

fisherbrand

ELECTROCHEMISTRY Focus on pH

Fisherbrand and Fisher Chemical working together to deliver reliable and essential products that meet your most demanding electrochemistry requirements



Like you, we constantly marvel at the wonders all around us and within us that deepen our devotion to the world of science. For over 50 years we've poured that same endless passion into creating and continually refining the Fisherbrand™ portfolio: value-packed products that make your lab life easier each and every day when it matters most.

Partnering with industry-leading manufacturers allows us to deliver quality products that are just right for you across all the categories you use most, including:

- Consumables
- Equipment and Instruments
- Safety
- Lab Essentials

In addition to the extensive Fisherbrand range, Fisher Scientific is also your partner of choice for chemicals and bioreagents. Fisher Chemical and Fisher BioReagents deliver convenience, quality and consistency and are the leading provider of chemicals and bioreagents to many research sectors such as academia, pharmaceuticals, biotechnology and healthcare.

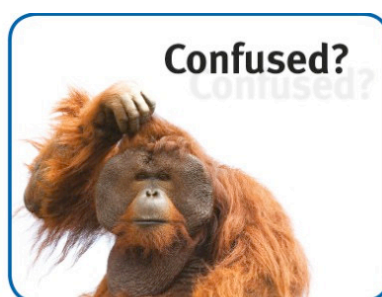
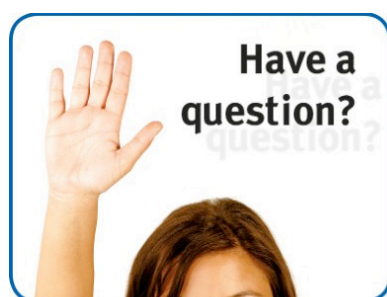
- Fisher Chemical offers more than 4,000 chemicals of the highest quality, including organic and inorganic reagents and compounds, ready made solutions and high purity solvents. All chemicals are ISO 9001:2008 certified and undergo rigorous quality assurance and testing procedures, ensuring excellent lot-to-lot and bottle-to-bottle consistency. Supported by a clear and simple grade and application structure, choosing the product that best suits your requirements is easy.
- Fisher BioReagents offers over 1,000 products dedicated to molecular biology research, biochemistry and cellular biology. It is your single source for high purity products.



Together Fisherbrand, Fisher Chemical and Fisher BioReagents offer reliable and essential laboratory products, helping you to produce your best work each and every day.

**New products are constantly being introduced into the Fisherbrand family
For the full range visit www.eu.fishersci.com/go/fisherbrand**

This brochure is dedicated to providing you with a comprehensive overview of our Fisherbrand pH and electrochemistry portfolio. Featuring a range of instruments, consumables and Fisher Chemicals, as well as useful product resources such as selection guides, troubleshooting guides, FAQ's and workflows, it is a great lab companion.



Check out our Frequently Asked Questions

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Laboratory Reagents Handbook

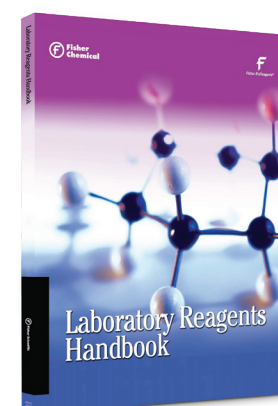
For a fuller range of Fisher Chemical and Fisher BioReagents, please refer to our Laboratory Reagents handbook. This handbook features...

For the analytical chemist:

- Over 4400 Fisher Chemical products dedicated to many analytical applications, including Optima™ LC/MS grade solvents and high purity acids for trace elemental analysis
 - Colour coded applications
 - Physical & chemical data
 - Hazard, packaging and storage information
 - Detailed specifications

For the life scientist:

- A dedicated section relating to four key application areas
 - Protein chemistry
 - Molecular biology
 - Cell biology
 - Core bioreagents

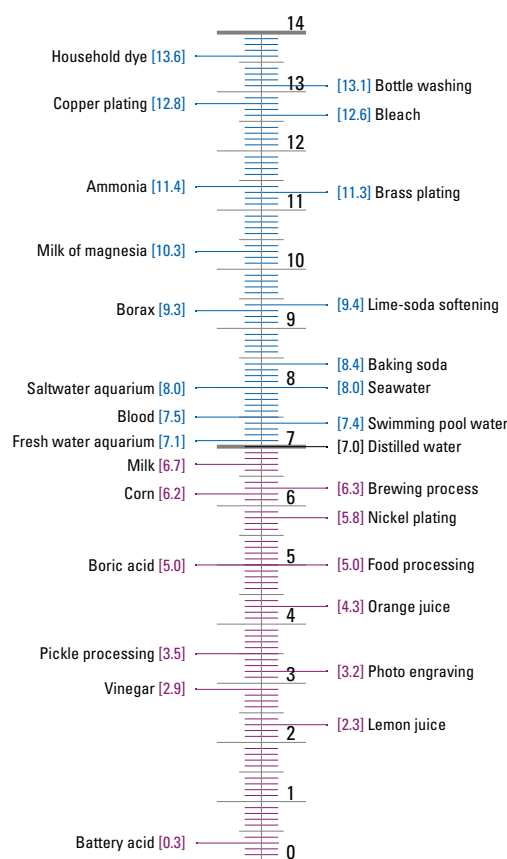


Electronic version on www.eu.fishersci.com

Introduction to pH and Electrochemistry	pH Electrodes - Introduction	Technical Resources
Focus on Water Analysis Workflow	pH Electrode Theory	pH Electrode Preparation
accumet™ pH and Electrochemistry Meters	Relationship Between pH and Temperature	pH Electrode Calibration
accumet™ Portable & Benchtop Meter Selection Guide	Electrode Selection	Calibration Procedure <ul style="list-style-type: none"> • Two or More Buffers • One Buffer
Fisherbrand accumet™ AE, AB and XL Benchtop Meter Series	Combination or Half-Cell? Glass or Plastic Body? Refillable or Non-Refillable? Single or Double-Junction (TRIS compatible)?	pH Electrode Measurements
accumet™ AE Series <ul style="list-style-type: none"> • pH Meter, AE150 accumet™ AB Series <ul style="list-style-type: none"> • pH Meter, AB150 • pH Meter, AB200 • pH Meter, AB250 accumet™ XL Series <ul style="list-style-type: none"> • pH Meter, XL150 • pH Meter, XL200 • pH Meter, XL250 • pH Meter, XL500 • pH Meter, XL600 	pH Electrode Features	Sample Requirements pH Measurement Procedure Measurement Recommendations
	pH Electrode Selection Guide	pH Electrode Maintenance
	pH Electrode Connectors	Looking After Your Electrode Filling and Draining a Refillable pH Electrode
Fisherbrand accumet™ AET, AE & AP Series Portable Meters and Pocket Testers	pH Electrodes ORP Electrodes Electrode Accessories	pH Electrodes Storage
accumet™ AET Series <ul style="list-style-type: none"> • AET15 pH Tester • AET30 Conductivity Tester accumet™ AE Series <ul style="list-style-type: none"> • AE6 pH Meter • AE6C Conductivity Meter accumet™ AP Series <ul style="list-style-type: none"> • AP110 Portable pH Meter • AP115 Portable pH Meter • AP125 Portable pH Meter 	pH Buffer Solutions & Indicators	Short Term Electrode Storage (up to one week) Long Term Electrode Storage (more than one week)
	Standard Buffer Solutions	pH Electrode Cleaning Procedures
	pH2 pH3 pH4 pH5 pH6 pH7 pH8 pH9 pH10	General Rules and Tips
	Colour-Coded Buffer Solutions	Troubleshooting Guide
Other Probes and General Accessories for accumet™ Meters	pH Indicators	Frequently Asked Questions (FAQ's)
accumet™ Benchtop Stirring Probe Conductivity, Dissolved Oxygen and Temperature Probe Cables and Other General Accessories	Full Range Indicators Universal Indicators pH Indicator Paper, Sticks pH Indicator Paper, Reels	Fisher Chemical
		Indicators, Reagents & Stains
		Reagents for COD
		Water & Hydrogen Peroxide for Analysis
		Standard Solutions for Volumetric Analysis

Introduction to pH and Electrochemistry

Next to temperature and mass, pH is the third most common laboratory measurement. It crosses over many disciplines from water/wastewater analysis (see our Water Analysis Workflow focus on the next page) basic research and development, environmental, chemical and life sciences, and an endless number of industrial applications. Below are some examples of pH in a few common industrial and household products.



pH is used as a convenient way to compare the relative acidity or alkalinity of a solution at a given temperature. The term pH itself is thought to be derived from a combination of 'p' for the word 'power' and 'H' for the symbol of the element hydrogen. Put together, 'pH' therefore denotes the 'power of hydrogen'.

Mathematically, the pH is the degree of acidity or alkalinity of a solution based on the hydrogen ion activity, represented by the equation:

$$\text{pH} = -\log [\text{H}^+]$$

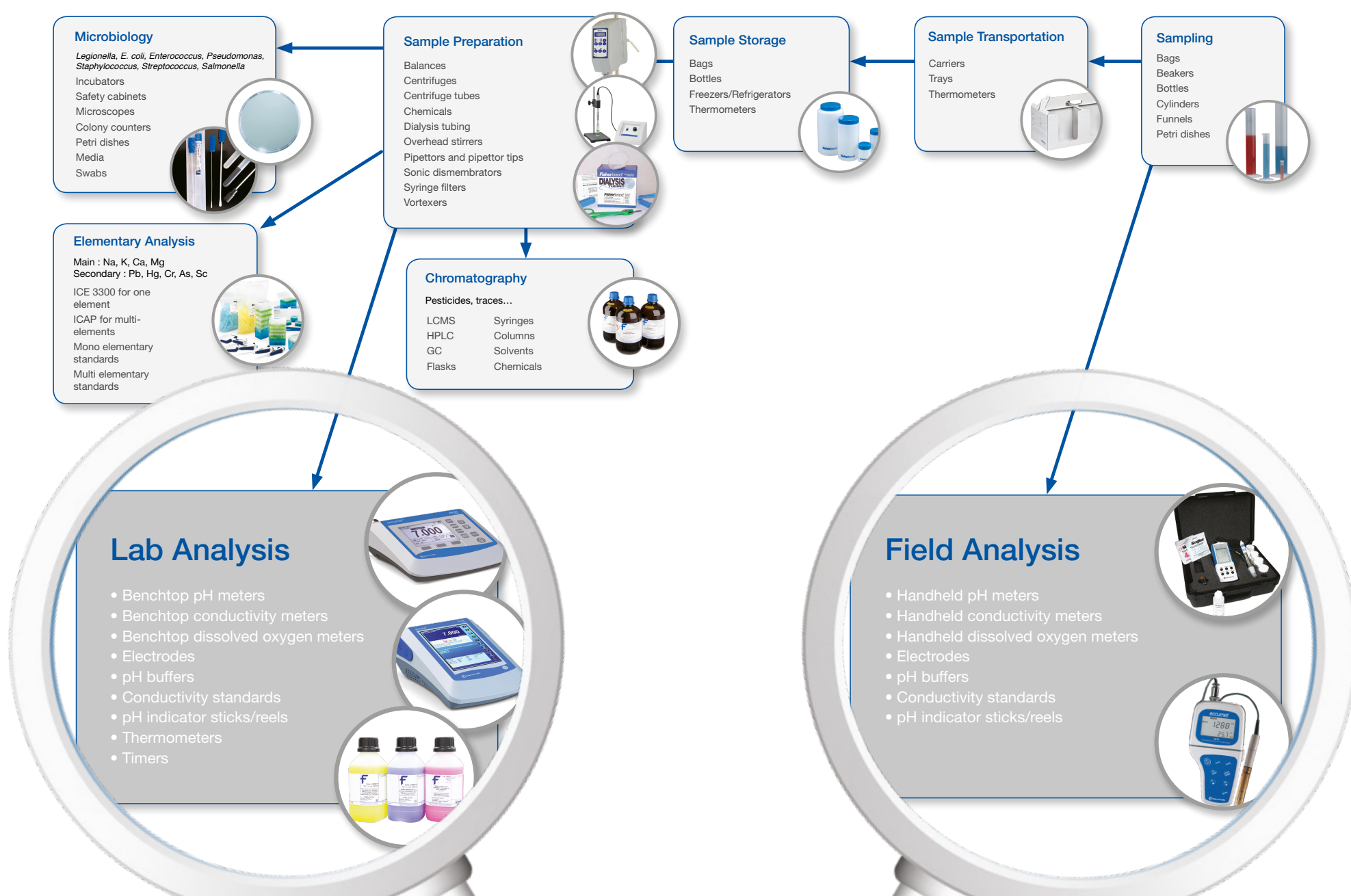
Stated mathematically, pH is the negative logarithmic value of the hydrogen ion. As it is based on a log scale, each pH unit represents a factor of 10, so a solution with a pH of 5 is 100 times more acidic than pH of 7.

pH is measured on a scale of 1-14, 1 being very acidic, 14 being very alkaline and 7 neutral. A pH of 7 describes a neutral solution because the activities of hydrogen and hydroxide ions are equal. When the pH is below 7, the solution is described as acidic because the activity of hydrogen ions are greater than that of hydroxide ions; as the hydrogen ion activity increases, so the pH value decreases. Conversely, when the pH is above 7, the solution is described as basic (or alkaline) because the activity of hydroxide ions is greater than that of hydrogen ions.

pH can be measured in a number of different ways. These include basic tests such as using test papers (litmus paper for example) and chemicals (e.g. universal indicators), through to using more sophisticated items of equipment such as colorimeters and photometers and electrochemical sensors. This brochure will focus on electrochemistry, the most accurate of all the methods.

Focus on Water Analysis Workflow

pH and electrochemistry is an essential part of most water analysis protocols. Depend on Fisherbrand, Fisher Chemical and Fisher BioReagents to provide products for every step of your water analysis workflow.



accumet™ Electrochemistry Meters

The comprehensive accumet™ portfolio from Fisherbrand is your dedicated range of pH and electrochemistry meters and accessories. These instruments represent the state of the art for measuring pH, mV (ORP), ion concentration, conductivity, total dissolved solids (TDS), dissolved oxygen and temperature. Most of these instruments are capable of measuring more than one of these parameters.

The Fisherbrand **accumet™ AB** series of benchtop pH meters offer accuracy, simplified performance and innovative features such as a backlit display, multiple views, date/time for GLP requirements, expanded memory, custom buffer calibration options, a calibration alarm, three-position electrode holders, stirring capability, upgradeable software, and the option to mount on a wall. The meters can be set to display local language and feature user prompts and context-specific 'help' screens.

The **AB150** from this range is Fisherbrand's top selling pH meter and is the instrument of choice for routine laboratory pH needs. Two further models have recently been added to this range - the AB250, with ISE capability, and the AB200, the first AB multi-parameter instrument for both pH and conductivity.

The Fisherbrand **accumet™ AE** series of basic benchtop and portable meters is also designed for performing routine measurements without complicated features or processes at a budget-friendly price. The benchtop models offer user-friendly functionality, stored datasets in a non-volatile memory and a meter-attachable electrode stand. This allows for efficient sample reading and recording with flexible display options – display both pH and temperature or mV and temperature simultaneously. The portable AE models offer you the greatest value-for-money for your basic measurement needs with rugged and user-friendly IP54 rubber boots for protection against harsh field conditions. These models also feature high accuracy of ± 0.01 pH or 0.05% for conductivity, multi-point push-button calibration with auto-buffer recognition and even self-diagnostic messages for easy troubleshooting.

The Fisherbrand **accumet™ XL** series of benchtop meters bring more advanced designs, including a large vivid colour touchscreen with multiple channels and new features including two stirring probe ports, a three-position electrode holder, upgradeable software, and USB and RS232 connectivity, making these popular meters better than ever. Similar to the AB series, the XL series can be set to display local language and features user prompts and context-specific 'help' screens.

The Fisherbrand **accumet™ AP** series of handheld portable meters are ideal for the researcher 'on the go'. For both indoor and outdoor use, the AP series feature soft touch keys with comfort grip, making one-handed operation a breeze. Other features include rugged waterproof housing (IP67 rated), a large LCD screen with backlighting and easy-to-use plain language text.

The Fisherbrand **accumet™ AET** pocket testers offer high accuracy and ease of use. These pocket testers are uniquely designed to last longer with more user-friendly features, including an easy twist-off user-replaceable sensor and lower operating cost requirement. Simple pH and conductivity measurement has never been easier with these best-in-class testers, which feature push-button operations to allow for simple, quick and accurate measurement and hassle-free calibration procedures utilising a customized LCD which also displays temperature. These testers are waterproof to IP67 standard too.

So, taken together, the **accumet™ XL, AB, AET, AE & AP** series of meters all represent high quality, user-friendly and cost-effective instruments for every application and budget. The chart on the next page will guide you in selecting the right meter for your particular application.

accumet™ Meter Selection Guide



Fisherbrand accumet™ AE, AB and XL Benchtop Meter Series

The Fisherbrand **accumet™ AE, AB and XL** series of benchtop meters are available either as meters only, which include an electrode arm, RS232 and USB cables (where relevant), power supply and user manual, or else as a kit, which additionally includes the appropriate electrode and probes for immediate use.










The range includes our **AE150** pH meter which is designed for simple, routine measurements without complicated features and processes at a budget-friendly price.

Also within this range, the **AB150** is Fisherbrand's top selling pH meter. It is the perfect choice for all laboratories as an accurate, easy-to-use pH/mV meter with exceptionally high accuracy and resolution. Find out more about the **AB150** and the rest of our newly expanded and upgraded range of benchtop meters in this section.



Benchtop Meter Selection Guide

Find the right accumet™ benchtop meter for your particular application using the selection guide below.

									
Model	AE150	AB150	AB200	AB250	XL150	XL200	XL250	XL500	XL600
Colour Touch Screen					•	•	•	•	•
pH-mV (BNC) / Temp	•	•	•	•	•	•	••	••	••
Ion Selective-mV (BNC) / Temp				•			••	••	••
Conductivity / TDS / Resistivity / Salinity / Temp			•			•		•	•
Dissolved Oxygen / Temp									•
Stirring Probe		•	•	•	•	••	••	••	••
USB Device / RS-232		•	•	•	•	•	•	•	•
USB Host / RS-232 / RJ-45 (Ethernet)					•	•	•	•	•

•• = Dual Channel Capacity

accumet™ AE150 Benchtop Meter

All the essential functions needed for routine measurements without complicated features and processes all at a budget-friendly price.

- Designed for routine pH measurements in the lab with convenience in mind – user-friendly functionality, 100 dataset storage in non-volatile memory and meter-attachable electrode stand
- Efficient sample reading and recording with flexible display options – display both pH and temperature or mV and temperature simultaneously
- One to five point pH calibration
- Automatic buffer recognition with selection of two pH buffer sets
- pH slope and offset display
- One point mV calibration
- One point ATC temperature probe calibration
- Automatic or manual temperature compensation
- ‘Ready’ icon to indicate measurement stability and electrode condition icon to indicate status



Technical Specification

pH

Range	.....0.00 to 14.00pH
Resolution	.....0.01pH
Accuracy	.....±0.01pH
Calibration Points	...1 to 5 points with automatic buffer recognition (ABR)
pH Buffer Calibration Options	.....USA: pH 1.68, 4.01, 7.00, 10.01, 12.45.....NIST: pH 1.68, 4.01, 6.86, 9.18, 12.45

mV Mode

Range	.....±1999mV
Resolution	.....0.1mV (±199.9mV), 1mV beyond ±200mV
Accuracy	.....±0.2mV (±199.9mV), ±2mV beyond ±200mV
Offset Adjustment	.....Up to ±150mV

Temperature Mode

Range	.....0.0 to 100.0°C
Resolution	.....0.1°C
Accuracy	.....±0.3°C
ATC Temperature Calibration	.....Offset in 0.1°C increments; Offset range: ±5°C
Temperature CompensationAutomatic or manual (0 to 100°C)

Memory

.....	100 Datasets
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Hold Function

.....	.Yes
-------	------

Self-Diagnostic Messages

.....	.Yes
-------	------

pH Slope & Offset Display

.....	.Yes
-------	------

Inputs

...	.BNC, 2.5mm phono plug, reference pin tip, ground
-----	---

Output

.....	.Recorder (±2000mV)
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Power Requirements

.....	.AC/DC 9V adapter (110/220VAC, 50-60Hz)
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Warranty

.....	.Three years
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Description

15514693	AE150 meter only, includes stand and power adapter
15524693	AE150 education set, includes meter, single junction gel pH electrode, ATC probe, stand and power adapter
15534693	AE150 bio set, includes meter, double junction gel pH electrode, ATC probe, stand and power adapter
15544693	AE150 3-in-1 set, includes meter, 3-in-1 single junction gel pH/ATC electrode, stand and power adapter



15563633



15593633



15503643



15573633



15583633

Parts and Accessories for AE Series Meters

	Description
15563633	Single junction gel pH electrode
15593633	Double junction gel pH electrode
15503643	pH/ATC gel pH electrode
15573633	ATC electrode 90mm
15583633	ATC electrode 120mm

accumet™ AB Series

- Multiple views
 - Backlight display
 - Date/time for GLP requirements
 - Customer buffer calibration options
- Three-position electrode holder
 - Stirring capability
 - Upgradeable software
 - Wall mounting available



pH Meter, AB150

Intuitive, simple operation and high accuracy in a compact, affordable meter

Technical Specification

pH		Temperature Mode	
Range	..... -2.000 to 20.000pH	Resolution	..... 0.1°C/0.1°F
Resolution	..... 0.1/0.01/0.001pH	Accuracy	..... ±0.3°C/±0.5°F
Accuracy	..... ±0.002pH + 1LSD	Calibration	..... Offset in 0.1° increments; offset range: ±5°C/9°F
Buffer Sets	..... USA: 2.000, 4.010, 6.997, 10.013, 12.000	Output	..... RS-232 (phono plug), mini-B USB, stirrer
	..... NIST: 1.678, 4.010, 6.865, 9.184, 12.460	Language Selection	...English, French, Spanish, German, Italian, Chinese, Korean, Portuguese
	..... DIN: 1.090, 3.060, 4.650, 6.790, 9.230, 12.750	Memory	..... 500 datasets, viewable
	..... FSCI: 1.000, 3.000, 6.000, 8.000, 10.000, 13.000	Datalogging	..... Manual, timed (selectable every 3 to 3600 seconds).
	..... CUSTOM: Any 2-5 values, ≥1.0pH unit apart		..... Printer or CSV format
Slope Display	..... Yes, up to five different slopes with offset		
Temp Compensation	..... Automatic or manual (0 to 100°C/32 to 212°F)		
mV Mode			
Range	..... ±2000.0mV/Rel.mV		
Resolution	..... 0.1mV		
Accuracy	..... ±0.2mV or ±0.05% whichever is greater		
Offset Adjustment	..... Up to ±150mV		

Description

12840633	AB150 Meter - Includes meter, electrode arm, RS232 & USB cables, 100/240V power supply, and manual
12870633	AB150 Kit - Includes meter, TRIS compatible pH/ATC electrode (Cat. No 11500194), electrode arm, RS232 & USB cables, 100/240V power supply, and manual
12880633	AB150 BioBasic Kit - Includes meter, TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), electrode arm, 110/220V power supply, and manual

pH Meter, AB200

An accurate, affordable, multi-parameter instrument

Technical Specification

pH		Temperature Mode	
Range	..... -2.000 to 20.000pH	Resolution	..... 0.1°C/0.1°F
Resolution	..... 0.1/0.01/0.001pH	Accuracy	..... ±0.3°C/±0.5°F
Accuracy	..... ±0.002pH + 1LSD	Calibration	..... Offset in 0.1° increments; offset range: ±5°C/9°F
Buffer Sets	..... USA: 2.000, 4.010, 6.997, 10.013, 12.000		
	..... NIST: 1.678, 4.010, 6.865, 9.184, 12.460	Output	..... RS-232 (phono plug), mini-B USB, stirrer
	..... DIN: 1.090, 3.060, 4.650, 6.790, 9.230, 12.750	Language Selection	..... English, German, French, Italian & Spanish
	..... FSCI: 1.000, 3.000, 6.000, 8.000, 10.000, 13.000	Memory	..... 500 datasets, viewable
	..... CUSTOM: Any 2-5 values, ≥1.0pH unit apart	TDS Mode	
Slope Display	..... Yes, up to five different slopes with offset	Range:	..... 0.00ppm to 500ppt (@ TDS factor 1.00)
Temp. Compensation	..... Automatic or manual (0 to 100°C/32 to 212°F)	Resolution	..... 0.00ppm to 500ppt (@ TDS factor 1.00)
Conductivity Mode		Accuracy	..... 0.01/0.1ppm ; 0.001/0.01/0.1ppt
Range	..... 0.00µS to 500.0mS	TDS Factor	..... ±1% full scale
Resolution	..... 0.01/0.1µS ; 0.001/0.01/0.1mS	Datalogging	..... Manual, timed (selectable every 3 to 3600 seconds).
Accuracy	..... ±1% full scale		..... Printer or CSV format
Coefficient (Per °C)	..... Linear & pure ; adjustable 0.000 to 10.000%		
Normalisation	..... 15.0 to 30.0°C		

Description

12800643	AB200 Meter - Includes meter, electrode arm, RS232 & USB cables, 100/240V power supply, and manual
12810643	AB200 Kit - Includes meter, TRIS compatible pH/ATC electrode (Cat. No 11500194), electrode arm, RS232 & USB cables, 100/240V power supply, and manual

pH Meter, AB250

With a versatile BNC connection for pH, redox/ORP, or ion selective measurements

Technical Specification

pH		Ion Mode	
Range	..... -2.000 to 20.000pH	Range	..... 0.001 to 19999 (±2000mV)
Resolution	..... 0.1/0.01/0.001pH	Resolution	..... 0.001/0.01/0.1/1 (automatic)
Accuracy	..... ±0.002pH + 1LSD	Units	..... ppm, mg/L, molar
Buffer Sets	..... USA: 2.000, 4.010, 6.997, 10.013, 12.000	Accuracy	..... 0.5% full scale (monovalent ion)
	..... NIST: 1.678, 4.010, 6.865, 9.184, 12.460		..... 1% full scale (divalent ion)
	..... DIN: 1.090, 3.060, 4.650, 6.790, 9.230, 12.750	Calibration Points	..... 2 to 6 points from one of following groups
	..... FSCI: 1.000, 3.000, 6.000, 8.000, 10.000, 13.000		..... 0.001, 0.01, 0.1, 1, 10, 100
	..... CUSTOM: Any 2-5 values, ≥1.0pH unit apart		..... 0.01, 0.1, 1, 10, 100, 1000
Slope Display	..... Yes, up to five different slopes with offset		..... 0.02, 0.2, 2, 20, 200, 2000
Temp. Compensation	..... Automatic or manual (0 to 100°C/32 to 212°F)		..... 0.1, 1, 10, 100, 1000, 10000
mV Mode			..... 0.05, 0.5, 5, 50, 500, 5000
Range	..... -2.000 to 20.000pH	Temperature Mode	
Resolution	..... 0.1/0.01/0.001pH	Resolution	..... 0.1/0.01/0.001pH
Accuracy	..... ±0.002pH + 1LSD	Accuracy	..... ±0.002pH + 1LSD
Offer Adjustment	..... Up to ±150mV	Calibration	..... Offset in 0.1° increments; offset range: ±5°C/9°F
		Output	..... RS-232 (phono plug), mini-B USB, stirrer
		Language Selection	..... English, French, Spanish, German, Italian, Chinese, Korean & Portuguese
		Memory	..... 500 datasets, viewable
		Datalogging	..... Manual, timed (selectable every 3 to 3600 seconds).
			..... Printer or CSV format

Description

12850633	AB250 Meter - Includes meter, electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12860633	AB250 Kit - Includes meter, TRIS compatible pH/ATC electrode (Cat. No 11500194), electrode arm, RS-232 & USB cables, 100/240V power supply, and manual



11550164



11500194



10236064



11550174



12860653

Replacement Parts and Accessories for AB Series

Description	
11550174	TRIS compatible accuTupH combination electrode, double-junction, glass body, refillable
11500194	TRIS compatible pH/ATC combination electrode, double-junction, plastic body, refillable
10236064	ATC probe for AB/XL series benchtop meters
12860653	accumet™ stirring probe



For best results, connect optional stirrer probe, Cat. No 12860653 for efficient mixing and fast, accurate measurements!

accumet™ XL Series

- Colour touch screen
- Two stirring probe ports
- Three position electrode holder
- Upgradeable software
- USB & RS232 connectivity



pH Meter, XL150

Simple yet powerful, large full-colour touch screen for easy operation

Technical Specification

pH		Temperature Mode	
Range	..... -2.000 to 20.000pH	Resolution	..... -5.0 to 105.0°C
Resolution	..... 0.1/0.01/0.001pH	Accuracy	..... 0.1°C (0.1°F)
Accuracy	..... ±0.1/0.01/0.002 ±1LSD	Calibration	..... ±0.2°C (±0.3°F)
Buffer Sets	..... USA: 2.00, 4.01, 7.00, 10.01, 12.00	Output	..... RJ45, RS232, USB-A, mini-B USB, two stirrer ports
	..... NIST: 1.68, 4.01, 6.86, 9.18, 12.46	Language Selection	..... English, French, Spanish, German, Italian, Chinese,
	..... DIN 19267: 1.09, 3.06, 4.65, 6.79, 9.23, 12.75		..... Korean & Portuguese
	..... FSCI: 1.00, 3.00, 6.00, 8.00, 10.00, 13.00	Datalogging	..... 2000-reading datalog capability
	..... Pure water: 4.10, 6.97, 9.15		
	..... CUSTOM: 2-5 points; any values ≥1.0pH units apart		
mV Mode			
Range	..... ±2000mV/Rel mV		
Resolution	..... 0.1		
Accuracy	..... ±0.2		

Description

12890633	XL150 Meter - Includes meter, electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12820643	XL150 Kit - Includes meter, TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), electrode arm, RS232 & USB cables, 110/220V power supply, and manual

pH Meter, XL200

No need to swap probes – measure and display two channels simultaneously

Technical Specification

pH		Conductivity Mode	
Range	..... -2.000 to 20.000pH	Range	..... ±2000mV
Resolution	..... 0.1/0.01/0.001pH	Resolution	..... 0.001/0.01/0.1mS
Accuracy	..... ±0.1/0.01/0.002 ±1LSD	Accuracy	..... ±1% full scale
Auto Buffer Recognition	..... Five preset buffer groups + custom	Output	RJ45, RS232, USB-A, mini-B USB, two stirrer ports
mV Mode		Language Selection	..English, French, Spanish, German, Italian, Chinese, Korean & Portuguese
Range	..... ±2000mV/Rel mV		
Resolution	..... 0.1		
Accuracy	..... ±0.2		
Temperature Mode			
Resolution	..... -5.0 to 105.0°C		
Accuracy	..... 0.1°C (0.1°F)		
Calibration	..... ±0.2°C (±0.3°F)		

Description

12830643	XL200 Meter - Includes meter, electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12840643	XL200 Kit - Includes meter, TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), Conductivity/Temp probe, electrode arm, RS232 & USB cables, 100/240V power supply, and manual

pH Meter, XL250

Multiple BNC ports allow flexibility



Technical Specification

pH		Ion Mode	
Range	..... -2.000 to 20.000pH	Range	..... 0.001 to 19999 (±2000 mV)
Resolution	..... 0.1/0.01/0.001pH	Resolution	..... 0.1/0.01/0.001
Accuracy	..... ±0.1/0.01/0.002 ±1LSD	Accuracy	..... ±0.5% full scale (monovalent ion)
Auto Buffer Recognition	..... Five preset buffer groups + custom		..... 1% full scale (divalent ion)
mV Mode		Output	. RJ45, RS232, USB-A, mini-B USB, two stirrer ports
Range	..... ±2000mV/Rel mV	Language Selection	...English, French, Spanish, German, Italian, Chinese, Korean & Portuguese
Resolution	..... 0.1		
Accuracy	..... ±0.2		
Temperature Mode			
Resolution	..... -5.0 to 105.0°C		
Accuracy	..... 0.1°C (0.1°F)		
Calibration	..... ±0.2°C (±0.3°F)		

Description

12850643	XL250 Meter - Includes meter, electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12860643	XL250 Dual pH/ISE Kit - Includes meter, TRIS compatible accuTupH pH electrode (Cat. No 11550174) , ATC probe (Cat. No 10236064), electrode arm, RS232 & USB cables, 110/220V power supply, and manual
12870643	XL250 Fluoride Kit - Includes meter, fluoride electrode, TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), electrode arm, RS-232 & USB cables, 110/220V power supply, and manual
12890643	XL250 Ammonia Kit - Includes meter, ammonia electrode (Cat. No 11510134), TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), electrode arm, RS-232 & USB cables, 110/220V power supply, and manual

pH Meter, XL500

Multi-channel operation simplifies your lab work

Technical Specification

pH					
Range	.....	-2.000 to 20.000pH	Ion Mode	Range	..... 0.001 to 19999 (±2000mV)
Resolution	.....	0.1/0.01/0.001pH		Resolution	..... 0.1/0.01/0.001
Accuracy	.....	±0.1/0.01/0.002 ±1LSD		Accuracy	..... ±0.5% full scale (monovalent ion)
Auto Buffer Recognition	.....	Five preset buffer groups + custom			..... 1% full scale (divalent ion)
mV Mode			Conductivity Mode	Range	..... 0 to 500.0mS
Range	.....	±2000mV/Rel mV		Resolution	..... 0.01/0.1µS ; 0.001/0.01/0.1mS
Resolution	.....	0.1		Accuracy	..... ±1% full scale
Accuracy	.....	±0.2	Output		. RJ45, RS232, USB-A, mini-B USB, two stirrer ports
Temperature Mode			Language Selection		...English, French, Spanish, German, Italian, Chinese, Korean, & Portuguese
Resolution	.....	-5.0 to 105.0°C			
Accuracy	.....	0.1°C (0.1°F)			
Calibration	.....	±0.2°C (±0.3°F)			



Description	
12880643	XL500 Meter - Includes meter, electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12800653	XL500 Kit - Includes meter, TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), conductivity/temp probe , electrode arm, RS-232 & USB cables, 100/240V power supply and manual

pH Meter, XL600

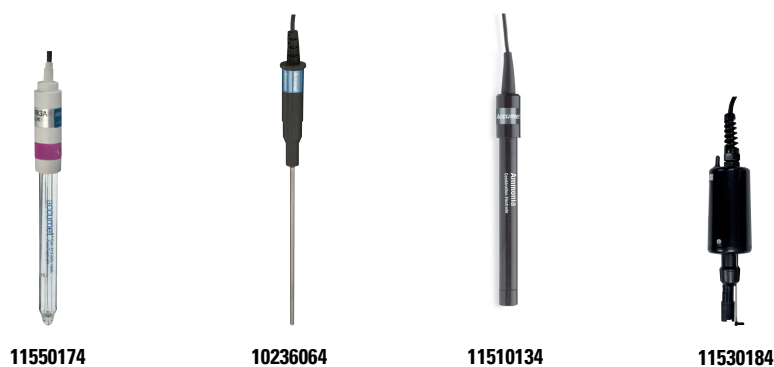
A complete lab in one instrument

Technical Specification

pH					
Range	.....	-2.000 to 20.000pH	Ion Mode	Range	..... 0.001 to 19999 (±2000mV)
Resolution	.....	0.1/0.01/0.001 selectable		Resolution	..... 0.001/0.01/0.1/1 (automatic)
Accuracy	.....	±0.1/0.01/0.002 ±1LSD		Units	..... ppm, mg/L, molar
Cal. Points	.....	Up to six preset or five custom		Accuracy	..... 0.5% full scale (monovalent ion)
Buffer Sets	.....	USA: 2.000, 4.010, 6.997, 10.013, 12.000			..... 1% full scale (divalent ion)
	.....	NIST: 1.678, 4.010, 6.865, 9.184, 12.460		Cal. Points	..... 0.001, 0.01, 0.1, 1, 10, 100
	.....	DIN: 1.090, 3.060, 4.650, 6.790, 9.230, 12.750			..... 0.01, 0.1, 1, 10, 100, 1000
	.....	FSCI: 1.000, 3.000, 6.000, 8.000, 10.000, 13.000			..... 0.02, 0.2, 2, 20, 200, 2000
	.....	CUSTOM: Any 2-5 values, ≥1.0pH unit apart			..... 0.1, 1, 10, 100, 1000, 10000
					..... 0.05, 0.5, 5, 50, 500, 5000
Slope Display	.....	Yes, with offset	Conductivity	Range	..... 00.00µS to 500.0mS
Multiple Slope Display	.....	Yes, up to five different slopes		Resolution	..... 0.01/0.1µS; 0.001/0.01/0.1mS
Temp Compensation	.....	Automatic or manual (0 to 100°C/32 to 212°F)		Accuracy	..... ±1% full scale
Temp Range (Meter)	.....	0.0 to 100.0°C/32.0 to 212.0°F		Cal. Points	..... Automatic (4 points); maximum 1 per range
Inputs	.....	BNC, ATC			..... Manual (5 points); maximum 1 per range
mV Mode				Cell Constant	..... 0.010 to 10.000
Range	.....	±2000.0mV		Cell Types	..... 2 or 4 cell with ATC
Rel. mV Range	.....	±2000.0mV		Coefficient (Per °C)	..... Linear & pure; adjustable 0.000 to 10.000%
Resolution	.....	0.1		Normalisation	..... 15.0 to 30.0°C/59.0 to 86.0°F
Accuracy	.....	±0.2mV or ±0.05% whichever is greater		Compensation	..... Automatic with supplied cell or manual
Offset Adjustment	.....	Up to ±150mV		Temp Compensation	..... 0.0 to 100°C/32.0 to 212.0°F
Temperature Mode			Output		..... (0.0 to 80°C/32.0 to 176.0°F with supplied cell)
Resolution	.....	0.1°C/0.1°F	Language selection		. RJ45, RS232, USB-A, mini-B USB, two stirrer ports
Accuracy	.....	±0.3°C/±0.5°F			...English, French, Spanish, German, Italian, Chinese, Korean & Portuguese
Calibration	.....	Offset in 0.1° increments; Offset range: ±5°C/9°F	Datalogging		..... Manual, timed selectable every 3 to 86400 sec. (24hours)
			TDS		
			Range	.....	..... 0.00ppm to 500ppt (@ TDS factor 1.00)
			Resolution	.....	..... 0.01/0.1ppm; 0.001/0.01/0.1ppt
			Accuracy	.....	..... ±1% full scale
			Cal. Points	.....	..... Up to five
			TDS Factor	.....	..... 0.400 to 1.000



Description	
12820653	XL600 Meter - Includes meter, electrode arm, RS-232 & USB cables,100/240V power supply, and manual
12810653	XL600 Kit - Includes meter, TRIS compatible accuTupH pH electrode, ATC probe (Cat. No 10236064), conductivity/temp probe (Cat. No 11550164), electrode arm, RS-232 & USB cables, 100/240V power supply, and manual
12830653	XL600 Deluxe Kit - Includes meter, self-stirring BOD probe (Cat. No 11530184), TRIS compatible accuTupH pH electrode (Cat. No 11550174), ATC probe (Cat. No 10236064), conductivity/temp probe (Cat. No 11550164), electrode arm, RS-232 & USB cables, 100/240V power supply, and manual



Replacement Parts and Accessories for XL Series

Description	
11550174	TRIS compatible accuTupH combination electrode, double-junction, glass body, refillable
10236064	ATC probe for AB/XL series benchtop meters
11510134	Ammonia electrode, gas sensing ISE combination, refillable, BNC connection plastic body 108mm x 12mm 60°C max. temperature, 0.009 to 1700ppm
11530184	DO/BOD/temp probe, self-stirring



For best results, connect the optional stirrer probe, Cat. No 12860653 for efficient mixing without the need for magnetic stir bars and fast, accurate measurements!

Fisherbrand accumet™ AET, AE & AP Portable Meters and Pocket Testers

The accumet™ AET, AE & AP series of waterproof, portable meters and pocket testers provide accurate measurements anytime, anywhere.

pH measurement has never been easier with the **AET15** pocket pH Tester. With high accuracy and an easy twist-off user-replaceable sensor, the AET15 pocket tester is uniquely designed to last longer with more user-friendly features and lower operating cost requirements. A double junction electrode makes the AET15 ideal for dirty water and solutions with heavy metals or contaminants, whilst an increased reference gel volume offers significantly longer electrode life.

The **AET30** pocket conductivity tester measures across a wide conductivity range from pure water to waste water, and comes with simultaneous temperature display and auto-ranging capabilities. Signature designs such as automatic temperature compensation and manual calibrations are retained, giving you accurate, reliable readings over a broad conductivity range every time you measure.

The **AE6** and **AE6C** portable meters offer you the greatest value-for-money for basic pH and conductivity measurement needs. Rugged and user-friendly, these no-frill meters come with protective rubber boots and hinges that conveniently double up as benchtop stands. As well as having splash-proof keypads and large custom LCDs which make them ideal for field work, both meters come in kit versions which include probes, calibration solutions and a rugged carrying case too.

The **AP100** series meters are small enough for a shirt pocket, yet smart enough for any laboratory. The kits include an unbreakable pH/temperature electrode that is refillable for a fast response and the longest life. The AP125 also accepts any ion selective electrode (ISE) with a BNC connection for direct ion concentration measurement from 0.001 to 99,999ppm.

In this section discover why Fisherbrand accumet™ portable meters are perfect for the researcher ‘on the go’.

Portable Meter Selection Guide

Find the right accumet™ portable meter for your particular application using the selection guide below



Model	AET15	AET30	AE6	AE6C	AP110	AP115	AP125
pH	•		•		•	•	•
Conductivity		•		•			
ISE							•
ATC					•	•	•
Date/Time						•	•
Datapoint Storage					200	200	200

accumet™ AET15 pH tester

Product features

- Large display screen - dual display LCD for enhanced readability, provides comprehensive meter information
- Waterproof, dustproof housing - IP67 rated, maintains the integrity of your tester even in harsh conditions. Plus it floats!
- User-replaceable sensor - reuse the same meter body many times
- Double junction sensor offers longer lasting usage
- Push-button calibration with auto-buffer recognition - quick, easy calibration with no calibration mistakes
- Automatic Temperature Compensation (ATC) - ensures optimum accuracy under fluctuating temperatures
- Choice of USA or NIST pH buffer standards with up to three points
- Temperature display readout simultaneously
- Auto power-off saves battery power after non-use
- 'Hold' function freezes reading momentarily for easy viewing
- Self-diagnostic for easy troubleshooting (e.g battery indicator, message codes)
- Enhanced power saving allows extended power consumption up to 500 hours with single battery set

Applications

General: Ideal for quick and accurate pH checks in pools and spas, aquariums and hydroponics operations, or anywhere frequent pH testing is required. accumet™ AET15 pH Tester meets requirements for many standard environmental and ASTM test methods.

Industrial: Use for cooling towers, food processing water testing and process/wastewater testing in metal finishing, photo development, printing and chemical industries.

Research and Educational: Useful in schools, many laboratory applications and ecology studies.

Specifications

pH Range	-1.0 to 15.0pH
pH Resolution	0.01pH
pH Accuracy	±0.01pH
Temperature Display	0 to 50°C or 32 to 122°F
Temperature Resolution	0.1°C/°F
Temperature Accuracy	0.5°C / 0.9°F
No. of Calibration Points	Three points
pH Buffer Options	USA - pH 4.01, 7.00, 10.01; NIST - pH 4.01, 6.86, 9.18
LCD Display	Dual display with battery indicator, error messages/codes
ATC	Yes
Special Functions	Large dual custom display, self-diagnostic; hold function
Auto power-off	After 8.5 minutes
Power	4 x 1.5V alkaline button cell batteries; >500 hrs
Warranty	Two years

Ordering information

Description	
15553653	pH Tester accumet™ AET15 with ATC and temperature readout. Includes replaceable double junction pH sensor, lanyard and alkaline button cell batteries
Replacement accessories	
15523643	Spare pH sensor for AET 15 tester



accumet™ AET30 conductivity tester

Product features

- Multi-range with selectable or auto-ranging options - One tester measures everything from pure water to waste water!
- User-replaceable sensor - Replace the sensors yourself. Sensors last longer with element made of SS316 stainless steel and sensor casing made of VALOX™ for superior chemical durability
- Large display screen - Simultaneous temperature readouts, displays mode, ATC, battery level
- Single and multi-point calibrations with automatic or manual options
- Waterproof, anti-roll design - IP67 waterproof housing keeps tester good even under wet conditions. Unique anti-roll ribbed design ensures firm grip
- Innovative cup-style - Innovative sensor housing design can be used as dip-style or cup-style for holding small volume of samples

Applications

General: For use in water and wastewater treatment, boiler blow-down, electroplating rinse tanks, drinking water, hydroponics, printing industry, aquaculture, aquaria, fish farms, swimming pools and spas

Specifications

Conductivity Range	0 to 200µS/cm
	0 to 2000µS/cm
	0 to 20mS/cm
Conductivity Resolution	0.1µS/cm; 1µS/cm; 0.01mS/cm
Conductivity Accuracy	±1% of full scale
ATC	Yes (0 to 50°C / 32 to 122°F)
Temperature Coefficient	2% per °C, fixed
Calibration Points	Three auto or three manual
Temperature Display	Yes
Temperature Range	0 to 50.0°C / 32.0 to 122.0°F
Temperature Resolution	0.1°C / 0.1°F
Temperature Accuracy	±0.5°C / ±0.9°F + 1 LSD
Temperature Calibration	±5.0°C / ±9.0°F
Non-Volatile Memory	Yes
Auto Power-Off	8.5 minutes after last key pressed
Power Requirement	4 x 1.5 V 'A76' micro alkaline batteries (included)
Battery Life	More than 150 hours
Dimensions/Weight	Tester: 16.5cm x 3.8cm; 90g
Boxed Dimensions/Weight	18.5cm x 6.5cm x 5cm; 200g
Warranty	Two years

Ordering information

Description	
15563653	Conductivity tester, accumet™ AET30 with ATC and temperature display. Includes replaceable cup type sensor, lanyard and alkaline button cell batteries
Replacement accessories	
15533643	Spare conductivity sensor for AET30 tester



accumet™ AE6 portable pH meter

Product features

- Multi-point calibration (up to five points) with auto-buffer recognition - choice of USA, NIST or pure water buffer standards with ±0.01 pH accuracy
- Automatic Temperature Compensation (ATC) for the highest accuracy under fluctuating temperatures
- ‘Hold’ function momentarily freezes reading for easy viewing and recording
- Auto-power off saves battery power after non-use
- Self-diagnostic with message codes for easy troubleshooting
- Large custom LCD provides optimum viewing even at a distance
- Protective rubber boot shields meter from accidental knocks and features a sturdy built-in stand for easy bench-top operation
- Models also available as a complete field kit in a rugged carrying case for on-site meter calibration and measurement

Applications

Water quality testing: For analysing water in pools and spas, lithographic processes, boiler and cooling tower water analysis and all types of quality assurance and water quality testing.

Environmental/agricultural: Use in ecology studies, aquaria, aquaculture and nutrients levels in hydroponics.

Research and educational: Ideal for quick, accurate checks in laboratories and schools.

Specifications

pH Range	0.00 to 14.00pH
pH Resolution & Accuracy	0.01pH and ±0.01pH
Temperature Range	0 to 100.0°C
Temperature Resolution & Accuracy	0.1°C and ±0.5°C
mV Range	-1000 to +1000mV
mV Resolution & Accuracy	1mV and ±1mV
Temperature Compensation	Automatic/Manual (0 to 100°C)
No. of Calibration Points	Up to five points
pH Buffer Options	1.68, 4.01, 7.00, 10.01, 12.45 (USA)
	1.68, 4.01, 6.86, 9.18, 12.45 (NIST)
	4.10, 6.97 (Pb)
Special Functions:	Auto power-off after 17 minutes
	Hold & self-diagnostic messages
Power	4 'AAA' x 1.4V batteries
Warranty	Three years

Ordering information

	Description
15523653	Portable pH meter accumet™ AE6. Includes a pH/temp electrode, rubber armour/stand, batteries and manual
15533653	Portable pH/ORP meter, accumet™ AE6B. Includes double junction pH electrode and ATC probe, rubber armour/stand, batteries and manual
15646895	Portable pH meter accumet™ AE6AK. Includes plastic carrying case, 1 x pH 4.01, 1 x pH 7.00 buffer solutions, storage solution and 1 x deionised (rinse) water (all solutions are 60mL each). Does not ship with a pH electrode
15656895	Portable pH meter accumet™ AE6BK. Includes plastic carrying case, 1 x pH 4.01, 1 x pH 7.00 buffer solutions, storage solution and 1 x deionised (rinse) water (all solutions are 60mL each)
15676895	Portable pH meter, accumet™ AE6K. Includes plastic carrying case, 1 x pH 4.01, 1 x pH 7.00 buffer solutions, storage solution and 1 x deionised (rinse) water (all solutions are 60mL each)
	Replacement accessories
15563633	Single junction gel pH electrode
15503643	pH/ATC gel pH electrode
15593633	Double junction gel pH electrode
15573633	ATC electrode 90mm
15583633	ATC electrode 120mm
15543643	Grip-clip electrode holder



accumet™ AE6C portable conductimeter

Product features

- Multi-point push-button calibration (up to five points) with ±1% full scale accuracy
- Option of quick, easy automatic calibration or customised, near-to-sample manual calibration
- Auto-ranging for conductivity/TDS measurements for fast response and best resolution over wide measurement range
- Automatic Temperature Compensation (ATC) for optimum accuracy under fluctuating temperatures
- ‘Hold’ function momentarily freezes reading for easy viewing
- Auto power-off saves battery power after non-use
- Self diagnostic with message codes for easy troubleshooting
- Large custom LCD provides optimum viewing even at a distance
- Electrode with built-in ATC designed for minimal air bubble entrapment during measurement
- Protective rubber boot shields meter from drops and features a sturdy built-in stand for easy bench-top operation
- Model also available as a meter kit which contains everything you need for calibration and measurement in a rugged carrying case



Applications

Routine testing: For quick, accurate conductivity or TDS checks in laboratories, out in the field and schools.

Environmental/agricultural: Useful in nutrient and fertiliser checks in hydroponics and agricultural industries.

Water quality testing: For analysing hard water, untreated water, industrial and rinse water, drinking water, effluent water, pool water and incoming process water. Ideal for all types of quality assurance, printing industries and water quality testing.

Specifications

Conductivity Range	0 to 19.99µS/cm
	19.9µS/cm to 199.9µS/cm
	199.9µS/cm to 1999µS/cm
	2.00mS/cm to 19.99mS/cm
	20.0mS/cm to 199.9mS/cm
Conductivity Resolution & Accuracy	0.05% full scale and ±1% full scale + 1 LSD
Calibration Points	Four (one per range) auto; five (one per range) manual
Temperature Range	0 to 80.0°C (32 to 176°F)
Temperature Resolution & Accuracy	0.1 °C (0.1°F) and ±0.5°C (±0.9°F)
Temperature Compensation	Automatic / Manual (0 to 80°C)
Cell Constant	0.1, 1.0, 10.0 (selectable)
Temperature Coefficient	0.0% to 3.0%
Temperature Normalisation	20.0 to 25.0°C
No. of Calibration Points	Up to five maximum, (one per range)
Special Functions	Auto power-off after 17 minutes;
	Hold & self-diagnostic messages
Power	4 'AAA' x 1.4V batteries; >100 hours
Warranty	Three years

Ordering information

Description	
15543653	Portable conductivity meter, accumet™ AE6C. Includes conductivity/ATC electrode, rubber armour/stand, batteries and manual
15666895	Portable conductivity meter, accumet™ AE6CK, Includes plastic carrying case, 1 x 1413uS, 1 x 12.88mS KCl, 1 x 3000ppm 442 standard solutions & 1 x deionised rinse water (all solutions are 60mL each)
Replacement accessories	
15513643	Conductivity/ATC electrode
15573633	ATC electrode 90mm
15583633	ATC electrode 120mm
15543643	Grip-Clip electrode holder

AP Series pH Meters

Pocket-sized portable meters for indoor or outdoor use

- Large LCD with backlighting and plain language text making it easy to view and use
- Durable waterproof IP67 housing
- pH resolution and date/time to meet GLP (AP115, AP125)
- 200 datapoint internal memory
- Three year meter warranty and one year electrode warranty



	Model No	AP110	AP115	AP125
pH	Range, pH	-2.00 to 20.00	-2.00 to 20.00	-2.00 to 20.00
	Resolution, pH	0.1/0.01	0.1/0.01/0.001	0.1/0.01/0.001
	Accuracy, pH	±0.01	±0.002	±0.002
	pH calibration	Up to 5 or 6 points from three sets: USA: 2.00, 4.00, 7.00, 10.00, 12.00 NIST: 1.68, 4.01, 6.86, 9.18, 12.45 EURO: 1.00, 3.00, 6.00, 8.00, 10.00, 13.00		
mV	Range, mV	±2000	±2000	±2000
	Resolution, mV	0.1/1	0.1/1	0.1/1
	Accuracy, mV	±0.2/2	±0.2/2	±0.2/2
	Calibration points	1 (rel. mV)	1 (rel. mV)	1 (rel. mV)
Ion conc. (AP125 only)	Range, concentration	-	-	0.001 to 99,999
	Resolution, concentration	-	-	1, 2 or 3 significant digits
	Accuracy, concentration	-	-	Monovalent: 0.5% full scale, Trivalent: 1% full scale
	Calibration	-	-	Available values: 0.1, 0.5, 1, 2, 5, 10, 50, 100, 500, 1,000 Calibration points: from 2 to 5
Temperature	Range, °C	-5 to 100	-5 to 100	-5 to 100
	Resolution, °C	0.1	0.1	0.1
	Accuracy, °C	±0.3	±0.3	±0.3
	Calibration, temperature	Calibration points: 1 (ATC) and 1 (MTC) Available values: 1 point ±5 adjustment (ATC), -5 to 100 default adjustment (MTC)		
General	Clock	-	Yes, date/time and GLP	Yes, date/time and GLP



Description	
11580184	AP110 Meter only - Includes meter, 9V battery, and manual
11590184	AP110 Kit - Includes meter, pH/ATC electrode (Cat. No 11560194), refill solution, hard carrying case, sample bottles, pH calibration packets, 9V battery, and manual
11560184	AP115 Meter only - Includes meter, 9V battery, and manual
11570184	AP115 Kit - Includes meter, pH/ATC electrode (Cat. No 11560194), refill solution, hard carrying case, sample bottles, pH calibration packets, 9V battery, and manual
11540184	AP125 Meter only - Includes meter, 9V battery, and manual
11550184	AP125 Kit - Includes meter, pH/ATC electrode (Cat. No 11560194), refill solution, hard carrying case, sample bottles, pH calibration packets, 9V battery, and manual

Replacement Parts and Accessories for AP100 Series Portable Meters

Description	
11560194	pH/ATC electrode refillable, single-junction epoxy body for AP100 series portable meters



Other Probes and General Accessories for accumet™ Meters

accumet™ Benchtop Stirring Probe

- Provides mixing without the need for magnetic stir bars or stir plates
- Saves valuable bench space
- Quiet operation
- Adjustable speed control
- No additional power required
- Multi-parameter XL benchtop models can accept up to two probes for simultaneous stirring
- Compatible with the following models: XL150, XL200, XL250, XL500, XL600, AB150, AB250, AB200

	Description
12860653	accumet™ benchtop stirring probe
12840653	Replacement paddle with stirring rod
11510234	Electrode holding arm and bracket for AB & XL series benchtop meters



Conductivity, Dissolved Oxygen and Temperature Probes

Conductivity/temperature electrodes for AB200, XL200, XL500, and XL600 benchtop meters

	Sensor Type	Body Type	Nominal Cell Constant	Ideal Range
11530164	Two-Cell	Plastic	10	1mS/cm to 200mS/cm
11560164	Four-Cell	Glass	10	1mS/cm to 200mS/cm
11530084	Four-Cell	Plastic	1	10µS/cm to 100mS/cm
11540084	Four-Cell	Plastic	10	1mS/cm to 200mS/cm



Dissolved oxygen probes and accessories for XL600 benchtop meters

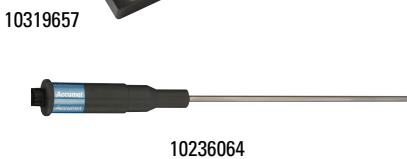
	Description
11530184	Self-stirring DO/BOD/temp probe
10319657	Membrane kit for 11530184. Includes six membrane caps, polishing disc, and electrolyte filling solution



ATC/Temperature probes

	Description
10236064	ATC for XL and AB series benchtop meters
11540234	ATC for AP100 series portable meters

All temperature probes are stainless steel and have a 91cm (3-ft) cable.



Other General Accessories

	Description
12880653	Compact thermal printer for AB and XL series, 100 to 240V. Includes two rolls paper and four plug types for global use
12890653	Replacement thermal paper for 12880653 (pack of 2 rolls)
11510234	Electrode arm and bracket for all AB and XL series benchtop meters
12800663	Optical USB mouse. Compatible with any XL series
12850653	Replacement power supply for AB150, AB200, AB250, XL150, XL200, XL250,XL500, XL600, 100/240 VAC
12870653	Replacement RS-232 output cable for PC and printer
11530124	Adapter cable, pin plug to BNC input jack. Use with metallic electrodes having pin connectors



pH Electrode Theory

pH electrode measurements are made by comparing the readings in a sample with the readings in standards whose pH has been defined (i.e. standard buffers). When a pH sensing electrode comes in contact with a sample, a potential develops across the sensing membrane surface that varies with pH. A separate reference electrode provides a second, unvarying potential to quantitatively compare the changes of the sensing membrane potential. Combination pH electrodes are composed of a sensing electrode with a reference electrode built into the same electrode body. Combination electrodes provide the same selectivity and response as the two electrode (half-cell) system, but also offer the obvious advantage of having to operate and maintain just a single piece of equipment. A meter serves as the readout device and calculates the difference between the reference electrode and sensing electrode potentials in millivolts. The millivolts are then converted to pH units and shown on the meter display.

Electrode behaviour is described by the Nernst equation: $E = E_0 + 2.3 \frac{RT}{nF} \log aH^+$

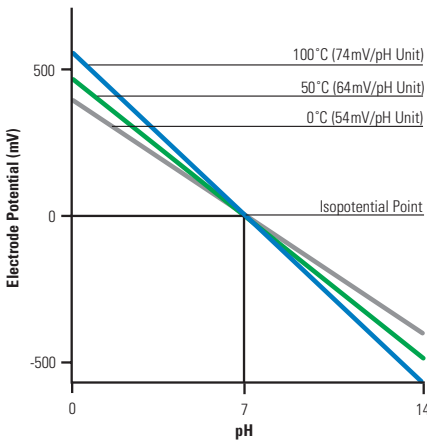
Where E is the measured potential from the sensing electrode, E_0 is related to the potential of the reference electrode, $(2.3 \frac{RT}{nF})$ is the Nernst factor and $\log aH^+$ is the pH. The Nernst factor, $2.3 \frac{RT}{nF}$, includes the Gas Law constant (R), Faraday's constant (F), the temperature in degrees Kelvin (T) and the charge of the ion (n). For pH, where $n = 1$, the Nernst factor is $2.3 \frac{RT}{F}$. Since R and F are constants, the factor and therefore electrode behaviour is dependent on temperature.

The electrode slope is a measure of the electrode response to the ion being detected and is equivalent to the Nernst factor. When the temperature is 25°C, the theoretical Nernst slope is 59.16mV/pH unit. Fisherbrand accumet™ pH meters display the slope as a percentage of the theoretical value. For example, a 98.5% slope is equivalent to a slope of 58.27mV/pH unit for a two-point calibration. The pH meter detects the pH sensing bulb signal, reference signal and temperature signal and uses these values to calculate the pH using the Nernst equation. Fisherbrand accumet™ pH meters contain pH versus temperature values for most commonly used buffers. This allows the meter to recognise a particular pH buffer and calibrate with the correct buffer value at the measured temperature.

Relationship between pH and Temperature

The most common cause of error in pH measurements is temperature. Temperature variations can influence pH for the following reasons:

- The electrode slope will change with variations in temperature.
- Buffer and sample pH values will change with temperature.
- Measurement drift can occur when the internal elements of the pH and reference electrodes are reaching thermal equilibrium after a temperature change.
- When the pH electrode and temperature probe are placed into a sample that varies significantly in temperature, the measurements can drift because the temperature response of the pH electrode and temperature probe may not be similar. Furthermore, the sample may not have a uniform temperature, so the pH electrode and temperature probe are responding to different environments.



Electrode slope changes can be compensated for by using an automatic temperature compensation (ATC) probe. Fisherbrand accumet™ pH meters calculate the electrode slope based on the measured temperature of the pH buffers. The meter will automatically adjust the pH buffer value to the actual pH of the buffer at the measured temperature.

The pH values of buffers and samples will change with variations in temperature because of their temperature-dependent chemical equilibria. The pH electrode should be calibrated with buffers that have known pH values at different temperatures. Since pH meters are unable to correct sample pH values to a reference temperature, due to the unique pH versus temperature relationship of each sample, calibration and actual measurements should be performed at the same temperature and sample pH values should be recorded with the sample temperature.

Nominal pH Value at 25°C	0°C	5°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
1.68	1.67	1.67	1.67	1.67	1.68	1.69	1.71	1.72	1.74	1.77	1.79
4.01	4.00	4.00	4.00	4.00	4.02	4.04	4.06	4.09	4.13	4.16	4.21
6.86	6.98	6.95	6.92	6.87	6.85	6.84	6.83	6.84	6.85	6.86	6.88
7.00	7.11	7.08	7.06	7.01	6.98	6.97	6.97	6.97	6.99	7.03	7.08
9.18	9.46	9.40	9.33	9.23	9.14	9.07	9.01	8.96	8.92	8.89	8.85
10.01	10.32	10.25	10.18	10.06	9.97	9.89	9.83	9.79	9.78	9.78	9.80
12.46	12.79	12.73	12.67	12.52	12.36	12.17	11.96	11.73	11.47	11.19	10.89

Electrode Selection

When selecting a pH measurement system, choose your meter based on what features you need, for example, resolution, output, memory, portability, etc. Choose the corresponding pH electrode for your meter based primarily on your sample type and conditions, e.g. wastewater with sulfides, temperature, frequent or constant usage five days a week, etc.

While many electrodes might work adequately for a particular application, not all will perform equally or last as long as others. Usually in situations in which a pH electrode “didn’t last long”, the electrode is not matched well for the application, resulting in poor performance, and ultimately failure. Understanding the different electrode options that are available and knowing how to use them to your advantage is a critical step to getting the most out of your pH measurement system.

The following section will provide you with an overview of the different types of electrode available for use with the accumet™ range. If, however, you have any further questions concerning electrode selection, then please contact our Product Support Advisors.

Combination or Half-Cell?

There are two components within a pH electrode system. A pH indicating (or sensing) electrode, which develops a potential dependent on the pH of the sample, and the reference electrode, which provides a constant voltage for the meter to compare against. These two cells also help complete the electrical circuit between the meter and the sample. Combination electrodes have both the indicating and reference electrodes “combined” into one electrode. Alternatively, separate half-cell sensing and reference electrodes can be used. Since reference electrodes are often outlasted by sensing electrodes, you only need to replace one electrode at a time, which can mean lower costs when compared to having to buy a new combination electrode each time.

In practical terms, nearly all electrodes used today are combination electrodes. There are many reasons for this, for example, many pH meters require an adapter to accept half-cell electrodes, handling multiple electrodes is undesirable (or impossible with small samples!), half cells don’t have built in ATC and therefore require a third electrode for temperature compensation, the complexity of diagnosing electrode problems, and, most of all, the reduced cost and improved performance of today’s combination electrode designs.

Glass or Plastic Body?

To decide on which to use, let us look at the advantages and disadvantages of each, starting with the glass body electrode. Glass electrodes are easier to clean and maintain since they can tolerate just about any solvent and inorganic material (with the exception of HF!) and can adequately handle higher temperatures, with the bulb typically able to go up to 100°C. The fact that glass electrodes also have a glass sensing bulb is also an advantage. Since the seal that joins the bulb to the body is similar material, it is one less thing that can go wrong during measurement. This is an especially important consideration for applications that involve repeated and extreme heating and cooling – the expansion and contraction that occurs is handled much better by glass electrodes. The downsides of glass electrodes are fairly obvious – they are generally more expensive than plastic, and they have a greater potential for breakage.

Plastic body electrodes are less expensive than glass and can usually take much more abuse in the lab and in the field. Most electrodes with built-in temperature compensation elements are also plastic due to the complexity in manufacturing them. As a result, plastic electrodes are most popular with field and portable meters, but can also be used in laboratory environments. To protect the inner glass sensing bulb, many plastic electrodes use an integral housing that limit the bulb exposure, but these can often be difficult to clean.

In addition to the body material, different body styles are also available for use when measuring certain sample types. As well as the standard, familiar design, the Fisherbrand range incorporates spear-shaped electrodes (for measuring semi solids, meats, cheeses etc), thin stem semi-micro electrodes (for small samples and where space is limited) and the robust Tuff-Tip electrodes, designed for more hard-wearing conditions.

Refillable or Non-Refillable?

All pH electrodes use and inevitably leak solution. Refillable electrodes do so more quickly, but can be easily replenished when they need to be topped up. Conversely, gel-filled electrodes leak very slowly, but when they run out or the gel is no longer flowing, it cannot be replenished and the whole electrode must be replaced.












Refillable electrodes are generally more expensive than gel-filled equivalent electrodes but respond much faster. They also last longer, because the filling solution can be replaced indefinitely; however the periodic requirement for solution top-up is inconvenient and a primary disadvantage. Another downside is generation of dried salt residues if the filling hole is left open for extended periods, which may require cleaning.

In summary, gel-filled electrodes are less expensive, require less maintenance, and are usually plastic. High quality gel formulations have also extended their once limited shelf-life in recent years.

Single or Double-Junction (TRIS compatible)?

This decision is extremely important and should not be overlooked. If you will be measuring samples that have sulfides, proteins, heavy metals, TRIS, or anything that might react with silver, or if you will be testing samples that are unknown, use a double-junction electrode. Calomel electrodes would also be suitable but have fallen out of favour due to their mercury content. Single-junction electrodes are less expensive, but offer no other advantages. If you use a single-junction electrode in a solution with TRIS, it's just a matter of time before it fails. For dirty samples and those high in particulates, electrodes with sleeve-type junctions offer the longest life span. Whilst other electrodes can become clogged and unresponsive with these challenging sample types, sleeve junctions reduce the risk of clogging. Therefore, while these are generally more expensive, they will need replacing much less frequently in difficult sample types. Sleeve junction electrodes are also TRIS compatible.

pH Electrode Features

pH Electrode Styles		pH Electrode Body Materials		pH Electrode Junctions				
<ul style="list-style-type: none">• Standard 12mm electrode diameter for use in a wide variety of sample volumes		Glass Body <ul style="list-style-type: none">• Compatible with virtually any sample, including solvents• Easy to clean		Sleeve and Laser-Drilled Hole (Open) <ul style="list-style-type: none">• Best junction for dirty, difficult samples• Junction is clog-free and easy to clean• Ideal for thick or viscous samples, compatible with all sample types				
<ul style="list-style-type: none">• Semi-Micro 6mm to 8mm electrode diameter for sample sizes down to 200µL		Plastic Body <ul style="list-style-type: none">• Extremely durable and rugged to prevent breakage• Value-priced		Ceramic and Glass Capillary <ul style="list-style-type: none">• Better junction for routine lab or field use• Junction is high quality and durable• Ideal for most applications and samples				
<ul style="list-style-type: none">• Micro 1mm to 5mm electrode diameter for samples as small as 0.5µL and containers as small as 384 well plates								
<ul style="list-style-type: none">• Tuff-Tip™ Durable and tough protective tip for heavily loaded samples								
<ul style="list-style-type: none">• Spear Tip For piercing solid or semi-solid samples and measuring small volume samples								
<ul style="list-style-type: none">• Flat Surface Tip For surface pH measurement of solid or gel samples or small volume samples								
				Wick and Glass Fibre <ul style="list-style-type: none">• Good junction for routine lab or field use• Junction used with rugged plastic electrodes• Ideal for aqueous samples				

Use the selection guide below to help you choose the the right Fisherbrand electrode for your particular application.

pH Electrode Selection Guide

Sample/Application Type	Recommended Electrode Type	Cat. No
General purpose for many common sample types, e.g., aqueous samples, drinking water etc	Glass bodied	11749798
	Plastic bodied	11706358
Food and drink, e.g., juices, baby food, cheese	Tuff-Tip	11755638
	Spear tip	11736209
Environmental samples, e.g., wastewater, soils, sea water	Tuff-Tip	11755638
Low ionic strength e.g., treated effluent, deionised water, distilled water Non-aqueous e.g., solvents, alcohols	Sleeve junction	11726358
Life science samples, Tris-containing reagents, proteins etc	Tuff-Tip	11755638
Small samples e.g., samples stored in test tubes, small flasks and beakers	Micro thin-stem Semi-micro	11769798
High-viscosity samples, e.g., slurries, suspended solids	Sleeve junction	11726358

pH Electrode Connectors

The type of pH electrode connector can vary according to the brand of the meter as well as the electrode type. The following information provides you with a brief overview of these connectors. However, if you require any further assistance connecting your electrode to your meter contact our Product Support Advisors.

- The **BNC** connector is accepted by the vast majority of modern pH meters. It is characterised by its twist-locking action.



- The **DIN** connector, although not as common as a BNC, is still used by several different meter types.



- The **S7** (screw cap) connectors are becoming more popular due to their flexibility. Electrodes with an S7 head can be connected to a variety of meter inputs using a separate cable.



Refer to 'Electrode Accessories' (see next page) for the Fisherbrand electrode adapter cables which will allow you to connect probes from alternative manufacturers to your accumet™ pH meter.



pH Electrodes

	Electrolyte	Style	Body Material	pH Range	Temperature Range °C	Dimensions, mm	Cable	Connector	Sample/ Application Type
11706358	Gel	Standard	Plastic	0 to 13	0 to 80	12 x 120	1m	BNC	General/field purpose
11776348	Gel	Standard	Plastic	0 to 13	0 to 80	12 x 120	1m	DIN	General/field purpose
11786348	Gel	Standard	Plastic	0 to 14	0 to 80	12 x 120	-	S7	General/field purpose
11749798	KCL 4M + AgCl	Standard	Glass	0 to 13	0 to 80	12 x 120	1m	BNC	General/laboratory purpose
11739798	KCL 4M + AgCl	Standard	Glass	0 to 13	0 to 80	12 x 120	1m	DIN	General/laboratory purpose
11786338	KCL 4M + AgCl	Standard	Glass	0 to 14	0 to 80	12 x 160	-	S7	Laboratory purpose
11726358	KCL 3M + AgCl	Sleeve junction	Glass	0 to 14	0 to 80	12 x 120	-	S7	Laboratory purpose/low ionic strength/non-aqueous or viscous samples
11769798	KCL 4M + AgCl	Micro electrode	Glass	0 to 13	0 to 80	6 x 115	1m	BNC	Small samples
11709818	KCL 4M + AgCl	Micro electrode	Glass	0 to 13	0 to 80	6 x 115	1m	DIN	Small samples
11736209	Gel	Spear tip	Glass	1 to 11	0 to 70	6 x 92	-	S7	Food and drink
11755638	Gel	Tuff-Tip*	Plastic	0 to 14	-5 to 100	12 x 120	1m	BNC	Environmental samples
11765638	Gel	Tuff-Tip*	Plastic	0 to 14	-5 to 100	12 x 120	1m	DIN	Environmental samples
11775638	Gel	Tuff-Tip*, double junction	Plastic	0 to 13	-5 to 100	12 x 120	1m	BNC	Environmental samples
11785638	Gel	Tuff-Tip*, double junction	Plastic	0 to 13	-5 to 100	12 x 120	1m	DIN	Environmental samples

* Tuff-Tip is a robust alternative to conventional laboratory pH electrodes where membrane breakage is a problem. The rugged pH bulb is protected by the unique Tuff-Tip shape making this electrode shockproof



ORP Electrodes

	Electrolyte	Body Material	pH Range	Temperature Range °C	Dimensions, mm	Cable	Connector
11768452	Gel	Plastic	±1500 mV	0 to 80	12 x 120	1m	BNC
11778452	Gel	Plastic	±1500 mV	0 to 80	12 x 120	1m	DIN
11758452	Gel	Plastic	±1500 mV	0 to 80	12 x 120	-	S7

Electrode Accessories

	Description	Dimensions, mm
11746348	Connector cable S7 to BNC, 1m	12 x 120
11736348	Connector cable S7 to DIN, 1m	12 x 120

Standard buffer solutions for pH meter calibration



Next to temperature and mass, pH is the third most common laboratory measurement, and buffer solutions are frequently used as a means of keeping pH at a nearly constant value in a wide variety of chemical and biochemical applications. For example, many enzymes only work under very precise conditions so it is very important that the buffer maintains the correct pH; if the pH moves outside of a narrow range, the enzyme may stop working and denature. Industrially, buffers are used in fermentation processes and in setting the correct conditions for dyes used in colouring fabrics.

For such very precise work it is important that pH meters are calibrated before each measurement. Standard buffer solutions, of known pH value, allow calibration of the meter/electrode system to ensure that accurate measurements are taken subsequently. Certified accurate buffers are available from Fisher Chemical as ready-to-use standard or colour-coded solutions, concentrated solutions, capsules and prepackaged salts. All have the special characteristic of resisting pH change in the event of dilution or acid/base contamination. It is generally recommended to use a minimum of two-point standardisation; first with a buffer value close to the electrode systems zero potential (typically pH 7); and also with an additional acid or base buffer whose values encompasses the expected pH value of the sample (refer to 'pH Electrode Calibration'). For best accuracy, the calibration should be performed with ATC at the same temperature as the expected samples.

In this section you will discover that Fisher Chemical have all the standard buffers you need. Manufactured to exacting standards and packaged for convenience, you'll find a buffer to meet virtually every laboratory or field application.



Buffer Standard Solutions



pH2 Buffers

	Description	Pack qty
10703324	Buffer standard solution pH2.00 (glycine), traceable to NIST	500mL
10578040	Buffer standard solution pH2.00 (glycine), traceable to NIST	1L
10588040	Buffer standard solution pH2.00 (glycine), traceable to NIST	2.5L
10080632	Buffer concentrated solution pH2.00 (glycine) (one ampoule makes 500mL)	100mL
10214390	Buffer concentrated solution pH2.00 (glycine) (each ampoule makes 500mL)	6 x 100mL

pH3 Buffers

	Description	Pack qty
10104823	Buffer standard solution pH3.00 (phthalate), traceable to NIST	500mL
10111430	Buffer standard solution pH3.00 (phthalate), traceable to NIST	1L
10665492	Buffer standard solution pH3.00 (phthalate), traceable to NIST	2.5L

pH4 Buffers

	Description	Pack qty
10734751	Buffer tablets pH4.00 (phthalate) makes 100mL of solution per tablet	50 tablets
10545151	Buffer standard solution pH4.00 (phthalate), traceable to NIST	500mL
10675492	Buffer standard solution pH4.00 (phthalate), traceable to NIST	1L
10030190	Buffer standard solution pH4.00 (phthalate), traceable to NIST	2.5L
10040190	Buffer standard solution pH4.00 (phthalate), traceable to NIST	5L
10305950	Buffer standard solution pH4.00 (phthalate), traceable to NIST	10L
10234390	Buffer standard solution BS pH4.00 (phthalate) BS 1647 traceable to NIST	1L
11413843	Buffer concentrated solution BS pH4.00 (phthalate) (one ampoule makes 500mL)	100mL
10508050	Buffer concentrated solution pH4.00 (phthalate) (each ampoule makes 500mL)	6 x 500mL

pH5 Buffers

	Description	Pack qty
10609483	Buffer standard solution pH5.00 (phthalate), traceable to NIST	500mL
10588230	Buffer standard solution pH5.00 (phthalate), traceable to NIST	1L
10294430	Buffer standard solution pH5.00 (phthalate), traceable to NIST	2.5L

pH6 Buffers

	Description	Pack qty
10690404	Buffer standard solution pH6.00 (phosphate), traceable to NIST	500mL
10000210	Buffer standard solution pH6.00 (phosphate), traceable to NIST	1L
10685682	Buffer standard solution pH6.00 (phosphate), traceable to NIST	2.5L
10695682	Buffer BS standard solution pH6.87 (phosphate), traceable to NIST	1L
11482694	Buffer BS concentrated solution pH6.87 (phosphate)	6 x 100mL

pH7 Buffers

	Description	Pack qty
10000642	Buffer solution pH7.00 (phosphate)	500mL
10457440	Buffer tablets pH7.00 (phosphate), makes 100mL per tablet	50 tablets
10082521	Buffer standard solution pH7.00 (phosphate), traceable to NIST	500mL
10151570	Buffer standard solution pH7.00 (phosphate), traceable to NIST	1L
10457640	Buffer standard solution pH7.00 (phosphate), traceable to NIST	2.5L
10010210	Buffer standard solution pH7.00 (phosphate), traceable to NIST	5L
10616072	Buffer standard solution pH7.00 (phosphate), traceable to NIST	10L
10204440	Buffer concentrated solution pH7.00 (phosphate) (each ampoule makes 500mL)	6 x 100mL

pH8 Buffers

	Description	Pack qty
10593854	Buffer standard solution pH8.00 (borate), traceable to NIST	500mL
10070210	Buffer standard solution pH8.00 (borate), traceable to NIST	1L
10141620	Buffer standard solution pH8.00 (borate), traceable to NIST	2.5L
10164373	Buffer standard solution pH8.00 (borate), traceable to NIST	10L
10764074	Buffer concentrated solution pH8.00 (borate), one ampoule makes 500mL	100mL
10294480	Buffer concentrated solution pH8.00 (borate), each ampoule makes 500mL	6 x 100mL

pH9 Buffers

	Description	Pack qty
10622261	Buffer tablets pH9.2 (borate), makes 100mL per tablet	50 tablets
10395792	Buffer standard solution pH9.00 (borate), traceable to NIST	2.5L
10082531	Buffer standard solution pH9.2 (borate), traceable to NIST	500mL
10142000	Buffer standard solution pH9.2 (borate), traceable to NIST	1L
10590911	Buffer standard solution pH9.2 (borate), traceable to NIST	2.5L
10030180	Buffer standard solution pH9.2 (borate), traceable to NIST	5L
10419370	Buffer standard solution pH9.2 (borate), traceable to NIST	10L
10246531	Buffer concentrated solution pH9.2 (borate), one ampoule makes 500mL	100mL
10385750	Buffer concentrated solution pH9.2 (borate), each ampoule makes 500mL	6 x 100mL
11472694	Buffer BS standard solution pH9.225, traceable to NIST	1L
10395750	Buffer standard solution pH9.23 (borate), traceable to NIST	1L

pH10 Buffers

	Description	Pack qty
10789234	Buffer standard solution pH10.00 (borate), traceable to NIST	500mL
10429560	Buffer standard solution pH10.00 (borate), traceable to NIST	1L
10214200	Buffer standard solution pH10.00 (borate), traceable to NIST	2L
10274240	Buffer standard solution pH10.00 (borate), traceable to NIST	5L
10132050	Buffer concentrated solution pH10 (borate), each ampoule makes 500mL	6 x 100mL

Colour Coded Buffer Solutions

	Description	Pack qty
15850064	Buffer colour coded solution pH4.00 (phthalate) red, traceable to NIST	500mL
15860064	Buffer colour coded solution pH4.00 (phthalate) red, traceable to NIST	1L
15870064	Buffer colour coded solution pH4.00 (phthalate) red, traceable to NIST	2.5L
15880064	Buffer colour coded solution pH4.00 (phthalate) red, traceable to NIST	5L
15890064	Buffer colour coded solution pH4.00 (phthalate) red, traceable to NIST	10L
10164863	Buffer colour coded concentrated solution pH4.00 (phthalate) red (one ampoule makes 500mL)	100mL
10090200	Buffer colour coded concentrated solution pH4.00 (phthalate) red (each ampoule makes 500mL)	6 x 100mL
10000642	Buffer colour coded solution pH7.00 (phosphate) yellow, traceable to NIST	500mL
10477830	Buffer colour coded solution pH7.00 (phosphate) yellow, traceable to NIST	1L
10274480	Buffer colour coded solution pH7.00 (phosphate) yellow, traceable to NIST	2.5L
10171570	Buffer colour coded solution pH7.00 (phosphate) yellow, traceable to NIST	5L
10131620	Buffer colour coded solution pH7.00 (phosphate) yellow, traceable to NIST	10L
10498020	Buffer colour coded concentrated solution pH7.00 (phosphate) yellow (each ampoule makes 500mL)	6 x 100mL
10774074	Buffer colour coded solution pH10.00 (borate) blue, traceable to NIST	500mL
10284240	Buffer colour coded solution pH10.00 (borate) blue, traceable to NIST	1L
10723991	Buffer colour coded solution pH10.00 (borate) blue, traceable to NIST	2.5L
10102100	Buffer colour coded solution pH10.00 (borate) blue, traceable to NIST	5L
10459750	Buffer colour coded solution pH10.00 (borate) blue, traceable to NIST	10L
10293862	Buffer colour coded concentrated solution pH10.00 (borate) blue (one ampoule makes 500mL)	100mL
10615112	Buffer colour coded concentrated solution pH10.00 (borate) blue (each ampoule makes 500mL)	6 x 100mL

Full Range Indicators

	Description	pH range	Colour change	Pack qty
10366340	Full range indicator pH range 1 to 13, contains methylated spirit	1.0-13.0	See colour chart on bottle	100mL
10488610	Full range indicator pH range 1 to 13, contains methylated spirit	1.0-13.0	See colour chart on bottle	500mL

Universal Indicators

	Description	pH range	Colour change	Pack qty
10090470	Universal indicator pH range 4 to 10, contains methylated spirit	4.0-10.0	See colour chart on bottle	100mL
10468420	Universal indicator pH range 4 to 10, contains methylated spirit	4.0-10.0	See colour chart on bottle	500mL
10705351	Universal indicator pH range 4 to 10, contains methylated spirit	4.0-10.0	See colour chart on bottle	2.5L

pH Indicator Paper, Sticks

- 85mm x 6mm sticks with different indicator papers sealed onto each strip
- The pH is determined by comparison with a colour chart supplied. The sticks are sufficiently long to avoid contact between the fingers and the test sample

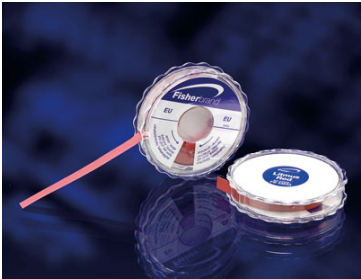
	Description	pH range	Pack qty
10642751	pH indicator paper stick non-bleeding supplied with colour comparison chart	0.0 to 14.0	100 sticks
10018080	pH indicator paper stick non-bleeding supplied with colour comparison chart	0.0 to 6.0	100 sticks
10017950	pH indicator paper stick non-bleeding supplied with colour comparison chart	1.7 to 3.8	100 sticks
10353641	pH indicator paper stick non-bleeding supplied with colour comparison chart	3.6 to 6.1	100 sticks
10333501	pH indicator paper stick non-bleeding supplied with colour comparison chart	4.5 to 10.0	100 sticks
11386454	pH indicator paper stick non-bleeding supplied with colour comparison chart	6.0 to 7.7	100 sticks
10271751	pH indicator paper stick non-bleeding supplied with colour comparison chart	7.0 to 14.0	100 sticks



pH Indicator Paper, Reels

- Dispenser reels each 5m x 7mm (l x w), except 10433151 which is 5m x 10mm (l x w).

	Description	Type	Colour change	pH range	Pack qty
11567382	pH indicator paper reel	Litmus red	Red to blue	5.0 to 8.0	4
11577382	pH indicator paper reel	Litmus blue	Blue to red	5.0 to 8.0	4
10482341	pH indicator paper reel	pH	pH specific	1.0 to 14.0	4
11517392	pH indicator paper reel	pH	pH specific	0.5 to 5.5	4
11527392	pH indicator paper reel	pH	pH specific	4.0 to 7.0	4
11537392	pH indicator paper reel	pH	pH specific	6.4 to 8.0	4
11557392	pH indicator paper reel	pH	pH specific	9.0 to 13.0	4
10433151	pH indicator paper reel	pH, three colour	pH specific	1.0 to 11.0	4



Technical Resources

Here to give you a helping hand!

Fisher Scientific's Product Support Team is your dedicated information resource. Our Product Support Advisors are all highly qualified professionals who are here to support and guide you to the fastest, most effective and efficient answer to your enquiry.

Areas of technical expertise include:

- Bioreagents and Life Science
- Chemicals and Chromatography
- Consumables
- Equipment
- Safety

This section features a number of helpful resources such as how to prepare, calibrate, store and clean your electrodes as well as a troubleshooting guide and FAQ's. If, however, this information does not resolve your issue, or if you have questions not covered below, then:

Contact our Product Support Advisors



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pH Electrode Preparation

You will need:



This is a general procedure for preparing most pH electrodes. However, it is important that you also refer to the user guide or instruction manual for your particular electrode for any specific preparation requirements.

1. Remove the protective shipping cap, sleeve or bottle from the electrode pH-sensing bulb and save the cap, sleeve or bottle for storage. If the electrode has a storage bottle covering the pH-sensing bulb, unscrew the storage bottle cap before removing the electrode from the storage bottle.
2. Clean any salt deposits from the electrode exterior by rinsing it with distilled water.
3. If the electrode is refillable, uncover the fill hole and add the appropriate filling solution to the electrode. To maintain an adequate flow rate, the level of filling solution must always be above the reference junction and at least one inch above the sample level. The fill hole should be open whenever the electrode is in use.
4. Gently shake the electrode downward (similar to a clinical thermometer) to remove any air bubbles that may be trapped inside.
5. Soak the electrode in a standard pH electrode storage solution for at least 30 minutes.
6. Connect the electrode to the meter.
7. Select at least two standard pH buffers that bracket the expected sample pH in readiness for calibration (see next section).

pH Electrode Calibration

You will need:

pH meter

Electrode

Wash bottles

pH buffers

Water



Beaker

Stirrer

Magnetic follower

accumet™ stirrer probe



Calibration Recommendations

- Always pour fresh pH buffers into clean beakers for calibration. Choose buffers that are one to three pH units apart.
- Check the electrode slope daily by performing at least a two-buffer calibration. The slope should be 92 to 102% (54.43 to 60.34 mV per pH unit).
- If the electrode is refillable, uncover the fill hole during calibration to ensure a uniform flow of filling solution. The filling solution level inside of the electrode must be at least one inch above the buffer solution level.
- The buffer solution level must be above the pH electrode reference junction when the electrode is immersed in the buffer.
- Between buffers, rinse the electrode with distilled water and then with the next buffer. To reduce the chance of error due to polarisation, avoid rubbing or wiping the electrode bulb. Use a lint-free tissue and gently blot the bulb.
- Use a magnetic stir plate and stir bar or the accumet™ benchtop stirring probe to stir all buffers and samples at a moderate, uniform rate. The stirrer probe can be used with the AB and XL series of benchtop meters.
- Place a piece of insulating material, such as cardboard, between the magnetic stir plate and beaker to prevent measurement errors from the transfer of heat to the sample.
- Handle micro pH electrodes with particular care. Do not touch the pH bulb and stem against the bottom or walls of the sample containers.

Calibration Procedure

Two or more buffers. This procedure is recommended for precise measurements.

1. Verify that the pH electrode was prepared correctly and connect the electrode to the meter.
2. Select two pH standard buffers that bracket the expected sample pH. The first buffer should be near the electrode isopotential point (pH 7) and the second buffer should be near the expected sample pH (pH 4 or pH 10). The pH buffers should be at same temperature as the sample. If the buffers and samples are at varying temperatures, temperature compensation is recommended.
3. Rinse the electrode with distilled water and blot it dry with a lint-free tissue.
4. Place the electrode into the first buffer. When the reading is stable, set the meter to the pH value of the first buffer at the measured temperature. Refer to the meter instruction manual for a detailed procedure. The table below provides pH values for buffers at various temperatures.
5. Rinse the electrode with distilled water and blot it dry with a lint-free tissue.
6. Place the electrode into the second buffer. When the reading is stable, set the meter to the pH value of the second buffer at the measured temperature. Refer to the meter instruction manual for a detailed procedure. The table below provides pH values for buffers at various temperatures.
7. The meter should display a 92 to 102% slope or 54.43 to 60.34mV per pH unit, depending on the pH meter. Refer to the meter instruction manual for details on how the meter displays the calibration information.

For one buffer

1. Verify that the pH electrode was prepared correctly and connect the electrode to the meter.
2. Select a pH buffer that is near the expected sample pH. The pH buffer should be at same temperature as the samples. If the buffer and samples are at varying temperatures, temperature compensation is recommended.
3. Rinse the electrode with distilled water and blot it dry with a lint-free tissue.
4. Place the electrode into the buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature and set the calibration slope to 100% or 59.16mV per pH unit, depending on the pH meter requirements. Refer to the meter instruction manual for a detailed procedure. Please note that a single point calibration is not as accurate as a multi-point one and should only be done when absolutely necessary as it relies on a near perfect electrode to give good readings. Where possible always use a minimum two point calibration. The table below provides pH value for buffers at various temperatures.

Nominal pH Value at 25°C	0°C	5°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
1.68	1.67	1.67	1.67	1.67	1.68	1.69	1.71	1.72	1.74	1.77	1.79
4.01	4.00	4.00	4.00	4.00	4.02	4.04	4.06	4.09	4.13	4.16	4.21
6.86	6.98	6.95	6.92	6.87	6.85	6.84	6.83	6.84	6.85	6.86	6.88
7.00	7.11	7.08	7.06	7.01	6.98	6.97	6.97	6.97	6.99	7.03	7.08
9.18	9.46	9.40	9.33	9.23	9.14	9.07	9.01	8.96	8.92	8.89	8.85
10.01	10.32	10.25	10.18	10.06	9.97	9.89	9.83	9.79	9.78	9.78	9.80
12.46	12.79	12.73	12.67	12.52	12.36	12.17	11.96	11.73	11.47	11.19	10.89

pH Electrode Measurements

You will need:

pH meter



Electrode



Wash bottles



pH buffers



Water



Beaker



Stirrer

Magnetic follower



accumet™ stirrer probe



Sample Requirements

- Electrodes with a plastic body should only be used in aqueous solutions.
- Electrodes with a glass body may be used in nonaqueous solutions and solutions that contain organic solvents. A minimum of 20% water must be present in the sample for the best measurement results.
- The standard Ag/AgCl electrodes, micro Ag/AgCl electrodes and economy electrodes contain a single junction silver/silver chloride reference that will become clogged in solutions that contain silver complexing or binding agents such as TRIS buffer, proteins and sulfides. Frequent cleaning may be required when measuring these solutions, which will shorten the electrode life. Proteins cause the additional problem of coating the pH-sensing bulb, so extra care should be taken to keep the electrode clean while measuring samples that contain proteins.

pH Measurement Procedure

1. Verify that the pH electrode has been prepared and calibrated correctly. If the electrode is refillable, make sure that the fill hole is uncovered and the filling solution level is at least one inch above the sample solution level.
2. Rinse the electrode with distilled water and blot it dry with a lint-free tissue.
3. Place the electrode into the sample. Use a magnetic stir plate and clean stir bar or the accumet™ benchtop stirring probe to stir the sample at a moderate, uniform rate.
4. When the measurement is stable, record the pH value and temperature of the sample.

pH Measurement Recommendations

- Check the electrode slope daily by performing at least a two-buffer calibration. The slope should be 92 to 102%.
- Unless otherwise specified, only use the recommended filling solution in refillable pH electrodes.
- If the electrode is refillable, uncover the fill hole during measurements to ensure a uniform flow of filling solution. The filling solution level inside the electrode must be at least one inch above the sample solution level.
- The sample solution level must be above the pH electrode reference junction when the electrode is immersed in the sample.
- Between measurements, rinse the electrode with distilled water and then with the next solution to be measured. To reduce the chance of error due to polarisation, avoid rubbing or wiping the electrode bulb. Use a lint-free tissue and gently blot the bulb.
- Use a magnetic stir plate and stir bar or the accumet™ benchtop stirring probe to stir all buffers and samples at a moderate, uniform rate. The stirrer probe can be used with the AB and XL series of benchtop meters.
- Place a piece of insulating material, such as cardboard, between the magnetic stir plate and beaker to prevent measurement errors from the transfer of heat to the sample.
- If the electrode is refillable and the electrode is used in dirty or viscous samples or the electrode response becomes sluggish, empty the electrode completely and hold the reference junction under warm running water. Empty any water from the electrode and fill it with fresh filling solution. For a more thorough cleaning, refer to the 'pH Electrode Cleaning Procedures' section.
- Flat surface electrodes may be used on any moist surface or in liquids.
- Handle micro pH electrodes with particular care. Do not touch the pH bulb and stem against the bottom or walls of the sample containers.

pH Electrode Maintenance

You will need:

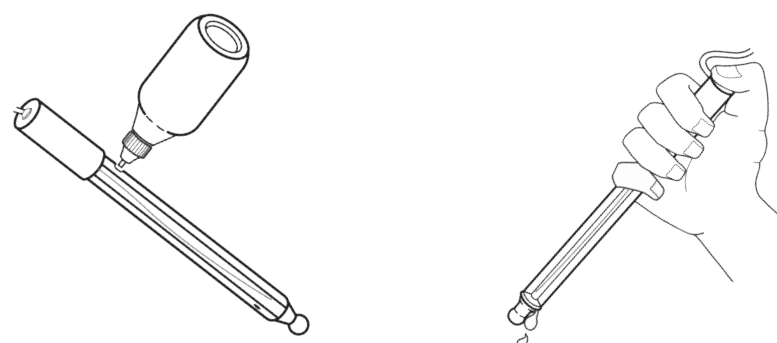


Looking After Your Electrode

1. On a weekly basis, inspect the pH electrode for scratches, cracks, salt crystal build-up, or membrane/junction deposits.
2. Rinse off any salt build-up with distilled water. Remove any membrane/junction deposits by soaking the electrode in 0.1M HCl for 15 minutes or soaking the electrode in a 0.1M KCl solution heated to 55°C for 15 minutes. If the electrode is dirty, clogged or coated, refer to the 'pH Electrode Cleaning Procedures' section for a more thorough electrode cleaning procedure.
3. If a refillable electrode is used, drain the reference chamber, flush it with distilled water until all of the salt crystal build-up inside of the electrode is removed, flush it with fresh filling solution and then finally fill the reference chamber with further fresh filling solution.
4. Soak the electrode in standard pH electrode storage solution for 1 to 2 hours.

Filling and Draining a Refillable pH Electrode

To fill an electrode, install the flip spout cap onto the filling solution bottle and lift the flip spout to a vertical position. Insert the spout into the electrode fill hole and add filling solution up to the fill hole. If a flushable electrode is used, push down on the electrode cap to allow a few drops of filling solution to drain out of the electrode and release the cap to reset the renewable junction. Push down and release the cap until the junction returns to its original position and add filling solution up to the fill hole. To drain most electrodes, insert a lint-free tissue or pipette into the fill hole and remove all of the filling solution. If a pipette is used, do not insert it too far into the electrode and do not touch the inner glass tube with the pipette. To drain a flushable pH electrode, make sure that the fill hole is uncovered, place a waste beaker under the electrode and push down on the electrode cap to remove all of the filling solution. The filling solution will flow out of the renewable junction near the pH bulb.



pH Electrode Storage

To ensure a quick electrode response and an unclogged electrode junction, the electrode should never be stored dry and the pH-sensing bulb and reference junction must not dry out. Always store the pH electrode in pH electrode storage solution.

Short Term Electrode Storage (up to one week)

Soak the electrode in pH electrode storage solution. To minimise the chance of breakage, micro pH electrodes should be attached to an electrode stand and suspended in a beaker that contains storage solution. The electrode should not touch the sides or bottom of the beaker.

Long Term Electrode Storage (more than one week)

If the electrode is refillable, fill the reference chamber up to the fill hole with the appropriate electrode filling solution and securely cover the fill hole with parafilm. Cover the pH-sensing bulb and reference junction with a protective cap, sleeve or storage bottle containing storage solution. Before returning the electrode to use, prepare it as per a new electrode.

pH Electrode Cleaning Procedures

You will need:

Transfer pipette



Electrode



Wash bottles



pH buffers



Water



One of the most common reasons for a pH electrode not working properly is because it is dirty, clogged or coated with sample. Cleaning a dirty, clogged or coated electrode restores proper electrode performance and prolongs its useful life.

These instructions provide a starting point for developing an effective cleaning procedure.

1. Choose a suitable cleaning solution (for example, from the Thermo Scientific™ Orion™ range)
2. Shake the cleaning solution. Pour enough of the cleaning solution into the beaker to cover the electrode junction.
3. Soak the electrode for five to ten minutes in the cleaning solution while moderately stirring the solution. Electrodes with wick junctions may require more cleaning time.
4. Remove the electrode from the cleaning solution and rinse it thoroughly with distilled water.
5. If cleaning a refillable electrode, remove the filling solution from the electrode using a plastic pasteur pipette and add fresh filling solution to the electrode. Repeat this step two or three times for optimal electrode performance.
6. If cleaning a flushable electrode, flush a few drops of filling solution through the electrode junction by pressing down on the electrode cap. Ensure that the junction flushes and resets properly. Refill the electrode with filling solution.
7. Soak the electrode in standard pH electrode storage solution for at least 30 minutes.
8. Rinse the electrode thoroughly with distilled water and measure samples as usual. If the electrode response is slow or the electrode does not calibrate correctly, repeat the cleaning procedure. Viscous samples and samples that contain solid materials often require additional cleaning and additional filling solution changes.

General Rules and Tips

- When using refillable electrodes, open the fill hole during calibration and measurement – but remember to close it afterwards when finished!
- The level of electrolyte in the outer cavity of refillable electrodes should be kept above the level of the solution being measured to prevent reverse electrolyte flow.
- When taking measurements, the electrode need only be immersed far enough to cover both the glass pH sensing bulb and reference junction to obtain accurate readings.
- Electrodes perform best when they are hydrated. However, if they dry out they can be reconditioned to normal performance again. Soaking in electrode storage solution helps to optimise and re-establish the thin hydration layer on the sensing bulb that is critical to pH measurement.
- Rinsing the electrode with deionised or distilled water between samples is fine, but storage in deionised or distilled can be detrimental as it will rob critical ions from the sensing bulb. Also, avoid wiping or touching the sensing bulb so as to maintain the hydration layer and avoid producing any electrical charge.
- Moving or touching the electrode cable may result in unstable readings due to the high impedance (resistance) of the pH glass membrane and introduce noise.
- To eliminate temperature errors associated with the electrode, manual or automatic temperature compensation (ATC) should be used for best accuracy. Since temperature changes pH, the sample temperature should always be noted with pH readings, so, for example, record results as “pH8.43 @ 23.2°C”, instead of just “pH8.43”.
- Always use fresh pH buffers for calibration. Excessive air exposure and sunlight can alter the buffer’s value – especially pH10 buffers which are particularly susceptible to drift.



Troubleshooting Guide

Here are some of the most commonly experienced problems associated with pH and other electrochemical measurements, along with some useful suggestions for solving them.

Problem	Cause	Suggestions
<i>pH</i>		
Meter will not calibrate	Meter	<ul style="list-style-type: none"> • ‘Short out’ meter in mV mode by inserting one end of a paper clip in to the centre of the BNC connection, touch outer edge with other end. Meter should read 0mV. If you get a different reading, meter may be in need of repair.
	Buffers	<ul style="list-style-type: none"> • Ensure that fresh buffer solutions are always used • Rinse electrode between buffer solutions • Are pH buffers more than 1.0pH unit apart? Custom pH calibrations must be more than 1.0pH unit apart.
	Electrode	<ul style="list-style-type: none"> • Ensure that electrode has been stored correctly • Check electrode for cracks/scratches etc. • Clean electrode • Drain, flush and refill electrode • Replace electrode
	Technique	<ul style="list-style-type: none"> • Make sure that reading is being given sufficient time to stabilise
Meter is giving erratic readings or readings are not stable	Electrode	<ul style="list-style-type: none"> • Check electrode for cracks/scratches etc. • Clean electrode • Drain, flush and refill electrode (ensure fill solution level is high) • Uncover fill hole during measurement • Shake any air bubbles out of electrode • Is electrode tip cracked? If so replace electrode. • Electrodes will typically last 6-12 months. If beyond this, the electrode may need replacing
	Technique	<ul style="list-style-type: none"> • Make sure that reading is being given sufficient time to stabilise
Electrodes are typically only lasting <6 months when being used with Tris buffers/protein samples	Electrode	<ul style="list-style-type: none"> • For Tris buffer and protein samples, a double junction electrode is typically needed. Refer to ‘pH Electrode Selection Guide’ for further advice
New electrode has arrived with white crystalline build up	Electrode	<ul style="list-style-type: none"> • The fill solution has crystallised around the electrode. This is harmless and will not alter performance. It just needs to be wiped away or simply rinsed off.
Electrode bulb/body is cracked and leaking	Electrode	<ul style="list-style-type: none"> • Replace electrode. Refer to the ‘pH Electrode Selection Guide’ for further advice.
Instrument reads inaccurate temperature	ATC Probe	<ul style="list-style-type: none"> • Calibrate using water bath or known accurate thermometer • Faulty thermistor– repair or replace.
Other potential problems	Temperature	<ul style="list-style-type: none"> • Is sample being measured at constant room temperature? If not, then ATC (automatic temperature compensation) probe may be useful • If this is not possible, then efforts should be made to make measurements at a consistent temperature (e.g. 25°C)
	Operator technique	<ul style="list-style-type: none"> • Ensure operator is properly trained in measurement technique (refer to meter instruction manual for further information)
	Sample type	<ul style="list-style-type: none"> • Whilst Tris buffers can pose a particular problem, other samples may also require a specific electrode type. Particulate samples and solid/semi solid samples may also present a problem. Refer to ‘pH Electrode Selection Guide’ for further advice or contact Fisher Scientific Product Support Team if unsure.

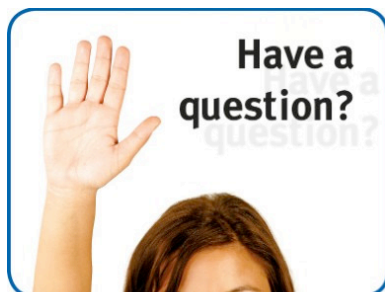
Problem	Cause	Suggestions
<i>Conductivity</i>		
Erratic or inconsistent conductivity readings	Meter	<ul style="list-style-type: none"> Perform self test or meter diagnosis programme (refer to meter instruction manual for further information)
	Conductivity cell	<ul style="list-style-type: none"> Is correct cell constant being used for the sample? Low and high conductivity samples will likely require a different cell constant to be selected. Refer to the table in the FAQ section for further information.
	Technique	<ul style="list-style-type: none"> Make sure that reading is being given sufficient time to stabilise Ensure operator is properly trained in measurement technique (refer to meter instruction manual for further information)
<i>accumet™ Meter Specific Issues</i>		
ISE Display reads “- - -”	Two point calibration has not been performed.	<ul style="list-style-type: none"> Perform two point calibration
Conductivity - can't adjust or can't calibrate	Conductivity calibration standards/settings	<ul style="list-style-type: none"> AUTO calibration values (84µS, 1413µS, 12.88mS, or 111.8mS) are not used. Change Cal Method to MANUAL.
Conductivity - second calibration point replaces the first	Settings	<ul style="list-style-type: none"> Only one point per range can be calibrated. Re-consider your SINGLE or MULTI Cal Method setting.
TDS - Standard does not match	Settings	<ul style="list-style-type: none"> Adjust TDS factor as needed to correct value.
“OR” or “UR” error message	Meter	<ul style="list-style-type: none"> “Over range” or “Under range” condition - check that electrode is connected
Forgotten password	Meter	<ul style="list-style-type: none"> Please send a written request with your name, contact information, and instrument serial number to Fisher Scientific Product Team Email: fisheruk.productsupport@thermofisher.com; a temporary password will be issued

Contact our Product Support Advisors

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Frequently asked questions (FAQ's)

This section lists some of the most frequently asked questions from our customers about electrochemistry and pH measurement as received by our Life Science and Chemical Specialists, together with the answers they provided. If you are unable to find the answer to your question, are stuck and need help or are simply confused and unsure of which product best suits your research needs, the Product Support Team are here and ready to respond to your enquiries.



Check out our Frequently Asked Questions

Contact our Product Support Advisors



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Questions about pH

Q. I am looking to test samples containing Tris buffers, which electrode shall I use?

A. A number of electrodes could be suitable, but what's important is that it is a "double junction" electrode. Refer to the 'pH Electrode Selection Guide' for further advice.

Q. My electrodes are failing within a short time frame, what could be the issue?

A. Not all electrodes are suitable for all sample types. Refer to the 'pH Electrode Selection Guide' or for further advice contact the Fisher Scientific Product Support Team.

Q. I've heard of some samples I should be wary of using standard electrodes in, what are they?

A. Standard electrodes use silver ions in their reference system. Proteins, Tris buffers and general biological samples all react with silver ions and this reaction can lead to the electrode having a shorter life span.

Q. I am having trouble calibrating my meter, what could I be doing wrong?

A. Fresh buffer solutions (preferably certified to a known standard) should always be used. The age of an electrode should also be considered. Electrodes have a useful lifetime of approximately 6 months to a year, and should be treated as a consumable.

Q. Which pH buffers should I use to calibrate my electrode?

A. To ensure accurate and reliable readings, we always recommend calibrating in three pH buffers, normally pH 4, 7 and 10. However, depending on the accuracy you actually require, this can be done at as few as two pH points (e.g. 4 and 7 or 7 and 10) or as many as five points on the Fisherbrand accumet™ meters. Important points to remember when choosing pH buffers are to make sure that they encompass the typical pH range that you expect your samples to fall within, and to never calibrate at points more than 3 pH units apart (calibrating at 4 and 10 for example will not give good results). Always calibrate at pH7 regardless.

Q. How regularly should I calibrate?

A. The meter should be calibrated regularly using fresh buffers. If used on a daily/weekly basis, then this should be before each use. If the meter is in constant use throughout each day, then it may better calibrating midway through each day as part of a calibration routine.

Q. Will the temperature of my sample be an issue?

A: The pH value of any sample varies with temperature (see table below), so for accurate readings it is always best to measure the temperature too. If you are measuring at a different temperature to which you calibrate at, it may be worth considering an ATC (automatic temperature compensation) probe, or an electrode with one built in to measure this. Modern pH meters will adjust the slope value of the electrode as the temperature changes, ensuring the readings stay accurate.

Nominal pH value at 25°C	0°C	5°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
1.68	1.67	1.67	1.67	1.67	1.68	1.69	1.71	1.72	1.74	1.77	1.79
4.01	4.00	4.00	4.00	4.00	4.02	4.04	4.06	4.09	4.13	4.16	4.21
6.86	6.98	6.95	6.92	6.87	6.85	6.84	6.83	6.84	6.85	6.86	6.88
7.00	7.11	7.08	7.06	7.01	6.98	6.97	6.97	6.97	6.99	7.03	7.08
9.18	9.46	9.40	9.33	9.23	9.14	9.07	9.01	8.96	8.92	8.89	8.85
10.01	10.32	10.25	10.18	10.06	9.97	9.89	9.83	9.79	9.78	9.78	9.80
12.46	12.79	12.73	12.67	12.52	12.36	12.17	11.96	11.73	11.47	11.19	10.89

Q. Can I mix and match meters and electrodes from different manufacturers?

A. This is generally not a problem. The vast majority of manufacturers nowadays use a BNC connection between the electrode and the meter for standard pH electrodes. This can however cause an issue when using an ATC probe, as these connectors are not standardised and are manufacturer-specific.

Q. How regularly should I clean my electrode?

A. As regularly as possible. Cleaning and maintaining it will help prolong the electrode's life. It is worth noting that you must be careful not to leave an electrode soaking in aggressive cleaning solutions once clean. This could end up damaging the electrode.

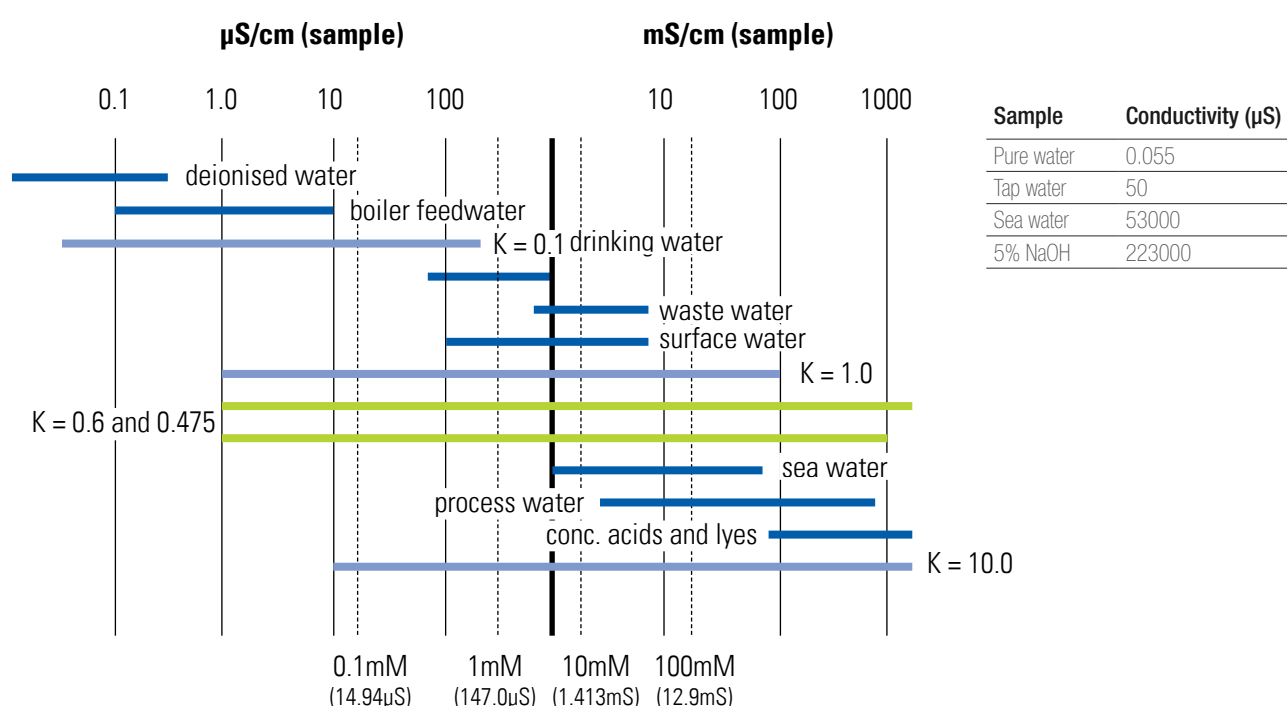
Key points to remember:

- Never re-use buffers
- Never polish the bulb
- Never store the electrode dry or in de-ionised water
- Never stir the sample or buffers with the electrode
- Never cover the reference fill hole during measurement
- Regularly change the reference fill solution

Questions about Conductivity

Q. I am looking to measure pure water samples. Is this possible?

A. This is possible. What's important is the conductivity cell constant (also known as the "K" value). A cell constant of 0.1 would be needed for pure water samples. Each cell constant has a limited sensing range so please make sure you choose one whose range encompasses that of your expected sample conductivity. See below for examples of sample types, approximate conductivity values, and suitable cell constants:



Q. Can I mix and match meters and conductivity cells from different manufacturers?

A. There is currently no standard connection for meters and conductivity cells and all manufacturers use a different system. It is therefore recommended that you stick to conductivity cells from the same manufacturer as your meter.

Q. Will temperature affect my conductivity measurement?

A. Temperature can have a substantial effect on conductivity. Raising the temperature obviously affects the chemical properties of aqueous solutions. This in turn contributes to the solution's conductivity. Typically, conductivity varies by 1 to 3% per degree °C

Q. How should I store my conductivity cell?

A. Conductivity cells require minimal storage compared to other electrode types. They can be stored in deionised water in between measurements. For overnight storage, they can be simply rinsed in deionised water and then stored dry.

Q. When should I calibrate my conductivity meter?

A. This should be done on a regular basis, before each use if possible (possibly as part of a daily calibration routine).

Fisher Chemical

Fisher Chemical offers more than 4,000 chemicals of the highest quality including organic and inorganic reagents and compounds, ready made solutions and high purity solvents. All chemicals are ISO 9001:2008 certified and undergo rigorous quality assurance and testing procedures, ensuring excellent lot-to-lot and bottle-to-bottle consistency. Supported by a clear and simple grade and application structure, choosing the product that best suits your requirements is easy.

Choose from our selection below of high quality Fisher chemicals and reagents most commonly used in pH and electrochemical applications.

Indicators, Reagents & Stains

	Description	Pack qty
10274290	Benedict's reagent, pure, quantitative	1L
10234340	Bicarbonate indicator solution, pure, concentrated stock reagent	250mL
10486870	Bicarbonate indicator solution, pure, concentrated stock reagent	500mL
10101760	Bromocresol green, pure, solution 0.04%, indicator grade	500mL
10070070	Bromocresol purple, pure, solution 0.04%, indicator grade	500mL
10080070	Bromophenol blue, pure, solution 0.04%, indicator grade	500mL
10213330	Bromophenol blue, pure, 0.2%, solution in Methylated spirits	500mL
10314980	Bromothymol blue, pure, solution 0.04%, indicator grade	500mL
10466870	Canada balsam, pure, dried, in xylene	100mL
10418980	Cresol purple, pure, solution 0.04 %, pH indicator	100mL
10030080	Cresol red, pure, solution 0.02 % pH indicator	500mL
10283850	Dimidium bromide-disulfine, extra pure, SLR, blue indicator stock solution	100mL
10598040	Fehling's solution No. 1, pure, to B.P. 1988	1L
10101480	Fehling's solution No. 2, pure, to B.P. 1988	1L
10315950	Fehling's solution No. 1, pure, to Lane and Eynon modification	2.5L
10111480	Fehling's solution No. 2, pure, to Lane and Eynon modification	2.5L
10191520	Folin & Ciocalteu's phenol reagent, pure	500mL
10366340	Full range indicator, pH range 1 to 13, for pH measurement	100mL
10488610	Full range indicator, pH range 1 to 13, for pH measurement	500mL
10548230	Iodine solution - Wij's, pure, indicator grade	1L
10476870	Iodine solution - Wij's, pure, indicator grade	2.5L
10655112	Leishman's stain, pure, in 100% methanol	100mL
10284340	Litmus solution, pure, indicator grade	500mL
10549190	Methylene blue, pure, solution 0.015%, redox indicator	500mL
10579000	Methyl orange, pure, solution 0.04%, C.I. 13025, indicator grade	500mL
10060270	Methyl orange-xylene cyanol FF, pure, indicator grade	500mL
10020280	Methyl red, solution 0.01%, pure, spirit soluble, C.I. 13020, indicator grade	500mL
10695112	Methyl red, pure, solution 0.025%, indicator grade	500mL
10214110	Methyl red, pure, solution 0.01%, indicator grade	500mL
10615502	Methyl violet, pure, solution 1%, CI 42555, indicator grade	500mL
10131910	Millon's reagent, pure	100mL

Indicators, Reagents & Stains continued

	Description	Pack qty
10356330	Nessler's solution, pure, for detection and determination of NH ₃ and salts	500mL
10579190	Phenolphthalein solution, 0.2% in industrial methylated spirit (IMS)	500mL
10060300	Phenolphthalein solution, 0.2% in industrial methylated spirit (IMS)	2.5L
10274200	Phenolphthalein solution, 1% in industrial methylated spirit (IMS)	500mL
10191620	Phenol red, pure, solution 0.02% in water, indicator grade	500mL
10376280	Schiff's reagent, pure, for determination of aldehydes	500mL
10765921	Thymol blue, pure, 0.04% solution, indicator grade	500mL
10439190	Thymolphthalein, pure, solution 0.2%, indicator grade	500mL
10090470	Universal indicator, pH range 4 to 10, for pH measurement	100mL
10468420	Universal indicator, pH range 4 to 10, for pH measurement	500mL

Reagents for COD

	Description	Pack qty
10334980	Chloride colour reagent, pure	4.5L
10578420	Ficodox™, pure, mixed COD reagent	2.5L
10020230	Silver nitrate, for COD, solution 1000g/L	500mL
10030230	Silver sulfate, for COD, solution 5% w/v (d = 1.84) in sulfuric acid	2.5L

Water and Hydrogen Peroxide for Analysis

	Description	Pack qty
10020160	Hydrogen peroxide, 6% w/v, 20 volumes Extra Pure SLR	1L
10686832	Hydrogen peroxide, 6% w/v, 20 volumes Extra Pure SLR	2.5L
10345770	Water, Certified AR for Analysis	5L
10589770	Water, Certified AR for Analysis	10L
10626852	Water, Certified AR for Analysis	25L

Standard Solutions for Volumetric Analysis

	Description	Pack qty
10604922	Acetic acid, 0.1M (0.1N), ampoule solutrate	6 ampoules
10743991	Ammonium iron(II) sulfate, solution 0.025M ready to use	2.5L
10060180	Ammonium iron(II) sulfate, solution 0.1M (0.1 N) ready to use	1L
10639672	Ammonium thiocyanate, solution 0.1M (0.1 N) ready to use	1L
10264290	Ammonium thiocyanate, concentrated solution 0.1M (0.1N), ampoule	6 ampoules
10635112	Barium chloride, solution 1M (2N) ready to use	1L
10244340	Cerium(IV) sulfate, solution 0.1M, (0.1N) ready to use	1L
10335900	Cerium(IV) sulfate, concentrated solution 0.05M, (0.05N) , ampoule	6 ampoules
10121430	Ethylenediaminetetraacetic acid, trisodium salt, concentrated solution 0.2N (0.1M), ampoule	6 ampoules

Standard Solutions for Volumetric Analysis, continued

	Description	Pack qty
10010190	Ethylenediaminetetraacetic acid, disodium salt, solution 0.02N ready to use	1L
10764181	Ethylenediaminetetraacetic acid, disodium salt, solution 0.02N ready to use	2.5L
10558230	Ethylenediaminetetraacetic acid, disodium salt, solution 0.2N ready to use	1L
10568230	Ethylenediaminetetraacetic acid, disodium salt, solution 0.2N ready to use	2.5L
10000190	Ethylenediaminetetraacetic acid, disodium salt, solution 0.2N ready to use	10L
10497060	Ethylenediaminetetraacetic acid, disodium salt, concentrated solution 0.02N, ampoule	6 ampoules
10695872	Hydrochloric acid, pure, solution 5M, bench reagent, ready to use	2.5L
10733991	Hydrochloric acid, solution 0.02M (0.02N) ready to use	1L
10538040	Hydrochloric acid, solution 0.02M (0.02N) ready to use	2.5L
10325710	Hydrochloric acid, solution 0.1M (0.1N) ready to use	1L
10419560	Hydrochloric acid, solution 0.1M (0.1N) ready to use	2.5L
10510921	Hydrochloric acid, solution 0.1M (0.1N) ready to use	5L
10439560	Hydrochloric acid, solution 0.1M (0.1N) ready to use	10L
10522533	Hydrochloric acid, solution 0.2M (0.2N) ready to use	1L
10674722	Hydrochloric acid, solution 0.2M (0.2N) ready to use	2.5L
10646262	Hydrochloric acid, solution 0.5M (0.5N) ready to use	1L
10080210	Hydrochloric acid, solution 0.5M (0.5N) ready to use	2.5L
10467640	Hydrochloric acid, solution 1M (1N) ready to use	1L
10487830	Hydrochloric acid, solution 1M (1N) ready to use	2.5L
10488020	Hydrochloric acid, solution 1M (1N) ready to use	5L
10284480	Hydrochloric acid, solution 1M (1N) ready to use	10L
10214440	Hydrochloric acid, solution 2M (2N) ready to use	1L
10020210	Hydrochloric acid, solution 2M (2N) ready to use	2.5L
10605882	Hydrochloric acid, solution 5M (5N) ready to use	1L
10615882	Hydrochloric acid, solution 5M (5N) ready to use	2.5L
11478333	Hydrochloric acid, solution 5M (5N) ready to use	5L
10305760	Hydrochloric acid, concentrated solution 0.1M (0.1N), ampoule	6 ampoules
10315710	Hydrochloric acid, concentrated solution 0.5M (0.5N), ampoule	6 ampoules
10528050	Hydrochloric acid, concentrated solution 1M (1N), ampoule	6 ampoules
10625112	Iodine, solution 0.05M (0.1N) ready to use	1L
10375800	Iodine, solution 0.05M (0.1N) ready to use	2.5L
10294240	Iodine, solution 0.5M (1N) ready to use	1L
10090220	Nitric acid, 60%, concentrated solution 1N, ampoule	6 ampoules
10756101	Nitric acid, solution 0.1M (0.1N) ready to use	1L
10459560	Nitric acid, solution 1M (1N) ready to use	1L
10010230	Nitric acid, solution 1M (1N) ready to use	2.5L
10224010	Nitric acid, solution 2M (2N) ready to use	2.5L
10244490	1,10-Phenanthroline ferrous, pure, solution 0.025M ready to use	100mL
10479750	Potassium bromate-bromide, solution 0.0167M, (0.1N) ready to use	1L
10112100	Potassium chloride, 4M (4N) pure electrode filling solution	100mL
10070180	Potassium chloride, 4M pure electrode filling solution with silver chloride	100mL
10744181	Potassium chloride, pure saturated electrode filling solution	100mL
10358383	Potassium chloride, solution 3M ready to use	1L
10714761	Potassium dichromate, solution 0.0167M (0.1N) ready to use	2.5L
10408220	Potassium dichromate, concentrated solution 0.0167M (0.1N), ampoule	6 ampoules
10111720	Potassium hydroxide, solution 0.1M, (0.1N), (alcoholic) ready to use	1L
10686642	Potassium hydroxide, solution 0.1M (0.1N), (alcoholic) ready to use	2.5L
10366112	Potassium hydroxide, solution 0.1M (0.1N), (methanol) ready to use	1L
10744951	Potassium hydroxide, solution 0.5M (0.5N), (alcoholic) ready to use	1L
10676642	Potassium hydroxide, solution 0.5M (0.5N), (alcoholic) ready to use	2.5L

Standard Solutions for Volumetric Analysis, continued

	Description	Pack qty
10080190	Potassium hydroxide, solution 1M (1N), (alcoholic) ready to use	1L
10020200	Potassium hydroxide, solution 1M (1N), (aqueous) ready to use	2.5L
10598420	Potassium hydroxide, concentrated solution 0.1M (0.1N), (aqueous), ampoule	6 ampoules
10346140	Potassium hydroxide, concentrated solution 1M (1N), (aqueous), ampoule	6 ampoules
10191760	Potassium iodate, solution 0.05M ready to use	1L
10705721	Potassium permanganate, solution 0.02M (0.1N) ready to use	1L
10326190	Potassium permanganate, solution 0.02M (0.1N) ready to use	2.5L
10294670	Potassium thiocyanate, solution 0.1M (0.1N) ready to use	1L
10214680	Silver nitrate solution, pure, 0.025M (0.025N) ready to use	1L
10124713	Silver nitrate, solution 0.0282M (0.0282N) ready to use	250mL
10449370	Silver nitrate, solution 0.02M, (0.02N) ready to use	1L
10060220	Silver nitrate, solution 0.1M (0.1N) ready to use	1L
10111910	Silver nitrate, solution 0.1M (0.1N) ready to use	2.5L
10640423	Silver nitrate, solution 0.1M (0.1N) ready to use	10L
10366330	Silver nitrate, concentrated solution 0.1M (0.1N), ampoule	6 ampoules
10746101	Silver nitrate, solution 0.5M (0.5N) ready to use	1L
10725911	Silver nitrate, solution (1N) ready to use	1L
11402914	Sodium acetate, concentrated solution 0.1M, ampoule	1L
10316430	Sodium arsenite, solution 0.05M (0.1N) ready to use	1L
10776291	Sodium carbonate, solution 0.05M (0.1N) ready to use	1L
10496870	Sodium carbonate, solution 0.5M (1N) ready to use	2.5L
10538050	Sodium carbonate, concentrated solution 0.05M (0.1N) ampoule	6 ampoules
10508240	Sodium chloride, concentrated solution 0.1M (0.1N) ampoule	6 ampoules
10070190	Sodium hydroxide solution 2M (2N), BP and NIST standard solution, free from carbonate, ready to use	1L
10121670	Sodium hydroxide solution 2M (2N), BP and NIST standard solution, free from carbonate, ready to use	2.5L
10734951	Sodium hydroxide solution 2M (2N), BP and NIST standard solution, free from carbonate, ready to use	5L
10141860	Sodium hydroxide, solution 0.1M (0.1N), free from carbonate, ready to use	1L
10558050	Sodium hydroxide, solution 0.1M (0.1N), free from carbonate, ready to use	2.5L
10637032	Sodium hydroxide, solution 0.1M (0.1N), free from carbonate, ready to use	5L
10224630	Sodium hydroxide, solution 0.1M (0.1N), free from carbonate, ready to use	10L
10316190	Sodium hydroxide, solution 0.2M (0.2N), free from carbonate, ready to use	1L
10040200	Sodium hydroxide, solution 0.2M (0.2N), free from carbonate, ready to use	2.5L
10436602	Sodium hydroxide, solution 0.5M ready to use	1L
10438410	Sodium hydroxide, solution 0.5M ready to use	5L
10151810	Sodium hydroxide, solution 0.5M ready to use	10L
10765141	Sodium hydroxide, solution 1M (methanol) ready to use	1L
10528240	Sodium hydroxide, solution 1M (1N), free from carbonate, ready to use	1L
10745141	Sodium hydroxide, solution 1M (1N), free from carbonate, ready to use	2.5L
10755141	Sodium hydroxide, solution 1M (1N), free from carbonate, ready to use	5L
10666452	Sodium hydroxide, solution 1M (1N), free from carbonate, ready to use	10L
10070200	Sodium hydroxide, concentrated solution 0.1M (0.1N) ampoule	6 ampoules
10030200	Sodium hydroxide, concentrated solution 0.5M (0.5N) ampoule	6 ampoules
10696642	Sodium hydroxide, concentrated solution 1M (1N) ampoule	6 ampoules
10151860	Sodium nitrite, solution 0.5M (0.5N) ready to use	1L
10429180	Sodium thiosulfate, solution 0.1M (0.1N) ready to use	1L
10243960	Sodium thiosulfate, solution 0.1M (0.1N) ready to use	2.5L
10753694	Sodium thiosulfate, solution 0.1M (0.1N) ready to use	5L

Standard Solutions for Volumetric Analysis, continued

	Description	Pack qty
10121910	Sodium thiosulfate, solution 0.1M (0.1N) ready to use	10L
10677412	Sodium thiosulfate, concentrated solution 0.1M (0.1N) ampoule	6 ampoules
10070220	Sodium thiosulfate, concentrated solution 2.5M (to produce 0.5M /0.5N) ampoule	6 ampoules
10254150	Sulfuric acid, solution 0.01M (0.02N) ready to use	1L
10538620	Sulfuric acid, solution 0.01M (0.02N) ready to use	2.5L
10355710	Sulfuric acid, solution 0.05M (0.1N) ready to use	1L
10152050	Sulfuric acid, solution 0.05M (0.1N) ready to use	2.5L
10244150	Sulfuric acid, solution 0.05M (0.1N) ready to use	10L
10723611	Sulfuric acid, solution 0.1M (0.2N) ready to use	1L
10192000	Sulfuric acid, solution 0.1M (0.2N) ready to use	2.5L
10274100	Sulfuric acid, solution 0.1M (0.2N) ready to use	10L
10713611	Sulfuric acid, solution 0.25M (0.5N) ready to use	1L
10518810	Sulfuric acid, solution 0.25M (0.5N) ready to use	2.5L
10734761	Sulfuric acid, solution 0.5M (1N) ready to use	1L
10418030	Sulfuric acid, solution 0.5M (1N) ready to use	2.5L
10529000	Sulfuric acid, solution 0.5M (1N) ready to use	10L
10090250	Sulfuric acid, solution 1M (2N) ready to use	1L
10666072	Sulfuric acid, solution 1M (2N) ready to use	2.5L
10528620	Sulfuric acid, concentrated solution 0.05M (0.1N) ampoule	6 ampoules
10428030	Sulfuric acid, concentrated solution 0.5M (1N) ampoule	6 ampoules
10305810	Tetra-n-Butyl ammonium hydroxide, solution 0.1 M (0.1N) in toluene/methanol, ready to use	1L
10645112	Titanium(III) chloride, solution 0.2M (0.2N) ready to use	2.5L
10000240	Zinc sulfate, concentrated solution 0.05M ampoule	6 ampoules