

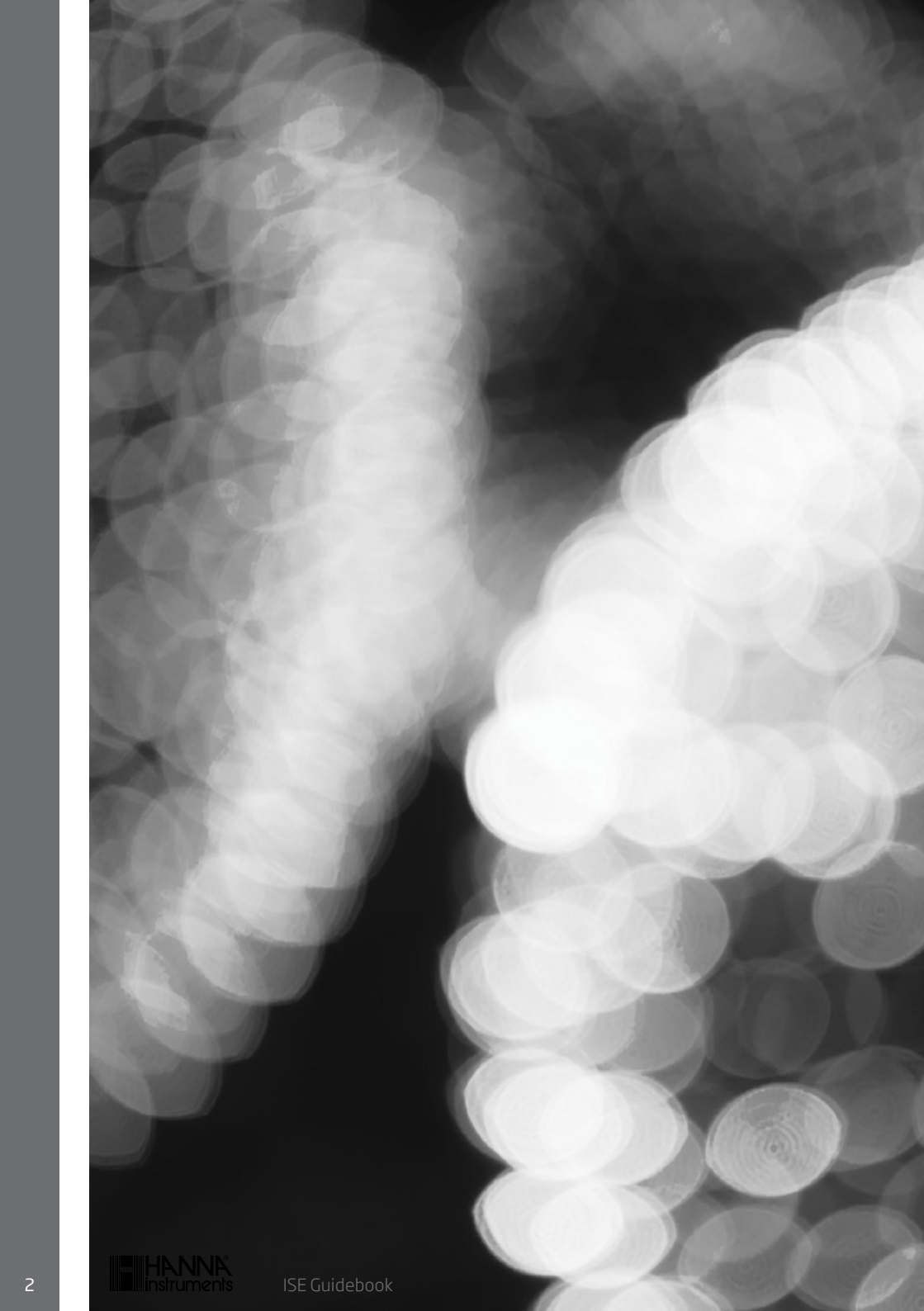


ISE Guidebook

A guide for choosing an
Ion Selective Electrode

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Ion Selective Electrodes

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Three methods of analysis

Potentiometric ion analyses with ion-selective electrodes (ISEs) are performed by use of one of three methods, each entailing its own advantages: direct potentiometry, incremental methods, and potentiometric titration. Hanna offers a solution for each of these methods.

Direct potentiometry

Direct potentiometry is a widely used method of performing ion analysis with ISEs. This method is highly effective when the user must quickly measure large batches of samples at varying concentrations. Our direct reading meters, such as the HI98191, display concentration of the unknown sample by a direct reading after calibration of the instrument with two or more standards; ionic strength adjustments are made to both samples and standards. In some applications, quick and reliable measurements can be made on-site without taking samples back to the laboratory.

Incremental methods

Incremental methods are useful techniques used to determine ion concentration in samples whose constituents are variable or concentrated. Incremental methods have some inherent advantages over direct potentiometry. The techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing sample carry over and possible liquid junction changes in the reference. Known addition, known subtraction, analyte addition, and analyte subtraction methods are four of these incremental techniques. All four techniques involve adding a standard to the sample, or sample to the standard; the meter then calculates the ion concentration of the sample.

Potentiometric titration

A potentiometric titration can increase the precision of ISE measurements and also the number of ionic species that can be determined. ISEs are commonly used as indicators for the titrant or sample species to follow the progress of a precipitation or complexometric titration. A small change in reactant addition corresponds to a large change in electrode potential at the stoichiometric endpoint. An example of a precipitation titration is the determination of chloride using silver nitrate. A silver ISE can be used to follow this titration. A complexometric titration is used for the determination of calcium. A calcium solution is titrated with the complexing agent, EDTA. During the titration there is a gradual decrease in the free Ca^{2+} ion concentration as more EDTA is added. The endpoint corresponds to the point at which all of the Ca^{2+} is complexed. The progress of this titration can be monitored using a calcium ISE.



Ion selective electrode types

Hanna's ISEs can be grouped into three general categories based upon construction.

Solid-state

Solid-state electrodes are available as both single half-cells or as combination electrodes complete with reference electrode. These electrodes incorporate a solid sensing surface made of compressed silver halides or solid crystalline material. Hanna's offering includes sensors for the determination of bromide, cadmium, chloride, cupric, cyanide, fluoride, iodide, lead and silver ions. Rugged, solid body construction ensures a long life.

Theory: A solid-state electrode develops a voltage due to ion-exchange occurring between the sample and the inorganic membrane. An equilibrium mechanism occurs due to the very limited solubility of the membrane material in the sample.

Liquid membrane

Liquid membrane electrodes are available as single half-cells or as combination electrodes complete with reference electrode. The sensing surfaces of these electrodes are comprised of a homogeneous polymer matrix containing organic ion exchangers that are selective for the determined ion. These sensors incorporate easily replaceable membrane modules and are available for measurements of nitrate, potassium and calcium.

Theory: The potassium electrode was one of the earliest liquid membrane sensors developed. The membrane is usually in the form of a thin disc of PVC impregnated with the antibiotic valinomycin. The exchanger, also known as an ionophore, is a ring structure that fits potassium ions inside, functioning as a lock and key mechanism. This type of membrane is not as rugged as the solid-state type so they are designed for easy replacement of the sensing module.

Gas membrane

Gas sensors are combination electrodes that detect dissolved gases in a solution. No external reference is required for these electrodes. The sensing element is separated from the sample solution by a gas permeable membrane. Hanna's offering of gas membrane ISEs include ammonia and carbon dioxide.

Theory: A gas sensor works due to the partial pressure of the measured gas in solution. The dissolved gas in the sample diffuses into the membrane and changes the pH in a thin film of unbuffered electrolyte on the surface of the internal pH sensor. Diffusion continues until the partial pressure of the sample and the thin film of electrolyte are the same. The pH change is proportional to the dissolved gas in the sample.



Reference and combination electrodes

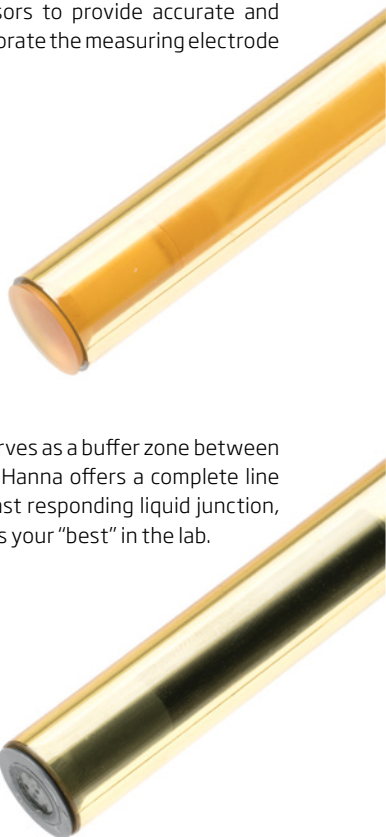
Hanna's reference electrode is used with our half-cell ISE sensors to provide accurate and repeatable measurements. Hanna's combination electrodes incorporate the measuring electrode with the reference, making them ideal for field measurements.

Reference

Reference electrodes are used to provide a stable voltage and electrolytic contact to measure a voltage gradient across a measurement membrane. Hanna has designed an easy to use, durable, double junction, quick-fill, sleeve-style reference electrode with a cone style junction to work with the ISE family of sensors. The design forms the liquid junction with the test solution at the tip of the junction cone, producing a highly stable reference electrode with reasonable, low flow rates. The model HI5315 is a silver/silver chloride half-cell with a permanent gel-filled internal cell. The outer fill solution is easily replaceable and serves as a buffer zone between the internal chloride ion-containing gel and the sample solution. Hanna offers a complete line of silver-free fill solutions to optimize your ion measurement. A fast responding liquid junction, excellent reproducibility, and ease of use will mark this reference as your "best" in the lab.

Combination

Combination electrodes include a sensor and reference electrode within one electrode body. Our combination ISEs provide the same selectivity and response as our ISE half-cells, but include our superior double junction reference in the same electrode body. Combination solid-state electrodes have a built-in solid-state sensor and quick refillable reference electrode. Our liquid membrane and fluoride combination electrodes have replaceable module construction and the Hanna double junction reference stability.



ISE standards

Code	Description
HI4001-01	0.1 M ammonia standard, 500 mL
HI4001-02	100 mg/L (ppm) ammonia standard (as $\text{NH}_3^- \text{N}$), 500 mL
HI4001-03	1000 mg/L (ppm) ammonia standard (as $\text{NH}_3^- \text{N}$), 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4001-00	alkaline ISA for ammonia and cyanide ISEs, 500 mL

Gas sensor fill solutions

Code	Description
HI4001-40	ammonia filling solution, 30 mL (4)

Specific solutions for ISE sensors

Code	Description
HI4000-47	pH 4 and pH 7 buffers with chloride ions background, used to check internal glass electrode of gas sensors, 10 packages each and 2 beakers
HI4001-45	conditioning and storage solution for HI4101 ammonia ISE, 500 mL

Accessories

Code	Description
HI4000-51	gas sensor replacement pH for ammonia sensor
HI4000-52	gas sensor membrane cap for ammonia
HI4001-51	ammonia membrane kit (20 loose)



Ammonia ISE

Parameter	HI4101
Type	gas-sensing; combination
Measurement Range	1M to $1 \cdot 10^{-6}$ M 17000 to 0.02 mg/L (ppm) 14000 to 0.016 mg/L as N
Optimum pH Range	>11
Temperature Range	0 to 40°C
Approximate Slope	-56
Body O.D.	12 mm
Insertion Length	120 mm
Body Material	Delrin®
Possible Applications	determination of ammonium, ammonia in wine, beer, water, waste water and soil
Ordering Information	HI4101 combination ISE with 1 m coaxial cable and BNC connector



Bromide ISEs

Parameter	HI4002	HI4102
Type	solid-state; half-cell	solid-state; combination
Measurement Range	1M to $1 \cdot 10^{-6}$ M 79910 to 0.08 mg/L (ppm)	1M to $1 \cdot 10^{-6}$ M 79910 to 0.08 mg/L (ppm)
Optimum pH Range	2 to 12.5	2 to 12.5
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	plants, soils, and as an indicator for titration	
Ordering Information	HI4002 half-cell ISE with 1 m coaxial cable and BNC connector	HI4102 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4002-01	0.1 M bromide standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)

ISE standards

Code	Description
HI4003-01	0.1 M cadmium standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)



Cadmium ISEs

Parameter	HI4003	HI4103
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.1M to $1 \cdot 10^{-7}$ M 11200 to 0.01 mg/L (ppm)	0.1M to $1 \cdot 10^{-7}$ M 11200 to 0.01 mg/L (ppm)
Optimum pH Range	2 to 12	2 to 12
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	+28	+28
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	electroplating, battery construction, laboratory and as an indicator for titrations	
Ordering Information	HI4003 half-cell ISE with 1 m coaxial cable and BNC connector	HI4103 combination ISE with 1 m coaxial cable and BNC connector



Calcium ISEs

Parameter	HI4004	HI4104
Type	polymer membrane; half-cell	polymer membrane; combination
Measurement Range	1M to $3 \cdot 10^{-6}$ M 40080 to 0.12 mg/L (ppm)	1M to $3 \cdot 10^{-6}$ M 40080 to 0.12 mg/L (ppm)
Optimum pH Range	4 to 10	4 to 10
Temperature Range	0 to 40°C	0 to 40°C
Approximate Slope	+28	+28
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy/PVC	PEI/PVC
Possible Applications	determination of free calcium in beverages, water, and seawater	
Ordering Information	HI4004 half-cell ISE with 1 m coaxial cable and BNC connector	HI4104 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4004-01	0.1 M calcium standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4004-00	ISA for calcium ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7082	electrolyte solution, 3.5 M KCl, 30 mL (4)

Specific solutions for ISE sensors

Code	Description
HI4004-45	conditioning and storage solution for HI4004 and HI4104 calcium ISEs

Accessories

Code	Description
HI4004-51	calcium module for HI4004 half-cell ISE
HI4104-51	calcium module for HI4104 combination ISE

ISE standards

Code	Description
HI4005-01	0.1 M carbon dioxide standard, 500 mL
HI4005-03	1000 mg/L (ppm) carbon dioxide standard (as CaCO ₃), 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4005-00	ISA for carbon dioxide ISEs, 500 mL

Gas sensor fill solutions

Code	Description
HI4005-40	carbon dioxide filling solution, 30 mL (4)

Specific solutions for ISE sensors

Code	Description
HI4000-47	pH 4 and pH 7 buffers with chloride ions background, used to check internal glass electrode of gas sensors, 10 packages each and 2 beakers
HI4005-45	conditioning and storage solution for HI4105 carbon dioxide ISE

Accessories

Code	Description
HI4000-54	gas sensor replacement pH for carbon dioxide ISE
HI4005-53	carbon dioxide membrane kit (3 caps)



Carbon Dioxide ISE

Parameter	HI4105
Type	gas-sensing; combination
Measurement Range	1•10 ⁻² M to 1•10 ⁻⁴ M 440 to 4.4 mg/L (ppm)
Optimum pH Range	4.2 to 5.2
Temperature Range	0 to 40°C
Approximate Slope	+54
Body O.D.	12 mm
Insertion Length	120 mm
Body Material	Delrin®
Possible Applications	determination of carbonates as CO ₂ in water, soft drinks and wine samples
Ordering Information	HI4105 combination ISE with 1 m coaxial cable and BNC connector



Chloride ISEs

Parameter	HI4007	HI4107
Type	solid-state; half-cell	solid-state; combination
Measurement Range	1M to $5 \cdot 10^{-5}$ M 35500 to 1.8 mg/L (ppm)	1M to $5 \cdot 10^{-5}$ M 35500 to 1.8 mg/L (ppm)
Optimum pH Range	2 to 11	2 to 11
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	determination of free chloride ions in emulsified food products, beverages, plants, soils and as an indicator for titration	
Ordering Information	HI4007 half-cell ISE with 1 m coaxial cable and BNC connector	HI4107 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4007-01	0.1 M chloride standard, 500 mL
HI4007-02	100 mg/L (ppm) chloride standard, 500 mL
HI4007-03	1000 mg/L (ppm) chloride standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)

ISE standards

Code	Description
HI4008-01	0.1 M cupric standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)



Cupric ISEs

Parameter	HI4008	HI4108
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.1M to $1 \cdot 10^{-6}$ M 6355 to 0.06 mg/L (ppm)	0.1M to $1 \cdot 10^{-6}$ M 6355 to 0.06 mg/L (ppm)
Optimum pH Range	3 to 7	3 to 7
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	+27	+27
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	used as an indicator for titrations using chelates	
Ordering Information	HI4008 half-cell ISE with 1 m coaxial cable and BNC connector	HI4108 combination ISE with 1 m coaxial cable and BNC connector



Cyanide ISEs

Parameter	HI4009	HI4109
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.01M to $1 \cdot 10^{-6}$ M 260 to 0.02 mg/L (ppm)	0.01M to $1 \cdot 10^{-6}$ M 260 to 0.02 mg/L (ppm)
Optimum pH Range	>11	>11
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	determination of free cyanide ions in plating baths, waste water and in plant and soil samples	
Ordering Information	HI4009 half-cell ISE with 1 m coaxial cable and BNC connector	HI4109 combination ISE with 1 m coaxial cable and BNC connector

Ionic Strength Adjusters (ISA)

Code	Description
HI4001-00	0.1 M ammonia standard, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)

ISE Standards

Code	Description
HI4010-01	0.1 M fluoride standard , 500 mL
HI4010-02	100 mg/L (ppm) fluoride standard, 500 mL
HI4010-03	1000 mg/L (ppm) fluoride standard, 500 mL
HI4010-11	1 mg/L (ppm) fluoride standard premixed with TISAB II, 500 mL
HI4010-12	2 mg/L (ppm) fluoride standard premixed with TISAB II, 500 mL
HI4010-10	10 mg/L (ppm) fluoride standard premixed with TISAB II, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4010-00	TISAB II for fluoride ISEs, 500 mL
HI4010-05	TISAB II for fluoride ISEs, 1 Gal
HI4010-06	TISAB III concentrate for fluoride ISEs, 500 mL
HI4010-30	kit containing 4 bottles each of: HI4010-10, HI4010-11 and HI4010-00

Accessories

Code	Description
HI4110-51	fluoride module for HI4110 combination ISE



Fluoride ISEs

Parameter	HI4010	HI4110
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.01M to $1 \cdot 10^{-6}$ M 260 to 0.02 mg/L (ppm)	0.01M to $1 \cdot 10^{-6}$ M 260 to 0.02 mg/L (ppm)
Optimum pH Range	5 to 8	5 to 8
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI/epoxy
Possible Applications	determination of free fluoride in potable water, soft drinks, wine, plants, emulsified food products, plating and pickling acids	
Ordering Information	HI4010 half-cell ISE with 1 m coaxial cable and BNC connector	HI4110 combination ISE with 1 m coaxial cable and BNC connector



Iodide ISEs

Parameter	HI4011	HI4111
Type	solid-state; half-cell	solid-state; combination
Measurement Range	1M to $1 \cdot 10^{-7}$ M 127000 to 0.01 mg/L (ppm)	1M to $1 \cdot 10^{-7}$ M 127000 to 0.01 mg/L (ppm)
Optimum pH Range	2 to 13	2 to 13
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	determination of free iodide ions in emulsified food samples (iodized table salt), plants and for titration	
Ordering Information	HI4011 half-cell ISE with 1 m coaxial cable and BNC connector	HI4111 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4011-01	0.1 M iodide standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)

ISE standards

Code	Description
HI4012-01	0.1 M lead standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4012-00	ISA for lead/sulfate ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)



Lead/Sulfate ISEs

Parameter	HI4012	HI4112
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.1M to $1 \cdot 10^{-6}$ M; 20700 to 0.21 mg/L (ppm)	0.1M to $1 \cdot 10^{-6}$ M; 20700 to 0.21 mg/L (ppm)
Optimum pH Range	4 to 7	4 to 7
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	+27	+27
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	determination of lead ions in plating baths and as an indicator for titrations	
Ordering Information	HI4012 half-cell ISE with 1 m coaxial cable and BNC connector	HI4112 combination ISE with 1 m coaxial cable and BNC connector



Nitrate ISEs

Parameter	HI4013	HI4113
Type	polymer membrane; half-cell	polymer membrane; combination
Measurement Range	1.0M to $1 \cdot 10^{-5}$ M 6200 to 0.62 mg/L (ppm) 1400 to 0.4 mg/L (ppm) as N	1.0M to $1 \cdot 10^{-5}$ M 6200 to 0.62 mg/L (ppm) 1400 to 0.4 mg/L (ppm) as N
Optimum pH Range	3.0 to 8	3.0 to 8
Temperature Range	0 to 40°C	0 to 40°C
Approximate Slope	-56	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy/PVC	PEI/PVC
Possible Applications	determination of lead ions in plating baths and as an indicator for titrations	
Ordering Information	HI4013 half-cell ISE with 1 m coaxial cable and BNC connector	HI4113 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4013-01	0.1 M nitrate standard, 500 mL
HI4013-02	100 mg/L (ppm) nitrate standard (as N), 500 mL
HI4013-03	1000 mg/L (ppm) nitrate standard (as N), 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4013-00	ISA for nitrate ISEs, 500 mL
HI4013-06	nitrate interferent suppressant ISA, 500 mL

Silver-free reference fill solutions

Code	Description
HI7078	electrolyte solution, $(\text{NH}_4)_2\text{SO}_4$, 30 mL (4)

Accessories

Code	Description
HI4013-53	nitrate module for HI 4013 half-cell ISE (3 pack)
HI4113-53	nitrate module for HI 4113 combination ISE (3 pack)

ISE standards

Code	Description
HI4014-01	0.1 M potassium standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4014-00	ISA for potassium ISEs, 500 mL

Silver-free reference fill solutions

Code	Description
HI7076	electrolyte solution, 1 M NaCl, 30 mL (4)

Accessories

Code	Description
HI4014-51	potassium module for HI4014 half-cell ISE
HI4114-51	potassium module for combination ISE



Potassium ISEs

Parameter	HI4014	HI4114
Type	polymer membrane; half-cell	polymer membrane; combination
Measurement Range	1.0M to $1 \cdot 10^{-6}$ M 39100 to 0.039 mg/L (ppm)	1.0M to $1 \cdot 10^{-6}$ M 39100 to 0.039 mg/L (ppm)
Optimum pH Range	1.5 to 12.0	1.5 to 12.0
Temperature Range	0 to 40°C	0 to 40°C
Approximate Slope	+56	+56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy/PVC	PEI/PVC
Possible Applications	determination of potassium ions in wine, waters, soils and biological samples	
Ordering Information	HI4014 half-cell ISE with 1 m coaxial cable and BNC connector	HI4114 combination ISE with 1 m coaxial cable and BNC connector



Silver/Sulfide ISEs

Parameter	HI4015	HI4115
Type	solid-state; half-cell	solid-state; combination
Measurement Range	1.0M to $1 \cdot 10^{-6}$ M 107900 to 0.11ppm (Ag^+) 1.0M to $1 \cdot 10^{-7}$ M 32100 to 0.003 ppm (S^{2-})	1.0M to $1 \cdot 10^{-6}$ M 107900 to 0.11ppm (Ag^+) 1.0M to $1 \cdot 10^{-7}$ M 32100 to 0.003 ppm (S^{2-})
Optimum pH Range	2 to 8 (Ag^+) 12 to 14 (S^{2-})	2 to 8 (Ag^+) 12 to 14 (S^{2-})
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	+56 (Ag^+) / -28 (S^{2-})	+56 (Ag^+) / -28 (S^{2-})
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	PEI
Possible Applications	used as an indicator for titrations using silver nitrate; for the determination of sulfide ions in waters, paper liquors, natural waters and soils.	
Ordering Information	HI4015 half-cell ISE with 1 m coaxial cable and BNC connector	HI4115 combination ISE with 1 m coaxial cable and BNC connector

ISE standards

Code	Description
HI4015-01	0.1 M silver standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4000-00	ISA for halide ISEs, 500 mL
HI4015-00	SAOB (sulfide antioxidant buffer), 500 mL + 18 g (2 components)

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)

Accessories

Code	Description
HI4000-70	halide polishing strips (24)

ISE standards

Code	Description
HI4016-01	0.1 M sodium standard, 500 mL
HI4016-02	100 ppm sodium standard, 500 mL
HI4016-03	1000 ppm sodium standard, 500 mL

Ionic Strength Adjusters (ISA)

Code	Description
HI4016-00	ISA for sodium ISEs, 500 mL

Reference fill solutions containing silver chloride (AgCl)

Code	Description
HI7079	2M NH ₄ Cl sat. with AgCl electrolyte for sodium ISEs (contains AgCl), 30 mL (4)

Other solutions

Code	Description
HI4016-10	10 ppm sodium standard, 500 mL
HI4016-45	storage solution for sodium ISE, 500 mL
HI4016-46	conditioning solution for sodium ISE, 500 mL



Sodium ISE

Parameter	FC300B
Type	glass combination
Measurement Range	1M to $1 \cdot 10^{-5}$ M 22990 to 0.23 ppm
Optimum pH Range	9.75 to 14 pH
Temperature Range	0 to 80°C
Approximate Slope	+57
Body O.D.	12 mm
Insertion Length	120 mm
Body Material	glass
Possible Applications	water, soil, food products, soup, dairy, brines, soft drinks, beer, wine and laboratory
Ordering Information	FC300B combination ISE with 1 m coaxial cable and BNC connector



Reference Electrode for ISEs

Parameter	HI5315
Type	N/A
Measurement Range	N/A
Optimum pH Range	N/A
Temperature Range	0 to 85°C
Approximate Slope	N/A
Body O.D.	12 mm
Insertion Length	120 mm
Body Material	PEI
Possible Applications	used to complete electrical circuit and to provide stable reference voltage for ISE half-cells
Ordering Information	HI5315 reference electrode with 1 m coaxial cable and BNC connector

Silver-free reference fill solutions

Code	Description
HI7072	electrolyte solution, 1 M KNO_3 , 30 mL (4)
HI7075	electrolyte solution with KNO_3 and KCl , 30 mL (4)
HI7076	electrolyte solution, 1 M NaCl , 30 mL (4)
HI7078	electrolyte solution, $(\text{NH}_4)_2\text{SO}_4$, 30 mL (4)
HI7082	electrolyte solution, 3.5 M KCl , 30 mL (4)



HI7072



HI7082

ISE standards

Our wide selection of Hanna ISE standards are made and bottled in our own state-of-the-art solutions facility. ISE Standards are required for direct and incremental measurement techniques and are available with certificate of analysis.

Code	Description	Size
HI4001-01	0.1 M ammonia standard	500 mL
HI4001-02	100 mg/L (ppm) ammonia standard (as $\text{NH}_3\text{-N}$)	500 mL
HI4001-03	1000 mg/L (ppm) ammonia standard (as $\text{NH}_3\text{-N}$)	500 mL
HI4002-01	0.1 M bromide standard	500 mL
HI4003-01	0.1 M cadmium standard	500 mL
HI4004-01	0.1 M calcium standard	500 mL
HI4005-01	0.1 M carbon dioxide standard	500 mL
HI4005-03	1000 mg/L (ppm) carbon dioxide standard (as CaCO_3)	500 mL
HI4007-01	0.1 M chloride standard	500 mL
HI4007-02	100 mg/L (ppm) chloride standard	500 mL
HI4007-03	1000 mg/L (ppm) chloride standard	500 mL
HI4008-01	0.1 M cupric standard	500 mL
HI4010-01	0.1 M fluoride standard	500 mL
HI4010-02	100 mg/L (ppm) fluoride standard	500 mL
HI4010-03	1000 mg/L (ppm) fluoride standard	500 mL
HI4010-10	10 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-11	1 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-12	2 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-30	kit: HI4010-10, HI4010-11 and HI4010-00	500 mL (3 x 4)
HI4011-01	0.1 M iodide standard	500 mL
HI4012-01	0.1 M lead standard	500 mL

Code	Description	Size
HI4012-21	0.1 M sulfate standard	500 mL
HI4013-01	0.1 M nitrate standard	500 mL
HI4013-02	100 mg/L (ppm) nitrate standard (as N)	500 mL
HI4013-03	1000 mg/L (ppm) nitrate standard (as N)	500 mL
HI4014-01	0.1 M potassium standard	500 mL
HI4015-01	0.1 M silver standard	500 mL
HI4016-01	0.1 M sodium standard	500 mL
HI4016-02	100 ppm sodium standard	500 mL
HI4016-03	1000 ppm sodium standard	500 mL
HI4016-10	10 ppm sodium standard	500 mL



Specific solutions for ISE sensors

Code	Description	Size
HI4000-47	pH 4 and pH 7 buffers with chloride ions background, used to check internal glass electrode of gas sensors	10 each and 2 beakers
HI4001-45	conditioning and storage solution for HI4101 ammonia ISE	500 mL
HI4004-45	conditioning and storage solution for HI4004 and HI4104 calcium ISEs	500 mL
HI4005-45	conditioning and storage solution for HI4105 carbon dioxide ISE	500 mL
HI4016-45	storage solution for sodium ISE	500 mL
HI4016-46	conditioning solution for sodium ISE	500 mL

Gas sensor fill solutions

Code	Description	Size
HI4001-40	ammonia filling solution	30 mL bottles (4)
HI4005-40	carbon dioxide filling solution	30 mL bottles (4)



HI4001-40

Silver-free reference fill solutions

Recommended for our combination ISE electrodes and the Hanna HI5315 reference electrode. Reference electrodes should be topped off daily with the correct filling solution for optimum measurement performance. These solutions are silver-free to eliminate silver precipitates found with standard electrolytes.

Code	Description	Size
HI7072	electrolyte solution, 1 M KNO_3	30 mL bottles (4)
HI7075	electrolyte solution with KNO_3 and KCl	30 mL bottles (4)
HI7076	electrolyte solution, 1 M NaCl	30 mL bottles (4)
HI7078	electrolyte solution, $(\text{NH}_4)_2\text{SO}_4$	30 mL bottles (4)
HI7082	electrolyte solution, 3.5 M KCl	30 mL bottles (4)



HI7072

Reference fill solutions containing silver chloride (AgCl)

Code	Description	Size
HI7079	2M NH_4Cl sat. with AgCl electrolyte for sodium ISEs (contains AgCl)	30 mL bottles (4)

Sodium (Na⁺) ISE standard solutions

The sodium standard solutions are used for the calibration of the sodium ISE. They are also available in opaque bottles that meet the FDA (Food & Drug Administration) specifications.

Code	Description	Package	Code	Description	Package
HI7080L	2.3 g/L sodium standard solution	500 mL bottle	HI7087M	0.23 g/L sodium standard solution	230 mL bottle
HI7080M	2.3 g/L sodium standard solution	230 mL bottle	HI8080L	2.3 g/L sodium standard solution	500 mL FDA bottle
HI7086L	23 g/L sodium standard solution	500 mL bottle	HI8086L	23 g/L sodium standard solution	500 mL FDA bottle
HI7086M	23 g/L sodium standard solution	230 mL bottle	HI8087L	0.23 g/L sodium standard solution	500 mL FDA bottle
HI7087L	0.23 g/L sodium standard solution	500 mL bottle			

Sodium chloride (NaCl) standard solutions

These sodium chloride standard solutions are used for calibration of the sodium ISE. They are also available in opaque bottles that meet the FDA (Food & Drug Administration) specifications.

Code	Description	Package	Code	Description	Package
HI7081L	standard solution at 30 g/L sodium chloride	500 mL bottle	HI7088M	standard solution at 5.84 g/L sodium chloride	230 mL bottle
HI7081M	standard solution at 30 g/L sodium chloride	230 mL bottle	HI7089L	standard solution at 125 g/L sodium chloride	500 mL bottle
HI7083L	standard solution at 3.0 g/L sodium chloride	500 mL bottle	HI7089M	standard solution at 125 g/L sodium chloride	230 mL bottle
HI7083M	standard solution at 3.0 g/L sodium chloride	230 mL bottle	HI7090L	ISA solution for sodium ISE	500 mL bottle
HI7084L	standard solution at 58.4 g/L sodium chloride	500 mL bottle	HI7090M	ISA solution for sodium ISE	230 mL bottle
HI7084M	standard solution at 58.4 g/L sodium chloride	230 mL bottle	HI8084L	standard solution at 58.4 g/L sodium chloride	500 mL FDA bottle
HI7085L	standard solution at 0.3 g/L sodium chloride	500 mL bottle	HI8088L	standard solution at 5.84 g/L sodium chloride	500 mL FDA bottle
HI7085M	standard solution at 0.3 g/L sodium chloride	230 mL bottle	HI8089L	standard solution at 125 g/L sodium chloride	500 mL FDA bottle
HI7088L	standard solution at 5.84 g/L sodium chloride	500 mL bottle	HI8095L	standard solution at 146 g/L sodium chloride	500 mL FDA bottle

Fluoride standard solutions

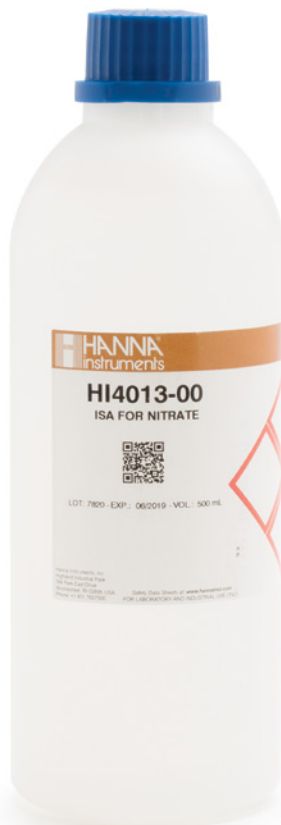
Fluoride standard solutions are used to calibrate all instruments that measure fluoride using a fluoride ISE.

Code	Description	Bottle
HI7023/1L	TISAB Solution	1 L
HI7023L	TISAB Solution	500 mL
HI7023M	TISAB Solution	230 mL
HI70701/1L	standard solution at 1 g/L F ⁻	1 L
HI70701L	standard solution at 1 g/L F ⁻	500 mL
HI70701M	standard solution at 1 g/L F ⁻	230 mL
HI70702/1L	standard solution at 10 mg/L F ⁻	1 L
HI70702L	standard solution at 10 mg/L F ⁻	500 mL
HI70702M	standard solution at 10 mg/L F ⁻	230 mL
HI70703/1L	standard solution at 100 mg/L F ⁻	1 L
HI70703L	standard solution at 100 mg/L F ⁻	500 mL
HI70703M	standard solution at 100 mg/L F ⁻	230 mL

Ionic Strength Adjusters (ISA)

Hanna Ionic Strength Adjusters (ISA) are formulated to provide a constant ionic strength in sample and standards alike, thus permitting concentration rather than activity measurements. In some cases ISAs adjust pH and eliminate matrix effects.

Code	Description	Size
HI4000-00	ISA for halide ISEs	500 mL
HI4001-00	alkaline ISA for ammonia and cyanide ISEs	500 mL
HI4004-00	ISA for calcium ISEs	500 mL
HI4005-00	ISA for carbon dioxide ISEs	500 mL
HI4010-00	TISAB II for fluoride ISEs	500 mL
HI4010-05	TISAB II for fluoride ISEs	1 gallon
HI4010-06	TISAB III concentrate for fluoride ISEs	500 mL
HI4012-00	ISA for lead/sulfate ISEs	100 mL (5)
HI4013-00	ISA for nitrate ISEs	500 mL
HI4013-06	nitrate interferent suppressant ISA	500 mL
HI4014-00	ISA for potassium ISEs	500 mL
HI4015-00	SAOB (sulfide antioxidant buffer)	500 mL + 18 g (2 components)
HI4016-00	ISA for sodium ISEs	500 mL



HI4013-00

Accessories

HI4000-50	liquid membrane sensor handle
HI4000-51	gas sensor replacement pH for ammonia sensor
HI4000-52	gas sensor membrane cap for ammonia
HI4000-54	gas sensor replacement pH for carbon dioxide ISE
HI4000-70	halide polishing strips (24)
HI4001-51	ammonia membrane kit (20 loose)
HI4004-51	calcium module for HI4004 half-cell ISE
HI4104-51	calcium module for HI4104 combination ISE
HI4005-53	carbon dioxide membrane kit (3 caps)
HI4110-51	fluoride module for HI4110 combination ISE
HI4013-53	nitrate module for HI4013 half-cell ISE (3 pack)
HI4113-53	nitrate module for HI4113 combination ISE (3 pack)
HI4014-51	potassium module for HI4014 half-cell ISE
HI4114-51	potassium module for combination ISE
HI740155P	capillary pipettes (20 pcs)
HI740159	plastic tweezers



HI4000-50



HI4000-51



HI4000-52



HI4000-70



HI4104-51



HI4001-51



HI4110-51



HI4013-53



Automatic Potentiometric (pH/mV/ISE) Titration System

The HI902C is an automatic titrator that complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI902C potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations, as well as back titrations and titre determinations. This powerful titrator automatically dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphing. In addition to titration, the HI902C also operates as a fully functional pH, mV/ORP, and ion selective electrode (ISE) meter.

Titration capabilities

Dynamic titrant dosing

- The dynamic dosing feature allows for timely and accurate titration results by relating the titrant volume dosed to the mV response from the titration reaction. This provides for larger doses near the beginning of a titration and smaller, more precise doses near the titration endpoint.

Equivalence endpoint detection

- Equivalence endpoint detection is critical in applications where fixed endpoints are not specified in standard methods. This endpoint indicates where the mV response from the titration is greatest with respect to the volume of titrant dosed.

Signal stability timing

- The signal stability feature monitors when the mV response of the titration reaction stabilizes before providing the next titrant dose. This ensures reliable measurement values throughout the length of a titration.

Multiple equivalence point detection

- The HI902C can detect multiple equivalence points during one titration as specified and required in certain standard methods and applications.

Method sequencing

- The HI902C offers users the option of linking two methods. This allows for two analyses to be run on the same sample including direct measurements, single endpoint titrations, multiple equivalence point titrations, and back titrations.

Multiple titration types

- Paired with the right electrode from our sensor line, our potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations, as well as back titrations and titre determinations.

Direct measurement functionality

- The HI902C performs as a high accuracy pH, ORP, and ion selective meter that can link, log, and report direct measurements. Users can easily track and manage data without the hassle of manual record keeping.

Burettes & dosing system

Exchangeable burette

- SystemWith Hanna's Clip-Lock™ burette feature, it only takes a few seconds to exchange titrants and reagents preventing cross-contamination and saving time.

Multiple burette sizes

- The HI902C comes standard with a 25 mL burette but may be equipped with a 5 mL, 10 mL, or 50 mL burette. Each burette is constructed with a ground glass syringe and chemically resistant PTFE plunger.

Precision dosing pump

- Our unmatched 40,000 step piston driven pump is capable of dosing extremely small and highly accurate volumes of titrant or reagent.

Automatic reagent addition

- A second burette may be programmed to volumetrically dispense reagent prior to titration or direct measurement. This helps achieve consistent and accurate results and prevents operator errors such as incorrect volumes or forgetting reagent addition

Interface & display

Interactive color display

- A large, color LCD screen clearly shows the chosen titration method along with results, units, titration volume, temperature, and mV or pH values.

Detailed titration graphs

- A real-time titration curve can be displayed during each titration; this feature is useful when new methods are tested or when a procedure requires optimization.

Data

Data storage

- up to 100 titration and pH/mV/ISE reports. Transfer data via USB.

Flexible GLP management

- All necessary GLP (Good Laboratory Practice) information can be recorded with each sample.

Connectivity & functionality

Multifunctional

- HI902C functions as a titrator, pH meter, mV/ORP meter, and ISE meter. Valuable laboratory bench space is saved, and multiple analyses can be performed on one sample.

Multiple connections

- The titrator offers device support for two analog boards, allowing up to two electrodes, two burettes, and two stirrers to be connected to one unit simultaneously.

Methods of Analysis

Customizable methods

- The HI902C can store up to 100 user-defined or standard titration and direct measurement methods. Each method may be modified and optimized for performance based on application and user requirements.

Titration method support

- Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support for any questions you might have along the way.

Market specific methods packs

- Hanna offers titration method packages for various markets including food, beverage, dairy, wine, and more. Ask our Sales Consultants about our library of market specific titration methods.

Adaptable standard methods

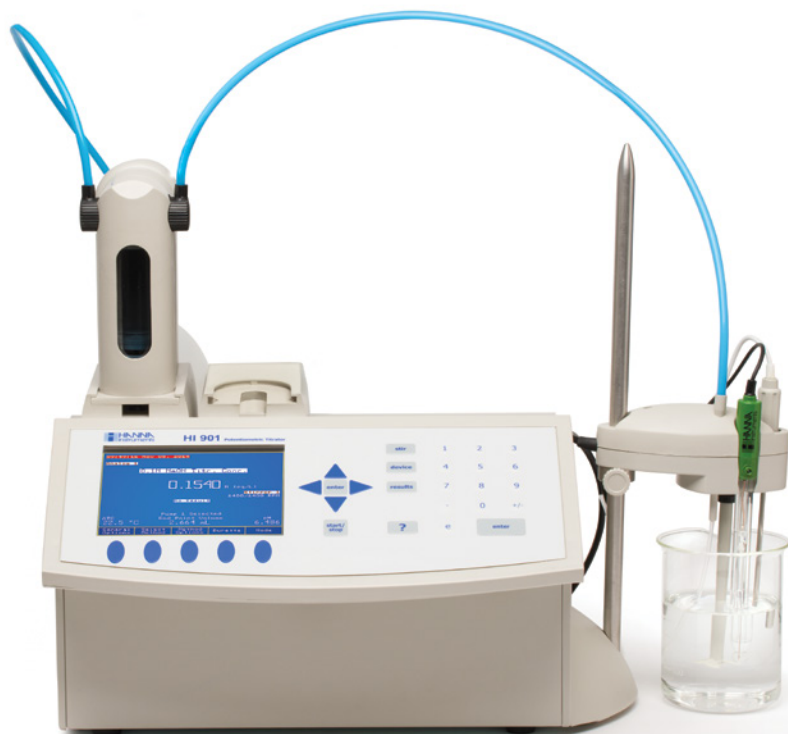
- Our technical experts can program and optimize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI902C system.

Autosampler connectivity

- The HI902C works seamlessly with our HI921 Autosampler featuring 16 or 18 sample tray options, automatic tray identification, and automatic beaker detection. Up to three peristaltic pumps for reagent addition and removal can be connected and real-time analysis and sequencing progress is visible on the HI902C display as well as indicated by the LED lights of the Autosampler.



Specifications	HI902C	
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1; 0.01; 0.001 pH
	Accuracy (@25°C/77°F)	±0.001 pH
	pH Calibration	up to five-point calibration, eight standard buffers and five custom buffers
	mV	
mV	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.1 mV
	mV Calibration	single point offset
	ISE	
ISE	Range	1•10 ⁻⁶ to 9.99•10 ¹⁰
	Resolution	1; 0.1; 0.01
	Accuracy (@25°C/77°F)	±0.5% monovalent; ±1% divalent
	ISE Calibration	up to five-point calibration, seven standard solutions and five user-defined standards
	Temperature	
Temperature	Range	-5.0 to 105.0°C; 23.0 to 221.0°F; 268.2 to 378.2 K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy (@25°C/77°F)	±0.1°C; ±0.2°F; ±0.1K, excluding probe error
	Additional Specifications	
Additional Specifications	Burette Size Capability	5, 10, 25 and 50 mL
	Burette Resolution	1/40000
	Display Resolution	0.001 mL
	Dosing Accuracy	±0.1% of full burette volume
	Display	5.7" (320 x 240 pixel) backlit color LCD
	GLP Conformity	instrumentation data storage and printing capabilities
	Ordering Information	<p>HI902C1-01 (US plug (type A)) and HI902C1-02 (European plug (type C)): titrator with one analog board, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump drive, temperature sensor, USB cable, USB flash drive and PC software.</p> <p>HI902C2-01 (US plug (type A)) and HI902C2-02 (European plug (type C)): titrator with two analog boards, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, USB flash drive and PC software.</p>
Accessories	HI900100	dosing pump
	HI900150	50 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
	HI900125	25 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
	HI900110	10 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
	HI900105	5 mL burette assembly (includes syringe, aspiration, and dispensing tubes)



Automatic Titration System

The HI901C automatic titrator complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI901C potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations. This powerful titrator dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphs automatically. In addition to titration mode, the HI901C also operates as a fully functional pH, mV/ORP, and ion selective electrode (ISE) meter.

This titrator is supplied with a pack of standard methods or you can create your own. Methods (standard or user) can be easily transferred between titrators via USB flash drive or PC application.

Titration capabilities

Dynamic titrant dosing

- Dynamic dosing allows for timely and accurate titration results by relating the titrant volume dosed to the mV response from the titration reaction. This provides for larger doses near the beginning of a titration and smaller, more precise doses near the titration endpoint.

Equivalence endpoint detection

- Equivalence endpoint detection is critical in applications where fixed endpoints are not specified in standard methods. This endpoint indicates where the mV response from the titration is greatest with respect to the volume of titrant dosed.

Multiple titration types

- Paired with the right electrode from our sensor line, our potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and titrations with an ion selective electrode.

Signal stability timing

- The signal stability feature monitors when the mV response of the titration reaction stabilizes before providing the next titrant dose. This ensures reliable measurement values throughout the length of a titration.

Methods of analysis

Customizable methods

- The HI901C can store up to 100 user-defined or standard titration methods. Each method may be customized and optimized for performance based on application and user requirements.

Titration method support

- Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support via phone or webinar for any questions you might have along the way.

Adaptable standard methods

- Our technical experts can program and customize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI901C system.

Burettes and Dosing System

Exchangeable burette system

- With Hanna's Clip-Lock burette, it only takes a few seconds to exchange titrants and reagents, preventing cross-contamination and saving time.

Multiple burette sizes

- The HI901C comes standard with a 25 mL burette but may be equipped with a 5 mL, 10 mL, or 50 mL burette.

Precision dosing pump

- Our unmatched 40,000 step piston driven pump is capable of dosing extremely small and precise volumes of titrant or reagent.

Data and storage

Customizable titration reports

- Each titration report is fully customizable so users can ensure they are storing and filing the appropriate data required for their application and procedures.

Flexible GLP management

- All necessary GLP (Good Laboratory Practice) information can be recorded with each sample.

Effortless data transfer

- Data can easily be transferred to a USB flash drive or PC with the Hanna HI900PC application software.

Connectivity and Functionality

Multifunctional with four working modes

- The HI901C functions as a titrator, pH meter, mV/ORP meter, and ISE meter.

Multiple connections (HI901C2 only)

- The titrator offers device support for two analog boards, which allows two electrodes and two stirrers to be simultaneously connected to one unit.

Multiple peripherals

- Users can print reports directly from the titrator using a standard parallel printer. An external monitor and keyboard may be attached for added versatility, as well as an analytical balance for automatic sample mass entry for titrations.

Specifications	HI901C1	HI901C2	
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH	
	Resolution	0.1; 0.01; 0.001 pH	
	Accuracy (@25°C/77°F)	±0.001 pH	
	pH Calibration	up to five-point calibration, eight standard buffers and five custom buffers	
mV	Range	-2000.0 to 2000.0 mV	
	Resolution	0.1 mV	
	Accuracy (@25°C/77°F)	±0.1 mV	
	mV Calibration	single point offset	
ISE	Range	1•10 ⁻⁶ to 9.99•10 ¹⁰	
	Resolution	1; 0.1; 0.01	
	Accuracy (@25°C/77°F)	±0.5% monovalent; ±1% divalent	
	ISE Calibration	up to five-point calibration, seven standard solutions and five user-defined standards	
Temperature	Range	-5.0 to 105.0°C; 23.0 to 221.0°F; 268.2 to 378.2 K	
	Resolution	0.1°C; 0.1°F; 0.1K	
	Accuracy (@25°C/77°F)	±0.1°C; ±0.2°F; ±0.1K, excluding probe error	
Additional Specifications	Analog Board(s)	1	2
	Each Analog Board Provides: (1) BNC (pH/mV/ISE) Input, (1) Reference Input, (1) Temperature Input, (1) Stirrer Input		
	Analog Board(s) Capability	1	2
	Dosing Pump Capability	2	2
	Burette Included	1 (25 mL)	1 (25 mL)
	Burette Size Capability	5, 10, 25 and 50 mL	
	Burette Resolution	1/40000	
	Display Resolution	0.001 mL	
	Dosing Accuracy	±0.1% of full burette volume	
	GLP Conformity	instrumentation data storage and printing capabilities	
Ordering Information	<p>HI901C1-01 and HI901C1-02 includes titrator with one analog board, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, 256 MB USB flash drive and PC software.</p> <p>HI901C2-01 and HI901C2-02 includes titrator with two analog boards, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, 256 MB USB flash drive and PC software.</p>		

Reagents

HI70401	potassium hydrogen phthalate, 20 g
HI70402	tartaric acid, 20 g
HI70403	sodium thiosulfate pentahydrate, 20 g
HI70404	potassium iodide powder packets, 100 packets
HI70405	glucose/fructose, 20 g
HI70406	sodium chloride, 20 g
HI70407	potassium iodate, 20 g
HI70408	oxalic acid, 20 g
HI70409	potassium permanganate, 20 g
HI70422	silver nitrate (0.1 M), 1L
HI70423	sodium hydroxide solution (0.11 N), 1 L
HI70424	amino-propanol buffer, 25 mL
HI70425	sulfuric acid solution (16%), 500 mL
HI70426	glyoxal solution (40%), 100 mL
HI70427	nitric acid solution (1.5 M), 500 mL
HI70428	sodium hydroxide solution (0.25N), 1 L
HI70429	silver nitrate solution (0.05 M), 1L
HI70432	hydrogen peroxide solution (3%), 25 mL
HI70433	stabilized iodine solution (0.01 N), 1L
HI70434	phosphoric acid (85%), 500 mL
HI70435	sodium hydroxide solution (5 M), 500 mL
HI70436	deionized water, 1 G
HI70437	potassium iodide concentrated (30%) solution, 500 mL
HI70438	tris buffer set, 1 L
HI70439	sodium thiosulfate solution (0.1 M), 1 L
HI70440	iodine stabilized solution (0.02 N), 1 L
HI70441	iodine stabilized solution (0.04 N), 1 L
HI70443	sulfuric acid solution (10%), 500 mL
HI70444	sulfuric acid solution (25%), 500 mL
HI70445	nitric acid solution (1 M), 500 mL
HI70446	Fehling solution A, 500 mL
HI70447	Fehling solution B, 500 mL
HI70448	silver nitrate solution (0.02 M), 1 L

HI70449	EDTA solution (0.02 M), 1 L
HI70453	hydrochloric acid solution (0.02 N), 1 L
HI70454	sodium hydroxide solution (0.02 N), 1 L
HI70455	sodium hydroxide solution (0.01 N), 1 L
HI70456	sodium hydroxide solution (0.1 N), 1 L
HI70457	sodium hydroxide solution (1 N), 1 L
HI70458	sulfuric acid solution (0.01 M), 1 L
HI70459	sulfuric acid solution (0.05 M), 1 L
HI70462	hydrochloric acid solution (0.01 N), 1 L
HI70463	hydrochloric acid solution (0.1 N), 1 L
HI70464	hydrochloric acid solution (1 N), 1 L
HI70465	hydrogen peroxide solution (30%), 25 mL
HI70466	phenylarsine oxide (PAO) solution (0.00564N), 500 mL
HI70467	pH 4.18 acetate buffer, 230 mL
HI70468	potassium iodide, 35g
HI70469	iodine solution (0.00188N), 230 mL (4)
HI70471	phenylarsine oxide (PAO) solution (0.000564N), 500 mL
HI70472	pH 7.15 phosphate buffer solution, 230 mL





Laboratory Research Grade Benchtop pH/mV/ISE and EC/TDS/Salinity/Resistivity Meter

The HI5522 is an advanced research grade benchtop pH/mV/ISE/EC/TDS/Salinity/Resistivity meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity. The HI5522 is rich in features including ISE incremental methods, data logging, alarm limits, comprehensive GLP, and many more while retaining simplicity in use with both dedicated key for routine operation and virtual keys that guide the user through setup options. The HI5522 ensures confidence in pH measurements with the exclusive Hanna Instruments CAL Check™ feature that alerts the user to potential problems during calibration including if the buffer is contaminated or the probe needs to be cleaned.

Highly customizable user interface

The user interface of the HI5522 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data.

Capacitive touch

The HI5522 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. The capacitive touch technology ensures the buttons never get clogged with sample residue.

Color graphic LCD

The HI5522 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

Two independent channels

The two measurement channels of the HI5522 are galvanically isolated to eliminate noise and instability.

Choice of calibration

Automatic buffer recognition, semiautomatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers. For the conductivity channel the calibration can be set to automatic standard recognition or user entry along with a choice of single or multi-point. Calibration can be performed up to four points when multi-point is selected.

Four-ring conductivity probe

Conductivity readings are performed with the HI76312 four-ring conductivity probe that has a built in temperature sensor for automatic temperature correction. The four rings are made with platinum and the body of the electrode is made of Polyetherimide (PEI) plastic that is resistant to many harsh chemicals. The four-ring design allows for this probe to be used over a wide range of measurements.

GLP data

HI5522 includes a GLP Feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, standards used for calibration.

CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time and the overall probe condition as a percentage that is based on the offset and slope characteristics.

ISE measurement with choice of concentration units

The HI5522 allows for calibration and readings in choice of concentration units. The choices of concentration units include ppt, g/L, mg/mL, ppm, mg/L, µg/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v and a user-defined unit.

ISE measurement with Incremental Methods

The known addition, known subtraction, analyte addition, and analyte subtraction incremental methods are pre-programmed into the HI5522. Simply follow the on screen guided procedure and the meter will perform the calculation automatically allowing for a higher level of accuracy to be obtained as compared to a direct ISE measurement.

Data logging

Three selectable logging modes are available on the HI5522: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot, with up to 100,000 total data points. Automatic logging features the option to save data according to sampling period and interval.

Data transfer

Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

Contextual help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



B

BNC

B

BNC+PIN

HI5522 includes HI1131B pH electrode and is also compatible with pH electrodes that use BNC and BNC+PIN connectors and ISE electrodes that use BNC connectors.

D

DIN

HI5522 includes HI76312 four-ring EC/TDS probe.

Specifications	HI5522	
pH**	Range	-2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD
	Calibration	automatic, up to five-point calibration, eight standard buffers available, and five custom buffers
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV ±1 LSD
ISE	Range	1 x 10 ⁻⁶ to 9.99 x 10 ⁻⁶ concentration
	Resolution	1; 0.1; 0.01; 0.001 concentration
	Accuracy	±0.5% (monovalent ions); ±1% (divalent ions)
	Calibration	automatic, up to five-point calibration, five fixed standard solutions available for each measurement unit, and five user defined standards
Temperature**	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K (without probe)
EC	Range	0.000 to 9.999 µS/cm; 10.00 to 99.99 µS/cm; 100.0 to 999.9 µS/cm; 1.000 to 9.999 mS/cm; 10.00 to 99.99 mS/cm; 100.0 to 1000.0 mS/cm absolute EC*
	Resolution	0.001 µS/cm; 0.01 µS/cm; 0.1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	±1% of reading (±0.01 µS/cm)
	Calibration	automatic standard recognition, user standard single point / multi-point calibration
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt
	Accuracy	±1% of reading (±0.01 ppm)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm
	Accuracy	±2% of reading (±1 Ω•cm)
Salinity	Range	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0%
	Resolution	0.01 for practical scale/natural sea water scale; 0.1% for percent scale
	Accuracy	±1% of reading
	Calibration	percent scale—one-point (with HI7037 standard); all others through EC
Ordering Information	HI5522-01 (115V) and HI5522-02 (230V) are supplied with HI1131B pH electrode, HI76312 EC/TDS probe, HI7662-T temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), pH 10.01 buffer solution sachet (2), 1413 µS/cm conductivity standard sachet (2), 12880 µS/cm conductivity standard sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual.	

(*) Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
 ** limits will be reduced to actual sensor limits



Laboratory Research Grade Two-Channel Benchtop pH/mV/ISE Meter

The HI5222 is an advanced research grade dual channel benchtop pH/ISE/mV meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity. The HI5222 is rich in features including 5 point calibration, selectable resolution, data logging, alarm limits, comprehensive GLP, automatic temperature compensation, and much more. It retains simplicity with both dedicated key for routine operation and virtual keys that guide the user through setup options.

Highly customizable user interface

- The user interface can display measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data.

Capacitive touch

- Sensitive capacitive touch buttons ensures the buttons cannot be clogged with sample residue.

Color graphic LCD

- The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

Two galvanically isolated pH/ ORP/ISE channels

- Each input channel has connectors for BNC probes, reference probes and a temperature sensor.

Choice of calibration

- Automatic buffer recognition, semi-automatic, and direct manual entry pH calibration options are available.

GLP data

- View calibration data and calibration expiration information.

CAL Check™

- CAL Check™ alerts users to potential problems during the calibration of the pH electrode.

ISE measurement with choice

of concentration units

- Allows for calibration and readings in choice of concentration units which

include ppt, g/L, mg/mL, ppm, mg/L, µg/mL, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v and a user-defined unit.

ISE measurement with incremental methods

- The known addition, known subtraction, analyte addition, and analyte subtraction incremental methods are pre-programmed.

Data logging

- Automatic, manual, and AutoHold logging are available. Automatic and manual logs up to 100 lots with 50,000 records max/lot with up to 100,000 total data points per channel.



HI5222 includes HI1131B pH electrode and is also compatible with pH electrodes that use BNC and BNC+PIN connectors and ISE electrodes that use BNC connectors.

Specifications	HI5222	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD
	Calibration	automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV ±1 LSD
ISE	Range	1 x 10 ⁻⁶ to 9.99 x 10 ¹⁰ concentration
	Resolution	1; 0.1; 0.01; 0.001 concentration
	Accuracy	±0.5% (monovalent ions); ±1% (divalent ions)
	Calibration	automatic, up to five-point calibration, seven fixed standard solutions available for each measurement unit, and five user defined standards
Temperature*	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K
Ordering Information	HI5222-01 (115V) and HI5222-02 (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual.	

* limits will be reduced to actual sensor limits

Waterproof Portable pH/ORP/ISE Meter

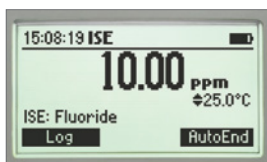
The HI98191 is a rugged, portable pH/ORP/ISE meter with the performance and features of a benchtop meter. The HI98191 is supplied with all necessary accessories to perform a pH/temperature measurement packaged into a durable carrying case.

Waterproof protection

HI98191 is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes. The probe features an IP68 rating for continuous immersion in water.

Automatic or manual temperature compensation

pH sensors incorporate a temperature sensor.



ISE sensors and calibration

HI98191 has 17 different standard ISE sensors pre-programmed in the meter. Selecting the appropriate sensor will automatically update the ion charge for slope calibration and can be calibrated up to five points with the choice of seven standards and five custom standards (choice of units). This meter allows an extensive choice of measurement units (ppm, ppt, g/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, % w/v, user) and has an expanded measuring range of 1.00×10^{-7} to 9.99×10^{10} .

Enhanced calibration

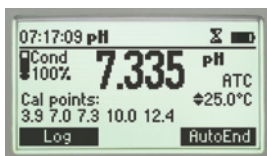
An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of range.

Data logging

The log-on-demand feature allows users to store up to 300 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored for retrieval at a later time.



CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances. During calibration users are alerted to problems such as a dirty or broken electrode or contaminated pH buffers. After calibration, the electrode's overall condition is displayed as a percentage.

Backlit graphic LCD display

The HI98191 features a backlit graphic LCD with on-screen help.

Long battery life

The battery icon on the display indicates remaining power. The four 1.5V AA batteries provide up to 200 hours of battery life.



HI98191 includes HI72911B titanium bodied pH/temperature electrode with BNC+Phono connector. Compatible with ISE combination electrodes that use BNC connectors.

Specifications	HI98191	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
mV*	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE*	Range	from 1.00 E ⁻⁷ to 9.99 E ¹⁰ concentration
	Resolution	3 digits 0.01; 0.1; 1; 10 concentration
	Accuracy	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)
	Calibration	up to five point calibration, six standard solutions available (0.1, 1, 10, 100, 1000, 10000 ppm)
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Ordering Information	HI98191 is supplied with HI72911B pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in an HI720191 rugged carrying case with custom insert.	

* limits will be reduced to actual sensor limits

Fluoride Portable Meter

One or two-point calibration

On-screen instructions

Automatic temperature compensation

- With the optional HI7662 temperature probe, the HI98402 can offer automatic temperature compensation of fluoride measurements over the range of -5.0 to 55.0°C.

The HI98402 is a rugged, waterproof, portable fluoride meter. The HI98402 requires the HI4010 epoxy body fluoride half-cell and the HI5313 plastic body reference electrode, both available separately.

The HI98402 requires two half-cell electrodes to measure fluoride. The HI4010 is a fluoride half-cell comprising an epoxy body and a lanthanum fluoride crystal sensing membrane. The HI5313 is a reference half-cell featuring a cone style junction that produces a highly stable reference potential and consistent flow rates of electrolyte into solution.



Specifications	HI98402	
Fluoride	Range	0.050 to 0.500 mg/L (ppm); 0.50 to 5.00 mg/L (ppt) 5.0 to 50.0 mg/L; 50 to 500 mg/L; 0.50 to 1.90 g/L (ppt)
	Resolution	0.001 mg/L (ppm); 0.01 mg/L; 0.1 mg/L; 1 mg/L; 0.01 g/L
	Accuracy	±5% of reading or ±0.02 mg/L (ppm) fluoride (with ±3°C from calibration temperature)
	Calibration	automatic from one or two point at 1 mg/L, 2 mg/L, 10 mg/L, 100 mg/L and 1000 mg/L
Temperature	Range*	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.2°C (±0.4°F) excluding probe error
Ordering Information	HI98402 is supplied with 1.5V AAA batteries (3), rugged carrying case and instructions.	
Required Accessories	HI4010 fluoride electrode with BNC connector and 1 m (3.3') cable	
	HI5313 reference electrode with 1 m (3.3') cable	
Recommended Accessories	HI7662 stainless steel temperature probe with 1 m (3.3') cable	



HACCP Compliant Salinity Foodcare Meter

One or two-point calibration

On-screen instructions

Fixed temperature compensation

Hanna has designed this waterproof salinity meter for use in food production.

The HI931102 is an ion selective meter that uses a sodium ion selective electrode to measure the sodium content of a solution and report it as g/L NaCl or percent NaCl. This powerful instrument has four ranges, capable of measuring concentrations from 0.150 g/L to 300 g/L. This meter is able to auto-range from sample to sample over an extremely broad range without the need for recalibration.

The optional HI7662 temperature probe provides temperature readings from -20 to 120°C.



Specifications		HI931102
NaCl	Range	0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl; 15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl; 0.0 to 30.0 % NaCl
	Resolution	0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl; 0.1 % NaCl
	Accuracy (@25°C/77°F)	±5% of reading
	Calibration	automatic, one or two-points at 3.00 g/L (HI7083) and 0.30 g/L (HI7085) or 30.0 g/L (HI7081) see page 25 for solutions.
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.2°C (±0.4°F) (excluding probe error)
Ordering Information	HI931102 is supplied with 1.5V AAA batteries (3), instructions and hard carrying case.	
Required Accessories	FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable (not included)	
	HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included)	

Salinity and Sodium Content Portable Meter

The HI931100 is a rugged, waterproof, portable salinity and sodium content meter. This meter offers many features including automatic calibration, automatic temperature compensation, auto-ranging, and on-screen instructions.

One or two-point calibration

On-Screen Instructions

Sodium ion selective electrode and temperature probe available separately

Fixed temperature compensation

- The HI931100 offers fixed temperature compensation of sodium measurements at 25°C.



Specifications	HI931100	
NaCl	Range	0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl; 15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl
	Resolution	0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl
	Accuracy (@25°C/77°F)	±5% of reading (NaCl)
	Calibration	automatic, one or two point at 0.30 g/L (ppt)(HI7085); 3.00 g/L (HI7083); 30.0 g/L (HI7081) see page 25 for solutions.
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.2°C (±0.4°F) (excluding probe error)
Ordering Information	HI931100 is supplied with 1.5V AAA batteries (3), instructions and hard carrying case.	
Required Accessories	FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable	
	HI7662 stainless steel temperature probe with 1 m (3.3') cable	



Sodium Content and Activity Portable Meter

The HI931101 is a rugged, waterproof, portable sodium content meter. This meter offers many features including automatic calibration, automatic temperature compensation, and on-screen instructions. There are four measurement ranges for sodium content, and a simple press of the MODE button allows for measurement of sodium ion activity.

One or two-point calibration

On-screen instructions

Sodium ion selective electrode and temperature probe available separately

Fixed temperature compensation

- The HI931101 offers fixed temperature compensation of sodium measurements at 25°C.

B

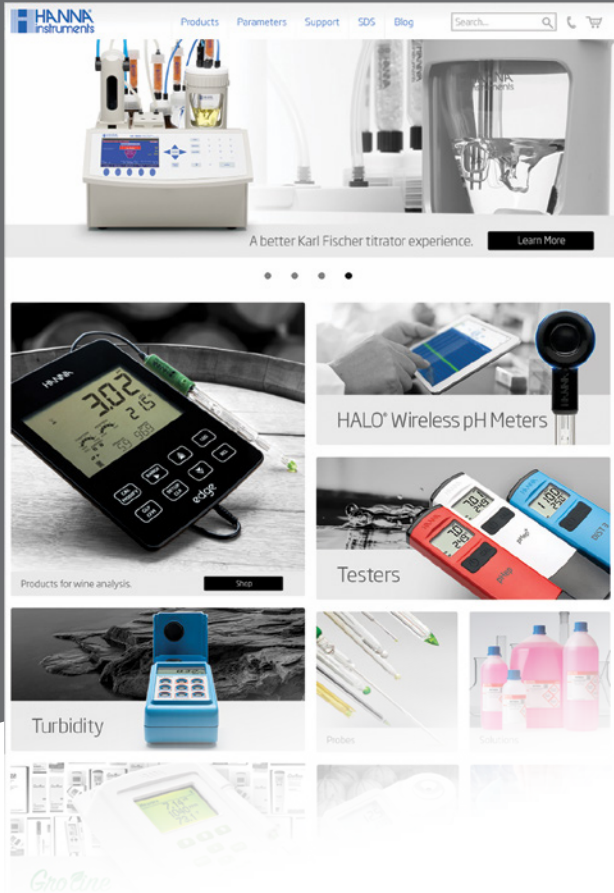
BNC

Specifications	HI931101	
Na	Range	0.00 to 3.00 pNa; 15.0 to 150.0 mg/L (ppm) Na; 0.150 to 1.500 g/L Na; 1.50 to 15.00 g/L Na; 15.0 to 60.0 g/L Na
	Resolution	0.01 pNa; 0.1 mg/L Na; 0.001 g/L Na; 0.01 g/L Na; 0.1 g/L Na
	Accuracy (@25°C/77°F)	±0.05 pNa; ±5% of reading (Na)
	Calibration	automatic, one or two point at 0.23 g/L (HI7087/HI8087); 2.3 g/L (HI7080/HI8080); 23.0 g/L (HI7086/HI8086) see page 25 for solutions.
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.2°C (±0.4°F) (excluding probe error)
Ordering Information	HI931101 is supplied with 1.5V AAA batteries (3), instructions and hard carrying case.	
Required Accessories	FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable	
	HI7662 stainless steel temperature probe with 1 m (3.3') cable	



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