

Instruction Manual of LS152 Human Machine Interface

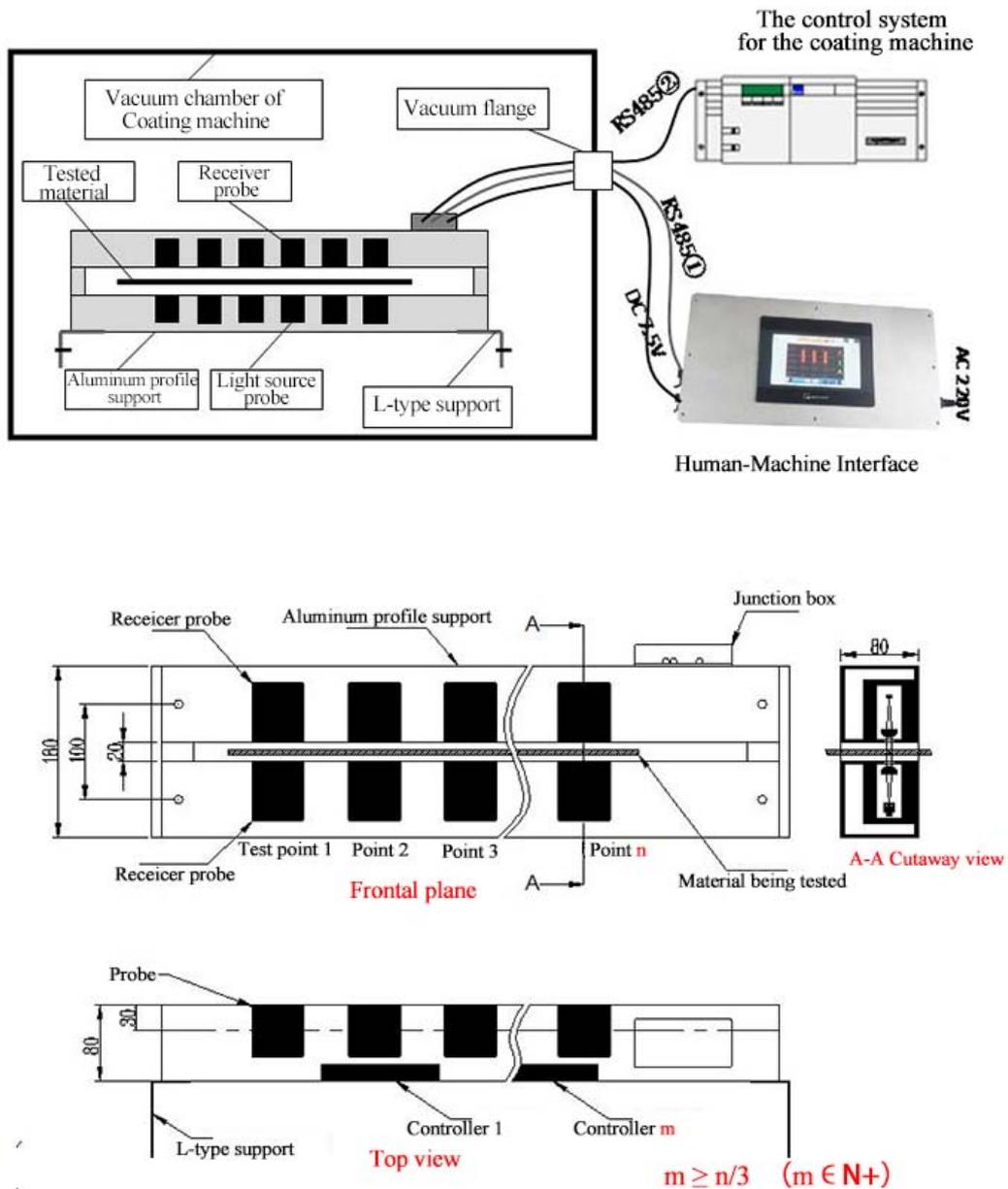
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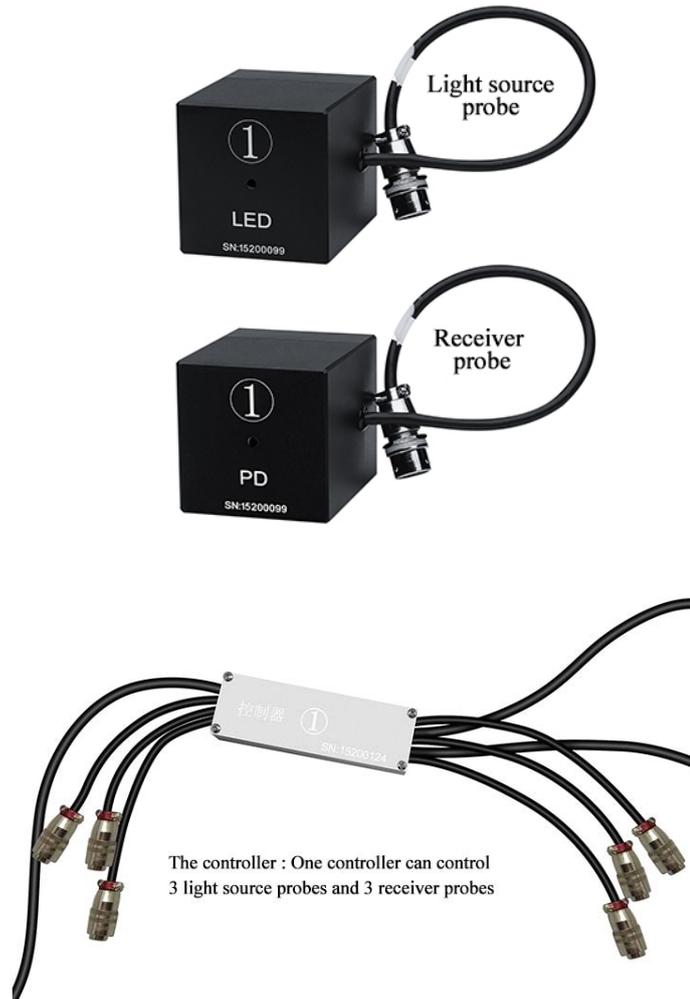
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I. Hardware connection

LS152 is mainly composed of two parts: “Human Machine Interface Control Box” and “Measurement and Control Host”. The power cable and communication cable must be connected before using the Human Machine Interface.





The connection method corresponds to the following table:

Human Machine Interface	Measurement and control host	PLC/PC
7.5V power supply	7.5V power supply	
RS485①	RS485①	
	RS485②	RS485

Note: The Human Machine Interface control box must be connected to the RS485① of the measurement and control host. If the connection is not correct, the communication of the human-machine interface will be abnormal; RS485② can be connected with the PLC of the computer or coating machine.

II. Operation interface description

After the Human Machine Interface is turned on, it will enter the main interface as shown below:



Note: This manual uses 3 test points as an example.

The first  icon in the upper left corner of the main interface is the communication status indicator. When the light is on (green), the communication is normal. If the light is off (gray), the communication is abnormal. You can click the “System State” interface to check which communication controller is not normal. Customers can refer to the third section of this manual to solve the problem.

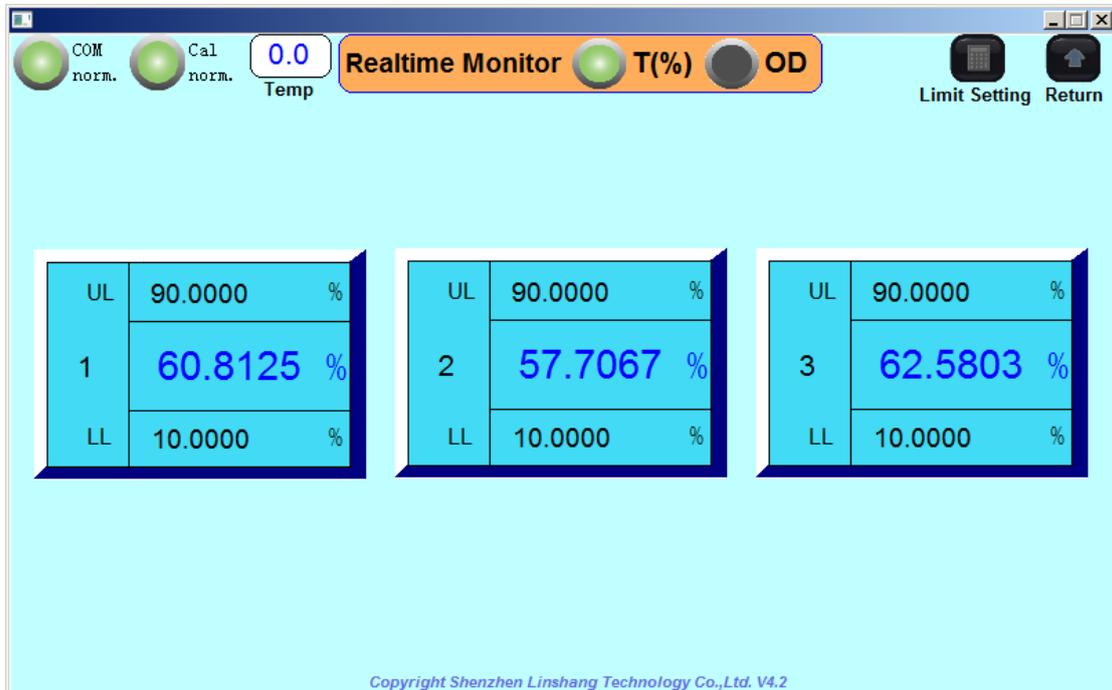
The second  icon in the upper left corner of the main interface is the calibration status indicator. If the indicator is green, the calibration of all the test points is normal. If the indicator is red, there is an abnormal calibration of the original value of the test point (if so, the test data of the point is not accurate). The inaccurate original value of the test point can be checked by clicking the “System State” button.

The “Temperature” in the upper left corner of the main interface shows the internal temperature when the “Measurement and Control Host” is working.

From the main interface, it can be seen that the Human Machine Interface contains 8 operable items: real-time monitoring, histogram, user setting, manual calibration, communication configuration, System State, system configuration and communication test. The respective operation items are described in detail below.

2.1 Real-time monitoring

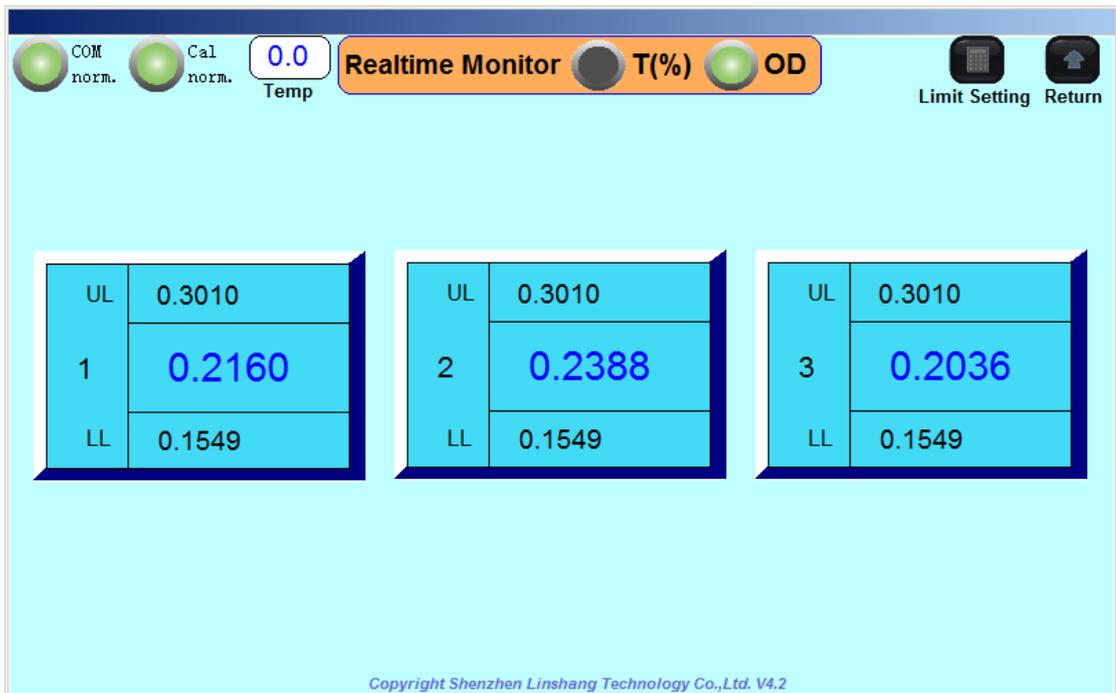
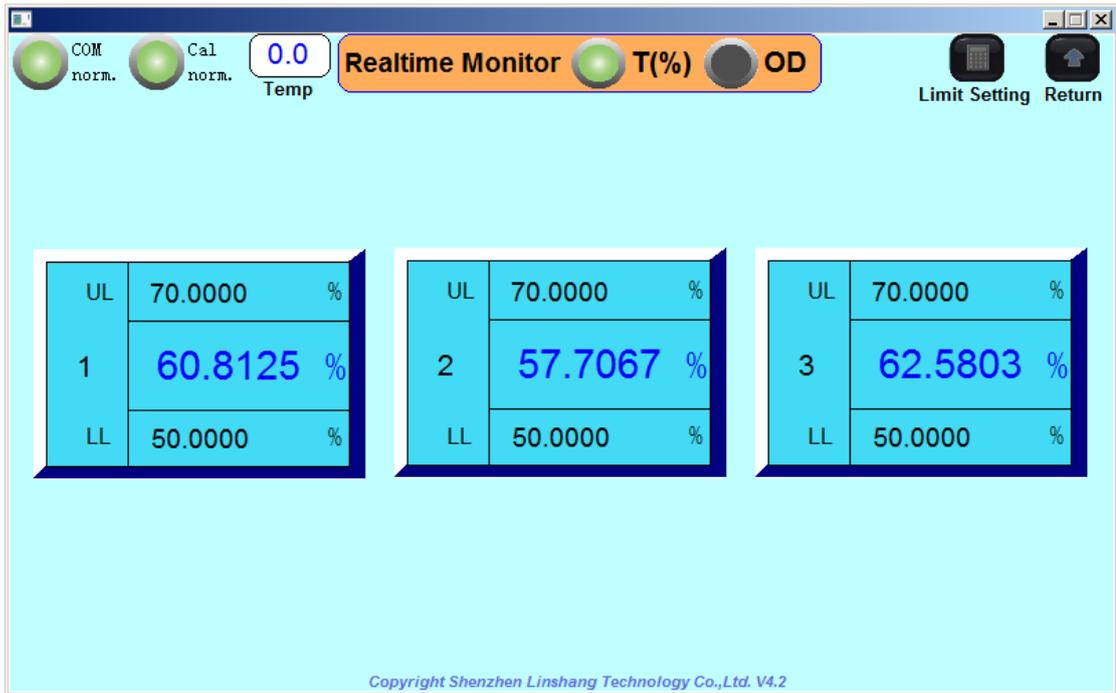
The following real-time monitoring interface will show by clicking the icon of “Real-time Monitoring”:



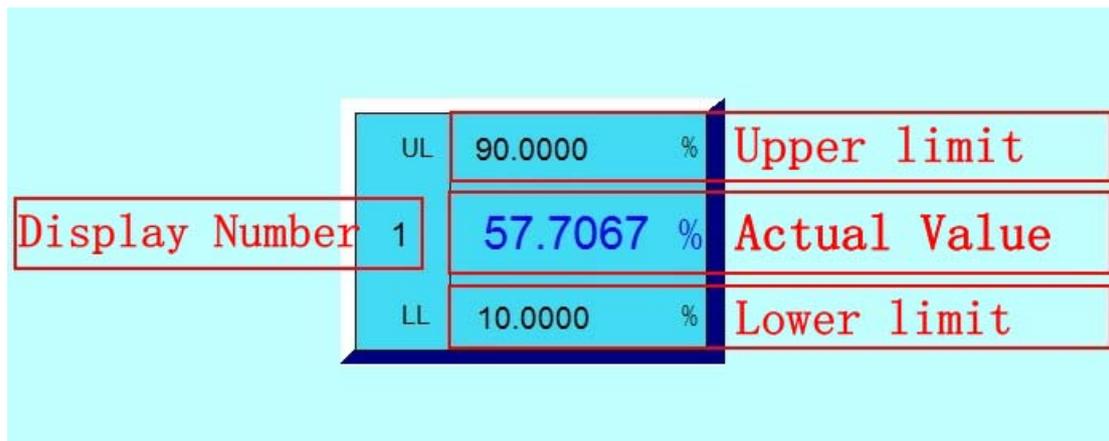
The function of real-time monitoring is to display real-time data of each test point conveniently.

Display methods include: transmittance display and optical density display

The display mode can be switched by clicking the  icon in  **T(%)**  **OD**; the  icon shows the current display mode. The optical density and transmittance display are one-to-one correspondence (*Note: $OD = \log_{10}(1/T)$ OD: Optical density T: transmittance*). Users can choose the appropriate display method according to their needs. The following two figures are the transmittance mode and the optical density mode.



The displayed contents include: display point number, upper limit value, lower limit value and measured value



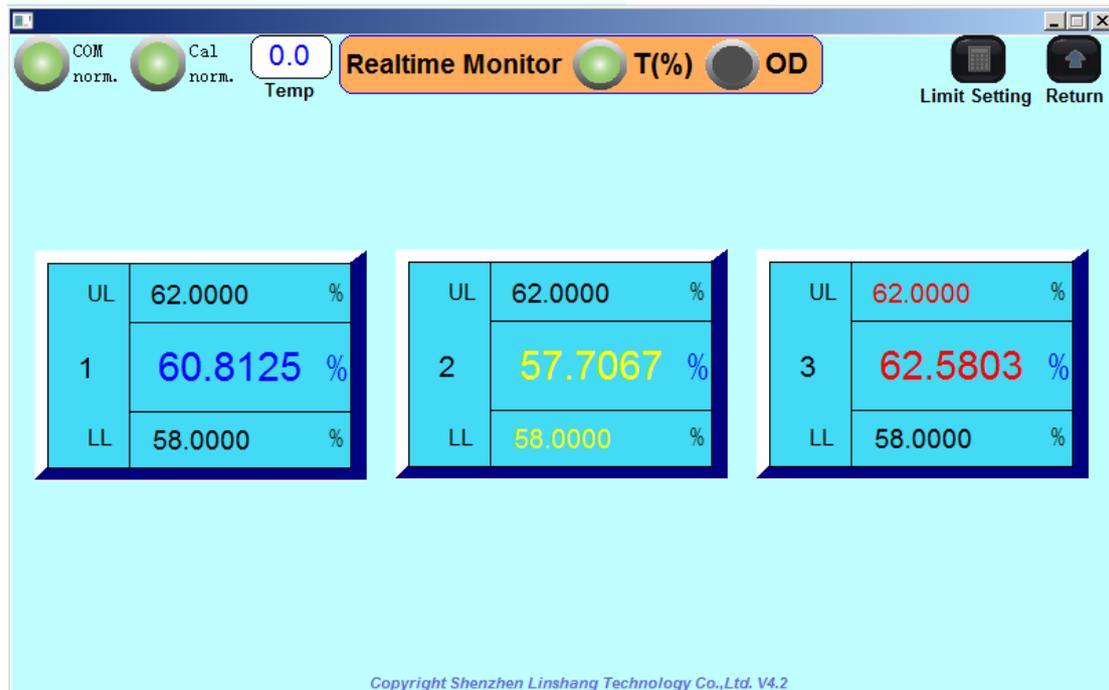
The image shows a digital display interface with three rows of data. The first row shows 'UL' (Upper Limit) at 90.0000%, with the label 'Upper limit' in red. The second row shows '1' (Display Number) at 57.7067%, with the label 'Actual Value' in red. The third row shows 'LL' (Lower Limit) at 10.0000%, with the label 'Lower limit' in red. A red box labeled 'Display Number' points to the '1' in the second row.

UL	90.0000	%	Upper limit
Display Number 1	57.7067	%	Actual Value
LL	10.0000	%	Lower limit

The display point number and upper and lower limits are manually settable. The user can make display setup for the test point number according to the situation. Generally, the default is incremented from 1, and the display point number can be set through the “User Settings” interface. The upper and lower limits are referenced to the test object settings. The setting method can be set through the “User Settings” interface, and the “Limit Settings” icon in the upper right corner can also be clicked for quick setting. The detailed settings will be discussed later.

The value of the upper and lower limits is to specify the qualified judgment standard of the test object. After the upper and lower limits are set, if the measured value is less than the lower limit value, the measured value and the lower limit value become yellow, and the measured value flashes; if the measured value is greater than the upper limit value, the measured value and upper limit value become red, and the measured value flashes; if there is no communication, there is no measured value display.

Example 1: A test sample has a transmittance base value of 60%, an upper limit of 62%, and a lower limit of 58%. The test results are as follows:

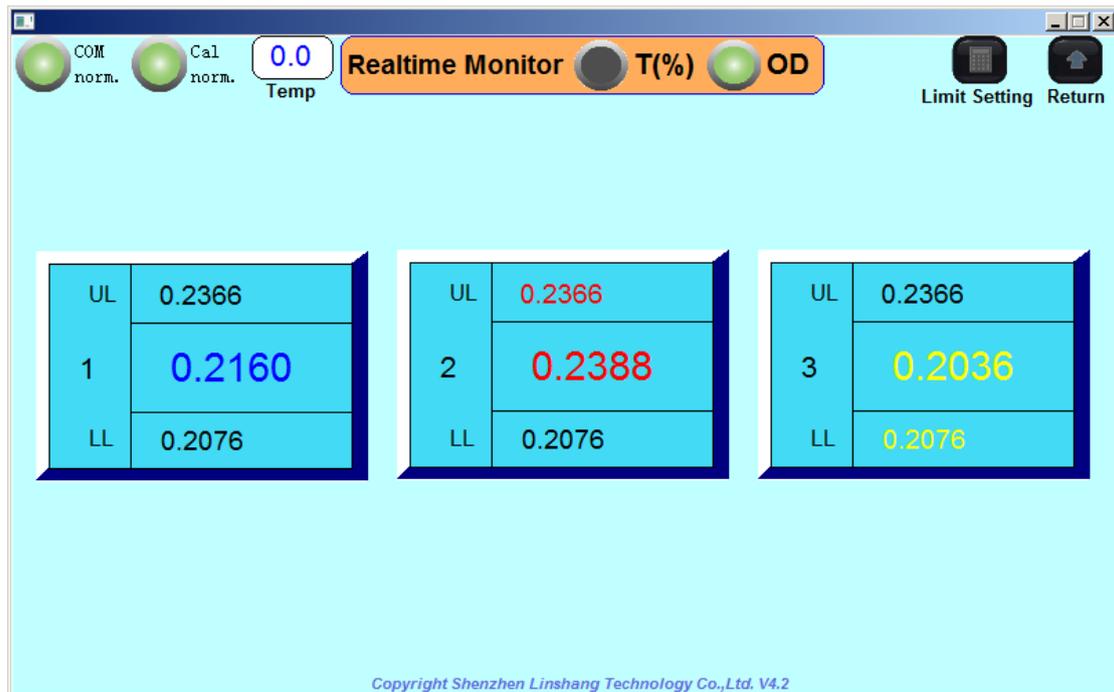


Test point 1 is qualified and the display color is blue;

Test point 2 is unqualified, the measured value is less than the lower limit value. So both the measured value and the lower limit value are displayed in yellow, and the measured value will also flash;

Test point 3 is unqualified, the measured value is greater than the upper limit value. For this reason both the measured value and the upper limit value are displayed in red, and the measured value will also flash.

Example 2: For a test sample with an optical density base value of 0.22, the upper limit is set to 0.23 and the lower limit is set to 0.21. The test results are as follows:



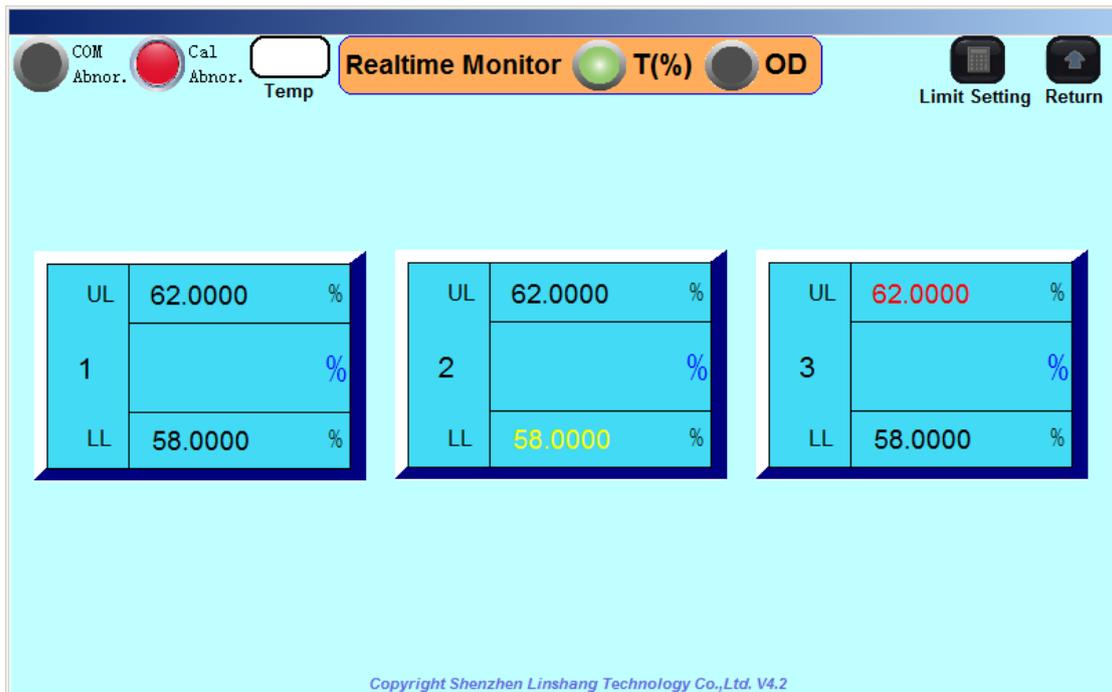
Test point 1 is qualified and the display color is blue;

Test point 2 is unqualified. The measured value is greater than the upper limit value, so both the measured value and the upper limit value are displayed in red, and the measured value will also flash;

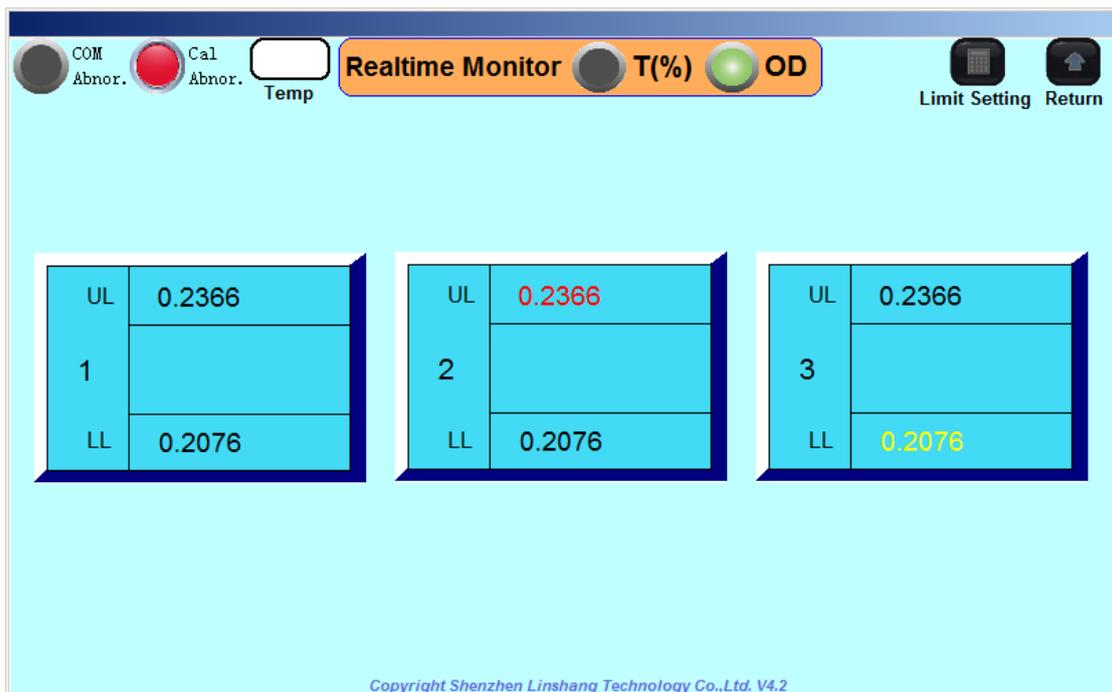
Test point 3 is unqualified. The measured value is less than the lower limit value, so both the measured value and the lower limit value are displayed in yellow, and the measured value will also flash.

If the communication is not normal, then there is no measured value display. The upper left corner indicator will show communication abnormality (gray). The calibration is abnormal (red), and there is no temperature value display. The result is as follows:

Transmittance display mode:



Optical density display interface:



Click the "Return" icon in the upper right corner to return to the main interface (all of the following return icons are used to return to the main interface, which will not be explained later).

2.2 Histogram

Click on the “Histogram” icon to enter the interface of the histogram as shown below:



As shown above: rectangular box shows the upper and lower limits, and the filled chart shows the measured values.

The histogram display mode can visually express the difference between the test point and the base value.

The ordinate range is the coordinate range set for the display of histogram. After inputting the good coordinates in the input frame of the ordinate range (the transmittance display mode can be set to the range: 0-120; the optical density display mode can be set to the range: -0.3-6). Clicking the “Set” icon will be confirm. The customer can also click the “Auto” icon directly. The device will adapt to the reasonable coordinate values according to the up and down values set by the customer.

If the measured value is within the upper and lower limits, the histogram of the test point is green; if the measured value is greater than the upper limit set by the customer, the histogram of the test point turns red; if the measured

value is less than the lower limit value set by the customer, the histogram of the test point turns yellow; if there is no communication, all histograms will turn gray.

Example 1: The base value of the transmittance of the test sample is 60%, the upper limit is set to 62%, and the lower limit is set to 58%. The test results are as follows:



The test point 1 is qualified, the histogram entity display color is green, and the top of the histogram is the measured value, which is also displayed in green;

Test point 2 is unqualified, the measured value is less than the lower limit value, so the histogram entity display color is yellow. The top of the histogram is the measured value, which is also shown as yellow, and the measured value will also flash;

Test point 3 is unqualified, the measured value is greater than the upper limit value, so the histogram entity display color is red, the top of the histogram is the measured value, which is also shown in red, and the measured value will also flash.

Example 2: For customers who use optical density display, the optical

density base value is 0.22. The upper limit is set to 0.23 and the lower limit is set to 0.21. The test results are as follows:



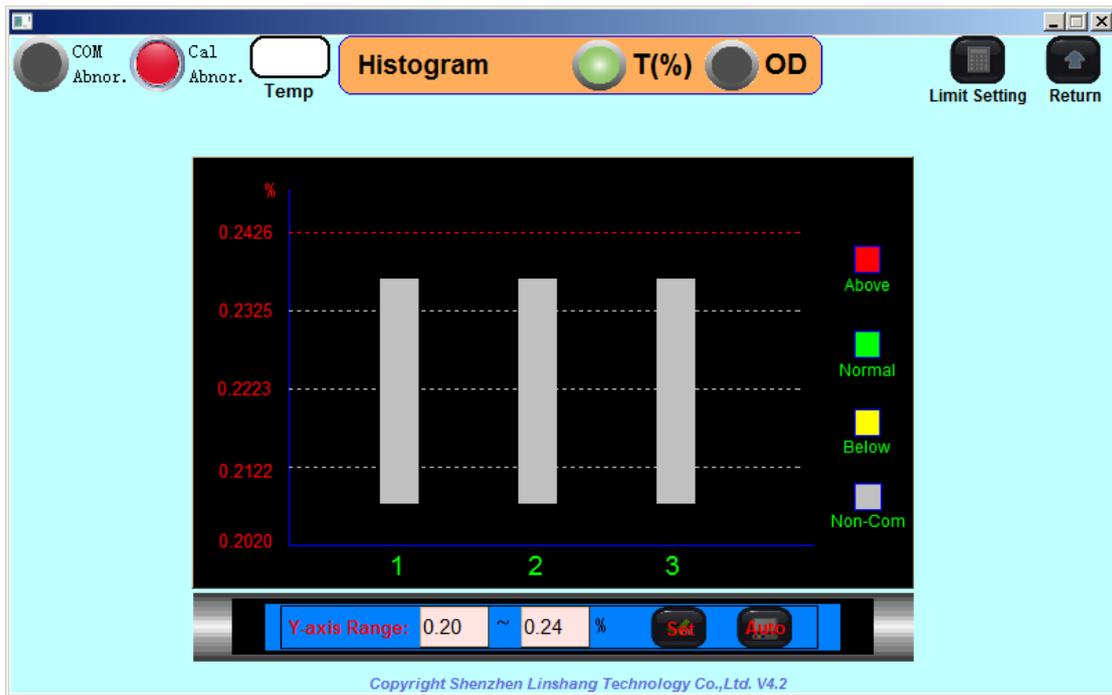
The test point 1 is qualified, the histogram entity display color is green, and the top of the histogram is the measured value, which is also displayed in green;

Test point 2 is unqualified, the measured value is greater than the upper limit value, so the histogram entity display color is red; the top of the histogram is the measured value, which is also shown in red, and the measured value will also flash;

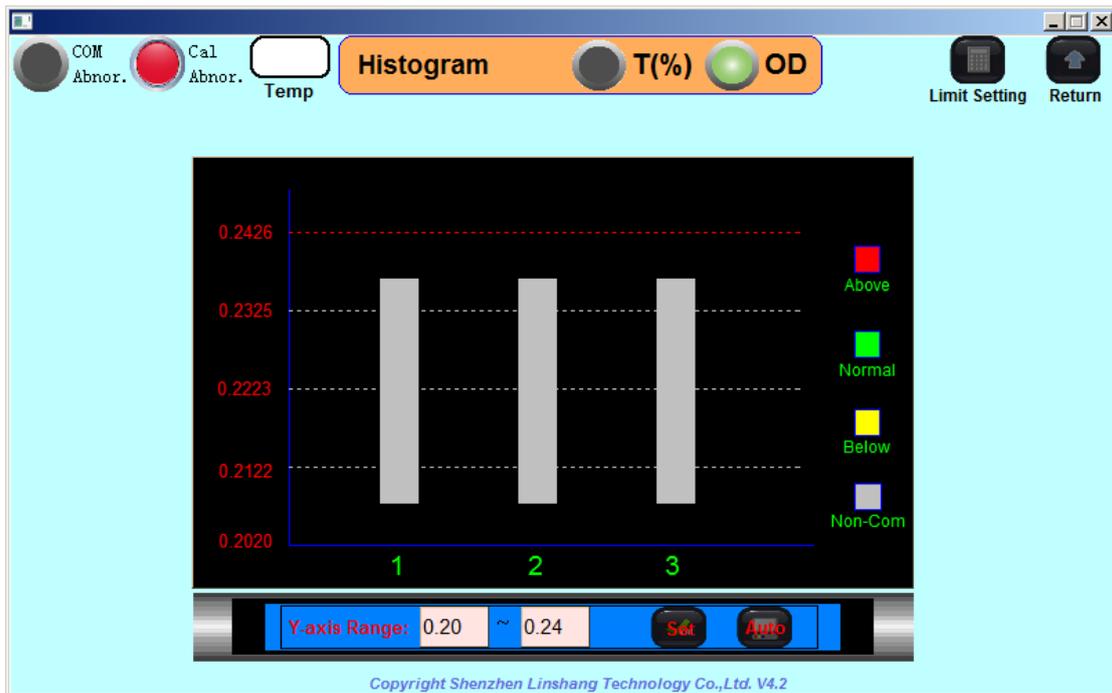
Test point 3 is unqualified, the measured value is less than the lower limit value, so the histogram entity display color is yellow; the upper part of the histogram is the measured value, and it is also displayed in yellow, and the measured value will also flash.

If the communication is not normal, then there is no measured value display, and the histogram is grayed out. The result is as follows:

Transmittance display mode:

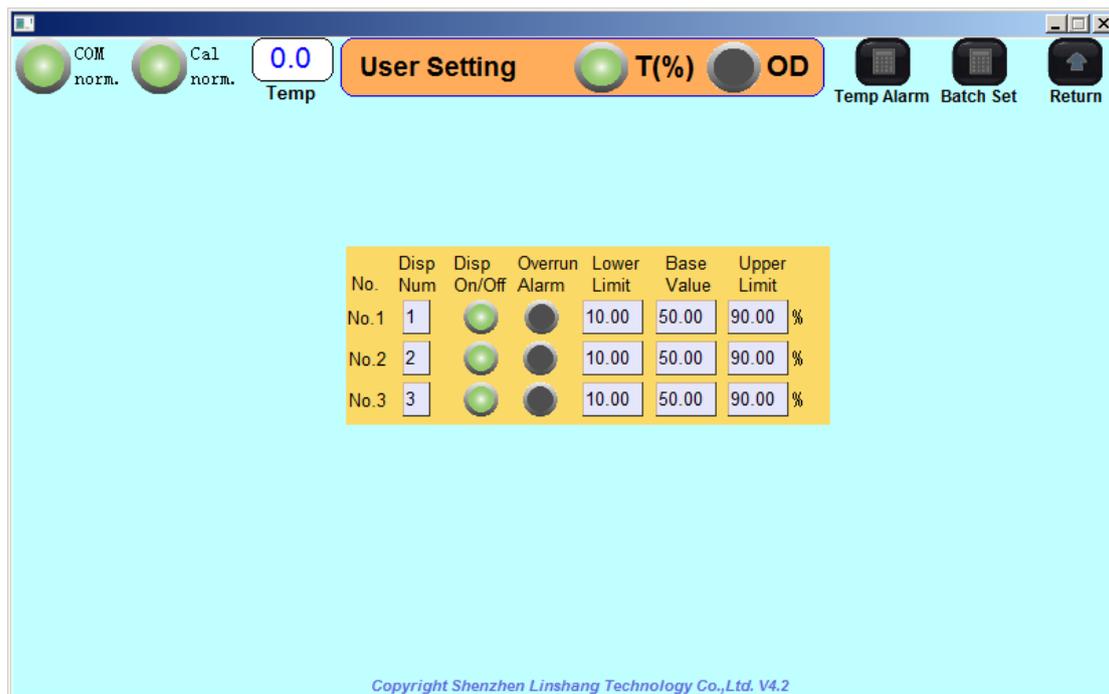


Optical density display mode:



2.3 User setting

Click the "User Setting" icon to enter the user setting interface as shown below:



The user setting is an interface that provides the user with the upper and lower limits, the base value, the display point number, whether the test point is displayed, and whether the alarm function is on after the upper and lower limits are exceeded.

Upper limit: the upper limit of the test object;

Base value: the qualified reference value of the test object;

Lower limit: the qualified lower limit of the test object;

Displayed point number: that is, the displayed number of the test point; the test point number is fixed inside the device as a natural number starting from 1 (No. 1, No. 2, No. 3...), and the fixed-point number is in the "measuring control host", and there are numerical values on it. However, in order to facilitate customer use, customers can customize the test point number specifically for display. The default display point number is equal to the fixed test point number from 1 in the system.

Whether test point used: that is, whether the test point can be displayed in "real-time monitoring" and "histogram";

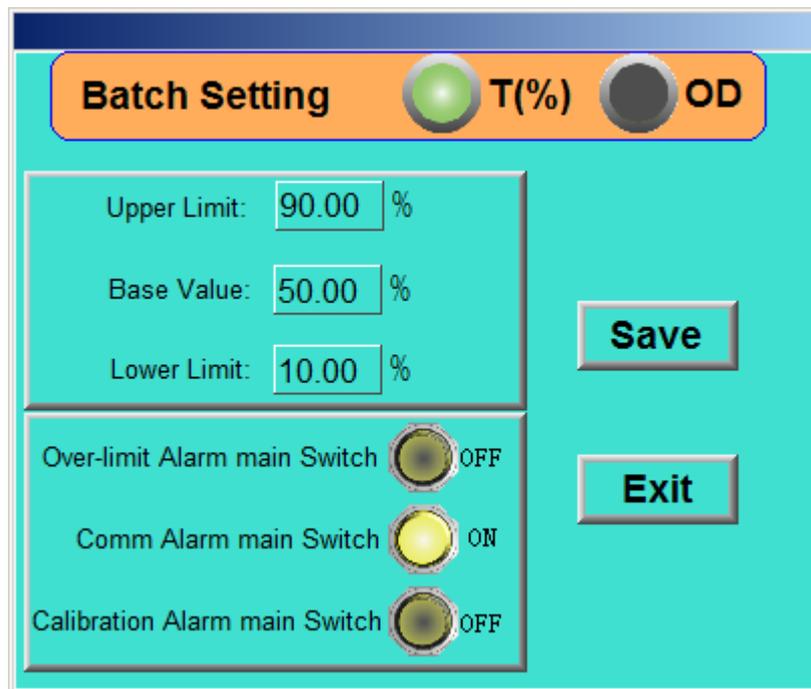
Over-limit alarm: it is possible to set whether an audible alarm will occur after the test point exceeds the limit value.

Alarm description: The alarm is divided into Human Machine Interface buzzer sound alarm and external alarm light sound and light alarm. The over-limit alarm can trigger Human Machine Interface buzzer alarm and external alarm light alarm (red light flashing) at the same time. Other alarms (communication abnormality, calibration abnormality, temperature over-limit) will only trigger the Human Machine Interface buzzer alarm.

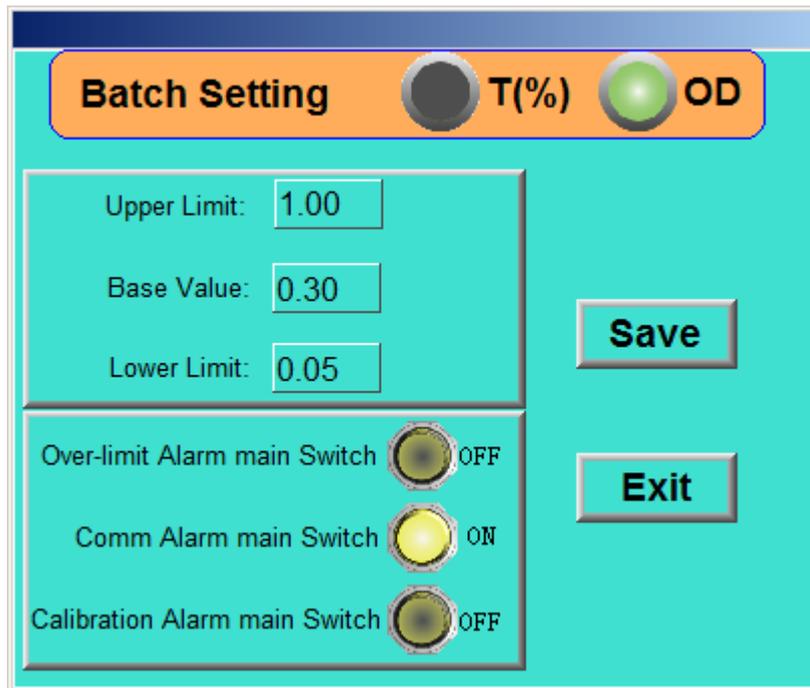
Note: When setting the upper and lower limits and the base value, it needs to meet: lower limit <= base value <= upper limit

Customers can choose the “Transmittance” or “Optical Density” display mode to set the parameters on the interface according to their own needs. If the settings of each test point are the same, the customer can select batch setting to improve the efficiency. The user can click on the upper right corner. Clicking the “Batch Set” icon will enter the batch setup interface.

Transmittance display mode:



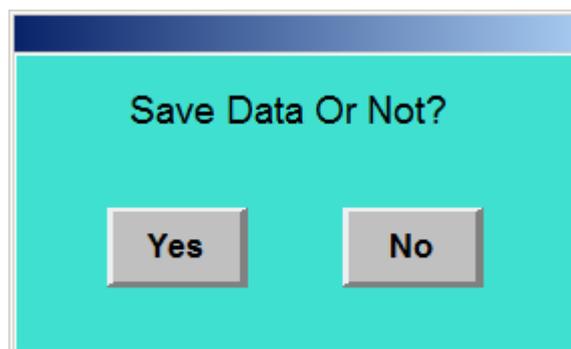
Optical density display mode:



The user can set the upper and lower limits, the base value, the over limit alarm (whether or not the alarm sound is emitted when the test point exceeds the upper and lower limits), the communication alarm (whether the alarm sound is generated when the communication is abnormal) and the calibration alarm (whether the alarm sound is issued when the calibration status is abnormal). After setting up, click the “Save” button and the “Exit” button.

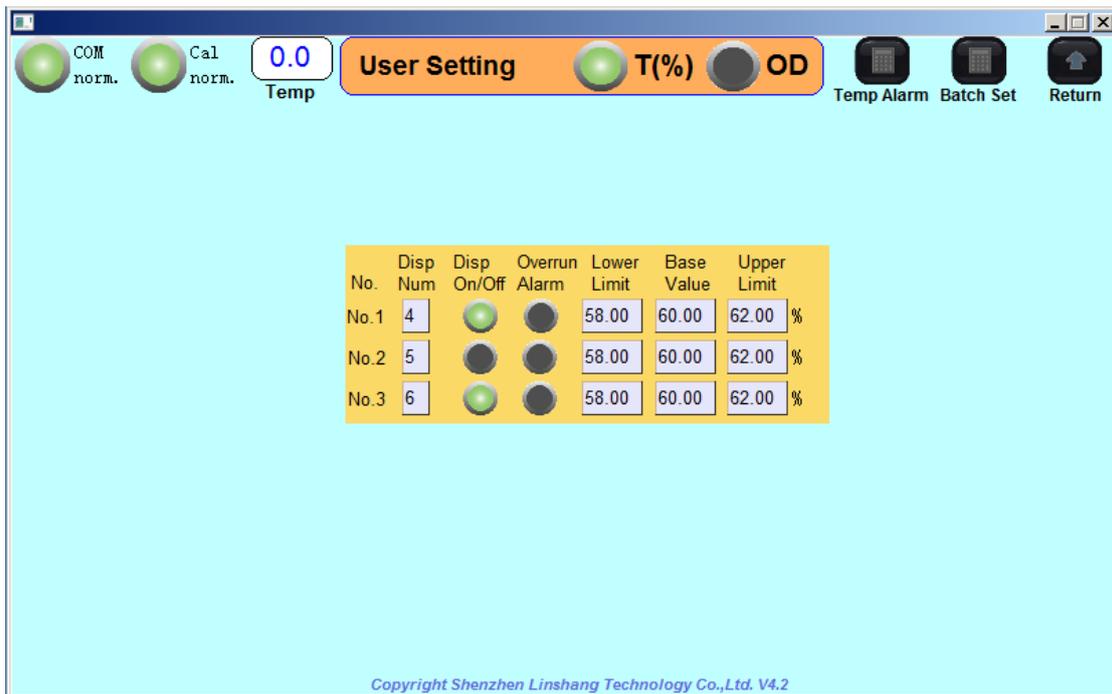
Note: The “Limit Setting” of the real-time monitoring interface and the histogram interface is the same as the “Batch Setting” function here. Users can click the “Limit Setting” in these two interfaces without entering the user setting interface.

When the customer exit the User Settings interface, the interface for saving data will appear as shown below:

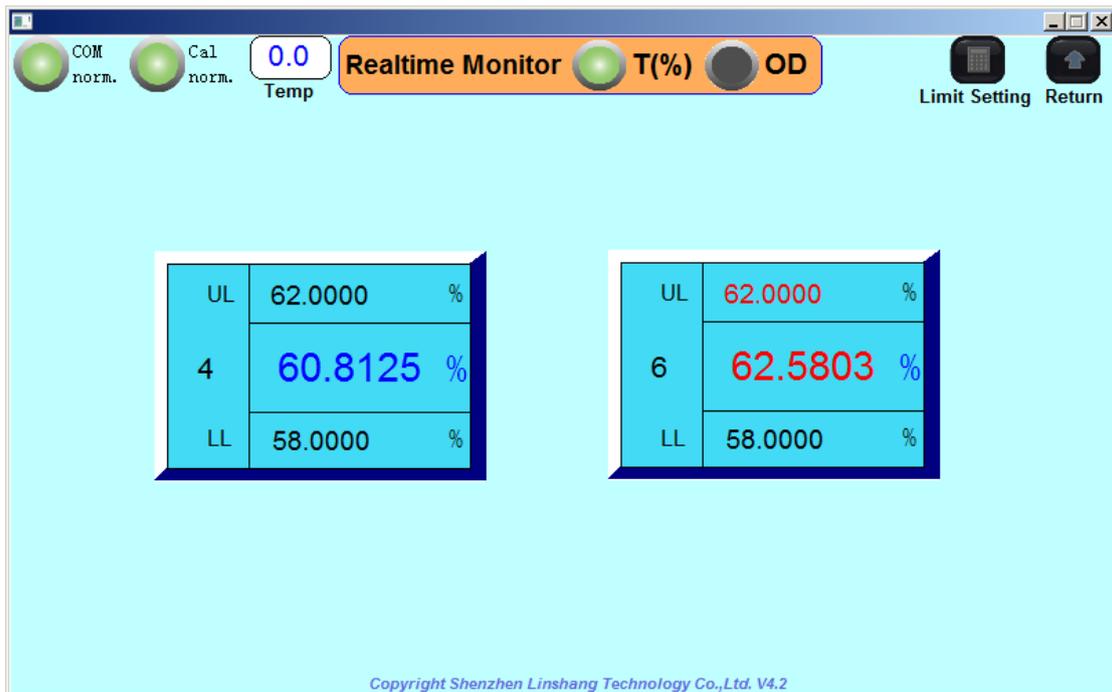


Click the "YES" button to save the data that just been set. If the customer click the "NO" button, the data you will not be saved and the data before the setting will be restored.

Example 1: The base value of the transmittance of the test sample is 60%, the upper limit is set to 62%, the lower limit is set to 58%, and the display points are points 4, 5, 6; 4 and 6 points display, and over-limit alarms will be turned off as shown below:



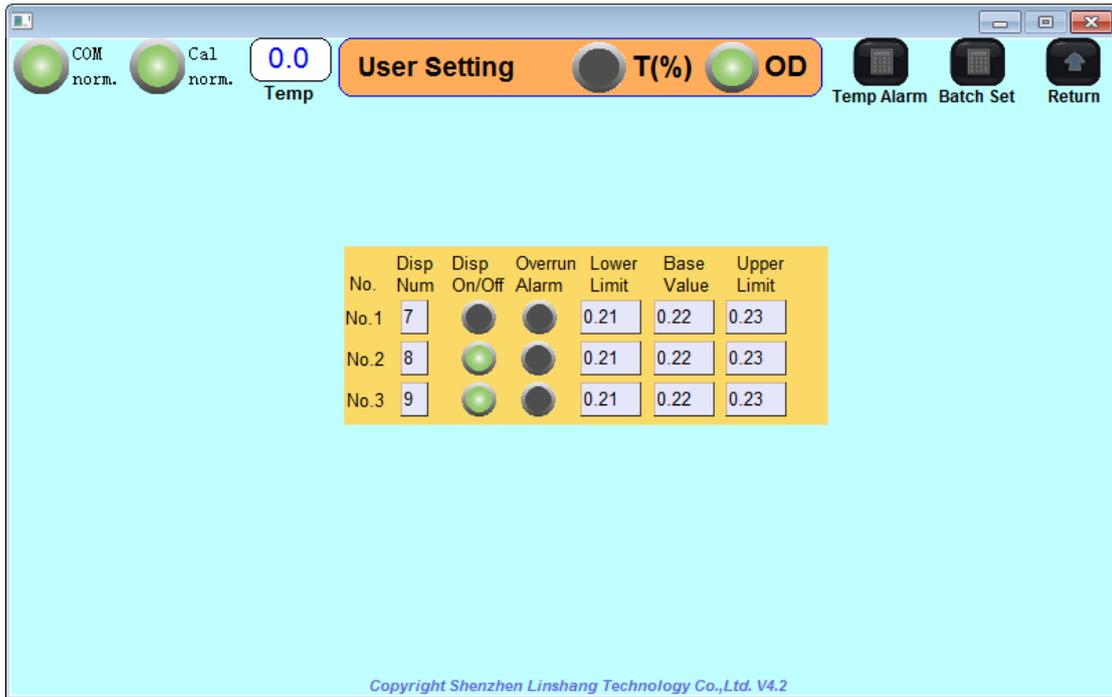
After the setting is completed and saved, enter the "Real-time Monitoring" interface, and only the interface of the 4th and 6th points will be displayed as shown below:



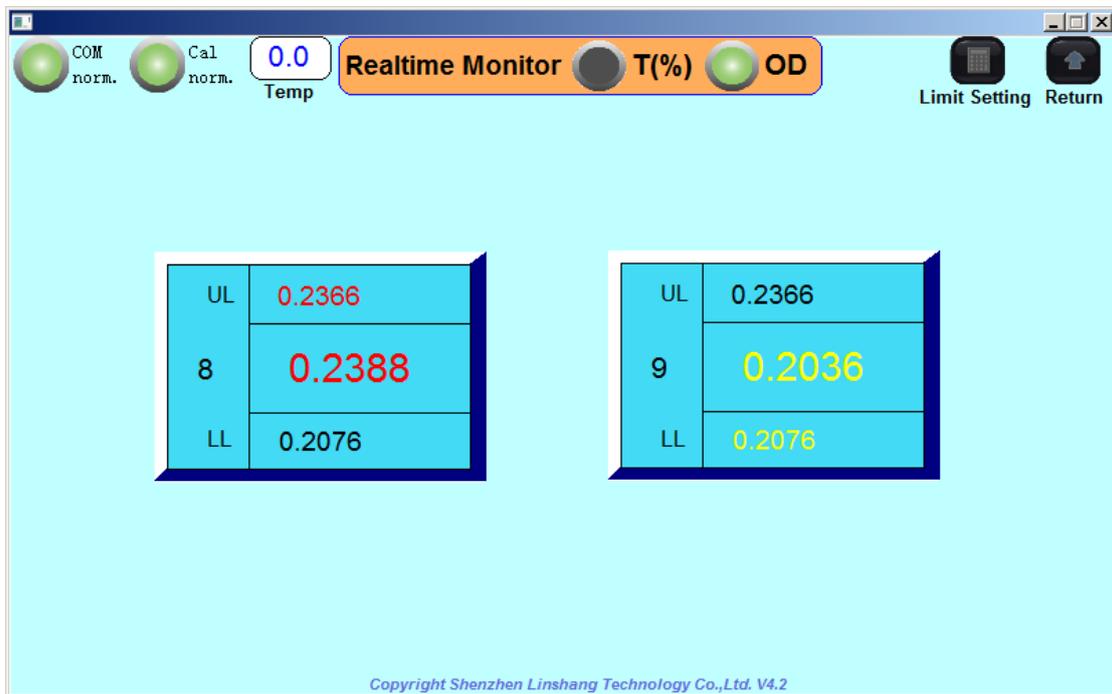
Enter the "Histogram" interface, and only the 4th and 6th points' interface will be shown as below:



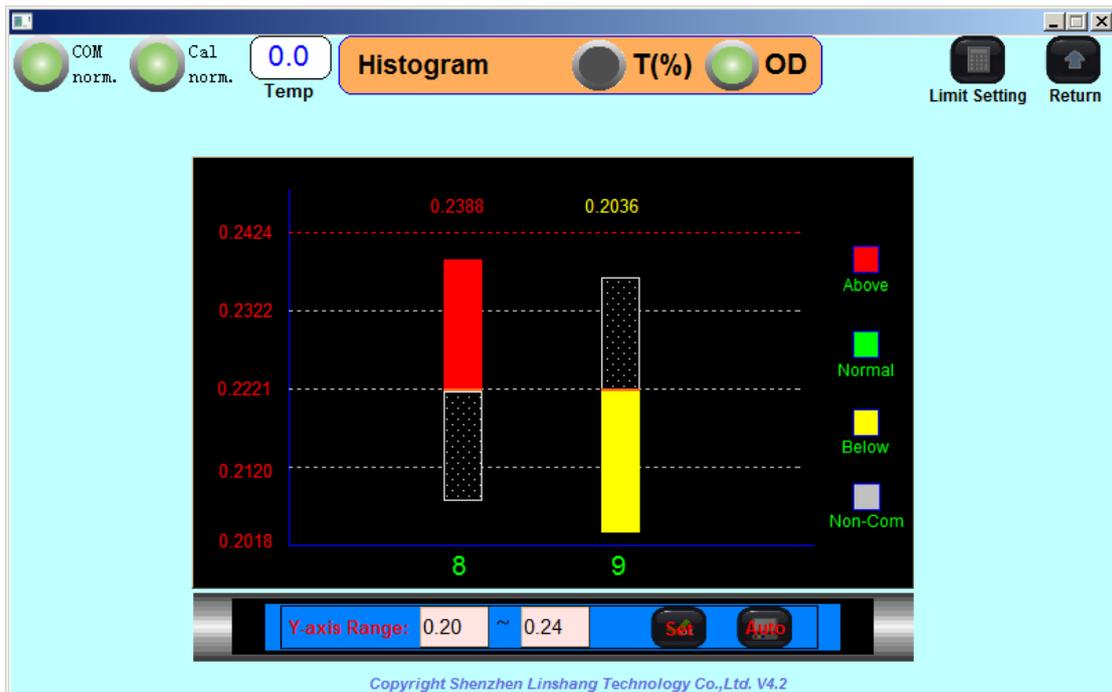
Example 2: For customers who use optical density display, assuming a test sample with an optical density base value of 0.22, the upper limit is set to 0.23, the lower limit is set to 0.21, and the display points are 7, 8, 9; 8 and 9 points display. Over-limit alarms are turned off as shown below:



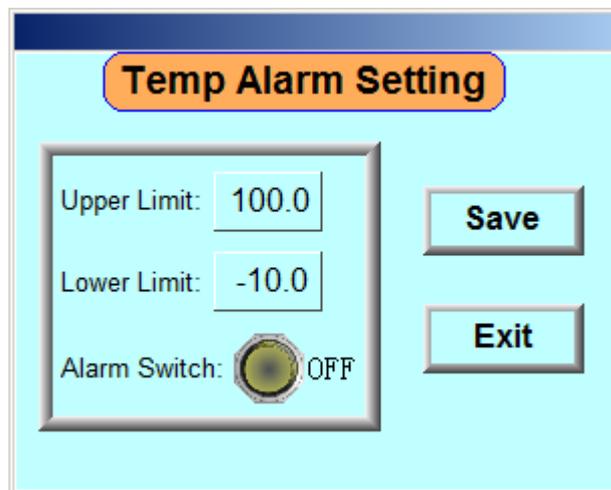
After the setting is completed and saved, enter the "Real-time Monitoring" interface, and only the interface of the 8th and 9th points will be displayed as shown below:



Enter the "Histogram" interface and only the interface of the 8th and 9th points can be displayed as shown below:



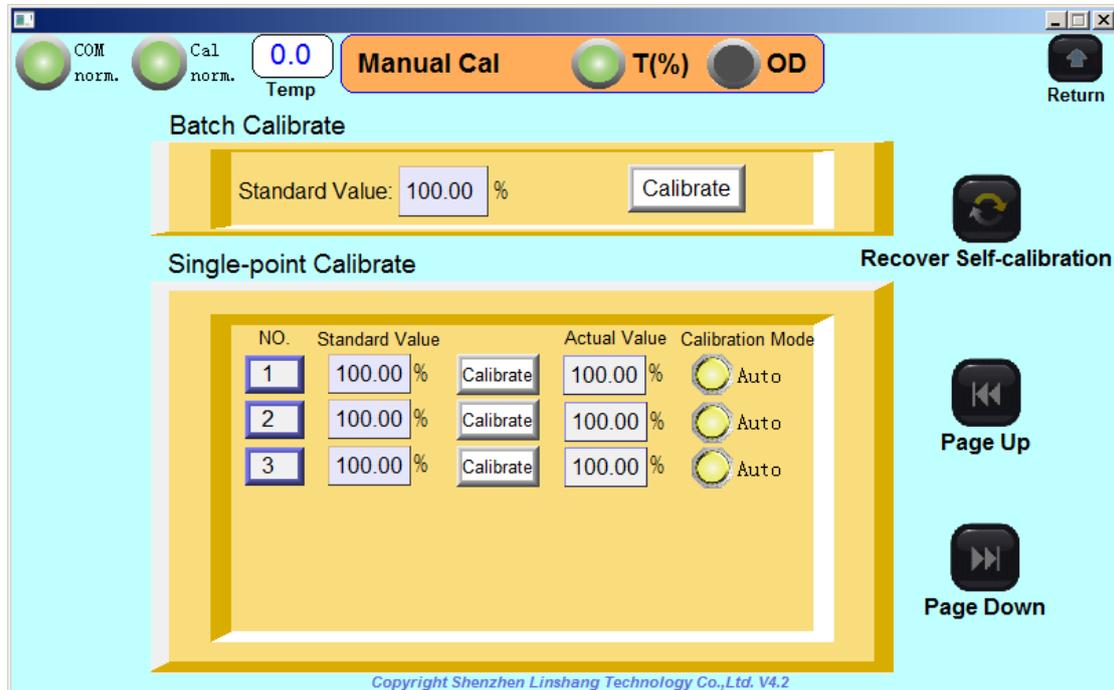
The “Temperature Alarm” button in the upper right corner is provided to the customer to monitor the internal temperature of the “measuring and control host”. In general, this temperature is the temperature inside the coating machine where the “measuring control host” is placed. After clicking, the following settings interface appears:



The user can set the upper and lower limits of the temperature and the alarm switch. After the setting is completed, click “Save” button. If the upper and lower limits are set, the alarm switch is turned on. When the temperature exceeds the upper and lower limits, an alarm sound of “click” will be made, and the temperature in the upper left corner of the interface will be red and flash.

2.4 Manual calibration

Click the “Manual Calibration” icon to enter the manual calibration interface as shown below:



Manual calibration is provided for the customer to refer to their own standard sample as the standard measurement calibration; the customer can also make zero calibration (with no test object; the calibration transmittance can reach 100%, or optical density can reach 0).

Calibration methods include: batch calibration and single point calibration

Batch calibration means the customer can enter the standard value in the input box and click the “Calibrate” button. All test points are set to standard values. The calibration mode of each point changes from automatic mode to manual mode, but it should be ensured that each test slot has the same standard sample before the batch calibration. If zero calibration is performed, the standard sample is not required, when there is no test sample between the test slot, the transmittance value is calibrated to 100%, or the calibration optical density value is zero.

COM norm. Cal norm. 0.0 Temp Manual Cal T(%) OD Return

Batch Calibrate

Standard Value: 100.00 % Calibrate

Single-point Calibrate Recover Self-calibration

NO.	Standard Value	Calibrate	Actual Value	Calibration Mode
1	100.00 %	Calibrate	100.01 %	Manual
2	100.00 %	Calibrate	100.00 %	Manual
3	100.00 %	Calibrate	99.98 %	Manual

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COM norm. Cal norm. 0.0 Temp Manual Cal T(%) OD Return

Batch Calibrate

Standard Value: 0.00 Calibrate

Single-point Calibrate Recover Self-calibration

NO.	Standard Value	Calibrate	Actual Value	Calibration Mode
1	0.00	Calibrate	0.00	Manual
2	0.00	Calibrate	0.00	Manual
3	0.00	Calibrate	0.00	Manual

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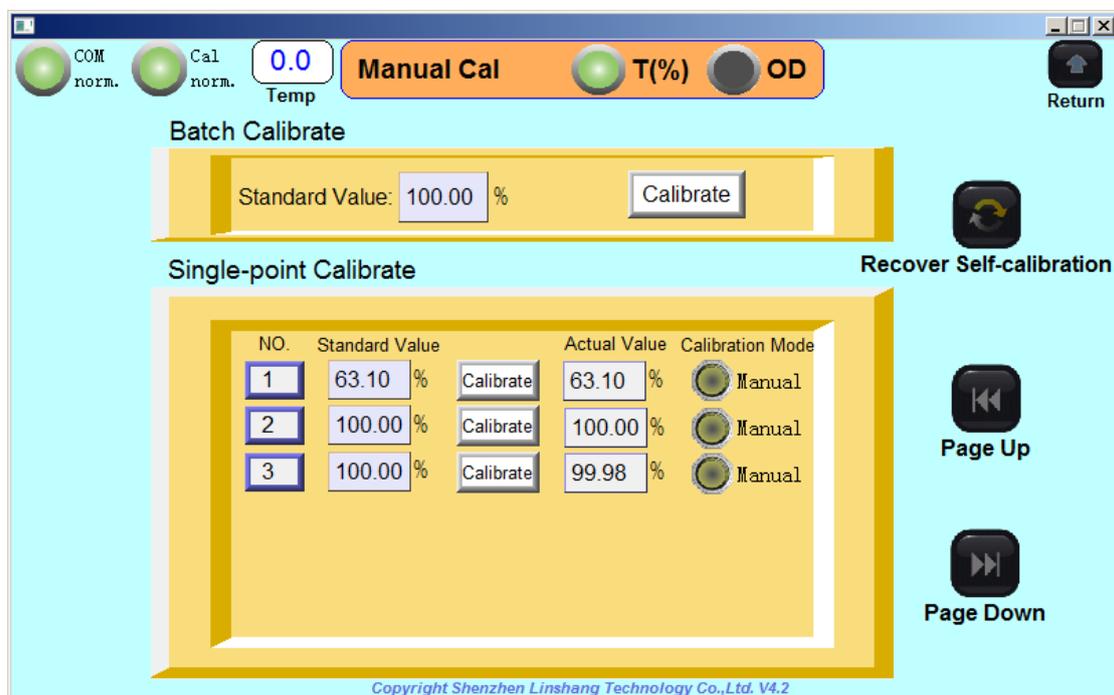
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In the manual calibration mode, the transmittance value displayed may be greater than 100% or less than 100% in the absence of the test sample. The optical density value may be greater than 0 or less than 0 in the absence of the test sample. If the deviation of transmittance or optical density is large after long-term use, zero calibration should be made before using it. In the auto calibration mode, the transmittance value will not exceed 100% and the optical density value will not be less than zero.

Single point calibration requires entering the standard value after the corresponding test point number and then clicking the “Calibration” button. However, before each test point is calibrated, it must be ensured that the test slot has a standard sample (zero calibration does not require a sample). When the corresponding points is more than 6. The customer can click the "Previous" and "Next" pages on the right to turn pages.

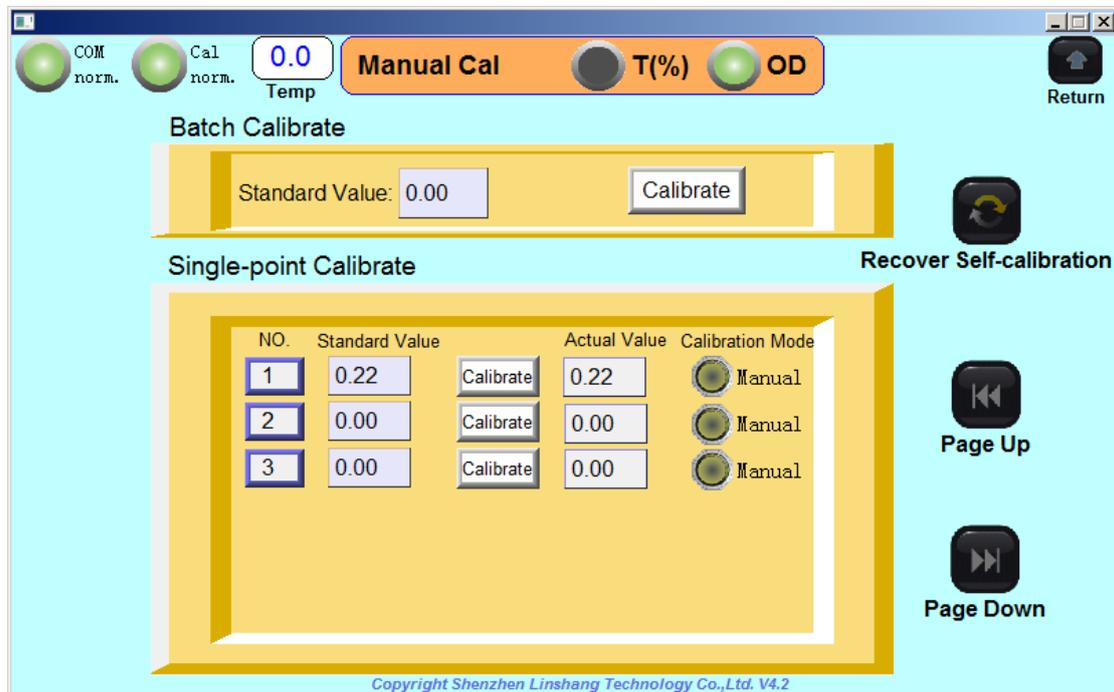
When a test point is manually calibrated, the calibration mode of the block controller changes from automatic calibration to manual calibration, and the measured value shows the measured data after calibration.

Example 1: There is a standard sample with a transmittance of 63.10%. It is calibrated to test points 1, 2, and 3 by single-point calibration. First, put the standard sample on the No. 1 test slot, and then enter 63.10 in the standard value. Click “Calibration”, the measured value of test point No.1 becomes 63.10%. Because one controller controls 3 test points, the calibration mode of test points 1, 2 and 3 changes from automatic calibration to manual calibration as shown below. :



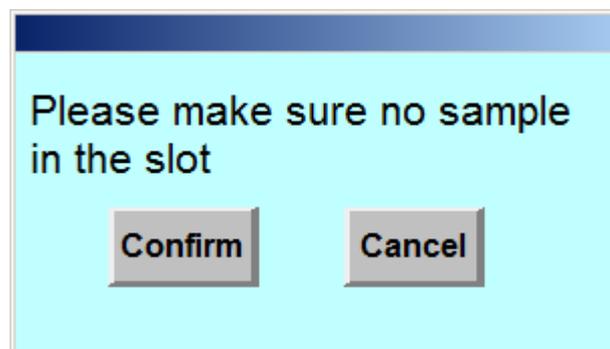
Example 2: When the customer uses the optical density display mode, if there is a standard sample with an optical density of 0.22, first place the standard

sample on the No. 1 test slot, enter 0.22 in the standard value, and then click “Calibration”. The measured value of test point No. 1 becomes 0.22. Because one controller controls 3 test points, the calibration mode of test points 1, 2 and 3 changes from automatic calibration to manual calibration as shown below:



The user can perform a single point calibration for all test points as described above.

If the manual calibration needs to be restored to automatic calibration, click the “Recover Self-Calibration” icon on the right, and the following interface will appear:



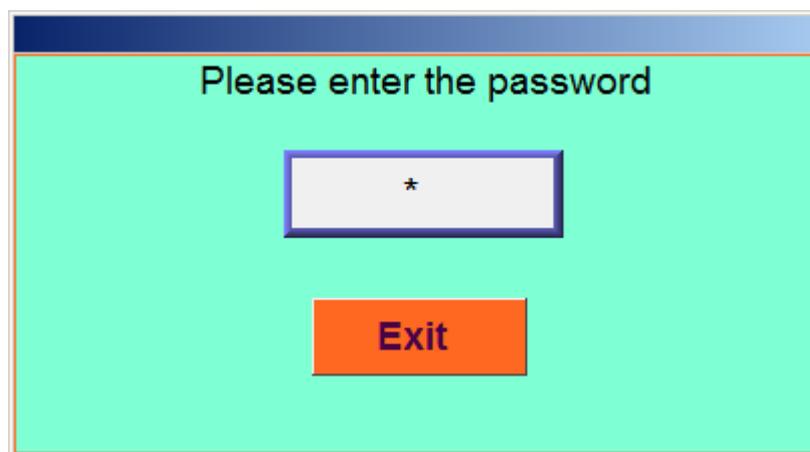
After ensuring that there is no sample in the test slot, click the "Confirm" button to return to automatic calibration.

Note: Manual calibration must be used when the customer has a standard

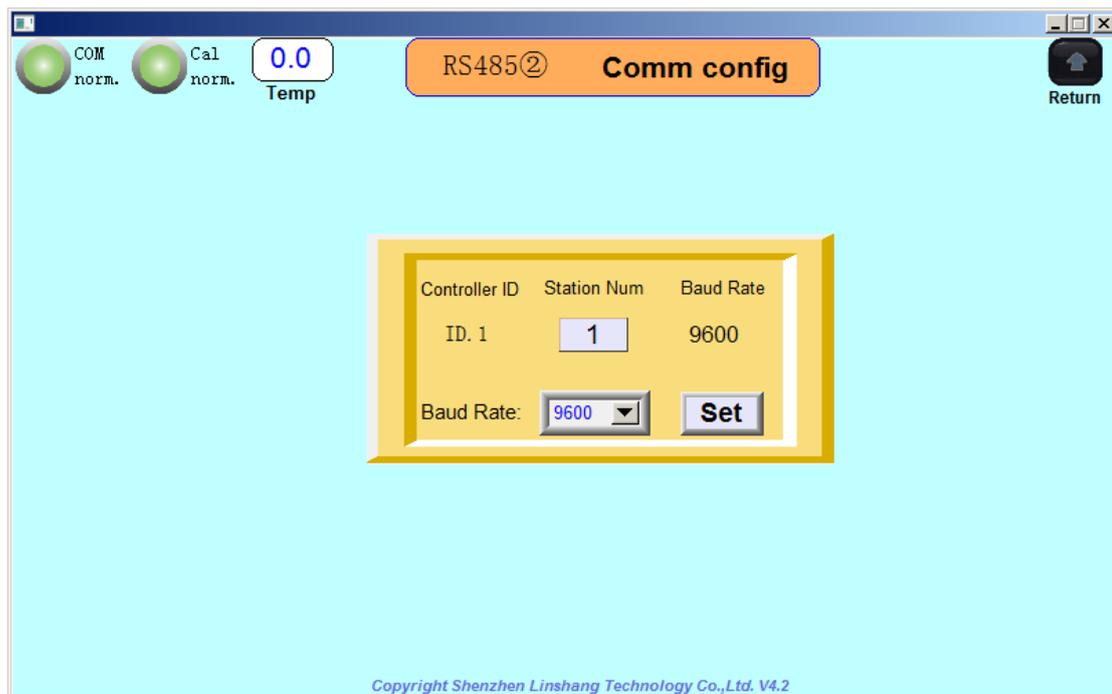
sample, otherwise it is not recommended for customers. The use of manual calibration will result in no return to full scale without test object or light source attenuation, so it is generally recommended that customers use automatic calibration.

2.5 Communication configuration

Click on the "Communication Configuration" icon and the password input box will appear as shown below:



Click the password input box and input **20130326** (Customer password) and then click "ENT" to enter the interface of communication configuration as below:



Note: The controller number is a fixed number of devices starting from 1 and a controller can control up to 3 test points. That is, only one controller is needed for 3 test points. For example, 5 test points require 2 controllers, and 10 test points are required for four controllers .

The communication configuration is used to facilitate the communication between the customer and the host computer (PC) or the closed-loop control of the coating machine. This communication configuration is set to RS4852 ② setting (**RS4851 ① communicates with the Human Machine Interface cannot be changed**), and the station number and baud rate can be configured. The default value of the station number is “controller number”. The controller number is the fixed natural number starting from 1 inside the device and the corresponding label is placed on the controller.

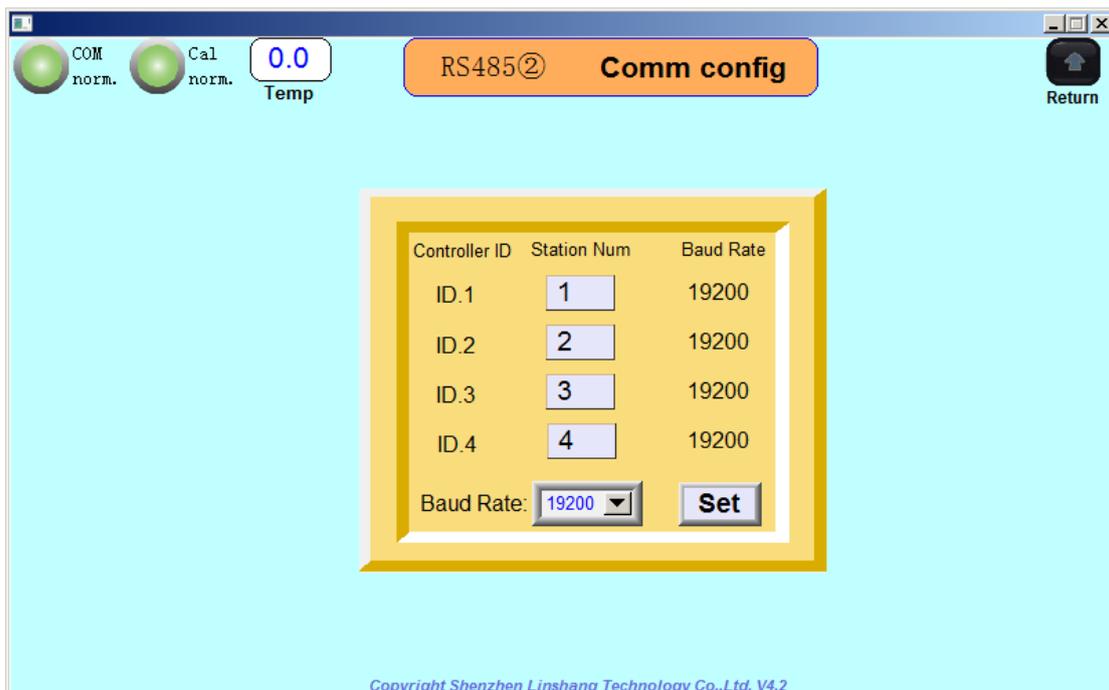
Station number: the number can be set as any number between 1~247, the same station number cannot appear; the station number is the address code in the MODBUS protocol.

Baud rate: The currently available baud rate is 4800, 9600, 15200 or 38400;

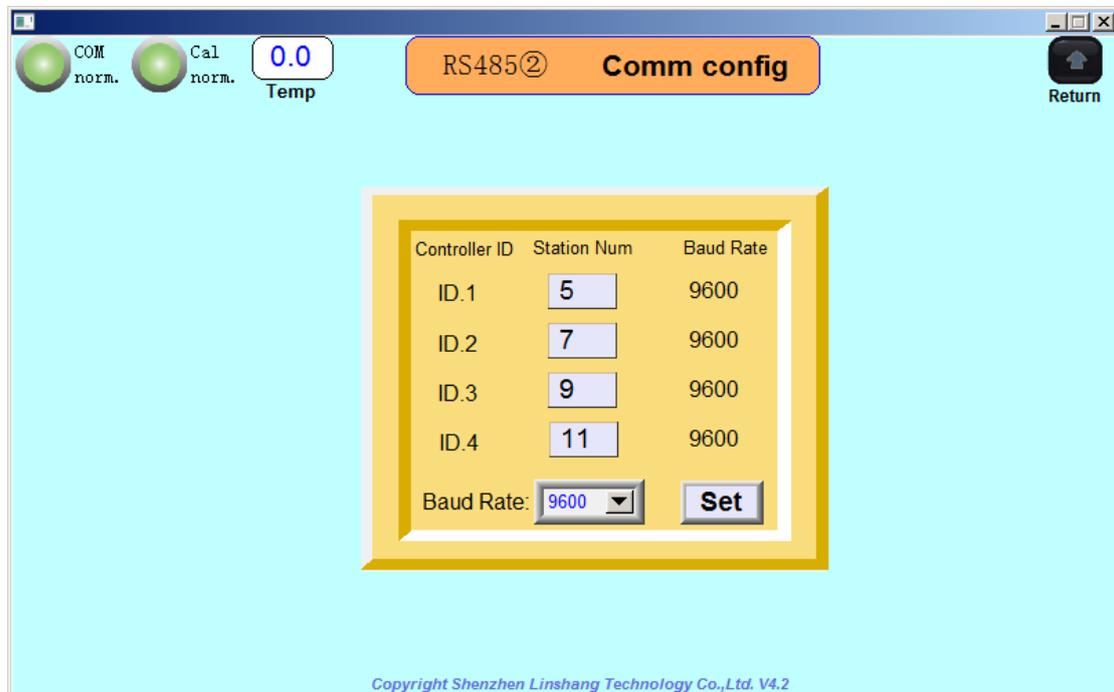
Click the “Settings” button after the setting is completed, and the station number and baud rate will be changed.

For example, after a “test and control host” with 11 test points (divide 11 by 3 means 4 controllers are needed) enters the communication configuration interface, it can be seen that 4 controller numbers correspond to 4 station numbers and one baud rate. The special rate. The device default No. 1 controller corresponds to station number 1; the second controller corresponds to station number 2, and so on, the default communication baud rate of the device is 19200 as shown below:

Controller No.	Station No. (Controller 485 communication address)	Corresponding test points
No. 1	Settable address range (1-247)	Test points No. 1-3
No. 2	Settable address range (1-247)	Test points No. 4-6
No. 3	Settable address range (1-247)	Test points No. 7-9
No. 4	Settable address range (1-247)	Test points 10-11



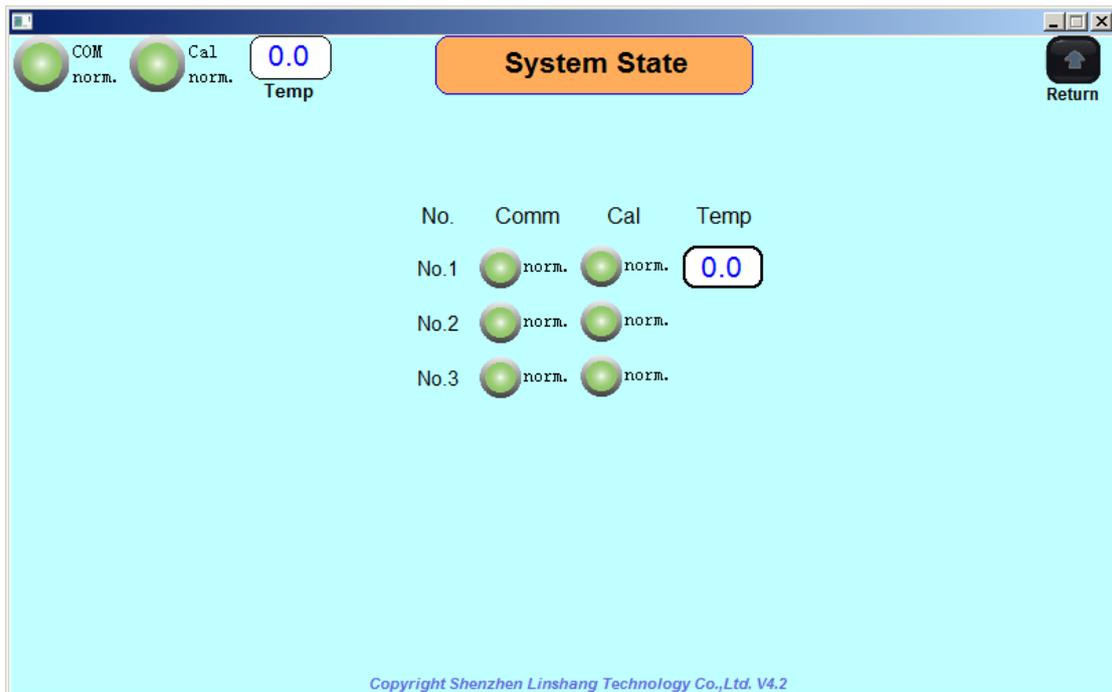
the communication station number can be set as any number between 1~247, for example the communication station number of the device can be set as 5, 7, 9, and 11. The baud rate can also be set as needed. Click the “Settings” button after the setting is completed as shown below:



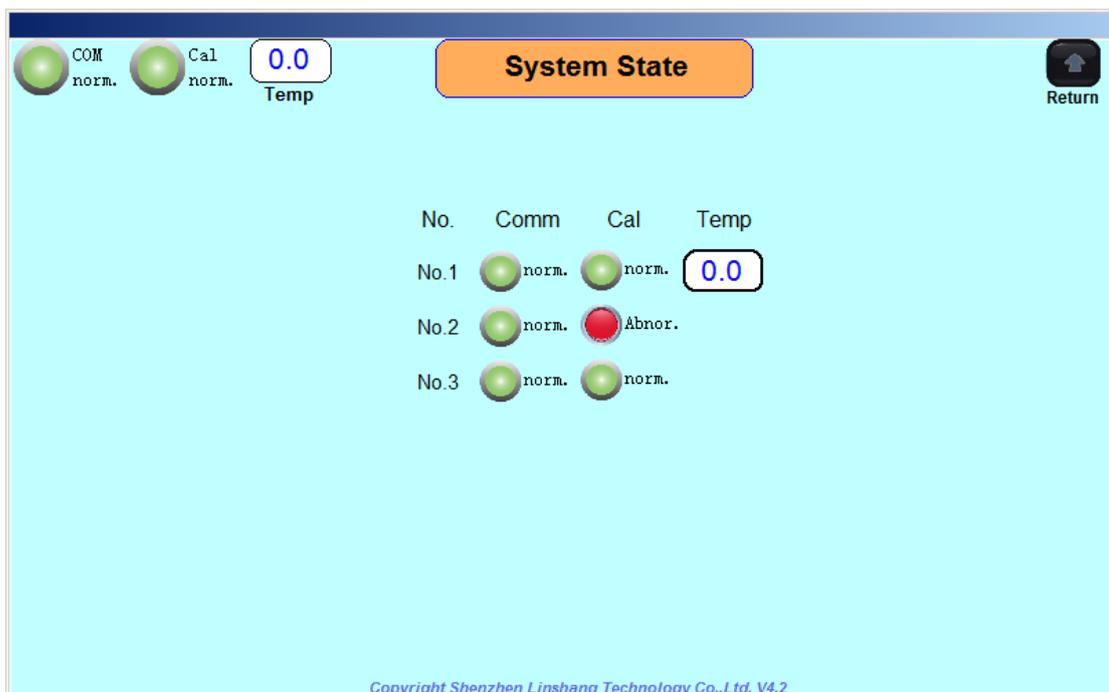
If the setting is completed successfully, the baud rate of each station number will be updated to the set baud rate. The PC and PLC can communicate with the LS152 through the station number and baud rate just used. If the baud rate with station number is not updated to the currently set baud rate, it means that the station number is not set successfully and needs to be set again.

2.6 System State

Click the “System State” icon to enter the interface of System State as shown below:



In this interface, the communication and calibration of each test point can be supervised. The environment temperature of each controller can also be checked. When the communication indicator or calibration indicator of the main interface shows abnormality, the customer can enter into the interface to check which test point goes wrong.



As shown in the above figure, the calibration of the 2nd test point is

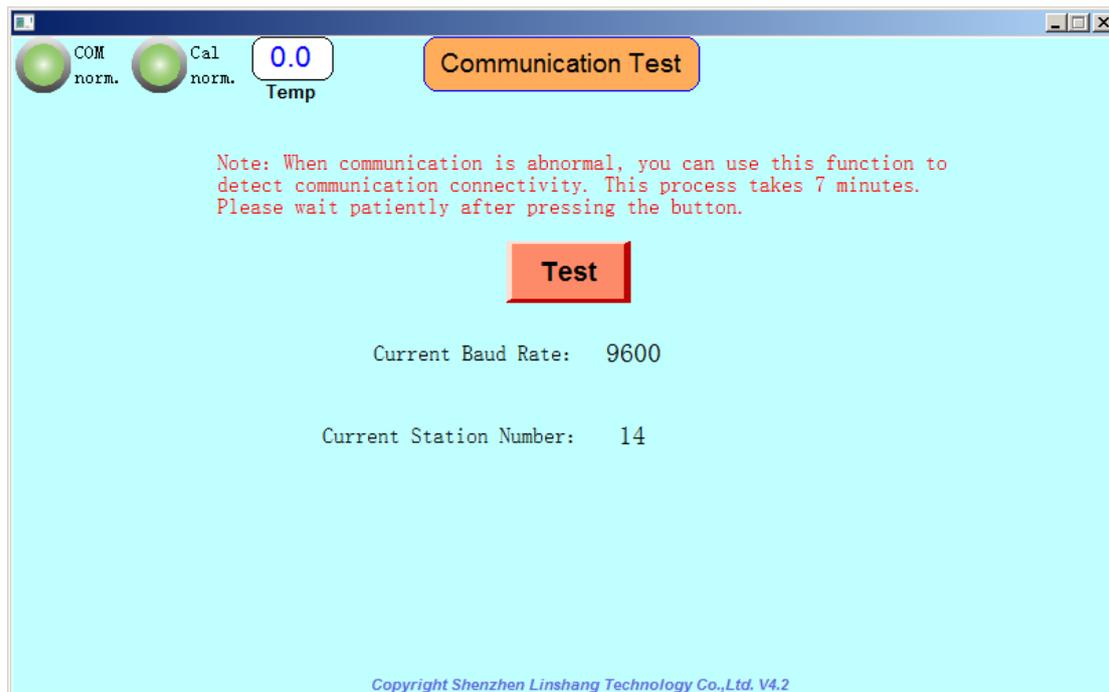
abnormal. The cause may be the attenuation of the light source, the wrong calibration method or too much dust on the test point. If this happens, please refer to the third section of this manual to solve the problem, or the customer can also contact with the supplier.

2.7 System configuration

System configuration is Original manufacturer configuration function and is not open to customers.

2.8 Communication test

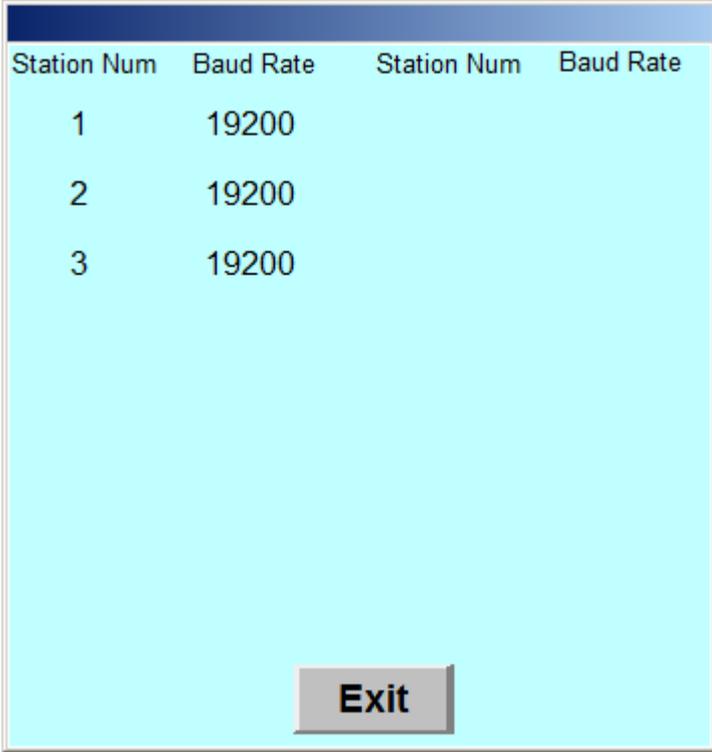
The communication test interface can be entered by clicking the icon of “communication test” as shown below:



This function is mainly used when the communication is abnormal, and the reason cannot be clarified after eliminating the problem of line connection. The communication polling test can be performed by using the “test” button in the above figure. The general test time is 7 minutes. After the test is completed, the station that can communicate and the baud rate can be displayed. This test can test the communication status of RS485①, and the communication status

of RS485②. When RS485② is tested, the RS485② communication interface needs to be interfaced with the Human Machine Interface communication interface.

If there is a “measure and test host” with 9 test points”, the following result will be shown by clicking the test button when the communication of RS485① is normal:



Station Num	Baud Rate	Station Num	Baud Rate
1	19200		
2	19200		
3	19200		

It can be seen from the test results that the station numbers that can communicate normally are 1, 2, and 3, and the baud rate is 19200. If one controller is broken, the corresponding station number and baud rate will not be detected.

Many customers will develop their own Human Machine Interface software according to the communication protocol. After modifying the station number and baud rate according to their own situation, there will be a problem that the debugging communication can not be connected. At this time, the function can be used to detect the set station number and baud rate, making it easy to reset and debug.

III. Description of common abnormality

3.1 Description of communication abnormality

After the power is turned on, when the communication indicator in the upper left corner of the display unit shows that there is something abnormal, and the calibration indicator is abnormal, and when there is no temperature display, the customer can enter the “System State” interface to check.

If all the controller are abnormal, it indicates that the Human Machine Interface is not communicating. There are three general reasons for the communication abnormality:

1. The power supply of the “measure and control host” is abnormal. Check whether the 7.5V power cable of the “measure and control host” and the “Human Machine Interface control box” is correctly connected. The multimeter can be used to measure whether the Power Supply voltage is 7.5V.
2. The communication cable is not wired correctly. Check if the RS485① communication line of the “measure and control host” and “Human Machine Interface control box” is connected correctly.
3. The controller is damaged and needs to be returned to the factory for repair.

If only some of the test points communicate abnormally, it is because the corresponding controller is damaged, or it is because there is a problem with the connection line, and it should be returned to the supplier for repair.

3.2 Description of calibration abnormality

When the calibration indicator in the upper left corner of the display unit is abnormal, it can be checked which point or which points is abnormal in the “System State” interface. Generally speaking there are four reasons for the

abnormity of calibration status:

1. The light path is blocked by dust, and the lens glass of the corresponding point can be wiped with a dust-free cloth.
2. In the automatic calibration state, there is a sample in the test slot when starting up.
3. The difference between the standard values of manual calibration and calibration plate is too big in the process of manual calibration.
4. The light source is permanently damaged. Please return it to the factory for repair.

3.3 Description of controller abnormity

When the measure transmittance of the Human Machine Interface with test points displays “11.1100” all the time, or when the measured optical density always displays “0.9543”, and the above-mentioned phenomenon keeps happening no matter if there is test object or if the device is restarted, it means the controller of the corresponding test points is broken (*the three test points controlled by the controller will show above fault*), it should be sent back to the factory for inspection and maintenance.

When the measure transmittance of the Human Machine Interface with test points displays “88.8800” all the time, or when the measured optical density always displays “0.0512”, and the above-mentioned phenomenon keeps happening no matter if there is test object or if the device is restarted, it means the controller or receiving probe is broken. The controller or corresponding receiving probe should be sent back to the factory for inspection and maintenance.

When the temperature on the main interface of Human Machine Interface keeps showing “88.8”, or when the controller temperature under “System State” interface keep displaying “88.8”, it means the temperature probe of the controller is broken, and the corresponding controller can be sent back to the



factory for repair.

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