HK-208 Benchtop Phosphate Meter

Instruction Manual

Version: 3.0

www.huakeyi.com

Beijing Huakeyi Power Plant Instrument Research Institute

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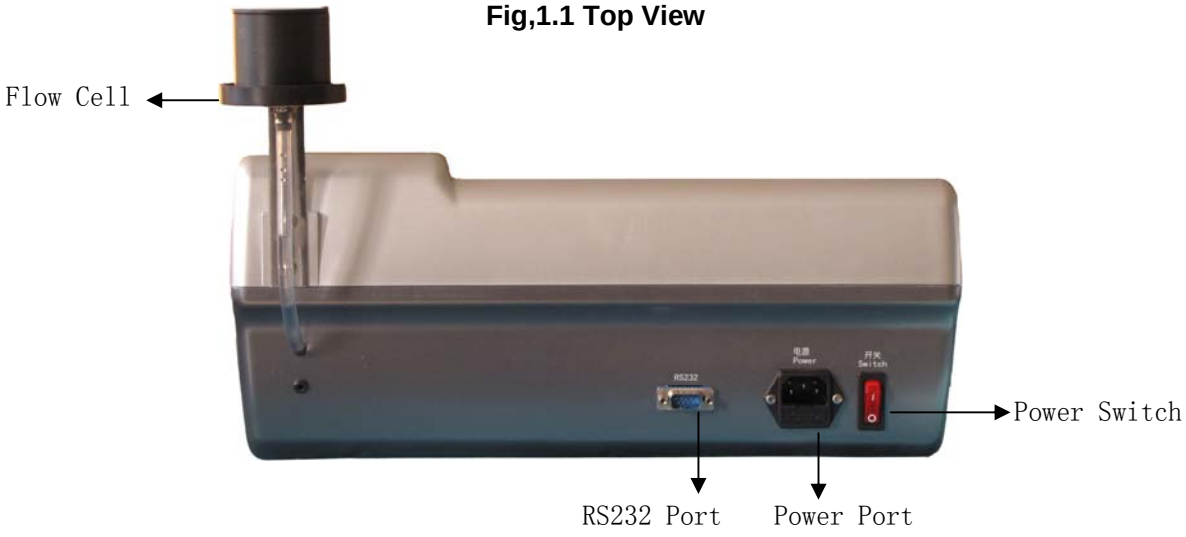
1. INTRODUCTION

1.1 Brief Introduction

The instrument is housed in a seal plastic enclosure, which is firm and waterproof. The measuring results can be read directly on the large LCD screen and the Chinese/English operating menu makes it easy to understand and operate. According to user's needs the measurement results can be stored in the instrument's internal memory and printed out and also the instrument can be connected to a computer.

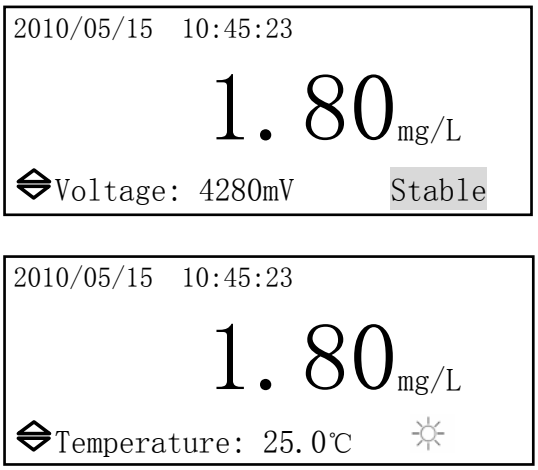
Fig,1.1 Top View



Fig,1.2 Rear View

1.2 Display and Operation Board

Normal measurement interface:



The upper line shows the current date and time.

The middle line shows the measured concentration of the phosphate.

The left side of the under line shows the "Voltage" or "Temperature" which you can switch by pressing ▼ or ▲ arrows. The right side of the under line shows the assistant information:

①If the left side shows the "Voltage" and the "Auto-Stable" is enabled, the right side will display "Stable" when the voltage is stable;

②while the "Temperature" is chose to be displayed in the left side, and the "Temperature Control" is enabled, the ☼ icon will display in the right side;

③"Draining" will display when it is draining.

Directions of the buttons:

ENTER:

1. Under programming or operating states, press ENTER to enter the selected menu or function;
2. After a modification of a parameter, press ENTER to validate and return to the previous interface;
3. Under measurement interface, press ENTER to save the measured data and meanwhile drain out the solution, and print the results if a printer is connected.

ESC:

1. Press ESC at the measurement interface to enter the main menu;
2. Under programming or operating states, press ESC to return to the previous menu, without saving the modification.

"↓、↑、←、→" Arrows:

1. Press ←、→ at measurement interface to adjust the contrast of the LCD(← getting lighter while →getting darker);
2. The arrows are used to move the cursor, vertically or horizontally, to choose the expected menu or item;
3. While chose some parameter or value, you can use ↓ and ↑ to modify the parameter or the number;
4. While viewing historical data, press ↓ and ↑ to view the adjacent pages.

Drain:

Press the drain button to drain out the solution inside the cuvette.

1.3 Working Principle

- Quote the phosphate analyzing method from the DL/T502.13-2006. The phosphate in the acid medium water reacts with the poly-vanadium-molybdenum acid to form the yellow phosphate–vanadium-molybdenum compound, and then measure the content of phosphate with the meter.

- The meter adopts the photo-electric colorimetric analysis principle. According to Lambert - Beer law: When a bunch of monochromatic parallel light gets through the colored solution, part of the light absorbed by the solution, assume the thickness of the solution is invariable, the relationship between the absorbance (extinction E) of the solution and the concentration of the colored material is direct proportion .Its mathematical expression as follows:

$$\lg\frac{I_0}{I} = K \cdot C \cdot L ....or.... E = K \cdot C \cdot L$$

Illustration: I_0 - Intensity of the initial light beam

I - Intensity of the transmitted light

C- Concentration of colored material

L- Thickness of the colored solution

K- Constant (related with the solution nature and incident light wave length)

2. SPECIFICATIONS

Measurement Range	:(0～20)mg/L or (0～50)mg/L
Display	: LCD display in English or Chinese
Analysis Error	: ±2%FS
Resolution	: 0.01 mg/L
Repeatability	: ≤ 1%
Stability	: ±1%FS/4h
Ambient Temperature	: (5～45)℃
Controlling Temperature	: ≥ 24℃ for colorimeter when “Temperature Control” is “Enabled”
Relative Humidity	: ≤ 90%RH, no condensation
Dimensions (L × W × H)	: 392mm × 260mm × 100mm
Power Supply	: (85～265) VAC; (45～65) Hz
Power Consumption	: 40W
Weight	: 5kg

3. REAGENT PREPARATION

REMARK

All the reagents should be stored in special label marked polyethylene plastic bottles. The bottles must be washed with detergent and water and then rinse for several times with high level deionized water thoroughly before use.

All the reagents should always be fresh and of analytical pure or higher quality grade. The grade Ⅰreagent water used must be of ultra purity. It is better to use ultra-water produced by high performance mixing-bed ion exchange device (at 25 ℃, the conductivity is less than 0.2μS/cm).

WARNING

Be cautious with the concentrated sulfuric acid, especially when diluting, it should inject the concentrated sulfuric acid to the water.

3.1 Reagent Preparation

- Vanadium ammonium molybdate solution:
  - ① Take 50g ammonium molybdate and 2.5g ammonium metavanadate and dissolve it in 400mL desalted water.
  - ② Take 195mL concentrated sulfuric acid (specific gravity=1.84) and slowly inject it into 250mL desalted water with constant stirring. Cool to room temperature.
  - ③ Inject the solution② to the solution① and dilute it into 1L with the desallted water.

3.2 Sample Coloration

Standard solution (1mg/mL)

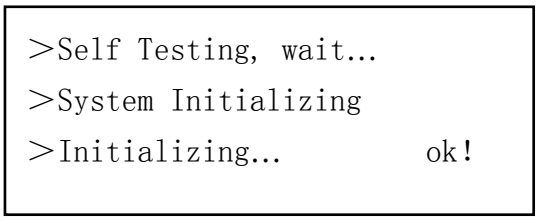
Take 1.433g potassium dihydrogen phosphate, which has been baked under 105℃; dissolve it in desalted and diluted to 1L.

4. PROGRAMMING

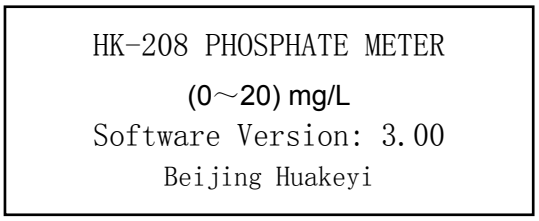
4.1 Power-on

Apply power to the meter and turn the switch on, firstly the meter carry on the “self-test” procedure, and then enters into the information interface automatically, the information interface will stay for 3 seconds and finally enters into the measurement interface.

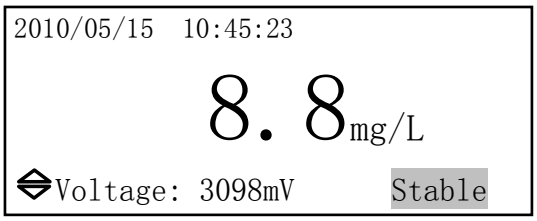
Self testing:



Information interface:



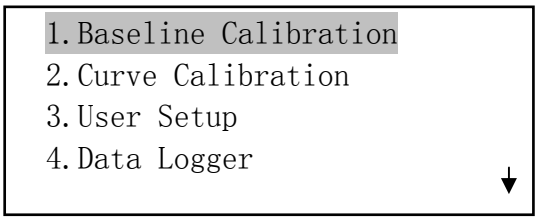
Measurement interface:

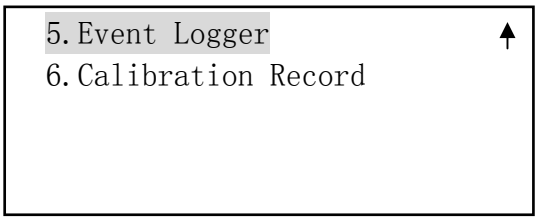


4.2 Program Unit

4.2.1 Main Menu

Under the measurement interface, press “ESC” to enter the main menu.

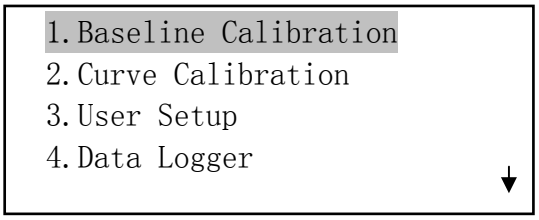




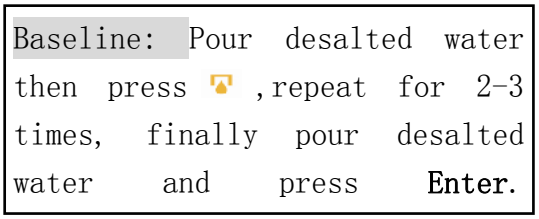
The six submenus are Baseline Calibration, Curve Calibration, User Setup, Data Logger, Event Logger and Calibration Record. Move the cursor by ▼ or ▲, and press “ENTER” to enter into the corresponding item, or press “ESC” to return to the measurement interface.

4.2.2 Baseline Calibration

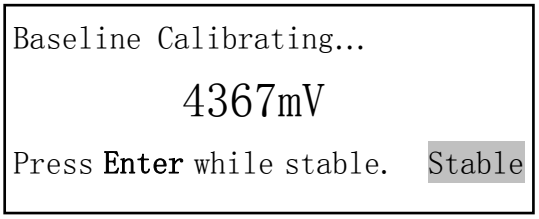
Move the cursor to “Baseline Calibration”:



Press “ENTER” to the prompt interface:



Follow the hint, and pour into desalted water to rinse the flow way of the meter for 2~3 times, at last pour into desalted water and press “ENTER” to start Baseline Calibration:



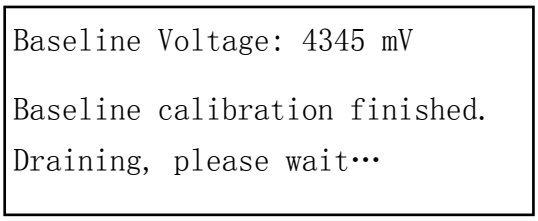
While the meter is carrying on Baseline Calibration, it is invalid to press “ESC”; and if the “Auto-Stable” function is disabled, there will be no Stable.

The Baseline Calibration is to eliminate the electrical drift, optical drift and temperature drift, in order to guarantee the accuracy of the meter.

In the above interface, the number in the middle line shows the measuring voltage value of the

desalted water. If the “Auto-Stable” is disabled, the user needs to press “ENTER” when the value is stable (±3 mV), and if the value is hard to be stable, you should rinse the cuvette again, generally, it is recommended to rinse the cuvette with desalted water thrice.

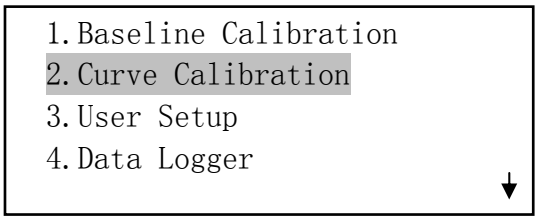
Press “ENTER” to save the data and complete Baseline Calibration, meanwhile, drain the water inside the cuvette.



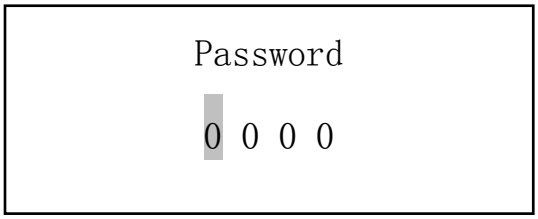
The above interface means the Baseline Calibration is finished. The user can either press “ESC” to return to main menu or wait until the meter return automatically after drained.

4.2.3 Curve Calibration

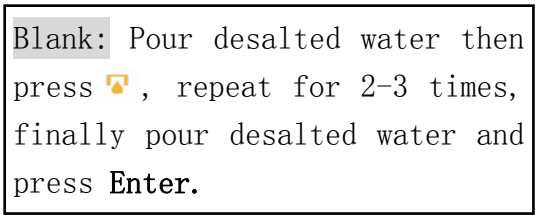
Move the cursor to “Curve Calibration”.



Press the “ENTER" to the password screen:



Use ← and → to move the cursor digit by digit; ↓ and ↑ to change the value of the selected digit. After inputting the correct password press “ENTER” to the prompt interface for Blank Calibration.



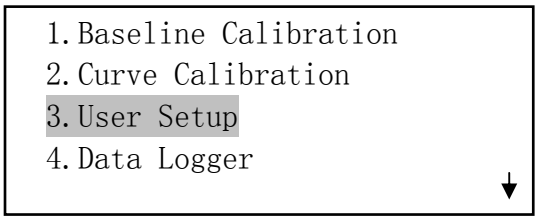
Proceed with the Curve Calibraion follow the prompts, the whole process of Curve Calibration is expatiated in **5.3.2. Curve Calibraion**.

NOTE:

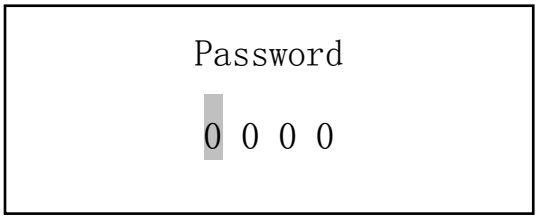
During measuring process, as the meter can only measure the different voltage that caused by the different absorbance of different solution, in that way, before normal measurement, the meter should establish a coordinate system that express the relation between the measuring voltage and the concentration of the phosphate, using standard solutions. According to the measured voltage value, the concentration of the solution can be calculated with the help of the coordinate system. The Curve Calibration is used exactly to establish this coordinate system.

4.2.4 User Setup

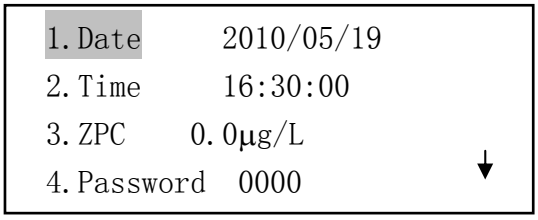
Move the cursor to “User Setup”:

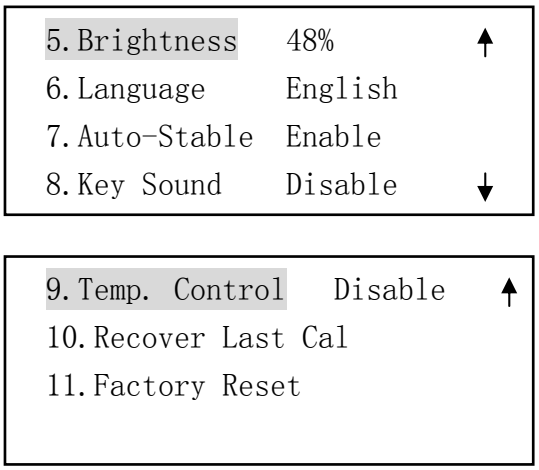


Then press the “ENTER" to the password screen:



Use ← and → to move the cursor digit by digit; ↓ and ↑ to change the value of the selected digit. After inputting the correct password press “ENTER” to enter the User Setup screen.





Use ▼ and ▲ to move the cursor to the target item, press "ENTER", then use ◄ and ► to move the cursor horizontally and use ▼ and ▲ to change the value.

- Date: Set the correct date.
- Time: Set the correct time.
- ZPC: Zero-Point Correction, the setting range is (-1.00 ~ +1.00) mg/L. When there is slight deviation between the measured value and the actual value, the set value will add to the measured value during measurement, e.g.: the measured value is 7.00mg/L while the actual value is 6.50mg/L, then set the ZPC as -0.50mg/L, and the display value in the measurement interface will be revised to 6.5mg/L

ATTENTION
The ZPC value should be set very cautiously and correctly, or it will bring in big deviations.

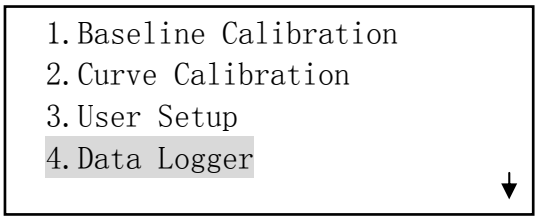
- Password: Input the new password.
- Brightness: Adjust the brightness of the LCD, ranging from 0% to 100%.
- Language: Choose the display language, English and Chinese are available.
- Auto-Stable: When set as "Enable", the meter will determine the stable state of the voltage value automatically and display "Stable" in the measurement interface, when set as "Disable" this function is invalid.
- Key Sound: When choose "Enable" the meter will beep when pressing any buttons and no sound if choose "Disable".
- Temp. Control: When choose "Enable" the meter will detect the surface temperature of the colorimeter, if lower than 25℃, it will heat up to 25℃ and keep the temperature; if higher

than 25℃ there will be no action. When choose “Disable” this function is invalid.

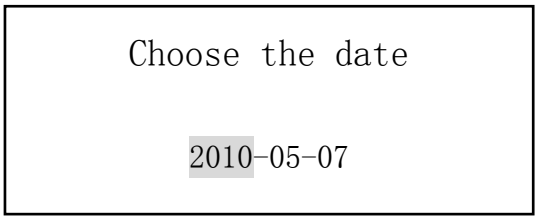
- Recover Last Cal: The meter can store the two latest calibration curves, it default to the latest calibration curve and the choice is “NO”, choose “YES” in this function will recover the previous curve.
- Factory Reset: Choose “YES” in this function it will clear all the data previously stored in the memory and all the settings will default to the factory settings.

4.2.5 Data Logger

In the main menu, move the cursor to “Data Logger”

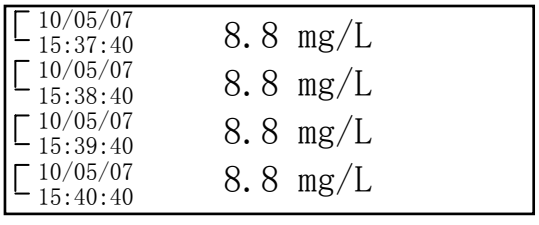


Press “ENTER” to the following screen:

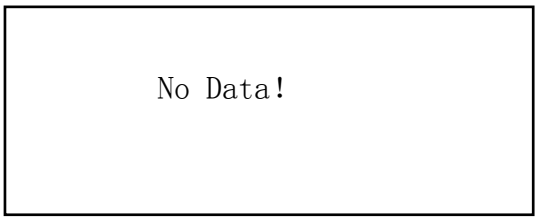


Use ← and → to move the cursor and use ↓ and ↑ to change the value, then press “ENTER” to validate the date and inquire the saved data, or press “ESC” to return to main menu.

The inquire results display as the following screen; the left side shows the date and exact time, while the right side shows the saved data. The meter can store 1000 records in the memory; use ↓ and ↑ to view the adjacent page.

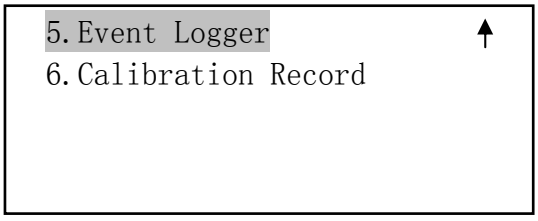


If there is no data saved at the corresponding date, this will display:



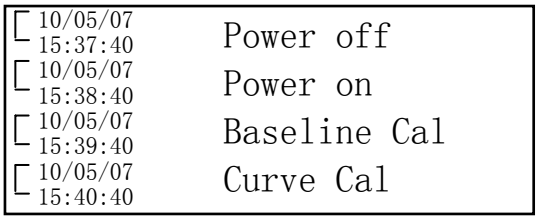
4.2.6 Event Logger

In the main menu, move the cursor to “Event Logger”



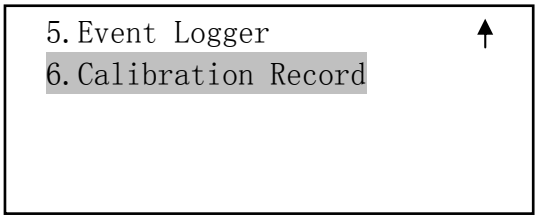
Press “ENTER” to the following screen, the left side shows the date and exact time, while the right side shows the operation.

The meter can store 1000 records in the memory; use ▼ and ▲ to view the adjacent page. Press “ESC” to return to the previous interface.

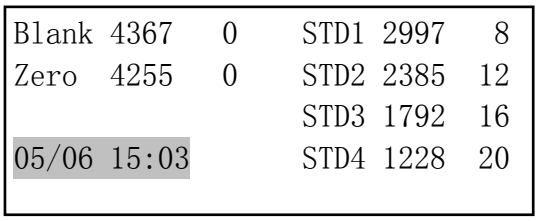


4.2.7 Calibration Record

In the main menu, move the cursor to “Event Logger”



Press “ENTER” to the following screen:



The Calibration Record can store two calibration curves, when enter the record screen, it shows the current curve the meter is now using, the under left side 05/06 15:03 shows the calibration time. Use ▼ or ▲ to view the last record.

5. OPERATION

5.1 Basic Requirement

1. Ambient temperature: (15~40)℃
2. Environmental humidity: ≤90%RH (no condensation)
3. Sample temperature: (15~40)℃(precision will be decreased if it is higher than 40℃)
4. No vibration and no corrosive gas around.

5.2 Installation

- Connect the drain tube to the meter on the right underside.
- Connect the power jack and apply power to the meter.

5.3 Calibration

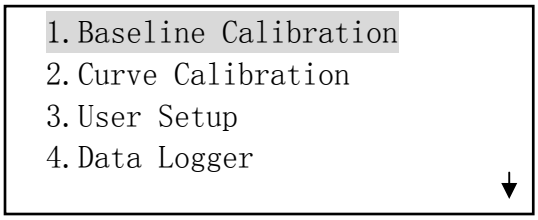
5.3.1 Baseline Calibration

The meter will be able to take normal measurement after curve calibration, therefore, temperature drift, electrical drift or optical drift are possible while measuring, a baseline calibration before measurement can eliminate these drifts.

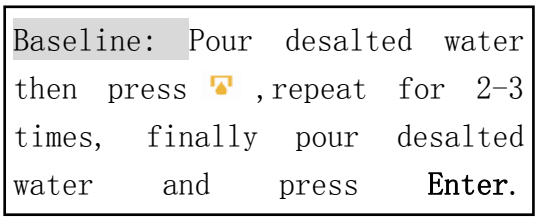
It is recommended to take a baseline calibration before every measurement to improve the accuracy.

Process:

✧ In measurement interface, press “ESC” to enter the main menu, the cursor will stay at “Baseline Calibration”.

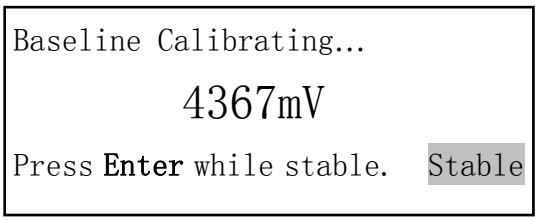


✧ Press “ENTER” to the prompt interface:

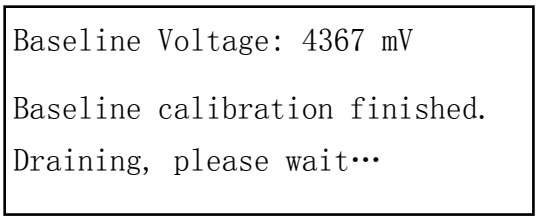


Follow the hint, and pour into desalted water to rinse the flow way of the meter for 2~3 times, at last pour into desalted water and press “ENTER” to start Baseline Calibration.

✧ Baseline calibrating, when the “Stable” shows, press “ENTER” to save the data and drain the sample.



✧ The following interface means the Baseline Calibration is finished. The user can either press “ESC” to return to main menu or wait until the meter return automatically after drained.



5.3.2 Curve Calibration

Curve calibration is necessary when **primarily use the meter** or **change the reagent** or **out of use for a long time**.

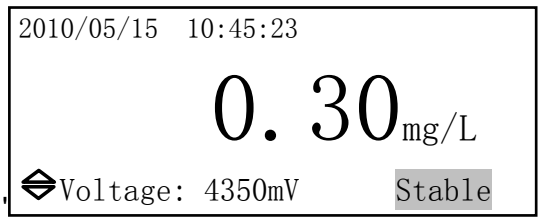
Preparation:

1. Blank solution (desalted water): at least 2 L.
2. Zero solution (colorated desalted water): at least 100mL.
3. Standard solutions: at least 100mL each.
4. Colorate the prepared standard solutions.

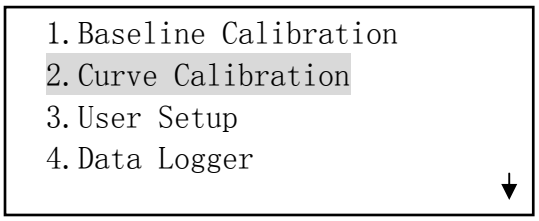
Process:

5.3.2.1 Blank Calibration

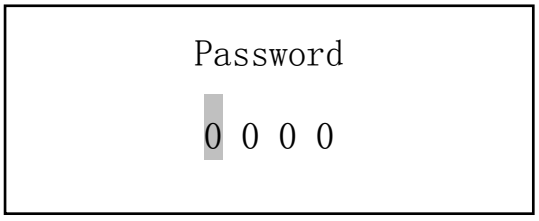
Measurement interface:



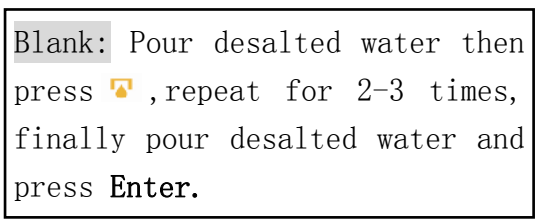
Press “ESC” to the main menu:



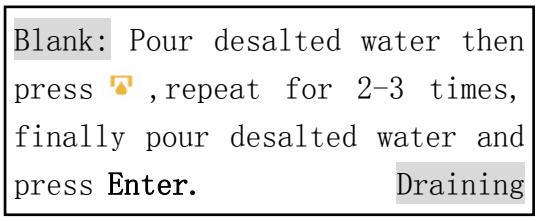
Choose “Curve Calibration” then press “ENTER" to the password screen:



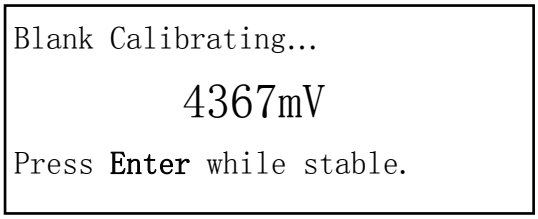
Enter the correct password and validate with “ENTER”:



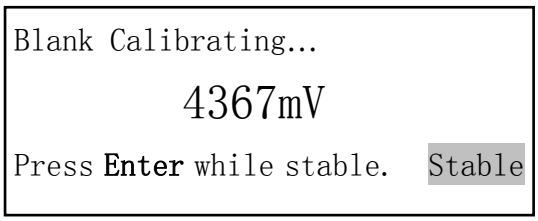
Follow the hint, pour into desalted water to rinse the flow way of the meter for 2~3 times, press to drain:



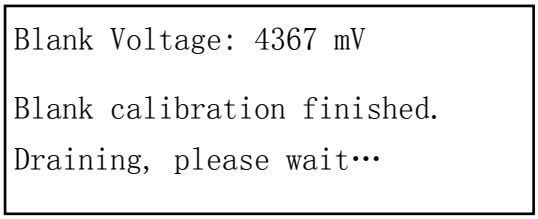
After draining, pour into desalted water and press “ENTER” to the Blank Calibration screen:



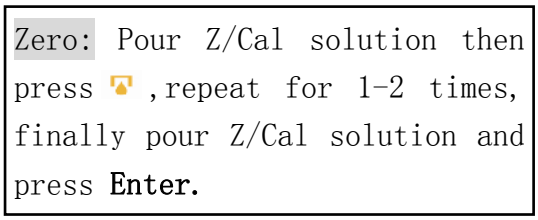
Observe the voltage value and wait for the “Stable”:



When “Stable” appears, press “ENTER” to see the voltage value of Blank Calibration:

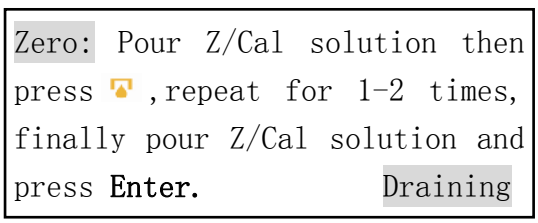


After draining, the meter will come to Zero Calibration automatically:

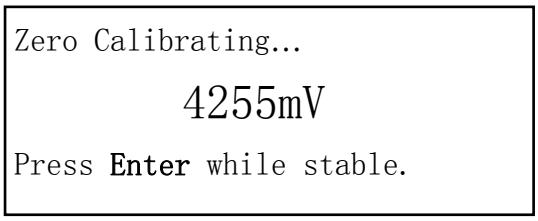


5.3.2.2 Zero Calibration

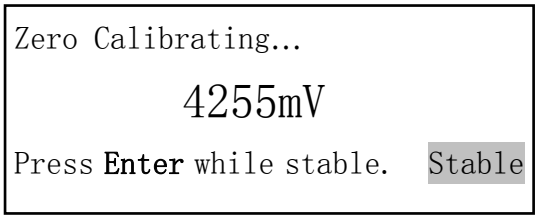
Follow the hint, pour into Zero solution to rinse the flow way, press to drain:



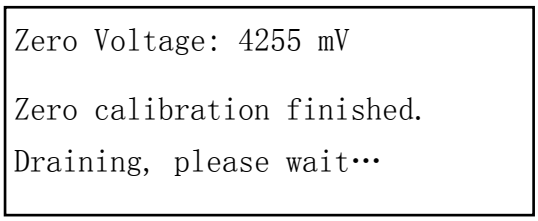
After draining, pour into Zero solution and press “ENTER” to the Zero Calibration screen:



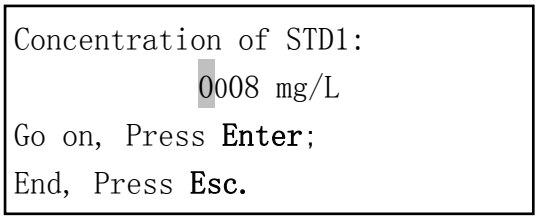
Observe the voltage value and wait for the “Stable”:



When “Stable” appears, press “ENTER” to see the voltage value of Zero Calibration:

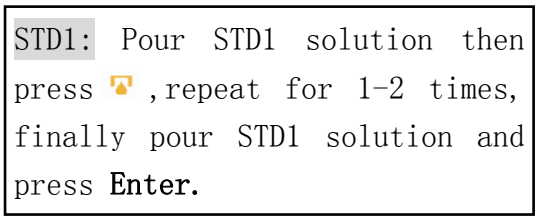


After draining, the meter will come to STD1 Calibration automatically:

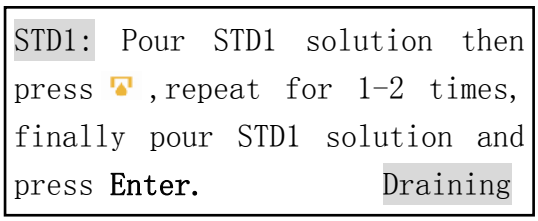


5.3.2.3 STD1 Calibration

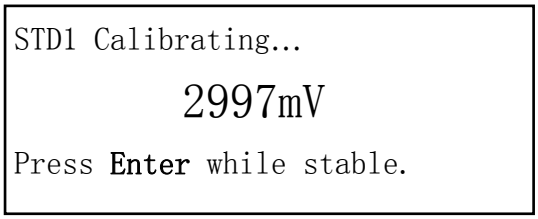
In the interface above, you can choose to end or continue with the calibration, enter the concentration value of SDT1 solution and validate with “ENTER” if you want to continue:



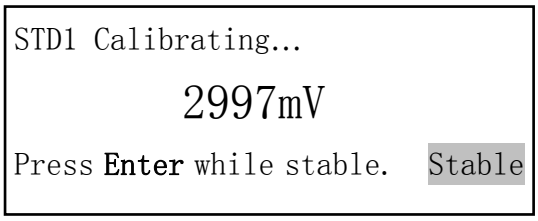
Follow the hint, pour into STD1 solution to rinse the flow way, press to drain:



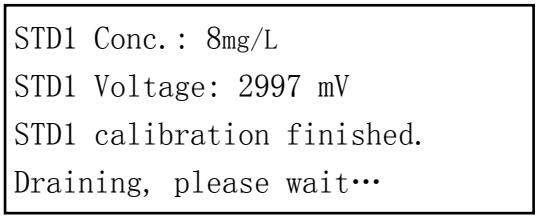
After draining, pour into STD1 solution and press “ENTER” to the STD1 Calibration screen:



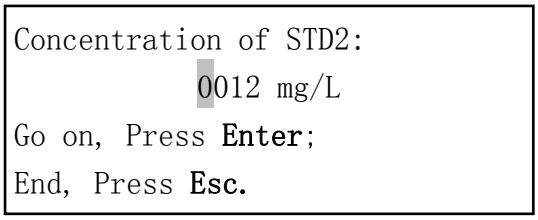
Observe the voltage value and wait for the “Stable”:



When “Stable” appears, press “ENTER” to see the voltage value of STD1 Calibration:

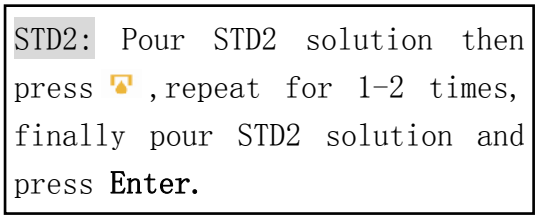


After draining, the meter will come to STD2 Calibration automatically:

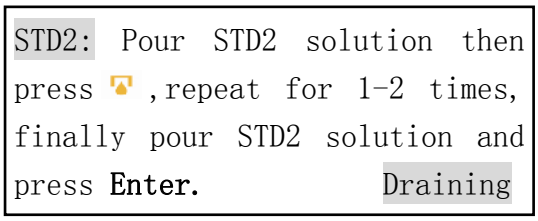


5.3.2.4 STD2 Calibration

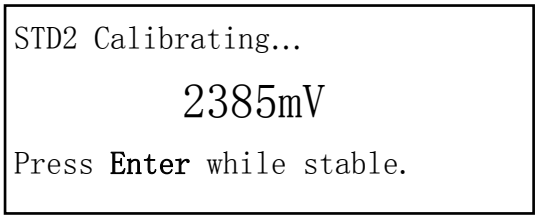
In the interface above, you can choose to end or continue with the calibration, enter the concentration value of SDT2 solution and validate with “ENTER” if you want to continue:



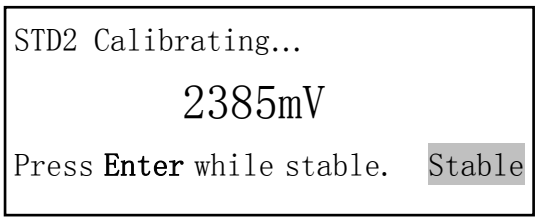
Follow the hint, pour into STD2 solution to rinse the flow way, press to drain:



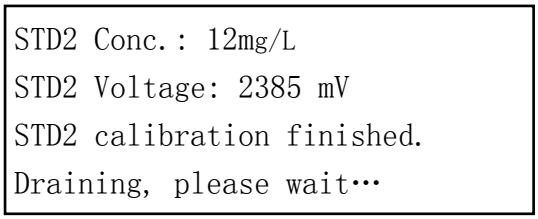
After draining, pour into STD2 solution and press “ENTER” to the STD2 Calibration screen:



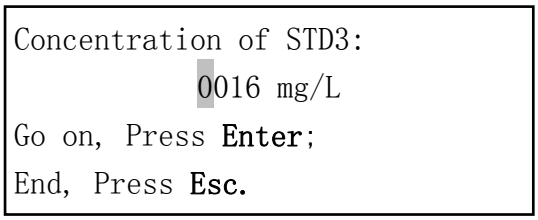
Observe the voltage value and wait for the “Stable”:



When “Stable” appears, press “ENTER” to see the voltage value of STD2 Calibration:

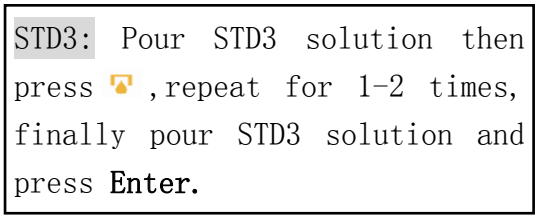


After draining, the meter will come to STD3 Calibration automatically:



5.3.2.5 STD3 Calibration

In the interface above, you can choose to end or continue with the calibration, enter the concentration value of SDT3 solution and validate with “ENTER” if you want to continue:



Follow the hint, pour into STD3 solution to rinse the flow way, press to drain:

```
STD3: Pour STD3 solution then
press ,repeat for 1-2 times,
finally pour STD3 solution and
press Enter.          Draining
```

After draining, pour into STD3 solution and press “ENTER” to the STD3 Calibration screen:

```
STD3 Calibrating...
        1792mV
Press Enter while stable.
```

Observe the voltage value and wait for the “Stable”:

```
STD3 Calibrating...
        1792mV
Press Enter while stable.  Stable
```

When “Stable” appears, press “ENTER” to see the voltage value of STD3 Calibration:

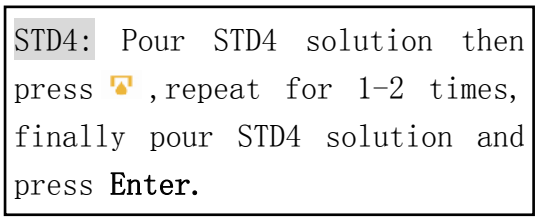
```
STD3 Conc.: 16 mg/L
STD3 Voltage: 1792 mV
STD3 calibration finished.
Draining, please wait…
```

After draining, the meter will come to STD4 Calibration automatically:

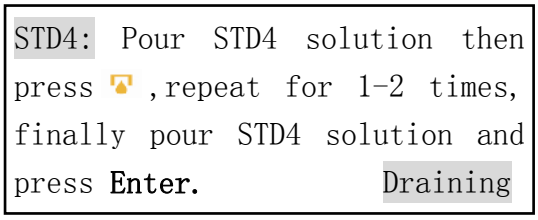
```
Concentration of STD4:
          0020 mg/L
Go on, Press Enter;
End, Press Esc.
```

5.3.2.6 STD4 Calibration

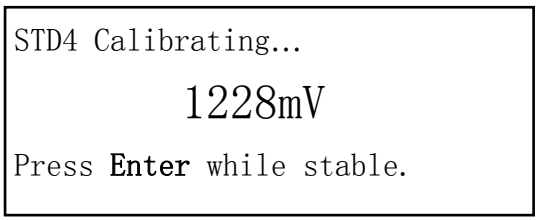
In the interface above, you can choose to end or continue with the calibration, enter the concentration value of SDT4 solution and validate with “ENTER” if you want to continue:



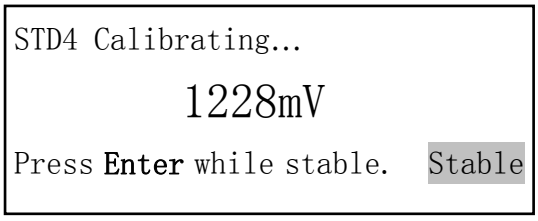
Follow the hint, pour into STD4 solution to rinse the flow way, press to drain:



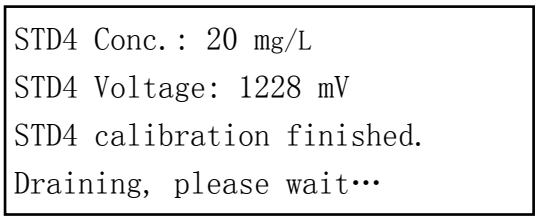
After draining, pour into STD4 solution and press “ENTER” to the STD4 Calibration screen:



Observe the voltage value and wait for the “Stable”:



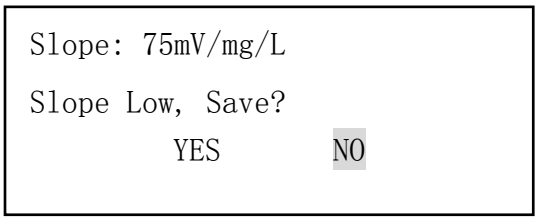
When “Stable” appears, press “ENTER” to see the voltage value of STD4 Calibration:



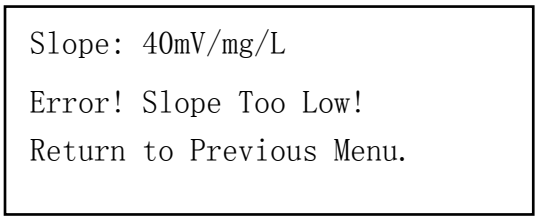
After draining, the meter will return to main menu automatically if calibration is successful.

5.3.2.7 Slope Low

If the slope is lower than the theoretical value during calibration process, there will be a prompt. For the slope low, the following prompt will appear and the operator should make a choice.



Choose “YES” to save the slope and continue to the next step; choose “NO” to return to the concentration-inputting screen and redo this step.



When this screen shows, the instrument will return to the concentration-inputting screen in 3 seconds without saving the data.

5.4 Sample Measurement

5.4.1 Requirements of Sample

1. Sample Temperature: ≥15℃.
2. Solid ingredient limit: ≤5μm; no colloid.

5.4.2 Sample Coloration

Take 50mL sample water, pour into a plastic beaker, and add the 5mL reagent solution, mix completely and lays aside for 3 minutes.

5.4.3 Sample Measurement

1. Do Baseline Calibration.
2. Under the measurement interface, pour into the colorated sample, when there is an overflow, press “DRAIN”. Repeat if necessary.
3. Pour into the colorated sample, wait and observe until the reading is stable and effective, then press “ENTER” to save the data and drain the solution in the cuvette.
4. When the drain valve is closed, use desalted water to rinse the flow way 2~3 times.
5. At last, fill the cuvette with desalted water for future use.

5.5 Attention

1. While measuring the sample, it is the better to do the measurement twice, and take the second demonstration value.
2. After measurement, fill the cuvette with desalted water and DO NOT drain.
3. After long-term use, the flow way of the meter needs to be cleaned, here is the cleaning process: open the cover of the meter, dismantle the cuvette, and rinse it with 5% hydrochloric acid.

6. APPLIANCE COMPLETE SET

HK-208 Benchtop Phosphate Meter	1 set
Instruction Manual	1 copy
Quality Certificate	1 piece
Packing List	1 piece
Spare Parts	according to the list
Thermal Printer	1 set

APPENDIX Ⅰ

Attentions

- DO NOT turn on or turn off the meter frequently, to avoid measurement drift.
- DO baseline calibration before every measurement, in order to get accurate measurement results.
- DO NOT place the solution container upon the meter, to avoid corruption of the meter case. If any liquid spatter to the case accidentally, clean it with dishcloth immediately.
- Preheat the meter at least 30 minutes before calibration or measurement.
- General password for the instrument is 9832.
- The drainpipe should be as short as possible and the end of the tube must contact the atmosphere but not immerse into water.

APPENDIX Ⅱ

Rational Determination of Curve Calibration Results

After calibration, you could view the voltage records in the “Calibration Record” menu, and you will find:

- The voltage values of Blank Calibration, Zero Calibration, STD1, STD2 ..... are decreasing orderly.
- The blank calibration voltage should be in the range of (4250~4400) mV, and a little lower for the zero calibration.
  - Assume the record shown as follows after calibration:

Blank	4367	0	STD1	2997	8
Zero	4255	0	STD2	2385	12
BGD		0	STD3	--	--
05/06	15:03		STD4	--	--

Through the above screen, we can see that four points have been done, and the values: Blank 4367, Zero 4255, STD1 2997, STD2 2385 are decreasing orderly.

STD1 2997 minus STD2 2385, the result is 612, then make 612 divided by 4 (the difference of 12 and 8), we got the corresponding voltage value of 1 mg/L phosphate standard solution is 153 mV.

If the result gained in this way is between (85~200) mV, that means the result maybe reasonable.

The above method is only one of the evidences to prove the calibration is reasonable. If the result is out of the prescriptive range, it is unreasonable. However, when it is in the range we cannot judge the result is reasonable only by this one evidence.

APPENDIX Ⅲ

Spare Parts

Name	Order No.	Model
208 motherboard assembly (3.0)	04.11.04.01.01	200S-ZB1-V3.00-P-0
208 photometer assembly (10mm)	04.01.48	S50-405
208 photometer assembly (25mm)	04.01.07	S20-405
208 photometer emission unit	04.01.25	420nm
200 flow cell (3.0)	01.02.14.12	TYE106-0
200 drain valve (3.0)	04.11.04.02.05	GY218-0/1-V1.0
200 housing shell	01.02.01.40	TYE101-0
photometer receive unit	04.01.30	1227
glass three-way	01.03.06.01	
25mm photocell	01.03.06.10	B25-2
200 buttons panel (3.0)	01.08.01.01.09	TYE109
200 heating assembly	04.11.04.02.13	TYE112-0
200 LCD display	04.01.47	CG081SYD-LYE
phosphate standard solution (60ml)	04.06.08	P-1K
thermal printer	01.19.09.01.01	SP-POS58

PRODUCTS &TECHNICAL SUPPORT

Laboratory Instruments

PHS-3C Benchtop pH Meter
HK-3C Benchtop pH Meter
DDS-307 Benchtop Conductivity Meter
HK-307 Benchtop Conductivity Meter
DWS-51 Benchtop Sodium Meter
HK-51 Benchtop Sodium Meter
HK-208 Benchtop Phosphate Meter
HK-218 Benchtop Silica Meter
HK-228 Benchtop Hydrazine Meter
HK-258 Portable Dissolved Oxygen Meter
HK-268 Acid/Alkali Concentration Meter
HK-508 Benchtop Iron Meter
HK-518 Benchtop Copper Meter

On-line Instruments

HK-108C Phosphate Analyzer
HK-108W Phosphate Analyzer
HK-118C Silica Analyzer
HK-118W Silica Analyzer
HK-128W Hydrazine Analyzer
HK-318 Dissolved Oxygen Analyzer
HK-328 pH Analyzer
HK-338 Conductivity Analyzer
HK-358 Sodium Analyzer (Cation Bed)
HK-358 Sodium Analyzer (Steam)
HK-368 Acid/Alkali Concentration Analyzer
HK-600 Channel Distributor
HK-7000A Toxic/Combustible Gas Alarm Controller
HK-7000D Toxic/Combustible Gas Alarm Controller
HK-7100A Combustible Gas Alarm Detector
HK-7100D Combustible Gas Alarm Detector
HK-7200A Toxic Gas Alarm Detector
HK-7200D Toxic Gas Alarm Detector

Technical Support

Beijing Huakeyi Power Plant Instrument Research Institute
Add: Nancun, Qiliqu, Shahezhen, Changping District, Beijing, P.R. China
Tel: 86-10-80705660
Fax: 86-10-80705682
Email: hky@huakeyi.com
Website: **http://www.huakeyi.com**

Essential Instruction!

1. **Read all instruction manual prior to installing, operating and servicing the product.**
2. **The Instrument should be stored in an area where is clean and dry.**
3. **Regularly check the status of meter.**
4. **If the meter is failed during warranty, please submit the following documents:**
   a. Alarm logger on failure;
   b. Operation records;
   c. Maintenance records.