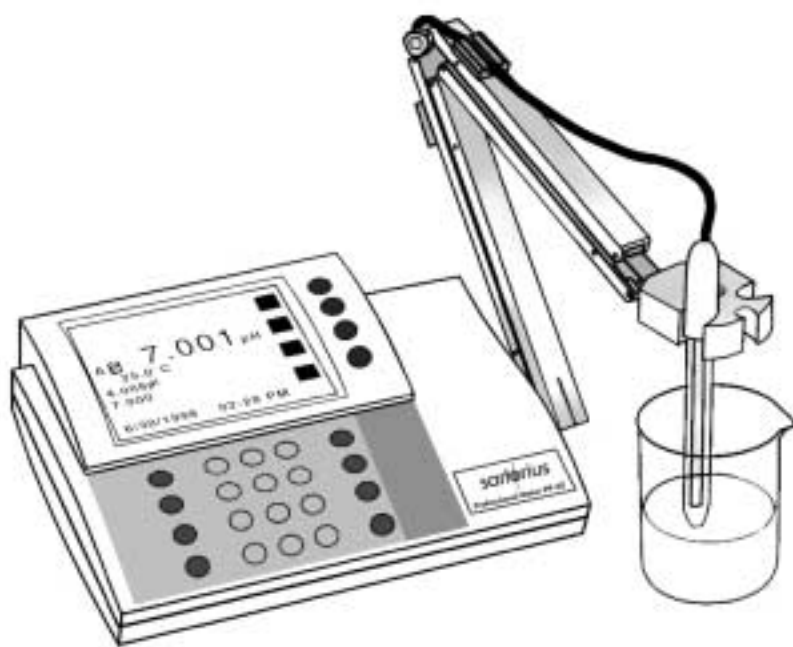


Sartorius Professional Meter

PP-15, PP-20, PP-25, PP-50

Operation Manual



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Warning and Safety Information

For safety and operating reasons, only authorized service technicians may open the Professional Meter Basic housing. Therefore, only authorized technicians may repair or perform maintenance on this pH meter. Any tampering with the pH meter or negligent or intentional damage to this equipment will void any warranty claims against the manufacturer.

If liquid gets into the Professional Meter, unplug it from AC power (mains supply) and have an authorized service technician check the pH meter.

If you do not plan to use this Professional Meter for a relatively long period, please disconnect it from AC power.

For safety reasons, use this equipment only for the application described in this operation manual.

Make sure that the buffers used for standardizing have exactly the same values that are stored.

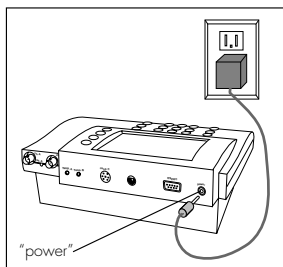
This Professional Meter allows automatic standardization using up to three buffers. When you enter a fourth buffer, the buffer farthest away is replaced by the new buffer pH. The Professional Meter performs automatic temperature compensation.

Information on Radio Frequency Interference

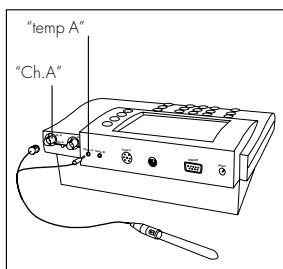
Warning!

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, 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, when operated in a commercial environment. Operation of this equipment in a residential area is likely to 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.

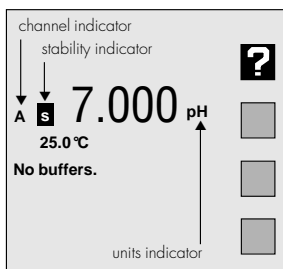
Quick Start Guide for pH Measurement



1. Connect power cable to meter connector on the rear panel marked **"power"** and to AC power source.



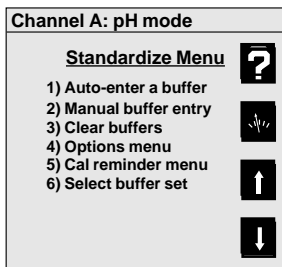
2. Connect the glass pH/ATC electrode to the channel A BNC connector marked **"Ch.A"** and to the channel A temperature connector marked **"Temp A."**



3. Verify that the meter is in pH mode on channel A. Use the **MODE** and **CHANNEL** keys to set the meter to the correct mode and channel, if necessary. (See Function keys).

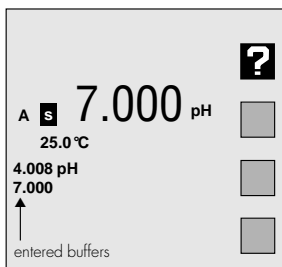
 **MODE**

 **CHANNEL**



 **STANDARDIZE**

 **CAL DATA**



4. Standardize the electrode by immersing the electrode in a buffer, pressing **STANDARDIZE**, pressing **1) Auto-enter a buffer** and following the prompts. Repeat this step to enter each buffer. The meter will check the electrode and buffers, and give an error message if there is a problem.

In addition to "Auto-enter a buffer", the Standardize Menu offers further functions.

Under menu item **4) Options menu**, you can select the resolution and other parameters for the current mode and channel.

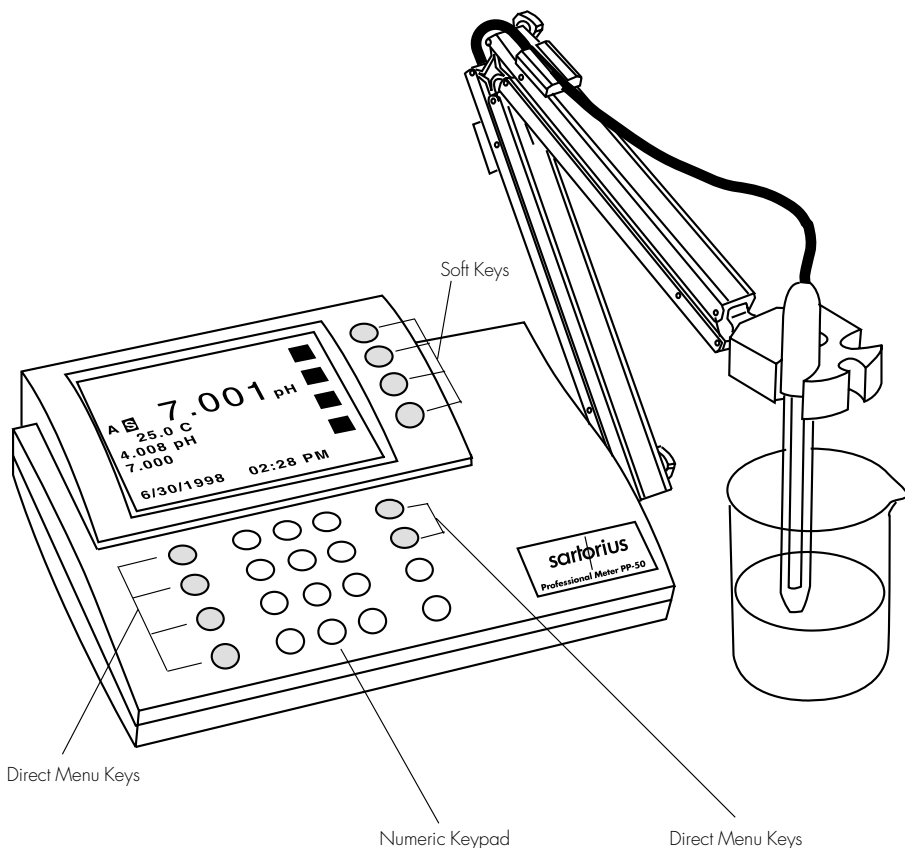
5. The display shows the current measurement, and indicates a stable reading with the indicator **S**. Press **CAL DATA** to review and graph the electrode calibration data.

Introduction

This electrochemistry meter is a powerful, versatile and accurate instrument. It features easy menu-based operation with easy to understand prompts and electrode/standard error checking.

These meters feature many advanced options, such as programmable stability criteria, programmable standardization reading delay times, multi-channel operation, fast reading update rates of twice per second for all channels, programmable alarms, programmable data logging of up to 620 data points and a superb RS-232 bidirectional serial interface for controlling the meter and obtaining data.

These meters use flash programmable ROM for the operating code. The meter operating code can easily be upgraded.



Direct Menu Keys, Soft keys and Display

The Sartorius Professional Meter uses six **Direct Menu** keys to access the menus and operations (such as selecting pH mode, standardizing, checking electrode calibration data, selecting the electrode channel).

There are four **soft keys** that provide additional operations; these soft keys change their function as needed and each soft key has an icon to indicate its current function.

The display is a backlit quarter-VGA screen capable of displaying all four electrode channels of a Model PP-50 simultaneously. The backlight will turn off after a period of non-use (the default is 45 minutes; set this time in the Setup menu); pressing any key will automatically turn the display backlight on again.

Electrode Connectors and Inputs

BNC ("Ch.A" or "Ch.B") connectors: pH, Ion Selective Electrodes and ORP (redox) electrodes attach to the meter through a BNC ("round twist-on") connector to channel A or channel B (Models PP-25 and PP-50 only).

Temperature ("Temp. A" or "Temp. B") connectors: use to connect the 2.5mm mini-phone plug from the temperature sensor (built into the pH electrode with the standard pH/ATC electrode) for Automatic Temperature Compensation (ATC).

Reference ("Ref.A" or "Ref.B") connectors: use for attaching a reference electrode tip-pin plug when a separate reference electrode is used.

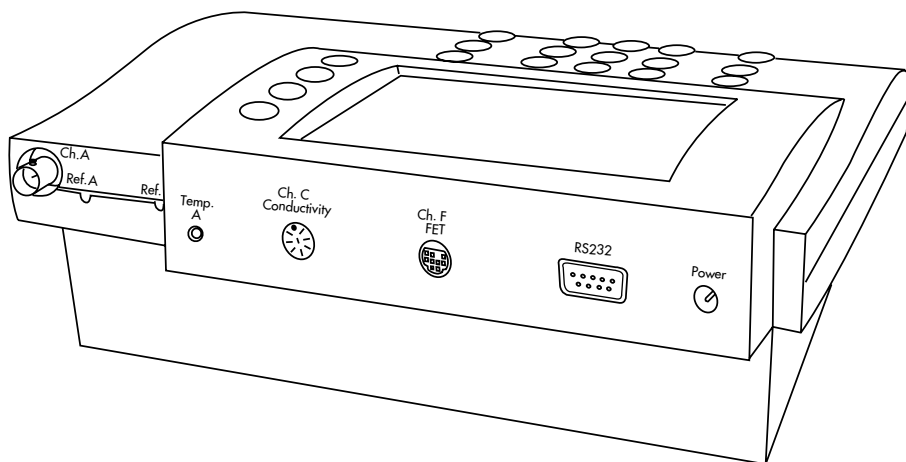
Conductivity DIN ("Ch.C conductivity") connector: use to connect a 4-band conductivity/ATC cell. These 4-band cells offer improved linearity and stability over older 2-band conductivity cells. (Models PP-20 and PP-50 only).

FET DIN ("Ch.F FET") connector: use to connect the solid-state Field Effect Transistor (FET) pH/ATC electrode. These non-glass pH electrodes offer certain advantages over conventional glass pH electrodes.

Serial port ("RS-232") DB-9 connector: use to connect a serial printer or a PC (personal computer). This bidirectional interface outputs data and receives meter commands.

Power ("Power") connector: use to connect a 5.5 mm OD x 2.1 ID coaxial connector with 12VDC at 500 mA (center pin negative).

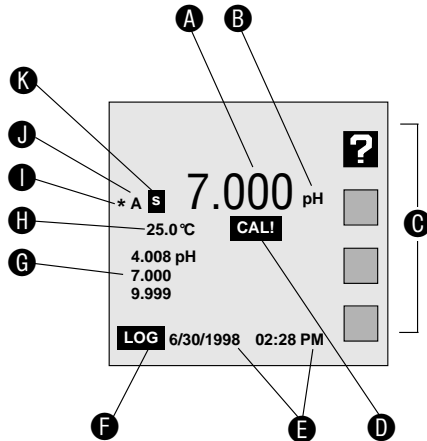
Note: The connectors shown are not available on all models.



Connectors for Model PP-50

LCD

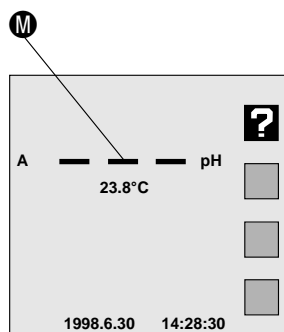
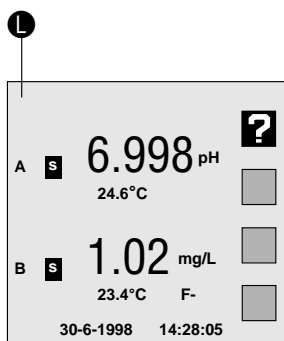
Single channel display



Note: Not all of the following will be displayed at the same time.

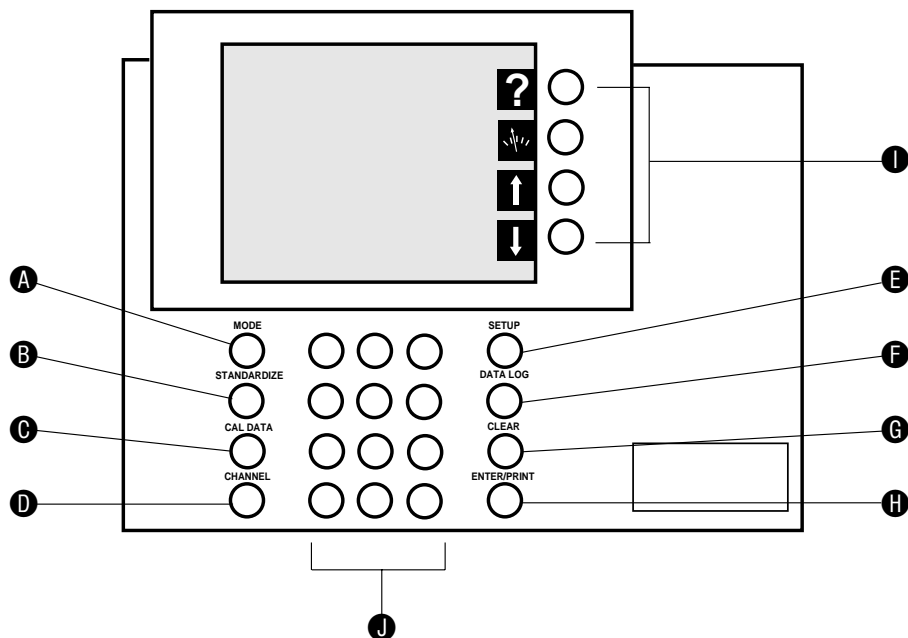
- A Result:** current measurement.
- B Units:** displays the units for the current measurement. Examples: pH, mV, mg/L F-, $\mu\text{S}/\text{cm}$ or $\Omega\text{-cm}$.
- C Soft key icons:** show the current function assigned to each soft key.
- D Calibration due reminder:** the **CAL!** icon reminds you a calibration is now due.
- E Date and time:** displayable in different formats.
- F Data logging:** the icon **LOG** indicates data logging is active.
- G Buffers/Standards:** in single channel mode, all entered buffers or standards are displayed. A "!" symbol next to a buffer indicates that the buffer is out of the entered calibration valid time (See Calibration reminder, page 21).

Dual channel display



- H Temperature:** displays the measured temperature when an electrode with ATC or a separate temperature probe is attached. Shows "M" when a manually entered temperature is being used.
- I Alarm:** "*" indicator means data is outside the set alarm limits.
- J Channel:** indicates which electrode channel (input) is being displayed. Channels A & B are BNC electrode inputs, Channel C is a conductivity cell input, and Channel F is a FET pH electrode input.
- K Stability:** the **S** indicates the electrode is stable to the selected criteria.
- L Multiple Channel:** display can show two (model PP-15), three (models PP-20 and PP-25) or four (model PP-50) electrode measurements with temperature simultaneously.
- M Out-of-range or non-valid reading:** dashes indicate that a measurement is not available. This usually means that the reading is out of range, or can mean that no standards have been entered in ion mode, or strict calibration has been set and the calibration has expired.

Function Keys



- A MODE:** selects the mode: pH, mV (Model PP-15), Ion (Models PP-25 and PP-50), Conductivity – Resistivity – NaCl Salinity – Practical Salinity-TDS (Models PP-20 and PP-50) to use for the currently selected channel.
- B STANDARDIZE:** enters buffers or standards for the currently selected channel. Use to enter pH buffers, relative mV offset, ion standards or conductivity/resistivity standards.
Also used to change other settings which affect the measurement.
- C CAL DATA:** displays and graphs buffers or standards with time and date stamp and electrode calibration data for the selected channel and mode.
- D CHANNEL:** selects the channel(s) (electrode inputs) to display.
Model PP-15 can display one or two channels simultaneously (Channels A and F).
The Model PP-20 can display up to three channels (Channels A, C and F).
Model PP-25 can also display one, two or three channels simultaneously (Channels A, B and F).
The Model PP-50 can display up to four channels simultaneously (Channels A, B, C and F).

- **SETUP:** the Setup menu is used to set various general meter settings, such as date and time, display contrast and serial port configuration.
- **DATA LOG:** displays the data logging menu used to set data logging and view the stored Data Log (see Data Logging).
- **CLEAR:** exits the current menu and returns to the previous menu, cancels the current operation or clears a number entry.
- **ENTER/PRINT:** accepts numeric values, menu selections or pending operations. In the main measure screen, it acts as a Print key, sending all current measurements to a printer/computer through the serial port and stores the measurements in the Data Log.
- **Soft keys:** these four keys access different operations at different times. Most menus offer a "Help" soft key and the "Measure" soft key, which allows a direct return to the main measuring screen, exiting all menus immediately. The "Up Arrow" and "Down Arrow" soft keys offer one way to select a menu item. The "Left Arrow" key is a backspace, which is active during number entry.
- **Numeric Keys:** Pressing a number key selects a numbered item in a menu. The number keys also allow entering values for buffer solutions, standards, and various meter settings.

Soft Keys



Help



Measure



Scroll up



Scroll down



Backspace



Graph



Exponent number entry



Incremental ion method



Measure lock



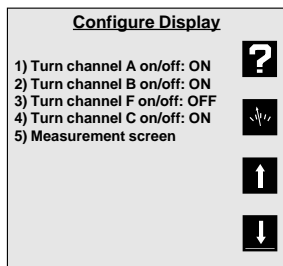
Measure unlock

Channels

The **CHANNEL** key is used to turn on or off each available channel. In single-channel operation, additional information is provided for the selected channel, including a list of all entered buffers or standards. In multi-channel operation, the **Mode**, **Standardize** and **Cal Data** menus ask for the channel before accessing the menu.

Model PP-15 offers single- or dual-channel operation using channel A (pH and ORP electrodes) and channel F (solid-state FET pH electrode). Model PP-20 has Channel A (pH and redox/ORP electrodes), Channel C (conductivity cells) and Channel F (solid-state FET pH electrode) for measurements.

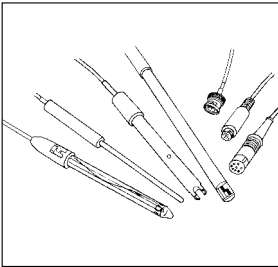
Model PP-50 Select Channel Screen



Model PP-25 offers up to three-channel simultaneous operation of channel A and channel B (pH, ORP and Ion Selective Electrodes) and channel F (solid-state FET pH electrode).

Model PP-50 provides up to four channel measurements with Channel A and Channel B (pH and ORP and ion selective electrodes), Channel C (conductivity cells) and Channel F (solid-state FET pH electrode).

Electrodes



The meter allows you to use a variety of glass membrane ("glass") pH/ATC electrodes, ion selective electrodes, conductivity/ATC cells, the Field Effect Transistor (FET) solid-state pH/ATC electrode, a separate temperature (ATC) probe, combination electrodes using a BNC connector, or separate electrode pairs with BNC connector and reference pin.

To measure	Use channel (connector)
------------	-------------------------

pH (glass membrane)	A (BNC)* or B (BNC)*
mV (ORP)	A (BNC)* or B (BNC)*
Ion (ISE)	A (BNC)* or B (BNC)*
Conductivity	C (DIN)
Resistivity	C (DIN)
Salinity	C (DIN)
TDS	C (DIN)
pH (FET)	F (mini-DIN)

* Separate reference electrodes can be used with "Ref. A" or "Ref. B" connectors.

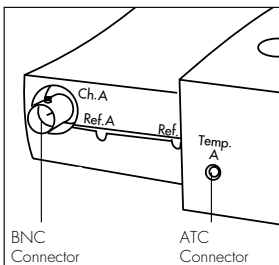
Preparing Electrodes and Conductivity Cells

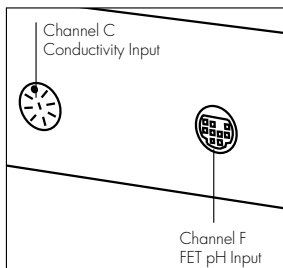
Remove the wetting cap or storage cap from the electrode. Before first using your pH electrode or whenever the electrode is dry, soak it several hours in an electrode filling or storage solution (3 molar KCl solution) or in a buffer for pH electrodes. Condition ISEs in the recommended solutions. Rinse conductivity cells with deionized water before use.

Connecting Electrodes

pH, ORP or ISE electrodes (with BNC connector):

Connect the electrode to the BNC input, either channel A or channel B (models PP-25 and PP-50 only), located at the rear of the meter. Push in and rotate the electrode's BNC connector until it locks in place. Connect the ATC connector to the **Temp. A** or **Temp. B** connector. To disconnect, twist the BNC connector in the opposite direction and pull.



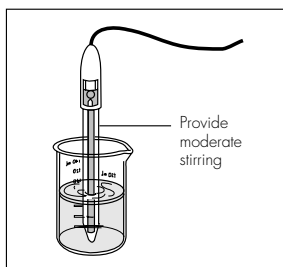


Electrode Pair Using a separate Reference Electrode (with Reference Pin Plug):

Connect the indicating electrode to the BNC input. Connect the reference electrode to the **Reference** input. Push the electrode's tip pin plug into the input to connect and pull out to disconnect.

Conductivity Cells (with DIN connector) and FET Electrode:

Align and push in the DIN connector fully to the channel C input (models PP-20 and PP-50 only). Pull carefully to disconnect.

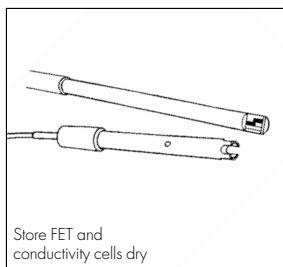
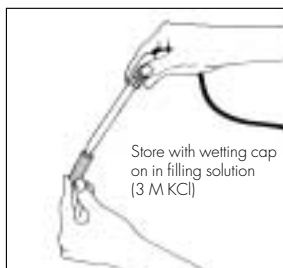


- All models allow use of both standard glass pH/ATC and solid-state FET (Field Effect Transistor) pH/ATC electrodes. The meter can store a calibration for both types of electrodes. Plug the FET electrode into the channel F mini-DIN input.

Using and Storing Electrodes

pH Glass Electrodes

- Provide moderate stirring for faster electrode response.
- Leave the fill hole open during all use.
- Rinse the electrode between each measurement with a portion of the next sample or buffer to be measured, or with deionized or distilled water.
- Keep glass electrodes wet when not being used by placing some electrode filling solution in the wetting cap and storing with the wetting cap on.
- Keeping glass electrodes "wet" will improve their performance. Store electrodes in electrode filling solution or storage solution (KCl, 3 mol/L).



Solid-State FET Electrode

- Allow the FET about 1 minute to stabilize when first connected. The FET electrode can be stored dry or in electrode storage solution. Provide moderate stirring.

Ion Selective Electrodes

- Add proper amount of Ionic Strength Adjuster (ISA) to all standards and samples, usually 1 mL ISA to 50 mL standard or sample.
- Provide moderate stirring for faster electrode response.
- Rinse the electrode(s) between each measurement with a portion of the next sample or standard to be measured, or with deionized or distilled water.
- Follow the instruction sheets for the individual electrode. Store as recommended.

Conductivity Cells

- When changing samples or standards, immerse the cell into the new solution, then lift and allow solution to drain out. Repeat two more times.
- Gently tap cell to dislodge air bubbles.

Meter Setup

Meter Setup Menu
1) Time and date menu
2) Select temperature units
3) Select contrast
4) Select language
5) Setup serial port
6) Keypress beep volume
7) Select video color scheme
8) Show meter information
9) Enable measure lock
0) Enable strict calibration
*) Set screen saver timeout
*) Restore factory defaults



Select Time Format
1) hr : min : sec
2) hr : min AM/PM





Select Date Format
1) mm / dd / yyyy
2) dd - mm - yyyy
3) yyyy.mm.dd

Enable Measure Lock
Display lock/unlock soft key?
1) Yes
2) No
If "measure lock" is enabled,
a "lock" soft key will appear on
the measurement screen.
After pressing this key, each
reading will freeze when stable,
and an "L" icon will appear. To
unlock the readings, press the
key again, or exit the screen.
Note: logged data will not lock.

Meter Setup Menu

Press **SETUP** to access the Meter Setup menu:

- Time and date menu:** use to set the time format (HH:MM:SS or HH:MM:AM/PM), the time, the date format (MM/DD/YYYY, DD-MM-YYYY or YYYY.MM.DD), and the date.
- Select temperature units:** use to select temperature measurement and display in degrees Celsius, degrees Fahrenheit or Kelvin.
- Select contrast:** use to select the display contrast, making the displayed characters lighter or darker. Select setting "5" for typical conditions.
- Select language:** use to select the language of your preference.
- Setup serial port:** use to configure the serial port start bits, baud rate and parity setting. This must match the settings of the printer or computer being used with the meter.
- Keypress beep:** use to adjust the loudness of the acoustic signal.
- Select video color scheme:** use to set the display to black characters on a white background or white characters on a black background.
- Show meter information:** use to show the meter model, software version and serial number.
- Enable measure lock:** use to enable the measure lock where a stable measurement is locked (frozen) for later review. Stability criteria should be set to SLOW for all channels and modes in use (see Options Menu).

Enable Strict Calibration	
Require calibration?	
1) Yes	
2) No	
If strict calibration is enabled, no measurements will be displayed for a channel with an expired cal reminder.	
	
Note: enabling this setting locks all cal reminders ON.	



0. **Enable strict calibration:** use to set strict calibration where no measurements are displayed if the calibration reminder has expired.

"±" **Set screen saver:** use to set a time for the backlight to turn off and the screensaver to activate.


"•" **Restore factory defaults:** use to reset all settings to factory defaults. On occasion it may be useful to completely reset the meter, for example, if other users have changed a setting.







Warning!

A reset also clears all electrode standardizations.

pH Mode


Channel A: pH mode

Standardize Menu 


- 1) Auto-enter a buffer 
- 2) Manual buffer entry 
- 3) Clear buffers 
- 4) Options menu 
- 5) Cal reminder menu 
- 6) Select buffer set 




Channel A: pH mode


Manual Buffer Entry 




Enter the actual pH of this buffer, after correcting for temperature:


pH 

Press Enter to accept. 

Channel A: pH mode

Cal Reminder Menu 

- 1) Turn reminder On/Off: OFF 
- 2) Set reminder interval: 01, 00 : 00 days, hr : min 
- 3) Standardization menu 

When the cal reminder expires, a "CAL!" (or "!!") icon will be displayed with the measurement and with each expired standard. If strict cal is ON, reminders are always ON, and expired channels show no measurements. 

pH Mode Standardization Menu

Press **MODE** and select 1) pH.





Press **STANDARDIZE** and the **pH Mode Standardize Menu** appears:

1. **Auto-enter a buffer:** use to add a new buffer which is auto-recognized by the meter, or update an existing buffer. Follow the prompts.
2. **Manual buffer entry:** use to enter a buffer value by manually entering the pH of the buffer.
3. **Clear buffers:** use to clear all buffers entered for the current channel (pH mode). If **all** entered buffers are being re-entered, it is usually not necessary to clear buffers before re-entering them.
4. **Options Menu:** use to define additional specific pH mode settings e.g. to set pH limits. (See page 22).
5. **Cal reminder menu:** use to set a timer reminding you to recalibrate. A **CAL!** icon will appear on the main screen and an exclamation mark beside the buffers for which the time has expired.





The calibration reminder is a reminder of when electrode calibration (with buffers) should be redone.

If strict calibration is set (see Meter Setup Menu) and when a calibration has expired the **CAL!** icon appears, and " - - " is displayed in place of the measurement. No measurements can be obtained until a calibration is performed.

Note: When strict calibration is set, the calibration reminders for all channels are turned ON, and cannot be turned off from the Cal Reminder Menu.

Channel A: pH mode	
<u>Select Buffer Set</u>	
1) 2, 4, 7, 10, 12 at 25C	
2) 2, 4, 7, 10, 12 at 20C	
3) 1, 3, 6, 8, 10, 13	
4) 1.68, 4.01, 6.86, 9.18, 12.46	
5) 1.09, 3.06, 4.65, 9.23, 12.75	
6) Select custom buffer set	
<u>Custom Buffer</u>	
No buffers	





6. **Select buffer set:** There are five auto-recognition buffer sets and the option to configure and use a custom buffer set of your own.

Channel A: pH mode	
<u>Configure Custom Buffer Set</u>	
1) Add a "built-in" buffer	
2) Add a manual buffer	
3) Delete a buffer	
4) Standardize menu	
<u>Custom Buffer</u>	
No buffers	
	

Select Custom Buffer Set

Use **Custom Buffer Set** to make a set of buffers containing the specific buffers in use (up to five buffers). Select **Custom Buffer Set** and configure the custom buffer set; then buffers from this set will be automatically recognized and entered.

Custom buffers can have any numeric pH value, or can be selected from the built-in temperature-corrected buffers. Using the built-in buffers allows temperature correction of the pH values of the buffers, offering more accuracy.

Channel A: pH mode	
<u>Options Menu</u>	
1) Select resolution	
2) Select stability criteria	
3) Select signal averaging	
4) Set standardization delay	
5) Set pH slope	
6) Standardize menu	
7) Manual temperature menu	
8) Data alarm menu	
9) Set isopotential point	

pH Mode Options Menu

1. **Select resolution:** use to set pH readings to 0.1, 0.01, or 0.001 pH units.
2. **Select stability criteria:** use to set stability criteria to slow, medium or fast to match the electrode's speed of response and the variability of the signal allowed for a "stable" (**S**) measurement.
3. **Select signal averaging:** use to set filtering of the electrode signal to very slow (10 readings), slow (8), medium (6), fast (4) or very fast (2). Slower settings give more stable readings, although may require longer times to reach stability.

4. **Set standardization delay:** use to set a reading delay time for the meter to wait before accepting an electrode signal during standardization. Programming a standardization reading delay helps slow responding electrodes reach equilibrium before the electrode signal is accepted.
5. **Set pH slope:** use to set a known electrode slope used by the meter with a zero- or single-point standardization. The normal default slope is 59.16 mV/pH. The meter allows a slope between 80 and 120 % efficiency to be entered.
6. **Standardize menu:** returns to the pH mode Standardization Menu.
7. **Manual temperature menu:** use to set a temperature to be used in the absence of an ATC probe or when manually overriding the ATC.
8. **Data alarm menu:** use to set pH limits. If the limits are exceeded, an alarm indication ("*") is displayed and recorded with any data points placed in the Data Log.
9. **Set isopotential point:** use to set an isopotential point for use in high accuracy electrode measurements (See Determining the Isopotential Point, page 47).

Notes:

1. Auto-recognized buffers are found in the auto-recognized built-in buffer sets. These buffers are auto-recognized by the meter, and are also automatically temperature-corrected for the variation of buffer pH with temperature.
2. When manually entering buffers, the exact pH of the buffer at the current temperature must be entered. All buffers change pH with temperature. For best accuracy, either use the built-in buffers or make sure manually entered buffers are at the expected temperature (so that their pH as entered is correct).

3. Auto-recognition Buffer Sets:
 - 1) 2, 4, 7, 10, 12 (nominal value adjusted at 25°C)
 - 2) 2, 4, 7, 10, 12 (nominal value adjusted at 20°C)
 - 3) 1, 3, 6, 8, 10, 13
 - 4) 1.68, 4.01, 6.86, 9.18, 12.46 (NIST buffers)
 - 5) 1.09, 3.06, 4.65, 9.23, 12.75 (DIN buffers)
 - 6) Select custom buffer set

4. Temperature Correction of Electrodes and Buffers

The meter automatically compensates for the temperature dependence of the electrode's response when measuring pH. The meter also compensates for buffer change in pH value with temperature. Temperature compensation is based on temperature either from an ATC probe or a manually entered temperature.

Actual Buffer pH vs. Temperature

pH 4.00 (4.01)/7.00/10.00 buffer (nominal 25°C)


Temperature (°C)	Buffer 4	Buffer 7	Buffer 10
30	4.016	6.991	9.947
25	4.008	7.003	10.000
20	4.003	7.020	10.057
15	4.000	7.042	10.119
10	3.998	7.069	10.187







Using a Solid-state FET (Field Effect Transistor) pH/ATC Electrode

By turning channel F (FET) on, an FET pH/ATC electrode can be directly used. pH and mV modes are available with the FET electrode. FET devices can have large offset potentials that vary with each transistor chip, so "**Manual buffer entry**" must be used to enter the first buffer. After one buffer has been entered using "**Manual buffer entry**", following buffers can usually be entered with "**Auto-enter a buffer.**"

Standardizing and Measuring pH


Channel A: pH mode

Standardize Menu 



1) Auto-enter a buffer 
 2) Manual buffer entry 
 3) Clear buffers 
 4) Options menu 
 5) Cal reminder menu 
 6) Select buffer set 

STANDARDIZE


Channel A: pH mode

pH Checklist 


Prepare buffer or sample.
 Rinse electrode.
 Place electrode in solution.
 Stir moderately.
 Press Enter to continue.





Channel A: pH mode

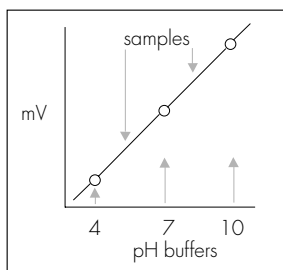
Manual Buffer Entry 

Enter the actual pH of this
 buffer, after correcting
 for temperature:

pH 

Press Enter to accept. 

1. Immerse the electrode in a buffer and stir moderately. The meter displays the current pH measurement.
2. Allow the electrode sufficient time to reach equilibrium.
3. Press **STANDARDIZE**, then press either 1) **Auto-enter a buffer** or 2) **Manual buffer entry**.
4. Follow the prompts on the display.
5. The meter waits for a stable signal, automatically recognizes the buffer (if using "**Auto-enter**"), checks the electrode and buffer and enters the buffer. The entered buffer appears on the display.
6. Alternatively, if the signal is not stable, you can press **ENTER** when the reading stabilizes according to your tolerance criteria. The meter then enters the buffer.
7. Repeat steps 1 through 4 to enter a second, third, fourth or fifth buffer. With more than one buffer, the meter performs a diagnostic check on the electrode. The electrode is considered good if the slope is between 90 to 105%. If a sixth buffer is entered, the buffer farthest away ("oldest") is replaced by the new buffer.
8. Press the CAL DATA key to check the function of the pH electrode. The pH's of the buffers entered and the slope of the electrode between every two points are displayed.



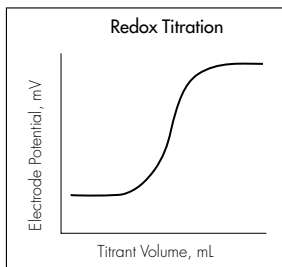
Hints to achieve better accuracy:

- During standardization, allow time for the electrode to stabilize before entering the buffer into the meter.
- Standardize using at least two buffers, bracketing the expected pH of your samples.
- Standardize at least daily for the most accurate readings.
- Open the fill hole on the electrode.
- Stir all buffers and samples.
- Rinse the electrode with deionized water between samples and buffers.
- Always use fresh buffers.

Clearing Buffers

Press **STANDARDIZE**, then press **3) Clear buffers** to clear buffers. If all previously entered buffers will be re-entered, it is not necessary to clear buffers since the meter will replace the previous values. If re-entering only some buffers, all the old buffers should be cleared.

mV Mode

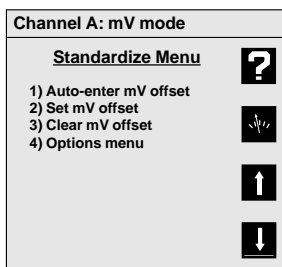


Millivolt measurements are used to measure ORP (oxidation-reduction potential) or redox potential, to check performance of pH or ion selective electrodes, and for redox titrations (see page 43).

The meter will measure millivolts (mV) by pressing **MODE** and selecting **2) mV**. Relative mV can be measured by entering a mV offset or using the current mV value as the mV offset.

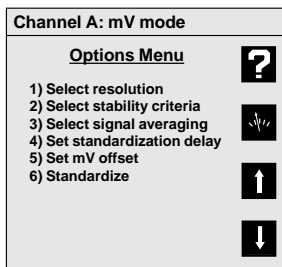
mV Mode Standardization Menu

In mV mode, press **STANDARDIZE** and the mV mode **Standardize Menu** appears:



1. **Auto-enter mV offset:** use to set the relative mV offset equal to the current mV reading. The current mV becomes 0.0 relative mV.
2. **Set mV offset:** use to manually enter a mV offset.
3. **Clear mV offset:** use to clear any offset that has been entered, returning the meter to absolute mV mode.
4. **Options menu:** a menu of additional settings specific to the mV mode. See below.

mV Mode Options Menu



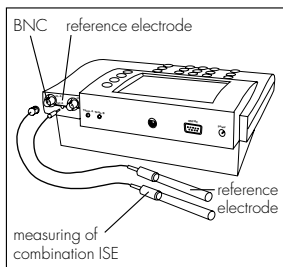
1. **Select resolution:** use to set mV readings to 1 or 0.1 millivolt resolution.
2. **Select stability criteria:** use to select stability criteria for slow, medium or fast response which use a tight, average or loose requirement to indicate a "stable" (**S**) reading.
3. **Select signal averaging:** use to set the meter to average readings that are very slow (10 readings), slow (8), medium (6), fast (4) or very fast (2).
4. **Set standardization delay:** use to set a length of time for the meter to wait before entering a relative mV standardization.

5. **Set mV offset:** use to manually enter a mV offset (same as in the **mV Standardize menu**).
6. **Standardize:** returns to the mV **Standardize Menu**.

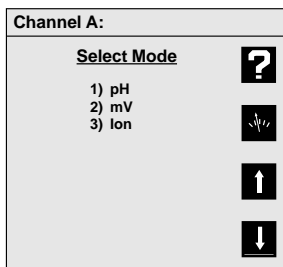
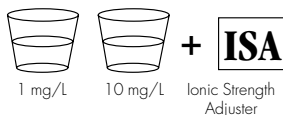
Clearing Relative mV Mode

Press **STANDARDIZE**, then press **3) Clear mV offset** to clear offset and return the meter to absolute **mV mode**.

Quick Start Guide for Ion Measurements

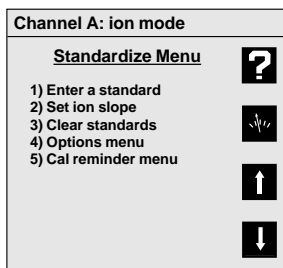


Example:







MODE

CHANNEL



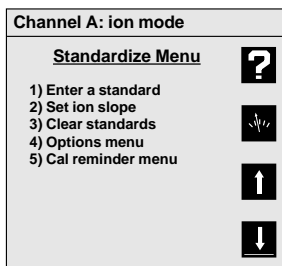
1. Connect the Ion Selective Electrode (ISE) and Reference Electrode, if required, to the meter. "Combination" ISEs have a reference electrode built-in, and do not require a separate reference electrode or connection.
2. Prepare two or more ion standards at concentrations bracketing typical sample solutions. Add the appropriate Ionic Strength Adjuster solution to each standard.
3. Set the meter to display the correct channel (the channel with the ISE attached, either A or B) using **CHANNEL**. Set the meter to **Ion** mode: press **MODE**, then **3) Ion**.
Note: The meter will display "— — —" (no valid data) until an ion standard has been entered.
4. Immerse the electrode(s) in the standard, provide stirring (a magnetic stirrer is recommended), and allow sufficient time (1 to 5 minutes depending on the ISE) for the electrode to reach a stable signal.
5. Press **STANDARDIZE**, **1) Enter a standard**, and follow the prompts to enter an ion name and units. Custom ion names can be entered or read by selecting **Custom** in **Select Ion Name**. To enter additional ion standards, press **STANDARDIZE** and follow the prompts displayed. See the Standardizing and Measuring Ion section for more information.

Channel A: ion mode	
Ion	<u>Cal Data</u> 
1.00 mg/l 08/01/1998 08:32 AM	
57.15 mV/decade	
10.0 mg/l 08/01/1998 08:35 AM	
	

 CAL DATA

- Check the ISE response by pressing **CAL DATA** to see the standards and the ISE slope between calibration points (standards). The meter will allow an ion electrode slope between 5.92 mV/decade (10% slope) and 70.99 mV/decade (120% slope).

Ion Mode



 MODE

 STANDARDIZE

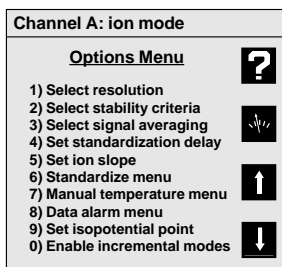
Ion Mode Standardize Menu

Select channel A or B. Press **MODE** and then press **3) Ion** for ion mode. Press **STANDARDIZE** and the **Ion Mode Standardize Menu** appears.

1. **Enter a standard:** use to add a new standard or update (re-enter) an existing standard. Follow the prompts. With the first standard you select the ion name and units. Use **Custom** to enter an ion name.
2. **Set ion slope:** for one-point ion calibration, use to manually enter a slope for the selected ion electrode. Useful if the ISE has a known, stable slope so that measurements can be made after entering a single ion standard.

Note: When two or more standards are entered, the meter uses the actually determined slope(s).

3. **Clear standards:** use to clear standards for the electrode standardization selected.
4. **Options Menu:** use to set various additional parameters to the ion mode. See below.
5. **Cal reminder menu:** use to set a timer reminding you to recalibrate. A **CAL!** icon will appear on the main screen and an exclamation mark will appear beside the standards which need to be re-entered.

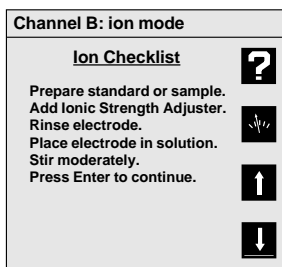
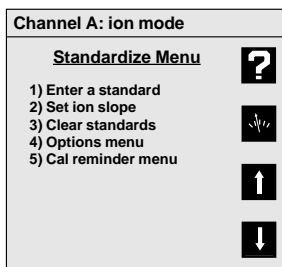
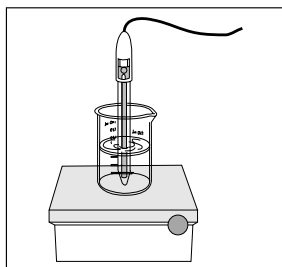
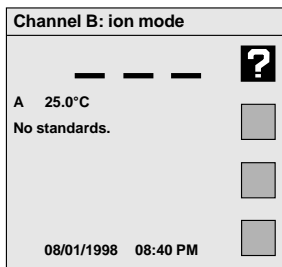


Ion Mode Options Menu

1. **Select resolution:** use to set the readings to 1, 2, or 3 significant digit resolution.
2. **Select stability criteria:** use to set the stability criteria to slow, medium or fast to match the electrode's speed and stability of response, providing tight, medium and loose requirements for a stable (**S**) indication.
3. **Select signal averaging:** use to set filtering of the electrode signal to very slow (10 readings), slow (8), medium (6), fast (4) or very fast (2). Slower settings give more stable readings, although may require longer times to reach stability.

4. **Set standardization delay:** use to set a reading delay time for the meter to wait before accepting an electrode signal during standardization. Programming a standardization reading delay helps slow-responding electrodes reach equilibrium before the electrode signal is accepted. Delays of 1 minute for fast ISEs and 5 to 10 minutes for slow ISEs are appropriate.
5. **Set ion slope:** use to enter a known ion electrode slope for a one-point standardization.
6. **Standardize menu:** returns to the **ion mode standardize menu**.
7. **Manual temperature menu:** use to set a manual temperature for use in the absence of an ATC probe or when manually overriding the ATC.
8. **Data alarm menu:** use to enter ion limits to be entered. If the limits are exceeded an alarm indication ("*") is displayed.
9. **Set isopotential point:** use to manually enter an isopotential point. For the determination of the isopotential point see page 47.
0. **Enable incremental modes:** use to turn on the known addition/subtraction type ion methods. See page 35.

Standardizing and Measuring Ion



1. Set the meter to ion mode (use **MODE**) and turn on the channel (use **CHANNEL**) with the Ion Selective Electrode (either Channel A or B).

The meter displays “— — —”, indicating no valid measurement, until at least one ion standard has been entered.

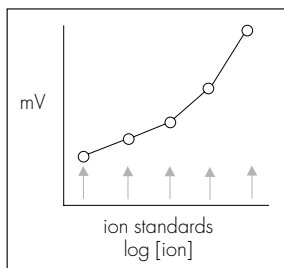
2. Prepare a standard, and add the appropriate Ionic Strength Adjuster (ISA) solution to the standard.
3. Immerse the electrode(s) in the solution and stir continuously.

4. Press **STANDARDIZE**, select the correct channel if prompted to do so, and select **1) Enter a standard** to add a standard. If this is the first standard to be entered, select the ion name and units.

Follow the prompts. Be sure to allow enough time for the electrode to reach a stable signal.

Note: The default standardization delay for ion mode is 30 seconds. This can be set by the user. See Ion Mode Options Menu, page 31.





5. The meter waits for a stable signal and enters the standard. The entered standard appears in the display (in single-channel mode). Alternatively, if the signal is not stable, you can press **ENTER** when the reading stabilizes according to your tolerance criteria. The meter then enters the standard.
6. Repeat steps 2 through 5 to enter additional standards. Up to seven standards can be entered. With more than one standard, the meter performs a diagnostic check on the electrode.







Helpful Hints:





- Stir constantly.
- Allow the electrode time to reach a stable reading before entering the standard into the meter.
- To achieve better accuracy, standardize using at least two standards, bracketing the expected range of your samples.
- Standardize from low to high concentrations.
- Always use fresh standards.
- Use standards and samples near the same temperature.
- Remember to add Ionic Strength Adjuster to each standard and sample.

Measuring Ion Using Known Addition Type (Incremental Ion) Methods

Channel A: ion mode	
Enable Incremental Modes	
Display ion soft key?	
1) Yes	
2) No	
If incremental modes are enabled, a '+/- ion' soft key will appear on the measurement screen. Pressing this key will lead you through the steps to take one "known (standard) addition" or "analate (sample) addition" incremental ion measurement.	
	
	

Select Measurement Technique	
1) Known (standard) addition	
2) Analate (sample) addition	
Select 'known addition' to add a small volume of known standard to the sample.	
Select 'analate addition' to add a volume of sample to a volume of known standard.	
The meter will automatically detect subtraction techniques.	



Channel A: Known addition mode	
Incremental Ion Measurement	
S 58.7 mV	
Prepare sample and note volume.	
Add Ionic Strength Adjuster.	
Rinse electrode.	
Place electrode in solution.	
Stir moderately.	
Press Enter to accept.	

The meter provides known ("standard") addition/subtraction and analate ("sample") addition/subtraction incremental methods for measuring ion concentrations. These advanced ion measurement techniques are useful in overcoming certain problems in ion analysis.



In **Known addition/subtraction**, a volume of sample is obtained, Ionic Strength Adjuster is added, and the ion electrode potential is obtained. Then a small volume of standard is added to the sample, and a second electrode potential is obtained. From the change in electrode potential, the ion concentration in the sample can be calculated. Interference from complexation and other ions can often be overcome by the known (standard) addition method.

In **Analate addition/subtraction**, the ion electrode is placed in a volume of standard and the potential obtained. Then a small volume of sample is added and a second electrode potential is obtained. This method helps overcome problems from widely differing sample ionic strengths or temperatures.

Enable Incremental Ion Modes

Press **STANDARDIZE**, select the channel (if necessary), **4) Options menu**, **0) Enable incremental modes**, then **1) Yes**.

This will "turn on" a special soft key in the main measure screen which is a direct access soft key to start a known addition type measurement.

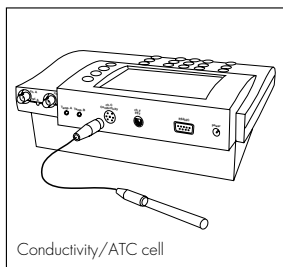
Channel A: Known addition mode	
Incremental Ion Measurement	
S 95.2 mV	
Delta = 36.5 mV	
Add aliquot of known standard. Stir moderately.	
For best accuracy, add volume until Delta > 4.0 mV.	<input type="text"/>
Note total volume added.	<input type="text"/>
Press Enter to accept.	<input type="text"/>

Using a Known Addition Type Incremental Ion Measurement

Press the incremental method soft key, select **1) Known (standard) addition** or **2) Analate (sample) addition**.

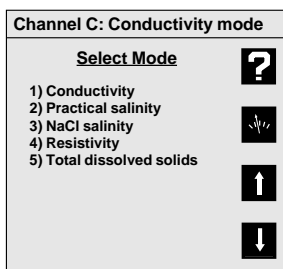
Follow the prompts to place the electrode in the first solution and obtain a reading, add an aliquot (a known volume) of standard or sample, obtain a second electrode reading, and enter the sample volume and standard volume and concentration. The meter then displays the calculated ion concentration in the original sample. Press **ENTER** to leave the result screen and return to the measure screen to use direct reading ion measurements or start another known addition type measurement (see page 29).

Quick Start Guide for Conductivity/Resistivity/Salinity/TDS Measurements



1. Connect the conductivity/ATC cell to the meter.

2. Prepare one or more conductivity/resistivity standard solutions at values near typical sample solutions.

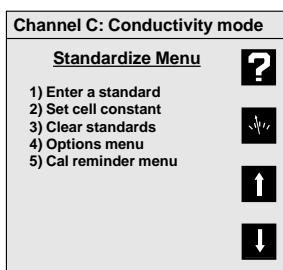


3. Set the meter to display channel C using **CHANNEL**. Set the meter to the correct mode using **MODE** (Conductivity, Practical salinity, NaCl salinity, Resistivity or Total dissolved solids).

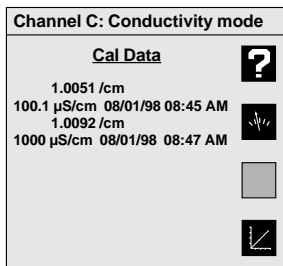
4. Place the conductivity cell in the standard, immerse the cell past the fill vent hole, then lift and allow the solution to drain out. Immerse and drain at least three times to fully flush the inner chamber of the cell. Gently tap the cell to dislodge any air bubbles.

CHANNEL

MODE



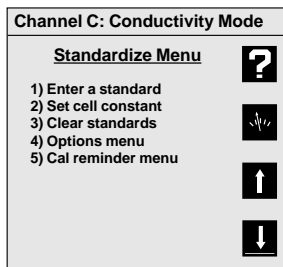
5. Press **STANDARDIZE**, then **1) Enter a standard** and follow the prompts to enter the value of the standard. Repeat these steps to enter up to five conductivity/resistivity standards. Each standard is displayed in the main measuring screen when in single-channel display.



6. Check the cell performance by pressing **CAL DATA** to display the standards and the cell constants between standards.

CAL DATA

Conductivity/Resistivity/Salinity/ TDS Menus



 CHANNEL

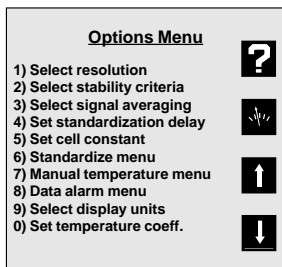
 STANDARDIZE

Conductivity/Resistivity/Salinity/ TDS Standardize Menu

Turn on Channel C using the **CHANNEL** key.
Press **STANDARDIZE** and the **Standardize Menu** is displayed.

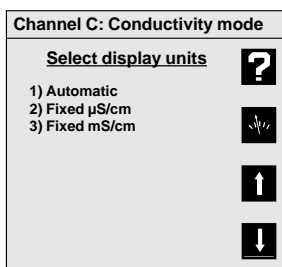
1. **Enter a standard:** use to enter or re-enter a conductivity standard. Follow the prompts.
2. **Set cell constant:** use to manually enter a known conductivity cell constant for use with no standards. If the cell constant is known and stable, then this allows standardizing the cell without using standard solutions. If a standard is entered, the actual cell constant is calculated and used.
3. **Clear standards:** use to clear all existing standards. This is useful if new standards are to be entered.
4. **Options menu:** accesses additional settings used with each conductivity-type mode. See below.
5. **Cal reminder menu:** use to set a timer reminding you when to recalibrate. A **CAL!** icon appears on the main screen and an exclamation mark appears beside those standards which need to be re-entered.
6. **[TDS mode only] Calculate solids factor:** use this to allow the meter to calculate a solids factor.*
7. **[TDS mode only] Set solids factor:** use to manually enter a known solids factor * for a particular sample type. This factor must be within the range of 0.1...0.2 mg/l/ μ S/cm.

* The "solids factor" is used to correlate the conductivity measurement with the weight-based TDS measurement for a sample type.




Conductivity Mode Options Menu




1. **Select resolution:** use to set readings to 1 through 4 significant digits resolution.
2. **Select stability criteria:** sets stability criteria used to determine when the meter indicates Stable **S**.
3. **Select signal averaging:** use to set filtering of the cell signal to very slow (average 10 readings), slow (8), medium (6), fast (4) or very fast (2 readings). Slower settings give more stable readings, and are recommended with conductivity measurements.
4. **Set standardization delay:** use to set a reading delay time used by the meter when entering conductivity standards. Programming a reading delay helps by ensuring sufficient time for the cell signal to become stable before being entered into the meter.
5. **Set cell constant:** use to manually enter a known conductivity cell constant. (Same as in "Standardize Menu").
6. **Standardize Menu:** use to return to the "Standardize Menu".
7. **Manual temperature menu:** use to set a manual temperature for use in the absence of an ATC probe or when manually overriding the ATC.
8. **Data alarm menu:** use to set ion limits to be entered. If the limits are exceeded an alarm indication ("*") is displayed along with the reading.
9. **Select display units:** the meter automatically switches between $\mu\text{S}/\text{cm}$ and mS/cm in conductivity, or between $\text{ohm}\cdot\text{cm}$, $\text{kiloohm}\cdot\text{cm}$ and $\text{megohm}\cdot\text{cm}$ in resistivity. If it is better to display a fixed unit, the "Fixed" settings allow that.




Channel C: Conductivity mode

Select Reference Temperature 

1) 15°C
2) 20°C
3) 25°C








Channel C: Conductivity mode

Set Temperature Coefficient 


Enter the value for this solution:

1.90 %/°C








Press Enter to accept.

Channel C: Conductivity mode

Standardize Menu 

1) Enter a standard
2) Set cell constant
3) Clear standards
4) Options menu
5) Cal reminder menu

0. **Set temperature coeff(icient):** use to set the reference temperature to correct all conductivity and TDS measurements to, and set the temperature coefficient for the temperature correction. Salinity measurements by definition are corrected to 20°C. Resistivity measurements are not temperature-corrected.

Standardizing and Measuring Conductivity/Resistivity/Salinity/TDS

1. Set the meter to display channel C (use **CHANNEL**). Set the meter to the correct mode (Conductivity, Resistivity, NaCl salinity, Practical salinity or Total dissolved solids) using **MODE**.
2. Place the conductivity cell in the standard, immerse the cell past the fill vent hole, then lift and allow the solution to drain out. Immerse and drain at least three times to fully flush the inner chamber of the cell. Gently tap the cell to dislodge any air bubbles.
3. Press **STANDARDIZE**, select the channel if necessary, then **1) Enter a standard** and follow the prompts to enter the value of the standard. Repeat these steps to enter up to five conductivity/resistivity standards. Each standard is displayed in the main measuring screen when in the single-channel display. Use multiple standards that cover the range of values expected in samples. Generally, standards should be a factor of ten apart in conductivity.

Data Logging

Data Log Menu

- 1) View data log
- 2) Turn logging On/Off: ON
- 3) Set logging interval
- 4) Clear data log
- 5) Set sample number
- 6) Set sample label
- 7) Print data log

Number of points in log:
350

The meter will store up to 620 data points in an internal data log. Press **PRINT** when in the main measure screen to store the current result with channel, stability, temperature, result, units, sample label, sample number, and date and time in the data log. **PRINT** also outputs this data through the RS-232 serial port. All channels displayed are printed and data logged.

Data Log

A	S	25.3°C	4.176	pH	
00102	06/26/98	9:32AM			
B	S	25.4°C	1.03	mg/L F-	
00101	06/26/98	9:31AM			
A	S	25.3°C	6.713	pH	
00100	06/26/98	9:31AM			

Data Log Menu

Press **DATA LOG** and the Data Log Menu will appear.

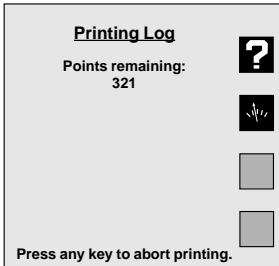
1. **View data log:** shows the stored data, one screen at a time. Press the arrow soft keys to page up and down through the stored data. Press **CLEAR** or **Enter** to return to the menu.
2. **Turn logging on/off:** turns the data logging on or off for all displayed channels.
3. **Set logging interval:** allows you to enter the time interval for automatic data logging.
4. **Clear data log:** clears all stored data points from memory.
5. **Set sample number:** allows a number to be assigned to the first sample. This number will increment for each consecutive sample logged.
6. **Set sample label:** A custom user-definable name can be entered. This label will be printed and stored with all data. To enter a label, repeatedly press a number key to select the desired character, then press **ENTER**. Repeat for all characters, then scroll up or down to "save and exit" and press **ENTER**.

Set Logging Interval

Enter the time between data samples.

01 : 00 : 00 hr:min:sec

Please Enter to accept



7. **Print data log:** use to send all data points in the data log to the RS-232 serial port.



Warning

The data log is kept in instrument RAM (Random Access Memory), which is powered by the external power supply. Removing power from the meter will lose the stored data in the data log.

Note:

Meter settings and electrode standardization data are kept in the separate non-volatile memory (ROM). Unplugging the meter has no effect on these stored items.

Troubleshooting

Testing the Electrode and Meter

To test the meter for correct operation with a pH, ORP or ion selective electrode, short the BNC input connector (either Channel A or B) using the BNC Shorting Cap that was supplied with the meter on the BNC connector(s). Select the correct channel using **CHANNEL**. Select mV mode by pressing **MODE** and selecting **2) mV**. Verify that the meter is in absolute mV mode (display shows "mV", not "rel mV"). If the meter reads $0 \pm 0.3 \text{ mV}^*$, and is stable, the meter is measuring correctly.

To test the pH electrode, place it in a fresh pH 7 buffer. Select the correct channel for the electrode using **CHANNEL**. Press **MODE** and select **2) mV**. Verify that the meter is in absolute mV mode (display shows "mV", not "rel mV") and note the mV reading. Repeat for either a pH 4 or pH 10 buffer. If the electrode potential is within the limits shown, it is measuring correctly.

pH 7	$0 \pm 30 \text{ mV}$
pH 4	159 to 186 mV higher than pH 7 reading
pH 10	159 to 186 mV lower than pH 7 reading

*** Note:** Meter accuracy is $\pm 0.1 \text{ mV}$ at calibration temperature, not including long term drift and a temperature error. The zero and slope temperature coefficients of the meter over the range of 15 to 40°C specify 85 ppm/°C, or $\pm 4 \text{ mV}$ at full scale (worst case). The long term drift may not exceed 0.1 mV per month.

This results in an expected range of $0 \pm 0.3 \text{ mV}$ with 1-minute stability of $\pm 0.1 \text{ mV}$ at room temperature.

Technical Specifications

Models PP-15, PP-20, PP-25 and PP-50

Modes	pH	mV	Temperature
Range	−2.000 to 20.000	±1800.0	−5.0 to 105.0°C
Resolution	0.001/0.01/0.1	0.1/1	0.1
Accuracy	±0.002	±0.1	± 0.3
Temperature compensation	Automatic & manual: −5 to 105°C		
Slope control	Automatic, 90 to 105% Manual, 80 to 120%		
Ambient conditions	15 to 40°C, humidity from 0 to 90% (non-condensing)		
Power requirements	230 V 50/60 Hz (Additional voltages available)		
Equipment supplied			
Meter kit with electrode kit includes:	Meter, power supply, high performance glass-body pH/ATC “3-in-1” electrode, electrode arm, AC adapter and operation manual.		
Meter only kit includes:	Meter, AC adapter and operation manual.		

Models PP-25 and PP-50

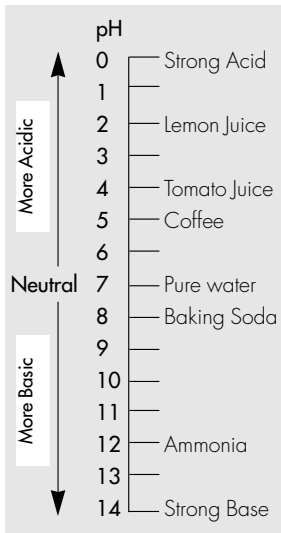
Mode	Ion
Range	1.00E-9 to 9.99E 9
Resolution	1, 2, or 3 significant figures
Accuracy	± 0.17%n (n = ion charge)
Slope control	Automatic or manual, 5.9 mV/decade (10% slope) to 71 mV/decade (120%)
Number of standards	7

Models PP-20 and PP-50

Mode	Conductivity	Resistivity	Practical Salinity	NaCl Salinity	TDS
Range*	0.01–300,000 µS/cm	30 Ω · cm – 20 M Ω · cm	0.01 – 42 ppt	0.01 – 70 ppt	0.005 – 300,000
Resolution	1, 2, 3, or 4 significant figures				
Accuracy	± 0.5%				
Input resistance	10 · 10 ¹² Ω				
Cell constant	Automatic or manual, 0.01–100				
Temperature coeff.	Off or On (0 – 4%/°C)				
Number of standards	5				

* depending on cell constant (from 0.1 to 10/cm)

pH Theory



pH scale showing the relative acidity or basicity of some common substances

The measurement of pH plays an important role in water quality applications as well as in industry and research. pH is a measure of acidity or alkalinity of a solution, and is usually written:

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

where $[\text{H}_3\text{O}^+]$ is the concentration of oxonium ions.

pH levels generally range from 0 to 14, with a pH value of 7 being the neutral point. pH values greater than 7 are alkaline, and pH values less than 7 indicate acidic solutions.

Conventional pH meters use a combination glass pH electrode, which includes a reference electrode.

The reference electrode provides a stable reference point and completes the electrical circuit.

The pH meter reads the voltage of the two electrodes, converts it to pH units, and displays the result.

These meters can also use a Field Effect Transistor (FET) pH/ATC electrode for measuring pH. The FET uses an ion-sensing solid-state membrane attached to a transistor to measure the hydrogen ion concentration of a solution. These non-glass pH electrodes offer durability, dry storage and a no-glass construction.

The electrode signal varies with the pH, according to the Nernst equation:

$$E = E^\circ + S \cdot \log [\text{H}^+]$$

Where:

E = measured electrode potential

E° = standard potential of the system (constant)

S = slope

Ion Selective Electrode Theory

The measurement of ions plays an important role in water quality applications, industry, research and environmental monitoring. Ion-selective Electrodes (ISEs) respond, more or less exclusively, to a specific type of ion in solution. The particular ion to which an ISE responds depends on the chemical makeup of its sensing membrane. ISEs operate according to a form of the Nernst equation:

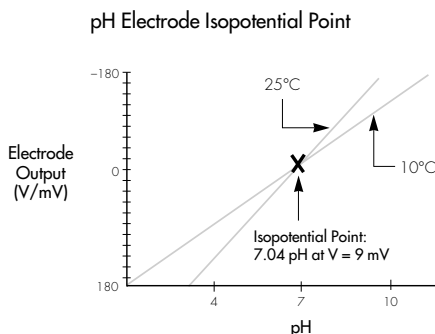
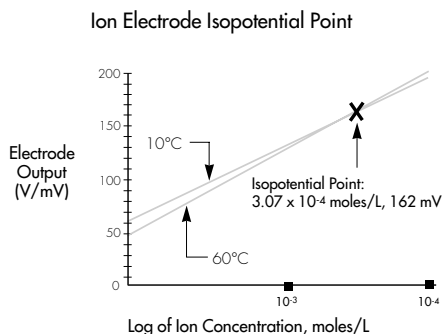
$$E = E_o + S \bullet \log [\text{ion}]$$

Determining the Isopotential Point

The isopotential point is the potential of an electrode system which does not change with temperature. The slope of an electrode changes with temperature according to the Nernst equation. At temperatures $<25^{\circ}\text{C}$, the Nernst factor is $<59.16\text{ mV}$; at temperatures $>25^{\circ}\text{C}$, the Nernst factor is $>59.16\text{ mV}$. (This is automatically allowed for with automatic temperature compensation.) In addition, the zero point of an electrode may change depending on the temperature. For accurate pH measurements, this change should be allowed for. This is done by determining the isopotential point of the pH or ion selective electrode for several buffers at various temperatures. Typical pH electrodes have isopotential points near zero mV (which is the default setting for the meter). For high accuracy pH measurements, or for ion-selective measurements where the sample temperature may widely vary, the isopotential point of the pH or ion-selective electrode may be experimentally determined and entered into the meter.

- Prepare a set of buffers or ion standards bracketing the linear range of the electrode. Place the buffers or standards in a temperature bath at known temperature.
- Place the meter into mV mode.
- Measure and record mV readings of each pH or concentration, and repeat at several temperatures.
- Plot the log of concentration or pH value versus mV reading.
- Connect the points for each temperature.
- To enter the isopotential point, access the pH mode Options Menu, then select "4. Standardize menu" and, afterwards, "9. Set isopotential point."

Where the lines intersect is the isopotential point.



RS-232 Serial Interface Meter Command Set

Sartorius Professional Meters have a bidirectional RS-232 serial port, which can be used to send commands to the meter and output data from the meter. Special characters (Ω , μ , ϵ) are coded using ASCII (not ANSI); use an ASCII font like "Terminal". Also use a terminal emulation like TTY or ANSI, not VT100.

Serial commands follow either "keystroke" mode or high level command mode consisting of "SET", "GET" and "DO" instructions.

(Note: "GET" and "DO" are optional).

Keystroke instructions

KEYS	M	mode
	Z	standardize
	C	cal data
	H	channel
	S	setup
	L	data log
	R	clear
	N	enter/print
	[0 to 9]	equivalent to pressing a numeric key
	-	+/- key
	.	decimal key
	E	used within a number to enter values in exponential form
	!	press soft key #1 (at top, usually help)
	@	press soft key #2 (usually return to measuring screen)
	#	press soft key #3 (usually up arrow)
	\$	press soft key #4 (at bottom, usually down arrow)

Notes: Key commands are acknowledged by the meter with a reply.
Keys = COMMAND_RECEIVED. Multiple keys can be concatenated together into a single command, for example, keys Z413@ (Standardize, options, resolution, set to 3, main), or keys Z4721.2-N@ (Set manual temperature to -1.2).

High Level Instructions

Use commands SET, GET, DO.

Follow command by a keyword like MODE, STDZPH, STDZCONDO, CALDATA, STDZCLEAR, CHANNEL, DATETIME, TIMESTAMP, DISPLAY, READ, INFO

Typical Syntax: [command] [keyword] [channel] [variable(s)]

Error conditions are replied to with an Error response; for example:

"Error: Need channel", "Error: Need mode", "Error: Unspecified".

Accepted commands have a response; indicated below for each command.

Mode Operations

set mode "channel character" "mode id"

Examples: SET MODE A PH
 SET MODE B MV
 SET MODE B ION
 SET MODE C CONDUCTIVITY

Returns confirmation; for example "SET MODE A PH" returns "A mode = PH".
Valid modes are (depending on the meter model) PH, MV, CONDUCTIVITY, RESISTIVITY, PRAC_SALINITY, NACL_SALINITY, DISSOLVED_SOLIDS.

[get] mode "channel character" "mode id"

Examples: [GET] MODE A
 Returns mode information on selected channel; "A Mode = MV".

Channel operations

set channel "channel character" "on | off"

Examples: SET CHANNEL A ON
 SET CHANNEL C OFF
 Returns confirmation; for example "A Channel = ON".

[get] channel "channel character"

Example: [GET] CHANNEL B
 Returns channel information; "A Channel = OFF".

(DO) READ "channel character" (Take reading w/temperature without sending to data log).

Standardization operations

[DO] STDZPH "channel character"

[DO] STDZCLEAR "channel character"

[DO] STDZCONDO "conductivity standard value"

[DO] CALDATA "channel character"

[DO] STDZPH A [Auto-enter a buffer]

Returns "Stdz pH = COMMAND_RECEIVED", followed by the Calibration Data printout.

[DO] STDZCLEAR A [Clear all buffers/standards.]

Returns "Stdz Clear = COMMAND_RECEIVED".

[DO] STDZCONDO 1000 [Enter a standard of 1000 uS/cm.]

Returns "C Stdz Condo = COMMAND_RECEIVED", followed by the Calibration Data printout.

[DO] CALDATA A

Returns "A Cal Data = COMMAND RECEIVED" followed by the Calibration Data printout.

General Meter Setup Operations

SET DATETIME MM/DD/YYYY HH:MM:SS [Leading 0s required, 24-hour time]

[GET] DATETIME Returns: "MM/DD/YYYY
HH:MM:SS"

[GET] INFO Returns Model, Version, Serial#.

(DO) DISPLAY display_text_string (at 0, 0) [x = pixel from left, 0 – 319]

(DO) DISPHY x y display_text_string [y = pixel from top, 0 – 239]

Example: DO DISPHY 15 0

Device ready, press any key.

SET TIMESTAMP #

(GET) TIMESTAMP (Set date/time using 'unix' seconds).

Maintenance

This product contains no user-serviceable parts. All replacement parts should be obtained from Sartorius or an authorized distributor.

Cleaning

The exterior surfaces of this product may be cleaned with a damp cloth or with mild detergent.



Caution

Changes or modifications not expressly approved by the manufacturer will void the user's warranty for this equipment.

Menu Tree Diagram

Mode (A, B & F)

- 1) pH
- 2) mV
- 3) Ion

pH Standardize Menu

- 1) Auto-enter a buffer
- 2) Manual buffer entry
- 3) Clear buffers
- 4) Options menu
- 5) Cal reminder menu
- 6) Select buffer set

pH Options Menu

- 1) Select resolution
- 2) Select stability criteria
- 3) Select signal averaging
- 4) Set standardization delay
- 5) Set pH slope
- 6) Standardize menu
- 7) Manual temperature menu
- 8) Data alarm menu
- 9) Set isopotential point

mV Standardize Menu

- 1) Auto-enter mV offset
- 2) Set mV offset
- 3) Clear mV offset
- 4) Options menu

mV Options Menu

- 1) Select resolution
- 2) Select stability criteria
- 3) Select signal averaging
- 4) Set standardization delay
- 5) Set mV offset
- 6) Standardize menu

Ion Standardization Menu

- 1) Enter a standard
- 2) Set ion slope
- 3) Clear standards
- 4) Options menu
- 5) Cal reminder menu

Ion Options Menu

- 1) Select resolution
- 2) Select stability criteria
- 3) Select signal averaging
- 4) Set standardization delay
- 5) Set ion slope
- 6) Standardize menu
- 7) Manual temperature menu
- 8) Data alarm menu
- 9) Set isopotential point
- 0) Enable incremental modes

Mode (C)

- 1) Conductivity
- 2) Practical salinity
- 3) NaCl salinity
- 4) Resistivity
- 5) Total dissolved solids

Conductivity Standardize Menu

- 1) Enter a standard
- 2) Set cell constant
- 3) Clear standards
- 4) Options menu
- 5) Cal reminder menu
- 6) Calculate solids factor
(TDS mode only)
- 7) Set solids factor
(TDS mode only)

Conductivity Options Menu

- 1) Select resolution
- 2) Select stability criteria
- 3) Select signal averaging
- 4) Set standardization delay
- 5) Set cell constant
- 6) Standardize menu
- 7) Manual temperature menu
- 8) Data alarm menu
- 9) Select display units
- 0) Set temp. coeff.

Data Log Menu

- 1) View data log
- 2) Turn logging On/Off: OFF
- 3) Set logging interval
- 4) Clear data log
- 5) Set sample number
- 6) Set sample label
- 7) Print data log

Setup Menu

- 1) Time and date menu
- 2) Select temperature units
- 3) Select contrast
- 4) Select language
- 5) Setup serial port
- 6) Keypress beep volume
- 7) Select video color scheme
- 8) Show meter information
- 9) Enable measure lock
- 0) Enable strict calibration
- ±) Set screen saver timeout
- .) Restore factory defaults

Accessories

	Order No.
pH/ATC Electrodes:	
Solid-state pH/ATC electrode, KCl filling	PY-P10
Glass pH/ATC electrodes, KCl filling	
Platinum diaphragm	PY-P11
Solid-state electrode, gel filling	PY-P20
Glass electrode, KCl filling, platinum diaphragm	PY-P21
FET (Field Effect Transistor) pH/ATC electrode	PY-P30
ATC connector	PY-T01
Data printer	YDP05-PH
Paper (5 rolls, each 50 m)	6906937
Ribbon	6906918
pH Buffer	
supplied in packs of 50 capsules. The content of the capsule is dissolved in 100 ml of distilled water	
pH = 4.01 ± 0.02 at 25°C	PY-Y01
pH = 7.00 ± 0.02 at 25°C	PY-Y02
pH = 9.00 ± 0.02 at 25°C	PY-Y03
pH = 10.00 ± 0.02 at 25°C	PY-Y04
Storage solution, for pH electrodes, 500 ml	PY-Y05
Cleaning solution, pepsin/hydrochloric acid, 500 ml	PY-Y06
Electrolyte solution, KCl (3 moles/l), free of silver ions, 500 ml	PY-Y07
Conductivity/resistivity standards, traceable back to NIST Standards	
0.084 mS/cm ± 1.0 % at 25°C, 500 ml	PY-Y10
0.147 mS/cm ± 1.0 % at 25°C, 500 ml	PY-Y11
1.413 mS/cm ± 1.0 % at 25°C, 500 ml	PY-Y12
12.88 mS/cm ± 1.0 % at 25°C, 500 ml	PY-Y13

Additional pH/ATC electrodes and connectors for special measuring conditions as well as ion selective electrodes or Redox electrodes are available upon request.

CE Marking

The **CE** marking affixed to the equipment indicates that the equipment meets the requirements of the following Directive(s):

Council Directive 89/336/EEC "Electromagnetic compatibility (EMC)"

Applicable European Standards:

Limitation of emissions:

EN 50081-2 Industrial environment

Defined immunity to interference:

EN 50082-1 Residential, commercial and light industry

EN 50082-2 Industrial environment

Warning!

This is a Class A device that can cause radio interference in residential areas.

If this should occur, the user may be required to take suitable measures to correct and eliminate such interference, and to pay the costs incurred as a result.

Important Note:

The operator shall be responsible for any modifications to Sartorius equipment and for any connections of cables or equipment not supplied by Sartorius and must check and, if necessary, correct these modifications and connections. On request, Sartorius will provide information on the minimum operating specifications (in accordance with the Standards listed above for defined immunity to interference).

Council Directive 73/23/EEC

"Electrical equipment designed for use within certain voltage limits"

Applicable European Standards:

EN 60950 Safety of information technology equipment including electrical business equipment

EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use
Part 1: General requirements

If you use electrical equipment in installations and under ambient conditions requiring higher safety standards, you must comply with the provisions as specified in the applicable regulations for installation in your country.

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specifications and design of the equipment
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The Sartorius logo consists of the word "sartorius" in a bold, lowercase, sans-serif font. A vertical line passes through the center of the letter 'o', which is highlighted with a yellow circle.