Green power, Hybrid power
pH, mV/ORP, RS232

pH METER

Model : PH-209G

Your purchase of this pH METER marks a step forward for you into the field of precision measurement. Although this pH METER is a complex and delicate instrument, its durable structure will allow many years of use if proper operating techniques are developed. Please read the following instructions carefully and always keep this manual within easy reach.

OPERATION MANUAL

TABLE OF CONTENTS

1. FEATURES

* Hybrid power, power supply from green power (handy generator) or battery. If power source come from " Green power ", battery is no need. Operate the generator 20 seconds will offer 10 minutes energy typically.
* Professional pH/mV METER.
  pH range : 0 to 14 pH x 0.01 pH.
  mV range : -1000 mV to 1000 mV.
* The instrument is with mV (millivolt) function for mV measurement. It can cooperate with optional ORP probe to be a professional ORP meter)
* Wide range manual temperature compensation adjustment .
* Optional ATC (Automatic Temp. Compensation) probe is available for pH measurement.
* Internal Temp. unit ℃ or ℉ selection.
* pH function with high input impedance avoids measuring error.
* Microprocessor circuit assures high accuracy and reliable performance.
* Large LCD, dual function display.
* Records Maximum and Minimum readings with recall.
* Data hold.
* Auto power shut off to battery life or manual power off.
* Powered by 006P DC 9V battery.
* RS 232/USB computer serial interface.
* Easy and automatic pH calibration procedures.
* Using the durable, long-lasting components and a strong lightweight ABS-plastic housing case.
* Wide applications: water conditioning, aquariums, beverage, fish hatcheries, food processing, photography, laboratory, paper industry, plating industry, quality control, school & college.

2. SPECIFICATIONS

2-1 General Specifications

Circuit	Custom one-chip of microprocessor LSI circuit.	
Display	40 mm x 32 mm LCD (Liquid crystal display).	
Measurement	pH	0 to 14 pH
	mV	-1000 mV to 1000 mV
Input Impedance	10^12 ohm	
Temperature Compensation for pH measurement	Manual	0 to 100 ℃, be adjusted by push button on front panel.
	Automatic (ATC)	* Cooperate the optional Temp. probe, TP-07. * 0 to 65 ℃.
pH Calibration	pH 7, pH 4, and pH 10, 3 points calibration ensure the best linearity and accuracy.	
Data hold	Hold the current reading value on the display.	
Memory Recall	Maximum and Minimum reading values can be saved and retrieved by record function.	
Power off	Auto shut off saves battery life or manual off by push button.	
Data Output	RS232/USB PC serial interface. * Connect the optional RS232 cable UPCB-02 will get the RS232 plug (D9 plug). * Connect the optional USB cable USB-01 will get the USB plug.	
Overload indication	"- - - -" symbol on the display.	
pH Electrode	Optional, Any pH electrode with BNC connector.	
Operating Temperature	0 ℃ to 50 ℃(32 ℉ to 122 ℉).	

Operating Humidity	Max. 80% RH.
Sampling Time	Approx. 1 second.
Power Supply *Hybrid power	**Green power :** Power from the handy generator, battery is no need.
	Battery power : DC 9V battery, 006P, MN1604 (PP3) or equivalent. * Alkaline or heavy duty type.
Power Consumption	Battery power : Approx. DC 4.5 mA.
Weight	362 g/0.8 LB (battery included).
Dimension	170 x 70 x 39 mm (6.7 x 2.8 x 1.1.5 inch).
Standard Accessories	Instruction manual...........1 PC.
Optional Probes & Accessories (Ref. page 20)	pH electrodes : * General purpose pH electrode, PE-03 * General purpose pH electrode, PE-11 * Professional pH electrode, PE-01 * Spear tip pH electrode, PE-04HD, PE-06HD * Glass electrode, PE-02 * Plane pH electrode, PE-08 * pH electrode build in Temp. sensor, PE-05T * pH electrode + Temp. probe, kit, PE-03K7 ATC probe (Automatic temp. probe), TP-07 ORP electrode, ORP-14 Hard carrying case, CA-06 Soft carrying case, CA-05A RS232 cable, UPCB-02 USB cable, USB-01 Application Software, SW-U801-WIN

2-2 Electrical Specifications (23 ± 5 ℃)

Measurement	Range	Resolution	Accuracy
pH	0 to 14 pH	0.01 pH	± (0.02 pH + 2 d)
mV	0 to ± 1000 mV	1 mV	± (0.5% + 2 d)

* pH accuracy is based on calibrated meter only.
* Specification tests under the environment RF Field Strength less than 3 V/M & frequency less than 30 MHz only.

3. FRONT PANEL DESCRIPTION
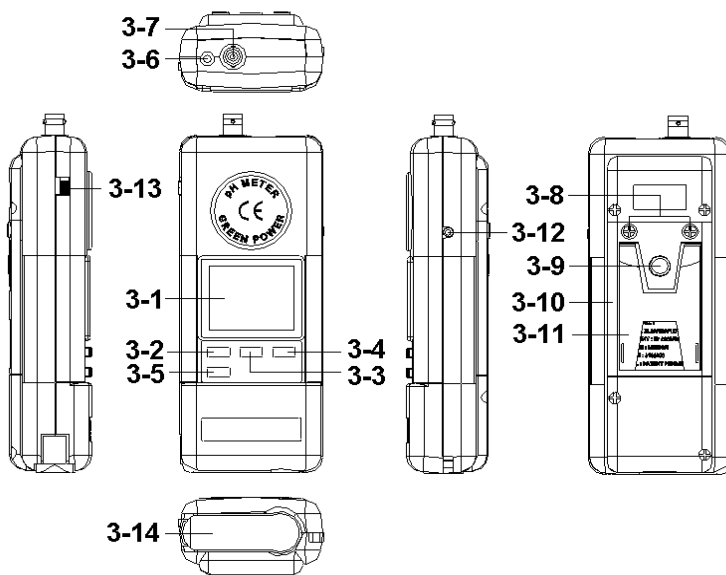
Fig. 1

3-1 Display

3-2 Power Button (ESC Button)

3-3 Hold BUTTON (FUNCTION/▲/CAL Button)

3-4 REC Button (ENTER/CAL Button)

3-5 ▼ Button (SET Button)

3-6 ATC Probe Input Socket

3-7 pH Electrode Input Socket (bnc Socket)

3-8 Screws for battery cover

3-9 Tripod Fix Nut

3-10 Battery compartment / Cover

3-11 Stand

3-12 RS232 Computer Interface Socket

3-13 Power type switch

3-14 Power generator's handle

4. POWER TYPE SELECTION

4-1 Green power (No battery) supply

If power supply will come from green power (handy generator), the procedures are following :

Slide the " Power type switch " (3-13, Fig. 1) to the " G " position, the meter will offer the power source from the Handy generator (Green power), battery is no need.

1) There is a " Power generator's handle " (3-14, Fig. 1) on the bottom of the housing case.

Power generator's handle
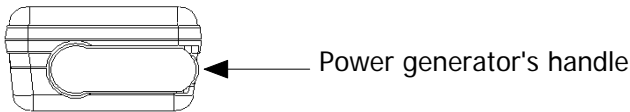
2) a. Power off the meter.
   b. Lift and extend the " Power generator's handle " and rotate the handle in clockwise direction will generate the power energy into the meter, refer Fig. a. b. c.

Fig. a

lift

Fig. b

extend

Fig. c

rotate

c. Operate the generator 20 seconds will offer 10 minutes power supply for the meter typically. If operate the generator more time, the meter will save more power into the meter.

4-2 Battery supply

If intend use the battery power, the procedures are following :

Install the DC 9V battery into the " Battery compartment " (3-10, Fig. 1)

Slide the " Power type switch " (3-13, Fig. 1) to the " B " position, the meter will offer the power source from the battery.

5. MEASURING PROCEDURE

5-1 pH Measurement
Calibration procedures are recommended to be done before pH measurement, refer section 6, page 10.
1) Connect the pH ELECTRODE to the " pH BNC Input Socket " (3-7, Fig. 1).
2) Power on the instrument by pressing the " Power Button " (3-2, Fig. 1).

3) **Manual temperature compensation**

* If intend to make the operation under the " Manual temperature compensation ", setting the desired Temp. compensation value first, details refer to page 15 section 6-1 " Manual temperature compensation setting "

Automatic temperature compensation

   * If intend to make operation under the ATC (
     Automatic temperature compensation, it should
     prepare an optional Temp. probe TP-07, plug the
     Temp. probe's plug into the " ATC Probe Input
     Socket " (3-6, Fig. 1) and insert the Temp. sensing
     head into the measurement solution, the lower
     LCD display will show the temperature value of solution.

4) Place the pH electrode into the solution, the instrument
   will have the pH value on the display.
5) After the measurement, please rinse the electrode with
   distilled water.

5-2 mV Measurement (ORP Measurement)

The instrument build in mV (millivolt) measurement
function, which enable you to make ion-selective, ORP
(oxidation-reduction potential), and other precise mV
measurements.
1) Power on the instrument by pressing the " Power
   Button " (3-2, Fig. 1).
2) Press the " FUNCTION Button " (3-3, Fig. 1) continuously
   at least two seconds until Display show the " mV "
   indicator then release the button, it is ready for the
   " mV " (ORP) measurement.
3) Connect the ORP ELECTRODE to the " BNC Input
   Socket " (3-7, Fig. 1).

   * During the Display show the " mV " indicator, press
     the " FUNCTION Button " (3-3, Fig. 1) continuously
     at least two seconds until Display show the " pH "
     indicator then release the button, the meter will
     return to " pH " measurement.

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5-3 Temp. Measurement
1) Plug the " Optional ATC Temp. Probe, TP-07 "
   into the " ATC Probe Input Socket " (3-6, Fig. 1).
2) Place the " Temp. Probe " into the measurement
   solution, the Display will show the temperature
   value that sensing from the Temp. probe's head.

5-4 Data Hold
 Press the " Hold Button " (3-3, Fig. 1) will hold the
 measured value & the LCD will indicate a " HOLD " symbol
on the display during the measuring.
 * Press the " Hold Button " again to exit the data hold
   function.

5-5 Data Record (Max., Min. reading)
* The data record function records the maximum and
   minimum readings. Press the " REC. Button " (3-4, Fig. 1)
   to start the Data Record function and there will be a
   " REC " symbol on the display.
* With the " REC " symbol on the display :
   a) Press the " REC. Button " (3-4, Fig. 1) once, the
      " REC Max " symbol along with the maximum value
      will appear on the display.

      If you intend to delete the maximum value, just press
      the " Hold Button " (3-3, Fig. 1) for a while, then
      the display will show the " REC " symbol only &
      execute the memory function continuously.

   b) Press the " REC. Button " (3-4, Fig. 1) again, the
      " REC Min " symbol along with the minimum value
      will appear on the display.

      If you intend to delete the minimum value, just press
      the " Hold Button " (3-3, Fig. 1) for a while, then
      the display will show the " REC " symbol only &
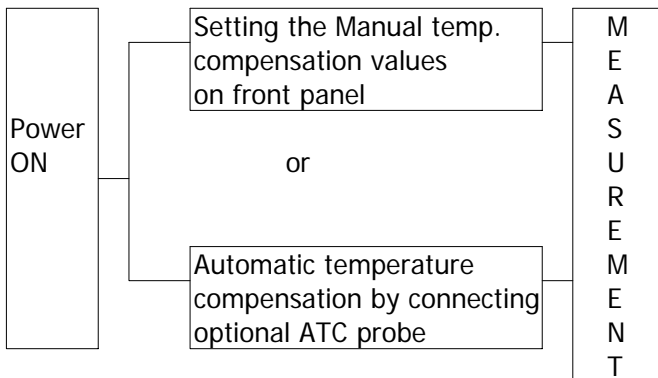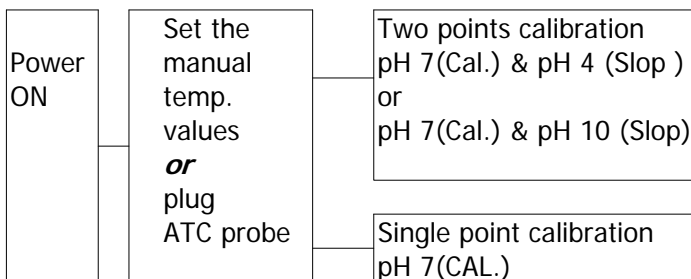   execute the memory function continuously.

   c) To exit the memory record function, just press the
      " REC " button for 2 seconds at least. The display will
      revert to the current reading.

5-6 Following are the block diagrams for quick measuring procedures

pH measuring procedures

Power ON	Setting the Manual temp. compensation values on front panel	M E A S U R E M E N T
	or	
	Automatic temperature compensation by connecting optional ATC probe	

Calibration

Power ON	Set the manual temp. values *or* plug ATC probe	Two points calibration pH 7(Cal.) & pH 4 (Slop) or pH 7(Cal.) & pH 10 (Slop)
		Single point calibration pH 7(CAL.)

Other measuring procedures

DATA HOLD	MEMORY RECORD Max., Min.	RS232 OUTPUT

Power management

AUTO POWER OFF (Not available during Memory Record Function)	or	MANUAL POWER OFF
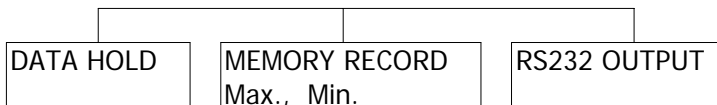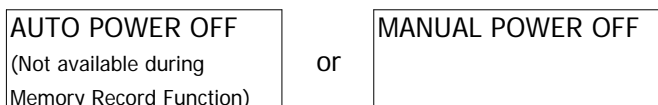
6. pH CALIBRATION PROCEDURE

6-1 Calibration Consideration

 The most ideal pH ELECTRODE generates 0 mV at pH 7.00 (177.4 mV at pH 4) and the meter has been always calibrated with signals which simulate the most ideal pH ELECTRODE (based on 25℃ ambient environment). However not every pH ELECTRODE is as accurate as the most ideal one, so calibration procedures are necessary to be done before the first time measurement.
In addition to the first time measurement, users are also recommended to execute the calibration procedures to ensure the high accuracy measurement.

6-2 Required Equipment for Calibration
1) pH ELECTRODE (optional).
2) pH-7, pH-4 pH buffer solutions (optional).

6-3 Two Points Calibration Procedure
1) Connect the pH ELECTRODE to the " pH BNC Input Socket " (3-6, Fig. 1).
2) Power on the instrument by pressing the " Power Button " (3-2, Fig. 1).
3) Adjust the " Temperature Compensation Value " to make it same as the temperature value of the pH buffer solution.

 Manual temperature compensation value adjustment procedure, refer to section 5-1 (Page 6).
 Automatic temperature compensation value adjustment procedure, please refer to 5-1 (Page 7).

pH 7 calibration

* Immerse the electrode in the pH 7 buffer solution.
* Press once the two " CAL Buttons " (3-3. 3-4, Fig. 1)
  together, the upper display show value of " 7.00 "
  and the lower display show the text " CAL " .

```
     7.00
     CAL
```

* Press the " ENTER Button " (3-4, Fig. 1) once,
  the upper display (7.00) will flash for around 6
  seconds then stop to flash.

```
     7.00 ———— Flashing around 6 second
     CAL
```

After that, the meter calibrates itself automatically,
then show :
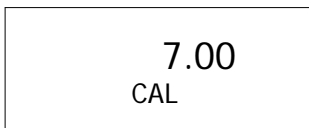
```
     End
     CAL
```

```
   7.00        Finish  the pH 7.00
               calibration
```
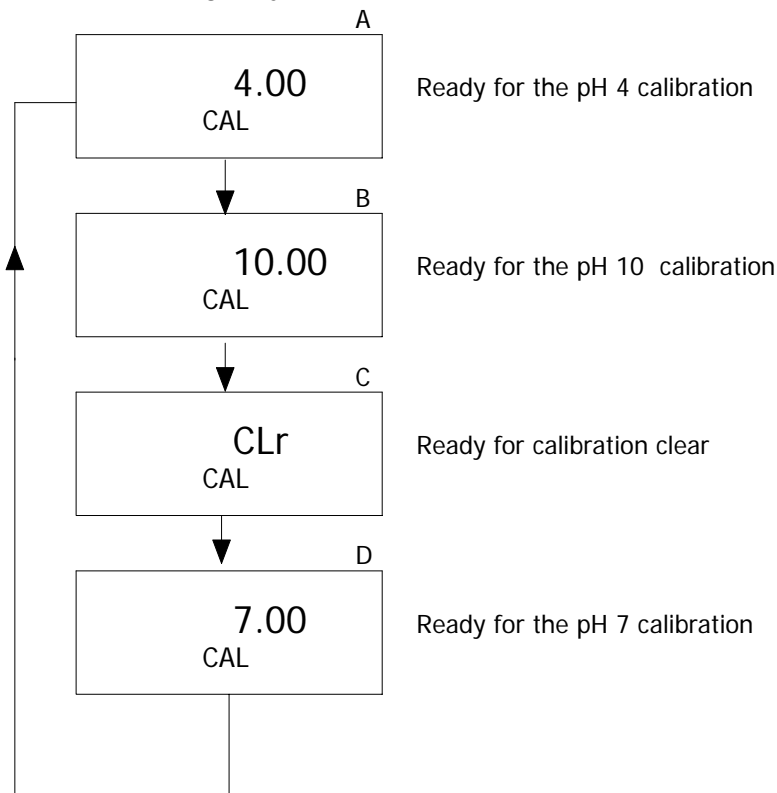
pH 4 or pH 10 calibration

  * Rinse the electrode with distilled water at first.
  * Immerse the electrode in the pH 4 buffer solution (or pH 10 buffer solution).
  * Press once the two " CAL Buttons " (3-3. 3-4, Fig. 1) together and once , the upper display show value of " 7.00 " and the lower display show the text " CAL " .

```
        7.00
     CAL
```

  * Press both the " ▲ Button " (3-3, Fig. 1) or " ▼ button " (3-5, Fig. 1) once in sequence, the screen will show as following in cycle.

A
```
       4.00
    CAL
```
Ready for the pH 4 calibration

B
```
       10.00
    CAL
```
Ready for the pH 10 calibration

C
```
       CLr
    CAL
```
Ready for calibration clear

D
```
       7.00
    CAL
```
Ready for the pH 7 calibration

* **For the pH 4 calibration just select the above
A screen.
For the pH 10 calibration just select the above
B screen.**

* Upon select the screen A or (screen B), then press
the " ENTER Button " (3-4, Fig. 1) once, the upper
display (7.00 or 4.00) will flash for around 6 seconds,
then stop to flash. After that, the meter calibrate
itself automatically, then show :
then show :

```
           End
           CAL
```
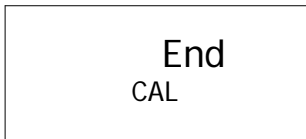
* Then the screen will return the normal measuring
screen and finish the pH 4 (pH 10) calibration.
* Rinse the electrode with distilled water again.

4) **Repeat above pH 7 calibration, pH 4 (pH 10)
calibration procedures two times at least.**
5) The instrument and electrode are now finished the
" Two Points Calibration " & ready for the measurement.

Remark :
* The two points calibration can be executed either
pH 7 calibration and pH 4 calibration
or
pH 7 calibration and pH 10 calibration
* It should make the pH 7 calibration at first then
following the pH 4 (pH 10) calibration.
It can not make the calibration that start from the
pH 4 (pH 10) calibration at first.

Calibration clear

**During execute the calibration procedures, if
happen some thing wrong (Display show Error
information), then execute the following
" Calibration clear " procedures will clear all the
existing calibration data and return to the Default
value.
However after execute the " Calibration clear ".
then make the calibration again. If the Display
still show the " Err " (error information), then
the " Standard solution " or the pH electrode "
may existing problem.**

The " Calibration clear " procedures are :
* Do not necessary to connect the pH Electrode
  to the meter.
* Refer page 12, select the " CLr " screen (C screen),
  press the " ENTER Button " (3-4, Fig. 1) once, the
  Display will show following and finish the " Calibration clear "
  procedures.

```
          End
          CAL
```

6-4 Single Point Calibration
If pH 4 and pH 10 buffer solution are not available, single
point (pH 7) calibration can be executed only, refer to
page 11. The pH 4 (pH 10) calibration can be
overleaped.
However for more accurate measuring result and linearity,
two points calibration is always recommended.

7. ADVANCED SETTING

When execute the following Advanced Setting Procedures should cancel the " Hold function " and the " Record function " first. The display will not show the " HOLD " and the " REC " indicator

Press the " SET Button " (3-5, Fig. 1) continuously at least five seconds will enter the " Advanced Setting ", then press the " ▲ Button " (3-3, Fig. 1) or " ▼ Button " (3-5, Fig. 1) once a while in sequence to select the four main function, the upper Display will show " SEt ", the lower display will show :

noAtc.... Setting the manual Temp. compensation value
℃(℉).... Change the Temp ℃, ℉ unit
OFF....... Auto power ON/OFF management
Code..... Setting the further calibration code

7-1 Setting the manual Temp. compensation value
When the lower display show " noAtc " :
1) Press the " Enter Button " (3-4, Fig. 1) once, the upper display will show " Manual Temp. compensation value " with Temp. unit, use the " ▲ Button " (3-3, Fig. 1) or " ▼ Button " (3-5, Fig. 1) to select the " Manual Temp. compensation value ".
2) After setting the " Manual Temp. compensation value ", press the " Enter Button " (3-4, Fig. 1) will save the setting value with default.

   * If before press the " Enter Button ", just press the " ESC Button " (3-2, Fig. 1) will escape the Advanced Setting procedures without saving the setting value into the circuit memory.

* **The function of " Setting the manual Temp. compensation value " can be activated when the ATC Temp. probe is not to plug into the " ATC Probe Input Socket " (3-6, Fig. 1) only. If the meter already plug in the " ATC Temp. probe ", it can not set the " Manual Temp, value ".**

7-2 Change the Temp ℃, ℉ unit
When the lower display show " ℃ " or " ℉ " :
1) Press the " Enter Button " (3-4, Fig. 1) once, the upper display will show the text " C " or " F ", use the " ▲ Button " (3-3, Fig. 1) or " ▼ Button " (3-5, Fig. 1) to select the upper text to " C " or " F ".

   C - The Temp. unit is ℃.
   F - The Temp. unit is ℉.

2) After select the upper text to " C " or " F ", press the " Enter Button " (3-4, Fig. 1) will save the setting Temp. unit (℃,℉) with default.

   * *If before press the " Enter Button ", just press the " ESC Button " (3-2, Fig. 1) will escape the Advanced Setting procedures without saving the selecting Temp. unit into the circuit memory.*

7-3 Auto power ON/OFF
When the lower display show " OFF " :
1) Press the " Enter Button " (3-4, Fig. 1) once, the upper display will show " YES " or " no " , use the " ▲ Button " (3-3, Fig. 1) or " ▼ Button " (3-5, Fig. 1) to select the upper text to " no " or " YES ".

   no - Auto Power Off management will disable.
   YES - Auto Power Off management will enable..

2) After select the upper text to " no " or " YES ", press
the " Enter Button " (3-4, Fig. 1) will save the
setting function with default.

> * If before press the " Enter Button ", just press
> the " ESC Button " (3-2, Fig. 1) will escape the
> Advanced Setting procedures without saving the
> function into the circuit memory.

7-4 Setting the further calibration code
When the lower display show " Code " :
It just press the " ESC Button " (3-2, Fig. 1) to exit due
to this setting function is for the service technician only,
not available for the user.

8. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm
terminal (3-12, Fig. 1).
The data output is a 16 digit stream which can be utilized
for user's specific application.
A RS232 lead with the following connection will be required
to link the instrument with the PC serial port.
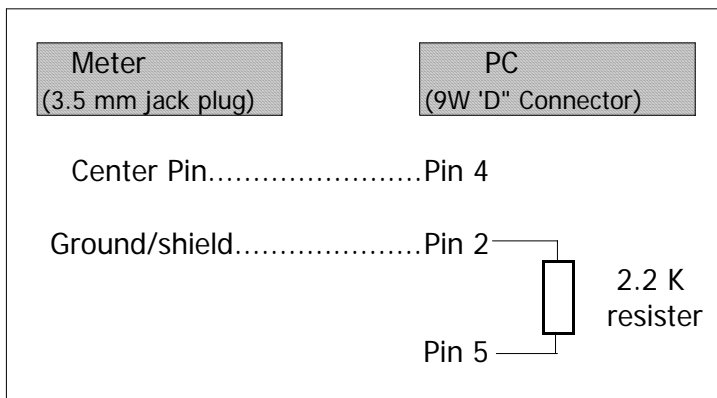
The 16 digits data stream will be displayed in the following format :

```
D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0
```

Each digit indicates the following status :

Each digit indicates the following status :

D15	Start Word		
D14	4		
D13	When send the upper display data = 1 When send the lower display data = 2		
D12, D11	Annunciator for Display		
	℃ = 01	℉ = 02	pH = 05
	mV = 18		
D10	Polarity 0 = Positive 1 = Negative		
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP		
D8 to D1	Display reading, D8 = MSD, D1 = LSD *For example :* *If the display reading is 1234, then D8 to D1 is :* *00001234*		
D0	End Word		

RS232 setting

Baud rate	9600
Parity	No parity
Data bit no.	8 Data bits
Stop bit	1 Stop bit

9. BATTERY REPLACEMENT

1) Use the battery power supply, when the left corner of LCD display show " ⊏⎯╳⎯⊐ ", it is necessary to replace the battery. However, in-spec. measurement may still be made for several hours after low battery indicator appears before the instrument become inaccurate.

2) Loose the " Screws for Battery Compartment " (3-8, Fig. 1) take the " Battery Cover " (3-8, Fig. 1) away from the instrument and remove the battery.

3) Replace with DC 9V battery (006P or equivalent), and reinstate the cover.

4) Make sure the battery cover is secured after changing the battery.

10. OPTIONAL PROBES AND ACCESSORIES

ATC PROBE Model : TP-07	* ATC (Automatic Temperature Compensation) Probe for pH function.	
	Measurement	Range
	$^{\circ}C$	0 $^{\circ}C$ to 65 $^{\circ}C$
	$^{\circ}F$	32$^{\circ}F$ to 149 $^{\circ}F$

CARRYING CASE CA-06	Hard carrying case 280 x 195 x 65 mm
CARRYING CASE CA-05A	Soft carrying case with sash 260 x 110 x 55 mm

ORP ELECTRODE Model : ORP-14	Select to the mV function, plug the ORP electrode into the BNC socket to become a professional ORP (oxidation-reduction potential) Meter.

pH ELECTRODE Model : PE-03	General purpose, laboratory & field usage. 12.3 mm dia. x 160 mm. Epoxy body, 1 - 13 pH.
pH ELECTRODE Model : PE-11	General purpose, laboratory & field usage. 10 mm dia. x 130 mm. Epoxy body, 1 - 13 pH. (0 - 14 pH typical)
pH ELECTRODE Model : PE-01	Professional, laboratory & field usage. 9.5 mm dia. x 130 mm. Epoxy body, 0 - 14 pH.
SPEAR TIP pH ELECTRODE Model : PE-04HD PE-06HD	The " Spear Tip pH electrode " is perfect for those pH measurements in applications where sample piercing is required. Meat, sausage and cheese are ideal applications. The electrode features a very durable glass measuring spear packaged in a rugged virtually unbreakable epoxy body. Range : 0 to 14 pH (PE-04HD) Range : 1 to 13 pH (PE-06HD)
Glass pH ELECTRODE Model : PE-02	Glass body heavy duty pH Electrode, 0 to 14 pH.
Plane pH ELECTRODE Model : PE-08	Glass body plane pH Electrode, 0 to 14 pH.

pH ELECTRODE with Temp. kit Model : PE-03K7	* One kit combine pH electrode PE-03 and Temp. probe TP-07 as a whole unit. * Easy operation for the pH measurement under the ATC (Automatic Temp. Compensation)

pH ELECTRODE build Temp. sensor Model : PE-05T	* pH electrode build in Temp. sensor inside. * General purpose, laboratory and field usage. * Epoxy body, 1 - 13 pH.

BUFFER SOLUTION pH-07	pH 7.00 standard buffer solution. for calibration purpose.
BUFFER SOLUTION pH-04	pH 4.00 standard buffer solution. for calibration purpose.

RS232 cable UPCB-02	Interface cable for connecting between the meter & the computer. (D9 plug).
USB cable USB-01	Interface cable for connecting between the meter & the computer. (USB plug).
SOFTWARE SW-U801-WIN	Windows version application software applies as the performance of data logging system & data recorder...