



## PH METER

MET21-02



# INDEX

1. Introduction	2
1.1 Introduction	2
1.2 Technical Specification	2
1.3 Function Introduction	3
2. Safety Notices	4
3. Terms Explanation	5
4. Overview and Installation	6
4.1 Overview	6
4.2 Instrument installation	7
5. Instrument Operation	9
5.1 Screen Icons	9
5.2 Key Functions	10
5.3 Instrument Settings	12
5.4 Calibration	14
5.5 Measurement	16
6. Maintenance and Troubleshooting	17
6.1 Maintenance	17
6.2 Electrode usage and maintenance	18
6.3 Troubleshooting	19
7. Technical Support	20
8. Appendix	21

# 1. Introduction

## 1.1 Introduction

MET21-02 portable pH meter is not only suitable for sampling, measuring the pH value of aqueous solution and measuring electrode potential (mV) value in laboratories of industrial and mining, research institutes, but also especially suitable for pH measurement in field and mobile environment

### General Features

LCD display screen, 3.5 inches. Powered by lithium batteries, no need to replace batteries frequently, suitable for long-term use The instrument displays electrode slope and data stability marks. Support electrode calibration function, up to 2-point calibration. Automatic calibration function, automatic identification of three pH standard buffer solutions: 4.01pH, 7.00pH and 10.01pH. Support manual calibration function, custom standard solution. Manual temperature compensation. IP65 waterproof. The metre is fit to field measurements and outdoor measurements.

## 1.2 Technical Specification

Table 1-1 Instrument Specifications

Model		MET21-02
pH level		0.1 pH
mV	Range	(-1400~1400)mV
	Minimum resolution	1mV
	Electronic unit indication error	±0.2% (FS)
	Electronic unit repeatability	2mV
	Electronic unit input current	≤1×10 <sup>-11</sup> A
	Electronic unit input impedance	≥3×10 <sup>11</sup> Ω
pH	Range	(0.00~14.00)pH
	Minimum resolution	0.01pH
	Electronic unit indication error	±0.03pH
	Electronic unit repeatability	0.02pH
	Instrument indication error	±0.05pH
	Instrument repeatability	0.03pH
Temperature	Range	Manual, (0.0~60.0)°C

Use environment	Ambient temperature: (0~40) °C Relative humidity: not more than 85%
Dimensions(L×B×H), Weight(kg)	80mm ×225mm×35mm , about 0.4kg
Power supply	Rechargeable lithium battery, power adapter (Input AC 100~240V, Output DC 5V)

## 1.3 Function Introduction

Table 1-2 Main functions

Function		Explanation
Basic function	Backlight Power	●
	Reset settings	●
	Power failure protection	●
	Protection	IP65
	Automatic shutdown	●
Reading function	Reading Mode	continuous-read
pH/mV measurement	PH electrode status/performance display	Electrode slope
	Multi-point calibration	2
	Automatic identification of standard solutions	1 group standard solution
	Custom standard solution	Manual identification of standard solutions
	Manual temperature compensation	(0.0~60.0)°C
Temperature function	Temperature unit	°C

## 2. Safety Notices

Please read the entire contents of this manual carefully before use, and please keep this manual properly. The user **MUST** use the instrument following this manual to avoid damage to the user and equipment.

Before using the meter, **READ** the following notes:

**DO NOT DISASSEMBLE** the device for inspection or repair. To prevent electric shock or damage to the device, **DO NOT** place cables and connectors in any liquid, wet or corrosive environment. Please use the defaulted power adapter **DO NOT** use it if the power cord is damaged (the wire is exposed or broken). **DO NOT** use it in flammable and explosive environments. **DO NOT** use it if the user finds any abnormalities such as damage or deformation of the device.

The following identifiers will be used in this manual.

### 【TIPS】

Tips help to use the meter.



## 3. Terms Explanation

**pH Slope:** The amount of potential change generated by each 1 pH change, expressed in mV/pH or by 100% Theoretical Slope (PTS).  $\text{pH} = -\log[\text{H}]$ , where [H] means molar concentration (mol/L) of H ions. **E0 of pH:** Also known as "zero potential", usually refers to the potential value at pH 7. **One-point calibration:** Calibration with a standard solution **Two-point calibration:** Calibration with two standard solutions.

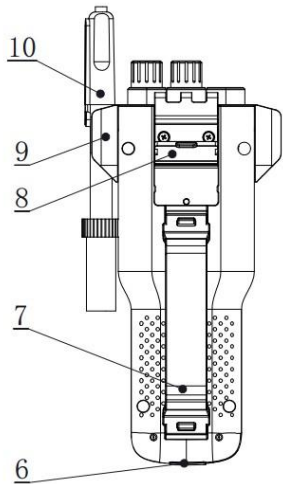
**Multi-point calibration:** Calibration with more than two standard solutions.

# 4. Overview and Installation

## 4.1 Overview

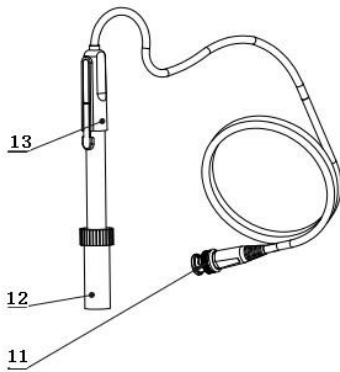
- 1 Meter Body
- 2 Power Key
- 3 Function selection key
- 4 Display
- 5 Socket protective cap

Figure 4-1. Overview-Front View



- 6 Power sockets
- 7 Wristbands
- 8 Flip Tilting Stand
- 9 Electrode Holder
- 10 Electrode

Figure 4-2 Overview- Back View



- 11 pH electrode connectors
- 12 Electrode protection cap
- 13 pH electrodes

Figure 4-3 Electrodes and connectors

## 4.2 Instrument installation

### 4.2.1. Wristband Installation

Push the wrist strap switch at the wrist strap head to open the closed round hole.

Snap the opened round hole card slot into the shaft of the corresponding instrument housing and close the round hole.

The lower wristband card slot is also operated as above.



Figure 4-4 Wristband Installation

### 4.2.2. Electrode Connection

Insert the electrode holder into the T-shaped port corresponding to the meter body; Insert the pH electrode into the electrode holder and hold it firmly; Find the connector, insert the measuring electrode into the corresponding place on the meter.

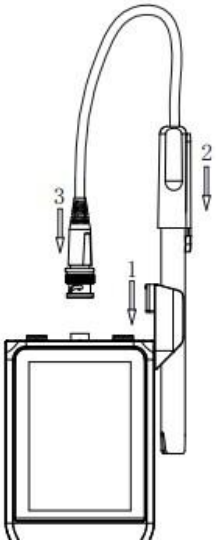


Figure 4-5 Electrode connection

## 5. Instrument Operation

### 5.1 Screen Icons

The meter uses segment LCD as the display, and the overall design is as follows: The upper shows the status prompt area; the middle is the measurement result area; the lower right is the current percent slope, and the bottom is the main function area, including measurement function, calibration function, setting function.

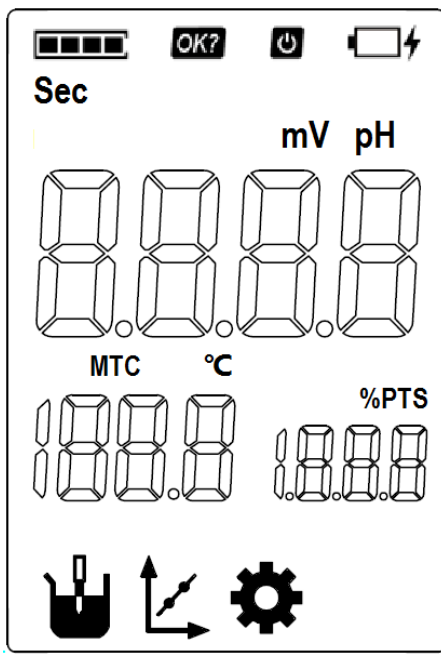










Fig. 5-1 Screen icons explanation

Table 5-1 Symbol Explanation



No.	Symbol	Explanation	Note
1		Reading state	All four segments are lit up in stable state
2		Confirm the option	Display when user confirmation is required
3		Automatic shutdown	Display when automatic shutdown is valid
4		Low power	Display when battery is low
5		Charging	Display when connected to the power charger
6	mV	mV result unit	Unit: mV
7	pH	pH result unit	Unit: pH
8	Sec	Time unit	Unit: Sec
9	°C	Temperature	Unit: °C
10	MTC	Manual temperature compensation	Represented by character string MTC
11	%PTS	Percentage slope value	Represented by character string %PTS
12		Measurement	
13		Calibration	
14		Setting	

## 5.2 Key Functions

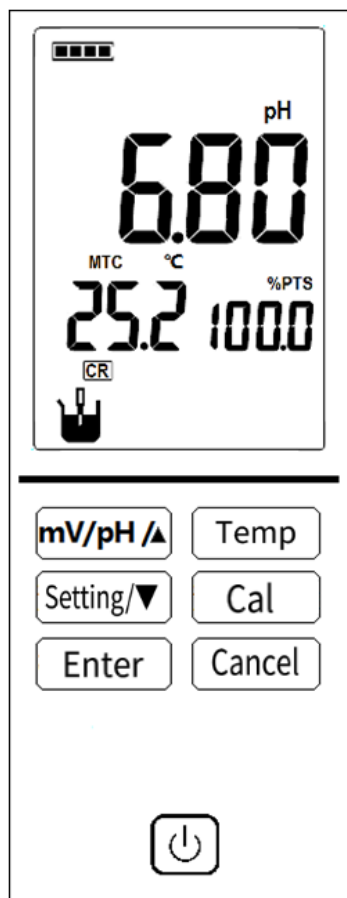

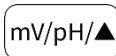


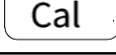
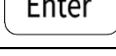
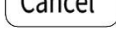


Figure 5-2 Instrument keys

Table 5-2 Key Function Explanation

No.	Key	Explanation	Note
1		Power key	Press to switch on the instrument. Press and hold for more than 3 seconds to switch off. Can be used as a backlight power key after switching on.
2		mV/pH/Up	Switch mV and pH display in measurement state. The value increases when the function is set.
3		Setup	Enter the setting function. The value decreases when setting the function.
4		Temperature	Set manual temperature value.
5		Calibration	Enter the calibration function during measurement.
6		Enter	Confirm some function.
7		Cancel	Give up some function.

## 5.3 Instrument Settings

### 5.3.1. Switch On/Off



Press  to start. The meter performs self-test, and then enters the measurement state. If it cannot be turned on, the built-in lithium battery may be insufficient. Please use the default power charger to connect and charge it, and wait 15 minutes before turning it on. After use, the user can press  and hold the key for more than 3 seconds to switch off.

Table 5-3 Characters displayed on the power operation interface

No.	Character display	Explanation
1	U4	Switch On, Software Version
2	OFF	Switch Off

#### 【TIPS】

Please use the default power charger for charging, so as not to damage the instrument and bring you



unnecessary losses. Please check the electrode sockets on the back of the meter, and make sure that they are connected with measuring electrodes or short-circuit plugs, otherwise it may damage the high-resistance components of the meter and bring you unnecessary losses. The lithium battery of the meter should not be charged continuously for a long time. It can be fully charged in about 4 hours in the switch-off state, that is, the charging cable can be removed after the indicator light is always on. It is strictly forbidden to continuously charge for 24 hours.

### 5.3.2. Temperature Settings

This meter does not support the connection of temperature electrodes, the user needs to use a thermometer to measure the temperature of the solution.

Press the "Temp" key, and adjust the temperature to the specified temperature value through the up and down key.

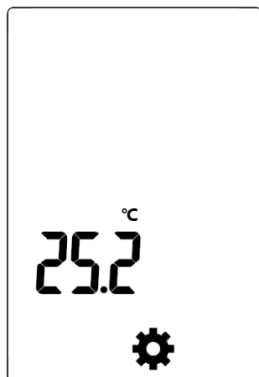


Figure 5-5 Setting temperature display

### 5.3.3. Instrument Settings

The meter supports a variety of functions, including the manual temperature value, setting the automatic switch-off time, factory reset, etc. The user presses the "Setting/▼" key, the meter will display the setting logo, SEL and serial number, the user presses up and down keys to adjust, presses the "Enter" key to select.

Table 5-4 Set function list in the measurement status

No.	Explanation	Note
1	Temperature Settings	Flashing display °C
2	Automatic shutdown settings	Flashing display "APD"(Auto Power Down)
3	Reset settings	Flashing display "rSt" (Reset)and "dFt" (Default)

### 5.3.3.1 Automatic shutdown settings

The meter provides auto shutdown function. When the meter is not using and set the auto shutdown, the meter switches off automatically. There are six options: off, 300 Sec, 600 Sec, 1200 Sec, 1800 Sec, and 3600 Sec.

### 5.3.3.2 Reset settings

When the meter is not working. Users can reset the meter from the defaults backup. The default setting includes the electrode slope is 100%, the temperature is 25.0°C, the reading mode is continuous reading mode, the automatic switch-off function is turned off, etc.

## 5.4 Calibration

### 5.4.1 Prepare electrodes

Before using the pH electrode, please pay attention to the following items:

Pull out the electrode protection cap at the bottom end of the pH electrode, and pull down the rubber sleeve at the upper end of the electrode to expose the small hole at the upper end. Clean the electrodes with distilled water. For details on the use and storage of the pH electrode, please refer to the electrode instruction manual.

### 5.4.2 pH electrode Calibration

Table 5-5 Characters displayed on the calibration operation interface

No.	Character display	Explanation
1	Auto	Display when the standard solution is automatically identified, indicating Auto Recognition.
2	Non	Display when the standard solution is manually identified, indicating Manual Recognition.
3	Err	Display when calibration fails, indicating Error.

4	OH	Display when the confirmation is valid during calibration, indicating OK.
5	End	Display when calibration is completed.

The pH electrode has a certain drift in different use environments or when it has not been used for a long time, resulting in different electrode slopes and zero points. It needs to be re-calibrated with a standard buffer solution.

If the user needs to perform two-point calibration, two standard solutions must be prepared in advance. If only one-point calibration is required, only one standard buffer solution is required.

One-point calibration is suitable for the situation where the measurement accuracy is not high. At this time, the percentage slope of the electrode is taken as 100%. Usually, two-point calibration or multi-point calibration is used to improve the measurement accuracy of pH.

Generally, when the meter is used continuously, it is recommended to calibrate once a day.

The meter supports automatic identification of standard buffer solutions, and can identify three standard solutions of 4.01pH, 7.00pH, and 10.01pH.

Users can refer to the appendix to prepare pH standard buffer solution, or purchase market standard buffer solutions.

Prepare 1-2 standard buffers and deionized water as required to start calibration. The calibration steps are as follows (for reference):

In the measurement state, press the "Cal" key to enter the electrode calibration state (the default is automatic identification mode, the word "Auto" is displayed) Wash the pH electrode repeatedly with distilled water, put it in a certain standard buffer solution (such as 7.00pH standard buffer solution), the instrument displays pH value and temperature value (such as 7.00pH, 25.0°C).

Use a thermometer to measure the temperature value of the standard solution, press the "Temp" key and adjust to the specified temperature value (such as 25.2°C) with the up and down key . Wait for the reading to stabilize, press the "Enter" key, and the meter stores the calibration data and displays the calibration result, that is, the nominal pH value at 25.2°C.

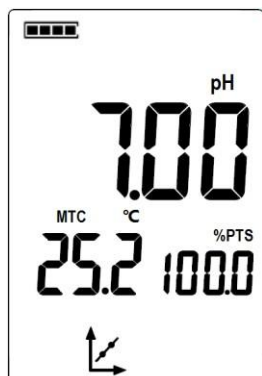


Figure 5-7 Calibration display

When performing multi-point calibration, repeat the process above, after cleaning the electrode, put it in other standard solutions, and then repeat the measurement of temperature and set the temperature value, and confirm after the data is stable. The meter supports up to 2-point calibration. When the user finishes calibrating 2 standard solutions, the meter will automatically end the calibration and return to

the measurement state. If the user only needs to calibrate 1 point, you can manually press the "Cancel" key to terminate the calibration.

If the user uses a non-standard pH buffer solution to calibrate the electrode, the user must know the relationship between the pH value of the non-standard solution and the temperature in advance, that is, the nominal pH at a certain temperature, and then control the temperature of the constant temperature tank to make the standard solution reach specified temperature value.

Calibration steps are as follows (for reference ):

Place the standard solution in a constant temperature tank, in which the temperature is controlled to a certain temperature value. Long press the "Cal" key to switch to manual identification mode and display the word "Non", press the up and down key to set the nominal pH value at the current temperature;

Press the "Temp" key and adjust to the specified temperature value

by the up and down key, and press the "Enter" key to complete the temperature value input.

After the data is stable, press the "Enter" key to complete the Calibration.



**【TIPS】**

Standard pH buffer solutions are usually obtained in two ways, users can prepare or purchase standard solutions by themselves.

Customized: Please refer to appendix to prepare pH standard buffer

Purchase standard buffers: Users can also directly purchase certified standard buffers produced by professional manufacturers, very convenient. In order to facilitate the use of users and reduce a lot of work for users to prepare standard solutions, our company produces and prepares pH standard buffer solutions, which users can purchase directly. It is very convenient to calibrate the electrode with a standard solution before measurement.

## **5.5 Measurement**

### **5.5.1 Measurement preparation**

Before measurement, the user should understand the properties and attributes of the substance (sample) to be measured; the method of routine testing; know the basic operation and application of the meter; know the use and maintenance of conventional electrodes.

The user needs to prepare the sample first, or the standard solution that needs to re-calibrate the electrode, etc.

5.5.2 After pH electrode calibration, pH value and potential value of the solution can be normally measured.

The measurement steps are as follows (for reference):

Immerse the electrode in the solution to be measured. Use a thermometer to measure the temperature value of the current solution, and then manually set the temperature value. Wait for the data to stabilize, and then read the measurement results.

Press the mode key "mV/pH" to switch the mV value or pH value display.

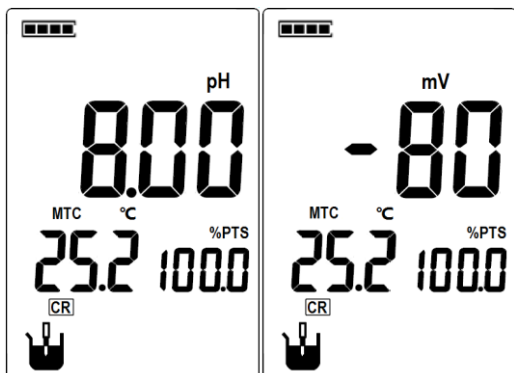


Figure 5-8 Measurement display



**【TIPS】**

To ensure accurate measurement, the sample volume in the container should be sufficient to ensure that the junction of the measuring and the reference electrode is completely immersed in the sample. For accurate measurement, it is recommended that users calibrate and measure at the same temperature.

## 6. Maintenance and Troubleshooting

### 6.1 Maintenance

The correct use and maintenance of the meter can ensure the normal and reliable operation of the meter, especially the pH meter, which has a high input impedance and is easily damaged by static electricity and other electromagnetic interference; In addition, it will often come into contact with chemicals, and the use environment is relatively harsh, so reasonable maintenance is required:

The measurement electrode socket of the meter must be kept clean and dry; After the electrode is disconnected, please connect the Q9 short-circuit plug to the socket to prevent high resistance damage. When calibrating the electrode with pH standard buffer solution, ensure the reliability of the buffer solution, otherwise it will affect the accuracy of the measurement results. The meter is equipped with a professional protective cover. Please use the defaulted power adapter. The meter uses a built-in lithium battery to provide working power, and an indicator light is designed under the meter switch key, which is convenient for users to understand the power information of the meter.

Table 6-1 Lithium battery power indicator status

No.	Meter status	Charging state	Switch-on and off key indicator status
1	Meter shutdown	Not charging	Close
2	Turn on the meter.	Not charging	Constant light

3	Turn on the meter.	Charging	The power is displayed in the form of 1 to 4 consecutive flashes. The higher the flashing frequency, the more power; the constant light indicates that it is fully charged
4	Meter shutdown	Charging	

Lithium batteries are high-energy storage components, please pay attention to the following items when using them:

Strictly prohibited to be close to high temperature objects above 85° C. Water is strictly prohibited inside the meter. Keep away from flammable and explosive substances. When the meter is not used for a long time, the power of the lithium battery will also decrease, and the state of serious shortage will appear. Please connect the charger before use, and turn it on after 15 minutes of charging. The lithium battery of the meter should not be charged continuously for a long time. It is recommended that the charging time be controlled within 8 hours. It can be fully charged in about 4 hours in the shutdown state, that is, the charging cable can be removed after the indicator light is always on. Continuous charging for 24 hours is strictly prohibited.

## 6.2 Electrode usage and maintenance

Before using the electrode, you should read the electrode manual carefully to know the type, structure and application scope of the electrode. For composite pH electrodes with plastic shells, the following points should generally be noted:

The external reference supplement of the composite electrode is 3mol/L potassium chloride solution. The supplement can be added from the small hole at the top of the electrode. When the composite electrode is not in use, the rubber cover should be pulled to prevent the supplement from drying up. After removing the electrode protection cap, the sensitive glass bubble of the electrode should be avoided from contacting with hard objects. Any damage or scratching will make the electrode ineffective. After the measurement, the electrode protection cap should be covered in time. A small amount of external reference supplement should be placed in the protection cap to keep the electrode bulb moist. Do not immerse the electrode in distilled water for a long time. The Q9 short-circuit plug of the electrode should be kept clean and dry to prevent short-circuit by rust, otherwise it will cause measurement inaccuracy or failure. Electrodes should avoid long-term immersion in protein solutions and acidic fluoride solutions, and should avoid contact with silicone oil. Due to the different electrode materials, please select the appropriate electrode according to the actual use to avoid damage to the electrode. Repair pH Electrodes: After long-term use of the electrode, if the slope decreases slightly, the bottom end of the electrode can be immersed in 4% HF (hydrofluoric acid) for (3-5) s, wash with distilled water, and then soak in 0.1 mol/L hydrochloric acid solution to rejuvenate. Clean pH Electrode: If the measured solution contains substances that are easy to contaminate the sensitive bulb or block the liquid junction and make the electrode passivated, the slope will decrease and the display reading will be inaccurate. If this phenomenon occurs, according to the nature of the contaminant, the electrode should be cleaned with an appropriate solution to regenerate the electrode.

Table 6-2 Reference table of electrode contaminants and cleaning agents

Contaminant	Detergent
-------------	-----------



Inorganic metal oxide	Less than 1 mole /L of dilute acid
Organic fatty substances	Dilute detergent (weak alkaline)
Resin polymer material	Alcohol, acetone, ether
Protein hemocyte precipitate	5% pepsin +0.1mol/L HCl solution
Pigment substance	Dilute bleach solution, hydrogen peroxide

For more details, see pH electrode instructions.

## 6.3 Troubleshooting

Table 6-3 Common Troubleshooting

Phenomenon	Probable reasons	Solutions
1.No Display	<ol style="list-style-type: none"> <li>1. Not turn on.</li> <li>2. Instrument damage.</li> <li>3. Damaged power adapter.</li> </ol>	<ol style="list-style-type: none"> <li>1. Connect the charger, wait a moment and press the power key to turn it on.</li> <li>2. Replace or repair as specified.</li> <li>3. Replace the power adapter.</li> </ol>
2.Inaccurate measurements	<ol style="list-style-type: none"> <li>1. Poor electrode performance.</li> <li>2. Electrode calibration error.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace electrodes.</li> <li>2. Recalibrate the electrode.</li> </ol>

## 7. Technical Support

### Accessories

Please refer to the accessories table for purchasing recommendations.

Table 7-1 Meter accessories

Name	Description
E-201F pH composite electrode	Conventional sample measurement
pH standard buffer reagent	pH4.01,7.00, 10.01
Power charger	DC5V, meet lithium battery charging

Table 7-2 Optional electrodes (for other models, see the official website for details)

Model Name	Electrode plug	Description
962241 pH Combination Electrode (Blade spear)	BNC(Q9)	Suitable for solid and semi-solid piercing samples
962242 pH Composite Electrode (Flat )	S7-BNC(Q9)	Suitable for surface or droplet samples
962244 pH composite electrode (Slender)	S7-BNC(Q9)	Suitable for trace samples above 0.2mL, or narrow-bore containers
962243 pH composite electrode (Long)	S7-BNC(Q9)	Suitable for large volume container samples
962102 pH composite electrode (Cleanable)	BNC(Q9)	Suitable for highly polluting samples such as emulsions, suspensions, and viscous
962223 pH composite electrode (RoHS )	S7-BNC(Q9)	RoHS Compliant
962224 pH composite electrode (High temp. resistance)	S7-BNC(Q9)	Suitable for high temperature samples

## 8. Appendix

### Appendix 1

#### pH-Temperature Relationship Table of pH Standard Solution

Temperature(°C )	1.68	4.01	7.00	10.01
5	1.67	4.00	7.09	10.25
10	1.67	4.00	7.06	10.18
15	1.67	4.00	7.04	10.12
20	1.68	4.00	7.02	10.06
25	1.68	4.01	7.00	10.01
30	1.68	4.01	6.99	9.97
35	1.69	4.02	6.98	9.93

40	1.69	4.03	6.97	9.89
45	1.7	4.04	6.97	9.86
50	1.71	4.06	6.97	9.83

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