VWR™

VWR™ sympHony™ Meter User Guide

sympHony™

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Chapter I
Introduction

Congratulations! You have selected one of seven models of the VWR™ sympHony™ meters designed for electrochemistry measurement in the field or in the laboratory.

- Single Parameter meters provide single measurement of pH, Dissolved Oxygen, or Conductivity.

- Dual Parameter meters provide dual-parameter measurement of pH/DO, pH/Conductivity, or pH/ISE (ion selective electrode).

- Multiple Parameter meter provides multi-parameter measurement including mV/ORP.

Built to meet the demands of busy, multi-user laboratories or plant environments, all meters are microprocessor controlled aiding in the delivery of accurate and precise measurements. The waterproof portable meters can even withstand submersion for short periods of time without any negative effect on operation. To better meet the needs of users in environmental protection and control, food and beverage, pharmaceutical, and university/research laboratories, the sympHony meters include these key features:

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

- **AUTO-READ™** – The instrument automatically starts a measurement and automatically prints or logs data when the reading becomes stable.

- **Stirrer Control** – Benchtop meters have stirrer control for the Stirrer and the Auto-Stir™ BOD probe eliminating the need for additional stir plates and stir bars.

An easy-to-reference pictorial style Quick Guide, attached to each meter, supports daily use.

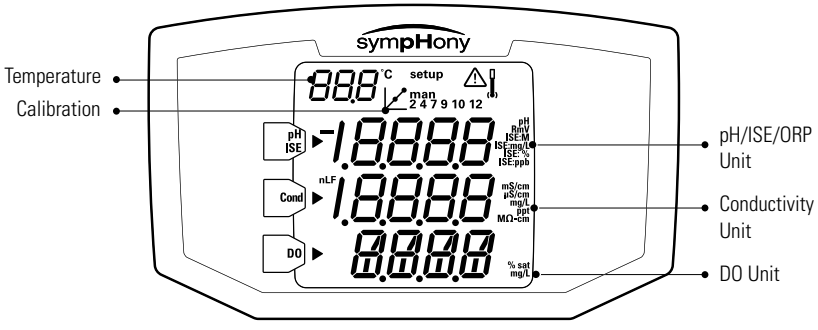
Please read this manual thoroughly before using your benchtop or portable meter. Any use outside of these instructions could invalidate your warranty and/or cause permanent damage to the meter.

Chapter II
Display

General Description

Throughout a given process, the LCD on any sympHony meter provides **Temperature** and **Calibration** data. The **setup** only appears when the meter is in setup mode. The ⚠ indicates an error condition; when displayed with the 🌡, a sensor quality issue exists.

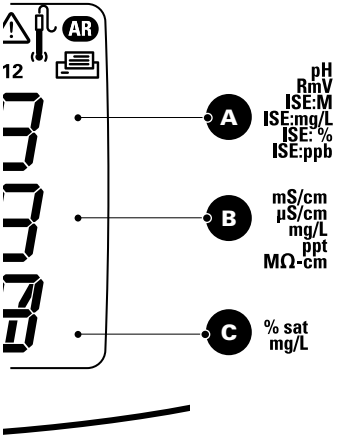
AR, and 🖹 functions will be discussed in greater detail on **page V-6** and **VI-1**.



Multi Parameter meter

Depicted here is the primary LCD of the sympHony meter capable of multi-parameter measurement.

Note: *the lowest 3 lines of data correspond to what is being measured.* ▲



pH, mV, Rel mV, or ISE

Conductivity, TDS, Salinity, or Resistivity

Dissolved Oxygen % Saturation,
DO Concentration,
or Barometric Pressure

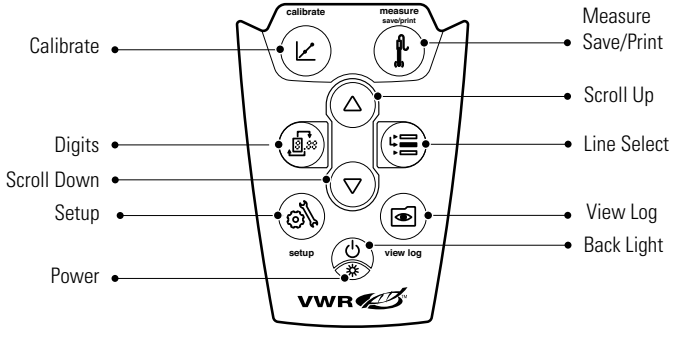
Units of measure, displayed on the right side of the screen, will flash until the reading is stable.

Chapter III
Keypad

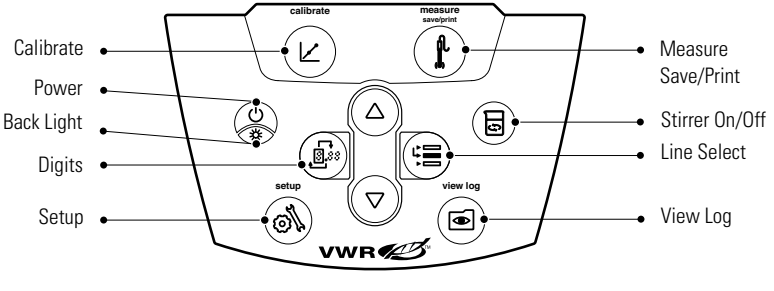
General Description

Keypad layout is the same for all sympHony meters. The portable models have 9 keys. The benchtop models have 10 keys due to the addition of a button.

Portable Keypad



Benchtop Keypad



The center area of the ergonomically designed keypad is the focal point for setting up and navigating the meter. In particular,  and  /  are used frequently to change LCD views.

Convenience features include:

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

- **Automatic Shut-off** – All sympHony meters will shutdown after 20 minutes without a keypress. This maximizes battery power on portable meters or benchtop meters being run on battery power.

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

- **Visual Alarm Signals** – Flashing  and  indicate calibration settings need adjustment. For more detail, refer to subsequent sections of this manual discussing specific measurement techniques.

To become familiar with each function, please review these icon definitions.

Icon Definitions

Key	Description	Key	Description
	• Turns meter on, if shut off. • Toggles backlight on & off, if meter is on. • If meter is on, holding down  will turn off the meter.	 	• Changes measurement mode of the selected line. • Changes selected line in Setup, Methods & Log View. • Edits the value of the flashing digit for Setup, Password entry, and Calibration.
	Switches arrow on left of the screen between 3 display lines to select and edit.		Changes selected digit to edit and moves decimal point when changing values in Setup, Password entry, & Calibration.
	Starts calibration for currently selected line and measurement mode. • If arrow is pointed to the top line and the current units are pH,  will start a pH calibration. • Each time  is pressed in the calibration it will accept the current point value and move to the next cal pt until the max # of cal pts are performed, then it will return to measurement mode.		• Print & Log a measurement in continuous or timed measurement mode. • Prints, Logs, & Freezes screen when the reading becomes stable. • Exits SETUP and returns to measurement mode. • Accepts Cal pt and returns to measurement mode.
	Enters SETUP menu starting with selected line and measurement mode: If arrow is pointed to top line and current units are ISE, then  will enter the ISE setup screen.		Enters LOG View & Download Screens.
			Turns stirrer on & off.

NOTES

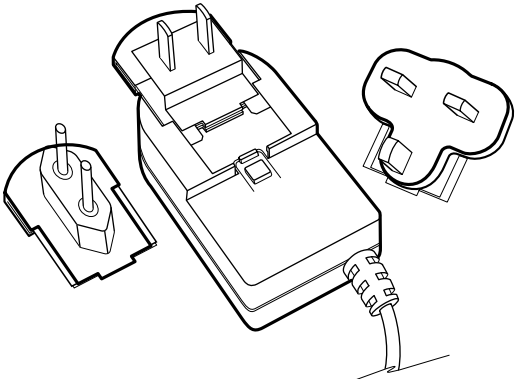
Chapter IV
Preparation

Installing Power Adapter

The universal power supply which is included with your benchtop meter is the ONLY power supply source recommended for use with this unit. Use of any other power supply will void your meter warranty.

The external electrical power supply is rated to be operated at 100-240 VAC, 0.5A, 50/60 Hz.

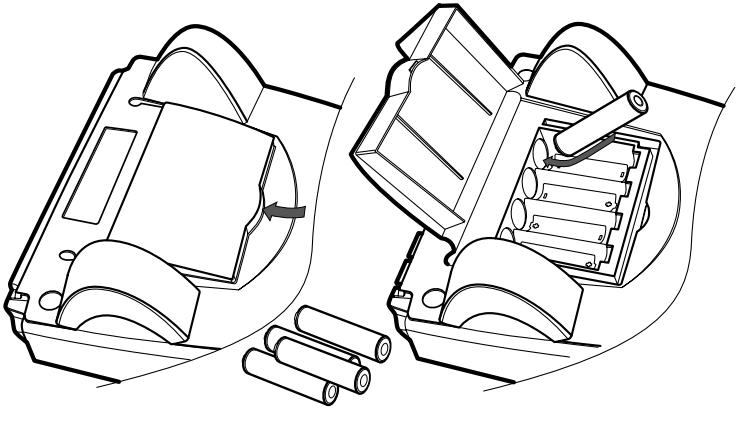
Based on your power source, select one of the three plugs provided – 110V, 220V, 240V – and slide it into the grooves on the adapter. A click will be heard when the plug is properly in place.



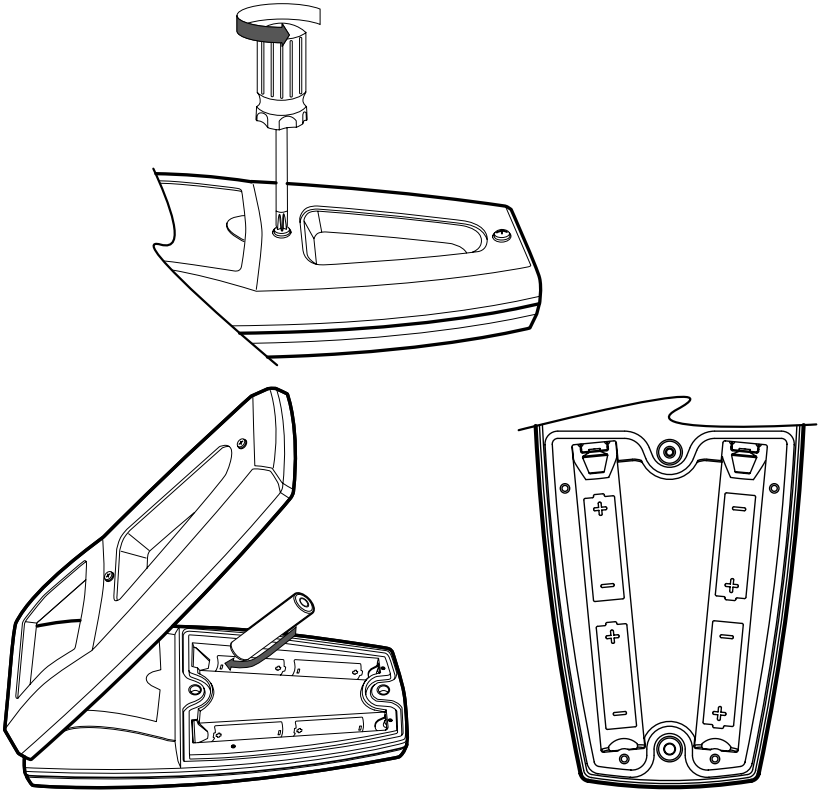
Installing Batteries

sympHony meters use four AA Alkaline batteries. Do not use lithium or rechargeable batteries. Improper installation of non-alkaline batteries could create a hazard.

1. Confirm meter is "off".
2. Gently place meter upside down on a clean, lint-free cloth to prevent scratching of LCD.
3. Remove the battery case cover.
4. Insert new batteries with the "+" pole oriented as depicted in the battery compartment housing.
5. Replace the cover.
6. Stored data, calibrations and methods will remain in the meter's nonvolatile memory when batteries are being replaced, however, date and time may need to be reset.



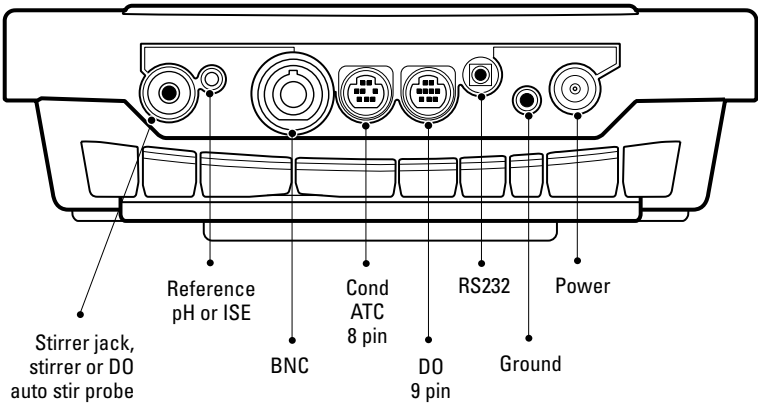
To access the battery compartment in portable meters, loosen the two screws in the center back of the meter. Note these are captive screws which cannot be completely removed.



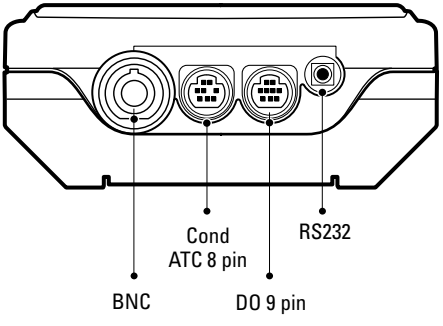
Connecting the Electrodes

Follow the diagrams below to correctly connect electrodes and probes to the meter. The multi-parameter is depicted; dual-parameters and single-parameters will have fewer connections.

Benchtop Meter – Electrode Connections



Portable Meter – Electrode Connections



Some connections serve multiple uses, for example:

- Use the BNC post to connect pH, ISE and ORP combination and sensing electrodes with a waterproof BNC connector.
- Benchtop meters have a pin tip jack for a separate reference electrode. These require an appropriate BNC sensing electrode for measurement.
- The 970899WP Dissolved Oxygen electrode can be used with the BNC connector.
- Use the waterproof 8 pin MiniDIN connector for Conductivity probes. All Orion Star series 2- and 4- electrode cell conductivity probes have built-in temperature sensors.
- The waterproof 8 pin MiniDIN connector is also used for Automatic Temperature Compensation (ATC) probes.
- The DO autostir probe uses the waterproof 9 pin MiniDIN connector and the stirrer jack for the smaller probe connector.

Turning On the Instrument

With the batteries installed in the portable meters, or either the batteries installed or line power attached to the benchtop meter, press the  to turn on the instrument. A quick press of the  after the meter has powered up will toggle the backlight on & off. When the benchtop is drawing line power, the backlight will stay "on" until turned "off" with the  . To turn "off" the meter press and hold the  for 3 seconds.

Chapter V
Menu Setup

Navigation Tips	
	• Press ▲ / ▼ to scroll through main menu items on the top line. You will see corresponding grey text on the LCD.
	• The ⚙ enters the setup mode.
	• Use ☰ to select top, middle or bottom line. • Use ▲ / ▼ in combination with ⚙ to edit the values in selected line. • Use ☰ to accept changes and return the arrow icon to the top line.
	• Use ✓ to save changes and return to the measurement mode.

General Menu Settings

The following table describes general instrument setup.

Description	Display	Range of Values	Default Value	Method Specific
Manual Temperature Compensation Setting	gEn dEgC 25.0	-5.0 - 105	**25.0**	Yes
Stirrer Speed Setting (Benchtop only)	gEn Stlr 4	OFF, 1, 2, 3, 4, 5, 6, 7	**4**	Yes
Auto-Shut Off Selection	gEn AUtO On	OFF, On	**On**	Yes

- **Manual Temperature** setting controls temperature compensation when no temperature sensors are attached to the instrument.

- **Stirrer Speed Setting** (benchtop meters only) sets the speed from 1 through 7 with speed 1 being the slowest and 7 being the fastest. A speed of 3 or 4 is recommended for most applications.

- **Auto-Shut Off** is the default which automatically turns off the instrument after 20 minutes elapse without a key press. To override this feature, select “Off” and the instrument will continue to operate.

To access these settings:

1. In the measurement mode press  .
2. Press  /  to scroll through the setup menu until 9En is displayed on the top line.
3. Press  to accept selection and move the arrow icon to the middle line.
4. Press  /  to scroll through:
   a. dE9C = Manual Temperature Setting
   b. St Ir = Enable and Set Stirrer Speed
   c. AUtO = Auto-Shut Off enable/disable
5. Press  to accept the selection and move the arrow icon to the bottom line.
   a. Press  /  to identify and  to edit next value.
   b. Press  to accept the selection and move the arrow icon to the top line.
6. Press  to return to the measurement mode.

Time and Date Setup

The following table describes in greater detail the abbreviations shown on the display screen.

Description	Display	Range of Values	Default Value	Method Specific
Time: Hour Setting	dAtE HOUr HH12	**00 - 23** Sets the hour of the current time in 24Hr format	**12**	Yes
Time: Minute Setting	dAtE tInE mm12	**00 - 59** Sets the minutes for the current time	**00**	Yes
Date Format	dAtE tyPE dmy	**mdy, dmy** Month, Day, Year or Day, Month, Year Selection	**mdy**	Yes
Date: Year Setting	dAtE yEAr 2004	**00 - 99** Sets the year for the current date from 2000 to 2099	**04**	Yes
Date: Month Setting	dAtE dAtE mm01	**01 - 12** Month Setting 01 “Jan” Thru. 12 “Dec”	**01**	Yes
Date: Day of the Month Setting	dAtE dAy dd01	**01 - 31** Day of the Month	**01**	Yes

1. In the measurement mode press .
2. Press / to scroll through the setup menu until dAtE is displayed on the top line.
3. Press to confirm setting and move the arrow icon to the middle line.
4. Press / to scroll through:
   a. HOUr = Current Hour
   b. t InE = Current Minute
   c. tYPE = Format the date stamp as either "mdy" (month, day, year) or "dmy" (day, month, year)
   d. dAtE = Current Month (Use numeric equivalents for months of the year)
   e. dAY = Current Day of the Month
   f. YEAr = Current Year
5. Press to accept selection and move the arrow icon to the bottom line.
6. Press / and to edit the selected value.
7. Press to accept the selection and move the arrow icon to the top line.
8. Repeat steps 3-7 to edit time and date settings as needed.
9. Press to return to the measurement mode.

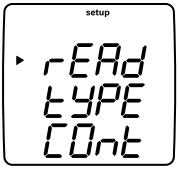
Continuous, Timed, or AUTO-READ™ Measurement Selection

The following table describes in greater detail the abbreviations shown on the display screen.

Description	Display	Range of Values	Default Value	Method Specific
Continuous, Timed, or Auto-Read Measurement Selection	rEAd tyPE COnt	**Cont, AUtO, timE** Timed, Continuous, or Auto-Read; Auto Prints and Datalogs in AUTO & Timed Modes	**Auto**	Yes
Timed Reading Setting	rEAd tImE 00:00	**00:05 - 99:61** Timed Readings in Minutes & Seconds	**01:00**	Yes

To change settings, simply use (menu) and (△) / (▽) to move between options. Pressing (menu) will confirm the change of a value and end the flashing display.

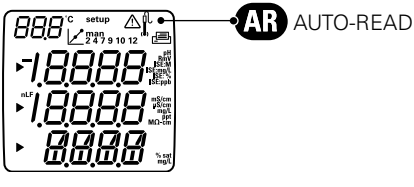
sympHony meters allow you to select your preferred timing for measurement intervals.



- In continuous mode the instrument is constantly making measurements and updating the screen. To Print & Log the measurement in this mode press (thermometer).
- In timed mode the instrument is constantly making measurements, updating the display, and will automatically log and print data at a pre-selected time interval.
  - In the setup menu enter the minutes & seconds between timed readings by pressing (△) / (▽) to change the value of the flashing digit. Press (print) to change the digit to be scrolled.
  - The minimum time interval is 5 seconds. Acceptable time ranges are: 00:05 – 99:59

- In AUTO-READ mode the instrument starts a measurement whenever (↓) is pressed. Once the reading becomes stable, the display freezes while data is automatically logged and printed.

  - The AUTO-READ mode will also automatically operate the **Stirrer Control**. It will stop stirring when the reading becomes stable. To set the stirrer speed, press (⚙). Using (△) / (▽) to select:

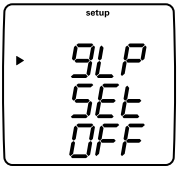


Getting Started with GLP Methods

The following table describes in greater detail the abbreviations shown on the display screen.

Description	Display	Range of Values	Default Value	Method Specific
Enable or Disable Methods "Setting"	gLP SEt On	**OFF, On** When on will allow storing And using 10 stored Methods	**OFF**	No
Enable & Set Instrument Password	gLP PASS 0000	**0000 - 9999** Sets the Setup/Method Password; 0000 disables passwords	**0000**	No

Method Selection



1. In the measurement mode press  .
2. Press  /  to scroll through setup menu until GLP is displayed on the top line.
3. Press  to accept the selection and move the arrow icon to the middle line.
4. Press  /  to scroll until SEt is displayed.
5. Press  to accept the selection and move arrow icon to the bottom line.
6. Press  /  to edit the value to On.
7. Press  to accept the selection and move arrow icon to the top line.

8. Press  to return to the measurement mode.

9. Press  .

10. Press  /  to assign a method number.

11. Press  to implement method and return to measurement mode or press  to enter the setup menu for the selected method.

Password Selection

Each method can be password protected to prevent unauthorized individuals from changing the setup options.

As a default setting, all sympHony meters are shipped with the Password set to 0000. Retaining this setting allows unlimited access by any user.

To set the **Password protection feature**:

1. In measurement mode press (setup).
2. Press (▲) / (▼) to scroll through the setup menu until 9LP is displayed on the top line.
3. Press (menu) to accept the selection and move arrow icon to the middle line.
4. Press (▲) / (▼) to scroll until PASS is displayed.
5. Press (menu) to accept the selection and move the arrow icon to the bottom line.
6. Press (▲) / (▼) and (enter) to enter the password.
7. Press (menu) to accept the selection and return the arrow icon to the top line.
8. Press (measure) to return to the measurement mode display.

When (setup) is pressed the password entry screen will appear and the user must enter the password to proceed into the setup menu.

Selecting Measurement Modes

In the measurement mode the arrow icon on the left side of the display screen indicates which mode is selected. Use ▲ / ▼ to scroll through the various modes associated with a selected line. Use ☰ to move the arrow icon to the next line, and then toggle ▲ / ▼ to scroll through the modes associated with the selected line.

pH
mV
Rel mV
ISE
Off

µS/cm or **mS/cm** for conductivity
mg/L for TDS
ppt for Salinity
MΩ-cm for resistivity
Off

%Sat for DO percent saturation
mg/L for DO concentration
Barometric Pressure
Off

For setup information related to specific techniques, refer to **Chapter 7** through **Chapter 11** of this manual.

Setting Calibration

The (⌐) indicates calibration mode or calibration setup.

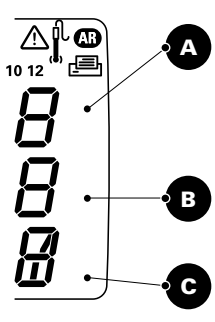
Before beginning a calibration, prepare the electrode or probe according to the instructions received with the electrode. The calibration standards or buffers or calibration sleeve should also be prepared prior to the calibration. After preparing the electrode or probe per manufacturer's instructions, connect the electrode or probe to the meter. Basic information on proper calibration for each measurement technique is found in the appropriate section of this manual.

General Navigation for Selecting Calibration

1. In measurement mode press (≡) until the arrow icon on the left of the screen is pointed toward the measurement mode to the calibrated:

   pH, ORP, ISE • Conductivity • DO

2. Press (△) / (▽) until the appropriate icon is lit for the measurement mode to be calibrated.



pH
RmV
ISE:M
ISE:mg/L
ISE: %
ISE:ppb
– pH/ORP/ISE

pH icon – pH Calibration
RelmV icon – ORP Calibration
ISE icon or no icon – ISE Calibration

mS/cm
µS/cm
mg/L
ppt
MΩ-cm
– Conductivity Calibration

mS/cm, µS/cm, mg/L, ppt icon and MΩ-cm

% sat
mg/L
– DO Calibration

%Sat or mg/L icon

No icon – Barometer Calibration

3. Then press (⌐) to begin the selected calibration.

Calibration Alarm Setup

The following table describes in greater detail the abbreviations shown on the display screen.

Description	Display	Range of Values	Default Value	Method Specific
pH Calibration Alarm Setting	dUE PH 0	**0000 - 9999** Time in Hours; 0000 = Cal Alarm Off	**0000**	Yes
ORP Calibration Alarm Setting	dUE OrP 0	**0000 - 9999** Time in Hours; 0000 = Cal Alarm Off	**0000**	Yes
ISE Calibration Alarm Setting	dUE ISE 0	**0000 - 9999** Time in Hours; 0000 = Cal Alarm Off	**0000**	Yes
Conductivity Calibration Alarm Setting	dUE COnd 0	**0000 - 9999** Time in Hours; 0000 = Cal Alarm Off	**0000**	Yes
Dissolved Oxygen Calibration Alarm Setting	dUE dO 0	**0000 - 9999** Time in Hours; 0000 = Cal Alarm Off	**0000**	Yes

The following steps enable calibration alarms:

1. In the measurement mode, press .
2. Press / to scroll through the setup menu until dUE is displayed on the top line.
3. Press to accept the selection and move the arrow icon to the middle line.
4. Press / to scroll through the measurement modes.

5. Press  to accept the selection and move the arrow icon to the bottom line.
6. Press  /  and  to edit the calibration interval.
7. Press  to accept the selection and move the arrow icon to the top line.
8. Press  to return to the measurement mode display.

Chapter VI
Data Archiving and Retrieval

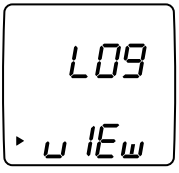
The SympHony meters offer all the features required to create printouts of data reports in full compliance with Good Laboratory Practice (GLP).

Description	Display	Range of Values	Default Value	Method Specific
Data Log roll-over or	LOg	**nO, yES**	**yES**	yes
Delete on Download Option	dEL			
Selection	yES			

Datalog Setup

1. In the measurement mode press the setup key.
2. Press ▲ / ▼ to scroll through the setup menu until LO9 is displayed on the top line of the display.
3. Press ☰ to enter dEL setting on the middle line.
4. Press ☰ to move to the bottom line.
5. Press ▲ / ▼ to select either.
   a. YES to indicate automatic log deletion after download to a computer or printer
   b. nO to roll-over data log when memory is full
6. Press ☰ to accept the selection and return to the top line.
7. Press the thermometer key to return to the measurement mode.

Log View Setup



1. In the measurement mode, press (eye) to see LOG displayed.
2. Press (△) / (▽) to select uIEw, SEnd or CALO on the bottom line.
3. Press (menu) to accept the selection.
   a. uIEw enables display of the log point number on the **Temperature line**. The time of the log point on the top line, the date of the log point on the middle line, and the year of the log point on the bottom line.
      i. Press (△) / (▽) to select log point number to view.
      ii. Press (eye) to view the selected log point.
      iii. Press (eye) to return to log point number selection menu.
   b. SEnd will output all measurement log points to a printer or computer.
      i. Press (eye) to send log.
   c. CALO will output all calibrations to a computer or printer.
      i. Press (eye) to send log.
4. Press (thermometer) to return to measurement mode.

RS-232 Interface Setup

The following table describes in greater detail the abbreviations shown on the display screen.

Description	Display	Range of Values	Default Value	Method Specific
Baud Rate Selection	r232 bAUd 1200	**1200, 2400, 4800, 9600**	**9600**	No
Printout Format	r232 OUtF Prnt	**Print** **COmP**	**Print**	No

Note: *A multi-parameter printout will display the header and footer only once. Each section will be separated by a blank. If display of a particular function is turned "off," then that section will not be printed.* ▲

1. . From the measurement screen press (setup).
2. Use (△) / (▽) to scroll through the menus until r232 is displayed on the top line.
3. Press (menu) to accept the selection and move the arrow icon to the middle line.
4. Press (△) / (▽) to select bAUd rate for the serial port.
5. Press (menu) to move the arrow icon to the bottom line.
   a. Use (△) / (▽) to select one of the values: 1200, 2400, 4800, or 9600.
   b. Press (menu) to accept the entry and move the arrow icon to the top line.

6. Press  to move the arrow icon to the middle line.
7. Press  /  to select OUtF which controls the output format.
8. Press  to move the arrow icon to the bottom line.
   a. Use  /  to select one of the following two values:
      i. Prnt = printer format
      ii. COmP = comma delimited format for integration with LIMS or data analysis software.
   b. Press  to accept the entry and move the arrow icon to the top line.
9. Press  to return to the measurement mode.

Chapter VII
pH Technique

The following table describes pH setup.

Description	Display	Range of Values	Default Value	Method Specific
pH Resolution	**rES**	0.1, **0.01**, 0.001	**0.01**	Yes
pH Buffer Set	**bUF**	**USA** (USA/Orion Buffers) 1.68, 4.01, 7.01, 10.01, 12.46 **EUrO** (Euro Buffers) 1.68, 4.01, 6.86, 9.15	**USA**	Yes

To access the pH Setup Menu

1. In the measurement mode press (setup).
2. Press (△) / (▽) to scroll through the setup menu until PH is displayed on the top line.
3. Press (menu) to confirm setting and move the arrow icon to the middle.
4. Press (△) / (▽) to select rES for Resolution.
5. Press (menu) to select option and move the arrow icon to the bottom line.
   a. Use (△) / (▽) to set the desired resolution.

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

7. Press (menu) to move to middle line and press (up) / (down) to select bUF for Auto-Buffer setting and press (menu) again to move to the bottom line.

8. Press (up) / (down) to select either USA or EUrO; press (menu) to accept the selection.

9. Press (temp) to return to measurement mode.

pH Calibration Alarm Setting

The Caution symbol accompanied by the flashing (temp) and flashing **pH** units alerts the operator that pH needs to be recalibrated. In advance of beginning measurements, the operator may select the number hours to elapse before the alarm is affected; a setting of 0000 turns off the calibration alarm. To set the alarm from the setup screen, find dUE/PH, then use (up) / (down) and (menu) to display:

dUE
PH
0000-9999

pH Calibration for 1-5 Points

The calibration points should bracket the expected pH range of the samples to be measured. Calibration points should be not less than 1 pH unit apart and not greater than 4 pH units apart.

It is recommended that a two buffer calibration, using buffers that bracket the expected sample range, be performed at the beginning of each day to determine the slope and offset of the electrode. This step will also compensate for any changes in the electrode and determine if it is working properly. For optimal accuracy perform a one buffer calibration every two hours to compensate for electrode drift using a fresh aliquot from one of the buffers used in the initial calibration.

Fresh buffers should be used each time you calibrate.

Care should be taken when rinsing the electrode with deionized water and gently blotting all remaining water drops with a lint-free tissue prior to moving the electrode to the next beaker. **DO NOT** wipe a glass or epoxy electrode body with a tissue as static build up will result.

1. Prepare the electrode for use according to the instructions received with the electrode.

2. In setup mode select the buffer set of NIST (USA) or DIN (EUro) being used for the proper buffer recognition to occur.

3. Press (menu) until the arrow icon is pointing to the pH measurement line.

4. Press (cal).

5. Rinse the electrode and ATC probe and place into the buffer.

6. Wait for the **pH** to stop flashing.

   a. Auto Buffer Recognition – When the **pH** stops flashing the meter will display the temperature-corrected pH value for the buffer.

   b. Manual Calibration – When the **pH** stops flashing the meter will display the actual buffer value read by the pH electrode. Use the and / to change the pH value to the temperature-corrected pH value for the buffer.

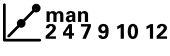
7. Once the correct buffer value is shown on the meter display, press to proceed to the next calibration point and repeat steps 5 through 7 or press to save the calibration.

8. The slope will be displayed before the meter returns to the measurement mode. SLP is displayed in the lower field and the actual electrode slope, in percent, is displayed in the main field.

   a. On a 1 point calibration use the and / to edit the slope then press to return to the measurement mode.

   b. On the 2 or more point calibration the meter will automatically go to measurement 2 seconds after display of SLP.

After calibration, the electrode and meter are ready to start taking sample measurements. Make sure that the instrument is in measurement mode and that the **pH** is lit. If the is not lit, press to return to measurement mode. If the **pH** is not lit, press until the arrow on the left of the display is pointing at the top line. Then press until the **pH** lights. You are now ready to start measuring.



The **man** display indicates manual pH calibration was performed. The numbers on the top of the display indicate which pH Auto buffers were used in the last calibration.

pH Measurements

1. Rinse the electrode, as well as ATC probe and stirrer if being used, in deionized water. Blot dry with a lint-free tissue. Do not wipe glass electrodes as static charge will build up on the sensor.

2. Place the electrode in your sample.

   a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is enabled then pressing  will start the stirrer.

   The  will flash until the reading is stable. Once the reading is stable you can Log & Print the measurement by pressing the  . If you are recording the data into a notebook, record the pH as well as the temperature at which the pH reading is taken. If the stirrer is in motion, press  to turn off the stirrer before removing the stirrer from the sample.

   b. If you are in AUTO-READ™ mode then press  to start the measurement. Once the reading is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled, then the stirrer will turn on when  is pressed and turn "off" once the reading has stabilized.

   When using the AutoStir™ BOD Probe, pressing the button on the probe will start the AUTO-READ measurement.

   c. If you are in Timed Measurement mode then the meter will start making measurements as soon as it goes into measurement mode at the frequency selected in setup. It will automatically Log & Print each measurement. If you are using the benchtop meter and the stirrer control is enabled then pressing  will start the stirrer. Pressing  again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. When all samples have been measured, rinse the electrode with deionized water and blot dry. Consult your electrode manual for proper electrode storage instructions.

Chapter VIII
Dissolved Oxygen Technique

Dissolved Oxygen Setup Options

The following table describes Dissolved Oxygen setup.

Description	Display	Range of Values	Default Value	Method Specific
Dissolved Oxygen %Saturation Resolution	DO rES 1	**1, 0.1** DO % Saturation Resolution	**0.1**	Yes
Dissolved Oxygen Concentration Resolution	DO rES 0.1	**0.1, 0.01** DO Concentration "mg/L" resolution	**0.01**	Yes
Dissolved Oxygen Barometric Pressure Compensation Selection	DO bAr AUtO	**AUtO, mAn** Selects Internal Barometer or Manual Pressure	**AUtO**	Yes
Dissolved Oxygen Manual Barometric Pressure Setting	DO PrES 760.0	**450.0 - 850.0** Manual Pressure Compensation Value	**760.0**	Yes
Dissolved Oxygen Salinity Correction Selection	DO SAL AUtO	**AUtO, mAn** Selects Method of Salinity Correction; Meters w/Cond Only	**AUtO**	Yes
Dissolved Oxygen Manual Salinity Correction Factor	DO SALF 0	**0 - 45** Manual Salinity Correction Factor	**0**	Yes
Dissolved Oxygen Calibration Type Selection	DO CALt Air	**Air, H_2O, mAn, SEt0** Air = Water Sat Air, H_2O = Air Sat Water, mAn = Manual, SEt0 = Zero Cal	**Air**	Yes

DO Setup Steps

1. From the Measurement mode, press  .

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

3. Press  to confirm the setting and move the arrow icon to the middle line.

4. Press  /  to scroll through:
   a. rES **+ % Sat** = % Saturation Resolution
   b. rES **+ mg/L** = Concentration Resolution
   c. bAr = Barometer Type (Auto/Manual)
   d. PrES = Manual Pressure Compensation
   e. SAL = Automatic/Manual Salinity Compensation
   f. SALF = Manual Salinity Correction
   g. CALt = Calibration Type

5. Press  to select the option and move the arrow icon to the bottom line.

6. Press  /  and  to enter the value. The previous table identifies what you will see on the display and the range of values which may be entered.

7. After entering a value, press  to complete programming of that option and move the arrow icon to the top line. Repeat steps 3 through 7 for all options.

8. Press  to return to measurement mode.

Special Features

Before beginning DO setup, note these special features:

- The resolution selection automatically engages algorithms to optimize the accuracy, precision, and response of the DO measurement.

- sympHony meters include an internal barometer for pressure compensation. In general we recommend using the internal barometer, but you may wish to use manual pressure compensation if you are measuring DO with a submerged probe or in a pressurized vessel where the probe is exposed to higher pressures than the meter.

    - DO Manual Pressure Setting screen will only appear if Manual Barometric Pressure compensation has been selected. The pressure in entered in mm of Hg (Mercury). See the following table to convert from other units of pressure.

	hPa (mBar)	mm Hg (torr)	Inches Hg	lbf/in2 (PSI)
1 hPa (mBar)	1	0.75006	0.02953	0.014504
1 mm Hg (torr)	1.3332	1	0.039370	0.019337
1 Inches Hg	33.864	25.400	1	0.491154
1 lb/in2 (PSI)	68.9475	51.7149	2.03602	1

    Example: *To convert 14.7 PSI to mm Hg, multiply 14.7 by 51.7149 to get 760.21 mm Hg.* ▲

- Automatic DO Salinity Correction Selection is only available on 4-Star and 5-Star meters designed to measure conductivity as well as DO. On these meters, the instrument automatically takes the conductivity reading to calculate the salinity correction factor then applies that to the DO measurement.

    - A conductivity probe must be used in addition to the DO probe for automatic salinity correction.

- The user may disable the automated process by selecting the mAn setting rather than AUtO.
- DO Manual Salinity Correction Factor Setting adjusts the dissolved oxygen concentration in mg/L based on the samples salinity. Use the following table to select an appropriate salinity factor. A typical value for Sea Water is 35, but does vary considerably based on location.

Conductivity in mS/cm	Salinity Value	Conductivity in mS/cm	Salinity Value	Conductivity in mS/cm	Salinity Value
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		

Salinity depending on the conductivity at 20 ˚C
ppt = Parts per Thousand Salinity

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

DO Calibration

Prior to calibration the probe must be prepared and polarized.

- The DO probe is continuously polarized when connected to the meter. When first connected, or after an interval of more than 60 minutes has elapsed since the probe was last connected, allow 30 to 60 minutes for polarization. Interrupted connections of less than one hour will take 5 to 25 minutes for the readings to stabilize.
- Zeroing the Probe – a DO probe can generate a 0.02 to 0.05 mg/L positive error in an oxygen free (anoxic) solution. If this error is unacceptable, then zero the probe when using a new sensing membrane, using fresh filing solution, or when measuring dissolved oxygen below 1 mg/L or 10% saturation.

An air calibration should be done prior to the zero calibration.

1. In the measurement mode press (⚙).
2. Press (△) / (▽) until dO is shown on the top line.
3. Press (☰) to confirm the setting and move the arrow to the middle line.
4. Press (△) / (▽) to scroll to CALt.
5. Press (☰) to select setting and move arrow icon to the bottom line.
6. Press (△) / (▽) to select one of the following calibration modes.
   a. Air denotes calibration performed in water saturated air using the air calibration sleeve. This is generally the simplest and most accurate calibration method. It is also the meter's default setting. If the calibration selection in (⚙) has not been changed, then pressing (↙) will automatically perform an Air calibration. Due to the inherent differences between water-saturated air and air-saturated water, upon stability, the air standard is set to 102.3 % saturation.

i. The highest possible accuracy is reached when calibration temperature is the same as the measuring temperature.

ii. Moisten the sponge or absorbent cloth in the calibration sleeve with water and insert the probe into the sleeve, but without touching the water saturated material. For BOD measurements, this calibration can be performed in a BOD bottle.

iii. For oxygen levels below 1 mg/L, a second zero calibration point is often required.

b. H2O denotes Water Calibration performed using a water sample that is 100% saturated with air. It is the least commonly used calibration method.

c. mAn display denotes manual calibration using a water sample with a know concentration of dissolved oxygen. It can be used to calibrate the sensor to the value achieved by a Winkler titration.

i. A Winkler calibration involves performing a manual Winkler titration and then using that sample as a standard. The titration oxygen level result is entered in a Winkler calibration as the DO standard value. This correlates the meter input to the Winkler titration. Note, this method is inherently less accurate due to the possibility of titration errors introduced when the calibration is set to the titration test results

d. SEtO is a zero calibration, which is used for very low level DO measurements. Not generally required unless you are making measurements below 5% Saturation or 0.5 mg/L.

7. The probe and calibration standard (water-saturated air or air-saturated water) should be allowed to reach equilibrium before the system is calibrated.

8. Press  to accept selection and return the arrow icon to the top line.

9. Press  to return to measurement mode.

Calibrating with Water Saturated Air

The Air calibration function must be enabled in Setup before the calibration is started.

1. Prepare the calibration sleeve* by removing the reservoir cap from the bottom of the sleeve. Remove the sponge from the cap and saturate it with water. Squeeze all excess water out of the sponge so that it is merely damp. Replace the sponge into the cap and replace the cap onto the calibration sleeve.

* A standard 300 mL BOD bottle may also be used for AIR calibration. Fill the bottom of the bottle with 50 mL of distilled water. Be sure to use the BOD funnel accessory (Orion Cat. Nos. 080360 or 080160, depending on the probe in use). Place the probe into the funnel so that it is just above the stirring paddle. Ensure that there are no drops of water on the surface of the membrane. Ensure that the water level is 1/2 inch below the tip of the probe. Allow at least 30 minutes for the bottle to equilibrate.

2. Place the dissolved oxygen probe into the calibration sleeve. Ensure that the probe membrane does not come into contact with the sponge in the calibration sleeve. Also ensure that there are no drops of water on the membrane.

3. Make sure Setup has Air calibration set.

4. To initiate the Air calibration, press (cal). The "cal" indicator will light up.

5. While the electrode signal is stabilizing, the meter will flash a dissolved oxygen reading (based upon the current calibration data) in the main field. Once the input has stabilized, 102.3 % saturation will be displayed for three seconds. The meter will return to measure mode.

Water Calibration

The H2O calibration function must be enabled in Setup before the calibration is started. When stability is reached, the water standard is set to 100 % or the corresponding concentration value.

The highest possible accuracy is reached when calibration temperature is the same as the measuring temperature.

1. Prepare the calibration standard by bubbling air through a beaker of stirred deionized water for at least one hour. Ensure that the stirring is vigorous enough to provide adequate mixing yet not forceful enough to create a vortex in the beaker. Make sure that the water level is high enough to fully submerge the probe thermistors, which are located inside the metal band above the membrane cap. Ensure that no air bubbles accumulate on the surface of the membrane.

Note: *Some magnetic stirrers generate enough heat to change solution temperature. To avoid this, place a piece of cardboard, foam rubber or other insulating material between the stir plate and sample beaker.* ▲

2. Place the dissolved oxygen probe into the aerated water so that the sensors are immersed. Ensure that there are no air bubbles accumulating on the membrane.

3. To initiate the Water calibration, press (cal). The "cal" indicator will light up.

4. While the electrode signal is stabilizing, the meter will flash a dissolved oxygen reading (based upon the current calibration data) in the main field. Once the input has stabilized, 100.0 % saturation will be displayed for three seconds.

5. The slope value (SLP) will then be displayed. The meter will return to measure mode.

Calibration to the Winkler Titration Method

Many regulatory agencies require the determination of dissolved oxygen in water to be referenced to the Winkler Titration Method. The Meter allows the user to scroll the dissolved oxygen measurement to correlate with the value obtained from the Winkler titrated sample. The mAn calibration function must be enabled in Setup before the calibration is started.

1. Place the dissolved oxygen probe into the sample. Make sure that the water level is high enough to fully submerge the probe thermistors, which are located inside the metal band above the membrane cap. Ensure that the stirring is vigorous enough to provide adequate mixing yet not forceful enough to create a vortex in the beaker. Ensure that there are no air bubbles accumulating on the membrane.

Note: *Some magnetic stirrers generate enough heat to change solution temperature. To avoid this, place a piece of cardboard, foam rubber or other insulating material between the stir plate and sample beaker.* ▲

2. To initiate the Winkler titration calibration, press (cal). The "cal" indicator will light up.

3. While the electrode signal is stabilizing, the meter will flash a dissolved oxygen reading (based upon the current calibration data) in the main field. Once the input has stabilized, the concentration value, which corresponds to saturation at the current temperature, pressure and salinity, will be displayed.

4. The concentration value should then be adjusted to the value that was obtained via the Winkler titration. Use (△) / (▽) and (setup) to enter value. Press (temp) to accept the concentration value.

5. The slope value (SLP) will then be displayed for three seconds. The meter will then return to measure mode.

Probe Zero Calibration

If the expected sample range is at the lower end of the dissolved oxygen scale, you may want to perform a zeroing of your probe. If the probe exhibits any residual current, this calibration will compensate for it. A Probe Zero calibration should always follow as the second point determination of a two-point calibration. To remove the effects of a Probe Zero calibration, perform an Air, Water or Winkler calibration as a one-point calibration. To perform a Probe Zero calibration, follow the steps outlined below.

1. Perform either an A Ir, H2O, or mAn (Winkler) calibration before continuing with the Probe Zero calibration. See the appropriate calibration procedure above.

2. Enable the SEtO calibration function in Setup before the calibration is started.

3. Prepare an oxygen scavenging solution, such as sodium sulfide. Add 15 grams of sodium sulfide to 250 mL of deionized water. Stir until most of the salt has dissolved. Transfer the solution into a BOD bottle. Place the overflow funnel into the bottle so that it is snugly sealed.

4. Place the probe into the bottle ensuring that the thermistor is fully submerged in the solution. Place the bottle on a magnetic stirrer and stir gently.

5. Allow the solution to eliminate all oxygen from the membrane module. This should take at least 5 minutes.

6. To initiate the Probe Zero calibration, press (cal). The "cal" indicator will light.

7. While the electrode signal is stabilizing, the meter will flash a dissolved oxygen reading (based upon the current calibration data) in the main field. Once the input has stabilized, 0.0 will be displayed.

8. The user must press (probe) to zero the probe.

9. The slope value SLP will then be displayed for three seconds. The meter will then return to measure mode.

10. After performing the probe zeroing, thoroughly rinse the probe with deionized water.

Note: *Prior to using the BOD funnel and bottle again, be sure to remove all traces of the oxygen scavenging solution for accurate measurements.* ▲

DO Measurememts

1. Rinse the electrode, as well as ATC probe and stirrer if being used, in deionized water. Blot dry with a lint-free tissue. Do not wipe glass electrodes as static charge will build up on the sensor.

2. Place the electrode in your sample.

   a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is enabled then pressing (stir) will start the stirrer.

   The  will flash until the reading is stable. Once the reading is stable you can Log & Print the measurement by pressing the (temp). If you are recording the data into a notebook, record the pH as well as the temperature at which the pH reading is taken. If the stirrer is in motion, press (stir) to turn off the stirrer before removing the stirrer from the sample.

   b. If you are in AUTO-READ™ mode then press (temp) to start the measurement. Once the reading is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled, then the stirrer will turn on when (temp) is pressed and turn "off" once the reading has stabilized.

When using the AutoStir™ BOD Probe, pressing the button on the probe will start the AUTO-READ measurement.

c. If you are in Timed Measurement mode then the meter will start making measurements as soon as it goes into measurement mode at the frequency selected in setup. It will automatically Log & Print each measurement. If you are using the benchtop meter and the stirrer control is enabled then pressing  will start the stirrer. Pressing  again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. When all samples have been measured, rinse the electrode with deionized water and blot dry. Consult your electrode manual for proper electrode storage instructions.

NOTES

Chapter IX
Conductivity Technique

Definitions of Terms

Before proceeding with instrument setup, the user is advised to become familiar with the following concepts:

- Conductivity Linear Temperature Compensation L In is a default setting in the sympHony meters.

- The conductivity of a solution with a specific electrolyte concentration changes with temperature. The relationship of the change in conductivity as a function of temperature is described by a solution's temperature coefficient. Temperature coefficients vary with each solution. Some examples are shown in the table which follows. This meter uses 2.1%/˚C as the default linear temperature coefficient, which is representative of many aqueous samples, to compensate for temperature changes. The meter has an adjustable temperature coefficient of 0.0 to 10.0%/˚C.

  Table IX-1 – Typical Temperature Coefficients Between 25 and 50 ºC (Percent change of Conductivity per ºC)

Solution	%/˚C
Ultrapure Water	4.55
Salt (NaCl) Solutions	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 TDS Factor: Total Dissolved Solids (TDS) refers to the dissolved inorganics in a solution. These dissolved inorganics will carry a current and will be reflected as a conductivity reading. Since a relationship can be shown between conductivity and TDS, a conductivity reading can be used as an estimation of the presence of inorganics.

- The standard method of determining TDS (Total Dissolved Solids) is by evaporating the sample to dryness at 180 ˚C and weighing the residue. After evaporating the sample, one would have to calculate a specific "factor" for the solution by taking the TDS value obtained in weighing and dividing it by the conductivity of the sample. This factor would then be multiplied by the subsequent conductivity readings to obtain the TDS value of the sample as referenced in Standard Methods for Water and Wastewater.

    - This Meter allows the operators to enter their own TDS factor for the calculation of the TDS value in mg/L, with a selectable range from 0.01 to 10.00 and a default value of 0.49. The default value for TDS factor on the meter is 0.49, which is a reasonable estimate of a TDS factor for natural water applications.

- Auto-Calibration for conductivity uses a default cell constant to determine the value of the conductivity standard. In order for the instrument to Auto-recognize a conductivity standard it must know the cell constant within a factor of 3. So the meter needs a nominal cell constant for the probe being used. If the real cell constant was 1.0 then having an estimate of any value between 0.3 and 3.0 would be sufficient to determine which standard was being used and therefore determine the standards temperature corrected value for calibration.

    - The instrument Auto-recognizes conductivity standards 1413 µS/cm,100 µS/cm, and 12.9 mS/cm only.

- Conductivity Temperature Reference: By definition, temperature compensated conductivity of a solution is the conductivity which that solution exhibits at the reference temperature. The temperature is chosen to be either 25 ˚C, 20 ˚C, or 15 ˚C. A measurement made at the reference temperature needs no compensation. The closer the sample is to the reference temperature, the smaller the error will be if the meter temperature coefficient is incorrect. The meter automatically compensates for temperature changes based on the temperature coefficient and the reference temperature when a temperature measurement is simultaneously made.

- Conductivity Cell Type & Manual Ranging: This allows you to select a Standard (Std) cell where the conductivity plates are parallel to each other, or Planar (PLnr) where the conductivity plate are on the same plane. Almost all conductivity cells are of the Standard arrangement. This also allows the user to fix the meter in one range. This can be useful with extremely long cables where cable capacitance could cause non-linearities due to the drive frequency change between ranges.

Conductivity Setup

Description	Display	Range of Values	Default Value	Method Specific
Conductivity Temperature Compensation Selection	COnd tC LIn	**OFF, LIn, nLF** Selects Temp Comp OFF, Linear, or Ultra-pure Water	**Lin**	Yes
Conductivity Linear Temperature Compensation Coefficient Setting	COnd COEF 2.1	**0.0 - 10.0** Linear Temp Compensation Coefficient in %/C	**2.1**	Yes
Conductivity TDS Factor Setting	COnd tdSF 0.49	**0.00 - 10.0** TDS factor	**0.49**	Yes
Conductivity Auto-Calibration Default Cell Constant Setting	COnd CELL 0.475	**0.001 - 199.0** Cell Constant used for Cond Auto-Standard	**0.475**	Yes
Conductivity Temperature Reference Selection	COnd trEF 25	**15, 20, 25** Conductivity Reference Temperature	**25**	Yes
Conductivity Cell Type & Manual Ranging Selection	COnd tyPE PLnr	**PLnr, Std, 1, 2, 3, 4, 5, 6, 7** Standard, Planer Cond Cell Or sets Manual range 1-7	**Std**	Yes

1. In the measurement mode press  .
2. Press  /  to scroll through the Setup Menu's until COnd is displayed on the Top line.
3. Press  to accept the selection and move the arrow icon to the middle line.

4. Press ▲ / ▼ to scroll through the following Conductivity settings:
   - tC = Temperature Compensation Selection. The users may elect to turn temperature compensation OFF, select linear L In temperature compensation, or a non-linear nLF temperature compensation for natural and ultra-pure water.
   - COEF = Temperature coefficient for L In (linear) temp compensation expressed in % /C.
   - tdSF = TDS Factor for Total Dissolved Solids measurement
   - CELL = Conductivity Cell Constant (nominal cell constant used for Auto-Calibration)
   - trEF = Reference temperature for temperature compensation. Options are 15 degrees C, 20 degrees C, or 25 degrees C.
   - tYPE = Conductivity cell type (Planar or Conventional)
5. Press ☰ to accept the selection and move the arrow icon to the bottom line.
6. Press ▲ / ▼ and ❄ to edit value.
7. Press ☰ to accept the selection and move the arrow to the top line.
8. Repeat steps 3-7 to edit conductivity settings as needed.
9. Press 🌡 to return to measurement mode.

Conductivity Calibration for 1-5 Points

- Select a conductivity probe with an appropriate cell constant for the expected conductivity of the samples to be measured. A flow cell is recommended for greater low level measurement accuracy. Fresh standards should be used for each calibration.

- Verify the correct reference temperature has been selected in the conductivity setup menu.

- All conductivity calibrations are performed in mS/cm or µS/cm. The other measurement modes of conductivity are calculated using the cell constant determined from the calibration measurement parameters selected in the setup menu.

1. Prepare the probe for use according to the probe user guide or operator's manual.

2. In the measurement mode press  until the arrow icon is pointing to the conductivity measurement line.

3. Press  .

4. Rinse the probe and place into the conductivity standard.

5. To perform a Manual Calibration – The screen will display the cell constant on the bottom line and the conductivity value on the middle line. Use  and  /  to change the cell constant until the displayed conductivity value matches the conductivity of the conductivity standard at the measured temperature.

    - If you do not start changing the cell constant within 5 seconds the meter will automatically proceed to the AutoCal™/DirectCal™ screen.

6. To perform an AutoCal or Direct Calibration – Wait for the **µS/cm** or **mS/cm** icon to stop flashing.

   - AutoCal – When the **µS/cm** or **mS/cm** icon stop flashing the meter will display the temperature corrected value of the conductivity standard.

   - Direct Calibration – When the **µS/cm** or **mS/cm** icon stop flashing the meter will display the actual conductivity value read by the conductivity probe. Use  and  /  to change the conductivity value to the actual value of the conductivity standard at the measured temperature.

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

8. After the value for the last standard has been entered the cell constant will be displayed CELL appears in the lower field and the actual CELL constant appears in the main field. The meter will automatically advance to the measurement mode. The  is displayed above the main field.

To Take a Conductivity Measurement

1. Rinse electrode and place into sample. Record conductivity directly from the main meter display when the **mS/cm** or **µS/cm** icon stops flashing indicating a stable value. Temperature is displayed in the top left corner of the display.

2. Place the electrode in your sample.

   a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is enabled then pressing  will start the stirrer.

The  will flash until the reading is stable. Once the reading is stable you can Log & Print the measurement by pressing the  . If you are recording the data into a notebook, record the pH as well as the temperature at which the pH reading is taken. If the stirrer is in motion, press  to turn off the stirrer before removing the stirrer from the sample.

b. If you are in AUTO-READ™ mode then press  to start the measurement. Once the reading is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled, then the stirrer will turn on when  is pressed and turn "off" once the reading has stabilized.

When using the AutoStir™ BOD Probe, pressing the button on the probe will start the AUTO-READ measurement.

c. If you are in Timed Measurement mode then the meter will start making measurements as soon as it goes into measurement mode at the frequency selected in setup. It will automatically Log & Print each measurement. If you are using the benchtop meter and the stirrer control is enabled then pressing  will start the stirrer. Pressing  again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. When all samples have been measured, rinse the electrode with deionized water and blot dry. Consult your electrode manual for proper electrode storage instructions.

Chapter X
ISE Technique

Definition of Terms and Concepts

- ISE Resolution selects the number of significant digits displayed in measurement mode. In addition, the resolution selection is used algorithms to optimize the accuracy, precision, and response of the ISE measurement.

- ISE Units denote the units to be displayed in measurement & calibration. Both measurement and calibration must be performed in the same units.

- ISE Calibration Standard Concentration Range selects the stability criteria to be used in the ISE calibration. For most calibrations the H IgH setting is the best option. The LOw setting can improve the accuracy of low concentration measurements by allowing the sensor a longer amount of time to stabilize in the calibration standard.

- ISE Auto-Blank Correction uses algorithm to compensate for sensor non-linearities in low-level measurements. Since these require the use of a set of non-linear equations that can only be calculated numerically, the user cannot analytically verify the calibration. In applications were analytical verification is a requirement, the user can choose the turn the Auto-blank correction OFF.

ISE Setup Options

Description	Display	Range of Values	Default Value	Method Specific
ISE Resolution	ISE rES 1	**1, 2, 3** ISE Resolution in Significant Digits	**1**	Yes
ISE Units	ISE UnIt PPb	**M, mG/L, per, PPb, nOnE** ISE Units Displayed	**PPb**	Yes
ISE Calibration Standard Concentration Range	ISE rAng HIgH	**LOw, HIgH** Stability criteria used during ISE Calibration	**HIgH**	Yes
ISE Auto-Blank Correction	ISE nLIn AUtO	**AUtO, OFF** Enables or Disables Calibration Auto-Blank	**AUtO**	Yes

1. In the measurement mode press  .

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

3. Press  to accept the selection and move to the middle line.

4. Press  /  to scroll through the following options:

   - rES = Resolution
   - Un It = ISE Measurement units
     - **M** = Molar
     - **mG/L** = mg/L
     - **PEr** = Percent
     - **PPb** = Parts per Billion
     - **nOnE** = No units

- rAn9 = ISE Measurement range
  - **HIgH**
  - **LOw**
- nL In = Non-linear Blank Correction
  - **OFF**
  - **AUtO**

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

6. Press  /  and  to edit the selected value.

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

8. Repeat steps 3 through 7 to edit ISE settings as needed.

9 Press  to return to measurement mode.

Preparation of Standards

The standards should be prepared in the same ISE units as required by the sample results. It is preferable to use serial dilutions with volumetric glassware to obtain the different concentration levels.

> ***Note:*** *Any reagents such as ionic strength adjustors, should be added to samples and standards as specified in the electrode User Guide or Instruction Manual.* ▲

The calibration points should bracket the expected concentration range of the samples and there should be a tenfold change in concentration (i.e. 1 ppm and 10 ppm or 10 ppm and 100 ppm).

Fresh aliquots of standard should be used at each calibration.

Prior to each day's measurements, a two or more point calibration should be performed. To verify the calibration the electrode should be placed in a fresh aliquot of standard and if the value has changed the electrode should be recalibrated.

Recommended slopes are given with electrode instructions.

It is recommended that the calibration and sample measurements be taken at the same temperature for greater accuracy and reproducibility.

> ***Note:*** *For greater low-level measurement accuracy, a new low-level ISE calibration option is available. An additional rinse of the electrode with the next standard or sample solution is recommended for any low level measurements.* ▲

Autoblank Correction

Blank correction occurs automatically when calibrating with three or more standards. This feature automatically calculates and corrects for background levels of the species of interest.

Auto-Blank correction can be turned off in ISE setup as described in the ISE setup instructions.

ISE Setup Options

1. In measurement mode press  .
2. Press  /  to scroll through setup menu until **ISE** is displayed on the top line.
3. Press  to accept the selection and move arrow icon to the middle line.
4. Press  /  until nL In is displayed on the middle line.
5. Press  to accept the selection and move arrow icon to the bottom line.
6. Press  /  to scroll:
   - OFF – Auto Blank correction OFF
   - AutO – Auto Blank correction ON
7. Press  to accept the selection and move arrow icon to the top line.
8. Press  to return to the measurement mode.

ISE Calibration for 1-5 Points

1. Prepare the electrode and standard for use according to the electrode user guide or instruction manual.

2. Press  until the arrow icon is pointing to the **ISE** measurement line.

3. Press  .

4. Rinse the electrode and place into the standard.

5. Wait for **ISE** to stop flashing. Press  and  to change the value of the standard.

6. Press  to proceed to the next calibration point and repeat steps 4-6 or press  to save the calibration.

7. The slope will be displayed before the meter returns to the measurement mode. SLP is displayed in the lower field and the actual electrode slope, in **mV**, is displayed in the main field.

   Note: *For a 2 or more point calibration the meter will automatically proceed to measurement mode after 3 seconds. For a 1 point calibration the meter will allow you to edit the slope then press*  *to proceed to measurement mode.* ▲

   Note: *If editing a negative number for slope:* ▲

   a. *Press*  *until no digit is blinking and the arrow icon is blinking.*

   b. *Press* to change the sign of the slope.

   c. *Press*  *to save.*

ISE Measurement

After calibrating the electrode the meter is ready to start making measurements. Make sure that the instrument is in measurement mode (is lit) and that the **ISE** is lit. If the is not lit press to return to measurement mode. If the **ISE** is not lit, press until the arrow on the left of the display is pointing at the top line. Then press until the **ISE** lights. You are now ready to start measuring.

1. Rinse the electrode in deionized water.

2. Place the electrode in your sample.

   a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is disabled, then pressing will start the stirrer. The **ISE** will flash until the reading is stable. Once the reading is stable you can Log & Print the measurement by pressing . If the stirrer is on, press to turn off the stirrer before removing the stirrer from the sample.

   b. If you are in AUTO-READ™ mode then press to start the measurement. Once the reading is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled then the stirrer will turn on when is pressed and turn off once the reading has stabilized.

   c. If you are in timed measurement mode then the meter will start making measurements at the frequency you have specified during setup. It will automatically Log & Print each measurement. If you are using the benchtop meter & the stirrer control is enabled, then pressing will start the stirrer. Pressing again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. Once your are finished measuring samples, rinse the electrode with deionized water and blot dry. Then consult your electrode manual for proper electrode storage instructions.

Chapter XI
mV and ORP Technique

Definition of Terms and Concepts

- mV is a raw input reading and therefore does not have a user calibration.
- The sympHony meters can measure the absolute millivolts from pH, ISE, or ORP sensors.

Relative mV and ORP (E_H) Calibration

Note: *Auto-Calibration for ORP requires an Orion ORP electrode and Orion ORP calibration standards (Cat. Nos. 967901 and 967961).* ▲

1. Prepare the electrode and standard for use according to the electrode User Guide or Instructions Manual received with the electrode.
2. Press  until the arrow icon is pointing to the **pH/RmV** measurement line.
3. Press  /  until **RmV** is lit.
4. Press  .
5. Rinse the electrode and place into the ORP standard.
6. Wait for the **RmV** to stop flashing. When the **RmV** stop flashing the meter will display the temperature – corrected mV value as compared to the Standard Hydrogen Electrode (SHE or NHE) for the Orion ORP standard.
7. Press  to save the calibration.

If performing a manual calibration, when the **RmV** stops flashing, press  / and  to change the value, then press  or to accept the standard value and return to measurement mode. Use the temperature chart on the standard bottle or instruction sheet to enter the appropriate value for the temperature and reference type being used.

mV Measurement

Make sure that the instrument is in measurement mode (the  is lit) and that the arrow on the left of the display is pointing at the top line. Then press / until the **mV** lights. The mV will now be displayed. This mode is very helpful in troubleshooting because it displays the input signal being received from the electrode.

If the  is not lit, press to return to measurement mode. If the **mV** is not lit, press  until the arrow icon is pointing at the top line. Then press / until the **mV** lights. You are now ready to make measurements.

1. Rinse the electrode in deionized water.

2. Place the electrode in your sample.

    a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is disabled then pressing  will start the stirrer. **mV** will flash until the reading is stable. Once the reading is stable you can Log & Print the measurement by pressing . If the stirrer is on press to turn off the stirrer before removing the stirrer from the sample.

b. If you are in AUTO-READ mode then press  to start the measurement. Once the reading is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled then the stirrer will turn on when  is pressed and turn off once the reading has stabilized.

c. If you are in timed measurement mode then the meter will start making measurements as soon as it goes into measurement mode at the frequency set in setup. It will automatically Log & Print each measurement. If you are using the benchtop meter & the stirrer control is disabled then pressing  will start the stirrer. Pressing  again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. Once you have finished measuring samples, rinse the electrode with deionized water and blot dry. Then consult your electrode manual for proper electrode storage instructions.

Relative mV & ORP (E_H) Measurement

After calibrating the electrode the meter is ready to start making measurements. Make sure that the instrument is in measurement mode (the  is lit) and that the **Rel mV** is lit. If the  is not lit press  to return to measurement mode. If the **Rel mV** is not lit, press the  until the arrow on the left of the display is pointing at the top line. Then press  /  until the **Rel mV** lights. You are now ready to start measuring.

1. Rinse the electrode in deionized water.

2. Place the electrode in your sample.

   a. If you are in continuous measurement mode, the instrument will start measuring immediately. If you are using the benchtop meter & the stirrer control is disabled then pressing  will start the stirrer. The **Rel mV** will flash until the ready is stable. Once the ready is stable you can Log & Print the measurement by pressing  . If the stirrer is on press  to turn off the stirrer before removing the stirrer from the sample.

   b. If you are in AUTO-READ™ mode then press  to start the measurement. Once the ready is stable the meter will automatically Log & Print the results and freeze the display. If the stirrer is enabled then the stirrer will turn on when  is pressed and turn off once the reading has stabilized.

   c. If you are in timed measurement mode then the meter will start making measurements as soon as it goes into measurement mode at the frequency set in setup. It will automatically Log & Print each measurement. If you are using the benchtop meter & the stirrer control is enabled then pressing  will start the stirrer. Pressing  again will turn off the stirrer.

3. Remove the electrode from the sample and rinse with deionized water, then place it in your next sample and repeat step 2.

4. Once you have finished measuring samples, rinse the electrode with deionized water and blot dry. Then consult your electrode manual for proper electrode storage instructions.

Chapter XII
SympHony Meters Specifications

Environmental Operating Conditions	
Portable and Benchtop Meters	
Ambient Operating Temperature	5 to 45 °C
Relative Humidity	5 to 85%, Non-Condensing
Storage Temperature	- 20 to + 60 °C
Storage Humidity	5 to 85%, Non-Condensing
Pollution	Degree 2
Overvoltage	Category II
Altitude	up to 2000 m
Weight	Portable: 0.45 kg Benchtop: 0.54 kg
Size	Portable: 4.8 cm (H) x 9.7 cm (W) x 21.3 cm (D) Benchtop: 9.4 cm (H) x 18.0 cm (W) x 21.6 cm (D)
AC powered Meters	Indoors Use Only
Battery operated meters	Indoors/Outdoors
Wall Adapter Environmental Conditions	
Ambient Operating Temperature	0 to 40 °C
Relative Humidity	20 to 90%, Non-Condensing
Storage Temperature	- 20 to 85 °C
Storage Humidity	20 to 90%, Non-Condensing
Pollution	Degree 2
Overvoltage	Category II
Operating Altitude	up to 2000 m
Storage Altitude	up to 3000 m
Benchtop Meters	Indoors Use Only

SympHony Meters Specifications (cont'd)

Regulatory and Saftey
CE, CSA, TÜV, UL, FCC Class limits
Case Material
ABS
Shock and Vibration
Vibration, Shipping/Handling Per ISTA #1A Shock, Drop Test in Packaging Per ISTA #1A
Enclosure (designed to meet)
IP67 (Portable Meter) IP54 (Benchtop Meter)

Note: *If the products described in this manual are used in a manner that is not specified by VWR the protection provided by the equipment maybe impaired.* ▲

Single Parameter Meter Specifications (Benchtop & Portable)

Single-Parameter pH		
pH	Range	-2.000 to 19.999
	Resolution	0.1/0.01/0.001
	Relative accuracy	± 0.002
ORP	mV/RmV/Eh Range	± 1999.9
	Resolution	± 0.1
	Relative accuracy	± 0.2 mV or 0.5%, whichever is greater
Single-Parameter DO		
DO	Concentration	0.000 to 90.00 mg/L
	Relative Accuracy	0.2 mg/L
	% Saturation	0.0 to 600
	Salinity factor	0 to 45 ppt
	Barometric pressure	450-850 mm Hg
Single-Parameter Conductivity		
Conductivity	Range	0 - 5000 mS/cm cell constant dependent See probe specification for the cell constant
	Resistivity	0.0001 to 100 Megohms
	Salinity	0.01 to 80.0 ppt NaCl
	TDS	0.0 to 19.999.0 mg/L
	Cell Constant	0.001 to 199.9
	Reference temperature	15 °C, 20 °C or 25 °C (default), autoranging

Dual Parameter Specifications (Benchtop & Portable)

Dual-Parameter pH/ISE		
pH	Range	-2.000 to 19.999
	Resolution	0.1/0.01/0.001
	Relative accuracy	± 0.002
ISE	Concentration Range	0.0 to 19,900.0
	Units	M, mg/L, %, ppb, none
	Resolution	1, 2, or 3 sig. Digits
	Relative Accuracy	± 0.2 mV or 0.05%, whichever is greater
	mV/RmV	± 1999.9
ORP	mV/RmV/Eh Range	± 1999.9
	Resolution	± 0.1
	Relative accuracy	± 0.2 mV or 0.5%, whichever is greater
Dual-Parameter pH/DO		
pH	Range	- 2.000 to 19.999
	Resolution	0.1/0.01/0.001
	Relative accuracy	± 0.002
DO	Concentration	0.000 to 90.00 mg/L
	Relative Accuracy	0.2 mg/L
	% Saturation	0.0 to 600
	Salinity factor	0 to 45 ppt
	Barometric pressure	450-850 mm Hg
ORP	mV/RmV/Eh Range	± 1999.9
	Resolution	± 0.1
	Relative accuracy	± 0.2 mV or 0.5%, whichever is greater

Dual-Parameter pH/Conductivity		
pH	Range	- 2.000 to 19.999
	Resolution	0.1/0.01/0.001
	Relative accuracy	± 0.002
Conductivity	Range	0 - 5000 mS/cm cell constant dependent See probe specification for the cell constant
	Resistivity	0.0001 to 100 Megohms
	Salinity	0.01 to 80.0 ppt NaCl
	TDS	0.0 to 19.999.0 mg/L
	Cell Constant	0.001 to 199.9
	Reference temperature	15 °C, 20 °C or 25 °C (default), autoranging
ORP	mV/RmV/Eh Range	± 1999.9
	Resolution	± 0.1
	Relative accuracy	± 0.2 mV or 0.5%, whichever is greater

Multiple Meter Specifications (Benchtop & Portable)

Multi-Parameter pH/ISE/DO/Cond		
pH	Range	- 2.000 to 19.999
	Resolution	0.1/0.01/0.001
	Relative accuracy	± 0.002
ISE	Concentration Range	0.0 to 19,900.0
	Units	M, mg/L, %, ppb, none
	Resolution	1, 2, or 3 sig. Digits
	Relative Accuracy	± 0.2 mV or 0.05% whichever is greater
	mV/RmV	± 1999.9
DO	Concentration	0.000 to 90.00 mg/L
	Relative Accuracy	0.2 mg/L
	% Saturation	0.0 to 600
	Salinity factor	0 to 45 ppt
	Barometric pressure	450-850 mm Hg
Conductivity	Range	0 - 5000 mS/cm cell constant dependent See probe specification for the cell constant
	Resistivity	0.0001 to 100 Megohms
	Salinity	0.01 to 80.0 ppt NaCl
	TDS	0.0 to 19.999.0 mg/L
	Cell Constant	0.001 to 199.9
	Reference temperature	15 °C, 20 °C or 25 °C (default), autoranging
ORP	mV/RmV/Eh Range	± 1999.9
	Resolution	± 0.1
	Relative accuracy	± 0.2 mV or 0.5%, whichever is greater

Chapter XIII
Care and Maintenance

The sympHony meters combine simple three-button operation with exceptional long-life performance. Rugged enough for the most challenging environmental laboratory and field applications, all housings are dustproof and splash proof. The benchtop meters are rated IP54. The handheld meters are rated IP67 and may be immersed for up to one hour with no water incursion;
they even float!

Regular maintenance should include dusting and wiping the unit with a damp cloth. A mild water-based detergent may be used if necessary.

Spills should be removed immediately using the proper procedure for the type of spill.

Error Codes & Debugging

If an error code is displayed on the screen, the user must press  to clear.

Error Code	Description	Press to Clear	Cause	Trouble Shooting
E001	No Model Number	Yes	Memory Corrupted	Contact Customer Service
E002	No HW Calibration	Yes	Memory Corrupted	Contact Customer Service
E003	Bad HW Calibration	Yes	Memory Corrupted	Contact Customer Service
E004	RTC Failure	Yes	HW Transient or Failure	Reset Meter, if error reoccurs contact Customer Service
E005	User out of range	Yes	HW Transient or Failure	Re-enter value. Check specifications for range of correct values
E033	Keypad Failure	Yes	Hardware problem or user missed hitting one of the keys during the test	Re-run the self test to insure you have a hardware problem, then contact Customer Service

Error Code	Description	Press to Clear	Cause	Trouble Shooting
E034	Input Failure	Yes	Hardware problem or BNC shorting cap not attached during self test	Attach BNC shorting cap and return the self test
E035	Password Wrong	Yes	User entered incorrect password	Re-enter the password If you have forgotten your password contact Customer Service
E036	User Entered Wrong Value	Yes	User entered value is out of range	Re-enter value. Check specifications for range of correct values
E038	Log Full	Yes	User setup as delete on download & data log is full	Download the datalog or change setup to delete on download off. This will start over writing the oldest log values.
E105	Auto-Buffer Failure	Yes	Auto-buffer not recognized, will only happen in remote control	Contact Customer Service
E??	Memory Error	Yes	A memory read, write, verify, or checksum error This is ANY error message starting with E. The 2nd 2 digits refer to what memory section failed.	Clear error and if repeats return for service.
F01	No DO board in DO meter	Yes	Meter is missing DO board	Return for service
F02	No FET board in FET meter	Yes	Meter is missing FET board	Return for Service
F05	An option board is installed and none is required	Yes	Meter has a DO or FET board installed and it's not used in this model	Return for service

pH Events/Errors

Error Code	Description	Press to Clear	Cause	Trouble Shooting
105	pH Auto-Buffer Failure	Yes	Auto-buffer not recognized, will only happen in remote control	• Check that electrode is in correct buffer. • Check that correct buffer set in selected in the method setup. • Clean electrode & refill reference electrode • Perform a manual calibration. Some electrodes may operate outside of the range for pH autocalibration. This may be a sign of electrode aging and is normal.
107	pH Calibration Standard Error	Yes	The milivolts being measured are the same for two different standards.	• Check that the two different buffers are being used and that the electrode is in the correct buffer. • Make fresh buffers and repeat the calibration.
109	Bad pH Slope	Yes	The pH slope is not in the range of 80% to 120%	• Repeat calibration using fresh buffers • Clean electrodes and refill reference electrode • Refer to electrode instruction on how to check electrode

ISE Events/Errors

Error Code	Description	Press to Clear	Cause	Trouble Shooting
306	ISE Blank Error	Yes	The meter is unable to calculate a blank value. This error occurs when Auto Blank is enabled in setup and a three or more point calibration has been performed, when one solution has been defined as zero concentration and the actual concentration of the blank is substantially greater then the least concentrated standard. This can also occur during a one or two point calibration if one of the standards is defined as zero.	• Check to make sure electrodes were placed in the proper standards and blank solution and recalibrate. • Repeat calibration using fresh standards and blank solution. • Repeat using two standards of known concentration other then zero.
307	ISE Calibration Standard Error	Yes	The milivolts being measured are the same for two different standards.	• Check that the two different standards are being used and that the electrode is in the correct standard. • Make fresh standards and repeat the calibration.
309	Bad ISE Slope	Yes	The pH slope is not in the range of - 99 to + 99 mV/Decade	• Repeat calibration using fresh standards • Clean electrodes and refill reference electrode • Refer to electrode instruction on how to check electrode

Conductivity Events/Errors

Error Code	Description	Press to Clear	Cause	Trouble Shooting
705	Conductivity Auto-Standard Failure	Yes	Auto-standard not recognized, will only happen in remote control	• Check that electrode is in correct standard. • Recalibrate using fresh standards • Check that the appropriate cell constant is entered in the method setup. • Clean electrode • Replatinize conductivity cell (if applicable)
707	Conductivity Calibration Standard Error	Yes	The conductance being measured is the same for two different standards.	• Check that the two different standards are being used and that the electrode is in the correct standard. • Make fresh standards and repeat the calibration.
709	Conductivity Cell Constant	Yes	The cell constant is not in the range of 0.001 to 199.0	• Repeat calibration using fresh standards • Clean electrodes • Replatinize conductivity cell (if applicable

DO Events/Errors

Error Code	Description	Press to Clear	Cause	Trouble Shooting
809	Bad DO Slope	Yes	The DO slope is not in the range of 3.92 to 19.7 nano-amps / %saturation	• Repeat calibration • On Air calibration make sure sponge in calibration sleeve is damp. • On water calibration make sure water is saturated with air by bubbling but stirred to prevent keep bubbles off the membrane surface. • Polish the cathode and replace the membrane cap and fill solution.

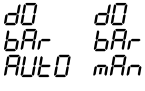
Troubleshooting

Conductivity

1. Temperature coefficient entry screen doesn't show up in Setup.
   - nLF or OFF is selected for the temperature compensation in Setup. Change conductivity temperature compensation to L In and the next screen allows the manual entry of the temperature coefficient.
2. Conductivity goes out of range when it should still be in range.
   - Check that the Cell Type selected in setup is Std and not one of the manual ranging numbers 1 – 7.

Dissolved Oxygen

1. Manual barometric pressure entry screen doesn't show up in Setup.



   - Auto is selected for barometric pressure compensation in setup. Change pressure compensation to manual and the next screen will be the manual pressure entry screen.
2. Manual salinity factor entry screen doesn't show up in Setup.
   - Auto is selected for salinity correction in setup. Change salinity correction to manual and the next screen will be the salinity factor entry screen.
3. The Auto-stir DO probe doesn't turn on when  is pressed.
   - Read Type must be set as Auto and a stirrer speed must be set to operate initiate auto-read & stirring from the BOD probe button.

ISE

1. It takes several minutes for the readings to stabilize in calibration.
   - Concentration range in setup maybe set too low. Change setting to high.
   - ISE may need maintenance, refer to the ISE electrode User Guide.
2. Auto-blank correction gives slope that is too low or cannot be manually checked.
   - Turn Auto-Blank correction off in Setup.

General

1. The display freezes and will not change value.
   - The meter is in Auto-Read mode. Press  to start a new measurement, or switch to continuous measurement in setup.
2. The Timed reading time entry screen doesn't show up in setup.
   - Measurement type is set to Auto-Read or Continuous mode in setup. Change to Timed mode and the next screen will be the timed reading time setting menu.
3. When I hit the Calibration key the display says "wAIt".
   - The meter is printing out and cannot enter calibration until printing is complete. If the meter is at a default baud rate of 9600 then this should rarely occur and not last more then a second before preceding to calibration. If it's set to a lower baud rate the delay could be several seconds.
4. The meter did not accept my setup changes. When I return to setup it still has the old values.
   - You either went back to the wrong setup or did not accept the value you entered by pressing the line select key before pressing measure to return to measurement mode.
5. How can I abort a calibration?
   - Pressing and holding  will abort any operation and return you to measurement mode.
6. My printout is just a string of numbers and units with commas.
   - The printout format in setup is set for computer output. Change this to Printer output.
   - The "SYSTEM" command was issued within 30 seconds of the printout.
7. When I press  , the stirrer doesn't work.
   - Go into setup and select a stirrer speed. The current setting is probably OFF.
   - The unit was running on batteries in a bench top unit.

Self-Test Instructions

1. Power up the meter and wait until the SW revision is displayed, then press  .

2. The display will then fully light and remain lit.

3. Once you have visual checked that all display segment have lit press  again and this will turn off the display.

4. After visually confirming that all the display elements are turned off, press  again the display will show KEY.

5. Press each key on the meter. If each key isn't pressed in 5 seconds it will display "Err" on the middle line & "033" on the bottom line indicating a key failure. Press  to clear the error and complete the self-test.

6. If all the keys are functioning then the meter will restart and go to measurement mode.

7. If you get the error 034 during the self-test, check that the shorting cap is installed on the meter.

8. Reject the meter if any errors are reported during self-test.

Example printouts

The examples below show the printer version of the RS232 output. If the user has selected the computer output, then the data will be presented in the same order, but only the raw data (no labels or units) will be given in a comma separated format. User fields will not be output in the computer format. A user field is a label with a line after it, such as "Sample # _____". In the example printouts, this computer output text will be in red.

Example of a pH printout using "printer" setting:

SB70P BENCHTOP pH

Meter S/n 123456

SW rev 1.29

Method # 5

06-29-2004 09:05:27

pH 10.45 pH

mV -183.3 mV

Temperature 25.0 C

Calibration # 3

Log # 2

Sample # _____

Example of a pH printout using "computer" setting:

112,123456,28,5,06-29-2004 09:05:27,-183.3,mV,10.45,pH,25.0,C,3,2

Note that the sample # and operator lines are not shown in the computer printout. Blank lines are also skipped. Units are given directly after a measurement. If a measurement does not have units, then this field will be blank.

Meter power-up, calibration and measurement printout header

Each printout will start with a particular style of header, shown below. For ease of documentation maintainability, this header is not shown in the examples below.

Company name	VWR Symphony (only valid when first turned on)	
Model	SB80PC BENCHTOP pH/cond Meter	
Serial number	Meter S/n	123456
SW rev	SW rev	1.29
Method number	Method #	5
Date & Time	06-29-2004	09:05:27
Calibration number & type	Calibration # 3 PH	
Blank		

Please note that the calibration number & type is only printed for calibrations, and the type can be one of the following options: pH, ORP, ISE, Planar Conductivity, Conductivity, DO air, DO zero, DO water, DO man.

Example of mV Measurement

MV mV	-183.3 mV	
Temperature	Temperature	25.0 C
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of pH Measurement

PH	pH	10.45 pH
MV	mV	-183.3 mV
Temperature	Temperature	25.0 C
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of ISE Measurement

Concentration	Concentration	100 ppb (or M or% or mg/L)
mV	mV	100.1 mV
Temperature	Temperature	25.0 C
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of ORP Measurement

Relative mV	Relative	120.1 mV
Absolute mV	Absolute	100.1 mV
Temperature	Temperature	25.0 C
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of Conductivity Measurement

Conductivity	Conductivity	1413 µS/cm
Conductance	Conductance	30.2 mS
Temperature	Temperature	25.0 C
Temp. Coefficient	Temp. Coefficient	10.0 %/C (or OFF, or NLF)
Temp. Reference	Temp. Reference	25.0 C
Cell Constant	Cell Constant	1.00 /cm
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of Resistivity Measurement

Resistivity	Resistivity	100.0 Mohm-cm
Conductance	Conductance	30.2 mS
Temperature	Temperature	25.0 C
Temp. Coefficient	Temp. Coefficient	10.0 %/C (or OFF, or NLF)
Temp. Reference	Temp. Reference	25.0 C
Cell Constant	Cell Constant	1.00 /cm
Calibration number	Calibration # 3	
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of TDS Measurement

TDS	TDS	100.0 mg/L
Conductance	Conductance	30.2 mS
Temperature	Temperature	25.0 C
Temp. Coefficient	Temp. Coefficient	10.0 %/C (or OFF, or NLF)

Temp. Reference	Temp. Reference	25.0 C
TDS Factor	TDS Factor	0.49
Cell Constant	Cell Constant	1.00 /cm
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of Salinity Measurement

Salinity	Salinity	100.0 ppt
Conductance	Conductance	30.2 mS
Temperature	Temperature	25.0 C
Cell Constant	Cell Constant	1.00 /cm
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of DO Measurement

Concentration	Concentration	100.0 mg/L
% Saturation	Saturation	60.0 %sat
Current	Current	100.0 nA
Temperature	Temperature	25.0 C
Barometric Pressure	Barometric Pressure	760.0 mmHg
Salinity Correction	Salinity Correction	20.0 ppt
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of a multi-parameter printout

A multi-parameter printout is the same as the above printouts, with the exception of a few minor changes.

1. the header and footer is only printed once.

2. Each section is separated by a blank line. The print out is determined by what is on the display.

3. If a particular line is turned off, then that section will not be printed out.

4. If all lines are turned off, nothing other than the header will get printed.

PH	pH	10.45 pH
MV	mV	-183.3 mV
Temperature	Temperature	25.0 C
Calibration number	Calibration #	2
Blank line		
Conductivity	Conductivity	1413 uS/cm
Conductance	Conductance	30.2 mS
Temperature	Temperature	25.0 C
Temp. Coefficient	Temp. Coefficient	10.0 %/C (or OFF, or NLF)
Temp. Reference	Temp. Reference	25.0 C
Cell Constant	Cell Constant	1.00 /cm
Calibration number		Calibration # 7
Blank line		
Concentration	Concentration	100.0 mg/L
% Saturation	Saturation	60.0 %sat
Current	Current	100.0 nA
Temperature	Temperature	25.0 C
Barometric Pressure	Barometric Pressure	760 mmHg

Salinity Correction	Salinity Correction	20 ppt
Calibration number	Calibration #	3
Log number	Log #	2
Operator	Operator _____	
Sample ID	Sample # _____	

Example of pH Calibration

Cal. Pt. 1	Point 1	
pH 1	pH	2.00 pH
mV 1	MV	190.0 mV
Temp. 1	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto
Blank line		
Cal. Pt. 2	Point 2	
pH 2	pH	4.55 pH
mV 2	mV	173.0 mV
Temp. 2	Temperature	25.0 C
Auto/Manual	Cal. Type:	Manual
Blank line		
Cal. Pt. 3	Point 3	
pH 3	pH	7.00 pH
mV 3	mV	0.0 mV
Temp. 3	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto
Blank line		
Cal. Pt. 4	Point 4	
pH 4	pH	10.01 pH
mV 4	mV	-170.0 mV
Temp. 4	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto

Blank line		
Cal. Pt. 5	Point 5	
pH 5	pH	13.85 pH
mV 5	mV	-192.0 mV
Temp. 5	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto
Blank line		
Slope P1 - P2	Slope 1	98.1 %
Slope P2 - P3	Slope 2	99.2 %
Slope P3 - P4	Slope 3	100.3 %
Slope P4 - P5	Slope 4	98.4 %
E01	Eo 1	50.1 mV
E02	Eo 2	50.1 mV
E03	Eo 3	50.1 mV
E04	Eo4	50.1 mV
Operator	Operator _____	

Example of ISE Calibration

Cal. Pt. 1	Point 1	
Concentration 1	Concentration	10.0 ppb
mV 1	mV	190.0 mV
Temp. 1	Temperature	25.0 C
Cal. Type 1	Cal. Type:	Manual
Blank line		
Cal. Pt. 2	Point 2	
Concentration 2	Concentration	23.1 ppb
mV 2	MV	173.0 mV
Temp. 2	Temperature	25.0 C
Cal. Type 2	Cal. Type:	Manual

Blank line		
Cal. Pt. 3	Point 3	
Concentration 3	Concentration	40.0 ppb
mV 3	MV	0.0 mV
Temp. 3	Temperature	25.0 C
Cal. Type 3 Blank line	Cal. Type:	Manual
Cal. Pt. 4	Point 4	
Concentration 4	Concentration	50.0 ppb
mV 4	MV	-170.0 mV
Temp. 4	Temperature	25.0 C
Cal. Type 4 Blank line	Cal. Type:	Manual
Cal. Pt. 5	Point 5	
Concentration 5	Concentration	60.0 ppb
mV 5	MV	-192.0 mV
Temp. 5	Temperature	25.0 C
Cal. Type 5 Blank line	Cal. Type: Manual	
Slope P1 - P2	Slope 1	59.1 mV/dec
Slope P2 - P3	Slope 2	59.2 mV/dec
Slope P3 - P4	Slope 3	59.6 mV/dec
Slope P4 - P5	Slope 4	59.4 mV/dec
E01	Eo 1	50.1 mV
E02	Eo 2	50.1 mV
E03	Eo 3	50.1 mV
E04	Eo4	50.1 mV
Blank correction	blank	0.123 ppb
Operator	Operator _____	

Example of Conductivity Calibration

Cal. Pt. 1	Point 1	
Conductivity 1	Conductivity	100.0 µS/cm
Conductance 1	Conductance	10.0 mS
Temp. 1	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto
Blank line		
Cal. Pt. 2	Point 2	
Conductivity 2	Conductivity	1413 uS/cm
Conductance 2	Conductance	32.2 mS
Temp. 2	Temperature	25.0 C
Auto/Manual	Cal. Type:	Auto
Blank line		
Cal. Pt. 3	Point 3	
Conductivity 3	Conductivity	12.9 mS/cm
Conductance 3	Conductance	67.2 mS
Temp. 3	Temperature	25.0 C
Auto/Manual	Cal. Type: Auto	
Blank line		
Cal. Pt. 4	Point 4	
Conductivity 4	Conductivity	111.9 mS/cm
Conductance 4	Conductance	100.0 mS
Temp. 4	Temperature	25.0 C
Auto/Manual	Cal. Type: Aut	
Blank line		
Cal. Pt. 5	Point 5	
Conductivity 5	Conductivity	200.0 mS/cm
Conductance 5	Conductance	150.5 mS

Temp. 5	Temperature	25.0 C
Auto/Manual	Cal. Type:	Manual
Blank line		
Cell Constant 1	K 1	1.000 /cm
Cell Constant 2	K 2	1.000 /cm
Cell Constant 3	K 3	1.000 /cm
Cell Constant 4	K 4	1.000 /cm
Cell Constant 5	K 5	1.000 /cm
Offset 1	Offset 1	0.00 µS/cm
Offset 2	Offset 2	50.0 µS/cm
Offset 3	Offset 3	50.0 µS/cm
Offset 4	Offset 4	50.0 µS/cm
Offset 5	Offset 5	50.0 µS/cm
Operator	Operator _____	

Example of ORP Calibration

Cal. Pt. 1	Point 1	
Rel. mV	Relative	130.2 RmV
mV	Absolute	150.5 mV
Temp.	Temperature	25.0 C
Auto/Manual	Cal. Type:	Manual
mV Offset	Offset 1	20.3 mV
Operator	Operator _____	

Example of DO Calibration

Cal. Pt. 1	Point 1	
Concentration	Concentration	8.70 mg/L (for Manual)
Saturation	Saturation	102.3 %sat (for AIR) 100.0 %sat (for H2O)
Electrode Zero current	Zero Current	10 nA
Current	Current	808.2 nA
Temp. (solution)	Temperature	25.0 C
Auto/Manual Blank Line	Cal. Type:	Auto(for Air/H2O/SET0) Manual (for Manual)
Barometric Pressure	Barometric Pressure	760.0 mmHg
Sal. Corr.	Salinity Correction	10.0 ppt
Operator	Operator _____	

Contact VWR Technical Service at **1(800) VWR-SUPP**. For the most current contact information, visit **www.vwr.com**.

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Chapter XIV
Declaration of Conformity

Manufacturer: Thermo Electron Corporation

Address: 166 Cummings Center
Beverly, MA 01915
USA

The above named Manufacturer hereby declares that the product(s) described below conforms to the Standards and Directives listed below:

SB70P benchtop
SB70D benchtop
SB70C benchtop
SB80PI benchtop
SB80PD benchtop
SB80PC benchtop
SB90M5 benchtop

SP70P portable
SP70D portable
SP70C portable
SP80PI portable
SP80PD portable
SP80PC portable
SP90M5 portable

Directive / Standard:

89/336/EEC Electromagnetic Compatibility (EMC) Directive

EN 61326:1997 + A1:1998 + A2:2001, Electrical equipment for measurement, control and laboratory use: EMC-requirements for measurement device per Annex D.

73/23/EEC Low voltage directive

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements.

These products have been manufactured in compliance with the provisions of the relevant Thermo Electron manufacturing and test documents and processes. Further, these documents and processes are recognized as complying with ISO9001: 2000 by QMI, listed as File #001911.

Place and date of issues:

Beverly, MA, February 22, 2005

Robert Manning

Manager of QA & Mfg Engineering

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 following symbol:

Thermo Electron 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 Thermo Electron's compliance with these Directives, the recyclers in your country, and information on Thermo Electron products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.

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