



accuTupH® / accuTupH+® Rugged Bulb Combination pH Electrodes

Catalog No.	Description	Connector	Refilling Solution
13-620-180	accuTupH Single Junction, Ag/AgCl reference	US Std with pin	SP135-500
13-620-181	accuTupH Single Junction, Ag/AgCl reference	BNC	SP135-500
13-620-182	accuTupH Double Junction, Ag/AgCl reference	US Std with pin	SP138-500
13-620-183	accuTupH Double Junction, Ag/AgCl reference	BNC	SP138-500
13-620-184	accuTupH+ Variable Temp. Double Junction, Ag/AgCl reference	US Std with pin	SP138-500
13-620-185	accuTupH+ Variable Temp. Double Junction, Ag/AgCl reference	BNC	SP138-500

Performance Specifications

pH Range	pH 0 to 14 ($\text{Na}^+ < 0.1\text{N}$)
Temperature Range	0 to +100°C (32 to 212°F)
Slope (out of box)	59 ± 3 mV/pH unit at 25 °C (95 to 105% slope)
Zero Point	pH 7
Offset (assymetry potential)	$0 \text{ mV} \pm 25 \text{ mV}$
Response Time	< 10 sec (95% response) from pH 7.00 to pH 4.01
Stability	< 3 mV drift / 24 hours in pH 7.00 buffer
Glass Membrane Impedance	< 300 Mohm at 25 °C
Reference Junction Impedance	< 50 Kohm at 25 °C
Body Material	Glass

accumet® accuTupH® / accuTupH+® rugged bulb electrodes are five times thicker than conventional glass pH electrodes. The high-performance of research quality glass combined with durability—up to 40 times tougher than conventional glass—make these an ideal choice for many applications. In addition to a rugged bulb, accuTupH+ electrodes offer a patented reference design (US Patent 4,608,148 / Canadian Patent 1,226,333), which produces superlative response for samples with widely varying temperatures.

accumet accuTupH / accuTupH+ are combination electrodes, meaning the reference and measuring/indicating electrodes are combined in a single housing. The junction used is a porous ceramic plug. When immersed in a solution, the reference electrode makes contact with the sample through the junction, thus completing electrical contact between the reference electrode, sample, and pH indicating electrode. Accumet combination electrodes use FS-5 universal glass, which offers high chemical resistance and low sodium error, responsive throughout the 0-14 pH range.

accumet accuTupH / accuTupH+ are refillable electrodes that utilize a patented easy-to-use fill hole design (US Patent 4,770,762). Electrodes are color coded for easy classification. A purple fill hole band signifies an electrode that is Tris compatible—typically using a double-junction or calomel reference—and are less prone to clogging by sulfides, heavy metals, or proteins. A blue fill hole band indicates a single-junction electrode designed for general purpose use for samples without sulfides, heavy metals, or proteins.

GETTING STARTED

Each accumet electrode has a unique serial number identified on its label and is quality checked before it leaves the factory. A factory label with data is included with each electrode.

Your electrode is shipped with an electrode storage bottle containing electrode storage solution. Occasionally some of the storage solution will creep out and appear as dry white crystal residue on the electrode. This will have no long-term effect on the electrode and can be simply be rinsed off with clean water. To remove the storage bottle from the electrode, first unscrew the lid completely then separate from the bottle—pulling the electrode directly out of the bottle before loosening the cap may damage the junction. Please remove the soaker bottle from the end of the electrode before use.

accumet refillable electrodes will include a bottle of SP138 or SP135 electrode filling solution (electrolyte) appropriate for your electrode along with a separate spout cap. New electrodes are shipped filled and with the filling hole closed. Adding fill solution to new electrodes should not be required. To add electrolyte to the electrode it is necessary to replace the cap on the electrolyte bottle with the spout cap.

A removable / optional black bulb protector is also included for added electrode protection. Please remove it gently if it is present.

The fill hole should be in the open position when in use. If necessary, rotate the hole in the cap ring from the closed to the open position.

If the electrolyte level in the reference cavity (outer annular space) is lower than $\frac{1}{4}$ inch or so below the cap, add SP138 (to purple band electrodes) or SP135 (to blue band electrodes) using the spout cap on the refilling bottle. If the electrolyte level is not visible, the electrode may be filled to capacity just beneath the hole. Extend the spout from the cap of the electrolyte bottle and firmly press it into the fill hole to make an airtight seal. While maintaining the seal, gently squeeze the filling bottle so that the electrode becomes pressurized.

Mount the electrode onto a suitable electrode holder and connect the electrode to the meter.

Immerse the electrode in pH 4 or pH 7 buffer for 5 to 10 minutes to condition the glass pH bulb.

ELECTRODE OPERATION

- 1) The level of electrolyte in the outer cavity should be kept above the level of the solution being measured to prevent reverse electrolyte flow. The electrode need only be immersed far enough to cover both the glass pH sensing bulb and reference junction to obtain accurate readings.
- 2) If the electrode has not been hydrated (placed in solution for more than one hour), allow the electrode to soak in a buffer (preferably pH 4) as needed prior to standardization or measurement. This will help to optimize and re-establish the thin hydration layer on the sensing bulb that is critical to pH measurement.
- 3) Rinse the electrode with deionized or distilled water between samples. Note: wiping the sensing bulb is not recommended as the thin hydration layer of the sensing bulb could be effected and electrical charges may be produced.
- 4) Moving or touching the electrode cable may result in unstable readings due to the high impedance (resistance) of the pH glass membrane.
- 5) 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. i.e.) "pH 8.43 @ 23.2 °C", not "pH 8.43".

CALIBRATION/STANDARDIZATION

New accumet pH electrodes are factory-tested to have an efficiency or "slope" of $\geq 95\%$. The theoretical pH response is 100% (59.16 mV/pH unit), so the millivolt difference between pH 4.00 and pH 7.00 certified calibration standards at 25°C should then be 177.48 mV. A 95% slope means that a new accumet electrode will have a response of at least 168.61 mV between these values. As electrodes naturally age this efficiency deteriorates. Periodic calibration against known standards is necessary to ensure the electrode efficiency. Most pH meters have features to display the current electrode slope and protection that warn users of a low slope (usually 90%) or prevent erroneous calibrations.

After following the calibration procedure of your meter, compare the measured pH reading of each calibration buffer to the pH value indicated for each buffer at the actual temperature. A chart with pH at various temperatures is usually found on the calibration standard packaging or label. Using a one-point standardization, proper response is indicated if the reading is within ± 0.05 pH units from the standardization point within 30 seconds when using certified pH buffers. Multiple-point standardization is recommended for more precise measurements. To provide a linear response in the area of interest, use one calibration standard above and one below the expected sample pH.

STORAGE

The electrolyte level in the outer cavity should be kept above the level of the solution being measured. Storing electrodes in distilled or deionized water is NOT recommended as it will deplete the hydration layer of refillable electrodes, and decrease the life of non-refillable electrodes. The electrode storage bottle can be used for short or long term storage. To re-use the storage bottle included with the electrode, slide the cap and then o-ring onto the electrode, insert the electrode midway into the bottle containing storage solution (or a 50:50 mixture of 4 M potassium chloride and pH 4 standard buffer) and gently screw on cap. Close the fill hole on liquid filled units. Insertion directly into the cap/bottle assembly with the cap/o-ring in place may cause harm to the electrode by damaging the junction or develop pressure and cause storage liquid to flow into the electrode.

TROUBLESHOOTING

SYMPTOM / CAUSE (REMEDY)

- **No response, all buffers or samples read the same pH—usually pH 7.00 or 0 mV** / Broken sensing bulb or wiring problem (replace electrode), probe not connected to input (verify correct channel selection when using multiple-channel meters), probe is not in contact with sample (remove electrode storage bottle or rubber bulb guard), meter automatically has frozen reading (verify that the hold feature or auto read feature is set to off when using meters with this feature)
- **Slow response with excessive crystallization inside probe** / electrolyte flow clogged from supersaturated electrolyte (“flush & fill” by remove the filling solution through the fill hole with a syringe or by shaking it upside down. Repeatedly flush and rinse the reference cavity with clean, 60-80°C water to dissolve crystals until removed. Replace filling solution and apply gentle pressure to filling hole. Re-hydrate electrode in storage solution or pH 4 buffer), (ensure fill hole is in open position). To prevent this in the future, ensure that the re-fill hole is closed when electrode is not in use.
- **Slow response due to clogged junction—usually with single-junction electrodes** / reaction with silver such as silver sulfide formation or protein deposits which causes a dark spot on the ceramic reference junction (For protein layers—prepare a 1% pepsin solution in 0.1 M of HCl and soak the reference junction for one hour in this solution. Rinse the electrode with distilled water. Alternatively, heat a diluted KCl solution to 60 to 80 °C. Place the sensing part of the electrode into the heated solution for about 10 minutes. Allow the electrode to cool in some unheated KCl solution.
- **Dried salt deposits present** / electrolyte residue deposited on electrode surface —often with new electrodes or periods of non-use. (simply dissolve the deposits in warm tap water followed by a brief soak in pH 4 buffer).
- **Slow Response, Noisy, unstable, or erratic readings** / sensing bulb dry or dirty (clean electrode with mild detergent & warm water and re-hydrate electrode) , temperature may be changing rapidly or electrode may be thermally shocked (allow electrode to reach sample temperature), sample may be non-aqueous (take 30 second readings and soak in pH buffer for one minute between measurements)

REPLACEMENTS & ACCESSORIES

Catalog No. Description

SB105	Fisher Buffer-Pac (500 mL each of pH 4, 7, and 10 buffers)
13-300-147	Single use assortment packets (five each of pH 4, 7, 10, and rinse)
SB101-500	pH 4.00, 500 mL
13-300-150	pH 4.00, single use packets 20/box
SB107-500	pH 7.00, 500 mL
13-300-149	pH 7.00, single use packets 20/box
SB115-500	pH 10.00, 500 mL
13-300-148	pH 10.00, single use packets 20/box
13-300-180	Rinse water, single use packets 20/box
SE40-1	Electrode storage solution, 1 L
13-300-178	Electrode storage solution, 500 mL
13-300-179	Electrode cleaning solution, 500 mL
13-620-499	Electrode storage bottle
SP135-500	Refill solution for single-junction (Accumet blue band) electrodes, 4M KCl Saturated with AgCl. KCl, 500 mL
SP138-500	Refill solution for calomel and double-junction (Accumet purple band) electrodes, Saturated KCl, 500 mL
13-620-19	Automatic Temperature Compensation (ATC) Probe for accumet AB, AR, XL benchtop series models, Mini-Phone Plug
15-094-28	NIST traceable calibration certificate for pH meters

WARRANTY

accumet electrodes are warranted to be free from defects in material and workmanship for a period of (12) months from date of purchase.

To place an order or for customer service, call 1-800-766-7000

To fax an order, use 1-800-926-1166

To order online: www.fishersci.com

For electrochemistry technical support, call 1-888-358-4706 or email accumet@thermofisher.com

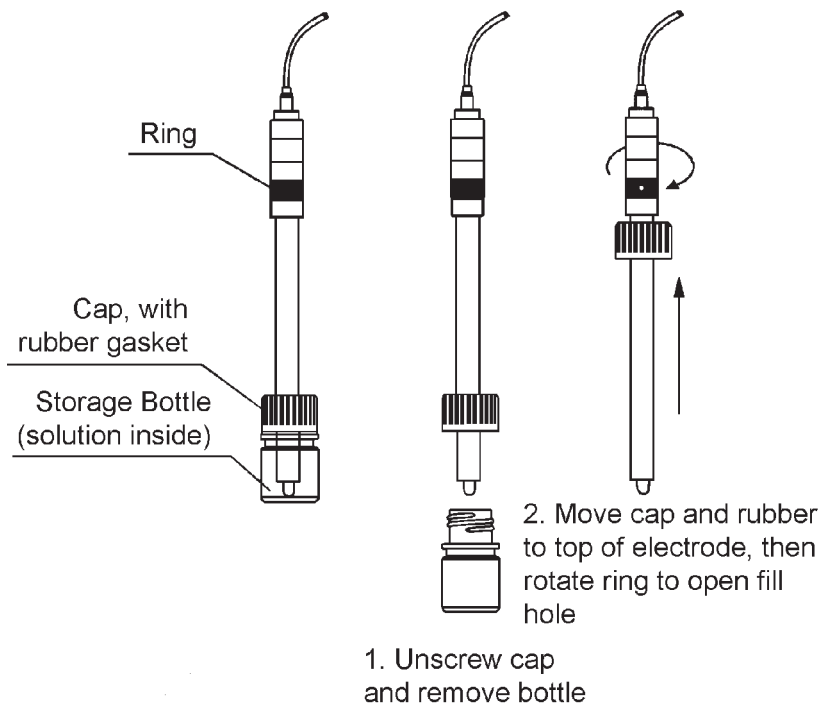
For a complete selection of electrodes and accessories, please refer to the Fisher General Catalog, website, or contact your Fisher Scientific sales representative

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FOR MEASUREMENT



FOR STORAGE

