User instructions

Sodium (Na^+) Ion Selective Electrode: Model ISENa38101 or ISENa38103 Electrode

Safety Information

Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*
	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.

Overview

The ISENa38101 or ISENa38103 electrode is a refillable combination sodium electrode with a built-in temperature sensor. The ISENa38101 or ISENa38103 electrode is available with a 1 or 3 meter cable and is intended for laboratory use. The electrode measures sodium concentration in water samples. A 59 mL bottle of 0.02M NH_4Cl Electrode Filling solution is included with the electrode.

Specifications

Note: *Specifications are subject to change without notice.*

Specification	Details
Electrode type	Digital combination electrode with a double junction, refillable junction reference and a built-in temperature sensor
Electrode resistance	< 800 Mohms at 25 °C
Range	0.023 mg/L ($1x10^{-6}$ M) to 23,000 mg/L (1 M) Na^+
Sample pH range	pH 4 to 14, must be adjusted to > pH 9 per Sodium ISA
Linear region	1.4 mg/L to 23,000 mg/L
Slope	-59 mV/pNa (98 to 103% at 25 °C per nernstian theoretical value)
Operating temperature range	0 to 50 °C
Storage temperature range	5 to 40 °C
Junction	Double ceramic porous pin
Reference type	Ag/AgCl
Fill solution	0.02M NH_4Cl
Response time in linear region	1 to 2 minutes in sample concentration > 1.4 mg/L
Minimum sample volume	25 mL
Dimensions	Diameter: 12 mm, Length: 103 mm, Total length: 220 mm, Cable length: 1 or 3 meter
Cable connection	Digital output and connector compatible with HQd meters
Ionic strength adjusters	Hach sodium ISA
Recommended standard solutions	10, 100, and 1000 mg/L Na^+ standard solution

Preparation for use

1. Remove the electrode soaker bottle from the electrode by loosening the soaker bottle cap.
2. Remove the tape from the filling-hole and the label from the electrode body.
3. Install the filling-hole cap by sliding it over the filling-hole. Close the filling-hole cap when not in use, and open when filling and during measurements.
4. Rinse the reference junction and glass bulb with Ionic Strength Adjustor (ISA) rinse solution (refer to ISA rinse solution preparation on page 8). Blot dry with a lint-free cloth.
5. If the electrode will not be used immediately, fill the soaker bottle halfway with prepared storage solution (refer to Storage solution preparation on page 8). Loosen the soaker bottle cap and push to install the soaker bottle on the electrode. Tighten the soaker bottle cap to secure. Solution is initially included within the electrode soaker bottle.

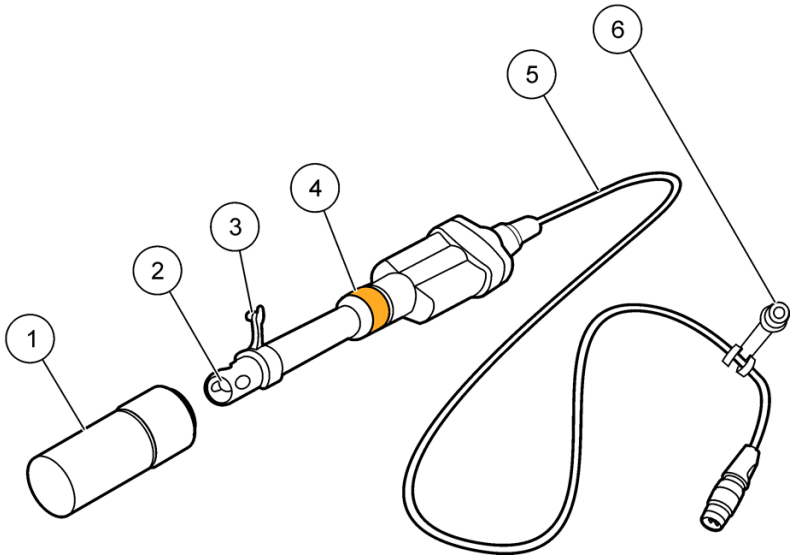


Figure 1 Electrode overview

1	Electrode soaker bottle	**4**	Filing-hole and tape
2	Reference junction, glass bulb and temperature sensor	**5**	1 or 3 meter cable
3	Filling-hole cap	**6**	Electrode soaker bottle holder

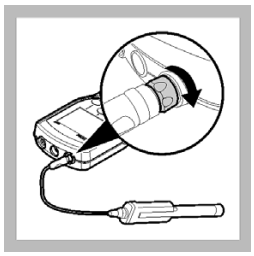
Calibration

Before calibration

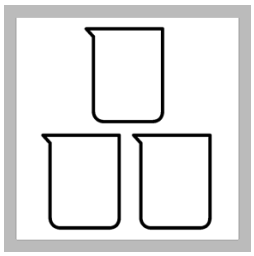
Note the temperatures of the standards during calibration. Temperatures between calibration standards should be kept within ± 1 ºC for optimal results.
The electrode must have the correct service-life time stamp. **Set the date and time in the meter before attaching the electrode.**
It is not necessary to recalibrate when moving a calibrated electrode from one HQd meter to another if the additional meter is configured to use the same calibration options. If the additional HQd meter uses different calibration options (e.g. standard calibration routine), calibrate the electrode or change the method settings/select a different method.
To view current calibration, select **DATA LOG** key, **View Probe Data**, then **View Current Calibration**.
If any two probes are connected, push the **UP** or **DOWN** arrow to change to the single display mode and show the **Calibrate** option.
Use an electromagnetic stirrer and stir samples at a moderate rate. Avoid resting the electrode on the bottom or sides of the container.
If a calibration error occurs, recalibrate using fresh, high quality standard solutions. Refer to Troubleshooting on page 12.
The filling-hole must be open for the proper flow of the filling solution.
If custom calibration or measurements settings are desired, a new method can be created by accessing the **ISENa381 Settings** menu.

Calibration notes

- Probes are initially calibrated at the factory. However, regular calibration by the user is recommended for the best measurement accuracy.
- Open the filling-hole cap to allow proper flow of filling solution when in use.
- Additional standard sets along with the minimum number of calibration points can be selected in the ISENa381 Calibration Options.
- The calibration is recorded in the electrode and the data log. The calibration is also sent to a PC, printer or flash memory stick if connected.
- Make sure the filling solution is above the sample level (Figure 2).
- Select Skip to omit a standard from the calibration routine. The minimum number of standards must be met for the Skip option to be displayed.
- The user must begin with the lowest concentration during calibration. This reduces carry over contamination to give optimal results.
- For measurements below 1 ppm (10^{-5} M), plastic lab-ware should be used.
- All samples should be stirred consistently as the electrode potentials are dependent on such stirring conditions.
- Always rinse the electrode with an ISA rinse solution between measurements and blot dry. **Never use only deionized water**. Refer to ISA rinse solution preparation on page 8.



1. Connect the electrode to the meter.



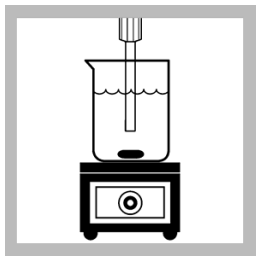
2. In three separate beakers or appropriate containers prepare 25-mL standard solutions of 10, 100 and 1000 mg/L Na^+ or use appropriate standards that bracket your application range as the standard set.



3. Add the contents of one sodium ionic strength adjustment (ISA) powder pillow to each standard.



4. Select **Calibrate**. The display will border the standard value that is to be read from the standard set.



5. Place the electrode in the 10 mg/L Na^+ solution (containing the ISA) or the displayed standard value on the meter calibration screen (bordered on display). Add a stir bar and place the beaker on an electromagnetic stirrer and stir at a moderate rate.



6. Press Read. The display will show Stabilizing...and lock on the value when complete. The display will highlight the standard value that has just been read and proceed to the next standard value.



7. Rinse the probe with ISA rinse solution (refer to ISA rinse solution preparation on page 8). Blot dry. Place the probe in the next order higher standard solution and repeat steps 5 and 6 and press Read for the 100 and 1000 mg/L Na^+ standard solutions or appropriate standards used.



8. When the minimum number of points are collected, the display will show **Done**. Continue calibration with the method specified calibration standards (up to the maximum number specified in the Na^+ method) until all have been read or select **Done** to review the calibration summary.



9. The display will show the calibration summary. Select **Store** to accept the calibration and return to the measurement mode. The calibration is recorded in the electrode and the data log.

Run check standard

The run check standard feature validates instrument performance between sample measurements. Use the run check standard feature for periodic or user-defined interval measurement of a traceable standard solution. Set the criteria for check standards from the ISENa381 settings menu.

Note: *Access control must be off or a valid password entered before any of the check standard method options can be changed.*

1. Select **Run Check Standard** from the Meter Options menu.

   Note: *Select the appropriate sensor if two probes are connected to the meter.*

2. Obtain the buffer solution specified in the display.
3. Place the electrode in the buffer solution and select **READ**. The display will show **Stabilizing...** and a progress bar as the electrode stabilizes in the standard. The display shows the value of the check standard and either **Check Standard Passed** or **Check Standard Failed**.

If the display reads **Check Standard Passed**, the check standard measurement is within the accepted limits defined by the administrative user. Select **Done** to proceed with sample measurement.

If the display reads **Check Standard Failed**, the measurement is outside of accepted limits defined by the administrative user and a recalibration is suggested. If the acceptance criteria is set to **Cal Expires on Failure: Yes**, the display will show the calibrate icon with a question mark until the electrode is recalibrated. Recalibrate the electrode to correct the status indicator (refer to Calibration on page 3).

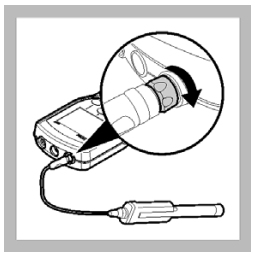
Measurement (Direct Method)

Before measurement

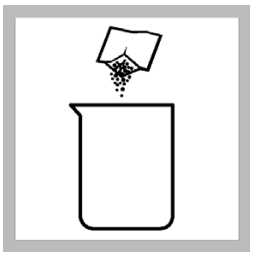
The electrode must have the correct service-life time stamp. **Set the date and time in the meter before attaching the electrode**.
The probe is factory calibrated in the range of 10 to 100 mg/L as Sodium (Na^+) and ready for use. For applications that require greater accuracy, precision and/or different calibration points for different Na^+ concentration ranges, perform a user calibration. Routine calibrations are required.
If complete traceability is required, enter a sample ID and operator ID before measurement.
For measurement errors, refer to Troubleshooting on page 12.
Use an electromagnetic stirrer and stir samples at a moderate rate. Avoid resting the electrode on the bottom or sides of the container.
The filling-hole must be open during measurement for the proper flow of the filling solution.
The filling solution must be above the sample level during measurement. Refer to Figure 2.

Measurement notes

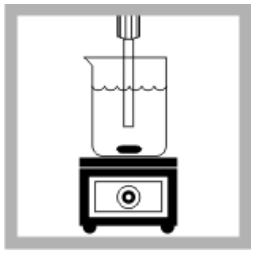
- Data is stored automatically in the data log when **PRESS TO READ** or **INTERVAL** is selected in the **Setup Measurement Mode**. If **Continuous** is selected, data will be stored only when the **STORE** key is pushed.
- Always rinse the electrode with a ISA rinse solution between measurements and blot dry. **Never use only deionized water**. Refer to ISA rinse solution preparation.
- Response times with smaller concentration changes generally will be longer and can be minimized by proper stirring and conditioning. Experiment to determine the proper stir rate if necessary.
- Note the temperatures of the samples during measurement. Temperatures between calibration standards and samples should be kept within ±2 ºC for optimal results.



1. Prepare the electrode for use. Refer to Preparation for use on page 2. Connect the electrode to the meter.



2. Prepare 25-mL of the sample(s) in beakers or appropriate containers. Add one sodium ionic strength adjustment (ISA) powder pillow to each before measurement.



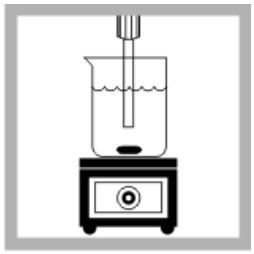
3. Place the electrode in the sample. Make sure the filling solution is above the sample level. Refer to Figure 2 on page 6.



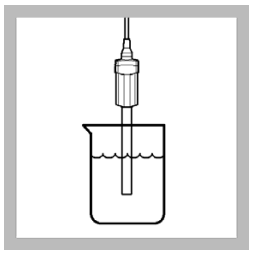
4. Select **Read**. The display will show **Stabilizing...** and a progress bar as the electrode stabilizes in the sample. If required by the application, also record the sample pH and temperature.



5. Rinse the probe with ISA rinse solution. Refer to ISA rinse solution preparation on page 8. Blot dry with a lint-free cloth.



6. Repeat steps 2 to 5 for additional measurements



7. Between uses, place the electrode in 25 mL sodium standard (containing Sodium ISA) that is similar in concentration to the samples to be analyzed. When finished, store the electrode. Refer to Storage on page 7.

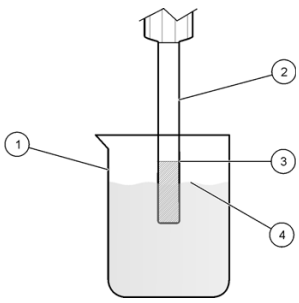


Figure 2 Measurement method

1	Sample container	**2**	electrode body	**3**	Filling solution level	**4**	Sample level

Interferences

The glass membrane responds to sodium as well as other ions, so interferences exist. Typically, electrode response to another ion increases the potential, causing a positive error. The response to other ions can be semi-quantitatively determined through the Nicholsky equation, an extended Nernst equation:

$$E = E^{\circ} + (RT/(zF))\ln[aN_a + KN_ax \times ax]$$

Where

- ax = the activity of the interfering ion
- KN_ax = the selectivity coefficient for the interfering ion relative to sodium

If the electrode is exposed to high levels of interferences, soak the electrode in 1 M sodium chloride to help remove the absorbed ions from the glass membrane. The major interferences are silver and hydrogen ions. Hydrogen ion concentration is reduced by the ISA which raises the pH. If the samples are extremely acidic, or have a high buffer capacity, check that the sample pH is above 9 after adding ISA. If necessary, ammonium hydroxide (NH_4OH) can be added to the calibration standards and samples in equal proportions to raise the pH. The ammonium hydroxide (NH_4OH) will not affect the measurement due to the low selectivity coefficient of NH_4^+ ion.

The ions that will interfere in sodium determinations are given for molar concentrations of all ions. The smaller the value of the selectivity coefficient results in lower interference. Approximate values of selectivity constants (K) are ordered from highest to lowest:

Interferences	
Ag+ (>1000)	H+ (20) - reduced by ISA addition
Li+ (0.01)	K+ (0.001)
Ti+ (0.0002)	—

Maintenance

Storage

Note: *For optimal performance, the reference junction must not dry out.*

Short-term storage

For short term storage, store the electrode in 25 mL of 100 mg/L Na^+ standard solution with one Sodium Ionic Strength Adjustor (ISA) powder pillow (0.4g).

Long-term storage (> 4 weeks)

1. Rinse the electrode with ISA rinse solution (refer to ISA rinse solution preparation). Blot the electrode with a lint-free cloth.
2. Fill the electrode soaker bottle halfway with 0.02M NH_4Cl Electrode Filling Solution.
3. Install the electrode soaker bottle. Make sure the storage solution in the cap completely covers the glass bulb.
4. Install the filling-hole cap.

Note: *The electrode must be conditioned again in 25 mL of 100 mg/L Na^+ standard solution with one Sodium Ionic Strength Adjustor pillow (0.4 g) for at least 8 hours prior to use.*

Clean the probe

For general contaminants:

- Rinse the electrode with ISA rinse solution and blot dry with a lint-free cloth. Refer to ISA rinse solution preparation.
- Soak the glass bulb for 12 to 16 hours in Electrode Cleaning Solution.

- Rinse or soak for 1 minute in 25 mL of 100 mg/L sodium standard (containing Sodium ISA).
- Calibrate and test the electrode again following measurement procedures.

Fill the electrode

1. Open the filling-hole cap.
2. Remove the cap from the tip of the filling solution bottle.
3. Insert the dispensing tip into the filling-hole and position downward.
4. Slowly squeeze the filling solution container and fill the electrode.

Note: *Fill the electrode completely for optimum performance.*

5. Close the filling-hole cap until use and save the filling solution container and cap for later use.

Note: *If the dispensing tip becomes clogged, remove dispensing tip and soak in warm water. Dry thoroughly and assemble.*

Storage solution preparation

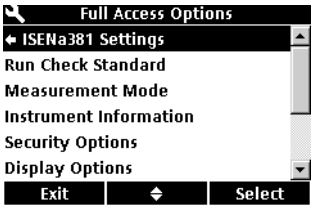
To prepare, add one Sodium Ionic Strength Adjustor (ISA) powder pillow (0.4 g) to 25 mL of 100 mg/L Na^+ standard solution.

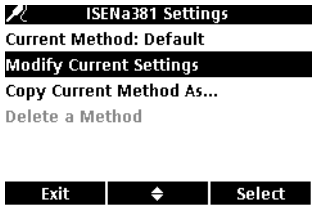
ISA rinse solution preparation

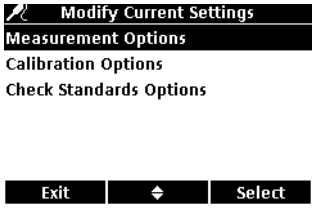
To prepare, add one Sodium Ionic Strength Adjustor (ISA) powder pillow (0.4 g) to every 25 mL of deionized water. Add prepared solution to rinse bottle and use as needed.

Advanced operations

Parameter-specific settings can be changed through the Full Access Options menu. Details about menu navigation, available options and how to change them are given in the screens, tables and procedures throughout this section.







The settings that can be changed are shown in Table 1.

Table 1Parameter-specific settings

Setting	Options
Measurement options	• Units • Significant digits • Auto stabilization • Stability criteria • Upper and lower range limits
Calibration options	• Standard set • Calibration units • Minimum calibration points • Slope limit • Calibration reminder

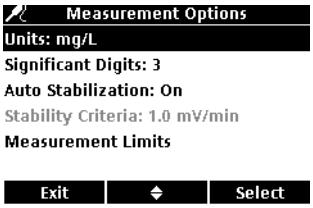
Table 1Parameter-specific settings

Setting	Options
Check standard options	• Standard • Check standard reminder • Acceptance criteria

Change measurement options

Methods are groups of default or user defined settings relevant to specific applications. If the meter is set to the default method and the Modify Current Settings option is chosen, a prompt will display to name the method after changes are entered. The settings are saved with this name to distinguish them from the default method settings, which cannot be changed. A saved method can be used instead of repeatedly adjusting individual settings.

Changes made to a user defined method are automatically saved with the existing name. Multiple methods can be saved for the same probe.



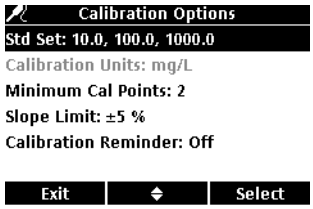
1. Make sure an electrode is connected to the meter.
2. Push the **METER OPTIONS** key and select (ISENa381) Settings.
3. Select Modify Current Settings.
4. Select Measurement Options.
5. Update the settings. Refer to Table 2.

Table 2 Measurement options settings

Setting	Options	Description
Units	mg/L (default) µg/L g/L g/kg mol/L mmol/L mol/kg % ppm ppb	Select the preferred unit for ISE measurements. ***Note:*** *mV units are shown when the detailed display is selected.*
Significant digits	2 3 (default) 4	Significant digits are the digits of a number that are known with certainty or have meaning that contributes to accuracy.
Auto stabilization	On (default) Off	The default stability drift rate is 1.000 mV/min. Lower stability criteria will require longer stabilization times, but the measurement will be more precise. Higher stability criteria will require shorter stabilization times, but the measurements may be less precise.
Stability criteria	0.1 - 9.9 mV/min	Selectable
Measurement limits	Lower limit (default: 0.023 mg/L) Upper limit (default: 14.00 mg/L)	The measurement limits can be set to match the acceptable values for the sample. When the measurement is above the upper limit setting or below the lower limit setting, the meter will show an “Out of limits” message. This message can alert the user to a potential problem with process conditions.

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
7. Push **EXIT** until the meter returns to the measurement mode.

Change calibration options



1. Make sure an electrode is connected to the meter.
2. Push the **METER OPTIONS** key and select (ISENa381) Settings.
3. Select Modify Current Settings.
4. Select Calibration Options.
5. Update the settings. Refer to Table 3.

Table 3 Calibration options settings

Settings	Options	Description
Standard set	10.0, 100.0, 1000.0 - mg/L 100.0, 1000.0 - mg/L Custom Standard Set (Standard set values will appear on Calibration Options screen. Refer to Table 4.) ***Note:*** *Only the minimum cal points must be satisfied for the* ***DONE*** *key to appear.*	Temperature compensated standard sets used for calibration. Standard set values will appear on Calibration Options screen. Custom standard sets are characterized at 25 °C. A custom standard can also be chosen by selecting **Custom buffer**.
Calibration units	mg/L (default) µg/L (available only for custom calibration set) g/L g/kg mol/L mmol/L mol/kg % ppm ppb	Select the preferred unit for ISE Calibration.
Minimum Cal points	2 or 3	Minimum number of points required before calibration can be completed.
Slope limit	Range: 1% to 10% (acceptable calibration slope criteria)	Slope must fall within set limits for successful calibration. A narrow tolerance gives a more accurate calibration.
Calibration reminder	Reminder Repeat: Off (default), 2 h, 4 h, 8 h, 2 d, 5 d, 7 d	Meter will make an audible sound when calibration is due and repeat the sound at selected interval.
	Expires: Immediately, Reminder + 30 min (default), Reminder + 1 hr, Reminder + 2 hr, Continue Reading	Calibration expires after specified time. ***Note:*** *Meter cannot be used to read samples after calibration has expired unless Continue Reading is selected.*

Table 4 Custom buffer sets

Buffer set values	Options	Description
Std1 Std2 Std3 Std4 Std5	10.0 mg/L	Pre-set temperature compensated standard values.
	100.0 mg/L	
	1000.0 mg/L	
	2299.0 mg/L (0.1 M NaCl)	
	Custom	Custom standard value. Custom standard values are not temperature compensated.
	No standard	Standard is undefined when this option is selected.

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
7. Push **EXIT** until the meter returns to the measurement mode.

Change check standard options



1. Make sure an electrode is connected to the meter.
2. Push the **METER OPTIONS** key and select (ISENa381) Settings.
3. Select Modify Current Settings.
4. Select Calibration Options.
5. Update the settings. Refer to Table 5.

Table 5 Check standard options settings

Settings	Options	Description
Standard	10.0 mg/L 100.0 mg/L (default) 1000.0 mg/L 0.1 M NaCl Custom	Value for check standard. Standard value will appear on Check Standards Options screen.
Check Standard reminder	Reminder: On or Off (default) Allow Defer:Yes	Meter automatically displays check standard screen if reminder is on. Measurement of check standard can be delayed if set to Yes.
Acceptance criteria	Acceptance Limits: 1% to 20% Cal Expires on Failure:Yes or No	Values that check standard must fall within in order to pass. Calibration expires if check standard fails.

Table 5 Check standard options settings (continued)

Settings	Options	Description
Standard units	mg/L (default) µg/L g/L g/kg mol/L mmol/L mol/kg % ppm ppb	Select the preferred unit for ISE check standard.
Standard value (for Custom standard option)	Enter standard value using up/down arrow keys	Value for the custom check standard.

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
7. Push **EXIT** until the meter returns to the measurement mode.

Troubleshooting

Message or symptom	Possible cause	Action
Probe not supported	Software not updated	Update the HQd software to the newest revision at www.hach.com/SoftwareDownloads. Refer to the HQd Series meter manual.
	HQd meter does not support IntelliCAL probe	Contact a Technical Support Representative.
Connect a probe or probe requires service	Electrode not connected properly	Disconnect, then connect the electrode. Tighten the locking nut.
	Software not updated	Update the HQd software to the newest revision at www.hach.com/SoftwareDownloads. Refer to the HQd Series meter manual.
	Large number of methods stored on electrode.	Continue to let electrode connect. Do not disconnect electrode.
	Damaged electrode	Verify connectivity with another electrode or meter to confirm isolated issue with probe. Contact a Technical Representative.
mV reading is the same for all solutions	Soaker bottle not removed	Remove the soaker bottle.
	Electrical issue	Contact a Technical Support Representative
Standard not recognized error	Soaker bottle not removed	Remove soaker bottle.
	Incorrect or contaminated buffer solution	Use fresh standard solution as specified in the method
	Contaminated filling solution	Replace the filling solution.
Slow response time	Tape not removed from the filling-hole	Remove the tape.
	Contaminated glass sensor	Clean the electrode.
	Contaminated filling solution	Drain and replace the filling solution with fresh solution.
	filling-hole cap closed	Open filling-hole cap while in use.
	Low sample temperature or temperature difference between samples	Check the sample temperature. The lower the temperature or the greater the difference of temperatures between samples, traditionally the longer the response time.

Troubleshooting (continued)

Message or symptom	Possible cause	Action
Slope out of range (refer to Checking electrode response on page 14)	pH is too low	Verify the ph is > 9 after each ISA addition
	Ionic strength adjustor (ISA) not used	Add ISA to each sample and standard
	Insufficient conditioning	Condition for at least 8 hours in storage solution. Refer to Storage solution preparation on page 8.
	Damaged electrode	Contact a Technical Support Representative
	Incorrect standards	Calibrate using freshly prepared standards
	Contaminated glass sensor	Clean the electrode and recalibrate.
Drifting/inaccurate readings	Contaminated glass bulb	Clean the electrode.
	Clogged reference	Rinse reference junction with ISA rinse solution thoroughly and shake the electrode downward to remove any air bubbles.
	Improper storage conditions/dehydrated glass bulb	Clean or condition the electrode and attempt another calibration. The electrode may not function correctly if the electrode has been left dry for extended periods of time. Attempt to re-condition the glass sensor and reference junctions by allowing the electrode to soak in storage solution (containing Sodium ISA) for at least 8 hours prior to use.
	Stabilization criteria not optimized for the application	Adjust the stabilization criteria in the measurement options menu.
	Magnetic stirrers may generate sufficient heat to change solution temperature.	Place a piece of insulating material between the stirrer and beaker.
	Filling-hole cap closed	Open the filling-hole cap while in use
	Damaged electrode	Contact a Technical Support Representative
	Electromagnetic Forces (EMF) such as voltaic cells, thermoelectric devices, electrical generators, resistors and transformers	Avoid testing in areas where EMF is present.
	Colloidal and/or particulates in the filling solution.	Replace the filling solution, calibrate and retest.
	Air bubbles around inner reference electrode	Gently tap the electrode with hand or shake the electrode downward to remove any air bubbles.
Out of range	Measurement value is outside of range	Verify that the sample is within the range of the electrode.
Out of limits	Check standard value is outside of limits set in the current method	Verify that the standard is within the limits of the current method.
		Create another method that expands the acceptable limits.
	Measurement value is outside of measurement limits set in the current method.	Verify that the sample is within the limits of the current method.
		Create a new method with an expanded range.
Temperature out of range	Calibration temperature value is outside of range	Verify that the sample temperature is within the range of the electrode.
		Verify that the temperature sensor is working correctly.
	Measured temperature is outside the range of the electrode.	Verify that the standard temperature is within the range of the electrode.
		Verify that the temperature sensor is working correctly.
	Check standard temperature value is outside of range	Verify that the check standard temperature is within the range of the electrode.

Checking electrode response

To verify electrode response, measure the electrode potential (in mV) of two Sodium Standard Solutions one decade apart in concentration, bracketing the expected sample concentration. For example, use 10 and 100 mg/L Sodium Standard Solutions. The two solutions should have potentials (difference in mV readings) that are -59 mV apart at 25 ºC. Both solutions should be above 1.4 mg/L Na^+.

Checking accuracy of sample reading

To verify sample measurement accuracy, add a spike of Standard Sodium Solution with volumetric pipet. Use the following table and formulas to calculate the percent of recovery.

Typically a percent of recovery of 100% ± 5% is a good indication that the instrument, technique, and the sample are not contributing to measurement errors.

Measured sample concentration	Volume of standard to add	Concentration of standard
1 - 2 mg/L	0.5 mL	100 mg/L
3 - 6 mg/L	1.0 mL	100 mg/L
7 - 15 mg/L	0.3 mL	1000 mg/L
15 - 30 mg/L	0.5 mL	1000 mg/L
30 - 60 mg/L	1.0 mL	1000 mg/L

Percent recovery

Use the following formula to calculate the percent recovery when the sample volume is 25 mL:

$E = (C \times V_1) / V_2$

$R = (A / (E + S)) \times 100$

Where:

- S = mg/L of Na^+ in sample (before spike)
- C = concentration of standard used for spiking (mg/L)
- V_1 = spike volume (mL)
- V_2 = spike volume (mL) + 25 mL sample volume
- E = expected concentration of spike (mg/L)
- R = percent recovery
- A = actual reading on meter after spike (mg/L Na^+)

Replacement Parts

Description	Quantity	Item Number
IntelliCAL ISENa381 electrode, standard, with 1 m cable	1	ISENa38101
IntelliCAL ISENa381 electrode, standard, with 3 m cable	1	ISENa38103

Accessories

Description	Quantity	Item Number
Citizen PD-24 USB handy printer, 120 - 220 VAC	1	2960100
Color coded electrode clips (5 color coded sets)	10/pkg	5818400
Electrode soaker bottle	1	5192900
Electrode soaker bottle holder	1	5829800
Field kit (includes glove kit, 2 probe holders and 5 120 mL sample cups)	1	5825800
Hot plate stirrer, 7x7 in., digital, 115 VAC	1	2881600
Hot plate stirrer, 7x7 in., digital, 230 VAC	1	2881602
IntelliCAL standard probe stand	1	8506600
Meter stand	1	4754900
Printer paper for PD-24, thermal	5/pk	5836000
Protective glove kit for meter	1	5828700
Probe holder for HQd meter (IntelliCAL standard models only)	1	5829400
USB and AC power adapter for HQd meters (included w/HQ40d)	1	5826300
USB keyboard for HQd meters (must have 5826300)	1	LZV582
Standard probe holder	2	5829400

Consumables

Description	Quantity	Item Number
Electrode filling solution, 0.02M NH_4Cl	59mL	2965126
Electrode cleaning solution	1	2965249
Sodium ionic strength adjuster	100/pkg	4451569
Sodium standard solutions		
10 mg/L Na^+ standard solution (1 L bottle)	1	2835153
100 mg/L Na^+ standard solution (1 L bottle)	500 mL	2318149
1000 mg/L Na^+ standard solution (1 L bottle)	500 mL	1474949
Beaker, Griffin, low form, glass, 50 mL	1	50041H
Beaker, polypropylene, low form, 50 mL	1	108041

HACH Company World Headquarters

P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Tel (800) -227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com • www.hach.com

International customers:
Tel +001 (970) 669-3050
Fax +001 (970) 669-2932
intl@hach.com



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