

**Thermo Scientific Orion VERSA STAR™
RDO/DO/Temperature Module**

Reference Guide



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This publication supersedes all previous publications on this subject.

Thermo Scientific Orion VERSA STAR™ RDO/DO/Temperature Module

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Chapter 1 Introduction

Thank you for your purchase of the Thermo Scientific Orion VERSA STAR™ RDO/DO/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:

- Works with and automatically recognizes Orion polarographic DO and RDO optical/luminescence-base probes
- Polarographic DO probe measurement range of 0 to 90 mg/L and 0 to 600% saturation
- RDO probe measurement range of 0 to 50 mg/L and 0 to 500% saturation
- Readings compensate for temperature, salinity and barometric pressure
- Automatic and manual datalogging options
- Quick calibration using water-saturated air, air-saturated water, Winkler titration or zero point

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

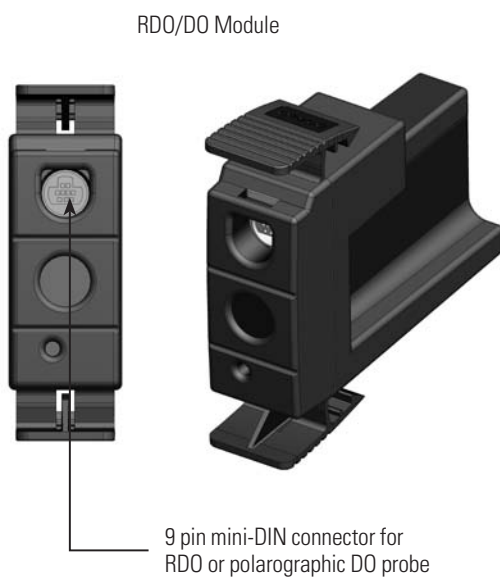
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Chapter 2 Module Overview

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. Select either the RDO or Polarographic DO probe based on sample range and testing requirements.
2. Place selected probe in the meter's electrode arm. If using the RDO probe, attach the included adapter.
3. Attach the 9 pin mini-DIN connection into the RDO/DO module.
4. Attach the stirrer to the side of the meter and into the meter's electrode arm, if needed for your test method.
5. Set up area with deionized rinse water, sample and other supplies.
6. Connect the meter for data collection (Hyperterminal, LIMS, Star Printer, etc), if desired.
7. Power the Orion VERSA STAR meter, stirrer, and data collection device(s).

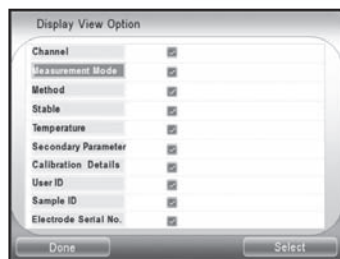
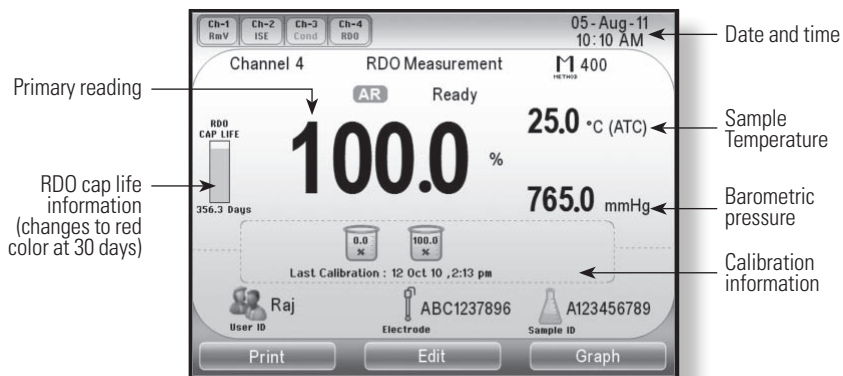


Module Maintenance

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 RDO Measurement Screen – Single Channel



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.

Chapter 3 Setup Menus

Setup Menus for Primary Measurements

1. Select the RDO/DO channel by pressing the channel key, then press **f3 (Setup)**.
The meter detects the RDO or DO probe type automatically and selects mode menu.
2. Select the options for your testing.

RDO/DO Setup Menu (Default values are in bold in the table below)

Probe Serial Number	Input
Sample ID	Off , Manual, Auto Increment
Resolution	Dependent on measurement unit: 0.1 (default) , 1 for % sat 0.01 (default), 0.1 for mg/L
Stability	Smart , Fast, Medium, Slow
Averaging	Off, Automatic Smart
Read Type	AutoRead , Timed, Continuous
Measurement Unit	mg/L, %
Pressure Compensation	Auto , Manual
Salinity Correction	Auto*, Manual
Alarm**	Limit, CalDue, Set Point

* For automatic salinity correction of RDO/DO reading, ensure oxygen probe and conductivity cell are in the same sample.

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

3. 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. There are two options:
 1. By checking/selecting the "Interval" box, 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.
 2. If the "Interval" box is unchecked/not selected, a single timed measurement will be taken. 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 interval 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.

RDO Probe Information

The RDO probe works with a unique optical cap. Information exclusive to this cap, such as:

- Serial number
- Remaining cap life
- Date of manufacture

can be found in the setup menu when the RDO probe is connected and recognized as the measurement mode.

1. Verify RDO probe is connected.
2. Press **setup/3**.
3. Use the arrows to highlight the channel with RDO if needed. Press **f3 (Select)** key.
4. Use the right arrow to highlight RDO Electrode Info to review information.

Setup Menu for Temperature

All of the temperature measurement settings are found in Temperature Setup menu for each measurement.

Temperature Unit	°C or °F selection
Temperature Input and Type	Ch-1 ATC, Ch-2 ATC, Ch-3 ATC, Ch-4 ATC, MTC
Temperature Cal	Ch-1* ATC only or All ATC allows all ATCs to be calibrated at once

* This number will change to match the setup menu channel.

Temperature probes can be set up in the measurement mode of the sample you are measuring. Ch-1 ATC allows the temperature probe to be used in more than one channel for temperature-compensated measurements, such as when a pH electrode and a 2-cell conductivity cell are in the same measurement sample. Temperature is a critical pH and conductivity measurement as the measurement values require a temperature correction to determine the reference value, often 25 °C in the America and 20 °C in Europe.

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Chapter 4 RDO/DO Calibration

Polarographic DO probes only – These probes need to be polarized prior to use. It is continuously polarized when connected to the meter. If the probe is new or has not been connected to the meter: connect the probe to the module connected to the meter, connect the meter to a power source and wait 30 minutes for polarization.

Calibration Methods

- **Water-Saturated Air (Air)** – The simplest and most accurate method, this method uses the calibration sleeve included with the DO probe. Due to the inherent differences between water saturated air and air-saturated water, 102.3% saturation will be displayed when the calibration reading is stable using a polarographic DO probe. For best accuracy, the calibration temperature should match the measuring temperature. Moisten the sponge or absorbent cloth in the calibration sleeve with distilled water and insert the probe into the sleeve without touching the water-saturated material.
- **Air-Saturated Water (Water)** – Use water that is 100% saturated with air. Bubble air into a water sample for an extended period of time, preferably overnight.
- **Winkler Titration (Manual)** – This method uses a water sample with a known concentration of dissolved oxygen and can be used to calibrate the DO probe to the value achieved by a Winkler titration. A manual calibration involves performing a Winkler titration and using that sample as a calibration standard. The oxygen level resulting from the titration is entered. This correlates the meter input to the Winkler titration. Due to the possibility of titration errors, this method is inherently less accurate.
- **Set Zero** – A zero point calibration requires oxygen-free solution. This method needs to be repeated each time the probe is replaced or modified (cap change with RDO probes; membrane change or fresh electrolyte with polarographic DO probes). This calibration is generally not required unless measurements will be taken below 10% saturation or 1 mg/L. An air or water calibration needs to be performed prior to a zero point calibration.

Calibration Procedure

1. Press **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.

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Chapter 5 Temperature Calibration

The ATC temperature display has a relative accuracy of $\pm 0.1^{\circ}\text{C}$. Temperature sensors built into RDO/polarographic DO probes have varying temperature accuracies, usually $\pm 0.5^{\circ}\text{C}$ to $\pm 2^{\circ}\text{C}$. *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 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.

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Chapter 6 Measurement

After successful calibration, the samples can be tested.

1. Rinse the RDO or DO probe with deionized water, blot dry with lint-free tissue.
2. Place RDO/DO probe, conductivity cell if required, and optional stirrer in first sample.
3. If the meter is in AutoRead mode (meter default) press **measure (esc) (1)** key. If the meter is in continuous or timed read mode, 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.

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**.
3. Use the arrow keys, **f2 (page)** key and **f3 (select)** key to:
 - a. set the communication protocol
 - b. turn on printing
 - c. select the print format
 - d. 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:

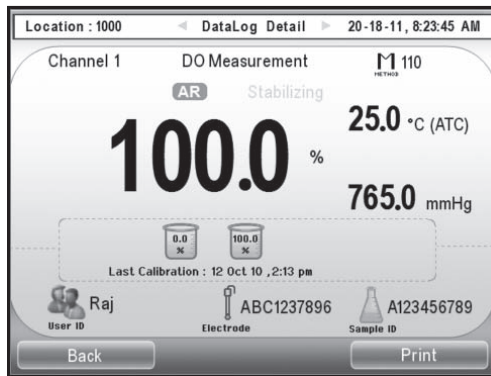
- reviewed
- printed individually, in a group or all
- deleted
- analyzed with general statistical information

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

Example Datalog View



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.

Example Calibration Log Display

Log #	Log Date & Time	Calibration Details	
101	12-Aug-11, 11:34 AM	Channel : 0	Method No : 110
101	12-Aug-11, 11:34 AM	Electrode : ABC1237896	Module No : 1
101	12-Aug-11, 11:34 AM	User ID : Raj	
101	12-Aug-11, 11:34 AM	Calibration Value	102.3 %
101	12-Aug-11, 11:34 AM	Calibration Current	1200.0 nA
101	12-Aug-11, 11:34 AM	Set Zero Calibration Value	0.0 %
101	12-Aug-11, 11:34 AM	Set Zero Calibration Current	1.2 nA
101	12-Aug-11, 11:34 AM	Calibration Slope	11.4 nA / %Sat
101	12-Aug-11, 11:34 AM	Calibration Pressure	766.2 mmHG
101	12-Aug-11, 11:34 AM	Calibration Salinity	0.0 ppt
101	12-Aug-11, 11:34 AM	Calibration Solution Temperature	25.0 °C
101	12-Aug-11, 11:34 AM	Calibration Membrane Temperature	25.0 °C

At the bottom of the screen, there are 'Back' and 'Print' buttons.

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.

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

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Singapore

RDO/DO/Temperature Module Specifications



RDO/DO Module (VSTAR-RD) Specifications		
Dissolved Oxygen	Concentration - Polarographic	
	Range	0 to 90 mg/L
	Resolution	0.01, 0.1
	Relative Accuracy	±0.2
	% Saturation - Polarographic	
	Range	0 to 600
	Resolution	0.1, 1
	Relative Accuracy	±2 %
	Concentration - RDO	
	Range	0 to 50 mg/L
	Resolution	0.01, 0.1
	Relative Accuracy	±0.1 mg/L up to 8 mg/L; ±0.2 mg/L from 8 to 20 mg/L; 10 % of reading, 20 to 50 mg/L
	% Saturation - RDO	
	Range	0 to 500
	Resolution	0.1, 1
	Relative Accuracy	±2 % up to 200 % saturation; ±10 % of reading above 200 % saturation
Automatic Barometric Pressure Correction	450.0 to 850.0 mm Hg	
Salinity Factor Correction	Automatic when used with conductivity module and probe or manual; 0 to 45 ppt	
Calibration Features	Water saturated air, air saturated water, manual (Winkler) and zero point	
Probe Type	Polarographic or RDO	
Temperature	Range	0 to 50 °C, 32 to 122 °F
	Resolution	0.1
	Relative Accuracy	±0.1
	Offset Calibration	1 point
Input	9-pin mini-DIN	

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

Ordering Information

CML #	Description
VSTAR00	<p>Orion VERSA STAR Benchtop Meter</p> <ul style="list-style-type: none"> - Electrode arm with redesigned holder - Universal power adapter
VSTAR10	<p>Orion VERSA STAR pH Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter with pH/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR12	<p>Orion VERSA STAR pH Benchtop Meter Kit</p> <ul style="list-style-type: none"> - 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	<p>Orion VERSA STAR Conductivity Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR conductivity/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR22	<p>Orion VERSA STAR Conductivity Benchtop Meter Kit</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR conductivity/temperature module - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 011007 conductivity standard, 1413 μS, 5x60 mL - Electrode arm with redesigned holder - Universal power adapter
VSTAR30	<p>Orion VERSA STAR RDO/Dissolved Oxygen Benchtop Meter Set</p> <ul style="list-style-type: none"> - Orion VERSA STAR meter - Orion VERSA STAR dissolved oxygen/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR32	<p>Orion VERSA STAR RDO/Dissolved Oxygen Benchtop Meter Kit</p> <ul style="list-style-type: none"> - 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</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 - 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 - 8172BNX 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 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 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 - 8157BNUMD Orion ROSS Ultra Triode pH/ATC probe - 013005MD Orion DuraProbe conductivity cell, K=0.475 - 083005MD Orion polarographic DO 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 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 - 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
8172BNX	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 Advanced Features

Dissolved Oxygen Barometric Pressure Compensation

The Orion VERSA STAR Meter with RDO/DO/Temperature module systems have an internal barometer that is used for pressure compensated dissolved oxygen readings. The meter can also use manual barometric pressure compensation if dissolved oxygen is measured with a submerged probe or in a pressurized vessel. The pressure must be entered as mm Hg.

$$1 \text{ mm Hg} = 0.03937 \text{ inch Hg} = 1.3332 \text{ hPa (mBar)} = 0.01934 \text{ PSI.}$$

Dissolved Oxygen Salinity Correction

Automatic salinity correction for dissolved oxygen readings reported as mg/L is available on the Orion VERSA STAR Meter with RDO/DO/Temperature module systems if both dissolved oxygen and Orion VERSA STAR Conductivity/Temperature modules are used simultaneously. The meter uses the conductivity value read by the conductivity cell to calculate the salinity correction factor and applies the factor to dissolved oxygen readings reported as mg/L.

Manual salinity correction can be used for dissolved oxygen readings reported as mg/L on all Orion VERSA STAR Meter with RDO/DO/Temperature module systems. The manual salinity correction factor must be entered as ppt (parts per thousand).

Conductivity at 20 °C (mS/cm)	Salinity Correction Value (ppt)	Conductivity at 20 °C (mS/cm)	Salinity Correction Value (ppt)	Conductivity at 20 °C (mS/cm)	Salinity Correction Value (ppt)
5	3	20	13	35	25
6	4	21	14	36	25
7	4	22	15	37	26
8	5	23	15	38	27
9	6	24	16	39	28
10	6	25	17	40	29
11	7	26	18	42	30
12	8	27	18	44	32
13	8	28	19	46	33
14	9	29	20	48	35
15	10	30	21	50	37
16	10	31	22	52	38
17	11	32	22	54	40
18	12	33	23	56	42
19	13	34	24		

This table was calculated from the International Oceanographic Tables, Vol. 1, National Institute of Oceanography of Great Britain, Womley, Godaming, Surrey, England and Unesco, Paris 1971.

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Water Analysis Instruments



North America

166 Cummings Center
Beverly, MA 01915 USA
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands

Tel: (31) 033-2463887
info.water.uk@thermo.com

India

Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Japan

Tel: (81) 045-453-9175
wai.asia@thermofisher.com

China

Tel: (86) 21-68654588
wai.asia@thermofisher.com

Singapore

Tel: (65) 6778-6876
wai.asia@thermofisher.com

Australia

Tel: (613) 9757-4300
in Australia (1300) 735-296
InfoWaterAU@thermofisher.com
www.thermoscientific.com/water

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