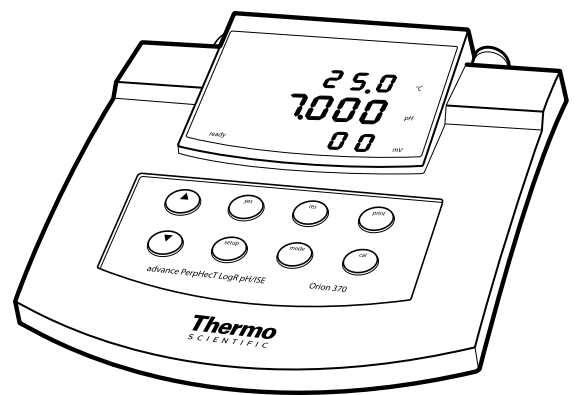


**Thermo Scientific
Orion 320, 350 and 370
PerpHecT[®] LogR[®] Meter**

User Guide



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This publication supersedes all previous publications on this subject.

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Chapter 1 Introduction

General Information

Thermo Scientific Orion pH and ISE meters are designed for every application, from basic pH measurements to advanced concentration analysis using ion selective electrodes. This user guide contains information on the preparation, operation and maintenance for the 320, 350 and 370 PerpHecT LogR meters. The 320 meter measures pH, millivolts (mV) and temperature. The 350 meter measures pH, millivolts (mV), oxidation-reduction potential (ORP) and temperature. The 370 meter measures pH, concentration (ISE), millivolts (mV), oxidation-reduction potential (ORP) and temperature.

All PerpHecT meters feature patented digital LogR technology, which allows fully temperature compensated measurements without a separate ATC probe. For maximum system accuracy, use Thermo Scientific Orion PerpHecT and PerpHecT ROSS pH electrodes. PerpHecT meters are microprocessor-controlled and feature pH autocalibration, patented digital LogR pH measurement mode, sealed keypads and large easy-to-read LED displays.

PerpHecT meters are ideal for busy, multi-user laboratories or plant environments. The pH measurements are easy with the help of advanced features such as autocalibration, LogR mode, automatic temperature compensation, choice of pH resolution and diagnostic operator assistance codes.

- The 320 PerpHecT meter is a basic meter designed for routine pH and mV measurements.
- The 350 PerpHecT meter offers an RS232 interface for connecting the meter to a printer or a computer. Other features include GLPcheck for monitoring electrode performance and GLPdoc that creates printouts that are compatible with good laboratory practice (GLP) requirements.
- The 370 PerpHecT meter offers basic ISE functions for measuring ion concentrations using an ion selective electrode and an RS232 interface for connecting the meter to a printer or a computer. Other features include GLPcheck for monitoring electrode performance and GLPdoc that creates printouts that are compatible with good laboratory practice (GLP) requirements.

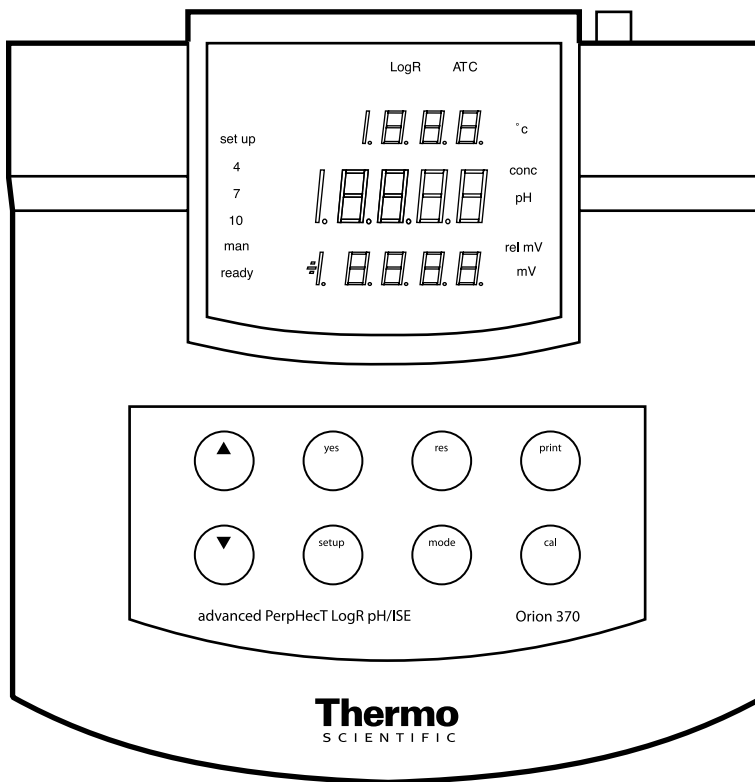


Figure 1 – 370 PerpHecT LogR Meter

Chapter 2 Meter Overview

Meter Display

A large bright LED display shows results in the main (middle) field. Temperature is displayed in the upper field. The lower display shows millivolts. The current operation mode is indicated along the right side of the display. The buffers used during the last pH calibration are designated by the indicators along the left side of the display. See **Figure 2**.

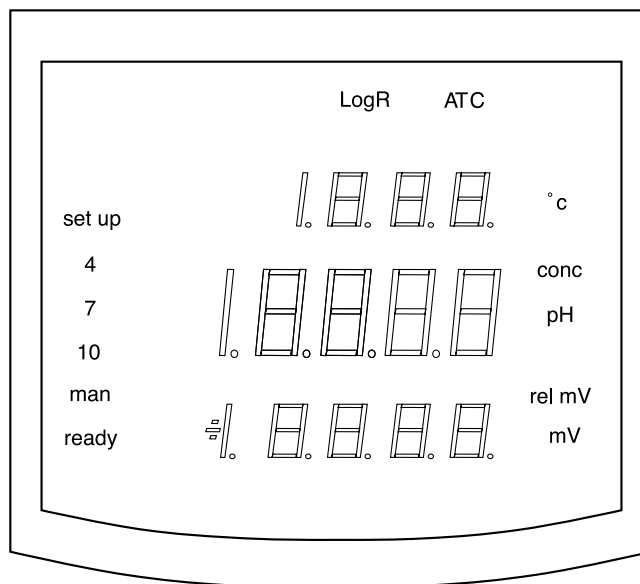


Figure 2 – 370 PerpHecT Meter Display

Meter Display Icons

setup – Indicates that the meter is in the setup menu, which is used to define or view meter operating parameters.

LogR – Indicates that the meter is in the LogR temperature measurement or calibration mode. Automatic temperature compensation is activated in the meter setup menu and achieved through the pH electrode. LogR function is active when the LogR icon appears in the display.

ATC – Indicates that an ATC probe is connected to the meter and operational. Manual temperature compensation is activated when the ATC and LogR symbols are not displayed.

°C – The ATC icon in the upper display is lit when temperature is measured with an ATC probe. The LogR icon is lit when LogR temperature measurement is activated. If neither is on, manual temperature setting is active.

ready – Displayed when the electrode signal has stabilized (pH, conc, rel mV, mV and °C) and when the calibration standard input has stabilized.

320 Meter Keypad

The 320 meter has a six button keypad that is used to control all meter functions.

Key	Function
mode	Press to select the measurement mode. Used to initiate LogR temperature calibration when LogR function is enabled.
yes/res	Press to accept settings, calibration points or to change display resolution.
scroll (▲ ▼)	Press to change a setup parameter. Also used in the measurement mode to scroll manual temperature settings.
cal	Press to initiate pH calibration.
setup	Press to enter setup menu. Setup menu is entered to change meter operating parameters and to enter manual calibration buffer values.

350 and 370 Meter Keypad

The 350 and 370 meters have an eight button keypad used to control all meter functions.

Key	Function
mode	Press to select the measurement mode. Used to initiate LogR temperature calibration when LogR function is enabled.
yes	Press to accept settings, calibration points. May also be used to scroll through the setup menu without changing any parameters.
scroll (▲ ▼)	Press to change a setup parameter. Also used in the measurement mode to scroll manual temperature settings.
print	Press to print measurement data.
cal	Press to initiate pH, rel mV, or ISE (370 only) calibration.
setup	Press to enter setup menu. Setup menu is entered to change meter operating parameters and to enter manual calibration buffer values.
res	Press to change display resolution.

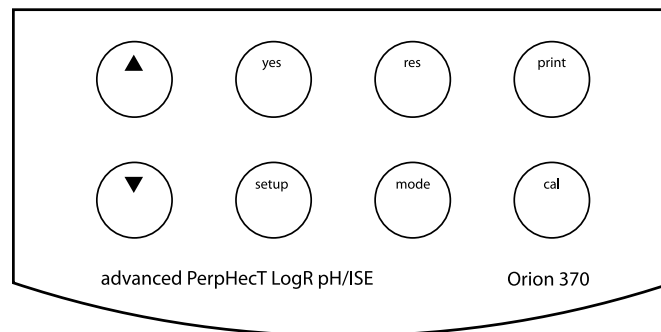


Figure 3 – PerpHecT Meter Keypad

Meter Connections

Power Supply – All PerpHecT meters are designed to operate with a 110 V line adaptor, Cat. No. 020125, 220 V line adapter, Cat. No. 020130 or 240 V line adapter, Cat. No. 020135. Plug the line adaptor securely into the line adapter input on the back of the meter and then plug the line adapter into an appropriate wall outlet.

Electrode Input – Attach a PerpHecT pH electrode or other pH electrode with a BNC connector to the BNC input on the back of the meter. Slide the electrode connector onto the BNC input and then push in and turn the connector clockwise to lock it into position. Electrodes with U.S. standard connectors may be used with an adaptor, Cat. No. 090033. Connect reference electrodes with pin tip connectors by pushing the connector directly into reference input. See **Figure 4**.

ATC Probe – Attach an ATC probe to the ATC input on the back of the meter by sliding the connector straight in until it is firmly in place. Use only Thermo Scientific Orion ATC probes that are designed for PerpHecT meters, Cat. No. 927005 (epoxy body), Cat. No. 927006 (glass body) or Cat. No. 927007 (stainless steel body).

RS232 – Attach the RS232 connector to the RS232 input on the back of the meter when using a printer or computer (350 and 370 meters only).

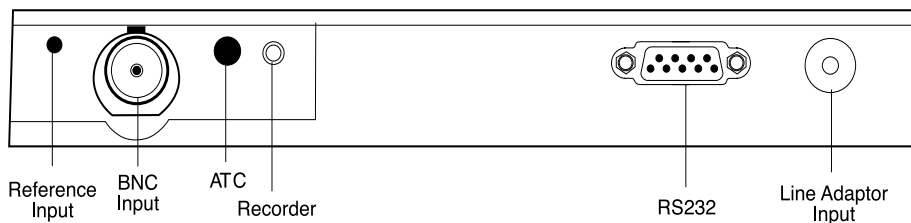


Figure 4 – PerpHecT Meter Connections

LogR Temperature Measurements

Obtaining accurate pH values depends on both the correct measurement of standard and sample temperatures and on the compensation for any variations in these temperatures. This thermal compensation has generally been accomplished either manually (by measuring sample solution with a thermometer and then entering the measured temperature on the meter), or automatically (by placing a separate temperature probe together with a pH electrode in the solution).

The temperature of a solution affects pH measurements in two ways:

1. The pH of buffers and samples actually changes with temperature. For buffers, this change is known and is built into the PerpHecT meters.
2. The slope of the calibration, which the meter uses to convert the raw millivolt readings of the electrode to pH values, changes with temperature. At 25 °C, a 10 degree change in temperature changes the slope by 3.4%.

How important is direct temperature compensation to pH measurement? To see the effects of temperature, look up your approximate sample temperature on the left side of **Table 1**. Read across the top to your approximate pH value. The value shown at the intersection is the error a 1° C change in temperature will cause in pH measurement without compensation. Accurate temperature compensation is essential to accurate pH measurement.

Table 1 – pH Error due to 1° C Temperature Change (in pH units)

Temp. (° C)	pH 6 or pH 8	pH 5 or pH 9	pH 4 or pH 10	pH 3 or pH 11	pH 2 or pH 12
10	0.004	0.007	0.011	0.014	0.018
20	0.003	0.007	0.010	0.014	0.017
30	0.003	0.007	0.010	0.014	0.017
40	0.003	0.006	0.010	0.013	0.016
50	0.003	0.006	0.009	0.012	0.015
60	0.003	0.006	0.009	0.012	0.015
70	0.003	0.006	0.009	0.012	0.015
80	0.003	0.006	0.008	0.011	0.014
90	0.003	0.006	0.008	0.011	0.014

PerpHecT pH meters allow for direct temperature measurement and temperature compensation from your pH electrode. With simultaneous measurement of pH and temperature, the patented digital LogR technology makes this possible using most standard glass pH electrodes. The system is based on using the electrical resistance of the glass sensing bulb as the temperature probe. The logarithm of the resistance of the bulb varies almost linearly with the reciprocal of the absolute temperature (see **Figure 5**). Almost all common pH glasses show a similar decrease in resistance with increasing temperature, and can be used with other meters. However, only the exact shape of the curve of PerpHecT electrodes is in the meter's memory. To maximize system performance and accuracy, use a PerpHecT or PerpHecT ROSS pH electrode.

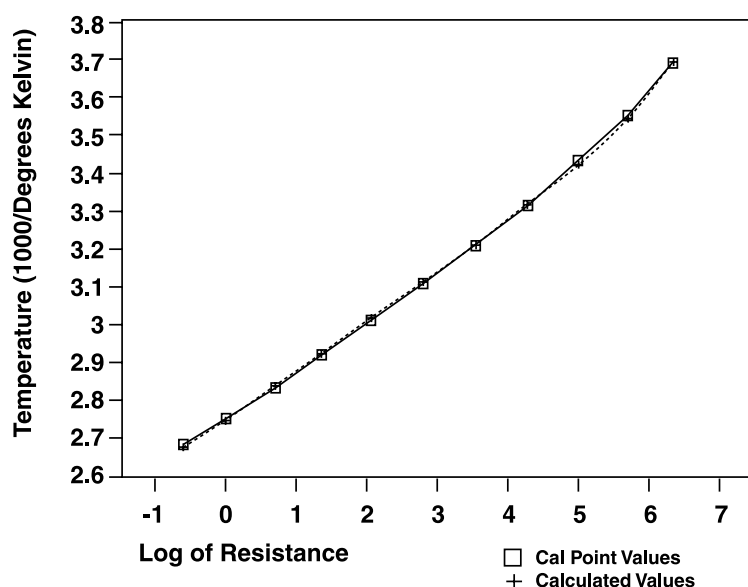


Figure 5 – LogR Resistance vs. Temperature Graph

Chapter 3 Operating the 320 Meter

Meter Power Up

Plug the meter into an approved wall outlet via the power line adaptor. The entire display (all icons) will be lit for about two seconds. Once all power up procedures have been completed, the meter automatically advances to the measurement mode.

Note: The first time the meter is powered up, a meter self-test and check out should be performed before using the meter for measurements. Refer to **Chapter 7, Meter Self Test** for instructions.

Setup Menu

Select the setup menu by pressing the **setup** key until the setup icon on the display is activated. This menu is used to define, change or view meter operating parameters. While in the setup menu, the **yes** key is used to scroll through the menu without changing parameters and to enter new parameters into meter memory. If a parameter has been changed, the **yes** key must be pressed to activate the change. The **scroll** (**▲ ▼**) keys are used to change the settings within each function. To exit the setup menu, press the **mode** key.

Setup Parameters

Slope – The current pH electrode slope in the meter memory will be displayed. The value is displayed as a percent of theoretical slope. The default setting is 100%. This function is for display purposes only. The value cannot be changed in the setup menu. To change the slope value, perform a two point calibration or set the slope during a one point calibration. Press the **yes** key to advance to next menu function.

LogR – When the LogR function is accessed, the LogR icon will be shown while the upper readout displays the current LogR setting (off for disabled and on for enabled). Press the **yes** key to accept the setting. To change the current setting, press a **scroll** (**▲ ▼**) key. Press the **yes** key to accept. The measured LogR temperature will be used to calculate temperature-compensated pH values.

Manual Buffer Option – When the manual buffer option function is entered, the display will show STD (57d) or SET (5E7). To change the setting, press a **scroll** (**▲ ▼**) key. Press the **yes** key when the desired setting is displayed. When the STD option is selected, calibration may only be performed with standard buffers (pH 4.01, 7.00 and 10.01). When the SET option is selected, calibration may be performed with user-defined buffers within the 0 to 14 pH range. If SET is selected, the meter will advance to setting the manual buffer values. Buffer values must be at least 1 and not more than 4 pH units apart.

pH Calibration

A one or two buffer calibration should be performed using fresh buffers before pH is measured. Always use a fresh aliquot of buffer whenever calibrating. 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 of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in memory. For maximum accuracy, perform a one buffer calibration every two hours to compensate for electrode drift, using a fresh aliquot of pH 7 buffer.

When operating in the LogR mode, the meter does not require the use of a separate ATC probe. The PerpHecT meters measure the resistance of the pH sensing glass and converts the value to temperature-compensated pH measurements. For optimum results, PerpHecT electrodes or PerpHecT ROSS electrodes should be used.

For the best results, it is recommended that the meter be calibrated for temperature in the LogR mode. Alternately, an ATC probe may be used. If LogR or an ATC probe is not used, all samples and standards should be at the same temperature or manual temperature compensation should be used.

Stir all buffers and samples with a magnetic stirrer while a measurement is being made. 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 beaker.

Note: When making measurements in the LogR mode, you must calibrate for temperature before attempting a pH calibration.

Two Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose either pH 4.01 and pH 7.00 buffers or pH 7.00 and pH 10.01 buffers; whichever will bracket your expected sample range.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **yes** key to accept the last calibration buffer range (7-4 or 7-10) or select one of these calibration ranges using the **scroll** (**▲ ▼**) keys and then press the **yes** key to accept the buffer range.
4. The 7 buffer icon will be displayed. Place the electrode in the pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
5. The pH 4 (or pH 10) icon will be displayed. Remove the electrode from pH 7.00 buffer and rinse it with distilled water. Place the electrode in either pH 4.01 or 10.01 buffer, depending on calibration range that was selected. When the ready icon is shown, press the **yes** key to accept the buffer value.
6. SLP will be displayed while the calculated slope is displayed.
7. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability. The icons for the type of calibration performed will be shown until another calibration is performed.
8. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
9. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

One Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose a pH 7.00 buffer. Autocalibration with one buffer can only be performed using pH buffer 7.00.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **scroll** (**▲ ▼**) keys until 7 is displayed and then press the **yes** key to accept the calibration range.
4. Place the electrode in pH 7.00 buffer. When the ready icon is shown, indicating electrode stability, press the **yes** key.
5. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. This value can be edited using the **scroll** (**▲ ▼**) keys. Press the **yes** key to save the slope value.
6. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability.
7. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
8. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

Manual Calibration

Note: Manual calibration can be performed with any user-selected buffer(s). The difference between manual buffer values must be between one and four pH units.

1. Attach the electrode to the meter.
2. Press the **setup** key. Press the **yes** key until STD (57d) or SET (5E7) is displayed. Select SET and press the **yes** key. P1 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the first buffer and press the **yes** key to accept the new value. P2 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the second buffer and press the **yes** key to accept the new value. Press the **mode** key to return to the measurement mode.
3. Press the **cal** key. The display will show CAL for two seconds. The last calibration buffer range will be displayed. Use the **scroll** (**▲ ▼**) keys to select the SET option. Press the **yes** key to accept the SET option.
4. P1 will be displayed. Place the electrode into the first calibration buffer. When the ready icon is displayed, the user defined buffer value will be shown. Press the **yes** key to accept the value.
5. P2 will be displayed. Place the electrode into the second calibration buffer. When the ready icon is displayed, the user-defined buffer value will be shown. Press the **yes** key to accept the value.
6. SLP will be displayed for two seconds while the calculated slope is shown.
7. Rinse the electrode with distilled water and place it in the sample. Record the pH directly from the main meter display and temperature from upper field when the ready icon is displayed or when the electrode signal is stable.

LogR Temperature Calibration

This procedure should be performed at least once per week to ensure accurate temperature compensation when operating in the LogR mode. If the meter is powered down or the electrode is disconnected, the LogR temperature should be recalibrated. Refer to the **Appendix** for accuracy specifications and recommended calibration techniques.

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

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

When using the meter for the first time or restarting the meter in the LogR mode, a LogR temperature calibration must be performed. It is recommended that at least a two-point temperature calibration be performed to meet optimum system accuracy. Refer to the **Appendix** for additional information.

LogR Calibration

1. To perform a LogR calibration, the LogR function must first be enabled in setup menu. Press the **setup** key. Press the **yes** key until the LogR icon is shown. Press the **scroll** (▲ ▼) keys until on is displayed. Press the **yes** key to enable the LogR function. Press the **mode** key to exit the setup menu. When the LogR function is enabled, the LogR icon will be shown while the meter is in the measurement mode.
2. In the measurement mode, press the **mode** key until the meter shows the LogR icon and CAL on the main display. Press the **yes** key to begin the LogR temperature calibration sequence. The last LogR calibration type (1-PT, 2-PT or 3-PT) will be shown on the display. 2-PT is the default setting. Use the **scroll** (▲ ▼) keys to change calibration type and then press the **yes** key.
3. The display will show CAL 1 in the main readout. The measured temperature value, based on the last calibration, will be displayed. Place the PerpHecT or ROSS PerpHecT pH electrode into a temperature-controlled pH buffer or tap water solution. Measure the temperature of the solution using a NIST-traceable thermometer. When the LogR signal stabilizes, the ready icon will be shown.
4. Adjust the temperature value using the **scroll** (▲ ▼) keys. Press the **yes** key to accept the value.
5. If a two point calibration was selected, CAL 2 will be displayed on the main readout. Follow steps 3 and 4 to set the second temperature value. Repeat the same steps if a three point calibration is selected.
6. The meter will proceed to the pH measurement mode after accepting the final temperature value.

Note: A calibration may be aborted before saving the final calibration point by pressing the **mode** key. This will cause the system to display ESC, proceed to pH mode and retain to the previous LogR temperature calibration data.

mV / ORP Measurements

1. Press the **mode** key to select the mV mode. Disable the LogR function in the setup menu.
2. Connect the ORP electrode to the meter.
3. Place the electrode in a sample. When the reading stabilizes, record the mV and temperature values.

Automatic Temperature Compensation

For automatic temperature compensation, connect an ATC probe to the meter and disable the LogR function in the setup menu. Attach the ATC probe to the 3.5 mm phone jack on the rear panel of the meter. See **Figure 4**. The 320, 350 and 370 PerpHecT meters can be used with the PerpHecT epoxy body ATC probe, Cat. No. 927005; the PerpHecT glass body ATC probe, Cat. No. 927006; and the PerpHecT stainless steel body ATC probe, Cat. No. 927007.

Manual Temperature Compensation

For manual temperature compensation, disconnect the ATC probe and disable the LogR function in the setup menu. Manual temperature may only be set when the LogR function is disabled and there is no ATC probe connected to the meter. In the measurement mode, use the **scroll** (**▲ ▼**) keys to manually set the temperature value. This temperature will be used to calculate temperature-corrected pH values.

Chapter 4 Operating the 350 Meter

Meter Power Up

Plug the meter into an approved wall outlet via the power line adaptor. The entire display (all icons) will be lit for about two seconds. Once all power up procedures have been completed, the meter automatically advances to the measurement mode.

Note: The first time the meter is powered up, a meter self-test and check out should be performed before using the meter for measurements. Refer to **Chapter 7, Meter Self Test** for instructions.

Setup Menu

Select the setup menu by pressing the **setup** key until the setup icon on the display is activated. This menu is used to define, change or view meter operating parameters. While in the setup menu, the **yes** key is used to scroll through the menu without changing parameters and to enter new parameters into meter memory. If a parameter has been changed, the **yes** key must be pressed to activate the change. The **scroll** (**▲ ▼**) keys are used to change the settings within each function. To exit the setup menu, press the **mode** key.

Setup Parameters

Slope – The current pH electrode slope in the meter memory will be displayed. The value is displayed as a percent of theoretical slope. The default setting is 100%. This function is for display purposes only. The value cannot be changed in the setup menu. To change the slope value, perform a two point calibration or set the slope during a one point calibration. Press the **yes** key to advance to next menu function.

LogR – When the LogR function is accessed, the LogR icon will be shown while the upper readout displays the current LogR setting (off for disabled and on for enabled). Press the **yes** key to accept the setting. To change the current setting, press a **scroll** (**▲ ▼**) key. Press the **yes** key to accept. The measured LogR temperature will be used to calculate temperature-compensated pH values.

Print Function – The current print function setting will be displayed in the main field and PrT will be displayed in the upper field. The default setting is manual print, shown as 00 on the display. To change the setting to print on ready, press the **scroll** (**▲ ▼**) keys until 01 is displayed. Press the **yes** key when the desired setting is displayed.

Manual Buffer Option – When the manual buffer option function is entered, the display will show STD (57d) or SET (5E7). To change the setting, press a **scroll** (▲ ▼) key. Press the **yes** key when the desired setting is displayed. When the STD option is selected, calibration may only be performed with standard buffers (pH 4.01, 7.00 and 10.01). When the SET option is selected, calibration may be performed with user-defined buffers within the 0 to 14 pH range. If SET is selected, the meter will advance to setting the manual buffer values. Buffer values must be at least 1 and not more than 4 pH units apart.

Date/Time – Set the date and time using the **scroll** (▲ ▼) and **yes** keys. YEAR will be displayed in the lower field with the current year displayed in the main field. Use the **scroll** (▲ ▼) keys to set the year. Press the **yes** key to accept the year setting.

MON will be displayed in the lower field with the month value displayed in the main field. Use the **scroll** (▲ ▼) keys to set the month. Press the **yes** key to accept the month setting.

DAY will be displayed in the lower field with the current day in the main field. Use the **scroll** (▲ ▼) keys to set the day. Press **yes** to accept the day setting.

HOUR will be displayed in the lower field with the current hour displayed in the main field. Use the **scroll** (▲ ▼) keys to set the hour. Press the **yes** key to accept the hour setting.

MIN will be displayed in the lower field with the current minutes displayed in the main field. Use the **scroll** (▲ ▼) keys to set the minutes. Press the **yes** key to accept the minute value.

Note: When making a change to the date or time, you must proceed through the entire date and time setup sequence by pressing the **yes** key to accept both current and changed settings.

Serial Number Input – The six digit meter serial number may be entered into the meter memory to document GLPcheck procedures. When the serial sequence is entered, the display will read UPPr. Use the **scroll** (▲ ▼) keys to set the first 2 digits of the meter serial number. Press **yes** to accept. The display will read LO. Use the **scroll** (▲ ▼) keys to set the last 4 digits. Press the **yes** key to accept.

pH Calibration

A one, two or three buffer calibration should be performed using fresh buffers before pH is measured. Always use a fresh aliquot of buffer whenever calibrating. 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 of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in memory. For maximum accuracy, perform a one buffer calibration every two hours to compensate for electrode drift, using a fresh aliquot of pH 7 buffer.

The instrument uses a point to point calibration scheme, i.e. the meter stores in memory the different electrode slopes for each portion of the calibration curve. When measuring in a particular region of the curve, the electrode slope for that region is employed in the calculation of sample pH. After calibration, the average electrode slope for all the segments of the entire calibration curve is displayed. Use of this scheme increases accuracy in the different regions of the calibration curve. However, the electrode slope may appear lower than normal, especially if buffers from the pH extremes (pH less than 2.00 or pH greater than 12.00) are used.

When operating in the LogR mode, the meter does not require the use of a separate ATC probe. The PerpHecT meters measure the resistance of the pH sensing glass and converts the value to temperature-compensated pH measurements. For optimum results, PerpHecT electrodes or PerpHecT ROSS electrodes should be used.

For best results, it is recommended that the unit be calibrated for temperature in the LogR mode. Alternately, an ATC probe may be used. If LogR or an ATC probe is not used, all samples and standards should be at the same temperature or manual temperature compensation should be used.

Stir all buffers and samples with a magnetic stirrer while a measurement is being made. 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 beaker.

Note: When making measurements in the LogR mode, you must calibrate for temperature before attempting a pH calibration.

Three Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose pH 4.01, pH 7.00 and 10.01 buffers.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **scroll** (▲ ▼) keys until 3PT is displayed and then press the **yes** key to accept the calibration range.
4. The 4 buffer icon will be displayed. Place the electrode in the pH 4.01 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
5. The 7 buffer icon will be displayed. Place the electrode in the pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
6. The 10 buffer icon will be displayed. Place the electrode in the pH 10.01 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
7. SLP will be displayed while the calculated slope is displayed.
8. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability. The icons for the type of calibration performed will be shown until another calibration is performed.
9. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
10. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

Two Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose either pH 4.01 and pH 7.00 buffers or pH 7.00 and pH 10.01 buffers; whichever will bracket your expected sample range.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **yes** key to accept the last calibration buffer range (7-4 or 7-10) or select one of these calibration ranges using the **scroll** (**▲ ▼**) keys and then press the **yes** key to accept the buffer range.
4. The 7 buffer icon will be displayed. Place the electrode in the pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
5. The pH 4 (or pH 10) icon will be displayed. Remove the electrode from pH 7.00 buffer and rinse it with distilled water. Place the electrode in either pH 4.01 or 10.01 buffer, depending on calibration range that was selected. When the ready icon is shown, press the **yes** key to accept the buffer value.
6. SLP will be displayed while the calculated slope is displayed.
7. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability. The icons for the type of calibration performed will be shown until another calibration is performed.
8. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
9. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

One Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose a pH 7.00 buffer. Autocalibration with one buffer can only be performed using pH buffer 7.00.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **scroll** (**▲ ▼**) keys until 7 is displayed and then press the **yes** key to accept the calibration range.
4. Place the electrode in pH 7.00 buffer. When the ready icon is shown, indicating electrode stability, press the **yes** key.
5. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. This value can be edited using the **scroll** (**▲ ▼**) keys. Press the **yes** key to save the slope value.
6. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability.
7. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
8. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

Manual Calibration

Note: Manual calibration can be performed with any user-selected buffer(s). The difference between manual buffer values must be between one and four pH units.

1. Attach the electrode to the meter.
2. Press the **setup** key. Press the **yes** key until STD (57d) or SET (5E7) is displayed. Select SET and press the **yes** key. P1 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the first buffer and press the **yes** key to accept the new value. P2 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the second buffer and press the **yes** key to accept the new value. Press the **mode** key to return to measurement mode.
3. Press the **cal** key. The display will show CAL for two seconds. The last calibration buffer range will be displayed. Use the **scroll** (**▲ ▼**) keys to select the SET option. Press the **yes** key to accept the SET option.
4. P1 will be displayed. Place the electrode into the first calibration buffer. When the ready icon is displayed, the user defined buffer value will be shown. Press the **yes** key to accept the value.
5. P2 will be displayed. Place the electrode into the second calibration buffer. When the ready icon is displayed, the user-defined buffer value will be shown. Press the **yes** key to accept the value.
6. SLP will be displayed for two seconds while the calculated slope is shown.
7. Rinse the electrode with distilled water and place it in the sample. Record the pH directly from the main meter display and temperature from upper field when the ready icon is displayed or when the electrode signal is stable.

LogR Temperature Calibration

This procedure should be performed at least once per week to ensure accurate temperature compensation when operating in the LogR mode. If the meter is powered down or the electrode is disconnected, the LogR temperature should be recalibrated. Refer to the **Appendix** for accuracy specifications and recommended calibration techniques.

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

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

When using the meter for the first time or restarting the meter in the LogR mode, a LogR temperature calibration must be performed. It is recommended that at least a two-point temperature calibration be performed to meet optimum system accuracy. Refer to the **Appendix** for additional information.

LogR Calibration

1. To perform a LogR calibration, the LogR function must first be enabled in setup menu. Press the **setup** key. Press the **yes** key until the LogR icon is shown. Press the **scroll** (▲ ▼) keys until on is displayed. Press the **yes** key to enable the LogR function. Press the **mode** key to exit the setup menu. When the LogR function is enabled, the LogR icon will be shown while the meter is in the measurement mode.
2. In the measurement mode, press the **mode** key until the meter shows the LogR icon and CAL on the main display. Press the **yes** key to begin the LogR temperature calibration sequence. The last LogR calibration type (1-PT, 2-PT or 3-PT) will be shown on the display. 2-PT is the default setting. Use the **scroll** (▲ ▼) keys to change calibration type and then press the **yes** key.
3. The display will show CAL 1 in the main readout. The measured temperature value, based on the last calibration, will be displayed. Place the PerpHecT or ROSS PerpHecT pH electrode into a temperature-controlled pH buffer or tap water solution. Measure the temperature of the solution using a NIST-traceable thermometer. When the LogR signal stabilizes, the ready icon will be shown.
4. Adjust the temperature value using the **scroll** (▲ ▼) keys. Press the **yes** key to accept the value.
5. If a two point calibration was selected, CAL 2 will be displayed on the main readout. Follow steps 3 and 4 to set the second temperature value. Repeat the same steps if a three point calibration is selected.
6. The meter will proceed to the pH measurement mode after accepting the final temperature value.

Note: A calibration may be aborted before saving the final calibration point by pressing the **mode** key. This will cause the system to display ESC, proceed to pH mode and retain to the previous LogR temperature calibration data.

mV / ORP Measurements

1. Press the **mode** key to select the mV mode. Disable the LogR function in the setup menu.
2. Connect the ORP electrode to the meter.
3. Place the electrode in a sample. When the reading stabilizes, record the mV and temperature values.

Relative mV / ORP Measurements

1. Press the **mode** key to select the rel mV mode. Disable the LogR function in the setup menu.
2. Connect the ORP electrode to the meter.
3. Press the **cal** key to initiate a calibration sequence. The display will show CAL for the entire calibration. The displayed reading will be the absolute mV reading. If using the Thermo Scientific Orion ORP standard and Thermo Scientific Orion ORP electrode with Cat. No. 900011 filling solution, the absolute mV reading should be 220 mV \pm 60 mV.
4. When the ready icon is shown, indicating electrode stability, 0.0 rel mV will be displayed. Use the **scroll** (**▲ ▼**) keys to set a user-defined value, if necessary. Press the **yes** key to accept the calibration.
5. Place the electrode in a sample. When the reading stabilizes, record the relative mV and temperature values.

Automatic Temperature Compensation

For automatic temperature compensation, connect an ATC probe to the meter and disable the LogR function in the setup menu. Attach the ATC probe to the 3.5 mm phone jack on the rear panel of the meter. See **Figure 4**. The 320, 350 and 370 PerpHecT meters can be used with the PerpHecT epoxy body ATC probe, Cat. No. 927005; the PerpHecT glass body ATC probe, Cat. No. 927006; and the PerpHecT stainless steel body ATC probe, Cat. No. 927007.

Manual Temperature Compensation

For manual temperature compensation, disconnect the ATC probe and disable the LogR function in the setup menu. Manual temperature may only be set when the LogR function is disabled and there is no ATC probe connected to the meter. In the measurement mode, use the **scroll** (**▲ ▼**) keys to manually set the temperature value. This temperature will be used to calculate temperature-corrected pH values.

GLPcheck™ Electrode Diagnostic Procedure

The 350 PerpHecT meter features a built-in pH electrode test procedure that will print out the complete documentation of the electrode results when the following criteria are met:

Note: The electrode test procedure is for pH electrodes only.

1. For complete documentation of the GLPcheck, an external printer or computer device must be connected via the RS232 interface.
2. A three point pH calibration must be performed with pH 4.01, pH 7.00, and pH 10.01 buffers. Refer to the Three Point Autocalibration procedure.
3. Upon successful completion of the three point calibration sequence, gLP CAL g00d will appear on the meter display and the meter will automatically send the documented results to the external device.
4. The time, date, meter serial number (if entered), slope, average Eo, mV and temperature of each buffer and Electrode Good will be printed.
5. Unsuccessful pH calibrations will result in Service Electrode and E-23 Bad Slope being printed. Clean the pH electrode as direct in the pH electrode user guide, use fresh buffers and repeat the calibration sequence. If problems persist, or refer to the **Troubleshooting** section for troubleshooting procedures.

Notes

Chapter 5 Operating the 370 Meter

Meter Power Up

Plug the meter into an approved wall outlet via the power line adaptor. The entire display (all icons) will be lit for about two seconds. Once all power up procedures have been completed, the meter automatically advances to the measurement mode.

Note: The first time the meter is powered up, a meter self-test and check out should be performed before using the meter for measurements. Refer to **Chapter 7, Meter Self Test** for instructions.

Setup Menu

Select the setup menu by pressing the **setup** key until the setup icon on the display is activated. This menu is used to define, change or view meter operating parameters. While in the setup menu, the **yes** key is used to scroll through the menu without changing parameters and to enter new parameters into meter memory. If a parameter has been changed, the **yes** key must be pressed to activate the change. The **scroll** (**▲ ▼**) keys are used to change the settings within each function. To exit the setup menu, press the **mode** key.

Setup Parameters

Slope – The current electrode slope in the meter memory will be displayed. In pH mode, the value is displayed as a percent of theoretical slope. The default setting is 100%. In the ISE mode, the value is displayed in mV/decade. The default setting is 59.2 mV/decade. This function is for display purposes only. The value cannot be changed in the setup menu. To change the slope value, perform a two point calibration or set the slope during a one point calibration. Press the **yes** key to advance to next menu function.

LogR – When the LogR function is accessed, the LogR icon will be shown while the upper readout displays the current LogR setting (off for disabled and on for enabled). Press the **yes** key to accept the setting. To change the current setting, press a **scroll** (**▲ ▼**) key. Press the **yes** key to accept. The measured LogR temperature will be used to calculate temperature-compensated pH values.

Print Function – The current print function setting will be displayed in the main field and PrT will be displayed in the upper field. The default setting is manual print, shown as 00 on the display. To change the setting to print on ready, press the **scroll** (**▲ ▼**) keys until 01 is displayed. Press the **yes** key when the desired setting is displayed.

Manual Buffer Option – When the manual buffer option function is entered, the display will show STD (57d) or SET (5E7). To change the setting, press a **scroll** (▲ ▼) key. Press the **yes** key when the desired setting is displayed. When the STD option is selected, calibration may only be performed with standard buffers (pH 4.01, 7.00 and 10.01). When the SET option is selected, calibration may be performed with user-defined buffers within the 0 to 14 pH range. If SET is selected, the meter will advance to setting the manual buffer values. Buffer values must be at least 1 and not more than 4 pH units apart.

Date/Time – Set the date and time using the **scroll** (▲ ▼) and **yes** keys. YEAR will be displayed in the lower field with the current year displayed in the main field. Use the **scroll** (▲ ▼) keys to set the year. Press the **yes** key to accept the year setting.

MON will be displayed in the lower field with the month value displayed in the main field. Use the **scroll** (▲ ▼) keys to set the month. Press the **yes** key to accept the month setting.

DAY will be displayed in the lower field with the current day in the main field. Use the **scroll** (▲ ▼) keys to set the day. Press **yes** to accept the day setting.

HOUR will be displayed in the lower field with the current hour displayed in the main field. Use the **scroll** (▲ ▼) keys to set the hour. Press the **yes** key to accept the hour setting.

MIN will be displayed in the lower field with the current minutes displayed in the main field. Use the **scroll** (▲ ▼) keys to set the minutes. Press the **yes** key to accept the minute value.

Note: When making a change to the date or time, you must proceed through the entire date and time setup sequence by pressing the **yes** key to accept both current and changed settings.

Serial Number Input – The six digit meter serial number may be entered into the meter memory to document GLPcheck procedures. When the serial sequence is entered, the display will read UPPr. Use the **scroll** (▲ ▼) keys to set the first 2 digits of the meter serial number. Press **yes** to accept. The display will read LO. Use the **scroll** (▲ ▼) keys to set the last 4 digits. Press the **yes** key to accept.

pH Calibration

A one, two or three buffer calibration should be performed using fresh buffers before pH is measured. Always use a fresh aliquot of buffer whenever calibrating. 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 of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in memory. For maximum accuracy, perform a one buffer calibration every two hours to compensate for electrode drift, using a fresh aliquot of pH 7 buffer.

The instrument uses a point to point calibration scheme, i.e. the meter stores in memory the different electrode slopes for each portion of the calibration curve. When measuring in a particular region of the curve, the electrode slope for that region is employed in the calculation of sample pH. After calibration, the average electrode slope for all the segments of the entire calibration curve is displayed. Use of this scheme increases accuracy in the different regions of the calibration curve. However, the electrode slope may appear lower than normal, especially if buffers from the pH extremes (pH less than 2.00 or pH greater than 12.00) are used.

When operating in the LogR mode, the meter does not require the use of a separate ATC probe. The PerpHecT meters measure the resistance of the pH sensing glass and converts the value to temperature-compensated pH measurements. For optimum results, PerpHecT electrodes or PerpHecT ROSS electrodes should be used.

For best results, it is recommended that the unit be calibrated for temperature in the LogR mode. Alternately, an ATC probe may be used. If LogR or an ATC probe is not used, all samples and standards should be at the same temperature or manual temperature compensation should be used.

Stir all buffers and samples with a magnetic stirrer while a measurement is being made. 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 beaker.

Note: When making measurements in the LogR mode, you must calibrate for temperature before attempting a pH calibration.

Three Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose pH 4.01, pH 7.00 and 10.01 buffers.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **scroll** (**▲ ▼**) keys until 3PT is displayed and then press the **yes** key to accept the calibration range.
4. The 4 buffer icon will be displayed. Place the electrode in the pH 4.01 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
5. The 7 buffer icon will be displayed. Place the electrode in the pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
6. The 10 buffer icon will be displayed. Place the electrode in the pH 10.01 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
7. SLP will be displayed while the calculated slope is displayed.
8. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability. The icons for the type of calibration performed will be shown until another calibration is performed.
9. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
10. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

Two Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose either pH 4.01 and pH 7.00 buffers or pH 7.00 and pH 10.01 buffers; whichever will bracket your expected sample range.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **yes** key to accept the last calibration buffer range (7-4 or 7-10) or select one of these calibration ranges using the **scroll** (**▲ ▼**) keys and then press the **yes** key to accept the buffer range.
4. The 7 buffer icon will be displayed. Place the electrode in the pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the ready icon is shown, indicating electrode stability, press the **yes** key to accept the buffer value.
5. The pH 4 (or pH 10) icon will be displayed. Remove the electrode from pH 7.00 buffer and rinse it with distilled water. Place the electrode in either pH 4.01 or 10.01 buffer, depending on calibration range that was selected. When the ready icon is shown, press the **yes** key to accept the buffer value.
6. SLP will be displayed while the calculated slope is displayed.
7. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability. The icons for the type of calibration performed will be shown until another calibration is performed.
8. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
9. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

One Point Autocalibration

1. Attach the pH electrode to the meter.
2. Choose a pH 7.00 buffer. Autocalibration with one buffer can only be performed using pH buffer 7.00.
3. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Press the **scroll** (▲ ▼) keys until 7 is displayed and then press the **yes** key to accept the calibration range.
4. Place the electrode in pH 7.00 buffer. When the ready icon is shown, indicating electrode stability, press the **yes** key.
5. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. This value can be edited using the **scroll** (▲ ▼) keys. Press the **yes** key to save the slope value.
6. The meter will automatically proceed to the measurement mode. The ready icon will be shown to indicate electrode stability.
7. If operating in the LogR mode or using an ATC probe, the temperature-corrected pH reading will be displayed.
8. Rinse the electrode with distilled water and place it into the sample. Record the pH and temperature directly from the meter display when the ready icon is displayed or when the electrode signal is stable.

Manual Calibration

Note: Manual calibration can be performed with any user-selected buffer(s). The difference between manual buffer values must be between one and four pH units.

1. Attach the electrode to the meter.
2. Press the **setup** key. Press the **yes** key until STD (57d) or SET (5E7) is displayed. Select SET and press the **yes** key. P1 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the first buffer and press the **yes** key to accept the new value. P2 will be displayed. Use the **scroll** (**▲ ▼**) keys to set the user-defined value for the second buffer and press the **yes** key to accept the new value. Press the **mode** key to return to measurement mode.
3. Press the **cal** key. The display will show CAL for two seconds. The last calibration buffer range will be displayed. Use the **scroll** (**▲ ▼**) keys to select the SET option. Press the **yes** key to accept the SET option.
4. P1 will be displayed. Place the electrode into the first calibration buffer. When the ready icon is displayed, the user defined buffer value will be shown. Press the **yes** key to accept the value.
5. P2 will be displayed. Place the electrode into the second calibration buffer. When the ready icon is displayed, the user-defined buffer value will be shown. Press the **yes** key to accept the value.
6. SLP will be displayed for two seconds while the calculated slope is shown.
7. Rinse the electrode with distilled water and place it in the sample. Record the pH directly from the main meter display and temperature from upper field when the ready icon is displayed or when the electrode signal is stable.

LogR Temperature Calibration

This procedure should be performed at least once per week to ensure accurate temperature compensation when operating in the LogR mode. If the meter is powered down or the electrode is disconnected, the LogR temperature should be recalibrated. Refer to the **Appendix** for accuracy specifications and recommended calibration techniques.

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

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

When using the meter for the first time or restarting the meter in the LogR mode, a LogR temperature calibration must be performed. It is recommended that at least a two-point temperature calibration be performed to meet optimum system accuracy. Refer to the **Appendix** for additional information.

LogR Calibration

1. To perform a LogR calibration, the LogR function must first be enabled in setup menu. Press the **setup** key. Press the **yes** key until the LogR icon is shown. Press the **scroll** (▲ ▼) keys until on is displayed. Press the **yes** key to enable the LogR function. Press the **mode** key to exit the setup menu. When the LogR function is enabled, the LogR icon will be shown while the meter is in the measurement mode.
2. In the measurement mode, press the **mode** key until the meter shows the LogR icon and CAL on the main display. Press the **yes** key to begin the LogR temperature calibration sequence. The last LogR calibration type (1-PT, 2-PT or 3-PT) will be shown on the display. 2-PT is the default setting. Use the **scroll** (▲ ▼) keys to change calibration type and then press the **yes** key.
3. The display will show CAL 1 in the main readout. The measured temperature value, based on the last calibration, will be displayed. Place the PerpHecT or ROSS PerpHecT pH electrode into a temperature-controlled pH buffer or tap water solution. Measure the temperature of the solution using a NIST-traceable thermometer. When the LogR signal stabilizes, the ready icon will be shown.
4. Adjust the temperature value using the **scroll** (▲ ▼) keys. Press the **yes** key to accept the value.
5. If a two point calibration was selected, CAL 2 will be displayed on the main readout. Follow steps 3 and 4 to set the second temperature value. Repeat the same steps if a three point calibration is selected.
6. The meter will proceed to the pH measurement mode after accepting the final temperature value.

Note: A calibration may be aborted before saving the final calibration point by pressing the **mode** key. This will cause the system to display ESC, proceed to pH mode and retain to the previous LogR temperature calibration data.

ISE (Concentration) Calibration

A calibration should be performed before concentration is measured. A two point standard calibration should be performed at the beginning of each day and every time electrodes are changed to determine the slope of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in memory. Refer to the electrode user guide for the recommended calibration frequency.

During calibration, always use the most dilute standard first. The meter will automatically recognize the slope (i.e., will recognize anion or cation electrodes). Standards should bracket the sample range and be in the same concentration units. The electrode slope displayed after the calibration is the slope between the two points used for the calibration curve.

Any convenient concentration units can be used, including molarity (M), ppm, percent (%), etc. The meter will not display the units, so the operator must keep the type of concentration units consistent between calibration standards.

For the best results, allow all samples and standards to reach the same temperature before measurement. An ATC probe may be used to read temperature of samples and standards, but the meter does not compensate concentration (ISE) measurements for temperature.

Note: The LogR function must be disabled when using the ISE mode.

Note: The 370 meter can only perform a two point ISE calibration.

Two Point ISE Calibration

1. Attach the ion selective electrode (ISE), and half-cell reference electrode (if a half-cell ISE electrode will be used), to the meter.
2. In the measurement mode, press the **mode** key until the conc icon is displayed.
3. Select two standards that bracket the expected sample range. A decade change in concentration between standards is recommended. For example, if the expected sample concentration is 25 ppm, select 10 ppm and 100 ppm standards for calibration. Refer to the ion selective electrode (ISE) user guide for information on adding ionic strength adjuster (ISA) to all samples and standards as required.
4. Place the electrode(s) into the least concentrated standard.
5. Press the **cal** key to initiate calibration sequence. The display will show CAL for two seconds. Then P1 will be shown in the upper display field. When the ready icon is shown, indicating electrode stability, use the **scroll** (**▲ ▼**) keys to set the value of the first standard. Press the **yes** key to accept the standard one value.
6. Remove the electrode(s) from the first standard, rinse the electrode(s) with distilled water and place the electrode(s) in the most concentrated standard.
7. P2 will be shown in the upper display field. When the ready icon is shown, indicating electrode stability, use the **scroll** (**▲ ▼**) keys to set the value of the second standard. Press the **yes** key to accept the standard one value.
8. The slope will be displayed in mV/decade. A printout will occur if an external printer is connected to the meter. The meter will automatically proceed to the measurement mode.
9. Remove the electrode(s) from the second standard. Rinse the electrode(s) with distilled water and place the electrode(s) into a sample.
10. Record the concentration and temperature directly from the meter when the ready icon is displayed or when the electrode signal is stable.

mV / ORP Measurements

1. Press the **mode** key to select the mV mode. Disable the LogR function in the setup menu.
2. Connect the ORP electrode to the meter.
3. Place the electrode in a sample. When the reading stabilizes, record the mV and temperature values.

Relative mV / ORP Measurements

1. Press the **mode** key to select the rel mV mode. Disable the LogR function in the setup menu.
2. Connect the ORP electrode to the meter.
3. Press the **cal** key to initiate a calibration sequence. The display will show CAL for the entire calibration. The displayed reading will be the absolute mV reading. If using the Thermo Scientific Orion ORP standard and Thermo Scientific Orion ORP electrode with Cat. No. 900011 filling solution, the absolute mV reading should be 220 mV \pm 60 mV.
4. When the ready icon is shown, indicating electrode stability, 0.0 rel mV will be displayed. Use the **scroll** (**▲ ▼**) keys to set a user-defined value, if necessary. Press the **yes** key to accept the calibration.
5. Place the electrode in a sample. When the reading stabilizes, record the relative mV and temperature values.

Automatic Temperature Compensation

For automatic temperature compensation, connect an ATC probe to the meter and disable the LogR function in the setup menu. Attach the ATC probe to the 3.5 mm phone jack on the rear panel of the meter. See **Figure 4**. The 320, 350 and 370 PerpHecT meters can be used with the PerpHecT epoxy body ATC probe, Cat. No. 927005; the PerpHecT glass body ATC probe, Cat. No. 927006; and the PerpHecT stainless steel body ATC probe, Cat. No. 927007.

Manual Temperature Compensation

For manual temperature compensation, disconnect the ATC probe and disable the LogR function in the setup menu. Manual temperature may only be set when the LogR function is disabled and there is no ATC probe connected to the meter. In the measurement mode, use the **scroll** (**▲ ▼**) keys to manually set the temperature value. This temperature will be used to calculate temperature-corrected pH values.

GLPcheck™ Electrode Diagnostic Procedure

The 370 PerpHecT meter features a built-in pH electrode test procedure that will print out the complete documentation of the electrode results when the following criteria are met:

Note: The electrode test procedure is for pH electrodes only.

1. For complete documentation of the GLPcheck, an external printer or computer device must be connected via the RS232 interface.
2. A three point pH calibration must be performed with pH 4.01, pH 7.00, and pH 10.01 buffers. Refer to the Three Point Autocalibration procedure.
3. Upon successful completion of the three point calibration sequence, gLP CAL g00d will appear on the meter display and the meter will automatically send the documented results to the external device.
4. The time, date, meter serial number (if entered), slope, average Eo, mV and temperature of each buffer and Electrode Good will be printed.
5. Unsuccessful pH calibrations will result in Service Electrode and E-23 Bad Slope being printed. Clean the pH electrode as direct in the pH electrode user guide, use fresh buffers and repeat the calibration sequence. If problems persist, or refer to the **Troubleshooting** section for troubleshooting procedures.

Notes

Chapter 6 Interfacing the 350 and 370 Meters with Printers and Computers

The 350 and 370 PerpHecT meters are equipped with one way RS232 ports that allow meter data to be transferred to a printer or PC.

The PRT300 printer, Cat. No. PRT300 (110 V) or PRT301 (220 V), is the recommended printer for PerpHecT meters. The printer includes the interface cable needed to connect the meter and printer. The default dip switch setting on the printer are factory configured for the PerpHecT meters.

A computer interface cable, Cat. No. 0ACBL0, is available for connecting the PerpHecT meters to the serial port of an IBM or compatible PC. For other computers and communication devices, a suitable cable must be fabricated.

The following technical information outlines the pin configurations, data transfer hardware and software settings for the 350 and 370 meters.

1200 baud rate
Eight data bits
No parity
One start bit
One stop bit

Table 2 – Computer Cable Pinouts

Meter	Pin	Printer
RXD	2	
TXD	3	RXD
DSR	4	
SIG GND	5	SIG GND
DTR	6	
RTS	7	
CTS	8	RTS

Jumper pins 4 and 6 together. The RS232 port on the meter is a nine pin D-shell male connector (DB-9 style).

WIRE DIAGRAM

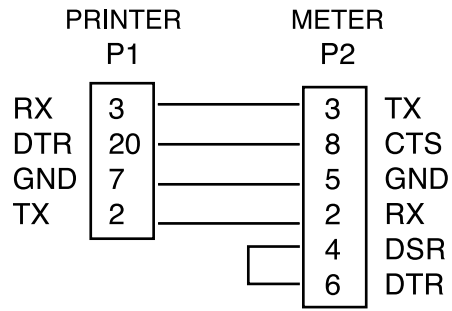


Figure 6 – Printer Wiring Diagram

Chapter 7 Customer Services

Troubleshooting Guide

Malfunction	Possible Cause	Solutions
No meter display	No power to meter	Check that meter is connected to a power supply and that the power supply is connected to an appropriate wall socket. Check that the proper power supply is securely connected to the meter. Connect the meter to a new power supply, Cat. No. 020125 (110 V), Cat. No. 020130 (220 V) or Cat. No. 020135 (240 V)
Erratic readings or out-of-range readings	Meter or electrode failure	Follow the meter self-test and check-out procedure in this user guide. Check the electrode operation by following the instructions in the electrode user guide. Ensure a proper, secure electrode connection to the meter.

Meter Self-Test and Checkout Procedures

During the self-test, the meter will display various codes corresponding to the section of the instrument being checked. The meter displays the number of the test in the main field. Additional meter displays occur depending on the test being performed. If any problems are found, an operator assistance code corresponding to the test that failed will be displayed. Note the code and press the **yes** key to continue. If an operator assistance code appears during self-test, check to make sure that the shorting cap is securely attached and then repeat the test. If the problem persists, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/contactwater.

It is recommended that the meter self-test and checkout procedures be performed when the meter is operated for the first time or any time that operational problems arise. These procedures verify the proper operation of the 320, 350 and 370 PerpHecT meters.

Meter Self-Test

Note: Ensure that the shorting cap is securely attached to the BNC input on the rear panel of the meter prior to the self-test.

1. Disconnect all of the electrodes and probes from the meter and attach the BNC shorting cap to the BNC input on the meter.
2. Disconnect the power supply from the meter. Press and hold the **yes** key and reconnect the power supply to the meter. After the meter powers up for about five seconds, release the **yes** key. The meter should automatically perform seven diagnostic tests.
3. When 0 is shown on the display, press each key one at a time in any order. A numeric digit will be displayed upon each keypress.
4. After the self-test is complete, the meter will automatically proceed to the measurement mode.
5. If any problems are found during the self-test, refer to the meter self-test operator assistance codes.

Test	Function\Display
Test #1	Segment display checks meter display. Ensures that all segments are lit.
Test #2	RAM check verifies the proper operation of the Random Access Memory.
Test #3	External input checks the electrode input channel. Electrode must be disconnected and BNC shorting cap must be plugged in for this test.
Test #4	Ground reference checks the meter ground.
Test #5	Temperature reference checks the ATC reference.
Test #6	Internal reference checks the internal reference of the meter.
Test #7	Keypad test checks that the keypad is functioning properly. During this test all keys must be pressed when the meter displays 0. As each key is pressed, a number corresponding to the key is displayed. When all the keys have been pressed, the ready icon will be displayed. If no keys are pressed or there is a problem with a key, the meter will recognize an error and display E-07. Press the yes key to continue.

Meter Self-Test Operator Assistance Codes

The meter has a self-test circuit, which verifies proper electronic operation. Operator assistance codes are used to inform the user of an out-of-range value or meter problem. During the self-test a special series of codes, E-02 through E-07, indicate problems with the meter hardware. Should one of these codes appear, contact the Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/contactwater.

Code	Function
E-02	RAM Check Error
E-03	Input Channel Error – Ensure that the BNC shorting cap is securely attached to the meter and repeat the self-test.
E-04	Ground Reference Error
E-05	Temperature Reference Error
E-06	Internal Reference Error
E-07	Internal Keypad Error – Press each key when prompted during the self-test.

320 Meter Check-Out

1. After the self-test is complete, the meter will return to the measurement mode. Keep all of the electrodes disconnected from the meter and keep the BNC shorting cap attached to the BNC input on the meter. Press the **mode** key until the pH mode indicator is displayed. The main display should read a steady 7.00 ± 0.02 .
 - a. If the display does not read a steady 7.00 ± 0.02 , press the **cal** key. The display will show CAL for two seconds.
 - b. Press the **scroll** (**▲ ▼**) keys until 7 is displayed and then press the **yes** key to accept the calibration range. When the ready icon is shown, press the **yes** key.
 - c. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. Set this value to 100.0 using the **scroll** (**▲ ▼**) keys. Press the **yes** key to save the slope value.
 - d. The meter should advance to the pH measurement mode and the display should read a steady 7.00 ± 0.02 .
2. In the measurement mode, press the **mode** key until the meter displays the mV icon. The display should read 0 ± 1 mV. If the meter does not read 0 ± 1 mV with the BNC shorting cap attached to the BNC input, contact Technical Support.

350 Meter Check-Out

1. After the self-test is complete, the meter will return to the measurement mode. Keep all of the electrodes disconnected from the meter and keep the BNC shorting cap attached to the BNC input on the meter. Press the **mode** key until the pH mode indicator is displayed. The main display should read a steady 7.00 ± 0.02 .
 - a. If the display does not read a steady 7.00 ± 0.02 , press the **cal** key. The display will show CAL for two seconds.
 - b. Press the **scroll** (**▲ ▼**) keys until 7 is displayed and then press the **yes** key to accept the calibration range. When the ready icon is shown, press the **yes** key.
 - c. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. Set this value to 100.0 using the **scroll** (**▲ ▼**) keys. Press the **yes** key to save the slope value.
 - d. The meter should advance to the pH measurement mode and the display should read a steady 7.00 ± 0.02 .
2. In the measurement mode, press the **mode** key until the meter displays the rel mV icon. The display should read 0.0 ± 0.2 rel mV.
 - a. If the display does not read 0.0 ± 0.2 rel mV, press the **cal** key. The display will show CAL for the entire calibration.
 - b. When the ready icon is shown, use the **scroll** (**▲ ▼**) keys to set the rel mV reading to 0.0 rel mV. Press the **yes** key to save the value.
 - c. The meter should advance to the rel mV measurement mode and the display should read 0.0 ± 0.2 rel mV.
3. In the measurement mode, press the **mode** key until the meter displays the mV icon. The display should read 0 ± 1 mV. If the meter does not read 0 ± 1 mV with the BNC shorting cap attached to the BNC input, contact Technical Support.

370 Meter Check-Out

1. After the self-test is complete, the meter will return to the measurement mode. Keep all of the electrodes disconnected from the meter and keep the BNC shorting cap attached to the BNC input on the meter. Press the **mode** key until the pH mode indicator is displayed. The main display should read a steady 7.00 ± 0.02 .
 - a. If the display does not read a steady 7.00 ± 0.02 , press the **cal** key. The display will show CAL for two seconds.
 - b. Press the **scroll** (**▲ ▼**) keys until 7 is displayed and then press the **yes** key to accept the calibration range. When the ready icon is shown, press the **yes** key.
 - c. SLP will be displayed while 100.0 (or the previous calibration slope value) is displayed. Set this value to 100.0 using the **scroll** (**▲ ▼**) keys. Press the **yes** key to save the slope value.
 - d. The meter should advance to the pH measurement mode and the display should read a steady 7.00 ± 0.02 .
2. In the measurement mode, press the **mode** key until the meter displays the rel mV icon. The display should read 0.0 ± 0.2 rel mV.
 - a. If the display does not read 0.0 ± 0.2 rel mV, press the **cal** key. The display will show CAL for the entire calibration.
 - b. When the ready icon is shown, use the **scroll** (**▲ ▼**) keys to set the rel mV reading to 0.0 rel mV. Press the **yes** key to save the value.
 - c. The meter should advance to the rel mV measurement mode and the display should read 0.0 ± 0.2 rel mV.
3. In the measurement mode, press the **mode** key until the meter displays the mV icon. The display should read 0 ± 1 mV. If the meter does not read 0 ± 1 mV with the BNC shorting cap attached to the BNC input, contact Technical Support.

Operator Assistance Codes

The operator assistance codes E-20 through E-36 alert the operator to a potential problem while calibrating or measuring with the meter. Several steps can be taken to eliminate the problem in each case. If the code persists after trying the suggested solutions, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/contactwater.

Note: Press any key to clear an error message from the display.

Code	Description	Solutions
E-20	Out of Range Reading Error	<ul style="list-style-type: none">• The error code will occur when the electrode is out of solution. The code will disappear when electrode is returned to solution.• The sample value may be out of the measurement range. Check the meter system using a calibration buffer.• Recalibrate the meter system using fresh buffers.• Refer to the electrode user guide for instructions on how to clean and condition the electrode.
E-21	Auto Buffer Recognition (ABR) Error / pH Autocalibration Error	<ul style="list-style-type: none">• The electrode voltage being measured is greater than ± 0.5 pH units from the nominal value for the pH buffer.• Verify that pH 4.01, 7.00 and 10.01 buffers are being used.• Recalibrate the meter system using fresh buffers.• Refer to the electrode user guide for instructions on how to clean and condition the electrode.• Verify that the buffer that the meter is prompting for (4, 7 or 10 icons) is the buffer being used.• Perform a manual calibration. Non-standard calibration buffers may be used only for manual calibrations.
E-22	Calibration Standard Error	<ul style="list-style-type: none">• The pH, ORP or ISE values being measured are the same for two different buffers/standards.• Check that two different buffers/standards are being used for calibration and the correct buffer/standard is being measured.• Recalibrate the meter system using fresh buffers/standards.
E-23	Bad Slope	<ul style="list-style-type: none">• The pH electrode slope is not in the range of 80% to 120%• Refer to the electrode user guide for instructions on how to clean and condition the electrode.• Recalibrate the meter system using fresh buffers/standards.

Code	Description	Solutions
E-29	Printer Error	<ul style="list-style-type: none"> • The meter is trying to send information to a printer and there is no printer connected to the meter or the printer is not turned on. • If a printer is being used, check that the printer is properly connected. • If a printer is not being used, disable the printer setting in the setup menu.
E-31	Bad Value	<ul style="list-style-type: none"> • A value has been entered that is not within the acceptable range for that function. • Press any key to acknowledge error. Re-enter a new value within the allowable range. <p>Acceptable values are as follows:</p> <ul style="list-style-type: none"> • pH: 0.000 to 14.000 • Slope: 80.0 to 120.0 • Relative mV: +/- 1999.9 • Concentration: 0.000 to 19,900 • Temperature: TEMP: 0.0 to 100.0 • Manual buffers must be at least one and not more than four pH units from each other.
E-35	Bad LogR Standard	<ul style="list-style-type: none"> • The error code will occur when two calibration standards do not differ in temperature by the minimum allowable difference in LogR mode. • The difference between temperature calibration points must be at least 5 °C. • The difference in the entered value must be greater than 5 °C.
E-36	No LogR Cal	<ul style="list-style-type: none"> • The error code will occur when the calibration coefficients from a LogR calibration are out of range. • An incorrect temperature value may have been entered. Recheck the temperatures of the calibration standards and recalibrate for LogR. • Check the electrode and electrode inputs.
E-40	Serial Memory Error	<ul style="list-style-type: none"> • The error code will be displayed during the meter power-up when an error occurs with accessing the factory calibration data or when the operator is changing the serial number. • Unplug the power from the meter and reconnect the power to the meter after ten seconds. • If the serial number was being changed, exit the setup menu and then re-enter the serial number in the setup menu.

Assistance

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

Warranty

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

Notice of Compliance

Warning: This meter may radiate radio frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer's instructions, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a commercial environment. Operation of the meter in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Note: To meet or exceed FCC regulations the Thermo Scientific Orion power supply must be used.

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

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

Certificate of Conformity

Manufacturer: Thermo Fisher Scientific Inc.

Address: 166 Cummings Center
Beverly, Ma 01915
USA

We hereby declare that the products:
Thermo Scientific Orion 320, 350 and 370 PerpHecT
LogR Meters from serial number 002000

Conform with the following standards and documents:
Safety: IEC 1010 Safety for Laboratory Equipment
UL 1262 Laboratory Equipment
CSA C22.2 No. 151 Laboratory Equipment

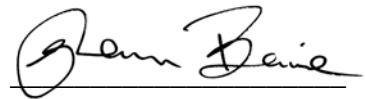
Emissions:
EN 55022 Emissions
FCC Part 15 Class A

Immunity:
EN50082-1 Generic Immunity
IEC 801-2 ESD Susceptibility
IEC 801-3 Radiated Susceptibility
IEC 801-4 Conducted Susceptibility

These Thermo Scientific Orion products have been manufactured in compliance with the provisions of the relevant Thermo Fisher Scientific manufacturing and test documents and processes. Further, these documents and processes are recognized as complying with ISO 9000:2000 by QMI, listed as File # 001911.

Place and date of issue:

Beverly, MA.
January, 2008



Glenn Benvie
Senior QA Engineer

Notes

Chapter 8 Ordering Information and Specifications

Ordering Information

Cat. No.	Description
037000	370 PerpHecT meter (110 V) and 9272BN PerpHecT Sure-Flow Ag/AgCl pH electrode
037001	370 PerpHecT meter (220 V) and 9272BN PerpHecT Sure-Flow Ag/AgCl pH electrode
0370A0	370 PerpHecT meter (110 V) and 8272BN PerpHecT ROSS Sure-Flow pH electrode
0370A1	370 PerpHecT meter (220 V) and 8272BN PerpHecT ROSS Sure-Flow pH electrode
0370G0	370 PerpHecT meter (110 V), 8272BN PerpHecT ROSS Sure-Flow pH electrode, PRT300 printer and printer interface cable
0370G1	370 PerpHecT meter (220 V) 8272BN PerpHecT ROSS Sure-Flow pH electrode, PRT301 printer and printer interface cable
0370A9	370 PerpHecT meter (110 V)
0370A8	370 PerpHecT meter (220 V)
0370A7	370 PerpHecT meter (240 V)
035000	350 PerpHecT meter (110 V) and 9272BN PerpHecT Sure-Flow Ag/AgCl pH electrode
035001	350 PerpHecT meter (220 V) and 9272BN PerpHecT Sure-Flow Ag/AgCl pH electrode
0350A0	350 PerpHecT meter (110 V) and 8272BN PerpHecT ROSS Sure-Flow pH electrode
0350A1	350 PerpHecT meter (220 V) and 8272BN PerpHecT ROSS Sure-Flow pH electrode
0350G0	350 PerpHecT meter (110 V), 8272BN PerpHecT ROSS Sure-Flow pH electrode, PRT300 printer and printer interface cable
035003	350 PerpHecT meter (110 V), 8220BNWP PerpHecT ROSS micro pH electrode, PRT300 printer, printer interface cable and one 475 mL bottle each of pH 4.01 buffer, pH 7.00 buffer, pH 10.01 buffer and ROSS storage solution
035004	350 PerpHecT meter (220 V) 8272BN PerpHecT ROSS micro pH electrode, PRT301 printer, printer interface cable and one 475 mL bottle each of pH 4.01 buffer, pH 7.00 buffer, pH 10.01 buffer and ROSS storage solution
0350A9	350 PerpHecT meter (110 V)
0350A8	350 PerpHecT meter (220 V)
0350A7	350 PerpHecT meter (240 V)

Cat. No.	Description
032000	320 PerpHecT meter (110 V) and 9202BN PerpHecT Ag/AgCl pH electrode
032001	320 PerpHecT meter (220 V) and 9202BN PerpHecT Ag/AgCl pH electrode
0320A0	320 PerpHecT meter (110 V) and 8202BN PerpHecT ROSS pH electrode
0320A1	320 PerpHecT meter (220 V) and 8202BN PerpHecT ROSS pH electrode
032006	320 PerpHecT meter (110 V), 8220BNWP PerpHecT ROSS micro pH electrode, and one 475 mL bottle each of pH 4.01 buffer, pH 7.00 buffer, pH 10.01 buffer and ROSS storage solution
032007	320 PerpHecT meter (220 V), 8220BNWP PerpHecT ROSS micro pH electrode, and one 475 mL bottle each of pH 4.01 buffer, pH 7.00 buffer, pH 10.01 buffer and ROSS storage solution
032004	320 PerpHecT meter (110 V), 9156APWP AquaPro pH electrode and swing arm electrode stand
032005	320 PerpHecT meter (110 V), 9156APWP AquaPro pH electrode and swing arm electrode stand
0320A9	320 PerpHecT meter (110 V)
0320A8	320 PerpHecT meter (220 V)
0320A7	320 PerpHecT meter (240 V)
090043	Swing arm electrode stand
090070	Basic electrode stand and holder
090045	BNC shorting cap
PRT300	Ink printer (110 V) and interface cable
PRT301	Ink printer (220 V) and interface cable
PRT302	Ink ribbon for PRT300 and PRT301 printers
0ACBL0	Computer interface cable
020125	110 V power supply
020130	220 V power supply
020135	240 V power supply
8202BN	PerpHecT ROSS combination pH electrode with glass body and BNC connector
8203BN	PerpHecT ROSS combination pH electrode with glass body, semi-micro tip and BNC connector
8220BNWP	PerpHecT ROSS combination pH electrode with glass body, micro tip and waterproof BNC connector
8235BN	PerpHecT ROSS combination pH electrode with epoxy body, flat surface tip and BNC connector
8256BN	PerpHecT ROSS combination pH electrode with epoxy body and BNC connector
8272BN	PerpHecT ROSS Sure-Flow combination pH electrode with glass body and BNC connector

Cat. No.	Description
9202BN	PerpHecT Ag/AgCl combination pH electrode with glass body and BNC connector
9203BN	PerpHecT Ag/AgCl combination pH electrode with glass body, semi-micro tip and BNC connector
9206BN	PerpHecT Ag/AgCl low maintenance gel combination pH electrode with epoxy body and BNC connector
9207BN	PerpHecT Ag/AgCl low maintenance gel pH/ATC Triode with epoxy body, BNC connector and 3.5 mm phono tip connector
9256BN	PerpHecT Ag/AgCl combination pH electrode with epoxy body and BNC connector
9272BN	PerpHecT Ag/AgCl Sure-Flow combination pH electrode with glass body and BNC connector
927005	ATC probe with epoxy body and 3.5 mm phono tip connector
927006	ATC probe with glass body and 3.5 mm phono tip connector
927007	ATC probe with stainless steel body and 3.5 mm phono tip connector
910001	pH electrode storage solution, 475 mL
910060	pH electrode storage solution, 5 x 60 mL
9100CB	pH electrode storage solution, 19 L (5 gallon) cubitainer
810001	ROSS pH electrode storage solution, optimizes ROSS pH electrode performance and life, 475 mL
911110	pH electrode rinse solution, 10 PerpHecT individual buffer pouches
911125	pH electrode rinse solution, 25 PerpHecT individual buffer pouches
900020	pH electrode cleaning solution kit, includes 1 x 30 mL bottle each of cleaning solution A and C, 1 x 60 mL bottle each of cleaning solution B and D, beaker and pipette
910199	All-in-One pH buffer kit, includes 475 mL bottle each of 4.01, 7.00, 10.01 buffers and pH electrode storage solution (910001), pH electrode storage bottle
910168	pH 1.68 buffer, 475 mL
910104	pH 4.01 buffer, 475 mL
910410	pH 4.01 buffer, 10 PerpHecT individual buffer pouches
910425	pH 4.01 buffer, 25 PerpHecT individual buffer pouches
910105	pH 5.00 buffer, 475 mL
910686	pH 6.86 buffer, 475 mL
910107	pH 7.00 buffer, 475 mL
910710	pH 7.00 buffer, 10 PerpHecT individual buffer pouches
910725	pH 7.00 buffer, 25 PerpHecT individual buffer pouches
910918	pH 9.18 buffer, 475 mL
910110	pH 10.01 buffer, 475 mL
911010	pH 10.01 buffer, 10 PerpHecT individual buffer pouches
911025	pH 10.01 buffer, 25 PerpHecT individual buffer pouches
910112	pH 12.46 buffer, 475 mL

Specifications

	320	350	370
pH Range	0.00 - 14.00	0.000 - 14.000	0.000 - 14.000
pH Resolution	0.1, 0.01	0.1, 0.01, 0.001	0.1, 0.01, 0.001
pH Accuracy	± 0.02 (at 25 °C)	± 0.005 (at 25 °C)	± 0.005 (at 25 °C)
pH Calibration Points	1 or 2	1, 2 or 3	1, 2 or 3
mV Range	± 1999	± 1999.9	± 1999.9
mV Range (In LogR Mode)	± 1000	± 1000.0	± 1000.0
mV Resolution	1	0.1	0.1
mV Accuracy	± 1 or ± 0.1% of reading, whichever is greater	± 0.2 or ± 0.05% of reading, whichever is greater	± 0.2 or ± 0.05% of reading, whichever is greater
Relative mV Range	N/A	± 1999.9	± 1999.9
Relative mV Resolution	N/A	0.1	0.1
Relative mV Accuracy	N/A	± 0.2 or ± 0.05% of reading, whichever is greater	± 0.2 or ± 0.05% of reading, whichever is greater
Temperature Range	0.0 - 100° C	0.0 - 100° C	0.0 - 100° C
Temperature Resolution	0.1	0.1	0.1
Temperature Accuracy	± 1.0	± 1.0	± 1.0
Temperature Compensation	Automatic or Manual	Automatic or Manual	Automatic or Manual
LogR Temp. Accuracy (20 °C Calibration Range)	± 0.5 °C	± 0.5 °C	± 0.5 °C
Concentration Range	N/A	N/A	0.000 - 19900
Concentration Resolution	N/A	N/A	0.1, 0.01, 0.001
Concentration Accuracy	N/A	N/A	± 0.5% of reading
Concentration Calibration Points	N/A	N/A	2
Digital Interface	N/A	RS232 output	RS232 output
Recorder	No	Yes	Yes
Clock	No	Yes	Yes
Battery Backup	No	Yes	Yes
Environmental Specifications (all meters):	Indoor use only Altitudes up to 2000 meters Temperature between 5 °C and 45 °C Relative humidity between 5% and 85%		

Appendix A LogR™ Temperature Accuracy Tables

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

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

* For 20 °C temperature compensation spans.

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

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

* For 20 °C temperature compensation spans.

Notes

Notes

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