Instruction Manual R1.3
Santacary Technology Co., Ltd.
Portable pH Meter
Model BE500

INTRODUCTION

Thank you for selecting the BE500 portable pH meter. This meter is an outstanding combination of advanced electronics design and sensor technology. It's the most economical choice of a precise pH meter.
Please read this manual carefully to properly use and maintain the meter.
Santacary Technology reserves the right to update the contents of this manual without giving prior notices.

DESCRIPTION

Features

- Measuring principle: Glass electrode method
- pH Range : 0.00 to 14.00 pH with max accuracy of ±0.01 pH
- Support 1,2 and 3 points pH calibration
- Automatic and Manual Temperature Compensation provides accurate reading over the entire range
- Selectable pH buffer group (USA / NIST)
- Equipped with a large backlit LCD display
- Comes with a carrying case convenient for in-field use
- Powered by 4 AAAA alkaline batteries

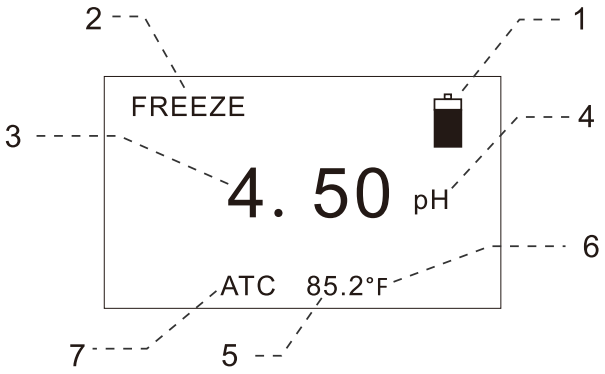
Device


2
1
3
4
5
347
Mode
Cal/
Menu
MI/▲
MR/▼
Enter
Santacary


1
2

1. pH electrode input BNC jack
2. Temperature probe input jack
3. LCD Display
4. Keypad and Panel
5. Tilt stand is located on the rear of the meter

LCD Display



1. Low Battery Indicator
2. Mode Status Icon
3. pH Measuring Value
4. pH Unit
5. Temperature
6. Temperature Unit
7. ATC or MTC Icon

ATC--Auto Temperature Compensation

MTC--Manual Temperature Compensation

Package Included

1. Meter

2. pH electrode
3. Temperature sensor
4. Buffer powder set
5. A bottle with electrode external reference powder
6. Instruction manual
7. 4 AAAA alkaline batteries
8. Portable toolbox for meter

OPERATION

The BE500 pH meter is powered by 4 AAAA alkaline batteries.

Keypad Operation

There are six buttons on the BE500 panel (see below Figure). Their functions are described in table1.

Table 1Keypad Operation and Functions

Keypad	Operation	Functions
	Short Press	Power on and enter **MEASUREMENT**

		mode when meter is power off
	Long Press (>3s)	Power off
Mode	Short Press	In **MEASUREMENT** mode : toggles the Temperature Units of measure (°C or °F)
		In **FREEZE** mode : release the held reading to return to **MEASUREMENT** mode
Cal/ Menu	Short Press	Momentarily press the Cal/ Menu button to enter **MENU** mode. There are six menu items by pressing the Cal/ Menu button shortly to loop. The menu items are described in the table 3.
MI/▲	Short Press	In the **MEASUREMENT** mode the user presses it to manually log one pH reading onto the meter memory. Note that the new data will automatically overwrite the old data in memory
		In the **MENU** mode : • In MTC (manual temperature compensation) menu item: press to increase temperature value • In USA/NIST menu item: press to toggles between USA and NIST pH Standard Calibration Solution Series
MR/▼	Short Press	In the **MEASUREMENT** mode the user presses it to enter **DATA** mode and view the latest data log.

		In the **MENU** mode : • In MTC (manual temperature compensation) menu item: press to decrease temperature value • In USA/NIST menu item: press to toggles between USA and NIST pH Standard Calibration Solution Series
Enter	Short Press	In the **MEASUREMENT** mode, momentarily press the Enter button to freeze a displayed reading on the LCD and enter **FREEZE** mode. The FREEZE display icon will appear.
		In the **MENU** mode, save and implement the Menu item then returns to **MEASUREMENT** mode.

Note:
When LCD backlight is off, press any button to turn on the backlight before operation. LCD backlight will turn off automatically after 60 seconds of button inactivity.

Changing the Operation Mode

BE500 pH meter has four operation modes: **MEASUREMENT**, **MENU**, **DATA** and **FREEZE** mode (see table 2). Change the operation mode from four available modes depending on the purpose of use. The status icon indicates the current mode.

Table 2 Operation Modes

Mode Name	Mode Status Icon	Functions
MEASUREMENT mode	(None)	Performs measurement
MENU mode	(None)	Performs calibration setup, calibration and MTC setup
DATA mode	DATA	Displays the saved data
FREEZE mode	FREEZE	Data is frozen

Users can change the operation mode using the corresponding key. However changing to the MENU mode, DATA mode, or FREEZE mode is possible only from the MEASUREMENT mode. When changing to a different mode, first change to the MEASUREMENT mode and then change to the desired mode.

Menu Mode Operations

By pressing the **Cal/ Menu** button, the meter enters into **MENU** mode. There are six menu items by pressing the **Cal/ Menu** button shortly to loop. The menu items are described in table3.

Table 3 Menu Operations

Menu Items	Functional Description
St. Buffer: USA or **St. Buffer: NIST**	Setting the pH Standard Calibration Solution Series: USA or NIST series. User presses **MI/▲** or **MR/▼** to toggle the settings. Press **Enter**

	button to confirm the setting and return to the **MEASUREMENT** mode.
PH Calibration 1 7.00 pH (USA) or **PH Calibration 1 6.86 pH** (NIST)	To make the first point pH Calibration. User presses the Enter button to implement the first point pH Calibration
PH Calibration 24.01 pH (USA) or **PH Calibration 24.01 pH** (NIST)	To make the 2nd point pH Calibration. User presses the Enter button to implement the 2nd point pH Calibration
PH Calibration 210.01 pH (USA) or **PH Calibration 29.18 pH** (NIST)	To make the 3rd point pH Calibration. User presses the Enter button to implement the 3rd point pH Calibration
MTC : xx°C	Setting the MTC (Manual Temperature Compensation) temperature. User presses MI/▲ or MR/▼ button to adjust temperature compensation accordingly. Press Enter button to confirm the setting and return to the **MEASUREMENT** mode.
EXIT	User presses the Enter button to exit the **MENU** mode and return to the **MEASUREMENT** mode.

Connecting Electrodes and Temperature Sensor

The pH electrode connects to the BNC jack on the top left of the meter.
Align the BNC connector slots with the posts of meter's jack and rotate connector clockwise until it locks. Do not force it. To remove, rotate the connector in counter-clockwise direction until it unlocks, and slide the connector off the jack.
The temperature Sensor connects to the micro aviation jack on the top middle of the meter.
When measurements have been completed, be sure to store the pH electrode in its protective vial/cap.

Operating Hints

This section gives some brief operating hints and good laboratory practices to help assure trouble free pH measurements.
1. If you are measuring hot or cold samples without the use of an ATC probe, the values displayed are not accurate. You should be calibrating and measuring at room temperature.
2. When transferring from one sample to another, always rinse the electrode with distilled water and blot dry. Handle the electrode carefully and do not use it as a stirring rod.
3. Use new calibration buffers.
4. For small sample volumes, make sure that the pH bulb is in contact with the sample.
5. Response time is a function of both the electrode and the solution. Some solutions have very fast response while others, particularly those with low ionic strength, may take several minutes.
6. Samples must be in solution (water). Users cannot measure the pH of a dry sample.
7. See the next sections for general pH electrode maintenance.

PH ELECTRODE

The pH electrode contains polycarbonate silicone rubber material and glass components at the part contacting the sample. Before measuring the sample, please confirm that your sample solution does not harm the above materials.

There is a vial/cap stored with KCL (potassium chloride) storage solution on top of the electrode. The electrode use procedures are below:

1. Before using, loosen the cap of the vial, take out the electrode.

2. Put the electrode measuring end down, hold the electrode and shake it for several times to make the electrode bulb full of solution without bubbles.
3. Keep the electrode filling port open, connect the electrode plug with the pH meter. When connecting the electrode into the meter, please slowly rotate the connector, identify the location of the mount to insert it, and then screw it on. Please note that do not pull on the

cables in case of poor contact. Please keep the connector clean and dry.

4. Rinse electrode in distilled water and then do measurement. When the electrode is dipped into the test sample solution, stir it for a few seconds to remove potential air bubbles inside the probe to help the measurement get stabilized quickly.
5. During the electrode calibration and measurement, ensure that the external reference liquid level is more than 10 mm higher than the measured liquid level.
6. When not in use, clean the electrode in time after use and place the electrode back to the vial and tighten the cap so that the pH electrode can be stored in the best condition. Please keep an appropriate amount of 3.0 mol/l KCL (potassium chloride) solution in the electrode protection bottle, insert the electrode and make the measuring end of the electrode completely immersed in the KCL solution. Remember to close the filling port and put the electrode back into the packaging toolbox for room temperature storage.

PH CALIBRATION

The BE500 pH meter allows 1 to 3 points calibration. We recommend that you perform at least 2 points calibration for high accuracy measurement. The meter adopts two series of standard buffer solutions: USA and NIST as shown in Table 4. Users can select which one to use in Menu Operation.

Press the Cal/ Menu button one times and "St. Buffer: USA" or "St. Buffer: NIST" appears on the display.

Press the MI/▲ button or MR/▼ button to switch between "St.

Buffer: USA" and "St. Buffer: NIST".

Press Enter button to confirm the setting and return to the measurement screen.

Table4 Calibration Mode

	USA Standard Buffers	NIS Standard Buffers	When to adopt
1-Point Calibration	7.00 pH	6.86 pH	accuracy≤± 0.1 pH
2-Point Calibration	7.00 pH and 4.01 pH	6.86 pH and 4.01 pH	Measuring range: 0 to 7.00 pH
	7.00 pH and 10.01 pH	6.86 pH and 9.18 pH	Measuring range: >7.00 pH
3-Point Calibration	7.00 pH, 4.01 and 10.01 pH	6.86 pH, 4.01 and 9.18 pH	Wide measuring range

pH Calibration Considerations

The pH Electrode must be calibrated with the companion meter as often as possible for best results.

The frequency that you need to calibrate your meter depends on the tested samples, performance of electrodes, and the requirement of the accuracy.

1) For High-Accuracy measurements (≤±0.02pH), the meter should be calibrated before test every time;
2) For ordinary-accuracy Measurements (≥±0.1pH), once calibrated, the meter can be used for about a week or longer.

In the following cases, the meter must be re-calibrated:

1) The electrode hasn't been used for a long time or the electrode is

brand new.

2) After measuring strong acid (pH<2.00) or strong base (pH>12.00) solutions.
3) After measuring fluoride-containing solution and strong organic solution
4) There is a big difference between the temperature of the test sample and the temperature of the buffer solution that is used in the last calibration.

pH Calibration Procedure

Prepare buffer solutions for 7.00 pH and either 4.01 pH or 10.01 pH (6.86 pH, 4.01 pH or 9.18 pH if using NIST). Each pH buffer powder should be dissolved in 250ml pure water or deionized water in volumetric flask.

To eliminate temperature errors associated with the pH electrode, attach the Automatic Temperature Compensation (ATC) probe for best accuracy.

Without temperature compensation, pH accuracy will worsen as samples deviate from 25 ºC and 7.00 pH.

The 1st point must be 7.00 pH (or 6.86 if using NIST). Then choose other calibration solutions to conduct 2nd and 3rd points.

Step 1. To make the first point calibration

1) Rinse the pH electrode with distilled water, place the electrode and temperature sensor into the 7.00 pH (or 6.86 if using NIST) buffer solution. The end of the electrode must be completely immersed into the calibration solution. Stir the electrode gently to create a homogeneous solution. Let it stand still and wait for the reading to stabilize or wait for >3 minutes.
2) Press the Cal/ Menu button twice to select the item "PH Calibration 1 7.00 pH" (or "PH Calibration 1 6.86 pH" if using NIST) in the MENU

mode.

3) Press **Enter** button to calibrate the meter (first point). The device automatically save the calibration data and returns to the MEASUREMENT mode after it finishes the process.

Step 2. To make the 2nd point calibration

1) Take out pH electrode, rinse it in distilled water, and dry it. Place the electrode (and temperature probe) into the 4.01 pH (or 4.01 pH if using NIST) buffer solution. The end of the electrode must be completely immersed into the calibration solution. Stir the electrode gently to create a homogeneous solution. Let it stand still and wait for the reading to stabilize or wait for >3 minutes.

2) Press the **Cal/ Menu** button third times to select the item "PH Calibration 2 4.01 pH" (or "PH Calibration 2 4.01 pH" if using NIST) in MENU mode.

3) Press **Enter** button to calibrate the meter (2nd point). The device automatically save the calibration data and returns to the MEASUREMENT mode after it finishes the process.

Step 3. To make the 3rd point calibration

1) Take out pH electrode, rinse it in distilled water, and dry it. Place the electrode (and temperature probe) into the 10.01 pH (or 9.18 pH if using NIST) buffer solution. The end of the electrode must be completely immersed into the calibration solution. Stir the electrode gently to create a homogeneous solution. Let it stand still and wait for the reading to stabilize or wait for >3 minutes.

2) Press the Cal/ Menu button fourth times to select the item "PH Calibration 3 10.01 pH" (or "PH Calibration 3 9.18 pH" if using NIST)

3) Press Enter button to calibrate the meter (3rd point). The device automatically save the calibration data and returns to the MEASUREMENT mode after it finishes the process.

Single point calibration should only be carried out with 7.00 pH, or 6.86 pH: Perform Step 1.

For highest accuracy, perform a multiple-point calibration.

2-point calibration:

1) Use the 7.00 pH and 4.01 pH (or 6.86 pH and 4.01 pH if using NIST) solutions for measurements that are expected to be on the lower side of the scale : Perform Step 1 and Step 2.

2) Use the 7.00 pH and 10.01 pH (or 6.86 pH and 9.18 pH if using NIST) solutions for measurements that are expected to be on the higher side of the pH scale : Perform Step 1 and Step 3.

3-point calibration: all three ranges can be calibrated for a full 3-point pH calibration ： Perform Step 1, Step 2 and Step 3.

The pH calibration summary is as table 5.

Table 5 pH Calibration Procedure

	Calibration Step(s)	**When to adopt**
1-Point Calibration	Step 1	accuracy≤±0.1 pH
2-Point Calibration	Step 1 -> Step 2	Measuring range: 0 to 7.00 pH
	Step 1 -> Step 3	Measuring

		range: >7.00 pH
3-Point Calibration	Step 1 -> Step 2 -> Step 3	Wide measuring range

All new calibration values will automatically override existing calibration data. The non-volatile memory will retain calibration values upon power shut-off.

Calibration buffer solution

For calibration accuracy, the pH of the standard buffer solution must be reliable. Always use fresh pH buffer solutions for calibration. Do not reuse buffer solutions as they change with prolonged exposure to air (especially 10 pH buffer) resulting in decreased measurement accuracy.

PH MEASUREMENT

To measure the sample pH, rinse the pH electrode in distilled water, dry it, and dip it into sample solution. Immerse at least 3 cm from the tip of the pH electrode in the sample solution. Swirl or stir the solution gently and let it stand still in the sample solution. Wait for the reading to stabilize for a while. The reading is the pH value.

pH measurements are displayed in the range of 0.00 to 14.00 in the middle, larger digit display area of the meter's LCD. Measurements made outside of this range will yield dashes (--) on the LCD. The temperature value is shown below the pH reading on the LCD.

Automatic/Manual Temperature Compensation

pH measurements are most accurate when the temperature of the

solution under test is known and a temperature compensation factor is applied to the measurement. This is achieved using Automatic or Manual Temperature Compensation (ATC/MTC).

If a temperature electrode is used, ATC and the sample temperature are displayed on the LCD screen.

If the meter does not detect a temperature electrode or one is not used, the meter automatically switches to MTC mode and MTC appears on the screen.

MTC can be set as described in below:

1. Press the Cal/ Menu button five times until "MTC : 25°C" appears on the display.
2. Press the Mode button to switch between °C and °F .
3. Then press MI/▲ or MR/▼ button to adjust temperature compensation accordingly
4. Press Enter button to confirm the setting and return to the measurement screen.

The default MTC temperature value setting is 25 °C (77°F).

Note: °C = (5/9)*(°F - 32)

pH isothermal measurement principle

According to the pH isothermal measurement principle, the closer the test sample's temperature is to the calibration solution's, the higher the accuracy of the measurement. So this principle is recommended to follow when conducting tests.

TECHNICAL SPECIFICATIONS

This section describes the specifications of the meter and the technical information.

pH Specification:

pH Range	0.00 to 14.00 pH
Measuring principle	Glass electrode
Resolution	0.01 pH
Accuracy	±0.01 pH
Calibration Points	1 to 3 points
Buffer Groups	4.01, 7.00, 10.01 (USA) 4.01, 6.86, 9.18 (NIST)
Temperature Compensation	Automatic / Manual (0 to 100 °C)

Temperature Specification:

Temperature Range	0 to 100.0 °C (32.0 to 212.0 °F)
Resolution	± 0.1°C (± 0.1°F)
Display Options	°C/°F switchable
Accuracy	±0.5°C (±0.9°F)

General Specification:

Operating Temperature	5 to 60.0 °C (41.0 to 140.0 °F)
Power Supply	4 AAAA alkaline batteries
Dimensions	90x175x42mm (3.54x6.89x1.65")
Weight	258 grams (9.1 oz.)

MAINTENANCE

Cleaning and Storage

The BE500 pH Meter needs no maintenance except for an occasional wipe with a damp cloth. It is good laboratory practice to wipe away any spills as soon as they occur.

The front panel and case can be cleaned with a mild solution of detergent and water. Apply sparingly with a soft cloth and allow drying completely before using. Do not use aromatic hydrocarbons or chlorinated solvents for cleaning.

pH Electrode Maintenance

1. Daily maintenance

The KCL soaking solution contained in the supplied protective vial is used to maintain the sensitivity of the glass bulb. Loosen the vial, remove the electrode and rinse in distilled water before taking a measurement. Insert the electrode and tighten the vial after measurements to prevent the reference solution from leaking. If the soaking solution is turbid or moldy, replace it with KCL solution.

The electrode should NOT be soaked in pure or distilled water, protein solution or acid fluoride solution. In addition, do not soak the electrode in organic lipids.

If the electrode response has become sluggish or inaccurate, change the external reference solution. If that does not improve the response then the pH sensing glass has probably become coated with some of the samples being tested. The procedure of preparing external reference solution are

1) A plastic bottle with powder is attached to the packing box. Please

add a proper amount of deionized aquatic products at the 20 ml scale and shake well before use.

2) Users can also strive for 55.9g of analytical pure potassium chloride and prepare 250ml solution with deionized water.

2. Protect glass bulb

The sensitive glass bulb at the front of the composite electrode should not come in contact with hard surfaces. Scratches or cracks on the electrode will cause inaccurate readings. Before and after each measurement, the electrode should be rinsed with distilled water. If a sample sticks to the electrode or it's contaminated, the electrode should be thoroughly cleaned using a soft brush and then rinsed with distilled water. After that, soak it in the KCL solution again for 6 hours.

3. Renew glass bulb

Electrodes that have been used over a long period will become aged. Soak the electrode in 0.1mol/L hydrochloric acid for 24 hours, then wash the electrode in distilled water, then soak it in KCL storage solution for 24 hours.

The method to prepare 0.1mol/L hydrochloric acid: dilute 9mL hydrochloric acid in distilled water to 1000mL.

For serious passivation, dip the bulb in 4% HF (hydrofluoric acid) for 3-5 seconds, and wash it in distilled water, then soak it in the KCL storage solution for 24 hours to renew it.

4. Which occasions are not suitable to use this product for measurement?

1) It is not recommended to use this product to measure oil, viscosity or samples containing more fine particles
2) It is not recommended to use this product for measurement in non-aqueous samples

TROUBLESHOOTING

Symptom / Issue	Possible Cause / Resolution
Cannot power on	Please check whether the batteries have power
Electrode response has become sluggish or inaccurate	Please reference section of pH Electrode Maintenance or replace a new pH electrode
Why does the electrode surface sometimes have white powder adhesion?	This is caused by the salting out of the potassium chloride in the reference filling solution, which does not affect the use of the electrode. Rinse it with deionized water.

SUPPORT

The quickest way to obtain technical support is via email. Please send all support inquires to info@santacary.com.
Please include a clear, concise definition of the problem and any relevant troubleshooting information or steps taken so far, so we can duplicate the problem and quickly respond to your inquiry.

WARRANTY

This meter is supplied with a warranty against significant deviations in material and workmanship for a period of TWO years from date of purchase whereas probe with a SIX month warranty.
If repair or adjustment is necessary and has not been the result of abuse or misuse within the designated period, please return and correction will be made without charge.
Santacary Technology will determine if the product problem is due to deviations or customer misuse. Out of warranty products will be repaired on a charged basis.

Exclusions

The warranty on your meter shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Unauthorized modification or misuse
- Operation outside of the environment specifications of the products

RETURN

Authorization must be obtained from our Customer Service Department or authorized distributor before returning items for any reason.
Please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss.
Santacary Technology will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: Santacary Technology Co., Ltd. reserves the right to make improvements in design, construction, and appearance of products without notice.

CONTACT US

Santacary Technology Co., Ltd.
Zhaobei Building B, the 7th Industrial Road 7
Shekou, Shenzhen, 518067,
Guangdong, China
Email: info@santacary.com

www.santacary.com