



Sodium, Potassium, Calcium, Chloride, and pH Measurement

Agilent Model 123 Ion Selective Electrode meter

Instruction Manual

Notices

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A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

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A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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Measuring salt?

Refer to Section 5 to measure Na⁺ and calculate for sodium chloride.
Refer to Section 8 to directly measure % salt using Agilent Salt Standards.

Section 1—Introduction

The Agilent Model 123 Ion Selective Electrode meter is specifically designed for the determination of sodium, potassium, calcium, chloride, and pH in foods, beverages, and other feed and food products. It features two independent measurement channels, with dedicated calibration and slope controls, permitting two ions to be measured concurrently. Choosing calibration set points of 1.0, 10, or 100 and bracketing sample concentrations within calibration standards enables high sensitivity measurement.

Measurement Range	Resolution
20 (0.01 to 19.99)	0.01
200 (0.1 to 199.9)	0.1
2,000 (1 to 1,999)	1

The LCD display provides a direct readout of the sample concentration in the unit of measure of the chosen calibration solution. CMOS circuitry provides reliability, stability, and low power requirements. The Model 123 is designed for in-line operation with an AC power adapter, and variable-site operation with a replaceable 9 V alkaline battery (active life in excess of 150 hours).

Notes, Cautions, and Warnings

NOTE

- Always store electrodes in an upright position.
- Keep out of direct sunlight when performing chloride measurements.
- All solutions should be used at room temperature.

CAUTION

High humidity may cause damage to the electronic components and should be avoided.

WARNING

Only use a non-rechargeable 9 V alkaline battery or the supplied AC power adapter to power this device.

WARNUNG

Verwenden Sie nur eine nicht wiederaufladbare 9-V-Alkalibatterie oder das mitgelieferte Netzteil, um dieses Gerät mit Strom zu versorgen.

ATTENTION

Utilisez uniquement une pile alcaline 9 V non rechargeable ou l'adaptateur secteur fourni pour alimenter cet appareil.

ATTENZIONE

Utilizzare solo una batteria alcalina da 9 V non ricaricabile o l'adattatore di alimentazione CA in dotazione per alimentare questo dispositivo.

ADVERTENCIA

Utilice únicamente una batería alcalina no recargable de 9 V o el adaptador de alimentación de CA suministrado para alimentar este dispositivo.

警告

只能使用不可充电的9V碱性电池或随附的交流电源适配器为本设备供电。

Section 2—Meter Specifications

Parameter	Desired Specifications and known preclusions
Operating Ambient Temperature	10 to 45 °C (50 to 115 °F)
Operating Relative Humidity	5 to 85% (noncondensing)
Operating Altitude	2,000 m
Storage Temperature	10 to 45 °C (50 to 115 °F)
Storage Relative Humidity	5 to 85% (noncondensing)
Meter Weight	1.5 kg (3.25 lbs)
Meter Dimensions (H × W × D)	3 × 7 × 13 in
Pollution	Degree 2
Overvoltage	Category II
Power Source	AC power adapter, 100 to 240 VAC, 50/60 Hz, 7.2 W (max) input, 12 VDC, 5mA output Battery 9 V alkaline (optional)
Shock and Vibration	Testing per ISTA #1A
Regulatory and Safety	CE, RoHS, WEEE
Warranty	1 year (12 months)
Modes	3 modes
Range	20 to 2,000
Resolution	0.001/0.01/0.1
Accuracy	±1%
Calibration Control	Manual (90 to 110%)
Slope Control	Manual (90 to 110%)

Controls and inputs

Front panel

Front Panel	
Display	High contrast LCD display.
Range Knob	Controls power to the meter, and enables one of three measurement ranges to be selected.
For Channel 1 and Channel 2	
Slope Knob	Ten-turn potentiometer to adjust for variations in the slope (sensitivity) of each electrode.
Calibrate Knob	Ten-turn potentiometer to adjust the offset potential of the electrode.
Mode Knob	Switch to select channel and ion type to be measured and displayed. Options include: pH, Cl ⁻ , or Na/K/Ca ⁺⁺ .

Rear panel

Rear Panel	
For Channel 1 and Channel 2	
Sensing Electrode Connector	BNC connector for sensing electrode
Reference Electrode Jack	Standard tip jack connector for reference electrode
CAL Switch	Three-position slide switch for calibration set points of 1.0, 10, and 100
Note: The position of the slide switch MUST match the value of the Calibration Standard used to calibrate the meter. For example, if using 100 ppm Sodium Calibration Standard, the slide switch must be in the 100 position. If using 10.0 mg Cl/g Chloride Standard, the slide switch must be in the 10 position.	
Power In	Jack for supplied AC power adapter; use of any other adapter will result in damage to the meter.
Battery Compartment	Houses a replaceable 9 V alkaline battery, with an active life in excess of 150 hours. It is recommended to replace the battery every three months. The low battery light indicates that less than five hours of battery life remains.

Section 3—Installation

1. Carefully unpack the shipping carton containing the Model 123 Ion Selective Electrode meter (p/n 123), AC power adapter (p/n M11000 or M13001), and one or two electrode holders and support rods (p/n 1231). Save all original packaging material.
2. Place the Model 123 on a clean, dry surface, avoiding areas of extreme temperature and humidity.
3. Slide the support rods into the mounts on the side of the instrument. Secure by tightening the thumb screw.
4. Slide the electrode holder onto the support rod. Fix the height of the holder to the desired level with the thumb screw.
5. The meter will run on battery power in excess of 150 hours. If using the power adapter, insert the plug end into the power jack at the rear of the instrument. Depending on the plug type (115 V or 220/240 V), plug the AC power adapter into the corresponding 115 V or 220/240 V AC supply. The battery connection will automatically disconnect once the AC power adapter is in place.
6. Unpack any remaining system components, such as sensing or reference electrodes, standards, or reagents. Retain electrode caps for long-term storage.

Section 4—General Guidelines

- The Model 123 meter requires no warm-up or stabilization time.
- Either channel can be used for all measurements.
- Jacks and electrode connectors must be kept clean and dry to avoid noise, errors, and poor performance.
- Standards are ready to use. They are prediluted, and no further treatment is required.
- The reference electrodes must be filled with the appropriate Reference Fill Solution at all times.
- Care must be taken to avoid cross-contamination of samples, standards, or buffers. Never pour used standards back into supply bottles. Discard used solutions appropriately.
- If the Slope or Calibration controls are moved after standardization, system restandardization is required.
- **The position of the calibration slide switch on the back of the Model 123 must match the value of the standard being used for calibration. pH is the only exception; any CAL slide switch position is allowed for pH.**

123 meter care

- Ensure that liquids are not spilled on the meter. Liquid spills may cause irreparable damage.
- The meter may be wiped down with a clean damp cloth only. Do not use harsh cleaners.
- Keep the electrode connectors clean and free of moisture.

Section 5—Sodium Overview

The Model 123 Ion Selective Electrode meter is uniquely designed for measuring sodium across varied feed and food products. While sodium is most often measured for its nutritional interest and requirements for food labeling, it is also a large determinant of flavor quality. Sodium is considered by many to give a better indication of desirable flavor than either chloride or salt.

A detailed investigation of sodium determination using the Agilent System was performed for numerous matrices. The Sodium/Potassium Ready-to-Use Reagent is formulated to fix the pH and ionic strength at optimum levels, regardless of the type of sample being analyzed. In addition, all bound sodium is released for analysis.

The Agilent Standard Solutions were formulated specifically for the Agilent Sodium Analysis procedures. They have been prepared with specific Agilent Ready-to-Use Reagents to compensate for the necessary 1 g/100 mL dilution of the sample by the reagent. Failure to add the appropriate Agilent reagent into the sample or the use of other manufacturer's standards will introduce significant errors.

Components and supplies

Reagent	Part Number
Sodium/Potassium Ready-to-Use Reagent	82506-G, 82506-5G
Sodium/Potassium Reagent Concentrate	82507-Q, 82507-G, 82507-5G
Sodium Extracting Solution (for animal feed analysis only)	55555-G, 55555-5G
Standard	Part Number
Calibration Sodium Standard (100 ppm)	82511-Q, 82511-G, 82511-5G
Sloping Sodium Standard (10 ppm)	82510-Q, 82510-G, 82510-5G
Electrode	Part Number
Sodium Sensing Electrode	51023
Sodium Reference Electrode	51010-NA
Electrode Maintenance	Part Number
Sodium/Potassium Reference Internal Fill Solution	55410

Sodium system test procedure

Note: All solutions are to be used at room temperature.

A) Instrument setup

1. Connect the Sodium Reference Electrode (clear plastic barrel) to the Reference Electrode jack for either Channel 1 or 2.
2. Connect the Sodium Sensing Electrode to the Sensing Electrode BNC connector of the same channel, and slide the electrodes into the electrode holder.
3. Set the Channel CAL switch on the rear panel to the 100 position for the corresponding channel.
4. Set the Mode knob to Na/K/Ca++ for the corresponding channel.
5. Set the Range knob to 2000.
6. Dispense approximately 50 mL of 100 ppm Sodium Calibration Standard into a sample cup.
7. Immerse both electrodes into the Sodium Calibration Standard solution cup.
8. Swirl gently, and wait approximately one hour for electrode stabilization.
9. Adjust the Calibration knob to 100.

IMPORTANT: The CAL switch must be set to the same value as the Sodium Calibration Standard. If the system does not stabilize, please:

- Check for an air bubble trapped in the reference electrode. To dislodge visible air bubbles, unscrew the outer barrel and tap the side of the inner glass tube lightly on the bench top.
- Check for static electricity build-up on the probes. If the signal appears noisy, please reference Section 10—Tips and Techniques on page 33.
- Check for cleanliness of the electrodes. Cleaning Instructions are located on page 14.

B) Sodium standardization

- i. Mark pairs of sample containers:
 1. RINSE CAL and CAL for the calibration procedure.
 2. RINSE SLOPE and SLOPE for the sloping procedure.
 3. RINSE and SAMPLE # for each sample measurement to be taken.
- ii. Calibration
 1. Set the Range knob to 2000.
 2. Transfer 40 mL of 100 ppm Sodium Calibration Standard into the RINSE CAL and CAL sample containers.
 3. Immerse the electrodes into the RINSE CAL container, and gently swirl to ensure maximum solution contact.
 4. Immerse the electrodes into the CAL container, and allow 1 to 2 minutes to stabilize.
 5. Adjust the Calibrate Knob to display a value of 100.

- iii. Slope
 1. Set the Range switch to 200.
 2. Transfer 40 mL of 10 ppm Sodium Standard into the RINSE SLOPE and SLOPE sample containers.
 3. Immerse the electrodes into the RINSE SLOPE container, and gently swirl to ensure maximum solution contact.
 4. Immerse the electrodes into the SLOPE container, and allow 1 to 2 minutes to stabilize.
 5. Adjust the Slope Knob to display a value of 10.0.
- iv. Sodium calibration recheck
 1. Rinse the electrodes with the Calibration Standard, and immerse the electrodes in a fresh sample cup of 100 ppm Calibration Standard. If the readout varies by >2%, the slope setting may be in error. Recalibrate and slope as required.
 2. The system is standardized for sodium measurement when the readout does not vary by >2% over 45 seconds. If the electrodes are slow to stabilize, follow the Sodium Sensing Electrode Cleaning Procedure on page 14.

Note: Electrodes must always be calibrated first and sloped second; significant errors result if this order is reversed.

C) Sodium measurement

Two conditions are necessary for accurate results. A sufficient amount of product must be taken to be representative of the production batch. The material must be blended well to ensure that homogenized samples contain representative amounts of sodium. Refer to Section 10—Tips and Techniques on page 33.

1. Homogenize the sample, if necessary.
2. Weigh 1 to 2 g of homogenized sample into a glass beaker or flask.
3. Record the sample weight to three significant figures (for example, 1.43 g).
4. Add 100 ±0.5 mL of Sodium Ready-to-Use Reagent.
5. Stir or wet blend for approximately 1 minute to release the sodium.
6. Transfer 40 mL of the blended sample into both the RINSE and SAMPLE containers.
7. Immerse both electrodes into the RINSE solution, and gently swirl to guarantee maximum solution contact.
8. Immerse both electrodes into the SAMPLE solution, and gently swirl.
9. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
10. Multiple samples may be tested without repeating the Sodium Standardization procedure. Standardization may be required after 10 to 20 samples, and the frequency will depend on sample conditions and time between measurements.

Sodium in animal feed

1. Homogenize the sample in a coffee grinder or equivalent milling device for one minute or until the consistency of a fine powder is achieved.
2. Weigh 1 to 2 g of homogenized sample into a glass beaker or flask.
3. Record the sample weight to three significant figures (for example, 1.43 g).
4. Add 10.0 ±0.1 mL of Sodium Extracting Solution and mix thoroughly to ensure that all feed particles are wetted and no clumps remain. Let the sample solution stand for 10 minutes.
5. Add 90.0 ±0.5 mL of Sodium Ready-to-Use Reagent.
6. Stir for approximately 1 minute.
7. Transfer 40 mL of the blended sample into both the RINSE and SAMPLE containers.
8. Immerse both electrodes into the RINSE solution, and gently swirl to guarantee maximum solution contact.
9. Immerse both electrodes into the SAMPLE solution, and gently swirl.
10. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
11. Multiple samples may be tested without repeating the Sodium Standardization procedure. Standardization may be required after 10 to 20 samples, and the frequency will depend on sample conditions and time between measurements.

D) Data analysis

The meter reading displays the concentration of the test solution in the same unit of measure as the calibration solution. For the concentration of the ion in the sample, the recorded sample weight and the procedure's dilution must be considered. To calculate the concentration for the homogenized sample, the meter reading has to be divided by the sample weight and multiplied by the conversion factor. When determining in units of % salt, the value is further multiplied by the molecular weight (MW) factor. Refer to Table 1 and the following equation:

$$\text{Sample concentration} = \frac{\text{Meter reading}}{\text{Sample weight (g)}} \times \text{Factor} \times \text{MW Factor}$$

Table 1.

Calibration Solution p/n	Measured Units	Factor	MW Factor
82511	ppm	100	–
82511	mg/100 g	10	–
82511	mg/g	0.1	–
82511	%	0.01	–
82511	% salt (NaCl)	0.01	2.54

Sodium electrode maintenance

A) Storage

Electrodes should be stored upright in 100 ppm Sodium Standard for optimal performance. For long-term storage, wash the sensing electrode with lukewarm soapy water, rinse with distilled or deionized water, and store dry with the shipping cap on. Rinse the reference electrode with distilled water, and store dry with the shipping cap on. Do not use laboratory cleaning solutions, which are likely to be high in sodium ions. Excessive temperatures may distort the electrode barrel, and should be avoided.

NEVER STORE THE REFERENCE ELECTRODE IN DISTILLED WATER. Prolonged exposure to distilled water disturbs the distribution of electro-active chemicals in the pores of the ceramic rod. Subsequent measurements will likely drift and develop noise. If the reference electrode has been stored in distilled water, performance can potentially be restored by soaking it overnight in 100 ppm Sodium Calibration Standard.

B) Cleaning

Sensing Electrode: Visual inspection of the tip of the Sodium Sensing Electrode may show a layer of fat and grease build-up, resulting in slow electrode response. An improved response can be achieved by washing the Sensing Electrode in a warm, aqueous solution of liquid, sodium-free detergent, followed by rinsing with DI water. The glass sensing membrane should sparkle after cleaning.

Reference Electrode: The Sodium Reference Electrode generally never needs cleaning, except to remove lumps of fats, grease, or sample material. These may be removed by blotting with a lab wipe dampened with DI water. NEVER use etchant or cleaning compound on the Sodium Reference Electrode as this will damage the sensing tip.

C) Regeneration

Reference Electrode: Sodium Reference Electrodes are designed to be very low maintenance. Every six months, the outer fill solution should be replaced.

1. Unscrew the outer barrel.
2. Empty the fill solution, and wash the barrel with DI water.
3. Fill the barrel to the halfway mark with Sodium Reference Fill Solution.
4. Gently screw the outer barrel back onto the Sodium Reference Electrode.
5. Soak the electrode in 100 ppm Sodium Calibration Standard for one hour.
6. Standardization is required after fill solution replacement.

Note: If response times remain slow or if there is drift or noise, electrode replacement is required.

Section 6—Potassium Overview

The 123 meter is uniquely designed for measuring potassium in foods and other matrices. The importance of potassium in human nutrition has been firmly established. Mounting evidence suggests the ratio of potassium to sodium is the determinant of nutritional benefits rather than either alone. A National Research Council publication, *Diet and Health: Implications for Reducing Chronic Disease Risk*, indicated that $K^+ : Na^-$ is the prime determinant of vascular health and hypertension in sodium-sensitive hypersensitivities. Within certain limits, the higher the ratio, the larger the benefit.

A detailed investigation of potassium determination in a number of different products was performed by Agilent, and the Sodium/Potassium Reagent was formulated based on this study. This reagent is designed to fix pH and ionic strength at optimum levels, regardless of the type of sample being analyzed.

The Agilent Standard Solutions were formulated specifically for the Agilent Potassium Analysis procedures. They have been prepared with specific Agilent Ready-to-Use Reagents to compensate for the necessary 1 g/100 mL dilution of the sample by the reagent. Failure to add the appropriate Agilent Reagent to the sample, or the use of other manufacturer's standards will introduce significant errors in the measurements.

Components and supplies

Reagent	Part Number
Sodium/Potassium Ready-to-Use Reagent	82506-G, 82506-5G
Sodium/Potassium Reagent Concentrate	82507-Q, 82507-G, 82507-5G
Standard	Part Number
Calibration	
Potassium Standard (100 ppm)	82555-Q, 82555-G
Potassium Standard (100 mg/100 mL)	82531-Q, 82531-G
Sloping	
Potassium Standard (50 ppm)	82533-Q, 82533-G
Potassium Standard (200 mg/100 mL)	82532-Q, 82532-G
Electrode	Part Number
Potassium Sensing Electrode	51333
Potassium Reference Electrode	51010-K
Electrode Maintenance	Part Number
Potassium Electrode Regenerating Solution	55000-P
Sodium/Potassium Reference Fill Solution	55410

Potassium system test procedure

Note: All solutions are to be used at room temperature.

A) Instrument setup

1. Connect the Potassium Reference Electrode (clear plastic barrel) to the Reference Electrode Jack for either Channel 1 or 2.
2. Connect the Potassium Sensing Electrode to the Sensing Electrode BNC connector of the same channel and slide the electrodes into the electrode holder.
3. Set the Channel CAL switch on the rear panel to the 100 position for the corresponding channel.
4. Set the Mode knob to Na/K/Ca++ for the corresponding channel.
5. Set the Range knob to 2000.
6. Dispense approximately 50 mL of either 100 ppm or 100 mg/100 mL Potassium Standard into a sample cup.
7. Immerse both electrodes into the Potassium Calibration Standard solution.
8. Allow approximately one hour for electrode stabilization.
9. Adjust the Calibration knob to 100.

Note: The CAL switch must be set to the same value as the Potassium Calibration Standard. If the system does not stabilize, please:

- Check for an air bubble trapped in the reference electrode. To dislodge visible air bubbles, unscrew the outer barrel and tap the side of the inner glass tube lightly on the bench top.
- Check for dirty electrodes. Cleaning instructions are located on page 18.

B) Potassium standardization

- i. Mark pairs of sample containers:
 1. RINSE CAL and CAL for the calibration procedure.
 2. RINSE SLOPE and SLOPE for the sloping procedure.
 3. RINSE and SAMPLE # for each sample measurement to be taken.
- ii. Calibration
 1. Set the Range switch to 2000.
 2. Transfer 40 mL of Potassium Calibration Standard into the RINSE CAL and CAL sample containers.
 3. Immerse the electrodes into the RINSE CAL container, and gently swirl to ensure maximum solution contact.
 4. Immerse the electrodes into the CAL container, and allow 1 to 2 minutes to stabilize.
 5. Adjust the Calibrate Knob to display a value of 100.

iii. Slope

1. Transfer 40 mL of the Potassium Sloping Standard into the RINSE SLOPE and SLOPE sample containers.
2. Immerse the electrodes into the RINSE SLOPE container, and gently swirl to ensure maximum solution contact.
3. Immerse the electrodes into the SLOPE container, and allow 1 to 2 minutes to stabilize.
4. Adjust the Slope Knob to display a value of 50 or 200, depending on the sloping standard used.

iv. Potassium calibration recheck

1. Rinse the electrodes, and immerse them in a fresh sample cup of Calibration Standard. If the readout varies by >2% from the value of the Calibration Standard, the slope setting may be in error. Recalibrate and slope as required.
2. The system is standardized for potassium measurement when the readout does not vary by >2% over 45 seconds. If the electrodes are slow to stabilize, follow the Potassium Sensing Electrode Cleaning Procedure on page 18.

Note: Electrodes must always be calibrated first and sloped second; significant errors result if this order is reversed.

C) Potassium measurement

Two conditions are necessary for accurate results. A sufficient amount of product must be taken to be representative of the production batch. The material must be blended well to ensure that homogenized samples contain representative amounts of potassium. Refer to Section 10, Tips and Techniques on page 33.

1. Homogenize the sample, if necessary. Weigh 1 to 2 g of homogenized sample into a glass beaker or flask.
2. Record the sample weight to three significant figures (for example, 1.43 g).
3. Add 100 ±0.5 mL of Potassium Ready-to-Use Reagent.
4. Stir or wet blend for approximately 1 minute to release the potassium.
5. Transfer 40 mL of the blended sample into both the RINSE and SAMPLE containers.
6. Immerse both electrodes into the RINSE solution, and gently swirl to guarantee maximum solution contact.
7. Immerse both electrodes into the SAMPLE solution, and gently swirl.
8. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
9. Multiple samples may be tested without repeating the potassium standardization procedure. Standardization may be required after 10 to 20 samples; frequency will depend on sample conditions and time between measurements.

D) Analysis

The meter reading displays the concentration of the test solution in the same unit of measure as the calibration solution. For the concentration of the ion in the sample, the recorded sample weight and the procedure's dilution must be considered. To calculate the concentration of the homogenized sample, the meter reading must be divided by the sample weight, and multiplied by the dilution factor. To calculate the % salt, this value is further multiplied by the molecular weight (MW) factor. Refer to Table 2.

$$\text{Sample concentration} = \frac{\text{Meter reading}}{\text{Sample weight (g)}} \times \text{Factor} \times \text{MW Factor}$$

Table 2.

Calibration Solution p/n	UOM	Factor	MW Factor
82555	ppm	100	–
82555	mg/100 g	10	–
82555	mg/g	0.1	–
82555	%	0.01	–
82555	% KCl	0.01	1.907
82531	mg/100 mL	1	–

Potassium electrode maintenance

A) Storage

Electrodes should be rinsed with deionized or distilled water, blotted with a lab wipe and stored dry and upright. For long-term storage, store with the shipping cap on. Do not use laboratory cleaning solutions. Excessive temperatures may distort the electrode barrel, and should be avoided.

NEVER STORE THE REFERENCE ELECTRODE IN DISTILLED WATER. Prolonged exposure to distilled water disturbs the distribution of electro-active chemicals in the pores of the ceramic rod. Subsequent measurements will likely drift and develop noise. If the reference electrode has been stored in distilled water, performance can potentially be restored by soaking it overnight in Potassium Calibration Standard.

B) Cleaning

Sensing Electrode: Visual inspection of the tip of the Potassium Sensing Electrode may show a layer of fat and grease build-up, resulting in slow electrode response. Cleaning of the Potassium electrode is restricted to washing the barrel and sensing membrane in distilled/deionized water and gently blotting with a tissue or lab wipe.

Reference Electrode: The Potassium Reference Electrode generally never needs cleaning, except to remove lumps of fats, grease or sample material. These may be removed by blotting with a lab wipe dampened with DI water. NEVER use etchant or cleaning compound on the Potassium Reference Electrode, as this will damage the sensing tip.

C) Regeneration

Sensing Electrode: With time, the potassium sensing membrane will need to be regenerated by soaking it overnight in Potassium Electrode Regenerating Solution. Standardization is required after regeneration.

Note: If calibration is still not possible, electrode replacement is necessary.

Reference Electrode: Potassium Reference Electrodes are designed to be very low maintenance. Every six months, the outer fill solution should be replaced.

1. Unscrew the outer barrel.
2. Empty the fill solution, and wash the barrel with DI water.
3. Fill the barrel to the halfway mark with Potassium Reference Fill Solution.
4. Gently screw the outer barrel back onto the Potassium Reference Electrode.
5. Soak in Potassium Calibration Standard for one hour.
6. Standardization is required after fill solution replacement.

Note: If response times remain slow or have drift or noise, electrode replacement is necessary.

Section 7—Calcium Overview

Calcium is the most abundant mineral in the body and supports bone, vascular, muscular, and neural health. For this reason, it is reported on nutritional labeling. Calcium content in feed and grain is also closely monitored as a key economic factor as it affects poultry laying rations, shell thickness, fatigue, and bone weakness. Increased calcium levels over the optimal percentage results in higher feed costs with marginal improvement to these factors. The Model 123 ISE meter is a critical component to any calcium measurement program. It avoids corrosive chemicals and ashing, and provides a direct readout of calcium concentration.

The precision and accuracy of a calcium analysis depends markedly on the pH of the sample, the ionic strength, and the presence of species that bind calcium, making the calcium ion unavailable for analysis. The Calcium Ready-to-Use Reagent fixes the pH and ionic strength at optimum levels, regardless of the type of sample being analyzed. In combination with the Calcium Extracting Solution, bound calcium is released for analysis. The Agilent Standard solutions are formulated specifically for the Agilent Calcium Analysis procedures. They have been prepared with specific Agilent RTU Reagents to compensate for the necessary dilution of the sample. Failure to add the appropriate Agilent reagent to the sample or the use of other manufacturer's standards will introduce significant errors in the measurements.

Components and supplies

Reagent	Part Number
Calcium Ready to Use Reagent	82571-G, 82571-5G
Calcium Reagent Concentrate	82570-Q, 82570-G, 82570-5G
Calcium Extracting Solution	55777-P, 55777-Q, 55777-G, 55777-5G
Standard	Part Number
Calibration	
Calcium Standard (1.0 wt%)	82572-Q, 82572-G
Calcium Standard (10.0 wt%)	82575-Q, 82575-G
Calcium Standard (100 mg/100 mL)	85700-Q, 85700-G
Sloping	
Calcium Standard (0.10 wt%)	82573-Q, 82573-G
Calcium Standard (1.0 wt%)	82572-Q, 82572-G
Calcium Standard (10 mg/100 mL)	85790-Q, 85790-G
Electrode	Part Number
Calcium Electrode	51770
Calcium Reference Electrode	51010-CA
Electrode Maintenance	Part Number
Calcium Electrode Regenerating Solution	53000-P
Calcium Reference Fill Solution	56000-P

Calcium system test procedure

Note: All solutions are to be used at room temperature. There are multiple units of measure available for Calcium Standardization Solutions. Please review Table 3 (page 22) for the corresponding Cal switch and Range switch settings for each standards option, and refer to the measurement section for the best units for each sample type.

A) Instrument setup

1. Connect the Calcium Reference Electrode (clear plastic barrel) to the Reference Electrode jack for either Channel 1 or 2.
2. Connect the Calcium Sensing Electrode to the Sensing Electrode BNC connector of the same channel, and slide the electrodes into the electrode holder.
3. Set the Channel CAL switch to the correct position for the corresponding channel. Refer to Table 3 for settings.
4. Set the Mode knob to Na/K/Ca⁺⁺ for the corresponding channel.
5. Set the Range knob to the correct range. Refer to Table 3 for settings.
6. Dispense approximately 50 mL of Calcium Calibration Standard into a sample cup.
7. Immerse both electrodes into the Calcium Calibration Standard solution.
8. Allow one hour or more for electrode stabilization. Overnight soaking may be warranted.
9. Adjust the Calibration knob to the value of the Calcium Calibration Standard.

Note: The CAL switch must be set to the same value as the Calcium Calibration Standard.

If system does not stabilize, please:

- Check for an air bubble trapped in the reference electrode. To dislodge visible air bubbles, unscrew the outer barrel, and tap the side of the inner glass tube lightly on the bench top.
- Check for dirty electrodes. Cleaning instructions are located on page 26.

B) Calcium standardization

- i. Mark pairs of sample containers:
 - RINSE CAL and CAL for calibration procedure
 - RINSE SLOPE and SLOPE for sloping procedure
 - RINSE and SAMPLE # for each sample measurement to be taken
- ii. Calibration
 1. Set Range and CAL switches to the appropriate setting. Refer to Table 3 for the switch settings to be used.
 2. Transfer 40 mL of Calcium Calibration Standard into the RINSE CAL and CAL sample containers.
 3. Immerse the electrodes into the RINSE CAL container, and gently swirl to ensure maximum solution contact.
 4. Immerse the electrodes into the CAL container, and allow 1 to 2 minutes to stabilize.

5. Adjust the Calibrate Knob to display the value of the Calibration Solution.
- iii. Slope
1. Transfer 40 mL of Calcium Sloping Standard into the RINSE SLOPE and SLOPE sample containers.
 2. Immerse the electrodes into the RINSE SLOPE container, and gently swirl to ensure maximum solution contact.
 3. Immerse the electrodes into the SLOPE container, and allow 1 to 2 minutes to stabilize.
 4. Adjust the Slope Knob to display the value of the Sloping Standard.
- iv. Calcium Calibration Recheck

Table 3.

Calibration Solution p/n	Calibration Solution Concentration	Slide Switch	Range Knobs
82572	1.0 wt%	1	20
82575	10.0 wt%	10	200
85700	100 mg/100 mL	100	2000

1. Rinse the electrodes and immerse them in a fresh sample cup of Calibration standard. If the readout varies by >2% from the value of the Calibration Standard, the slope setting may be in error. Recalibrate and slope as required.
2. The system is standardized for calcium measurement when the readout does not vary by >2% over 45 seconds. If the electrodes are slow to stabilize, follow the Calcium Sensing Electrode Cleaning Procedure on page 26.

Note: Electrodes must always be calibrated first and sloped second; significant errors result if this order is reversed.

C) Calcium measurement

Two conditions are necessary for accurate results. A sufficient amount of product must be taken to be representative of the production batch. The material must be blended well to ensure that homogenized samples contain representative amounts of calcium. Refer to Section 10—Tips and Techniques on page 33.

Calcium in solids

Calcium Calibration Standard (10.0 wt%) and Calcium Sloping Standard (1.0 wt%) are recommended for measuring calcium in solids.

1. Homogenize the sample. Dry solids are to be ground to the consistency of flour. Wet solids are to be blended to a uniform consistency.
2. For solids containing less than 10% calcium, weigh 2.50 g of homogenized sample into a glass beaker or flask. For solids containing more than 10% calcium, weigh 1.0 g of sample into a glass beaker or flask.
3. Record the sample weight to three significant figures (for example, 1.45 g).
4. Add 100 ±0.5 mL of Calcium Extracting Solution.
5. Stir for approximately 20 minutes or wet blend to release calcium, ensuring all particles are wetted.

6. Add 2.0 mL of the extracted sample solution to 100 ±0.5 mL of the Calcium Ready-to-Use Reagent.
7. Stir the sample solution for approximately 1 minute.
8. Transfer 40 mL of the sample solution into the RINSE and SAMPLE sample containers.
9. Immerse both electrodes into the container marked RINSE solution, and gently swirl the solution for approximately 1 minute to guarantee maximum solution contact.
10. Immerse both electrodes into the container marked SAMPLE solution, and gently swirl.
11. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
12. Multiple samples may be tested without repeating the calcium standardization procedure. Standardization may be required after 10 to 20 samples; frequency will depend on sample conditions a time between measurements.

Calcium in liquids other than juices

Calcium Standard (10 wt%) and Calcium Standard (1 wt%) are recommended for Calcium measurements in liquids.

1. Homogenize the sample. Vigorously shaking to disperse any sediment is the recommended method to ensure a homogeneous liquid sample. If density is known, the sample can be weighed.
2. Make an Extraction/Reagent Solution by adding 2.0 mL of Calcium Extracting Solution to 100.0 ±0.5 mL of Calcium Ready-to-Use solution. (Larger volumes may be prepared using the same ratio of Extracting Solution to Ready-to-Use Reagent).
3. **For liquids containing less than 1% calcium:** Add 1.0 mL of sample to the Extraction/Reagent Solution.
For liquids containing more than 1% calcium: Dilute 1.0 mL of sample with 100 ± 0.5 mL deionized water. Add 1.0 mL of the diluted sample to the Extraction/Reagent Solution.
Note: If the density is known, weigh out the calculated mass of a 1.0 mL sample (for example, if density = 1.05, weigh out 1.05 ±0.02 g of sample).
4. Stir the resulting sample solution for approximately 1 minute.
5. Transfer 40 mL of the sample solution into the RINSE and SAMPLE sample containers.
6. Immerse both electrodes into the RINSE solution container, and gently swirl the solution to guarantee maximum solution contact.
7. Immerse both electrodes into the SAMPLE solution container, and gently swirl.

8. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
9. Multiple samples may be tested without repeating the calcium standardization procedure. Standardization may be required after 10 to 20 samples; frequency will depend on sample conditions and time between measurements.

Calcium in fruit juices, beverages, and brines

Calcium Standard (100 mg/100 mL) and Calcium Standard (10 mg/100 mL) are recommended for Calcium measurements in fruit juices.

1. Homogenize the sample. Vigorously shaking to disperse any sediment is the recommended method to ensure a homogeneous liquid sample. If the juice contains pulp, the sample can be weighed using the known density of the juice.
2. Pipette 2.00 mL of well mixed sample into a glass beaker or flask. Alternatively, if the density is known, weigh out the calculated mass of a 2.0 mL sample (for example, if density = 1.05, weigh out 2.10 ± 0.02 g of sample).
3. Record the sample weight to three significant figures (for example, 1.43 g).
4. Add 2 mL of Calcium Extracting Solution, and swirl to mix.
5. Allow the sample solution to sit for approximately 1 minute.
6. Add 100 ± 0.5 mL of Calcium Ready-to-Use Reagent, and stir to mix.
7. Transfer 40 mL of the sample solution into the RINSE and SAMPLE sample containers.
8. Immerse both electrodes into the RINSE solution container, and gently swirl the solution to guarantee maximum solution contact.
9. Immerse both electrodes into the SAMPLE solution container, and gently swirl.
10. Allow the digital display readout to stabilize for 1 to 2 minutes. **Note:** The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.
11. Multiple samples may be tested without repeating the calcium standardization procedure. Standardization may be required after 10 to 20 samples; frequency will depend on sample conditions and time between measurements.

D) Analysis

The direct readout of the meter display is the calcium concentration of the sample in weight percent, if the sample is weighed, or in mg/100 mL, if the sample is volumetrically measured. Refer to Table 4.

Sample Concentration = Meter Reading × Factor

Table 4.

Calibration Solution p/n	Measured Units	Sample Weight	Factor
82575	wt %	2.5 g	1
82575	wt %	1.0 g	2.5
82572 (liquids <1%)	wt %	-	0.05
82572 (liquids >1%)	wt %	-	5
85700 (fruit juice by volume)	mg/100 mL	-	1
85700 (fruit juice by density)	mg/100 mL	Sample weight in g	1

Measuring calcium in limestone?

Calcium measurement in solid mineral samples such as limestone (CaCO_3) requires digestion to report the dissolved calcium in weight percent. A modified standardization and measurement procedure using electrodes, reagents, and standards is available.

Calcium electrode maintenance

A) Storage

Electrodes should be stored in Calcium Calibration Standard for optimal performance. For long-term storage, rinse Sensing and Reference electrodes with deionized or distilled water, and store dry with the shipping cap on. Do not use laboratory cleaning solutions. Excessive temperatures may distort the electrode barrel and should be avoided.

NEVER STORE THE REFERENCE ELECTRODE IN DISTILLED WATER. Prolonged exposure to distilled water disturbs the distribution of electro-active chemicals in the pores of the ceramic rod. Subsequent measurements will likely drift and develop noise. If the reference electrode has been stored in distilled water, performance can potentially be restored by soaking it overnight in Calcium Calibration Standard.

B) Cleaning

Sensing electrode: Visual inspection of the tip of the Calcium Sensing Electrode may show a layer of fat and grease build-up, resulting in slow electrode response. The membrane is susceptible to pinholes and tears. To clean, wet a cotton swab with Calibration Standard, gently rub the surface of the membrane and barrel, then let soak for 10 to 20 minutes in Calibration Standard.

Reference electrode: The Calcium Reference Electrode generally never needs cleaning, except to remove lumps of fats, grease, or sample material. These may be removed by wiping with a lab wipe dampened with DI water. NEVER use etchant or cleaning compound on the Calcium Reference Electrode as this will damage the sensing tip.

C) Regeneration

Sensing electrode: With time, the Calcium sensing membrane will need to be regenerated. First, soak overnight in Calcium Electrode Regenerating Solution, then soak 20 minutes in Calcium Calibration Standard. Standardization is required after regeneration.

Note: If calibration is still not possible, electrode replacement is necessary.

Reference electrode: Sodium Reference Electrodes are designed to be very low maintenance. Every six months, the outer fill solution should be replaced.

1. Unscrew the outer barrel.
2. Empty the fill solution, and wash the barrel with DI water.
3. Fill the barrel to the halfway mark with Calcium Reference Fill Solution.
4. Gently screw the outer barrel back onto the Calcium Reference Electrode.
5. Soak in Calcium Calibration Standard for one hour.
6. Standardization is required after fill solution replacement.

Note: If response times remain slow or have drift or noise, electrode replacement is necessary.

Section 8—Chloride Overview

The Agilent 123 meter is uniquely designed for measuring chloride in foods. Chloride, as a measure of salt content, typically requires traditional, wet chemistry methods and stoichiometric calculations. The direct method enabled by the Model 123 ISE meter is faster than titration, and eliminates the use of silver nitrate, avoiding hazardous waste disposal. A detailed investigation of chloride determination in a number of different products was carried out at Agilent. The Agilent Chloride Reagent was formulated based on this study, and is designed to fix pH and ionic strength at optimum levels, regardless of the type of sample being analyzed.

Agilent Standard Solutions are formulated specifically for Agilent Chloride Analysis procedures. They have been prepared with specific Agilent Ready-to-Use Reagents to compensate for the necessary 1 g/100 mL dilution of the sample by the reagent. Failure to add the appropriate Agilent Reagent to the sample, or the use of other manufacturer's standards will introduce significant errors in the measurements.

Components and supplies

Reagent	Part Number
Chloride Ready-to-Use Reagent	82551-G, 82551-5G
Chloride Reagent Concentrate	82550-G, 82550-5G
Standard	Part Number
Calibration	
Chloride Standard (10 mg/g)	82518-Q, 82518-G
Salt Standard (10.0 wt%)	82558-Q, 82558-G
Sloping	
Chloride Standard (3 mg/g)	82552-Q, 82552-G
Salt Standard (1.00 wt%)	82557-Q, 82557-G
Salt Standard (50.0 wt%)	82559-Q
Electrode	Part Number
Chloride Electrode	51553
Chloride Reference Electrode	51550
Electrode Maintenance	Part Number
Chloride Electrode Cleaning Compound	52000
Chloride Reference Fill Solution	55415

Chloride system test procedure

Note: All solutions are to be used at room temperature.

A) Instrument setup

1. Connect the Chloride Reference Electrode (clear plastic barrel) to the Reference Electrode jack for either Channel 1 or 2.
2. Connect the Chloride Sensing Electrode to the Sensing Electrode BNC connector of the same channel, and slide the electrodes into the electrode holder.
3. Set the Channel CAL switch to the 10 position for the corresponding channel.
4. Set the Mode knob to Cl^- for the corresponding channel.
5. Set the Range knob to 200.
6. Dispense approximately 50 mL of either 10 mg/g Chloride Standard or 10% Salt Standard into a sample cup.
7. Immerse both electrodes into the Calibration Standard solutions.
8. Allow approximately one hour for electrode stabilization.
9. Adjust the Calibration knob to 10.

Note: The CAL switch must be set to the same value as the Calibration Standard.

If system does not stabilize, please:

- Check for an air bubble trapped in the reference electrode. To dislodge visible air bubbles, unscrew the outer barrel and tap the side of the inner glass tube lightly on the bench top.
- Check for dirty electrodes. Cleaning instructions are located on page 30.

B) Chloride standardization

- i. Mark a series of sample containers:
 1. RINSE CAL and CAL for the calibration procedure.
 2. RINSE SLOPE and SLOPE for the sloping procedure.
 3. RINSE and SAMPLE # for each sample measurement to be taken.
- ii. Calibration
 1. Set the Range switch to 200.
 2. Transfer 40 mL of 10 mg/g Chloride Standard or 10% Salt Standard into the RINSE CAL and CAL sample containers.
 3. Immerse the electrodes into the RINSE CAL container, and gently swirl to ensure maximum solution contact.
 4. Immerse the electrodes into the CAL container, and allow 1 to 2 minutes to stabilize.
 5. Adjust the Calibrate Knob to display a value of 10.
- iii. Slope

1. Transfer 40 mL of 3 mg/g Chloride Standard or 1% Salt Standard into the RINSE SLOPE and SLOPE sample containers.
2. Immerse the electrodes into the RINSE SLOPE container, and gently swirl to ensure maximum solution contact.
3. Immerse the electrodes into the SLOPE container, and allow 1 to 2 minutes to stabilize.
4. Adjust the Slope knob to display a value of the sloping standard, either 3.0 or 1.0.

Note: If measuring a high concentration salt sample (for example, brine, or spice mixes), slope with the 50% Salt Standard in place of the 1% Salt Standard. Adjust the Slope knob to display 50.0.

iv. Chloride calibration recheck

1. Rinse the electrodes and immerse them in a fresh sample cup of Calibration standard. If the readout varies by >2% from the value of the Calibration Standard, the slope setting may be in error. Recalibrate and slope as required.
2. The system is standardized for Chloride measurement when the readout does not vary by >2% over 45 seconds. If the electrodes are slow to stabilize, follow the Chloride Sensing Electrode Cleaning Procedure on page 30.

Note: Electrodes must be calibrated first and sloped second; errors result if this order is reversed.

C) Chloride measurement

Two conditions are necessary for accurate results. A sufficient amount of product must be taken to be representative of the production batch. The material must be blended well to ensure that homogenized samples contain representative amounts of chloride. Refer to Section 10—Tips and Techniques on page 33.

1. Homogenize the sample, if necessary.
2. Weigh 1 to 2 g of homogenized sample into a glass beaker or flask.
3. Record the sample weight to three significant figures (for example, 1.43 g).
4. Add 100 ±0.5 mL of Chloride Ready-to-Use Reagent.
5. Stir or wet blend for approximately 1 minute to release the chloride.
6. Transfer 40 mL of the blended sample into the RINSE and SAMPLE containers.
7. Immerse both electrodes into the RINSE solution container, and gently swirl the solution to guarantee maximum solution contact.
8. Immerse both electrodes into the SAMPLE solution container, and gently swirl.
9. Allow the digital display readout to stabilize for 1 to 2 minutes, and record the value.

Note: The first sample measured after standardization may take longer to stabilize due to differences between standard and sample matrices.

10. Multiple samples may be tested without repeating the chloride standardization procedure. Standardization may be required after 10 to 20 samples; frequency will depend on sample conditions and time between measurements.

D) Analysis

The meter reading displays the concentration of the test solution in the same unit of measure as the calibration solution. For the concentration of the ion in the sample, the recorded sample weight must be considered. To calculate the concentration of the homogenized sample, the meter reading must be divided by the sample weight. Refer to Table 5.

$$\text{Sample concentration} = \frac{\text{Meter reading}}{\text{Sample weight (g)}}$$

Table 5.

Calibration Solution p/n	Measurement Units
82518	(mg/g) chloride
82558	wt % salt

Chloride electrode maintenance

A) Storage

For optimal performance, store the Chloride Sensing Electrode dry, and the Reference Electrode in Chloride Calibration Standard. Rinse the sensing electrode with deionized or distilled water, and store it dry and out of direct sunlight. For long-term storage, rinse the reference and sensing electrodes with distilled water, and store dry with the shipping cap on. Do not use laboratory cleaning solutions. Excessive temperatures may distort the electrode barrel, and should be avoided.

NEVER STORE THE REFERENCE ELECTRODE IN DISTILLED WATER. Prolonged exposure to distilled water disturbs the distribution of electro-active chemicals in the pores of the ceramic rod. Subsequent measurements will likely drift and develop noise. If the reference electrode has been stored in distilled water, performance can potentially be restored by soaking it overnight in Chloride Calibration Standard.

B) Cleaning

Sensing Electrode: Visual inspection of the tip of the Chloride Sensing Electrode may show a layer of fat and grease build-up, resulting in slow electrode response. Cleaning of the Chloride electrode is restricted to washing the barrel and sensing membrane in distilled/deionized water, and wiping with a clean tissue or lab wipe.

Reference Electrode: The Chloride Reference Electrode generally never needs cleaning, except to remove lumps of fats, grease, or sample material. These may be removed by wiping with a lab wipe dampened with DI water. NEVER use etchant or cleaning compound on the Chloride Reference Electrode, as this will damage the sensing tip.

C) Regeneration

Sensing Electrode: With time, the chloride sensing surface will need to be regenerated by polishing with Chloride Electrode Cleaning Compound. The following procedure should restore sensitivity. Standardization is required after regeneration.

1. Wet the sensing surface with DI water.
2. Moisten a soft, lint-free cloth with DI water.
3. Place a small amount of cleaning compound on the damp cloth.
4. Gently rub the sensing surface in a circular motion for approximately 30 seconds.
5. Rinse with DI water to remove any remaining Cleaning Compound.

Note: If calibration is still not possible, electrode replacement is necessary.

Reference Electrode: Chloride Reference Electrodes are designed to be very low maintenance. Every six months, the outer fill solution should be replaced.

1. Unscrew the outer barrel.
2. Empty the fill solution, and wash the barrel with DI water.
3. Fill the barrel to the halfway mark with Chloride Reference Fill Solution.
4. Gently screw the outer barrel back onto the Chloride Reference Electrode.
5. Soak in Calibration Standard for one hour.
6. Standardization is required after regeneration.

Note: If response times remain slow or have drift or noise, electrode replacement is necessary.

Section 9—Concentrates Overview

Reagent Concentrates are economical to purchase, provide for efficient space savings, and are easily diluted with water to prepare their Ready-to-Use (RTU) Reagent Solution counterpart. Each 20 L concentrate provides over 150 L of RTU Reagent.

Analyte	Reagent Concentrate p/n	RTU Reagent p/n
Sodium/Potassium	82507-Q, 82507-G, 82507-5G	82506-G, 82506-5G
Calcium	82570-G, 82570-5G	82571-G, 82571-5G
Chloride	82550-G, 82550-5G	82551-G, 82551-5G

Further streamline RTU reagent preparation with the Agilent Omnijet dispenser (p/n 54000). Specifically configured for use with the 4 L bottle, this variable-volume repipet maintains a closed reagent system, enables rapid and accurate solution dispensing, and eliminates the need for additional glassware.

Components and supplies

1. Reagent Concentrate, mixed well
2. Empty 4 L plastic reagent bottle and cap
3. Omnijet dispenser or 500 mL Class A volumetric glassware
4. Distilled/deionized water containing <0.1 ppm Na⁺

Dilution procedure

Note: The Reagent Concentrate contains a surfactant that foams when agitated. The following sequence will reduce foaming and eliminate any associated inconvenience and volume error.

1. Fill the empty reagent bottle with approximately 2.5 L of distilled/deionized water.
2. Dispense 500.0 ±5 mL of Reagent Concentrate into a reagent bottle.
3. Add additional distilled/deionized water to bring the final volume to 3.8 L.
4. Cap tightly and mix thoroughly.

Section 10—Tips and Techniques

Homogenization

Accurate measurement is dependent on homogeneous and representative sampling. Completely blend the test sample to ensure that any clumps or semisolids are completely incorporated (it is best to avoid foaming). This releases the ionic constituents for measurement. Certain blending techniques are more effective for different food samples:

- **Food processor:** Solids such as meats or vegetables without liquids
- **Coffee grinder:** Dry foods such as crackers or feeds
- **Food blenders:** Liquids with solids such as soups

Electrode response

Membrane-based electrodes may become slow to respond, drift, or slightly less sensitive over time. Soaking in Regenerating Solution will help displace ion inhibitors that gradually accumulate in the membrane. Soaking times may vary; up to 24 hours may be required. A minimum of 20 minutes soaking in Calibration Solution post regeneration is also advised. Regeneration will not fix problems associated with ionophore leaching or differential leaching of ionophore and anion inhibitors. Ionophore displacement is an unavoidable result of electrode aging, and electrode replacement is required.

Negligible changes in meter readings when transferred between calibration and sloping solutions can be the result of pinholes in the sensing membrane of the electrode. This cannot be fixed, and electrode replacement is required.

Erratic readings

If unstable readings are observed, particularly when working around the meter, static electricity buildup within the system is a likely cause. To confirm, wave a hand toward the meter and see if the readings fluctuate, then settle. Low humidity environments, synthetic fabrics, latex gloves, and moving the electrodes up and down the electrode holder rod can cause static build-up. To discharge the static:

- First, place the electrodes in the holder.
- Then, place one hand on the BNC connector on the back of the meter.
- Using the other hand, connect the electrodes.

It is also helpful to configure the electrodes so that the reference electrode is slightly below the sensing electrode. Therefore, when submersing the electrodes into the calibrating solution, the reference electrode enters first.

Measurement accuracy

Measurements are most accurate if the meter readings fall between the cal and sloping solution or between 5 and 200. If outside this range, sample weight can be adjusted, or predilution used. For example, most food samples use 1 to 2 g, but spice mixes and soup concentrates might require a predilution. Adjustments in the calculations need to be made if sample weight or dilutions are used.

Section 11—Troubleshooting

The Agilent Model 123 does not contain any user serviceable parts. There are, however, a number of simple tests to establish whether a problem lies with the Model 123 meter, the electrodes, the connections, or the technique in use by the operator.

Symptom	Possible Cause(s)	Action
Model 123 totally blank or no digits on the display are showing	Power not switched on	Switch power on
	Agilent Power Adapter not plugged in	Plug in Agilent Power Adapter
	Battery needs replacing	Replace battery
Digital display noisy	Sensing and/or reference electrode(s) not in solution	Make sure electrodes are immersed in solution
	Electrodes not plugged into proper jacks	Plug electrodes into proper jacks
	Mode Switch in wrong position	Set Mode Switch to proper setting
	Noise induced by magnetic stirrer	Remove magnetic stirrer
	Electrical noise from machinery in area	Move system to quieter area or remove machinery. Connect a ground wire from Model 123 case to a ground, metal water pipe, or equivalent
	Defective sensing or reference electrode	Replace electrode
	Very wet or highly humid environment	Move system to clean, dry area
Digital display readout stays at or near calibration value (for example, pH7, 100 ppm Na, 10 wt% Salt, 10 mgCl/g, and so forth) Cannot slope the electrodes. Little or no change in display value with changes in the concentration of sensed ion	Defective electrode	Replace electrode
	Wet or contaminated electrode connectors and/or Model 123 jacks	Carefully clean connectors and/or jacks with Distilled/deionized water and let dry for several hours
	Defective Model 123	Contact Agilent for service
Cannot standardize electrodes: insufficient Cal and/or Slope range or display remains over range	Calibration, Range, and/or Mode Switches incorrectly set	Check settings; set properly
	Incorrect or contaminated standards used for calibration and/or sloping	Use correct standards. Use fresh bottles of standards
	Electrode connector(s) and/or Model 123 jacks wet or contaminated	Carefully clean connectors and/or jacks with distilled/deionized water and let dry for several hours
	Electrode(s) defective	Replace electrodes
Display over range only with sample measurement	Calibration, Range, and/or Mode Switches incorrectly set	Check settings and set properly
	Sensing and/or reference electrode not in solution	Ensure both electrodes are immersed
	Electrodes not plugged into proper jacks	Plug electrodes into proper jacks
	Concentration of sensed ion (Na, Cl, K, etc.) in sample is too high	Set Range Switch to higher range if possible. Otherwise, dilute sample
	Calibration and/or Slope controls shifted or improperly set during calibration	Restandardize the system
	Defective electrode(s)	Replace electrode(s)
	Reference electrode empty	Fill outer barrel of reference electrode with the proper fill solution
Digital display will not stabilize	Air bubble present in either sensing electrode or reference	Gently tap sensor to release bubble

Section 12—Regulatory Compliance

CE compliance

The Agilent 123 meter complies with European Standards and EC Directives:

Electromagnetic Compatibility: EMC (2014/30/EU)

Low Voltage Electrical Safety: LVD (2014/35/EU)

RoHS Directive (2011/65/EU, including all amendments currently in force)

Packaging Directive (2013/2/EU)

WEEE Directive (2012/19/EU)

Declaration of Conformity (DoC) available online at www.agilent.com

Note: Modification of this instrument in any manner will void this certification. The owner/operator is responsible to ensure that no modifications are installed as the device as tested in accordance with all EU requirements may not function properly as intended.

Disposal

Please consider the environment when disposing of the instrument and packaging materials. Please recycle all environmentally friendly waste. Directive 94/62/EC limits the total concentration of four heavy metals to less than 100 ppm. Agilent meet these requirements. Please contact your local government agency or facility operator for the proper disposal of the instrument, power supply, and battery.

Safety, EMC, and Quality

Conforms to the International Electrotechnical Commission (IEC) 61010-1 safety standard.

Conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1, Class A
- IEC/EN 61326-1

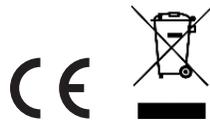
This ISM device complies with Canadian ICES-001(A).

Cet appareil ISM est conforme a la norme NMB-001(A) du Canada.

Class A EMC certification

This equipment has been evaluated for its suitability for use in a commercial environment. When used in a domestic environment, there is a risk of radio interference.

Designed and manufactured under a quality system registered to ISO 9001.



Request a meter evaluation

Email chem-standards-support@agilent.com

www.agilent.com/en/product/chemical-standards

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