



# **Installation and Operation Manual of Machine Vision Software for DW-200S Visual Micro-spot Welding Robot**

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## **Current Version:**

V1.00

## **Direction for Use**

Please carefully read this manual before installing or operating the software. Then, perform operations according to the instructions in the manual. Please contact us in case of any abnormal operation, and we will offer warm-hearted service for you.

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# 1 Preface

## 1.1 Software Introduction

DW-200S visual micro-spot welding robot identifies parts by means of machine vision technology, then automatically extracts the copper wire in the set area, with a certain point on the copper wire positioned as the welding position, and outputs it to the high-precision robot motion control platform. The high-resolution camera in the system acquires the image signal, analyzes the part features in real time by the method of digital image processing, and automatically judges the part position deviation and copper wire state, realizing the intelligent welding production.

## 1.2 Image Input

The software input and output are images and part direction information respectively. To effectively identify parts and accurately judge the part direction, proper image input for the system must be guaranteed. The imaging requirement of the software is: **the copper wire is a dark grey or black slim line with obvious margin and bright white background (pad).**

# 2 Software Installation and Uninstallation

## 2.1 Upper Computer Software Installation

- 1) Place the installation disk into CD-ROM;
- 2) Double click to open the driver disk;
- 3) Run the file “DW-200S\_V1.00\_Setup.msi”, and then set the installation path and complete the software installation according to the prompts.

Note: It is recommended to install the software in such non-system disks as disk D.

## 2.2 Software Start

In general, the software automatically runs after the computer is started. The following operation method can be adopted if it is required to manually restart the software due to any abnormality or other circumstance:

- 1) Click the shortcut “DW-200S” on the desktop to start the program;
- 2) Open “My Computer” to enter the installation path (default: “D:\Program Files\MingSeal\DW-200S”), find the file “DW-200S.exe” under the folder, and double click it to run;

### 2.3 Software Uninstallation

Taking the XP system as an example, the uninstallation method is as follows:

- 1) Click “Start”;
- 2) Enter “Control Panel”;
- 3) Select “Add/Delete Program”;
- 4) Find “DW-200S” in the list, and click “Change/Delete”;
- 5) Click “Yes” in the pop-up message box to uninstall the software.

## 3 Interface and Basic Functions

### 3.1 Description of Main Interface

Main interface and its components of the upper computer software are as shown in Fig. 1.

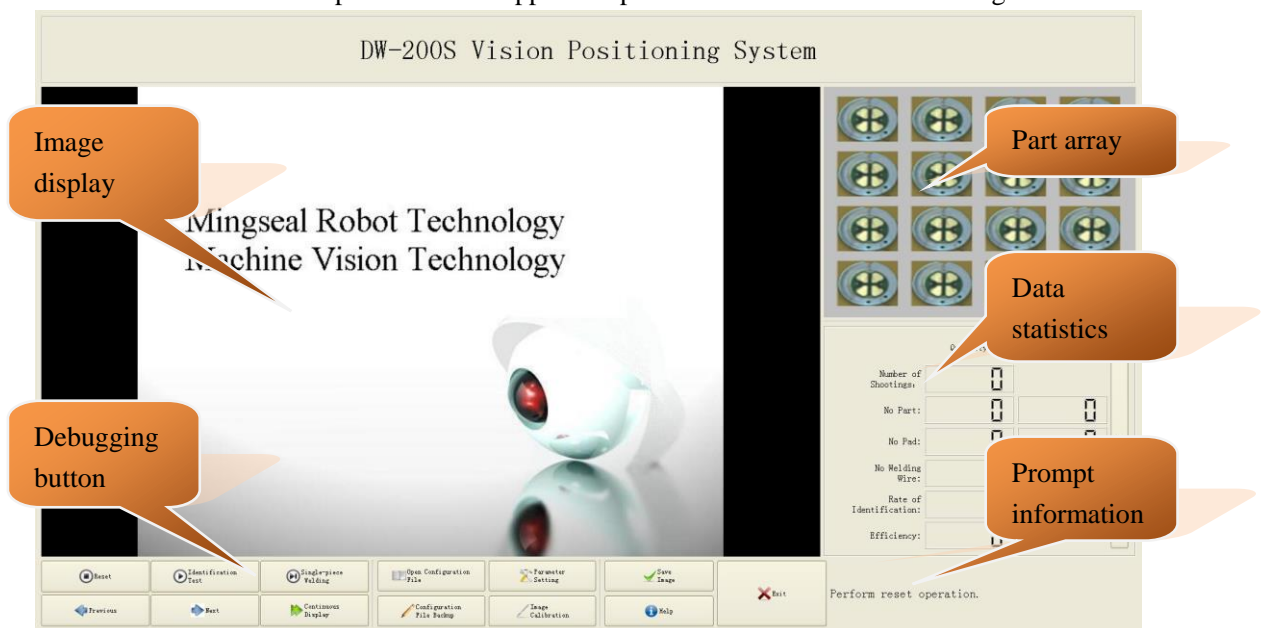




Fig. 1 Software Startup Interface

The software interface mainly consists of a title bar, an image display window, a part array window, data statistics information, a prompt information bar, and several operation and control buttons.

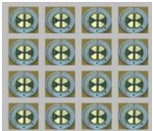
The software system name is displayed on the title bar;

The image display window can display the real-time image and its processing result;

**Table 1 Function Description of Main Interface Controls**

Control Name	Type	Operating Mode	Function Description
 Reset	Button	Mouse click	The machine will perform the reset action after clicking this button;
 Identification Test	Button	Mouse click	The software will perform a complete image processing process and display the image

			processing result after clicking this button.
	Button	Mouse click	Click this button to perform the single-piece welding action after extracting the welding point position through the “Positioning Test”.
	Button	Mouse click	A setting dialog box will pop up to set relevant parameters.
	Button	Mouse click	Load the system parameters from the specified file.
	Button	Mouse click	Save the system parameters into a file.
	Button	Mouse click	Save the current image as a file.
	Button	Mouse click	The platform will move to the previous shooting position after clicking this button.
	Button	Mouse click	The platform will move to the next shooting position after clicking this button;
	Button	Mouse click	Change between “Continuous/Single Frame” modes to display the image.
	Button	Mouse click	Start an image calibration process to calibrate the relative position of the image and the welding work surface.
	Button	Mouse click	Display the help document.
	Button	Mouse click	Close the software.

	Picture	Mouse double click	A part arrangement mode setting dialog box will pop up to set the part shooting position after double clicking this picture.
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### 3.2 Function Menu

After right clicking a part icon in the “Image Display” area and “Part Array” area on the main interface, the pull-down menu will pop up as shown in Fig. 2 and Fig. 3 respectively.



Fig. 2 Right-click Menu Items in Image Display Area

Table 2 Description of Right-click Menu Items in Image Display Area

No.	Menu Item	Description
1	Image Brightness Adjustment	A dialog box will pop up after clicking this item. Adjust the image brightness by setting the exposure time and image gain value of the camera, so that the contrast ratio of the welding wire and the pad is optimal.
2	Show Ruler	A reference ruler will be drawn on the image display window based on the image system calibration result after clicking this item.
3	Turn On/Off Light Source	Manually control the ON/OFF state of the light source below the camera after clicking this item.
4	Start/Close Monitoring Camera	The window will automatically change between the image processing camera and the monitoring camera after clicking this item.
5	Set Shooting Delay	A dialog box will pop up to set the shooting delay after clicking this item. The delay means the interval between the time when the platform moves to the shooting position and the time when the image shooting is started, so as to reduce the interference of equipment shake with the image acquisition during the platform movement.
6	Manual	After clicking this item, it is possible to adjust the



	Fine-adjustment of Platform	platform position within the image display range by pressing and holding the left button and dragging the cursor. After that, the current coordinate value can be seen at the lower right corner.
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Taken the current part  
 Set the offsets for current welding  
 Set all weld offsets zero

Fig. 3 Right-click Menu Items in Part Array Area

Table 3 Descriptions on Right-click Menu Items in the Part Array Area

No.	Menu Item	Description
1	Shoot Current Part	The motion platform will move to this shooting position after clicking this item.
2	Set Welding Offset of Current Part	<p>A dialog box will pop up after clicking this item to set the position compensation for the part welding at this position. Wherein, the configurable quantity corresponds to the number and sequence of search areas in the parameter setting. That is to say, if the number of search areas currently set is 2, two pad offsets respectively corresponding to the offset positions of the welding points identified in the two search areas can be set.</p> <p>The welding offset is in mm.</p> <p>It is recommended not to set any offset value with this function as far as possible.</p>
3	Zeroing of All Welding Offsets	Cancel the welding point offsets of all parts in the current parameter configuration.

## 4 Application Setting

When using any new parts, please set the software by referring to the following procedures.

### 4.1 Part Array Mode Setting

- (1) Fully load the tooling plate with parts, and then place it onto the loading platform;
- (2) Reset;
- (3) Double click the part arrangement mode picture at the upper right corner of the interface, and set relevant parameters in the pop-up dialog box as shown in Fig. 4;

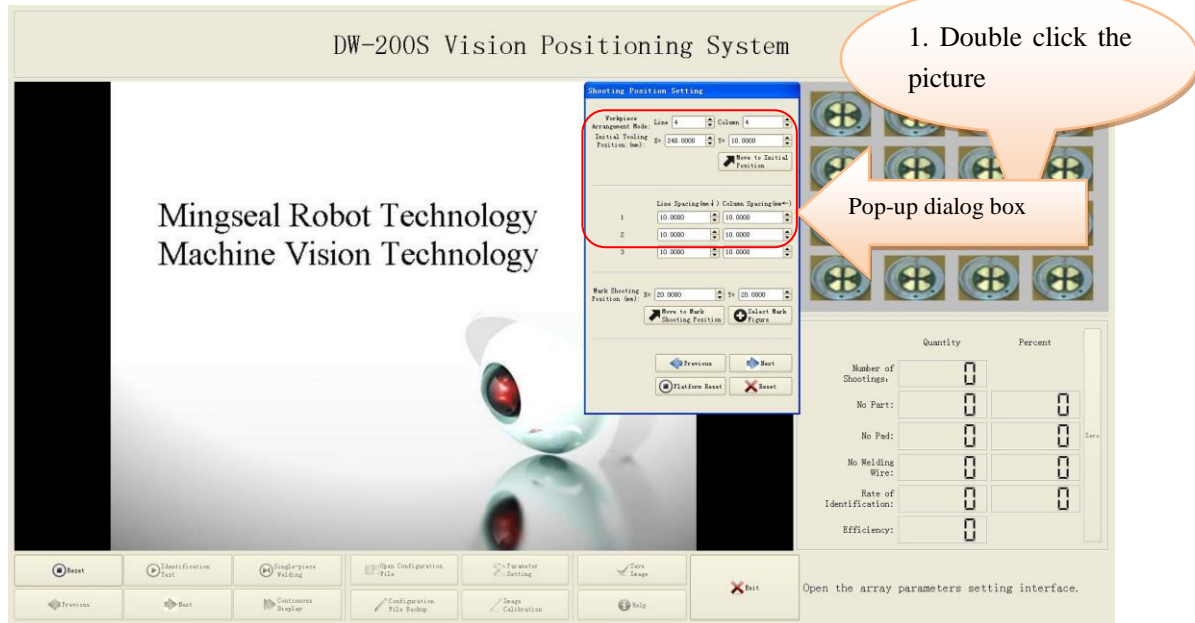


Fig. 4 Array Mode Setting Window

Wherein, the arrangement mode means the mode in which the parts are placed onto the tooling plate. The array picture will show the corresponding change after the corresponding value is modified.

The initial position represents the distance between the lens shooting center and the first part (upper right corner of the loading plate) during reset, and the unit is mm. For example, the figure (11, 23) indicates X axis of the platform moves 11mm towards the right, and Y axis moves 23mm backwards. The first part is in the camera field, and the part shall be moved to the image center as far as possible during setting.

Besides, the line spacing and column spacing represent the distance between each line and previous line or each column or previous column respectively, and can be set according to the tooling design dimension. Wherein, the line and column definitions are: the first line and first column are shot for the first time, and the first line and second column are shot after clicking “Next”, and so on.

- (4) Check one by one whether each part can be moved to the camera field by pressing the “Next” button. Exit the dialog window after setting.

## 4.2 Image System Calibration

### 4.2.1 Calibration Setting

- (1) Cut a piece of printed mark figure (see Appendix) into a size of 10mm\*10mm, and paste it onto a proper position of the tooling with double-sided adhesive (e.g. the center of tooling plate), **while guaranteeing that the mark is flush with the welding surface height;**
- (2) Double click the part arrangement mode picture at the upper right corner of the interface, adjust and set the “Shooting Base Point Coordinate” in the pop-up dialog box, and click the “Move to Shooting Base Point”, so that the mark figure is in the image as shown in Fig. 5.
- (3) Click the “Select Base Point Figure”, move the cursor into the image, and click the left mouse button in the central position of the cross mark; the software will automatically

extract the central position of the cross mark figure as shown in Fig. 5.

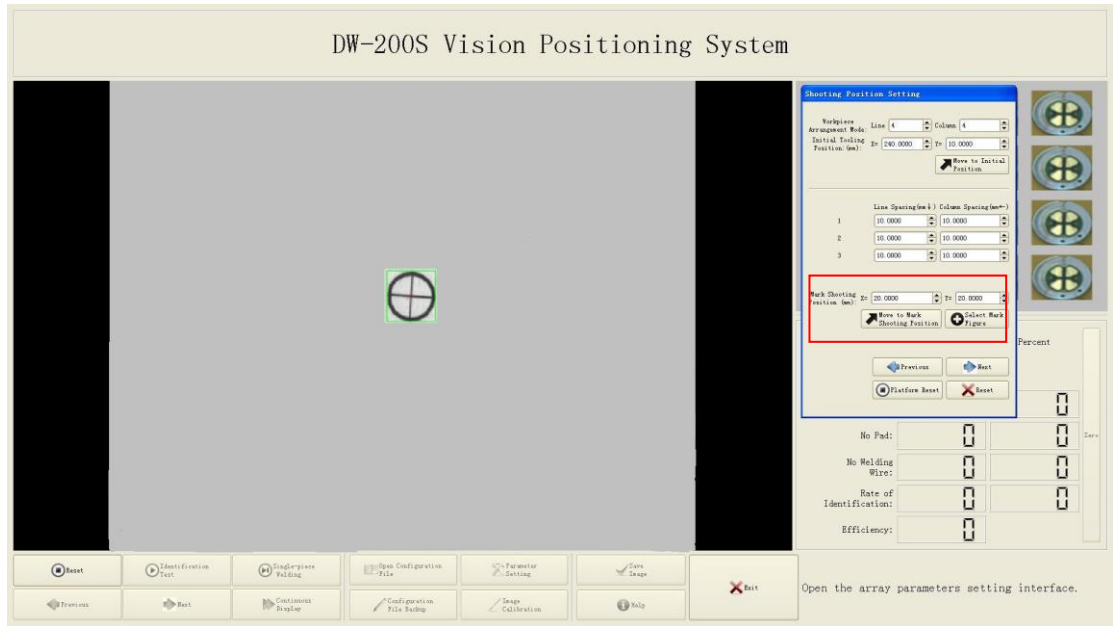


Fig. 5 Calibration Parameter Setting

Note: Do not tear down or move the mark after setting for use during calibration operation.

#### 4.2.2 Image System Calibration

- (1) Place the tooling with the mark figure onto the loading platform.
- (2) Click the “Image Calibration” icon on the main interface, and then wait for the machine to automatically complete the calibration process.

Note: Pay attention to viewing the prompt information, and refer to 4.2.1 for resetting if the calibration fails.

#### 4.2.3 Calibration of Welding Reference Point

- (1) Place the tooling with the mark figure onto the loading platform.
- (2) Press the “Calibrate” key at the upper left corner of the metal keypad of the machine; and the machine will automatically move the loading platform.
- (3) Then, move the figure to be close to the welding head. At this time, adjust the relative position of the platform and the welding head through three groups of direction keys X, Y and Z on the metal keypad, making the welding head center aligned with the mark figure center;
- (4) Press the “OK” key on the metal keypad to reset the equipment.

Note: Pay attention to viewing the prompt information, and refer to 4.2.1 for resetting if the calibration fails.

### 4.3 Image Processing Parameter Setting

Move a part to the camera shooting position after setting the part array mode and completing the image system calibration; then click the “Parameter Setting” button on the main interface and set relevant image processing parameters in the pop-up dialog box as shown in Fig. 6.

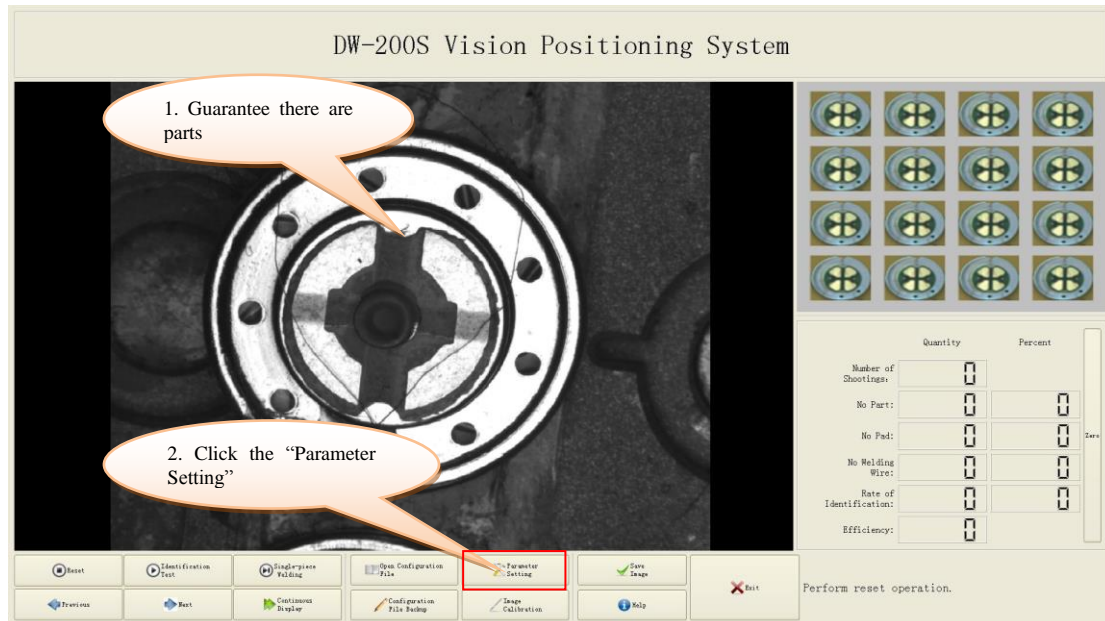


Fig. 6 Parameter Setting

#### 4.3.1 Identification Parameter Setting

- (1) Select the “Parameter Setting” page in the pop-up dialog box, as shown in Fig. 7;
- (2) Click the “Select Part Template”, then move the mouse to an appropriate location, press and hold the left mouse button to draw a rectangle including the part image in the image;
- (3) Click the “Add Search Area”, move the cursor into the image, and draw one or several rectangles including the pad according to the number of the pads required to be welded in the parts. The dimension and position of each rectangle can be finely adjusted in the parameter list at the upper right side; wherein, the positioning mode of the welding point is the positioning type of the welding point after the welding wire is extracted; the software supports the topmost, bottommost, leftmost and rightmost endpoints of the welding wire respectively, and if the offset is set, then move an offset value oppositely according to the different positioning mode. For instance, if the positioning mode is set to “Left Side Point”, and the offset is “0.2”, it indicates that the welding point is located at a position on the leftmost of the welding wire but moved by 0.2mm towards the right. The offset isn’t supported if the point positioning mode is “Middle Point”.
- (4) Set the “Number of Welding Points” according to the number of welding points of a single workpiece required to be welded among the workpieces.
- (5) Click the “Automatic Measurement” at the right side of the “Pad Segmentation Threshold”, and then select a rectangle including the pad boundary in the image with the mouse; the software will automatically calculate the contrast ratio of the pad and the background and display it on the interface. Fill this value in the “Pad Segmentation Threshold”.
- (6) Click the “Automatic Measurement” at the right side of the “Welding Wire Diameter”, and then select a small section of welding wire in the image respectively; the software will automatically calculate the welding wire diameter in the current image. Fill this value in the corresponding “Welding Wire Diameter” parameter item.
- (7) Click the “Automatic Measurement” at the right side of the “Welding Wire Contrast

Ratio”, and then select a small section of welding wire in the image respectively; the software will automatically calculate the contrast ratio of the welding wire and the pad in the current image. Fill this value in the corresponding “Welding Wire Contrast Ratio” parameter item. Note: The wire width and contrast ratio automatically calculated by the software are only for reference; and if the identification rate is low, these two values can be appropriately decreased.

- (8) The “Length Coefficient” represents the characteristics of the object which is identified by the software as the welding wire, and is similar to the ratio of welding wire length and diameter, and is recommended to be “4-10”; if the welding wire on the pad is short, this value can be decreased.
- (9) Click the “Clear Defined Pads” button; click the “Select New Pad Shape” button; at this time, the contour lines of various parts on the image will be automatically displayed. If the pad cannot be accurately identified among the contour lines, adjust the “Pad Segmentation Threshold” until the accurate pad contour is displayed in the image. Then, move the mouse into the image, click the inside of the pad contour; the software will automatically fill this pad into white. If the shape of all pads is the same, only one pad can be selected; otherwise, if there are several pads of different shape required to be welded, please respectively select more.
- (10) Click the “Save”.

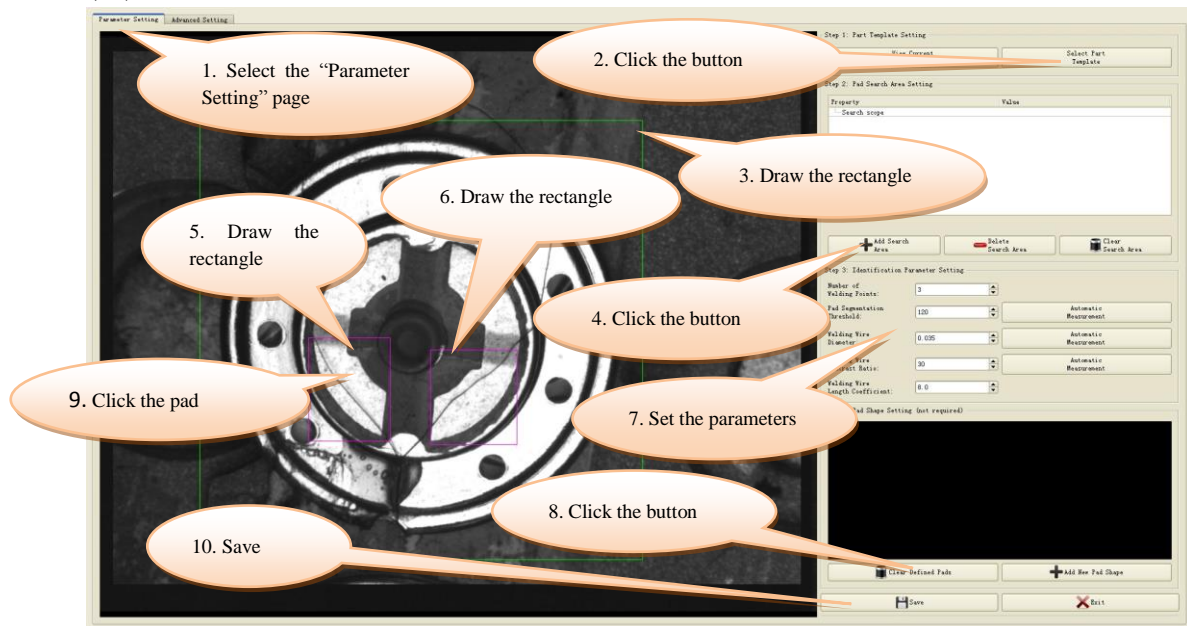


Fig. 7 Part Template Setting

### 4.3.2 Advanced Setting

- (1) Select the “Advanced Setting” property page in the pop-up dialog box, as shown in Fig. 8;
- (2) Parameter description

Parameter Item	Description	Remark
X-axis Resolution	Motor	The fixed value of DW-200S X axis is 0.0040, and the fixed value of Y axis is 0.0040. Please do not modify them without permission.
Y-axis Resolution	Motor	

X-axis Effective Stroke	The fixed value of DW-200S is 0-300. Please do not modify it without permission.	
Y-axis Effective Stroke	The fixed value of DW-200S is 0-200. Please do not modify it without permission.	
Loading & Unloading Position	It represents the material waiting position for the upper & lower clamps of the loading plate.	
Welding Reference Point	It represents the reference position of welding, and can be manually modified, so as to finely adjust the reference point in the case of lack of calibration figures.	
Synchronous Correction of Image Reference Point and Welding Reference Point	If this item is checked, ensure that there are mark figures specified in 4.2.1 when adjusting the welding reference point. Otherwise, the reference point can be finely adjusted according to the welding effect. It is recommended not to check this item.	
Initial Step During Automatic Calibration	It represents the displacement distance between the second and the third shooting points during image calibration, and the set value is recommended to be "2-4".	Unit: mm
Part Position Tracking	If this item is cancelled, the system will not track the part deviation automatically.	Must be checked
Part Rotation Support	If the direction of parts is different in the clamp, this item needs to be checked. Note: Only support the rotation of vertical angle such as 90, 180 and 270, etc. at present.	
Pad Center as Welding Point after Identification	For the workpiece with small pad, the pad center coordinates will be sent as the spot welding position, after the welding wire position is identified.	
Wireless Spot Welding (Pad Center)	The pad center coordinates will be taken as the spot welding position, after the pad position is identified, and there is no need to identify the welding wire.	
Part Similarity	It represents the matching degree of the real time image and the set template, which falls within the value range of 0-1; the bigger the value is, the higher the requirement for part consistency is.	Recommended value 0.4-0.7
Pad Similarity	It represents the matching degree of the real time pad shape and the set pad shape, which falls within the value range of 0-1; the bigger the value is, the higher the requirement for the pad consistency is.	Recommended value 0.4-0.7
Filling Coefficient of Welding Wire	It represents whether the enhanced processing is applied to the cooper wire image; and if the	

welding wire in the image shows a dark margin and white middle, this value can be set to 3~5; otherwise, if the cooper wire is of uniform gray, it can be set to 0-2.

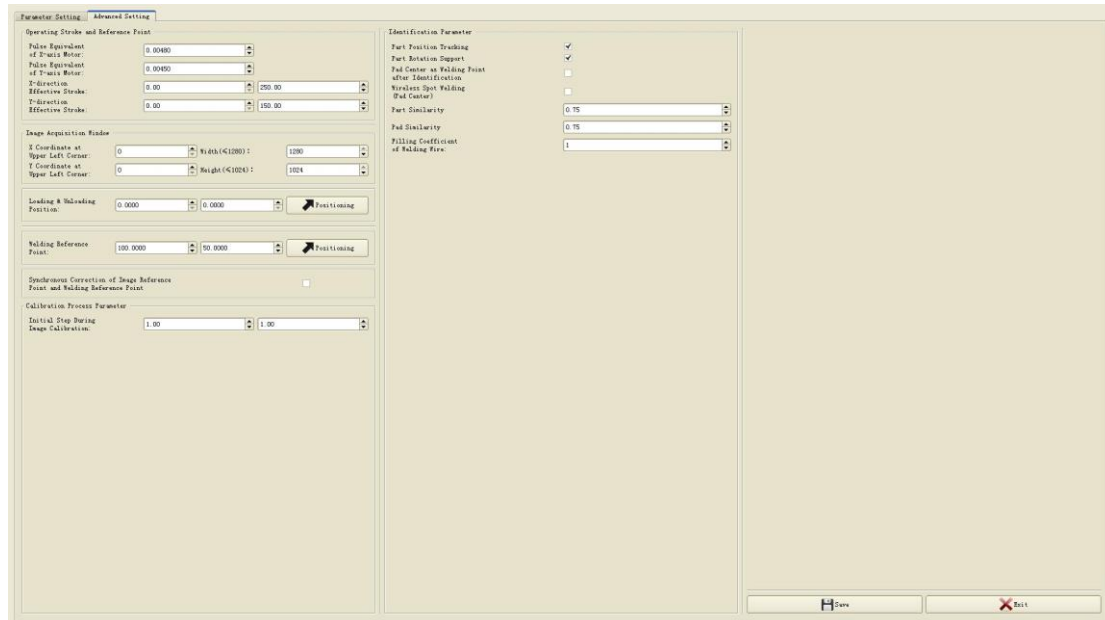


Fig. 8 Advanced Setting

## 5 Appendix

### 5.1 Mark Figure

The mark is a circle with a diameter of 6mm and a cross sign; see Fig. 9 for detailed dimensions. It can be drawn and printed with the software such as CAD and Word according to the dimensions, and the document can be separately taken out and printed; extra edges must be reserved when the cutting function is applied; and it shall be pasted after being cut into 10mm×10mm as shown by the dotted line in Fig. 9.

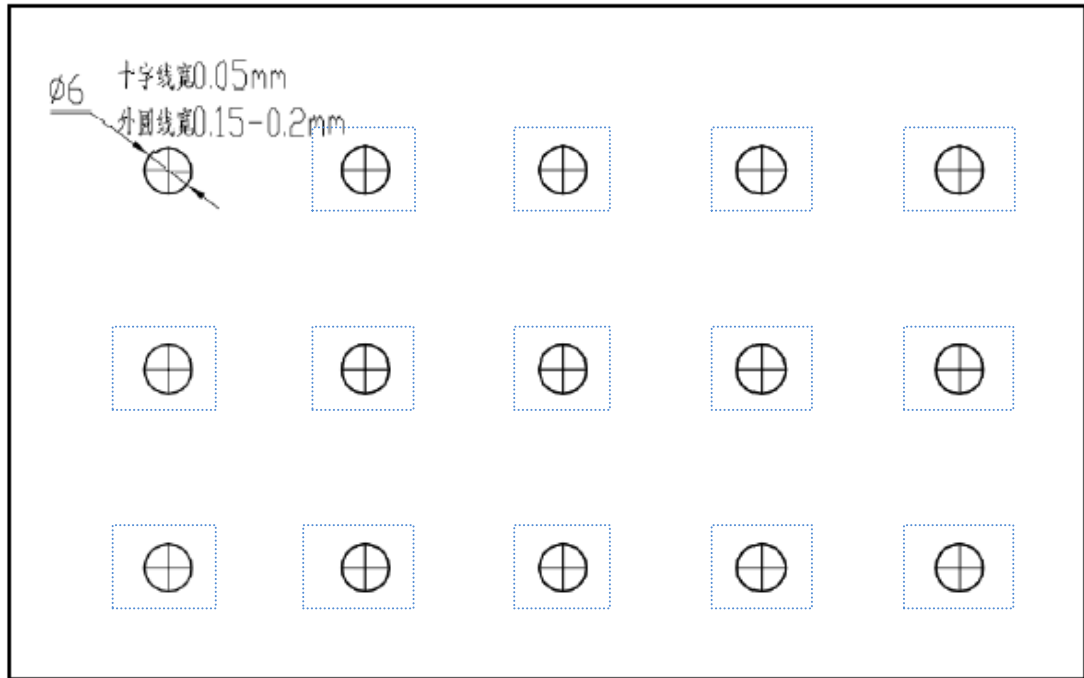


Fig. 9 Cross Mark Figure