

Technical Specification

Intelligent Measure and Control System for Width of Float Glass

Shanghai Gaozhun Automation System Co., Ltd.

I .General description

1.1 Main technical features and indexes

Standard PAL black/white video input

Brightness, chroma and contrast are adjustable via software.

Resolution of image pickup: $768 \times 576 \times 16$ bit

Image and graph are displayed on the same screen, realizing easy regulation of the control parameters.

1.2 Working principles of the system: As shown in Figure 1

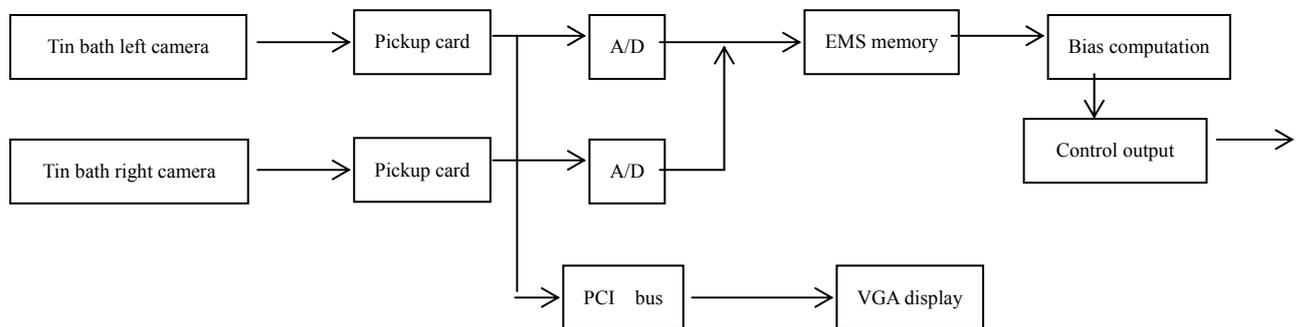


Fig. 1 Working Principle

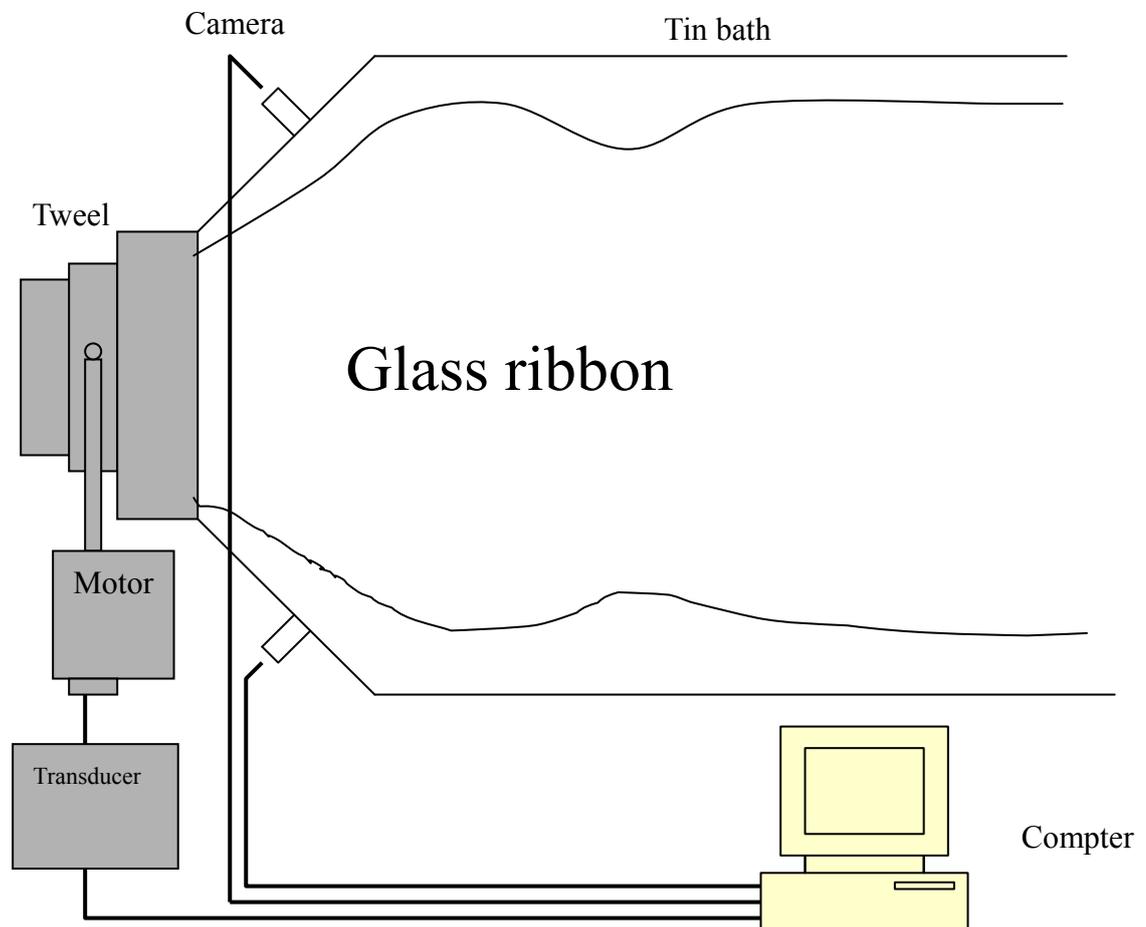


Fig. 2 System Structure

1.3 System structure: as shown in Fig. 2 above

1.4 Configuration of computer system

CPU:	Pentium 586 or chip superior Pentium 586; speed will be over 500MHz;
Bus speed	133MHz or more
Internal memory	256M or more
Hard disk	Residual space more than 1G
Operation system	Chinese WINDOWS 2000 system

II. Procedures for installing system hardware

Take off the cover of the computer cabinet, insert two DH-VRT-CG400 image cards into the idle slots of the PIC bus and the control card of PCL-725 into the idle slot of ISA bus; fix the retainer on the cabinet with screw and put on the cover, then connect the video source. For the DH-VRT-CG400 image cards, 15-pin socket or the BNC joint on the card can be used as the input interface. Finally, connect the output socket of the video source with the socket of the image card.

1# input port is used as the video input terminal of the image pickup card.

III. Procedures for installing system software

3.1 Confirm that the Chinese WINDOWS 2000 system is installed, if not, install it.

3.2 Install the driver (cg400_win2000xp) for the image pickup card:

If the driver of the image pickup card is not installed in the system, the system is able to detect automatically the hardware information after the computer starts-up, install the driver of the hardware according to the system prompt. After the said installation is over, open the backup copy of the software (cgcard performance install), run SETUP program and install according to the prompt.

After installation, copy the document Taskkeyhock.dll supplied along with the disk to the file under the content of WinNT\SYSTEM32.

3.3 Set the WINDOWS screen to the size of pixel 1024*768, color is set as real multicolor, 16 bits, and the taskbar is set into the state of auto concealed.

3.4 Click “Start/Program/ Daheng Imavision CGCard/One card performance”, to run the demonstration program of image pickup; click “View/Capture” and observe whether the picture in the window is clear. Click “Parameter/Allocate Memory”, set the allocated internal memory in “Try to allocate” as 8000, as shown in Fig. 3.

Insert the installing disc (one CD) of Intelligent Measure & Control System for Float Glass Ribbon Width into the machine, copy “Blbk.exe”, “WinIo.dll”, “WinIo.sys” and “WINIO.VXD” to C:\BK.

3.5 Restart the computer

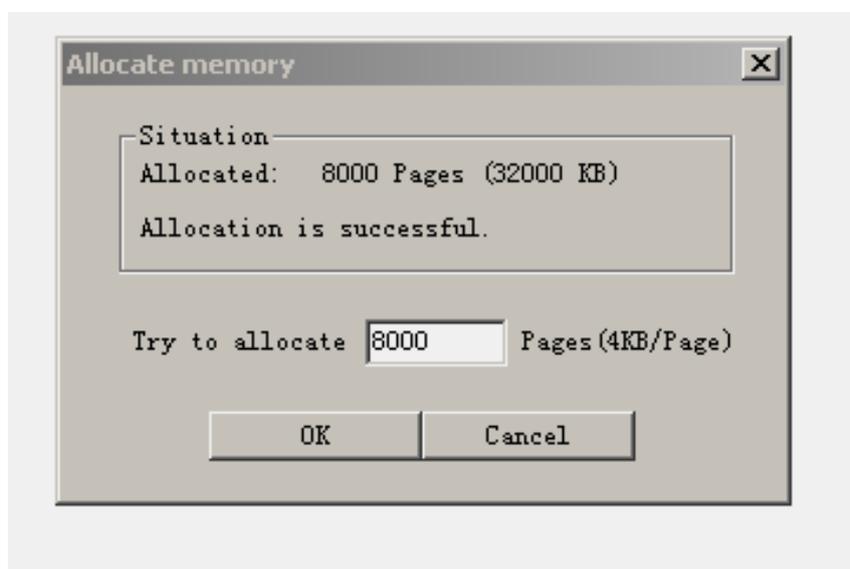


Fig. 3

IV. Installation and debugging of the camera at frontend

4.1 The protection cover, Model GS-BK, for the camera of the intelligent measure and control system for float glass ribbon width is mainly used in the float glass production line to observe the operating conditions of glass ribbon at the entrance of tin bath. The equipment is fully made of stainless steel and thus good at corrosion resistance. Meanwhile, being equipped with universal coupling, it can be adjusted within an angle range of 20°freely. The equipment is fixed onto the wall of tin bath directly and can block exchange of gas inside and outside the tin bath effectively. In order to meet the needs of different customers, the equipment adopts variable high temperature pinhole lens. Its angle of view can be adjusted freely within the range of 6° to 17° , suitable for

the observing requirements of all kinds of furnace bodies.

4.2 Main features and indexes

4.2.1 Specifications of image system

- Scanning system: CCIR 625lines/50fields, 2:1 interlace
- Video output amplitude: 1.0 Vp-p
- Video output polarity: Positive
- Video output impedance: 75 Ω
- Signal-to-noise ratio: >40dB
- Definition: Level is not lower than 520 lines
- visual angle: F20~F60, adjustable
- Adopt black/white monitor system

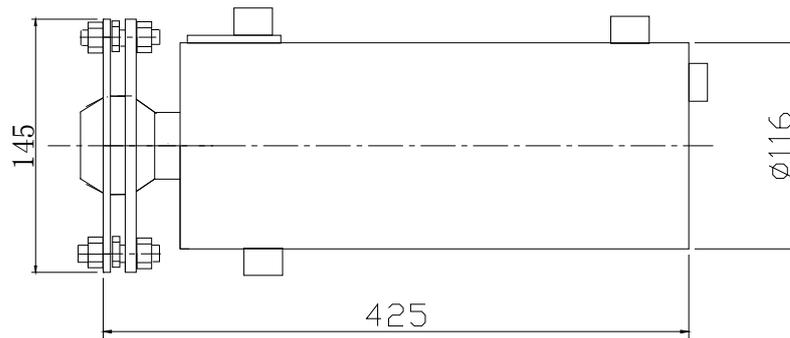
4.2.2 Overall dimensions: 425×145×145 (L×W×H)

4.2.3 Environmental qualification for use

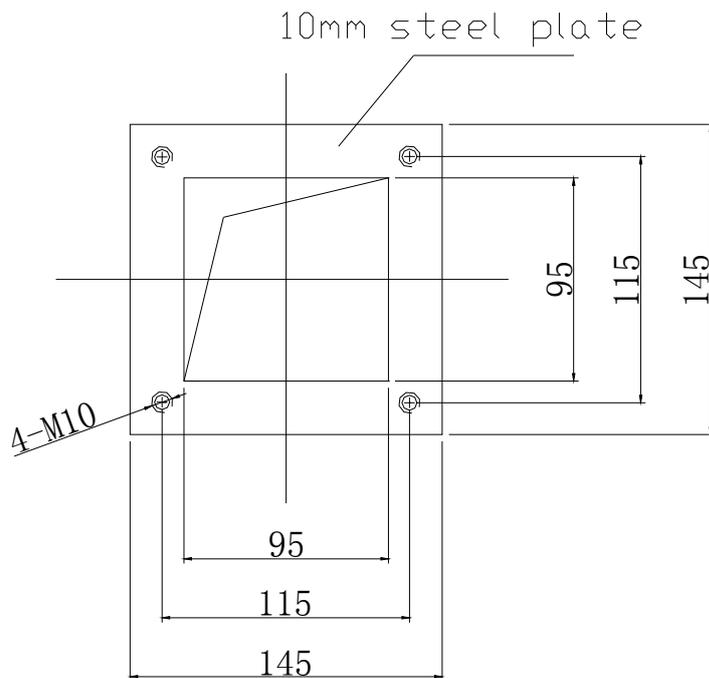
- Compressed air: Nitrogen is used for cooling
 - a. Connecting duct orifice G1/2"
 - b. Inlet pressure $\geq 0.1\text{MPa}$
 - c. Inlet temperature $\leq 35^\circ\text{C}$
 - d. Min. flow rate: $0.03\text{m}^3/\text{min}$
- Cooling water: Soft water is most favorable.
 - a. Connecting duct orifice G1/2"
 - b. Inlet pressure 0.1Mpa - 0.4Mpa
 - c. Min. flow rate 5L/min
 - d. Inlet temperature $\leq 35^\circ\text{C}$
- Temperature of working environment
 - a. Ambient temperature 5-60°C.
 - b. Temperature in the tin bath <1200°C

4.3 Shape and installing dimension

4.3.1 Figuration drawing



4.3.2 Diagram of installing dimension



4.4 Installation of frontend equipment

Customers must open a hole for installation on the wall of sideseal at the entrance of the tin bath. First fix the M10 screw mounted on the equipment onto the wall of sideseal and sheathe asbestos plate and stainless steel plate and fix them with nut, then assemble the protective cover and fix it. Connect cooling water and cooling air. Till this step,

the equipment can be put into operation.

4.5 Picture adjustment

Screw off the rear cover and take out the shelf, fix the pickup camera and connect the video cable and turn on power supply, then aim at the article to be shot and adjust aperture and focus of the zoom lens till the picture acquired becomes the most distinct and finally fix the rear cover.

Loosen the fixed screw of the protective cover and turn the cover body to make the picture in the graphic range conform the process requirement and fix the cover till then.

V. Introduction to software operation

5.1 After the computer restarted, it will enter into Intelligent Measure and Control System for Width of Float Glass and display its main interface automatically. The main interface is shown in Fig. 4.



Fig. 4 Main Interface

The main interface of Intelligent Measure and Control System for Width of Float Glass includes the following parts: at the right up corner, there is exit button. It is used for exiting the system. Under it there is

alarm indication including “width alarm” and “width pre-alarm”. When the alarm is detected by the system, the relevant indication will turn from grey color into red color, accompanied with output of the buzzer. Next is up arrow and down arrow, showing the running status of the motor. If “▲” “▼” are in red, it indicates that the system is proceeding output control (give on-off signal to transducer); If they are in green, it indicates the output state of the last time. Again the next is the control panel, including four buttons, i.e. calibration, auto control, manual control and parameters. At the left corner of the interface, there are two monitor windows, where are displayed the pictures of the glass ribbon edges picked-up by the camera through the monitor hole opened at the tin bath wall of the 八-shaped section.(It should be assured that glass ribbon locates within the inner sides of the glass edges and on their outer sides is molten tin, the ribbon moves upwards). Inside the monitor window, there is a rectangle for calibration, used for the initial alignment of the glass edges.

5.2 When click the button of “calibration” with the left key of mouse, it will enter into the interface for calibration, as shown in Fig. 5

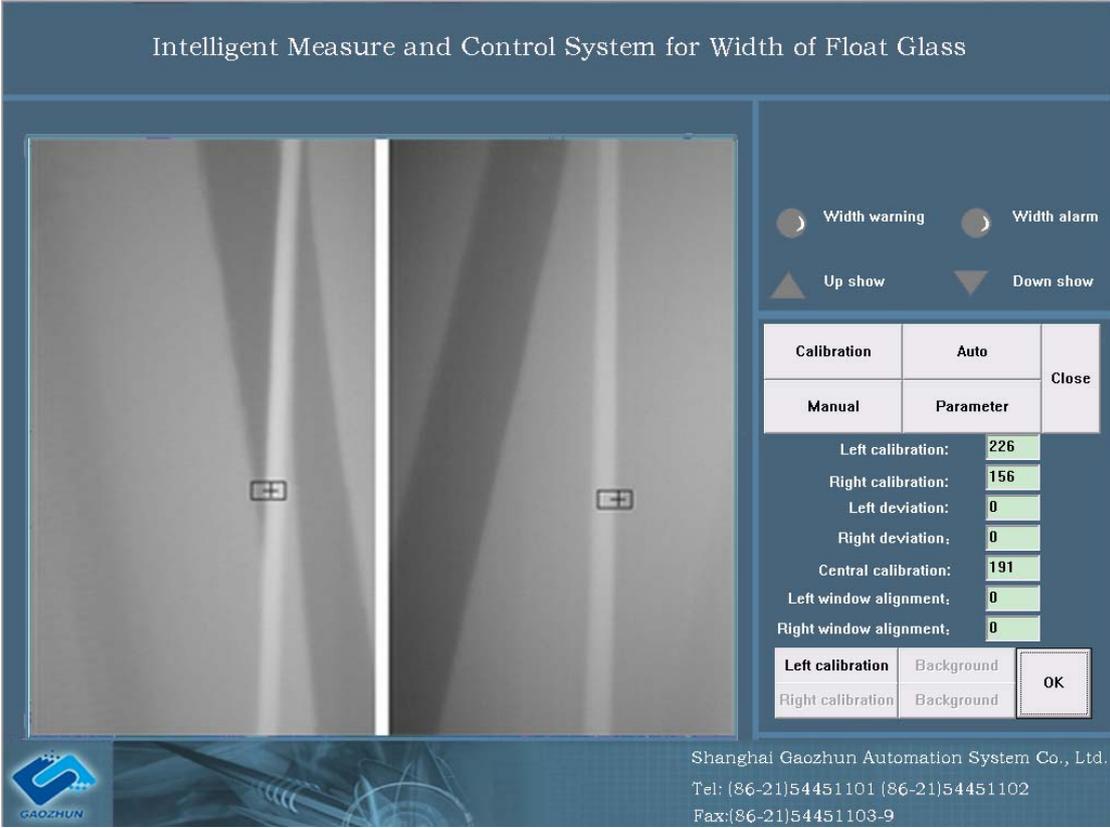


Fig. 5 Interface for Calibration

At the sub-control panel for calibration there are 7 small windows to

display left calibration, right calibration, central calibration, left deviation, right deviation, left window alignment and right window alignment individually and 5 buttons, i.e. “left calibration”, “left background”, “right calibration”, “right background” and “affirm” individually. After click the button of “left calibration” with the left key of mouse, 4 direction keys on the keyboard can be used to move the position of the black rectangle for calibration on the left side of the left monitor window (click each time, the figure will plus or minus 1), use the rectangle frame for calibration to cover the edges of glass, facilitating auto recognition and tracking of the glass edges by the system. Meanwhile the left window for calibration will display the abscissa of central point of rectangle frame for calibration. Click the button of “left background”, use 4 arrow keys to move the small white frame to the interior of the white side of the glass. With the same principle the right calibration can be finished too. The value of central coordinates is half of the summation of left and right coordinate. After finishing calibration, click the button of “affirm” with the left key of mouse to affirm the just operation and return to the main interface.

Remark: When it is necessary to increase the glass flow, move the two rectangular frames for calibration towards two sides, and assure that the small frame of background is within the interior of the white glass side.

The parameters of “left deviation”, “right deviation” are used to modify different width of the glass ribbon, which can be revised properly when the tracking cross does not reach the outer edge of the white glass side. After setting is finished, normally no modification is needed, only when the glass width deviated distinctly, fine adjustment becomes necessary.

The parameters of “left window alignment”, “right window alignment” are used to modify the left and right video tailoring positions of the picture window, i.e., when the ribbon edges are over close to the picture window, we can regulate these parameters to redefine the video tailoring positions, that can be done through restarting the program.

5.3 After click the button of “parameter” with the left key of mouse, it will enter into the interface of parameter setting, as shown in Fig. 6

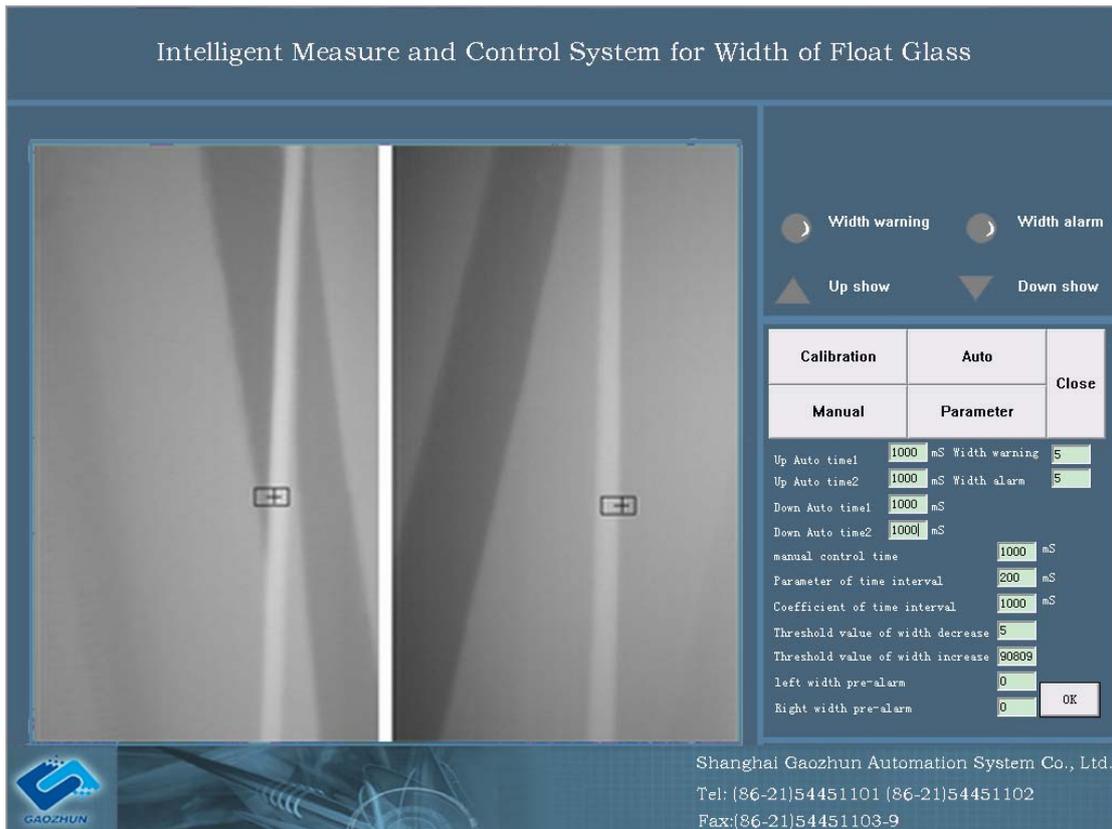


Fig. 6 Interface of Parameter Setting

The parameters listed in the above sub-control panel have the following meanings:

5.3.1 Parameter 1 of auto control time increase Unit: mS

5.3.2 Parameter 2 of auto control time increase Unit: mS

The above two parameters determine the controlled output time of flow increase of the single time (big or small of the switching value) when the system is in automatic state, i.e.:

Controlled output time = width deviation × parameter 1 of auto control time increase + parameter 2 of auto control time increase.

5.3.3 Parameter 1 of auto control time decrease Unit: mS

5.3.4 Parameter 2 of auto control time decrease Unit: mS

The above two parameters determine the controlled output time of flow decrease of the single time (big or small of the switching value) when the system is in automatic state, i.e.:

Controlled output time = width deviation × parameter 1 of auto control time decrease + parameter 2 of auto control time decrease.

5.3.5 Width pre-alarm parameter: used to set the initial value of pre-alarm for width deviation. When the width deviation is over this initial value, the system will give an alarm automatically (accompanied with howling of buzzer), accompanied with controlled output; when the deviation is less than the initial value, alarm will disappear automatically.

5.3.6 Width alarm parameter: used to set the initial value of pre-alarm for width deviation. When the centre deviation is over this initial value, the system will give an alarm automatically and at this moment, the system has no longer the controlled output; when the deviation is less than the initial value, alarm will disappear automatically.

5.3.7 Threshold value of auto controlled width decrease: used to set the threshold value for starting to decrease the flow when the system is in the state of automatic control (This value must be positive.). When the system detects that the width deviation is over this value, it will output a controlled quantity at a certain time interval (See item 7).

5.3.8 Threshold value of auto controlled width increase: used to set the threshold value for starting to increase the flow when the system is in the state of automatic control (This value must be negative.). When the system detects that the width deviation is less than this value, it will output a controlled quantity at a certain time interval.

5.3.9 Parameter of manual control time: its unit is mS and it determines the output value of the system when in the state of manual control upon one time click of the “increase” or “decrease” button.

5.3.10 Parameter of controlled time interval: its unit is mS.

5.3.11 Coefficient of controlled time interval:

The above two parameters determine the time interval for control each output, i.e.:

Time interval = controlled time interval – width deviation
× coefficient of controlled time interval.

5.3.12 Parameter of left or right width pre-alarm: When the left or right width deviation is over this initial value, the system will give an alarm automatically (accompanied with howling of buzzer), accompanied with controlled output; when the deviation is less than the initial value, alarm will disappear automatically.

After finishing all the settings, click the button of “Affirm” with the left key of mouse to confirm the settings and return to the main interface, all the given values are kept in the register list and can be called directly next time.

5.4 Click the button of auto control with the left key of mouse and enter the interface of auto control, as shown in Fig. 7

The sub-control panel of automatic control has 9 small windows to display coordinate and deviation value and two buttons of “zoom out” and “exit”, the cross cursor for calibration appears close to the centre of the rectangle for calibration. The meanings of various parameters are as follows:

- 5.4.1 Left calibration and right calibration stand for the abscissa of the center point of the rectangle for calibration;
- 5.4.2 Left coordinate and right coordinate stand for the abscissa of the center point of the cross cursor for calibration;
- 5.4.3 Left (right) deviation stands for the difference between left (right) coordinate and left (right) calibration;
- 5.4.4 Centre deviation stands for half of the summation of the left and right deviation;
- 5.4.5 Width deviation stands for the summation of the left and right deviation value.

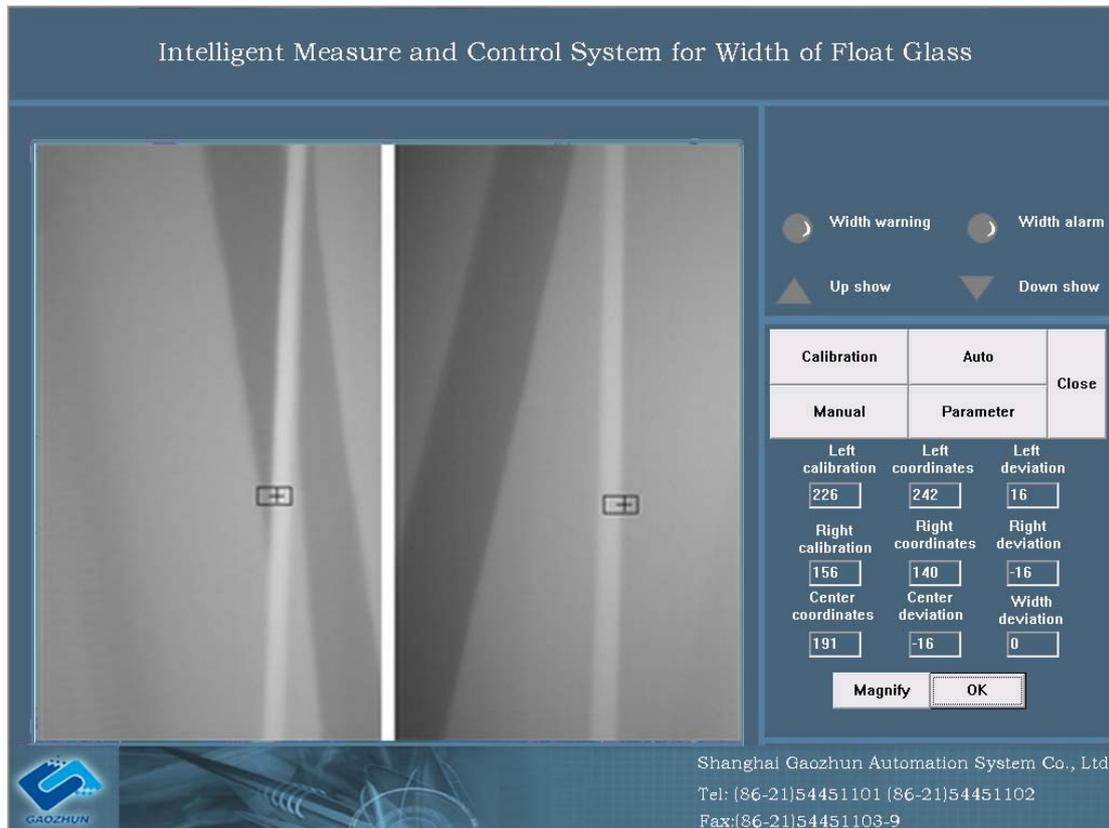


Fig. 7 Auto Control Interface

When the system tracks the glass sides automatically, the centers of the two cross cursors move along with the outer edges of the glass sides. If the value of center deviation (width deviation) is over the pre-set value, the indicating lamp of width alarm (center alarm) will flash and meanwhile the buzzer will send out alarm sound (only when the width alarm exists).

When the system has controlled output, the color of “up arrow”, “down arrow” change correspondingly, i.e., grey indicates the system does not act, red indicates the system is acting and green indicates the last motion status of the system.

Remark: Only when amount of width deviation appears in the system interface, will the system fall into the state of auto control.

5.5 When operator is far away from the screen of computer, the left key of mouse can be used to click the “Magnify” button to enter the magnify interface, shown in Fig. 8.

At this moment, the width deviation and center deviation will be displayed in larger letters so that the operator can read clearly in a

farther distance and the button of “Magnify” turns into “Reset” button. Click the reset button with the left key of mouse to return to the auto control interface; click the button of “Affirm” with the left key of mouse to return to the main interface.

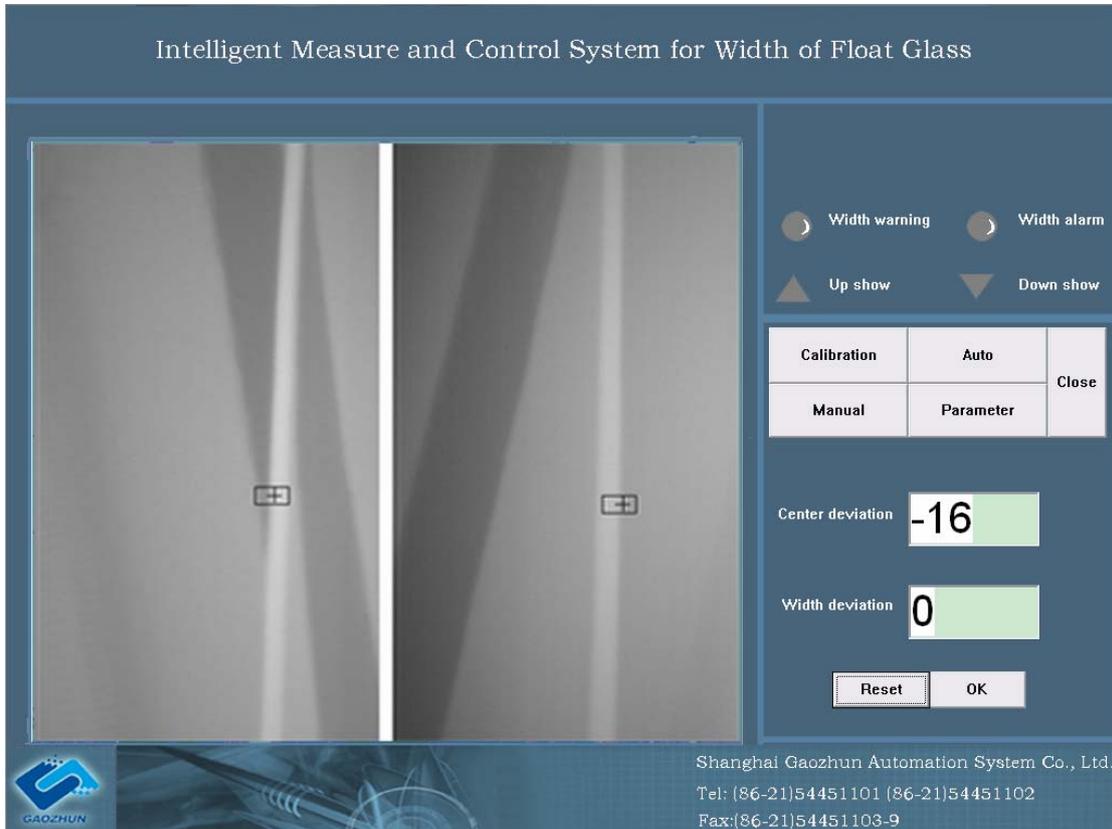


Fig. 8 Interface of Magnify

5.6 When use the left key of mouse to click the manual control button, the interface appeared is as shown in Fig. 9.

There are 3 buttons i.e. “up”, “down” and “affirm” on the sub-manual control panel. Click the “up” (“down”) button with the left key of mouse so that the flow of glass will increase (decrease). When the flow quantity change reaches a certain value, it may be observed in the monitor window that the edges of glass ribbon move towards the both sides (middle). Click the “Affirm” button with the left key of mouse, return to the main interface.

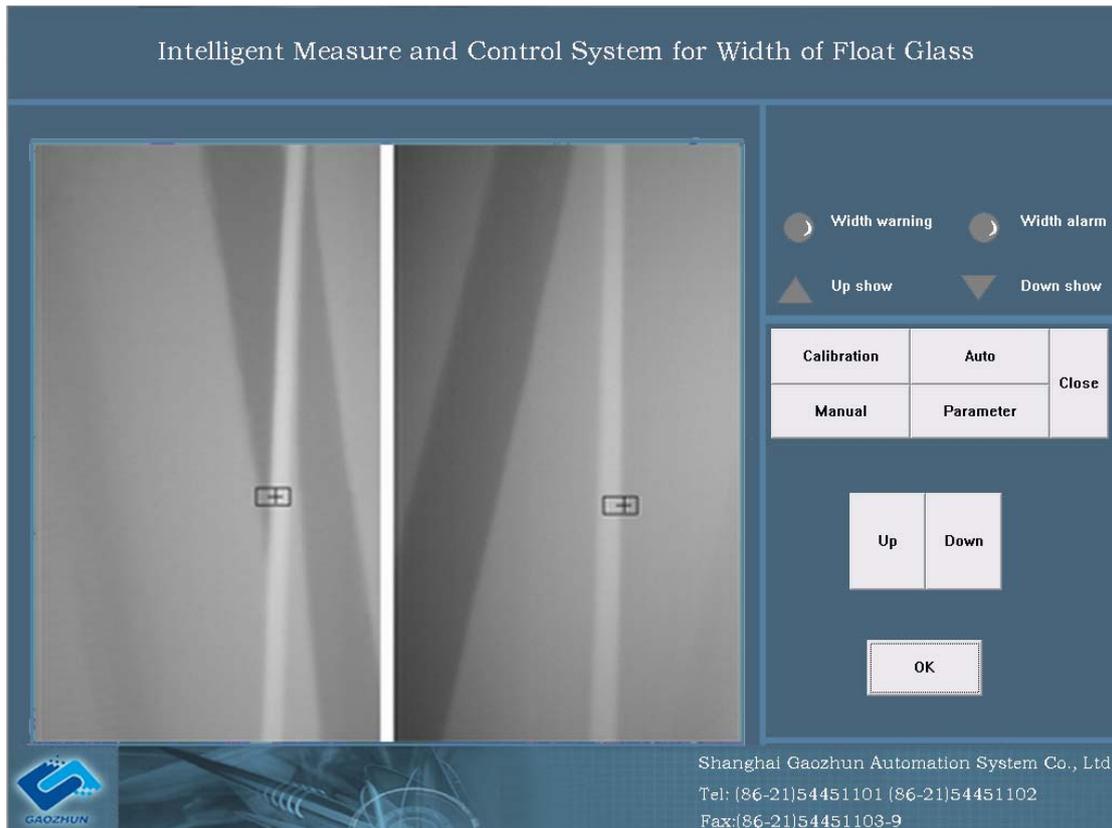


Fig. 9 Interface of Manual Control

5.7 When use the left key of mouse to click the exit button, it will enter the exit interface, shown in Fig. 10.

The exit interface will display alarm information and remind that customer should input password. Only when customers input the correct password, can they exit from the Intelligent Measure and Control System for Width of Float Glass; if the password led in is not correct, it will return to the main interface then. The identified password for the auto control system is “1111”.

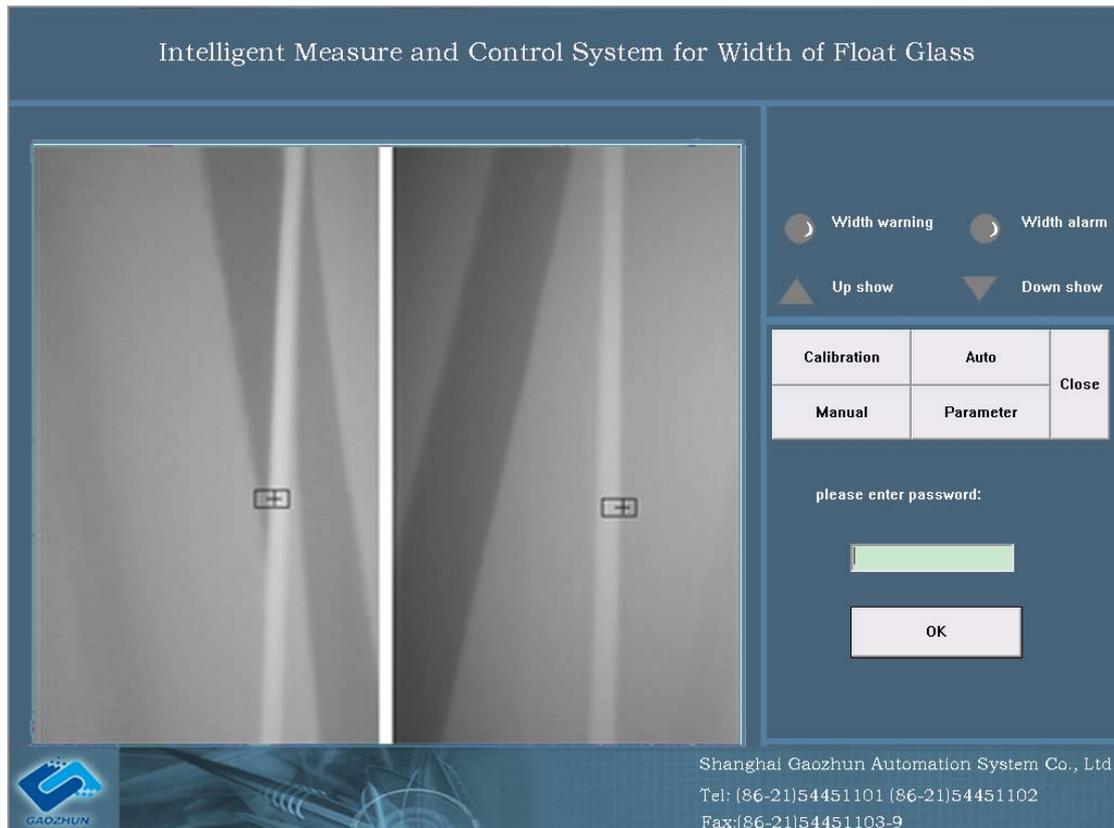


Fig. 10 Exit Interface

VI. Maintenance of the system

The various parts of hardware adopted for the system are of standard products, for their maintenance, one can refer to the instruction manuals of the equipment respectively. Since the system identifies the deviation in conformity with the picture, the quality of the picture is thus highly demanded. It should guarantee that the picture displayed by the system is legible, without any interference. Accumulation of tin dust on the lens will make the lens blurry, so it should be frequently cleaned in order to assure a legible picture

If the picture shown in the window is accompanied with interference, check firstly whether the video cable of the camera is good or not; and also check whether the camera is insulated from the water jacket. If the outer layer lacquer of the camera is worn-out, it is quite possible that the insulation between the camera and water jacket is destroyed and thus interference over the ground occurs. To solve the problem, one can wrap the camera with insulating tape.

VII. The present program is provided with encrypt function, before starting the machine, it is a must to insult the encrypt dog on the join

port. The encrypt dog should be checked regularly during the running period of the program. It is strictly forbidden to cramp out the encrypt dog in the state of start-up, otherwise, the errors in the lap of the gods will come into being.