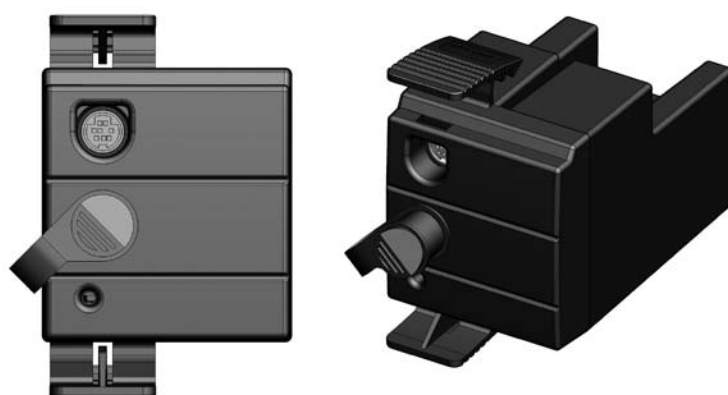


**Thermo Scientific Orion VERSA STAR™
pH with LogR® Temperature Module**

Reference Guide



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This publication supersedes all previous publications on this subject.

Thermo Scientific Orion VERSA STAR™ pH with LogR Temperature Module

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Chapter 1 Introduction

Thank you for your purchase of the Thermo Scientific Orion VERSA STAR™ pH with LogR Temperature Module. This module is for use with the Thermo Scientific Orion VERSA STAR Advanced Electrochemistry Benchtop Meter.

Some key features of this module include:

- pH range from -2 to 20 with resolution options of 0.001, 0.01 and 0.1
- mV and RmV ranges from ± 2000 mV
- Automatic and manual datalogging options
- Up to 6-point pH calibration with automatic recognition for USA/NIST and DIN buffers
- The ability to fix calibration errors without a complete recalibration thanks to calibration editing
- Temperature-compensated results directly from the pH bulb with patented LogR technology
- The most advanced electrode diagnostics information through the use of the LogR technology

Please read this reference guide thoroughly. Any use outside of these instructions may invalidate your warranty and cause permanent damage to the meter.

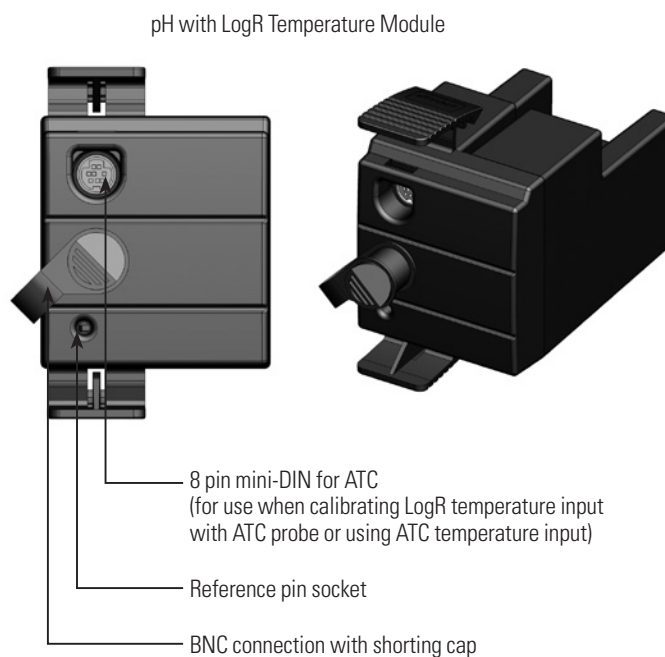
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Chapter 2 Module Overview

To connect the modules to the meter and for specific information regarding the meter outputs, please see the Orion VERSA STAR Reference Guide. The Reference Guide is on the CD included with the meter and also available at www.thermoscientific.com/water.

Module Connections and Inputs

1. Prepare the pH Triode® or electrode/ATC probe for use as instructed in user guide.
2. Place electrode and ATC and Orion Star stirrer probe (cat. no. 096019, optional) in meter's electrode arm.
3. Attach the BNC and ATC connectors to the meter module. If using the stirrer probe, attach probe to the meter and assign the probe to the channel in the setup menu for instrument settings.
4. Set up work area with calibration buffers, rinse water, sample & other supplies.
5. Connect the meter for data collection (Hyperterminal, LIMS, Star Printer, etc), if desired.
6. Power the Orion VERSA STAR meter, Orion Star stirrer, and data collection device(s).



Module Maintenance

For routine maintenance, dust and wipe the module with a damp cloth. If necessary, warm water or mild water-based detergent can be used. Maintenance can be performed on a daily, weekly or monthly basis, as required by operating environment. Immediately remove any spilled substance using the proper cleaning procedure for that spill type.

Display Information from Module

Example pH Measurement Screen – Single Channel

Primary reading →

Calibration information with electrode slope from last calibration and buffer points →

Date and time →

Sample temperature →

Corresponding mV reading →

Electrode condition and slope →

pH bulb resistance information when LogR temperature compensation is used (appears automatically) →

The information on the display can be customized. Enter the setup menu to make changes.

1. Press **Setup**.
2. Use the arrow keys to highlight Inst. Settings, press **(f3/select)** key.
3. Use the arrow key to highlight Display View. Press **(f3/select)** key.
4. Follow the onscreen prompts to choose what you would like to see on the measurement screen.

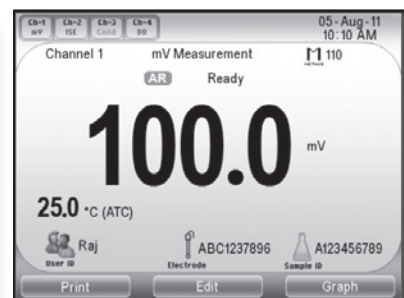
Example Single Channel Display Screens for ORP, RmV & mV Modes



ORP screen



RmV screen



mV screen

Chapter 3 Setup Menus

Setup Menus for Primary Measurements

1. Select the pH channel by pressing the channel key, then press **f3 (Setup)**.
2. Scroll with the **(>) key**, highlight the appropriate pH module, press **f3 (Select)**.
3. Arrow the cursor to Mode, press **f3 (Select)**, arrow to pH, press **f3 (Select)**.
4. Select the options.

pH Setup Menu

(Default values are in bold in the table below)

Electrode ID	Input
Sample ID	Off , Manual, Auto Increment
Resolution	0.1, 0.01, 0.001
Stability	Smart , Fast, Medium, Slow
Averaging	Off, Automatic Smart
Read Type	AutoRead , Timed, Single-Shot, Continuous
Buffer Group	USA , DIN, Custom
Isopotential Value	Off, On 7.000
Linear Regression	Off , On
Alarm**	Limit, CalDue, Set Point

** Limit and set point alarm default set to 'off'.
Cal due alarm set to 12 hours.

ORP, RmV and mV Setup Menus

(Default values are in bold in the table below)

Electrode ID	Input
Sample ID	Off , Manual, Auto Increment
Resolution	1.0, 0.1
Stability	Smart , Fast, Medium, Slow
Averaging	Off, Automatic Smart
Read Type	AutoRead , Timed, Single-Shot, Continuous
Alarm**	Limit, CalDue*, Set Point

Note: Different modes (mV, RmV, ORP) in the pH module have setup options relevant to that mode. *Only for ORP and RmV modes.

** Limit and set point alarm default set to 'off'.
Cal due alarm set to 12 hours.

5. Press the **f1 (Back)** button to step back to the main screen.

Read Type Information

There are three main read types available as shown in the setup menus.

- **Auto-Read** – The meter will display the measurement as it stabilizes and lock and hold the measurement when it is stable. (The AR icon will lock on the screen.) Once the measurement is locked, the meter will automatically export the measurement to the data log, if the data log is enabled in the setup menu, and to a printer or computer, if a printer or computer is connected to the meter and enabled in the setup menu. To take a new measurement, press **measure (esc)/1**.
- **Timed** – The meter will read and display a measurement at the set time interval that is programmed by the operator. At the set time interval, the meter will automatically export the measurement to the data log, if the data log is enabled in the setup menu, and to a printer or computer, if a printer or computer is connected to the meter and enabled in the setup menu. If selected, enter the time interval value in a hours:minutes:seconds format using the numeric keypad and press **f3 (select)** key.
- **Single Shot** – A single timed measurement will be taken after the set time has expired. The meter will apply the same saving and exporting data conditions as with the set time interval to record and export data, but lock after one timed reading has expired. Press **measure (esc)/1** to reset the countdown clock and take a new reading.
- **Continuous** – The meter will continuously measure and update the display. This read type is useful when performing an experiment that requires continuous measurements to be taken. Press the **log/print/0** key to export the measurement to the data log, if the data log is enabled in the setup menu, and to a printer or computer, if a printer or computer is connected to the meter and enabled in the setup.

Isopotential Value

The slope of all electrodes changes with temperature, based on the Nerst equation. The slope curves at the different temperatures intersect at the isopotential point, which is the concentration at which the potential of the electrode does not vary with temperature. For glass pH electrodes, this value is 7.00.

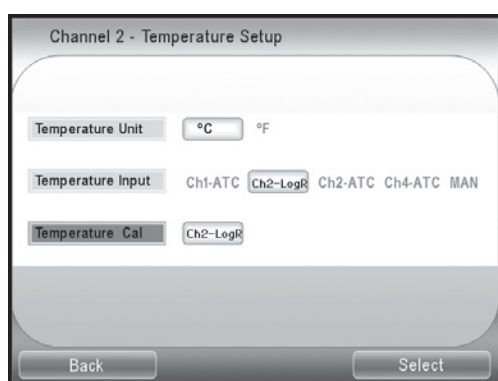
Linear Regression Information

The default is off which uses the traditional, segmented approach. The segmented approach is the most accurate and precise. More information can be found in the appendix section of this reference guide under the Multipoint Calibration Curve Feature.

Selecting “on” for this option results in the use of a single best fit line for the calibration curve, and can be beneficial if pH measurements vary greatly.

Selecting the Temperature Reading and Compensation Setting

1. In the measurement mode, press **setup/3** key.
2. Use the **arrow** keys to highlight the pH channel with LogR and press **f3 (Select)**.
3. Press the **right arrow** key to highlight *Temperature*, and press **f3 (Select)**.
4. Use the **arrow** keys to highlight the desired *Temperature Input*. The selection is automatically saved when highlighted.
 - *LogR* uses the resistance of the pH electrode's glass bulb.
 - *ATC* uses the automatic-temperature compensation (ATC) probe.
 - *MAN* uses the temperature value entered in the "Temperature Cal MAN" input.



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Chapter 4 pH, RmV and ORP Calibration

pH Calibration

Up to six pH buffers can be used for calibration. This can be a combination of automatically-recognized USA/NIST or DIN buffer values and custom buffers. Always use fresh pH buffers and select buffers that bracket the sample pH and are at least one pH unit apart. Prepare the pH electrode according to the instructions in the electrode user guide.

1. Press **f1 (Cal)** to perform a pH calibration.
2. Follow screen prompts for calibration. Use fresh buffers, rinse electrode with DI water before each reading, blot with a lint free tissue.
3. USA and DIN buffer sets are automatically recognized based off the selection in the setup menu, and the meter allows custom buffers to be used for up to 6 calibration points. Custom buffer option prompts for the nominal values and stores data.
4. During calibration, points can be edited or retested prior to acceptance.
5. Information for the last calibration can be displayed on the main measurement screen. Refer to this reference guide, Chapter 2 Module Overview, Display Information section for more information.

RmV Calibration

One standard can be used for relative mV calibration. Always use fresh standard. Prepare the electrode according to the instructions in the electrode user guide.

1. Press **f1 (Cal)** to enter calibration mode.
2. Follow the screen prompts for calibration.
3. The calibration can be saved or printed when complete.
4. Information for the last calibration can be displayed on the main measurement screen. Refer to this reference guide, Chapter 2 Module Overview, Display Information section for more information.

ORP Calibration

The mV reading of an ORP standard is dependent on the ORP electrode reference system, reference material, filling solution and ORP standard temperature. An ORP electrode can be automatically calibrated to read 420 mV relative to the Standard Hydrogen Electrode (E_{H}) at 25 °C when the Orion ORP standard (cat. no. 967901 or 96791), Orion ORP electrode (cat. no. 9678BNWP, 9778BNWP, 9180BNMD or 9179BNMD) and Orion 4M KCl filling solution (cat. no. 900011) or 4M KCl gel (in electrode with cat. no. 9179BNMD) are used. The raw mV reading of an electrode with the same conditions is 220 mV at 25 °C.

One standard can be used for ORP calibration. Always use fresh standard. Prepare the electrode according to the instructions in the electrode user guide.

1. Press **f1 (Cal)** to enter calibration mode.
2. Follow the screen prompts for calibration.
3. The calibration can be saved or printed when complete.
4. Information for the last calibration can be displayed on the main measurement screen. Refer to this reference guide, Chapter 2 Module Overview, Display Information section for more information.

Chapter 5 Temperature Calibration

For improved temperature accuracy, the Orion VERSA STAR meter and pH with LogR Temperature module system offers the option for temperature calibration. One point can be calibrated for an Automatic Temperature Compensation (ATC) probe. Up to three points can be calibrated when LogR temperature input is being used. Please review the information below prior to 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 in the next section.

1. In the measurement mode, press **setup/3** key.
2. Use the **arrow** keys to highlight the pH channel with LogR and press **f3 (Select)**.
3. Press the **right arrow** key to highlight Temperature, and press **f3 (Select)**.
4. *Temperature Input* should be set to LogR. Use the **arrow** keys to highlight the appropriate LogR temperature channel if LogR is not already selected. Select the appropriate channel with LogR for *Temperature Cal* and press **f3 (Select)**.

5. **If using an ATC probe:**

- a. Verify the pH electrode and ATC probe are connected to the pH with LogR module.
- b. Place the pH electrode and ATC probe into the water bath.

If using a NIST reference:

Disconnect the ATC probe (if connected to the pH with LogR module) and place the pH electrode into the water bath.

6. Stir moderately, using the stirrer probe (cat. no. 096019, sold separately) or stir plate with stir bar. Press **f3 (Start)**.
7. After the reading stabilizes, follow the prompts to edit temperature value with **f3 (Edit)** or accept the value with **f2 (Accept)**.
8. Up to three temperature points can be calibrated for LogR. For additional temperature points, press **f2 (Next)** and repeat steps 5 and 6. When finished, press **f3 (Cal Done)** to complete and store the calibration.

Note: To store the calibration data, the **f3 (Cal Done)** key must be pressed. Press **measure (esc)/1** key or **f1 (Back)** to exit calibration without saving.

ATC Probe Calibration Technique

The ATC temperature display has a relative accuracy of ± 0.1 °C. ATC probes (both separate and those built into electrodes) have varying temperature accuracies, usually ± 0.5 °C to ± 2 °C. *Use this function only if necessary.* Since the temperature offset calculated during the calibration is applied to all future temperature measurements, recalibrate if a different ATC probe is used. For temperature calibration, the probe needs to be connected to the meter and the calibration solution should have a known, stable temperature. It is recommended that two NIST-traceable thermometers be used to measure and verify solution temperature.

1. Press **f3 (setup)** key.
2. Use the arrow keys to highlight the channel that the temperature probe is connected to. Press **f3 (select)**.
3. Use the arrow keys to highlight Temperature and press **f3 (select)**.
4. Use the arrow keys to highlight the appropriate Temperature Cal option and press **f3 (select)**.
5. Follow the onscreen prompts.

Chapter 6 Measurement

After a successful calibration, the samples can be tested.

1. Rinse the electrode with deionized water. Blot dry with lint-free tissue.
2. Place electrode/ATC probe in first sample and stir gently.
3. If the meter is in AutoRead mode (meter default) or single-shot read mode, press **measure (esc) (1)** key. If the meter is in timed or continuous read modes, the meter will immediately start taking readings.
4. If in AutoRead mode and datalog is enabled (default), the reading will automatically be stored when the "AR" appears. If in continuous read mode and datalog is enabled, press **log/print (0)** key to store into the meter's memory. If in timed read mode, the reading is automatically stored after each interval. If in single-shot read mode, the reading is stored automatically after the single-shot time has passed.

Note: To enable or disable datalogging, press **setup** and select Inst. Settings.

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Chapter 7 Methods

The meter stores up to ten methods per channel with the last calibration data stored for each method. Use the channel setup to access and modify methods.

1. Press **f3 (setup)** key.
2. Use the arrow keys to highlight the appropriate channel. Press **f3 (select)**.
3. Use the arrow keys to highlight Method and press **f3 (select)**.
4. The methods can be loaded, copied, saved and edited by following the onscreen prompts.

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Chapter 8 Data Storage and Review

Data Storage Settings

Measurement Read Type

The measurement read type determines when the meter sends measurements to outputs as selected in the setup menu and when properly connected to the meter. These are set individually for each channel. Measurement Read Type is set per channel in the setup menu. Please refer chapter 3 Setup Menus in this reference guide for more information.

Datalog, Computer and Printer Export Settings

Orion VERSA STAR Meters have a 2000-datalog capability. To make your selection:

1. From measurement mode, press **setup/3**.
2. Press the arrow keys to highlight Inst. Settings. Press **setup/3**. Use the **down arrow** key to highlight your desired communication output port:
 - a. USB
 - b. RS232
 - c. USB Printer – enables communication through the micro-USB port directly to a USB printer.
3. Press **f2 (page)** key, use the **arrow** keys and **f3 (select)** key to:
 - a. turn on printing
 - b. select the print format
 - c. turn on datalogging

For more information on these settings, refer to the Orion VERSA STAR Reference Guide, Chapter 3 Instrument Settings to turn on Data Log to enable data storage.

Datalog Review

This option allows for stored data to be:

- reviewed
- printed individually, in a group or all
- deleted
- analyzed with general statistical information

The datalog will reflect a screen capture of all the information at the time of datalogging.

To review datalog information

- Press **log view (9)** key
- Press **f3 (select)** key
- Follow prompts to review information

Calibration Review

This feature allows for review and printing of each of the last 10 calibrations for each parameter of the meter. The information will match the information recorded for that calibration.

To review calibration information

1. Press **log view (9)** key.
2. Press **right arrow (6)** key to select CalLog information and **down arrow (8)** to highlight the desired parameter.
3. Press **f3 (select)** key and follow the prompts.

Chapter 9 Customer Services

Troubleshooting Guide

Error	Recommended Actions
Measurement is flashing 9999 and over range or under range.	Measurement is outside the allowable measurement range. Check electrode connection and settings in the setup menu. Clean the electrode according to the electrode user guide and recalibrate the electrode with new buffers or standards. If the error continues, perform the meter self test in the diagnostics menu.
The measurement freezes and will not change.	The meter is in AutoRead mode. (AR icon appears solid on the display.) Press measure (esc)/1 key to take a new reading or go to setup to change the read type.
The meter does not automatically recognize the pH buffer during calibration.	Verify the correct buffer set was selected in the setup menu. The meter uses raw mV readings to recognize the buffer. As the electrode ages or becomes dirty, its mV readings will drift. Check buffers and clean electrode according to electrode instructions.

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, or the latest application and technical resources for Thermo Scientific Orion products, visit www.thermoscientific.com/water.

Warranty and Registration

To register your new meter and for the most current warranty information, visit www.thermoscientific.com/water.

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 above.

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 that may assist the detection of substances subject to the RoHS Directive are available at www.thermoscientific.com.

Declaration of Conformity

Manufacturer: Thermo Fisher Scientific Inc.

Address: Ayer Rajah Crescent
Blk 55 #04-16/24
Singapore 139949
Singapore

Hereby declares that the following products:

Orion VERSA STAR Advanced Electrochemistry Benchtop Meters with Modules are rated 100 to 240 VAC, 50/60 Hz, 0.5A.

Equipment Class:

Measurement, control and laboratory
Orion Star A-series meters are EMC Class A

Conforms with the following directives and standards:

EN61326-1:2006

Electromagnetic Compatibility (EMC Directive)

Electrical equipment for measurement,
control and laboratory use - EMC requirements

EN61010-1:2001

Safety Standards

UL61010-1:2004

Safety requirements for electrical equipment for measurement,

CAN/CSA C22.2 No. 61010-1-04

control and laboratory use - general requirements



Cheow Kwang Chan
QA/Regulatory Manager

Place and Date of Issue:
12 December, 2011
Singapore

pH with LogR Temperature Module Specifications



pH Module (VSTAR-PH) Specifications		
pH	Range	-2.000 to 20.000
	Resolution	0.1, 0.01, 0.001
	Relative Accuracy	±0.002
	Calibration Points	Up to 6
	Calibration Editing	Yes
	Adjustable ISO Point	Yes
mV/RmV	Range	±2000.0 mV
	Resolution	0.1
	Relative Accuracy	±0.2 mV or ±0.05 % of reading whichever is greater
	E _H ORP Mode	Yes
Temperature	Range	-5 to 105 °C, 23 to 221 °F
	Resolution	0.1
	Relative Accuracy	±0.1
	Offset Calibration	1 point
LogR Temperature	Range	0 to 100 °C (0 to 212 °F)
	Resolution	0.1
	Relative Accuracy	±0.5
	Resistance Range	0 to 6000 MΩ
	Resistance Resolution	0.1 MΩ up to 1999.9 MΩ, 1 MΩ above 1999.9 MΩ
	Offset Calibration	3 points
Inputs		pH: BNC, reference pin ATC: 8-pin mini-DIN

NOTE: We reserve the right to make improvements. Specifications subject to change without notice.

Ordering Information

CML #	Description
VSTAR00	Orion VERSA STAR Benchtop Meter - Electrode arm with redesigned holder - Universal power adapter
VSTAR10	Orion VERSA STAR pH Benchtop Meter Set - Orion VERSA STAR meter with pH/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR12	Orion VERSA STAR pH Benchtop Meter Kit - Orion VERSA STAR meter with pH/temperature module - 8302BNUMD Orion ROSS Triode pH/ATC probe - 096019 Orion Star stirrer probe - 810199 ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - Electrode arm with redesigned holder - Universal power adapter
VSTAR20	Orion VERSA STAR Conductivity Benchtop Meter Set - Orion VERSA STAR meter - Orion VERSA STAR conductivity/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR22	Orion VERSA STAR Conductivity Benchtop Meter Kit - Orion VERSA STAR meter - Orion VERSA STAR conductivity/temperature module - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 011007 conductivity standard, 1413 μ S, 5x60 mL - Electrode arm with redesigned holder - Universal power adapter
VSTAR30	Orion VERSA STAR RDO/Dissolved Oxygen Benchtop Meter Set - Orion VERSA STAR meter - Orion VERSA STAR dissolved oxygen/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR32	Orion VERSA STAR RDO/Dissolved Oxygen Benchtop Meter Kit - Orion VERSA STAR meter - Orion VERSA STAR dissolved oxygen/temperature module - 083005MD Orion polarographic DO probe - 080017 calibration sleeve for DO probe - 080513 DO probe maintenance kit - 970802 BOD funnel/stirrer - 080360 BOD adapter - Electrode arm with redesigned holder - Universal power adapter

CML #	Description
VSTAR40A	<p>Orion VERSA STAR pH/ISE Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/ISE/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR40A2	<p>Orion VERSA STAR pH/ISE Benchtop Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/ISE/temperature module - 8102BNUWP Orion ROSS Ultra pH electrode - 096019 Orion Star stirrer probe - 927007MD ATC probe, stainless steel - ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - Electrode arm with redesigned holder - Universal power adapter
VSTAR40B	<p>Orion VERSA STAR Benchtop Meter with Two pH/ISE Modules Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Two Orion VERSA STAR pH/ISE/temperature modules - Electrode arm with redesigned holder - Universal power adapter
VSTAR40B2	<p>Orion VERSA STAR Benchtop Meter with Two pH/ISE Modules Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Two Orion VERSA STAR pH/ISE/temperature modules - 8102BNUWP Orion ROSS Ultra pH electrode - 096019 Orion Star stirrer probe - 927007MD ATC probe, stainless steel - ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - Two electrode arms with redesigned holders - Universal power adapter
VSTAR50	<p>Orion VERSA STAR pH/Conductivity Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/temperature module - Orion VERSA STAR conductivity/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR52	<p>Orion VERSA STAR pH/Conductivity Benchtop Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter with pH/temperature module - Orion VERSA STAR conductivity/temperature module - 8157BNUMD Orion ROSS Ultra Triode pH/ATC probe - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 810199 ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - 011007 conductivity standard, 1413 μS, 5x60 mL - Electrode arm with redesigned holder - Universal power adapter

CML #	Description
VSTAR80	<p>Orion VERSA STAR pH with LogR Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/temperature with LogR technology module - 927007MD ATC probe, stainless steel - Electrode arm with redesigned holder - Universal power adapter
VSTAR82	<p>Orion VERSA STAR pH Benchtop Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/temperature with LogR technology module - 8172BNWP Orion ROSS Sure-Flow pH electrode - 927007MD ATC probe, stainless steel - ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - 810007 ROSS fill solution, 5x60 mL - Electrode arm with redesigned holder - Universal power adapter
VSTAR90	<p>Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Benchtop Multiparameter Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/ISE/temperature module - Orion VERSA STAR conductivity/temperature module - Orion VERSA STAR dissolved oxygen/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR91	<p>Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Ultimate Benchtop Multiparameter Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Two Orion VERSA STAR pH/ISE/temperature modules - Orion VERSA STAR conductivity/temperature module - Orion VERSA STAR dissolved oxygen/temperature module - Two 096019 Orion Star stirrer probes - Two electrode arms with redesigned holders - Universal power adapter

CML #	Description
VSTAR92	<p>Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Benchtop Multiparameter Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR pH/ISE/temperature module - Orion VERSA STAR conductivity/temperature module - Orion VERSA STAR dissolved oxygen/temperature module - 8157BNUMD Orion ROSS Ultra Triode pH/ATC probe - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 083005MD Orion polarographic DO probe - 096019 Orion Star stirrer probe - 080017 calibration sleeve for DO probe - 080513 DO probe maintenance kit - 970802 BOD funnel/stirrer - 080360 BOD adapter - 810199 ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - 011007 conductivity standard, 1413 μS, 5x60 mL - Electrode arm with redesigned holder - Universal power adapter
VSTAR93	<p>Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Ultimate Benchtop Multiparameter Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Two Orion VERSA STAR pH/ISE/temperature modules - Orion VERSA STAR conductivity/temperature module - Orion VERSA STAR dissolved oxygen/temperature module - 8157BNUMD Orion ROSS Ultra Triode pH/ATC probe - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 083005MD Orion polarographic DO probe - Two 096019 Orion Star stirrer probes - 080017 calibration sleeve for DO probe - 080513 DO probe maintenance kit - 970802 BOD funnel/stirrer - 080360 BOD adapter - 810199 ROSS solution kit (475 mL each of pH 4, 7 and 10 buffers; storage solution; cleaning solution; and pH electrode storage bottle) - 011007 conductivity standard, 1413 μS, 5x60 mL - Two electrode arms with redesigned holders - Universal power adapter

Accessories	
CML #	Description
VSTAR-PH	Orion VERSA STAR pH/temperature module
VSTAR-ISE	Orion VERSA STAR pH/ISE/temperature module
VSTAR-CND	Orion VERSA STAR conductivity/temperature module
VSTAR-RD	Orion VERSA STAR RDO/DO/temperature module
VSTAR-LR	Orion VERSA STAR pH/temperature with LogR technology module
STARA-BEA	Benchtop electrode arm for Orion Star A-series meters
STARA-HB	Freestanding base for use with Orion Star A-series benchtop electrode arm
STARA-PWR	Replacement universal power adapter for Orion VERSA STAR meters
096019	Orion Star stirrer probe
8102BNUWP	Orion ROSS Ultra pH electrode, refillable, glass body
8172BNWP	Orion ROSS Sure-Flow pH electrode, glass body
8156BNUWP	Orion ROSS Ultra refillable pH electrode, epoxy body
8157BNUMD	Orion ROSS Triode pH/ATC electrode, refillable, epoxy body
8302BNUMD	Orion ROSS Triode pH/ATC electrode, refillable, glass body
8172BNWP	Orion ROSS Sure-Flow pH electrode, glass body
8611BNWP	Orion ROSS sodium combination ISE
927007MD	Orion ATC probe, stainless steel body
927005MD	Orion ATC probe, epoxy body
013005MD	Orion DuraProbe conductivity cell, 4-cell, K=0.475
013016MD	Orion conductivity cell, flow through, K=0.1
083005MD	Orion dissolved oxygen probe, polarographic
086030MD	Orion auto-stir DO/BOD probe, polarographic
087010MD	Orion RDO optical DO probe, 3 m cable
810199	Orion ROSS all-in-one pH buffer kit
910104	Orion pH 4.01 buffer, 475 mL
910107	Orion pH 7.00 buffer, 475 mL
910110	Orion pH 4.01 buffer, 475 mL
011008	Orion conductivity standard, 100 μ S/cm, 5x60 mL bottles
011007	Orion conductivity standard, 1413 μ S/cm, 5x60 mL bottles
011006	Orion conductivity standard, 12.9 mS/cm, 5x60 mL bottles
1010001	Orion conductivity calibration resistor kit
9512HPBNWP	Orion high-performance ammonia ISE
9512BNWP	Orion standard ammonia ISE
951007	Ammonia standard, 1000 ppm, 475 mL
951210	Low-level ammonia ISA
951211	Ammonia ISA, 475 mL
951209	Fill solution for Orion high-performance ammonia ISE, 60 mL
951202	Fill solution for standard ammonia ISE, 60 mL
951213	Ammonia ISE storage solution
9609BNWP	Orion fluoride combination ISE
040906	Fluoride standard, 1 ppm with TISAB II, 475 mL
040907	Fluoride standard, 2 ppm with TISAB II, 475 mL
040908	Fluoride standard, 10 ppm with TISAB II, 475 mL
940909	TISAB II, 1 gallon
8611BNWP	Orion ROSS sodium combination ISE

Appendix A Advanced Features

Automatic pH Buffer Recognition Feature

The Orion VERSA STAR Meter and pH with LogR Temperature module systems are capable of automatically recognizing pH 1.68, 4.01, 7.00, 10.01 and 12.46 buffers or pH 1.68, 4.01, 6.86, and 9.18 buffers during a pH calibration, depending on the pH buffer set that is selected in the setup menu. 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 reading of the pH electrode in the buffer must be about ± 30 mV from the theoretical mV reading of the buffer in order for the meter to automatically recognize the buffer.

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




Testing a pH Electrode for Automatic Buffer Recognition

To verify that the raw mV reading of the pH electrode in use is ± 30 mV from the theoretical mV reading of the buffer, and therefore verify that the pH electrode in use is capable of performing automatic buffer recognition, perform the following procedure.

1. Set the measurement mode to mV. Prepare the pH electrode according to the instructions in the pH electrode user guide.
2. Rinse the pH electrode with distilled water, blot it dry with a lint-free tissue and place the pH electrode into a pH 4.01 buffer at approximately 25 °C.
3. Wait for the measurement to stabilize and record the mV value of the pH 4.01 buffer when the meter indicates that the measurement is stable. The read type selected in the setup menu will determine how the mV measurements are displayed by the meter.
4. Remove the pH electrode from the pH 4.01 buffer.
5. Rinse the pH electrode with distilled water, blot it dry with a lint-free tissue and place the pH electrode into a pH 7.00 buffer at approximately 25 °C.
6. Wait for the measurement to stabilize and record the mV value of the pH 7.00 buffer when the meter indicates that the measurement is stable.
7. The mV reading of the pH electrode in pH 4.01 buffer should be in the range of +207 to +147 mV and the mV reading of the pH electrode in pH 7.00 buffer should be in the range of -30 to +30 mV. If the mV readings of the pH electrode are in the correct ranges, the pH electrode is capable of performing automatic buffer recognition. If the mV readings of the pH electrode are not in the correct ranges, the values of the pH buffers will need to be manually entered during a pH calibration.

Electrode Condition Icon

The electrode condition icon indicates the performance of the pH electrode, based on the last saved calibration and electrode measurement stability.

Icon	pH Electrode Definition of Icon
	Electrode condition is good and the electrode slope is 90 to 110 %.
	Electrode condition is fair and the electrode slope is 80 to 120 %.
	Electrode condition is bad and the electrode slope is less than 80 % or greater than 120 %. Consult the electrode user guide for instructions on how to clean, condition and troubleshoot the electrode.

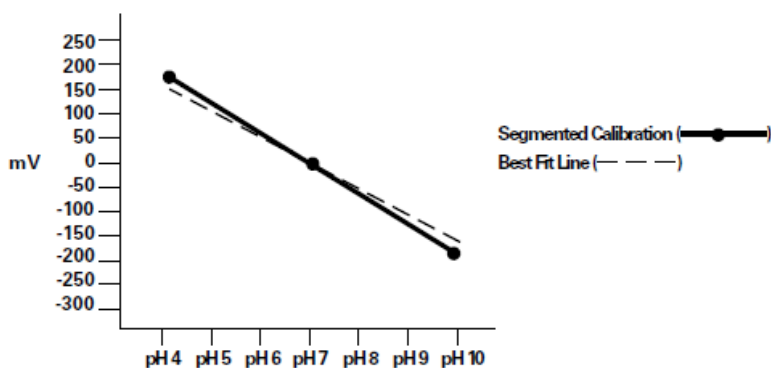
Multipoint Calibration Curve Feature

The Orion VERSA STAR Meter and pH with LogR Temperature module systems utilize a point-to-point scheme for multipoint calibrations in the pH mode. In this technique, straight line segments are drawn between each successive pair of calibration points. Separate slope and E_0 values are calculated using the adjacent pair of data points. For example, in a five point calibration, four slopes and five E_0 values are calculated to correspond to the four line segments that connect the data. pH values for samples are calculated according to the segment that their potential values fall into.

Those above or below the range of calibration are calculated by extrapolation from the top or bottom most segment.

The displayed slope is an average slope of the separate segments. The slope may be outside the range normally expected for an electrode. For example, if the slope of one segment is low, then the average will be lower than theoretical, even though the response may be Nernstian over most of the range.

The figure below is an example of a typical calibration curve using this method.



Appendix B About LogR Technology

LogR Temperature Measurements

Orion VERSA STAR Meter and pH with LogR Technology Module systems 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. To maximize system performance and accuracy, use a ROSS pH electrode.

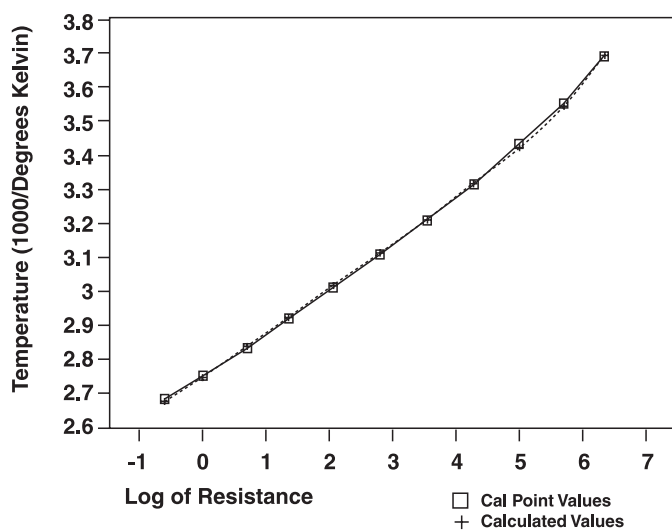


Figure 1 – LogR Resistance vs. Temperature Graph LogR™ Temperature Accuracy Tables

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.

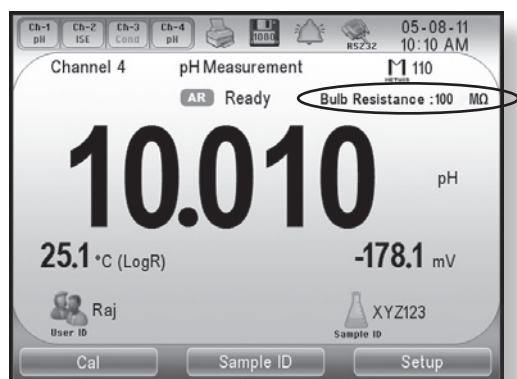
Appendix C Advanced Orion VERSA STAR Meter and pH with LogR Module's Electrode Diagnostics

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 VERSA STAR Meter and pH with LogR Module system allows 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

The pH electrode bulb resistance value can be found right on the measurement screen when LogR is selected for the temperature input.



For assistance setting the temperature input, refer to chapter 3 of this reference guide, the section titled "Selecting the Temperature Reading and Compensation Setting".

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 VERSA STAR Meter and pH with LogR Module system'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 M Ω 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 VERSA STAR Meter and pH with LogR Module system'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.

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