



## PH METER

BMET-202



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# 1. Introduction

## 1.1 Introduction

BMET-202 portable pH meter is a newly designed functional instrument that can be widely used in universities, environmental protection, medicine, food, sanitation, geological prospecting, metallurgy, ocean exploration and other fields measurements for acid rain detection, industrial wastewater, surface water, drinking water, beverages, daily chemical products, textiles and other related industries.

### ✧ General Features

- High resolution LCD display, 5.7 inches.
- Multi-reading
- feature
- allows
- auto-read,
- timed-read and continuous-read.
- Automatic/Manual temperature compensation ensures accurate results.
- Auto-hold feature senses and locks the measurement endpoint.
- Data storage 500 sets (GLP-compliant).
- Support for USB or RS-232 communication.
- Reset feature automatically resumes all settings back to factory default options.
- IP54 waterproof.
- 1-5 points calibration with standard recognition.
- Selectable pH buffer groups, including NIST, DIN, GB, USA.
- Automatic electrode diagnosis with pH slope and offset display.

## 1.2 Technical Specification

Table 1-1 Technical Specifications

|          |                                  |                        |
|----------|----------------------------------|------------------------|
| Model    |                                  | BMET-202               |
| pH level |                                  | 0.01pH                 |
| mV       | Range                            | (-2000.0~2000.0)mV     |
|          | Minimum resolution               | 0.1mV                  |
|          | Electronic unit indication error | ±0.1% or ±0.3mV        |
|          | Electronic unit repeatability    | 1mV                    |
|          | Electronic unit input current    | ≤1×10 <sup>-12</sup> A |
|          | Electronic unit input impedance  | ≥1×10 <sup>12</sup> Ω  |

|                               |                                  |                                                                        |
|-------------------------------|----------------------------------|------------------------------------------------------------------------|
| pH                            | Range                            | (-2.00~20.00)pH                                                        |
|                               | Minimum resolution               | 0.01pH                                                                 |
|                               | Electronic unit indication error | ±0.01pH                                                                |
|                               | Electronic unit repeatability    | 0.005pH                                                                |
|                               | Instrument indication error      | ±0.02pH                                                                |
|                               | Instrument repeatability         | 0.01pH                                                                 |
| Temperature                   | Range                            | (-5.0~110.0)°C                                                         |
|                               | Minimum resolution               | 0.1°C                                                                  |
|                               | Electronic unit indication error | ±0.2°C                                                                 |
|                               | Instrument indication error      | ±0.4°C (0°C -60°C)<br>±1.0°C (Other range)                             |
| Use environment               |                                  | Environment temperature: (0~40)°C Relative humidity: not more than 85% |
| Dimensions(L×B×H), Weight(kg) |                                  | 242mm×195mm×68mm , 0.9kg                                               |
| Power supply                  |                                  | Power adapter, Input: AC100~240V Output: DC9 V                         |

## 1.3 Function Introduction

Table 1-2 Functions Specification

| Features       |                                      | Explanation |
|----------------|--------------------------------------|-------------|
| Basic Function | Languages                            | English     |
|                | Backlight adjustment                 | ●           |
|                | Automatic diagnostics                | ●           |
|                | Reset settings                       | ●           |
|                | Default parameter                    | ●           |
|                | Prompt Sound                         | ●           |
|                | Time settings                        | ●           |
|                | Power failure protection             | ●           |
|                | Firmware upgrade                     | ●           |
|                | Anti-interference automatic recovery | ●           |
|                | Automatic shutdown                   | ●           |
|                | Protection                           | IP54        |

|                  |                          |                         |
|------------------|--------------------------|-------------------------|
| Reading Function | Reading balance settings | ●                       |
|                  | Auto-lock reading        | ●                       |
|                  | Reading Mode             | Continuous, Auto, Timed |
|                  | Sample ID                | ●                       |
| Data Management  | Storage                  | 500 sets                |
|                  | View                     | ●                       |
|                  | Delete                   | ●                       |
|                  | GLP                      | ●                       |

| Features                            |                                          | Explanation             |
|-------------------------------------|------------------------------------------|-------------------------|
| Communications and external devices | Printer                                  | RS232 Serial Printer    |
|                                     | Content and format customization         | GLP, Standard, custom   |
|                                     | PC                                       | ●                       |
| pH/mV Measurement                   | pH electrode status/performance          | Slope, Electrode status |
|                                     | Multi-point calibration                  | 5 points                |
|                                     | Automatic standard solutions recognition | 4 Group                 |
|                                     | Standard solutions customization         | ●                       |
|                                     | Standard groups customization            | 1 Group                 |
|                                     | Automatic temperature compensation       | ●                       |
|                                     | Manual temperature compensation          | ●                       |
|                                     | pH electrode diagnostics                 | ●                       |
| Temperature Measurement             | Temperature units                        | °C , °F                 |

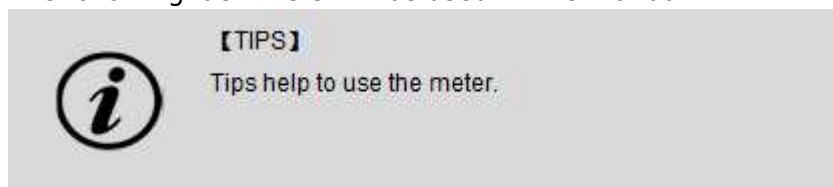
## 2. Safety Notices

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 in flammable and explosive environments.
- DO NOT use if the user finds any abnormalities such as damage or deformation of the device.

The following identifiers will be used in this manual.



## 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", it usually refers to the potential value at a pH of 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

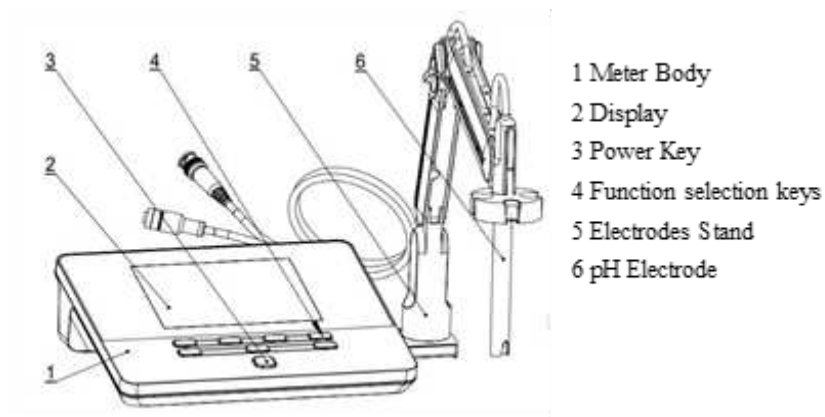


Figure 4-1 Overview-Front view

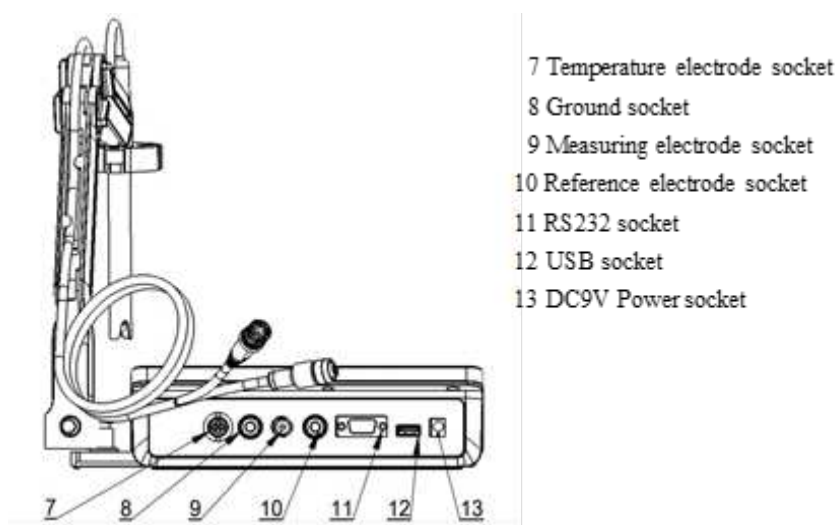


Figure 4-2 Overview- Back view

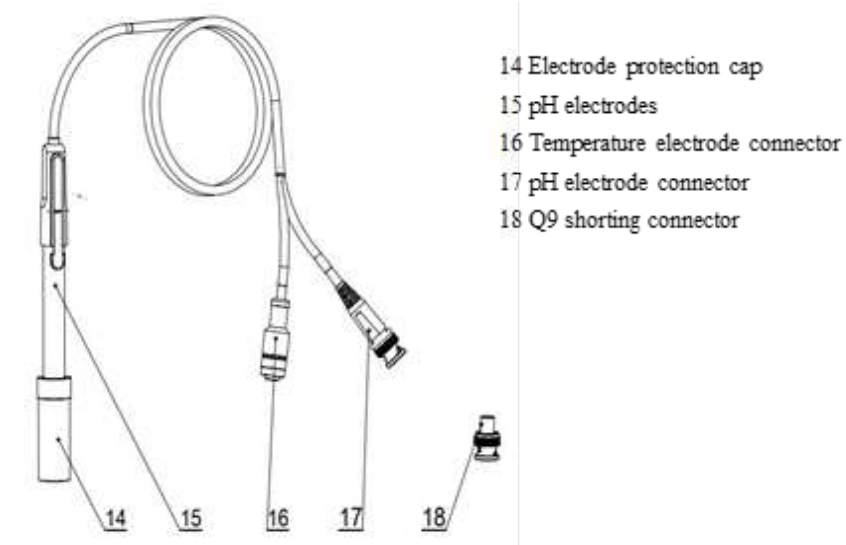


Figure 4-3 Electrodes and

connectors

## 4.2 Instrument Installation

### 4.2.1 Electrodes Stand Installation

1. Pull out the electrode holder fixing plate on the right side of the instrument.
2. Press the electrode holder support onto the vertical shaft of the electrode holder drawer.
3. Tighten the set screw at the bottom of the electrode holder support.

### 4.2.2 Electrodes Connection

1. Mount the pH electrode (15) on the electrode holder (5).
2. Find the measuring electrode socket (9) on the back of the instrument, unplug the Q9 short circuit plug (18), then, insert the pH electrode into the measuring electrode socket (9).
3. Insert the other four-pin aviation of the pH electrode into the temperature electrode socket on the back of the instrument.

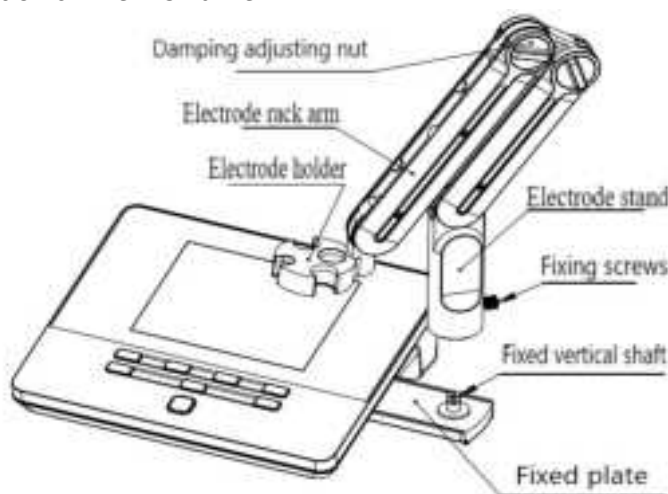


Figure 4-4 Electrode stand installation

## 5. Instrument Operation

### 5.1 Switch On/Off

After connecting the power adapter, the electrode holder and electrode, press and release to  switch on the meter. The startup screen shows software version and other related information. After the self-test program, the screen turns to the homepage and the meter is ready to measure.

The meter equipped with 8 function keys. Users press and hold the  key for more than 3 seconds and release to shut down.



## 5.2 Screen Icons



Figure 5-1 Screen icons explanation

1 Title. 2 System time. 3 Measurement parameters and balance status. 4 Main measurement box. 5 Calibration information. 6 User ID. 7 Sample ID. 8 Operation tips. 9 Soft function keys.

The instrument displays symbol identification that has the following functional implications:

Table 5-1 Symbol explanation

| No. | Symbol | Explanation                                                                                                                                  |
|-----|--------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1   |        | Reading status, display the measurement status of reading, stable, locked each indicates that the processing, stable, and reading completed. |
| 2   |        | The percentage slope of the pH electrode calibration data                                                                                    |
| 3   |        | The standard buffer solution for calibration                                                                                                 |
| 4   |        | Time to Calibrate Electrodes                                                                                                                 |
| 5   |        | Standard solution for pH electrode calibration                                                                                               |
| 6   |        | Automatic temperature compensation                                                                                                           |
| 7   |        | Manual temperature compensation                                                                                                              |
| 8   |        | User ID                                                                                                                                      |
| 9   |        | Sample ID                                                                                                                                    |
| 10  |        | Operation Tips                                                                                                                               |

## 5.3 Function Key

Figure 5-2 The Screen and key

Table 5-2 Key function explanation

| No. | Keys                                                                              | Explanation | Note                                                             |
|-----|-----------------------------------------------------------------------------------|-------------|------------------------------------------------------------------|
| 1   |  | Power       | Press to switch on/off                                           |
| 2   |  | Setting     | Set the parameters and settings                                  |
| 3   |  | Cancel      | Cancel the operation                                             |
| 4   |  | Enter       | Confirm the option                                               |
| 5   |  | F1          | Function key, Corresponds to the function options on the screen  |
| 6   |  | F2          | Function key, Corresponds to the function options on the screen  |
| 7   |  | F3          | Function key, Corresponds to the function options on the screen  |
| 8   |  | F4          | Soft function keys, corresponding to the functions on the screen |

## 5.4 Instrument Settings

In the standby interface of the instrument or during the measurement process, you can set the instrument parameters through the soft function key "Setting".

### 5.4.1 Tutorial settings

For the first use, please follow the guide to settings the measurement parameters. After all the settings, press the "Enter" to return to the previous page.

### 5.4.2 Reading Mode Settings

The meter provides three reading modes, including continuous readings, auto readings, and timed readings.

- Continuous reading: The instrument displays real-time measurement results. User can end the measurement at any time and save the last result.
- Auto-reading: The measurement reached the balance, and the meter locked the reading result. The meter offers "Fast", "Medium", "Strict" and "Custom" four options for endpoint detection conditions.
- Time reading method: Timed Reading contains two kinds of timed reading methods: "Interval Measurement" and "Timed Measurement". "Interval Measurement" provide measurement results at interval time and "Timed Measurement" provide measurement result after a set time.

Table 5-3 Reading parameters settings

| Stability Type             |             | pH       |
|----------------------------|-------------|----------|
| Fast                       | Stable time | 4s       |
|                            | Fluctuation | 1mV      |
| Medium                     | Stable time | 6s       |
|                            | Fluctuation | 0.5 mV   |
| Strict                     | Stable time | 8s       |
|                            | Fluctuation | 0.1mV    |
| Custom (Recommended value) | Stable time | 1 to 30s |
|                            | Fluctuation | 0.1~1mV  |

### 5.4.3 pH Parameter Settings

#### 5.4.3.1 pH standard groups

The pH electrode needs to be calibrated with a pH standard buffer solution, and different countries and regions often use pH standard buffer solutions prepared with different standards. For the convenience of your use, the instrument has built-in three commonly used standard solutions including GB, DIN and NIST. You can choose according to the actual situation. The instrument also supports the construction of custom standard solution groups. You can select the required standard solution from the standard buffer solution library to form a custom standard solution group.

Table 5-4 Standard solution groups

| Groups | Contents                                                                                 |
|--------|------------------------------------------------------------------------------------------|
| NIST   | 1.68pH, 4.01pH, 6.86pH, 7.00pH, 7.42pH, 10.01pH, 12.47pH                                 |
| USA    | 1.680pH, 4.010pH, 7.000pH, 10.010pH                                                      |
| DIN    | 1.68pH, 2.00pH, 3.56pH, 3.78pH, 4.01pH, 6.87pH, 7.00pH, 7.42pH, 9.18pH, 10.01pH, 12.45pH |
| GB     | 1.68pH, 3.56pH, 4.00pH, 6.86pH, 7.41pH, 9.18pH, 12.46pH                                  |

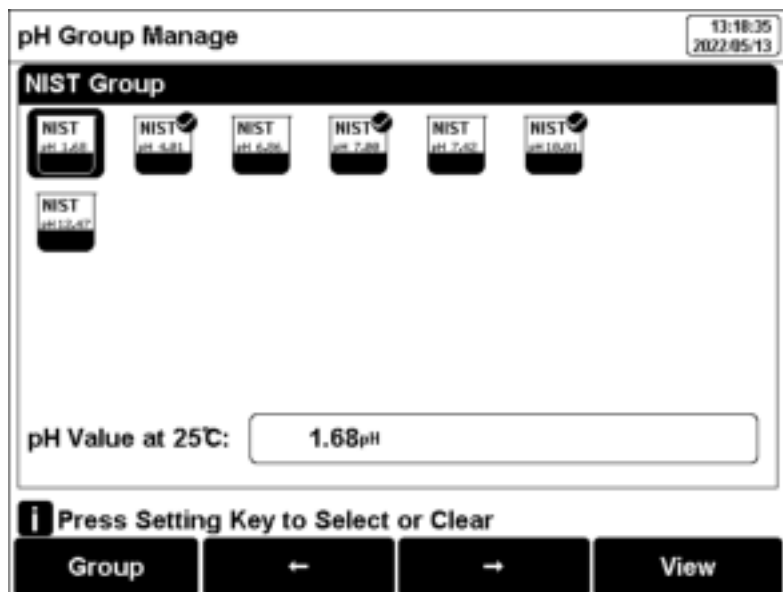


Figure 5-3 Selection of standard groups and

standard solution

After selecting the standard solution group, we need to select the standard buffer solution used for calibration from the standard solution group. The instrument supports up to 5-point calibration, that is, up to 5 standard solutions can be selected. Since the pH values of multiple standard buffer solutions in the standard solution group may be very close, to ensure that the instrument can correctly identify the standard buffer solution, will limit the selection of standard solutions with neighboring pH values. The check mark indicates the currently used standard solution group and the corresponding standard solution.



**【TIPS】**

Selecting the correct standard solution group has an important influence on the correct calibration of the electrode. If the selected standard solution group is different from the pH standard buffer solution used, it will lead to wrong calibration results.

#### 5.4.3.2 Recognition

In some special cases, it is necessary to use some non-standard pH buffer solutions, or use two very close pH standard buffer solutions for electrode calibration. In this case, the manual standard solution identification function can be used. When set to "Manual Mode", the pH value of the current standard solution can be input during and used for electrode calibration.

#### 5.4.3.3 Resolution setting The pH measurement resolution of the instrument is adjustable.

pH resolution: 0.01pH and 0.1pH.

mV resolution: 0.1 mV and 1 mV.

### 5.4.4 Temperature Parameter Settings

The temperature unit of the meter is selectable in °C and °F. Temperature compensation mode: ATC and MTC.

ATC means automatic compensation. MTC means manual compensation.

It allows user to input the temperature.

## **5.4.5 Data Management Settings**

### **5.4.5.1 Sample ID type**

The instrument supports three setting methods of Sample ID: number order, time order, and manual.

- Number order: The sample ID No. is increasing with series number.
- Time order: The sample ID No. is increasing with sample measuring time. Format: Year/Y, Month/M, Day/D, Hour/H, Minutes/M, Second/S
- Manual: Manually set the sample ID No. It allows samples to manually enter the sample ID when saving or printing data.

### **5.4.5.2 Result Autosave**

When this function is enabled, the meter saves the results when the reading is stable in the auto-reading and interval timed reading mode.

### **5.4.5.3 Data Overwrite**

The meter provides 500 sets of measurement results storage space. When this function is enabled, the results data that exceeds capacity will be overwritten the old results data.

## **5.4.6 Output option**

The data format is GLP, STD Format, and Custom. It could select one data format to output the result. data format to output the result.

## **5.4.7 User ID Settings**

Set the user ID.

## **5.4.8 System Parameter Settings**

### **5.4.8.1 System Date & Time**

Settings of system date and time.

### **5.4.8.2 Buzzer setting**

Users can set the key sound by this setting.

### **5.4.8.3 Brightness setting**

Users can adjust the screen brightness by this setting.

### **5.4.8.4 Auto Power off**

The meter provides auto shutdown function. When the meter is not using, the meter switches off automatically.

### **5.4.8.5 Restore Default**

The meter supports "Restore Default" and "Restore Parameters". "Restoring Default" will restore all meter parameters to the factory state. "Restoring parameters" will restore the measurement parameters to the factory state.

#### 5.4.8.6 Software version

Users can find the software version information on the general setting page.

## 5.5 pH Measurement

### 5.5.1 Calibration Preparation

The electrode slope and zero potential of pH electrodes drift slightly over time. To accurately measure pH, it is recommended to calibrate the pH electrode before use, the instrument supports 1-5-point calibration.

One point calibration is a calibration process with a single standard solution, commonly applied in a quick test. The calibration slope is 100% in here.

Two-point calibration is to use two pH standard buffer solutions to calibrate the electrode, and construct a linear calibration curve through two points. Two-point calibration is the most commonly used calibration method, and it is usually recommended that the pH value of the solution to be measured lies between the two standard buffer solutions. Two-point calibration can improve pH measurement accuracy.

Multi-point calibration is a calibration process with more than one standard solution. It is recommended to calibrate between two standard buffer solutions at the pH of the solution to be tested. Multi-point calibration covers a wider measurement range for accurate pH measurement. Before starting calibration, please prepare one or more pH standard buffer solutions.



#### 【TIPS】

Standard 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.

### 5.5.2 Standards group selection

Before starting calibration, please prepare one or more pH standard buffer solutions. The meter has standards recognition function. Please set the Standard Group before the measurement.

You can also set the identification type to "Manual Mode" and manually enter the nominal value during the calibration process.

### 5.5.3 pH Calibration

The calibration process is as follows:

1. Setting.
  - Set the parameters (e.g. pH).
  - Select NIST standard solution group, and check pH 4.01, pH 7.00 and pH 10.01 three standard solutions.
  - Set the Auto Mode recognition.

- Connect the ATC probe or enter the temperature manually.

2. Press the F2 "Calibrate" for one-parameter measurements or press the F2 "Calibrate"-"pH Calibration" for multi-parameter measurements.

3. Put the cleaned electrode into pH 4.01 standard solution.

4. Wait for the instrument to display "Auto Mode Matched", press the F4 "Start".

5. If only 1-point calibration is required, after 1-point calibration is completed, press the "Enter" key to complete the calibration.

6. If multi-point calibration is required, please replace the pH7.00 and pH10.01 standard buffer solutions. After cleaning the electrode, put the electrode into the standard solution. After the instrument recognizes it successfully, the instrument reads stably, press the F4 "Next Point" to complete the calibration.

7. After completing the calibration, press the "Enter" key to complete the calibration, save the calibration results and end the calibration, directly enter the start interface. If the checked standard solution group is 5, automatically end the calibration after five points of calibration.



Figure5-4 pH electrode calibration information

## 5.5.4 pH Measurement

The measurement process is as follows:

1. Setting.

- Set the parameters (e.g., pH).
- Set the reading mode (e.g., continuous reading, auto-reading, or timed format).
- Put the electrode into test solution under test.
- In the idle status, press F4 "Measure" to enter into measurement status.
- When the reading is stable, press "Enter" to read the results.
- Press the "Save" to save the measurement results.
- Press the "Output" to print the measurement result when connect to the printer.
- Between measurements, stored pH electrode in distilled or deionized water.
- After measurement, rinse the pH electrode with deionized water thoroughly.

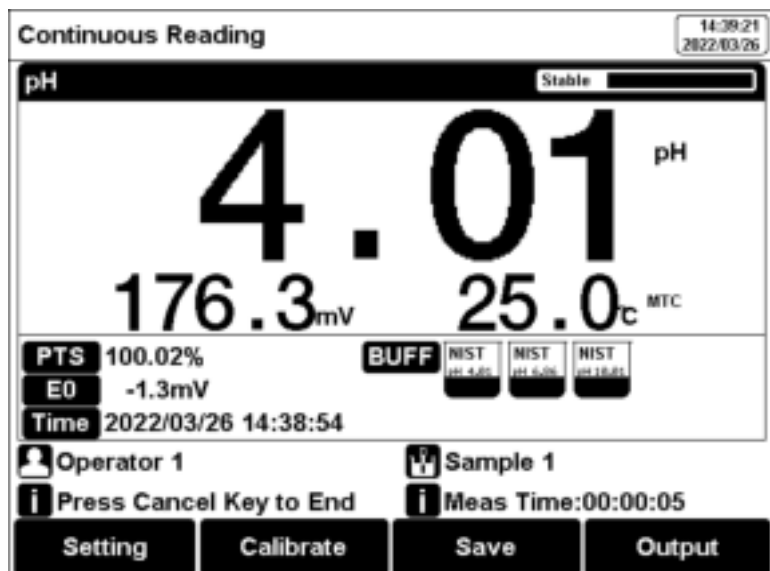


Figure 5-8 pH measurement information



**【TIPS】**

- The measurement end of the pH and reference electrode should well be immersed into the sample solution.
- For high accuracy measurement, make sure the measurement is carried out at the lab with constant temperature and pressure.
- If the two temperatures are different, it is recommended to use a pH combination electrode with temperature compensation or use a separate temperature electrode for automatic temperature compensation. Or use a thermometer to measure the temperature of the current solution, and manually set the temperature for manual compensation.

## 5.6 Data Management

Press "Data" to view the detail of results.

The meter stores the measurement results independently according to the measured parameters. The meter provides data Storage 1000 sets for each parameter (pH/pX/ISE/EC/Resistivity/TDS/Salinity/DO/Saturation).

The user can press "Delete" into the delete menu. It allows users to select the current data or all data to delete.

The user can view the data filter by parameter, locate No. or stored date. By the filter setting, press "Start Search" to look up the data. The filter data shows in a graph. Press "←" and "→" to choose data. User can choose one and press "Enter" key to see the detail result. Users can press "Delete" to delete the current result. Press "Output" to select the output data. The format supports output the current result,



output matched result and output all result.

Figure 5-16 Results setting view

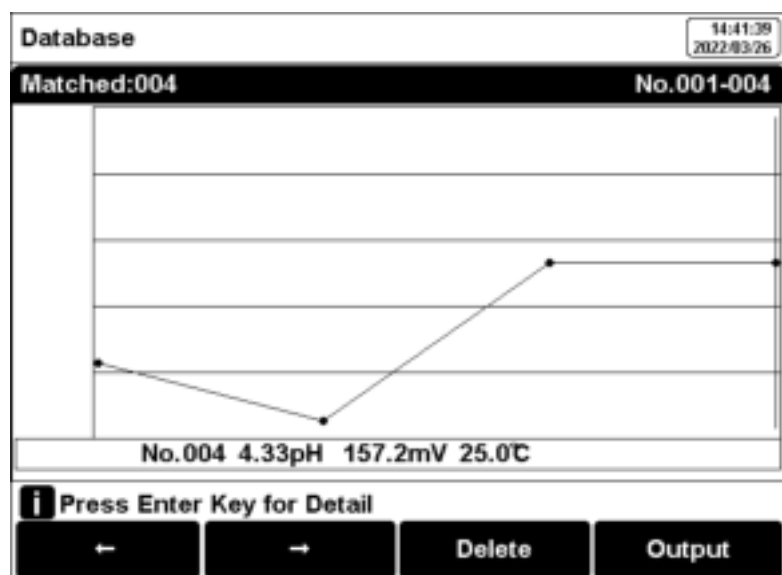


Fig 5-16 Review the stored resulted by graph

**【TIPS】**

➤ Please turn off the power supply of the instrument and printer before connecting the printer for safety.

➤ The instrument communication baud rate is 9600bps, the default setting is 8 data bits, a start bit and a stop bit, with no parity check.

The format is roughly as follows:

```

*****
Report Title:

Measure Time: 2021/01/19 12:27:28
Operator: Operator 1
Model: BMET-202pH Meter
Serial Number:
SW Version: Ver 1.00

-----
MATCHED INFO
Stored Num: 28
Matched Num: 1
Stored No.: 15

-----
CALIB INFO
Calib Operator: REX Team
Calib Time: 2020/05/13 08:30:00
Calib Num: 3

-----
CALIB RESULT
STD 1: 4.00pH 177.3mV 25.0° C
STD 2: 6.86pH 8.0mV 25.0° C
STD 3: 9.18pH -129.1mV 25.0° C
pH Slope 1: 100.00%
pH EQ 1: 0.0mV
pH Slope 2: 100.00%
pH EQ 2: 0.0mV

-----
BRIEF INFO
Reading Mode: Timed Reading
Stable Type: Medium
Temp Comp Type: ATC

-----
SAMPLE INFO
Sample ID: Sample 1

-----
RESULT
Result: 7.00pH
Signal Value: -0.0mV
Temp Value: 25.0c

-----
Signature:

```

## 6. Maintenance/Troubleshooting

### 6.1 Meter Maintenance

The correct use and maintenance of the instrument can ensure the accurate and reliable performance of the instrument. Maintenance plays an important role in pH measurements, which have high input impedance and are susceptible to damage from static electricity and electromagnetic field disturbances. Additionally, exposure to chemicals or harsh use environments can affect performance.

When the pH measuring electrode socket is not connected to the electrode, please insert the Q9 short-circuit plug to prevent the meter from being damaged. Please place the Q9 short-circuit plug in a dry and clean environment to prevent the short-circuit plug from being corroded to affect the short-circuit effect.

If the instrument is not used for a long time, please disconnect the power supply.

Keep the meter and accessories clean and away from acids, alkalis, and any corrosive solutions/gases.

The housing material of this meter is sensitive to certain organic solvents such as toluene, xylene, and methyl ethyl ketone (MEK). If liquid enters the housing, it may damage the instrument. Users can clean the meter surface with pure water and detergent.

- Unplug the meter and remove all connected cables.
- Remove the electrode holder.
- In order to avoid damage to the meter during long-distance transportation, please try to use the original

packaging.

## 6.2 Electrodes Maintenance

Before using the electrode, you should read the electrode manual carefully to understand the type, structure and application scope of the electrode.

For more details, please refer to the electrode instruction manual.

## 6.3 Troubleshooting

Table 6-1 Troubleshooting

| Phenomenon                  | Probable reasons                                                                                         | Solutions                                                                                                                   |
|-----------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. No Display               | 1. Damage to the meter.                                                                                  | 1. Connect the adapter and press the power key to turn it on, replace or repair as required.                                |
| 2. Incorrect mV measurement | The electrode is out of service life.<br>The connector is in poor contact.                               | Replace the electrodes<br>Connect the protection plug, if the potential is not 0mV, please contact the after-sales service. |
| 3. Incorrect pH measurement | Refer to as 2.1.<br>Refer to as 2.2.<br>The electrodes are not calibrated or are calibrated incorrectly. | Refer to as 2.1<br>Refer to as 2.2<br>Re-calibrate the electrode or replace the standard solution                           |

If the meter still does not work, please contact your local dealer for further assistance.

## 7. Technical Supports

### Accessories

Please refer to the accessories table for purchasing recommendations.

Table 7-1 Meter accessories

| Name                                        | Description          |
|---------------------------------------------|----------------------|
| E-301-QC 3 in 1pH composite electrode       | pH Measurement Probe |
| Standard pH buffer solution 4.01/7.00/10.01 | Standard solution    |

# 8. Appendixes

## Appendix 1

pH-Temperature Relationship Table of pH Standard Solutions

| 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  |



**Biolab Scientific Ltd.**

Trillium Executive Center, East Tower, 675 Cochrane Dr, Markham, Ontario L3R 0B8, Canada  
Email: [info@biolabscientific.com](mailto:info@biolabscientific.com) | Website: [www.biolabscientific.com](http://www.biolabscientific.com)