

Automatic Melting Point Apparatus

User's Manual

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Record of History Versions

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Warning: the responsible person shall be aware that if the apparatus is not used in a way required by the manufacturer, protection provided by it may be deteriorated.



Warning: carefully handle various solutions used for analysis according to the laboratory safety regulation. Refer to the corresponding material safety data sheets. Always wear the lab coat, goggles and rubber gloves. Avoid being scalded when handling hot reagent.



Warning: electric shock hazard. Only professional personnel are allowed to open the covers and panels.

I. Characteristics and Usages

The melting point of a substance refers to the temperature at which the crystalline material turns from solid state into liquid state. In the organic chemistry field, melting point measurement is a basic approach to judge the nature of a substance, and one of the significant methods to measure the purity.

The MP4 series automatic melting point apparatuses are the first melting point apparatuses carrying the Android system and video technology perfectly in China. They can show the temperature curves, optical signals and real-time video images conveniently and have functions of local storage, recording, watermarking and playback. The color changes and decomposition temperature can be observed through the video. The unique layered heat insulation design not only effectively resists interference of the external environment, thus guaranteeing the stability and accuracy, but also allows shorter temperature rise and drop speed, thus reducing the waiting time. The apparatuses can be broadly applied for chemical industries and pharmaceutical researches, and are necessary for producing medicines, perfumes and dyes and measuring other organic crystalline substances.

Characteristics:

Super-large 8.1-inch high-definition capacitive touch screen

720P high-definition camera, 8× optical magnification, sample detail magnification and visible sample detail changes

Steplessly adjustable linear heating rate between 0.10°C-20.00°C

Storage of customer experiment methods, historical measurement data, video and maps

Connectivity to USB printer or thermal printer or export of experiment reports to USB disk

Built-in Wifi, allowing wireless network connection and use of cloud services

Complete compliance with Chinese Pharmacopoeia GLP

Complete compliance with FDA 21CFR11, and functions of audit trail, electronic signature, tamper-proof data output, leveled user management and free permission allocation

Conformance of the whole apparatus to TART quality certification standard for laboratory analytical instruments

II. Technical Parameters

	MP420	MP430
Display mode:	8.1-inch capacitive touch screen	8.1-inch capacitive touch screen
Temperature range:	Room temperature: 300°C	Room temperature: 350°C
Temperature resolution:	0.1°C	0.1°C
Repeatability:	0.2°C (heating rate: 0.20°C/min)	0.2°C (heating rate: 0.20°C/min)
Accuracy:	±0.4°C (<200°C) ±0.7°C (<300°C)	±0.4°C (<200°C) ±0.7°C (<300°C)
Heating rate:	0.1°C--20°C	0.1°C--20°C
Standard capillary tube inside size:	Diameter:0.9~1.1mm;wall thickness:0.10~0.15mm	Diameter:0.9~1.1mm;wall thickness:0.10~0.15mm
Processing capability:	4 pcs/batch	4 pcs/batch
User management:	Not available	20
Data interface:	USB×3, RS232, Wi-Fi, RJ45	USB×3, RS232, Wi-Fi, RJ45
Manual measurement:	Available	Yes
Automatic measurement:	Not available	Not available
Video playback function:	Not available	Yes
Data storage capacity:	8 G	16 G
Conformity to FDA21 CFR part 11:	No	Yes
Audit trail function:	No	Yes
Type of compatible printer:	Thermal printer	Thermal printer and laser printer
3Q:	Not available	Not available
Standard component suite:	Not available	Not available
Power supply:	100--240VAC 50Hz/60Hz	100--240VAC 50Hz/60Hz
Dimension:	305*220*230	305*220*230
Power:	120W	120W

	MP450	MP470
Display mode:	8.1-inch capacitive touch screen	8.1-inch capacitive touch screen
Temperature range:	Room temperature: 350°C	Room temperature: 400°C
Temperature resolution:	0.1°C	0.1°C
Repeatability:	0.2°C (heating rate: 0.20°C/min)	0.2°C (heating rate: 0.20°C/min)
Accuracy:	±0.4°C (<200°C) ±0.7°C (<300°C)	±0.4°C (<200°C) ±0.7°C (<300°C)
Heating rate:	0.1°C--20°C	0.1°C--20°C
Standard capillary tube inside size:	Diameter:0.9~1.1mm;wall thickness:0.10~0.15mm	Diameter:0.9~1.1mm;wall thickness:0.10~0.15mm
Processing capability:	4 pcs/batch	4 pcs/batch
User management:	20	30
Data interface:	USB×3, RS232, Wi-Fi, RJ45	USB×3, RS232, Wi-Fi, RJ45
Manual measurement:	Yes	Yes
Automatic measurement:	Yes	Yes
Video playback function:	Yes	Yes
Data storage capacity:	16 G	32 G
Conformity to FDA21 CFR part 11:	No	Yes
Audit trail function:	No	Yes
Type of compatible printer:	Thermal printer and laser printer	Thermal printer and laser printer
3Q:	Not available	Not available
Standard component suite:	Not available	Not available
Power supply:	100--240VAC 50Hz/60Hz	100--240VAC 50Hz/60Hz
Dimension:	305*220*230	305*220*230
Power:	120W	120W

	MP490
Display mode:	8.1-inch capacitive touch screen
Temperature range:	Room temperature: 400°C
Temperature resolution:	0.01°C
Repeatability:	0.2°C (heating rate: 0.20°C/min)
Accuracy:	±0.4°C (<200°C) ±0.7°C (<300°C)
Heating rate:	0.1°C--20°C
Standard capillary size:	Inside diameter: 0.9~1.1mm; wall thickness: 0.10~0.15mm
Processing capability:	4 pcs/batch
User management:	100
Data interface:	USB×3, RS232, Wi-Fi, RJ45
Manual measurement:	Yes
Automatic measurement:	Yes
Video playback function:	Yes
Data storage capacity:	128 G
Conformity to FDA21 CFR part 11:	Yes
Audit trail function:	Yes
Type of compatible printer:	Thermal printer and laser printer
3Q:	Yes
Standard component suite:	Yes
Power supply:	100--240VAC 50Hz/60Hz
Dimension:	305*220*230
Power:	120W

III. Component Names

The structural composition of the apparatus is as shown in the figure:



Fig. a Front view of the apparatus

1. Upper Cover and Sample Chamber (see Fig. b for details)
2. 8.1-inch touch screen
3. Ventilation holes



Fig. b Upper Cover and Sample Chamber

The user can Load the test sample into the capillary tube (length $\geq 80\text{mm}$; inner diameter: $0.9\sim 1.1\text{mm}$; thickness: $0.10\sim 0.15\text{mm}$), and then insert the tube into the four Sample Chamber (see Fig. b). One batch accepted 1-4 samples.

Sample loading requirements: grind the crystalline sample into fine powder, dry it as required sample preparation standard, load the dried sample into a clean and dry capillary melting point tube (as mentioned above), take a glass tube about 800mm long vertically on a glass plate, and Let the capillary with sample fall in for several times, until the sample in the capillary is compressed to a height of 3-5mm. For easily decomposed and easily dehydrated sample, heat-seal the other end of the capillary.

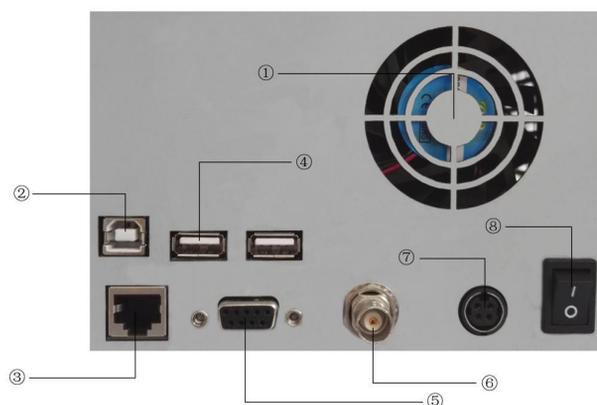


Fig. c Rear view of the apparatus

1. Ventilation holes
2. Type-B USB interface
3. RJ45 network interface
4. Type-A USB interface
5. RS-232 interface
6. BNC interface
7. Power outlet
8. Power switch

IV. Introduction to Functions

1. Self-test interface

When the apparatus is turned on, the self-test process of the key internal hardware appears, as shown in the interface of Fig. 1. Ticks will appear behind items if it pass the self-test and crosses will appear behind those if it not pass. If no hardware error is found, the screen automatically go to the next interface. If a hardware error is found, click “Ignore” in the pop-up window, the screen will continue going to the next interface and the apparatus will be used (not recommended; used for service engineer debugging only); if clicking “Confirm” to log in, you can only view and use the functions of “Help” to contact local service for maintenance, and all other functions are disabled.

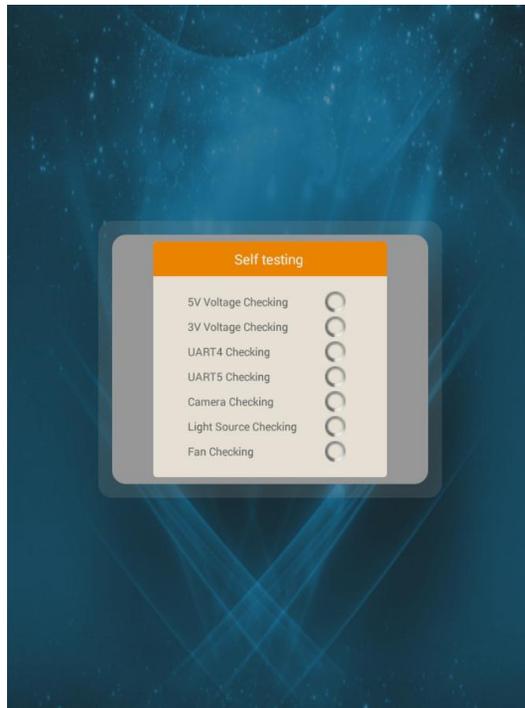


Fig. 1

2. Log-in interface

When the self-testing is completed or the current user is exited, the interface is as shown in Fig. 2. Please choose and enter correct user name and password, and then click “Login” (the default user name of the highest-permission user is “admin”, and the default password is “888888”).



Fig. 2

3. Test interface

The test interface includes 3 tabs: Parameter Setting, Automatic Test and Manual Test. In Parameter Setting (as shown in Fig. 3), the sample name, sample number, initial temperature, final temperature, heating rate, coordinate axis length or test calling method can be set.

Among them, the initial temperature, heating rate and coordinate axis length are mandatory, and others are optional. When the final temperature is blank, the system automatically chooses the highest final temperature which is settable within the allowed scope.

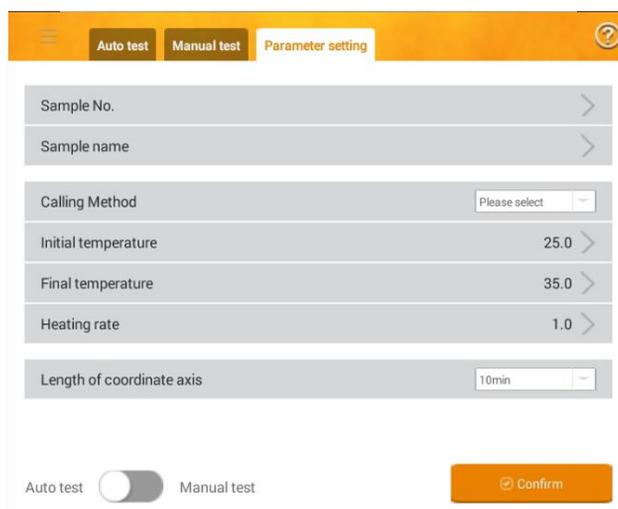


Fig. 3

[Sample No.]: only digits are allowed;

[Sample name]: English text, Chinese text, digits or symbol are allowed;

[Initial temperature]: the value range is 0~400;

[Heating rate]: the value range is 0.10~20.00 (including 0.10 and 20.00);

[Final temperature]: the value range is 0~400 and it must be higher than the initial temperature. When the final temperature is reached, the apparatus automatically drops the temperature to the initial one and waits for the user to make subsequent operations. When the final temperature is blank, the maximum available value is calculated automatically.

[Method]: choose one option from the list of methods saved in the method base, and fill the parameters of the designated method into the corresponding input boxes;

[Coordinate axis length]: designate the maximum value of the horizontal axis of the graph only three options: 10 minutes, 15 minutes and 20 minutes.

[Automatic/manual test]: When finish setting and click the “Confirm” button, and the screen will go to the automatic or manual test page;

4. Automatic test interface

After completion of setting of parameters like the initial temperature and heating rate in the test interface, if the screen goes to the automatic test interface, it is as shown in Fig. 4.

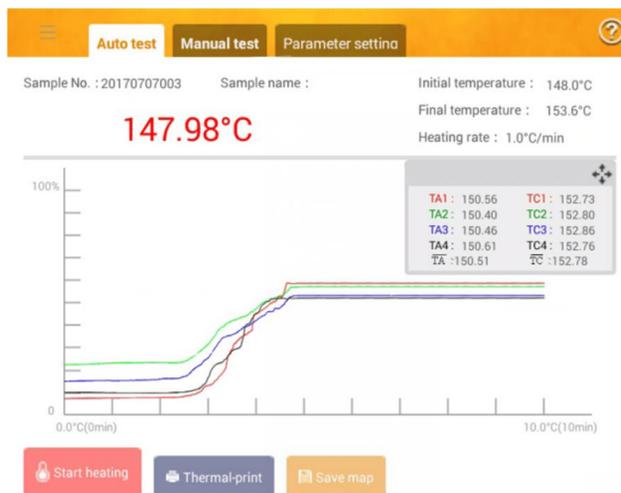


Fig. 4

TA1 to TA4 respectively refer to the initial melting points of the corresponding sample position.

TC1 to TC4 respectively refer to the final melting points of the corresponding sample position

\overline{TA} : average initial melting points of TA1 to TA4

\overline{TC} : average final melting points of TC1 to TC4;

[Start heating]: you can click this button to heat at the designated rate when the current temperature stably remains within $\pm 0.1^{\circ}\text{C}$ of the set initial temperature, and the test starts at this time;

[Save graph]: click this button to save the current graph as an image in the external USB disk behind the apparatus (the saving will not be successful by clicking this button when there's no external USB disk connected).

[Terminal print]: click this button, and the apparatus will immediately print current measurement data through a thermal printer connected at the RS232 interface.

[?]: Help function, showing the causes and correct countermeasures of common problems.

Notice:

- **The maximum time of automatic sample test is 20 minutes. The part exceeding the time length set in the horizontal axis or the maximum value of 20 minutes is not shown in the map. If the sample is not fully molten in 20 minutes during test, it is suggested for the user to adjust the parameter accordingly;**

Before test, make sure the sample cell is empty, please go to the parameter setting page to ensure that the parameters are correct, and click the "Confirm" button again to go to the corresponding test page. When the actual temperature reaches the range of preset initial one $\pm 0.1^{\circ}\text{C}$ (a buzzer beeps), charge the sample to be tested (if you charge the sample first and then enter the automatic test page, test will get abnormal), and press [Start heating] to test the sample melting point. At this time, you can view the video above the interface to observe the melting process of the tested sample, the apparatus automatically shows the sample melting curve, and automatically records the initial and final melting points of the sample.

- **If "Save graph" or "Save video" in the "system setting" is set to "Yes", the map or video of this experiment will be automatically recorded after completion of the test.**

5. Manual test interface

After completion of setting of parameters like the initial temperature and heating rate, if the screen goes to the manual test interface, it is as shown in Fig. 5.

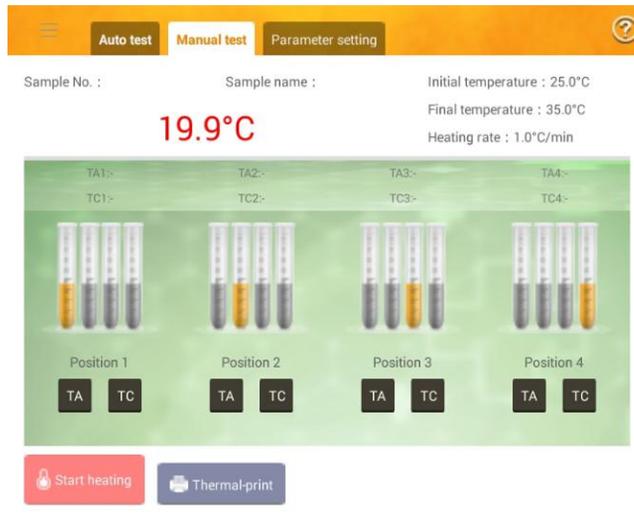


Fig. 5

[Start heating]: you can click this button to heat at the designated rate when the current temperature stably remains within $\pm 0.1^{\circ}\text{C}$ of the set initial temperature, and the test starts at this time;

[Terminal print]: click this button, and the apparatus will immediately print the experiment data measured currently through a thermal printer connected at the RS232 interface.

[TA]: click this button below the corresponding sample position, and the system will mark the current temperature as the initial melting temperature of the sample in this position;

[TC]: click this button below the corresponding sample cell, and the system will mark the current temperature as the final melting temperature of the sample in this channel;

[?] : Help function, showing the causes and correct countermeasures of common problems.

Notice:

- **If the final temperature is not set, the highest reachable temperature will be automatically selected according to different models, without time restraint and map display;**

Before each test, when the sample cell is empty, please go to the parameter setting page to ensure that the parameters are correct, and click the “Confirm” again to go to the corresponding test page. When the actual temperature reaches the preset temperature $\pm 0.1^{\circ}\text{C}$ (a buzzer beeps), then load the sample (if loading the sample first and enter the manual test page, it will cause testing abnormal), and press [Start heating] to do the testing. At this time, you can view the video to observe the melting process of the tested sample, and the initial and final melting points of the samples in each

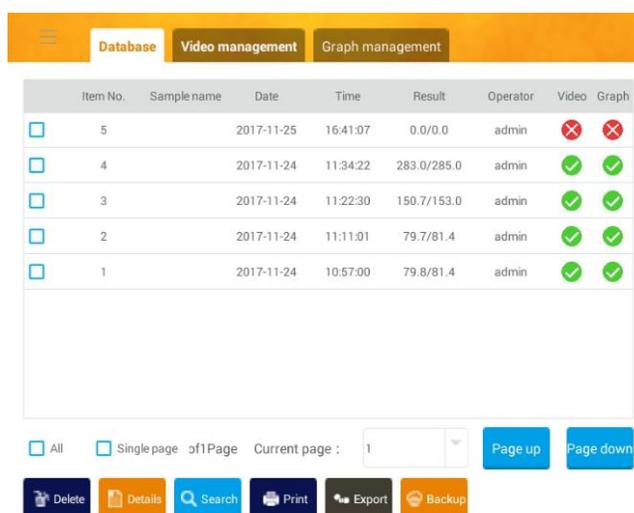
channel shall be recorded by clicking TA or TC.

- If “Save video” in the "system setting” is set to “Yes”, the video of this experiment will be automatically recorded after completion of the test.

6. Database interface

Click [Data] in the left and then click [Database] at the top to go to the database interface, as shown in Fig. 11. This interface is used to display and inquire the data saved by the user, and the video files and graph files which are corresponding to each test data can be correlated. The maximum storage capacity is 128G (MP490).

The latest data saved ranks at the top, i.e., Serial No 6 in the Fig.11 is the latest measurement data.



Item No.	Sample name	Date	Time	Result	Operator	Video	Graph
<input type="checkbox"/>	5	2017-11-25	16:41:07	0.0/0.0	admin	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	4	2017-11-24	11:34:22	283.0/285.0	admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	3	2017-11-24	11:22:30	150.7/153.0	admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	2	2017-11-24	11:11:01	79.7/81.4	admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	1	2017-11-24	10:57:00	79.8/81.4	admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

All Single page of 1 Page Current page : 1

Fig. 11

[Delete]: delete the selected data and its correlated video and graph;

[Details]: show the detail information of one data end user selected;

[Search]: the search window will pop up for user to search for the conforming test data (all the data is shown by default when the apparatus is powered on; if you want all the data to be shown again after search, please change the search condition);

[Print]: print the selected test report with A4 paper through a WIFI laser printer of designated model,

[Export]: generate a test report from the selected test data and export it to a USB disk.

[Cloud backup]: upload all the test data to the web server;

[Page up]: go to the previous page;

[Page down]: go to the next page;

In the “Video” and “Graph” columns at the end of each data row of the test list, “√” means that the data has correlated video or graph, while “×” means that it has no correlated video or graph. If “√” is shown, click “√” in the “Video” or “Graph” column in this row, the system will go to the “Video management” page or “Map management” page, and helps you screen the correlated video or map record for further operation.

7. Video management interface

The interface is as shown in Fig. 12.

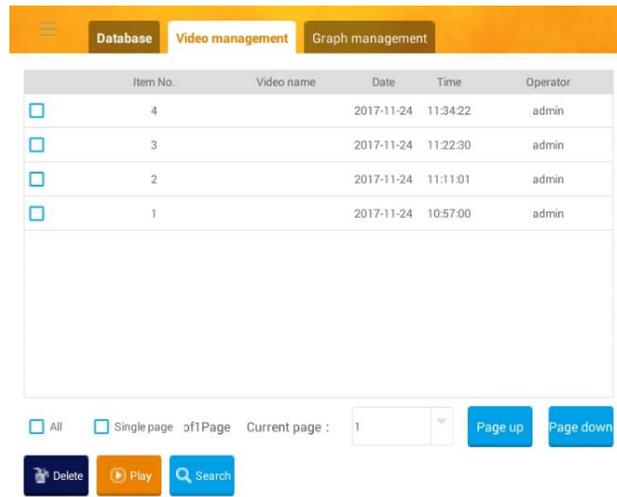


Fig. 12

[Delete]: delete the video file in the selected row (without deleting the test data and map);

[Play]: play the experiment video in the selected row;

[Search]: The search window will pop up for user to search for the conforming video file;

[Page up]: go to the previous page;

[Page down]: go to the next page;

8. Graph management interface

The interface is as shown in Fig. 13.

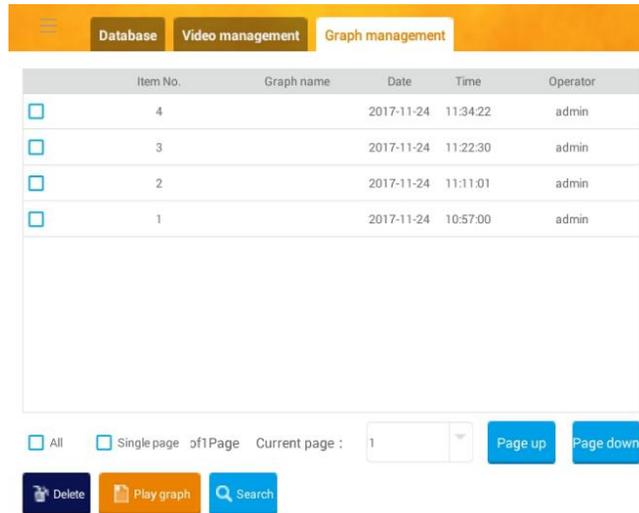


Fig. 13

[Delete]: delete the Graph file in the selected row (without deleting the test data and video);

[Play map]: play the experiment map in the selected row;

[Search]: The search window will pop up for user to search for the conforming graph file;

[Page up]: go to the previous page;

[Page down]: go to the next page;

9. User management interface

Click [User] in the left and then [User management] at the top to enter the user management interface as shown in Fig. 14.

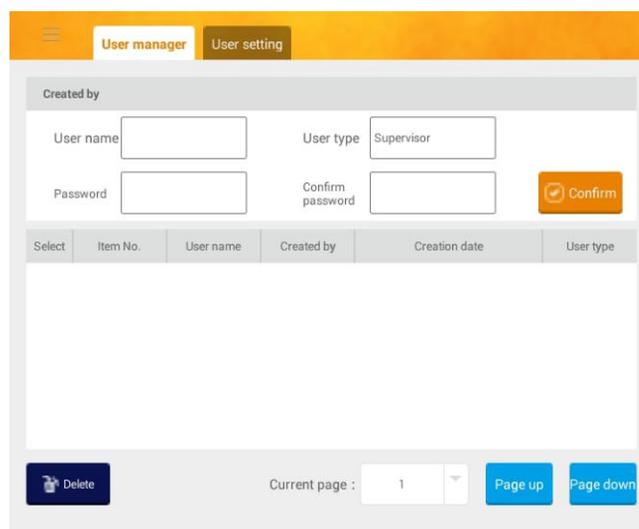


Fig. 14

An account having the permission to create new users is allowed to perform addition

operation in the current page while an account having no such permission is allowed to view only. After entering the user name and password, click [Confirm] and a window will pop up to inquire the permission to be given to the new account, as shown in Fig. 15. Click [Save] after completing permission allocation;

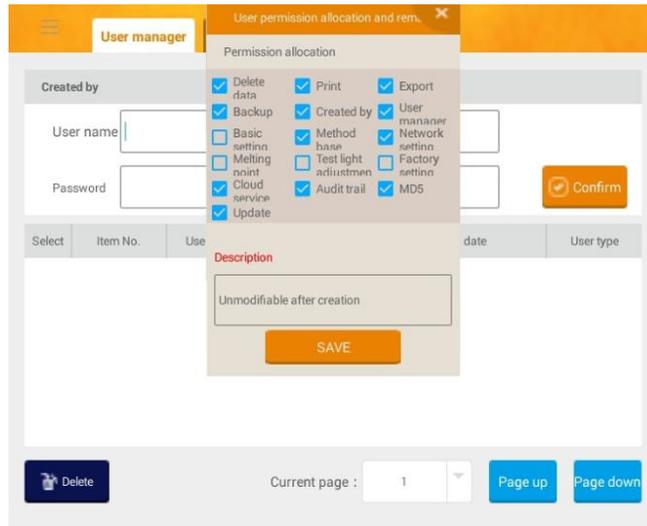


Fig. 15

10. User setting interface

In this page, operations including avatar modification, password modification, automatic login enabling and current account exiting can be performed to the account currently logged in, as shown in Fig. 16.

When [Auto login] is enabled, this account will be automatically logged in without the need of inputting the password at the time of each switch-on, and each operation performed is recorded in the name of this account. Operation steps can be reduced for login. However, it is not suggested to enable this function if there's a high requirement on audit trail.

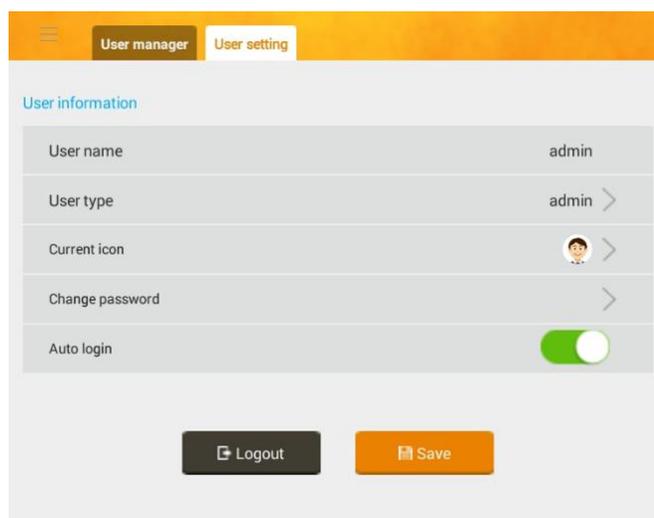


Fig. 16

[Log out]: log out of the current account, and go back to the user name and password inputting interface;

[Save]: save the icon and password which have been modified in this page.

11. Function setting interface

In the setting interface, select the [Setting] tab to enter the interface, as shown in Fig. 17.

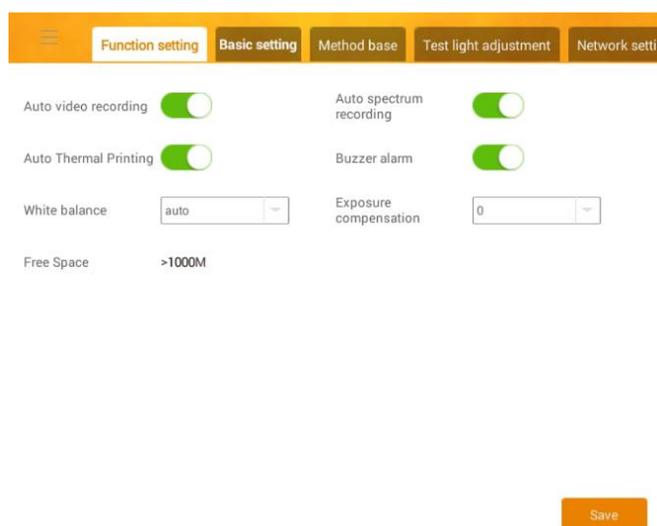


Fig. 17

[Auto-record]: if this function is enabled, recording will be started when “Start heating” is clicked in automatic or manual test and stopped when the final temperature is reached, and the record will be saved;

[Auto-save map]: if this function is enabled, the map will be recorded when the automatic test reaches the final temperature and the experiment is finished;

[Auto-thermal-print]: if this function is enabled, the data of the completed experiment will be printed through a thermal printer connected at the RS232 interface when the automatic or manual test reaches the final temperature and the experiment is finished;

[Buzzer warning]: if this function is enabled, the buzzer will beep to prompt the operator to operate the next step when the automatic or manual test steadily remains at the set initial temperature;

[Save]: save the above settings.

12. Preference interface

In the setting interface, select the [Preference] tab to enter the interface, as shown in Fig. 18.

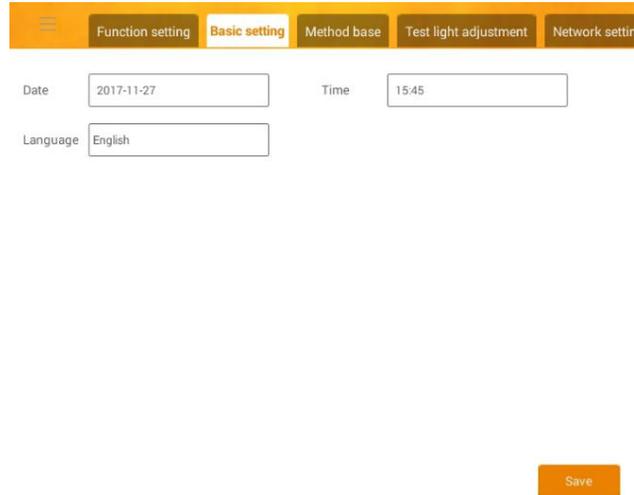


Fig. 18

In this page, the date, time and language (Simplified Chinese or English) can be set.

13. Library interface

In the setting interface, select the [Library] tab to enter the interface, as shown in Fig. 19.

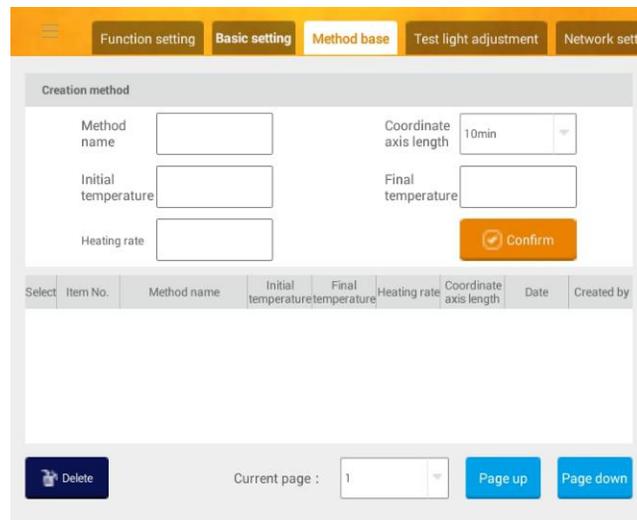


Fig. 19

The setting rule of the parameters in this page same as [testing] tab The saved method can be selected from [method] drop-down box in the [parameter setting] page of the [testing] tab.

14. Network setting interface

In the setting interface, select the [Network setting] tab to enter the interface, as shown in Fig. 20.

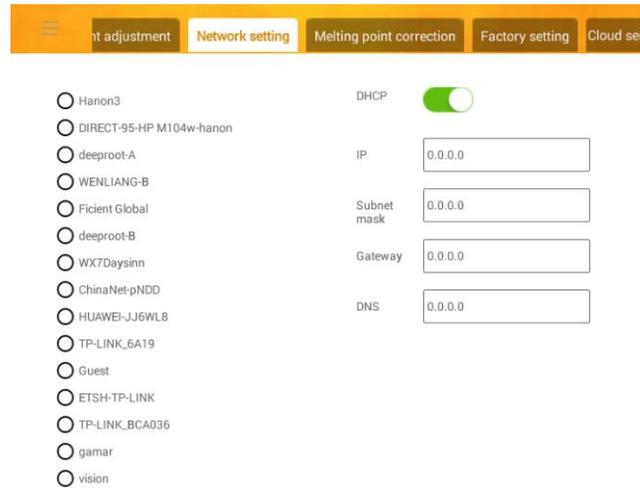


Fig. 20

The wireless networks searched are shown in the left. Click the name of the wireless network you want to connect to, input password, and a black dot will be shown at the front of the name of the wireless network which has been connected. After the wireless network has been connected, cloud service operations can be performed. When the wireless AP named as “DIRECT-95-HP LaserJet M104W” is connected, it can be used to print the experiment report with A4 paper.

If the DHCP in the right is enabled, the IP address will be automatically distributed; or else, it shall be input manually.

When network is connected through RJ45 in the back, the wireless network is invalid on the left.

15. Melting point calibration interface

In the setting interface, select the [Melting point calibration] tab to enter the interface, as shown in Fig. 21.

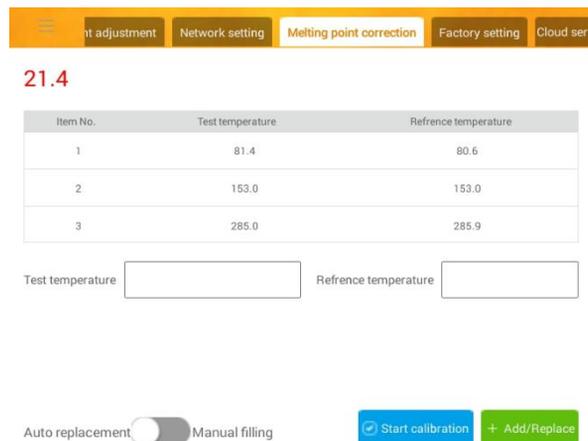


Fig. 21

[Start calibration]: click this button to go to the parameter setting page of the test page which is the same as the ordinary sample test method. After completion of the test, click “Confirm” or “Quit” to go back. If “Confirm” is clicked, the system will fill the average value of the measured melting point value into the “Testing value” box as shown in Fig. 21;

[Add/Replace]: click this button after inputting valid testing value and standard temperature; if “Auto filling” is selected, the system will compare the input value with that saved in the calibration list, choose the optimum filling proposal and inquire for confirmation before replacement; if “Manual filling” is selected, a row existing in the calibration list shall be designated for replacement, and the system will inquire for confirmation before replacement;

[Auto filling/Manual filling]: in case of auto filling, the system chooses the optimum filling proposal; in case of manual filling, the row expected to be replaced shall be designated.

16. Audit trail interface (MP430/MP470/MP490 only)

In the setting interface, select the [Audit trail] tab to enter the interface, as shown in Fig. 22.

Key operations by all the users are recorded in this sheet which is similar to a system log. An external USB disk can be used to export this audit trail log in MD5-encrypted Excel format.

The time points recorded in the audit trail sheet include: modification of date or time, deletion of test database content, system upgrade, boot time (accurate to minutes), power-on, self-test failure and error reporting, intensity adjustment of the light, calibration of sensor, permission allocation, video file deletion, upload, download and deletion of cloud backup, user addition and deletion, user password modification, user permission change, login with user name, test method addition, deletion and modification, modification of auto login name, and password incorrect.

Select	Item No.	Operator	Date	Time	Operation interface	Sub interface	Events
<input type="checkbox"/>	100	admin	2017-11-27	15:42:11	Login		Login
<input type="checkbox"/>	99	admin	2017-11-27	15:42:11	Initialize	Self test	normal
<input type="checkbox"/>	98	admin	2017-11-27	15:40:49	Update	Update with USB disk	Update
<input type="checkbox"/>	97	admin	2017-11-27	15:40:43	Login		Login
<input type="checkbox"/>	96	admin	2017-11-27	15:40:43	Initialize	Self test	normal
<input type="checkbox"/>	95	admin	2017-11-27	15:38:22	Login		Login
<input type="checkbox"/>	94	admin	2017-11-27	15:38:22	Initialize	Self test	normal
<input type="checkbox"/>	93	admin	2017-11-27	15:37:47	Login		Login
<input type="checkbox"/>	92	admin	2017-11-27	15:37:47	Initialize	Self test	normal

Single page All 1/7 Page [PAGE DOWN](#) [Export](#) [Search](#)

Fig. 22

[Export]: click this button to export the audit trial record sheet in MD5-encrypted Excel format to the external USB disk in the back of the apparatus (it will not be successfully exported if there's no USB disk);

17. Troubleshooting interface

Click [Help] in the right to go to the troubleshooting interface as shown in Fig. 23. It display error code lists. Corresponding explanations are given to the names of different error and appropriate countermeasures are suggested in the list.

error_code	error_reason	error_idle
UART4 communication fails	Hardware fails or wires get loose	Ask for after-sales maintenance
UART5 communication fails	Hardware fails or wires get loose	Ask for after-sales maintenance
COM_+5V power supply fails	Hardware fails or wires get loose	Ask for after-sales maintenance
RTD_+3.3V power supply fails	Hardware fails or wires get loose	Ask for after-sales maintenance
Cooling fan driving circuit fails	Hardware fails or wires get loose	Ask for after-sales maintenance
Support_Camera adjustable power supply fails	Hardware fails or wires get loose	Ask for after-sales maintenance
Support_Detection adjustable power supply fails	Hardware fails or wires get loose	Ask for after-sales maintenance
The camera is not detected	Hardware fails or wires get loose	Ask for after-sales maintenance
Error of the actual furnace temperature is reported	The apparatus is not working at allowed ambient temperature, the apparatus heating furnace does not allow heating or cooling by external equipment, or the hardware fails	Please confirm that the apparatus is working at allowed ambient temperature (0-40°C)

Fig. 23

18. Update interface

Click [Help] in the right and select the [Update] tab to go to the software update interface as shown in Fig. 24. For “Update via internet”, be sure to update by clicking the “Update” button with Internet connection. For “Update with USB disk”,

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put the update file under the root directory, plug the disk into the USB interface in the back of the apparatus, and click “Update with USB disk” to complete update.

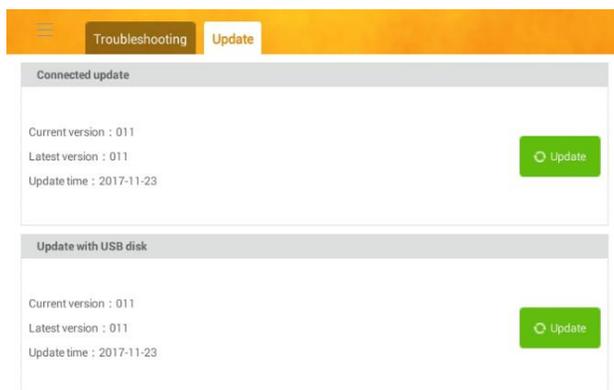


Fig. 24

V. Operation Steps and Method of Use

1. Sample preparation with capillary tube

Using agate mortar grind and dry. Position a dry and clean glass tube (about 800mm long) vertically on a glass plate. Make the capillary melting point tube containing the test sample fall in the glass tube for multiple times, until the sample powder in the capillary melting point tube is compressed at the tube bottom with an approximate height of 3-5mm. For easily decomposed and easily dehydrated sample, heat-seal the other end of the capillary melting point tube.

2. Operation procedure

2.1 Automatic test (Testing naphthalene as a example, sample number: 002, final melting point of sample: 81.1°C)

Step 1: Switch on the instruments.

Step 2: Go to the main interface, select test type (automatic or manual) and input 002 as the sample number, naphthalene as the sample name, 75°C as the initial temperature, 1°C/min as the heating rate, and 85°C as the final temperature(because already know melting point is **81.1°C**), enable [Auto test], ensure that the sample chamber is empty, and press [Confirm] to go to the corresponding interface.

Step 3: When the actual temperature stable at 75°C (the buzzer beeps), load the sample into sample chamber; when the buzzer beeps again to indicate stable temperature, press [Start heating]; when the sample start melting, the apparatus automatically shows the initial melting point; when it melted the apparatus automatically shows final melting point.

Step 4: After all the results display on the screen, operator can wait for automatic stop at the time of reaching the final temperature, or press [Stop heating] to stop it. Press [Thermal-print] to print out data (if setting result automatic print, the result will print out automatically when the test finish without the need of pressing [Thermal-print]). If operator want to test same sample, just repeat the process from step 2.

2.2 Manual test (Testing naphthalene as a example, sample number: 002, final melting point of sample: 81.1°C)

Step 1: turn on the power switch.

Step 2: Go to the main interface, select test type (automatic or manual) and input 002 as the sample number, naphthalene as the sample name, 75°C as the initial temperature, 1°C/min as the heating rate, and 85°C as the final temperature(because already know melting point is **81.1°C**), enable [Manual test], ensure that the sample chamber is empty, and press [Confirm] to go to the corresponding interface.

Step 3: When the actual temperature stable at 75°C (the buzzer beeps), load the

sample into sample chamber; when the buzzer beeps again to indicate stable temperature, press [Start heating] and observe the sample melting processing from the video on the screen; when the test sample start melting, click [TA] in the corresponding sample cell; when it melted, click [TC] in the corresponding sample cell.

Step 4: After all the results display on the screen, operator can wait for automatic stop at the time of reaching the final temperature, or press [Stop heating] to stop it. Press [Thermal-print] to print out data (if setting result automatic print, the result will print out automatically when the test finish without the need of pressing [Thermal-print]). If operator want to test same sample, just repeat the process from step 2.

3. Calibration

3.1 Calibration procedure

Calibration for **naphthalene** (melting point: 81.1°C)

Step 1: go to “melting point calibration” tab to set the parameters of reference sample-- naphthalene; input 81.1°C as the standard melting point of the sample, 75°C as the initial temperature, 1°C/min as the heating rate, and 85°C as the final temperature, and then press [Start calibration] to go to the parameter setting page. If the correction is performed in an automatic test way, please refer to the above automatic test method.

Step 2: if the test result is normal, press [Confirm], and the test temperature will be automatically filled in the [Measurement temperature] input box; or press [Quit] to leave the correction interface.

Step 3: if [Auto filling] is selected, click [Add/Replace], and the system will automatically choose an existing correction point closest to this measurement value for replacement (in the case of less than three correction points, only add new calibration point, no replacement). If [Manual filling] is selected, choose the value expected to be replaced, and then click Add/Replace] (in the case of less than three correction points, only add new calibration point, no replacement).

3.2 Suggested set value for standard sample

Set the parameters of naphthalene: input reference value 81.1°C (or the value noted on the attached certificate) as the melting point, 75°C as the initial temperature, 1°C/min as the heating rate, and 85°C as the final temperature;

Set the parameters of reference sample, adipic acid by inputting 153.2°C (or the value noted on the attached certificate) as the sample melting point, 146°C as the initial temperature, 1°C/min as the heating rate, and 156°C as the final temperature;

Set the test parameters of anthraquinone: input 285.7°C (or the value noted on the attached certificate) as the sample melting point, 278°C as the initial temperature, 1°C/min as the heating rate, and 288°C as the final temperature;

Notice:

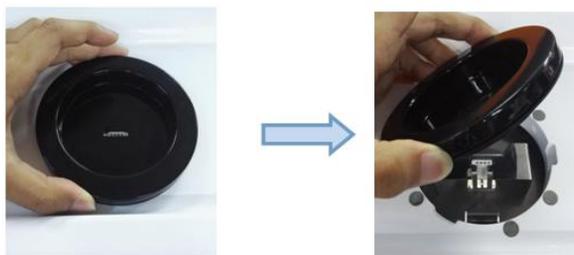
- **The apparatus has been calibrated before delivery and thus does not need to do calibration in a short term.**
- **If the user find any abnormality during calibration, press “Recovery to factory setting” to recovery the original data of the apparatus.**
- **The apparatus can be calibrated by using 1 to 3 types of reference samples.**

VI. Daily Maintenance

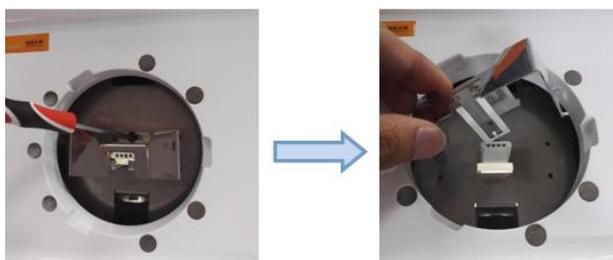
1. The apparatus shall be used in dry and well-ventilated indoor space. Do not expose it to water to prevent damp. The apparatus has a three-pin power plug. The grounding terminal shall be connected to ground and not replaced by a neutral line.
2. The capillary tube used for the apparatus shall be provided by the manufacturer itself and not replaced by one manually drawn to prevent breakage due to over-tightness. Fine capillary tubes shall be picked before use.
3. If the apparatus is not in use for a long period of time, it is suggested to turn off the power switch in the back of it and unplug the power line.
4. If there's no subsequent operation within a short period after completion of a sample test at high temperature (actual temperature $\cong 250^{\circ}\text{C}$), please adjust the initial temperature to 50°C promptly to let the apparatus temperature drop quickly. Remain the apparatus at the low temperature to wait for subsequent operations or turn it off.

VII. Handling of Capillary Tube Breakage

If the capillary tube is broken in the heating furnace when in use, remove it in the following steps:



Remove upward the upper cover fixed by a magnet;



Loosen the screw in the upper side of the ceramic-fixed metal plate with a screw driver, press inward the left side and right side, so that the limiting hooks at the four corners get loose, and then remove the ceramic-fixed metal plate;

Note: when loosening the screw, avoid it from falling inside the apparatus.



The capillary tube broken in the furnace can be removed after the ceramic sheet is extracted upward.

VIII Common Failures and Countermeasures

Failure	Cause Analysis	Countermeasure
The screen does not work after power-on	<ol style="list-style-type: none"> 1. The power supply is not connected 2. The screen harness inside the apparatus is loose 3. The fuse is burnt out 	<ol style="list-style-type: none"> 1. Connect the power plug or power on the main switch 2. Return to the factory for overhaul 3. Return to the factory for overhaul
Failure is reported during power-on self-test	The corresponding hardware may fail	Restart and observe; if failure is reported again, return to the factory for overhaul
Map and video saving fails	<ol style="list-style-type: none"> 1. "Auto-save graph" is set to "No" 2. The internal storage space is insufficient 	<ol style="list-style-type: none"> 1. Set "Auto-save graph" to "Yes" 2. Delete useless correlated files to reserve larger storage capacity
[Start heating] is invalid	<ol style="list-style-type: none"> 1. Thermostatic control to the initial temperature has not been performed yet 2. The current temperature does not steadily remains within $\pm 0.1^{\circ}\text{C}$ of the set initial temperature 	<ol style="list-style-type: none"> 1. Go to the parameter setting page, set appropriate initial temperature and heating rate, and then click "Confirm" 2. Wait until the current temperature gets steady
The automatic test result is abnormal	<ol style="list-style-type: none"> 1. There're foreign substances in the sample cell of the heating furnace 2. The capillary tube has been put in the furnace when "Confirm" is clicked in the parameter setting page 3. The light source brightness is wrong or 	<ol style="list-style-type: none"> 1. Clean the sample cell 2. Remove the capillary tube and do a re-test 3. Return to the factory for overhaul 4. Automatic test is not available for this types of samples; switch to manual test

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	<p>changes over time</p> <p>4. The light transmittance of the sample is very low</p>	
The melting point result is inaccurate	<p>1. The platinum resistor is aged</p> <p>2. There're foreign substances in the sample cell of the heating furnace</p> <p>3. There's a temperature deviation</p>	<p>1. Return to the factory for overhaul</p> <p>2. Clean the sample cell</p> <p>3. Correct the melting point</p>
Only the "Help" page is available after account login	At least one failure occurs during power-on self-test	Restart and observe; if failure is reported again, return to the factory for overhaul
The repeatability is low	<p>1. The samples are inconsistent</p> <p>2. The capillary tube size is inconsistent</p>	<p>1. Strictly follow the specification</p> <p>2. Strictly pick conforming capillary tubes</p>
The sample melting process cannot be clearly observed during test	<p>1. Certain lighting angle of the light source to the sample cell lead to shade at the bottom inside the cell</p> <p>2. The sample is in dark color</p>	Observe the capillary tube by rotating it

IX. Attention

1. Bake the test sample as required, grind it in a dry and clean mortar, and strike the capillary tube by the free fall method so that the sample powder is closely concentrated at the tube bottom with a height of not more than 3mm. The samples of the same batch shall have the same height to ensure consistent test results.
2. During the test, if the sample melting process is too long, and the apparatus automatically drops the temperature down to the initial one when the final melting point has not been measured yet, expand the time range in the coordinate axis, raise the final temperature, and test again.
3. The initial temperature value of some samples has an influence on the melting point test result. Please operate according to the specification.
4. If the linear heating rate is different, the test results are inconsistent. It is required to formulate proper specification. Generally, the higher the rate is, the higher the reading is. The melting point readings at different rates can be unified by using experiment-corrected values. For samples with unknown melting points, high-rate heating or manual test can be performed, the final temperature can be left blank, and automatic test can be performed after a range is obtained.
5. Handle the apparatus slightly when using it, keep it far away from acidic and basic solution, avoid using it under strong light, and do not open the upper cover in hot or heating state to avoid scalding.
6. If the capillary tube is broken or damaged in the sample cell, cool down the apparatus, disconnect the power supply and remove it. (Refer to the preface of the specification for detailed operation method)
7. To export data, insert the USB disk, wait a moment for the system to recognize the external USB disk, and then make operations.

X. After-sales Services and Producer Responsibility

Manufacturer will take responsibility during the warranty, excluding the following circumstances:

1. The warranty period has elapsed;
2. The apparatus is damaged due to misuse;
3. The apparatus is damaged due to disassembly without the manufacturer's permission;
4. The apparatus is damaged due to inappropriate transportation and keeping.