

Technical Specification

Intelligent Detection System for Metal Level in Float Glass Furnace

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I . General Description

In the production of float glass, whether the metal level in furnace is stable or not has direct influence to the normal production. Nowadays, the on-line automatic detection device for metal level popularly used at home and abroad are divided, according to their working principles, into four kinds: electric contact, pneumatic, photoelectrical and nuclear radiation.

The level meter of electric contact type has a sensor, the platinum probe. Its working principle is as follows: the platinum probe keeps on an up-and-down movement, when it contacts or not contact the metal level, there exists a difference between its electric resistance values. This difference is used to judge the instant position of the probe when it contacts the metal level, so that the metal level can be measured. However, the measuring accuracy and reliability are poor , because they depend on, to a considerable degree, cleanness degree of the metal, the tip shape of the probe and its corrosion extent. Moreover, it needs considerable maintenance, owing to conglutination of glass and mechanic failure.

Regarding of the pneumatic level meter and photoelectrical level meter, due to the shortcomings of themselves, they haven't been successfully used on a single production line in China.

The level meter of nuclear radiation type owns an emission device which is a radioactive radiation source. The device is mounted on a side of the furnace pocket close to the metal level. On another side of the pocket installed is a radiation receiver. The average metal level in the pocket is measured according to the radiation received. At the pocket and its side, the temperature is comparatively lower, thus glass viscosity and surface tension are rather high. As a result, measuring the metal level there, the change is lagging to a certainty. Besides, due to adoption of nuclear radiation material, it becomes more difficulty in the respects of maintenance and handling.

The basic principle of image-type level meter is shown as Diagram 1. Setting a symbol block on one side wall of the furnace at a location close to the metal level, on the block there is a rectangle groove. Because of reflection by the molten glass, a symmetric false image A1 appears under

the glass. When the distance between A and the metal level is h , then the distance between A and A1 is $2h$. If the level rises to Δh , then the distance between A and A1 is $2\Delta h$. Open a small observation hole just opposite to the position of A on another sidewall of the furnace, use a camera to pick up the images of A and A1 through this small hole, the video signal goes into image analysis and processing system. After analysis and processing, $2h$ is calculated out, so that the variation of the metal level is measured.

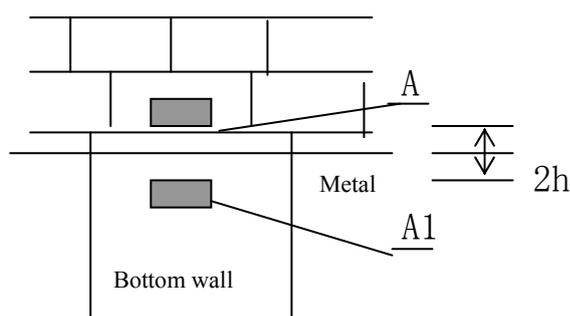


Diagram 1 Schematic Drawing of Principle

In order to increase measuring resolution and accuracy as much as possible, the distance between the groove A and the metal level h should be as less as possible at the premise that the measuring range and production requirement can be satisfied. At the same time, the visual fields for the camera pickup should take the area which is the largest scope where A and A1 can possibly appear so as to make full use of the camera resolution. In addition, the water jacket of the camera should be fixed as firm as possible.

The intelligent image-type check and measure system developed by our company is at present an up-to-date level measuring device. It is of non-contact, different from those contact-type level meters liable to be influenced by glass temperature, viscosity etc. Being simple in structure, it is easy to be installed, used and maintained and enjoys high measuring accuracy and reliable safety in running. It can also complete automatically its own scaling and calibration. Moreover, due to its image visualizability, we can carry out real-time observation of any changes in metal level, avoiding of such defect of other level meters, i.e., it is not easy to perceive when the level meter is out of order.

1. Main technical performance and indexes

Video type: stand PAL, black/white video input, software of brightness, colority and contrast can be adjusted;

Resolution: 0.1mm

Accuracy: $\pm 0.2\text{mm}$

Sampling cycle: $\leq 5\text{s}$

2. System structure

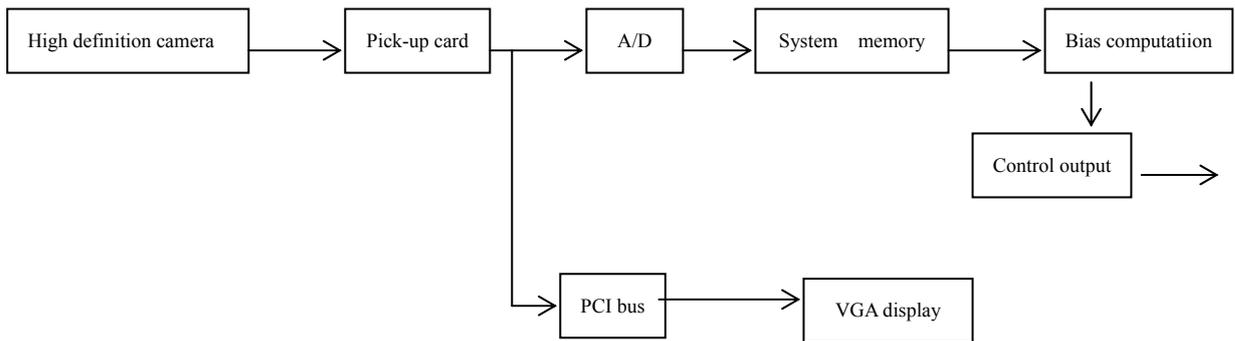


Diagram 2 Working Principle

3. Configuration of computer system

CPU: Pentium chip 586 or more, speed: $> 500\text{MHz}$

Bus speed: 133MHz or more

EMS memory: 256M or more

Hard disc: remaining space $> 10\text{G}$

Operating system: Chinese system Windows 2000

II. Procedures for installing system hardware

Open the cover of computer case, insert image card DH-VRT-CG400 into a free PCI bus slot and output card Yanhua PCL-728 into a free ISA bus slot; fix the retaining piece on the case with screws, close the cover and connect video source. 15-needle socket is used as input and output interfaces of the image card DH-VRT-CG400. Connect the output plug of the video source with the video input plug of the image card socket.

III. Procedures for installing system software

1. Confirm that the Chinese system Windows 2000 has been installed in the machine, if not, install it.
2. Install the driver (cg400_win2000xp) for image pickup card:
When the machine is logged on, the system will check up the

- pickup card, install the driver according to the given prompts.
- 2.1 Operate the mounting procedure 'setup.exe' in 'cgcard_performance instal', then restart the computer;
 - 2.2 Copy 'Monitor.exe', 'Winio.vxd', 'WinIo.sys', 'WinIo.dll' in the system disc down to C:\Ym;
 - 2.3 When pick up the images to the memory, the pickup may not succeed owing to the too small memory allocated by the system. In such a case, it is necessary to modify the allocated memory size of the pickup card in 'Start/Program/Daheng Imavision CGCard/One card performance', set the memory space to be applied of Item 'Paramter/Allocate Memory' at 8000 K, as shown in Diagram 3. Restart windows system.

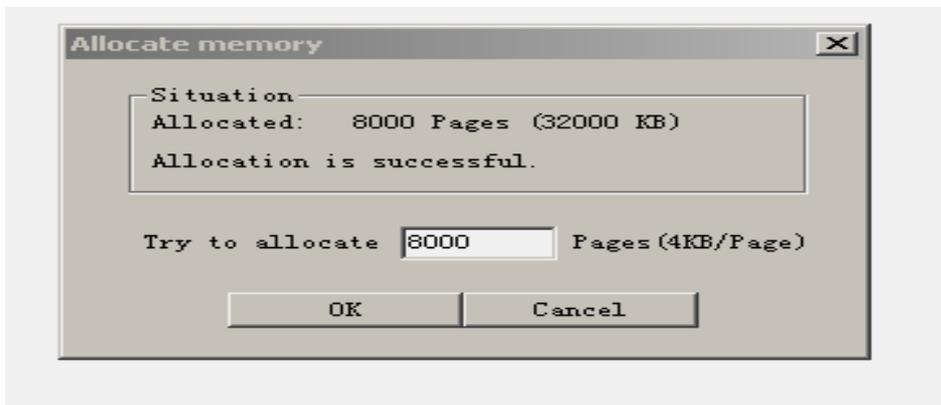


Diagram 3

3. Installation and configuration of system file

- 3.1 Install softdog driver: insert the subpanel into floppy drive and run file 'instdrv.exe', carry out installation according to the given prompts;
- 3.2 System installation and configuration: Set catalog 'metal level' in c:\, copy the supplied file 'Monitor.exe' down to this catalog. Set catalog 'mdb' in c:\, copy the supplied data base document 'Monitor.mdb' to under this catalog.

Configure this data base in the control panel: pitch on in order in the control panel 'management tool' → 'data source ODBC' → 'user DSN' → 'addition' → 'Driver Microsoft Access Drive (*.mdb)' → 'completion' → fill 'monitor' into 'name of data source' → 'select data base', click 'confirm' to finish, as shown in Diagram 5.

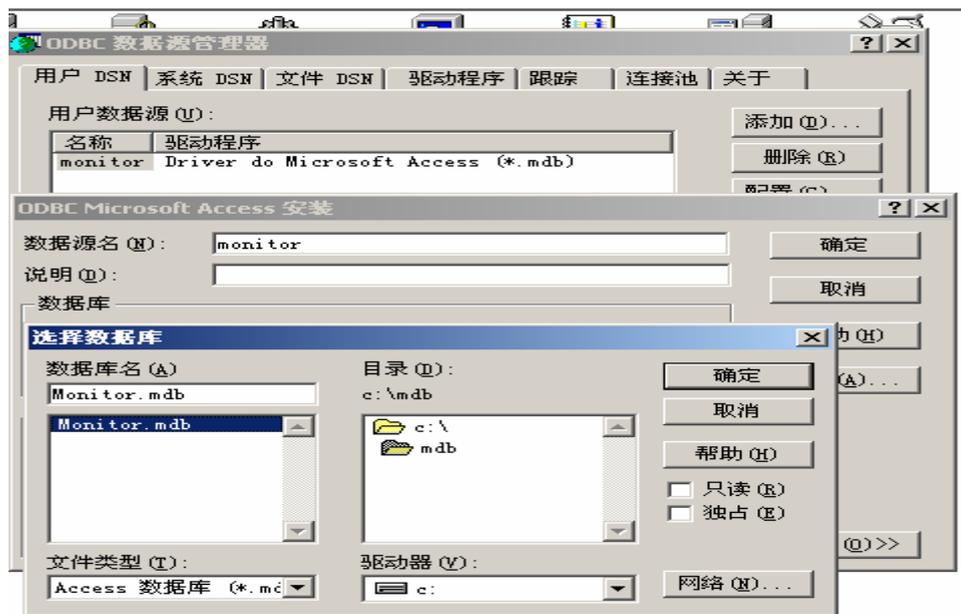


Diagram 5

IV. Run of ystem program

Double click 'monitor.exe' on the desktop to start the system program. The primary interface of this program is composed of the following parts as shown in Diagram 6: image window region, parameter region, bias value display region and trend region.



Diagram 6

1. Click the button of 'setup parameter', after inputting password, the interface for setting up the parameter ejects out. The definitions of various parameters are as follows:
 'Original height of metal level' stands for the height of a reference point. The system will compare the present metal level with this value so as to check out the actual deviation. Normally, at the time of standard level, half of the centre distance between the hole and its false image is taken as this value, which reflects truly the centre distance between metal level and the false image of the hole. Therefore, at the time to regulate metal level, this value can be increased or reduced. Increase this value, the level height to be set up is cut down; 'Detection range' stands for the range ability corresponding to 4—20mA standard putout signal; 'Hole height' stands for the height of the hole opened on the symbol block; 'Pickup channel' stands for the video input port of the pickup card. See Diagram 7



Diagram 7

2. Click the button of 'Image Calibration', after inputting password, the cursor becomes a small cross, move mouse to locate the cross in image window. Click the left key of mouse, drag the mouse so as to envelop fully the hole and its false image with a pane, then confirm, as shown in Diagram 8 below.

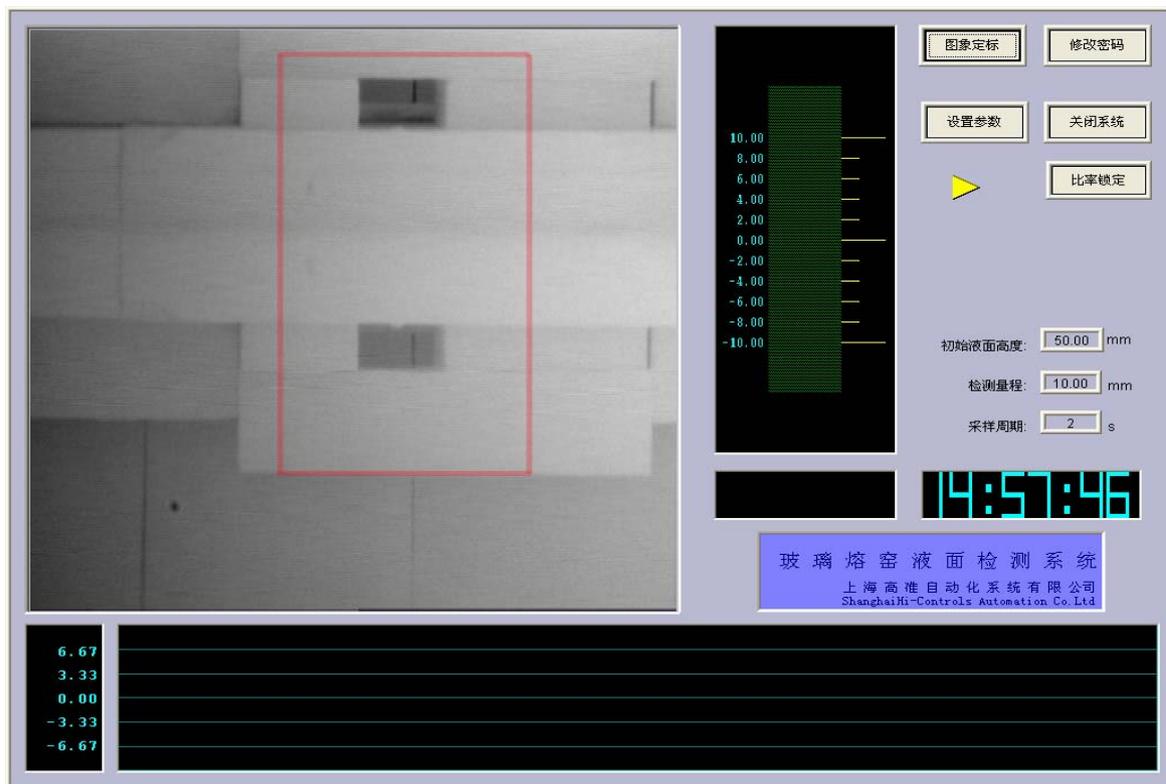


Diagram 8

3. Click button ‘▲’, the system begins to initialize. During the process of initialization, the system will complete automatically calibration of image checkout, as shown in Diagram 9.

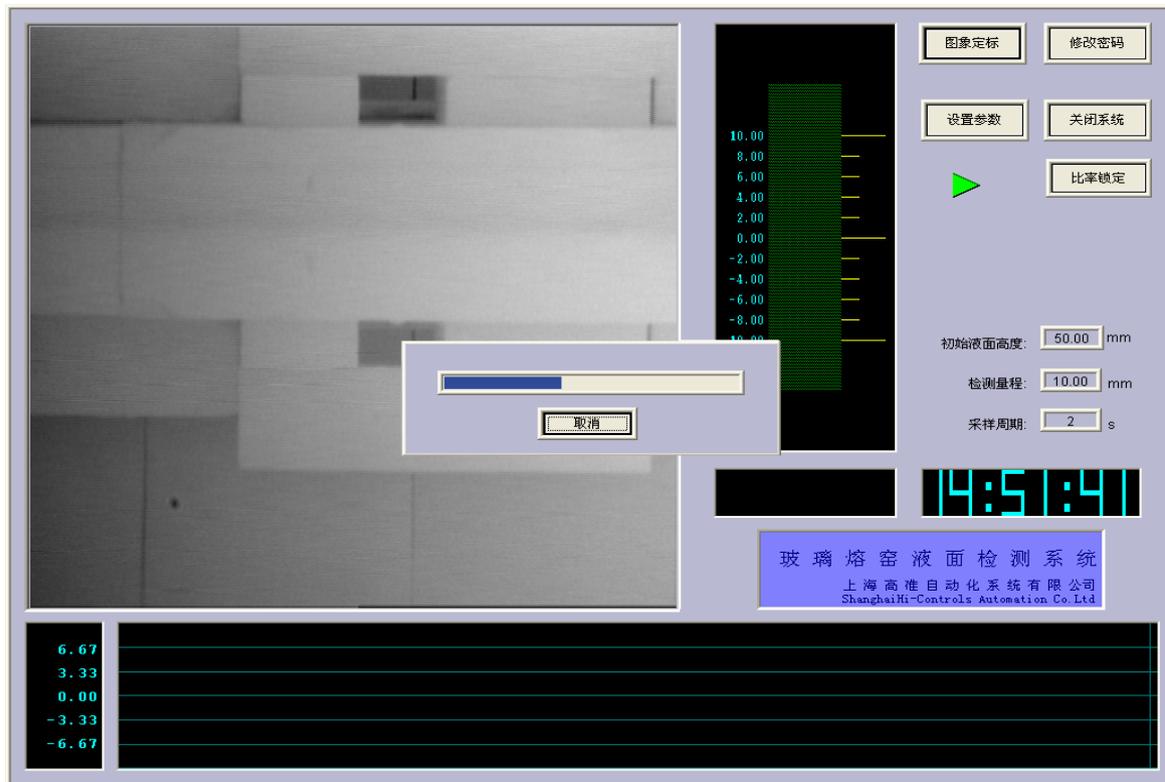


Diagram 9

4 After initialization is completed, the system starts to checkout level deviation. In the region of deviation display, the present level deviation is shown by a dynamic rod shaped graph and the bias value is displayed below the graph. When the value of deviation is out of the range ability, the rod shaped graph will change from green to red. At the same time, the deviation trend record of the present hour will be displayed in the trend region, as shown in Diagram 10.

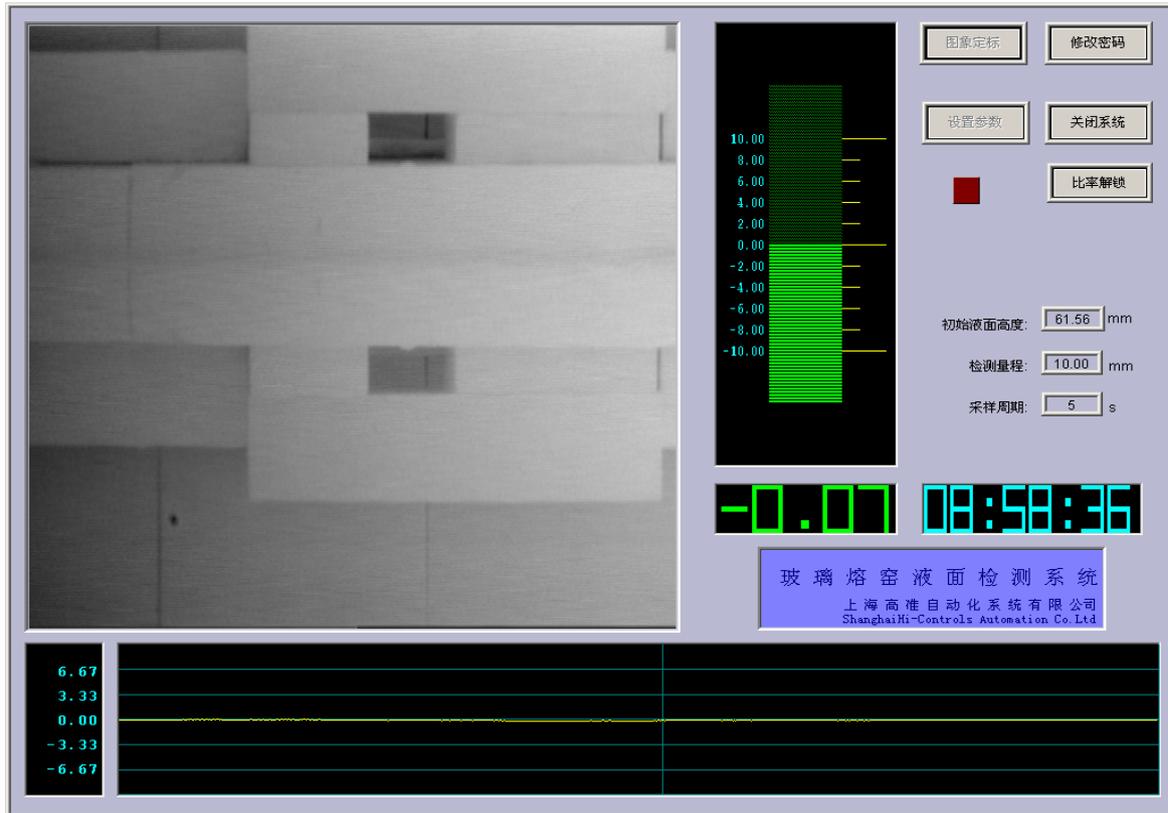


Diagram 10

- Click the button of 'Ratio Lock', a prompt frame as shown in Diagram 11 appears, this function is used to calculate the ratio of actual millimeters to the corresponding pixel in the image. The main purpose is to prevent deviation value from fluctuating too much after several times of calibration.

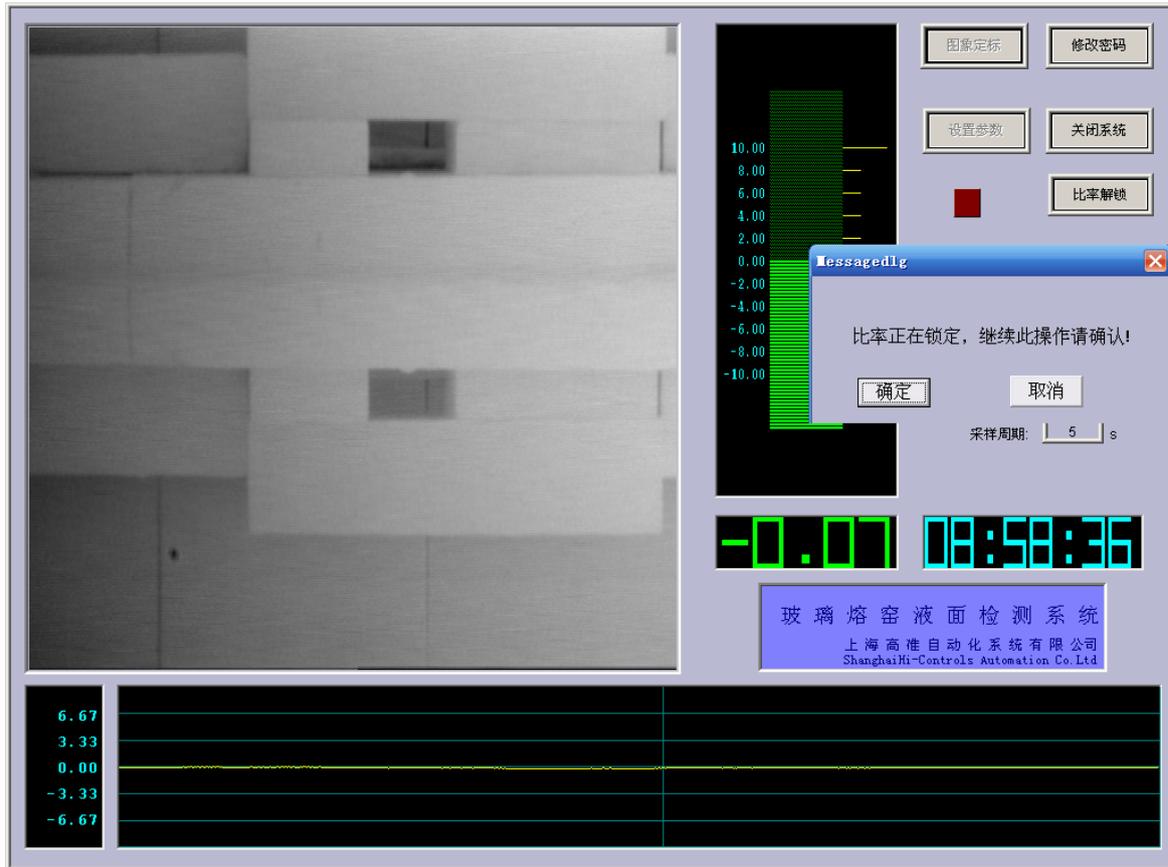


Diagram 11

6. Password is set for some operations in the system for the sake of management. The user can set and revise the password freely, as shown in Diagram 12.

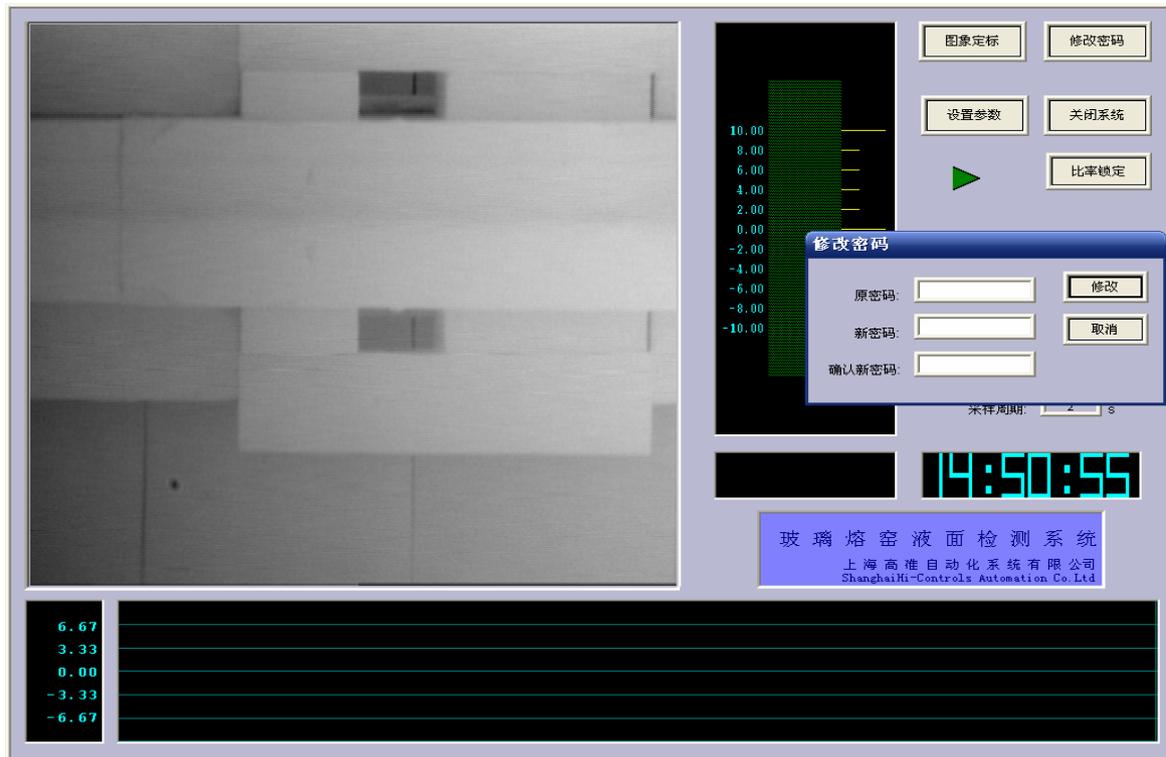


Diagram 12

V. System maintenance

The system is of simple structure, so the maintenance is not so much. The only point the user should pay attention to is not to collide with the water jacket of camera and the bracket, for fear the change of image position. If it is found that the image position has changed and run out of the calibrated window, we can recalibrate in case the image is still in the image window; if the image is out of the window or deviated too much, it is necessary to regulate the water jacket position again, so as to guarantee that the hole and its false image are situated completely within the image window. For camera and lens adjustment, please refer to their respectively technical specifications.