

# Dry Block Temperature Calibrator

**CKT3800-150A/B**



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# 1 Safety precautions

## 1.1 safety information

Please use the instrument in accordance with this manual. Otherwise the protective function of the instrument may be affected. See the security information in the warning and attention sections below.

The following definitions apply to the terms "warning" and "attention."

"Warning" indicates conditions and actions that may endanger users.

"Caution" indicates conditions and actions that may damage the instrument used.

### 1.1.1 warning

To avoid personal injury, follow these guidelines.

#### Summary

**Please do not** Use this instrument for other applications other than calibration. The instrument is designed for temperature calibration. Any other use can cause unpredictable harm to users.

**Please do not** Place the instrument under a cabinet or other object. Space needs to be left at the top so that probes can be inserted and taken out safely and easily.

Special care should be taken when using this instrument for a long time at high temperature. No monitoring is recommended during operation at high temperature. There may be safety problems.

Do not use any other direction equipment except vertical. Tilting instruments or pulling them back may cause a fire.



#### Watch out for burns

**Please do not** Touch the thermostat with your hand while working.

**Please do not** Use instruments near combustible materials.

Attention should be paid when using this instrument for a long time at high temperature

In constant temperature higher than 100 °C, the screen will display the high temperature warning icon and text. Do not remove plug-ins to avoid personal injury or fire, whether the instrument is working or not.

Do not shut down the instrument when temperature higher than 100 °C. This can lead to dangerous situations. Choose the set point is below 100 °C, and close the output, and let it cool before shut down the instrument.

## **2 Brief introduction**

This product is easy to carry, easy to use, easy to quickly and reliable temperature calibration, widely used in machinery, chemical, food, medicine and other industries.

At present, the existing dry type inspection furnace in China generally has the disadvantages of slow cooling and slow constant temperature, so it takes a long time for users to calibrate. The latest generation of dry shaft furnace of our company adopts the most advanced international cooling principle design, which has the features of rapid cooling and rapid constant temperature, greatly improving the existing calibration efficiency.

The temperature control circuit measured by high-precision sensor is gentle and reliable, which ensures that the precision is higher than that of other domestic manufacturers and the technology is up to international standards. The world's first touch operation, use simple and quick.

### **2.1 main features**

Small size, light weight, easy to carry;

Various types of insert tubes can meet different sizes and quantities of sensor testing and calibration. And can be customized according to the special needs of users;

The horizontal and vertical temperature fields are good.

The depth of being checked is the industry leader;

5.0-inch TFTLCD touch screen, 16-bit color RGB display, full touch operation, intuitive and eye-catching;

Rapid cooling, convenient setting, good temperature control stability;

Quick replacement of the heat flow;

With load short circuit, load break, sensor protection and other functions.

## **3 Quick reference**

### **3.1display interface**

Display Interface: digital display mode and graphic display mode, showed as Fig 3.1.1 and Fig

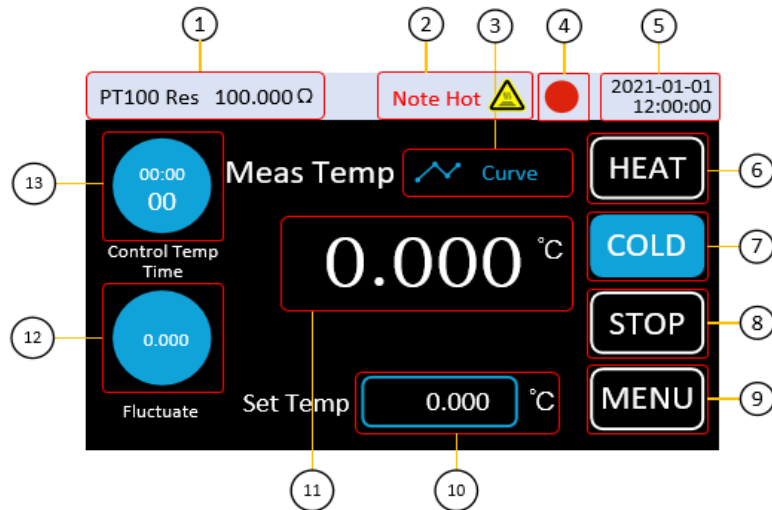


Fig 3.1.1 Digital Display Mode

- ①. PT100 resistance value: Refresh the resistance value of the resistance inside of the dry furnace in real time
- ②. High temperature warning: when the thermostat temperature is over 100 °C, the flickering words “Note Hot” and warning icon will be displayed.
- ③. Real-time graph: digital display mode can be switched to real- time graph mode.
- ④. Main output indicator light: indicates whether the heating module or cooling module is working or not, gray means not working, red means working;
- ⑤. Heat Button: after setting the temperature that higher than environment temperature, click heat button.
- ⑥. Cool Button: after setting the temperature that lower than environment temperature, click cool button
- ⑦. Stop button: when the instrument is working(heating or cooling), click it and stop working.
- ⑧. Menu button: enter into menu interface.
- ⑨. Temperature setting: enter into temperature setting interface, setting range: -20 (-30) ~ 150°C
- ⑩. Temperature measurement: Real-time refresh the measured temperature of the RTD inside the dry body furnace, that is, the inner field temperature of the dry body furnace;
- ⑪. Temperature fluctuation: refresh the measured temperature difference between the maximum and minimum in a period of time in real time;
- ⑫. Temperature control time: the time consumed in the current temperature control process is updated in real time from the start heating to the end of heating.

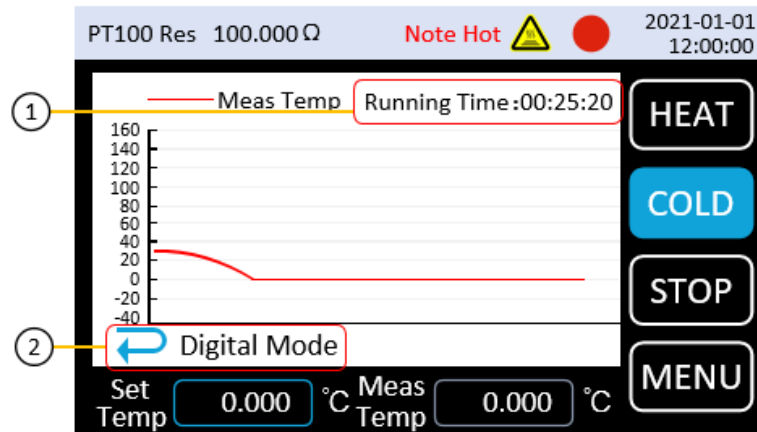


Fig 3.1.2 Graph Display Mode

A complete graph can show a maximum of 600 temperature points which is refreshing with frequency of 3 seconds/ time. Full screen curve will be a scrolling display.

- ①. Running time: refresh the time period from starting the furnace in a real time.
- ②. Digital Display Mode: switch from the graph display mode to digital display mode

## 3.2 Start Dry Block Calibrator

### 1. Connect AC power

Use the power cord provided in the attachment to connect the dry furnace to the 220V ac power supply.

### 2. Turn on switch

Turn on the front power switch

### 3.If the equipment is not starting successfully, please check according to the following steps:

- 1) check whether the power line is in well connection
- 2) if the instrument does not start still after checking, please check whether the power fuse has been fused, if necessary, Please replace the fuse.
- 3) if the instrument does not work after the above inspection, please contact the relevant department.



## 3.3 Ready to Use

Follow these steps to quickly use:

### 1. Set the target temperature

As shown in figure 3.1.1, click the setting temperature input box under the main interface, pop up the temperature window, enter the target temperature, click "confirm" button, return to the main interface, and the temperature setting is successful.

2. Start heating/ cooling

Click  to run the instrument . The button color will turn to blue  and the output indicator light will flash at a specific time interval.

3. Stop working

Click  to stop working.

## 4 Operation Instructions

### Menu Structure:

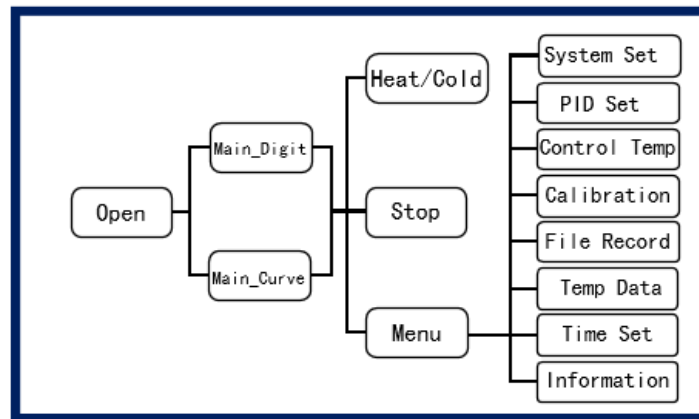


Fig 4.1 Menu Structure

### 4. 1 Menu

The menu interface is mainly divided into 8 functional modules, which are system setting, output parameter setting, temperature control setting, temperature correction, file recording, temperature control data, time setting, system information, showed as Fig4.2

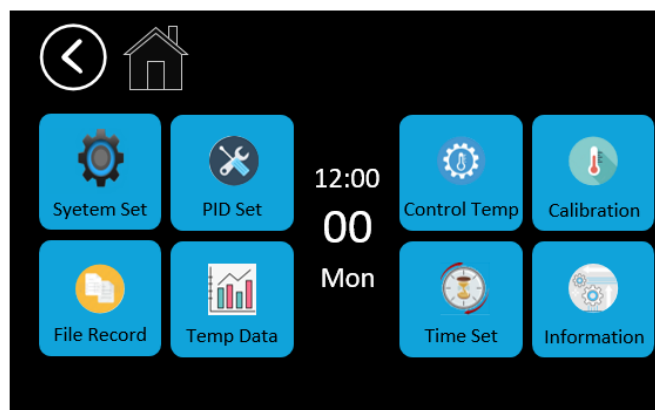


Fig 4.2 Menu Interface

## 4.2 System Setting

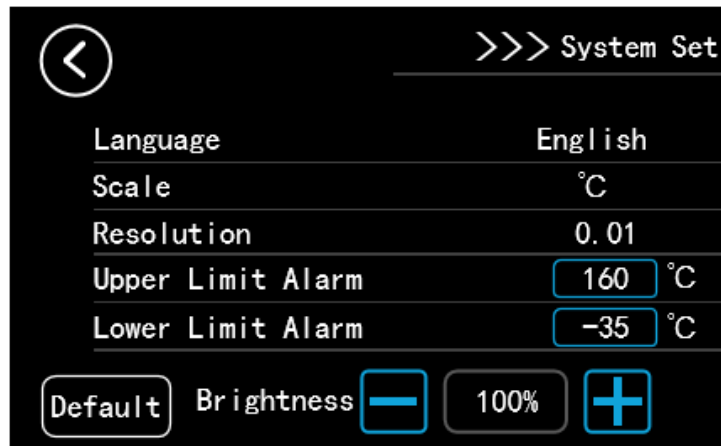


Fig 4.3 System Setting Interface

**System Settings:** general setting items, including Language, Scale, Resolution rate, Brightness, Temperature Upper and Lower Limit Alarm, showed as Fig 4.3.

Click **Default**, will restore the system settings to factory settings.

### 1. Language Setting

Support Chinese and English for option. Click the corresponding area on the screen to set.

### 2. Scale setting

Support degrees Celsius °C and Fahrenheit °F two system scales. Click the corresponding area on the screen to set.

### 3. Resolution Rate Setting

Support 0.01 and 0.001 resolution rate for options. Click the corresponding area on the screen to set.

### 4. Upper Limit Alarm

Used to set alarm upper limit. When the output is turned on, if the temperature of the thermostat block exceeds the alarm upper limit, the system will pop up the temperature alarm window, the buzzer will beep, and the output will be forcibly closed. The setting range is -45°C~160°C, and cannot be upper than the upper limit alarm .

### 5. Lower Limit Alarm

Used to set alarm lower limit. When the output is turned on, if the temperature of the thermostat block is below the alarm lower limit, the system will give a warning information. The setting range is -45°C~160°C, and cannot be lower than the lower alarm limit.

### 6. Brightness setting

Percentage value setting, a total of 5 stalls, respectively 20%, 40%, 60%, 80%, 100%, click the "+/-" button to adjust the brightness .

## 4.3 Parameter Output Settings

Parameter	Value	Unit
Period	3	s
Kp	300	%
Ti	53	s
Td	14	s
Out Limit	100	%

Buttons: Default, Save

Fig 4.4 Parameter Output Setting

**Parameter Output Setting:** In the process of heating and cooling, PID control is adopted to control the temperature field of dry body furnace. On this screen, users can customize PID output parameters to meet the on-site requirements. Before delivery, the system presets a set of PID parameters made by manufacturer, as shown in Figure 4.4.

Press the  button to restore PID output parameters to factory defaults.

### 1. PID cycle setting

The adjustment operation period of the meter, is in seconds, ranges from 1 to 100. The preset value is 3. This parameter has a great influence on the quality of regulation, and an appropriate value can solve the overshoot and oscillation phenomenon perfectly, and obtain a better response speed. We suggest modify the value based on the preset value.

### 2. PID proportional coefficient setting

The proportional coefficient P in PID, in %, ranges from 1 to 9999. The preset value is 300. The scale factor determines the size of the scale band. The smaller the proportional band is, the stronger the regulating effect is (equivalent to increasing the amplification coefficient); On the contrary, the larger the proportion band, the weaker the regulating effect. You are advised to change the value based on the preset value.

### 3. PID integral time setting

PID integral time I, unit: s, set range: 1~9999, system preset is 53. Integration time determines the intensity of integration. If the integration time is short, the integration effect is


strong and the time to eliminate the static difference is short. However, if the integration time is too strong, the oscillation may occur when the temperature is stable. On the contrary, the integration effect is weak when the integration time is long, but it takes a long time to eliminate the static difference. We suggest modify the value based on the preset value.

#### 4. PID differential time setting

PID integral time D, unit: s, set range: 1~9999, system preset is 14. Differential time determines the intensity of differential action. The longer differential time is, the stronger differential effect is. Being sensitive to temperature change, it can reduce temperature overshoot. However too strong differential effect may increase the temperature oscillation amplitude and lengthen the stability time.

#### 5. Power limit

The unit is %. The setting range is from 1 to 100. The system preset value is 100. A larger value indicates a higher output power and faster heating rate, which may adversely affect the service lifetime of the heating module.

Note: click the  button after setting, the setting value will be saved, otherwise it will be failed actions.

## 4. 4 Temperature Control Setting

**Temperature control setting:** Used to determine whether the temperature control reaches the stable state. As shown in Figure 4.5, taking the parameters in the figure as an example, when the measured temperature reaches to setting temperature point within the deviation of  $\pm 0.50^{\circ}\text{C}$  and the fluctuation is less than or equal to  $\pm 0.20^{\circ}\text{C}$  for 3 minutes, the system will determine that the temperature control is stable. At this moment, the users can collect the measured data of the sensor under inspection.

When the system determines that the temperature is stable, the buzzer rings, and the words "PV" on the main interface will be displayed in green.

Users can also modify the temperature control parameters based on their own requirements. The smaller the temperature fluctuation and target deviation are, the larger the stability time is, the more stringent the conditions for determining the temperature control stability are, and the longer the time is needed to achieve the stability. We suggest modify the parameters based on the preset value.

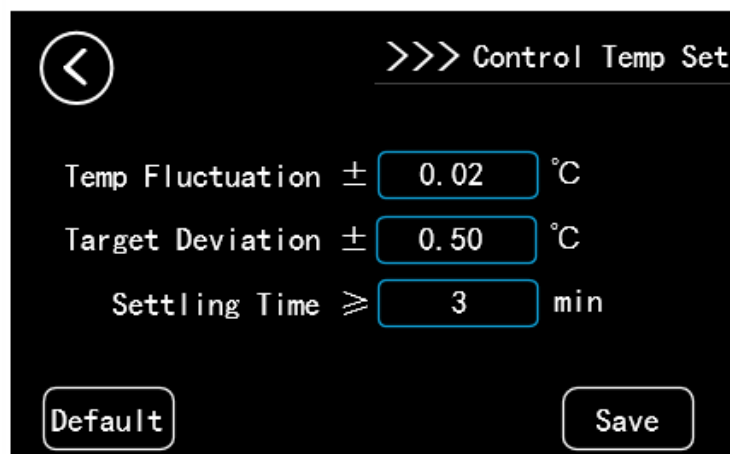


Fig 4.5 System System Interface

### 1. Temperature Fluctuation


The measured temperature difference between the maximum and minimum within a period, is used to reflect the stability of the measurement temperature.

### 2. Target Deviation

The difference between the measured temperature and the set temperature reflects the deviation between the measured temperature and the target temperature.

### 3. Stability time

Time duration of temperature measurement between the defined temperature fluctuation and target deviation.

**Note:** click  button after setting, the setting value will be saved, otherwise it will be failed actions.

**Note:** The temperature stability criteria of the system are for reference only.

## 4. 5 Temperature Calibration Mode

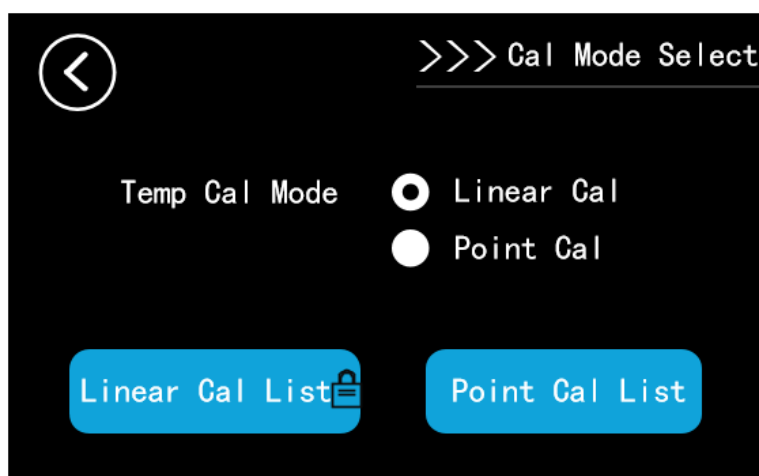


Fig 4.6 Temp Correction Mode

**Temperature calibration selection:** used to select temperature correction mode, including

linear correction mode and point correction mode, as shown in Figure 4.6.

### 1. Liner Calibration

Linear correction ensures the accuracy and reliability of the data in the whole range by establishing multiple linear equation in two unknowns using calibration data. For example: already correct the point -20 °C and -10°C in this mode, all temperature points between -20°C and -10°C are corrected.

### 2. Point Calibration

The point correction only corrects the error of the fixed set temperature point. The set value and correction value in the "fixed point correction table" can be changed. For example, if temperature points -20°C and -10°C are corrected in this mode, only two temperature points -20°C and -10°C are corrected, and other temperature points between -20°C and -10°C are not corrected.

## 4. 6 Temperature Correction

**Temperature correction:** Used to correct the measured temperature value. When the temperature measurement accuracy of the main interface is poor, users can use the temperature correction interface to correct it. In the interface of temperature correction mode, press the key of

"Linear Cal List" or "Point Cal List" to enter the interface of temperature correction, as shown in FIG. 4.7 and 4.8.

SV	CORR	SV	CORR	SV	CORR	SV	CORR
-40	-40.00	10	10.00	60	60.00	110	110.00
-30	-30.00	20	20.00	70	70.00	120	120.00
-20	-20.00	30	30.00	80	80.00	130	130.00
-10	-10.00	40	40.00	90	90.00	140	140.00
0	0.00	50	49.94	100	100.00	150	150.00

Buttons: Default, Sync To Point, Save

Fig 4.7Temp Liner Cor Interface

SV	CORR	SV	CORR	SV	CORR	SV	CORR
-40	-40.00	10	10.00	60	60.00	110	110.00
-30	-30.00	20	20.00	70	70.00	120	120.00
-20	-20.00	30	30.00	80	80.00	130	130.00
-10	-10.00	40	40.00	90	90.00	140	140.00
0	0.00	50	50.00	100	100.00	150	150.00

Buttons: Default, Save

Fig4.8Temp Point Cor Interface

The system provides 20 temperature points. When there is an error between the measured temperature and the real temperature, modify the correction value to correct the current measured temperature value.

Principle of modification: the user needs to provide a reference standard temperature sensor. When the temperature control reaches stability, the difference between the measured temperature of the dry body furnace and the real temperature measured by the standard sensor is added on the basis of the original modified value corresponding to the set value. For example, the temperature of the dry furnace is set at 50°C, and when the temperature control reaches stability, the measured temperature on the main interface of the dry furnace is displayed as 49.97°C, and the real

temperature measured by the standard sensor is 50.03°C, so the difference between the two is -0.06°C. In the correction interface, the correction value in the blue box corresponding to the set value of 50°C is currently 50.00°C, which is changed to 49.94°C. it means modify

50 50.00 to 50 49.94, and click Save. Then return to the main interface and wait for the temperature control to stabilize again. If the temperature measurement accuracy is still not ideal, it can be repaired again with the same method on the basis of the correction value of 59.94°C until the correction of temperature point 50°C is completed.

**Restore default:** Added the option to restore the temperature value to the factory value state and restore it to the uncalibrated state, as shown in Figure 4.9. If modifying the temperature value by misoperation, users can restore the temperature value to the factory default value. If "Default" has no effect, modify any temperature value and try again.

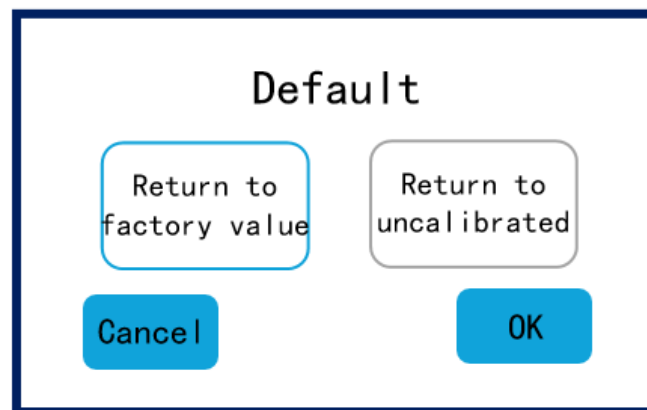


Fig 4.9 Restore Default Interface

Note: click the Save button after setting, the setting value will be saved, otherwise it will be failed actions.

## 4.7 File Recording

**File recording list:** File directory. A total of 10 data files can be saved. On the file list page, the name of each file, the time and date of the last file modification are displayed. If the file is empty, nothing is displayed. See Figure 4.10.



The image shows a 'Sensor Attribute' dialog box. It has a title bar 'Sensor Attribute' in blue. Below the title bar, it says 'Sensor1'. There are three input fields: 'Number' with the value '001', 'Type' with the value 'pt100', and 'Unit' with the value '°C'. At the bottom, there are three buttons: 'Cancel', 'Delete', and 'OK'.

Fig 4.12 Sensor Property Editing

- ①. Number: a maximum of 4 English characters, click the corresponding area to input;
- ②. Indexing sign: a maximum of 8 English characters, click the corresponding area to input;
- ③. Data units: including °C to °F,  $\Omega$ , mV to °F.
- ④. Delete: Deletes all information about the current sensor.

## 4.8 Temperature Control Data

**Temperature control file list:** file directory. A total of 50 data files can be saved. The name, data, time of each file are displayed in the temperature control file list. If the file is empty, nothing is displayed. See Figure 4.13.

The image shows the 'Temp Data File List' interface. It has a title bar '>>>Temp Data File List'. There is a back arrow button on the left. Below the title bar, there is a list of files. Each file entry consists of a file icon, a file name, a date, and a time. The files are numbered 01 to 05. File 01 has the name 'FileName00112233', date '2021-01-01', and time '12:00:00'. To the right of the file list, there is a 'Storage' toggle switch set to 'ON' and a 'Memory' indicator showing '1/50'. At the bottom, there are three buttons: 'LastPage', 'NextPage', and 'Delete A'.

4.13 Temp Control List Interface

- 1) **Storage function:** When the storage function is enabled, the system will pop up a dialog box whether to store temperature control data every time the heating operation is started. If storage is enabled, temperature control data is stored at a frequency of 3 seconds per time. If the storage function is disabled, no prompt is displayed (the configuration cannot be changed during the temperature control process).
- 2) **up and down page turning:** you can view the first five or the last five temperature control data files;

3) **Delete all:** Press the "Delete A" button to delete all 50 temperature control data files at a time. It takes a long time, please wait patiently.

**Temperature control file:** Displays the file name, file number, date and time, temperature setting, number of temperature points, total temperature control time, and time when the temperature control reaches stability. If the file is empty, nothing is displayed. See Figure 4.14.

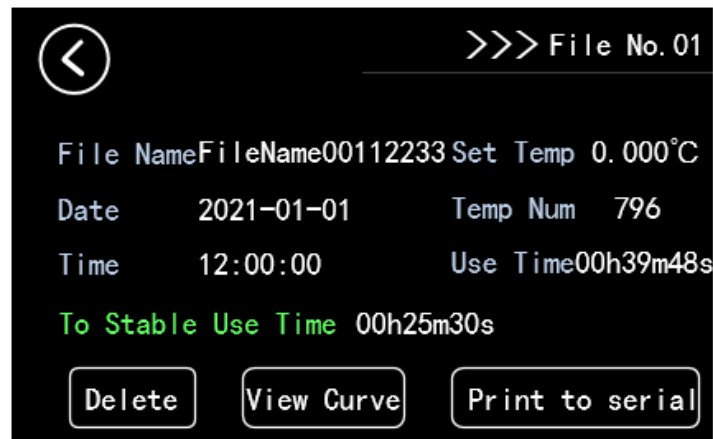


Fig 4.14 Temperature Control Files

- 1) **Delete files:** Deletes one current file. Other files are not affected. Empty files will give no response when clicking.
- 2) **Graph viewing:** File for empty point press no response; The date of temperature control in the files is displayed as curve graph, that is, historical curves, as shown in Figure 4.15. Empty files will give no response when clicking.

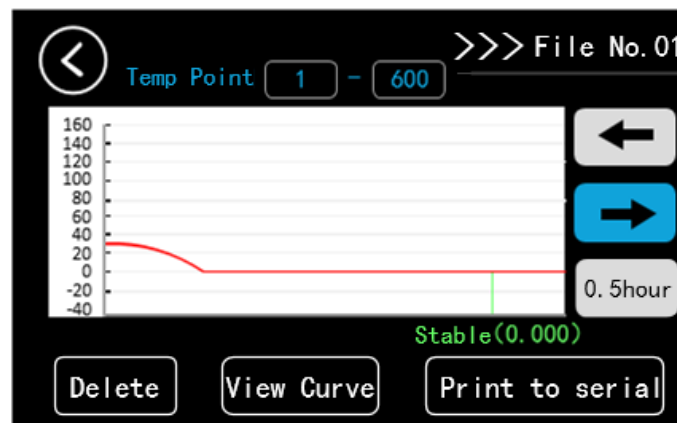


Fig 4.15 Viewing Curve Graph

In this interface, a graph screen can display a maximum of 600 temperature control data. Based on the storage frequency of temperature control data of 3 seconds per time, a graph screen takes 0.5 hours. Users can view the following temperature control data by turning to the right.

When temperature control reaches stability, the current measured temperature will be displayed in green as shown in Fig 4.15

3) **Print to the serial port:** Send all the information in the temperature control data file to the serial port tool. Connect the USB communication interface of the dry body furnace to the PC, and the

effect is shown in Figure 4.16. Empty files will have no response when clicking.(USB communication Function is optional with extra charge, please contact manufacturer if necessary)

```
0.001
0.002
0.003
0.000
0.001
0.002
0.003
0.000
0.001
0.002
0.003
0.000
0.003
0.000
0.003
0.000
File Number:01
File Name:FileName00112233
Set temp value:0.000
To Stable Use Time:00h25m30s
Number Of Control Temp:796
Time Of Control Temp:00h39m48s
```

Fig 4.16 Serial Port Interface

## 4.9 Time Setting

Time setting: Used to modify the time and date, refresh in the upper right corner of the main interface in real time, as shown in Figure 4.17.

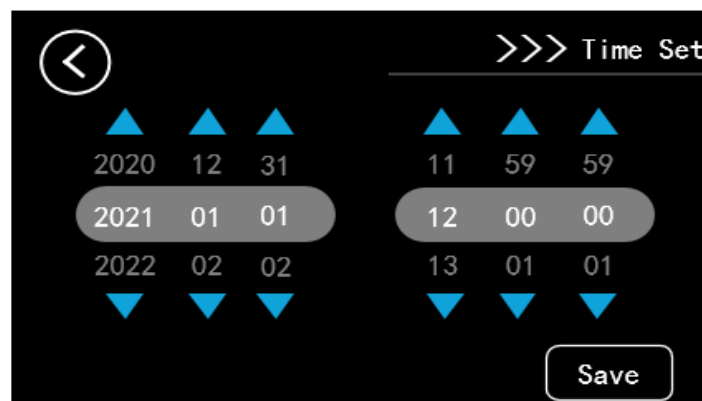



Fig 4.17 Time Setting Interface

Modify the time parameter through the "▲" and "▼" buttons in the corresponding item.

Note: click the  button after setting, the setting value will be saved, otherwise it will be failed actions.

## 4.10 System Information

System information: display the basic information of dry furnace, including serial number, software version number, file function and communication function, as shown in Figure 4.18.

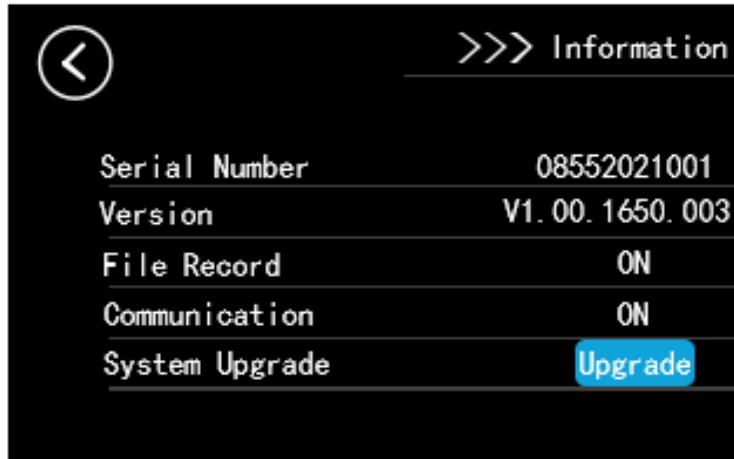


Fig 4.18 System Information Interface

## 5 Technical Index

**Note:** This technical index shall be effective under the environment of  $23\pm5^{\circ}\text{C}$  and the product shall be stable for 10 minutes after reaching the set temperature:

- Scale unit:  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$
- Model:
  - Model: ET2501-150A:  $-20^{\circ}\text{C}\sim 150^{\circ}\text{C}$
  - Model: ET2501-150B:  $-30^{\circ}\text{C}\sim 150^{\circ}\text{C}$
- Accuracy:  $\leq \pm 0.1^{\circ}\text{C}$
- Temperature Control Precision: 0.1%
- Resolution rate: 0.01 and  $0.001^{\circ}\text{C}$  for option;
- Heating speed:  $25^{\circ}\text{C}\sim 50^{\circ}\text{C}$  6mins;  $50^{\circ}\text{C}\sim 100^{\circ}\text{C}$  15mins;  
 $100^{\circ}\text{C}\sim 150^{\circ}\text{C}$  20mins;
- Cooling speed:  $25^{\circ}\text{C}\sim 0^{\circ}\text{C}$  15mins;  $0^{\circ}\text{C}\sim -20^{\circ}\text{C}$  15mins;  
 $-20^{\circ}\text{C}\sim -30^{\circ}\text{C}$  22mins;
- Temperature stability:  $\leq \pm 0.2^{\circ}\text{C}/15\text{ mins}$ ;
- Insert depth: 165mm
- Numbers of inserted sensors and hole size:
  - 4 holes(standard),  $\phi 6$ 、 $\phi 8$ 、 $\phi 10$ 、 $\phi 12\text{mm}$ (ET2501-150A).
  - 4 holes(standard),  $\phi 6$ 、 $\phi 8$ 、 $\phi 8$ 、 $\phi 10\text{mm}$  (ET2501-150B).

## **6 General technical specification**

- Environment temperature ranges: 0~50°C (32-122°F);
- Environmental humidity ranges: 0%-90% (No condensation);
- Dimension: 250mm×150mm×310mm (L×W×H)
- Net Weight: 11kg;
- Working voltage: 220V.AC±10%, 45-65Hz.
- Power: 300W.

## **7 Maintenance**

### **1.General maintenance**

1) the instrument should be rectified for 1 year or so, so as to ensure the indicator of the instrument meets the requirements.

### **2. Replace fuse tube**

The fuse tube is installed under the power socket switch.

Specification of fuse tube:

20A L 250V the type of fuse  $\Phi 5 \times 20$ mm

Operation steps:

- 1) Turn off the power and unplug the power cord.
- 2) Find the location of the fuse and remove the blown fuse according to the device.
- 3) Replace the new fuse tube and reload it.