbon Dioxide (carbonate)	CO_2	- - -	- - -	- - -	- - -	CO35	Gas Sensing
Chloride	Cl^-	CL01	CL43	CL03	- - -	- - -	Solid State
Chlorine (Total Residual)	Cl_2	RC01	- - -	- - -	- - -	- - -	Solid State
Cupric	Cu^{++}	CU01	CU43	CU03	- - -	- - -	Solid State
Cyanide	CN^-	CN01	CN43	CN03	- - -	- - -	Solid State
Fluoride	F^-	FL01	FL43	FL03	- - -	- - -	Solid State
Fluoroborate	BF_4^-	BF11	BF43	- - -	BF12	- - -	PVC Membrane
Iodide	I^-	ID01	ID43	ID03	- - -	- - -	Solid State
Lead	Pb^{++}	PB01	PB43	PB03	- - -	- - -	Solid State
Nitrogen Oxide	NO_x	- - -	- - -	- - -	- - -	NO35	Gas Sensing
Nitrate	NO_3^-	NO11	NO43	- - -	NO12	- - -	PVC Membrane
Nitrite	NO_2^-	N211	N243	- - -	N212	- - -	PVC Membrane
Potassium	K^+	KT11	KT43	- - -	KT12	- - -	PVC Membrane
Silver	Ag^+	SS01	SS43	SS03	- - -	- - -	Solid State
Sulfide	S^{2-}	SS01	SS43	SS03	- - -	- - -	Solid State
Surfactant	X^+	XT11	XT43	- - -	XT12	- - -	PVC Membrane
Sodium	Na^+	NA01/02	NA31	NA44	- - -	- - -	Glass Membrane
Thiocyanate	SCN^-	SC11	SC43	SC03	- - -	- - -	Solid State

Electrode Accessories

ASI offers a multitude of OEM electrode accessories. Over the years, ASI has developed several accessories that make the functionality, maintenance and use of electrodes more convenient for users. The latest development is the MicroStirrer™. While only a few of the accessories are listed, ASI would be pleased to offer our engineering services to assist your company in the development of your accessories. Why wait - contact ASI today.

Micro Stirrer™

The Micro Stirrer, exclusively available from ASI, snaps on the end of any 12mm electrode and provides a stirring mechanism when used with a magnetic stir plate. (See front cover)

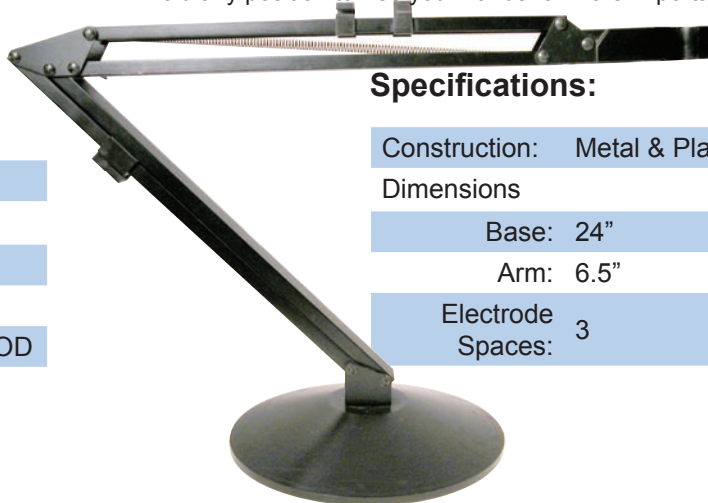


Specifications:

Construction:	Plastic, magnet
Dimensions	
Body:	17 x 24mm
Magnet:	6mm disk
Available for:	12mm & 0.5 in OD

Electrode Arm

The ASI electrode arm is custom manufactured with the end user in mind. With a coiled metal spring, this electrode arm will hold any position to free your hands for more important tasks.



Specifications:

Construction:	Metal & Plastic
Dimensions	
Base:	24"
Arm:	6.5"
Electrode Spaces:	3

Range @ 25°C	pH Range	Temperature Range (°C)	Known Interferences
1 x 10 ⁻⁶ to 1 M / (0.02 to 14,000 ppm)	Above 11	0 to 50	Volatile Amines
1 x 10 ⁻⁶ to 1M / (0.02 to 18,000 ppm)	4 to 10	0 to 50	K ⁺ , Na ⁺
5 x 10 ⁻⁶ to 1M / (0.4 to 79,900 ppm)	1 to 12	0 to 80	I ⁻ , Cl ⁻ , S ²⁻ , CN ⁻ and NH ₃
1 x 10 ⁻⁷ to 1 x 10 ⁻¹ M / (0.01 to 11,000 ppm)	2 to 8	0 to 80	Hg ²⁺ , Ag ⁺ & Cu ²⁺ must be absent, high levels of Pb ²⁺ & Fe ²⁺
5 x 10 ⁻⁷ to 1 M / (0.02 to 40,000 ppm)	2.5 to 11	0 to 50	Pb ²⁺ , Hg ²⁺ , Si ²⁺ , Fe ²⁺ , Cu ²⁺ , Ni ²⁺ , NH ₃ , Na ⁺ , Li ⁺ , Tris ⁺ , K ⁺ , Ba ⁺ , Zn ²⁺ , Mg ²⁺
10 ⁻⁴ to 10 ⁻² M / (4.4 to 400ppm)	4.8 to 5.2	0 to 50	Volatile Weak Acids
5 x 10 ⁻⁵ to 1M / (1.8 to 35,500 ppm)	2 to 12	0 to 80	CN ⁻ , Br ⁻ , I ⁻ , OH ⁻ & S ²⁻ must be absent
10 ⁻⁷ to 3 x 10 ⁻⁴ M / (0.01 to 20 ppm)	3 to 10	0 to 50	- - -
10 ⁻⁷ to 10 ⁻¹ M / (6.4 X10 ⁻³ to 6,000 ppm)	2 to 6	0 to 80	Hg ²⁺ & Ag ⁺ must be absent; high levels Fe ²⁺ , Br ⁻ and Cl ⁻
8 x 10 ⁻⁶ to 1 x 10 ⁻² M / (0.2 to 260ppm)	10 to 14	0 to 80	I ⁻ , Br ⁻ , Cl ⁻ , S ²⁻ must be absent
1 x 10 ⁻⁶ to saturation / (0.02ppm to saturation)	5 to 7 @ 10-6M 11 @ 10-1M	0 to 80	OH ⁻
7 x 10 ⁻⁶ to 1M / (0.6ppm to 30,000)	2 to 12	0 to 40	I ⁻ , BF ⁻ , Br ⁻ , Cl ⁻ , ClO ₄ ⁻ , ClO ₃ ⁻ , F ⁻ , HCO ₃ ⁻ , HPO ₄ ⁻² , PO ₄ ⁻³ , NO ₂ ⁻ , NO ₃ ⁻ , SO ₄ ⁻²
5 x 10 ⁻⁸ to 1M / (0.01 to 127,000ppm)	0 to 14	0 to 80	CN ⁻ , S ₂ O ₃ ²⁻ , Cl ⁻ , S ²⁻ , NH ₃
1 x 10 ⁻⁶ to 1 x 10 ⁻¹ M / (0.2 to 20,700ppm)	4 to 7	0 to 80	Hg ²⁺ , Ag ⁺ , Cu ²⁺ must be absent; Fe ²⁺ & Cd ²⁺
4 x 10 ⁻⁶ to 5 x 10 ⁻³ M / (0.2 to 220ppm)	- - -	- - -	- - -
7 x 10 ⁻⁶ to 1M / (0.4 to 60,000ppm)	2.5 to 11	0 to 50	ClO ₄ ⁻ , I ⁻ , ClO ₃ ⁻ , F ⁻
3.6 x 10 ⁻⁶ to 1.4 x 10 ⁻² M / (0.02 to 100ppm)	2 to 12	0 to 40	- - -
1 x 10 ⁻⁶ to 1M / (0.04 to 39,000ppm)	2 to 12	0 to 50	Cs ⁺ , NH ₄ ⁺ , TI ⁺ , H ⁺ , Ag ⁺ , Tris ⁺ , Li ⁺ , Na ⁺
Ag ⁺ : 10 ⁻⁷ to 1M / (0.01 to 107,900ppm)	2 to 12	0 to 80	Hg ²⁺
S ⁻ : 10 ⁻⁷ to 1M / (0.003 to 32,100ppm)	2 to 12	0 to 80	Hg ²⁺
End Point Indicator	- - -	0 to 40	- - -
4 x 10 ⁻⁶ to 1M / (0.1 to 23,000ppm)	Above 9	0 to 80	H ⁺ , K ⁺
5 x 10 ⁻⁶ to 1M / (0.29 to 58,100ppm)	2 to 10	0 to 80	I ⁻ , Br ⁻ , CN ⁻ , NH ₃ , S ₂ O ₃ ²⁻ , Cl ⁻ , OH ⁻ , S ²⁻

Species used by Industry

Agriculture:	Nitrate, calcium, sodium, potassium, bromide, chloride, ammonia & fluoride
Plant Tissue:	Nitrate, chloride, fluoride, iodide, cyanide, calcium, sodium and potassium
Fertilizer:	Nitrate using the ammonia electrode, potassium and fluoride
Aquaculture:	Ammonia and calcium
Biomedical Research:	Calcium, carbon dioxide and ammonia
Education:	Various ISEs electrodes are used in most colleges and universities
Food Processing:	Chlorides, nitrate, sodium and fluoride
Milk and Dairy Products:	Chloride, calcium, fluoride, sodium and iodide
Soft Drinks:	Chloride, fluoride, carbon dioxide and residual chlorine
Alcohol:	Potassium, sodium, CO ₂ , fluoride, bromide, calcium, and residual chlorine
Vegetables:	Nitrate, chloride
Geology and Mining:	Fluoride, calcium, cyanide
Metallurgy and Metal Plating:	Fluoride, cupric, cyanide, fluoroborate, nitrate
Plating Baths:	Chloride, residual chlorine and ammonia
Pulp and Paper:	Sodium, chloride, calcium and sulfate
Petroleum Refining:	Ammonia, chloride
Pharmaceuticals:	Fluoride
Sewage Treatment:	Nitrate, ammonia, residual chlorine
Steam and Power Generation:	Chloride, sodium, residual chlorine, fluoroborate
Drinking Water:	Total residual chlorine, nitrate, calcium, chloride, and fluoride
Natural Water:	Bromide, calcium, chloride, fluoride, nitrate, potassium, silver, sodium, cupric
Sea Water:	Sodium, chloride, fluoride, nitrate and ammonia

Standard Methods & Applications

SPECIES	ASTM	EPA	APHA	AOAC	USGS
ALKALINITY	D1067-88	310.1	2320B	973.43	I-1030
AMMONIA	D1426-89	350.3	4500-NH ₃ (F), (G)	- - -	I-1524
BROMIDE	D1246-88	60 FR 37974 (6)	- - -	- - -	- - -
CARBON DIOXIDE	D513-88A	- - -	- - -	- - -	- - -
CHLORIDE	D512-89	60FR 37974 (6)	4500-CL (D)	971.27, 980.25	- - -
CHLORIDE BY TITRATION	- - -	- - -	- - -	962.05, 962.07, 963.05, 966.10, 969.10	- - -
CHLORINE RESIDUAL	- - -	59 FR 62456	4500-CL (I)	- - -	- - -
CYANATE	- - -		4500-CN (L)	- - -	- - -
CYANIDE	D2036-89A	60 FR 37974 (6)	4500-CN (E) (F)	- - -	- - -
FLUORIDE	D3868-79, D1179-88B, D1179-88A	59 FR 62456, 60 FR 37974 (6)	4500-F (C)	984.37, 975.08, 973.10	I-1327, I-2327
IODIDE	D3869	- - -	- - -	- - -	
KJELDAHL NITROGEN	D3590-89A	.351.4	4500-NORG (A) (B)	- - -	- - -
NITRATE	- - -	59 FR 62456 60 FR 37974 (6)	4500-NO ₃ (D) (G)	- - -	- - -
POTASSIUM	- - -	- - -	3500-K (E)	- - -	- - -
SODIUM	D2791	- - -	- - -	976.25	- - -
SULFIDE	D4658	60 FR 37974 (6)	- - -	- - -	- - -

Calibration Solutions



ASI offers buffers, reagents, standards, filling solutions, ionic strength adjusters and many more high quality solutions. For over 14 years we have developed our solutions capability to support our growth in the ISE and other sensor markets. Our dedication to quality has ensured that thousands of electrodes have been tested using the highest quality solutions available. With over 150 different solutions in our inventory, ASI is ready to handle your solution needs. We offer standard sizes that fit almost any application or request: 1 gallon, 1 liter (32 oz.), 500 milliliter (16 oz), 250 milliliter (8 oz), 125 milliliter (4 oz), 30 milliliter (1 oz).

Our 1 oz and 4 oz bottles are used primarily for ISA and filling solutions and come standard with our convenient flip top cap that enables ease of use. In addition, all bottles are sealed with our leak/tamper proof seal that ensures that all solutions are fresh when they arrive at your location. The cap seal provides a long term storage solution for your lab.

Ion Name	Fill Solution	ISA	0.1 M Standard	1000ppm Standard
Ammonia	RF1001	AJ0002	SD2001	SD2002
Ammonium	RF0012	AJ0015	SD2001	SD2002
Bromide	RF0007	AJ0003	SD2003	SD2004
Cadmium	RF0007	AJ0003	SD2005	SD2006
Calcium	RF0005	AJ0004	SD2007	SD2008
Carbon Dioxide (Carbonate)	RF1009	- - -	SD2100	SD2110
Chloride	RF0007	AJ0003	SD2011	SD2012
Chlorine (Total Residual)	RF00CR	AJ00CR	SD0CR1	SD0CR2
Cupric	RF0007	AJ0003	SD2015	SD2016
Cyanide	RF0007	AJ0001	- - -	SD2018
Fluoride	RF0007	AJ0009	SD2019	SD2019
Fluoroborate	RF0017	AJ00FB	SD2101	SD2111
Iodide	RF0007	AJ0003	SD2023	SD2024
Lead	RF0007	AJ0012	SD2025	SD2026
Nitrogen Oxide	RF1010	AJ00N2	SD2102	SD2112
Nitrate	RF0011	AJ0011	SD2029	SD2030
Nitrite	RF0016	AJ0031	SD2103	SD2113
Potassium	RF0012	AJ0015	SD2037	SD2038
Silver	RF0007	AJ0003	SD2039	SD2001
Sulfide	RF0007	AJ0020	SD2039	SD2114
Surfactant	RF0015	AJ0032	SD2104	SD2115
Sodium	RF0014	AJ0033	SD2105	SD2116
Thiocyanate	RF0013	AJ0034	SD2106	SD2117

**When placing orders for any ASI solution, just add a dash and the ounce size (1, 4, 8, etc) to the end for the specific size that you require. (e.g. SD0024-16)



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