

Labmate



Iodine Meter

LMIDM-A100

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1. Safety Measures

Read the entire contents of this manual carefully before use, and 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.
- 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 identifier will be used in this manual.



【TIPS】

Tips help to use the meter.

2. Introduction

Iodine Meter LMIDM-A100 is designed for the measurement of iodine ion concentrations within a range of 0.06 to 127000 ppm. With a direct ion concentration readout, it simplifies the measurement process for accurate results. It features an LCD display and a user-friendly system menu for easy setting of parameters. Implements an automatic electrode diagnosis function to maintain sensor performance.

3. Features

- ✓ Fitted with Iodine ion selective electrode
- ✓ Advanced with a reset setting function
- ✓ Integrated with auto hold function for better recording
- ✓ Designed with a built-in real-time clock to timestamp events
- ✓ Includes a USB communication interface to transfer and store data
- ✓ Facilitates temperature compensation for accurate readings
- ✓ Provided with stability indicator for real-time information
- ✓ Upgraded with a calibration due reminder for regular calibration of the meter

4. Specifications

Model No.	LMIDM-A100
I Measurement Range	1×10 ⁸ to 1M, 0.06 to 127000 ppm
I Measurement Accuracy	± 1 % F.S.
Resolution	0.001, 0.01, 0.1, 1
Temperature Measurement Range	0 to 105 °C, 32 to 221 °F
Temperature Accuracy	± 0.5 °C, ± 0.9 °F
Temperature Resolution	0.1°C
Temperature Compensation	0 to 100 °C, 32 to 212 °F
mV Range	(-1999.9) to 1999.9 Mv
mV Accuracy	± 0.2 mV
mV Resolution	0.1 mV
Calibration Points	2 to 5 points
Calibration Solutions	0.001, 0.01, 0.1, 1, 10, 100, 1000, 10000 ppm, mol / L, mg / L
Compensation Mode	Manual or automatic
Data Hold Function	Manual or automatic endpoint detection
Reset Function	Yes
Stability Condition	Low or high
Calibration Due	0 to 31 days
Power Off	Manual or automatic (10,20,30 minutes)
Memory	Stores up to 500 sets of data

Iodine Meter LMIDM-A100

Output	USB communication interface
Connector	BNC
Display	LCD (130 × 110 mm)
Power	DC 5 V, using AC adapter, AC 220 V / 50 Hz
Dimension (L × W × H)	210 × 188 × 60 mm
Weight	1.5 kg

5. Applications

Iodine meter is used to measure the concentration of iodine in a given solution or substance. They are employed in various applications, including laboratory research, environmental monitoring, and industrial processes.

6. Instrument Introduction

Overview

1) Front View

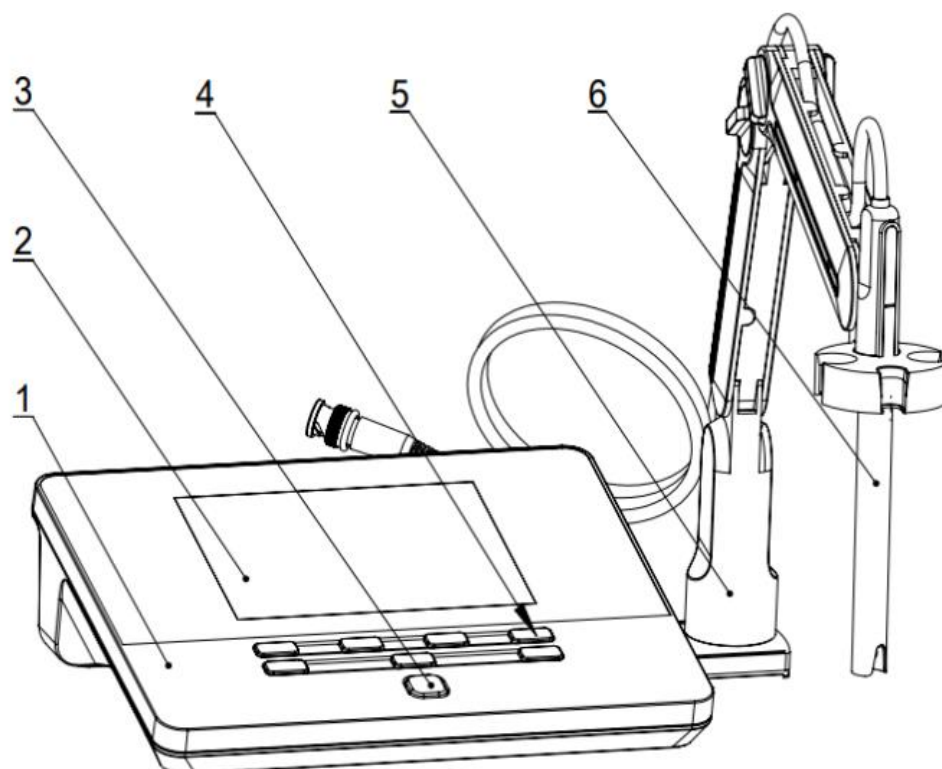


Figure-1

1. Meter Body
2. Display
3. Power key
4. Function Selection Key
5. Electrodes Stand
6. Ion Electrode

2) Back View

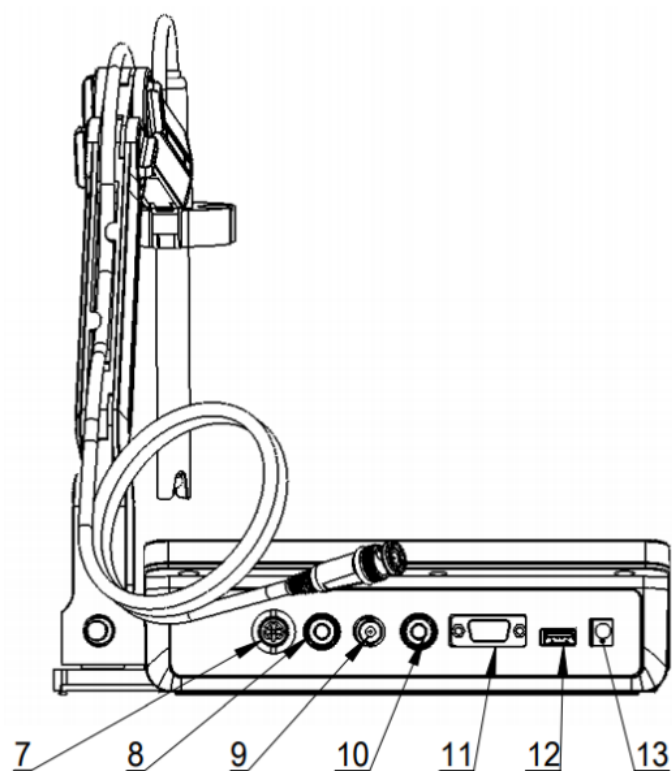


Figure-2

- 7. Temperature Electrode Socket
- 8. Ground Socket
- 9. Measurement Electrode Socket
- 10. Reference Electrode Socket
- 11. RS232 Socket
- 12. USB Socket
- 13. DC9V Power Socket

3) Electrodes and Connectors

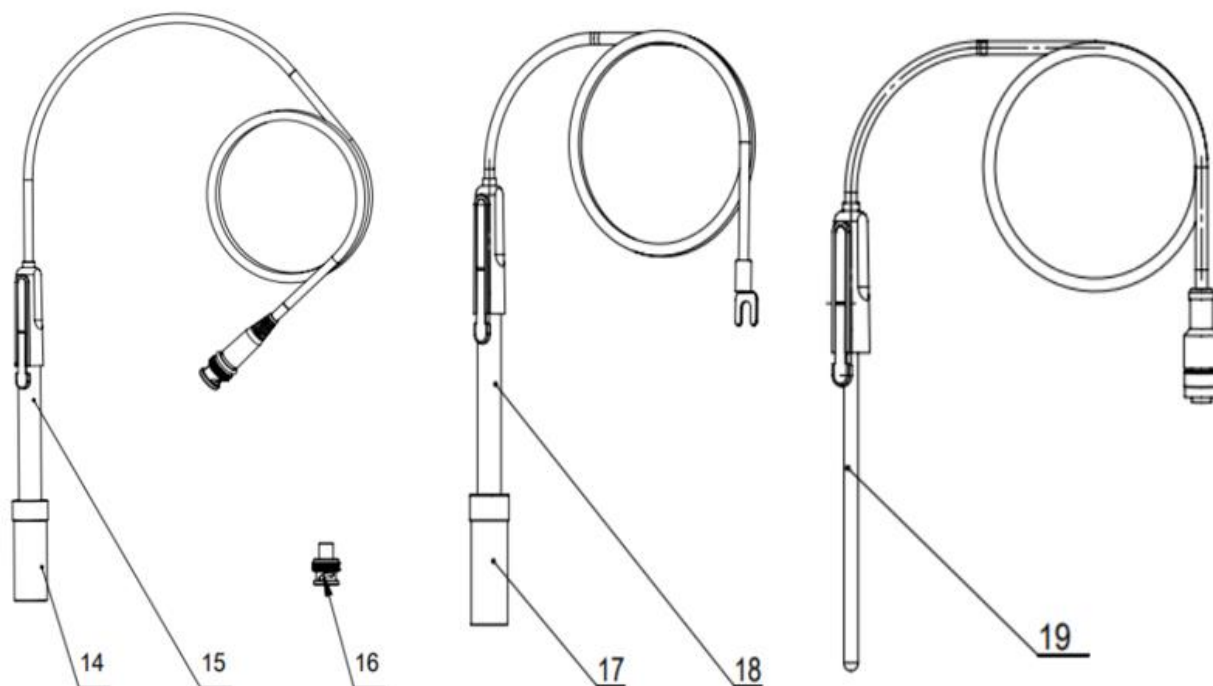


Figure-3

- 14. Ion Electrode Protection Cap
- 15. Fluoride Ion Electrode
- 16. Q9 Short Circuit Plug
- 17. Reference Electrode Protection Cap
- 18. Reference Electrode
- 19. Temperature Electrode

4) Connector Specifications

Connector	Electrode Type
BNC (Q9)	pH, ion-selective electrode
Banana	Reference electrode

7. Installation

7.1 Electrodes Stand Installation

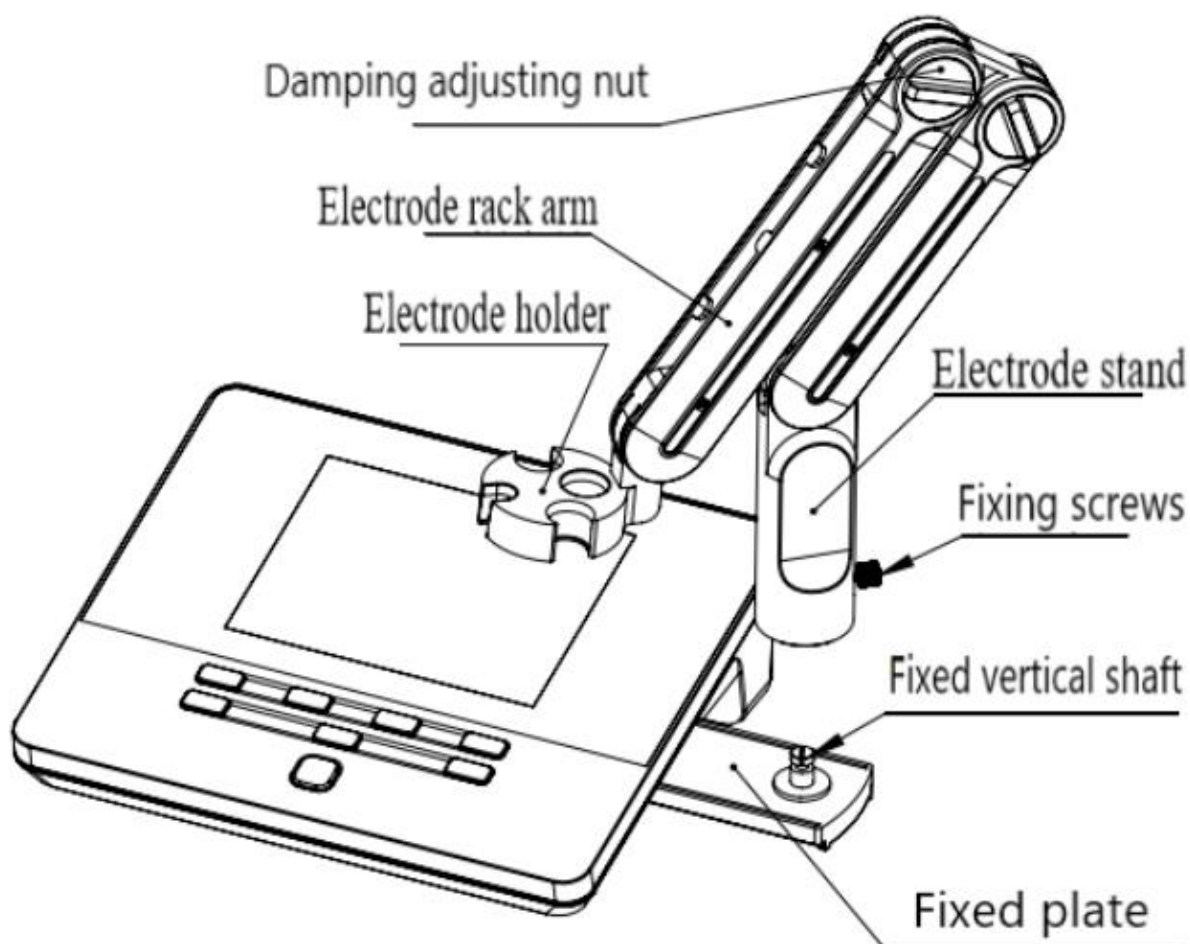


Figure-4 (Electrode Stand Installation)

- 1) Pull out the electrode holder fixing plate on the right side of the instrument.
- 2) Insert the center hole of the multifunctional electrode holder support (as in the above **Figure-4**) into the vertical shaft of the multifunctional electrode holder drawer.
- 3) Tighten the set screw on the lower part of the electrode holder's pole.

7.2 Electrodes Connection

- 1) Push the Fluoride ion electrode (**15**) (**Figure-3**) into the electrode holder (**5**). Find the measuring electrode socket (**9**) on the back of the instrument, and unplug the Q9 shorting circuit connector (**16**). Then, insert the fluoride ion electrode connector into the measuring electrode socket (**9**).
- 2) When other electrodes are used as required, Insert the electrode connector to the corresponding socket on the back of the instrument in the same way as above.
- 3) The pH meter adopted a pH combination electrode with a four-pin aviation connector. For replacement purchasing, choose electrodes with the proper connector.

8. Operations

8.1 Switch On/Off

- 1) After connecting the power adapter and installing the electrode stand and electrode, press  to switch on the meter.
- 2) The startup screen shows the software version and other related information. After the self-test program, the screen turns to the homepage and the meter is ready to measure.
- 3) The instrument uses touch keys as operation and control equipment and is equipped with 8 keys in total.
- 4) Users can complete the corresponding operations by pressing the corresponding function keys. Also, press  and hold the key for more than 3 seconds and release it to shut down.

8.2 Screen Icons



Figure-5

- | | |
|----------------------------|----------------------------|
| 1. Instrument Model | 6. Calibration Information |
| 2. System Time | 7. User ID |
| 3. Measurement Parameters | 8. Sample |
| 4. Reading Status | 9. Operations Tips |
| 5. Measurement Information | 10. Soft Function Keys |

Iodine Meter LMIDM-A100

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

No.	Symbol	Explanation
1.		Reading status, displays 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.		Standard solution.
5.		Current measuring ions.
6.		The time of calibration.
7.		Standard solution for pH calibration.
8.		Standard solution for ion calibration.
9.	ATC	Automatic temperature compensation.
10.	MTC	Manual temperature compensation.
11.		User ID
12.		Sample ID
13.		Operation Tips.
14.	Auto Mode	Auto-recognition of Standards.
15.	Manual Mode	Manual recognition of Standards.

8.3 Function Key

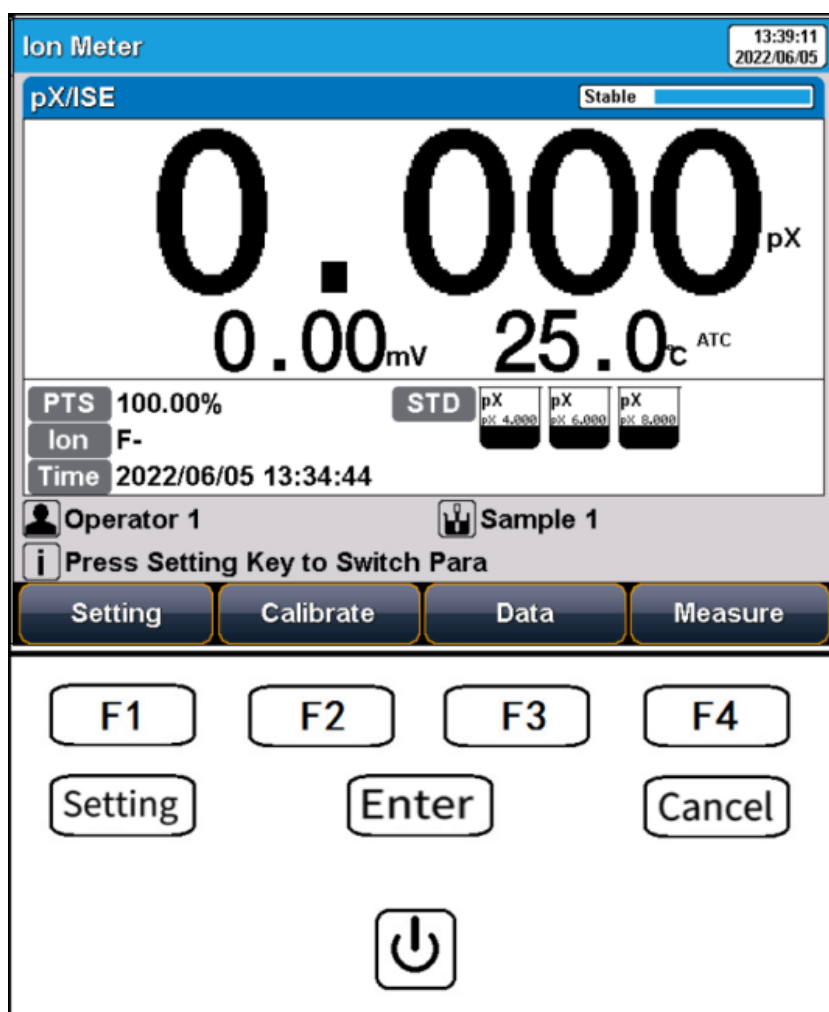


Figure-6

No.	Key	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.

8.4 Instrument Settings

In the measuring, users can set the instrument parameters by pressing "**Setting**" to set the measuring parameters.

8.4.1 Tutorial Setting

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

8.4.2 Measurement Parameter Settings

It could select one measurement parameter from pH, pX/ISE, and Ion Concentration.

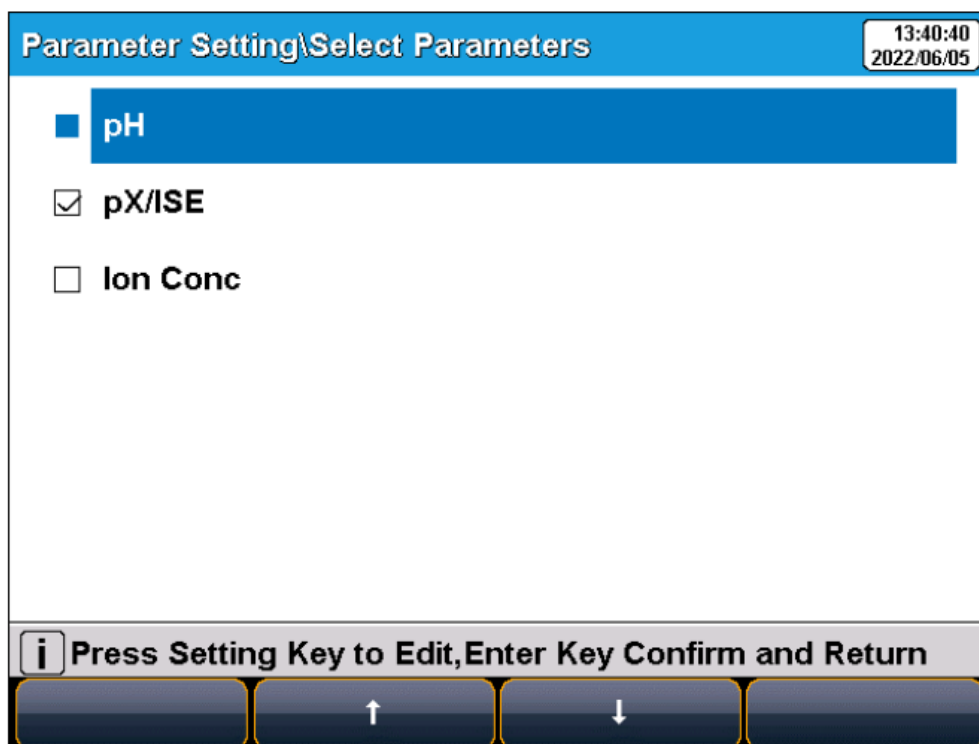


Figure-7 (Instrument measurement parameter selection)

8.4.3 Reading Mode Settings

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

- 1) **Continuous reading:** The instrument displays real-time measurement results. Users can end the measurement at any time and save the last result.
- 2) **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.
- 3) **Timed reading method:** Timed Reading contains two kinds of timed reading methods; "**Interval Measurement**" and "**Timed Measurement**". "**Interval Measurement**" provides measurement results at interval time and "**Timed Measurement**" provides measurement results after a set time.

Stability Type		pH	pX/Ion concentration
Fast	Stable time	4s	4s
	Fluctuation	0.6mV	0.3mV
Medium	Stable time	6s	8s
	Fluctuation	0.1mV	0.08mV
Strict	Stable time	8s	12s
	Fluctuation	0.03mV	0.03mV
Custom (Recommended value)	Stable time	1 to 30s	1 to 30s
	Fluctuation	0.03~1mV	0.03~1mV

8.4.4 pH Parameter Setting

1) pH standard solution group management

The meter provides various Standards Groups including DIN, NIST, USA, and MERK. And allows the user to prepare customized Standard groups.

Standard Solution Groups:

Groups	Contents
DIN	1.680pH, 2.000pH, 3.557pH, 3.775pH, 4.008pH, 6.865pH, 7.000pH, 7.416pH, 9.184pH, 10.014pH, 12.454pH
NIST	1.677pH, 4.008pH, 6.864pH, 7.000pH, 7.416pH, 10.014pH, 12.469pH
USA	1.680pH, 4.010pH, 7.000pH, 10.010pH
MERK	2.000pH, 4.000pH, 7.000pH, 9.000pH, 12.000pH

- Usually, we use the pH value corresponding to 25.0°C to mark the pH standard buffer solution, such as NIST 7.00pH standard solution, which means the standard pH buffer solution is 7.00pH, and it is 7.00pH at 25.0°C.

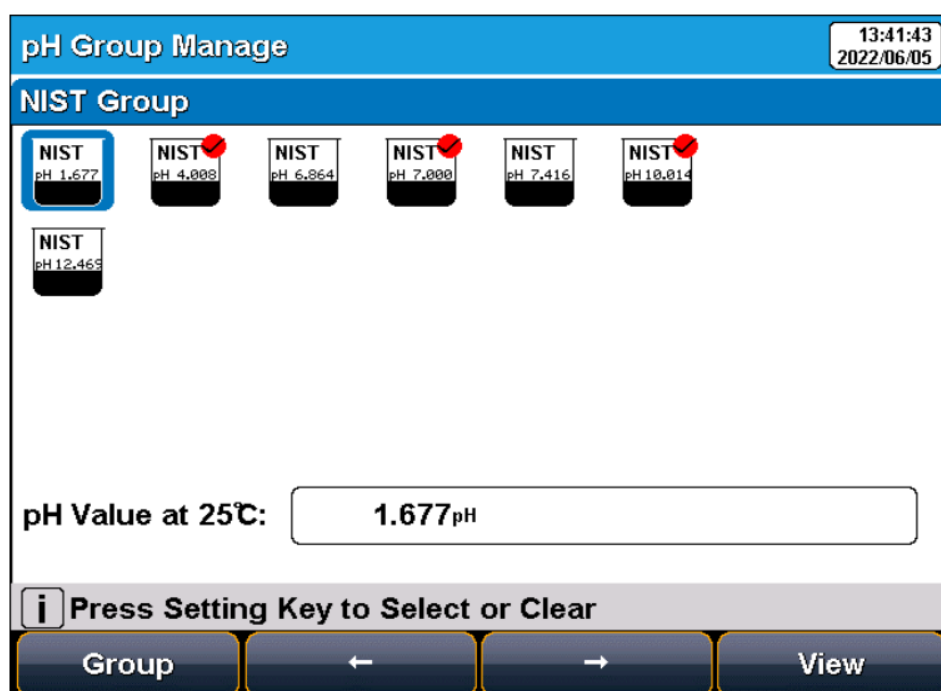


Figure-8 (Selection of standard groups and standard solution)

- 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, ensuring 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】

If the selected standard solution group is different from the pH standard buffer solution used, it will lead to wrong calibration results.

2) Manual standard solution identification

In some special situations, it is necessary to use some non-standard pH buffer solutions or 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 identification**", the pH value of the current standard solution can be input during and used for electrode calibration.

3) Resolution settings

- The pH measurement resolution of the instrument is adjustable.
- **pH resolution:** 0.001pH, 0.01pH, and 0.1pH.
- **mV resolution:** 0.01mV, 0.1 mV, and 1 mV.

8.4.5 pX/ISE parameter settings

1) Select ion mode

The measurement ions are selected as follows:

- **The instrument has built-in:** F⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, BF₄⁻, NH₄⁺, K⁺, Na⁺, Ca²⁺, Cu²⁺, Pb²⁺, Ag⁺, etc. Before measuring the corresponding ions, the user needs to select the corresponding ion mode and the corresponding measurement electrode.
- For an ion method not provided, a new method needs to be created. Press "**Create**", and fill in the information of the ion to finish the ion method customization.

Select Ion Mode		13:53:32 2022/06/05
Ion Num: 12	Ion Info	
Ag+	Ion Name:	Ag
Na+	Ionic Order:	+
K+	Mol.wt.:	108.0
NH4+	Creator:	REX Team
Cl-	Create Time:	2020/05/13 08:30:00
F-		
NO3-		
<i>i</i> Press Setting Key to Select Ion, Setup Key to Modify		
	↑	↓
	Create	

Figure-9 (Manage and select ion modes)

2) Select measurement mode

- Users can choose the following ion measurement methods according to their requirements. In general, when the ion measurement parameter selects pX or ion concentration measurement, it is recommended to use the direct reading concentration method for measurement, which has a fast measurement speed and is suitable for the measurement of batch samples. Standard addition, sample addition, and GRAN measurements are only valid when the measurement parameter selects ion concentration.
- When the measurement parameter selects "pX", the measurement mode is only valid for the direct reading concentration method; when the measurement parameter selects "ion concentration", the instrument supports 4 ion measurement modes: direct reading concentration method, standard addition method, sample addition method, GRAN Measurement method, users can choose according to actual requirements.

8.4.6 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 the user to input the temperature.

8.4.7 Data Management Settings

1) Sample ID setting

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

- **ID in number order:** The sample ID No. is increasing with series number, allow to set ID digits (3 to 5 digits) and initial sample ID.
- **ID in 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 sample ID:** Manually set the sample ID No when saving or printing data.

2) Autosave setting

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

3) Overwrite setting

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

8.4.8 Output option

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

8.4.9 User ID Settings

Set the user ID.

8.4.10 System Parameter Settings

1) System time settings

Settings of system time and data.

2) Buzzer settings

Users can set the key sound by this setting.

3) Backlight settings

Users can adjust the screen brightness by this setting.

4) Automatic shutdown settings

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

5) Reset settings

When the meter is not working. Users can reset the meter from the default backup.

6) Software version

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

8.5 pH Measurement

8.5.1 Calibration Preparation

- 1) 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 points of calibration.
- 2) **One-point calibration** is a calibration process with a single standard solution, commonly applied in a quick test. The calibration slope is 100% here. Two-point calibration uses two pH standard buffer solutions to calibrate the electrode and construct a linear calibration curve through two points.
- 3) **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.
- 4) **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, prepare one or more pH standard buffer solutions.

8.5.2 Standards group selection

- 1) Before starting calibration, prepare one or more pH standard buffer solutions.
- 2) The meter has a standards recognition function; set the Standard Group before the measurement.
- 3) Users can also set the identification type to "**Manual Mode**" and manually enter the nominal value during the calibration process.

8.5.3 pH calibration

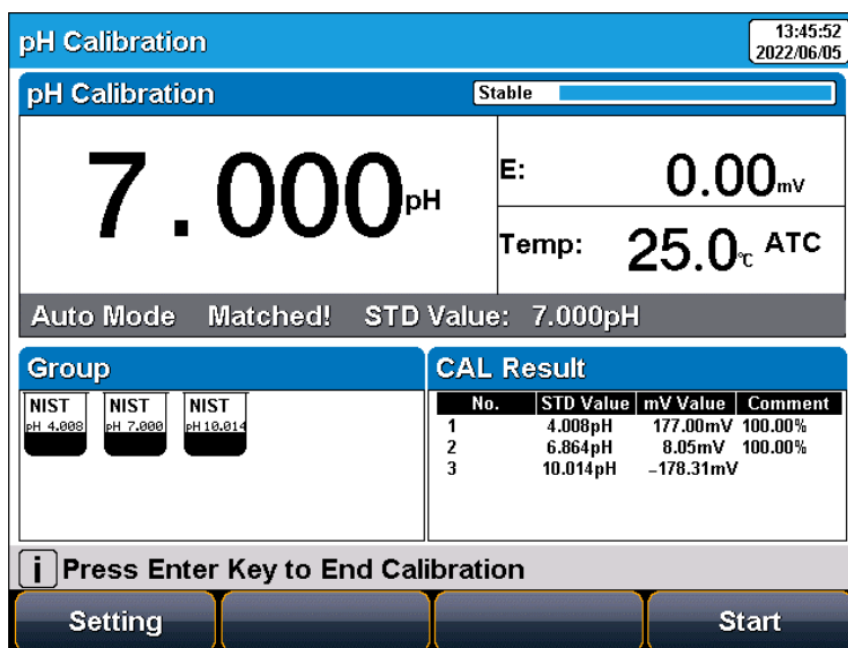


Figure-10 (pH electrode calibration information)

The calibration process is as follows:

- 1) Select a method. The method includes the parameter (e.g. pH), NIST standard solution group, pH 4.01, pH 7.00, and pH 10.01, auto Mode recognition.
- 2) Connect the ATC probe or enter the temperature manually.
- 3) Press the "**Calibrate**"-"**pH Calibration**".
- 4) Put the cleaned electrode into a pH 4.01 standard solution.
- 5) Wait for the instrument to display "**Auto Mode Matched**".
- 6) When the pH and temperature readings are stable, press the "**Start**".
- 7) If only 1-point calibration is required, after 1-point calibration is completed, press the "**End**" key to complete the calibration.
- 8) If multi-point calibration is required, please replace the pH7.00 and pH10.01 standard buffer solutions.
- 9) After cleaning the electrode, put the electrode into the standard solution. After the instrument recognizes it successfully, the instrument reads stably and presses the "**Next Point**" to complete the calibration.
- 10) After completing the calibration, press the "**End**" key to complete the calibration, save the calibration results, and end the calibration, directly entering the start interface. If the checked standard solution group is 5, automatically end the calibration after eight points of calibration.



【TIPS】

The meter will not save the date if the calibration results are not confirmed.

8.5.4 pH measurement

The measurement process is as follows:

- 1) Select a method. The method includes the parameter (e.g., pH), and reading mode (e.g., continuous reading, auto-reading, or time format).
- 2) Connect the ATC probe or enter the temperature manually.
- 3) Rinse the pH electrode with DI water, and dry it out.
- 4) Put the electrode into the test solution under test.
- 5) Put the measurement end of the electrode into the sample solution.
- 6) In the measurement status, press "**Start**" to enter into measurement status.
- 7) When the reading is stable, read the results.
- 8) Press the "**Save**" to save the measurement results and print the result.
- 9) Between measurements, store the pH electrode in distilled or deionized water.
- 10) After measurement, rinse the pH electrode with deionized water thoroughly.

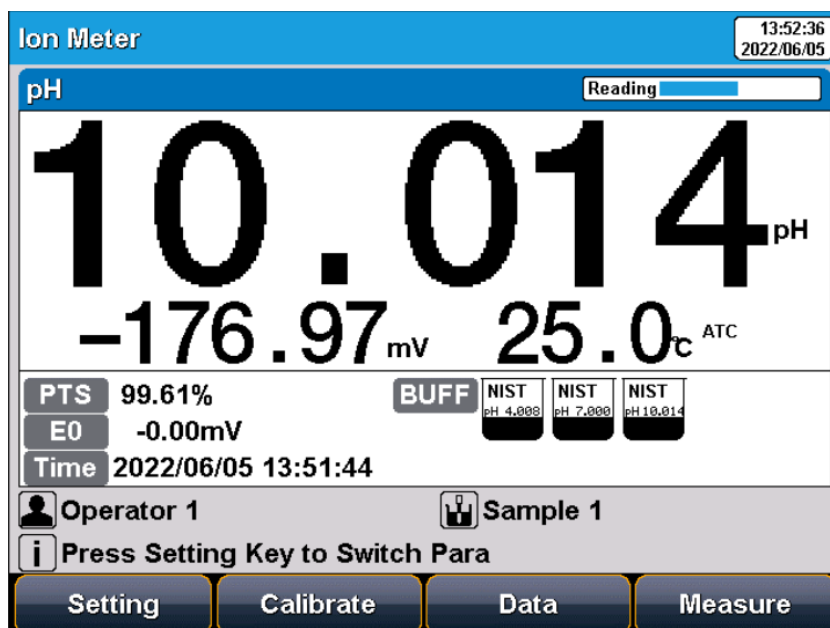


Figure-11 (pH measurement information)

【TIPS】

- The measurement end of the 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.

8.6 Ion Measurement

8.6.1 Preparation

The slope and zero potential value of the ion electrode will change with time, so the ion electrode needs to be calibrated before use, and the instrument supports up to 5-point calibration. For the specific use of the electrode, please refer to the electrode manual.

1) Ion-selective electrode

The ion-selective electrode is based on the ion-selective membrane, which can be divided into a single crystal membrane, salt membrane, glass membrane, and PVC ion-selective membrane. Ion-selective electrodes usually have single electrodes and composite electrodes. Single electrodes can be used with different reference electrodes and have better measurement performance for some low-concentration ions. Composite electrodes are more convenient and simpler to operate. Users could be flexible to choose according to their requirements.

2) Ionic strength adjustment buffer

- 1) The use of ion electrodes to measure ion concentration requires the addition of an ionic strength adjustment buffer.
- 2) The ionic strength of a solution has an important influence on the measurement of ion concentration. On the one hand, the ion-selective electrode directly measures the activity of the ion, $\alpha = \gamma c$.
- 3) Wherein, α is the activity of the ion, γ is the activity coefficient of the ion, and c is the ion concentration. Usually, the activity coefficient γ is affected by the ionic strength in the solution.
- 4) By adding an ionic strength adjustment buffer to the standard solution and the test solution, the measured solution has a similar ionic strength to the standard solution, thereby having a similar activity coefficient γ .
- 5) On the other hand, in a solution with low ionic strength, the potential of the reference electrode will show instability. The addition of the ionic strength adjustment buffer can help stabilize the reference electrode.
- 6) Various ion measurement needs various ionic strength adjustment buffer. Common ionic strength adjustment buffers are recommended in the following table:

Recommended ionic strength adjustment buffer: The final concentration of the ionic strength modifier in the standard or sample.

Ion category	Ionic strength adjustment buffer
Na ⁺	0.2 mol/L diisopropylamine
F ⁻	0.1 mol/L NaCl or TISAB
Cl ⁻	0.1 mol/L KNO ₃
Br ⁻	0.1 mol/L KNO ₃
I ⁻	0.1 mol/L KNO ₃
Ag ⁺	0.1 mol/L NaNO ₃
Cu ²⁺	0.1 mol/L NaNO ₃
Pb ²⁺	0.1 mol/L KNO ₃
S ²⁻	0.1 mol/L KNO ₃
K ⁺	0.05 mol/L MgAc ₂
Ca ²⁺	0.1 mol/L KCl
NO ₃ ⁻	0.1 mol/L NaH ₂ PO ₄
BF ₄ ⁻	0.1 mol/L Na ₂ SO ₄
ClO ₄ ⁻	0.1 mol/L NaCl

3) Standard solutions preparation

The best way to prepare standards is to use serial dilutions. Sequential dilution refers to diluting an initially prepared standard using a volumetric flask to obtain a second standard. Dilute the second standard to prepare a third standard. And so on until the required standard solution is obtained. In general, the concentration between two adjacent levels is a 10-fold relationship.

4) Activation of the ISE electrodes

When the electrode is used for the first time or has not been used for a long time, an activation is recommended. The electrode has better measurement performance after activation.

Ion electrode activation solution and activation time recommendation

Ion category	Activation solution	Activation time
Na ⁺	10 ⁻³ mol/L NaCl	2h
F ⁻	10 ⁻³ mol/L NaF	2h
Cl ⁻	10 ⁻³ mol/L KCl	2h
Br ⁻	10 ⁻³ mol/L NaBr	2h
I ⁻	10 ⁻³ mol/L NaI	2h
Ag ⁺	10 ⁻³ mol/L AgNO ₃	2h
Cu ²⁺	10 ⁻³ mol/L Cu(NO ₃) ₂	2h
Pb ²⁺	10 ⁻³ mol/L Pb(NO ₃) ₂	2h
S ²⁻	10 ⁻³ mol/L AgNO ₃	2h
K ⁺	10 ⁻³ mol/L KCl	2h
Ca ²⁺	10 ⁻³ mol/L CaCl ₂	2h
NO ₃ ⁻	10 ⁻³ mol/L NaNO ₃	2h
BF ₄ ⁻	10 ⁻³ mol/L NaBF ₄	2h
ClO ₄ ⁻	10 ⁻³ mol/L NaClO ₄	2h



【TIPS】

The activation time may variously be based on various activation solutions. See the ion-selective electrode manual for specifications.

5) Stirrer setting

The flow state of the solution influences the electrode potential of the ion-selective electrode. To improve the stability and repeatability of the measurement, it is recommended to use a stirrer to keep the flow rate of the solution stable during calibration and measurement.

8.6.2 Direct reading method

Direct Reading Measurement is a commonly used ion concentration measuring method. The Direct Reading mode uses the following Nernst formula to calculate the concentration:

$$E_x = E_0 + S \times \log(C_x + C_b)$$

Wherein,

Ex~ Equilibrium potential of the sample solution in mV.

E0~ zero potential value in mV.

S ~ Electrode slope (%).

Cx~ Concentration value of the sample solution, in mol/L.

Cb~ Blank concentration value in mol/L.

The electrode slope and zero potential value can be known from the calibration. When measuring the sample solution, the sample concentration result can be calculated from the formula. The direct-reading method is fast and suitable for quick test measurement of common samples.

1) Direct reading pX/ISC calibration

Parameter Setting\pX Parameter		13:54:32 2022/06/05
Ion Type:	F-	
Ion Conc Meas Mode:	Direct Reading	
Conc Unit:	mol/L	
pX Resolution:	0.001pX	
mV Resolution:	0.01mV	
i Press Setting Key to Edit, Enter Key Confirm and Return		
↑ ↓		

Figure-12 (Direct reading concentration method measurement mode)

The pX/ISE calibrations are suitable for the direct reading mode. The pX/ISE calibration process is as follows:

1. **Setting:**
 - Set the parameters (e.g., pX).
 - Set the ion mode (e.g. F-).
 - Set the Direct Reading as ion concentration measurement mode.
 - Set "Conc Unit", "pX Resolution" and "mV Resolution".
2. Add an appropriate amount of standard solution (usually 100 ml) to the beaker, then add an ionic strength adjustment buffer. Adjust the stirring speed of the solution for measurement.
3. Press the F2 "**Calibrate**"-"**pX Calibration**".
4. Put the cleaned electrode into the standard solution.

5. Press the F2 "**STD value**" to input the standard value of the standard solution.
6. Wait until the reading is stable, and press the F4 "**Start**".
7. If only 1-point calibration is required after 1-point calibration is completed, press the "**Enter**" key to complete the calibration.
8. If choosing multi-point calibration (up to 5), press "**Next Point**" to repeat the operation.
9. If the checked standard solution group is 5, automatically end the calibration after five points of calibration.

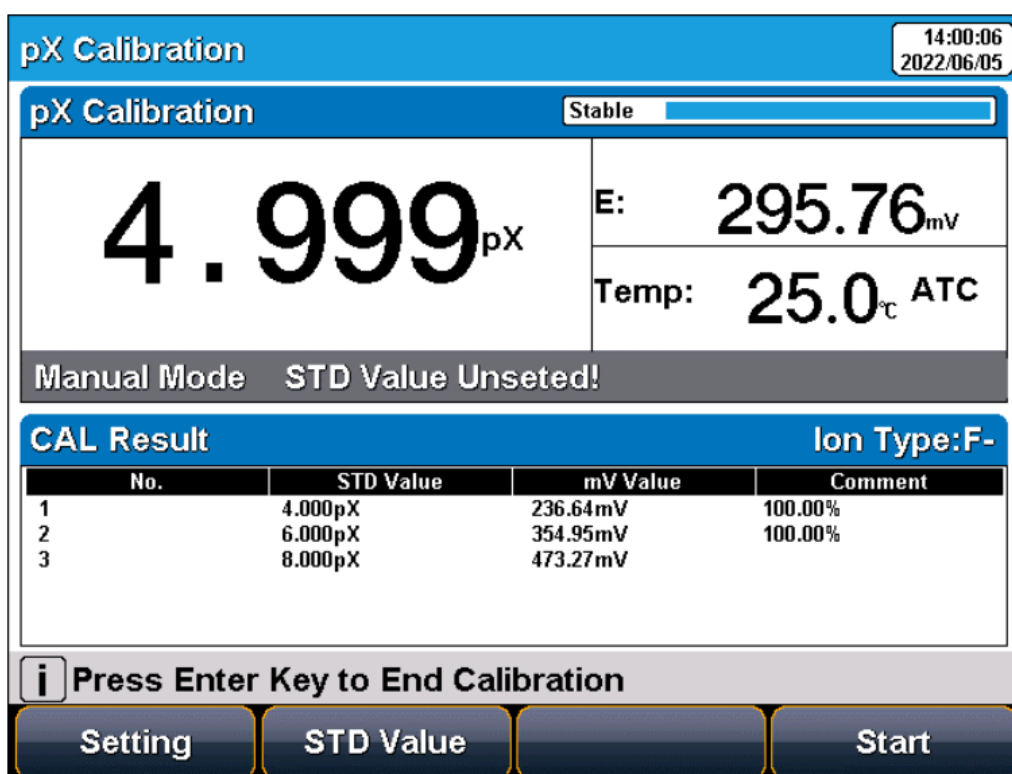


Figure-13 (pX/ISE calibration information)



【TIPS】

Please re-calibration for an unexpected measurement result.

A room temperature test solution is recommended.

It is recommended to calibrate from low concentration to high concentration standards.

2) Direct reading measurement

The measurement process is as follows:

1. Setting:

- Set the parameters (e.g., pX).
 - Set the ion type (e.g. F⁻).
 - Set the direct Reading as ion concentration measurement mode.
 - Set the concentration unit (e.g. mol/L).
 - Set the reading mode (e.g. continuous reading, auto-reading, or timed format).
2. Add an appropriate amount of standard solution (usually 100 ml) to the beaker, then add an ionic strength adjustment buffer. Adjust the stirring speed of the solution for measurement.
 3. In the idle status, press F4 "**Measure**" to enter into measurement status.
 4. When the reading is stable, read the results.
 5. Press the "**Save**" to save the measurement results.
 6. Press the "**Output**" to print the measurement result when connected to the printer.
 7. Between measurements, store the ISE electrode in distilled or deionized water.
 8. After measurement, rinse the ISE electrode with deionized water thoroughly.

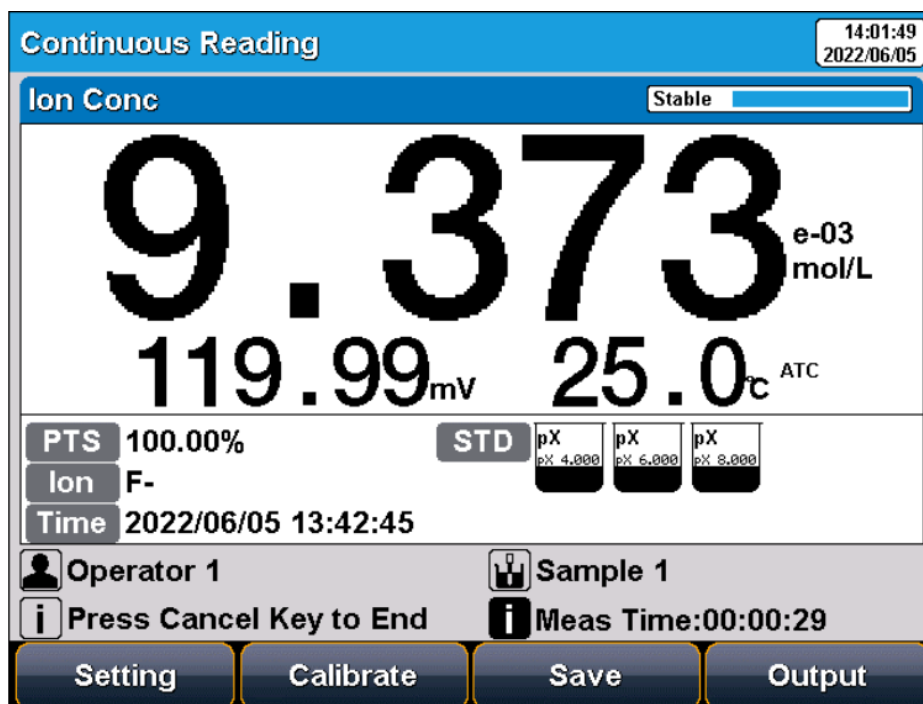


Figure-14 (pX/ISE measurement information)



【TIPS】

Different ISE probes have different potential values in a blank solution. If the blank potential is away from the reference value, the user can do an activation to improve the performance of electrodes. If the electrode still does not meet the requirements, a new electrode is quite considerable.

8.6.3 Standard addition method

Also known as the additive method, it is mainly used to measure samples with tiny content. First, the equilibrium potential value of the system is determined, then a standard solution of known concentration is added to the system and the equilibrium potential value of the system is determined. From the potential change, the sample concentration result can be calculated by the formula as follows:

$$C_x = \frac{\rho \times C_s}{(1 + \rho) \times 10^{(E_2 - E_1)/S} - 1} + \frac{\rho \times C_b}{(1 + \rho) \times 10^{(E_{b2} - E_{b1})/S} - 1}$$

Wherein,

C_x is the concentration value of the sample solution, in unit mol/L.

C_s is the concentration value of the standard (addition solution), in mol/ L.

S is the electrode slope (%).

C_b is a blank standard concentration value in mol/L.

E₁ is the potential value before the standard addition, in mV.

E₂ is the potential value after the standard addition, in mV.

ρ is the Standard add volume (V_s) / volume of sample to be tested (V_x).

E_{b1} is the potential value before the standard of calibration, in mV.

E_{b2} is the potential value after the standard of calibration, in mV.



【TIPS】

Before measuring, enter the related information of sample and standard, blank calibration can be also tested by this method.

Parameter Setting\pX Parameter		13:55:23 2022/06/05
Ion Type:	F-	
Ion Conc Meas Mode:	STD Addition	
Volume Before Add:	10.000mL	
Adding Volume:	0.100mL	
STD Conc Value:	2.000e-01mol/L	
STD Conc Unit:	mol/L	
Blank Conc:	0.000e+00mol/L	
Conc Unit:	mol/L	
Press Setting Key to Edit, Enter Key Confirm and Return		
↑ ↓		

Figure-15 (Standard addition method ion measurement mode)

The standard addition measurement process is as follows:

1. **Setting:**

- Set the parameters (e.g. Ion Conc).
 - Set the ion mode (e.g. F-).
 - Set the STD Addition as concentration measurement mode.
 - Set "**Volume Before Add**", "**Adding Volume**", "**STD Conc value**", "**STD Conc Unit**", "**Blank Conc**" and "**Conc Unit**".
 - Set the reading mode (e.g., continuous reading, auto-reading, or timed format).
2. Add an appropriate amount of sample solution (usually 100 ml) to the beaker, then add an ionic strength adjustment buffer. Adjust the stirring speed of the solution for measurement.
 3. Put the cleaned electrode into the standard solution.
 4. Press the F3 "**Measure**".
 5. Press "**Next**" after the reading is stable.
 6. Follow the prompts to add the preset standard.
 7. Press "**Next**" to measure the potential value of the solution.
 8. After the reading is stable, press "**Next**" to end the measurement.
 9. The results are shown by auto calculation.
 10. Press the "**Save**" to save the measurement results.
 11. Press the "**Output**" to print the measurement result when connected to the printer.

8.6.4 Sample addition method

The method is similar to the standard addition method and is mainly used to measure samples with high-content sample solutions. The standard is replaced by samples to add to the sample solution. The calculation formula is as follows:

$$C_x = C_s \times [(1 + \rho) \times 10^{(E_2 - E_1)/S} - \rho]$$

Wherein,

C_x~ the concentration value of the sample solution (addition solution), in mol/L.

C_s~ concentration value of the standard, in mol/L.

ρ ~Volume of the standard (V_s) / Volume of the sample to be tested (V_x).

E₁~ The potential value before the sample addition, in mV.

E₂~ The potential value after the sample addition, in mV.

S ~ Electrode slope (%).

Parameter Setting\pX Parameter
13:56:04
2022/06/05

Ion Type:	F-
Ion Conc Meas Mode:	Sample Addition
Volume Before Add:	10.000mL
Adding Volume:	0.100mL
STD Conc Value:	2.000e-01mol/L
STD Conc Unit:	mol/L
Blank Conc:	0.000e+00mol/L
Conc Unit:	mol/L

Press Setting Key to Edit, Enter Key Confirm and Return

←

↑

↓

→

Figure-16 (Sample addition method ion measurement mode)

The sample addition measurement process is as follows:

1. **Setting:**
 - Set the parameters (e.g. Ion Conc).
 - Set the ion type (e.g. F-).
 - Set the sample addition as concentration measurement mode.
 - Set "**Volume before Add**", "**Adding Volume**", "**STD Conc value**", "**STD Conc Unit**", "**Blank Conc**" and "**Conc Unit**".
 - Set the concentration unit (e.g. mol/L).
 - Set the reading mode (e.g., continuous reading, auto-reading, or timed format).
2. Add an appropriate amount of standard solution (usually 100 ml) to the beaker, then add an ionic strength adjustment buffer. Adjust the stirring speed of the solution for measurement.
3. Put the cleaned electrode into the standard solution.
4. Press the F3"**Measure**".
5. Press "**Next**" after the reading is stable.
6. Follow the prompts to add the preset sample.
7. Press "**Next**" to measure the potential value of the solution.
8. After the reading is stable, press "**Next**" to end the measurement.
9. The results are shown by auto calculation.
10. Press the "**Save**" to save the measurement results.
11. Press the "**Output**" to print the measurement result when connected to the printer.

8.6.5 GRAN method

The measurement process is like the standard addition method, mainly for measuring samples with low content. According to the mathematical principle of GRAN mode, the ion concentration results of the sample can be calculated using the following equation:

$$(V_s + V_x) \times 10^{E/S} = 10^{E_0/S} \times (C_x V_x) + 10^{E_0/S} \times (C_s V_s)$$

Wherein,

C_x~ the concentration value of the sample solution (addition solution), in mol/L.

C_s~ concentration value of the standard, in mL.

V_s~ volume of standard, in mL.

V_x~ Volume of the sample to be tested in mol/L.

E~ The equilibrium potential of the sample solution (sample), in mV.

E₀~ zero potential value, in mV.

S ~ electrode slope (%).

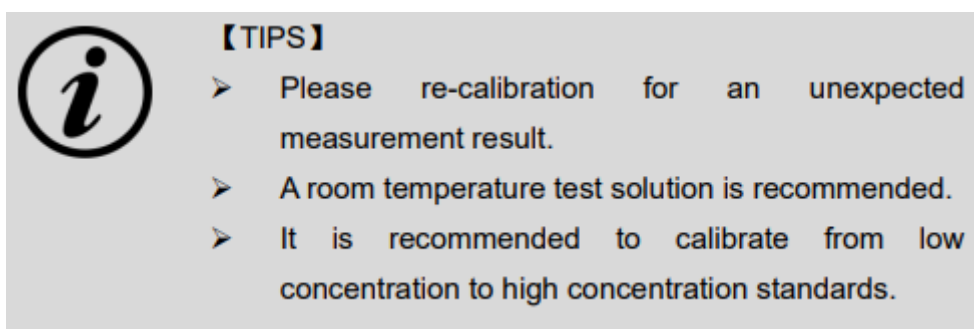
Parameter Setting\pX Parameter		13:57:01 2022/06/05
Ion Type:	F-	
Ion Conc Meas Mode:	GRAN Method	
Volume Before Add:	10.000mL	
Adding Volume:	0.100mL	
STD Conc Value:	2.000e-01mol/L	
STD Conc Unit:	mol/L	
Blank Conc:	0.000e+00mol/L	
Conc Unit:	mol/L	
<i>i</i> Press Setting Key to Edit, Enter Key Confirm and Return		
↑ ↓		

Figure-17 (Ion measurement mode of GRAN measurement method)

The GRAN measurement process is as follows:

1. Setting:

- Set the parameters (e.g. Ion Conc).
 - Set the ion mode (e.g. F-).
 - Set the GRAN as concentration meas mode.
 - Set "**Volume before Add**", "**Adding Volume**", "**STD Conc Value**", "**STD Conc Unit**", "**Blank Conc**" and "**Conc Unit**".
 - Set the reading mode (e.g., continuous reading, auto-reading, or timed format).
2. Add an appropriate amount of sample solution (usually 100 ml) to the beaker, then add an ionic strength adjustment buffer. Adjust the stirring speed of the solution for measurement.
 3. Put the cleaned electrode into the standard solution.
 4. Press the F3 "**Measure**".
 5. Press "**Next**" after the reading is stable.
 6. Follow the prompts to add the preset standard.
 7. Press "**Next**" to measure the potential value of the solution.
 8. After the reading is stable, repeat the step 6 and step 7 for 3 or 8 times.
 9. The results are shown by auto calculation.
 10. Press the "**Save**" to save the measurement results.
 11. Press the "**Output**" to print the measurement result when connected to the printer.



8.7 Data Management

- 1) Press "**Data**" to view the details of the results. The meter stores the measurement results independently according to the measured parameters.
- 2) The meter provides data Storage of 500 sets for each parameter (pH/mV/Temp). The user can press "**Delete**" in the delete menu.
- 3) It allows users to select the parameter data or all data to delete. The user can view the data filter by parameter, and locate No. or stored date. By the filter setting, press "**Start Search**" to look up the data.
- 4) The filter data is shown in a graph. Press "←" and "→" to choose data. Users can choose one and press the "**Enter**" key to see the detailed result.
- 5) Users can press "**Delete**" to delete the current result. Press "**Output**" to select the output data. The format supports the output of the current result, output matched result, and output of all results.

Database
14:05:56
2022/06/05

Filter

Parameter: pX

Filter by: Locate No

Start No.: 001

End No.: 005

Stored Num: 005

i Press Enter Key to Start Search

Delete
↑
↓
Start Search

Figure-18 (Results setting view)

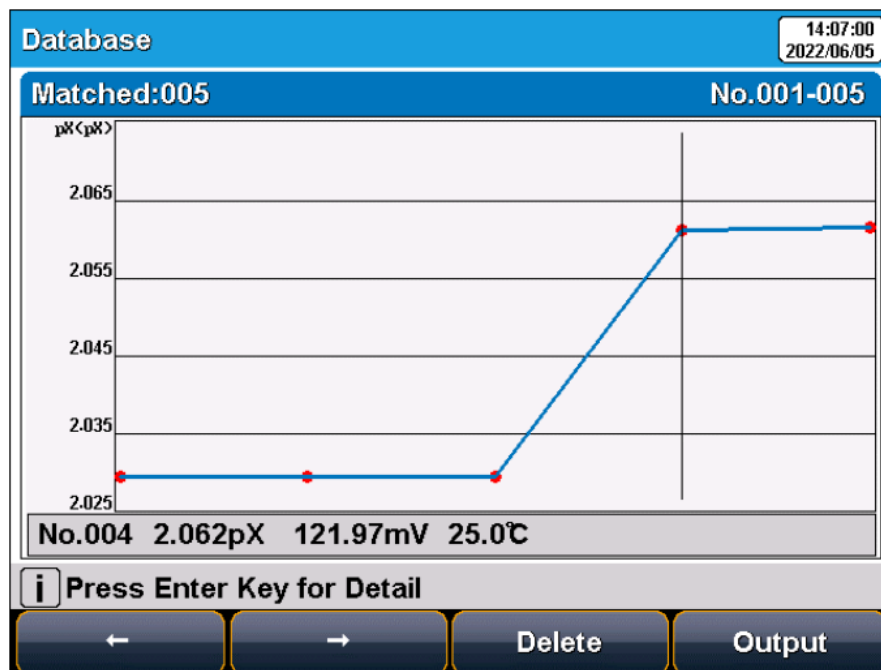


Figure-19 (Review stored results)



【TIPS】

- In order to ensure the correct use of the instrument and avoid burning the instrument and causing unnecessary losses to you, please turn off the power of the instrument and printer before connecting the printer.
- The communication baud rate of the meter is always 9600bps, the default setting is 8 data bits, one start bit, one stop bit, no parity.

The output format is approximately as follows:

```
*****
Report Title
-----
Measure Time:2021/01/19 12:27:28
Operator: Operator 1
Model:
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:  4.003pH    177.3mV    25.0c
STD 2:  6.864pH     8.0mV    25.0c
STD 3:  9.182pH   -129.1mV    25.0c
pH Slope 1:                100.00%
pH E0 1:                   0.0mV
pH Slope 2:                100.00%
pH E0 2:                   0.0mV
-----
.....BRIEF INFO
Reading Mode:              Timed Reading
Stable Type:               Medium
Temp Comp Type:            ATC
-----
.....SAMPLE INFO
Sample ID:                 Sample 1
-----
.....RESULT
Result:                    7.000pH
Signal Value:              -0.0mV
Temp Value:                25.0c
-----
Signature:
```

9. Maintenance

Meter Maintenance

The correct use and maintenance of the instrument can ensure accurate and reliable performance. Additionally, exposure to chemicals or harsh use environments can affect performance.

The pH/pX electrode socket has a protective plug, when the meter is not in use, insert the protective plug into the pH/pX socket.

- 1) If the meter is not used long, disconnect the power supply.
- 2) The electrode socket of the instrument must be kept clean and dry, and should not be in contact with acid, alkali, and salt solutions.
- 3) Keep the meter and accessories clean and away from acids, alkalis, and any corrosive solutions/gases.
- 4) Users can clean the meter surface with clean water and detergent.
- 5) When the meter is transported, please follow the instructions:
 - Remove all connected cables.
 - Remove the electrode holder.
 - Use the original packaging in long-distance transport to avoid damage.

10. Troubleshooting

Phenomenon	Possible Reasons	Solutions
No Display	It is not powered on.	Connect the adapter and press the power key to turn it on.
	Damage to the meter.	Replace or repair as required.
Incorrect mV measurement	The electrode is out of service life.	Replace the electrodes.
	The electrode plug is in poor contact.	Connect the protection plug, if the potential is not 0mV.
Incorrect pH measurement	The electrodes are not calibrated or they are calibrated incorrectly.	Recalibrate the electrode or replace the standard solution.
Incorrect pX/ISE measurement	The electrodes are not calibrated or they are calibrated incorrectly.	Recalibrate the electrode or replace the standard solution.
	Incorrect ISE probe.	Buy the correct ISE probe. Add ionic strength adjustment buffer.

11. Accessories

Optional Accessories
mV/ORP Electrode

12. Appendix

pH/pX

- **pH/pX Slope:** The amount of potential change generated by each 1 pH/pX change, expressed in mV/pH or by 100% Theoretical Slope (PTS). $pX = -\log[X]$, where [X] means molar concentration (mol/L) of X 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.

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



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