

**INSTRUCTIONAL MANUAL**  
**CAT. #72088-01, 72088-02**

**Advanced pH Meter &**  
**Advanced pH Meter Kit**



**Electron Microscopy Sciences**

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## Introduction

Benchtop level analysis in the field! Reads either pH (in 0.01 resolution) or mV in large digits, with time, date, and temperature (in °C or °F) shown simultaneously on the lower display. Also indicates stable reading, low battery and displays calibration data. Scroll 99 data points with time stamps and min/max readings directly on the backlit LCD.

### Features:

- Multi-display LCD screen
- 5 points pH calibration
- N.I.S.T. buffer recognition
- Maximum and minimum
- Hold function
- Backlight for dark environment operation
- Easy to view probe calibration data
- "Ready" icon on LCD display indicates stability for reading
- USB connection for online logging and uploading 99 memories to PC for analysis
- Automatic or manual temperature compensation
- External power adapter (optional) for long use testing
- Auto power off to save battery

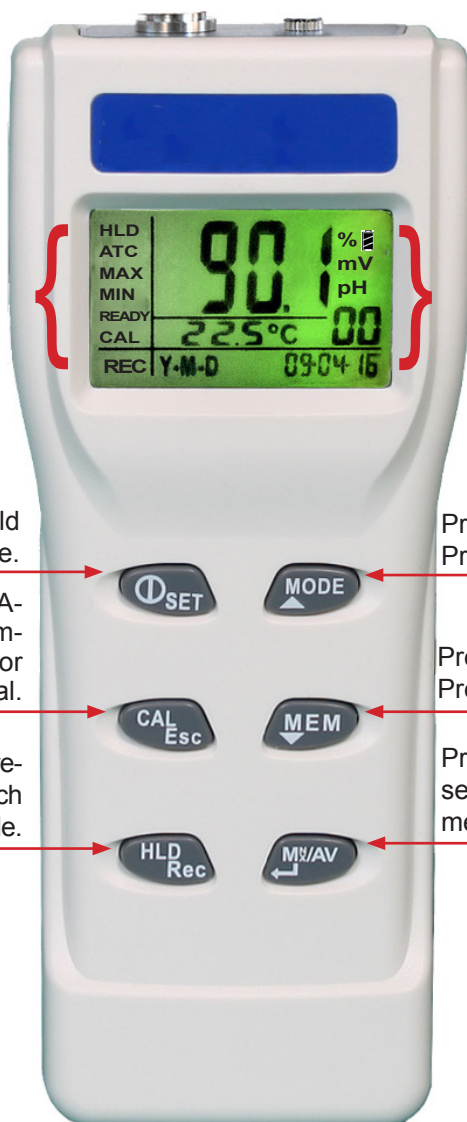
## LCD Display

- **HLD** Holds the current reading on the display.
- **ATC** means the meter is in automatic temperature compensation mode.
- **MAX, MIN** indicate maximum or minimum memory value.
- **READY** indicates the reading is stable.
- **CAL** indicates the meter is in calibration mode.
- **REC** indicates the meter is in recall mode.

Press to turn meter on/off. Press and hold for more than 1 second to enter SET mode.

Switch between NORMAL and CALIBRATION mode Press to enter manual temperature setting. In calibration, setting or recall mode, press to return to normal.

Press to freeze reading. Press again to release. Press for more than 1 second to switch between NORMAL and RECALL mode.



- **LCD** display indicates pH, mV, ORP (mV).
- **pH, mV** indicates the unit of measure displayed.
- The two digits to the right of °C °F on the display indicate the total number of records that contain stored data.
- Real time **88:88:88** is real-time Y-M-D or H:M:S.
- °C/°F are temperature units of measure.

Press to switch mode.  
Press to increase setting value.

Press to save current reading.  
Press to decrease the setting value.

Press to confirm calibration/parameter setting. Press to view the min/max of the memory in recall mode.

## Setup Mode

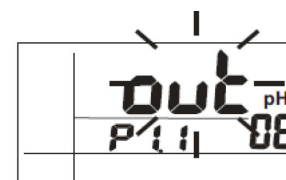
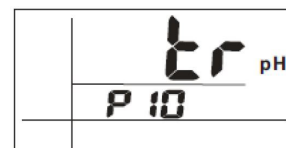
The advanced Setup Mode allows you to customize the following meter preferences and defaults:

P 1.0	Memory Transmission	P 5.0	Ready Function
P 2.0	Clear Memory	P 6.0	Temperature Units
P 3.0	Electrode (pH probe)	P 7.0	Real Time Clock
P 4.0	Buffer Solution (pH)	P 8.0	Reset

### P 1.0 Memory Transmission – transfers stored data from the meter to the computer

- NOTES:**
- ✓ To enter **Setup Mode**, press **SET** for about 2-3 seconds while the meter is in **Normal Mode**.
  - ✓ To exit **Setup Mode** without saving, press **ESC** until the **Normal Mode** appears.
  - ✓ If the meter is in **Setup Mode**, press **ESC** twice to exit.

1. Connect USB cable to the right side of the meter and connect the other end of the cable with the D-sub connector to the computer's serial port. Run the software associated with this feature.
2. Press **SET** for 2 seconds to enter setup.
3. The "TR" icon appears on the middle of the LCD display and P1.0 displays under the "TR" icon.
4. Press **MN/MX/AV**. The "OUT" icon flashes on the upper display and P1.1 displays under the "OUT" icon. This indicates that the memories are transferring. After transmission, the LCD will return to P1.0.

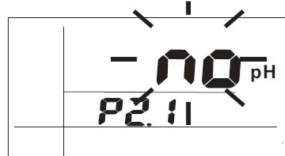
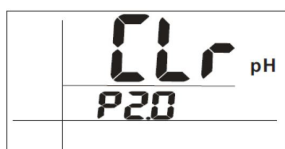


**NOTE:** The meter can store up to 99 records for each parameter. To transmit data for a different parameter, press ▲ to select desired parameter *before* entering setup.

### P 2.0 Clear Memory



The memory clear program is designed to clear 99 memories at one time. Proceed cautiously, as this operation cannot be reversed.



Press **MODE** to select the parameter you want cleared before entering **Setup Mode**.

1. Press **SET** for 2 seconds to enter setup.
2. Press ▲ to select memory clear function.
3. The "CLR" icon appears on the middle display and P2.0 illuminates in the lower display.
4. Press **MN/MX/AV** to enter P2.1.
5. The default "NO" icon flashes on the middle display and P2.1 appears in the lower display.
6. Press ▲ to change the status from "NO" to "YES" and then press **MN/MX/AV** again to confirm clearing of all memory. The LCD display will return to P2.0 when memories are deleted.

## Setup Mode, *continued*

### P3.0 View Slope & Offset

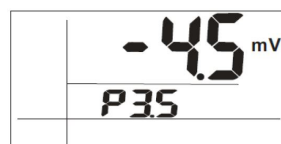
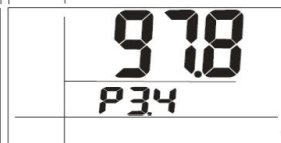
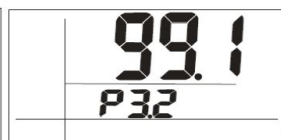
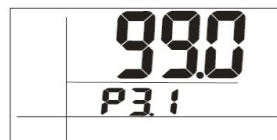
Press **MODE** to select the parameter you want cleared before entering **Setup Mode**.

1. Press **MODE** to select probe type as pH.
2. Press **SET** for 2 seconds to enter setup.
3. Press **▲** until the icon “ELE” appears in the middle display and P3.0 appears in the lower display.
4. Press **MN/MX/AV** to enter P3.1, the LCD displays one of four available slope values; P3.1, P3.2, P3.3, P3.4. If the value is less than 75% or more than 115%, change the probe immediately.
5. Press **MN/MX/AV** to enter P3.2, P3.3, and P3.4.

**NOTE:** The solution range definition differs between NIST and Custom buffers.

Solution Range				
Buffer	P3.1	P3.2	P3.3	P3.4
NIST	0.00 ~ 4.01	4.01~ 6.86	6.86~9.18	9.18~14.00
Custom	0.00 ~ 4.50	4.50~7.00	7.00~9.50	9.50~14.00

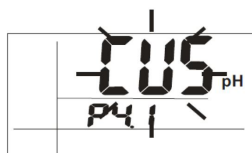
6. Press **MN/MX/AV** to enter P3.5 and view the offset value. The offset value is the mV value of pH 7 and the default offset value is 0.0. The offset value will be different after calibration. If the value is outside the range of  $\pm 60$  mV, replace the probe.



### P4.0 pH Calibration Buffer

This meter allows the selection of two different types of pH buffers: NIST or CUSTOM. Selection of the proper buffer type more accurately calibrates the probe to specific requirements.

- ✓ NIST buffer has five settings:  
pH 1.68, 4.01, 6.86, 9.18, 12.45
- ✓ CUSTOM buffer has five ranges:  
pH 1.00-3.00, 3.50-5.50, 6.00-8.00, 8.50-10.50, 11.50-13.50



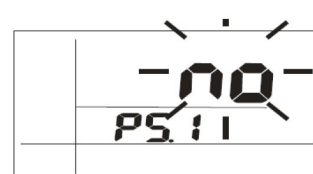
#### Select Buffer

1. Press **SET** for 2 seconds to enter setup.
2. Press **▲** to select pH buffer. “BUF” will appear on the middle of the LCD and P4.0 will appear on the lower portion.
3. Press **MN/MX/AV** to enter P4.1. The default “NIS” (NIST) will flash on the LCD and P4.1 will appear on the lower portion of the display. If you use N.I.S.T. buffers, press **MN/MX/AV** to confirm and the meter returns to P4.0.
4. If your requirement is not for NIST buffers, press **▲** to change the status to CUSTOM buffer.
5. Press **MN/MX/AV** to confirm and the meter will return to P4.0.

## Setup Mode, *continued*

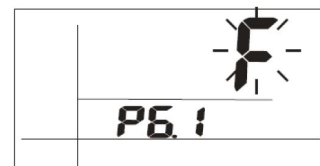
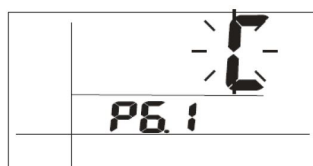
### **P5.0 Ready Icon** – enables/disables the “READY” icon, indicating that the measured reading is stable.

1. Press **SET** for 2 seconds to enter setup.
2. Press **▲** to select “READY” on the display.
3. Press MN/MX/AV to enter P5.1. “YES” will flash on the LCD display and P5.1 will appear on the lower display.
4. Press **▲** to switch between YES or NO.
5. Press MN/MX/AV to confirm.
6. Press ESC to return to Normal Mode.



### **P6.0 Temperature Units** – select either Celsius or Fahrenheit temperature scale

1. Press SET for 2 seconds to enter setup.
2. Press **▲** to select “U” on the upper display. P6.0 is displayed in the lower portion of display.
3. Press MN/MX/AV to enter P6.1. The last selected unit “C” or “F” will appear on the LCD.
4. Press **▲** to select either display.
5. Press MN/MX/AV to save the selection.
6. Press ESC to return to Normal Mode.



### **P7.0 Real Time Clock Setting** – adjusts the meter’s internal clock

NOTE: An internal battery powers the real time clock independent of the power source running the meter.

1. Press SET for 2 seconds to enter setup.
2. Press **▲** to select “RTC” on the LCD display. P7.0 appears on the bottom of the display.
3. Press MN/MX/AV to enter P7.1. The year flashes in the lower right corner of the LCD display. (The year is the last two digits only; for example, 1999 would be 99).
 

Symbol:	Y-M-D	H:M:S
Definition:	Yr.-Mo.-Day	Hr.-Min.-Sec.
Range:	99-12-31	23-59-59
4. Press MN/MX/AV to step through the following “P’s.” All are two digits.
 

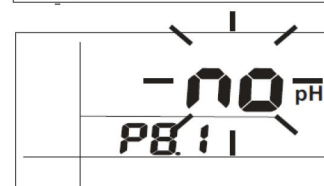
P7.1 = Year	P7.2 = Month	P7.3 = Day
P7.4 = Hour	P7.5 = Minute	P7.6 = Seconds
5. Press **▲** and **▼** to adjust values up or down, respectively.
6. Press ESC to return to P7.0 and Normal Mode.

## Setup Mode, *continued*

### **P8.0 Reset** – resets the meter to factory default setting

**NOTE:** Memory locations are not reset after this procedure.

1. Press SET for 2 seconds to enter setup.
2. Press ▲ to select the reset section of the meter.
3. “rSt” will appear on the LCD and P8.0 will appear directly below.
4. Press MN/MX/AV to enter P8.1.
5. Press ▲ to switch between “YES” or “NO.”
6. Press MN/MX/AV to confirm.
7. Press ESC to return to Normal Mode.



## Probe Calibration

**NOTE:** For highest accuracy:

- Calibrate before each use, if the readings seem erratic, and whenever the batteries are replaced.
- Two-point calibration produces the highest accuracy.
- When using single-point calibration, the buffer temperature must remain stable and the buffer value needs to be close to the sample that will be measured.

### **Directions**

1. Press POWER to turn the meter on and press **MODE** to select “pH” mode. “pH” appears on the LCD.
  2. Select the calibration buffer type: NIST or CUSTOM
- Note:** pH 4 may be calibrated using either the NIST (recommended option) or CUSTOM buffer. pH 7 and pH 10 require the CUSTOM buffer. (See SETUP MODE on page 14.)
3. Rinse the probe in de-ionized water or rinse solution. DO NOT wipe the pH probe dry. Wiping the probe may cause static and cause calibration and measurement instability.
  4. Select the pH buffer and pour enough solution to totally immerse the probe tip into a clean container.
  5. Dip the probe into the container, immersing the probe tip.
  6. Stir the probe gently to create a uniform sample.
  7. Press CAL to enter calibration mode. “CA” will flash on the LCD.
  8. The pH value appears on the main display and 2.00 appears on the secondary display (CUSTOM) or 4.00 appears on the secondary display (N.I.S.T.).
  9. When the measured pH value is stable and the Ready function is enabled (Refer to P5.0 READY ICON page 15). “READY” will appear on the left side of the LCD.

**Note:** If the pH value continues to display different values, check the buffer or probe. (Refer to TROUBLESHOOTING page 32).



## Probe Calibration - Directions, *continued*

NOTE: If using N.I.S.T. buffer: Skip to step 10.

NOTE: If using CUSTOM buffer: Follow instructions for your selected buffer solution:

### pH 4

Press HLD/REC. 4.50 appears on the secondary display. Use ▲ or ▼ to adjust to 4.00.

### pH 7

Press HLD/REC. 4.50 appears on the secondary display.

Press HLD/REC again. If the secondary value does not default to 7.00, use ▲ or ▼ to adjust to 7.00.

### pH 10

Press HLD/REC. 4.50 appears on the secondary display.

Press HLD/REC again. 7.00 appears on the secondary display.

Press HLD/REC again. 9.50 appears on the secondary display. Use ▲ or ▼ to adjust to 10.00.

10. Press MN/MX/AV to confirm. Press ESC to save and return to Normal Mode.

11. Change the buffer solution and repeat previous steps to achieve multiple point calibration.

**NOTE:** Clean the probe in between each buffer.

## Measurement Procedures

### NOTE:

- The meter is powered by 4 AAA batteries. Install batteries or connect an AC adapter to the power jack on the side of the meter.
- Connect a sensor probe to the BNC connector on top of the meter.
- For the pH probe with temperature sensor, also connect the plug into the jack to the right of the BNC connector.
- Connect the USB cable to the meter and computer to upload measurements for computer analysis.

Probe Measurement Parameters		
Probe	pH	mV
ORP Probe	N/A	Yes
pH Probe	Yes	Yes

**IMPORTANT:** The temperature of the measured liquid must be stable.

### pH Measurement

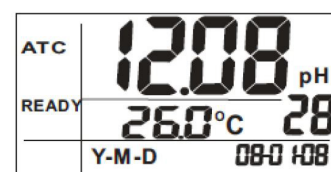
Readings with automatic or manual temperature compensation can be taken with this meter.

**Automatic temperature compensation:** Temperature sensor needs to be plugged into the meter.

**Manual temperature compensation:** default setting is 25°C. **NOTE:** It is also possible to manually adjust the temperature to match working conditions, as measured by a separate thermometer.

### Directions for taking measurement

1. Remove the pH probe soaker bottle by rotating the bottle and cap and slide the bottle and cap off the probe. Rinse the probe tip with de-ionized or distilled water before use. If the probe tip is dehydrated, soak it for 30 minutes in a KCl solution. DO NOT wipe the pH probe dry. Wiping the probe may cause static and cause calibration and measurement instability.
2. Press POWER to turn on. ATC appears to indicate that the automatic temperature compensation probe is connected and working properly.
3. Immerse the probe tip (glass bulb) completely into the sample.
4. Stir the probe gently to create a uniform sample.
5. Wait until the reading has stabilized. If selected in setup, "READY" illuminates to indicate a stable reading.

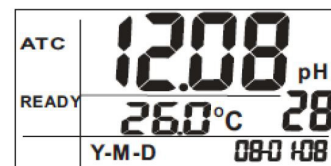


## Measurement Procedures, *continued*

### Directions for taking mV measurement ( $\pm 499\text{mV}$ )

**NOTE:** mV measurement range is from -499 mV to +499 mV with a pH probe.

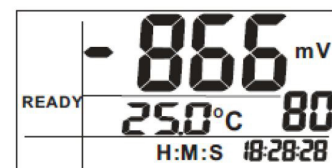
1. Remove the pH probe soaker bottle by rotating the bottle and cap and slide the bottle and cap off the probe. Rinse the probe tip with de-ionized or distilled water before use. If the probe tip is dehydrated, soak it for 30 minutes in a KCl solution. DO NOT wipe the pH probe dry. Wiping the probe may cause static and cause calibration and measurement instability.
2. Press POWER to turn on. Press MODE to select mV mode.
3. Immerse the probe tip (glass bulb) completely into the sample.
4. Stir the probe gently to create a uniform sample.
5. Wait until the reading has stabilized. If selected in setup, "READY" illuminates to indicate a stable reading.
6. To switch between mV and pH, press MODE.



### Directions for taking ORP (mV) Measurement ( $\pm 1999\text{mV}$ )

**NOTE:** ORP (Oxidation Reduction Potential) measurement range is -1999 mV to +1999 mV. Use an ORP probe for measurement:

1. Remove the pH probe soaker bottle by rotating the bottle and cap and slide the bottle and cap off the probe. Rinse the probe tip with de-ionized or distilled water before use. If the probe tip is dehydrated, soak it for 30 minutes in a KCl solution. DO NOT wipe the pH probe dry. Wiping the probe may cause static and cause calibration and measurement instability.
2. Press POWER to turn on. Press MODE to select mV measurement.
3. Immerse the probe tip (glass bulb) completely into the sample.
4. Stir the probe gently to create a uniform sample.
5. Wait until the reading has stabilized. If selected in setup, "READY" illuminates to indicate a stable reading.



**NOTE:** There is no need to take temperature compensation into consideration when using an ORP probe to measure.

## Temperature Compensation

### Automatic with pH probe (ATC):

Plug the temperature sensor connector into the jack on top of the meter next to the larger BNC connector.

### Manual with pH probe (MTC):

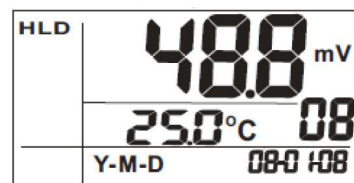
1. To set the temperature, press MN/MX/AV for more than 2 seconds, "CA" will flash on the LCD Display.
2. Press the ▲ or ▼ to change the temperature value and then press MN/MX/AV to save and return to Normal Mode.



## Hold Function

This function allows you to freeze the current reading on the display in Normal Mode.

1. Press HLD in Normal Mode. "HLD" appears on the display.
2. Press HLD and the meter returns to Normal Mode.

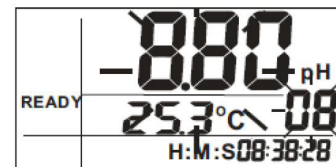


## Record Memory and Recall Memory

### Record Memory

The meter can store up to 99 records each of pH, mV, and ORP (mV) readings.

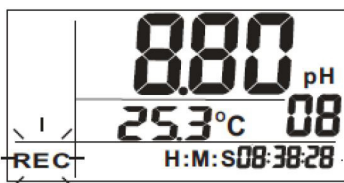
1. In any measurement or Hold Mode, press MEM to save the data.
2. The memory number and measured value will flash and then return to Normal Mode.



**NOTE:** Further data can not be saved once the memory is full. See Clear Memory on page 11 to create additional space.

### Recall Memory

This function recalls readings stored in the memory.



1. Press REC for more than 2 seconds to enter Recall Mode. "REC" will flash on the LCD display.
2. Press ▲ to select next memory content. Press ▼ to select previous memory.
3. To exit memory recall, press REC for more than 2 seconds.

## Recall Maximum & Minimum

This function reviews a maximum and minimum value for all the data points stored in memory.

1. Press REC for 2 seconds to enter Recall Mode. "REC" will flash on the LCD.
2. Press MN/MX/AV to view the minimum value of the memory.
3. Press MN/MX/AV again to view the maximum value.
4. To exit memory recall, press REC for more than 2 seconds.

## Backlight

- Press any button to activate the backlight function.
- The backlight turns off automatically after 10 seconds of inactivity.

## Auto Power Off

**NOTE:** The auto power off function will be disabled while in calibration mode.

- The meter turns off automatically after 20 minutes of inactivity.
- To override the function, hold down POWER and HLD simultaneously for 2 seconds when turning the meter on until "n" appears.



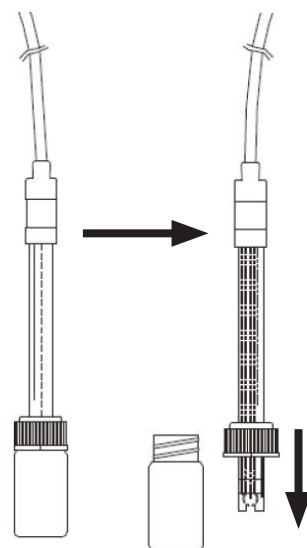
## Maintenance

### pH Probe

**NOTE:** pH probe must be kept wet when the meter is not in use. The probe is well protected by a plastic bottle containing solution.

#### To Use or Store Probe

- Rotate the bottle to remove from the probe. Pull down the cover and remove it from the probe.
- After use, put cover back on the probe and plug the probe into the bottle. Rotate the bottle to fit into the cover tightly.



#### Preventative Maintenance

- **Never** use distilled or de-ionized water for storage.
- **Never** touch or rub the glass bulb tip.
- **Always** keep the pH glass bulb wet by using the plastic bottle to protect and store the probe. It can also be stored in a KCl solution.
- **Always** rinse pH probe in de-ionized water before using.

#### Probe Testing

1. Connect the ORP probe to the meter via the BNC connector.
2. Put the probe in a buffer solution of pH 7.00 with saturated quinhydrone.
3. Stir; mV reading (E1) should be  $86 \pm 15$  mV.
4. Rinse the probe with distilled water between each use.

**NOTE:** Keep the ORP probe wet. If not in use for long periods, rinse and store in the soaker bottle filled with the saturated KCL solution.

### ORP Probe Cleaning

Slow response time and/or inaccurate reading can result from a contaminated sensing element. It is recommended to clean ORP after every use. Contamination can come from either mineral matter or oil/grease. Follow the protocol below for decontamination.

**Mineral Contamination** – put the sensing element in a HCl solution 0.1 N for 10 minutes. Rinse in distilled water.

**Oil/Grease Contamination** – clean with a mild detergent, then rinse with distilled water.

**NOTE:** Upon completion of either cleaning method, immerse the probe in a saturated buffer solution with pH 4.01 for 15 minutes and rinse with distilled water.

### Probe Performance

The ORP probe sensing element is made of a high purity metal. Clean the element when slow response time and inaccurate readings occur which may be caused by an oxidation reduction coating that formed on the surface of the sensing element after it has been soaked in a solution for a long time period. Clean the element to.

A slow response time and inaccurate readings may also occur when measuring solutions with a low concentration of oxidation reduction matter and slow ion exchange rate. It may take 8-24 hours to obtain an accurate reading under these conditions.

## Troubleshooting

Issue	Solution
Meter does not turn on	<ol style="list-style-type: none"> <li>1. Press POWER for more than 2 seconds.</li> <li>2. Check connections of the power adapter or batteries.</li> </ol>
Unstable readings	<ol style="list-style-type: none"> <li>1. Stir the solution to make a uniform sample and make sure the sensor is completely immersed in the solution. <b>NOTE:</b> The measurement must be done while probe is in the container/solution.</li> <li>2. RF emissions from unknown source may disrupt readings, so move to new location for measurement.</li> </ol>
Readings not changing	<ol style="list-style-type: none"> <li>1. Check to see if meter is in "HOLD" mode.</li> <li>2. Release "HOLD" function.</li> <li>3. Check to see if meter is in "MTC," if so, input temperature value.</li> </ol>
Slow response	<ol style="list-style-type: none"> <li>1. Clean and re-calibrate the probe.</li> <li>2. Replace with a new probe.</li> </ol>
Wrong real time	<p><b>NOTE:</b> Incorrect real time display will not affect the measurements.</p> <ol style="list-style-type: none"> <li>1. Internal batteries (separate from internal batteries that power the meter) need replacing.</li> </ol>

## Error Codes

Error code	Description
E02	Reading is under the lower limit
E03	Reading is over the upper limit
E04	Preceded by another error
E12	Factory calibration data error; Reset meter
E13	Slope or Offset value of pH probe is out of range
E31	Measuring circuit failure; Restart meter
E32	Memory Integrated Circuit failure

## PC Connections

The meter can interface with a personal computer to capture online or stored data.

### Directions

1. Plug the USB cable into the cable jack on the side of the meter.
2. Plug D-sub 9 pin type connector into a computer Serial COM port. **NOTE:** COM ports 1-8 can be used.
3. Insert CD-Rom in computer and follow the procedure in the operation manual located on the CD.

### Protocol Information

Protocol Information	
USB protocol settings	9600 bps, 8 data bits, no parity. (Transmits ASCII code every second.)
Normal Data	pxx.xxpH: mxx.xxmV:Txxx.xC(F)@ 2007-04-18
	18:48:48LRCCRLF
Errors	ExxNul: ExxNul: ExxNul @ 2007-04-18
	18:48:48LRCCRLF
Description	\$pH:mV:TpH LRC CRLF
Reading the Values	First value is pH reading in pH Second value is Voltage reading in mV, Third value is Temperature of pH probe inC/F "x" is a numerical value

### Format in Memory Transmit pH Mode

Protocol Information	
Normal Data	Pxx.xxpH: Txxx.xC(F)#xx@2007-04-18
	18:48:48LRCCRLF
Errors	ExxNul: ExxNul: #xx @2007-04-18
	18:48:48LRCCRLF
Description	\$pH: Temp LRCCRLF

### Format in Memory Transmit mV Mode

Protocol Information	
Normal Data	Mxx.xxmV: Txxx.xC(F) #xx @2007-04-18
	18:48:48LRCCRLF
Errors	ExxNul: ExxNul #xx @2007-04-18
	18:48:48LRCCRLF
Description	\$mV:Temp LRC CRLF

## Power Supply

The meter can be powered by a 9V external adapter or by 4 AAA batteries. When using batteries, ensure the batteries are inserted into the compartment correctly and securely. NOTE: Check polarity before inserting the batteries.

## pH/mV Default Preferences (Display “pH” )

Program	Preference	Default	Displayed
P1.0	Memory (Transmitting)	No default	“tr”
P1.1	Memory Sent by USB	No default	“out”
P2.0	Memory Clear	“no”	“CLr”
P2.1	CLR Confirm	“no”	“no” / “yes”
P3.0	Electrode		“ELE”
P3.1-3.4	Slope	100.0%	Slope value
P3.5	Offset	0.0 mV	Offset value
P4.0	Buffer Solution		“buF”
P4.1	Select Buffer	“NIST”	“nist” / “cust”
P6.0	Ready Function		“rdy”
P6.1	Enable or Disable	“yes”	“no” / “yes”
P7.0	Temp Unit		“U”
P7.1	Select C or F	“C”	“C” or “F”
P8.0	Real Time Clock		“rtc”
P8.1-8.6	Setting YMD, HMS		“rtc”
P9.0	Reset	“no”	“rst”
P9.1	Reset Confirm	“no”	“no” / “yes”

## Specifications

Parameter	Range	Resolution	Accuracy
pH	0 to 14	0.01	± 0.02 pH
mV	-499 to 499	± 0.1 mV (-199.9 to 199.9) otherwise ± 1mV	± 0.2 mV -199.9 to 199.9 otherwise ± 2 mV
ORP	-199.9 to 199.9	± 0.1 mV (-199.9 to 199.9) otherwise ± 1mV	± 0.2 mV -199.9 to 199.9 otherwise ± 2 mV
Temp °F	23 to 176°F	0.1°	± 2 °F
Temp °C	-5 to 80°C	0.1°	± 1 °C

**Specifications, continued**

*Operation temperature:* 5°C to 40°C

*Operation RH%:* Up to 95% without condensation

*Storage Temperature:* -20°C to 60°C

*Storage RH%:* Up to 95% without condensation

*Dimensions:* 7" × 2¾" × 1¼" (178 × 70 × 32 mm)

*Weight:* 6.5 oz (184 g)

**Temperature Effect on NIST pH Buffers**

	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C
<b>pH 1.68</b>	1.67	1.67	1.67	1.67	1.68	1.68	1.69	1.69	1.70	1.70	1.70
<b>pH 4.01</b>	4.01	4.01	4.00	4.00	4.00	4.01	4.01	4.02	4.03	4.04	4.06
<b>pH 6.86</b>	6.98	6.95	6.92	6.90	6.88	6.86	6.85	6.84	6.84	6.83	6.83
<b>pH 9.18</b>	9.47	9.38	9.32	9.27	9.22	9.18	9.14	9.10	9.07	9.04	9.01
<b>pH 12.45</b>	13.43	13.21	13.00	12.81	12.63	12.45	12.29	12.13	11.99	11.84	11.70



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