Orion Star™ LogR Meter

User Guide

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S C I E N T I F I C

The specifications, descriptions, drawings, ordering information and part numbers within this document are subject to change without notice.

This publication supersedes all previous publications on this subject.

Table of Contents

Chapter I **Introduction**

Congratulations! You have selected an industry-leading Thermo Scientific Orion Star LogR series meter that is designed for electrochemistry measurements in the field or in the laboratory. The exclusive LogR technology allows you to obtain temperature-compensated readings directly from the pH electrode.

All meters include a temperature measurement function, which allows for LogR, automatic or manual temperature compensation of readings. These meters are available to measure pH (Cat. No. 3112000) or pH and ISE (Cat. No. 3115000) depending on the meter version you have. The pH measurement capability includes a mV/relative mV/ORP function. Built to meet the demands of busy, multiple user laboratory or plant environments, all Orion Star LogR series meters are microprocessor controlled, which aids in the delivery of accurate and precise measurements.

In addition to the benefits of LogR technology, Orion Star LogR pH and pH/ISE meters include memory for 1000 datalog points, and a new easier method for calibrating the LogR setting. These meters include autosampler capability and are compatible with the AutoTration™-500 autosampler. Refer to the AutoTration-500 user guide for information on operating the Orion Star meters with the autosampler.

Note: *Please read this user guide thoroughly before using your meter. Any use outside of these instructions may invalidate your warranty and cause permanent damage to the meter.*

Meter Features

To better meet the needs of users in environmental protection and control, food and beverage, pharmaceutical and consumer product laboratories, the Orion LogR series meters include these key features:

- **Password Protected Methods** – The meter will save up to ten custom measurements and calibrations for future reference. Password protection of each method eliminates any tampering with methods as multiple users access only the procedure most appropriate to their work.

- **AUTO-READ™** – The meter takes a measurement and automatically prints or logs data when the reading becomes stable. The measurement is frozen on the display until the user prompts the meter to take a new measurement.

- **Stirrer Control** – Control for the stirrer probe, Cat. No. 096019 (sold separately), which eliminates the need for additional stir plates and stir bars.

- **SMART STABILITY™ and SMART AVERAGING™** – Remove the guesswork by automatically compensating for measurement conditions and optimizing the meter response time.

- **Display Backlight** – When the meter is on, a quick press of ⏻ will turn the backlight on and off. When the meter is operating on battery power, the backlight will automatically turn off after two minutes to conserve power. When batteries are low, the backlight will no longer turn on.

- **Automatic Shutoff** – The meters will shut down after 20 minutes without a keypress. This maximizes battery power when the meter is being run on battery power.

- **Audible Signals** – The meter will beep whenever a key is pressed, providing immediate verification that the user's input was received.

An easy-to-use reference guide, attached to each meter, shows 2-point LogR temperature calibration (using ATC probe).

Chapter II **Display**

General Description

Throughout a given process, the display on an Orion LogR series meter provides temperature and calibration data. The temperature appears in the left, top corner of the display. The ✐ icon indicates that a calibration mode or calibration setup menu is active. The **man**, **2**, **4**, **7**, **9**, **10**, and **12** icons indicate which pH buffers were saved after a pH calibration is performed. The **setup** icon only appears when the meter is in setup mode. The ⚠ icon indicates an error condition and when it is displayed with the 🌡 icon, a calibration alarm or sensor quality issue exists. The **AR** icon indicates that the AUTO-READ measurement mode is active and is discussed in greater detail in the **Meter Setup** section.

Temperature

Calibration

pH
ORP
ISE (on Cat. No. 3115000)
Temperature

Resistivity of pH electrode (when LogR technology in use)

Temperature Compensation method (LogR, ATC or manual)
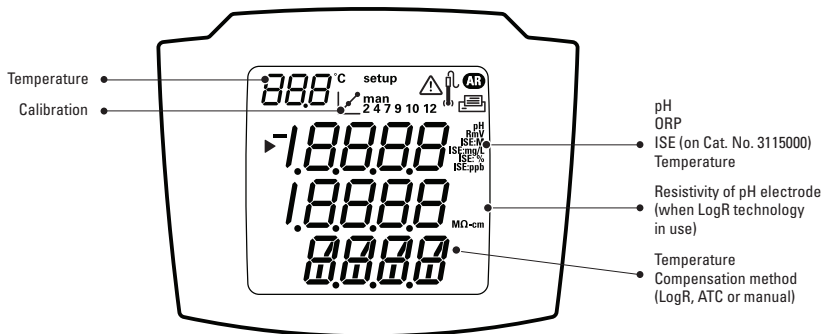
Measurement Unit Icons

In the measurement mode, the arrow icon on the left side of the display screen indicates the active line. Press $\triangle$ / $\triangledown$ to scroll through the measurement unit icons. If the LogR Temperature Reading and Compensation Setting is currently active, the resistance across the pH electrode bulb can be shown on the second line. Press to move the arrow icon to between the first and second lines and press $\triangle$ / $\triangledown$ to scroll through the measurement unit icons associated with the selected line.

A — pH, mV, relative mV, or ISE unit

B — Resistivity unit when LogR is in use
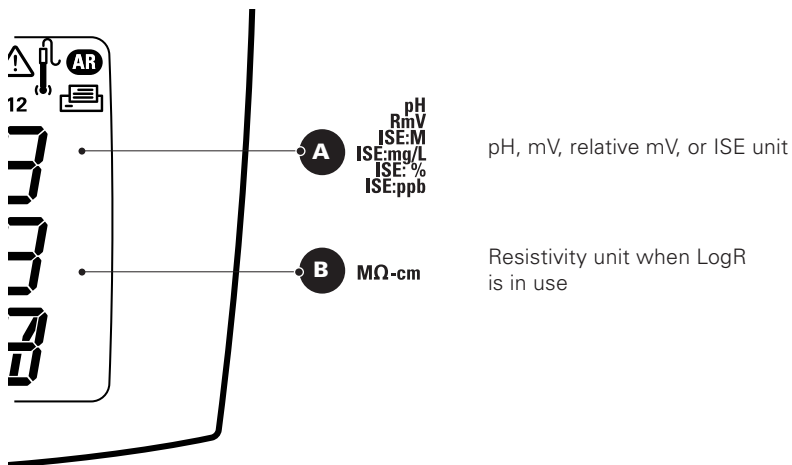
The units of measurement, which are displayed on the right side of the screen, will flash until the reading is stable.

Chapter III Keypad

General Description

The keypad layout is the same for the Orion Star LogR pH and pH/ISE meters.

Key Definitions

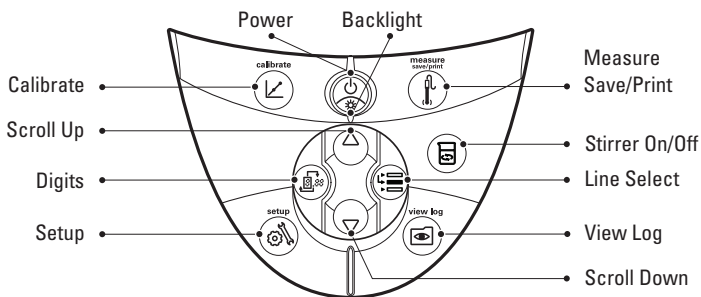| Key	Description	Key	Description
⏻	Turns the meter on, if the meter is off. Toggles the backlight on and off, if the meter is on. If the meter is on, hold down the key for about three seconds to turn off the meter.	△ ▽	Changes the measurement units of the selected line in the measurement mode. Changes the value on the selected line in the setup, methods and log view modes. Edits the value of the flashing digit for setup, password entry and calibration modes.
	Scrolls the arrow icon on left of screen among the three display lines, so the selected line can be modified as the options allow.		Selects the next digit to edit and moves the decimal point for setup, password entry and calibration modes.
⤲	Starts the calibration for the selected line in the measurement mode. If the arrow icon points to the top line and the displayed units are pH, pressing the key will start a pH calibration. Each time the key is pressed in the calibration mode, the meter will accept the calibration point and move to the next point until the maximum number of calibration points are reached.		Prints and logs a measurement in the continuous or timed measurement modes. Prints, logs and freezes the display when the reading becomes stable in the AUTO-READ measurement mode. Exits the setup menu and returns to measurement mode. Accepts the calibration and returns to measurement mode.
⚙	Enters the setup menu, starting with selected line in the measurement mode. If the arrow icon points to the top line and the displayed units are ISE, pressing the key will enter the ISE setup screen.		Enters the log view and download menu.
			Turns the stirrer on and off.

Chapter IV Preparation

Installing the Power Adapter

The universal power adapter that is included with your benchtop meter is the only power adapter recommended for use with this unit. The use of any other power adapter will void your meter warranty. The external electrical power adapter is rated to be operated at 100 to 240 VAC, 0.5 A, 50/60 Hz.

Based on your wall outlet, select one of the four plug plates provided (110 V, 220 V, 240V) and slide it into the grooves on the adapter. A click will be heard when the plug is properly in place.
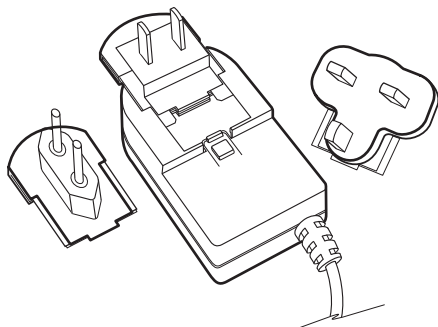
Connect the output plug of the power adapter to the power input on the benchtop meter. Refer to the diagram in the **Connecting the Electrodes** section.

Batteries can be installed in the benchtop Orion Star LogR series meters, so the meter setup settings are protected if the meter is disconnected from the wall outlet or a brief power outage occurs.

Installing the Batteries

Orion Star LogR series meters use four AA alkaline batteries. Do not use lithium or rechargeable batteries. Improper installation of non-alkaline batteries could create a hazard.

Note: *For benchtop meters, the installation of batteries is not required if the unit will always be connected to a power source via the universal power supply.*

1. Confirm that the meter is off and gently place the meter upside down on a clean, lint-free cloth to prevent scratching the LCD.

2. Remove the battery case cover.

3. Insert new batteries with the + side orientation as depicted in the battery compartment housing.

4. Replace the battery case cover.

5. Stored data, calibrations and methods will remain in the meter's nonvolatile memory when the batteries are being replaced. However, the date and time may need to be reset when the batteries are changed.
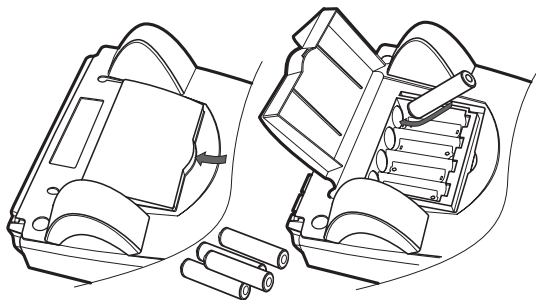
Connecting the Electrodes

Follow the diagram below to correctly connect electrodes and probes to the meter.

Meter Electrode Connections

Stirrer jack

Reference, pH, ORP or ISE

BNC, pH, ORP or ISE

8 pin miniDIN ATC

RS232

Ground

Power
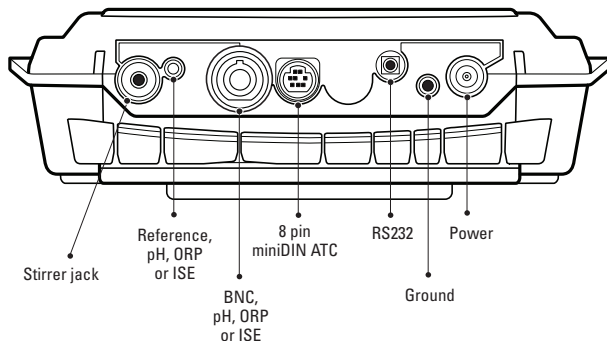
Meter Connections

• Use the BNC input to connect pH, ISE and ORP electrodes with a BNC or waterproof BNC connector.

• Benchtop meters have a reference input that is used to connect a separate reference electrode. Reference electrodes require an separate, appropriate sensing electrode for measurements.

• Use the 8 pin miniDIN input for automatic temperature compensation (ATC) probes.

• The stirrer jack can be used to connect the stirrer probe 096019, sold separately.

• Connect a printer or computer to the RS232 input using the appropriate cable.

Turning on the Instrument

With the power adapter attached or the batteries installed in the benchtop meter, press ⏻ to turn on the meter.

Press ⏻ when the meter is powered on to toggle the backlight on and off. The backlight will stay on until ⏻ is pressed.

To turn off the meter, press and hold ⏻ for about three seconds.

Meter Maintenance

For routine meter maintenance, dust and wipe the meter with a damp cloth. If necessary, a warm water or a mild water-based detergent can be used. Perform meter maintenance on a daily, weekly or monthly basis, as required by the environment in which the meter is operated.

Immediately remove any spilled substance from the meter using the proper cleaning procedure for the type of spill.

Chapter V Meter Setup

Setup Menu

To navigate the setup menu:

1. Press (⚙) to enter the setup menu.

2. Press (△) / (▽) until the desired setup option is displayed on the top line.

3. Press (☰) to move the arrow icon to the middle line.

4. Press (△) / (▽) until the desired setup option is displayed on the middle line.

5. Press (☰) to move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press (△) / (▽) until the desired option is displayed. To enter a numeric value for an option on the bottom line, press (△) / (▽) to adjust each digit and (▦) to move to the next digit. For example, to change the pH measurement resolution press (△) to scroll from 0.01 to 0.001 on the bottom display line.
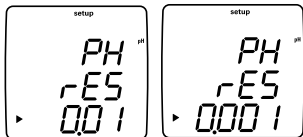
7. Press (☰) to move the arrow icon to the top line.

8. Repeat steps 2 through 7 to program a new setup option or press (🌡) to exit the setup menu and return to the measurement mode.

Note: *Refer to Appendix A for a description of the special setup menu features.*

Setup Menu Table – The following table is for the Orion Star LogR meter as you scroll though with the up ⏶ arrow. ISE information applies only to the Orion Star LogR pH/ISE meters, Cat. No. 3115000.

Top Line	Middle Line	Bottom Line	Setup Menu Description (default setting, method specific)
PH	rES	0.1, 0.01, 0.001	pH measurement resolution **(0.01, yes)**
PH	bUF	USA, EUr0	pH buffer set for automatic buffer recognition during calibration, USA buffers are 1.68, 4.01, 7.00, 10.01, 12.46 and EUrO buffers are 1.68, 4.01, 6.86, 9.18 **(USA, yes)**
ISE	rES	1, 2, 3	ISE measurement resolution in significant figures **(1, yes)**
ISE	Unlt	m, mgL, PEr, PPb, n0nE	ISE measurement units **(PPb, yes)**
ISE	rAng	L0w, HIgH	ISE concentration range for calibration stability criteria **(HIgH, yes)**
ISE	nLln	AUt0, 0FF	ISE automatic blank correction for low-level calibration **(AUt0, yes)**
dUE	PH	0 to 9999	pH calibration alarm value in hours, 0 is off **(0, yes)**
dUE	0rP	0 to 9999	ORP calibration alarm value in hours, 0 is off **(0, yes)**
dUE	ISE	0 to 9999	ISE calibration alarm value in hours, 0 is off **(0, yes)**
dUE	LOGr	0 to 9999	LogR calibration alarm value in hours, 0 is off **(0, yes)**
rEAd	tyPE	AUt0, tlmE, C0nt	Measurement read type as AUTO-READ, timed or continuous **(AUt0, yes)**
rEAd	tlnE	00:05 to 99:59	Timed measurement value in minutes and seconds **(01:00, yes)** **Note:** This submenu is only available when the timed measurement read type is selected.
L0g	dEL	n0, YES	Delete datalog after download option, select YES to delete the datalog when it is downloaded or select nO to loop through the datalog and not delete the datalog when it is downloaded **(n0, yes)**
L0g	AUt0	0FF, 0n	Automatic datalog point saving option **(0FF, yes)**
gEn	dEgC	-5.0 to 105	Manual temperature value **(25.0, yes)**
gEn	Stlr	0FF, 1, 2, 3, 4, 5, 6, 7	Stirrer speed **(4, yes)**
gEn	PASS	0000 to 9999	Meter password entry **(0000, yes)**
gEn	AUt0	0n, 0FF	Automatic meter shutoff option **(0n, no)**
gEn	bAtt	0n, 0FF	Battery power options, to use battery power as the primary power source, select On. To allow clock backup capabilities only, select OFF. See following section, General Menu Settings, for more information regarding this setup. **(0FF, no)**
gLP	SEt	0FF, 0n	GLP option, GLP feature enables or disables methods **(0FF, no)**
dAtE	H0Ur	HH00 to HH23	Hour setting **(HH12, no)**
dAtE	tlnE	mm00 to mm59	Minute setting **(mm00, no)**
dAtE	tYPE	mdY, dmY	Date format as month, day, year or day, month, year **(mdY, no)**

dAtE	YEAr	2000 to 2099	Year setting **(2004, no)**
dAtE	dAtE	mm01 to mm12	Month setting **(mm01, no)**
dAtE	dAY	dd01 to dd31	Day of the month setting **(dd01, no)**
r232	bAUd	1200, 2400, 4800, 9600	Baud rate setting **(9600, no)**
r232	OUtF	Prnt, COmP	Output format for printer or computer, COmP format is comma delimited **(Prnt, no)**
AUt0	SAPL	OFF, On	Autosampler – **(OFF, no)**
AUt0	trAY	28, 48	Beaker tray setting **(28, no)**
AUt0	rlnb	1, 2, 3, 4, 5	Number of rinse beakers **(3, no)**
AUt0	rSEC	5 to 60	Rinse time in each rinse beaker, seconds **(10, no)**
AUt0	PH	0, 1, 2, 3	pH calibration points **(3, no)**
AUt0	OrP	n0, YES	ORP calibration option, appears if 0 was selected for PH **(n0, no)**
AUt0	ISE	0, 2, 3	ISE calibration points, appears if 0 was selected for PH **(2, no)**
1	AUt0	ISE1	Concentration value of ISE standard 1, appears if 2 or 3 was selected for the ISE calibration points **(1, no)**
10	AUt0	ISE2	Concentration value of ISE standard 1, appears if 2 or 3 was selected for the ISE calibration points **(10, no)**
100	AUt0	ISE3	Concentration value of ISE standard 1, appears if 3 was selected for the ISE calibration points **(100, no)**
AUt0	n0SA	0 to 47	Number of sample beakers **(1, no)**
tC	tyPE	LOgr, AtC, mAn	Temperature Reading and Compensation Setting. Choice of LogR technology, automatic or manual temperature measurement and compensation **(LOGr, yes). Note:** LogR available only for pH and mV modes.

General Menu Settings
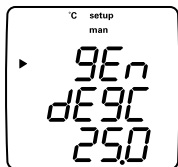
- **Manual Temperature** controls temperature compensation when no temperature sensor is attached to the meter.

- **Stirrer Speed** sets the stirrer speed from 1 (slowest) through 7 (fastest) and off.

- **Password Protection** protects setup menu options and methods from being accidentally erased or tampered with.

- **Automatic Shutoff** controls whether the instrument will automatically turn off after 20 minutes without a keypress.

- **Battery Power Options** control whether the meter will use the batteries to backup the real-time clock only (OFF option) or use the batteries for complete meter operation (On option). If meter is changed from On to OFF with no power adapter connected, the meter will power off in 60 seconds.

   Note: *LogR technology requires a certain level of power. Depending on the meter settings (such as backlight and read type), battery life can vary significantly. Choosing the OFF option saves battery power.*

1. In the measurement mode, press (⊚).

2. Press (△) / (▽) to scroll through the setup menu until *gEn* is displayed on the top line.

3. Press (☰) to accept the selection and move the arrow icon to the middle line.

4. Press (△) / (▽) to scroll through *dEgC* for the manual temperature setting, *St Ir* for the stirrer speed setting, *PASS* for password entry, *AUtO* for the automatic shutoff setting and *BAtt* for battery backup or full operation.

5. Press ⊜ to accept the selection and move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press △ / ▽ until the desired option is displayed. To enter a numeric value for an option on the bottom line, press △ / ▽ to adjust each digit and ⊞ to move to the next digit.

7. Press ⊜ to accept the selection and move the arrow icon to the top line.

8. Repeat steps 3 through 7 to change another general setting or press ⟨🌡⟩ to return to the measurement mode.

Time and Date Settings

```
setup
▸ dAtE
  HOUr
  HH 12
```

- The date and time settings are saved with the data and calibration log points and are included with the data that is sent to a computer or printer.

- The date format can be set to read month, day, year or day, month, year according to the user's preference.

1. In the measurement mode, press (⚙).

2. Press (△) / (▽) to scroll through the setup menu until **dAtE** is displayed on the top line.

3. Press (☰) to accept the selection and move the arrow icon to the middle line.

4. Press (△) / (▽) to scroll through **HOUr** for the current hour setting, **t InE** for the current minute setting, **tYPE** for the date format setting, **dAtE** for the current month setting, **dAY** for the current day setting and **YEAr** for the current year setting.

5. Press (☰) to accept the selection and move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press (△) / (▽) until the desired option is displayed. To enter a numeric value for an option on the bottom line, press (△) / (▽) to adjust each digit and (⊞) to move to the next digit.

7. Press (☰) to accept the selection and move the arrow icon to the top line.

8. Repeat steps 3 through 7 to change another time and date setting or press (🌡) to return to the measurement mode.

AUTO-READ™, Continuous or Timed Measurement Settings
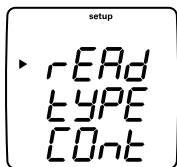
- In the AUTO-READ mode, the meter starts taking a measurement when (🌡) is pressed. Once the measurement is stable, the display freezes and the data is logged and printed. The AUTO-READ mode also controls the stirrer. The stirrer starts when (🌡) is pressed and stops when the measurement becomes stable.

- In the continuous mode, the meter is constantly taking measurements and updating the display. Press (🌡) to log and print a measurement in this mode.

  Note: *When running on battery power, this option will significantly decrease battery life.*

- In the timed mode, the meter is constantly taking measurements and updating the display. The meter logs and prints the measurement at the selected time interval.

1. In the measurement mode, press (⚙).

2. Press (△) / (▽) to scroll through the setup menu until r E A d is displayed on the top line.

3. Press (☰) to accept the selection and move the arrow icon to the middle line.

4. If the timed measurement setting is active, press (△) / (▽) to scroll through t Y P E for the measurement read type and t I n E for the timed reading interval.

5. Press (☰) to accept the selection and move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press (△) / (▽) until the desired option is displayed. To enter a numeric value for an option on the bottom line, press (△) / (▽) to adjust each digit and (⌨) to move to the next digit.

7. Press (icon) to accept the selection and move the arrow icon to the top line.

8. Repeat steps 3 through 7 to change another measurement setting or press (icon) to return to the measurement mode.

Temperature Reading and Compensation Settings

This setting specifies the method for sample temperature measurement and for temperature compensation of pH measurements.

```
      setup
 ▸  tC
    tYPE
    LO9r
```

- With the LogR setting, this method uses the resistance of the pH electrode's glass bulb. Note: This setting cannot be used with relative mV readings, or with ISE readings for the Orion Star LogR pH/ISE meter, Cat. No. 3115000.

- The ATC setting uses the automatic temperature compensation (ATC) probe.

- To use the temperature value entered under the General Menu Setting, select the manual setting.

1. In measurement mode, press 🔧.

2. Press △ / ▽ to scroll through the setup menu until tC is displayed on the top line.

3. Press ☰ twice to accept the selection and move the arrow icon to the bottom line.

4. Press △ / ▽ to scroll through $LO9r$ for the LogR setting, AtC for the ATC probe setting and mAn for the general menu setting temperature value.

5. Press ☰ to accept the selection and move the arrow icon to the top line.

6. Press 🌡 to return to the measurement mode.

Selecting the Measurement Parameter

In the measurement mode, the arrow icon on the left side of the display indicates the active line. Press (△) / (▽) to scroll through the measurement unit icons of the first line. If the LogR Temperature Reading and Compensation Setting is currently active, the resistance across the pH electrode can be shown on the second line. Press (⬚) to move the arrow icon to the desired measurement line and press (△) / (▽) to scroll through the measurement parameters associated with the selected line.

The measurement lines and icons for the Star LogR meter are shown below. pH, mV and RmV capabilities are in all Orion Star LogR meters. ISE capabilities are for Orion Star LogR pH/ISE meters, Cat. No. 3115000.

A

pH
mV
RmV
ISE - only on the Orion Star LogR pH/ISE meters. ATC or manual temperature reading and compensation setting needs to be selected.

No icon for temperature

No icon and no measurement – the measurement line is turned off

B

MΩ-cm - For resistivity across pH electrode bulb measured by LogR temperature reading and compensation setting

No icon and no measurement

C

Displays the temperature reading and compensation setting that is currently in use (LOgr, AtC, mAn). To change this setting, refer to the prior section titled "Temperature Reading and Compensation Settings".

Method Setup

The Orion Star LogR meters can save up to 10 methods when the GLP function is enabled. When a method is selected, the meter will use the last calibration performed in that method, so electrodes that share a common meter connection can be more easily interchanged. When using multiple methods, a calibration must be performed for each method that will be used.

1. To enable the GLP function:

   a. In the measurement mode, press (⊚▨).

   b. Press (△)/(▽) until $\mathcal{GLP}$ is displayed on top line.

   c. Press (☰) to move the arrow icon to the middle line and press (△)/(▽) until SEt is displayed.

   d. Press (☰) to move the arrow icon to the bottom line and press (△)/(▽) until On is displayed.

   e. Press (☰) to move the arrow icon to the top line.

   f. Press (🖉) to exit the setup menu and return to the measurement mode.

2. To display and change the current method number:

   a. In the measurement mode, press (⊚▨). The current method number will be displayed.

   b. Press (△)/(▽) to select a new method number.

   c. Press (⊚▨) to save the method number and press (🖉) to return to the measurement mode.

Chapter VI pH Technique

pH Setup Menu

Note: *Refer to the Setup Menu section for the Setup Menu Table, which contains a complete list of meter setup options and descriptions. Refer to Appendix A for a description of the special setup menu features.*

1. In the measurement mode, press ⊚.

2. Press △ / ▽ to scroll through the setup menu until PH is displayed on the top line.

3. Press ≔ to accept the selection and move the arrow icon to the middle line.

4. Press △ / ▽ to scroll through rES for pH measurement resolution and bUF for the automatic buffer recognition setting.

5. Press ≔ to accept the selection and move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press △ / ▽ until the desired option is displayed.

7. Press ≔ to accept the selection and move the arrow icon to the top line.

8. Repeat steps 3 through 7 to change another pH setting or press ⌐ to return to the measurement mode.

pH Calibration

1. Prepare the electrode according to the electrode user guide.

2. In the setup mode, select the buffer set (USR or $EUrO$) that will be used for the automatic buffer recognition feature.

3. In the measurement mode, press (⊞) until the arrow icon points to the top line, press (△) until the **pH** icon is shown and press (↙) to begin the calibration.

4. Rinse the electrode, and ATC probe if being used, with distilled water and place into the buffer.

5. Wait for the **pH** icon to stop flashing.

   a. Automatic buffer recognition – When the **pH** icon stops flashing the meter will display the temperature-corrected pH value for the buffer.

   b. Manual calibration – When the **pH** icon stops flashing the meter will display the actual pH value read by the electrode. Press (⊡) until the first digit to be changed is flashing, press (△) / (▽) to change the value of the flashing digit and continue to change the digits until the meter displays the temperature-corrected pH value of the buffer. Once the pH buffer value is set, press (⊡) until the decimal point is in the correct location.

6. Press (↙) to proceed to the next calibration point and repeat steps 4 and 5 or press (⌐) to save and end the calibration.

7. The actual electrode slope, in percent, will be displayed in the main field and SLP will be displayed in the lower field.

   a. For a one point calibration, press (⊡) and (△) / (▽) to edit the slope and press (⌐) to return to the measurement mode.

   b. For a two or more point calibration, the meter will automatically proceed to the measurement mode after the slope is displayed.

pH Measurement

Note: *Turn on the automatic datalog feature to send measurements to the meter datalog at the frequency specified in each measurement mode. Refer to the Data Archiving and Retrieval section for details. If the automatic datalog feature is off, connect the meter to a printer or computer to record the measurements.*

1. Rinse the electrode with distilled or deionized water. Shake off any excess water and blot the electrode dry with lint-free tissue.

2. Place the electrode into the sample.

   a. If the meter is in the continuous measurement mode, it will start reading immediately and continuously update the display. The **pH** icon will flash until the reading is stable. Once the reading is stable, log and print the measurement by pressing (🌡). If a benchtop meter is used and the stirrer is enabled, press (🗒) to start the stirrer. Press (🗒) again to turn off the stirrer before removing the electrode and stirrer from the sample.

   b. If the meter is in the AUTO-READ measurement mode, press (🌡) to start the reading. The **AR** icon will flash until the reading is stable. Once the reading is stable, the meter will log and print the measurement and freeze the display. If a benchtop meter is used and the stirrer is enabled, the stirrer will turn on when (🌡) is pressed and turn off when the reading is stable.

   c. If the meter is in the timed measurement mode, it will start reading immediately and continuously update the display. The meter will log and print the measurement at the frequency specified in the setup menu. If a benchtop meter is used and the stirrer is enabled, press (🗒) to start the stirrer. Press (🗒) again to turn off the stirrer before removing the electrode and stirrer from the sample.

3. Remove the electrode from the sample, rinse it with distilled or deionized water, blot it dry, place it in the next sample and repeat step 2.

4. Once all of the samples have been measured, rinse the electrode with distilled or deionized water and blot it dry. Consult the electrode user guide for proper storage techniques.

pH Temperature Display

Orion Star Plus LogR meters allow the temperature to be viewed on individual measurement lines in addition to the temperature display on the top, left of the screen.

To view the temperature for the pH measurement line:

1. In the measurement mode, press (icon) to select the top display line. The arrow icon will point to the selected line.

2. Press (up arrow) / (down arrow) to change the value on the selected line. The top line can be changed to display pH (pH), millivolts (mV), relative millivolts (RmV), concentration (ISE), temperature (no icon) or a blank line.

Chapter VII LogR and Automatic Temperature Compensation (ATC) Calibration

LogR Temperature Calibration Information

This procedure should be performed at least once per week to ensure accurate temperature compensation when operating in the LogR mode. If the meter is powered down or the electrode is disconnected, the LogR temperature should be recalibrated. When using the meter for the first time or restarting the meter in the LogR mode, a LogR temperature calibration must be performed. It is recommended that at least a two-point temperature calibration be performed to meet optimum system accuracy. Up to three points can be calibrated. Refer to the **Appendix B** for additional information.

Choose a temperature calibration range that is at least 5 °C apart, depending on your expected operating range. Evenly bracket your expected sample temperature range. A maximum 20 °C range is recommended for maximum accuracy. For example, for measurements around 20 °C, calibrate at 10 °C and 30 °C. For a temperature span greater than 20 °C, a three-point temperature calibration is recommended. For many samples, a single-point calibration near the expected sample temperature will yield adequate results. A constant temperature bath or a hot plate is recommended to hold the temperature of calibrating solution.

For best results during temperature calibration, it is recommended that a pH buffer or tap water be used as the temperature calibrating solution. Do not use distilled water because the conductivity is too low to obtain a good calibration.

LogR Calibration Technique

LogR calibration can be done by using an ATC probe or with a NIST reference. An accurate and the fastest method is to use an ATC probe. The most accurate method is to use a NIST reference, such as a NIST-traceable thermometer.

Note: The meter defaults to using an ATC probe for LogR calibration. If the temperature reading for the ATC probe requires adjustment, follow the instructions for ATC probe calibration technique on the next page.

Prior to starting LogR calibration, the temperature reading and compensation setting should be LogR (shown as LOgr on the third display line.) If this is not the case, refer to the section titled Temperature Reading and Compensation Settings. The first screen when starting the temperature calibration shows the setting being calibrated.

To calibrate with the use of an ATC probe:

1. In the measurement mode, press ⊜ until the arrow icon points to the top line.

2. Select temperature mode by pressing △ / ▽ until the measurement line shows temperature.

3. Rinse pH electrode and ATC probe with distilled water. Place both electrode and probe into the solution. Stir moderately. Press ⤓

4. CAL. 1 will display. When the reading stabilizes, the arrow icon and first digit will flash. The meter will display the temperature measured by the ATC probe.

5. Press ⤓ to proceed to the next calibration point and repeat steps 3 and 4 or press 🌡 to save and end the calibration.

LogR and Automatic Temperature Compensation (ATC) Calibration

To calibrate with the use of a NIST reference:

1. If an ATC probe is connected, disconnect the ATC probe.

2. In the measurement mode, press (≣) until the arrow icon points to the top line.

3. Select temperature mode by pressing (△) / (▽) until the measurement line shows temperature.

4. Rinse pH electrode with distilled water. Place the electrode into the solution. Stir moderately. Press (↙)

5. CAL. 1 will display. When the reading stabilizes, the arrow icon and first digit will flash to display actual LogR temperature reading.

6. Press (⌖) until the first digit to be changed is flashing. Press (△) / (▽) to change the value of the flashing digit and continue changing the digits until the display matches the numbers of the NIST reference's reading. Press (⌖) until the decimal point is in the correct location.

7. Press (↙) to proceed to the next calibration point and repeat steps 4 through 6 or press (🌡) to save and end the calibration.

ATC Probe Calibration Technique

The temperature calibration mode of the Orion Star LogR meter allows the temperature measurement of the ATC probe to be manually adjusted.

1. Connect an ATC probe to the meter and change the temperature input to ATC in the setup menu.

2. In the measurement mode, press (☰) to choose the top measurement line and press (△) / (▽) until the temperature is shown for the selected line.

3. Press (↙) to begin the calibration.

4. When the reading stabilizes, the arrow icon and the first digit will flash. Enter the temperature by pressing (△) / (▽) to adjust each digit and (▦) to move to the next digit.

5. Press (↙) to save and end the calibration.

Chapter VIII mV, Relative mV and ORP Technique

All meters with pH measurement capability include a mV, relative mV and ORP function. Measure the raw millivolt (mV) values of an electrode in the mV mode. Calibrate the relative millivolt (RmV) values of a redox electrode for oxidation-reduction potential (ORP) measurements in the relative mV/ORP mode.

Note: The mV measurements are raw readings and cannot be calibrated. Use the relative mV mode to calibrate mV measurements.

LogR Note: For relative mV readings, the meter will automatically switch the temperature reading and compensation setting to ATC, or manual temperature compensation if an ATC probe is not connected.

Relative mV and ORP Calibration

1. Prepare the electrode according to the electrode user guide.

2. In the measurement mode, press (⊞) until the arrow icon points to the top line, press (△) until the **RmV** icon is shown and the temperature reading and compensation setting has updated (approximately 3 seconds). Press (↙) to begin the calibration.

3. Rinse the electrode with distilled water and place it into the standard.

4. Wait for the **RmV** icon to stop flashing. If the raw mV reading of the electrode is 220 mV ± 60 mV, when the **RmV** icon stops flashing the meter will automatically calculate and display the E_H mV value for the electrode at the measured temperature. If the raw mV reading of the electrode is outside of the 220 mV ± 60 mV range, when the **RmV** icon stops flashing the meter will display 000.0 RmV. Press (⊞) until the first digit to be changed is flashing, press (△) / (▽) to change the value of the flashing digit and continue to change

the digits until the meter displays the mV value of the standard. To change the value to negative or positive number, press (icon) until none of the digits are blinking and the arrow icon is blinking and then press (icon) to change the sign of the mV value.

5. Press (icon) to save and end the calibration. The mV offset will be displayed and the meter will automatically proceed to the measurement mode.

mV, Relative mV and ORP Measurement

Note: *Turn on the automatic datalog feature to send measurements to the meter datalog at the frequency specified in each measurement mode. Refer to the Data Archiving and Retrieval section for details. If the automatic datalog feature is off, connect the meter to a printer or computer to record the measurements.*

1. Rinse the electrode with distilled or deionized water. Shake off any excess water and blot the electrode dry with lint-free tissue.

2. Place the electrode into the sample.

   a. If the meter is in the continuous measurement mode, it will start reading immediately and continuously update the display. The **mV** or **RmV** icon will flash until the reading is stable. Once the reading is stable, log and print the measurement by pressing $\left(\int\!\!\!\!\int\right)$. If the stirrer is enabled, press $\left(\boxed{\boxminus}\right)$ to start the stirrer. Press $\left(\boxed{\boxminus}\right)$ again to turn off the stirrer before removing the electrode and stirrer from the sample.

   b. If the meter is in the AUTO-READ measurement mode, press $\left(\int\!\!\!\!\int\right)$ to start the reading. The **AR** icon will flash until the reading is stable. Once the reading is stable, the meter will log and print the measurement and freeze the display. If the stirrer is enabled, the stirrer will turn on when $\left(\int\!\!\!\!\int\right)$ is pressed and turn off when the reading is stable.

   c. If the meter is in the timed measurement mode, it will start reading immediately and continuously update the display. The meter will log and print the measurement at the frequency specified in the setup menu. If the stirrer is enabled, press $\left(\boxed{\boxminus}\right)$ to start the stirrer. Press $\left(\boxed{\boxminus}\right)$ again to turn off the stirrer before removing the electrode and stirrer from the sample.

3. Remove the electrode from the sample, rinse it with distilled or deionized water, blot it dry, place it in the next sample and repeat step 2.

4. Once all of the samples have been measured, rinse the electrode with distilled or deionized water and blot it dry. Consult the electrode user guide for proper storage techniques.

Chapter IX **ISE Technique**

The Orion Star LogR pH/ISE meter, Cat. No. 3115000, is capable of measuring ISE values. When reading or calibrating ISE, the meter automatically switches the temperature reading and compensation setting to RLC, or mRn if ATC probe is not connected. (The temperature reading and compensation setting is shown on the third line of the display.) Refer to the Selecting the Temperature Reading and Compensation Setting section to change this setting if needed.

ISE Setup Menu

Note: *Refer to the Setup Menu section for the Setup Menu Table, which contains a complete list of meter setup options and descriptions. Refer to Appendix A for a description of the special setup menu features.*

1. In the measurement mode, press $(\textcircled{\tiny \textbackslash})$.

2. Press $(\triangle)$ / $(\triangledown)$ to scroll through the setup menu until ISE is displayed on the top line.

3. Press $(\textcircled{\tiny :=})$ to accept the selection and move the arrow icon to the middle line.

4. Press $(\triangle)$ / $(\triangledown)$ to scroll through rES for the ISE measurement resolution, $Un\ IL$ for the ISE measurement units, $rRn9$ for the ISE calibration range and $nL\ In$ for the non-linear blank correction feature.

5. Press $(\textcircled{\tiny :=})$ to accept the selection and move the arrow icon to the bottom line.

6. To scroll through a list of options on the bottom line, press $(\triangle)$ / $(\triangledown)$ until the desired option is displayed. To enter a numeric value for an option on the bottom line, press $(\triangle)$ / $(\triangledown)$ to adjust each digit and $(\textcircled{\tiny ⊞})$ to move to the next digit.

7. Press $(\textcircled{\tiny :=})$ to accept the selection and move the arrow icon to the top line.

8. Repeat steps 3 through 7 to change another ISE setting or press $(\textcircled{\tiny ♪})$ to return to the measurement mode.

ISE Calibration

The calibration standards should be prepared in the same ISE units as the desired sample results. Start the calibration with the lowest concentration calibration standard and work up to the highest concentration calibration standard. Any reagents, such as ionic strength adjustors, should be added to samples and standards as specified in the electrode user guide.

1. Prepare the electrode, standards and any other required solutions for use according to the electrode user guide.

2. In the measurement mode, press (≔) until the arrow icon points to the top line, press (△) until the **ISE** icon is shown and the temperature reading and compensation setting (the third line of the display) has updated (approximately 3 seconds). Press (↙) to begin the calibration.

3. Rinse the electrode with distilled or deionized water, shake any excess water off, blot it dry and place the electrode into the least concentrated standard.

4. Wait for **ISE** icon to stop flashing. Press (🗊) until the first digit to be changed is flashing, press (△) / (▽) to change the value of the flashing digit and continue to change the digits until the meter displays the concentration value of the standard. Once the standard value is set, press (🗊) until the decimal point is in the correct location.

5. Press (↙) to proceed to the next lowest calibration standard and repeat steps 3 and 4, working from the lowest concentration standard to the highest concentration standard, or press (🌡) to save and end the calibration.

6. The actual electrode slope, in mV per decade concentration, will be displayed in the main field and $5LP$ will be displayed in the lower field.

   a. For a one point calibration, press (🗊) and (△) / (▽) to edit the slope. To change the sign of the slope to negative or positive, press (🗊) until none of the digits are blinking and the arrow icon is blinking and press (△) to change the sign of the slope. Press (🌡) to return to the measurement mode.

b. For a two or more point calibration, the meter will automatically proceed to the measurement mode after the slope is displayed.

ISE Measurement

Note: *Turn on the automatic datalog feature to send measurements to the meter datalog at the frequency specified in each measurement mode. Refer to the Data Archiving and Retrieval section for details. If the automatic datalog feature is off, connect the meter to a printer or computer to record the measurements.*

1. Rinse the electrode with distilled or deionized water. Shake off any excess water and blot the electrode dry with lint-free tissue.

2. Place the electrode into the sample.

    a. If the meter is in the continuous measurement mode, it will start reading immediately and continuously update the display. The **ISE** icon will flash until the reading is stable. Once the reading is stable, log and print the measurement by pressing ( ). If the stirrer is connected, press ( ) to start the stirrer. Press ( ) again to turn off the stirrer before removing the electrode and stirrer from the sample.

    b. If the meter is in the AUTO-READ measurement mode, press ( ) to start the reading. The **AR** icon will flash until the reading is stable. Once the reading is stable, the meter will log and print the measurement and freeze the display. If the stirrer is enabled, the stirrer will turn on when ( ) is pressed and turn off when the reading is stable.

    c. If the meter is in the timed measurement mode, it will start reading immediately and continuously update the display. The meter will log and print the measurement at the frequency specified in the setup menu. If the stirrer is enabled, press ( ) to start the stirrer. Press ( ) again to turn off the stirrer before removing the electrode and stirrer from the sample.

3. Remove the electrode from the sample, rinse it with distilled or deionized water, blot it dry, place it in the next sample and repeat step 2.

4. Once all of the samples have been measured, rinse the electrode with distilled or deionized water and blot it dry. Consult the electrode user guide for proper storage techniques.

ISE Temperature Display and Calibration

ISE Temperature Display

Orion Star LogR meters allow the temperature to be viewed on individual measurement lines in addition to the temperature display on the top, left of the screen.

To view the temperature for the ISE measurement line:

1. Press and hold (🌡) until the meter displays the measurement mode.

2. Press (☰) to choose the top display line. The arrow icon will point to the selected line.

3. Press (△) / (▽) to change the value on the selected line. The top line can be changed to display pH (pH), millivolts (mV), relative millivolts (RmV), concentration (ISE), temperature (no icon) or a blank line.

ATC Probe Calibration Technique

The temperature calibration mode of the Orion Star LogR meter allows the temperature input for the ATC probe to be manually adjusted.

1. Connect an ATC probe to the meter and change the temperature reading and compensation setting to ATC in the setup menu.

2. In the measurement mode, press (☰) to choose the top measurement line and press (△) / (▽) until the temperature is shown for the selected line.

3. Press (✓) to begin the calibration.

4. When the reading stabilizes, the arrow icon and the first digit will flash. Enter the temperature by pressing (△) / (▽) to adjust each digit and (🔢) to move to the next digit.

5. Press (✓) to save and end the calibration.

Chapter X Data Archiving and Retrieval

Datalog and Calibration Log

Star LogR pH and pH/ISE meters have a 1000 point datalog.

Orion Star LogR meter printouts include the meter name, serial number and software version. The pH and ISE calibration printouts include the average slope, the slope between points and the E_o per point.

Automatic Datalog Feature

The automatic datalog feature that can be turned on or off. To enable the automatic recording of data into the datalog:

1. In the measurement mode, press (⊙⟍).

2. Press (△) / (▽) until LOG is displayed on top line.

3. Press (⫶☰) to accept the selection and move the arrow icon to the middle line and press (△) / (▽) until $AUTO$ is displayed.

4. Press (⫶☰) to accept the selection and move the arrow icon to the bottom line and press (△) / (▽) until On is displayed.

5. Press (⫶☰) to accept the selection and move the arrow icon to the top line.

6. Press (🌡) to save the setup option and return to measurement mode.

Datalog Deletion Setting

The datalog deletion setting determines if the meter will automatically delete the datalog after it is downloaded to a printer or computer and if the meter will overwrite the datalog points when the datalog is full. If the datalog deletion setting is set to YES, the meter will automatically delete the datalog after the datalog is downloaded to a printer or computer. The meter will also display the $Err\ 038$ error message when all 1000 datalog points are filled and the datalog must be downloaded to a printer or computer to clear the error message. If the datalog deletion setting is set to nO, the meter will overwrite the oldest datalog point when all 1000 datalog points are filled and will not delete the datalog after the datalog is downloaded to a printer or computer.

1. In the measurement mode, press ⊛.

2. Press △ / ▽ until LOG is displayed on top line.

3. Press ⊟ to accept the selection and move the arrow icon to the middle line and press △ / ▽ until dEL is displayed.

4. Press ⊟ to accept the selection and move the arrow icon to the bottom line and press △ / ▽ until YES or nO is displayed.

5. Press ⊟ to accept the selection and move the arrow icon to the top line.

6. Press ⊟ to save the setup option and return to measurement mode.

Note: *If the datalog is not required, set the datalog deletion setting to nO to prevent the error 038 (datalog full) message.*

Viewing and Printing the Datalog and Calibration Log

Star LogR meters include a calibration log view feature in addition to the datalog view, datalog print and calibration log print features.

To view the datalog or calibration log:

1. In the measurement mode, press (⊙).

2. Press (△) / (▽) to scroll through $u\ IEw$ to view the datalog, $CALu$ to view the calibration log or $CALE$ to view the LogR calibration log.

3. Press (⊙). The meter will display the date/time screen. The log number will be on the top of the screen and the time, date and year the log was recorded will be on the top, middle and bottom display lines respectively. Press (△) / (▽) to scroll through the log.

4. Press (⊙). The meter will display the data or calibration point associated with the selected date/time screen.

   a. Press (⬆) to print the individual data point.

   b. Press (△) / (▽) to scroll through the log.

   c. Press (⊙) to return to the date/time screen.

5. To exit the log view mode, press (⊙) until the meter displays the date/time screen and press (⬆).

To send the datalog or calibration log to a printer or computer:

1. Connect the meter to a printer or computer and verify the meter baud rate and output settings in the setup menu.

2. In the measurement mode, press (⊙).

3. Press (△) / (▽) to scroll through $5End$ to print the datalog or $CAL5$ to print the calibration log.

4. Press (◉) to send the selected data to the printer or computer.

To interface the meter with a computer:

The Orion LogR meters can send measurement and calibration data to a computer in a comma delimited format that is easy to parse in computer programs like Excel. Select the *r232*, *OUtF*, *COmP* output setting in the setup menu.

To send data from the meter to a computer using HyperTerminal:

1. Connect the meter to a computer port using the computer interface cable, Cat. No. 1010053.

2. Click on the start button on the lower left side of the computer screen. Select *All Programs, Accessories, Communications* and *HyperTerminal*.

3. When the HyperTerminal window opens, enter a file name, select an icon for the connection and click on the *OK* button.

4. When a new window opens, go to the Connect Using drop-down menu, select the *COM* port that the meter is connected to and click on the *OK* button.

5. A window will open with the *COM* port properties listed. Select the following settings from the drop-down menus and then click on the *OK* button.

   Bits per second: 9600

   Data bits: 8

   Parity: None

   Stop bits: 1

   Flow control: Hardware

6. Send data from the meter to HyperTerminal.

Chapter XI Declaration of Conformity

Manufacturer: Thermo Fisher Scientific Inc.
                       Ayer Rajah Crescent
                       Blk 55 #04-16/24
                       Singapore 139949
                       Singapore

Hereby declares that the following product:

Orion Star LogR pH and LogR pH/ISE Meters

Conforms with the following directives and standards:

2004/108/EC - Electromagnetic Compatibility (EMC Directive)
EN 61326-1:2006 – Electrical equipment for measurement, control and laboratory use - EMC requirements

2006/95/EC - Low Voltage Directive (LVD)
EN 61010-1:2001 – Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements

Cheow Kwang Chan   Place and Date of Issue:
QA/Regulatory Manager   February 25, 2010
                                    Singapore

Notice of Compliance

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A and B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against such interference when the equipment is operated in a commercial and residential environment.

"This digital apparatus does not exceed the (Class A and B) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications (ICES-003)."

"Le présent appareil numérique n' émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A et B) prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada (la norme NMB-003)."

WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the symbol as shown.

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State and this product should be disposed of or recycled through them. Further information on compliance with these Directives, the recyclers in your country, and information on Thermo Scientific Orion products to assist in the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.

Chapter XII **Troubleshooting**

Meter Self Test

1. Disconnect all of the electrodes and probes from the meter and cover all of the meter inputs with the black caps.

2. Power on the meter, wait until the software revision is displayed and press (🌡).

3. All the segments on the display will turn on. Visually inspect the display segments to verify that all of the segments are lit and press (🌡).

4. All the segments on the display will turn off. Visually inspect the display segments to verify that all of the segments are not lit and press (🌡).

5. The display will read HEY. Press every key on the keypad one at a time in any order. If the keys are not pressed within five seconds of one another, the display will read $Err\ 033$, which indicates a key failure. Press (🌡) to clear the error 033 message and complete the self test. If all the keys are pressed and functioning, the meter will restart and proceed to the measurement mode.

Note: If the meter reads $Err\ 034$ during the self test, ensure that all of the electrodes are disconnected from the meter, all of the meter inputs are covered with the black caps and the BNC shorting cap is firmly attached to the BNC meter input. This error code usually occurs if the BNC shorting cap is missing or not fully connected to the BNC meter input during the meter self test.

Meter Error Codes

- If the reading on the screen is flashing 9999, the value is out of range. Perform the meter self test, clean the electrode according to the electrode user guide and re-calibrate the electrode with new standards.

- If the ⚠ icon is lit and the reading is flashing, the sensor needs to be calibrated according to the user's set calibration interval or the pH slope is outside the range of 85 % to 115%.

- Press 🌡 to clear an error code. Error codes show Err on the middle line and a set of three alphanumeric characters on the bottom line. Some of these codes are errors, some are warnings and some are purely informational.

Error Code	Description	Troubleshooting
002, 026, E##, F##	Hardware or Memory Error	Press 🌡 to clear the error. If the error occurs again, contact Technical Support.
005	Value Outside Allowable Range	Press 🌡 and re-enter the value. Check meter specifications for the allowable range of values.
033	Keypad Failure	Repeat the self test. When the meter reads KEY, press all the keys, including the power key, within five seconds of one another.
034	BNC Input Failure	Disconnect all the electrodes from the meter, connect the BNC shorting cap to the meter and repeat the self test.
038	Datalog Full	Download the datalog to a printer or computer, turn the automatic datalog feature off in the setup menu or change the datalog setting to LOG, dEL, nO in the setup menu so the meter deletes the datalog points when the datalog is full.
D##	Remote Control Error	Check the programming instructions to verify the correct commands, names and values.
107	pH Calibration Standard Error	The millivolts measured during calibration are the same for two buffers. Review the calibration procedure and verify that the electrode was placed in the buffers at the appropriate time. Clean the electrode according to the electrode user guide. Re-calibrate the electrode with fresh buffers.
109	Bad pH Slope or Calibration Offset	Clean the electrode according to the electrode user guide. Re-calibrate the electrode with new buffers.
200	Autosampler Interface Error	The meter is unable to send a signal to the autosampler. Make sure that the autosampler is properly connected to the meter.
201	Autosampler Signal Error	The autosampler is unable to receive a signal from the meter. Review the meter setup parameters and make sure that the baud rate of the meter is set to 1200.

Error Code	Description	Troubleshooting
202	Autosampler is Jammed	Turn the autosampler off and wait 45 seconds before turning it back on. The autosampler should return to the home position.
203	Unstable Reading from Autosampler	The measurements taken using the autosampler are unstable. Check the electrodes for proper function. Make sure that the electrode cables are properly connected.
306	ISE Automatic Blank Error	Disable the automatic blank feature in the setup menu and re-calibrate the meter without using a zero concentration standard.
307	ISE Calibration Standard Error	The millivolts measured during calibration are the same for two standards. Review the calibration procedure and verify that the electrode was placed in the standards at the appropriate times. Clean the electrode according to the electrode user guide. Re-calibrate the electrode with fresh standards.
309	Bad ISE Slope	Clean the electrode according to the electrode user guide. Re-calibrate the electrode with freshly prepared standards.
707	LogR Temperature Calibration Points are Too Close	Calibrate using two temperature points that are at least 5 °C apart. Another method is to check the resistance value. The resistance value between each calibration point should have a difference of at least 10%. To check, set the meter to the LogR temperature input mode. Adjust the first line with the arrows to display the temperature value and adjust the second line to read the resistance value of the electrode at the first temperature and then read the resistance value of the electrode at the second temperature.
711	pH Calibration with Invalid LogR Temperature Reading	Perform a LogR temperature calibration. (Refer to the slide-out card on the meter or chapter 7 of the user guide.) If this does not correct the error code, refer to the probe troubleshooting section in the electrode manual or appendix C of this user guide.

General Troubleshooting

Problem: The display freezes and the measurement values will not change.

Solution: The meter is in the AUTO-READ measurement mode (the AR icon will appear in the top, right corner of the display). Press (🌡) to start a new reading or select another measurement mode in the setup menu.

Problem: When switching between measurement parameters, the reading takes a few seconds to update after I make my selection.

Solution: When scrolling between the measurement parameters, the meter waits approximately 3 seconds to confirm your measurement selection. After your selection is made, if there needs to be a change in circuitry, the meter will automatically route it. During this time, the display will flash the temperature reading and compensation setting (information on line 3). The meter will then automatically display the appropriate reading on line one when complete.

Problem: When I press (✒) the meter displays _wA It_.

Solution: The meter is printing and cannot enter the calibration mode until the printing is done. This should rarely occur if the meter is set to a 9600 baud rate. If the meter is at a lower baud rate, the delay will be longer.

Problem: The meter did not accept the change I made in the setup menu.

Solution: After making a change in the setup menu, press (📋) until the arrow icon points to the top line (confirms the change) and then press (🌡) to save the change and return to the measurement mode.

Problem: How do I abort a calibration?

Solution: Press and hold (🌡) to abort any meter operation and return to the measurement mode.

Problem: The printout is a string of numbers and units with commas.

Solution: The output format in the setup menu is set to the computer output or the printer baud rate is set incorrectly in the setup menu. Change the output format to the printer output in the setup menu. Change the baud rate to the correct value for the printer that is being used.

Problem: When I press the stirrer button, the stirrer doesn't work.

Solution: The current stirrer setting is off. Set the speed to 1 through 7 in the setup menu.

Problem: The timed measurement time entry screen does not appear in the setup menu.

Solution: The meter is in the AUTO-READ or continuous mode. When the meter is set to the timed mode, the next setup screen will be for time entry.

pH Troubleshooting

Problem: The meter does not recognize the pH buffer value during calibration.

Solution: Verify that the correct buffer set was selected in the setup menu. The meter uses the raw mV reading of the electrode to recognize a buffer during calibration. As the electrode ages or becomes dirty, its mV readings will drift and you will need to manually enter the pH buffer value when calibrating.

ISE Troubleshooting

Problem: It takes several minutes for the readings to stabilize during a calibration.

Solution: The concentration range in the setup menu is set to low. Change the concentration range to high.
The ISE resolution is set to 3 digits in the setup menu. Change the ISE resolution to 2 digits for faster stabilization of the readings.

Problem: When I use the automatic blank correction setting and calibrate an ISE, the meter gives a slope that is too low or cannot be manually checked.

Solution: Turn the automatic blank correction setting off in the setup menu.

LogR Troubleshooting

Problem: The meter does not recognize the ATC probe during calibration.

Solution: Verify that the ATC probe is connected to the meter. Press and hold to abort any meter operation and return to the measurement mode. Change the temperature reading and compensation setting to ATC in the setup menu. If the meter defaults to $m\overline{H}n$, verify the connection of the ATC probe by disconnecting and securely reconnecting the ATC probe.

Problem: The temperature reading and compensation setting (third line of the display) automatically changes to AtC or mAn when in relative mV or ISE measurement parameters.

Solution:	The LogR technology is only available for pH and mV measurements. When reading relative mV (RmV) or ISE values, the meter switches to RtC, or mRn if an ATC probe is not connected. Selecting the pH or mV measurement parameter will automatically switch the meter back to LogR, if that was the setting prior to ISE or RmV readings.
Problem:	LogR temperature value is not within the expected range.
Solution:	Verify that the LogR calibration has been completed. If the temperature reading and compensation setting was not set to LogR, the LogR setting was not calibrated. The first screen when starting the temperature calibration shows the setting.
Problem:	The resistance display shows "-------"
Solution:	The resistance input is over 6000 Mohms. This resistance value is normal for a new electrode not yet placed into a solution. Prepare the new electrode for testing and place into a solution.

Assistance

After troubleshooting all components of your measurement system, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/contactwater.

For the latest application and technical resources for Thermo Scientific Orion products, visit www.thermo.com/waterapps.

Warranty

For the most current warranty information, visit www.thermo.com/water.

Chapter XIII Meter Specifications

Meter Specifications

Environmental Operating Conditions

Portable and Benchtop Meter Environmental Operating Conditions	
Operating Ambient Temperature	5 to 45 °C
Operating Relative Humidity	5 to 85 %, non-condensing
Storage Temperature	-20 to +60 °C
Storage Relative Humidity	5 to 85 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Altitude	Up to 2000 meters
Weight	0.91 kg
Size	9.4 cm (H) x 17.0 cm (W) x 22.4 cm (D)
AC Powered Meters	Indoor use only
Battery Operated Meters	Indoor or outdoor use
Regulatory and Safety	CE, CSA, TÜV, UL, FCC Class limits
Case Material	ABS
Shock and Vibration	Vibration, shipping/handling per ISTA #1A Shock, drop test in packaging per ISTA #1A
Enclosure (designed to meet)	IP54

Universal Power Adapter Environmental Operating Conditions	
Operating Ambient Temperature	0 to 50 °C
Operating Relative Humidity	0 to 90 %, non-condensing
Storage Temperature	-20 to +75 °C
Storage Relative Humidity	0 to 90 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Operating Altitude	Up to 2000 meters
Benchtop Meters	Indoor use only

Meter Parameter Specifications

pH	
Range	-2.000 to 19.999
Resolution	0.1, 0.01, 0.001
Relative Accuracy	± 0.002
Calibration Points	1 to 5
Millivolts, Relative Millivolts, ORP	
Range	± 1999.9 mV
Resolution	0.1 mV
Relative Accuracy	± 0.2 mV or 0.05 % of reading, whichever is greater
ISE (for Orion Star LogR pH/ISE meters, Cat. No. 3115000)	
Range	0 to 19999
Resolution	1 to 3 significant figures
Relative Accuracy	± 0.2 mV or 0.05 %, whichever is greater
Displayed Units	M, mg/L, %, ppb or no units
Calibration Features	Linear point to point, selectable non-linear automatic blank correction and low concentration range stability
LogR	
Temperature Relative Accuracy	± 0.1 °C; ± 0.3 °C from 0 to 9.9 °C when resistance > 1000 MΩ
Temperature Calibration Options	ATC probe, NIST reference
Resistance Range	0 to 6000 MΩ
Resistance Resolution	0.1 up to 1999.9 MΩ, 1 above 1999.9 MΩ
Temperature	
Range	0 to 100 °C
Resolution	0.1 up to 99.9 °C, 1.0 over 99.9 °C
Calibration Points	1 to 3
Relative Accuracy	± 0.1 °C

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

Ordering Information

Cat. No.	Description
3112000	Orion Star LogR pH benchtop meter with stainless steel ATC probe (927007MD), universal power adapter and user guide
3112001	Orion Star LogR pH benchtop meter with stainless steel ATC probe (927007MD), PerpHecT electrode (9202BN), electrode stand, electrode storage solution and one pint each of pH buffer 4, 7 and 10
3112101	Orion Star LogR pH benchtop meter with stainless steel ATC probe (927007MD), PerpHecT electrode (9202BN) and electrode stand
3115000	Orion Star LogR pH/ISE benchtop meter with stainless steel ATC probe (927007MD), universal power adapter and user guide
3115001	Orion Star LogR pH/ISE benchtop meter with stainless steel ATC probe (927007MD), PerpHecT ROSS Sure-Flow electrode (8272BN), electrode stand, electrode storage solution and one pint each of pH buffer 4, 7 and 10
3115101	Orion Star LogR pH/ISE benchtop meter with stainless steel ATC probe (927007MD), PerpHecT ROSS Sure-Flow electrode (8272BN) and electrode stand
090043	Swing arm electrode stand
1010003	Replacement universal power adapter
1010006	Star series printer with RS232 printer interface cable (Cable Label 250302-001)
1010053	RS232 computer interface cable
096019	Stirrer probe with paddle
8202BN	PerpHecT ROSS combination pH electrode with glass body
8220BNWP	PerpHecT ROSS combination pH electrode with micro tip and glass body
8203BN	PerpHecT ROSS combination pH electrode with semi-micro tip and glass body
8272BN	PerpHecT ROSS Sure-Flow combination pH electrode with glass body
9202BN	PerpHecT combination pH electrode with glass body
9206BN	PerpHecT gel-filled, combination pH electrode with epoxy body
9272BN	PerpHecT Sure-Flow combination pH electrode with glass body
8102BNUWP	ROSS Ultra combination pH electrode with glass body
8165BNWP	ROSS Sure-Flow combination pH electrode with epoxy body

Meter Specifications

8172BNWP	ROSS Sure-Flow combination pH electrode with glass body
9107BNMD	Gel-filled pH/ATC Triode with epoxy body
9157BNMD	Refillable pH/ATC Triode with epoxy body
9165BNWP	Sure-Flow combination pH electrode with epoxy body
9172BNWP	Sure-Flow combination pH electrode with glass body
927005MD	ATC probe with epoxy body
927007MD	ATC probe with stainless steel body
9512HPBNWP	High performance ammonia combination ion selective electrode
9609BNWP	Fluoride combination ion selective electrode
9707BNWP	Nitrate combination ion selective electrode
8611BNWP	ROSS sodium combination ion selective electrode

Visit www.thermo.com/water for additional meter kits, accessories, electrodes and solutions.

Appendix A Meter Setup Menu Features

pH Setup Menu Features

Automatic buffer recognition

The Orion Star LogR pH and pH/ISE meters are capable of automatically recognizing pH 1.68, 4.01, 6.86, 7.00, 9.18, 10.01 and 12.46 buffers during a pH calibration. During a calibration, the meter uses the selected buffer set and the raw mV reading of the pH electrode in the buffer to recognize and display the buffer value at the measured temperature. The raw mV value must be about ± 30 mV from the theoretical mV reading of the buffer in order for the meter to automatically recognize the buffer.

Buffer	mV Range	Buffer	mV Range	Buffer	mV Range
1.68	+285 to +345	7.00	- 30 to + 30	10.01	-207 to -147
4.01	+207 to +147	9.18	-99 to -159	12.46	-293 to -353
6.86	+38 to -22				

ISE Setup Menu Features

Concentration Range

The Orion Star LogR pH/ISE meters can be set for a high or low ISE concentration range that is used to determine the calibration stability criteria. If a high ISE concentration range is selected, the meter will perform a normal calibration with no delay in displaying the calibration standard value. If a low ISE concentration range is selected, the meter will wait about three to five minutes before displaying a stable reading for the calibration standard values. The delay will depend on the species being measured and the concentration of the calibration standards. The low ISE concentration range is designed to improve the accuracy of low concentration measurements by allowing the electrode to have a longer amount of time to stabilize in the calibration standards.

Automatic Blank Correction

The Orion Star LogR pH/ISE meters have an ISE automatic blank correction feature that uses an algorithm to compensate for the non-linearity of the ion selective electrode in low-level standards and samples. Since the automatic blank correction feature requires the use of a set of non-linear equations that can only be calculated numerically, the user cannot analytically verify the calibration and the average slope value that is displayed on the meter may be outside of the slope range that is specified in the electrode user guide. In applications were analytical verification is required, the automatic blank correction feature should be turned off.

Appendix B About LogR Technology

LogR Temperature Measurements

Orion Star LogR meters allow for direct temperature measurement and temperature compensation from your pH electrode. With simultaneous measurement of pH and temperature, the patented digital LogR technology makes this possible using most standard glass pH electrodes. The system is based on using the electrical resistance of the glass sensing bulb as the temperature probe. The logarithm of the resistance of the bulb varies almost linearly with the reciprocal of the absolute temperature (see **Figure 1**). Almost all common pH glasses show a similar decrease in resistance with increasing temperature, and can be used with other meters. However, only the exact shape of the curve of PerpHecT electrodes is in the meter's memory. To maximize system performance and accuracy, use a PerpHecT or PerpHecT ROSS pH electrode.
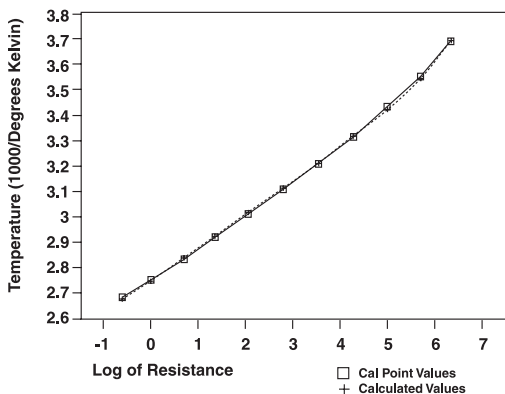
Figure 1 – LogR Resistance vs. Temperature Graph LogR™ Temperature Accuracy Tables

LogR Temperature Accuracy Tables

Table 1 – Two Point LogR Calibration Average Temperature Compensation pH error at pH 3 and pH 11 pH

Electrode	Average Temp. Error 0 to 25 °C (°C)	Average Temp. Error above 20 °C * (°C)	Average Temp. Compensation Error 0 to 25 °C (pH units)	Average Temp. Compensation Error above 20 °C * (pH units)
8202BN	0.36	0.10	0.004	0.001
8203BN	0.13	0.02	0.002	0.000
8235BN	0.04	0.14	0.000	0.002
8256BN	0.22	0.06	0.003	0.001
8272BN	0.23	0.06	0.003	0.001
9202BN	0.21	0.06	0.003	0.001
9203BN	0.20	0.10	0.002	0.001
9206BN	0.29	0.06	0.003	0.001
9207BN	0.16	0.07	0.002	0.001
9256BN	0.27	0.07	0.003	0.001
9272BN	0.22	0.06	0.003	0.001

* For 20 °C temperature compensation spans.

Table 2 – Three Point LogR Calibration Average Temperature Compensation pH error at pH 3 and pH 11 pH

Electrode	Average Temp. Error 0 to 25 °C (°C)	Average Temp. Error above 20 °C * (°C)	Average Temp. Compensation Error 0 to 25 °C (pH units)	Average Temp. Compensation Error above 20 °C * (pH units)
8202BN	0.04	0.03	0.000	0.000
8203BN	0.04	0.01	0.000	0.000
8235BN	0.07	0.06	0.001	0.001
8256BN	0.04	0.06	0.000	0.001
8272BN	0.02	0.01	0.000	0.000
9202BN	0.03	0.06	0.000	0.001
9203BN	0.06	0.05	0.001	0.001
9206BN	0.02	0.02	0.000	0.000
9207BN	0.07	0.07	0.001	0.001
9256BN	0.02	0.00	0.001	0.000
9272BN	0.22	0.06	0.003	0.001

* For 20 °C temperature compensation spans.

Appendix C Advanced Orion Star LogR Meter's Electrode Diagnostics

Electrode Trouble-Shooting Using LogR Technology

Many factors affect the performance of your pH combination electrode. While the majority of problems seen in electrode performance relate to reference issues, changes over time in the sensing glass can negatively impact performance. Thermo Scientific Orion Star LogR meters allow you to monitor these effects. This can save time, helping to identify cases where cleaning and maintenance will not be able to rejuvenate your electrode.

Viewing Electrode Resistance

To view the electrode resistance, the third line of the display, indicating the temperature reading and compensation setting, should show $LOGr$. If RtC or mRn is shown, refer to the user guide, chapter 5 *Temperature Reading and Compensation Settings* section, to change this setting. With $LOGr$ displayed on the third line, press (icon) to move the arrow icon to the second line and press (△) / (▽) to display the resistance value.

Out-of-the-box electrode check

This is a quick check to diagnose a bad electrode from the start.

1. Remove the pH electrode from the box.

2. Connect the pH electrode to the meter.

3. Read the resistance value.

    a. If this is 0, the electrode needs to be replaced.

    b. Otherwise, follow the instructions in the electrode manual to fill and prepare the electrode for measuring. Perform the initial electrode check when the electrode is ready.

Initial electrode check

To get the most out of the Orion Star LogR meter's diagnostics, you may want to establish a regular schedule of resistance testing. Perform an initial check of your electrode resistance and record the temperature and resistance value in the table below, or perform a LogR calibration and output the calibration information from the meter to a computer or printer. (Refer to the chapter titled LogR and Automatic Temperature Compensation (ATC) Calibration and the chapter titled Data Archiving and Retrieval for more information).

1. Rinse the electrode with deionized water and blot dry with a lint-free tissue.

2. Insert the electrode into the solution and gently stir - if a stirrer probe is enabled, press the stir key to start and stop stirring.

3. Record the temperature and resistance value for reference.

Note: Electrode bulb thickness and diameter vary from electrode to electrode resulting in normal variation in resistance. In most cases the initial value is not a definitive test of electrode condition except in extreme cases, for example, see the *initial low readings* information below. When changing electrodes, do not be alarmed if the resistance varies dramatically from your previous electrode.

Initial low readings – If the resistance is below 1 MΩ in a solution at room temperature (22 ° to 27 °C), this indicates a damaged electrode. In this case the electrode will most likely need to be replaced.

Periodic electrode testing

Periodically check your electrode resistance following the steps above and record values in the table below. While diagnostic testing at (or near) 25 °C is ideal due to the resistance stability at this temperature, this may not be possible. Nonetheless, it is important to maintain as many sampling variables constant to get the most out of your periodic testing. The resistance reading is fully dependent on temperature. When testing, using the same solution type at a known, stable temperature at or around the same temperature value each time would be the most beneficial method.

Small variances in resistance – Resistance will typically increase as the bulb ages. This is no cause for concern. Over time this can lead to slower response rates,

slope degradation, and reduced immunity to noise. By keeping track of the change in resistance (delta, as listed in the log example below), this information may be used to determine when to replace your electrode, before failure occurs, eliminating down time.

Large decreases in resistance – When the glass pH membrane resistance is more than ten times lower than the expected resistance value (at a given temperature), it is often an indication of membrane crack in the bulb or shorting, leading to a total failure in function. If you see this type of change in the resistance reading, no further testing or care will resolve the problem. A new electrode will be needed at this point.

Increases in resistance – As the electrode ages, the resistance of the electrode's glass bulb increases. Eventually, the aging of the electrode, and visible increase in resistance, manifests in a slower response rate, low slope, and reduced immunity to noise. At some point the resistance becomes "super high". The Orion Star LogR meter's diagnostics help you pinpoint the causes of your reduced performance and quickly show you the effectiveness of your cleaning and care processes.

• If the resistance values are not out of expected range, but electrode response continues to be slow or erratic, these effects may also be seen as a result of reference clogging or contamination. You should reference the additional electrode care notes below.

• If the resistance value between checks increases substantially higher, the fill solution may be depleted. Refer to the additional electrode care notes below for the proper fill solution levels of a refillable electrode.

• If the resistance values show a "super high" resistance, cleaning and care may improve performance, but will not be able to return the probe to like new condition. Consider purchasing a new electrode.

Electrode Diagnostics Log

Electrode SN	Date	Temperature	Resistance	Delta*	Notes
SN 1234 (example)	1/1/10		350	--	Initial test
SN 1234 (example)	1/8/10		20	320	Significantly low resistance indicates electrode failure.

*Change in resistance value from prior reading

Additional Electrode Care Notes

The Orion Star LogR meter's diagnostic capability can help notify you if additional electrode care steps need to be taken. If you have seen slow or erratic electrode responses, here are some issues and tips for electrode care that you may want to follow to get your electrode working properly again.

Air Bubbles

Make sure that there are no air bubbles present. Shake the electrode (as with a clinical thermometer) to remove air bubbles.

Dry Electrode and Salt Deposits

If the electrode has been stored dry, rinse the electrode with distilled water to remove any salt deposits that may have formed.

a. for refillable electrodes, fill the electrode with the appropriate electrode fill solution. Rehydrate the electrode by soaking it in the recommended electrode storage solution for one hour prior to use.

b. for sealed electrodes, soak the electrode in electrode storage solution for one hour to rehydrate.

Refillable Electrodes

If you have a refillable electrode, check the following:

a. the amount of fill solution in the electrode. The meniscus should be just below the fill hole or at the very least one inch (2.54 cm) above the sample level. If the level in the electrode is too low, fill with the appropriate fill solution. Ensure no air bubbles are present. (Refer to above note regarding air bubbles if needed.)

b. if the electrode has not been used for some time. Replace the fill solution by emptying the electrode of the old fill solution. Fill with the electrode fill solution and soak for one hour in electrode storage solution prior to use.

c. the filling hole. To allow adequate flow of the electrode solution during measuring, the filling hole needs to be open. Verify that the filling hole sleeve/

plug is not covering the filling hole. If there is some salt crystallization blocking the filling hole, rinse off the electrode with distilled water to remove the salts. Avoid water ingress into the electrode filling hole. If the electrode becomes contaminated during rinsing, follow the steps in part d.

d. the reference fill solution. If the fill solution becomes contaminated it will be necessary to replace the fill solution. To do this:

   i. drain the reference chamber through the filling hole (either with a pipette or invert the electrode and use a wipe to draw the solution out from the filling hole).

   ii. Flush with fresh filling solution and refill the chamber. Ensure no air bubbles are present. (Refer to above note regarding air bubbles if needed.)

   iii. Rehydrate by soaking the electrode in electrode storage solution for one hour.

Deionized Water

Deionized water should not be used as a substitute for electrode storage solution, or as the solution for the periodic electrode testing when resistance readings are gathered, as there are not enough salts in this type of water.

a. If deionized water has been used for storage, ions will have been leached out of the electrode's fill solution.

   i. If you have a refillable electrode, replace the fill solution in the electrode. Rehydrate the electrode by soaking it in the recommended electrode storage solution for one hour prior to use.

   ii. for sealed electrodes, replacement of the electrode is suggested.

b. If deionized water has been used during the periodic testing process, the resistance change from the testing process to reading a sample could be dramatic leading to incorrect analysis of electrode faults and readings. Simply

change the sample used during the periodic testing process to match the sample type normally measured during testing, and reference the data from the new sample.

Cleaning

Dirt and deposits may accumulate on your electrode over time, hindering performance. In addition to rinsing the electrode between samples and prior to storage, inspect the electrode periodically for dirt and deposits. Thermo Scientific Orion pH electrode cleaning solutions can be used to remove dirt and deposits without causing damage to the electrode. Depending on your contaminant, select the proper electrode cleaning solution from the table below and follow the steps below.

Contaminant	Orion Catalog Number	Description
Protein	900021	pH Electrode Cleaning Solution A
Bacteria	900022	pH Electrode Cleaning Solution B
General	900023	pH Electrode Cleaning Solution C
Oil and Grease	900024	pH Electrode Cleaning Solution D
Unknown / Varies	900020	pH Electrode Cleaning Solution Kit – Includes 1 x 30mL each of solutions A and C, and 1 x 60mL each of solutions B and D

1. Shake the cleaning solution. Pour enough of the cleaning solution into the beaker to cover the electrode junction and immerse the section of the electrode that requires cleaning.

2. Soak the electrode for a few minutes in the cleaning solution while moderately stirring the solution.

3. Remove the electrode from the cleaning solution and rinse the electrode thoroughly with distilled water to remove all traces of the cleaning solution.

4. If cleaning a refillable electrode, remove the filling solution from the electrode using the pipette that is included in the kit. Add fresh filling solution to the electrode. Repeat removing and adding filling solution two or three times for optimal electrode performance.

5. Rinse the electrode thoroughly with distilled water and read the resistance of the electrode on the Orion LogR meter. Repeat the cleaning procedure if the resistance value has moved closer to the expected, but is still slow to respond.

If the resistance does not improve (moves closer to the expected resistance) or becomes worse, replacement of the electrode is suggested.

Note: Viscous samples and samples that contain solid materials often require additional cleaning and additional filling solution changes.

Reference your electrode manual for more specific care tips.

Appendix D **Autosampler Interfacing**

Meter and Autosampler Setup

1. Select a location for the system and unpack the autosampler and meter components. Prepare the autosampler according to the autosampler user guide.

2. Interface the autosampler with the meter. Use the autosampler to meter interface cable, Cat. No. ATA02, to connect the 2.5 mm phono jack RS232 port on the meter to the Com 1 RS232 port on the autosampler.
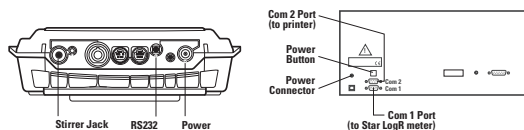
3. If the Orion Star printer will be used, use the autosampler to printer interface cable, Cat. No. 223664-001, to connect the Com 2 RS232 port on the autosampler to the 25 pin female RS232 port on the printer.

   Note: *The printer must have a 9600 baud rate to be connected to the* autosampler. The Orion Star printer, Cat. No. 1010006, is recommended for use with the Orion Star LogR meter and AutoTration-500 autosampler system.

4. Prepare and install the electrodes. Prepare the electrodes according to the electrode user guides. Connect the electrodes to the back of the meter using the extension cables and cable management system provided with the autosampler. Insert the electrodes into the electrode holder on the autosampler If a stirrer probe will be used, connect the stirrer probe to the stirrer jack on the back of the meter and insert it into the electrode holder on the autosampler.

5. Connect the meter, autosampler and printer to a power supply and turn on the power. The default meter baud rate is 9600 and the default autosampler baud rate for the Com 1 port is 1200, so the meter baud rate needs to be set to 1200 or the autosampler dip switches need to be adjusted to 9600 for the Com 1 port.

Meter Preparation for Operating the Autosampler

1. In the measurement mode, change each display line to the desired parameter and blank any unneeded lines. See the Selecting the Measurement Parameter section for detailed instructions.

2. Review and change the parameters for basic meter functions in the setup menu.

Note: The first time the meter is prepared for use with the autosampler, confirm all of the applicable setup menus. As long as the meter is connected to a power supply, the setup parameters do not need to be reprogrammed. To prevent the meter from losing the programmed parameters in the event of a power failure, install four AA alkaline batteries in the meter.

PH bUF › USA	If a pH electrode will be calibrated on the autosampler, select the USA or EUrO buffer set that will be used for automatic calibration.
ISE Un It › PPb	If an ion selective electrode (ISE) will be calibrated on the autosampler, select the ISE units that will be used for calibration and analysis.
rEAd tYPE › AUtO	Set the read type on the meter to AUTO-READ.
LO9 AUtO › On	Turn the automatic datalogging feature On or OFF.
LO9 dEL › nO	Turn the datalog deletion setting to nO or YES. See the **Datalog and Calibration Log** section for details on setting this parameter.
9En St Ir › 4	If a stirrer probe will be used, set the stirrer speed. The stirrer speed can be set from one to seven or OFF.

9En *AUtO* › *OFF*	Turn the meter auto-shutoff feature OFF.
dAtE *HOUr* › *HH 12*	Set the date and time on the meter. See the **Time and Date Settings** section for details on setting this parameter.
r232 *bAUd* › *1200*	Set the baud rate on the meter to 1200. Alternatively, the meter baud rate can be set to 9600 and the autosampler dip switches can be set to 9600 for the Com 1 port. This is recommended when a printer or computer will be connected to the autosampler. See the **Autosampler Dip Switch Settings** section for instructions.
r232 *OUtF* › *Prnt*	Set the data output on the meter to printer or computer format.

3. Review and change the parameters for the autosampler in the setup menu.

|	
AUtO *SAPL* › *On*	Turn the autosampler function On or OFF.
AUtO *trAY* › *48*	Select the beaker tray that will be used. Either the 28 beaker or 48 beaker tray can be selected.
AUtO *r Inb* › *1*	Enter the number of rinse beakers. One to five rinse beakers can be used.
AUtO *rSEC* › *5*	Enter the electrode rinse time in each rinse beaker. The rinse time can be set from 5 to 60 seconds.
AUtO *PH* › *3*	If a pH electrode will be calibrated on the autosampler, enter the number of pH calibration points. Zero to three points can be selected. The meter must perform an automatic calibration with the autosampler, so only pH buffers in the selected buffer set can be used. Set the number of calibration points to zero if a pH calibration with the autosampler is not needed. This menu will only be shown if the meter has pH function.

| ```
setup
AUtO
OrP
▸  nO
``` | If an ORP electrode will be calibrated on the autosampler, turn the ORP calibration feature on by selecting YES. The meter must perform an automatic calibration with the autosampler, so only Thermo Scientific Orion ORP standard can be used. This menu will be shown if the number of pH calibration points is set to zero. |
| ```
setup
AUtO
ISE
▸   3
```
```
setup
1
▸ AUtO
ISE 1
``` | If an ISE electrode will be calibrated on the autosampler, enter the number of ISE calibration points. Zero, two or three points can be selected. Set the number of calibration points to zero if an ISE calibration with the autosampler is not needed. Once the number of ISE calibration points is selected, enter the calibration standard values in the setup menu. This menu will only be shown if the meter has ISE function and the number of pH calibration points is set to zero. |
| ```
setup
10
▸ AUtO
ISE2
```
```
setup
100
▸ AUtO
ISE3
``` | Press (icon) twice to move the arrow icon to the middle line and press (icon) to display the first standard value. Press (icon) to move the arrow icon to the top line and enter the value of the first standard. Press (icon) until the first digit to be changed is flashing, press (icon) / (icon) to change the value of the flashing digit and continue to change the digits until the meter displays the concentration value of the standard. Once the standard value is set, press (icon) until the decimal point is in the correct location. Repeat this procedure for the second and third standard (if used).

Press (icon) twice to move the arrow icon to the middle line and then press (icon) to display the next setup parameter. |
| ```
setup
AUtO
nOSA
▸  43
``` | Enter the total number of sample beakers to be measured. Do not include rinse beakers, calibration beakers or empty beakers. |

Note: *The error 005 message indicates that a bad value was entered. Press* (icon) *to return to the setup menu and check the allowed value range.*

Meter and Autosampler Operation

1. Prepare the samples, beakers and tray. Make sure that the autosampler function is set to On in the setup menu.

    The first one to five beakers are used as rinse beakers, depending on the number of rinse beakers selected in the setup menu. The next zero to three beakers are used as pH, ORP or ISE calibration beakers, depending on the type of calibration and number of beakers selected in the setup menu.

2. Press ⓕ to initialize the autosampler.

3. The autosampler will move the electrodes to the rinse beaker(s) for the time specified in the setup menu.

4. The autosampler will move the electrodes to the sample beaker and the meter will take a measurement.

5. The actual measurements will be shown on the display. If a stirrer probe is in use, the stirrer will automatically begin stirring when the measurement starts and end stirring when all measurement parameters are stable. When a stable reading is achieved, it will be saved in the datalog and/or sent to a printer or computer, depending on what was selected in the setup menu.

6. The autosampler will move the electrodes to the rinse beaker(s) for the time specified in the setup menu, move the electrodes to the next sample beaker and then the meter will take a new measurement. The autosampler and meter will continue this process until all sample beakers have been measured.

7. To repeat the same autosampler program, replace the tray and press ⓕ. To omit the calibration beakers, change the number of rinse beakers or modify another setup parameter for the autosampler, refer to the Meter Preparation for Operating the Autosampler section.
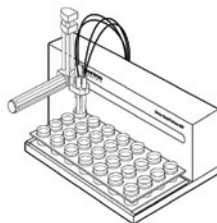
Pausing the Autosampler

To pause the autosampler during operation, press (🌡). To resume operation, press (🌡) again.

Stopping the Autosampler

To stop the autosampler during operation and abort the run, press and hold (🌡) for about 3 seconds.

Moving the Electrode Arm

At the end of a run, when the electrode arm has returned to home position and is lowered into beaker one, press (📇) to lift the electrode arm and press (📇) again to lower the electrode arm. See the diagram to the right. This action is operational only when the autosampler is not running and the electrode arm is in the home position.

Turning Off the Autosampler Function

To disable the autosampler, press (⊚) in the measurement mode to enter the setup menu. Press (△) until $RUtO$ is displayed on top line. Press (≔) until the arrow icon points to the middle line and press (△) until SLP is displayed. Press (≔) until the arrow icon points to the bottom line and press (△) until **OFF** is displayed. Press (≔) until the arrow icon points to the top line. Press (⊚) to return to measurement mode.

Autosampler Dip Switch Settings

The dip switch cover is located on the rear panel of the autosampler and a small Phillips head screw driver is needed to remove the dip switch cover. The ON position for the dip switches is down and the OFF position is up. To set the autosampler dip switches to 9600 for Com 1, adjust DIP switch 4 and DIP switch 5 to the OFF position (up).

	DIP 1	DIP 2	DIP 3	DIP 4	DIP 5
Even Parity		ON			
No Parity		OFF			
9600 Baud				OFF	OFF
1200 Baud				ON	OFF
2400 Baud				OFF	ON
38500 Baud				ON	ON

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