LABORATORY SENSORS

pH & Redox

HAMILTON
THE MEASURE OF EXCELLENCE™

Product overview

To order products from this catalog, please contact either your process sensor distributor or HAMILTON directly. We will be happy to put you in contact with your nearest distributor.

Other product lines from HAMILTON:

- pH electrodes and armatures for process applications
- Customized sensors and accessories
- Syringes
- SoftGrip™ pipettes
- SofTouch™ pipettes, SoftAide™ pipettes
- SofTop dispensers
- Diluters and dispensers
- Valves
- OEM components
- Pipetting robots
- Automated analyzers
- HPLC and GC columns
- GC liners

Contents

Innovations in electrochemistry

HAMILTON pH sensors offer you more! Our electrochemical sensors are reliable tools characterized by the highest quality, long life, and outstanding accuracy of measurement. In order to continue meeting these rigorous requirements, HAMILTON constantly strives toward new horizons in sensor technology. Thanks not only to the efforts of our R&D department, but also to their close relationship with colleagues in production, HAMILTON is able to offer the following innovative solutions:

The SINGLE PORE concept

Precise, reliable, and rapid readings with a patented system that ensure contact between the electrolyte and the sample.
Since its introduction in 1991, the patented SINGLE PORE concept just keeps on getting more and more successful. The advantage of this solution is clear to see: Instead of the many tiny pores in a ceramic diaphragm, a SINGLE PORE about 200 times larger in cross-section (in the form of a capillary) performs the task. This SINGLE PORE is practically impossible to clog. In combination with a dedicated electrolyte, the flow rate through the pore is defined, resulting in enhanced contact between the reference electrode and the measurement medium. This leads to a faster response time and more accurate readings.

However, even after a very successful 15 years, HAMILTON has found a way to further improve the design of the SINGLE PORE, so that today the SINGLE PORE GLASS electrode is even more robust and user-friendly than ever.

Note: The PTB (Physikalisch-Technische Bundesanstalt (Physical-Technical Federal Institute)) in Braunschweig, Germany, in a very wide-ranging and well documented study, determined the SINGLE PORE pH electrode to be the most accurate laboratory electrode in the test. Further information can be found in "Traceability of pH measurement" by Petra Spitzer: ISBN 3-89429-877-4 or ISSN 0947-7063.

POLISOLVE and POLISOLVE PLUS electrolyte

The innovative polymer reference electrolyte that solves so many application problems

Contrary to the widespread belief that pH electrodes with a polymer electrolyte cannot be used over the entire pH or temperature range, HAMILTON has succeeded in developing the innovative POLISOLVE polymer electrolyte that can be used over the complete pH range from 0 to 14, and in a temperature range from -10°C to 130°C.
POLISOLVE is compatible with most organic solvents, and is completely Acrylamide free. The combination of POLISOLVE electrolyte with the modified SINGLE PORE concept results in an extremely versatile laboratory electrode that is eminently suited to pH measurement in a wide range of uses, for example in:

- Ground water and coolants
- Galvanic baths
- Solutions containing color pigments
- Samples containing oil and fat
- Suspensions
- Solutions containing protein

And now, with POLISOLVE PLUS, HAMILTON has achieved an important new development that means even more stable reference signals. Thanks to an ingenious integrated filter system, reference poisons remain harmless for even longer. At the same time, troublesome diffusion potentials are minimized and measurement accuracy thereby enhanced. In short: POLISOLVE PLUS represents a significant contribution in extending the life of pH sensors.

The EVEREF reference system

Long electrode life, thanks to stable reference potentials

Stable reference systems are at the heart of reliable, long-life electrodes. This is why many HAMILTON electrodes are equipped with reference systems from the EVEREF family. The silver chloride reservoir is separated from the reference electrolyte by a diffusion distance that prevents the loss of silver chloride during temperature swings, thereby allowing the use of silver-free electrolyte.
The EVEREF® B labyrinth system used in the POLILYTE LAB electrodes further extends the diffusion distance, considerably lengthening electrode life in aggressive media. These electrodes provide outstanding results in ion-weak and partially aqueous solutions.

HAMILTON pH membrane glass

Guarantee the accuracy of your measurements

The continuous improvement of our pH membrane glass offers many previously unavailable benefits. Most laboratory electrodes have a V glass membrane. This unique glass possesses excellent mechanical stability and very low membrane resistance. This makes measurements possible in solutions with low conductivity.
HF glass is a development that guarantees the longest possible electrode life in processes containing hydrofluoric acid. In addition, this glass is well suited to the production of flat pH membranes. These are of great advantage, for example, with the Flatrode for readings of small volumes or on a flat surface areas.
HAMILTON H glass displays excellent characteristics and stable measurement values in media with low water content, for example as for example in anhydrous or only partially aqueous solutions.
The low alkali error of H glass means accurate measurements even at high pH values.

Conductivity standards

Certified by an accredited laboratory
Fulfills all requirements of United States Pharmacopia USP Chapter 625

HAMILTON is the first vendor in the world of conductivity standards to offer 1.3 and 5 µS/cm with a certified accuracy of ±1 % and a lifetime of 1 and 3 years, respectively. The composition of these standards is patented. The measurement procedure for determining conductivity has been developed in collaboration with DFM[1)] . A number of state metrological institutes that deal with measurement of electrolytic conductivity have started using these HAMILTON standards, since they lie in a low conductivity range and exhibit a previously unknown level of stability, confirmed by measurements performed by PTB[2)].
For this reason, in an inter-laboratory test among prestigious European metrological institutes (PTB, DFM, DKD[3)]) it was HAMILTON standards that were used as the measurement solution.

See page 18 for details

[1)] DFM: Danish Institute of Fundamental Metrology, Danemark
[2)] PTB: Physikalisch-Technische Bundesanstalt, Braunschweig
[3)] DKD: Deutscher Kalibrierdienst

Duracal pH buffers

Certified by an accredited laboratory
Easy handling and 5-year stability

A complete range of patented pH buffer solutions makes possible a pH stability never before achieved. HAMILTON guarantees DURACAL pH buffers to last for five years from the date of manufacture. The pH 9.21 and pH 10.1 buffers are even stable in air. High buffer capacities enable quick, stable calibrations.

Closed-loop traceability: In contrast with other manufacturers, who operate using only hierarchical (top-down) traceability, HAMILTON has developed a new approach featuring "closed-loop" traceability for the values 4.01, 7.00, 9.21 and 10.01. For users of DURACAL pH buffer solutions, this ensures a unique level of reliability.
Top-down traceability: With HAMILTON, the pH value of the DURACAL buffer is determined by a comparison with two secondary reference solutions.
Bottom-up traceability: From each batch manufactured, a representative quantity is measured at DKD. This ensures an external, independent verification by an accredited institute.
DKD issues an official calibration certificate for the corresponding DURACAL production batch.

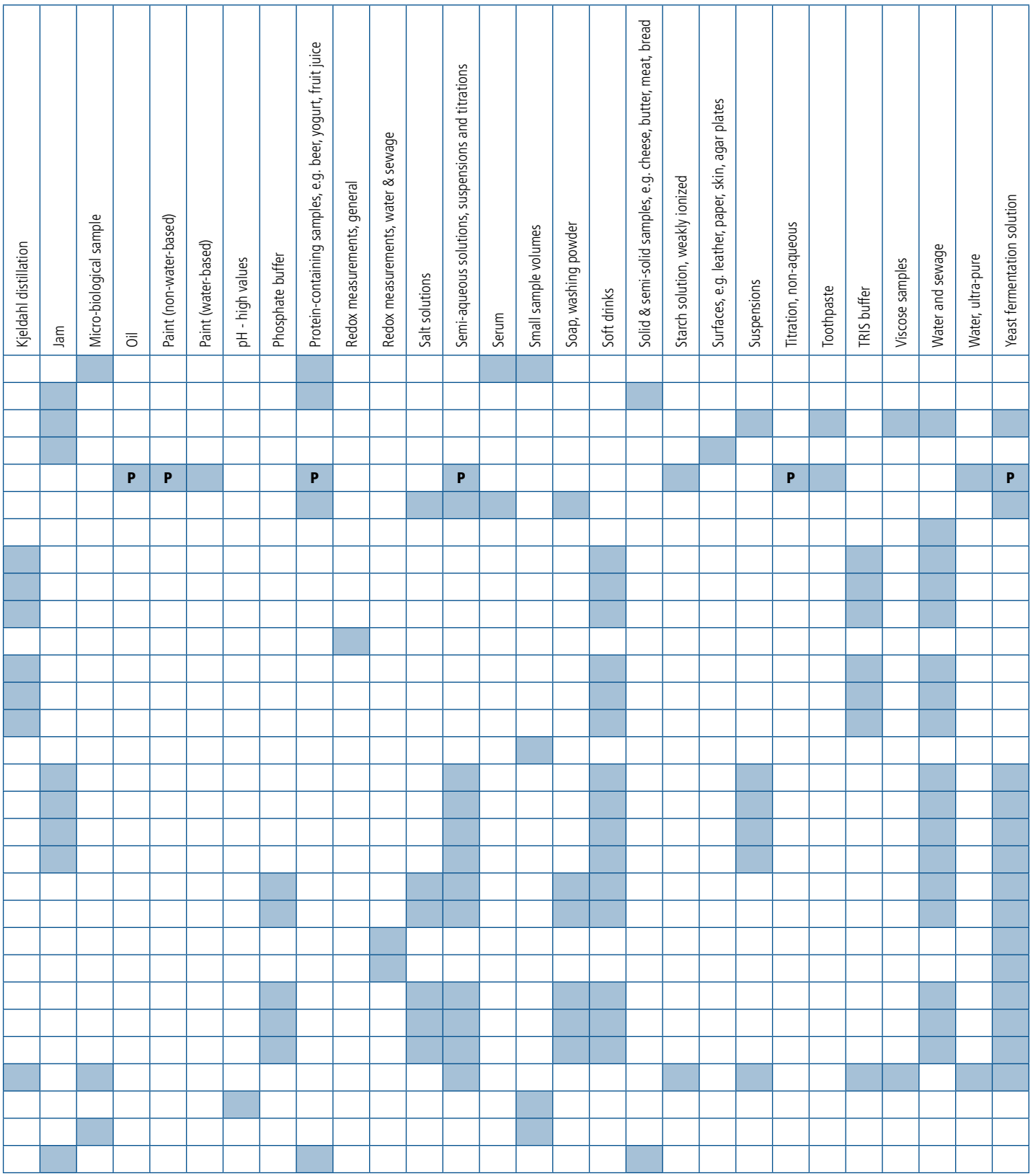
See page 20 for details

Application list

Electrode	PN	Page	Acid, battery	Acid, hydrofluoric	Aqueous emulsions, suspensions	Aqueous solutions	Calcium oxide solution	Calcium sulphate solution	Copper bath	Cosmetics	Crème fraîche, milk, cream	Cyanide decontamination	Disinfectant	Earth	Emulsions	Fat	Fertilizer solutions	Field measurements	Fixing baths	Fruit & vegetables	Galvanic baths	Hydrogen peroxide (30%)	Infusion solutions
Biotrode	238140	12																					
Double Pore	238400	13									■			■		■				■			
Filltrode	242064	11		■		■					■				■			■					
Flatrode	238401	12		■												■							
Flushtrode*	238060	11					■	■		**P**	**P**	■									■		
Foodtrode	238285	13									■												
Gel-Glass	238025	11				■																	
Liq-Glass	238000	9	■			■							■						■				
Liq-Glass BNC	238180	9	■			■							■						■				
Liq-Glass DIN	238185	9	■			■							■						■				
Liq-Glass ORP	238145	9																					
Liq-Glass Temp BNC	242056	9	■			■							■						■				
Liq-Glass Temp DIN	238406	9	■			■							■						■				
Liq-Glass Temp Lemo	242054	9	■			■							■						■				
Minitrode	238100	12																					
Polilyte Lab	238403	10			■	■	■								■		■						
Polilyte Lab Temp BNC	242060	10			■	■	■								■								
Polilyte Lab Temp DIN	242058	10			■	■	■								■								
Polilyte Lab Temp Lemo	242062	10			■	■	■								■								
Polyplast	238380	14				■											■	■					
Polyplast BNC	238381	14			■	■											■	■					
Polyplast ORP	238385	14																					
Polyplast ORP BNC	238384	14																					
Polyplast Temp BNC	242050	14			■	■											■	■					
Polyplast Temp DIN	238404	14			■	■											■	■					
Polyplast Temp Lemo	242052	14			■	■											■	■					
Single Pore Glass	238160	10	■					■	■				■		■		■				■	■	■
Slimtrode	238150	11																					
Spintrode	238197	12																					
Tiptrode	238080	13												■		■				■			

* With samples containing protein (**P**), replace the electrolyte 3 M KCl with the separately available electrolyte PROTELYTE (see page 16).

Application list



HAMILTON
THE MEASURE OF EXCELLENCE™

Design offers many advantages

- All electrodes are printed with an indelible serial number
- Individual test certificates with measured values
- Indelible marking means long-term readability
- Ergonomic electrode head
- Proven electrolyte sealing system
- High-quality seal between electrode head and cable (IP 68)
- Integrated, captive seal at the electrode plug head
- Blue interior buffer gives visual indication of contact with the pH diaphragm

Watering cap with screw lock

- Easy removal of the watering cap by means of the screw lock
- Secure sealing in the watering cap
- No spilling of electrolyte when removing the watering cap

Electrodes for general laboratory applications

LIQ-GLASS

PN 238000 **Liq-Glass (without cable)**
PN 238180 **Liq-Glass BNC**
PN 238185 **Liq-Glass DIN**

- Robust, combination pH electrode for daily laboratory use
- Universally applicable, even in strong acids as well as in normal laboratory use
- Ideally suited for acid/base titrations
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head, 1 m BNC or 1 m DIN

LIQ-GLASS TEMP

PN 242056 **Liq-Glass Temp BNC**
PN 238406 **Liq-Glass Temp DIN**
PN 242054 **Liq-Glass Temp Lemo**

- Robust, combination pH electrode for daily laboratory use
- Universally applicable, even in strong acids as well as in normal laboratory use
- Ideally suited for acid/base titrations
- Integrated temperature sensor (NTC 30 kOhm or Pt1000)
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: yes	NTC 30 kOhm (PN 238406): Pt1000 (PN 242054: 242056)
Sensor connection:	PN 242056: 1.2 m BNC cable / 1 x 4 mm banana plug
	PN 238406: 1.2 m DIN cable / 1 x 4 mm banana plug
	PN 242054: 1.2 m LEMO cable / 2 x 2 mm banana plug
	(2 adapters for 4 mm banana plug included)

LIQ-GLASS ORP

PN 238145 **Liq-Glass ORP**

- Robust, combination Redox electrode for all usual Redox measurements in the laboratory
- Universally applicable, even in strong acids as well as in normal laboratory use
- Long-term-stable EVEREF system
- Serial number, certificate

Specifications:

Redox: ± 2000 mV	T: -10 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: 3 x ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

Accessories on page 16

Electrodes for general laboratory applications

SINGLE PORE GLASS

PN 238160 SINGLE PORE Glass

- Highest accuracy and fast response time thanks to patented SINGLE PORE electrolyte contact
- Robust design for easy cleaning
- Wide applicability for example with emulsions or low-ion media, general laboratory applications
- Reported by PTB to be the most accurate laboratory electrode tested
- Minimal alkali error
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: SKYLYTE-CL (refillable)	Shaft material: glass
Diaphragm: SINGLE PORE	Reference system: EVEREF
Temperature sensor: no	Sensor connetion: S7 connector head

POLILYTE LAB

PN 238403 Polilyte Lab

- Maintenance-free, robust, combination pH electrode for easy use
- Universally applicable, especially suited for measurements in emulsions and suspensions
- Thanks to the SINGLE PORE clogging of the diaphragm is practically impossible
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 80°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: glass
Diaphragm: SINGLE PORE	Reference system: EVEREF-B
Temperature sensor: no	Sensor connection: S7 connector head

POLILYTE LAB TEMP

PN 242060 Polilyte Lab Temp BNC
PN 242058 Polilyte Lab Temp DIN
PN 242062 Polilyte Lab Temp Lemo

- Maintenance-free, robust, combination pH electrode for daily laboratory use
- Universally adjustable, especially suited for measurements in emulsions and suspensions
- Thanks to the SINGLE PORE clogging of the diaphragm is practically impossible
- Integrated temperature sensor (NTC 30 kOhm or Pt1000)
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 80°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: glass
Diaphragm: SINGLE PORE	Reference system: EVEREF-B
Temperature sensor: yes	NTC 30 kOhm (PN 242058): Pt1000 (PN 242060, 242062)
Sensor connection:	PN 242060: 1.2 m BNC cable / 1 x 4 mm banana plug
	PN 242058: 1.2 m DIN cable / 1 x 4 mm banana plug
	PN 242062: 1.2 m LEMO cable / 2 x 2 mm banana plug
	(2 adapters for 4 mm banana plug included)

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Electrodes for general laboratory applications

FLUSHTRODE

PN 238060 **Flushtrode**

- Easy-to-clean, combination glass electrode with sleeve diaphragm
- Ideally suited for viscous samples, ion-weak media, or media containing protein (e.g. cosmetics)
- For samples containing protein, the electrode should be filled with PROTELYTE (PN 238038)
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 80°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: sleeve diaphragm	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

SLIMTRODE

PN 238150 **Slimtrode**

- pH electrode with 6 mm shaft diameter, for measurements in test tubes
- Universally applicable, even in strong acids as well as in normal laboratory use
- Long-term-stable EVEREF system
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

FILLTRODE

PN 242064 **Filltrode**

- Robust pH electrode with plastic shaft
- Multiple applications, thanks to its flat membrane: e.g. for viscous media
- Easy to clean
- The ring diaphragm prevents clogging
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: SKYLYTE-CL (refillable)	Shaft material: plastic
Diaphragm: ring diaphragm	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

GEL-GLASS

PN 238025 **Gel-Glass**

- Maintenance-free, excellent value, pH electrode for less rigorous applications
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 60°C
Electrolyte: gel (maintenance-free)	Shaft material: glass
Diaphragm: ceramic	Reference system: Ag/AgCl
Temperature sensor: no	Sensor connection: S7 connector head

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Electrodes for special laboratory applications

BIOTRODE

PN 238140 **Biotrode**

- Combination pH electrode for measurements in very small volumes, e.g. microtiter plates
- Ideally suited for solutions containing protein, as PROTELYTE prevents clogging of the diaphragm
- Long-term-stable EVEREF system
- Requires an immersion depth of only 7 mm
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: Protelyte (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

MINITRODE

PN 238100 **Minitrode**

- Combination pH electrode for measurements in very small volumes, e.g. vials
- Long-term-stable EVEREF system
- Requires an immersion depth of only 7 mm
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

SPINTRODE

PN 238197 **Spintrode**

- Combination pH electrode for measurements in very small volumes, e.g. NMR tubes
- Long-term-stable EVEREF system
- Requires an immersion depth of only 7 mm
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

FLATRODE

PN 238401 **Flatrode**

- pH electrode with super-flat membrane for measurements of surfaces, e.g. paper, agar plates
- Robust plastic shaft and ring diaphragm
- Ring diaphragm guarantees quick response time because of enhanced contact between sample and reference
- Long-term-stable EVEREF system
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: SKYLYTE-CL (refillable)	Shaft material: Plastic
Diaphragm: ring diaphragm	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

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Electrodes for foodstuff applications

FOODTRODE

PN 238285 **Foodtrode**

- Robust, combination pH electrode for measurements in media containing protein
- 3 ceramic diaphragms guarantee quick and accurate measurements
- Easy to clean
- Long-term-stable, thanks to EVEREF system
- Serial number, certificate

Specifications:

pH: 0 – 14	T: -10 to 100°C
Electrolyte: PROTELYTE (refillable)	Shaft material: glass
Diaphragm: 3 x ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

DOUBLE PORE

PN 238400 **Double Pore**

- Maintenance-free, combination pH puncture electrode
- Especially for use with solid and semi-solid samples
- Ideally suited for measurements in meat and cheese
- 2 SINGLE POREs makes blockage of the diaphragm practically impossible
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: glass
Diaphragm: 2 x SINGLE PORE	Reference system: Ag/AgCl
Temperature sensor: no	Sensor connection: S7 connector head

TIPTRODE

PN 238080 **Tiptrode**

- Refillable, combination pH puncture electrode
- Especially for use with solid and part-solid samples
- Long-term-stable EVEREF system
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 100°C
Electrolyte: PROTELYTE (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: no	Sensor connection: S7 connector head

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Electrodes for portable equipment applications

POLYPLAST

PN 238380 **Polyplast**
PN 238381 **Polyplast BNC**

- Robust, maintenance-free, combination pH electrode
- Shatter-proof plastic shaft
- Especially for water and sewage
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: Plastic
Diaphragm: SINGLE PORE	Reference system: Ag/AgCl
Temperature sensor: no	Sensor connection: S7 connector head or 1 m BNC

POLYPLAST TEMP

PN 242050 **Polyplast Temp BNC**
PN 238404 **Polyplast Temp DIN**
PN 242052 **Polyplast Temp Lemo**

- Robust, maintenance-free, combination pH electrode
- Shatter-proof plastic shaft
- Especially for water and sewage
- Integrated temperature sensor (NTC 30 kOhm or Pt1000)
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: Plastic
Diaphragm: SINGLE PORE	Reference system: Ag/AgCl
Temperature sensor: yes	NTC 30 kohm (PN 238404): Pt 1000 (PN 242050/242052)
Sensor connection:	PN 242050: 1.2 m BNC cable / 1 x 4 mm banana plug
	PN 238404: 1.2 m DIN cable / 1 x 4 mm banana plug
	PN 242052: 1.2 m LEMO cable / 2 x 2 mm banana plug
	(2 adapters for 4 mm banana plug included)

POLYPLAST ORP

PN 238385 **Polyplast ORP**
PN 238384 **Polyplast ORP BNC**

- Robust, maintenance-free, combination Redox electrode
- Shatter-proof plastic shaft
- Especially for water and sewage
- Serial number, certificate

Specifications:

Redox: ± 2000 mV	T: 0 to 60°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: Plastic
Diaphragm: SINGLE PORE	Reference system: Ag/AgCl
Temperature sensor: no	Sensor connection: S7 connector head or 1 m BNC

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Electrodes for Portamess equipment

These electrodes are especially well suited for KNICK Portamess equipment
The electrode head creates a hermetic seal with the Portamess storage tube

LIQ-GLASS KNICK

PN 242068 **Liq-Glass Knick Temp DIN**

- Combination electrode for daily laboratory use, with glass shaft
- Universally applicable, even in strong acid as well as in normal use
- Serial number, certificate

Specifications:

pH: 0 to 14	T: -10 to 100°C
Electrolyte: 3 M KCl (refillable)	Shaft material: glass
Diaphragm: ceramic	Reference system: EVEREF
Temperature sensor: yes	Pt1000
Sensor connection:	1.2 m cable + DIN plug / 1 x 4 mm banana plug

POLYPLAST KNICK

PN 242070 **Polyplast Knick Temp DIN**

- Robust plastic shaft
- Ideally suited for field measurements
- Clogg-free SINGLE PORE guarantees quick and reliable measurements
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60°C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: Plastic
Diaphragm: SINGLE PORE	Reference system: Ag/AgCl
Temperature sensor: yes	Pt1000
Sensor connection:	1.2 m cable + DIN plug / 1 x 4 mm banana plug

DOUBLE PORE KNICK

PN 242066 **Double Pore Knick**

- Robust PEEK shaft
- Smallest possible surface sample contact with glass
- Ideally suited to measurements of solid and semi-solid samples (e.g. cheese, meat)
- 2 SINGLE POREs makes clogging of the diaphragm practically impossible
- Serial number, certificate

Specifications:

pH: 0 to 14	T: 0 to 60° C
Electrolyte: POLISOLVE (maintenance-free)	Shaft material: PEEK (high-performance plastic)
Diaphragm: 2 SINGLE POREs	Reference system: Ag/AgCl
Temperature sensor: no	Sensor connection: 1 m cable + DIN plug

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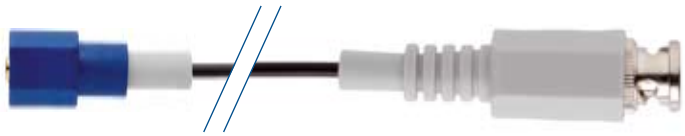
Accessories

Cables:

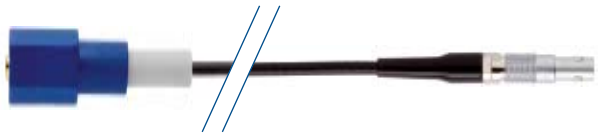
Cables are fitted with an S7 socket. The equipment-side plug must be chosen to fit the pH meter. The cables have a diameter of 3 mm and a standard length of 1 m, 3 m, and 5 m.

PN 355173: 1 m cable S7 / BNC *
PN 355176: 3 m cable S7 / BNC *
PN 355178: 5 m cable S7 / BNC *



PN 355174: 1 m cable S7 / DIN
PN 355177: 3 m cable S7 / DIN
PN 355179: 5 m cable S7 / DIN

PN 355175: 1 m cable S7 Lemo



* All BNC plugs are fitted with a protective cover.
This helps ensure reliable results, as the plug is better protected from fluid splashes.

Electrolytes and solutions:

Electrolyte:
PN 238036: 3 M KCl, 100 ml
PN 238936: 3 M KCl, 500 ml
PN 242080: SKYLYTE-CL, 100 ml
PN 238038: PROTELYTE, 100 ml

Storage solution
For long life and quick response times, it is best to store electrodes in our storage medium. This is a an acid-buffered solution that in addition to providing optimized storage, also ensures regeneration of the electrode.

PN 238931: Storage solution, 500 ml

Cleaning solutions
Depending on the nature of the application the pH glass or diaphragm can become contaminated. This is indicated by slow response of the electrode, or even incorrect readings. To overcome these problems, HAMILTON has developed a cleaning solution set.
The set comprises Cleaning Solution A, Cleaning Solution B, and a storage solution, each of 500 ml.

PN 238290: Cleaning solution set

pH simulators

Applications for pH simulators:

- **Testing cables and measurement devices**
- **ISO 9000 test device monitoring with DKD certificate**

Testing cables and measurement devices:
Sometimes pH measurement problems are attributed to defective or poorly-chosen pH sensors. But often the cause is poor-quality, worn, or defective pH cables , which no longer fulfill the high demands of insulation resistance. Not to be forgotten are similar faults in measurement devices, that also make reliable pH measurement impossible. These problems can be detected with the pH simulator, eliminating costly and time-consuming trials of different electrodes.

ISO 9000 test device monitoring:
To adapt the simulator for ISO 9000-compliant test device monitoring on the shop floor, the device must be certified by DKD, the German calibration service, which is accredited by PTB (Physikalisch-Technische Bundesanstalt, Braunschweig) for the measurements involved. The DKD certificate contains the measured mV values, which must be displayed by the measurement device being tested within the given tolerances.

pH SIMULATOR LAB

Simulates pH and Redox sensors
For testing cables and measurement devices
16 test values, including NIST pH buffer values
Testing of pH input resistance (Hi Z)
Adapter cable for BNC, standard S7 plug

- Easy and safe operation, using high-quality touch-buttons
- Simple, one-hand operation
- Large, easy-to-read illuminated display
- Testing of high-ohm measurement device input resistance and the often poor resistance of pH cables
- Battery level display ensures correct operation and eliminates unnecessary battery changes
- Waterproof front
- DKD certificate with measured mV values available as an option

pH SIMULATOR LAB

pH SIMULATOR PRO

Same as pH SIMULATOR LAB, but also includes:

- Protective rubber cover with folding support
- Service case with place for 2 x 250 mL pH buffer
- With SIMULATOR PRO, the rubber cover protects against minor knocks, mechanical damage, and also contains a leg to prop up the simulator for ease of reading
- The SIMULATOR PRO is equipped with extra adapter cables for VP cable tests, including Pt100 or Pt1000 simulations
- DKD certificate with measured mV values available as an option

pH SIMULATOR PRO

Specifications	
pH simulation values	pH 1.00, 1.68, 4.01, 6.86, 7.00, 9.18, 10.01, 12.45
pH simulation accuracy	±0.02 pH
mV simulation values	-1800, -900, -390, +390, +900, +1800 mV
mV simulation accuracy	±1 mV
pH input resistance test (Hi Z)	1 GOhm at pH 4.01 and 10.01
Display	LEDs, values separated for ease of operation
Output	BNC plugs, various adapter cables
Battery state display	LED
Power source	4 x AAA batteries
Operating temperature	0 to 40°C
Permissible air humidity	80% up to 30°C , linear decrease up to 50% at 40°C
Measurements	Approximately 140 x 170 x 35 mm

Label	PN
pH SIMULATOR LAB	237556
pH SIMULATOR LAB with certificate	237560
pH SIMULATOR PRO	237550
pH SIMULATOR PRO with certificate	237566
Replacement parts:	
Rubber protective cover	237552
Accessories:	
DURACAL pH buffer pH 4.01, 250 mL	238317
DURACAL pH buffer pH 7.00, 250 mL	238318
DURACAL pH buffer pH 9.21, 250 mL	238319
DURACAL pH buffer pH 10.01, 250 mL	238321

Conductivity standards

HAMILTON conductivity standards – leading in long-term stability and accuracy

Although seemingly a minor matter, calibration and verification of conductivity sensors is far from simple. This is particularly the case with measurements in the low conductivity range, for which stable and reliable calibration standards have been completely lacking up to now. Since a conductivity standard is not a buffer solution, the lower the value of the conductivity standard, then the greater the effect of entry of CO_2 or contamination.
HAMILTON is the first manufacturer to offer conductivity standards of 1.3 and 5 µS/cm with a certified accuracy of ±1%, and a lifetime of 1 and 3 years respectively. The composition of these standards is patented; the procedure for determining conductivity was developed in collaboration with DFM[1]. Many state metrological institutes that deal with measurement of electrolytic conductivity use HAMILTON standards, since they lie in a low conductivity range and exhibit the type of stability that has never been achieved before (see illustration "Stability over 3 years" on page 19, with test measurements by PTB[2]). During an interlaboratory test among prestigious European metrological institutes (PTB , DFM, DKD3) HAMILTON standards were used as the measurement solution.

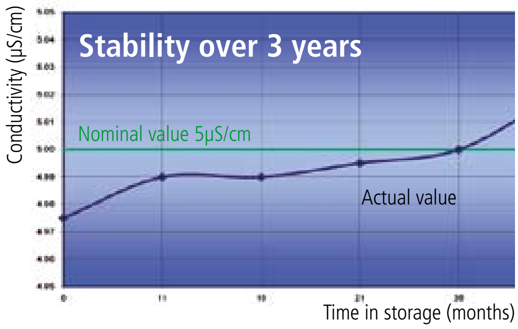
HAMILTON is different:

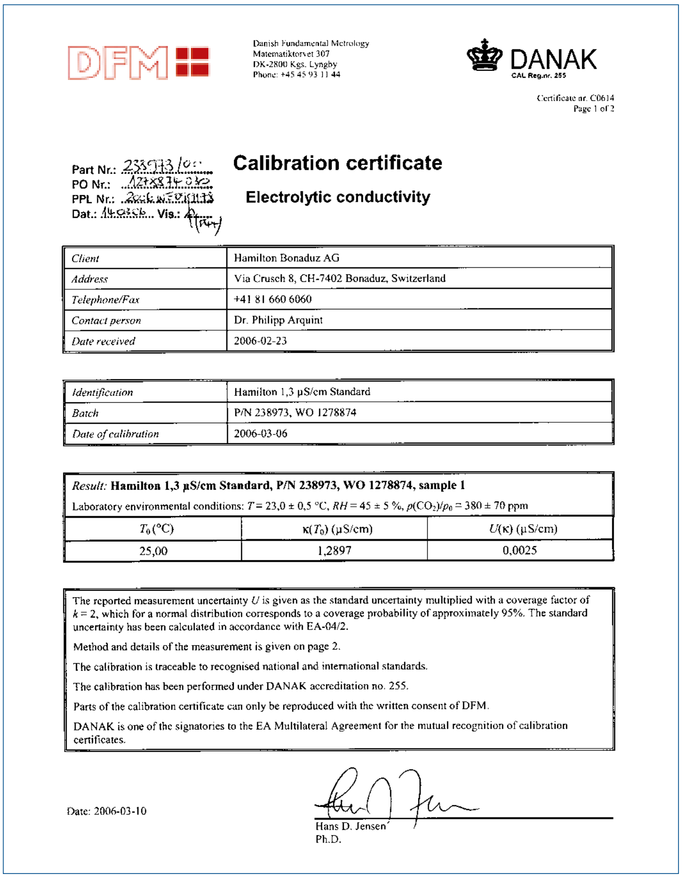
HAMILTON offers conductivity standards with various conductivity values, whose stability of ±1% is guaranteed over a lifetime of up to 3 years. These standards can be used repeatedly, on condition that the bottle is not left open (without its lid) for more than 1 hour in total.
In order to ensure the accuracy of the conductivity standards a representative number of bottles from each batch is measured by DFM. The DFM value is recorded on the calibration certificate and on each bottle. DFM enjoys the highest prestige in Europe in the area of electrolytic conductivity and is equipped with an absolute measurement cell that was developed in collaboration with NIST, and is accredited by the Danish accreditation agency DANAK to a conductivity of 0.9 µS/cm. DFM and NIST[4] have made comparisons of their measurement uncertainty and have confirmed in a series of scientific publications that the measurement accuracy is in each case the same. Because no primary standards exist in the low conductivity range, we depend on absolute measurement cells which trace electrical conductivity back to the SI units: meter and Volt. Testing of HAMILTON standards is thus carried out on the most precise measurement apparatus in the world, and certified accordingly.

[1] DFM: Danish Institute of Fundamental Metrology, Dänemark
[2] PTB: Physikalisch-Technische Bundesanstalt, Braunschweig
[3] DKD: Deutscher Kalibrierdienst
[4] NIST: National Institute of Standards and Technology, Gaithersburg MD, USA

Unique advantages:

- Remains stable for a minimum of 1 year for 1.3 μS/cm, and up to 3 years for all other values
- Certificate with calibration document from DFM (available at www.hamiltoncompany.com/cert)
- Expiry date shown on every bottle
- Bottles are permitted to stay open for a total of 60 minutes





DFM

Danish Fundamental Metrology
Matematiktorvet 307
DK-2800 Kgs. Lyngby
Phone: +45 45 93 11 44

DANAK
CAL Reg.nr. 255

Certificate nr. C0614
Page 1 of 2

Part Nr.: 238973/[illegible]
PO Nr.: [illegible]
PPL Nr.: [illegible]
Dat.: 14.03.06 Vis.: [illegible]

Calibration certificate

Electrolytic conductivity

Client	Hamilton Bonaduz AG
Address	Via Crusch 8, CH-7402 Bonaduz, Switzerland
Telephone/Fax	+41 81 660 6060
Contact person	Dr. Philipp Arquint
Date received	2006-02-23

Identification	Hamilton 1,3 μS/cm Standard
Batch	P/N 238973, WO 1278874
Date of calibration	2006-03-06

Result: **Hamilton 1,3 μS/cm Standard, P/N 238973, WO 1278874, sample 1**

Laboratory environmental conditions: $T = 23{,}0 \pm 0{,}5$ °C, $RH = 45 \pm 5$ %, $p(CO_2)/p_0 = 380 \pm 70$ ppm

T_0 (°C)	$\kappa(T_0)$ (μS/cm)	$U(\kappa)$ (μS/cm)
25,00	1,2897	0,0025

The reported measurement uncertainty U is given as the standard uncertainty multiplied with a coverage factor of $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been calculated in accordance with EA-04/2.

Method and details of the measurement is given on page 2.

The calibration is traceable to recognised national and international standards.

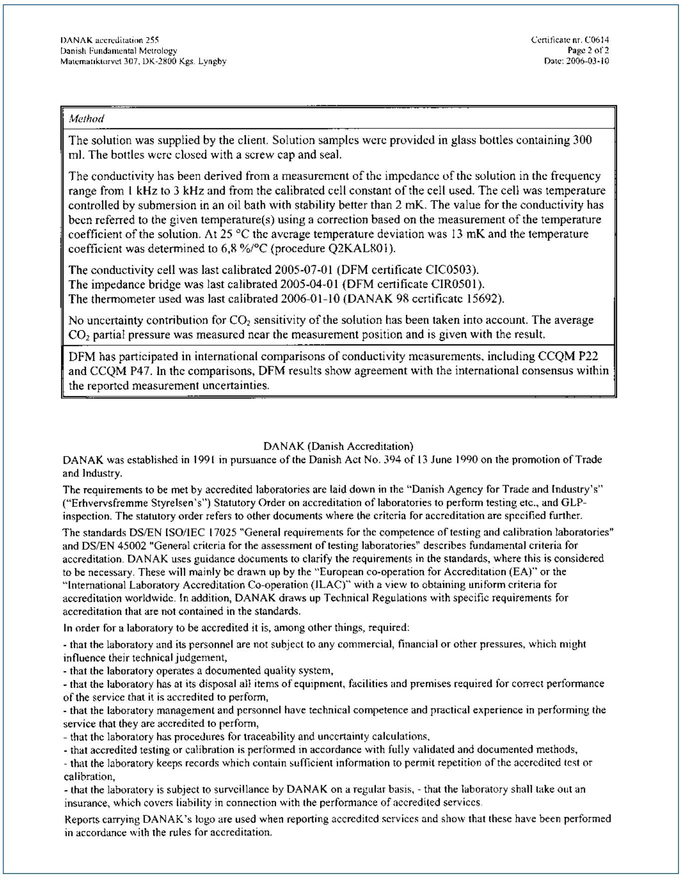
The calibration has been performed under DANAK accreditation no. 255.

Parts of the calibration certificate can only be reproduced with the written consent of DFM.

DANAK is one of the signatories to the EA Multilateral Agreement for the mutual recognition of calibration certificates.

Date: 2006-03-10

Hans D. Jensen
Ph.D.



DANAK accreditation 255
Danish Fundamental Metrology
Matematiktorvet 307, DK-2800 Kgs. Lyngby

Certificate nr. C0614
Page 2 of 2
Date: 2006-03-10

Method

The solution was supplied by the client. Solution samples were provided in glass bottles containing 300 ml. The bottles were closed with a screw cap and seal.

The conductivity has been derived from a measurement of the impedance of the solution in the frequency range from 1 kHz to 3 kHz and from the calibrated cell constant of the cell used. The cell was temperature controlled by submersion in an oil bath with stability better than 2 mK. The value for the conductivity has been referred to the given temperature(s) using a correction based on the measurement of the temperature coefficient of the solution. At 25 °C the average temperature deviation was 13 mK and the temperature coefficient was determined to 6,8 %/°C (procedure Q2KAL801).

The conductivity cell was last calibrated 2005-07-01 (DFM certificate CIC0503).
The impedance bridge was last calibrated 2005-04-01 (DFM certificate CIR0501).
The thermometer used was last calibrated 2006-01-10 (DANAK 98 certificate 15692).

No uncertainty contribution for CO_2 sensitivity of the solution has been taken into account. The average CO_2 partial pressure was measured near the measurement position and is given with the result.

DFM has participated in international comparisons of conductivity measurements, including CCQM P22 and CCQM P47. In the comparisons, DFM results show agreement with the international consensus within the reported measurement uncertainties.

DANAK (Danish Accreditation)

DANAK was established in 1991 in pursuance of the Danish Act No. 394 of 13 June 1990 on the promotion of Trade and Industry.

The requirements to be met by accredited laboratories are laid down in the "Danish Agency for Trade and Industry's" ("Erhvervsfremme Styrelsen's") Statutory Order on accreditation of laboratories to perform testing etc., and GLP-inspection. The statutory order refers to other documents where the criteria for accreditation are specified further.

The standards DS/EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" and DS/EN 45002 "General criteria for the assessment of testing laboratories" describes fundamental criteria for accreditation. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, DANAK draws up Technical Regulations with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- that the laboratory and its personnel are not subject to any commercial, financial or other pressures, which might influence their technical judgement,
- that the laboratory operates a documented quality system,
- that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform,
- that the laboratory management and personnel have technical competence and practical experience in performing the service that they are accredited to perform,
- that the laboratory has procedures for traceability and uncertainty calculations,
- that accredited testing or calibration is performed in accordance with fully validated and documented methods,
- that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test or calibration,
- that the laboratory is subject to surveillance by DANAK on a regular basis, - that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.

Reports carrying DANAK's logo are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Value at 25°C	Accuracy	Stability (in months)	Certificate from	Packaging unit	PN
1.3 μS/cm	±1%	12	DFM	Glass bottle 300 mL	238973
5 μS/cm	±1%	36	DFM	Glass bottle 300 mL	238926
15 μS/cm	±1%	36	DFM	Glass bottle 300 mL	238927
84 μS/cm	±1%	18	DFM	1 Calpack bottle 500 mL	238984
100 μS/cm	±1%	36	DFM	Glass bottle 300 mL	238934
147 μS/cm	±1%	18	DFM	1 Calpack bottle 500 mL	238985
1413 μS/cm	±1%	36	DFM	Glass bottle 300 mL	238928
1413 μS/cm	±1%	18	DFM	1 Calpack bottle 500 mL	238986
12288 μS/cm	±1%	18	DFM	1 Calpack bottle 500 mL	238988

DURACAL pH buffers

Can you trust your buffer solution?

GMP, GLP, ISO 9001, EN 45000, calibration, verification, traceability, certification from an accredited organization: key expressions that are increasingly important. The calibration of pH and Redox electrodes has never been easy. All calibration procedures assume that the labeled values of the calibration buffers are correct. But buffer values can change over time and so can your results.

A complete range of patented buffer solutions provides pH stability never before achieved. HAMILTON guarantees DURACAL pH buffers for 5 years after the date of manufacture. The pH 9.21 and pH 10.01 buffers are even stable in air. High buffering capacity provides rapid, stable calibration. The growth of fungus and micro-organisms is prevented.

Traceability

An important issue for the production of Certified Reference Material is to ensure traceability through an unbroken chain of comparisons to reference material of the highest metrological quality (Primary Reference Material) from NIST[1)] and PTB[2)] .

Unlike other manufacturers, where only top-down traceability is applied, HAMILTON works with circular or closed-loop traceability. This closed-loop traceability ensures users of the unique reliability of HAMILTON DURACAL buffers.

Top-down traceability: At HAMILTON, the pH value of DURACAL buffers is determined by comparison against two secondary reference buffer solutions. These are purchased from accredited suppliers of secondary reference materials. The solutions themselves are compared against primary reference solutions from PTB[1)] or NIST[2)]. The measurement uncertainties from each measurement comparison are known and documented.

Bottom-up traceability: To ensure the highest possible accuracy and full reliability of the pH value, a representative number of samples from every single production lot is sent to a German DKD[3)] laboratory (DKD-K-06901) for external, independent and impartial verification. In this laboratory, the DURACAL samples are compared against secondary reference solutions from DKD-K-06901. These secondary reference solutions are compared to a primary reference solution from PTB or NIST. At this stage, the loop is closed: the primary reference solutions are the start- and end-points of the circular traceability loop. DKD provides HAMILTON with a calibration certificate for every DURACAL production batch.

Due to the complete traceability of the measurement procedure and the assignment of uncertainties to the particular testing steps, the DURACAL buffers can be classified as "Certified Reference Material " (CRM-certified reference material).

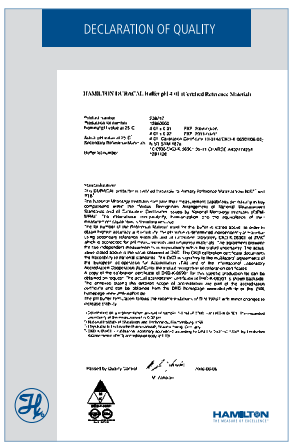
Features:

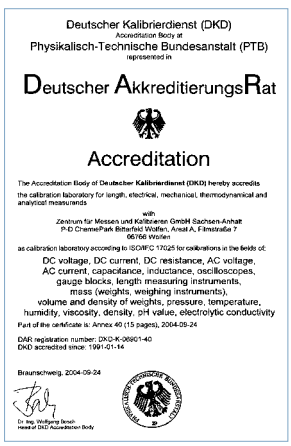
- Convenient 250 mL or 500 mL bottle with built-in calibration compartment
- Economical, only about 15 mL of buffer is used per calibration
- Certified pH value from a DKD laboratory accredited for pH measurement
- First class certificate with traceability to international standards
- Certificates available at http://www.hamiltoncompany.com/cert
- Expiration date on the bottle
- Immune to micro-organisms

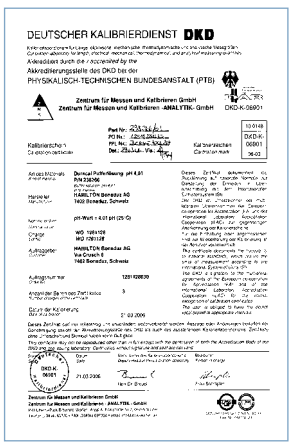
[1)] NIST
National Institute of Standards and Technology,
Gaithersburg MD, USA

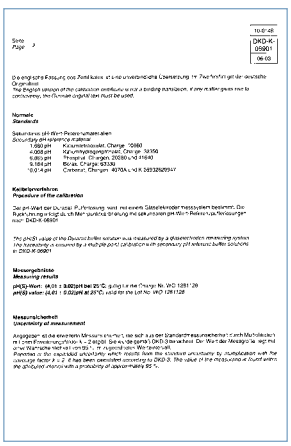
[2)] PTB
Physikalisch Technische Bundesanstalt,
Braunschweig, Germany

[3)] DKD
Deutscher Kalibrierdienst DKD-K-06901,
Zentrum for Messen und Kalibrieren GmbH,
Wolfen, Germany


DECLARATION OF QUALITY


Deutscher Kalibrierdienst (DKD)
Accreditation Body at
Physikalisch-Technische Bundesanstalt (PTB)
represented in
Deutscher AkkreditierungsRat
Accreditation


DEUTSCHER KALIBRIERDIENST DKD



Simple handling for professional results:

Step 1: Open bottle

Step 2: Fill calibration compartment

Step 3: Calibrate electrode

Step 4: Empty calibration compartment

pH buffers

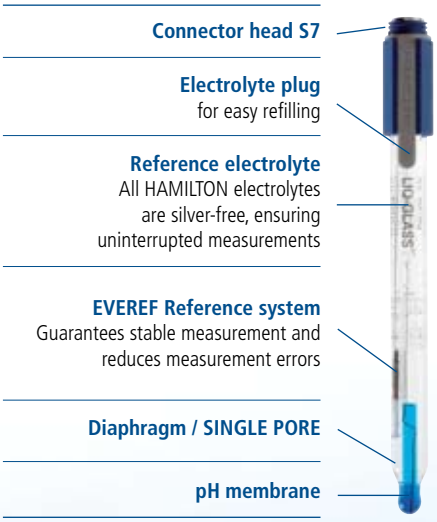
pH Value	Accuracy	Stability (in months)	Certified by	Packaging unit	PN
1.09	±0.02	60	HAMILTON	500 mL	238271
1.68	±0.02	60	HAMILTON	500 mL	238272
2.00	±0.02	60	HAMILTON	500 mL	238273
3.06	±0.02	60	HAMILTON	500 mL	238274
4.01	±0.01 / ±0.02	24 / 60	DKD	250 mL	238317
4.01	±0.01 / ±0.02	24 / 60	DKD	500 mL	238217
4.01	±0.01 / ±0.02	24 / 60	DKD	3 x 500 mL	238917
4.01	±0.01 / ±0.02	24 / 60	DKD	5 L	238332
4.01	±0.01 / ±0.02	24 / 60	DKD	10 L	238194
4.01	±0.01 / ±0.02	24 / 60	DKD	1000 L	238895
5.00	±0.02	60	HAMILTON	500 mL	238275
6.00	±0.02	60	HAMILTON	500 mL	238276
7.00	±0.01 / ±0.02	24 / 60	DKD	250 mL	238318
7.00	±0.01 / ±0.02	24 / 60	DKD	500 mL	238218
7.00	±0.01 / ±0.02	24 / 60	DKD	3 x 500 mL	238918
7.00	±0.01 / ±0.02	24 / 60	DKD	5 L	238333
7.00	±0.01 / ±0.02	24 / 60	DKD	10 L	238188
7.00	±0.01 / ±0.02	24 / 60	DKD	1000 L	238896
8.00	±0.02	60	HAMILTON	500 mL	238277
9.21	±0.02	60	DKD	250 mL	238319
9.21	±0.02	60	DKD	500 mL	238219
9.21	±0.02	60	DKD	3 x 500 mL	238919
9.21	±0.02	60	DKD	10 L	238216
9.21	±0.02	60	DKD	1000 L	238897
10.01	±0.02	60	DKD	250 mL	238321
10.01	±0.02	60	DKD	500 mL	238223
10.01	±0.02	60	DKD	3 x 500 mL	238923
10.01	±0.02	60	DKD	10 L	238187
10.01	±0.02	60	DKD	1000 L	238898
11.00	±0.02	24	HAMILTON	500 mL	238278
12.00	±0.02	24	HAMILTON	500 mL	238279
4.01/7.00/9.21	±0.01 / ±0.02	24 / 60	DKD	500 mL, mixed	238922
4.01/7.00/10.01	±0.01 / ±0.02	24 / 60	DKD	500 mL, mixed	238924

Redox buffers

Redox value	Accuracy	Stability (monthly)	Certified by	Packing unit	PN
271 mV	±5 mV	24	None	500 mL	238228
475 mV	±5 mV	24	None	250 mL	238322
475 mV	±5 mV	24	None	500 mL	238227

Practical advice for pH and Redox electrodes

Construction of a pH or Redox sensor

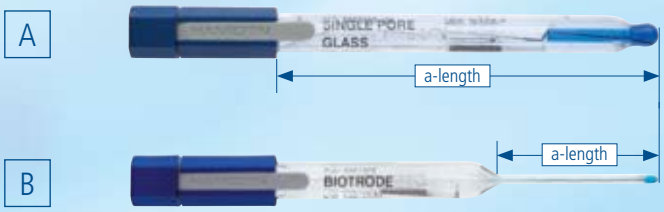


Length of the electrode

What is the a-length, and where does it start?

The a-length is dependent on the construction of the electrode. With electrodes that have a 12 mm shaft passing all the way through the body (see picture A) the a-length is measured from the connector head to the end of the electrode.

With electrodes that have a shaft diameter of less than 12 mm, the a-length begins at the diameter reduction (see picture B).



Calibration and measurement

- For quick and accurate results, the electrolyte plug should be open during measurements (Note: polymer electrolytes do not have an electrolyte plug).
- The electrode should be immersed at least to the diaphragm. The height to which the electrolyte is filled must always be above that of the measurement solution. This prevents the measurement solution from penetrating into the electrode.
- Always wait until the electrode reaches the temperature of the sample.
- Between measurements, the electrode should be rinsed off with deionized water. If necessary, dab it dry with a paper towel. Never rub the electrode dry with a paper towel, as it will become electrostatically charged, and give slow response times.
- To prevent problems, calibrate with DURACAL® buffer (see page 20/21). If you do not use DURACAL® buffer, never calibrate in the original bottle. Always use fresh buffer solution for calibration. Close the bottle after use.
- Dispose of used buffer responsibly.
- Read the operating instructions of the pH measurement device.

Practical advice for pH and Redox electrodes

Temperature influences

Both the pH/Redox value of the sample and the characteristics of the electrode are temperature dependent. Usually, the temperature dependency of the sample is unknown. Therefore, it is important to always record the measurement temperature together with the measured value. The automatic temperature compensation in measurement devices can only compensate for the temperature dependence of the electrode's characteristics curve (Nernst-Gleichung). For this purpose, temperature sensors (for example, Pt1000 or NTC 30kOhm) are used. In order to obtain the most accurate measurement, the sensor should always be calibrated at the same temperature at which measurements will later take place.
For measurements that will serve as a comparison between laboratory and process values, make sure that the laboratory measurement takes place at the same temperature as the process measurement.

Storage

For storage, place the electrode (with closed electrolyte plug) in the reference electrolyte, or better, in the HAMILTON storage solution (PN 238931). The storage solution helps to clean both the diaphragm and the pH glass. Electrodes must never be stored in deionized water.

Cleaning

Contamination of the diaphragm is the most frequent cause of measurement problems. Only infrequently do problems with the glass membrane occur. The diaphragm and the pH membrane should therefore be kept clean in order to avoid measurement errors and long response times. Use soap and water to remove oil, fat, and organic substances. In the event of protein contamination of the electrode, submerge the electrode in a fresh solution of 0.4% HCl, and 5 g/l pepsin. After every cleaning, the electrode should be conditioned in HAMILTON storage solution for at least 2 hours. Before carrying out new measurements, perform a new calibration.
To simplify cleaning, HAMILTON has developed a special cleaning set (PN 238290) with which you can easily remove most types of contamination from diaphragms and pH glass.

Most frequent causes of calibration problems

The 3 following problems occur most frequently during calibration:

- Zero calibration error
- Electrode slope inadequate
- Slow response, for example, longer than 3 minutes

There can be various causes for the problems named above. The most frequent are:

a) The buffer solutions used are either contaminated or out-of-date. It could also be that one of the buffer solutions used does not have the required buffer value – for this reason, never store buffer solutions in unmarked or dirty containers.

b) The reference electrolyte and / or the diaphragm are contaminated.

c) An old or defective electrode is used.

d) An electrode is used that has not been hydrated long enough (after dry storage or after cleaning with strong acid solution).

e) The pH membrane of the electrode is mechanically damaged, and has cracks.

f) The electrode is electrostatically charged (through rubbing of the electrode shaft with a cloth instead of careful dabbing with soft paper).

g) The temperature difference between electrode and buffer solution is more than 10°C.

i) The connection between electrode and measurement device can also cause problems: for instance, a break in the cable, or a short-circuit caused by moisture in the cable or electrode plug.

Specifications

pH or Redox Sensor	Nominal measurement range	Temperature range	Reference electrolyte	Reference system	Shaft material	Shaft diameter (mm)	Shaft diameter below (mm)
BIOTRODE	0 to 14	0 to 100°C	PROTELYTE	EVEREF	Glass	12	3
DOUBLE PORE	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Glass	12	6
DOUBLE PORE KNICK	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	PEEK	12	6
FILLTRODE	0 to 14	0 to 60°C	SKYLYTE-CL	EVEREF	Plastic	12	12
FLATRODE	0 to 14	0 to 60°C	SKYLYTE-CL	EVEREF	Plastic	12	12
FLUSHTRODE*	0 to 14	-10 to 80°C	3 M KCL	EVEREF	Glass	12	12
FOODTRODE	0 to 14	-10 to 100°C	PROTELYTE	EVEREF	Glass	12	12
GEL-GLASS	0 to 14	-10 to 60°C	GEL	Ag/AgCl	Glass	12	12
LIQ-GLASS	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS BNC	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS DIN	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS ORP	± 2000 mV	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS Temp BNC	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS Temp DIN	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS Temp Lemo	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
LIQ-GLASS KNICK	0 to 14	-10 to 100°C	3 M KCL	EVEREF	Glass	12	12
MINITRODE	0 to 14	0 to 100°C	3 M KCL	EVEREF	Glass	12	3
POLILYTE LAB	0 to 14	-10 to 80°C	POLISOLVE	EVEREF-B	Glass	12	12
POLILYTE LAB Temp BNC	0 to 14	-10 to 80°C	POLISOLVE	EVEREF-B	Glass	12	12
POLILYTE LAB Temp DIN	0 to 14	-10 to 80°C	POLISOLVE	EVEREF-B	Glass	12	12
POLILYTE LAB Temp Lemo	0 to 14	-10 to 80°C	POLISOLVE	EVEREF-B	Glass	12	12
POLYPLAST	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST BNC	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST ORP	± 2000 mV	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST ORP BNC	± 2000 mV	0 to 60 °C	POLYSOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST Temp BNC	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST Temp DIN	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST Temp Lemo	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
POLYPLAST KNICK	0 to 14	0 to 60°C	POLISOLVE	Ag/AgCl	Plastic	12	12
SINGLE PORE GLASS	0 to 14	0 to 100°C	SKYLYTE-CL	EVEREF	Glass	12	12
SLIMTRODE	0 to 14	0 to 100°C	3 M KCL	EVEREF	Glass	12	6
SPINTRODE	0 to 14	0 to 100°C	3 M KCL	EVEREF	Glass	12	3
TIPTRODE	0 to 14	0 to 100°C	PROTELYTE	EVEREF	Glass	12	6

* For samples containing protein, replace the 3 M KCl with the separately obtainable PROTELYTE electrolyte (see page 16).

** Adapter for 4 mm banana plug included.

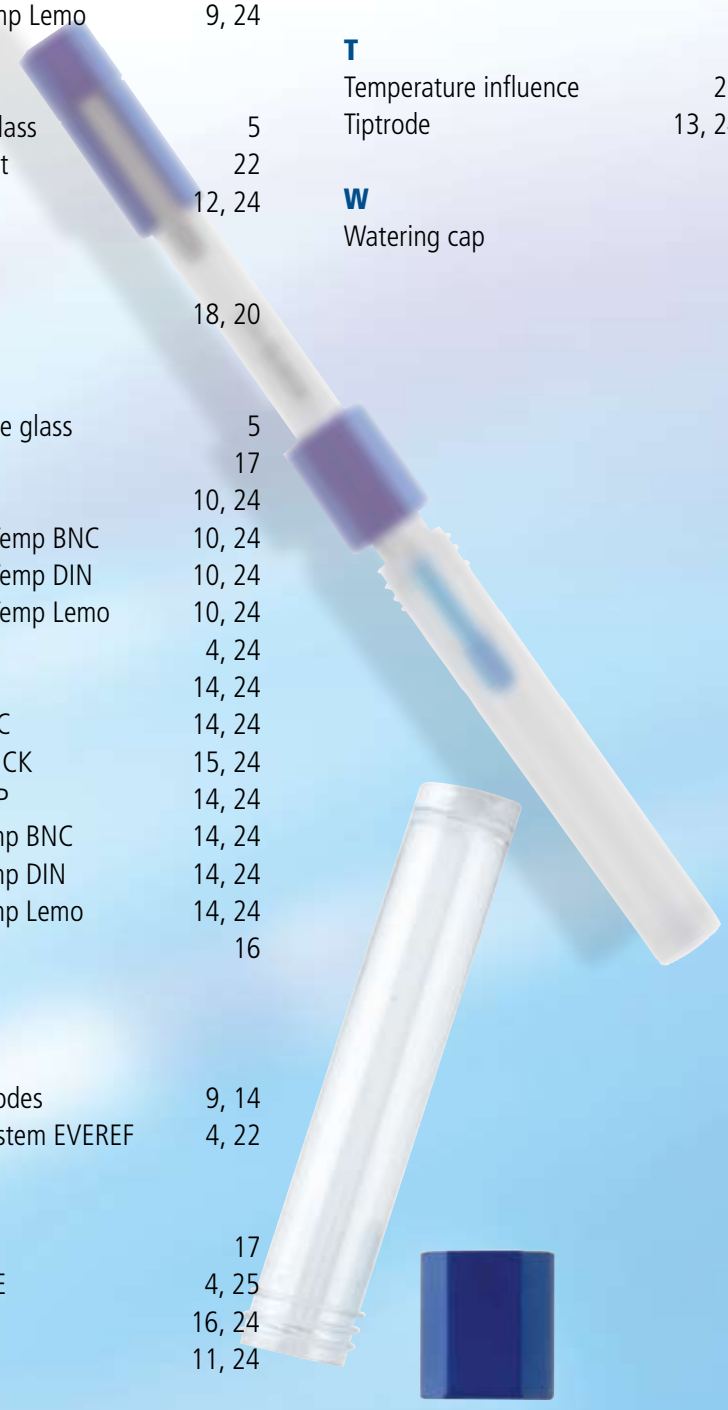
Shaft length (a)	Membrane glass	Membrane shape	Diaphragm	Number of diaphragms	Minimum immersion depth (mm)	Electrode head	Temperature sensor
60 mm	V glass	Cylindrical	Ceramic	1	7	S7	No
35 mm	V glass	Spear	SINGLE PORE	2	15	S7	No
35 mm	V glass	Spear	SINGLE PORE	2	15	Fixed cable with DIN plug	No
120 mm	HF glass	Flat	Ring	1	4	S7	No
120 mm	HF glass	Flat	Ring	1	1	S7	No
120 mm	V glass	Cylindrical	Ground sleeve	1	30	S7	No
120 mm	V glass	Cylindrical	Ceramic	3	20	S7	No
120 mm	V glass	Cylindrical	Ceramic	1	15	S7	No
120 mm	V glass	Cylindrical	Ceramic	1	15	S7	No
120 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with BNC plug	No
120 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with DIN plug	No
120 mm	Platin	Cylindrical	Ceramic	3	15	S7	No
120 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with BNC plug / 1 x 4 mm banana plug	Pt1000
120 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with DIN plug / 1 x 4 mm banana plug	NTC 30 kOhm
120 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with Lemo plug / 2 x 2 mm banana plug**	Pt1000
110 mm	V glass	Cylindrical	Ceramic	1	15	Fixed cable with DIN plug / 1 x 4 mm banana plug	Pt1000
60 mm	V glass	Cylindrical	Ceramic	1	7	S7	No
120 mm	V glass	Cylindrical	SINGLE PORE	1	15	S7	No
120 mm	V glass	Cylindrical	SINGLE PORE	1	15	Fixed cable with BNC plug / 1 x 4 mm banana plug	Pt1000
120 mm	V glass	Cylindrical	SINGLE PORE	1	15	Fixed cable with DIN plug / 1 x 4 mm banana plug	NTC 30 kOhm
120 mm	V glass	Cylindrical	SINGLE PORE	1	15	Fixed cable with Lemo plug / 2 x 2 mm banana plug**	Pt1000
120 mm	V glass	Cylindrical	SINGLE PORE	1	10	S7	No
120 mm	V glass	Cylindrical	SINGLE PORE	1	10	Fixed cable with BNC plug	No
120 mm	Platin	Cylindrical	SINGLE PORE	1	10	S7	No
120 mm	Platin	Cylindrical	SINGLE PORE	1	10	Fixed cable with BNC plug	No
120 mm	V glass	Cylindrical	SINGLE PORE	1	10	Fixed cable with BNC plug / 1 x 4 mm banana plug	Pt1000
120 mm	V glass	Cylindrical	SINGLE PORE	1	10	Fixed cable with DIN plug / 1 x 4 mm banana plug	NTC 30 kOhm
120 mm	V glass	Cylindrical	SINGLE PORE	1	10	Fixed cable with Lemo plug / 2 x 2 mm banana plug**	Pt1000
110 mm	V glass	Cylindrical	SINGLE PORE	1	10	Fixed cable with DIN plug / 1 x 4 mm banana plug	Pt1000
120 mm	H glass	Cylindrical	SINGLE PORE	1	15	S7	No
100 mm	V glass	Cylindrical	Ceramic	1	15	S7	No
180 mm	V glass	Cylindrical	Ceramic	1	7	S7	No
25 mm	V glass	Spear	Ceramic	1	17	S7	No

pH meter cross reference

Manufacturer	Model	Biotrode 238140	Double Pore 238400	Filltrode 242064	Flatrode 238401	Flushtrode 238060	Foodtrode 238285	Gel-Glass 238025	Liq-Glass 238000	Liq-Glass BNC 238180	Liq-Glass DIN 238185	Liq-Glass ORP 238145	Liq-Glass Temp BNC 242056	Liq-Glass Temp DIN 238406	Liq-Glass Temp Lemo 242054	Minitrode 238100	Polilyte Lab 238403	Polilyte Lab Temp BNC 242060	Polilyte Lab Temp DIN 242058	Polilyte Lab Temp Lemo 242062	Polyplast 238380	Polyplast BNC 238381	Polyplast ORP 238385	Polyplast ORP BNC 238384	Polyplast Temp BNC 242050	Polyplast Temp DIN 238404	Polyplast Temp Lemo 242052	SINGLE PORE Glass 238160	Slimtrode 238150	Spintrode 238197	Tiptrode 238080
Crison	PH 25	■	■	■	■	■	■	■	■	■		■	■			■	■				■	■	■				■	■	■	■	■
	Basic 20	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	GLP 21	■	■	■	■	■	■	■	■	■		■	■	■		■	■	■			■	■	■	■			■	■	■	■	■
	GLP 22	■	■	■	■	■	■	■	■	■		■	■	■		■	■	■			■	■	■	■			■	■	■	■	■
Eutech	EcoScan pH 5	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	EcoScan pH 6	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 11	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 110	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 300	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 310	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 510	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 1100	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 2100	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 1500	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 6000	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
	CyberScan pH 6500	■	■	■	■	■	■	■	■	■		■				■	■		■		■	■	■				■	■	■	■	■
Hanna	HI 901	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 902	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 9813-6	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 9813-5	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 9813-0	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 8010	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■				■	■	■	■	■
	HI 4212	■	■	■	■	■	■	■	■	■		■	■			■	■				■	■	■				■	■	■	■	■
	HI 4211	■	■	■	■	■	■	■	■	■		■	■			■	■				■	■	■				■	■	■	■	■
Metrohm	pH Meter 780	■	■	■	■	■	■	■	■			■			■	■	■			■	■		■				■	■	■	■	■
	pH/Ion Meter 781	■	■	■	■	■	■	■	■			■			■	■	■			■	■		■				■	■	■	■	■
	pH Mobile 826	■	■	■	■	■	■	■	■			■			■	■	■			■	■		■				■	■	■	■	■
	pH Lab 827	■	■	■	■	■	■	■	■			■			■	■	■			■	■		■				■	■	■	■	■
Mettler-Toledo	Seven Easy S20	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■	■				■	■	■	■
	Seven Multi S40	■	■	■	■	■	■	■	■	■		■	■			■	■				■	■	■	■				■	■	■	■
	Seven Multi S47	■	■	■	■	■	■	■	■	■		■	■			■	■				■	■	■	■				■	■	■	■
	pH Meter 1120 (-X)	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	pH Meter 1140 (-X)	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Seven Go pH SG2	■	■	■	■	■	■	■	■	■		■				■	■				■	■	■	■				■	■	■	■
Schott	CG 842	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	CG 843	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	CG 843 P	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Handylab pH 11	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Handylab pH 12	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Handylab pH/LF 12	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
Testo	Testo 230	■	■	■	■	■	■	■	■	■		■		■		■	■				■	■	■	■	■	■	■	■	■	■	■
WTW	InoLab pH Level 1	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	InoLab pH Level 2	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	InoLab pH Level 3	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	PH 540 GLP	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	InoLab 720	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	InoLab 730	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	InoLab 740 / 750	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	ProfiLine 197i	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Portable Meter 315	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Portable Meter 330	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Portable Meter 340	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■
	Portable Meter 350	■	■	■	■	■	■	■	■		■	■		■		■	■		■		■		■			■		■	■	■	■

For connections to a device that is not shown in the list above, please contact your laboratory supplier or the device manufacturer.

Alphabetical index



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