

**VAN LONDON COMPANY
COMBINATION pH ELECTRODE
INSTRUCTION MANUAL**

GENERAL INFORMATION

Van London combination electrodes offer the convenience of having the reference and measuring electrodes combined in a single housing. Basically, the design consists of a glass pH indicating electrode coaxially joined to a silver/silver chloride reference electrode. A temperature sensor for ATC may or may not be built into the electrode. The glass pH indication electrode is located at the center of the probe. The reference electrode is located in the outer annular space of the probe. The outer annular space contains the silver/silver chloride reference element, electrolyte (4M KCl saturated with AgCl) and the reference junction. 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.

The combination pH electrode comes in many styles and is designed for maximum reliability, accuracy, and ease of use. The outer body can be glass, epoxy, or other plastic materials. The plastic body electrode is available with a permanent non-removable bulb guard or a removable guard which is shipped attached to the cable. The reference half-cell can be refillable or permanently sealed at the factory and non-refillable. The refillable electrode will have one or two fill holes located underneath the cap at the top of the electrode. Some models are constructed with a built-in temperature sensor (ATC). The electrode is shipped with a protective boot or soaker bottle filled with a membrane/junction wetting agent (1:1 pH4 buffer/KCl). Crystals which may form around the protective boot will in no way affect electrode performance.

Van London combination pH electrodes are responsive over the full 0 to 14 pH range. Glass body liquid-filled laboratory probes are available in standard and micro sizes, and are recommended for most routine applications. Polymer body liquid-filled laboratory probes are available in multiple sizes and are preferred for applications where breakage is a problem. Polymer body gel-filled industrial probes are recommended for those applications where there is a need for both low maintenance and breakage resistance.

ELECTRODE SPECIFICATIONS

pH Range:	pH 0 to 14
Slope (Span):	95 – 102% (between pH 7 & 4 at 25°C)
7 pH Offset (Zero):	0 mV +/- 25 mV

New Van London pH electrodes are factory-tested to have an efficiency or slope greater than 95%. As electrodes naturally age, this efficiency deteriorates. Periodic calibration against known pH standards is necessary to ensure 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.

REQUIRED METER & BUFFERS

Meter: This electrode will work with any pH meter commercially available or mV meter that accepts a high resistance pH input. Consult the meter instruction manual for specific details on connecting/wiring the pH electrode to the meter or operating the meter. Some electrodes may require adaptor cables or detachable lead cables for connection to the pH and/or mV meter.

Buffers: For precise electrode standardization, two buffers are required, of which one should be close to the desired sample pH. pH 7.00 (at 25°C) buffer is normally recommended for initial standardization, followed by pH 4.01 (at 25°C) or pH 10.01 (at 25°C) buffer to span (slope) the electrode.

ELECTRODE PREPARATION

1. Remove the pH bulb protector boot or soaker bottle covering the pH bulb and rinse the bulb area with deionized water or pH buffer. Save the boot if the electrode will be stored.
2. 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 the crystals can be rinsed off with deionized or tap water.
3. It is possible that air bubbles may have migrated into the pH sensitive bulb during shipment. Since the electrode is not able to function with air behind the pH bulb, gently shake the electrode downward in the same manner as a clinical thermometer to remove any trapped air bubbles.

4. Reference electrodes that are refillable: For electrodes shipped with fill-hole plugs, remove the shipping tape covering the rubber fill-hole plug and withdraw the plug to expose the fill-hole. For electrodes shipped with a sleeve over the fill-hole(s), slide the rubber sleeve down and remove the shipping tape to expose the fill-hole. Fill the refillable electrodes with any fill solution(s) shipped with the electrode to a level just below the fill-hole(s). The fill hole should be open whenever the electrode is in solution. Cover the fill hole when not in use.
5. Reference electrodes with sleeve junction: Remove parafilm from underneath sleeve and slide teflon or glass sleeve firmly into position on tip of electrode. Measurements should be made with only the lower part of sleeve immersed. For sleeve junction electrodes, when the liquid junction becomes clogged, the electrode may be flushed after loosening the sleeve. If the sleeve freezes in place, soak it in warm water to loosen it. After the sleeve is free, replenish the filling solution.
6. Attach the removable bulb guard, if provided, to the electrode by sliding guard over the end of the electrode.
7. Mount the electrode onto a suitable electrode holder and connect the electrode to the meter.
8. Prior to first usage, or after long-term storage, immerse the pH bulb in pH 4 buffer for thirty minutes. This hydrates the pH bulb and wets the reference junction for optimum performance. The electrode is now ready for use.

ELECTRODE WIRING (COMBO COAX)

Clear (BNC Pin)	=	pH Signal
Black (BNC Shield)	=	Reference
White or Black, and Red	=	ATC
Green or Blue	=	Solution Ground

Color Code Variation – Direct replacement electrodes may differ from above color coding in order to match other manufacturer’s color schemes.

Wiring Tips – There are instances where a solution ground may be required for wiring but is not included with the electrode. In all cases, jumpering of the terminal marked “solution ground” with the terminal marked “reference” is all that is required. Consult the meter instruction manual for specific details on connecting/wiring the pH electrode.

MEASURING HINTS

1. For refillable electrodes, the level of electrolyte in the outer chamber should be kept above the level of sample solution to prevent sample contamination through the reference junction into the outer chamber. The electrode need only be immersed far enough to cover both the glass pH sensing bulb and reference junction to obtain accurate readings. The level of the electrolyte must always cover the inner reference element, otherwise electrical contact cannot be established. Add electrolyte as needed.
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 pH glass is not recommended as the thin hydration layer of the sensing bulb could be affected 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.

ELECTRODE CALIBRATION & SAMPLE pH MEASURE

1. Place the electrode in fresh pH 7.00 buffer and stir. Adjust the meter to read the buffer value according to the meter instruction manual. If needed, see ELECTRODE CLEANING section.
2. Rinse the electrode in distilled water and place the electrode in either fresh pH 4.01 buffer (if sample is acidic) or fresh pH 10.01 buffer (if sample is basic). Stir and allow meter reading to stabilize for 30 seconds to one minute. Adjust the meter reading to the buffer value according to the meter instruction manual. If needed, see ELECTRODE CLEANING section.

3. Rinse the electrode with distilled water. Place in sample and stir. Allow meter reading to stabilize for 30 seconds to one minute. Record reading. For best accuracy, the temperature of the buffers and samples should be identical and at room temperature.

ELECTRODE STORAGE

For short terms, always keep the pH bulb wet, preferably in a membrane/junction wetting agent (1:1 pH4 buffer/KCl). Other pH buffers or tap water are acceptable storage media, but avoid storage in distilled water. The protective boot/soaker bottle filled with wetting agent above will provide an ideal storage chamber for longer periods.

NOTE: Electrodes should not be stored for a period longer than 6 months for optimal performance. Electrode stock should be rotated accordingly.

ELECTRODE CLEANING

All pH electrodes will naturally age and undergo a reduction in their slope over time. Occasionally, this is accompanied by sluggish response. This aging is caused by either contamination of the glass membrane or by clogging of the liquid junction. Separate procedures are given below for cleaning the glass membrane surface and unblocking the junction.

Electrodes which are mechanically intact with no broken parts can often be restored to normal performance by one of the following procedures:

General Cleaning: Soak the electrode in 1:10 dilution of household laundry bleach in a 0.1-0.5% liquid detergent solution in hot water with vigorous stirring for 15 minutes. Place junction under warm, running tap water for 15 seconds. Drain/refill the reference chamber. Soak the electrode in storage solution for at least 10 minutes.

Salt Deposits: Dissolve the deposit by immersing the electrode in 0.1 M (1%) HCl for five minutes, followed by immersion in 0.1M (1%) NaOH for five minutes, and thorough rinsing with distilled water.

Oil/Grease Films: Wash electrode pH bulb in a little detergent and water. Rinse electrode tip with distilled water. If the film is known to be soluble in a particular organic solvent, rub the bulb gently with

this solvent using a tissue or soft cloth. Acetone or isopropyl alcohol are often used to remove films.

Clogged Reference Junction: Heat a diluted KCl solution to 60-80°C. Place the reference portion of the pH electrode into the heated KCl solution for approximately 10 minutes. Allow the electrode to cool while immersed in some unheated KCl solution.

Protein Deposits: Dissolve the deposit by immersing the electrode in a 1% pepsin solution with a background of 0.1M HCl for five minutes, followed by thorough rinsing with distilled water.

After any of these special cleaning procedures, remember to drain/refill the reference chamber, if refillable. Soak the electrode in wetting agent (storage solution) for at least 10 minutes. If these steps fail to restore normal electrode response, replace the electrode.

TROUBLESHOOTING HINTS

Symptom	Possible Causes	Next Step
Out of Range Reading	meter electrode electrode wired incorrectly air bubble on pH bulb	check meter with shorting plug check CALIBRATION check wiring connections remove electrode and reinsert
Noisy or Unstable Display	meter solution not grounded air bubble on pH bulb	check meter with shorting plug ground meter and electrode remove electrode and reinsert
Drift (reading slowly changing in one direction)	pH bulb contaminated reference clogged	see CLEANING hints see CLEANING hints
Low Slope	buffers contaminated pH bulb contaminated reference clogged electrode	use fresh buffers see CLEANING hints see CLEANING hints check CALIBRATION
	reference clogged electrode	see CLEANING hints check CALIBRATION

Troubleshooting

Symptom	Possible 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 the electrode
	Electrode is not connected to proper meter input	Verify that the electrode is connected to the correct meter input and the correct channel is selected when using a meter with multiple channels
	Electrode is not in contact with sample Meter has automatically frozen reading	Remove the electrode storage bottle or rubber bulb guard Verify that the meter's hold feature or auto-read feature is set to off when using a meter with this feature
Slow electrode response with excessive crystallization inside the electrode	Electrolyte flow clogged from supersaturated electrolyte	Flush and fill the electrode. 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 water at a temperature of 60-80°C to dissolve crystals until all crystals are removed. Replace the filling solution and apply gentle pressure to filling hole. Hydrate the electrode in storage solution or pH 4 buffer.
	Fill hole is closed during measurement or open during storage	Verify that the fill hole is in the open position during measurements and the closed position when the electrode is not in use.
Slow electrode response due to clogged junction	Sample reaction with silver in electrode filling solution, including silver sulfide formation or protein deposits that cause a dark spot on the ceramic reference junction	For protein deposits, prepare a 1% pepsin solution in 0.1 M HCl and soak the reference junction in this solution for one hour. Rinse the electrode with distilled water. For general cleaning, heat a diluted KCl solution to 60 to 80 °C. Place the sensing bulb of the electrode into the heated solution for about 10 minutes. Allow the electrode to cool in an unheated KCl solution.
Dried salt deposits present	Electrolyte residue deposited on electrode surface (occurs frequently with new electrodes or when the electrode is not used for a long period)	Dissolve the salt deposits in warm tap water and then soak the electrode briefly in pH 4 buffer
Slow electrode response, noisy, unstable or erratic electrode readings	Sensing bulb dry or dirty	Clean the electrode with mild detergent and warm water and then hydrate the electrode
	Temperature may be changing rapidly or electrode may be thermally shocked	Allow the electrode to reach sample temperature
	Sample may be non-aqueous	Take 30 second readings and soak the electrode in pH buffer for one minute between measurements

WARRANTY

Van London Company pH electrodes are warranted to be free from defects in material and workmanship for a period of 12 months from date of purchase. If a defect in material or workmanship occurs within the one year period, please contact Van London Company before returning items for any reason. When applying for authorization, please include data regarding the reason the items are being returned, the date of purchase and the invoice number.

To place an order or to contact customer service, call 1-800-522-7920.

To fax an order, use 832-456-6642.

To order online, visit www.vl-pc.com

For pH technical support, call 1-832-456-6641 or email tony@vanlondon.com.

We reserve the right to make changes, improvements, and modification to our pH products,