FISON

Automatic Potentiometric Titrator FM-APT-A300

Index

1. Safety Measures

- Read the manual carefully before operating the automatic potentiometer titrator.
- The titrator should be re-checked after one year of use to ensure it is still functioning correctly. If the re-check confirms that the titrator is qualified, it can continue to be used.
- The service life of the electrode is 12 months; after this period, its performance will decline, regardless of use. Replace the electrode on time to ensure accurate titration results.
- Calibrate the titrator regularly using appropriate standard solutions to ensure accurate measurements.
- Clean the electrode and other parts of the titrator after each use to prevent contamination and maintain performance.
- Avoid exposing the titrator and electrode to extreme temperatures or direct sunlight, as this can affect their performance.
- Use clean glassware and containers for titrations to avoid contamination and ensure precise results.
- Regularly inspect the titrator for any signs of damage, particularly the electrode and connectors, and replace any damaged components immediately.
- Make sure that the users are properly trained in the operation and handling of the potentiometer titrator to avoid errors.

2. Introduction

Automatic Potentiometric Titrator FM-APT-A300 is adopted with burette valve integrated design, to avoid mutual interference of different titrimetric solutions. Stirring system adopted with PWM technology, for adjusting the stirring speed during operation. Titrator performs automatic identification of pH standard solutions, also supports manual identification. LCD screen displays real time values test values, titration curve, and measurement results.

3. Features

- ✓ Burette valve integrated design
- ✓ Microprocessor controlled technology
- ✓ Titration endpoint reminder
- ✓ System supports setting system time, operation id, burette factor, stirring speed
- ✓ Advanced transmission system reduces noise during operation
- ✓ Complied with GLP norms
- ✓ Stores 200 sets of titration results and one set of titration curve
- ✓ Auto power-off protection
- ✓ Supports restore factor setting
- ✓ PC (to view, edit titration curve and statistical data)can be connected via the USB interface

4. Specifications

Model No.	FM-APT-A300
Titration modes	Pre-titrations, Preset end point titration, Blank titrations, Manual titrations, Macro titration, Micro titration, Volume setting titrations, Stored titration
Analysis methods	Acid-base Titration, Oxidation-reduction titration, Precipitation titration, Complexometric, Non-aqueous titration
Measurement Range	pH value: 0.00 to 14.00 pH mV value: -1800.0 to 1800.0 mV Temperature value: -5.0 to 105.0 °C
Resolution	pH value: 0.01 pH mV value: 0.1 mV Temperature value: 0.1°C
Accuracy	pH value: ± 0.01 pH mV value: ± 0.03 % mV Temperature value: ± 0.3°C
Burette Volume Accuracy	10 ml burette: ± 0.025 ml 20 ml burette: ± 0.035 ml
Burette filling solution speed	55 ± 10 s (when burette is In full scale)
Reproducibility of titration analysis	0.002
Relative reproducibility	≤ 0.2 mV
Relative stability	± 0.3 mV
Sensitivity of controlling titration	± 2 mV
Normal working conditions	Environment temperature: 5 to 35°C Relative humidity: ≤ 80% Power supply: AC220 V, 50 Hz No disturbance of electromagnetic field
Dimension (L×W×H)	500 × 540 × 490 mm
Weight	11 kg

5. Test Material

Sr. No.	Titration Type	Applications
1	Acid-base Titration	Drugs in Amino acids , benzo thiazide oil of total acid TBN
2	Redox Titration	Iodine value in food, peroxide value, vitamin C, water treatment, COD measurements
3	Precipitation Titration	Chlorine titration
4	Complexometric Titration	Calcium, Zinc ion titration, formaldehyde titration
5	Non-aqueous Titration	Per chloric acid titrations
6	pH value/ mV measurement	H+ pH/ mV , Reminding ions mV

6. Applications

Used in environmental and water testing industry, food additives and production industry, pharmaceutical, petrochemical fields for quality testing and research institutes.

7. Instrument Introduction

7.1 The front view of the meter

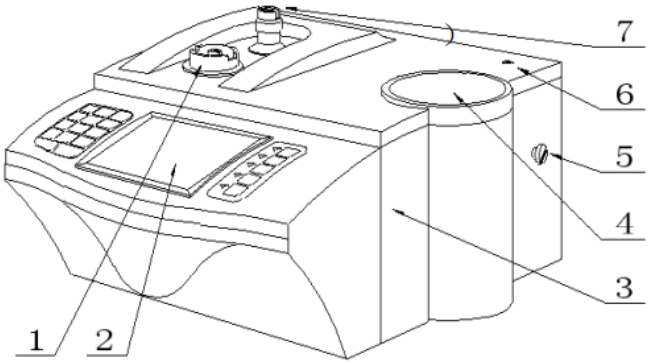

Figure-1

1. The fitting base of burette
2. The operation Interface
3. Main unit
4. Stirrer
5. Electrode holder fixing bolt
6. Electrode holder fixing hole
7. Valve steering tank

7.2 The rear panel of the meter

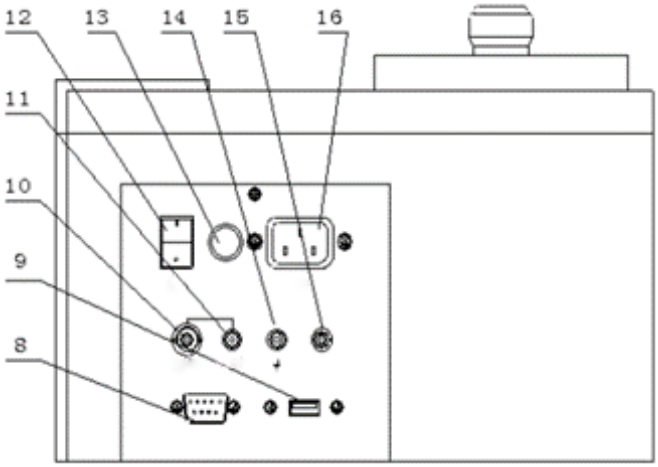

Figure-2

8. Printer socket
9. USB
10. Measuring electrode socket
11. Reference electrode socket
12. On/Off
13. Fuse
14. Ground
15. Temperature sensor socket
16. Power

7.3 Accessories

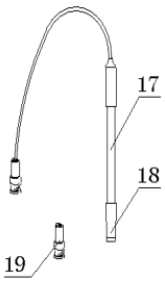

Figure-3

17. pH combination electrode
18. Electrode jacket
19. Q9 short circuit plug

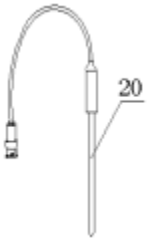

Figure-4

20. Temperature sensor

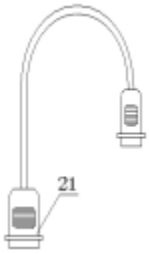

Figure-5

21. Printer line

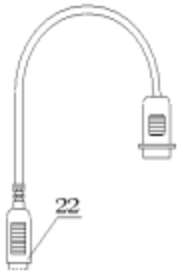

Figure-6

22. USB communication line

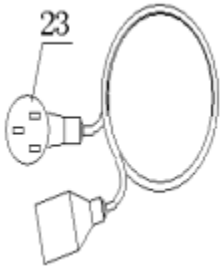

Figure-7

23. International universal power line

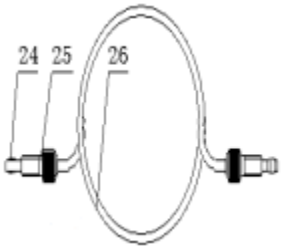

Figure-8

24. Clip pipe bushing (The filling tube will be sealed with screw thread side)
25. Clip pipe bolt
26. Filling pipe

8. Installation

Installing

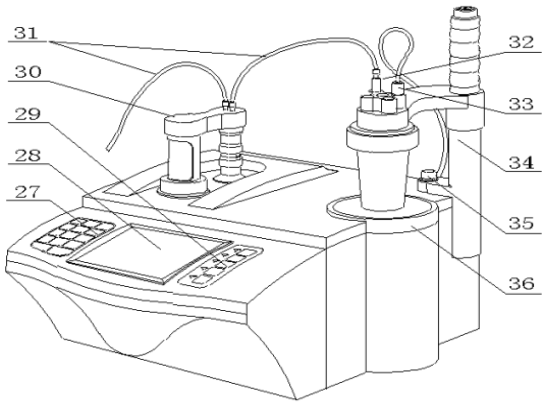

Figure-9

27. Keyboard
28. Screen
29. Function keys
30. Burette and valve
31. Filling pipe
32. Capillary tube
33. Sensor (electrode)
34. Electrode holder
35. Fixing bolt
36. Stirrer

8.1 Installation of titration pipe device and value

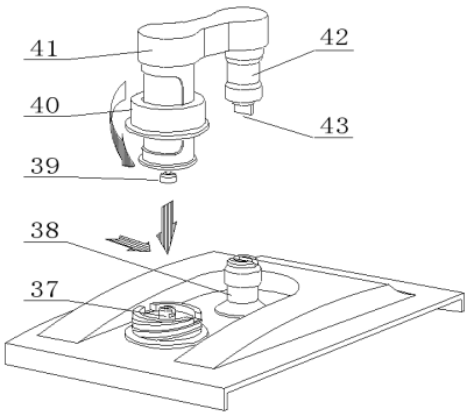

Figure-10

37. Top bar
38. Valve rotation bar (It should be fitted with other accessories.)
39. Piston (It should be fitted with other accessories.)
40. Fixing the bolt of the titration device
41. Joint plate between valve and burette
42. Valve
43. Valve rotation convex shaft

8.2 Installation of electrode holder and titration beaker

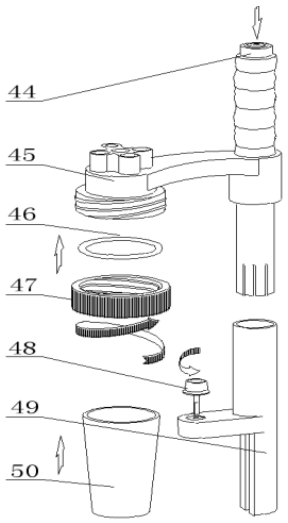

Figure-11

44. Button (The height can be adjusted when it is pressed.)
45. Electrode holder
46. Silicon rubber ring
47. Solution beaker fixing bolt
48. Electrode holder fixing bolt
49. Electrode holder fixing base
50. Solution beaker

8.3 Install the burette and valve

1) Put the main unit (3) on the laboratory table.
2) Install the burette and valve according to **Figure 10**. The piston should be fitted with the reversed T-shape groove of the top bar. Since the titration device and valve is integrated, the valve rotation convex shaft (43) should be interlocked with the valve steering tank (7) in **Figure 1**.
3) Press it downwards.
4) Tighten the titration device fixing bolt (40) when the piston and T-shape groove are fixed.

8.4 Install the electrode holder and titration beaker

1) Press the T-shape groove of the electrode holder fixing base (49) towards the electrode holder fixing bolt (5) according to **Figure 1** and **Figure 9**.
2) Tighten the fixing bolt (35) of the electrode holder. The height and angle of the titration beaker can be adjusted if the button (44) is pressed during inspection and sample solution replacement.
3) Put the silicon rubber ring (46) into the inner circle of the solution beaker fixing bolt (47) according to **Figure 11**.
4) Screw it on the electrode holder (45) outer nut for 2-3 circles.
5) Put the stirring bar into the solution beaker (50).
6) Fix the beaker from the bottom up and screw the fixing nut (47) tightly.

8.5 Connecting filling pipe

According to **Figure 9**, there are two threaded holes on the titration device and valve. (Facing the main unit) The left one is a burette inlet, and the right one is a burette outlet. According to the figure.

1) Connect the filling pipe (26) (the longer one) which only has the single clip pipe screw) with the upper left threaded hole. The other end of the filling pipe should be inserted into the storage bottle.
2) Take the shorter filling pipe out. (Both ends of it have a clip pipe screw.) One end is connected to the upper right threaded hole of the valve and the other end is connected to the titration capillary tube. Then insert the capillary tube into the hole of the electrode holder.

Note: The clip pipe bushing (24) and the clip pipe screw (25) must be connected tightly to avoid leakage.

8.6 Install the temperature sensor

1) Insert the temperature sensor connector into the temperature sensor socket according to **Figure 2**. Then insert the temperature sensor into the electrode holder fixing hole (45).
2) Take the short circuit plug off from the rear panel **(Figure 2)** and connect the pH combination electrode (17) with the socket of the measuring electrode. Unplug the electrode jacket (18) from the electrode. Insert pH combination electrode (17) into the electrode holder fixing hole (45) in **Figure 11**.
3) Put the filling pipe (26) to the bottom of the storage bottle.

9. Operations

9.1 General operation of the meter

1) Take the solution beaker apart before replacing the solution according to **Figure 11** during titration.
2) Loosen the fixing screw (47).
3) Raise the solution beaker high and revolve it to the position outside the main unit.
4) Hold the solution beaker (50) by hand.
5) Revolve and loosen the solution beaker fixing the screw cap (47).
6) Take the solution beaker (50) out.
7) Pour the solution out of the beaker and rinse it several times.
   Note: The stirring bars must also be rinsed.
8) Pour the sample solution into the solution beaker (50).
   Note: The stirring bars must be put in the bottom of the beaker (50).
9) Install the solution beaker (50) according to the methods of installing the electrode holder and titration beaker.
10) Screw the bolt cap (47) tightly.
11) Press the button and move the solution beaker downwards to the center of the stirrer (36) so that the solution beaker (50) is pressed against the stirrer (36) surface.
12) Finally, relax the button (44).

9.2 Connect

1) Connect the printer line (21) to the RS232 socket (8) on the rear panel.
2) Insert the universal power line (23) into the power socket (16).
3) Screw off the fuse cover from the fuse holder (13).
4) Install the fuseΦ5×20 (1A).
5) Screw the fuse cover tightly. (The fuse has been installed before the meter leaves the factory.)

9.3 Connect between the measuring electrode and reference electrode

1) Screw off the short circuit (28) from the measuring electrode 1 socket (23).
2) Insert the measuring electrode (48) into the measuring electrode 1 socket (23).
   Note: The short circuit plug (28) on the measuring electrode socket 2 (21) cannot be pulled out. Guarantee the short circuit plug (28) on the measuring electrode socket (21) in good condition.
3) The reference electrode should be connected with the reference electrode socket (22). At the same time, select the corresponding electrode socket in 'Setup'.

9.4 Functions

The titration modes include pre-titration, preset end-point titration, mode titration, blank titration and manual titration. Different electrodes can be matched with the meter to perform different titrations including acid and alkali titration, oxidation-reduction titration, precipitation titration, complexometric titration and non-aqueous titration. The above titrations are generated into special titration modes such as pre-titration, preset endpoint titration, blank titration or manual titration. The meter can be communicated with the software. The titration curve can be displayed on the computer to increase the additional value of the meter.

10. Software Operations

10.1 Keyboard

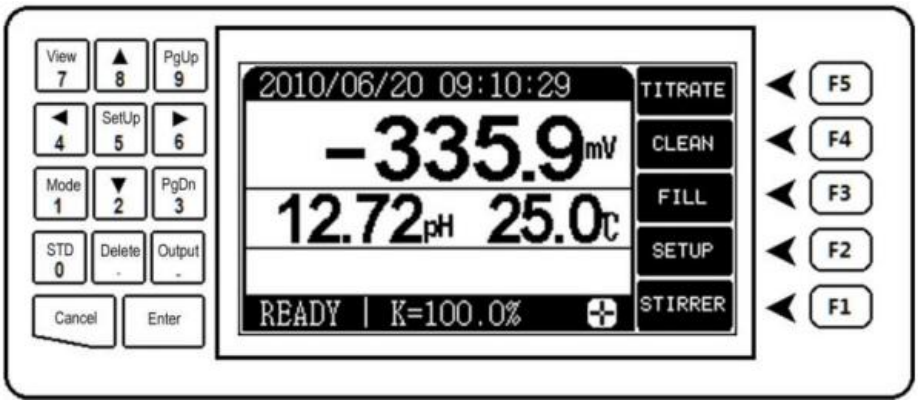

Figure-12

There are 19 keys in all. They are: 1/mode, 2/, 3/PgDn, 4/, 5/Setup, 6/, 7/View, 8/, 9/PgUp, 0/CAL, /Delete, -/Output, Enter, Cancel, F1, F2, F3, F4 and F5. The keys are scattered on both sides of the LCD. The left keys are the number key, the Enter key and the Cancel key. The right keys are function keys of (F1~F5). Their functions can be classified into three types:

10.1.1 'Enter' and 'Cancel' key

They can perform most of the functions.

1) The Enter key can confirm the corresponding operation.
2) The Cancel key will give up the corresponding operation.

10.1.2 Number keys

Figure-13

1) Negative sign, decimal point and digit (0-9) buttons are designed as function keys. When the user inputs data and sets up parameters, the keys are used as number keys.
2) In other situations, the number keys do not function, and the double function is effective. There are several important functions.
   Mode keys: If the user needs to repeat measuring certain solutions, and the measuring methods, titration reagents and sample concentration do not change, the meter can help the user generate a special titration mode for repeated use. The user can press this button after titration. The special mode can be generated according to the operation instructions.
   'Setup' key: It is used to set up system time, burette coefficient and stirrer.
   'CAL' key: It is used to calibrate the slope of the pH electrode.
   'Output' key: It is used to output titration results and titration data.

10.1.3 F1 to F5 function keys

They are the most often used keys. The main functions of the meter can be performed by these five keys. The actual functions vary with different modules. The meaning will be determined by the words on the right side of the LCD screen. For example, in the initial state, the LCD will display the following:
At this time,
The F5 key corresponds to titration.
The F4 key corresponds to cleaning.
The F3 key corresponds to the filling of the solution
The F2 key corresponds to the Setup function
The F1 key corresponds to stirring.
Pressing the corresponding key can perform corresponding functions. If the F5 key is pressed, the meter will perform titration. If the function key corresponds with a blank LCD, it means this key is not effective at this moment. In the diagram, the F5 key is ineffective in selecting menu items.
Note: The subsequent chapters will not appear as the instructions of 'F5/titrate' key and 'F4/clean'. They will illustrate the meaning of the function module directly, such as the more direct methods of pressing the 'Titrate' key and 'Clean' key.

10.2 Modes

The meter supports the following titration modes: Pre-titration mode, preset endpoint titration, mode titration, manual titration and blank titration.

10.2.1 Pre-titration

Pre-titration full scale is one of the main titration modes of the meter, many titration modes are generated from pre-titration mode. The meter can find the titration endpoint through pre-titration mode, thus special titration mode is generated.

10.2.2 Preset endpoint titration

If the titration endpoint value of the known sample solution is known, the preset endpoint titration function is available for fast titration. Input the endpoint number, endpoint pH or potential value and pre-controlled point value (the pre-controlled point is transferring point from high-speed titration to low-speed titration), and titration can be performed.

10.2.3 Mode titration

Mode titration is a kind of titration mode independently designed for a certain special titration reaction or application. The meter provides two kinds of special mode titrations.

1) HCl →NaOH (0.1mol/L)
2) K2Cr2O7 →Fe2+ (0.1mol/L)

The meter allows for generating special titration modes in some special fields. The user can use pre-titration first. After this titration ends, the user can press the **'Mode'** key to generate the special titration mode according to operation reminding. Specification titrating can be done later only if this mode is downloaded.

10.2.4 Manual titration

Set added volume and corresponding parameters to make manual titration. During titration, the user needs to add a solution and determine the potential stability and the next added volume. This titration mode will help users find the titration endpoint.

10.2.5 Blank titration

This mode is suitable for titration which demands less titrant (Generally blank titration is used when the titrant is less than 1mL.) In this mode, every time the meter adds 0.02ml of volume (users can revise this parameter), users can also set a pre-added volume parameter to accelerate titration.

10.3 Starting up

Press the **'Power'** key, and the meter will display the instrument model, name and software version. After self-check, the meter will enter the initial state. See the Figure.

Figure-14

1) The middle area of the LCD will display the current potential value, temperature and pH value.
2) The right-side display's function keys.
3) The bottom area displays the state of the meter, stirrer and slope of the electrode. At the same time, it displays the last titration mode. This state is called the initial state. All the module operation begins from this state.

At this time,

1) Press the **'TITRATE'** key to start titration
2) Press the **'CLEAN'** key can clean the burette
3) Press the **'FILL'** key can fill in the solution
4) Press the **'STIRRER'** key can turn them on or off the stirrer
5) Pressing this key can also set the stirring speed
6) Press the **'Setup'** key can set system time, operator No., burette, burette coefficient, manual temperature and calibrate zero potential
7) Press the **'View'** key can view the last titration data, result and last calibration data, titration mode and stored titration result
8) Press the **'CAL'** key can calibrate the electrode slope
9) Press the **'Output'** key can print titration data, results and calibration data out.

Cautions:

1) The burette, burette coefficient, and system time must be correctly set up.
2) The meter has a power-off protection function. If it is powered off suddenly, all parameters will not be lost.

10.4 Parameter setup

Figure-15

Parameter setup contains the setup of system time, operator No., burette type, burette coefficient, stirring speed, manual temperature and calibrated zero potential.

To operate the meter correctly, when it is operated for the first time, the user must check whether the set parameter accords with operating conditions. If not, the new parameter must be set. In ordinary operations, if users find some wrong operating condition, date, or time, set the relevant parameter again.

In the initial state, press the **'Setup'** key, and the meter will enter parameter setup mode. See the diagram. Then press arrow keys to move the cursor to the targeted parameter. Then press the **'Enter'** key and the meter will enter the corresponding parameter module.

10.4.1 Setup of system time

The clock of the meter is supplied with power from the button cell, and it has a certain timing error. Using it for too long will cause inaccurate timing. Reset it according to the accurate time when necessary. In the initial time, press the **'Setup'** key to select the time system item. See the diagram. The user can press arrow keys to move the cursor to the targeted time item. Then press the **'Setup'** key to input the actual time.

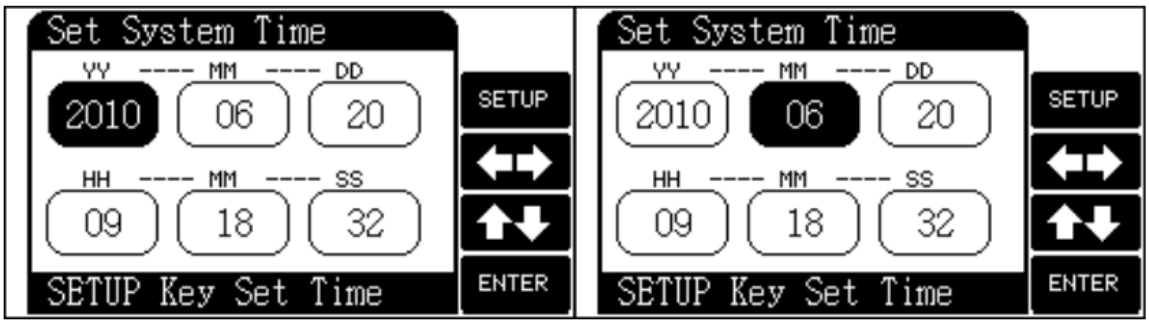

Figure-16

10.4.2 Setup of Operator No.

The meter allows the user to set No. as a part of the GLP norm. The range is 0~200. In the initial state, press the **'Setup'** key to select 'Set up operator No.' See the diagram. The user can press the 'Setup' key to input proper operator No.

Note: The meter will automatically display the information about the operator No., time, titration result and electrode calibration which meets with the GLP norm.

10.4.3 Setup of the stirrer

In the initial state, press the **'Setup'** key to select the stirrer item. See the diagram. The user can turn on or turn off the stirrer when needed. Pressing the '++' or '—' key can adjust the stirring speed or input the stirring speed directly.

10.4.4 Setup of the burette

Figure-17

Two kinds of burettes are provided with the meter. One kind is 10ml and the other kind is 20ml. The burette must be set according to the operating burette, otherwise, the meter will produce inaccurate results.

In the initial state, press the **'Setup'** key and select the burette setup item, and the user can set up the burette. See the diagram. The previous line displays the current burette type. The next line displays the corresponding burette factor. The factor of each burette should be calibrated. The burette will be labeled with the corresponding burette coefficient and the user can input it directly.

For example: If the burette is 20mL and the factor is 98.96%, the user should select 20ml burette.

In the initial state,

1) Press the **'Setup'** key to select the **"Burette"** item
2) Press the **"Setup"** key on the right side of the burette, and the meter will prompt as the diagram
3) Press the **'Enter'** key, and the meter will display 'Burette: 20mL burette'
4) Press the **'Setup'** key on the right side of Factor and input 98.86
5) Press the **'Enter'** key.

10.4.5 Setup of manual temperature

The temperature can be displayed when the meter is connected to the temperature sensor, otherwise, the manual temperature should be set up.

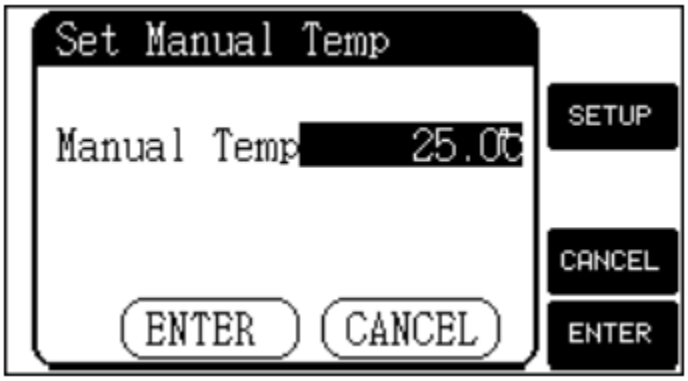

Figure-18

In the initial state,

Press the **'Setup'** key to select a manual temperature item such as the diagram. The user can set up the temperature according to the actual situation.

10.4.6 Calibration of zero potential

After the meter is connected to the short circuit plug, the corresponding potential should be displayed as 0.0mV. The high resistivity will drift in different environments and temperatures, and this is normal. If the user needs to calibrate zero potential, just press the **'Setup'** key in the initial state to select the calibrating zero potential item shown in the diagram. Press the **'Enter'** key to finish calibration.

10.4.7 Electrode calibrating

pH combination electrode will have some drift if it is not used for a long time or drift will appear in different environments. If the electrode slope and zero point are changed, recalibrate them with pH standard buffers. If the user needs to perform two-point calibration, two kinds of standard buffers must be prepared beforehand. If the user needs to perform a one-point calibration, then one kind of standard buffer is enough.

1) One-point calibration means the electrode system is calibrated with only one kind of pH standard buffer to calibrate automatically the potential value of the meter. The meter will take the percentage slope of the pH combination electrode as 100%. This method can be used to simplify the operation if precise measurement is not required.
2) Two-point calibration ensures pH precise measurement. Two-point calibration means the electrode system is calibrated with two standard buffers to obtain the actual percentage slope and potential value of the pH combination electrode. The detailed preparation method of standard buffers can be referred to in the appendix.

The meter can recognize 6 kinds of standard buffers automatically. It supports two kinds of buffer groups.
Group 1: 4.00pH, 6.86pH,9.18pH.
Group 2: 3.78pH, 7.00pH, 10.01pH.
During calibration, select the needed standard buffers.
For example, if you use a buffer of 4.00pH or 6.86pH or 9.18pH, select Group 1. Otherwise, select Group 2.
Note: Improper selection of buffer group will cause inaccurate results.

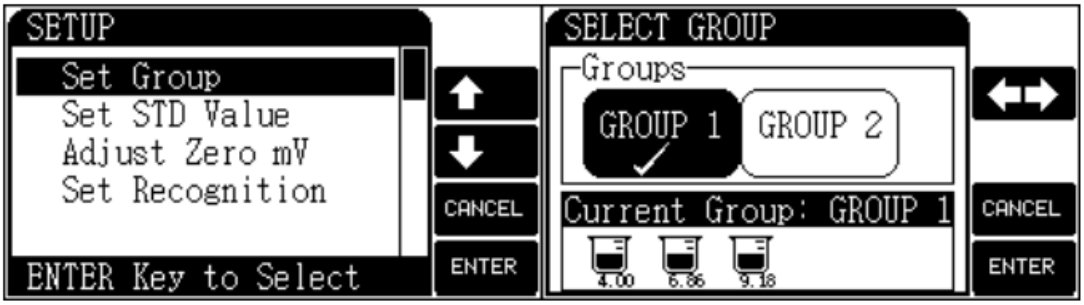

Figure-19

10.4.7.1 One-point calibration

The procedure of one-point calibration is as follows:

1) Prepare one kind of pH buffer.
2) Insert the pH combination electrode and temperature sensor into measuring electrode sockets. Clean the electrode with distilled water and put it in pH standard solution B (any one kind of the three pH standard buffers)

Figure-20

3) In the initial state, press the **'CAL'** key and the meter enters a one-point calibration working state.
4) At this time, the meter displays the present measured pH value, corresponding potential, current temperature and corresponding recognition method shown in Figure.
5) When the pH value is stable, press the **'Enter'** key, and the meter will save calibration data and remind users if they need to continue calibration.
   a. Press the **'Cancel'** key, the calibration will be finished, and the system return to the initial state.
   b. Press the **'Enter'** key, and the meter will enter two-point calibration.
   c. Press the **'Cancel'** key during calibration to finish calibration and the meter return to the initial state.

The meter can recognize standard buffers automatically. It supports two kinds of buffer groups. During calibration, select the actual buffer solution. In the calibration state, pressing the **'Setup'** key can select the buffers.
The meter supports manual recognition. For abnormal standard buffers, if the user knows the corresponding relationship between standard pH and temperature, he can switch to the manual recognition method. It can also calibrate the electrode slope.

The procedure of manual calibration will be as follows:

1) Prepare one or two standard buffers beforehand.
2) Press the **'Setup'** key to select the recognition method for manual recognition.
3) When the meter measures the current temperature and the display becomes stable, press the **'Setup'** key again to select the Calibration item and input the pH standard value at the current temperature.
4) When the potential displayed becomes stable, press the **'Enter'** key and the calibration is finished.
5) According to the same procedures, other standard solutions can also be calibrated.

10.4.7.2 Two-point calibration

The procedure of calibration is as follows:

1) When one-point calibration is finished and the meter prompts: **"Storing....Continue?'**, do not press the **'Cancel'** key to exit from calibration. Instead, press the **'Enter'** key to perform the second calibration.
2) Take the electrode out rinse it with distilled water and put it into pH buffer C.

3) When the pH value becomes stable, press the **'Enter'** key, and the meter will calculate and save electrode slope data. When the meter displays **FINISHED'**, it indicates that two-point calibration has been finished. Press the **'Cancel'** key to exit from calibration.

10.5 Calibrating of burette factor

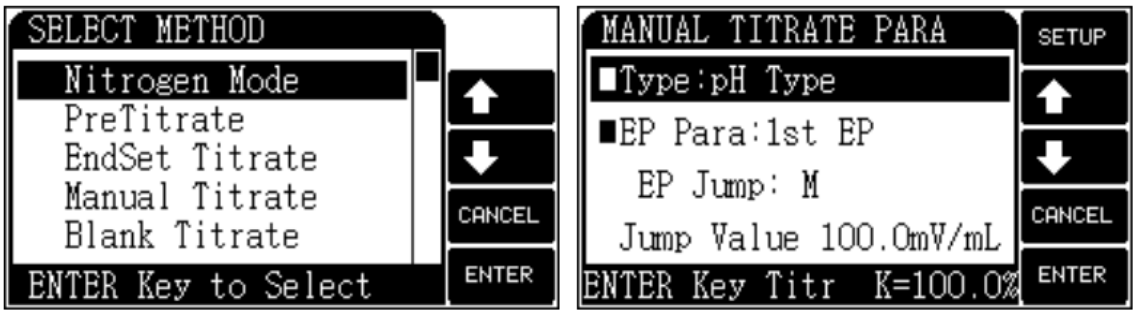

Figure-21

In the initial state,

1) Clean the burette several times.
2) Fill the burette with distilled water. (There must be no bubbles in the burette.)
3) Set the burette and set the burette coefficient as 100%.
4) Take a clean weighing and volumetric bottle.
5) First weigh the empty bottle with a balance of 1/10000.
6) Put the dripping tube into the bottle.
7) Press the **'Titrate'** key to select 'Manual Titrate'.
8) Press the **'Enter'** key as the Figure shows.
9) Set pre-added volume to '10ml' if it is 10ml burette.
10) Set the pre-added volume to '20ml' if it is 20 ml burette, (Ensure that the end volume is larger than the pre-added volume, refer to diagram)
11) Press the **'Enter'** key to begin titration after the setup. The meter will push the burette full of distilled water into the weighing and volumetric bottle, and then weigh it with balance.

Calculate the burette coefficient according to the following formula.

$$f = \frac{g_2 - g_1}{d * V_0} \times 100\%$$

In which:

F- Burette coefficient
g1- Weight of empty bottle
g2- Weight of the full bottle after filling the solution
d- Density of water
V_0- Volume of burette full scale

10.6 Cleaning

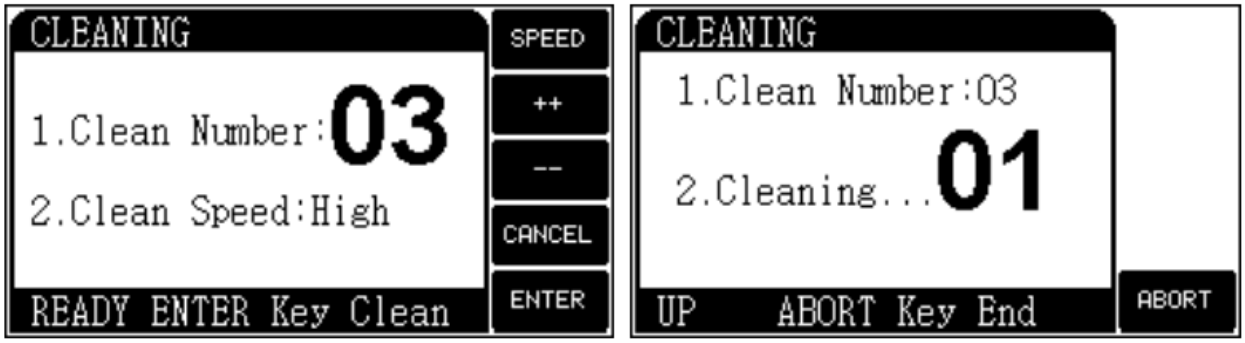

Figure-22

In the initial state,
Press the **'CLEAN'** key, and the meter will display as above figure. The number in the figure means the times of cleaning. The meter supports three cleaning speeds, and the user can select it when necessary.
At this time,

1) Pressing the '++' key can increase the cleaning times.
2) Pressing the '--' key can decrease the cleaning times (Or you can press the **'Setup'** key to input the number of cleaning times).
3) Press the **'Enter'** key to begin cleaning after setup. After cleaning, the meter returns to the initial state.

During cleaning,
Press the **'Cancel'** key to end cleaning and the meter will ask if the user wants to stop cleaning. It is shown in Figure.

Figure-23

At this time,

1) Press the **'Enter'** key and the meter will end cleaning and return to the initial state.
2) Press the **'Cancel'** key and the meter will continue cleaning.

10.7 Filling solution

In the initial state,

1) Press the **'FILL'** key and the meter will prompt a window as the following figure shows.
2) Press the **'Enter'** key to fill the solution.

Figure-24

After filling the solution, the meter will return to the initial state.

Figure-25

While filling in the solution,
Press the **'CANCEL'** key to stop filling the solution.
Note: Whenever the titration ends, the meter will automatically fill the solution.

10.8 Titrating

The meter provides the following titration modes: Nitrogen Mode, Pre-titrate (PreTitrate), preset endpoint (Endset) titrate, Manual titrate, Blank titrate, Mode Titrate and Great Mode. It can support the sample titration which has the five end points at most.

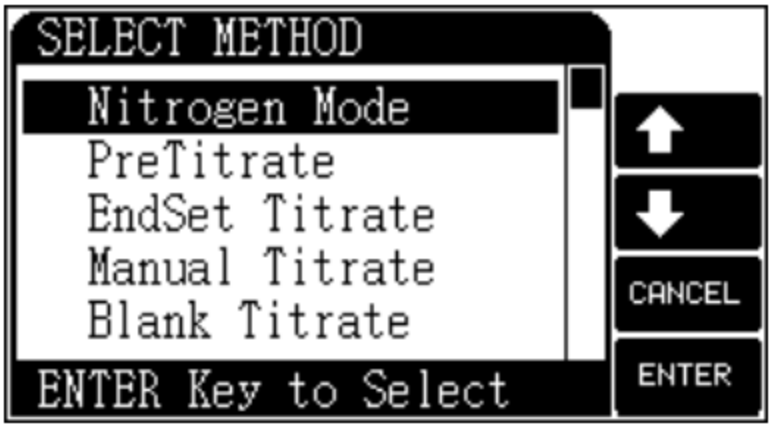

Figure-26

In the initial state,
Press the **'Mode'** key and the meter will display as above. The user can move the cursor to the corresponding titration mode and press the **'Enter'** key. The titration will begin after the corresponding titration mode is selected.

10.8.1 Repeat the previous titration mode

'Repeat previous titration mode' is set for convenience of operation. When users have finished pre-titration, preset endpoint titration or mode titration, the user can select 'Repeat previous titration' directly to repeat the previous titration. Users can ignore previous titration data, especially the data of preset endpoint and mode titration to make operation easier.

10.8.2 Pre-titration

In the initial state,

1) Press the **'Titrate'** key to select the pre-titration item and confirm the selection. The meter will enter the state of pre-titration parameter setup. See the figure.

Figure-27

Pre-titrate parameters contain: Type (Titration type), the controlled parameter of five endpoints (EP Para), endpoint jump grade (EP Jump), endpoint jump volume (Jump Value), Pre-adding volume (PreAdding), end volume (End Volume), the minimum added volume (Min Adding), titrant concentration (Titrant Conc), sample volume (Sample Vol), stirring speed (Stirrer), and set default (Set Default).

2) Move the cursor onto the corresponding item.
3) Press the **'Setup'** key to modify the parameter or value.
4) Press the **'Enter'** key after the modification, and the meter begins titration automatically.

10.8.2.1 Setup of pre-titration parameter (Pre-Titrate)

1) **Titration type parameter**
   The meter supports potential titration and pH pre-titration. Press the **'Setup'** key and the titration mode can be switched. When pH titration mode is selected, the meter will display the last calibrated electrode slope value. At this time, the meter allows the recalibration of the electrode slope. Press the **'Cal'** key and the **'Enter'** key to recalibrate the pH electrode.
2) **Endpoint parameter:** The endpoint parameter includes endpoint jump grade and endpoint volume corresponding to the five best endpoints.
   Endpoint jump volume
   It is the meter that distinguishes the endpoint. Endpoint jump volume is divided into three grades: Large, medium, and small. The user generally selects 'large', 'medium' and 'small'. The user does not need to set a detailed jump volume. If the user finds the jump volume is too small or the noise is too large so that the titration endpoint cannot be found, recommended user reset the jump volume. (Set the endpoint jump as 'small' when the jump is low. Set the endpoint jump as 'medium' or 'large' when it is very noisy.)

For multi-end point titration, the meter only allows five endpoints at most. The corresponding five endpoints have five independent controlled volumes which can be set the volume. For variable titration, there is no uniform mode or method.
To control and research conveniently, from the perspective of the user, we classify the endpoint jump into three grades. They are large jump range, medium jump range and small jump range. According to the titration, the general titration only requires setting the endpoint jump to medium jump. There is no need to know the detailed endpoint jump volume and perform a detailed setup.
If the meter cannot match the user's demands, the corresponding jump volume can be reset to match with user's requirements. Thus, generally, the user only needs to select among large, medium and small end-point jumps. Users can select the corresponding endpoint jump volume after knowing the detailed information about titration.

For example,

- To set the end point jump volume of the 1st endpoint as 'Large'.
- To set the end point jump volume of the 2nd endpoint as 'small'.

The detailed procedure is as follows:

- Move the cursor to the endpoint parameter and the meter displays: Endpoint jump: the first.
- Repeat selecting **'Setup'** and the meter displays "the 1st endpoint".
- Move the cursor to the endpoint and jump.
- The meter displays the Endpoint jump: Larger.
- Repeat pressing and select "Larger" it is set as large jump volume.
- Repeat the previous procedure.
- Set the 2nd endpoint jump volume as a small jump volume.

If the user hopes to know the endpoint jump volume of each endpoint, the user can move the cursor to the endpoint parameter as shown in the diagram. The meter displays the Endpoint parameter: the 1st endpoint, press the **'Setup'** key and the meter will display the endpoint jump volume of the corresponding endpoint. If the endpoint jump volume needs to be modified, input the new jump volume. The endpoint parameter contains the corresponding endpoint jump grade and jump volume of five endpoints.

3) **Pre-added volume parameter:** For some titrations, if the user knows the consumed volume of the endpoint, the user can accelerate the titration with this parameter. This parameter can control the volume during the first automatic addition when titration begins.
4) **End volume parameter:** This parameter is designed to avoid the damage of the meter caused by excessive addition. It is better to set this parameter. During titration, the total added volume will be determined automatically. Once the actual volume exceeds the preset end volume, the meter will stop titration and remind the user if it finishes titration or not. Users can select the needed one when necessary.
5) **The minimum added volume parameter:** For some special titrations or highly precise titrations, the user needs to set up this parameter. This parameter can ensure each added volume will not exceed the preset volume during titration.
6) **Titrant concentration parameter:** If the user knows the added titrant concentration in advance, set up this parameter. This parameter can be used to calculate sample concentration at the end of titration.
7) **Sample volume parameter:** If the user knows the sample volume in advance, set up this parameter. This parameter can be used to calculate sample concentration.
8) **Stirring speed parameter:** For some titrations, the user needs to adjust the chemical reaction speed of titration with different stirring speeds. Users can set up this parameter when necessary. When the titration begins, the meter will stir the sample at this speed.
9) **Set the Default:** This is the function selection. If the user has the wrong operation, or the parameter value is abnormal due to other reasons, this function can be used. The meter will recover the default parameter automatically. These parameters can meet with most of the operations.

10.8.2.2 Start Titration

After all specifications have been set up properly, press the **"Enter"** key to start the titration. The meter will display titration time, titration type, and the profile of potential versus volume added. At the bottom of the screen, current potential (or pH) and volume added are displayed.

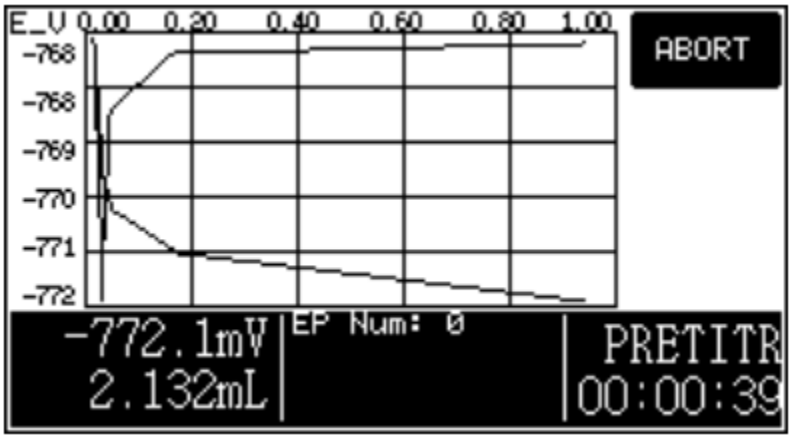

Figure-28

During titration, the meter will automatically start sampling, filling of solution, and distinguishing of endpoint. When the meter recognizes an endpoint of the titration, there will be three beepers to remind the customer and there will be potential (or pH), and volume added corresponding to the endpoint.

After the meter recognizes an endpoint of the titration, it will continue the titration to seek the next titration endpoint. If all endpoints have been recognized, press the **"Cancel"** key to stop the titration. The meter will prompt a window to remind "End Titrate?".

If the meter recognizes that the added volume is beyond the final volume (maximum volume) set up by the user, it will prompt the user to continue or not. Users can choose to end or continue the titration based on their case. Press the **"Enter"** key to end or press **"Cancel"** to continue.

Note: If the meter has recognized five endpoints, it will end the titration no matter whether there will be more endpoints or not.

10.8.2.3 Operation after pre-titration

After the titration, the meter will refill the titrant solution automatically. If the meter has recognized the endpoint, it will display titration results in the following format. The reminder is displayed in shiny color. Items displayed included the number of endpoints and consumed volume, endpoint potential, concentration, etc., corresponding to the endpoint.

V is the consumed volume of the titrant solution for the first endpoint.

E is the potential for the first endpoint.

C is the calculated concentration according to the first endpoint. If there is multi-point titration, the user can press arrow keys to display the results for other endpoints.

The concentration of an endpoint is calculated based on the following equation:

$$C = \frac{C_S * V_{EP}}{V_0}$$

In which:
C indicates concentrations
Cs indicates the concentration of titrant
VEP indicates the volume of the titrant solution consumed
V0 indicates the volume of the sample solution

1) Press the **"Save"** key to save the titration results.
2) Press the **"View"** key to display the titration curve.
3) Press the **"Output"** key to print the titration results.

Generation mode
If the user frequently performs the same type of titration, i.e., the type of titrant, endpoint and sample has a small variation range, this function will help to titrate quickly and conveniently.
Users can set up a specified module and just call this specified module when they perform such titration.
After a titration is finished and the titration has one or more endpoints, to set up a mode, press the "**Mode"** key. The meter will lead the user through the mode setup process.
After the mode generation has been initiated, first input the title for the mode as shown in the figure. The title can contain some description information to remind the user about the mode when the user calls or edits the module next time. The title can contain up to 20 symbols.

The rectangle on the top of the screen is the space for the title. The rectangle at the bottom of the screen displays the symbols that can be used for the title. Press the arrow key to the symbol needed. The corresponding symbol will be displayed in the space for the title. Press the key to confirm the selection of the symbol. The user needs to input the symbols one by one.

For example, NaOH →HCl After the title is input, press the **'Enter'** key. The meter can analyze the titration results automatically and set up the titration results as a mode. The mode can be called when performing such titration in the future.

Note: During pre-titration, pay attention to the following:
1) During the titration with a small jump near the endpoint, the customer must set the grade of the jump at "Small". Otherwise, the meter will not recognize the endpoint of the titration.

2) During the pre-titration, the titration will not be ended before it recognizes five endpoints. It will continue the titration forever. The titration will be ended by the user. If the user is satisfied with the current titration results, end the titration manually.
3) For pH titration, it is recommended for the user to calibrate the electrode before the titration.

10.8.3 Titration mode with preset endpoint

Figure- 29

For some special titrations, the user may know the type of titration and the endpoint. If so, these data can be utilized to control the titration and finish the titration. In the initial state of the meter, press the **'Titrate'** key to select the titration module with the preset endpoint. Confirm the titration module with the preset endpoint.
The specifications for the titration module with preset endpoint include the type of titration, number of endpoints, control parameters corresponding to each endpoint, the concentration of titrant solution, the volume of sample, speed of stirring, etc. Control parameters for an endpoint include endpoint, pre-point, on/off state of pre-point, the distance of pre-point, endpoint delay, etc. Use the arrow keys to the corresponding parameter and highlight it. Press the **"setup"** key to change the parameter or the value for that parameter. Press the **"confirm"** key after the change. Then, the meter will automatically start the titration with the preset endpoint. After the titration has been finished, the titration can be terminated as the termination method described for pre-titration.

10.8.3.1 Setup titration mode with preset endpoint (Endset Titrae)

1) **Titration type parameter:** This parameter for this mode is the same as the parameter for pre-titration mode. When pH titration is selected, the meter will display the slope of the pH response obtained by the last calibration. Now, it allows recalibration of the slope of pH response. Press the **"Cal"** key and press the **"Enter"** key to recalibrate the pH electrode.
2) **Number of endpoints:** Indicate the number of endpoints for the Pre-titration. The maximum number of endpoints is 5.

3) **Endpoint parameters:** There are five parameters corresponding to each endpoint, including endpoint potential value (or endpoint pH value), potential or pH of the pre-point, On/Off state of pre-point, volume of pre-point, and endpoint delay. Set up corresponding parameters according to the user's needs.
   Endpoint parameter: The user inputs the known value for the endpoint. Pre-point parameter: This parameter means that the endpoint is nearby and decreases the speed of the addition of titrant solution. The setup of this parameter will directly affect the accuracy, and the total time used for the titration. If the pre-point is too near to the endpoint, the accuracy of the titration may be lowered because of the high speed of the addition of the titrant solution. On the other hand, if the pre-point is far away from the endpoint, the total time used for titration may be extended. The pre-point should be ahead of the endpoint. Otherwise, it will lose its function. The pre-point is the turning point from fast titration to slow titration.
   For example: If the pre-point is set as 100 mV, the titration will switch from high speed to low speed when the potential reaches 100 mV.

The principle to set pre-point:

- For titration with a big jump near the endpoint, the pre-point should be set relatively far away from the endpoint. (Usually more than 100 mV ahead of the endpoint)
- For titration with a small jump near the endpoint, the pre-point should be set relatively near to the endpoint to increase the titration speed.

On/Off of pre-point and volume of pre-point: This parameter is designed to control the accuracy of titration. Usually, the user doesn't need to set it directly, but just to adopt the default setup. If the user thinks that the total used for the titration with a preset endpoint is too long, reset the volume of the pre-point by switching on the on/off state of the pre-point first. Speed up the titration by decreasing the distance of the pre-point, or vice versa. The volume of pre-point can be adjusted from 30-90%.
Endpoint delay: This parameter means the time after an endpoint has been recognized to confirm the endpoint. For acid and alkali titration with general reaction, and oxidation-reduction titration with fast reaction, 10 's is enough for the endpoint delay. If the ISE electrode is used as the indicator electrode, the endpoint delay will be longer.
Note: The default endpoint delay is 10' s for this meter and the maximum is 200 's. If the endpoint delay is set as 900' s, the meter will take the endpoint delay as infinite. If so, the meter can be used as titration with the constant value.

4) **Titrant concentration parameter:** If the user knows the titrant concentration, this parameter can be set. This parameter is used to calculate the concentration of the sample at the end of the titration.
5) **Sample volume parameter:** If the user knows the volume of the sample solution, this parameter can be set. This parameter is used to calculate the concentration of the sample at the end of the titration.

6) **Stirring speed parameter:** For some titration, the user may need to use different stirring speeds to adjust the reaction speed. Users set this parameter according to necessary. When the titrating begins, the meter will stir at this speed automatically.
7) **Recover default parameter:** In case of abnormal specifications resulting from the user's improper operation or other reasons, which makes the titration not be accomplished, the meter will recover to the default parameters automatically.

After all parameters have been set properly,
Press the **"Enter"** key to begin the titration with the preset endpoint. During the addition of the solution, the meter will automatically start sampling and judgment of the endpoint. When the meter recognizes an endpoint of the titration, it will automatically prompt a window to remind the user. The meter will continue the titrating until all endpoints set up by the user have been recognized. The titrating will automatically be stopped, and the meter will display the results. For the operation after the titration has been accomplished, refer to the corresponding section for pre-titration.

The following example explains the parameter setup
Example 1: The titration of one endpoint
- The endpoint potential A is set as 595 mV
- The pre-point potential B is set as 490 mV
- The initial potential C is 300 mV.

As A is higher than B, A must be higher than C too. Otherwise, the meter will display the mistake in the setup for pre-point at the beginning of the titrating and the titrating is discontinued. However, the meter allows B to be lower than C (e.g., C is 550 mV). If so, the meter will titrate slowly from the beginning of the titration. To the same principle, if A is lower than B, A must be lower than C too.

Example 2: The titration of two endpoints
- The first endpoint potential A1 is set up as 595 mV.
- The first pre-point potential B1 is set up as 490 mV.
- The second endpoint potential A2 is set as 800 mV.
- The second pre-point potential B2 is set up as 700 mV.
- The initial potential C is 300 mV.

As A1 is higher than B1, A2 must be higher than B2 and A2 must be higher than A1 too. If A2 is lower than B2 (e.g., B2 is set as 900 mV), the meter will display the mistake in the setup for pre-point at the beginning of the titration and the parameters have to be set again.
If A2 is lower than A1 (e.g., A2 is set up as 500 mV), the meter will not display "Titrate Begin Stirring" and the parameters have to be set up again. It is because, during titration, the meter cannot decrease from 595 mV to the second endpoint at 500 mV after it has increased from the first pre-point at 490 mV to the first endpoint at 595 mV. Additionally, A2 must be higher than C. Otherwise, the meter will display the mistake in the setup for pre-point at the beginning of the titration and the titration will be discontinued.

According to the same mechanism, if A1 is lower than B1, A2 must be lower than B2, A2 must be lower than A1, and A2 must be lower than C.

Example 3: The titration of more than two endpoints
The principle is the same as in example 2.
Note:

- To set up titration with multiple preset endpoints, endpoints and pre-points should have consistent direction and proper order. Otherwise, the meter cannot finish the titration. For example: If the user selects to set a titration with two endpoints, the first endpoint is set as 200 mV, the first pre-point is set as 100 mV, the second endpoint is set as -100 mV, and the second pre-point is set as 0 mV. The setup will lead to mistakes in operation.
- If the initial potential is 100 mV, the endpoint is set as 500 mV, and the pre-point is set as 600 mV, the setup for the pre-point is wrong. However, the pre-point is set up as 50 mV. If so, the meter will titrate slowly from the beginning of the titration.

10.8.4 Manual titration mode

In the manual titration, the user can manually fill and determine if the potential is stable and if it needs addition again.
In the initial state, press the **'TITRATE'** key to select manual titration. Confirm the mode and manual titration begins.
The mode is like the pre-titration mode. The manual titration mode includes the following parameters: Titration type, control parameters up to five endpoints including endpoint jump grade, number of endpoints, pre-added volume, end volume, next time adding volume, titrant concentration, the volume of sample, speed of stirring, etc.

- Move the arrow keys to the corresponding parameter and highlight it.
- Press the **'Setup"** key to change the parameter or the value for that parameter.
- Press the **"Enter"** key after the change to automatically start the pre-titration.

10.8.4.1 Setup of manual titration parameter

1) **Titration type parameter:** This parameter is the same as the titration type parameter in pre-titration. When the pH titration type is selected, the meter will display the last calibration electrode slope. Currently, the meter allows recalibration of the electrode slope. Press the **'Cal'** key and confirm the operation. Then pH electrode can be recalibrated.
2) **Endpoint parameter:** The endpoint parameter includes the endpoint jump grade corresponding to the endpoint (up to 5) and endpoint jump volume.
3) **Pre-added volume parameter:** For some titrations, if the user knows the generally consumed volume of the titration endpoint, the user can accelerate the titration speed with this parameter. This parameter controls the volume of the first automatic addition when titration starts.

4) **End volume parameter:** This parameter is to avoid excessive addition and overflowing. It prevents the damage and loss. It is better to set up this parameter. During titration, the meter will judge the total added volume. Once the addition exceeds the preset end volume, the meter will stop titration and remind if the user needs to finish the titration. The user can operate it according to actual needs.
5) **Next added volume parameter:** This parameter controls the next adding volume during manual titration. The user can also change it when titration starts.
6) **Titrant concentration parameter:** If the user knows the added titrant concentration in advance, the user can set up this parameter. This parameter can be used to calculate the sample concentration when the final titration ends.
7) **Sample volume parameter:** If the user knows the sample volume in advance, the user can set up this parameter. It can be used to calculate the sample concentration.
8) **Stirring speed parameter:** For some titration, the user may need to adjust the titration chemical reaction speed with different stirring speeds. The user can set up this parameter according to the actual needs. When the titration starts, the meter will stir the sample automatically at this speed.
9) **Set default:** This is a function selection. If the titration cannot be performed due to abnormal operation or wrong parameter setup, the user can use this function. The meter will recover the default parameter automatically. These parameters can be used in most operations.

10.8.4.2 Start manual titration process

After all parameters are set up correctly, press the 'Enter' key to start manual titration which is shown in the following diagram. The display interface is similar to that of other titrations. The only difference is to have two added keys. One is the key for addition and the other is for setup.

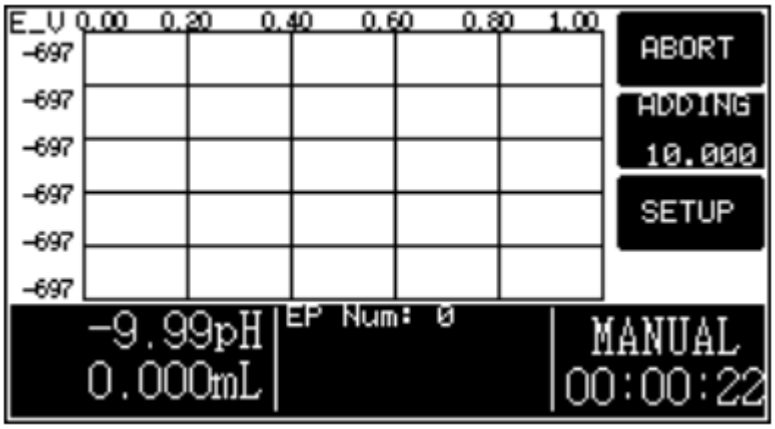

Figure-30

1) Press the **'Setup'** key to set up the next adding volume.

2) Press the **'ADDING'** key to add preset volume. After being added the preset volume, the meter still waits for further operation by the user. The procedure will continue like this until the user stops waiting or the volume has reached the preset end volume. In addition, wait until the potential or pH value becomes stable. Then the next filling can be performed. This method can guarantee the sampling accuracy of the meter, and the endpoint can be found. Once the meter finds an endpoint, it will display the consumed volume and endpoint potential (or pH value) corresponding to the endpoint.
3) Press the **'CANCEL'** key to finish titration. After titration, operate it according to the method of finishing pre-titration.

10.8.5 Blank titration

This titration mode is suitable for titration that consumes less titrant. Generally, it is suitable for titrants consumed below 1ml.

- Press the **'TITRATE'** key in the initial state.
- Select blank titration mode. The meter enters blank titration mode.

The blank titration mode is as same as the pre-titration mode. Blank titration mode includes the following parameters: Titration type, the controlling parameters of endpoints (up to 5) which includes endpoint jump grade (fixed), endpoint jump volume, pre-added volume, end volume, each added volume, titrant concentration, sample volume and stirring speed.

- Move arrow keys to the corresponding parameter.
- Press the **'Setup'** key to change the parameter or value.
- Press the **'Enter'** key to start the titration.

After titration, the user can operate according to the method of ending pre-titration.

10.8.5.1 Setup of blank titration parameter

1) **Titration type parameter:** This parameter is the same as the titration type When pH titration is selected, the meter will display the last calibrated electrode slope. At this time, the meter can recalibrate the electrode slope. Press the **'Cal'** key and confirm the operation. Then recalibrate pH electrode.
2) **Endpoint parameter:** The endpoint parameter includes 5 endpoint jump grades and endpoint jump volume. The details can be referred to in the pre-titration endpoint parameter.
3) **Pre-added volume parameter:** For some titrations, if know the general consumed volume of the titration endpoint, use this parameter to speed up titration. This parameter controls the volume of the first automatic addition when titration starts.
4) **End volume parameter:** This parameter is to avoid excessive addition and overflowing. It prevents the damage and loss. It is better to set up this parameter. During titration, the meter will judge the total added volume. Once the addition exceeds the preset end volume, the meter will stop titration and remind if the user needs to finish the titration. Operate it according to actual needs.

5) **Each added volume parameter:** Blank titration mode is to add pre-added volume. After addition, it adds the same volume in order. Since the total consumed volume is small, the revision of this parameter controls the titration accuracy.
6) **Titrant concentration parameter:** If the user knows the added titrant concentration in advance, he can set up this parameter. This parameter can be used to calculate the sample concentration in final titration.
7) **Sample volume parameter:** If the sample volume is known, set up this parameter. This parameter can be used to calculate the sample concentration.
8) **Stirring speed parameter:** Some titrations, need different stirring speeds to adjust the chemical reaction speed of titration. Set up this parameter according to the actual situation. When titration starts. the meter will stir automatically at this speed.
9) **Recover default parameter:** This is a function selection. If the titration cannot be performed due to abnormal operation or wrong parameter setup, use this function. The meter will recover the default parameter automatically. These parameters will meet with most operations.

10.8.6 Mode titration

The mode titration uploads the special titration mode generated by the user. The meter provides two kinds of titration modes:

1) HCl titrating NaOH
2) K2Cr2O7 titrating Fe2+

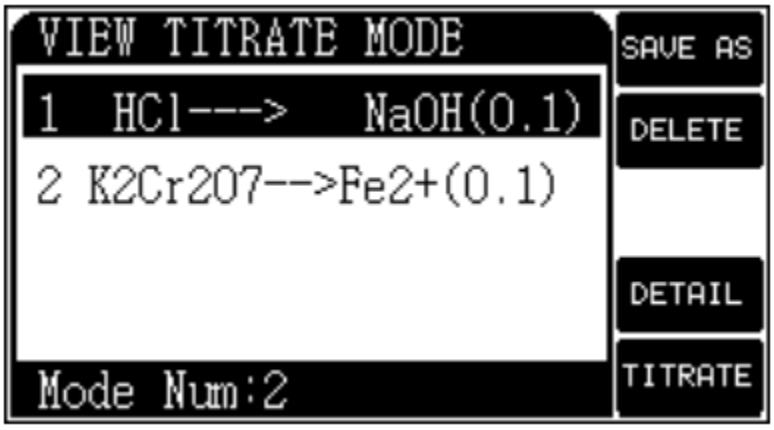

Figure-31

In the initial state,

- Press the **'TITRATE'** key to select the mode titration.
- Press the **'Enter'** key to confirm
- Select the mode and upload the corresponding mode for titration. The figure shows the current saved number of modes including system mode provided by the meter.

'HCl———>NaOH (0.1) ' means HCl titrates NaOH. The titrant concentration is 0.1mol/L. This is the name of the mode.

- Press the arrow keys currently.
- Select titration mode.
- Press the **'TITRATE'** key after selection to start the titration.
- Operate according to the method of ending pre-titration after titration.

Press the **'DETAIL'** key to view all information about certain titration mode as shown in the following diagram. The information includes the mode name, the operator which generates the mode, the time of mode generation, mode type, number of endpoints, the present endpoint parameter, titrant concentration, sample volume, and titration stirring speed. Users can revise it. (TU) Sometimes User may need to analyze a certain titration, but some controlling parameters are different. The user can use the copy function.

- Press the **'SAVE AS'** key.
- Copy the titration mode selected according to the meter allows.
- Press the **'CANCEL'** key to return to the initial state.

This titrator provides two special modes. One is:
HCl NaOH (0.1).
The other is
K2Cr2O7 Fe2+(0.1)
The rest modes require the user to generate their special modes through pre-titration, preset endpoint titration, manual titration and blank titration for the next operation.

10.9 Viewing function

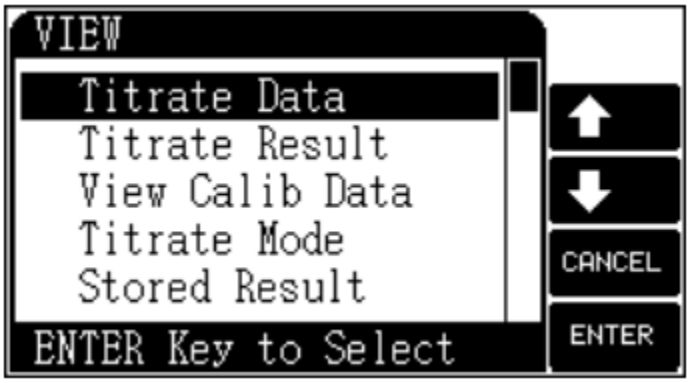

Figure-32

In the initial state,
Press the **'View'** key to view the last titration data (Titrate Data), titration result (Titrate Result), pH calibration data (View calibration data), titration mode (Titrate Mode), stored measuring result (Stored Result).

10.9.1 View titration data (Titrate Data)

After each titration, the meter will save current titration data for viewing and printing data. In the initial state,

- Press the **'View'** key to view titration data.
- Press the **'Enter'** key to confirm it and view titration data.
  At this time, the user can view the titration results. The titration mode can be generated, and titration data can be printed.

10.9.2 View titration result

After each titration, the meter will record some basic information automatically in titration. The information includes titration mode, titration type, starting time of titration, completing time of titration, operator, stirring speed, burette type, burette coefficient, titrant concentration, sample volume, endpoint number and current concentration.

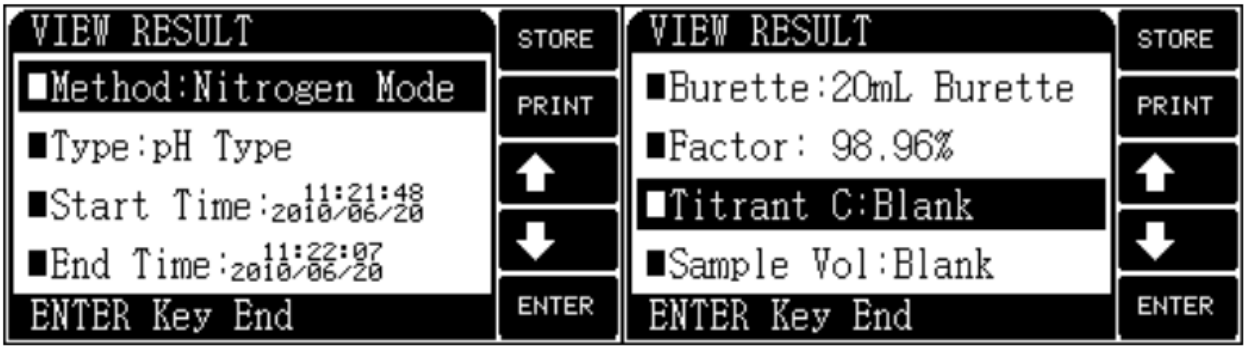

Figure-33

At this time,

1) Press the **'STORE'** key to save the titration result.
2) Press the '**PRINT**' key to print the titration result.

10.9.3 Viewing the last pH calibration result

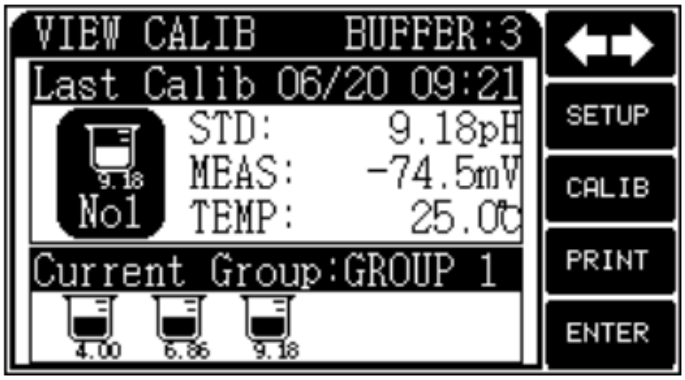

Figure-34

The meter can view the last pH calibration result.
At this time,

- Set up standard buffer group
- Recalibrate electrode slope or print the last calibration data.

In the initial state,

- Press the **'View'** key to view calibration data.
- Press the **'Enter'** key to confirm it. The last calibration result can be viewed.
- Press the **'PRINT'** key to print the calibration result.

10.9.4 View titration mode

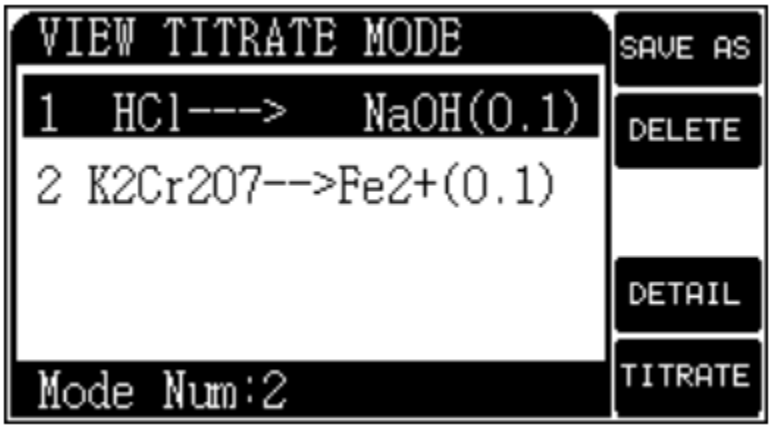

Figure-35

To view all titration modes including titration mode supplied at random. For details, refer to the mode titration.
At this time,

1) Press the '**TITRATE'** key to start titration
2) Press the '**CALIB'** key to return to the initial state.

10.9.5 View stored data

To save this titration curve for analysis after titration. Now the meter can save a set of curves including all data and values in this titration.
In the initial state,

1) Press the **'View'** key to view the saved data.
2) Press the **'Enter'** key to confirm, the saved titration curve can be viewed. The details are similar to the section of 'View titration data'.

10.9.6 View the saved result

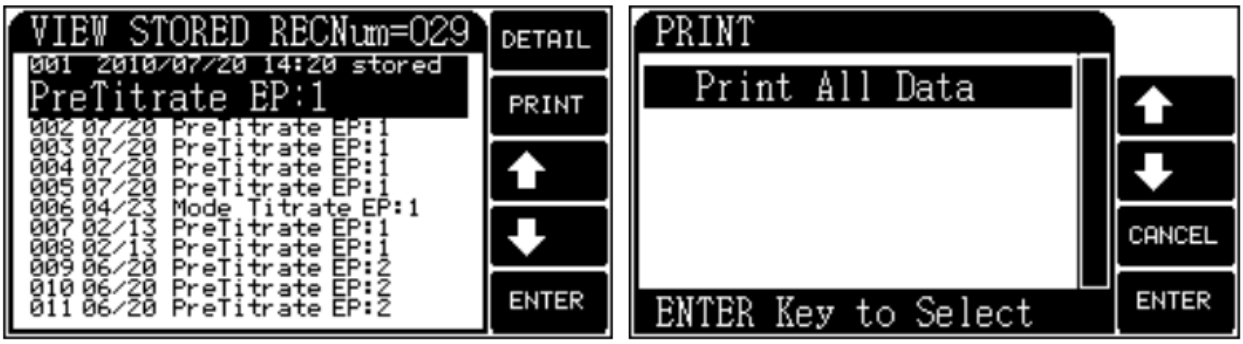

Figure-36

The meter can save 200 sets of titration data which supports GLP practice.
In the initial state,

1) Press the **'View'** key to view saved data.
2) Press the **'Enter'** key to confirm, the saved data can be viewed. The meter supports viewing detailed saved data.
3) Press the **'DETAIL'** key to view detailed titration results. The meter supports printing the saved data.

10.10 Print/Output function

The meter takes USB and RS-232 as output.

1) If the user has purchased the serial printer, it is recommended to choose the printer which can print over 24 words in one line.
2) If the user connects the printer to the computer, install the USB driver according to methods in the Appendix 14.1.
   In the initial state,
   - Select need data.
   - Press the 'Output' key to print or send the data to the PC The meter supports print titration data, titration result, calibrated data, saved data, saved result, etc.

     Note:

     1) Disconnect the power of the printer and the meter, and the printer can be connected to the meter.
     2) The meter adopts standard RS232 communication. The format is 9600, n,8,1. It means 9600bps baud rates, no odd-even check, 8 digits, and 1 stop bit.

11. Maintenance

1) Keep the sockets of the meter clean and dry. Keep them away from acidity, alkaline, and salt solutions and keep them damp-proof to ensure insulation and high input impedance performance of the meter.
2) When the meter is not used, insert a short circuit plug into the socket of the measuring electrode to prevent it from dust and steam.
3) When the meter is used in a place with higher humidity, dry the plug of the electrode with clean gauze first.
4) Often clean the whole burette with distilled water, especially the titrant which produces sediment or crystal (eg: AgNO3), clean the burette in time after it is used.
5) When using perchloric acid Acetic acid as the titrant, keep the ambient temperature higher than 16℃. Otherwise, it will produce crystal and damage the valve.

12. Troubleshooting

No.	Failure mode	Failure cause	Solution
1	No display after start-up	The power is off.	Check the power
		The fuse is damaged.	Replace the fuse of the same type
2	mV measurement is not correct.	The electrode performance declines.	Replace the new electrode
		The short circuit plug is not good.	Replace the Q9 short circuit plug.
3	pH measurement is not correct.	The electrode socket is set wrongly.	Set the correct electrode socket.
4	The printer does not work or works incorrectly	The printer is not connected to the power	Connect the printer power
		The printer line is not connected	Connect the printer line
		The printer is set wrongly	Set the correct printer type
		The printer is wrongly selected.	Replace the printer.
5	Pre-titration cannot find the endpoint	The endpoint jump is too small.	Set the jump grade to 'small'
		The titrant or sample is wrong.	Replace the titrant or sample the correct solution
		The endpoint volume is small	Change the mode to 'blank titration'
		The electrode is wrongly selected.	Select the electrode correctly.
6	Pre-titration has found the false endpoint	The setup of the pre-titration parameter is not suitable.	Set the jump grade to 'large'
7	Mode titration is wrong.		
	Find a false endpoint.	Pre-titration has found the false endpoint.	Turn off the false endpoint.
	The titration result is 0.000ml	The electrode socket is selected wrongly.	Set the correct electrode socket.
	Can’t find the endpoint	The mode is selected wrongly.	Select the correct titration mode.
8	The preset endpoint titration is wrong.		
	When the endpoints are over two, titration cannot be performed after the set parameter.	The parameter setup is wrong.	Set the correct parameter.

	The meter displays ‘pre-controlled point setup is wrong’ during titration.	The parameter setup is wrong, or the electrode socket is set wrongly.	Set the correct pre-controlled point.
			Set the correct electrode socket.
9	The stirrer doesn't work	The stirrer is not connected.	Connect the stirrer
		The stirrer is set wrongly.	Speed up the stirring rate.
		The stirrer is damaged.	Replace the stirrer
		The stirring bar has not been put in the beaker	Put the stirring bar.
10	There is a bubble in the filling tube.	Leakage occurs in the junction of the filling pipe.	Install the filling pipe.
11	The mechanical part does not work normally.	The burette is not installed correctly.	Install the burette.
12	The electrode is calibrated by mistake.	pH electrode performance is bad.	Replace the pH electrode.
		Buffer is prepared wrongly.	Prepare the buffer again.
		The electrode socket is selected wrongly.	Set the correct electrode socket.

13. Accessories

S. No	Accessory Name	Quantity
1	Reference electrode	1 PC
2	platinum electrode	1PC
3	silver electrode	1PC
4	pH glass electrode	1PC
5	temperature electrodes	1PC
6	Dropping tube	4 PCs
7	Solution cups	3PCs
8	Ejector tool	1PC
9	Burette valve device 10ml	1PC
10	Stir beads (small)	3pcs
11	Electrode holder device	1PC
12	Sealing ring	3pcs
13	Φ3.2 × 0.5Infusion tube (fluorine plastic)	2pcs
14	Inverted conical washer	3pcs
15	Plastic liquid storage bottle (500ml)	1PC
16	Φ5 × 20 (1A) Fuse	2pcs
17	Universal power supply cable	1PC
18	Serial printer cable	1PC
19	USB communication cable	1PC
20	Titration Software	1PC

14. Appendix

14.1 The preparation of pH standard buffers

1) **pH standard buffer A (pH4.00，25℃)**
   Weigh 10.12g (KHC8H4O4) which has been dried in the temperature range of 110℃ ~ 130℃ for 2 ~ 3 hours. Dissolve it in DI water and dilute the solution to 1 L.
2) **pH standard buffer B (pH6.86，25℃)**
   Weigh 3.388g (KH2PO4) and 3.533g (Na2HPO4) which have been dried in the temperature range of 110℃ ~ 130℃ for 2 ~ 3 hours. Dissolve it in DI water and dilute the solution to 1L.
3) **pH standard buffer C (pH9.18，25□)**
   To make the crystal composed, weigh 3.8g (Na2B4O7•H2O) with saturated sodium bromide (or NaCl added with Sucrose) solution in a dry container for the balance of two days (48 hours). Dissolve them in DI water and dilute the solution to 1L.

14.2 The demonstration of USB driver

If the user needs to use our titration software, operate it according to the manual. If the user has not installed the titration software on the computer, operate it according to the following procedures.

1) The meter adopts CP2102 as a USB interface.
2) After installing the driver, connect the meter and computer with a USB line. Turn the meter on. If this is the first time connecting the computer, the computer will display the prompt of finding hardware and installing the driver system. The user checks the serial port of the computer. If there is a sign of 'CP210x USB to UART Bridge (COMx)', it indicates the driver has been successfully installed. The 'x' of 'COMx' refers to the serial port mark, otherwise, the driver should be reinstalled.
3) The meter adopts standard RS232 communication. The format is 9600,n,8,1. It means: The Baud rate is 9600bps, no odd-even check, 8 digits, 1 stop bit.
4) The user uses an ordinary serial port for debugging software. When the user views titration data, titration result and calibration data, press the 'Output' key to get the result.