Instruction Manual

pHPLUS DIRECT

pH/mV/ISE Meter

Code 5-1936

PREFACE

This instruction manual serves to explain the use of the pHPLUS DIRECT meter.

It functions in two ways: first as a step by step guide to help you operate the meter; second, it serves as a handy reference guide.

This manual is written to cover as many anticipated applications of the pHPLUS DIRECT meter as possible. If there are doubts in the use of this meter, please do not hesitate to contact the LaMotte Tech Service Department.

LaMotte will not accept any responsibility for damage or malfunction to the meter caused by improper use of the instrument.

The information presented in this manual is subject to change without notice as improvements are made, and does not represent a commitment on the part of LaMotte Company.

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1. INTRODUCTION

Thank you for purchasing the pHPLUS DIRECT meter. This microprocessor-based handheld meter is economical and easy to use. It has a large custom LCD (Liquid Crystal Display) for clear and easy reading.

The pHPLUS DIRECT measures pH, mV (ORP), temperature and ion concentration of various ions (mono and di valence) with ion selective electrodes (ISEs).

Included with your meter are a robust rubber boot, 4 alkaline "AAA" batteries, buffer solutions, accessories, temperature sensor, instruction manual and a warranty card. To order other accessories and buffer calibration or standard solutions, please refer to Section 8 on Accessories for more information.

2. GETTING STARTED

2.1 Description of Keypad Functions

The pHPLUS DIRECT has six keys on its splash-proof keypad with tactile feedback. The keys include **ON/OFF**, **HOLD/ENTER**, **CAL**, **MODE**, ▲ and ▼ keys.

ON/OFF	Powers meter on and off. Meter starts up in the mode that you were in before turning the meter off.
MODE	Selects measurement mode for Ion, mV, pH and Temperature.
CAL	Allows calibration for Ion, pH, mV or Temperature, or to abort calibration without confirming any set value.
▲	Allows you to increase values during calibration mode.
▼	Allows you to decrease values during calibration mode.
HOLD/ENTER	Freezes the measured reading for easy viewing.
HOLD/ENTER	Confirms calibration value.

2.2 Description of LCD Annunciators

The meter has a large custom LCD that consists of 3½-digit segments and operation annunciators for pH, mV or °C (Temperature). Note that there is no annunciator shown in the Ion mode. Other annunciators include "HOLD" (when the **HOLD** function is activated) and "LOBAT" (low battery condition).

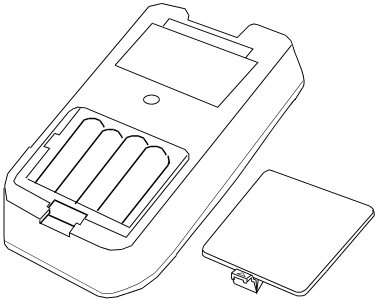
2.3 Inserting & Removing the Rubber Boot

1. To remove the meter from the rubber boot, push out the bottom edges of the meter until it is completely out of the boot. Ensure that the cables of the ISE/pH electrode or temperature probe are not connected

2. To insert the meter into the rubber boot, slide the top of the meter into the boot before pushing the bottom edge of the meter down to set it into position. Lift up the stand on the back of the meter for bench top applications if desired.

2.4 Inserting New Batteries

The battery compartment is found at the back of the instrument. To open the battery compartment, push in the direction of the arrow and lift up the cover. Note the polarity of the batteries before inserting them into position. After replacement, replace the cover and press down until it locks tight.



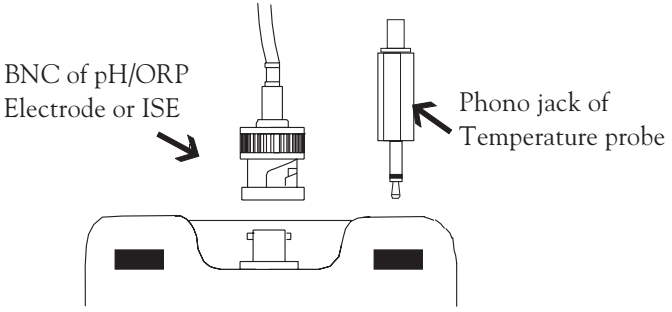
2.5 Battery Replacement

A "LO" annunciator in the LCD alerts you when battery power is running low. Replace the batteries with the type recommended by the manufacturer.

Caution: Power off the meter when changing the batteries.

2.6 Connecting the Electrode and Temperature Sensor

To connect the electrode to the meter, align the connector slots with the posts of the meter socket and rotate the connector clockwise until it locks. Do not force it when connecting. To remove the electrode, simply rotate the connector in a counterclockwise direction until it unlocks, and slide the connector off the socket.



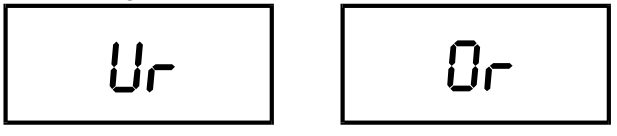
Insert the mini phono jack of the temperature sensor into the socket on the meter. Unplug the phono jack when not in use or when pH is being measured without any temperature compensation.

2.7 Condition the pH Electrode

Condition the pH electrode before the first use or if it has not been in use for a long time by soaking it in a container filled with pH 4 buffer solution for at least 1 hour. Rinse with tap water before proceeding.

2.8 Switching the Meter On

1. Press the **ON/OFF** key to power up the meter. All LCD segments will be displayed momentarily as the meter performs a self-diagnostic test, as shown in section 2.2. The meter will be in the Ion measurements mode if the meter has not been calibrated or reset. The display will show "---" .
2. Press the **MODE** key to choose the desired mode of measurement, The corresponding annunciator will be displayed on the LCD. In the temperature mode, the display will show 25°C (factory default), the last calibrated temperature if there is no temperature probe connected, or the current measurement value if a temperature probe is connected.
3. The display will show "Ur" if the measurement is under the minimum measurement or "Or" if the measurement is over the maximum measurement range.



3. CALIBRATION

3.1 pH Calibration

The meter is capable of calibrating up to 3 points using USA or NIST (nSt) pH buffer standards or 2 points with Low Ionic (Pb) pH buffer standards. All new calibration values will automatically override existing data.

USA	pH 4.01,7.00 and 10.01
NIST	pH 4.01, 6.86 and 9.18
Pb	pH 4.10 and 6.97

It is recommended that you perform at least a 2-point calibration at room temperature (25 °C) using standard buffers, starting with the first buffer at pH 7.00 (USA), pH 6.86 (NIST) or pH 6.97 (Pb) followed by other buffer values.

For a 1-point calibration, the calibration should be performed with a pH buffer value closest to the expected sample value being measured. Otherwise calibrating at pH 7.00, pH 6.86 or pH 6.97 is advisable.

The meter has automatic buffer recognition that identifies the correct pH buffer values during calibration. If non-standard pH buffers other than the above standards are used, or the electrode has worn out, the LCD will flash "Er1". Press the CAL key to abort calibration and resume measurement. In general all pH buffer values have the window of up to +/- 1 pH tolerance during calibration.

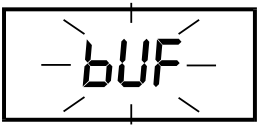
Ensure that you use new pH buffer solutions during calibration. Do not reuse buffer solutions as they may be contaminated and affect the calibration and accuracy of measurements. Always store buffer solutions in a dry, cool environment if possible.

Before use, remove the plastic protective cap on the pH electrode and condition the glass bulb by soaking it in tap water for 1-2 hours. This hydrates the glass bulb if the electrode is too dry or has not been used for a long period of time. Always rinse the probes with tap water or rinse solution before and after each calibration/sample measurement to avoid cross-contamination. For details refer to section 5 on Electrode care and maintenance.

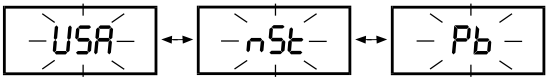
3.2 Selection of pH Buffer Standards

You must set the meter to accept either USA, NIST (nSt) or Low Ionic (Pb) pH buffer standard values before calibration. The factory default is USA standard. If you wish to abort this operation press the **CAL** key at any sequence and the meter reverts to pH measurement mode.

1. Press and hold the **MODE** key. Switch on the meter using **ON** key. The display shows "bUF" blinking.



2. Press the **ENTER** key to get into the buffer selection mode. Use the **MODE** key to toggle between USA, NIST or Pb standards as shown.



3. Press the **ENTER** key to confirm the buffer standards to be used. The display then reverts to pH measurement mode.

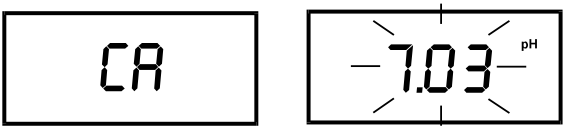
3.2.1 Resetting the User Calibrated Values

Note: only the temperature offset (if set) will not be erased.

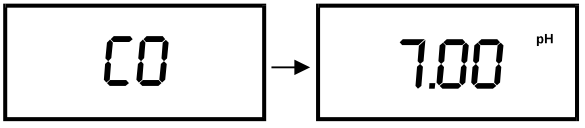
1. Press and hold the **CAL** key while switching on the meter using the **ON** key. The LCD shows "rSt" blinking.
2. Press the **MODE** key to abort this operation if you do not wish to reset
3. Press the **ENTER** key to confirm. The meter automatically clears all stored pH/Ion calibration or mV offset values and reverts to measurement mode.

3.2.2 pH Calibration using USA standard buffers

1. Pour a known pH buffer standard solution into a clean, dry container, e.g. pH 7.00. Power on the meter and it will automatically enter the measurement mode. Select the pH mode by pressing the **MODE** key if necessary.
2. Dip both the pH electrode and temperature probes into pH 7.00 buffer solution. Swirl gently and wait for the reading to stabilize (approx. 30 seconds depending on the electrode condition).
3. Press the **CAL** key to enter the pH calibration mode. "CA" will be displayed momentarily and the display will flash with the current uncalibrated reading.



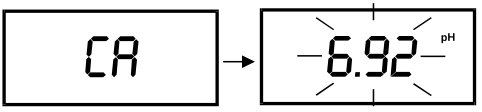
4. To abort or cancel the calibration without accepting the new value, press the **CAL** key. The meter then reverts to the pH measurement mode.
5. To proceed with the calibration, allow the reading to stabilize. The meter will automatically recognize pH 4.01, 7.00 or 10.01 buffers. Press the **ENTER** key to confirm the calibration and the LCD will display "CO" momentarily. The meter will revert to the measurement mode.



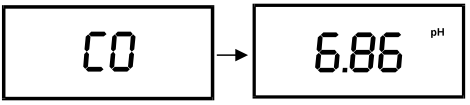
6. For a 2 or 3-point calibration, repeat step 3 with other pH buffer values of 4.01 and/or 10.01 for higher accuracy.

3.2.3 pH Calibration using NIST standard buffers

1. Pour a known pH buffer standard solution into a clean container, e.g. pH 6.86. Power on meter, and it will automatically enter the measurement mode. Select the pH mode by pressing the **MODE** key if necessary.
2. Dip both the pH electrode and temperature probes into the pH 6.86 buffer solution. Swirl gently and wait for reading to stabilize (approx. 30 seconds depending on the electrode condition).
3. Press the **CAL** key to enter the pH calibration mode. "CA" will be displayed momentarily and the display will flash with the current uncalibrated reading.



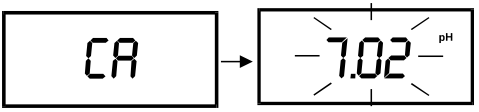
4. To abort or cancel the calibration without accepting the new value, press the **CAL** key. The meter then reverts to the pH measurement mode.
5. To proceed with the calibration, allow the reading to stabilize. The meter automatically recognizes pH 4.01, 6.86 or 9.18 buffers. Press the **ENTER** key to confirm the calibration and the LCD will display "CO" momentarily. The meter will revert to the measurement mode.



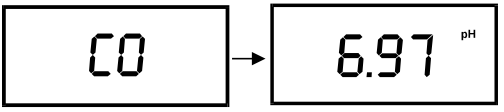
6. For a 2 or 3-point calibration, repeat step 3 with other pH buffer values of 4.01 and/or 9.18 for higher accuracy.

3.2.4 pH Calibration using Pb standard buffers

1. Pour a known pH buffer standard solution into a clean container, e.g. pH 6.97. Power on meter, and it will automatically enter the measurement mode. Select the pH mode by pressing the **MODE** key if necessary
2. Dip both the pH electrode and temperature probes into the pH 6.97 buffer solution. Swirl gently and wait for the reading to stabilize (approx. 30 seconds depending on the electrode condition).
3. Press the **CAL** key to enter the pH calibration mode. "CA" will be displayed momentarily and the display will flash the current uncalibrated reading.



4. To abort or cancel the calibration without accepting the new value, press the **CAL** key. The meter then reverts to the pH measurement mode.
5. To proceed with the calibration, allow the reading to stabilize. The meter will automatically recognize either pH 4.10 or 6.97 buffer. Press the **ENTER** key to confirm the calibration and the LCD will display "CO" momentarily. The meter will revert to the measurement mode.



6. For a 2-point calibration, repeat step 3 with pH 4.10 buffer for better accuracy.

3.3 Ion Calibration

The pHPLUS DIRECT meter is capable of up to 3-point ion calibration (minimum 2 point) with standard solutions to ensure accuracy across the entire range of the meter.

To exit calibration after you have first entered into ion calibration, press the **CAL** key again. No ion calibration values are stored into the meter's non-volatile memory. Note that ion calibration data is lost once the meter is reset when the batteries are removed and replaced.

If one calibration point is performed an error message "Er2" will be displayed after the single point calibration is completed. Recalibrate using a minimum of 2 points.

Calibration values are successfully stored if the ISE (Ion Selective Electrode) slope is within the specified tolerance of 15-90 mV/decade, otherwise an error message "Er3" is displayed.

If any of the calibration points are not within 1 decade, an error message "Er4" will be shown at the end of calibration process. The ion calibration options available include 0.1, 1.0, 10.0, 100.0 ppm. Recalibrate and ensure that all calibration points must be at least 1 decade apart from each other.

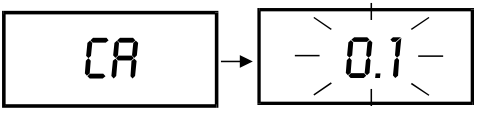
Ensure that you use new or fresh standard solutions during calibration. Do not reuse ion standard solutions as they may be contaminated and affect the calibration and accuracy of measurements. Always store standard solutions in a dry, cool environment if possible. Check that the ISE and ion standard solutions are kept in good condition, otherwise erroneous readings may be taken.

Before use, remove the plastic protective cap if present on the ISE (at the tip of sensor) and read the manufacturer's instructional manual. Briefly rinse the electrode with clean deionized water to remove any residue.

Rinse probes before and after each calibration or sample measurement to avoid cross-contamination. For more details please refer to Manufacturer's care and maintenance guide.

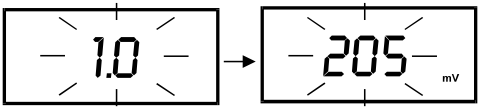
3.3.1 Multi-point Ion Calibration

1. If a calibration with a 1.0 ppm standard is desired, the 0.1 ppm calibration can be skipped (see below*).
2. For instance if a 1.0 ppm calibration standard is used, pour a known 1.0 ppm standard solution into a clean container. Power on the meter, and set the meter to Ion measurement mode.
3. Dip the ISE into the 1.0 ppm standard solution. Stir it gently. Press **CAL** key to enter into calibration mode.
4. The display shows "CA" momentarily followed by "0.1" flashing.

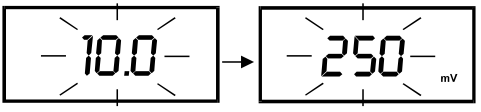


* If you wish to calibrate with a standard other than 0.1 ppm, press ▼ key once to select 1.0 ppm. Use the ▲ or ▼ key to select other options like 0.1, 10.0 or 100.0 ppm.

5. Press the **ENTER** key and the displayed value will show the corresponding measured mV reading that is equivalent to 1.0 ppm. Allow the reading to stabilize.



6. Press the **ENTER** key to confirm the first calibration point (e.g. 1.0 ppm). The display will show the next calibration option, 10.0 ppm. Rinse the electrode with distilled water and blot it dry if necessary.
7. Pour a known 10.0 ppm standard solution into another clean container. Dip the electrode into the standard solution. Stir it gently.
8. Press the **ENTER** key and the displayed value will show the measured mV reading that is equivalent to 10.0 ppm. Allow the reading to stabilize.



9. Press the ENTER key to confirm the second calibration point (e.g. 10.0 ppm). The display will show the next calibration option, 100.0 ppm.

To exit from the 2-point calibration, press the **CAL** key. The LCD will show "PXX mV" momentarily which is the ISE slope in mV value.

The meter then reverts to ion measurement mode. The calibration values are successfully stored into the memory. Otherwise an error message "Er3" will be displayed if the slope of ISE is lower than 15mV/decade or higher than 90mV/decade.

10. For a 3-point calibration when the LCD shows "100.0", press the **ENTER** key to proceed to last calibration point. Repeat the above procedure.

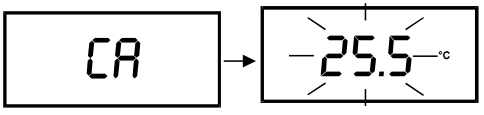
At the end of the 3 point calibration the meter will display the mV slope of the electrode as "PXX" and the calibration values will be successfully stored. Error messages will appear in the LCD if the calibration was unsuccessful with no values stored into memory.

3.4 TEMPERATURE CALIBRATION

3.4.1 With Temperature probe

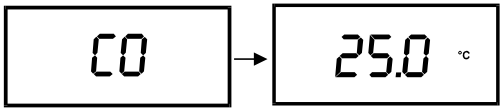
The temperature probe provided with the meter is factory-calibrated. Over time, temperature calibration may drift and require calibration. If there is a need to replace the probe the temperature probe should be calibrated prior to pH calibration.

1. Connect the temperature probe to the meter. Press the **MODE** key to enter the Temperature mode until "°C" annunciator appears on the LCD.
2. Compare the displayed value to a NIST certified thermometer or other thermometer known to be accurate. For best accuracy, place both the probe and thermometer in a constant temperature bath.
3. Press the **CAL** key to enter the temperature calibration mode. The LCD shows "CA" momentarily and the displayed reading flashes.



4. Press the ▲ and▼ keys until the LCD display shows the desired temperature. The meter allows an adjustable maximum value of ± 5 °C from the factory default.

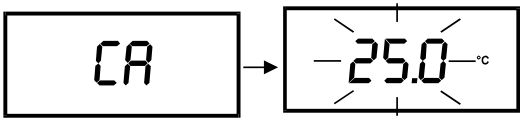
5. To cancel or abort this operation, press the **CAL** key. Note no new value will be stored into the meter's non-volatile memory. To confirm the calibration, press the **ENTER** key. The LCD displays "CO" momentarily, and the meter reverts to the measurement mode.



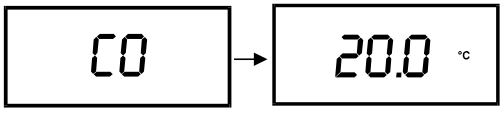
3.4.2 Without Temperature probe (no ATC)

If a temperature probe is not used, the meter compensates for the pH response based on a new calibrated temperature value manually set or at 25.0 °C (factory default).

1. Press the **MODE** key to enter into Temperature mode until "°C" shows on the LCD.
2. Compare the displayed value to a NIST certified thermometer or thermometer known to be accurate (dipped into a constant temperature bath).
3. Press the **CAL** key to enter the temperature calibration mode. The LCD shows "CA" momentarily and the displayed reading flashes. Note that this displayed value should either be 25.0 °C or the last set temperature value.



4. Press ▲ and ▼ keys until the display shows the desired temperature. Any value from 0 to 100 °C can be set.
5. To cancel or abort this operation, press the **CAL** key. Note no new value will be stored into the meter's non-volatile memory. To confirm the calibration, press the **ENTER** key. The LCD displays "CO" momentarily, and the meter reverts to measurement mode.



4. MEASUREMENT

4.1 Taking Measurements

1. Before measurement, rinse the pH/ORP electrode or Ion Selective Electrode (ISE) and temperature probe thoroughly with tap or distilled water to remove any impurities on the bodies of probes.
2. Power on the meter using the **ON** key. Press the **MODE** key to select the desired mode of operation (pH, mV, Ion or Temperature).
3. Dip both probes gently in the test sample, stir gently and wait for the reading to stabilize. Note the reading. Freeze the displayed reading if necessary, for details refer to Section 4.3.
4. Rinse the probes with tap water or rinse water thoroughly before taking the next sample measurement or storing the probes.

4.2 Millivolt (mV) Reference Check

The mV mode is used for the diagnosis of ISE or pH electrode condition. Press the **MODE** key to access the mV mode, the "mV" annunciator is displayed. The displayed value shows the absolute mV value of the ISE or pH electrode being measured.

4.3 Holding a Reading

To freeze or hold the displayed reading, press the the **HOLD** key once. The LCD will display the "HO" annunciator to indicate the **HOLD** function is activated.

4.4 Releasing a Held Reading

Press the **HOLD** key once again to deactivate the **HOLD** function or to release the frozen reading. The meter reverts to the current measurement mode, and the "HO" annunciator disappears from the LCD.

5. ELECTRODE CARE AND MAINTENANCE

For best results, always keep the ISE capped dry and pH/ORP electrode bulb wet. Store the pH/ORP glass bulb with pH electrode storage solution. pH buffers are also suitable. **NEVER** use deionized water for storage. Wash the probes thoroughly with distilled water after each use. Because the ISE or pH electrode is susceptible to contamination or dirt, clean it every 1 to 2 months depending on extent and condition of use.

Clean the pH/ORP electrode using a mild detergent. Wipe the probe with soft tissue paper. Avoid touching the glass membrane with your fingers. Wash the electrode thoroughly in tap water and then in distilled water. Recalibrate the meter after cleaning the electrode.

6. TROUBLESHOOTING

Problem	Cause	Solution
No display	Batteries not in place	a) Insert batteries. b) Re-insert batteries with correct polarity.
"LO" displays in the LCD	Low battery	Replace batteries with fresh ones.
Unstable reading	a) Electrode not deep enough in sample b) Dirty electrode c) Broken electrode	a) Place electrode deeper in sample. b) Clean electrode and recalibrate. c) Replace electrode.
"Er1" display	Buffer value out of tolerance	Use new pH buffer solution and recalibrate.
"Er2" display	Single point	Perform at least 2 point calibration.
"Er3" display	ISE slope not within the specified tolerance	Check ISE is in good working condition.
"Er4" display	Calibration points not within 1 decade	Ensure calibration points are at least 1 decade apart.
Not able to calibrate	a) Display freezes b) Faulty electrode	a) Release reading by pressing HOLD key. b) Replace electrode.

7. SPECIFICATIONS

Ion Range	0.01 to 1999 ppm
Resolution	0.01 ppm for 0.01 to 0.99 ppm; 0.1 ppm for 1.0 to 199.9 ppm; 1 ppm for 200 to 1999 ppm
Accuracy	+/- 1% of reading
No. of Calibration Pts	2 to 3 points (minimum 2 pts)
pH Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy	+/- 0.01 pH
pH Slope Range	80 to 120%
No. of Calibration Pts	1 to 3 points (push-button)
Buffer Option	pH 4.01, 7.00, 10.01 (USA) pH 4.01, 6.86, 9.18 (NIST) pH 4.10, 6.97 (Pb)
Temperature Range	0.0 to 100.0 °C
Accuracy	+/- 0.5 °C
Temperature Comp.	Automatic / Manual (0 to 100 °C)
Millivolt Range	-500 to 500 mV
Resolution	0.1 mV for –200 to 200 mV; 1 mV for 200 to 500 mV
Accuracy	+/- 0.2 and 2 mV resp.
FEATURES	
Auto-Buffer Recognition	as above pH buffer options
Hold Function	"HO"
Auto Shut Off	After 17 minutes
Low Battery	"LO"
Display	Single Custom LCD
Operating Temperature Power Requirements	0 to 50 °C
Power Requirements	4 x "AAA" Alkaline Batteries
Battery Life	500 hours
Meter Dim./Weight	14 x 7 x 3.5 cm / 200 g

8. ACCESSORIES

pH

pH Electrode	1904
Temperature Probe	1909
AC Adapter, 110 V	1726-110
AC Adapter, 220 V	1754
Buffer, pH 4.01, 120 mL	2866-J
Buffer, pH 7.00, 120 mL	2881-J
Buffer, pH 10.00, 120 mL	2896-J
Mini Buffer Tablets, pH 4.0, 50 tablets	3983A-H
Mini Buffer Tablets, pH 7.0, 50 tablets	3984A-H
Mini Buffer Tablets, pH 10.0, 50 tablets	3985A-H

Ion selective electrodes

Ammonia ISE	5-0043
Fluoride ISE	5-0048
Nitrate ISE	5-0052
Ammonia Accessory Kit	5-0098
Fluoride Accessory Kit	5-0099
Nitrate Accessory Kit	5-0100

Accessory kits include standard solution, replacement electrolyte, ionic strength adjuster, pipet and replacement membrane (Ammonia only).

9. WARRANTY

Repairs

Should it be necessary to return the meter for repair or servicing, pack the meter carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 1-800-344-3100, faxing 1-410-778-6394, or emailing tech@lamotte.com. Often a problem can be resolved over the phone or by email. If a return of the meter is necessary, attach a letter with the return authorization number, meter serial number, a brief description of problem and contact information including phone & FAX numbers to the shipping carton. This information will enable the service department to make the required repairs more efficiently.

Instrument Guarantee

This Instrument is guaranteed to be free from defects in material and workmanship for a period of one (1) year from the original purchase date. In the event that a defect is found during the warranty time frame, LaMotte Company agrees that it will be repaired or replaced without charge except for the transportation costs. This guarantee does not cover batteries.

This product can not be returned without a return authorization number from LaMotte Company. For warranty support or a Return Authorization Number, contact LaMotte Company at 1-800-344-3100 or tech@lamotte.com.

Limitations

This guarantee is void under the following circumstances:

- Damage due to operator negligence, misuse, accident or improper application.
- Damage or alterations from attempted repairs by an unauthorized (non-LaMotte) service.
- Damage due to improper power source, AC adapter or battery.
- Damage caused by acts of God or natural disaster.
- Damage occurred while in transit with a shipping carrier.

LaMotte Company will service and repair out-of-warranty products at a nominal charge.

Packaging And Delivery

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments. After the product leaves LaMotte Company, all responsibility for safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods.

LaMOTTE COMPANY

Helping People Solve Analytical Challenges®

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