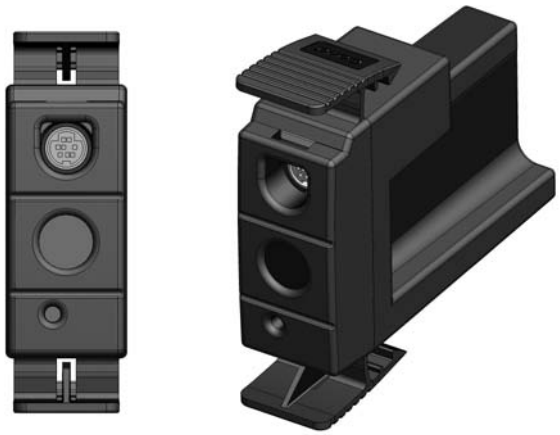
Thermo Scientific Orion VERSA STAR™
Conductivity/Temperature Module

Reference Guide



Thermo
SCIENTIFIC

Thermo Scientific Orion VERSA STAR™ Conductivity/Temperature Module

Table of Contents

This page intentionally left blank.

Chapter 1 Introduction

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

- Conductivity, TDS, salinity and resistivity capabilities
- Selectable reading reference temperatures of 5, 10, 15, 20 or 25 °C
- Compatibility with 2- or 4-cell conductivity cells
- Linear, non-linear, nLFu or EP curve options for conductivity
- Choice of practical salinity or natural sea water curves for salinity readings
- Automatic and manual datalogging options

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

This page intentionally left blank.

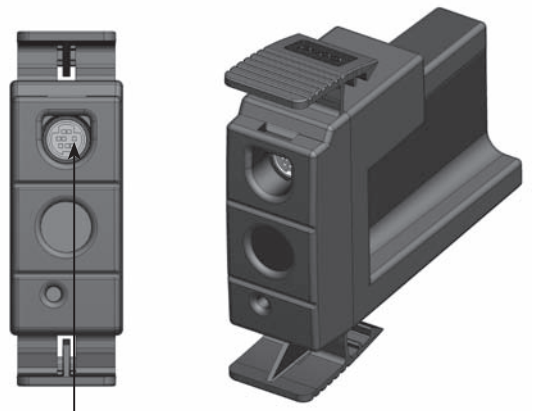
Chapter 2 Module Overview

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 a conductivity cell based on sample range and reporting requirements.
2. Place conductivity cell in the meter's electrode arm.
3. Attach the 8 pin mini-DIN connection into the conductivity module.
4. Attach the Orion Star stirrer probe (cat. no. 096019, sold separately) to the side of the meter and into the meter's electrode arm, if needed for your test method.
5. Set up area with standards, rinse water, sample & 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).

Conductivity Module



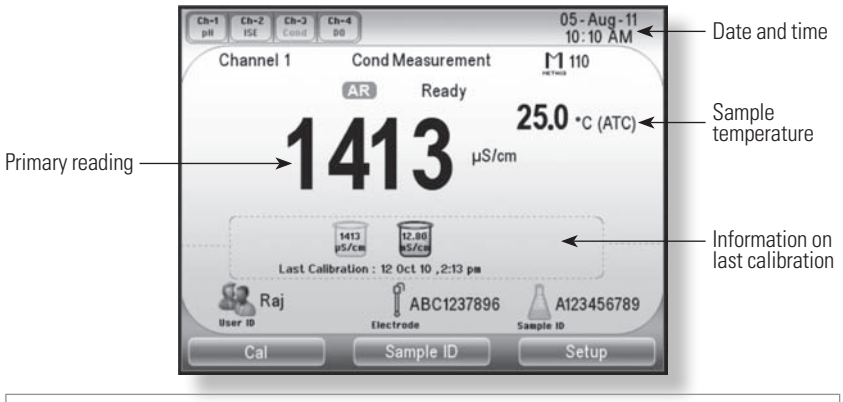
8 pin mini-DIN connector for conductivity probe

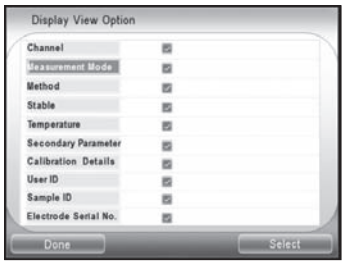
Module Maintenance

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 Conductivity 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 Conductivity channel by pressing the channel key, then press ***f3 (Setup)***.
2. Arrow over to highlight the appropriate conductivity module for setup, press ***f3 (Select)***.
3. Arrow the cursor to Mode, press ***f3 (Select)***, arrow to Conductivity, press ***f3 (Select)***.
4. Select the options for your testing.

Conductivity Setup Menu
(Default values are in bold in the table below)

Probe Serial Number	Input
Sample ID	**Off**, Manual, Auto Increment
Stability	**Smart**, Fast, Medium, Slow
Averaging	Off, **Automatic Smart**
Read Type	**AutoRead**, Timed, Continuous
Cell K (Constant)	Input cell constant
Reference Temperature	5, 10, 15, 20,or **25 °C**
Temp Compensation	**Linear**, nLFn, nLFu, EP
Temperature Coefficient	**2.1**
Alarm**	Limit, CalDue, Set Point

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

TDS, Salinity and Resistivity Setup Menus

TDS Setup Menu (Default values in bold)

Read Type	**AutoRead**, Timed, Continuous
Cell K (Constant)	Input cell constant
TDS Factor	**0.50**
Reference Temperature	5, 10, 15, 20, or **25** °C
Temp Compensation	**Linear**, nLFn, nLFu, EP, Off

Probe Serial Number	**Input**
Stability	**Smart**, Fast, Medium, Slow
Averaging	Off, **Automatic Smart**
Alarm	Limit, Set Point
Cell Type	**Standard**, USP

Salinity Setup Menu (Default values in bold)

Read Type	**AutoRead**, Timed, Continuous
Cell K (Constant)	Input cell constant
Salinity Type	**Practical Salinity**, Sea Water
Stability	**Smart**, Fast, Medium, Slow

Averaging	Off, **Automatic Smart**
Alarm	Limit, Set Point
Cell Type	**Standard**, USP

Resistivity Setup Menu (Default values in bold)

Read Type	AutoRead, Timed, Continuous
Cell K (Constant)	Input cell constant
Reference Temperature	5, 10, 15, 20, or 25 °C
Temp Compensation	Linear, nLFn, nLFu, EP, Off

Stability	**Smart**, Fast, Medium, Slow
Averaging	Off, **Automatic Smart**
Alarm	Limit, Set Point
Cell Type	**Standard**, USP

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.

Temperature Compensation Options

These options can vary according to the measurement mode.

- **Linear –** Most beneficial for use with samples with known and linear temperature coefficients.
- **nLFn –** This abbreviation is for non-linear natural pure water. It works best for low conductivity water such as pure waters and natural waters (ground, well or surface waters).
- **nLFu –** This abbreviation is for non-linear ultra pure water that contains no air or carbon dioxide.
- **EP –** Temperature-compensation is turned off when this is selected. Using this feature results in warning limits being displayed when the pure water sample is over the acceptable reading for that temperature per EP or USP requirements.

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.

This page intentionally left blank.

Chapter 4 Conductivity Calibration

The conductivity measurement modes are designed for applications to determine the quality of water in processes where dissolved ions (Salinity in psu, practical salinity units), purity (Resistance in low microSiemens/cm) and dissolved salts and other compounds (Total Dissolved Solids, TDS in ppt/ppm). Each measurement has its own units.

Conductivity spans a wide measurement range, so auto ranging in the live readings makes gathering sample data easier. As the readings change, the units display based on the value change. The Conductivity measurements are reported back to the Reference Temperature selected in setup.

Up to six conductivity standards can be used for calibration. Always use fresh standards and select standards that are near the sample conductivity. Prepare the conductivity cell according to the instructions in the conductivity cell user guide.

Note: For automatic calibration, the nominal cell constant of the conductivity cell must be entered in the setup menu before the calibration is performed. Use fresh Thermo Scientific Orion Conductivity Standards with values of 100 µS/cm, 1413 µS/cm and 12.9 mS/cm to use automatic calibration.

1. Press ***Cal (f1)*** to begin Conductivity calibration, bracketing expected sample range.
   Calibration may be 1 to 6 points.
   a. Use fresh standards, rinse cell with deionizer water before each reading, blot dry.
   b. Measure the Conductivity standards from the least concentrated standard to the most concentrated standard for greatest accuracy and to prevent carryover.
   c. Follow the onscreen prompts.
   d. During calibration, points can be edited or retested prior to acceptance. If the reading does not stabilize, you may press ***Override (f3)*** to take the reading.
   e. Accept the calibration when it is completed.
2. The calibration information is now displayed by standard beakers and concentrations used in the calibration when the main measurement screen returns. Press the ***log view (9)*** key to view calibration details. From log view, printing or sending data is an option.

This page intentionally left blank.

Chapter 5 Temperature Calibration

The ATC temperature display has a relative accuracy of ±0.1 °C. Temperature sensors built into the conductivity cells 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 conductivity cell 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.

This page intentionally left blank.

Chapter 6 Measurement

After successful calibration, the samples can be tested.

1. Rinse the conductivity cell with deionized water, blot dry with lint-free tissue.
2. Place conductivity cell and 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.

This page intentionally left blank.

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.

This page intentionally left blank.

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

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 recognize the conductivity standard during calibration.	Verify that the default cell constant was entered in the setup menu. The cell constant is usually printed on the conductivity probe cable. Check that it is one of the standard values autorecognized by the meter. Recalibrate with fresh standard.
The measurement is out of range when it should be in range.	Check that the conductivity probe is fully immersed in the solution. Review the settings in the setup menu. (Some key settings would be cell constant and temperature-related settings.)

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 **UL61010-1:2004** **CAN/CSA C22.2 No. 61010-1-04**	**Safety Standards** Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements

Cheow Kwang Chan
QA/Regulatory Manager

Place and Date of Issue:
12 December, 2011
Singapore

Conductivity/Temperature Module Specifications

Conductivity Module (VSTAR-CND) Specifications		
Conductivity	Range	0.001 µS to 3000 mS
	Resolution	0.001 µS minimum; 4 significant figures minimum
	Relative Accuracy	0.5 % reading ±1 digit
	Reference Temperature	5, 10, 15, 20, 25 °C
	Temperature Compensation	Linear (0 to 10.0 %/°C), nLn, nLFu, EP
	Compatible Cell Constants	0.001 to 199.9
	Calibration Points	Up to 6 points
	Calibration Editing	Yes
Resistivity	Range	2 ohm to 100 meg-ohm
	Resolution	2 ohms-cm
	Relative Accuracy	0.5 % reading ±1 digit
Salinity	Type	Practical salinity or natural sea water
	Range	0.01 to 80.0 ppt NaCl equivalent; 0.01 to 42 ppt sea water
	Resolution	0.01
	Relative Accuracy	±0.1
TDS	Range	0 to 200 ppt
	Resolution	4 significant digits
	Relative Accuracy	±0.5 % reading ±1 digit
	TDS Factor Range	Linear 0.01 to 10.00
Temperature	Range	-5 to 105 °C, 23 to 221 °F
	Resolution	0.1
	Relative Accuracy	±0.1
	Offset Calibration	1 point
Input		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 µS, 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	**Orion VERSA STAR pH/ISE Benchtop Meter Set** - Orion VERSA STAR meter - Orion VERSA STAR pH/ISE/temperature module - Electrode arm with redesigned holder - Universal power adapter
VSTAR40A2	**Orion VERSA STAR pH/ISE Benchtop Meter Kit** - 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	**Orion VERSA STAR Benchtop Meter with Two pH/ISE Modules** - Orion VERSA STAR meter - Two Orion VERSA STAR pH/ISE/temperature modules - Electrode arm with redesigned holder - Universal power adapter
VSTAR40B2	**Orion VERSA STAR Benchtop Meter with Two pH/ISE Modules Kit** - 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	**Orion VERSA STAR pH/Conductivity Benchtop Meter Set** - 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	**Orion VERSA STAR pH/Conductivity Benchtop Meter Kit** - 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	**Orion VERSA STAR pH with LogR Benchtop Meter Set** - Orion VERSA STAR meter - Orion VERSA STAR pH/temperature with LogR technology module - Electrode arm with redesigned holder - Universal power adapter
VSTAR82	**Orion VERSA STAR pH Benchtop Meter Kit** - 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	**Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Benchtop Multiparameter Meter Set** - 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	**Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Benchtop Multiparameter Meter Set** - 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	**Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Benchtop Multiparameter Meter Set** - 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	**Orion VERSA STAR pH/ISE/Conductivity/RDO/Dissolved Oxygen Ultimate Benchtop Multiparameter Meter Set** - 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 µS/cm, 5x60 mL bottles
011007	Orion conductivity standard, 1413 µS/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

Conductivity Temperature Compensation and Reference Temperature

The Orion VERSA STAR Meter with Conductivity/Temperature Module Systems have the ability to use a temperature compensation feature that calculates and displays the conductivity measurements at a reference temperature of 5 °C, 10 °C, 15 °C, 20 °C or 25 °C. The temperature compensation can be turned off or set to Linear, nLFn (non-linear natural non-degassed water), nLFu (non-linear ultra pure degassed water) or EP (temperature compensation off and warning is displayed if conductivity values are outside EP requirements for ultra pure water). The closer the sample temperature is to the selected reference temperature, the more accurate the conductivity measurement will be, especially if the temperature compensation coefficient is estimated or inaccurate. The conductivity of a solution with a specific electrolyte concentration changes with temperature and this relationship is described by the temperature coefficient of the solution. The meter has a default temperature coefficient of 2.1 percent change in conductivity per °C, which is representative of many aqueous samples.

Solution (25 °C to 50 °C)	Temperature Coefficient (% / °C)
Ultra Pure Water	4.55
Salt (NaCl)	2.12
5 % NaOH	1.72
Dilute Ammonia	1.88
10 % HCl	1.32
5 % Sulfuric Acid	0.96
98 % Sulfuric Acid	2.84
Sugar Syrup	5.64

Conductivity and Total Dissolved Solids (TDS)

The Orion VERSA STAR Meter with Conductivity/Temperature Module Systems measure TDS as the total amount of dissolved inorganics in a solution. The dissolved inorganics carry a current that is measured by the conductivity probe. Since there is a direct relationship between conductivity and TDS, conductivity readings are used to estimate the presence of inorganics. The user must enter a TDS factor between 0.01 and 10 mg/L in the setup menu.

The standard method of determining TDS involves evaporating a sample to dryness at 180 °C and weighing the residue. The TDS factor is calculated by taking the residue weight and dividing it by the sample conductivity. Subsequent conductivity readings are multiplied by the TDS factor to determine the TDS value of the sample.

Conductivity Automatic Calibration

The Orion VERSA STAR Meter with Conductivity/Temperature Module Systems are capable of automatically recognizing Thermo Scientific Orion 100 µS/cm (Cat. No. 011008), 1413 µS/cm (Cat. No. 011007 and 01100710) and 12.9 mS/cm (Cat. No. 011006 and 01100610) conductivity standards when the nominal cell constant of the conductivity cell is entered in the setup menu.

Table of Conductivity Standard Values vs. Temperature

Cat. No.	011005 01100510	011006 01100610	011007 01100710	01100910	011008
Temperature (°C)	111.9 mS/cm Conductivity Standard (mS/cm)	12.9 mS/cm Conductivity Standard (mS/cm)	1413 µS/cm Conductivity Standard (µS/cm)	147 µS/cm Conductivity Standard (µS/cm)	100 µS/cm Conductivity Standard (µS/cm)
0	65.10	7.135	776	81	54
1	66.84	7.344	799	83	56
2	68.59	7.555	822	86	58
3	70.35	7.768	846	88	59
4	72.12	7.983	870	91	61
5	73.91	8.200	894	93	63
6	75.70	8.418	918	96	64
7	77.50	8.638	943	98	66
8	79.32	8.860	968	101	68
9	81.15	9.084	992	103	70
10	82.98	9.309	1017	106	72
11	84.83	9.535	1043	108	73
12	86.69	9.763	1068	111	75
13	88.56	9.993	1094	114	77
14	90.45	10.22	1119	116	79
15	92.34	10.46	1145	119	81
16	94.24	10.69	1171	122	83
17	96.15	10.93	1198	125	85
18	98.08	11.16	1224	127	87
19	100.0	11.40	1251	130	88
20	102.0	11.64	1277	133	90
21	103.9	11.88	1304	136	92
22	105.9	12.12	1331	138	94
23	107.9	12.36	1358	141	96
24	109.9	12.61	1386	144	98
25	111.9	12.85	1413	147	100

Table of Conductivity Standard Values vs. Temperature (cont.)

Cat. No.	011005 01100510	011006 01100610	011007 01100710	01100910	011008
26	113.9	13.10	1441	150	102
27	115.9	13.35	1468	153	104
28	117.9	13.59	1496	156	106
29	120.0	13.84	1524	159	108
30	122.0	14.09	1552	161	110
31	124.1	14.34	1580	164	112
32	126.2	14.59	1608	167	114
33	128.3	14.85	1636	170	117
34	130.4	15.10	1665	173	119
35	132.5	15.35	1693	176	121
36	134.6	15.61	1722	179	123
37	136.7	15.86	1751	182	125
38	138.9	16.12	1780	185	127
39	141.0	16.37	1808	188	129
40	143.2	16.63	1837	191	131
41	145.4	16.89	1866	194	134
42	147.6	17.15	1896	197	136
43	149.8	17.40	1925	200	138
44	152.0	17.66	1954	203	140
45	154.2	17.92	1983	206	142
46	156.4	18.18	2013	209	145
47	158.7	18.44	2042	212	147
48	160.9	18.70	2071	215	149
49	163.2	18.96	2101	219	151
50	165.4	19.22	2130	222	154

Notes

This page intentionally left blank.

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

68X592002 Rev. A 12-11

Thermo SCIENTIFIC