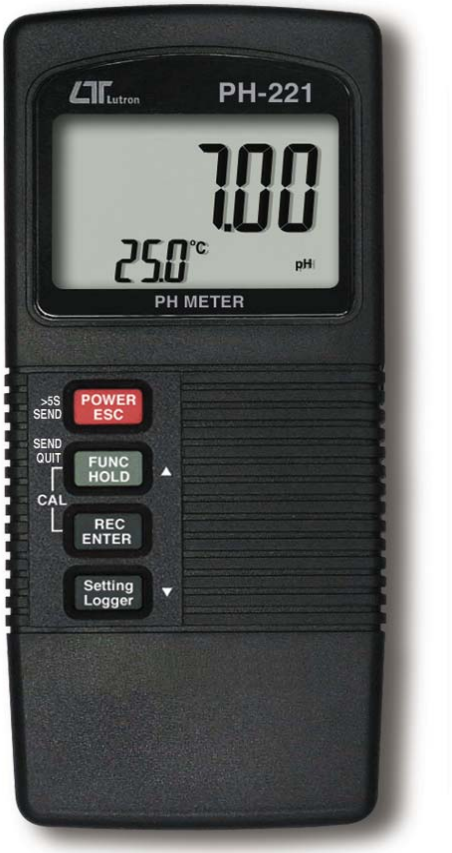
ATC, two displays

PH METER

Model : PH-221



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.

QUALITY ASSURED FIRM
ISO 9001
SGS
UKAS
QUALITY MANAGEMENT
005

OPERATION MANUAL

TABLE OF CONTENTS

1. FEATURES

* pH : 0 to 14.00 pH, mV : ± 1999 mV.
* mV function is used to accept the ORP electrode.
* BNC socket input, can accept most kind pH electrode.
* Separate pH electrode, easy for general purpose and remote measurement.
* pH measurement can select automatic temperature compensation (via. optional Temp. probe) or manual temperature adjustment.
* High input impedance for the pH function.
* Auto calibration for pH 7, pH 4 and pH 10.
* LCD with two display, easy readout.
* Manual and auto data logger, with flexible sampling time selection, can save max. 1,600 reading data.
* Can default auto power off or manual power off.
* Temperature unit can default to ℃ or ℉.
* Microcomputer circuit, intelligent function, high accuracy.
* Records Maximum and Minimum readings with recall.
* Data hold function for freezing the desired value.
* Build in the input socket for DC 9V power adapter.
* RS232 PC serial interface.
* Heavy duty & compact housing case.
* Available for wide applications, such as aquarium, beverage, fish hatcheries, food processing, photography, laboratory, quality control, school & colleges, swimming pools, water conditions.

2. SPECIFICATIONS

2-1 General Specifications

pH	Optional,
Electrode	Any pH electrode with BNC connector.

Measurement	pH	0 to 14 pH
	mV	-1999 mV to 1999 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)	With the optional temperature probe (TP-07) 0 to 65 ℃.
pH Calibration	pH 7, pH 4, and pH 10, 3 points calibration ensure the best linearity and accuracy.	
Circuit	Custom one-chip of microprocessor LSI circuit.	
Display	LCD size : 44 mm x 29 mm, dual function LCD display.	
Sampling Time of Data Logger	Manual	Push the data logger button once will save data one time. ** Set sampling time to 0 second.*
	Auto	1, 2, 5, 10, 30, 60, 600, 1800, 3600 seconds.
Data Logger number	Max. 1,600-point Data logger	
Data Hold	Freeze the display reading.	
Memory Recall	Maximum & Minimum value.	
Sampling Time of display	Approx. 1 second.	
Power off	Auto power shut off to save battery life or manual power off.	
Data Output	RS 232 PC serial interface.	
Operating Temperature	0 to 50 ℃.	

Operating Humidity	Less than 80% RH.
Power Supply	006P DC 9V battery (Alkaline or Heavy duty type). DC 9V adapter input. ** AC/DC power adapter is optional.*
Power Current	Approx. DC 6 mA.
Weight	200 g/0.44 LB. ** Include probe and batterry.*
Dimension	135 x 60 x 33 mm.
Accessories Included	Instruction manual.....1 PC
Optional probe and accessories	* pH electrode.....PE-03, PE-11, PE-01,PE-06HD PE-04HD, PE-05T, PE-03K7
	* Temp. probe for ATC..... TP-07
	* pH 7 buffer solution..... PH-07 * pH 4 buffer solution.....PH-04
	* ORP electrode..... ORP-14
	* RS232 cable.....UPCB-02. * USB cable.....USB-01 * Data Acquisition software..... SW-U801-WIN. * Data logger software.....SW-DL2005. * Hard carrying case.....CA-06 * Soft Carrying case..... CA-05A * AC to DC 9V adapter.

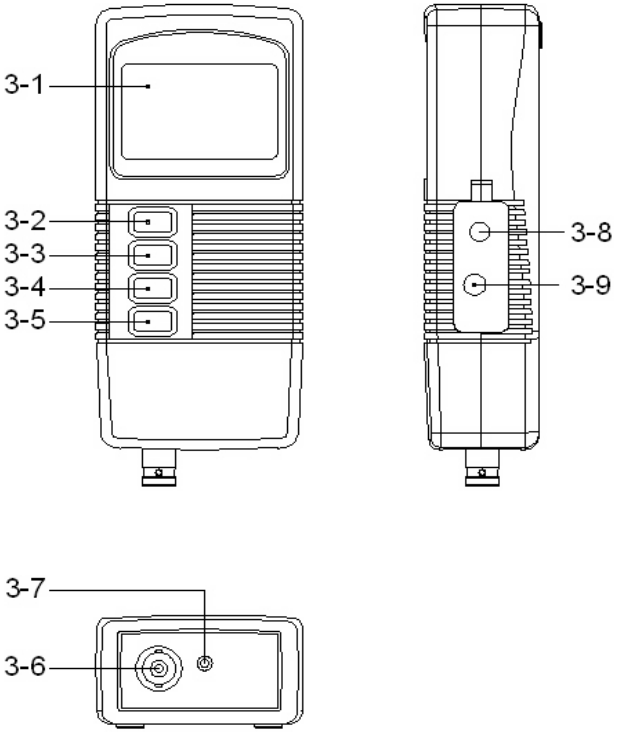
2-2 Electrical Specifications (23± 5 ℃)

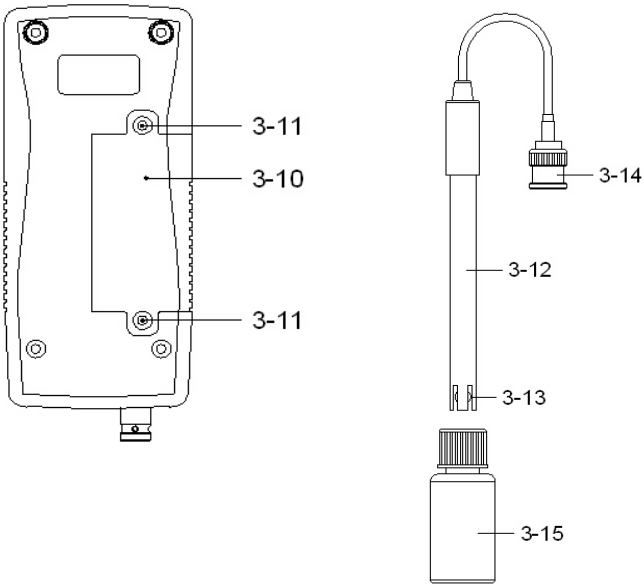
Measurement	Range	Resolution	Accuracy
pH	0 to 14 pH	0.01 pH	± (0.02 pH + 2 d)
mV	0 to ± 1999 mV	1 mV	± (0.5% + 2 d)

** pH accuracy is based on calibrated meter only.*

** Above specification tests under the environment RF Field Strength less than 3 V/M & frequency less than 30 MHz only.*

3. FRONT PANEL DESCRIPTION





3-1 Display
3-2 Power/ESC/Send button
3-3 FUNC/Hold button (Send quit/▲ button)
3-4 REC/Enter button
3-5 Setting/Logger button (▼ button)
3-6 pH probe socket (BNC socket)
3-7 Temp. probe socket (ATC probe socket)
3-8 DC 9V adapter socket
3-9 RS-232 output terminal
3-10 Battery compartment/Cover
3-11 Battery cover screws
3-12 pH electrode handle (optional)
3-13 pH electrode sensing head (optional)
3-14 pH electrode BNC plug (optional)
3-15 pH electrode protection bottle (optional)

4. MEASURING and CALIBRATION PROCEDURE

The meter default function are following :

* The display unit is set to pH.
* The temperature unit is set to ℃.
* Manual Temp. compensation setting (not ATC)
* Auto power off.
* The sampling time of data logger function is 1 seconds.

If the meter is first time to connect the pH electrode, it should make the calibration before operation, the calibration procedures refer to chapter 4-4, page 8.

4-1 pH measurement (manual Temp. compensation value adjustment)

1) Prepare the pH Electrode (optional), install the " Probe Plug " (3-14, Fig. 1) into the " pH Socket/BNC Socket " (3-6, Fig. 1).
2) Power on the meter by pressing " Power button " (3-2, Fig. 1) once.
   The up main display will show the pH value along with the " pH " indicator.
   The left down display will show the temperature value (manual Temp. value) with the " ℃ " (or ℉) indicator.

3) **Adjust the manual Temp. value same as the solution's temperature exactly, the procedures refer chapter 5-1, page 15.**
4) Hold the " Electrode Handle " (3-12, Fig. 1) by hand and let the " Sensing head " (3-13, Fig. 1) immersed wholly into the measured solution and little shake the probe.
5) The up main display will show the pH value of the measured solution, the left bottom display will show the setting Temp. compensation value.

4-2 pH measurement (ATC , automatic Temperature)

1) All the procedures are same as
   4-1 pH measurement (manual Temp. compensation value adjustment)
   but should prepare one temperature probe (optional, TP-07). Insert the TP-07's plug into the " Temp. probe socket " (3-7, Fig. 1), immerse the sensing head of temperature probe into the measurement solution.
2) The up main display will show the pH value, the left bottom display will show the sensing Temp. value of the measured solution.

When not use the Electrode, it should immerse the " Electrode sensing head " (3-13, Fig. 1) into the " Protection bottle " (3-15, Fig. 1).

4-3 mV 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) Prepare the ORP Electrode (optional, ORP-14), install the " Probe Plug " of ORP electrode into the " BNC socket " (3-6, Fig. 1).
2) Power on the meter by pressing " Power button " (3-2, Fig. 1) once.
   Pressing the " FUNC button " (3-3, Fig. 1) continuously (> 2 seconds), the display show " mV " indicator and the temperature value will be disappeared. Now the meter is ready for mV measurement (ORP measurement).

4) Insert the sensing head of ORP electrode into the measurement solution.
   The main display will show the mV value (ORP value).

   ** After the mV measurement, if pressing the " FUNC button " (3-3, Fig. 1) continuously (> 2 seconds) again will return to the pH measurement function.*

4-4 pH calibration

Calibrating Consideration

The pH meter already calibrated by mV signal that simulated from the ideal pH ELECTRODE mV output (base on 25 ℃ environment). However due to (a) An ideal electrode will produce 0 mV at pH 7.00, but most electrodes are slightly off. (b) The measuring environment temperature may not near 25 ℃ (15 to 35 ℃).

If intend to keep instrument combined electrode within high accuracy, it is necessary to make the following calibration procedures.

* *Basic calibration (single point calibration) :*
  pH 7 calibration.
* *Complete calibration (two points calibration) :*
  pH 7 calibration and pH 4 calibration.
  pH 7 calibration and pH 10 calibration.
* *During execute the calibration procedures, if the Display show " Err " error information, then please do the " Calibration clear " procedures, refer page 11.*

Requiring Equipment for Calibration

1) pH electrode
2) Buffer solutions :
   pH 7.00 buffer solution (PH-07, optional).
   pH 4.00 buffer solution (PH-04, optional).

Calibration procedures

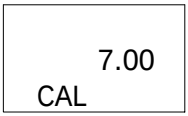
1) Prepare the pH Electrode (optional), install the " Probe Plug " (3-14, Fig. 1) into the " pH Socket/BNC Socket " (3-6, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
3) Adjust the " Temperature Compensation Value " to make it same as the temperature value of the pH buffer solution.

   * **Manual temperature compensation value adjustment procedure, refer to 5-1, page 15.**
   * **Automatic temperature compensation, it should plug in the ATC probe (optional, TP-07), please refer to 4-2, page 7.**

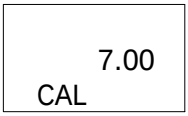
4) Hold the " Electrode Handle " (3-12, Fig. 1) by hand and let the " Sensing head " (3-13, Fig. 1) immersed wholly into the measured standard solution (pH 7.0, pH 4.0 or pH 10.0) and little shake the probe. Display will show the pH value of the solution.

*** If use the ATC probe, should immerse the ATC probe into the solution together.**

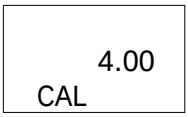
5) Use the two fingers to press the " REC button " (3-4, Fig 1) and " Hold button " (3-3, Fig. 1) at the same time, until Display will show the following screen then release the both fingers.



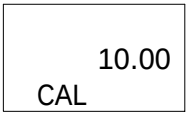
6) Press the " ▲ button " (3-3, Fig. 1) or " ▼ button " (3-5, Fig. 1) once in sequence to select the following screen.

a 

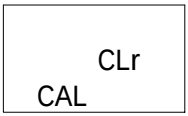
For pH 7.00 calibration

b 

For pH 4.00 calibration

c 

For pH 10.00 calibration

d 

Clear the existing calibration data

* After the above a, b, c screen is selected, then cooperate the relative standard solution, for example the

a screen should cooperate the pH 7.00 standard solution.
b screen should cooperate the pH 4.00 standard solution.
c screen should cooperate the pH 10.00 standard solution.

Press the " Enter Button " (3-4, Fig. 1), the upper Display will be flashing several seconds, then save the calibration data and finish the calibration procedures.

*** If select the d screen, press the " Enter button " (3-4, Fig. 1) will clear existing calibration data.**

During execute the calibration procedures, if happen some thing wrong (Display show Err information), then execute the above " Calibration clear " procedures will clear all the existing calibration data and return to the Default value.

7) The complete procedures should execute the two calibration points :

pH7 calibration
pH4 calibration (or pH10 calibration)

* The calibration procedures should execute start from pH 7 calibration then follow pH 4 (or pH 10) calibration. It can not execute the calibration procedures start from the pH 4 (pH 10) then follow the pH 7.
* During execute the calibration procedures, press the " ESC button " will exit the calibration procedures and return to normal measuring screen.
* Rinse the electrode with distilled water again when make each point calibration (pH7, pH4....).
* Repeat above two points procedures two times at least.

4-5 Data Hold

During the measurement, press the " Hold button " (3-3, Fig. 1) once will hold the measured value & the LCD will display a " HOLD " symbol.

* Press the " Hold button " once again will release the data hold function.

4-6 Data Record (Max., Min. reading)

* The data record function records the maximum and minimum readings. Press the " REC button " (3-4, Fig. 1) once 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 intend to delete the maximum value, press the " Hold button " (3-3, Fig. 1) once, 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 intend to delete the minimum value, press the " Hold button " (3-3, Fig. 1) once, 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.

4-7 Data Logger

The data logger function can save 1,600-point measuring data.

The data logger procedures are following :

a) Press the " REC button " (3-4, Fig. 1) once to start the Data record function and there will be a " REC " symbol on the display.

b) **Auto Data Logger (Sampling time should select to 1, 2, 5, 10, 30, 60, 600, 1800 or 3600 seconds)**

Press the " Logger button " (3-5, Fig. 1) once to start the Data Logger function. The " REC " symbol will flash per 1.5 second and the beeper will sound when save the data into the memory. Now the Data Logger function is executed.

Manual Data Logger (Sampling time should set to 0 second)

Press the " Logger button " (3-5, Fig. 1) once will save the data one time into the memory, at the same time the symbol " REC " will flash once and the beeper will sound.

Memory full

When execute the data logger function, if the upper display show " FULL " with flashing, it indicate the memory data already over 1,600 no. and the memory is full.

c) During the Data Logger function is executed, press the " Logger button " (3-5, Fig. 1) once will stop the data logger function, the " REC " symbol will stop to flash.
If press the " Logger button " (3-5, Fig. 1) once again will continuous the Data Logger function.

Note :

1) If intend to change the data logger sampling time, please refer to section 5-4, page 16.

2) If intend to know the space of balance data numbers into the memory IC, please refer to section 5-5, page 17.

3) If intend to clear the saving data from the memory please refer to section 5-6, page 17.

5. ADVANCED ADJUSTMENT PROCEDURE

Before executing Advanced Setting Procedures, exit the " Hold function " and the Record " function first.

- *** Press " Setting button " continuously at least 5 seconds to enter the setting function.**
- * After already set the desiring value (function), press the " Enter button " to save with default.
- * Press the " Esc button " to escape the setting procedures.

a. Hold the " Setting button " (3-5, Fig. 1) at least five seconds will enter the Advanced Setting Procedures.

b. One by one to press the " Setting button " (3-5, Fig. 1) once a while to select the main setting function in sequence and show on the text the lower display as :

noAtc.... Change the manual Temp. compensation value of pH function
℃..... Change the Temp ℃, ℉ unit
OFF..... Auto power ON/OFF management
SP-t..... Change the data logger sampling time
SPACE To show the balance data numbers in the memory
CLr..... Clear the existing saving data from the memory

5-1 Change the manual temperature value of pH function

(Lower display show " noAtc ")

This setting is available only when the plug of the temperature probe (optional, TP-07) is not inserted into the " Temp. probe socket " (3-7, Fig. 1).

a. After the low display show " noATC ", press the " Enter button " (3-4, Fig. 1) once. the " noAtc " symbol will flash. The up display will show the manual temperature compensation value, Use " ▲ button " (3-3, Fig. 1) and " ▼ button " (3-5, Fig. 1) to adjust the up display value until it same as the desiring temperature compensation value exactly.
b. After select the desiring value, press the " Enter button " (3-4, Fig. 1) to save the data with default.

5-2 Change the Temp ℃, ℉ unit

a. Use " ▲ button " (3-3, Fig. 1) to select " ℃ " or " ℉ ".
b. After select the desiring value (℃ or ℉), press the " Enter button " (3-4, Fig. 1) to save the data with default.

5-3 Auto power On/Off

(Lower display show " OFF ")

a. Use " ▲ button " (3-3, Fig. 1) to select " YES " or " no ".
   ** YES : Auto power off.*
   ** no : Auto power disable.*
b. After select the desiring function (YES or no), press the " Enter button " (3-4, Fig. 1) to save the function with default.

5-4 Change the data logger sampling time

(Lower display show " SP-t ")

a. Use " ▲ button " (3-3, Fig. 1) to select data logger sampling time to
   0, 1, 2, 5, 10, 30, 60, 600, 1800, 3600 seconds
b. After the sampling time value is determined, press the Enter button " (3-4, Fig. 1) to save the sampling time with default.

Note :
Set the sampling time to 0 second is used for the manual Data Logger function.

5-5 To show the balance data numbers in the memory

(Lower display show " SPACE ")

The display will show the balance data no. that exist into the memory (allow memorize data no.).

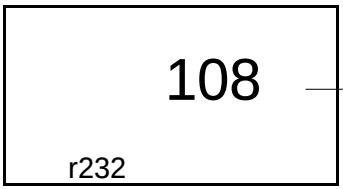
5-6 Clear the existing saving data from the memory

(Lower display show " CLr ")

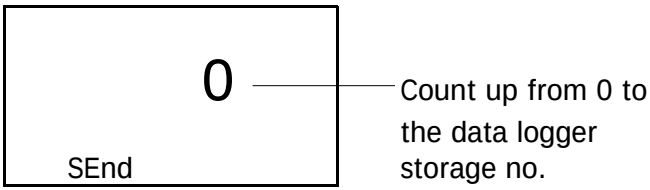
a. Use " ▲ button " (3-3, Fig. 1) to select " YES " or " no ".
   ** YES : It will execute the memory clear function..*
   ** no : It will be not to clear the memory.*
b. If select " YES ", press the " Enter button " (3-4, Fig. 1) the beeper will sound three sounds for warning, if really intend to clear the memory, then press the " Enter button " again.

6. SEND THE DATA OUT FROM THE METER

1) To send the data out from the meter, exit the " Hold function " and the " Record function " first.
2) Press the " Send button " (3-2, Fig. 1) at least 5 seconds until the lower display show " r232 ", then release the button.



3) Push the " Send button " (3-2, Fig. 1) once, the lower display will show " SEnd ", the upper no. will count up until reach the data logger storage no., at the same the storage data logger data will send out the meter from the " RS-232 output terminal " (3-9, Fig. 1).



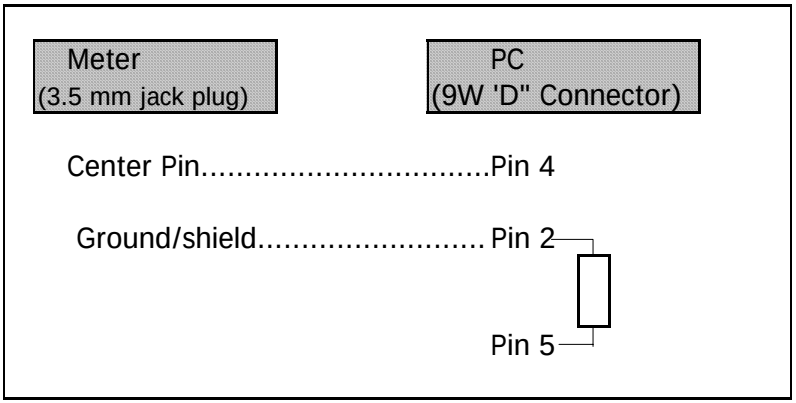
4) If intend up load the data to the computer, then should connect the optional RS232 cable/UPCB-02 or USB cable/USB-01 and cooperate the Data Logger software (optional, Model : SW-DL2005).
5) Press the " Send quit button " (3-3, Fig. 1) will escape the data sending function.

7. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm terminal (3-9, 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 :

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

8. BATTERY REPLACEMENT

1) 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) Open the " Battery Cover " (3-10, Fig. 1) away from the instrument by loosing the " Battery cover screws " (3-11, Fig. 1) and remove the battery.
3) Replace with 9V battery (Alkaline or Heavy duty type) and reinstate the cover.
4) Make sure the battery cover is secured after changing the battery.

9. OPTIONAL ACCESSORIES

Carrying case CA-05A	Soft carrying case with sash. (260 x 110 x 55 mm)
Carrying case CA-06	Hard carrying case. (280 x 195 x 65 mm)

RS232 cable UPCB-02	* Isolated RS232 cable. * Used to connect the meter to the computer
RS232 cable USB-01	* USB Computer interface cable. * Isolated USB cable.
Data Logger software SW-DL2005	* Software the used to download the data logger (data recorder) from the meter to computer.

Data Acquisition software SW-U801-WIN	* The SW-U801-WIN is a multi displays (1/2/4/6/8 displays) powerful application software, provides the functions of data logging system, text display, angular display, chart display, data recorder high/low limit, data query, text report, chart report.. .xxx.mdb data file can be retrieved for EXCEL, ACESS.., wide intelligent applications.

Power adapter	AC 110V to DC 9V, USA plug.
	AC 220V/230V to DC 9V. Germany plug.

pH optional accessories	pH Electrode, 1 to 13 pH. Model : PE-11
	pH Electrode, 1 to 13 pH. Model : PE-03
	pH Electrode, 0 to 14 pH. Model : PE-01
	Temperature probe (ATC probe) Model : TP-07
	SPEAR pH Electrode Model : PH-06HD, PH-04HD
	pH Electrode + Temp. probe, 2 in 1 Model : PE-03K7
	pH Electrode + Temp. probe, 2 in 1 Model : PE-05HT
	pH 7 BUFFER SOLUTION Model : PH-07
	pH 4 BUFFER SOLUTION Model : PH-04

mV accessory	ORP electrode, Model : ORP-14