

# Introduction to Orion ISE & ORP Electrodes

## Application

Measurement by ion selective electrode (ISE) is applicable in virtually every laboratory. Measure ion concentrations in such samples as water, food, pharmaceuticals, and biological samples. Analytical methods using ISEs have been developed and published throughout the world. The main advantages of electrode technology are the variety of analytical methods available. Choice of measurement method improves accuracy and reproducibility of results. Direct measurement is the most commonly used electrode method. Sample concentration is directly read on a specific ion meter or from a calibration curve. Incremental methods increase the number of measurable species. With these methods, electrode calibration is unnecessary, making them useful when measuring complex samples. Electrodes can also be used as end point detectors in titrations.

## Save Time and Money

Electrode measurements are simpler and faster than other analytical techniques. Time-consuming sample preparation steps such as filtrations and distillations are rarely needed. Analysis time is typically under one minute. A direct readout meter displaying concentration in units of your choice is the fastest, easiest ISE measurement system. Orion ISE/pH meters display concentration in units of your choice, completing the ISE measurement system. In comparison to other methods, such as atomic absorption or ion chromatography, the initial cost of setup is less and does not require additional expensive readout equipment. Methods are adaptable to both lab and field use. Sample color or turbidity does not affect the measurement. ISEs are inexpensive. Typically, the cost per test is only a few cents. The design of the sensing element determines the sensitivity and selectivity for the ion of interest. Orion ISEs have been designed to provide you with the optimum in performance and reliability.



Orion Ion Selective Electrodes

## Half-Cell Ion Selective Electrodes

Solid State Half-Cell Ion Selective Electrodes

- Fluoride, Bromide, Cadmium, Chloride, Cupric, Cyanide, Iodide, Lead, Silver/Sulfide, Thiocyanate

Plastic Membrane Half-Cell Ion Selective Electrodes

- Ammonium, Calcium, Chloride, Fluorocarbonate, Nitrate, Nitrite, Perchlorate, Potassium, Water Hardness

ROSS® Half-Cell Ion Selective Electrodes

- Sodium

## Gas Sensing Combination Ion Selective Electrodes

Gas Sensing Combination Ion Selective Electrodes

- Ammonia, Carbon Dioxide, Nitrogen Dioxide, Oxygen/BOD

## ionplus® Sure-Flow® Combination Ion Selective Electrodes

96 Series ionplus Sure-Flow Combination Ion Selective Electrodes

- Fluoride, Chloride, Bromide, Cadmium, Cupric, Cyanide, Iodide, Lead, Silver/Sulfide

97 Series ionplus Sure-Flow Combination Ion Selective Electrodes

- Calcium, Nitrate, Potassium, Nitrite

## ROSS Sure-Flow Combination Ion Selective Electrodes

- Sodium

## Redox (ORP) Electrodes

Epoxy ORP Triodes™

- Refillable and Low Maintenance

Combination ORP

- Epoxy Sure-Flow®, Glass

# Orion ISE Electrode Specifications

Orion ISE									
Species	Catalog number	Connector number	Construction	Construction range	Optimum temperature range	Required reference catalog number	Reference filling solution catalog number	Calibration standards catalog number	Required ISA(1) catalog number
Ammonia (NH <sub>3</sub> )	951201, 9512BNWP	U.S. Std., BNC (4)	Gas sensing combination	1.0 to 5 x 10 <sup>-7</sup> M 17,000 to 0.01 ppm	0 - 50 °C	Included	951202 inner	0.1 M NH <sub>4</sub> Cl / 951211	951006
Ammonium (NH <sub>4</sub> <sup>+</sup> )	931801	Sensing module (3)	Plastic membrane half-cell	1.0 to 5 x 10 <sup>-7</sup> M 17,000 to 0.01 ppm	0 - 50 °C	900200	900002 inner / 900018 outer	1000 ppm as N / 951007	-
Bromide (Br <sup>-</sup> ) ionplus® Design	963500, 9635BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow® solid state combination	1.0 to 5 x 10 <sup>-6</sup> M 79,900 to 0.40 ppm	0 - 80 °C	Included	900063	0.1 M NaBr / 940011	940011
Bromide (Br <sup>-</sup> )	943500, 9435BN, 9435SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 5 x 10 <sup>-6</sup> M 79,900 to 0.40 ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M NaBr / 943506	940011
Cadmium (Cd <sup>2+</sup> ) ionplus Design	964800, 9648BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow solid state combination	10 <sup>-1</sup> to 10 <sup>-7</sup> M 11,200 to 0.01 ppm	0 - 80 °C	Included	900061	Consult instruction manual	940011
Cadmium (Cd <sup>2+</sup> ) ionplus Design	944800, 9448BN, 9448SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	10 <sup>-1</sup> to 10 <sup>-7</sup> M 11,200 to 0.01 ppm	0 - 80 °C	900200	900002 inner/900003 outer	Consult instruction manual	940011
Calcium (Ca <sup>2+</sup> )	932000, 9320BN	U.S. Std., BNC (4)	Plastic membrane half-cell	1.0 to 5 x 10 <sup>-7</sup> M 40,100 to 0.02 ppm	0 - 40 °C	900100	900011	0.1 M CaCl <sub>2</sub> / 922006 100 ppm CaCO <sub>3</sub> / 923206	932011
Calcium (Ca <sup>2+</sup> ) ionplus Design	9720BNWP	BNC (4)	ionplus Sure-Flow Plastic membrane combination	1.0 to 5 x 10 <sup>-7</sup> M 40,100 to 0.02 ppm	0 - 40 °C	Included	900061	0.1 M CaCl <sub>2</sub> / 922006 100 ppm CaCO <sub>3</sub> / 923206	932011
Carbon Dioxide (CO <sub>2</sub> )	950200, 9502BNWP	U.S. Std., BNC (4)	Gas sensing combination	10 <sup>-2</sup> to 10 <sup>-4</sup> M 440 to 4.4 ppm	0 - 50 °C	Included	950202	0.1 M NaHCO <sub>3</sub> / 950206 1000 ppm as CaCO <sub>3</sub> / 950207	950210
Chloride (Cl <sup>-</sup> ) ionplus Design	961700, 9617BNWP	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 5 x 10 <sup>-6</sup> M 35,500 to 1.8 ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M NaCl / 941706 100 ppm Cl <sup>-</sup> / 941707 1000 ppm Cl <sup>-</sup> / 941708	940011 or 941709 / CISA
Chloride (Cl <sup>-</sup> )	941700, 9417BN, 9417SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 5 x 10 <sup>-6</sup> M 35,500 to 1.8 ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M NaCl / 941706 100 ppm Cl <sup>-</sup> / 941707 1000 ppm Cl <sup>-</sup> / 941708	940011 or 941709 / CISA
Chloride (Cl <sup>-</sup> )	931701	Sensing module (3)	Plastic membrane half-cell	1.0 to 5 x 10 <sup>-6</sup> M 35,500 to 0.18 ppm	0 - 50 °C	900200	900002 inner / 0.1 M KCl outer	0.1 M NaCl / 941706 100 ppm Cl <sup>-</sup> / 941707 1000 ppm Cl <sup>-</sup> / 941708	None required
Chloride (Cl <sub>2</sub> )	977000, 9770BNWP, 9770SC	U.S. Std., BNC (4), screw cap (2)	Solid state combination	3 x 10 <sup>-4</sup> to 10 <sup>-7</sup> M 20 to 0.01 ppm	0 - 50 °C	Included	None required	100 ppm as Cl <sub>2</sub> / 977007	977010 / iodide reagent 977011 / acid reagents
Cupric (Cu <sup>2+</sup> ) ionplus Design	962900, 9629BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow Solid state combination	0.1 to 10 <sup>-8</sup> M 6350 to 6.4 x 10 <sup>-4</sup> ppm	0 - 80 °C	Included	900063	0.1 M Cu(NO <sub>3</sub> ) <sub>2</sub> / 942906	940011
Cupric (Cu <sup>2+</sup> )	942900, 9429BN, 9629SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	0.1 to 10 <sup>-8</sup> M 6350 to 6.4 x 10 <sup>-4</sup> ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M Cu(NO <sub>3</sub> ) <sub>2</sub> / 942906	940011

# Orion ISE Electrode Specifications

Orion ISE									
Species	Catalog number	Connector number	Construction	Construction range	Optimum temperature range	Required reference catalog number	Reference filling solution catalog number	Calibration standards catalog number	Required ISA(1) catalog number
Cyanide (CN <sup>-</sup> ) ionplus Design	960600, 9606BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow® solid state combination	10 <sup>-2</sup> to 8 x 10 <sup>-6</sup> M 260 to 0.2 ppm	0 - 80 °C	Included	900062	Consult instruction manual	951011
Cyanide (CN <sup>-</sup> )	940600, 9406BN, 9406SC	U.S. Std., BNC (4), screw cap (2)	solid state combination	10 <sup>-2</sup> to 8 x 10 <sup>-6</sup> M 260 to 0.2 ppm	0 - 80 °C	Included	900062	Consult instruction manual	951011
Fluoride (F <sup>-</sup> ) ionplus Design	960900, 9609BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow® solid state combination	Saturated to 10 <sup>-6</sup> M saturated to 0.02 ppm	0 - 80 °C	Included	900061	0.1 M NaF/940906 100 ppm F <sup>-</sup> / 940907 1 ppm F <sup>-</sup> w/TISAB II / 040906 2 ppm F <sup>-</sup> w/ TISAB II / 040908	940909 / TISAB II 940911 / TISAB III
Fluoride (F <sup>-</sup> )	940900, 9409BN, 9409SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	Saturated to 10 <sup>-6</sup> M saturated to 0.02 ppm	0 - 80 °C	900100	900001	0.1 M NaF/940906 100 ppm F <sup>-</sup> / 940907 1 ppm F <sup>-</sup> w/TISAB II / 040906 2 ppm F <sup>-</sup> w/TISAB II / 040907 10 ppm F <sup>-</sup> w/TISAB II / 940908	940909 / TISAB II 940911 / TISAB III
Fluoroborate (BF <sub>4</sub> <sup>-</sup> )	930500, 9305BN	U.S. Std., BNC (4)	Plastic membrane half-cell	1.0 to 7 x 10 <sup>-6</sup> M 86,800 to 0.6 ppm	0 - 40 °C	900200	900002 inner dilute ISA outer	Consult instruction manual	930711
Iodide (I <sup>-</sup> ) ionplus Design	965300, 9653BNWP	U.S. Std., BNC (4)	ionplus Sure- Flow solid state combination	1.0 to 5 x 10 <sup>-8</sup> M 20,700 to 0.2 ppm	0 - 80 °C	Included	900063	0.1 M NaI / 945306	940011
Iodide (I <sup>-</sup> )	945300, 9453BN, 9453SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 5 x 10 <sup>-8</sup> M 127,000 to 5 x 10 <sup>-3</sup> ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M NaI / 945306	940011
Lead (Pb <sub>2</sub> <sup>+</sup> ) ionplus Design	968200, 9682BNWP	U.S. Std., BNC (4)	ionplus Sure- Flow solid state combination	0.1 to 10 <sup>-6</sup> M 20,700 to 0.2 ppm	0 - 80 °C	Included	900062	0.1 M Pb(ClO <sub>4</sub> ) <sub>2</sub> / 948206 0.1 M Na <sub>2</sub> SO <sub>4</sub> / 948207	Consult instruction manua
Lead (Pb <sub>2</sub> <sup>+</sup> )	948200, 9482BN, 9482SC	U.S. Std., BNC (4) screw cap (2)	Solid state half-cell	0.1 to 10 <sup>-6</sup> M 20,700 to 0.2 ppm	0 - 80 °C	900200	900002 inner / 900003 outer	0.1 M Pb(ClO <sub>4</sub> ) <sub>2</sub> / 948206 0.1 M Na <sub>2</sub> SO <sub>4</sub> / 948207	Consult instruction manual
Nitrate (NO <sub>3</sub> <sup>-</sup> ) ionplus Design	9707BNWP	BNC (4)	ionplus Sure- Flow plastic membrane combination	1.0 to 7 x 10 <sup>-6</sup> M 14,000 to 0.1 ppm as N	0 - 40 °C	Included	900046	0.1 M NaNO <sub>3</sub> / 920706 1000 ppm N / 920707 100 ppm N / 930707	930711 or 930710 / nitrate ISS
Nitrate (NO <sub>3</sub> <sup>-</sup> )	930700, 9307BNWP	U.S. Std., BNC (4)	Plastic membrane half-cell	1.0 to 7 x 10 <sup>-6</sup> M 14,000 to 0.1 ppm as N	0 - 40 °C	900200	900002 inner / 900046 or dilute ISA outer	0.1 M NaNO <sub>3</sub> / 920706 1000 ppm N / 920707 100 ppm N / 930707	930711 or 930710 / nitrate ISS
Nitrite (NO <sub>2</sub> <sup>-</sup> ) ionplus Design	9746BNWP	BNC (4)	ionplus Sure- Flow plastic membrane combination	1.4 x 10 <sup>-2</sup> to 3.6 x 10 <sup>-6</sup> M 100 to 0.02 ppm	0 - 40 °C	Included	900046	0.1 M NaNO <sub>2</sub> / 954606	934610
Nitrite (NO <sub>2</sub> <sup>-</sup> )	934600, 9346BN	U.S. Std., BNC (4)	Plastic membrane half-cell	1.4 x 10 <sup>-2</sup> to 3.6 x 10 <sup>-6</sup> M 100 to 0.02 ppm	0 - 40 °C	900100	900046	0.1 M NaNO <sub>2</sub> / 954606	934610
Nitrogen Oxide (NO <sub>x</sub> )	954600, 9546BN	U.S. Std., BNC (4)	Gas sensing combination	5 x 10 <sup>-3</sup> to 4 x 10 <sup>-6</sup> M 230 to 0.18 ppm	0 - 50 °C	Included	954602	0.1 M NaNO <sub>2</sub> / 954606	956410
Oxygen (O <sub>2</sub> )	970800, 9708BNWP	U.S. Std., BNC (4)	Gas sensing combination	0 to 14 ppm (nominal)	0 - 45 °C	Included	None required	None required	None required

# Orion ISE & ORP Electrode Specifications

Orion ISE									
Species	Catalog number	Connector number	Construction	Construction range	Optimum temperature range	Required reference catalog number	Reference filling solution catalog number	Calibration standards catalog number	Required ISA(1) catalog number
Perchlorate (ClO <sub>4</sub> <sup>-</sup> )	938101	Sensing module (3)	Plastic membrane half-cell	1.0 to 7 x 10 <sup>-6</sup> M 99,500 to 0.7 ppm	0 - 40 °C	900200	900002 inner / dilute ISA outer	Consult instruction manual	930711
Potassium (K <sup>+</sup> ) ionplus® Design	9719BNWP	BNC (4)	ionplus Sure-Flow® plastic membrane combination	1.0 to 10 <sup>-6</sup> M 39,000 to 0.04 ppm	0 - 40 °C	Included	900065	0.1 M KCl / 921906	931911
Potassium (K <sup>+</sup> )	931900, 9319BNWP	U.S. Std., BNC (4)	Plastic membrane half-cell	1.0 to 10 <sup>-6</sup> M 39,000 to 0.04 ppm	0 - 40 °C	900200	900002 inner / dilute ISA outer	0.1 M KCl / 921906	931911
Redox/ORP	967800, 9678BNWP	U.S. Std., BNC (4)	Epoxy Sure-Flow combination	–	0 - 80 °C	Included	900001 or 900011	967901 or 967961	None required
Redox/ORP	977800, 9778BNWP	U.S. Std., BNC (4)	Glass combination	–	0 - 75 °C	Included	900001 or 900011	967901 or 967961	None required
Redox/ORP/Temp	9179BNWP	BNC, 8 pin, DIN ATC (4)	Epoxy Triode™ Low Maintenance	–	0 - 80 °C	Included	None required	967901 or 967961	None required
Redox/ORP/Temp	9180BNWP	BNC, 8 pin, DIN ATC (4)	Epoxy refillable Triode	–	0 - 80 °C	Included	900011	967901 or 967961	None required
Silver/Sulfide (Ag <sup>+</sup> /S <sub>2</sub> <sup>-</sup> ) ionplus Design	961600, 9616BNWP	U.S. Std., BNC (4)	ionplus Sure-Flow solid state combination	1.0 to 10 <sup>-7</sup> M 107,900 to 0.01 ppm as Ag <sup>+</sup> ; 32,100 to 0.003 ppm as S <sub>2</sub> <sup>-</sup>	0 - 80 °C	Included	900062 or 900067 for Ag <sup>+</sup> or 900061 for S <sub>2</sub> <sup>-</sup>	Consult instruction manual	940011 for Ag <sup>+</sup> 941609 for S <sub>2</sub> <sup>-</sup>
Double/Platinum (KF)	977900	Double pin tip	Glass	Endpoint indicator	0 - 40 °C	None required	None required	None required	None required
Silver/Sulfide (Ag <sup>+</sup> /S <sub>2</sub> <sup>-</sup> )	941600, 9416BN, 9416SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 10 <sup>-7</sup> M 107,900 to 0.01 ppm as Ag <sup>+</sup> ; 32,100 to 0.003 ppm as S <sub>2</sub> <sup>-</sup>	0 - 80 °C	900200	900002 inner / 900003 outer	Consult instruction manual	940011 for Ag <sup>+</sup> 941609 for S <sub>2</sub> <sup>-</sup>
Silver Billet	9780SC	Screw cap (2)	Silver combination	Endpoint indicator	0 - 80 °C	Included	900011	Call Thermo for information	None required
Silver Billet	9781SC	Screw cap (2)	Silver half-cell	Endpoint indicator	0 - 80 °C	900200	900002 inner / 900003 outer	Call Thermo for information	None required
Sodium (Na <sup>+</sup> )	8411BNWP	BNC (4)	ROSS® half-cell	Saturated to 10 <sup>-6</sup> M saturated to 0.02 ppm	0 - 100 °C	800500 800300, or 800500U	900010 or 900012 for low level Na <sup>+</sup>	10 ppm Na <sup>+</sup> / 941105 100 ppm Na <sup>+</sup> / 941107 1000 ppm Na <sup>+</sup> / 841108 KA Std KA Kit, 1 M NaCl / 650700 0.1 M NaCl / 941706	841111 / 841113 / recondition solution
Sodium (Na <sup>+</sup> )	8611BNWP	BNC (4)	ROSS Sure-Flow combination	Saturated to 10 <sup>-6</sup> M saturated to 0.02 ppm	0-100 °C	Included	900010 or 900012 for low level Na <sup>+</sup>	10 ppm Na <sup>+</sup> / 941105 100 ppm Na <sup>+</sup> / 941107 1000 ppm Na <sup>+</sup> / 841108 KA Std, KA Kit, 1 M NaCl / 650700 0.1 M NaCl / 941706	841111
Surfactant	9342BN	BNC (4)	Plastic membrane half-cell	Endpoint indicator	0 - 40 °C	900200	900002 inner / 810007 outer	0.5 M Hyamine titrant 654201	654203 / sample additive
Thiocyanate (SCN <sup>-</sup> )	945800, 9458BN, 9458SC	U.S. Std., BNC (4), screw cap (2)	Solid state half-cell	1.0 to 5 x 10 <sup>-6</sup> M 58,100 to 0.29 ppm	0 - 50 °C	900200	900002 inner / 900003 outer	Consult instruction manual	940011
Water Hardness (X <sup>2+</sup> )	933200, 9332BN	U.S. Std., BNC (4)	Plastic membrane half-cell	1.0 to 6 x 10 <sup>-6</sup> M	0 - 50 °C	900100	900011	100 ppm CaCO <sub>3</sub> / 923206 0.1 M CaCl <sub>2</sub> / 922006	None required

## Key

- (2) Screw cap connector requires separate cable
- (3) Sensing modules require 93 Series electrode handle
- (4) U.S. Std. and BNC electrodes have 1 m cables

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