Automated Optical Inspection System

NeoDen Equipment

NeoDen 800

User Manual

V 3.2

 Warning	To ensure the safe use of AOI equipment, please read this Manual carefully before using it. Do not operate this equipment without professional training.

Company website: www.neodentech.com

Zhejiang Neoden Technology Co., Ltd.

As the equipment hardware and software of the Company have been continuously upgraded, the content described in this Manual might be different from real object of the equipment. The Company reserves the right to change the content of this Manual without prior notice to users.

If you have any doubts or problems about error, improvement, wrongly written words / omission words with this Manual and equipment, please contact us according to the contact information at the bottom of this page.

Zhejiang Neoden Technology Co., Ltd.

http://www.neodentech.com

No.18,Tianzihu Avenue,Tianzihu Town,Anji Country,Huzhou City,Zhejiang Province,China

Tel.: 0571-571-2626

 Warning	Please move the equipment with effective packaging materials and power protection. Failure to take appropriate safety measures may result in personal injury. This equipment complies with the wireless interference prevention standards of industrial/commercial area. The use of this equipment in the vicinity of residential regions may cause interference to the signals received by radio or television and may affect the functions of medical equipment. Please use it correctly according to the instructions in this Manual. Do not operate the equipment in a place without protection device, and do not ignore the safety regulations, warnings and precautions. Otherwise, personal injuries may be caused. It is strictly prohibited to operate the equipment with the lid open. Otherwise, personal injuries may be caused. When maintaining the equipment, please disconnect the power supply of the equipment before starting the operation. Otherwise, personal injuries may be caused.

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Chapter I Preface

Thank you for choosing our Automation Optical Inspection (AOI). This professional equipment is mainly used to check the mounting and welding quality, installation status and solder paste printing effect of the components on the SMT production line, and display the unqualified products through display terminal.

When using AOI, please observe the following matters:

- Please read this Manual thoroughly and use it correctly on the basis of full understanding.
- A copy of this Manual is attached. Please keep it for reference at any time.
- This Manual contains relevant information on the mechanical structure, safety maintenance, AOI programming and operation of this equipment, and is formulated for the personnel using this product.
- All information contained herein is subject to change without prior notice. The seller is not responsible for direct or indirect losses caused by manual changes.

Chapter II Main Uses and Scope of Application of Equipment

2.1 Introduction of AOI

2.1.1 What is AOI

AOI (Automatic Optical Inspection) is a new type of testing technology developing rapidly in recent years. It is composed of workbench, CCD camera system, electromechanical control and system software. During inspection, the circuit board to be inspected is first placed on the workbench of AOI machine, and the inspection program of the product to be inspected is called out through positioning. The X/Y workbench will send the circuit board under the lens according to the command of the set program. With the assistance of special light source, the lens will capture the image required by AOI system and carry out analytical processing. Then the processor will move the X/Y workbench to the next position to collect and carry out analytical processing on the next image. Through continuous analytical processing on the image, a higher inspection speed can be obtained. AOI image processing in essence is to digitize the captured images, and then compare them with pre-stored "standards". After analysis and judgment, if defects are found, their position will be prompted, and image characters will be generated for further confirmation by the operator. Or, the circuit board will be sent to the maintenance platform for maintenance.

2.1.2 Implementation goal of AOI

AOI used in SMT production line is mainly for the following two targets:

① Final quality: monitoring the final state of the product when it goes down the production line. At this time, AOI is usually placed at the end of the production line. In this position, the equipment can obtain a wide range of process control information.

② Process tracking: monitoring the production process by using inspection equipment. It is often required to place the inspection equipment at several positions on the production line to monitor the specific production conditions on-line and provide necessary basis for the adjustment of the production process.

2.2 Placement position of AOI

AOI can be arranged at multiple positions of the production line. For its main purposes, three positions are common:

① AOI inspection is arranged after solder paste printing: the AOI inspection is arranged after the solder paste printing, which is a typical arrangement because many defects are caused by poor solder paste printing. Insufficient solder paste may lead to component loss or open circuit.

② Before reflow soldering, the inspection equipment should be placed behind the chip for inspecting the defects caused by the defects of the chip.

③ After reflow soldering, the inspection equipment is placed after reflow soldering, which is the most common AOI placement position. It can inspect the defective products in all previous processes to ensure that the final defective products are not used by customers.

Chapter III Working Conditions of Equipment

To avoid external factors affecting the normal use of this equipment, please follow the following items:

3.1 Operating environment of this equipment:

The environment temperature of the equipment is: 10℃ to 35℃; the relative humidity is:35% to 80%.

The equipment should be placed in a place free from direct sunlight, dew and splashing of chemical liquids such as water and oil.

3.2 When the equipment is in normal use, please reserve a certain space in front of and behind the equipment so as to facilitate the maintenance of the equipment and the emission of internal heat. Do not cover the equipment with cover during its normal operation, so as not to affect the heat emission.

3.3 Please keep the equipment in the following places when the equipment is not used:

Environment temperature: 0℃ to 40℃; relative humidity: 35% to 80%

The equipment should be placed in a place free from direct sunlight, dew and splashing of chemical liquids such as water and oil.

To prevent dust, the equipment may be covered.

3.4 Impact or strong vibration should be avoided. Otherwise, the failure of equipment may be caused.

3.5 When cutting off the power supply of the equipment, please perform the system exit/shutdown process in the following order. If the power supply is directly cut off or restarted without performing this process, the data will not be kept intact and the hard disk may also be damaged.

The correct exit procedure is as follows:

Exit application program → Exit Windows → Cut off power supply

3.6 When the equipment is running, do not open the safety door of the equipment to avoid accidents.

3.7 Repeated ON /OFF of the power supply will cause the failure of the main machine. After the power supply is OFF, please restart the power supply after 20 seconds.

3.8 To prevent the PCB or equipment to be inspected from being damaged, please use the substrate of inspection object conforming to the specifications and dimensions of the equipment. It is necessary to note that the height requirements of the equipment for the parts of PCB are as follows:

Height of front part of PCB inspection surface ≤ 30 mm

Height of back part of PCB inspection surface ≤50mm

Chapter IV Main Technical Parameters

Programming mode: automatic writing, manual writing, CAD data import, automatic component library matching

Inspection mode: optimized inspection technology covering the whole circuit board. Jointed board and multi-mark with Bad Mark function

Inspection type: whether paste printing has parts defects such as offset, lack of tin, excessive tin, open circuit, pollution; whether there are mounting defects such as missing parts, offset, skew, Manhattan effect, side erection, turning over, wrong parts, breakage, reverse, etc; whether there are solder joint defects such as excessive tin, lack of tin, cold soldering and bridging; whether there are PCB defects such as copper foil pollution, black pad, blister, lack of copper foil, oxidation, etc.

Image recognition: automatically setting parameters (such as offset, polarity, short circuit, etc.) according to different inspection requirements.

SPC statistics function: recording the inspection data in the whole process, and making statistics and analysis. Viewing the production status and quality analysis of any area.

PCB size: 50*50mm(Min)-500*400mm(Max)

PCB bend: < 5mm or 3% of PCB diagonal length

Height of PCB parts: above < 30mm, below < 50mm

PCB transmission system: bottom-up fixing, automatic compensation for PCB deformation, automatic board feeding and discharging, automatic adjustment of width

Positioning accuracy: <16um

Movement speed: 800mm/sec

Image processing speed: 0402chip < 12ms

Camera and lighting system: full-color high-speed digital CCD camera, optional lens resolution between 10 , 15, 18, 20um available, three-channel RGB light source

Driving system: AC servo motor system, precision grinding ball screw

Minimum part inspection: 01005chip & 0.3pitch IC

Software system: Windows 7

Calculation methods: color operation, color extraction, gray scale operation, image comparison, etc.

Output display: 22-inch widescreen (16:10,1680*1050 resolution) display

Output signal: OK/NG signal, equipment operation status signal, alarm signal

Network communications: supported

Data transmission tool: supporting CAD, Excel, Txt and other commonly used formats

Machine models: NeoDen 800,

Weight of equipment: 550KG

Dimensions of equipment: 980*980*1620mm

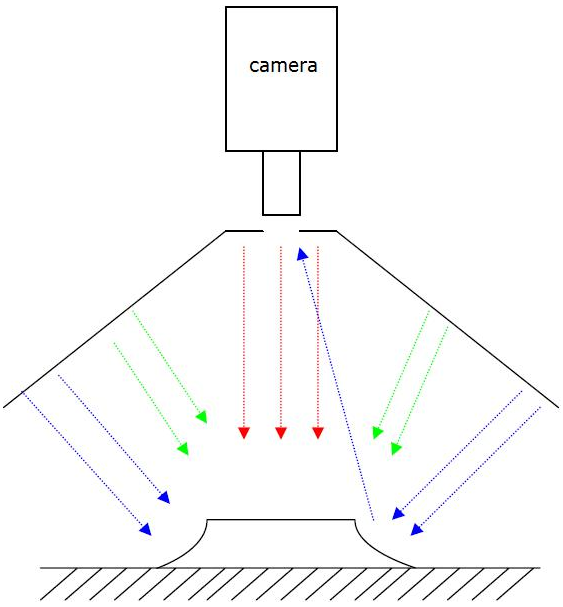
Air pressure requirement: compressed air in pipeline is required, ≥0.49MPa

Chapter V Main Working Principles

This equipment performs inspection mainly based on optical principle and comprehensive use of principles color operation, color extraction, gray scale operation, image contrast.

5.1 Optical principle

AOI's light source is composed of red, green and blue LED lamps. The three primary colors are combined into different colors. Combined with the specular reflection, diffuse reflection and oblique reflection in the optical principle, the welding of the patch elements on the PCB is displayed. As shown in the following figure:



5.2 Color operation principle

Through rasterization of a BMP picture, the imaging details, such as the position coordinates of the color distribution of each pixel and the color transition relationship between imaging grids, are analyzed and several functional formulas are listed. Then, data extracted from several similar pictures with the same area size is analyzed and calculated. The calculation results are restored according to the weight relationship set by software and the pixel colors and coordinates of the original BMP image to a virtual and weighted digital image. The main digital information covers the image's graphic outline, color distribution, weight relationships allowing changes, etc.

5.3 Principle of image contrast

During test, the equipment captures the images of the inspected circuit board through the CCD camera system, transfers the images into the computer through digital processing, calculates and compares the images with the standard images (the comparison items include the

size, angle, offset brightness, color and position of the components, etc.) and outputs the images with the comparison results exceeding the rated error threshold through the display, and displays the specific positions of the images on the circuit board.

5.4 Principle of color extraction

Any color can be mixed with red, green and blue in a certain proportion. A three-dimensional color cube is formed with red, green and blue. Color extraction is to cut a small color cube that we need from a set of color cubes. In other words, the color range is selected according to needs. Then, whether the ratio of the color in the inspected image that meets the color in the cube to the total number of colors in the image meets the setting range required. Under the red, green and blue light, this method is most suitable for the inspection of soldering tin such as resistance and capacitance.

5.5 Principle of gray scale operation

The target image is converted into gray scale image according to certain method. Then, a certain brightness threshold is selected for image processing. The image below the threshold is directly turned into black, and the image above the threshold is directly turned into white. In this way, the concerned regions, such as characters and IC short circuits, are directly separated from the original image.

Chapter VI Installation and Commissioning of Equipment

6.1 Equipment installation

This equipment is mainly divided into two parts, namely control system and image acquisition system. The equipment has been installed before leaving the factory. It is only necessary to confirm that all signal lines of the control system and image acquisition system have been correctly connected. Turn on the equipment after adjusting the level. Correct the light source and camera parameters.

6.2 Level adjustment

After the equipment is moved to the destination and the specific placement position of the equipment is determined, the level of the equipment must be adjusted first. Correct adjustment of the level can make the equipment run more smoothly, with less noise and longer service life. The steps for adjusting the equipment level are as follows:

- Suspend the four foot cups of the equipment and push it onto the wire body with casters. Ensure that the front rail of the equipment and the front rail of the front machine are on the same longitudinal line. Then adjust the foot cup downward to make the casters suspended, and raise the rail to make it on the same level as the rail of the front machine.
- Adjust the front, back, left and right levels of the equipment. At the same time, confirm that the reference of the equipment track and that of the front machine track are consistent on the longitudinal line and horizontal plane.
- If tools such as wooden stick are used to pry the equipment to slightly move it, please make sure that the wooden stick is in contact with the steel frame at the bottom of the equipment and is not contacted with the equipment casing. Otherwise, the casing will be damaged and even be deformed by forced pry.
- The track width can be adjusted to the same as that of the front machine track. The PCB sliding on both tracks should be smooth without height drop.
- Lock the fixing nuts of the four foot cups.

6.3 Starting the equipment

Connect the air pressure, connect the power supply according to the standard on the equipment nameplate, and ensure the safe grounding of the equipment. Turn on the red universal change-over switch on the right side of the equipment to start main power supply, check to ensure the emergency stop button has not been pressed. Then, turn on the power of the host. After the system normally enters the Windows interface, double click on the AOI software shortcut on the desktop to open the software.

If there is an emergency during operation, press the emergency button immediately. After eliminating the emergency and ensuring that the equipment and personnel are safe, rotate the emergency button clockwise and release it to reset. Press the RUN button again to turn on the main power of the equipment again.

Chapter VII Equipment Adjustment

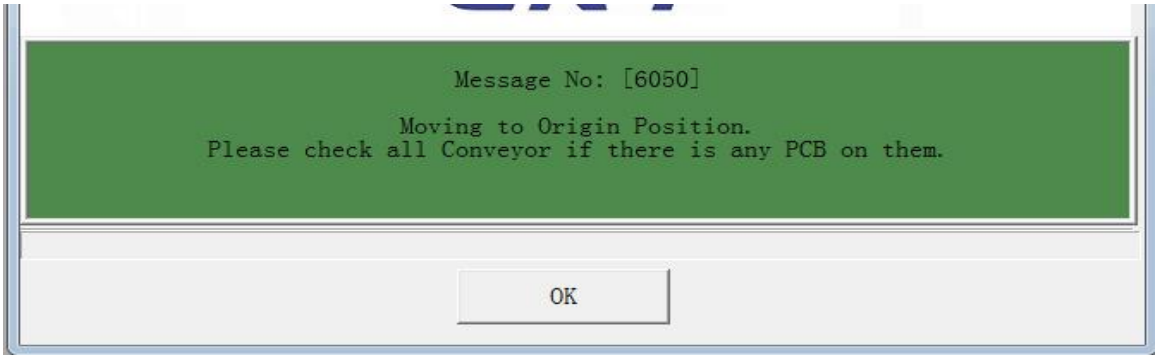
First, make sure that there are two small screw handles locked laterally on the side of the lens. The upper side is the aperture locking screw and the lower side is the focus locking screw. The aperture alignment scale is between 4 and 8, and the aperture locking screw is locked.

7.1 Start-up procedure

Make sure that the emergency stop on the panel is not pressed, and the safety light curtains on both sides of the splint are not blocked.

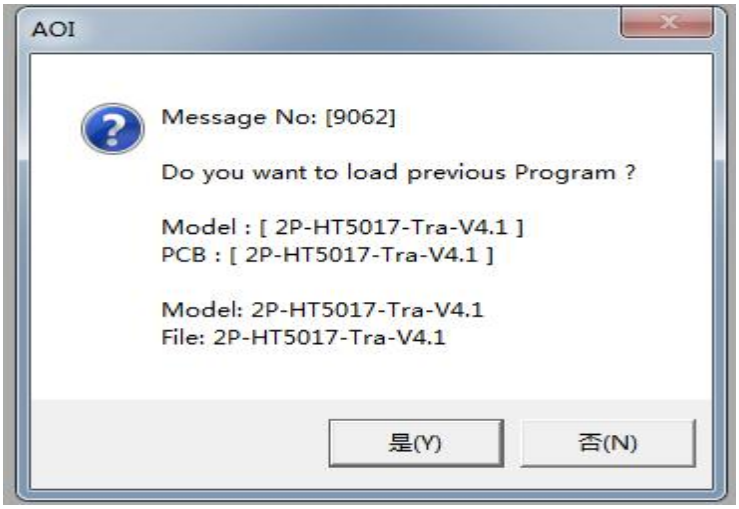
Double-click the shortcut icon of the device main program to start the AOI running program. Enter user: A001 password: 123456 (the default password is 123456).

A dialog box will prompt {Move to the Origin Position, please check whether the equipment is ready …}, click [［OK］],



After returning to the Origin Position; the dialog box prompts (move of the position to be operated); and click [［OK］].

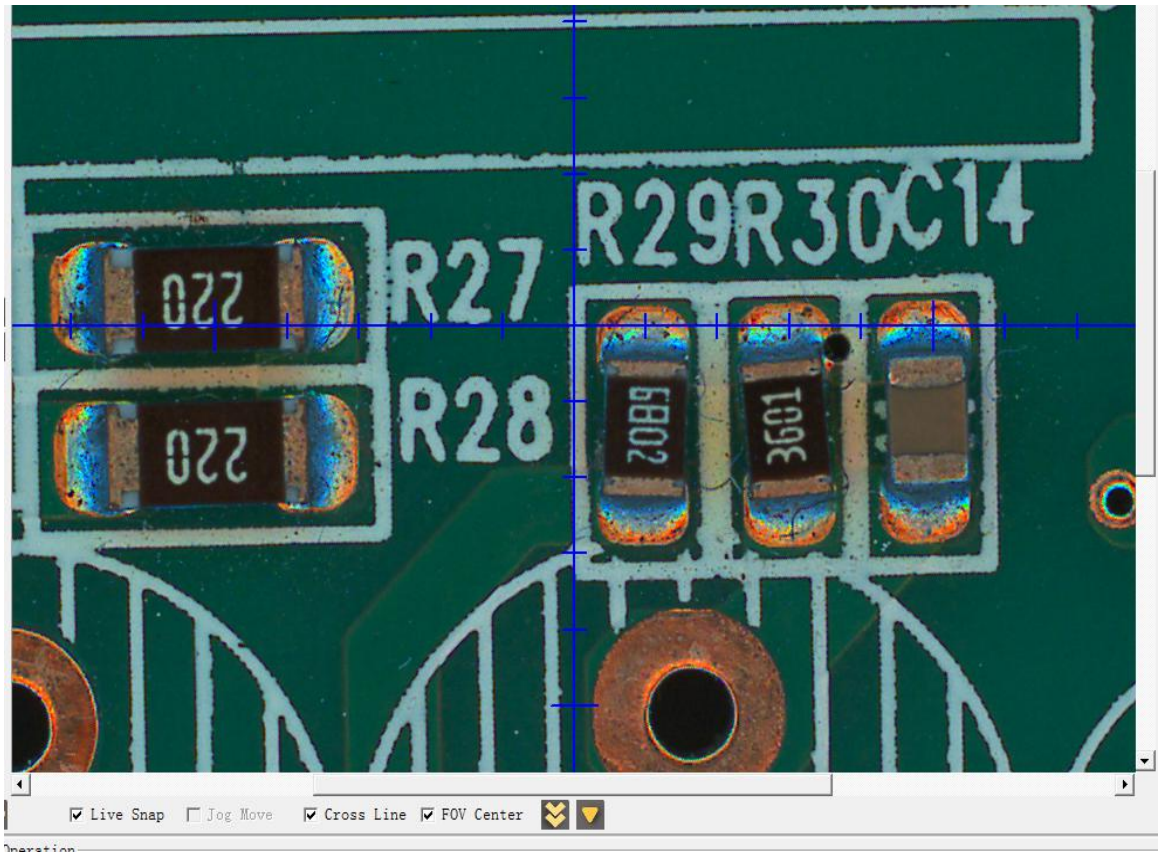
If prompted {Do you want to load previous Program?｝ Click [Yes] or [No] according to actual needs.



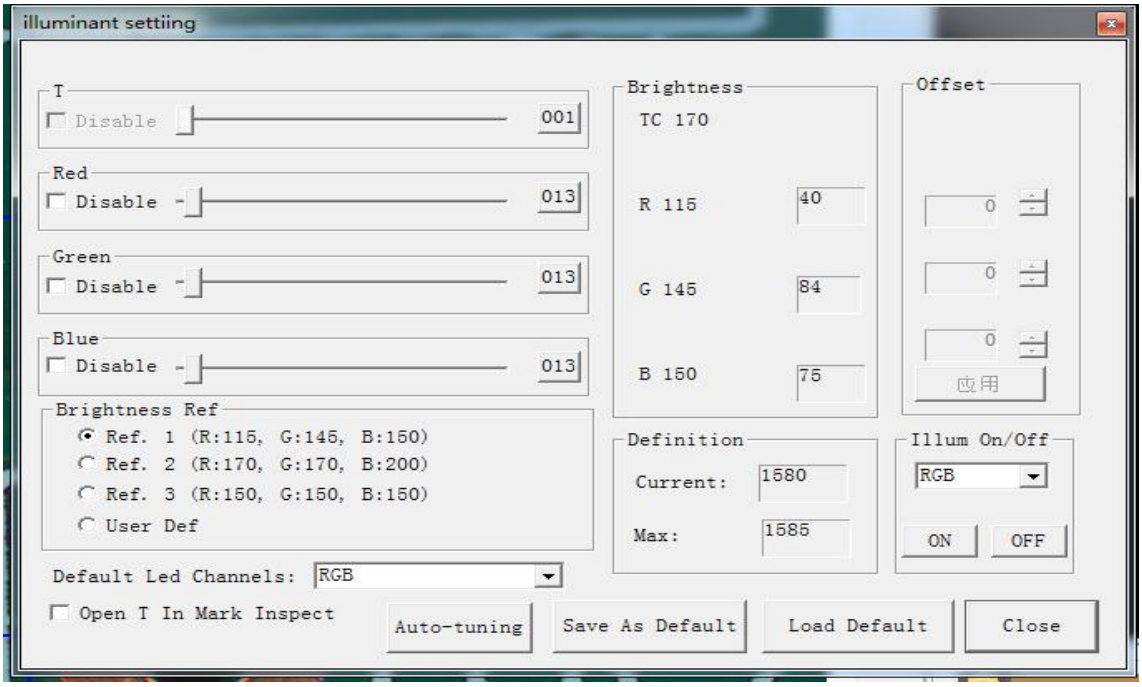
7.2 Camera focus correction (the camera focus correction work will be corrected before leaving the factory, if the height of the mobile camera is different from the fixture height of PCB, it needs to be corrected)

After starting AOI software, open [Working Mode]-[New Mode] in the upper left corner

Make sure that the screw thread between the lens and the camera is locked, select a PCB and put it on the test platform, aim at the components with silk screen printing on the PCB directly below the lens, open [System Configuration]-[Illuminant Setting] in the menu bar, and open [Continuous Acquisition], as shown in the following figure:



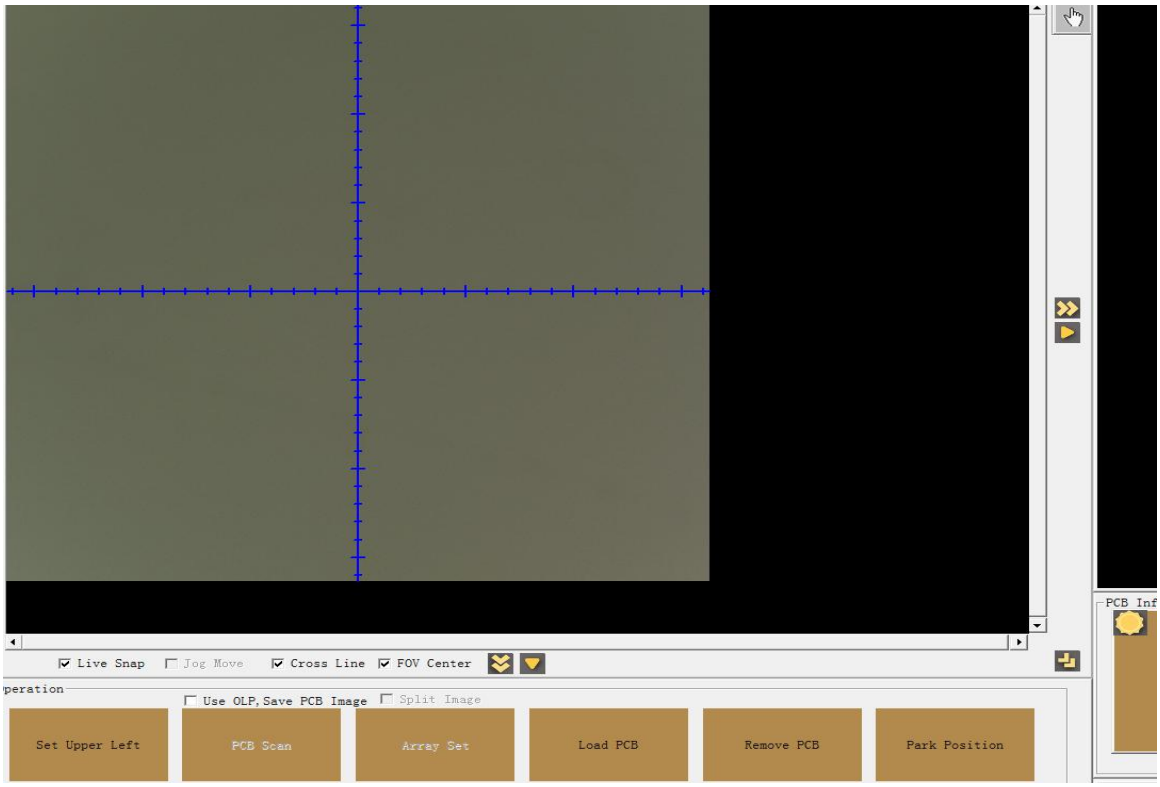
Then open System Configuration-Illuminant Setting as shown below:



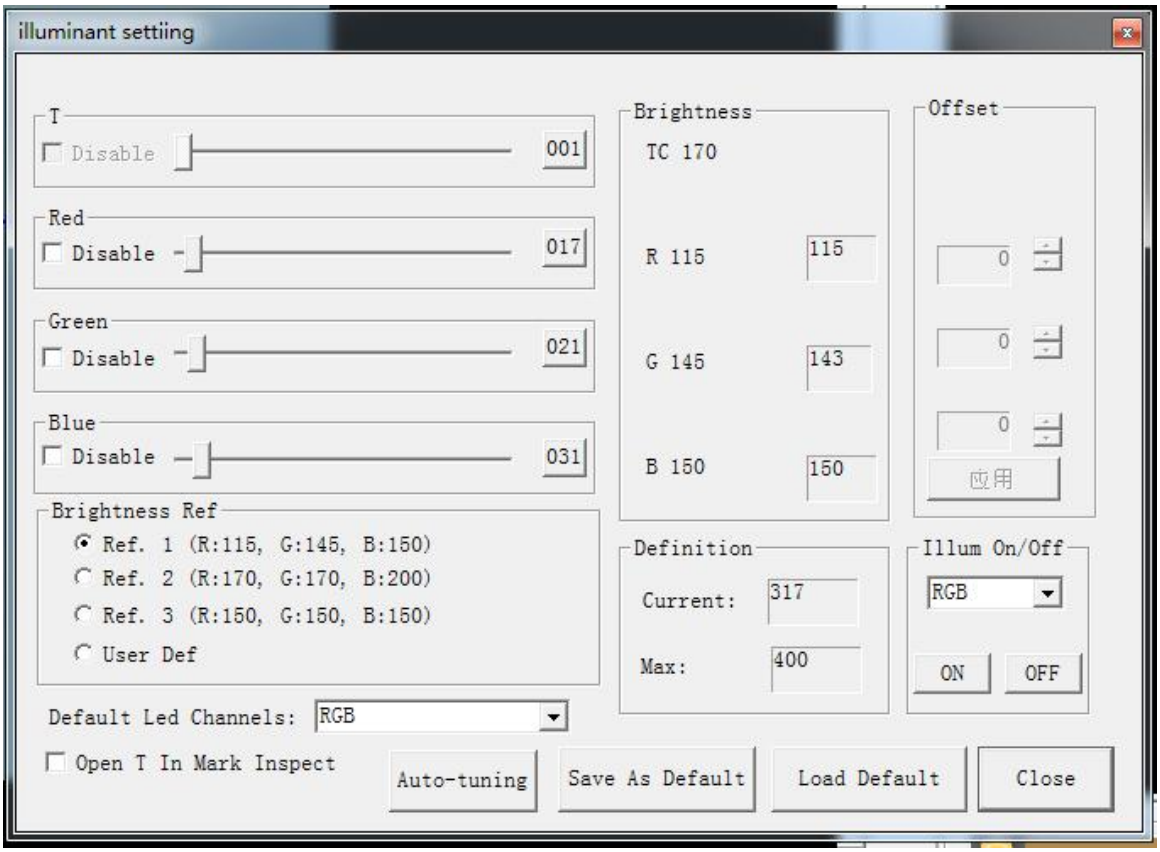
Loosen the focus locking screw, and gently rotate the lower end of the lens in one direction. At this time, the image will display the real-time state of sharpness change, and then rotate the lower end of the lens in the opposite direction. When the [Current Value] is adjusted to the maximum value from left to right, it proves that the focus has been adjusted to the standard value, that is, the best state of sharpness. Lock the focus adjusting screw at this time.

7.3 Illuminant setting (to be adjusted regularly)

Place the randomly distributed standard color card directly under the light source. When the whole inspection window displays the color card part, it is as shown in the following figure.



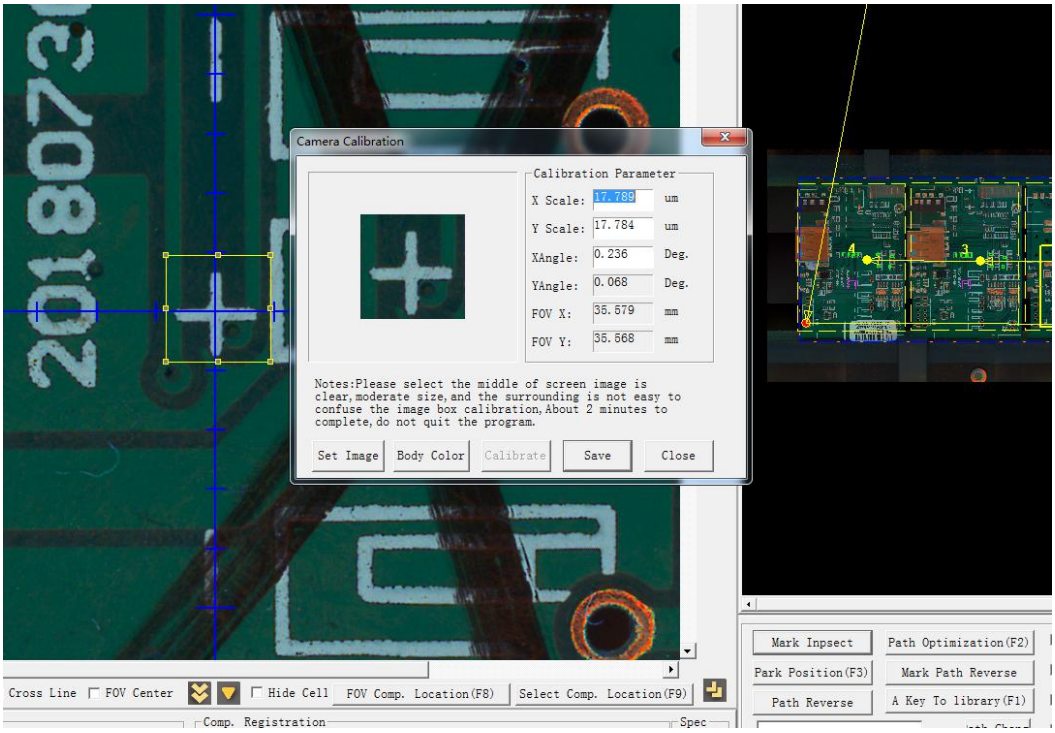
Open [System Configuration]-[Illuminant Setting] in the menu bar, select the appropriate adjustment reference value (generally select the reference value of 1), adjust the light source scroll bar on the left to set the feedback value of light source brightness to within ± 5 of the reference value, and then click [Save as Default], as shown in the following figure:



7.4 Camera lens calibration (the lens calibration will be completed before leaving the factory, and the camera needs to be calibrated again when moving the camera position)

The lens calibration is to measure the vertical and horizontal deviation of the camera lens by specific software, and then compensate and correct it by software. The horizontal deviation of the camera should be within the preset [Inherent Resolution]±1%, and the deviation between X and Y should not be greater than 0.3. the vertical deviation angle of the camera must be within±1 degree.

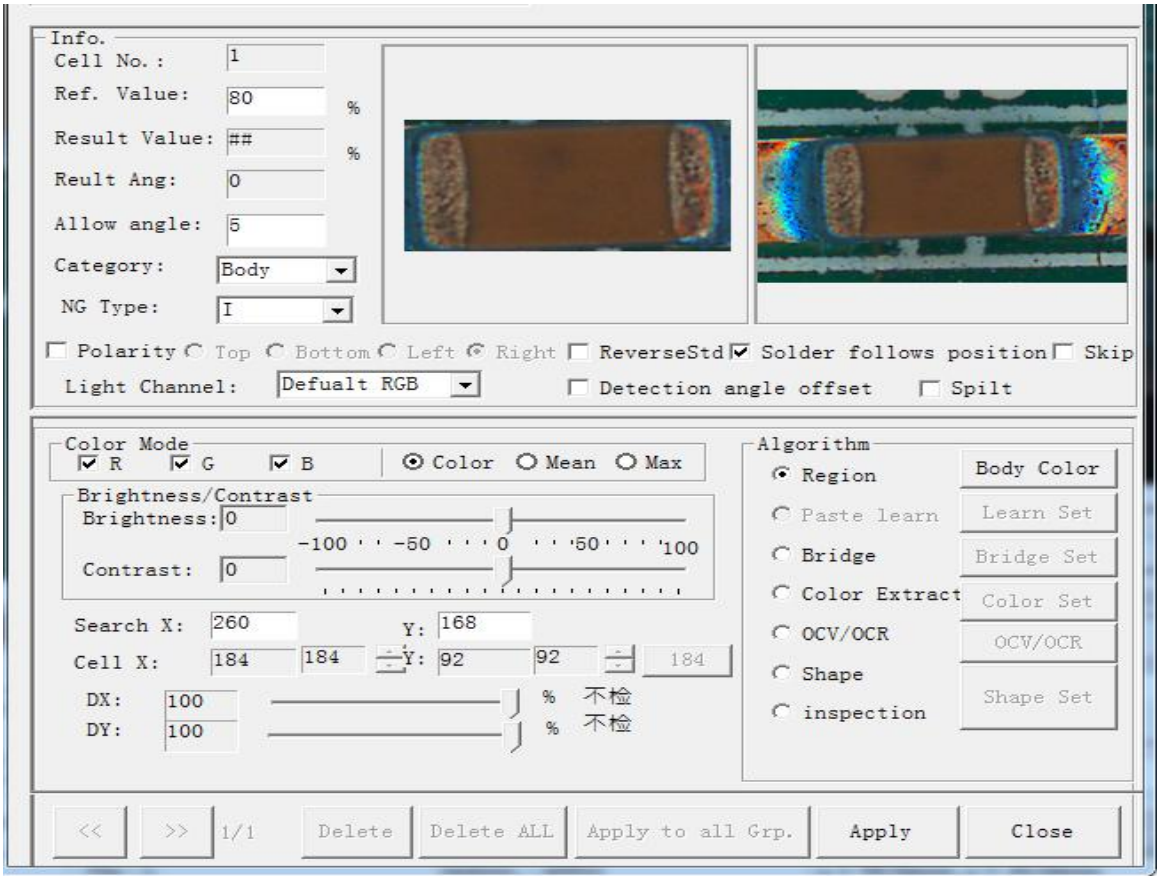
Calibration method: after debugging the camera definition, find a PCB and put it in AOI, then open AOI software and find a single figure (such as screen printing, patch material, through hole, etc.) on the PCB in [Working Mode]-[New Mode]. Note: if it is a unique figure, there cannot be the same figure around it), and move the camera to this position. Then, in the menu bar [System Configuration]-[Camera Calibration], select the selected graphics on the PCB with the left mouse button, click [Set Image], and then click [Calibrate], then the camera will automatically move from right to left and from top to bottom. After completion, the current image scale and angle will be automatically generated. Then click [OK]-[Save Parameters], as shown below:


Camera Calibration
Calibration Parameter
X Scale: 17.789 um
Y Scale: 17.784 um
XAngle: 0.236 Deg.
YAngle: 0.068 Deg.
FOV X: 35.579 mm
FOV Y: 35.568 mm
Notes:Please select the middle of screen image is clear,moderate size,and the surrounding is not easy to confuse the image box calibration,About 2 minutes to complete,do not quit the program.
Set Image
Body Color
Calibrate
Save
Close
Mark Inpsect
Path Optimization(F2)
Park Position(F3)
Mark Path Reverse
Path Reverse
A Key To library(F1)
Cross Line
FOV Center
Hide Cell
FOV Comp. Location(F8)
Select Comp. Location(F9)
Comp. Registration
Spec

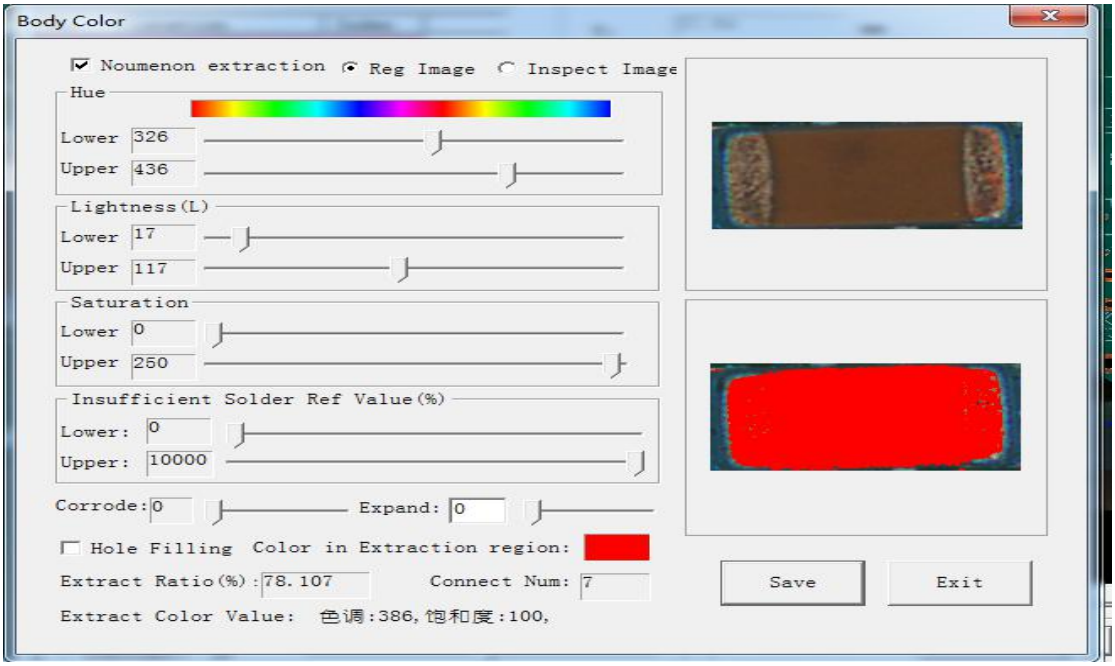
Chapter VIII Programming and Operation of Equipment

8.1 Introduction of software operation methods

Our AOI uses two categories: image contrast and color extraction, as shown in the following figure:

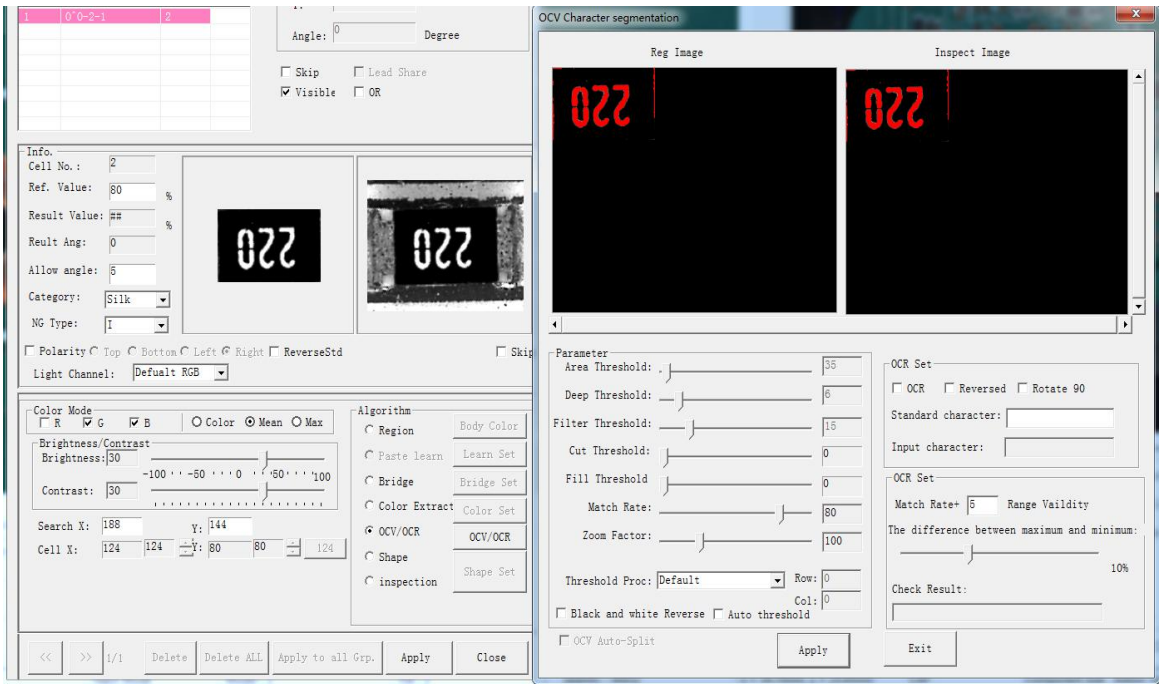


[Region Method]: the principle of this algorithm is image comparison. [Qualified Reference Value] is similarity, which can be modified according to actual conditions. The higher the qualified reference value is, the higher the inspection standard is. And the false alarm will be relatively difficult to debug. If the image is blurred, check [Mean] or [Maximum] or adjust [Lightness] and [Contrast] until the image is clear, and the inspection effect will be better. If you only compare a certain feature in the image, you can click [Noumenon Extraction], as shown in the figure:



In this window, the user selects [Noumenon Extraction], and extracts the pixel regions that simultaneously meet the threshold values of three channels, namely the hue, brightness and saturation of pixels in the image interval, by setting their threshold values, and displays them visually in the lower right extraction diagram. Users can also filter out regions with too large and too small regions by setting the extraction area ratio. If there is a hole in the middle of some extracted regions, the user can check [Hole Filling] to fill it. Please refer to color extraction for operation details here. This algorithm is generally used for noumenon inspection.

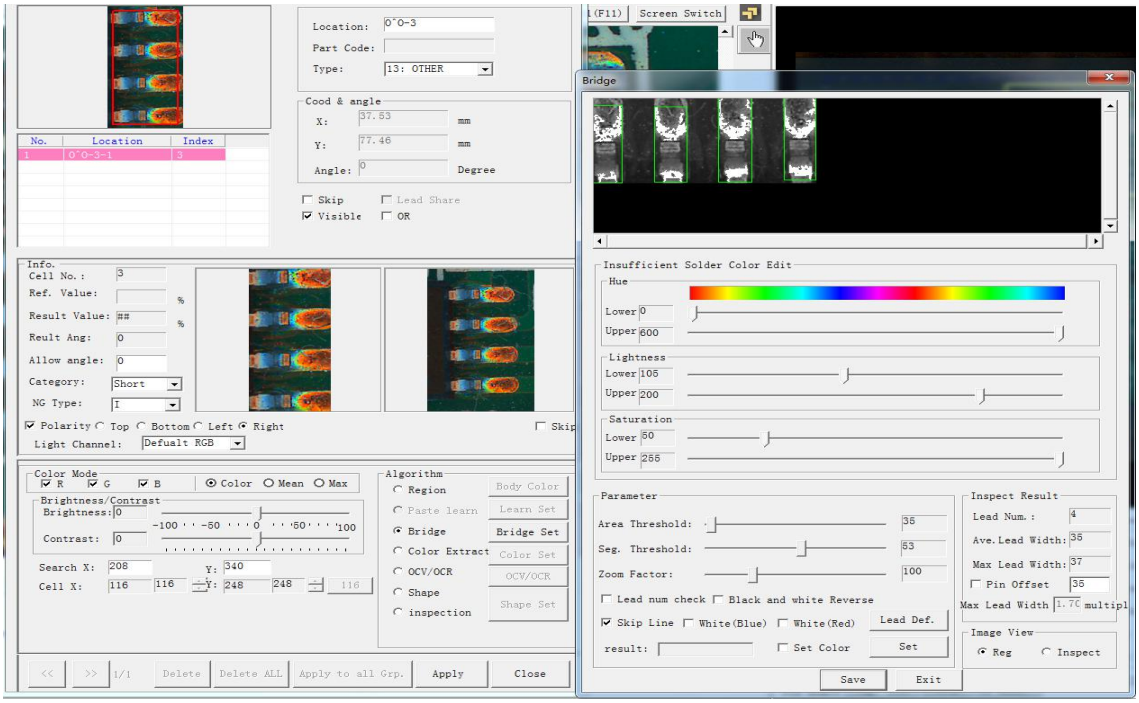
[OCV]: its principle is the same as that of the region method. It also uses image comparison, but only compares the character part after black and white processing, as shown in the following figure:



Click the "OCV" button to enter the OCV character segmentation window. The user can adjust

the OCV segmentation threshold through the scroll bar and select parameters, so that the image part to be extracted can be clearly identified, which is beneficial to improve the inspection stability. This algorithm is generally used for character inspection.

[IC Short Circuit]: this algorithm divides the IC dense solder legs to calculate the number of IC solder legs and their length and width. This algorithm is generally aimed at short circuit inspection of IC dense solder legs, as shown in the following figure:



Click the "Short Circuit Setting" button to enter the parameter setting window. The user can adjust the area threshold and segmentation threshold through the scroll bar and select parameters, and filter out interference parts, so that the pin parts in the template image can be clearly identified. The system will automatically identify the number of pins, the maximum pin width and the average pin width according to the vertical projection of the segmented communication domain. Under normal circumstances, the maximum pin width should be approximately equal to the average pin width.

If the maximum pin width is greater than 1.7 time of the average pin width under the same segmentation conditions during testing, it means that there are pins and their solder widths are beyond the normal range, which is most likely caused by solder short circuit. At this time, an NG error will be reported. If the user has checked the pin number test, the system will inspect the pin number at the same time during the test. If it is inconsistent with the setting, the system will also report NG error.

If the user's PCB itself has a white background with high brightness, and the traditional threshold segmentation cannot accurately isolate the solder from the PCB background color, the user can check the "Whiteboard". At this time, the system will use a specific channel algorithm to filter out the influence of white and increase the stability of segmentation.

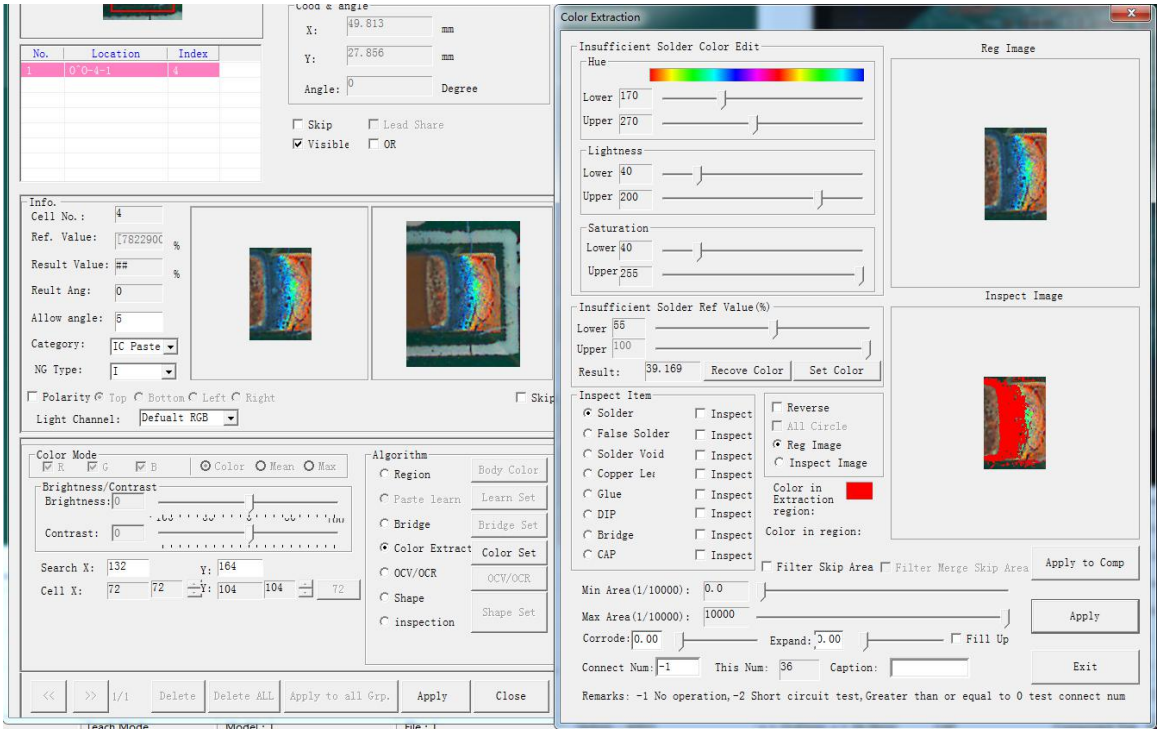
In some cases, there are white silk screens perpendicular to the pins on the PCB under the pins, which may also affect the pin division. At this time, the user can check "Ignore Long Straight Line" and open the setting window through the setting button, adjust the parameter division and set the range of that straight line. During inspection, the image within the range of

the straight line will not be included in the range of pin segmentation, so as to achieve the effect of filtering out the influence of the straight line.

The setting interface switches the registered image and the real-time image to be inspected to help users compare and debug. The parameter setting and adjustment is a set, but there are different display results corresponding to the two figures.

If the user needs to test each pin, except for the pin-by-pin frame definition, the user can enter the pin definition window through the "Set Pin" button, set the pin range in the upper part of the right image area of this window by using the normal frame method, select the correct pin direction in the upper left, and then click the “Generate Pin” button. If it is completed normally, these set pins will be generated with some inspection frames whose preset algorithm is color extraction, and will be combined into one component together with the external short-circuit frame. Users can modify the algorithm and adjust the parameters of the pin inspection frame as required.

[Color Extraction]: extracting a certain color in the image to calculate the proportion of a certain color in the whole image and the number of regions of a certain color in the whole image. This algorithm is generally used for solder joints and short circuits of solder joints, as shown in the following figure:



As a main inspection algorithm, the user enters the color extraction interface by clicking the "Color Extraction" button, and sets and tests the color extraction of the inspection frame

In the image region on the right side of the interface, the upper image is the original image, and the following is the extracted eligible region.

Unlike other algorithms, where each inspection frame only accommodates one standard (different standards can only be extended by grouping), in this system, the inspection frame of color extraction can accommodate eight different items and set eight different inspection standards at the same time. Each algorithm can be selected in combination, and the standards can be set separately.

Users of preset extraction items in the system can modify them through the corresponding item fields under them.

Color extraction sets the threshold values of hue, brightness and saturation of pixels in the image interval, extracts pixels that meet the threshold values of these three channels at the same time, and displays them visually in the extraction map. It takes the ratio of extracted pixels to pixels in the whole interval as the main inspection target, and sets the standard for the normal range around this target.

When setting, besides the color selected by the user in the extraction diagram, the result value will also be displayed. If the calibration is reliable, the system will estimate and display the actual region of the extraction region here at the same time.

During inspection, it is judged whether the pixel extraction value of the image in the inspection frame of the image to be inspected according to the extraction parameters can meet this color standard interval, so as to determine whether it passes or is NG. [Reverse Extraction] in the interface is to reverse the result.

To simplify the extraction of color parameters, double-click the left mouse button on the original image at the top right of the interface, and the system will automatically extract the color channel value of the mouse point and automatically preset the segmentation threshold. The extracted image at the bottom will be displayed correspondingly, and the array and scroll bar at the left will be automatically preset accordingly, so users can adjust and save on this basis.

In addition to the above basic conditions, on the basis of the results of color channel threshold extraction, the system can also set some additional conditions to filter again according to the extracted regions, so that users can realize more flexible application when dealing with the extraction range:

-In the case of multiple extraction regions, the user can filter out the large and small regions by setting the region ratio.

-In the case of multiple extraction regions, the user can set the standard number of regions. If the number of qualified regions is not equal to the standard, the inspection frame is judged as NG. The default standard of the system is -1, which means the number of uninspected regions. This function is more suitable for inspecting short circuit between solder joints.

If the user checks to filter out the shielding region, the intersection of this inspection frame and another set shielding frame will not participate in the extraction calculation, and this shielding will be reflected in the image display region. As a result, the extraction operation can be more precise and flexible.

The "Registered Image" and "Image to be Inspected" in the setting interface are used to switch between the registered image and the real-time image to be inspected, which helps users to compare and debug. The parameter setting and adjustment is a set, but there are different display results corresponding to the two figures.

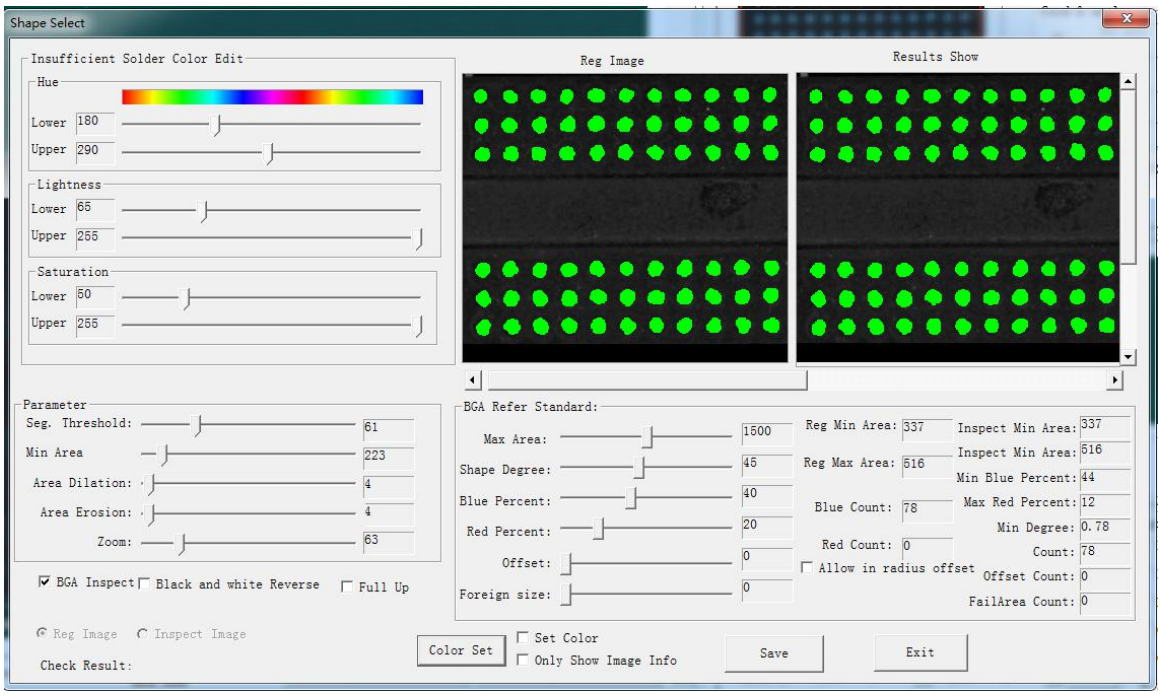
Usually, grouping is not implemented in the color extraction mode, otherwise it is easy to be confused.

After setting or adjusting the registration information parameters, the user needs to press the “Apply” button to save. If the component is checked in, the result will be stored in the check-in document; otherwise, it will be stored in the registration information of the component itself. If there are multiple groups in the inspection frame, the user can choose to update all groups with

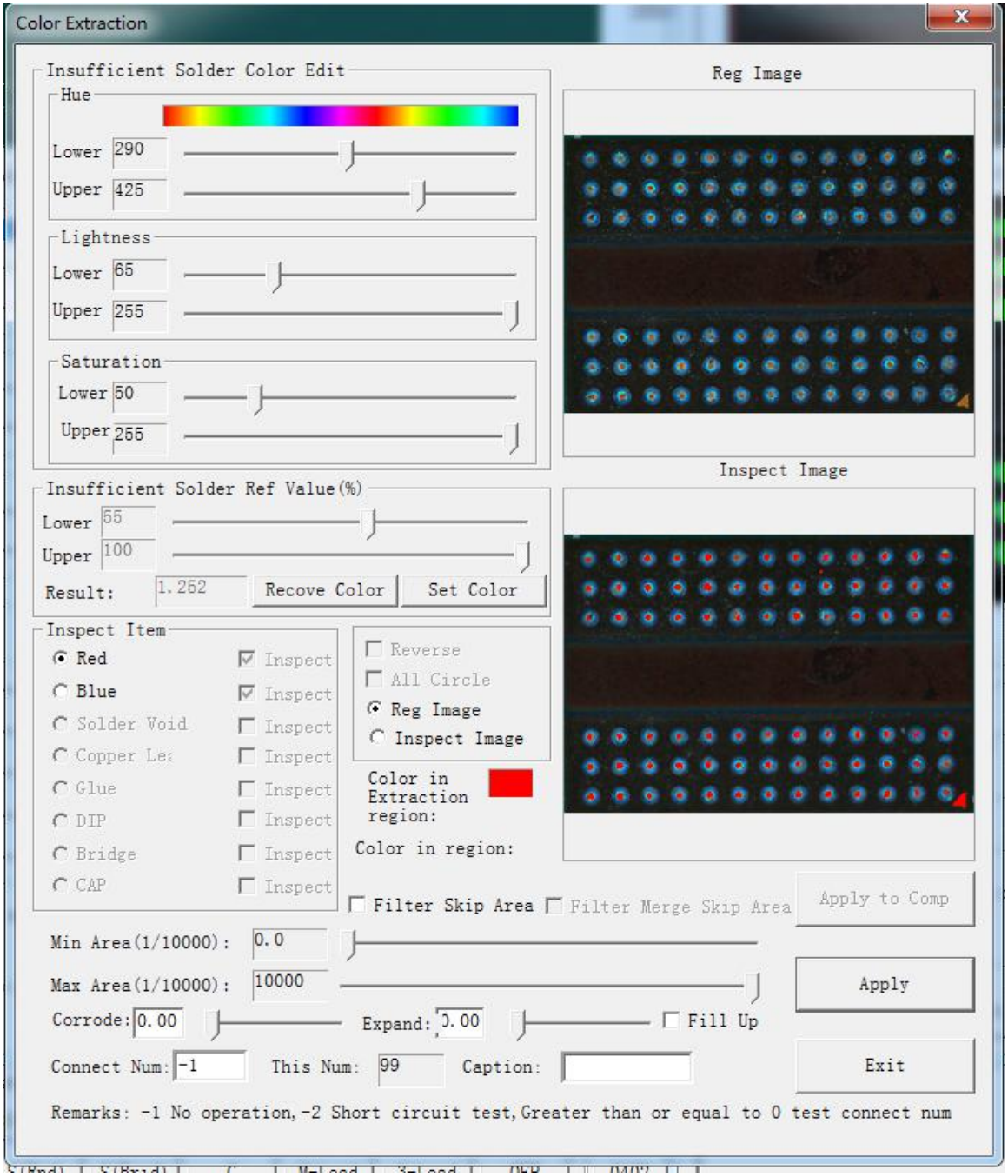
the modified information at the same time.

If there are multiple groups in the inspection frame, the user can switch between different groups by pressing the double-headed arrow in this interface, and press the “Delete” button to delete the current group (basic registration information cannot be deleted)

[Feature Method] This algorithm is generally used to inspect the spherical surface of BGA, and is used to inspect the number, offset, missing, crush, short circuit of balls, as shown in the following figure:



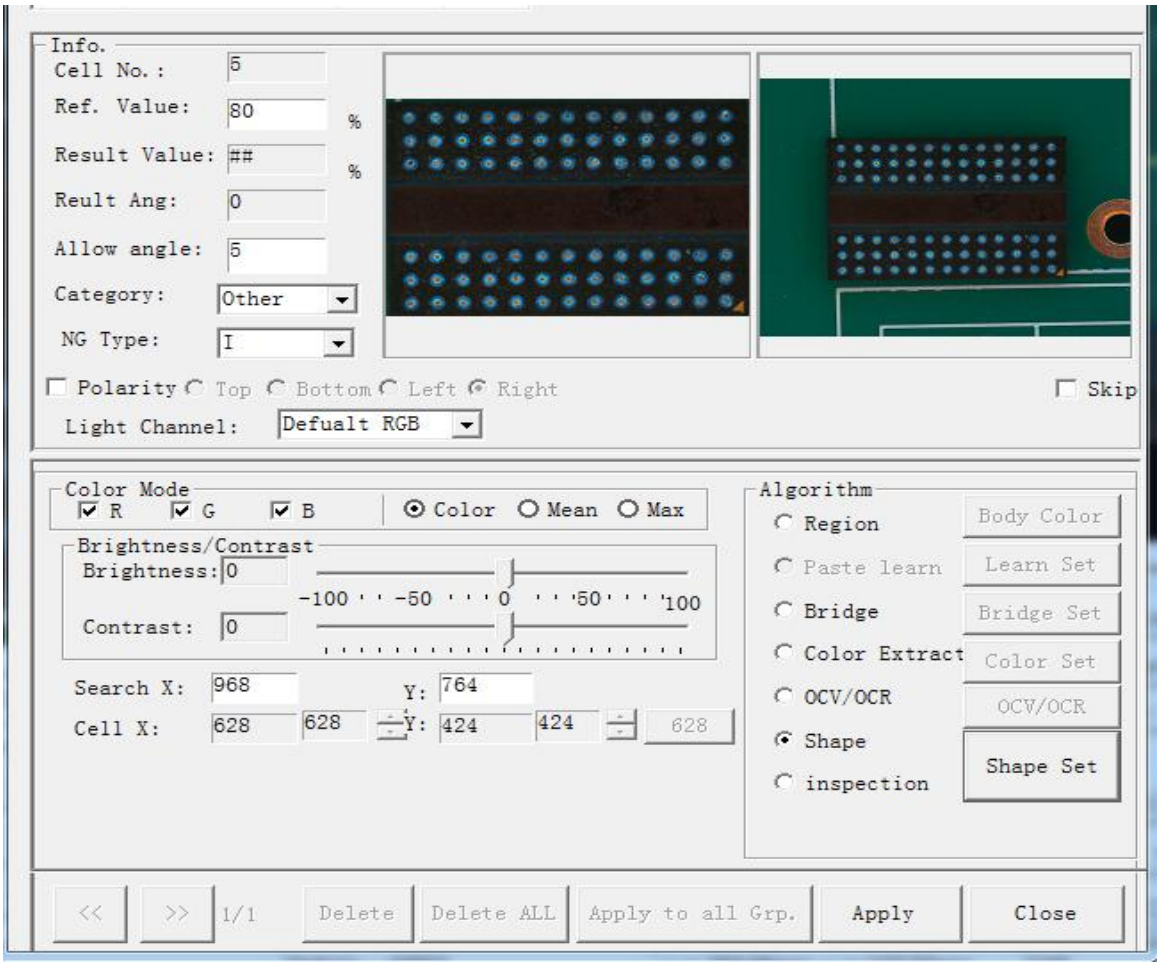
After entering this interface, first check [BGA Inspection] and then click [Color Set] to enter the following interface:



Set the hue, brightness and saturation of [Red] and [Blue] according to the method of color extraction. The extracted [Red] is the red in the middle of the ball, and the [Blue] is the color of tin on the ball. Then click [Only Apply to Current Inspection Frame]-[Exit] to return to the previous interface.

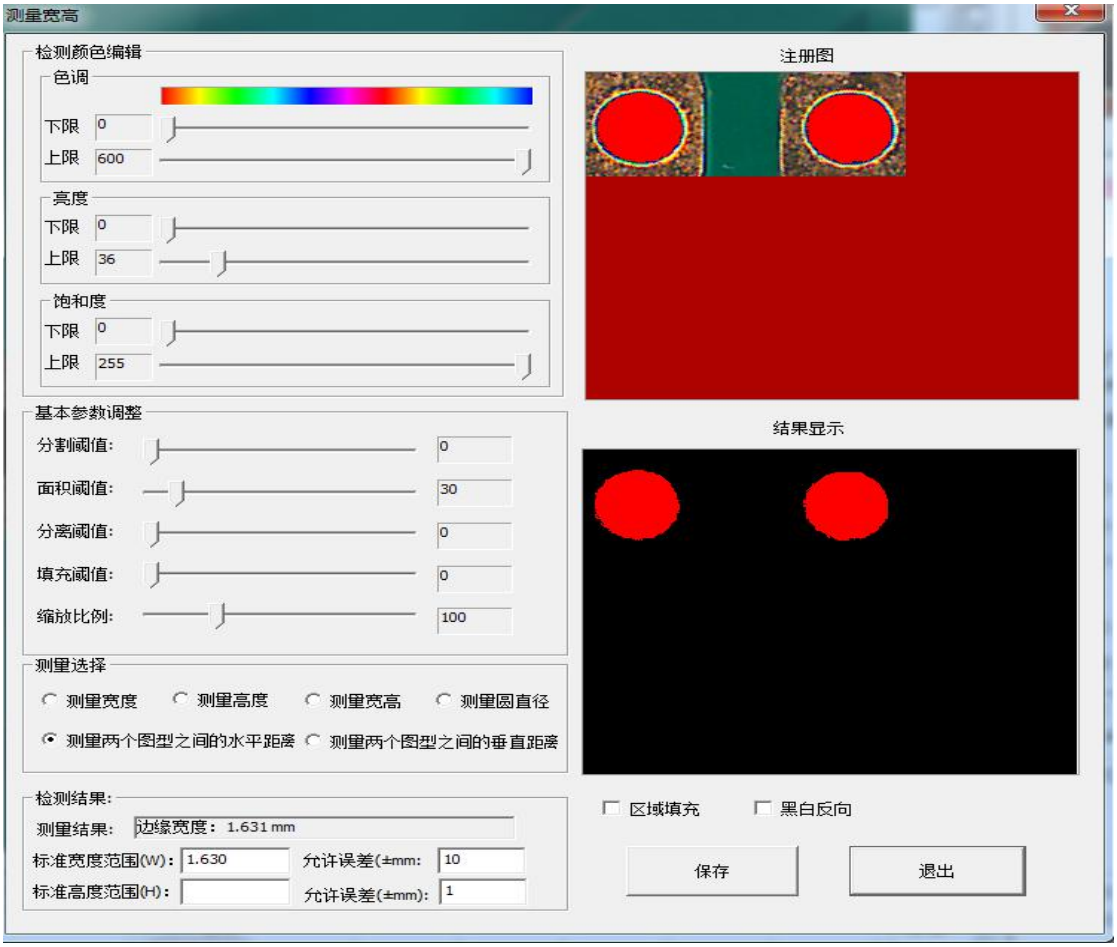
Divide each ball clearly by [Threshold Division], [Corrosion] and [Expansion], and then set the region range of the ball by maximum size and minimum size. The [Minimum Size of Registration Chart and [Maximum Size of Registration Chart] can be referred. Then set the parameter of shape degree to represent the similarity between each ball and circle. [Blue Ratio] represents the lowest blue ratio of each ball as a good product (lower blue ratio means less tin in the ball); [Red ratio] represents the highest red ratio of each ball as a good product (higher red ratio means larger crushed region of the ball); [Offset Value] is the allowed offset of the ball; [Foreign matter size] refers to the size of the foreign matter on BGA. After completing the setting in this interface, click [Save]-[Exit] to return to the previous interface, as shown in the

following figure:



In this interface, the [Qualified Reference Value] is set. This parameter is the number of BGA balls in this algorithm.

[Measurement] is used in this algorithm to measure the height and width of a single image and the distance between two images, as shown in the following figure:



Firstly, according to the principle of [Color Extraction], the image to be measured is extracted. Then check the measurement options below and enter the allowed error.

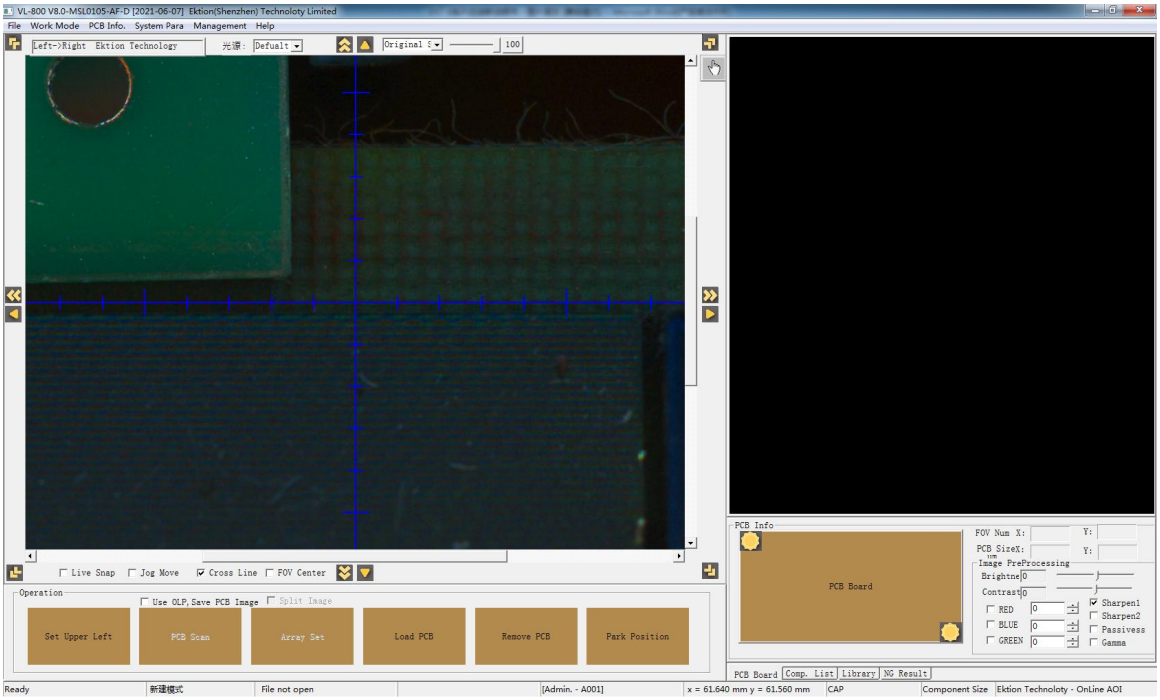
All the above algorithms are commonly used.

8.2 Manual program editing

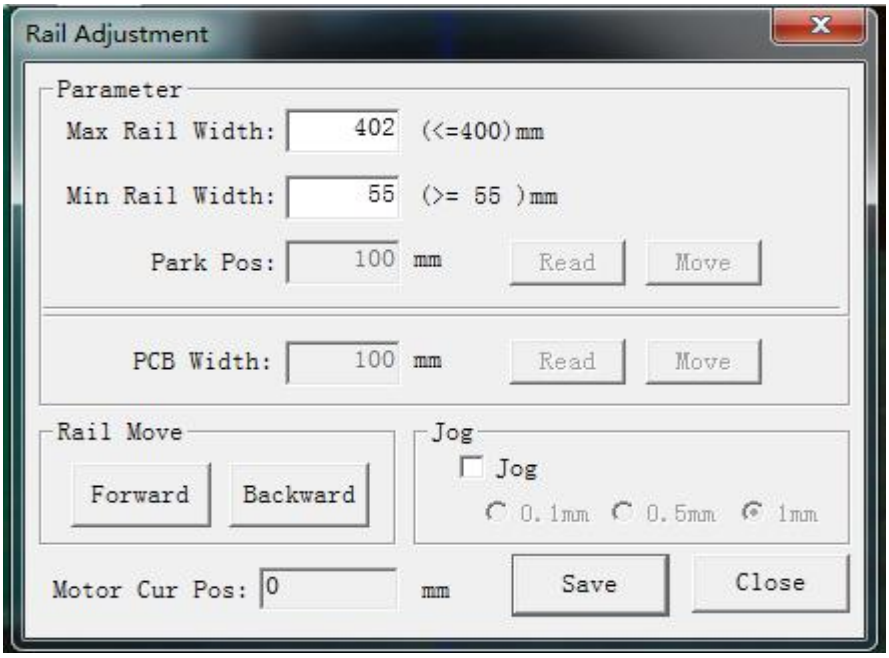
8.2.1 New mode

Open the AOI software according to {7.1 Start-up procedure}. (The following is from left to right)

Click [Work Mode]-[New Mode] in the top menu bar to enter the new mode, as shown in the following figure:



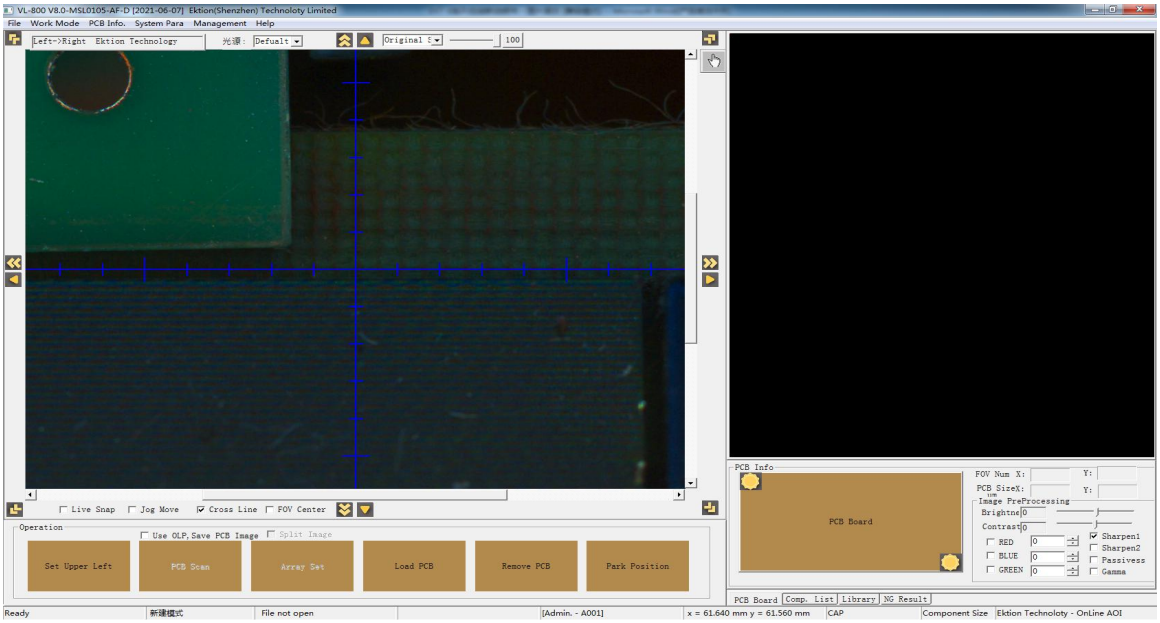
First, click [Track Width Adjustment] in [System Configuration] in the menu bar, as shown in the following figure: (this figure is NeoDen 880)



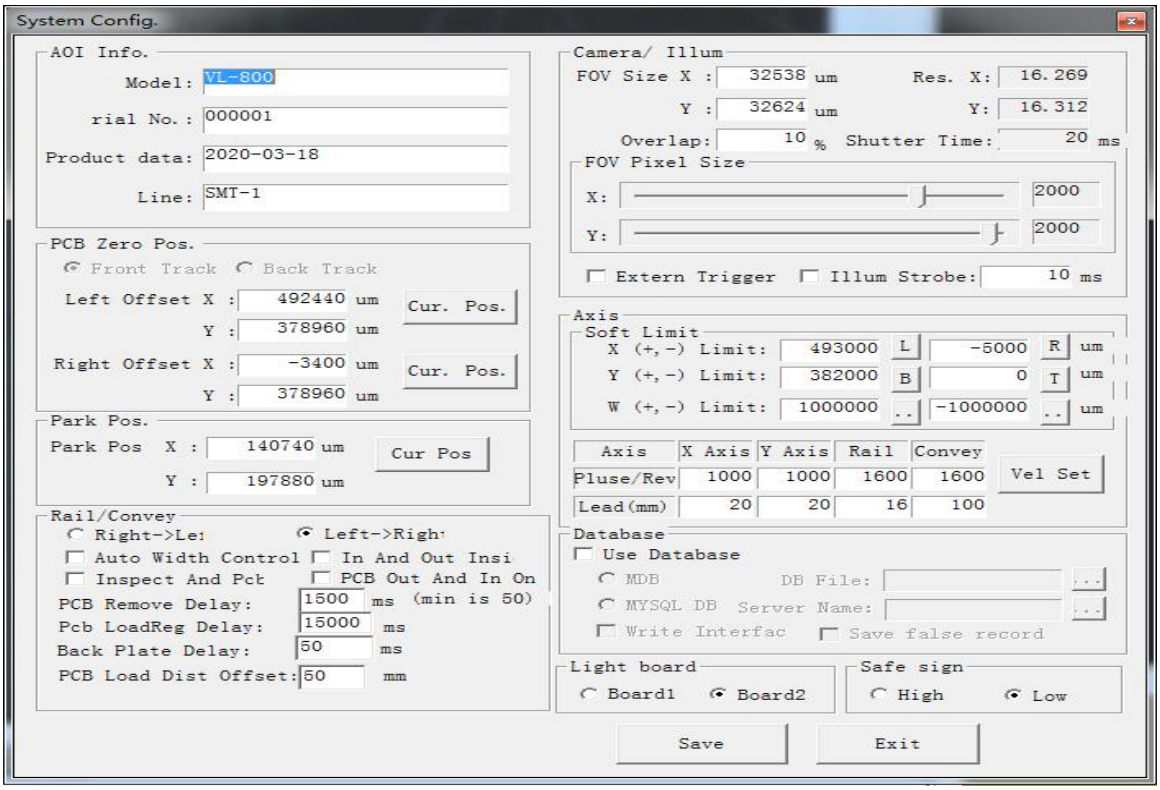
Select the corresponding track in this interface, and adjust the width of the track through [Up] and [Down] on the keyboard. (Note: Track 1 is fixed and not adjustable, and only Track 2 can be adjusted for the lower cover and monorail.) You can select [Jog] and then select the corresponding unit for fine adjustment. Click [Close] after the adjustment is completed

Then put the board on the corresponding track, and check [Front Track] or [Back Track] in the menu bar of the double track machine to switch. Put the PCB on the entry end of the track, and click [Enter Board] at the bottom of the interface. The PCB enters the normal inspection position in the track and is fixed.

Click the  in the lower right corner to let the camera automatically move to the lower left corner of PCB. On the basis of the image collected by the camera, confirm that the cross center point of the current camera is outside the lower right corner of PCB, as shown in the following figure:

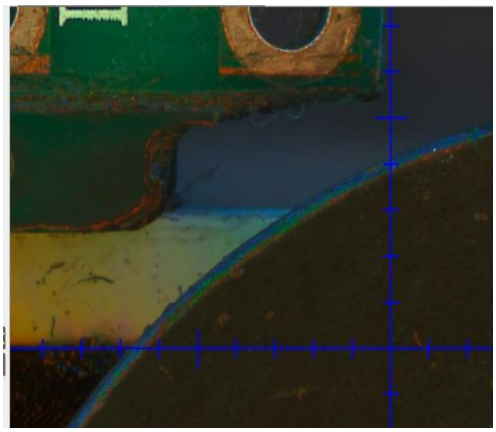


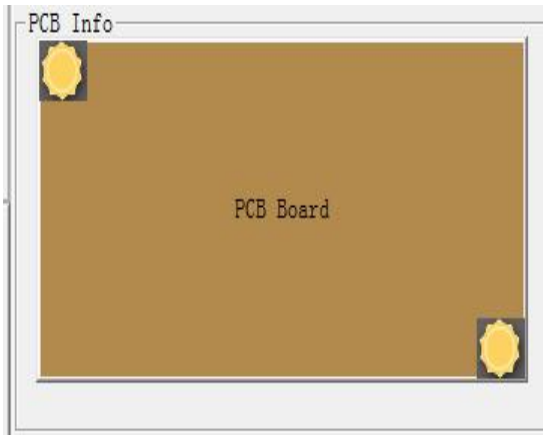
Because the position of track 3 is not fixed, the position of the lower right corner should be set for each program. First, after the board enters and is fixed, move the camera reticle position to the lower right corner of the board, as shown above. Then click [System Configuration]-[System Composition] in the menu bar, as shown in the following figure:



Then select [Rear Rail] in [PCB Zero Position] and click [Current Position] behind the right offset. At this time, the coordinates of [Right Offset] will change (right board is left offset). Then click [Save]-[Exit].

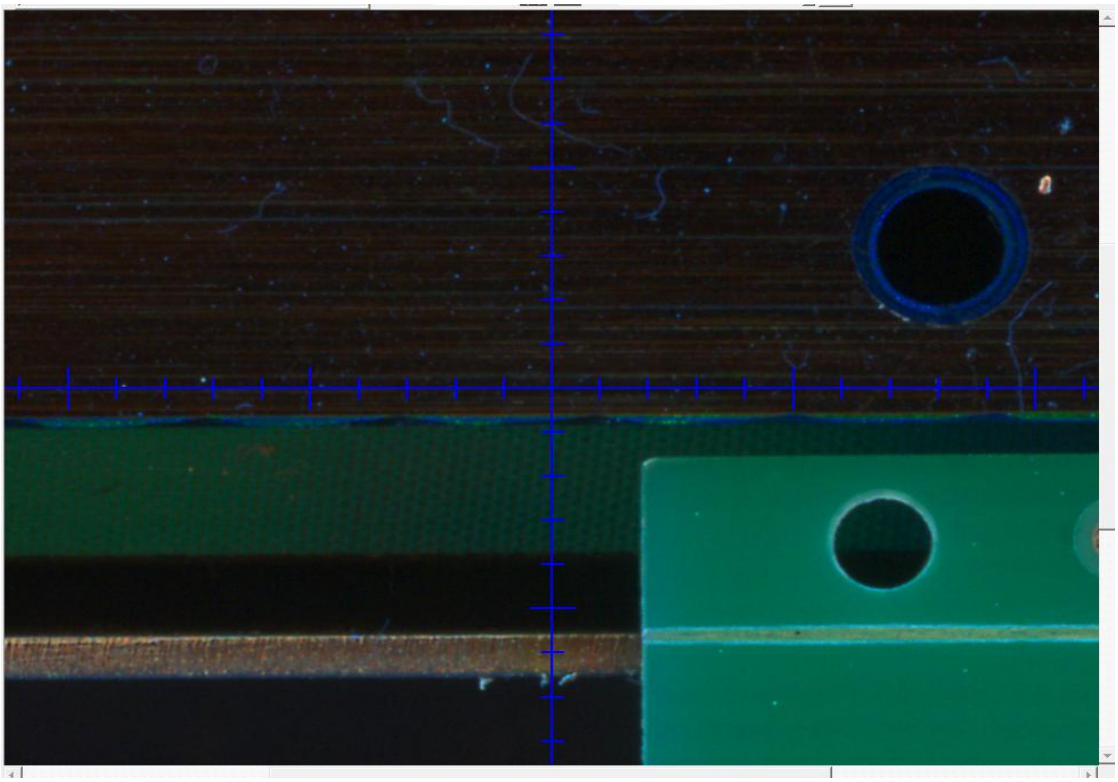
The lower right corner of the lower cover is the corner close to the right side of the track 2. As the track 2 is a moving track, it will be debugged according to the size of the board. So, the lower right corner of the lower cover cannot be fixed and needs debugging every time, as shown in the following figure:





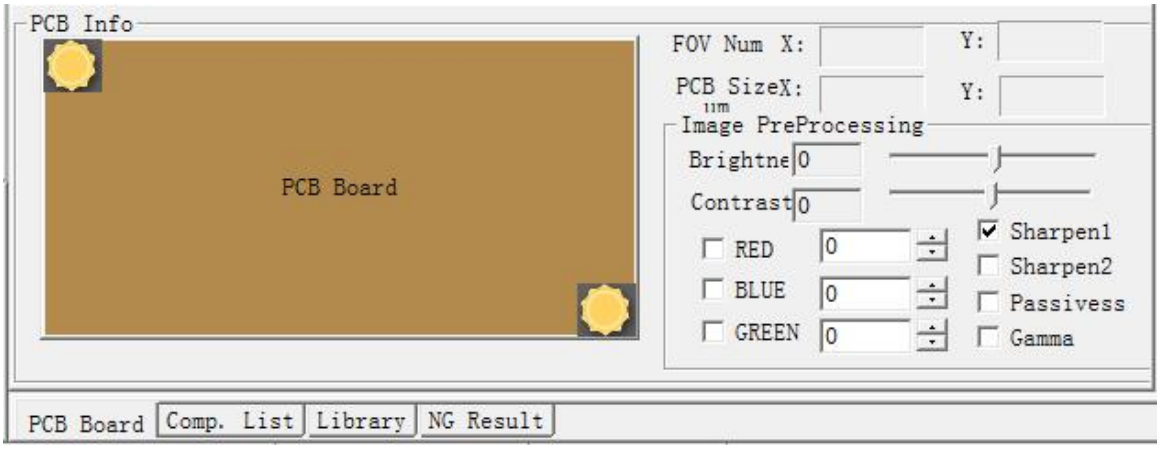
Move the camera position to the lower right corner of PCB first, then click [Current Position], and the system will set this position to the lower right corner.

Click the arrow around the image to move the center point of the camera beyond the upper left corner of PCB. It can be moved a little more distance beyond the upper left corner to ensure that the upper left corner has completely covered the whole PCB range.



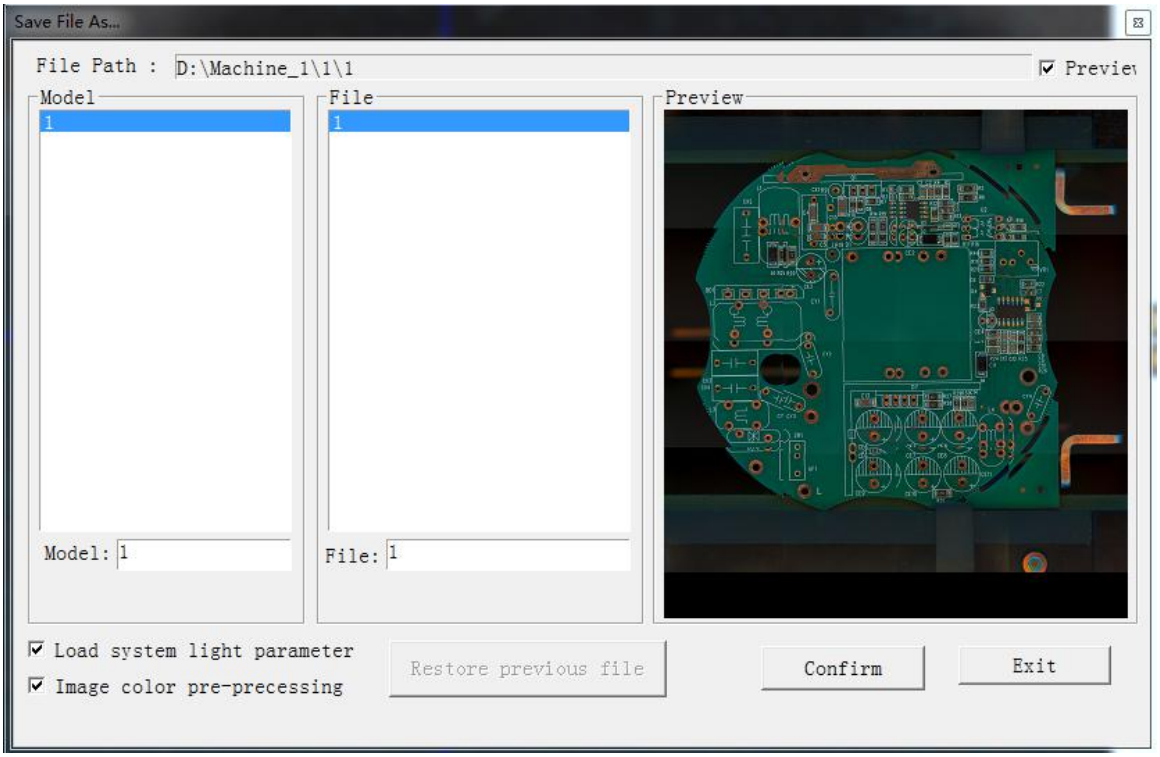
Then click [Operation]-[Set the upper right corner]. A dialog box will prompt: {Please extract the image of the whole PCB!} , click [Confirm]. Note: the above process of determining the lower right corner and upper left corner of PCB is only applicable to the left board placement direction. If the board is placed on the right side and the track direction is from right to left, it is to determine the lower right corner and upper left corner of PCB.

Before setting the upper right corner, if special PCB needs image pre-processing, it can be adjusted in the lower right corner of the interface, as shown in the following figure:

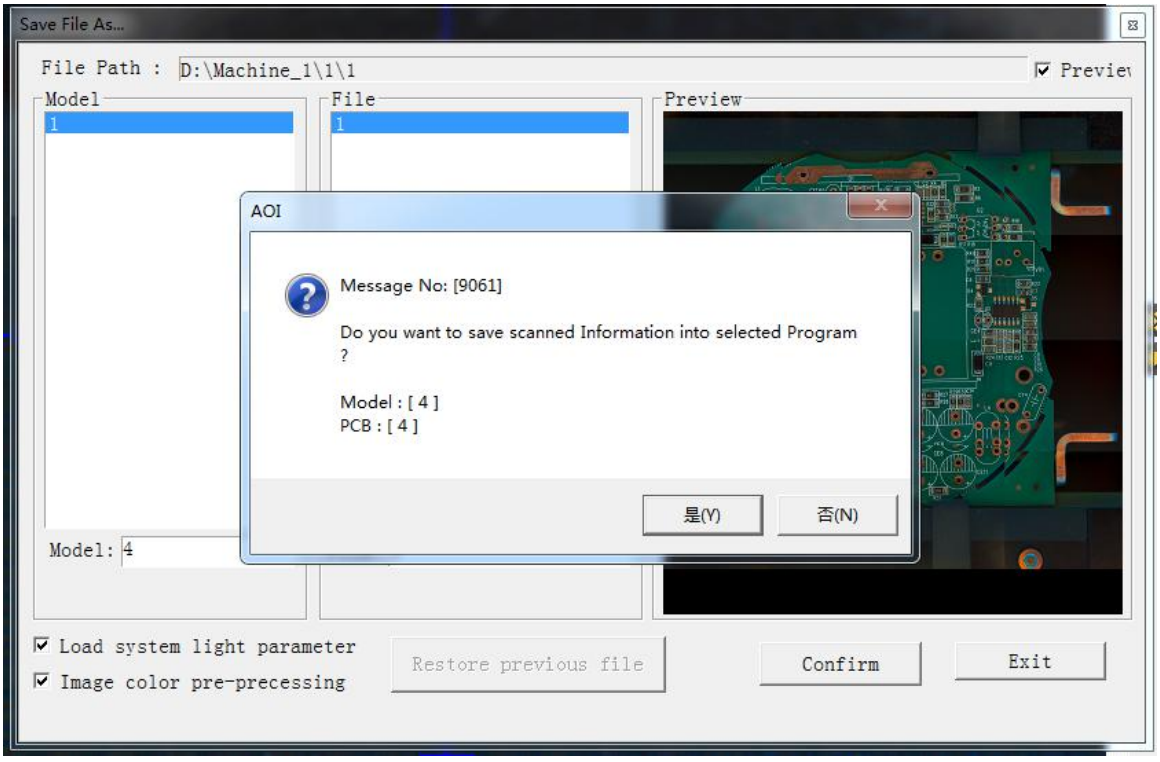


Note: If there are special PCB, the brightness and contrast can be adjusted based on each board, and the brightness of a certain channel can be increased as needed until the image is clear.

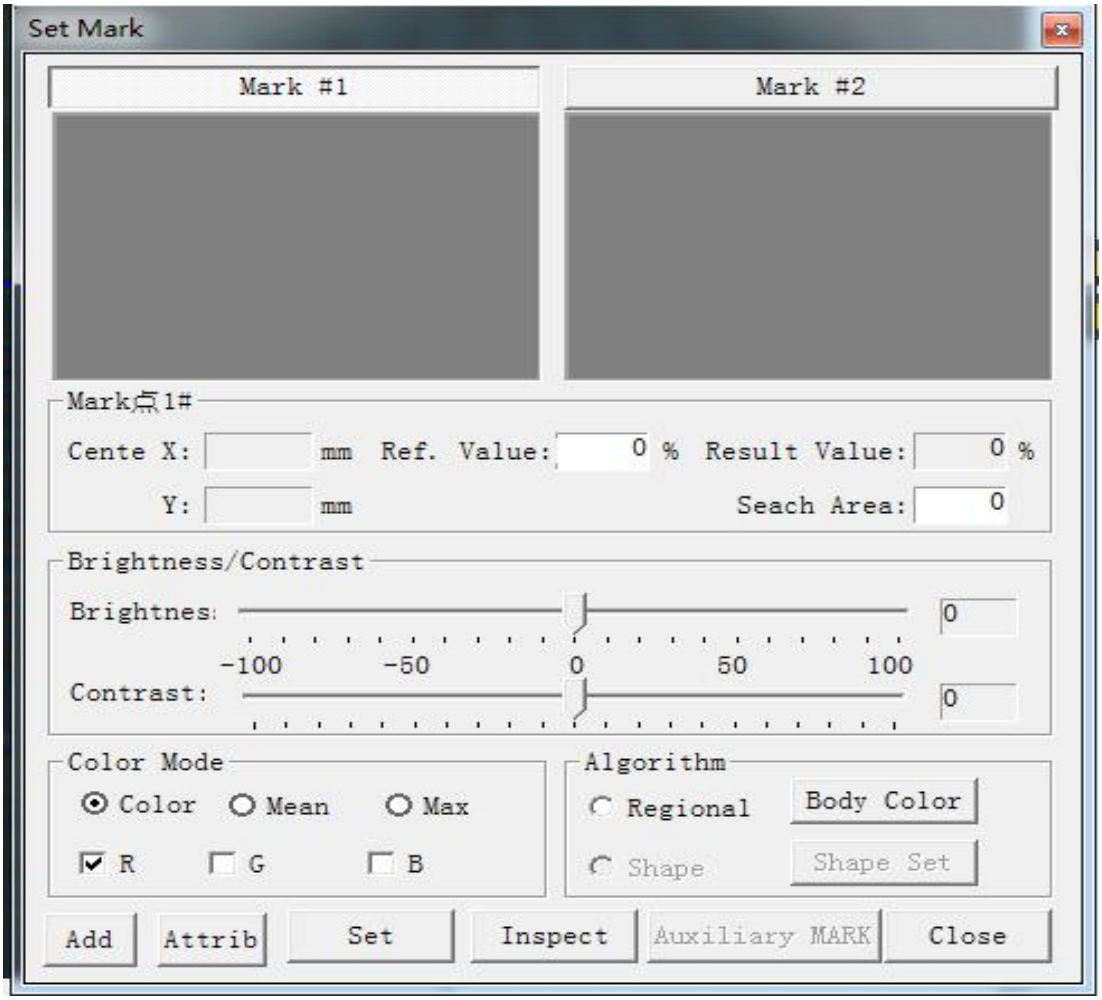
Next, click [Operation]-[PCB Scan], and a dialog box will prompt for setting the model name and file name of the program. Enter the model name and file name in the lower left box and click [OK].



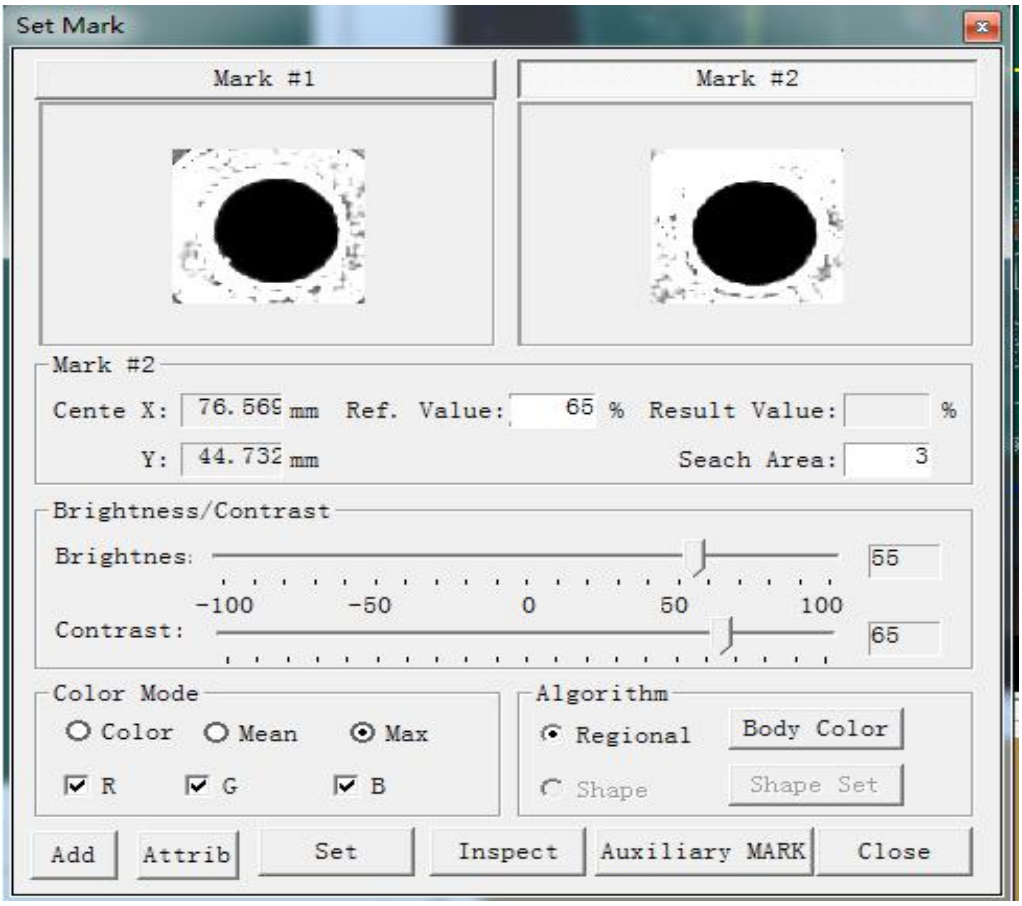
A dialog box will prompt for confirming the model name and filing the name information, as shown in the following figure:



Click [Yes], and the camera starts scanning the whole PCB image. After completion, a dialog box will prompt {Please set Mark Point}. Click [Confirm], and a dialog box for setting Mark point will appear, as shown in the following figure:



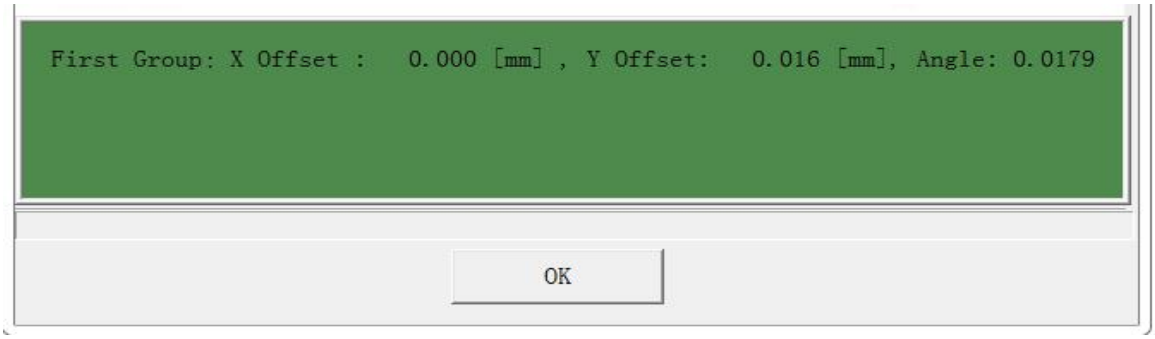
In Mark Point #1, drag the box with the left mouse button to select one of the mark points of PCB bevel angle. Click Set, and adjust brightness/contrast and color mode to make the outline of Mark point image clear. Click Mark Point #2 to switch to the setting of Mark point of another oblique angle, as shown below:

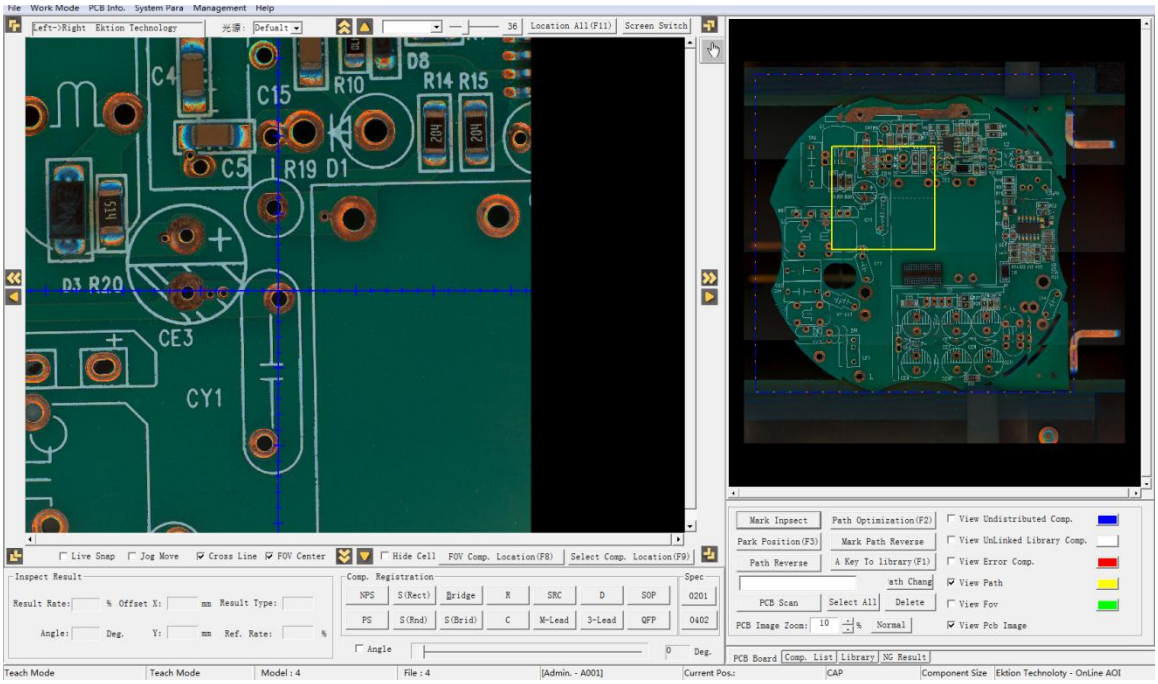


Note: the operation method of Mark point is region method, and the default value is 65, which can be modified according to the actual situation. Oxidation at Mark point can be inspected by noumenon extraction in region method, so the effect will be more stable. Click [Close] after Mark point setting is completed. The system will prompt {Whether to Enter Editing Mode Immediately}, and click [Yes] to enter editing mode.

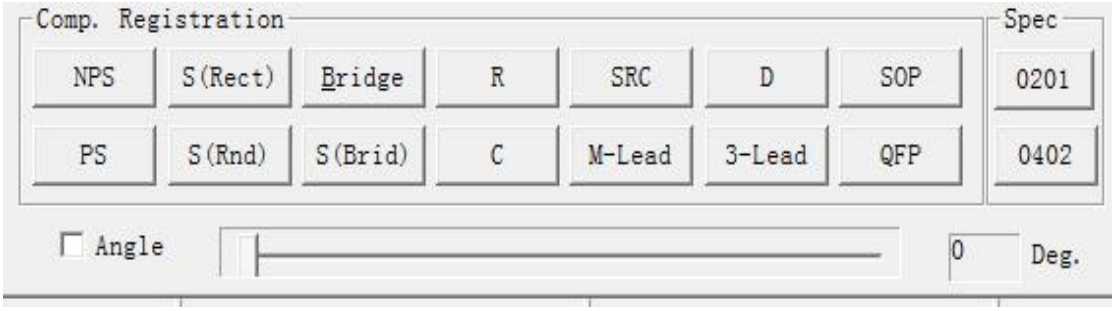
8.2.2 Editing mode

Close the Mark setting interface or click [Working Mode]-[Editing Mode] in the menu bar to enter the editing mode and inspect the Mark point. The inspection information will display the offset distance of the current Mark point. After clicking [Confirm], you will enter the editing mode.





According to different components, select the corresponding box selection method:



Non-polar single frame: generally outlining all non-polar capacitance and resistance inspection frames with specifications within 0402. It can also be used as the inspection frame for noumenon labeling of other components.

Polar single frame: generally outlining all polar capacitors and resistors with specifications within 0402. It can also be used for noumenon labeling of other components.

Resistance: indicating making the inspection frame for resistance.

Capacitance: indicating making the inspection frame for capacitance.

Solder joint square and solder joint circle: indicate making the inspection frame for wave soldering joint.

0201 and 0402: indicating making the inspection frame for 0201 and 0402 component

Diode: indicating making the inspection frame for diodes.

Tripod element: indicating making the inspection frame for triodes.

Unilateral leg: indicating making the inspection frame for IC that cannot be completely displayed on the window-table screen.

SOP: indicating the inspection frame of IC in SOP form. (it can only be used for SOP with

regular solder joints on both sides and complete display on one screen in the same window area)

QFP: indicating the inspection frame of QFP IC. (it can only be used for QFP with regular solder joints on four sides and complete display on one screen in the same window area)

If the component angle is not 45 degrees, check [Angle Registration] and pull the slider to rotate the image angle and then make frame.

After making the frame or left-clicking the corresponding inspection frame, the debugging window of the corresponding component frame will appear to modify the standard of the component frame.

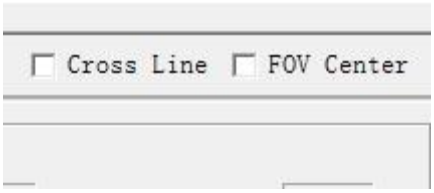
Click the  in the upper right corner of the interface. When the mouse moves to the image, it will switch to the corresponding icon. At this time, when you double-click a certain point on the image with the left mouse button, the center point of the camera will automatically move to this point. To exit  , just right-click.

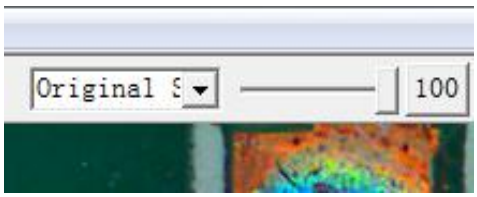
When dragging to make frame, try to adjust the angle, scale and position of the frame by using the space button, ↑ button or ↓ button. Or click the eight directional arrows outside the image frame to move the center point of the camera.

To exit the component box, just right-click.

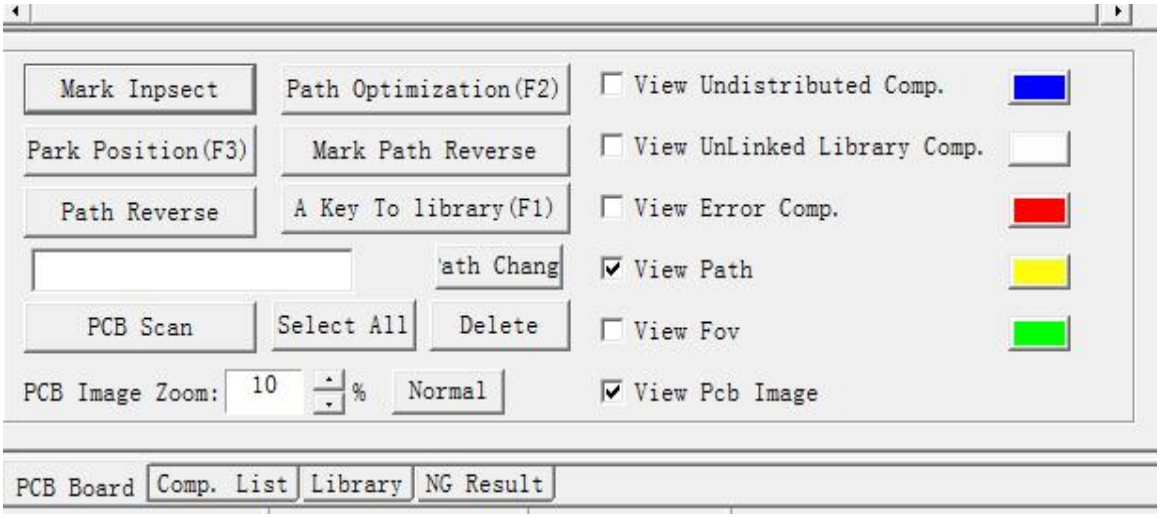
The image on the right side of the interface is the thumbnail of PCB, and the yellow box above is the position of the camera. Double-click the left mouse button at any position of the thumbnail, and the camera will move to the double-click position.

Do not check [FOV Center] at the bottom of the interface before making the component frame. Adjust the image scale at the top of the interface to make it suitable for editing the component, as shown in the following figure:



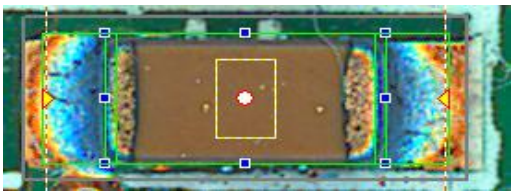


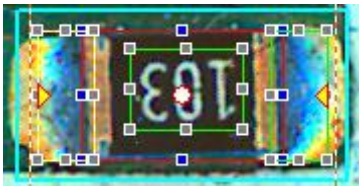
When there are multiple splicing boards on a PCB board, we only need to edit a small splicing board, and the thumbnail on the right side of the interface can also be enlarged and reduced by [Image Display Scale] in the following figure:



After adjustment, the component frame can be made.

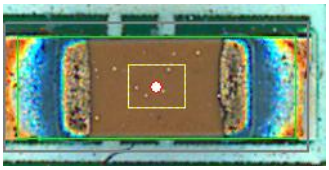
Capacitance and resistance: you can directly click on the capacitance and resistance box below and hold down the left mouse button to make the frame, as shown in the following figure:





The frame is based on the noumenon. After the noumenon is drawn, pad frames on both sides as well as silk screen frames in the middle will automatically generate (the color frame in the middle of the capacitor). If the automatically generating frame is inappropriate in size, you can click on the inappropriate frame to debug the size.

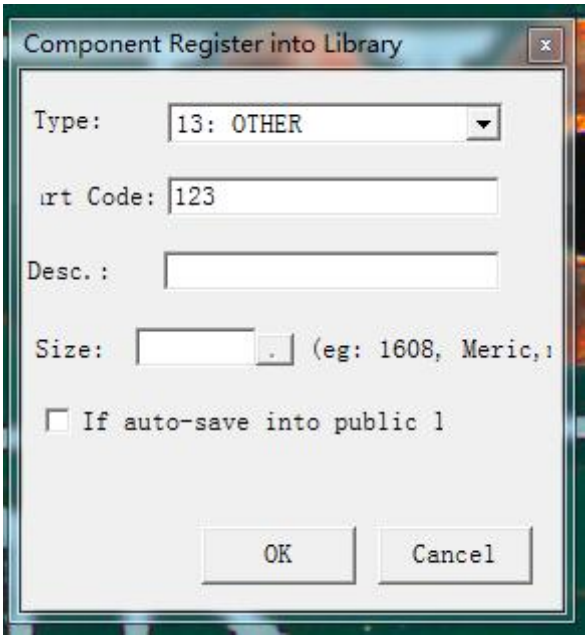
0402 or smaller capacitance resistance can be directly selected from small material frame, as shown in the following figure:



When making a small material frame, frame the bonding pad of the whole component and the body together, and a small frame for color inspection will be automatically generated in the middle. After making the frame, click the right mouse button where there are no components to cancel the selected box.

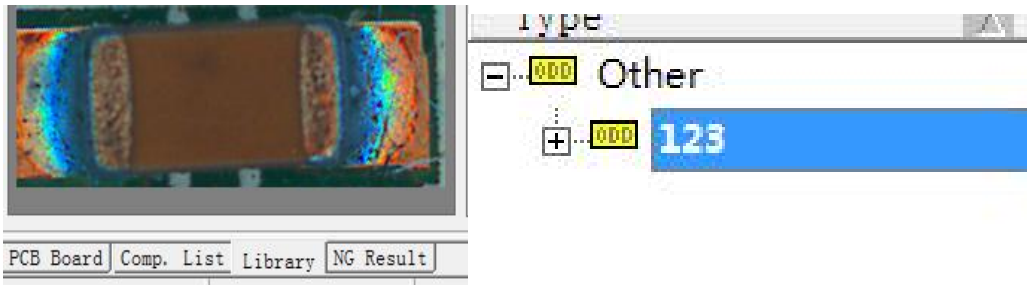
Each component is directly registered after making frame. The steps are: first select the components to be registered, then right-click and click [Component Register]

Figure:



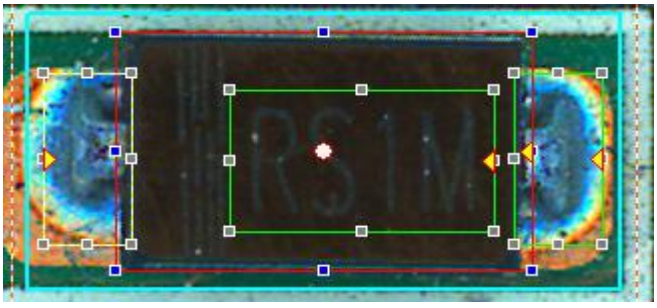
Select the type, manually enter the item number and remarks, and choose whether to deposit it in the public library (note: you can directly transfer it out from the public library when you execute other programs next time after depositing it in the public library), and then click [OK] to register it.

After registering, if there are the same components in the same spilt, you can select the made component frame , right-click [Single-Point Copy], then move the mouse to the same component and click the left mouse button, and right-click to cancel the copy box. Click [Space Key] to rotate by 45 degrees at a time. You can also double-click and select the component in the component library to copy it. As shown in the following figure:



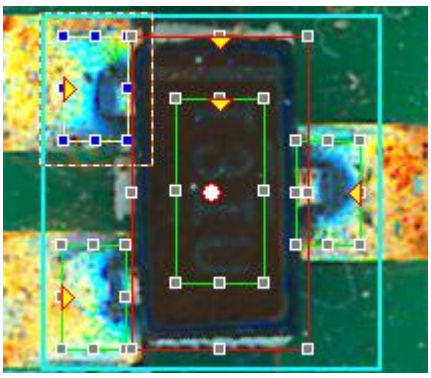
Note: before copying, the component must be registered. If it is not registered, [Single-Point Copy] cannot be performed.

Diode: [Diode] can be directly selected for making frame based on the noumenon of the diode. As shown in the following figure:



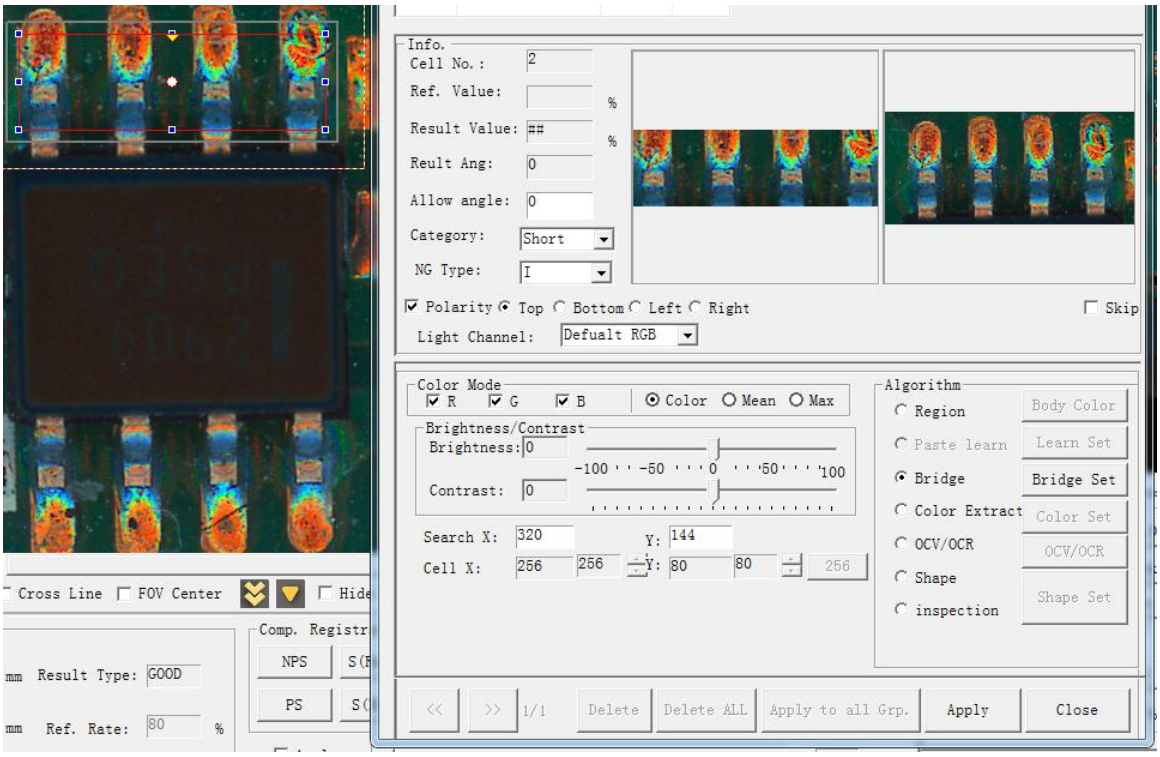
Adjust the size of each frame, and then register the component according to the method of capacitance and resistance. If there are the same components, copy them in the same way.

Triode: [Triangle] can be directly selected for making frame based on the noumenon of triode. As shown in the following figure:

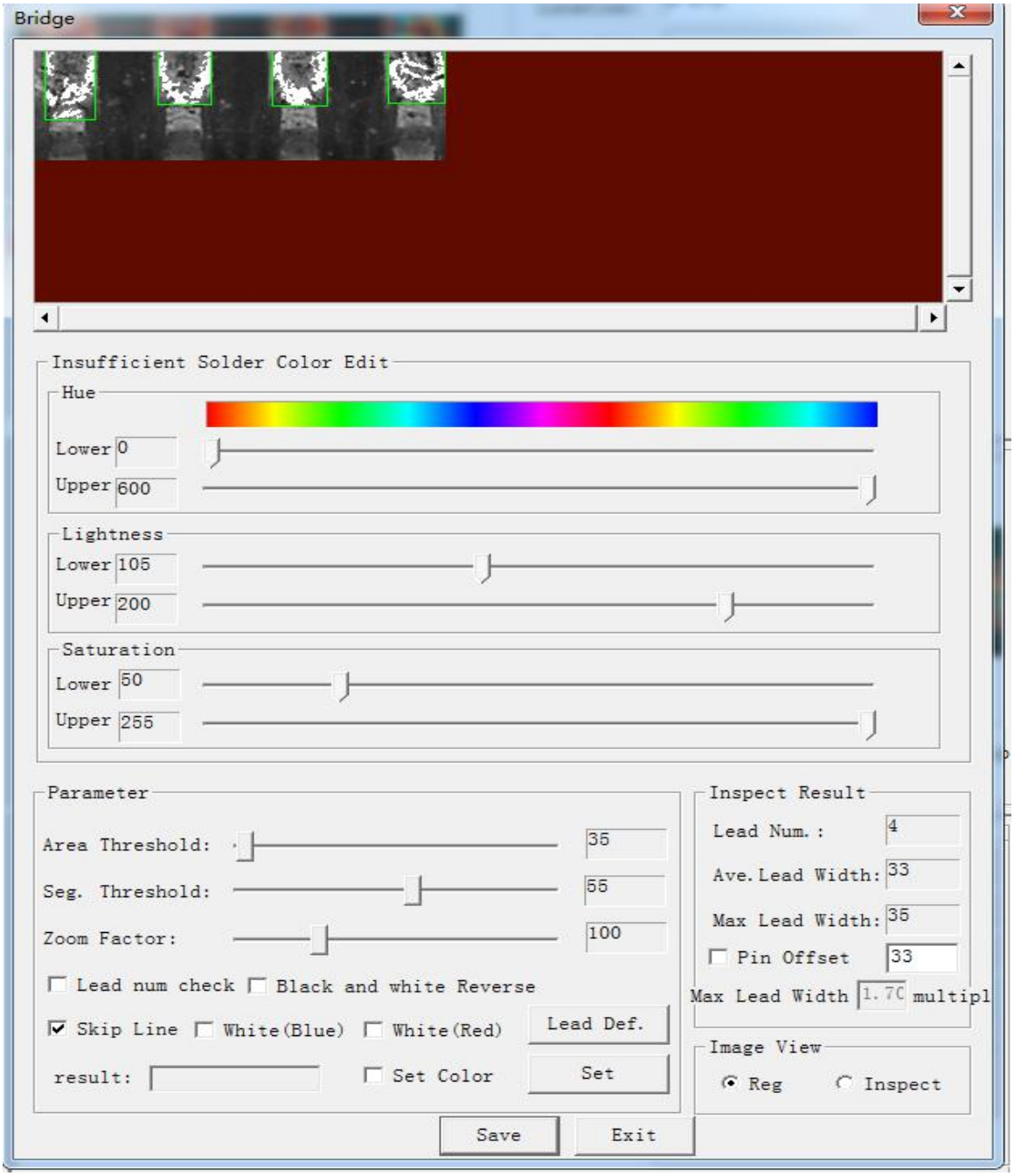


Adjust the size of each frame, and then register the component according to the method of capacitance and resistance. If there are the same components, copy them in the same way.

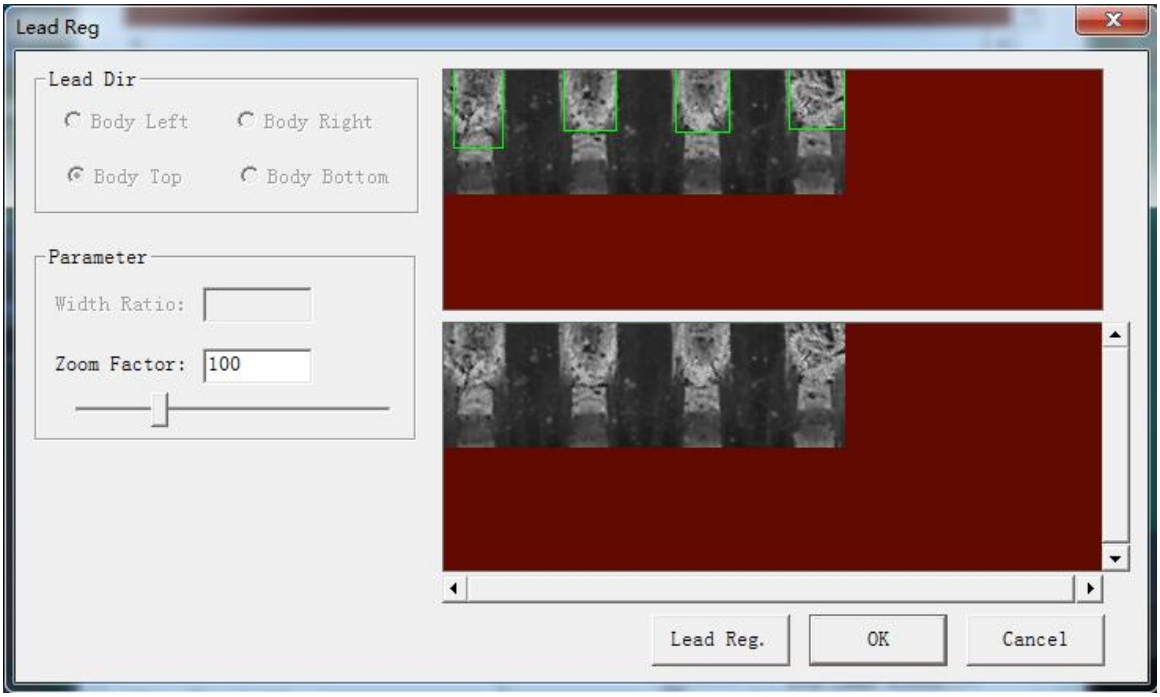
IC: the SOP frame can be directly selected to make the combined frame. However, because there are many types of IC components, we generally choose our own frame combination. In the following steps, take our own frame combination as an example, first select [Short Circuit Frame] to make the solder leg frames on both sides, as shown in the following figure:



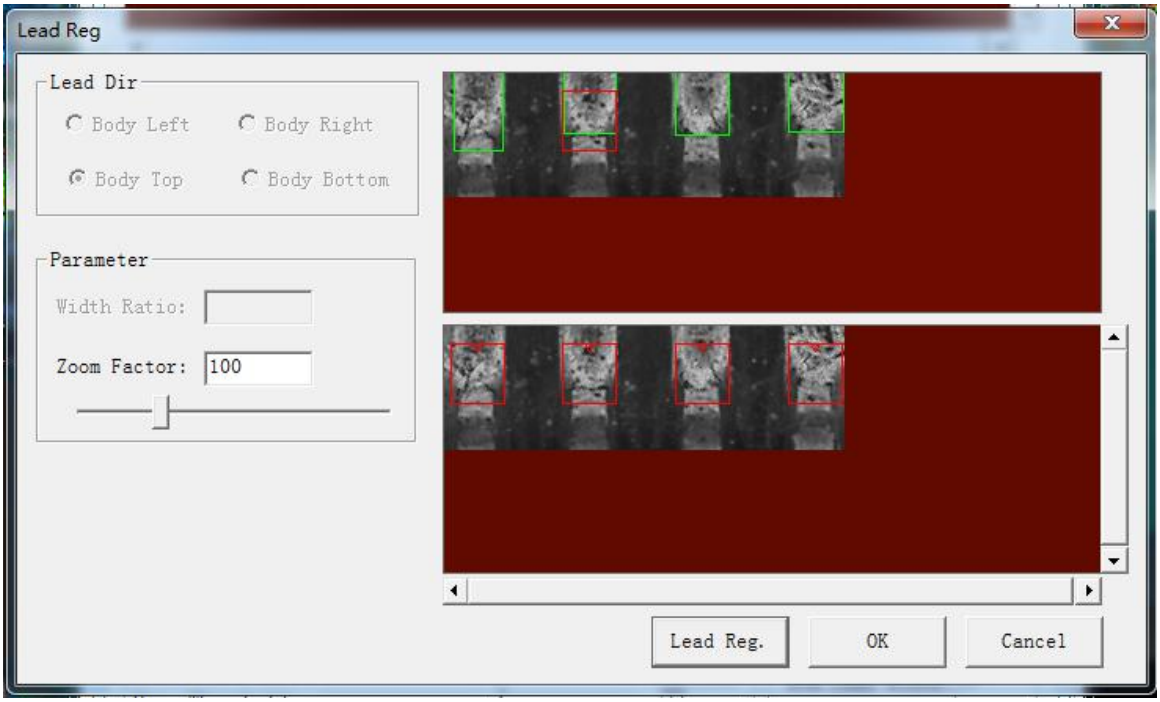
After that, the property interface of the component box will be displayed at the same time. If it doesn't come out, click the selected box with the left mouse button, and the property interface will also be displayed. Now check the polarity direction in the middle. [Top], [Bottom], [Left] and [Right] represent the position of the small arrow on the component frame. After checking, let the arrow point to the noumenon of IC. Then click [Short Circuit Setting] to enter the setting interface. As shown in the following figure:



Then divide each pin clearly by comparing with the above figure through [Area Threshold] and [Segmentation Threshold], or switch between [Registered Image] and [Image to be inspected]. (Note: If there is white silk screen printing between the white bottom plate and the corners and it is difficult to divide, you can check the [Whiteboard] below for division according to the situation). After the pins are divided, the software will automatically calculate the number and width of pins. Then check [Pin Number Check] (note: if you don't need to check the number of pins, you don't need to check), and then click [Set Pins] to set the pins. As shown in the following figure:

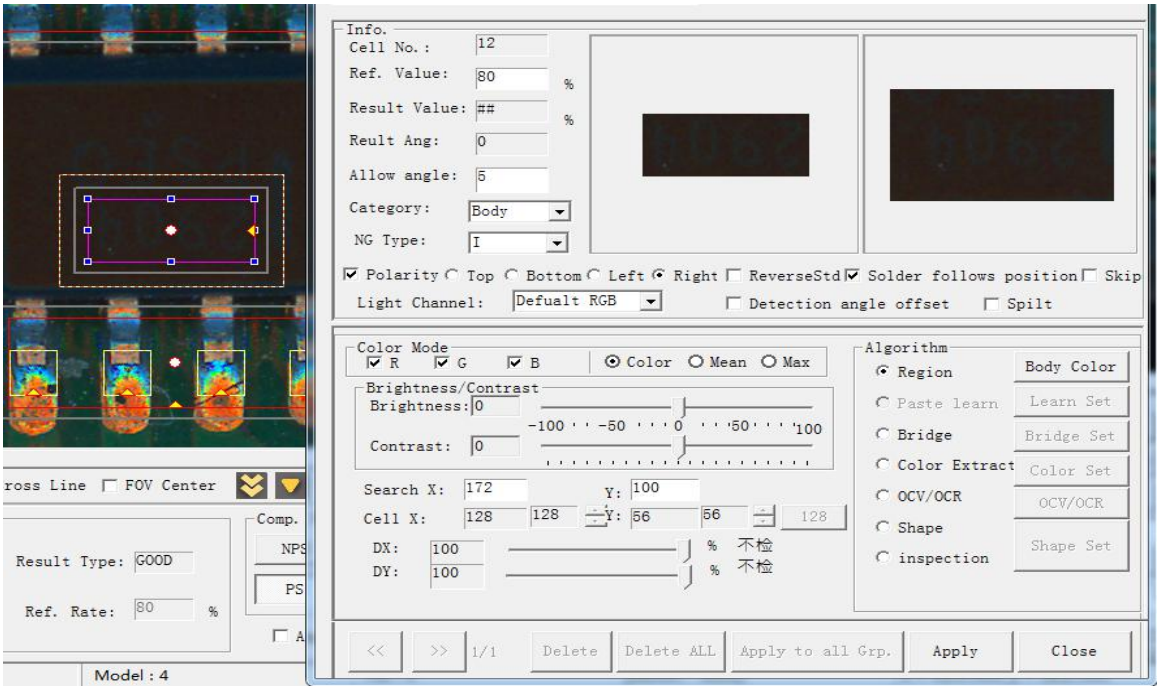


Select a standard pin from the pins in the upper part of this interface. Then select a standard pin frame with the left mouse button, and click [Generate Pin] after making the frame. All pin frames will be automatically generated. As shown in the following figure:

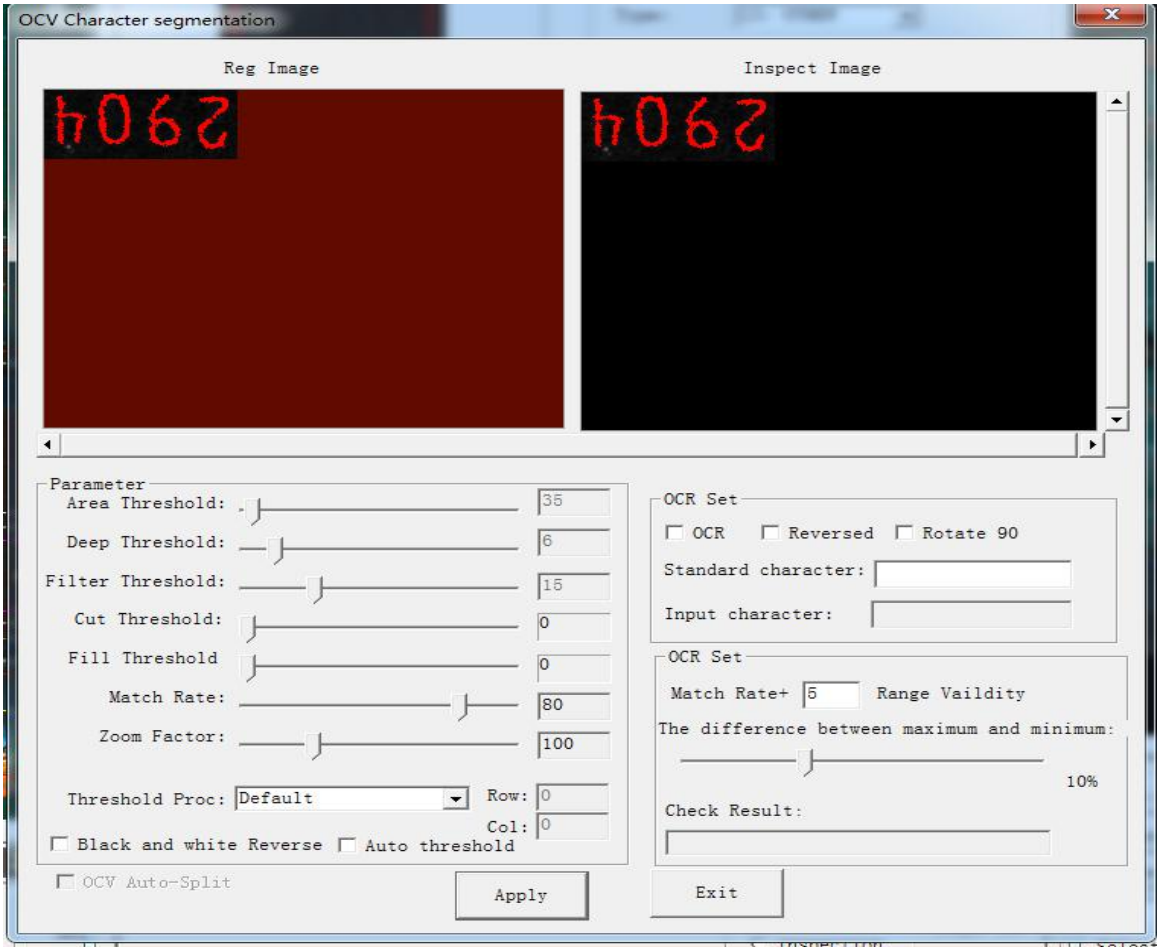


Then click [OK] to return to the previous interface. Click [Save] to return to the previous interface and click [Apply]-[Close]. Use the same method to make the pin on the other side.

Then, select [Polar Box] (note: for components have no direction, you can select [None-polar Box]) to screen print the characters on the IC body (note that all screen printing is not required, only clear and stable material characters need to be selected in the box), as shown in the following figure:



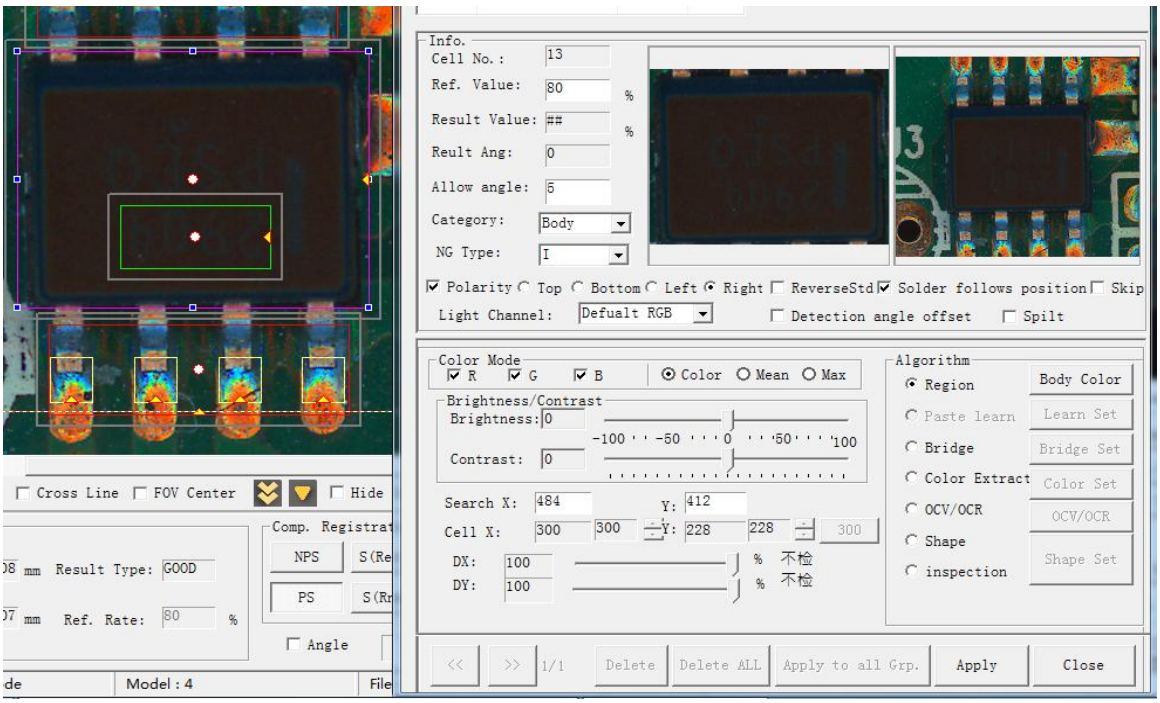
Then check [OCV/OCR] algorithm in the property interface, which is generally used for characters. Check it and click [OCV/OCR] to enter the setting interface, as shown in the following figure:



By debugging [Area Threshold], [Segmentation Threshold], [Filtering Threshold], [Corrosion] and [Filling], the characters can be clearly adjusted to the best. If it is black and white, check

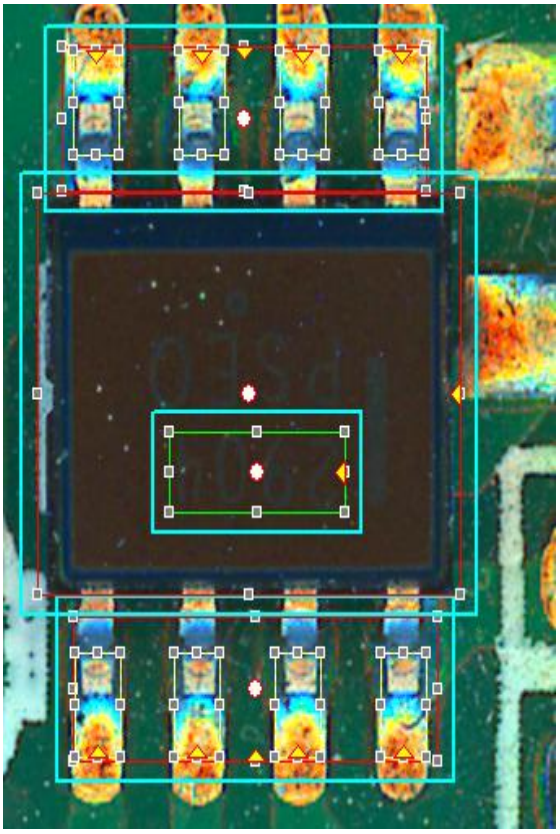
[Black and White Reverse] and then debug. When debugging is finished, click Apply-Exit to return to the upper interface, and then click [Apply]-[Close].

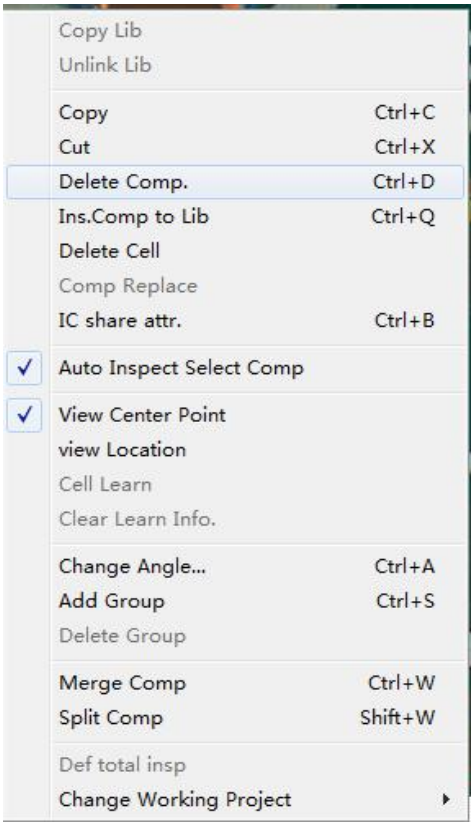
Select the noumenon of this IC by using the [Polar Box] (note: if the component has no direction, you can choose the [None-polar Box]) (note: if the IC is too large, you don't need to make the noumenon frame of the IC). As shown in the following figure:



In the property interface, the [Region Method] is used for noumenon by default. If the noumenon is unclear, check [Mean] or [Maximum]. In addition, the first three light source channels can be matched at will. You can also adjust [Brightness] and [Contrast] to make the image clear, and then click [Apply]-[Close].

After each individual inspection drawing is completed, select all the component boxes, and then click the right mouse button to select [Merge Comp]. As shown in the following figure:





It is to merge components into a combination. After merging into a whole, the component is registered. After registering, select a standard pin from each side pin, click with the left mouse button to select the lead frame, right-click and click [IC Solder Joint Sharing Standard]. Pins on each side will share one pin according to this method. The component IC is manufactured, and the same IC can be copied by Single-Point Copying according to the capacitance method.

QFP: the editing method of QFP is basically the same as that of IC, just drawing the [Short-circuit Boxes] on both sides and merge them together. Other editing methods are the same.

Other special-shaped components: for example (Pentagon, switch, card holder, etc.). Generally, first make each frame that needs to be inspected, and then select the appropriate operation method. After drawing, merge each box of the component into a whole, and then register the component.

Solder leg: [None-polar Frame] can be selected for the solder leg, and the color extraction can be selected as the calculation method (if there is not enough tin on individual components to show blue, the region method can be used.

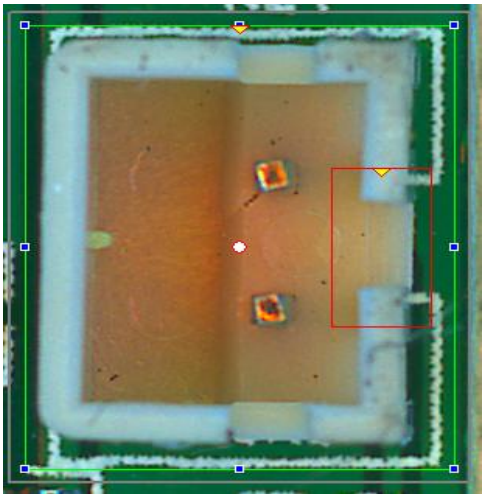
Noumenon frame: if the noumenon has polarity, choose [Polar Frame]. And choose [None-polar Frame] if it has no polarity. The editing method of the noumenon frame of IC is the same.

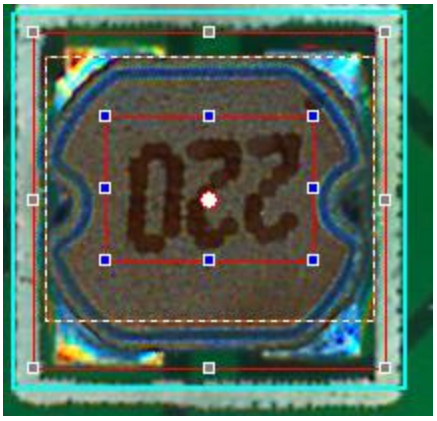
Screen printing frame: if the screen printing has polarity, choose [Polar Frame]. And choose [None-polar Frame] if it has no polarity. The editing method of the noumenon frame of IC is the same.

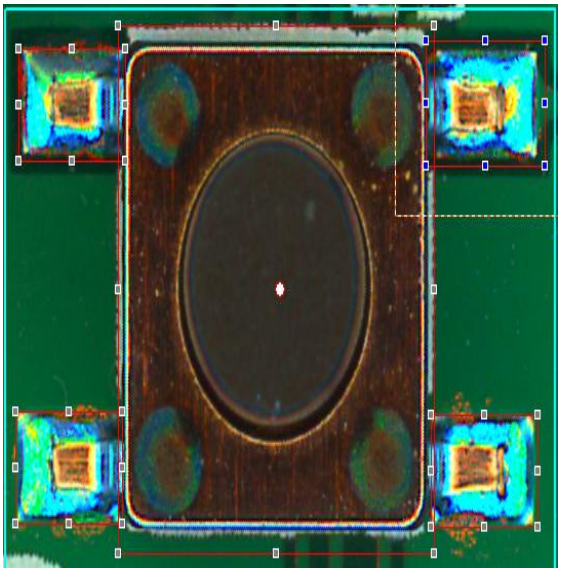
Dense pins: select [Short-circuit Frame] with reference to the same editing method of screen printing frame of IC.

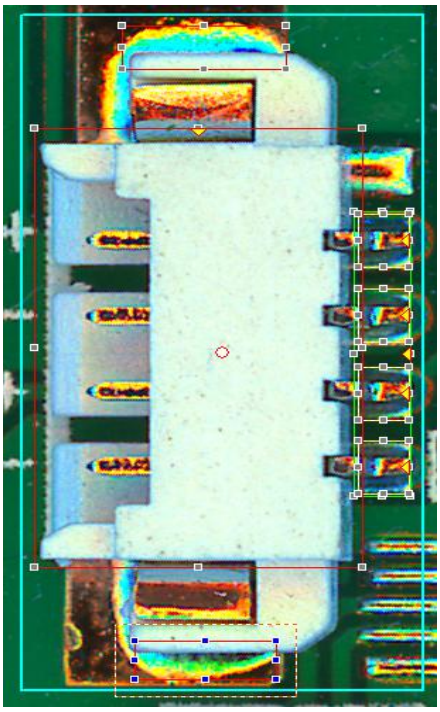
The following are pictures of editing methods for individual special-shaped components. As

shown in the following figure:

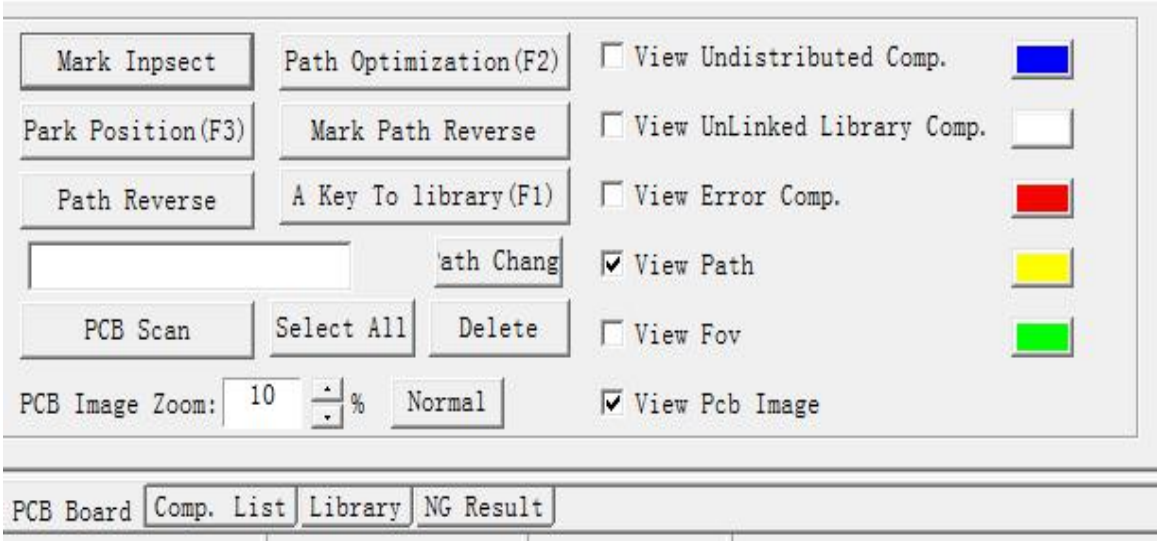






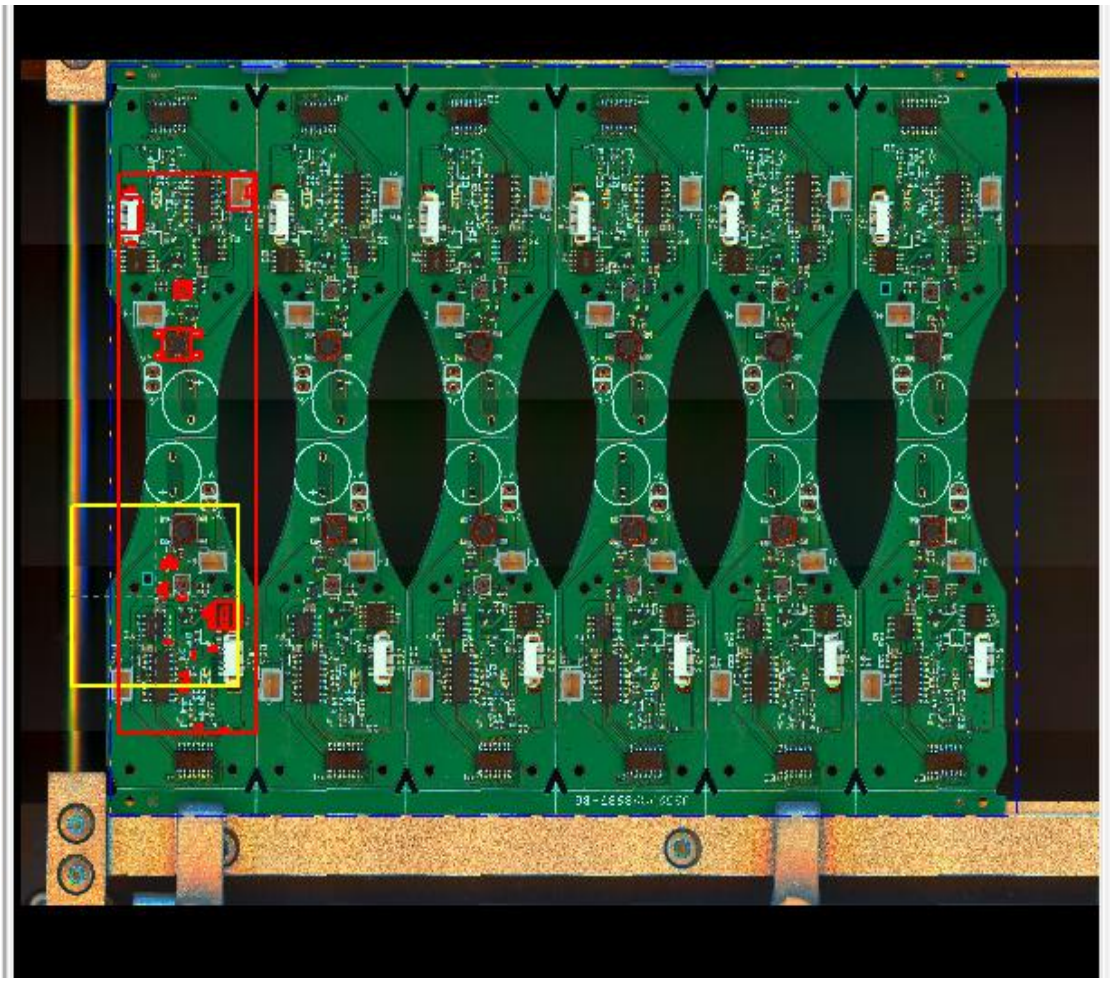


According to the above method, edit all the components of this split board and then click [One-click Register] (shortcut key F2), as shown in the following figure:

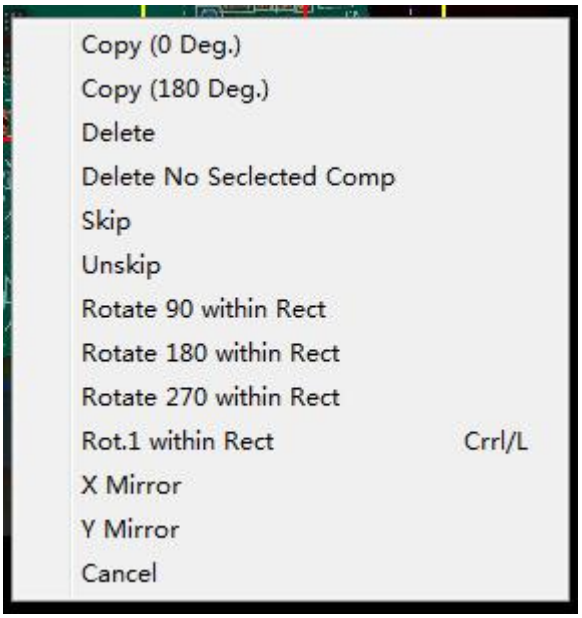


After registering, all the components forgot to be registered when editing the components will be registered. Then the component frame edited by this split editing will be copied to another split board. The specific operation is as follows:

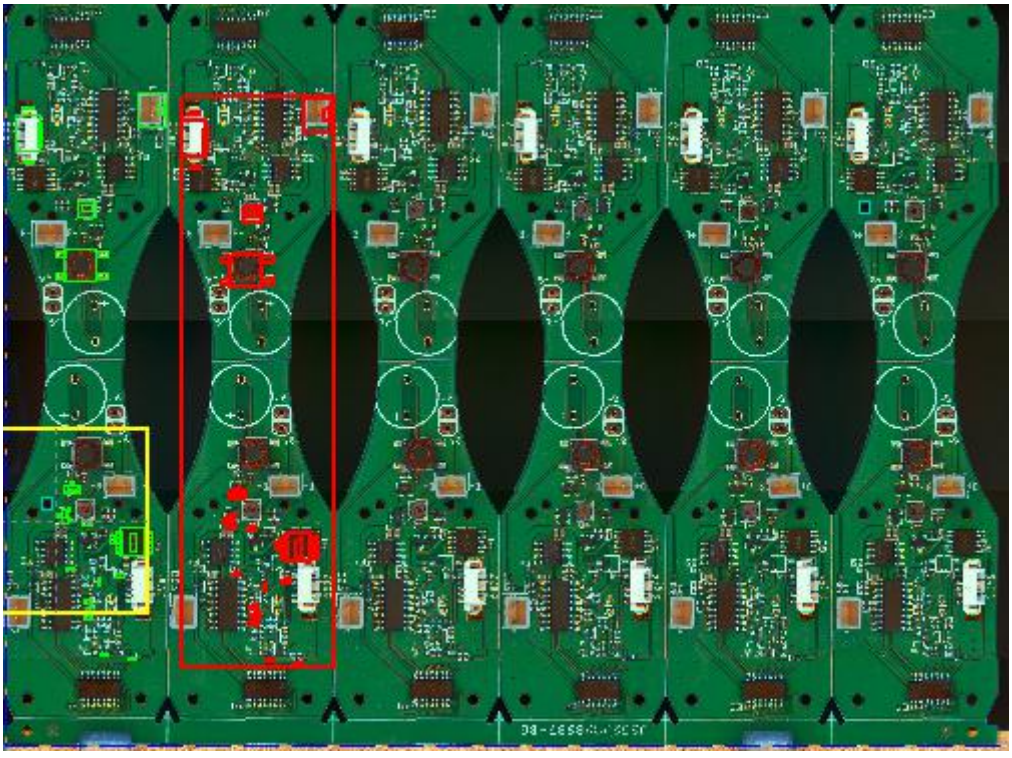
First, select the edited component split board in the left mouse button box on the thumbnail in the right, or directly click [Select All below]



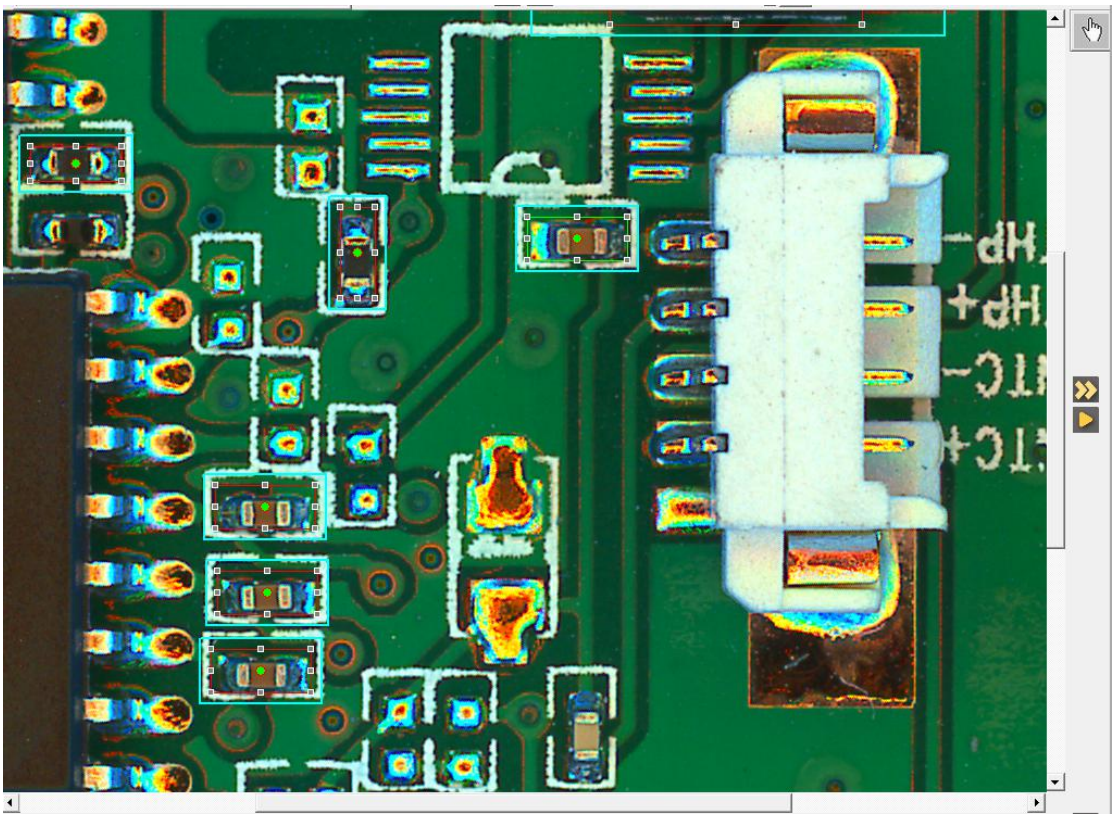
Right-click after selection, as shown in the following figure:



Click [Copy Component] (0 degree indicates no rotation, 180 degree indicates copying by rotation by 180 degree). Move the copied frame to the approximate position of the next spilt, and then click the left key. As shown in the following figure:

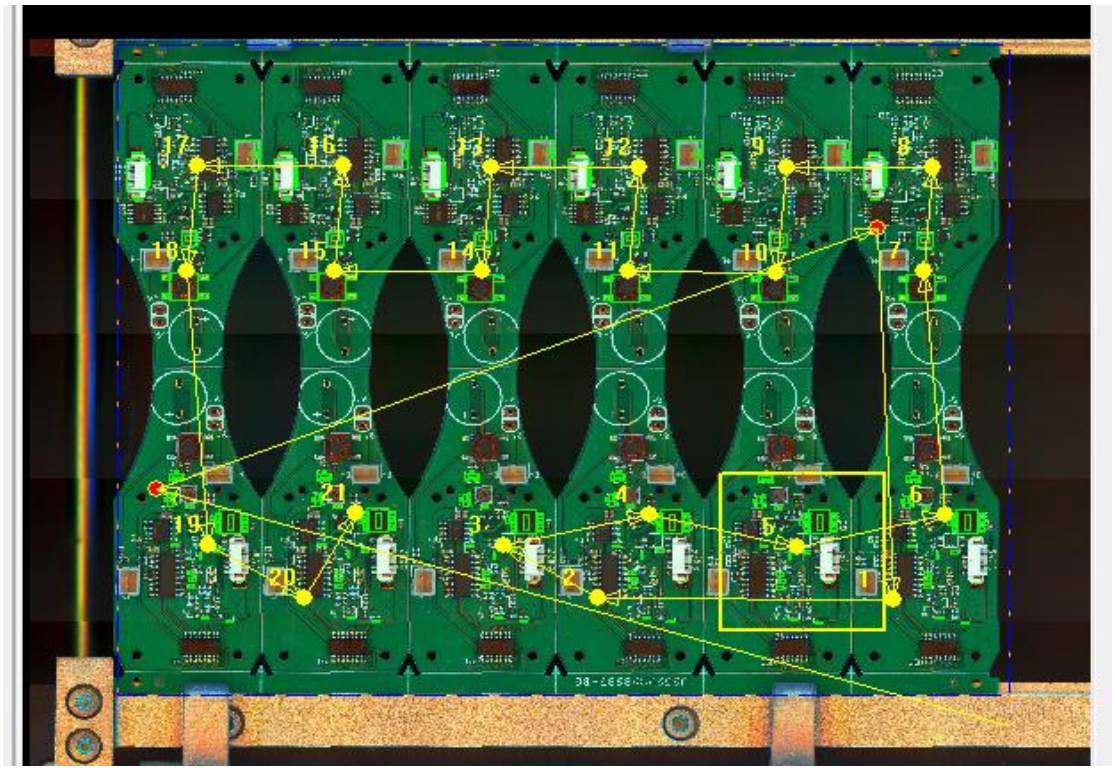


Then double-click the mouse to move the position of the camera to the copied spilt, and drag the whole components of the spilt to the correct position with the left mouse button on the diagram on the left side of the interface, and move them to the correct position. As shown in the following figure:

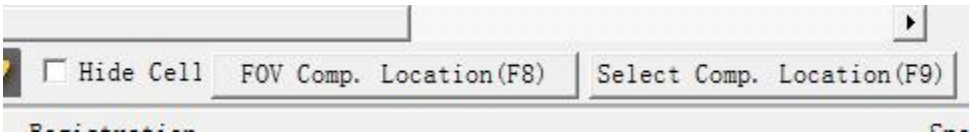


After alignment, click with the left mouse button in the blank place where there are no components, and copy all the spilt according to this method. (When there are many spilts, it is recommended to copy them together)

After copying all the spilts, click [Path Optimization] at the bottom of the interface, so that the running route of the camera will come out, and the camera will inspect according to the digital sequence of the path on FOV during later inspection. As shown in the following figure:



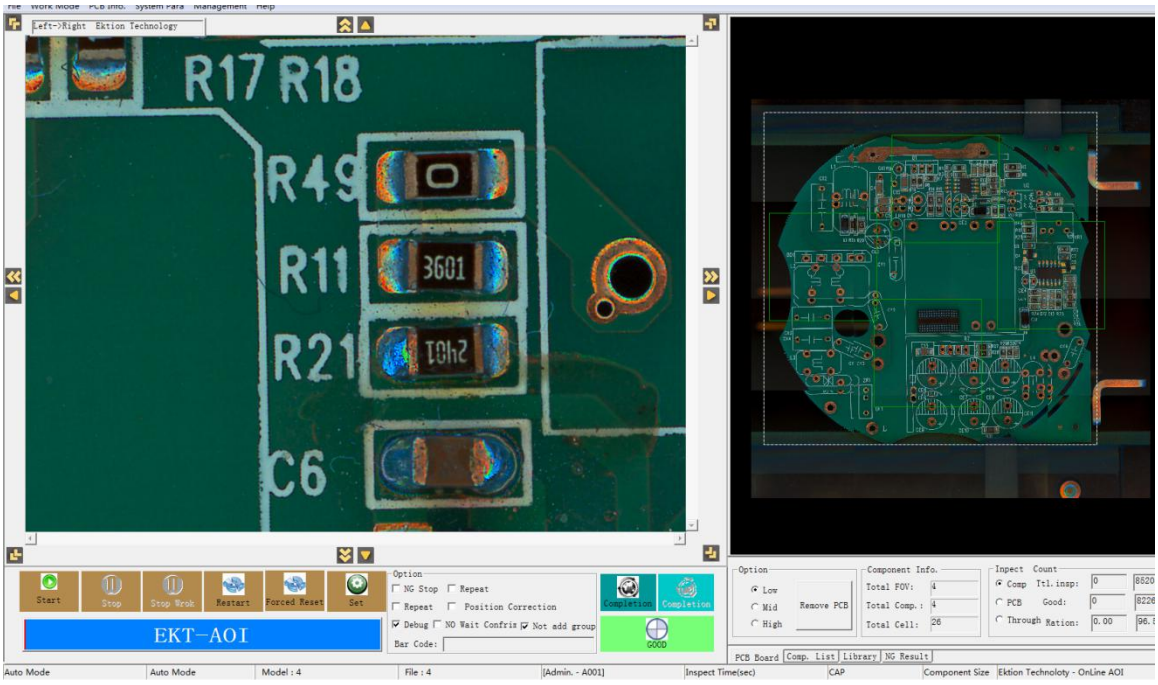
Click [FOV Component Positioning] or [Overall Positioning] if the inspection frame of individual components is found to be incorrect after completion, The former is to position the component frame inside the camera frame only according to the noumenon frame, while the latter is to position the component frame on the whole PCB board according to the noumenon frame, as shown in the following figure:



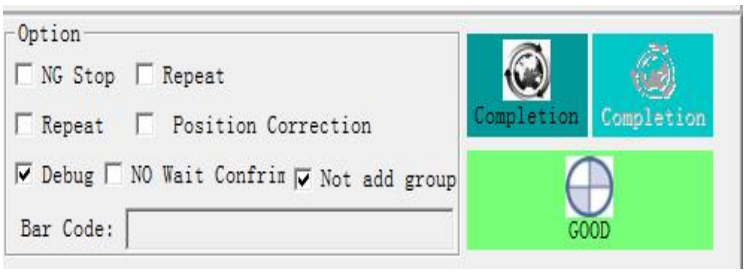
After positioning, click [File Management]-[Save] in the menu bar to complete the editing mode.

8.2.2 Debugging mode

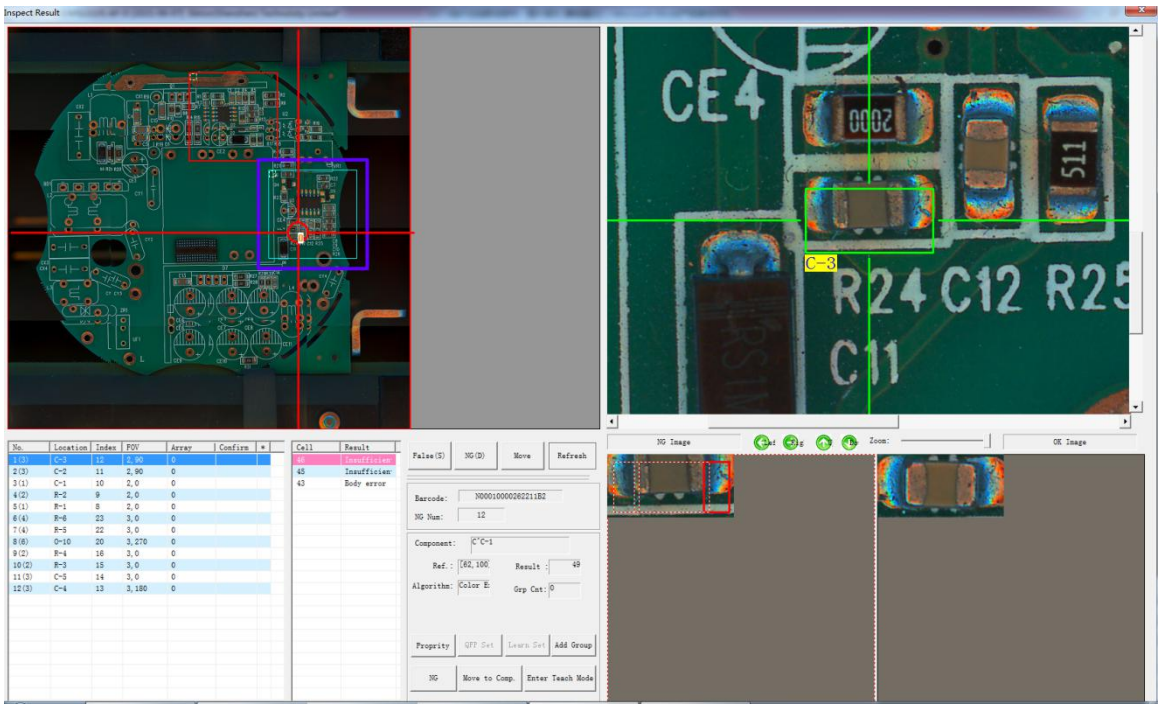
Enter the inspection mode in [Working Mode]-[Inspection Mode]. As shown in the following figure:



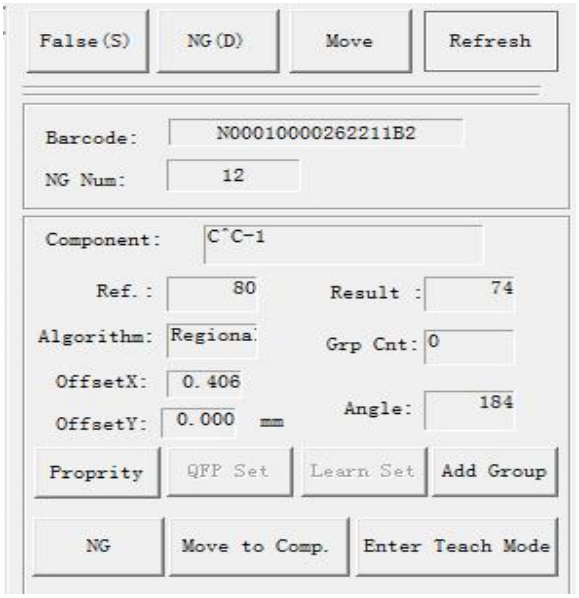
When debugging, check [Debug] and [Not Add Group], and then click [Start], as shown below:



[Space Key] is the shortcut key of the start key. If there is a board at the board entrance end, it will automatically enter for inspection. After the inspection is completed, the false alarm debugging interface will pop up. As shown in the following figure:

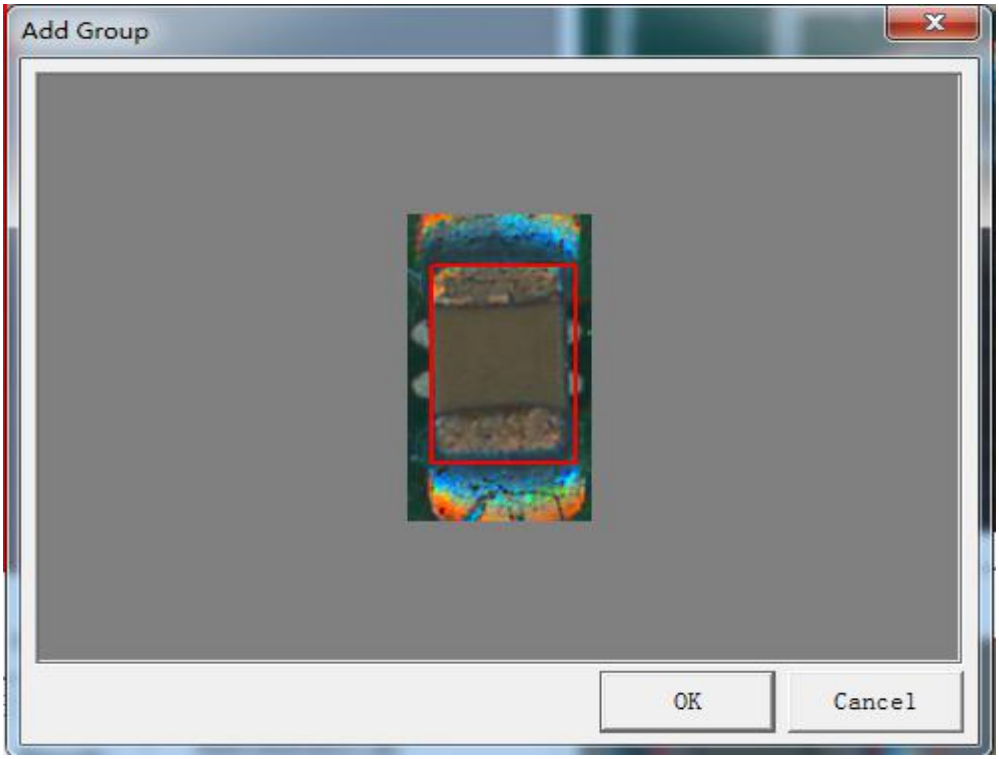


The upper left corner of this figure is the whole PCB image with crosshairs and marked positions. The upper right corner is the FOV enlarged image. The lower left corner is the components displayed by false alarm and the frame of each component displayed. The lower right corner is the standard image and the actual inspected image. The lower middle is the information of the component frame. False alarm debugging depends on the information location of the component frame, as shown in the following figure:

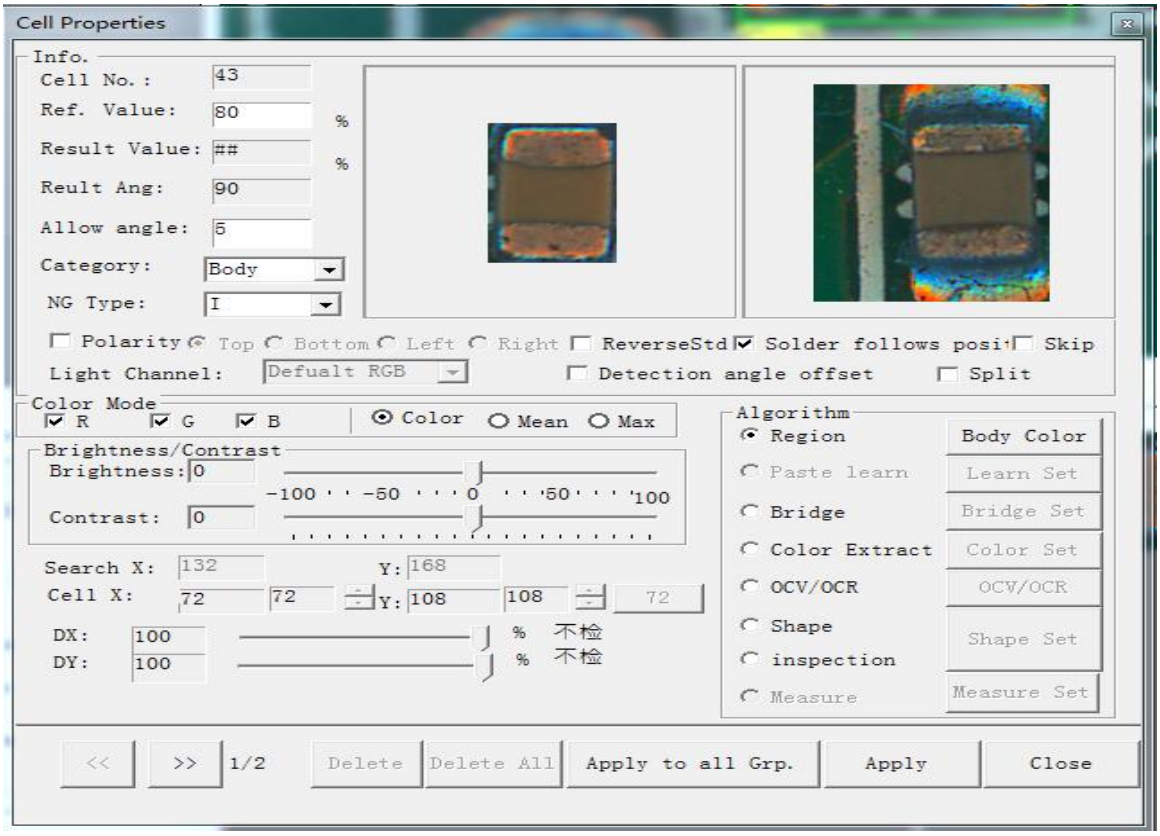


First, check the [Unit Type] of the component frame, that is, the operation method of the component frame.

The calculation methods are [Region Method] and [OCV]: for these two calculation methods, we adjust the false alarm by adding contrast images. That is, for good pictures, click [Add Group] (note: bad pictures and similar bad pictures cannot be added). As shown in the following figure:



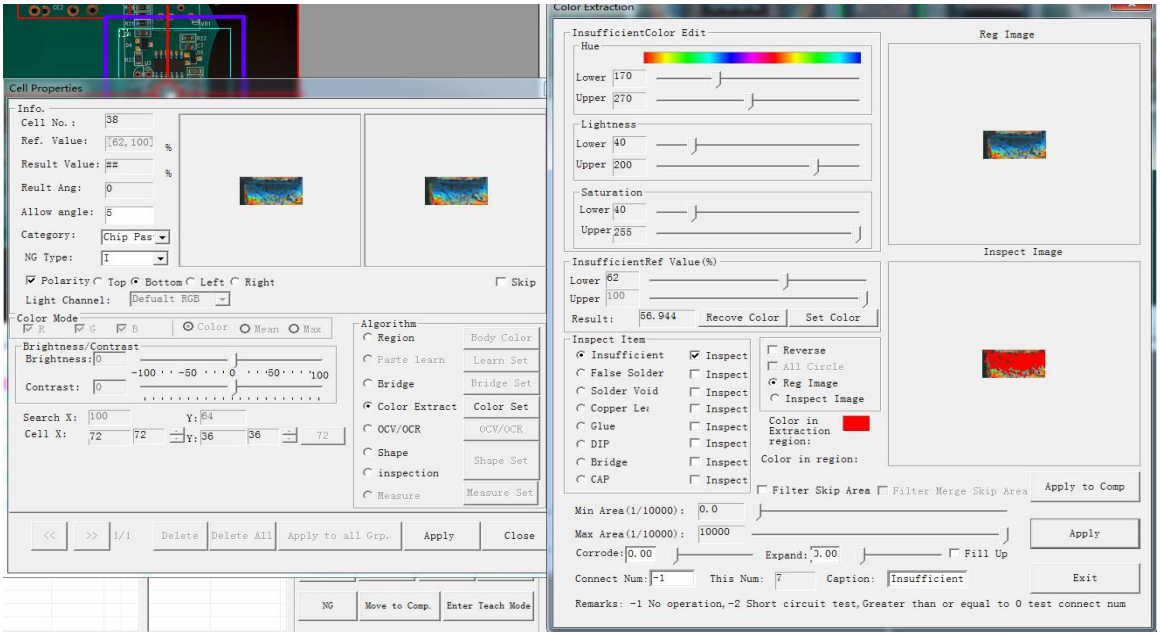
If the inspection frame is not on the component, drag it onto the component and click [OK] to finish. Click [Component Properties] if there is an error in adding pictures. As shown in the following figure:



In the lower left corner of this interface, find the wrong picture by turning back and forth and delete it (note: the first image is the registered image of the component, which cannot be deleted. But images from the second image can be deleted). If there are still many false positives after

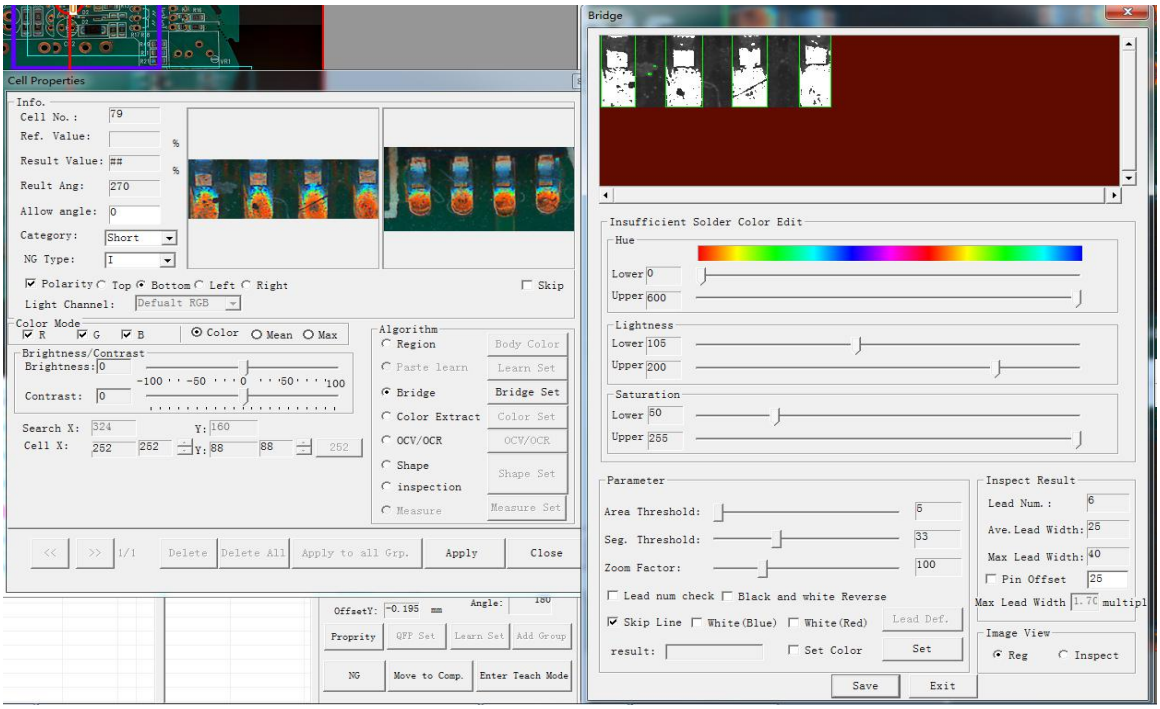
adding dozens of pictures, you can slightly lower the [Qualified Reference Value] in this interface to achieve the effect of false alarm debugging.

The calculation method is [Color Extraction]: first click [Component Properties]-[Color Extraction] as shown in the following figure:



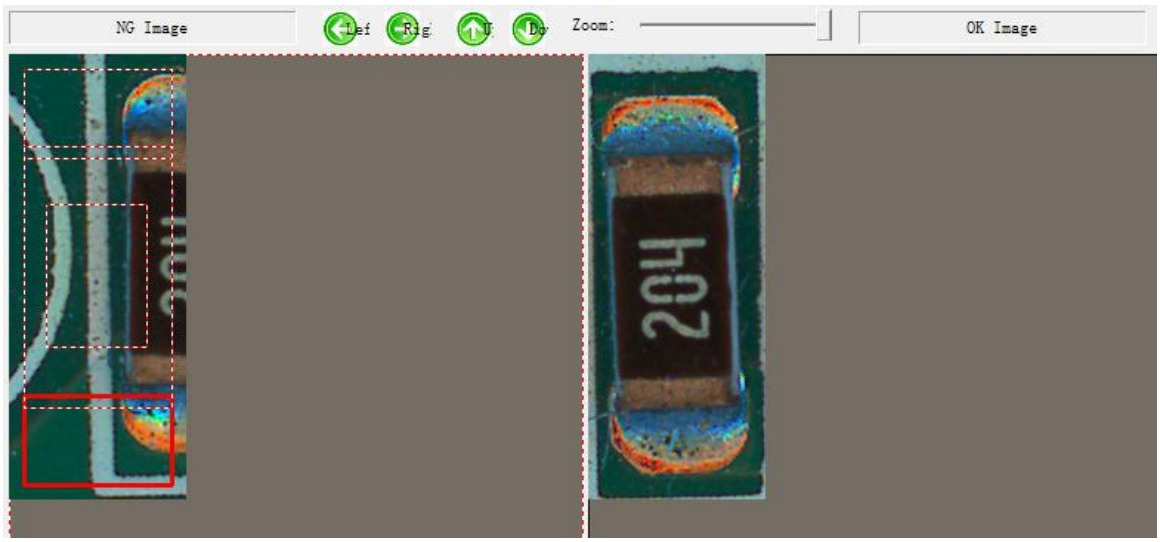
First, check [Image to be Inspected] to switch to the image to be inspected, and then see if the tin color is completely extracted. On the right side of the figure, the specified color will be displayed at the extracted position. If it is not completely extracted, it can be debugged by debugging [Hue], [Brightness] and [Saturation] (note: the color of the empty pad cannot be extracted). If all colors of tin are extracted, the lower limit of [Qualified Value] can only be lowered according to [Inspected Value] to adjust the false alarm. After adjustment, click [Apply to Current Components]-[Exit] and then return to the previous interface and click [Close].

The calculation method is [Short Circuit Inspection]: first click [Component Properties]-[Short Circuit Setting] as shown in the following figure:

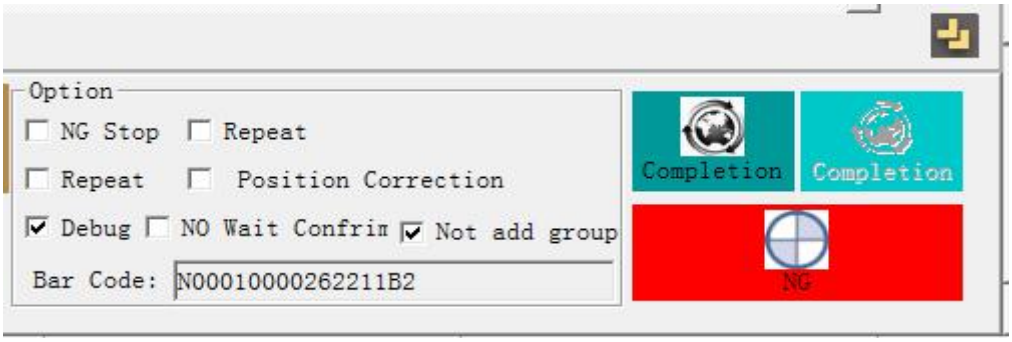


First, check [Image to be Inspected] to switch to the image to be inspected. Then check whether each pin in the upper part of this interface is clearly divided and whether there is foreign matter in the middle, and then debug and divide the pins by [Area Threshold] and [Division Threshold] until each pin is clearly divided, then click [Save] to return to the upper interface and click [Close].

Where the component frame is offset, as shown in the following figure:



The offset of a single component frame can be realized by the arrow at the top of the picture. If most component frames are offset, you can click [Move to Current Component]-[Enter Editing Mode] in the middle of the lower part of the interface, and then you will enter editing mode. The camera will automatically move to the currently shifted component and then adjust the position. After adjustment, click [Working Mode]-[Inspection Mode] in the menu bar and then click [NG] in the figure to return to the current false alarm interface, as shown below:



Debug false alarm according to this method, It is suggested that debugging should not be finished at one time, but be carried out from the new inspection download after several debugging, which is helpful to the efficiency of false alarm debugging. Click [Enter] on the keyboard to return to the start interface of inspection mode, and click [Board Out] at the bottom of the interface to discharge AOI. Debug a few more boards in this way. When the false alarm is reasonable, click [File Management]-[Save] in the initial interface. The debugging mode is completed.

8.3 CAD data import:

Using CAD data import method to edit programs can improve editing speed, reduce wrong links and effectively improve editing efficiency. To use CAD programming, it is necessary to first have the edited PCB CAD data, which includes the following elements: component pin position, component coordinate (X Y coordinate), patch angle, component material code.

The specific operation method is as follows: the file containing the above four kinds of data is exported in the form of TXT text file from the mounter or coordinate machine, and the redundant parameters of the TXT document are removed by EXCEL (only the file of single board cument is needed). The parameters are separated by unified tabs or comma or semicolon or space. The specific format is as follows:

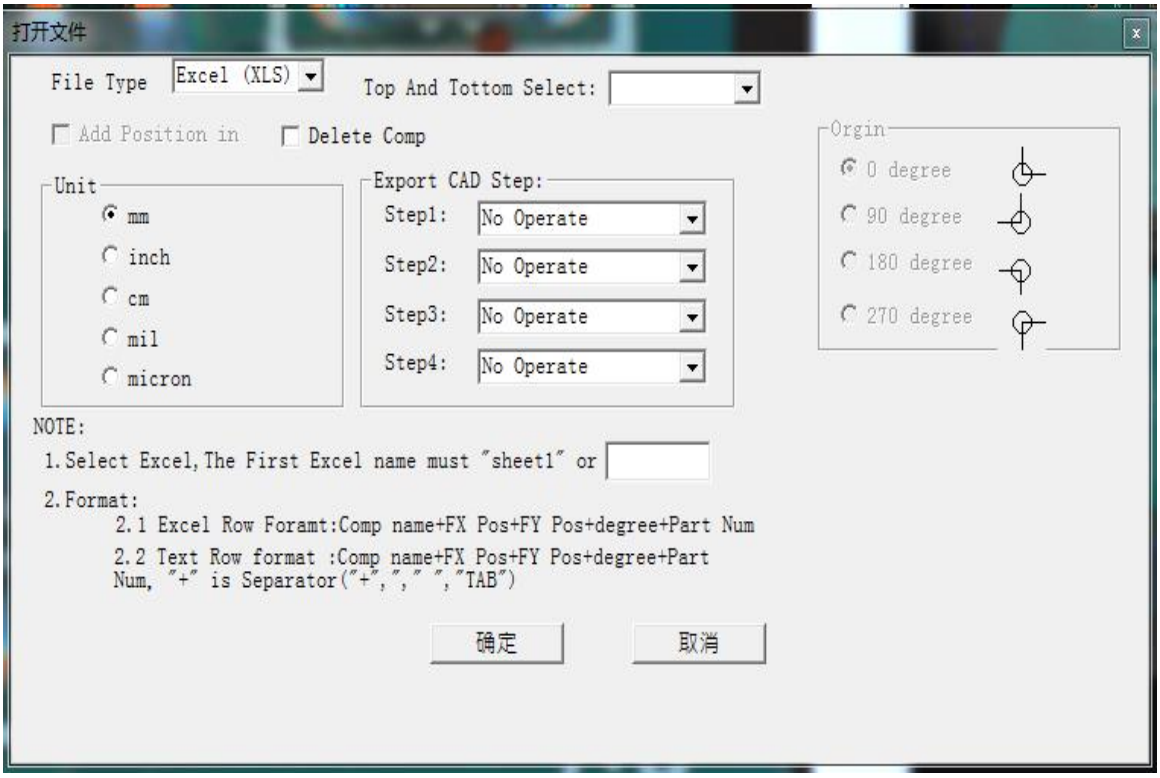
	A	B	C	D	E	F	G	H
1	位号	X坐标	Y坐标	角度	料号			
2	C34	-51.17	71.76	0	104/C0603			
3	C33	-67.37	71.76	0	104/C0603			
4	C37	-19.09	71.76	0	104/C0603			
5	C8	-56.12	38.86	0	104/C0603			
6	C17	-57.34	54.28	90	104/C0603			
7	C1	-57.62	34.67	90	104/C0603			
8	C36	-35.08	71.76	0	104/C0603			
9	C30	-67.75	23.21	90	104/C0603			
10	C21	-49.26	48.59	0	104/C0603			
11	C6	-21.5	42.29	0	104/C0603			
12	C11	-45.5	32.97	0	104/C0603			
13	C9	-21.75	49.82	0	104/C0603			
14	C4	-3.54	62.95	0	104/C0603			
15	C5	-33.1	58.66	0	104/C0603			
16	C2	-27.43	37.59	90	10UF/C0603			
17	C15	-55.31	18.03	0	10UF/C0603			
18	C7	-21.42	40.23	0	10UF/C0603			
19	C39	-65.85	18.03	0	10UF/C0603			
20	C13	-62.34	18.03	0	10UF/C0603			
21	C16	-73.98	58.55	0	10UF/C0603			
22	C14	-58.82	18.03	0	10UF/C0603			
23	R3	-3.54	59.42	0	热敏电阻NTC/10K/5%/R0603			
24	R67	-36.63	89.33	0	2.4k/R0603			
25	R55	-10.63	83.26	90	2.4k/R0603			
26	R64	-68.64	89.2	0	2.4k/R0603			
27	R99	-32.08	13.92	90	2.4k/R0603			
28	R96	-22.03	13.92	90	2.4k/R0603			
29	R49	-38.38	13.94	90	2.4k/R0603			
30	R101	-24.04	13.92	90	2.4k/R0603			
31	R4	-25.61	37.52	90	2.4k/R0603			
32	R94	-30.07	13.92	90	2.4k/R0603			
33	R41	-50.76	13.89	90	2.4k/R0603			
34	R40	-45.45	13.92	90	2.4k/R0603			
35	R95	-26.05	13.92	90	2.4k/R0603			
36	R100	-28.06	13.92	90	2.4k/R0603			
37	R75	-20.48	89.15	0	2.4k/R0603			
38	R50	-43.68	13.92	90	2.4k/R0603			
39	R65	-52.69	89.05	0	2.4k/R0603			
40	R102	-20.02	13.92	90	2.4k/R0603			

Sheet1

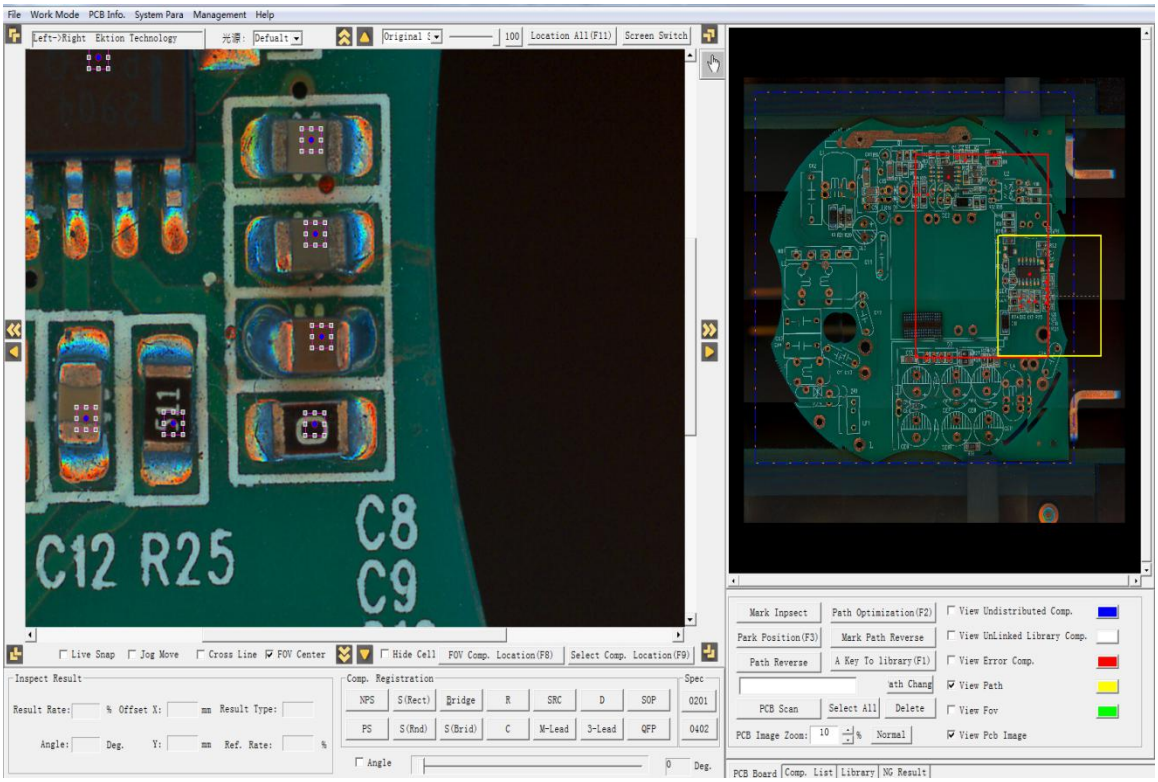
After sorting out the coordinates, start editing the program.

The method in the new mode is exactly the same as that in manual editing, so you can refer to the method of manual editing.

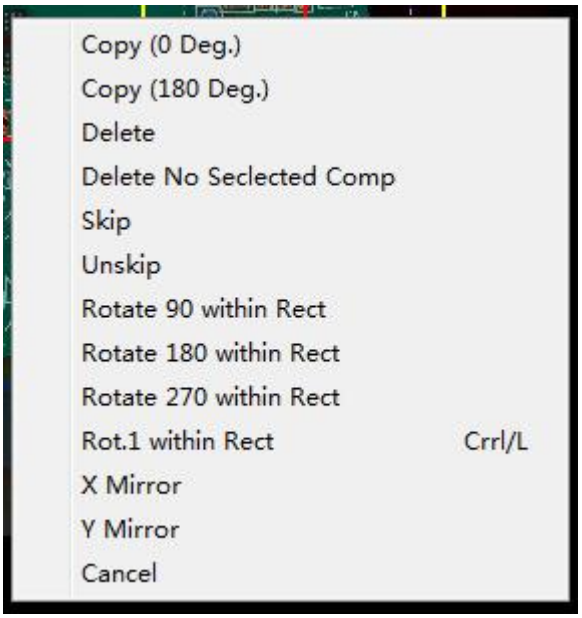
After entering edit mode, click [Work Mode] -[CAD Import] in the menu bar, then select the CAD file to be sorted, and click [Open] as shown below:



Then select [File Type] and [Unit]. If the first table name of the file is not sheet1, fill in the first table name. Then click [OK] to enter the following interface, as shown in the figure:

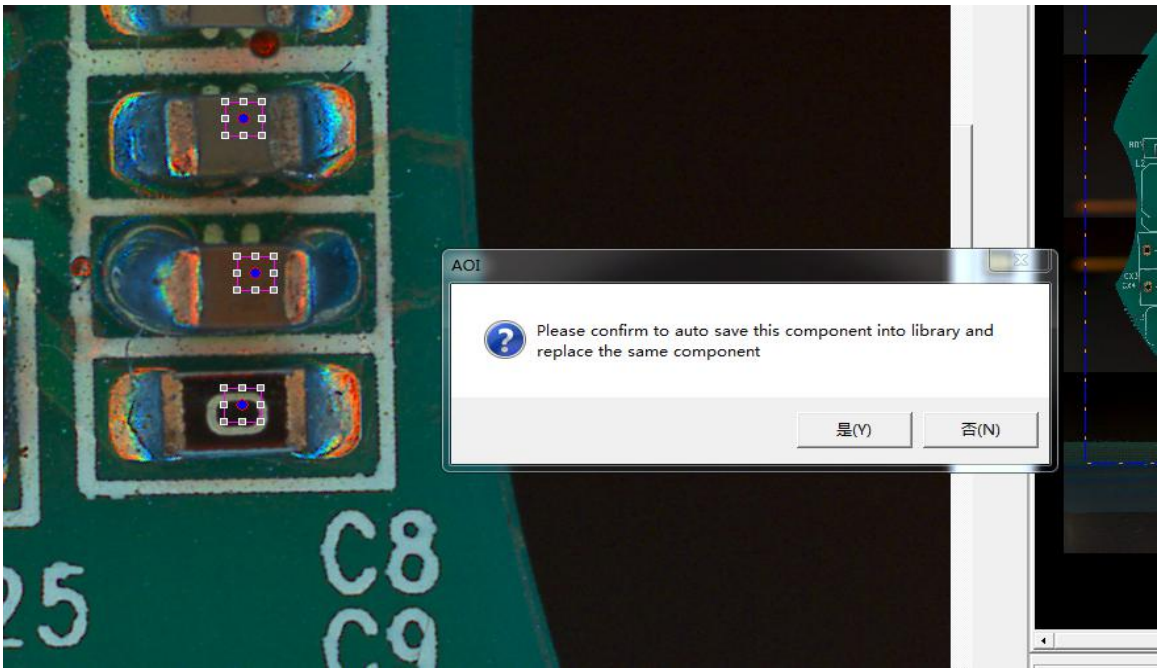


Enter this interface and click [Select All]. Click the right mouse button at the coordinate position of thumbnail, as shown below:



Rotate different angles in the frame, horizontally mirror and vertically mirror to match the position of coordinate points with components on PCB board, and then drag a coordinate point on the left figure to correct it, as shown above.

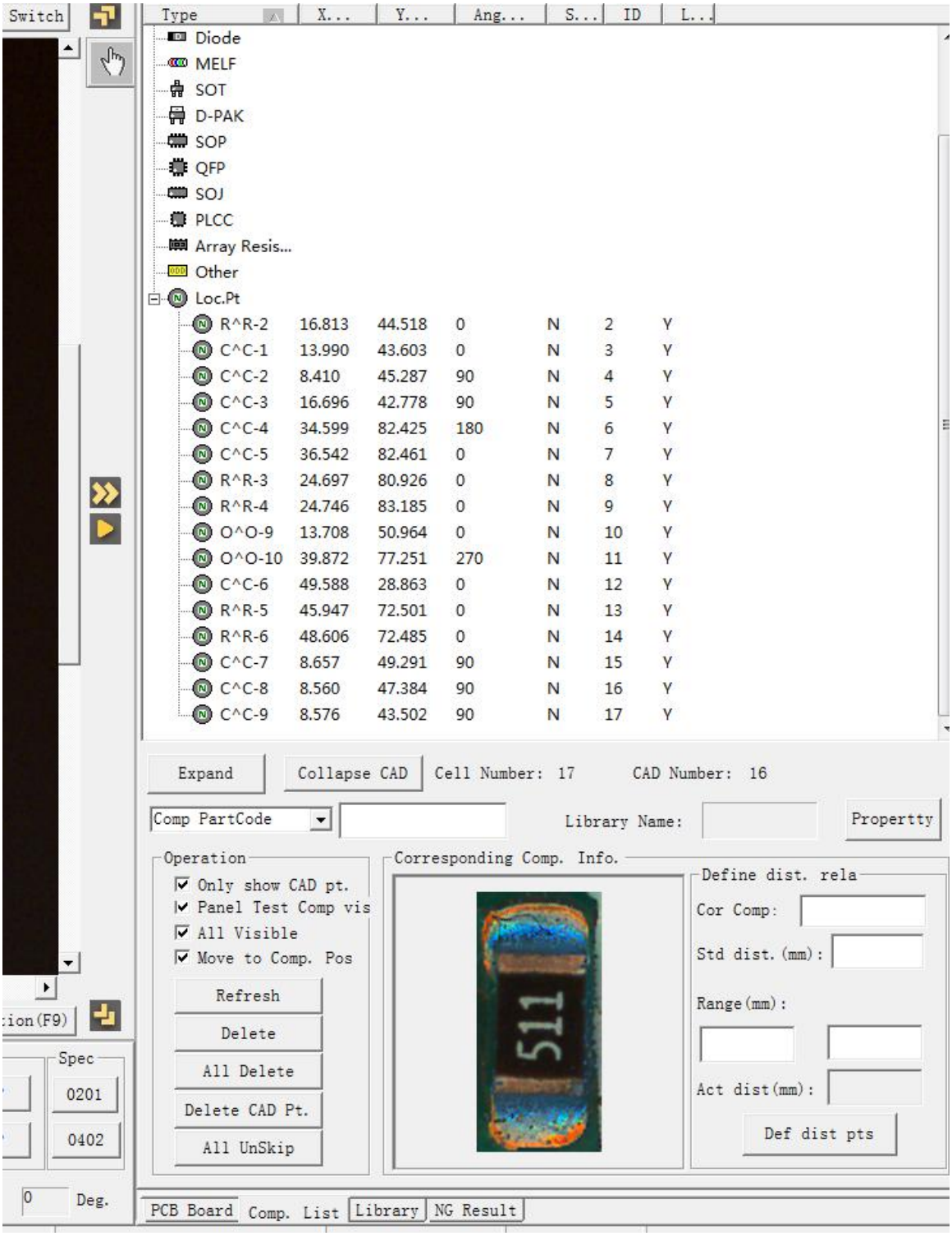
Then edit the component.The selection of the component frame is the same as manual editing, as shown in the following figure:



This interface will be prompted after the component frame is made. Click [Yes], and the component will be automatically registered and the inspection frame of the components of the same item will be automatically generated. However, after the component frame is registered, its size cannot be modified. Only the property interface of the component frame can be modified. If you need to change the size of the component frame after making the frame, click [No]. At this time, the component frame is not registered and you can change its size. Register it after proper adjustment. When registering, the item number will be automatically generated for this coordinate. After clicking [OK], the inspection frame of the components of the same item

number will be automatically generated at the same time.

To facilitate editing, you can click [Component List] and then check [Show CAD Points Only]. At this time, the coordinates of components that have already been made in the list will not be displayed. Left-click and double-click the camera on the left of any coordinate interface to automatically move to the current coordinate position, which is convenient for editing components. As shown in the following figure:



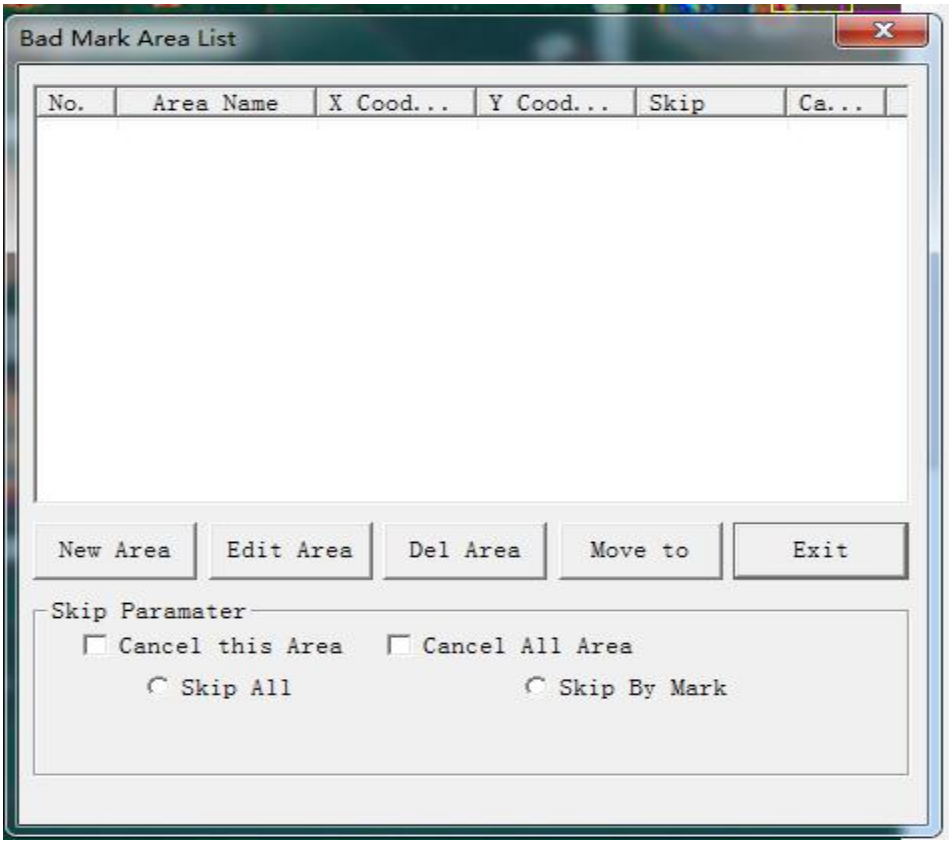
The remaining methods and steps of editing components are the same as manual editing.

In the debugging mode, the false alarm debugging is implemented as that in the manual editing.

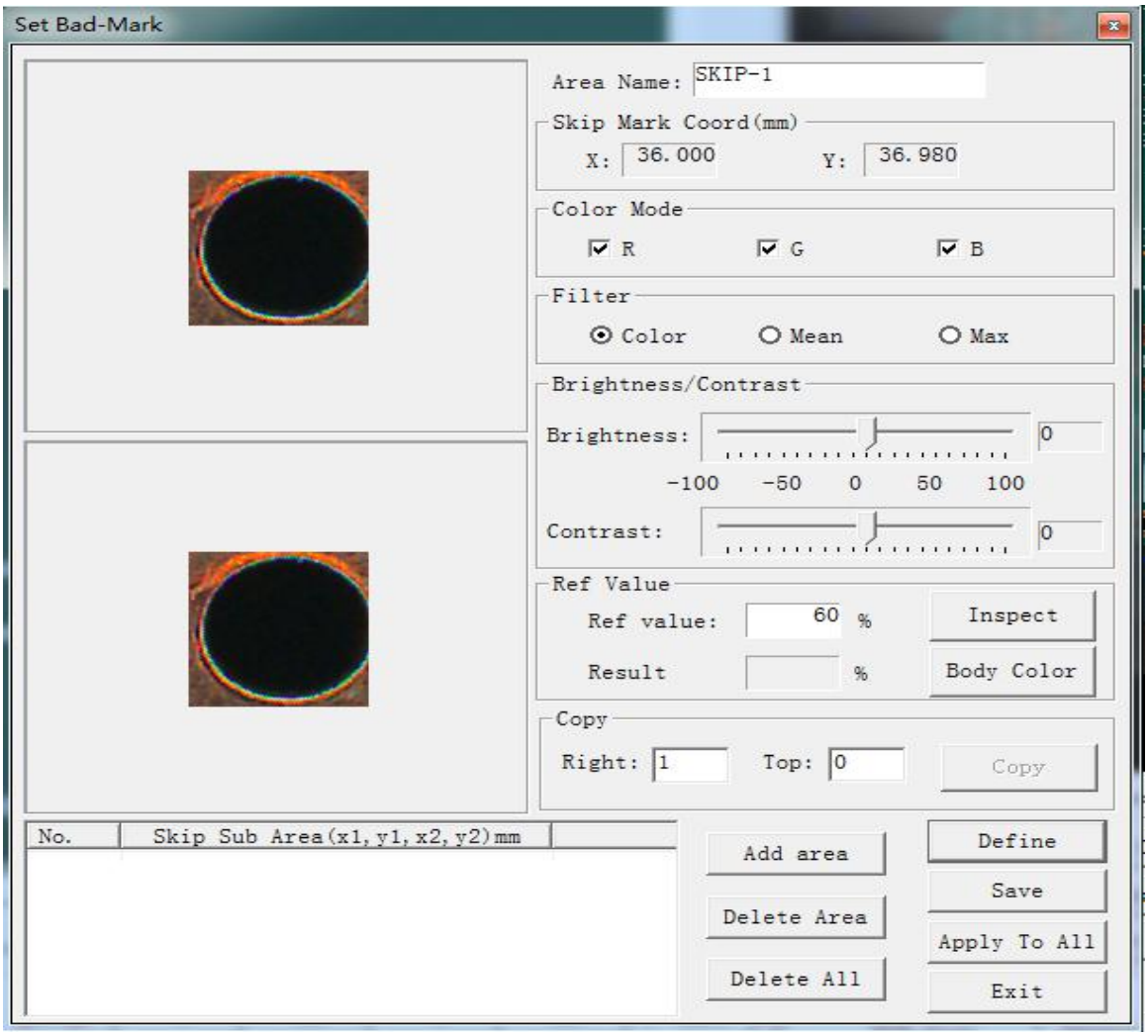
8.4 Setting of bad mark skip board

After the program editing and false alarm debugging are completed, the skip board can be set.

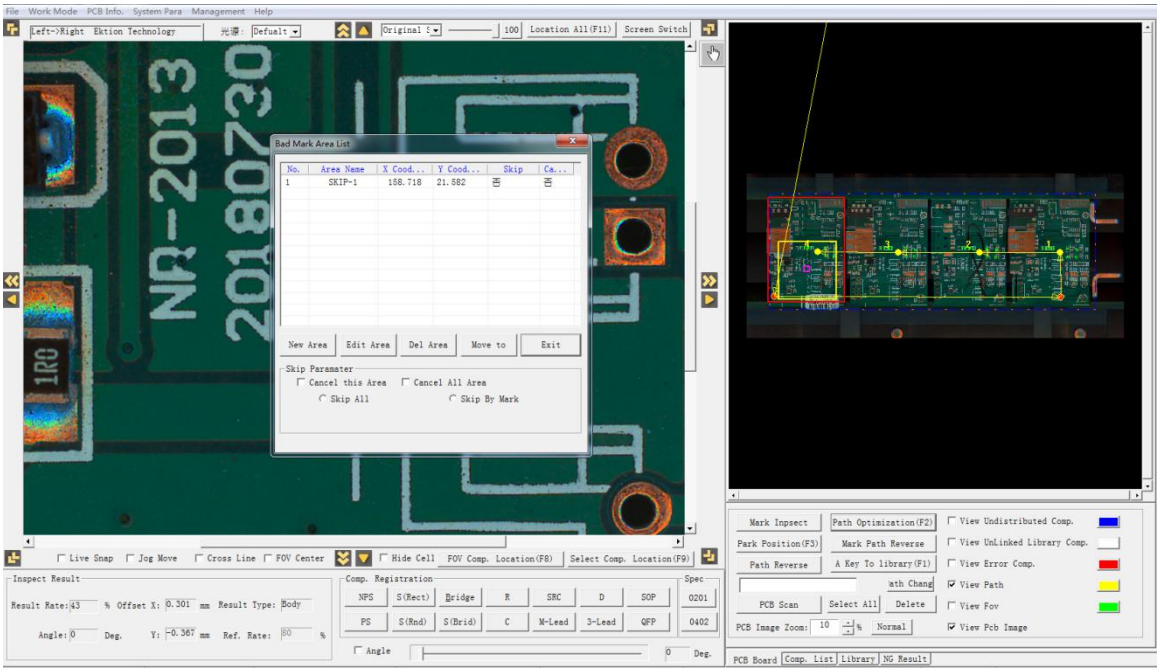
Enter [Editing Mode] after false alarm debugging. Then click [Base Board Configuration] in the editing mode and open [Set PCB Bad Mark], as shown below:



Click on [New Area], as shown in the following figure:

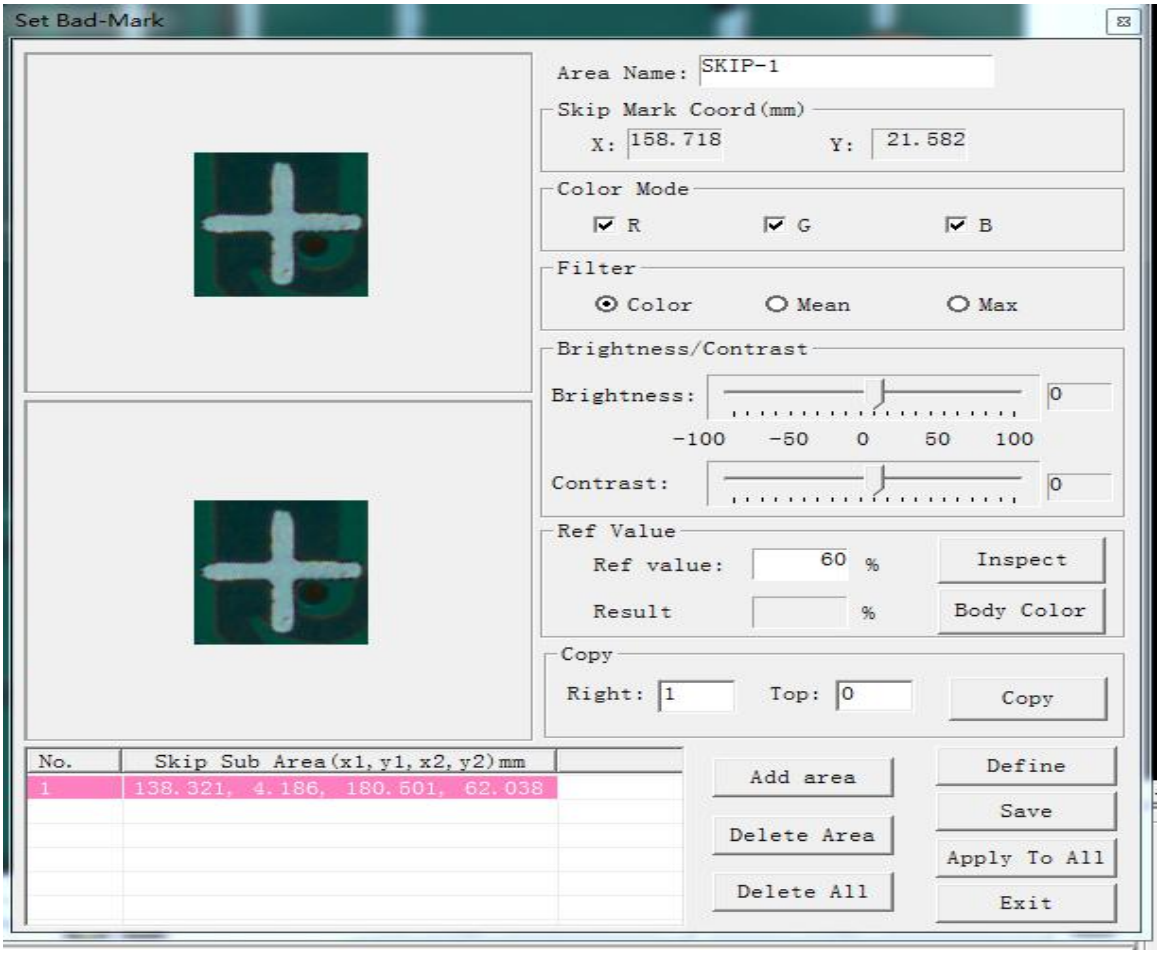


First, select a screen printing or through hole in the lower left spilt of PCB board, box this pattern in the left image of the interface, and then click [Set Image] to finish, as shown in the above figure. Box the single spilt of PCB in the lower left corner on the right thumbnail of the later interface, click [Add Sub Area] after the box is selected, and then click [Save]-[Exit] to finish, as shown in the following picture:

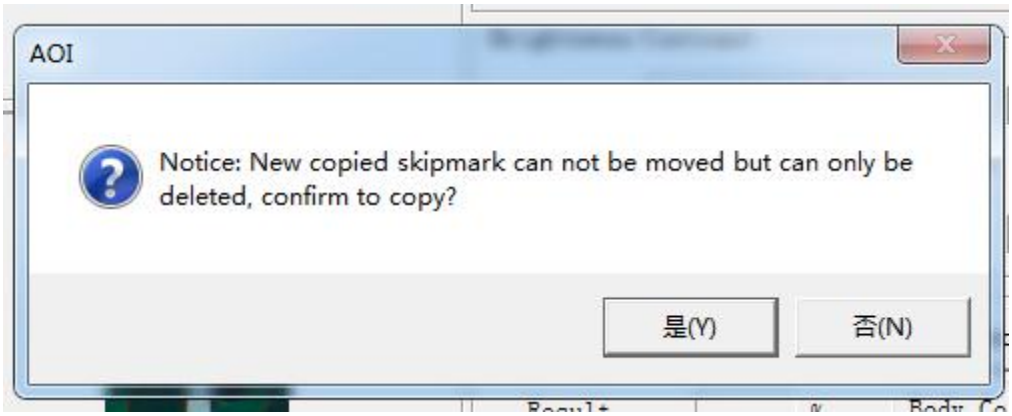


Then you can set to skip directly when NG reaches the set ratio (the system defaults to skip directly when the false alarm ratio of a single spilt reaches 50%)

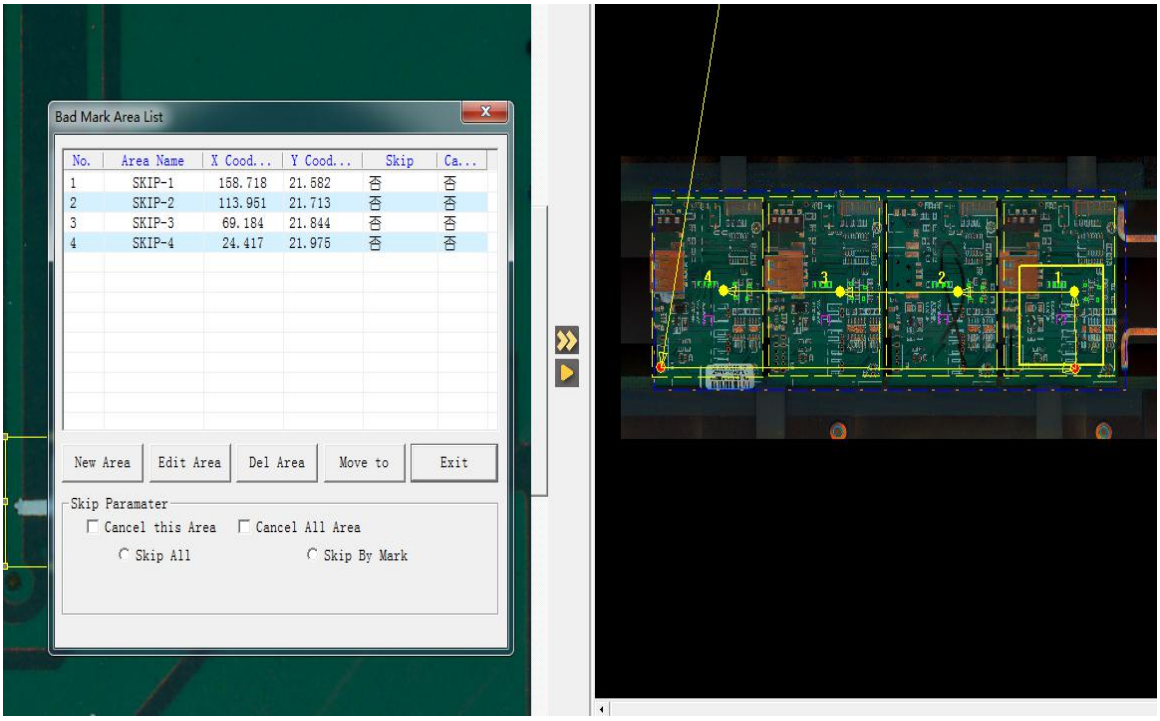
After setting, click [Edit Area], as shown in the following figure:



After entering this interface, check the same image defined in [New Area] on diagonal spilt (i.e., spilt in the upper right corner), and then enter the corresponding numerical value in front of [Copy] at the bottom of the interface according to the spilt arrangement. (Note: the new area shall prevail. Enter the number of areas on the right and the top, and the number of the new area is not counted). Then click [Copy], as shown in the following figure:



Then click [Yes] as shown in the following figure:



Click [Exit]. After editing, each single spilt will automatically generate a yellow dotted frame on the thumbnail on the right. Then click [Save] in [File Management].

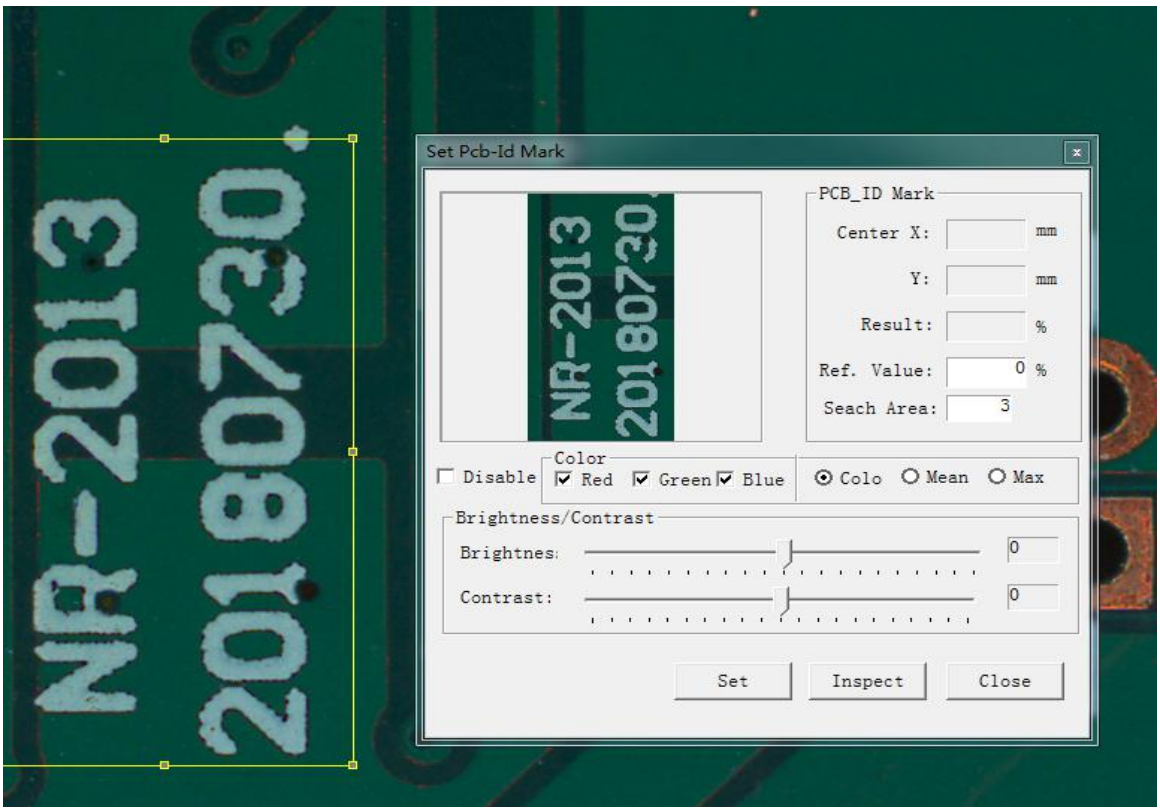
If there are spilts of different angles (yin and yang boards) on the PCB board, the operation of spilts of the same angle should be done first according to the above steps. Then, the operation of spilts of another angle should be started from [New Area] until it is finished.

8.5 Setting of ID mark

This function is used to inspect the front and back sides of PCB board at the same time, and two programs can be adjusted at the same time. When AOI inspects the board, the corresponding programs can be called for inspection by identifying different identification points on the front

and back sides of PCB board.

After debugging the program with false positives, enter [Set PCB-ID Mark] from [Base Board Configuration] in the menu bar, as shown below:



Then, select a fixed image from the whole PCB board, box it in the fact image on the left side of the interface, and click [Set], as shown above. (Note: a clear and stable image should be selected, and the same image cannot be found at the same position on the other side of the PCB.) Click [Close] after setting, and then click [Save] in [File Management] in the menu bar.

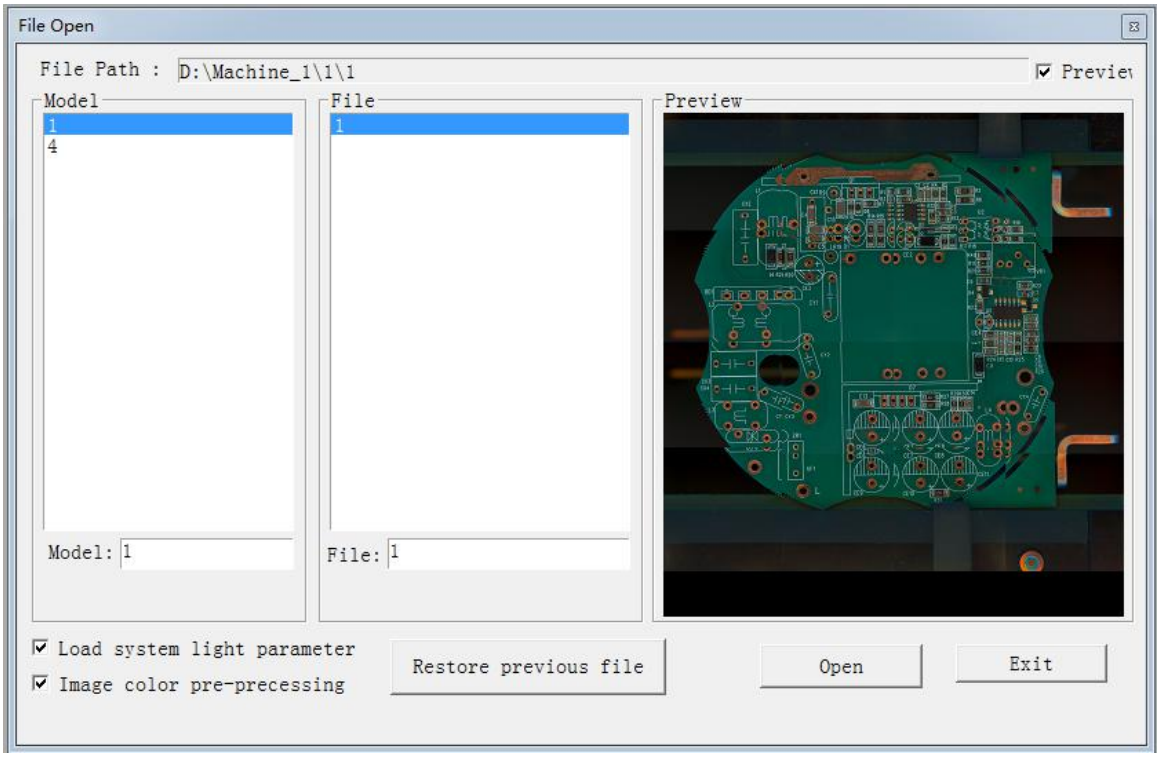
Then, click [set PCB-ID Mark] for the program on the other side in the same way. The following interface will be prompted when reopening the program with the set ID Mark, as shown in the following figure:

Then click [Yes] to open the program on the other side. When testing, the camera will first inspect the position of two ID Mark points. Upon inspection of that ID Mark, the corresponding program will be called for inspection.

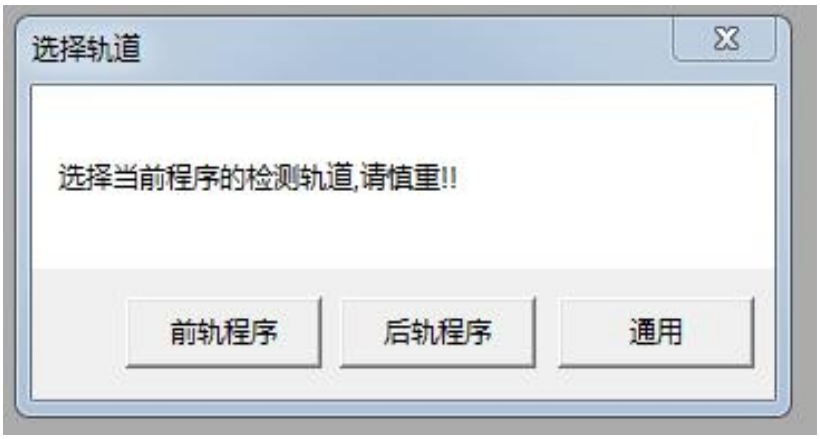
8.6 Normal inspection operation

After entering AOI software, adjust the width of the track corresponding to its board, and then adjust the lower right corner position of PCB board after the back rail and lower cover of double track need to enter the board according to the method of new program. (Note: the position of the lower right corner should be consistent with the position of the lower right corner when editing the program, so that this program can inspect.)

Then click [Open] in [File Management] in the menu bar, as shown below;

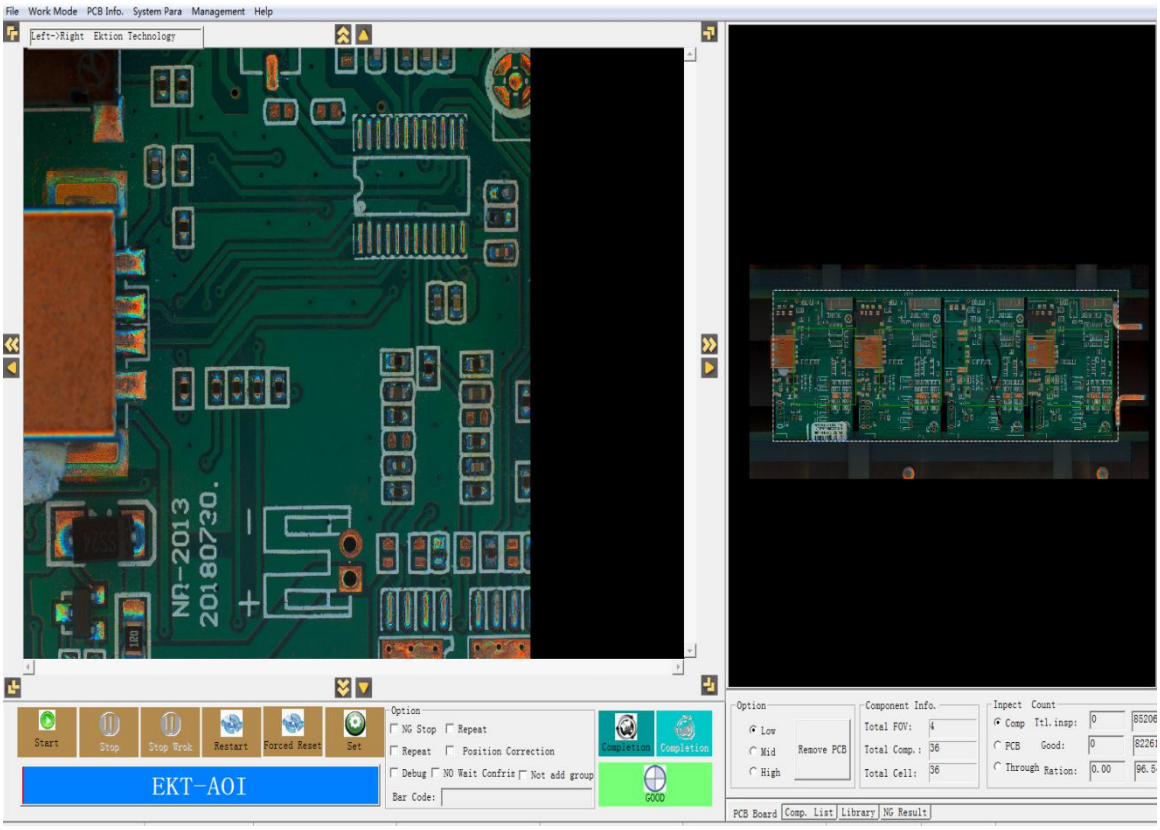


Then select the corresponding model and file and click [Open File], as shown below:

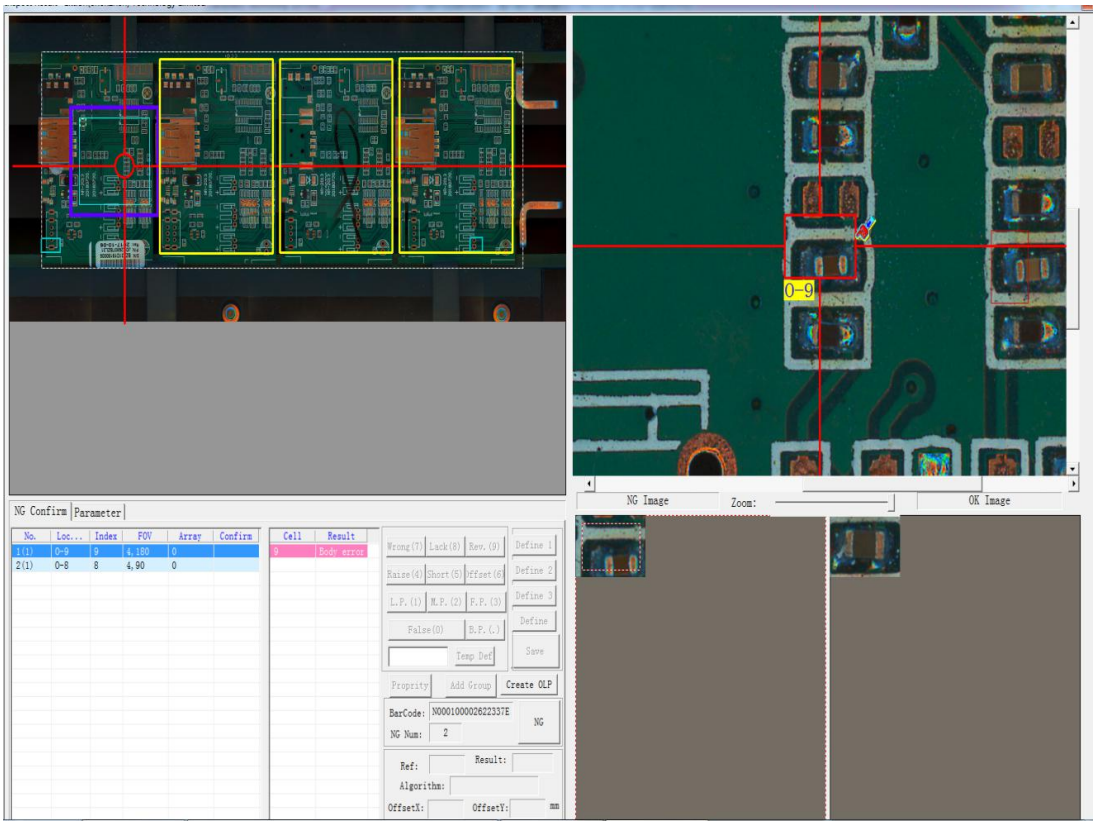


[ID Mark] should be made for double track, which will prompt the track corresponding to this program. After selection, it will prompt to import another program and then select its track.

After opening, select [Inspection Mode] in [Working Mode] in the menu bar, as shown below:



Do not check [Debug Mode] for normal inspection. Click [Start] or press [Space Key] on the keyboard and [Start Key] on the machine to start inspection. When there is a board at the board entrance end, it will automatically enter for inspection. After inspection, it will be automatically discharged. A false alarm interface will pop up after completion of AOI, as shown in the following figure:

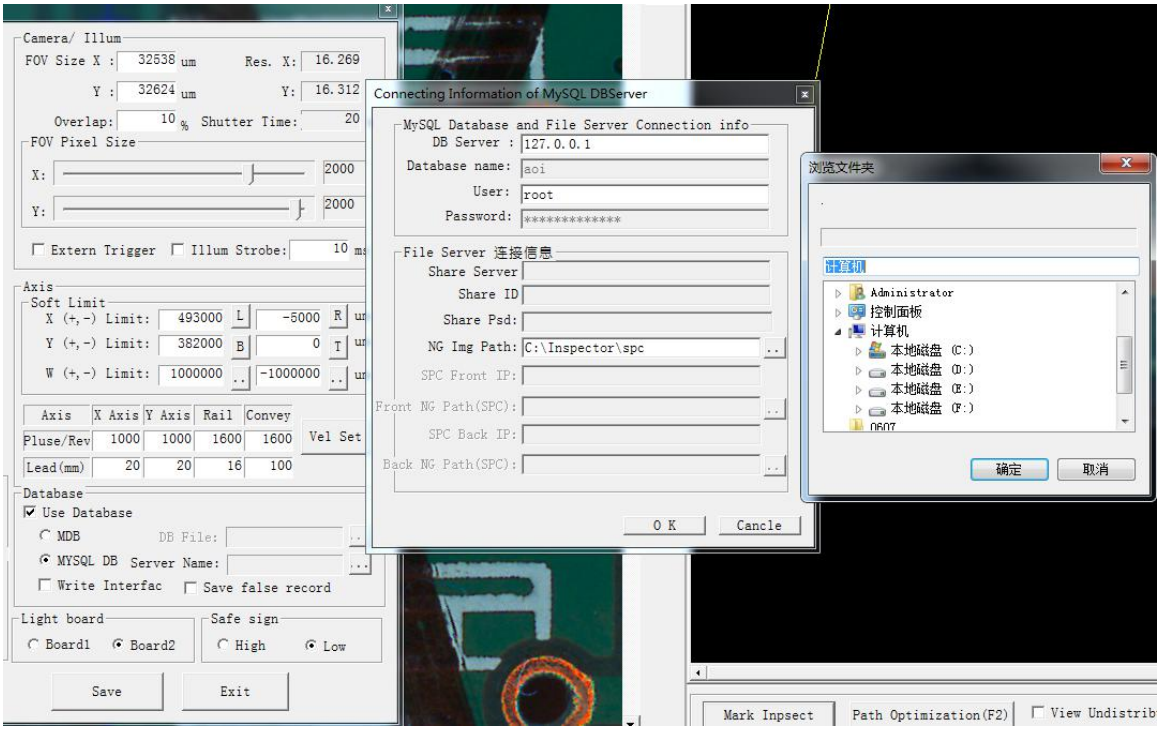


After entering the false alarm interface, a board at the front end will continue to enter for inspection. When inspecting the next board, check the false alarm of this board to ensure the speed.

As shown above, the top left is a thumbnail of PCB board, which is marked with the position of current false alarm. The spilt selected in the yellow box is the skip area, as shown in the rightmost spilt in the above figure. The upper right part is the FOV enlarged image. The lower left part is the misreported component, which can be viewed with the [Up] and [Down] keys of the keyboard. The lower right part is the actual image and registered image of components. Click the [Enter] key on the keyboard after viewing with the [Up] and [Down] keys to enter the false alarm interface of the next board.

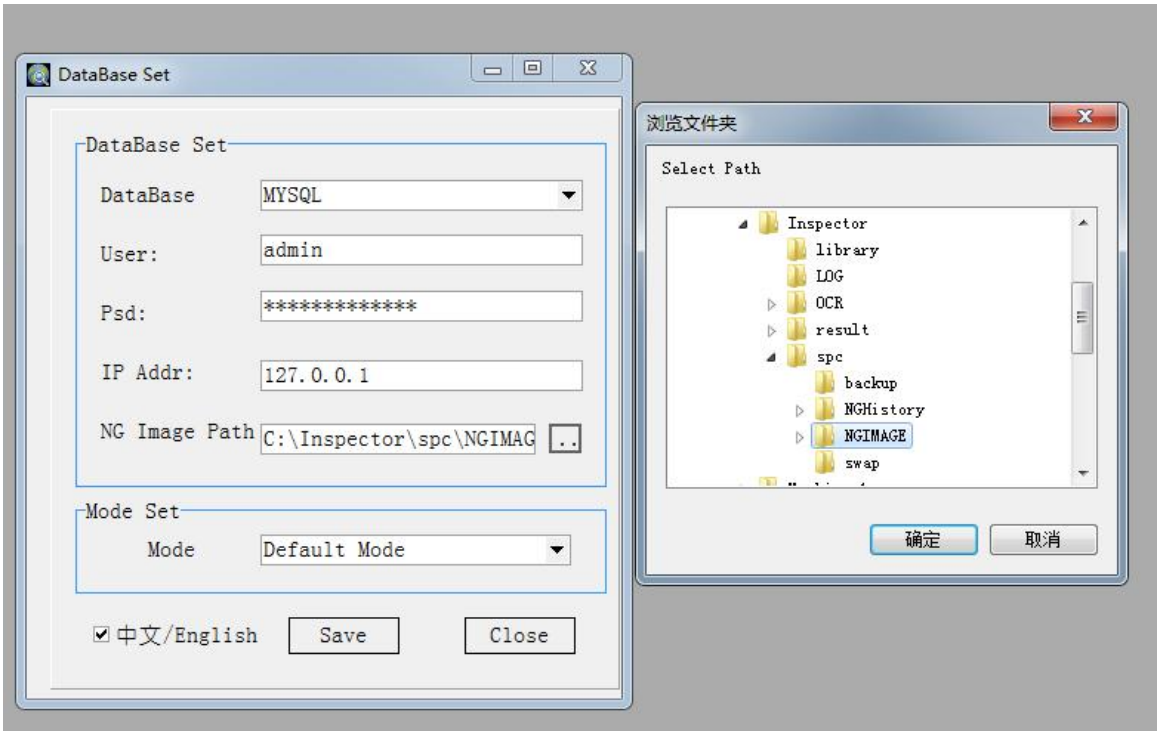
Chapter IX SPC Database Processing

Open [System Configuration]-[System Composition] in the menu bar, check [Use Database], select [MYSQL DB], and click [….] to enter the path setting interface. Ten click [….] behind [NG Image Path] to find the database path, as shown in the following figure;



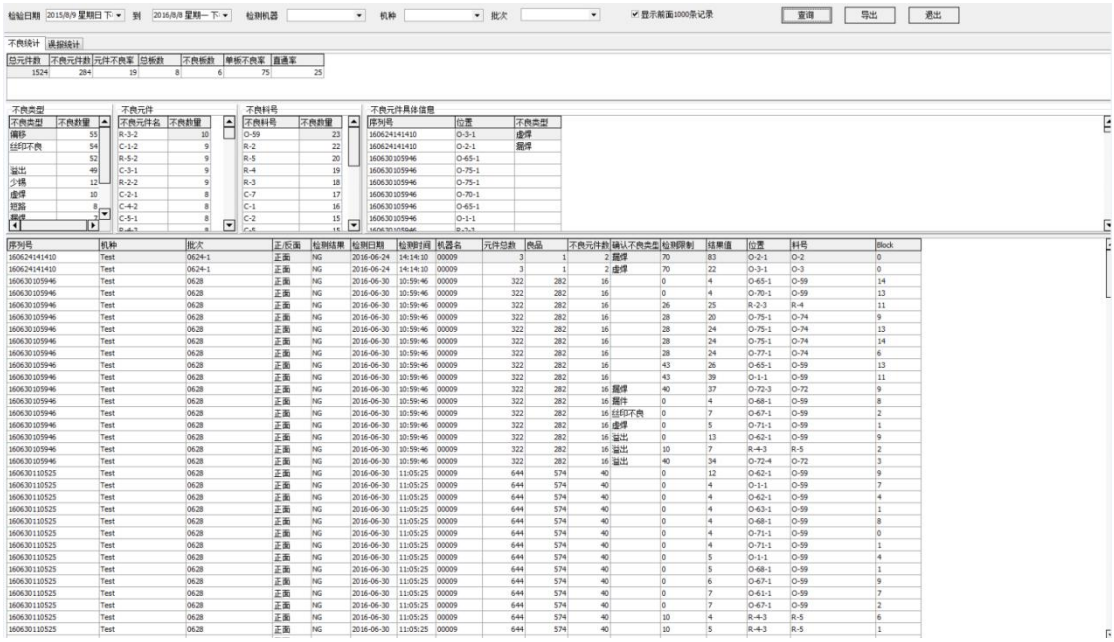
After setting, the data tested every day will be saved in SPC database.

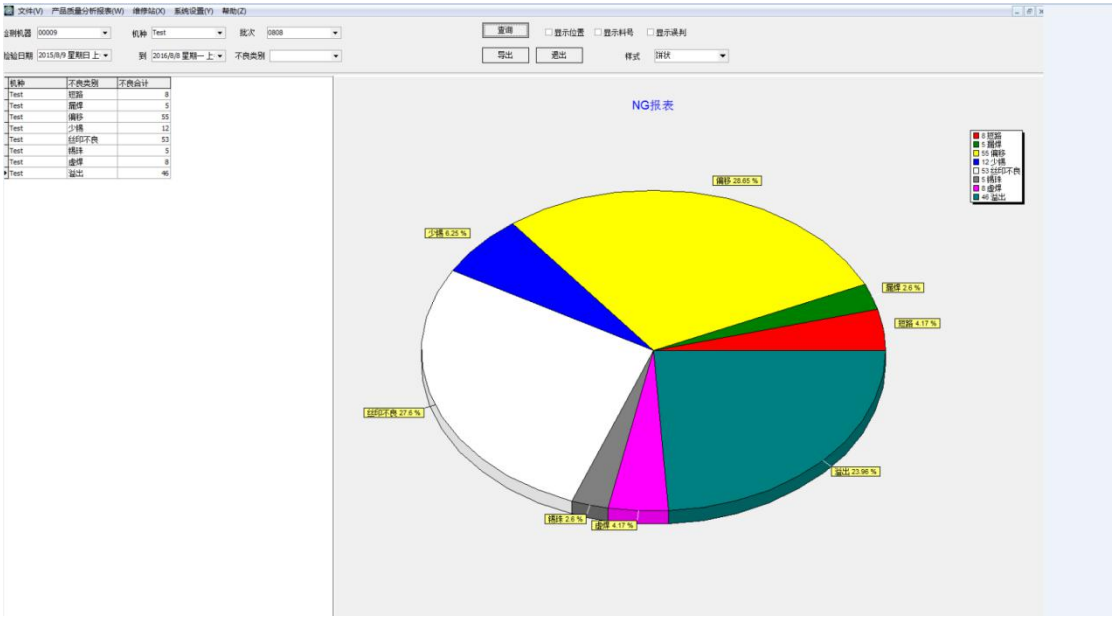
Then open [Statistical Report] in [Production Management] in the menu bar to enter SPC setting interface, as shown in the following figure:

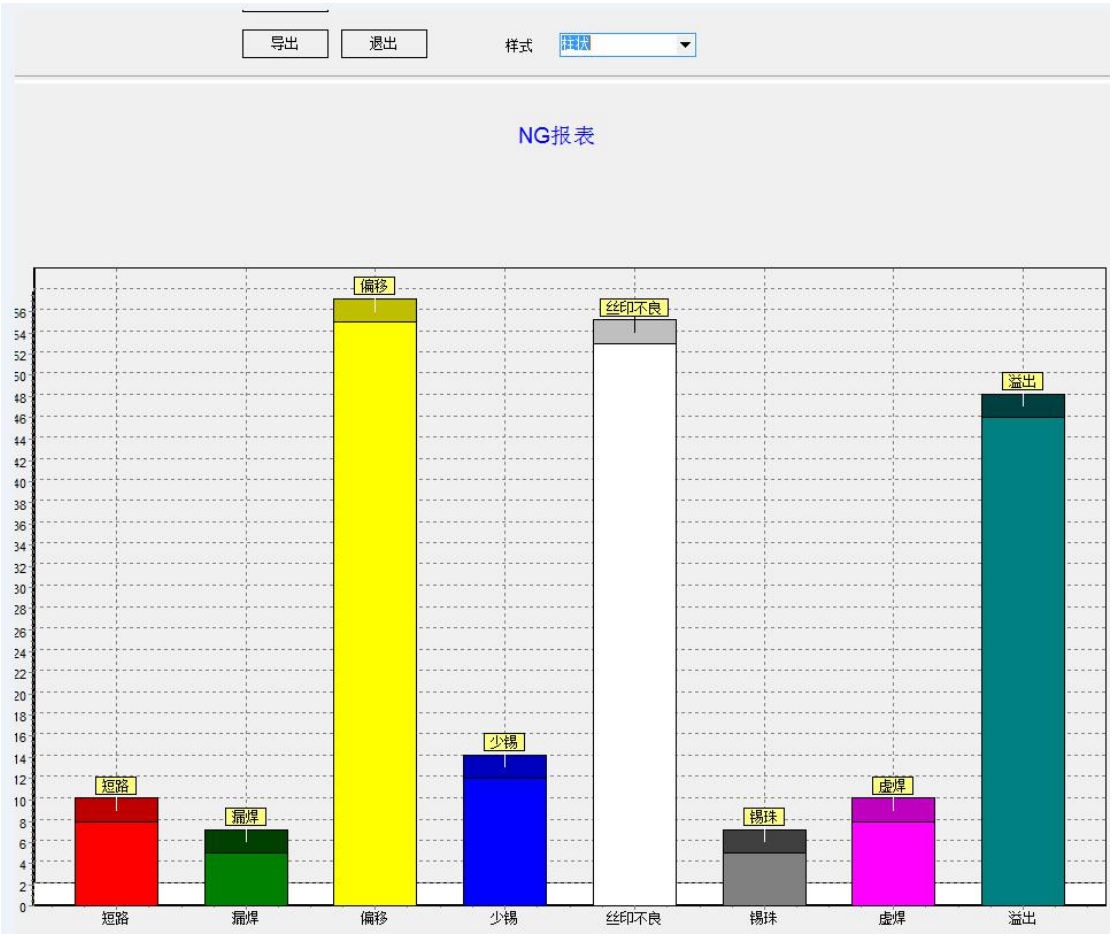


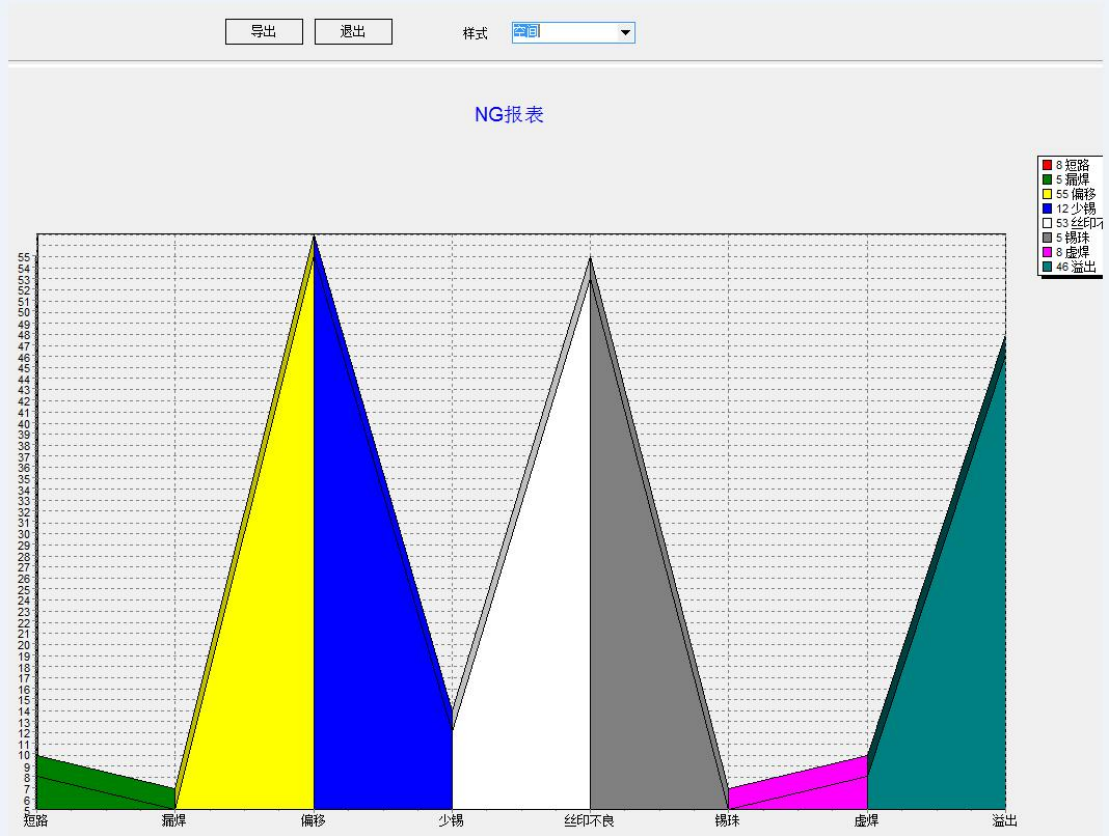
The login password is: aoisupervisor. NG file path is as shown above. Then click save. General factory settings have been completed.

After setting, you can query all kinds of reports in this SPC software, and query reports according to procedures, time periods and defect types.



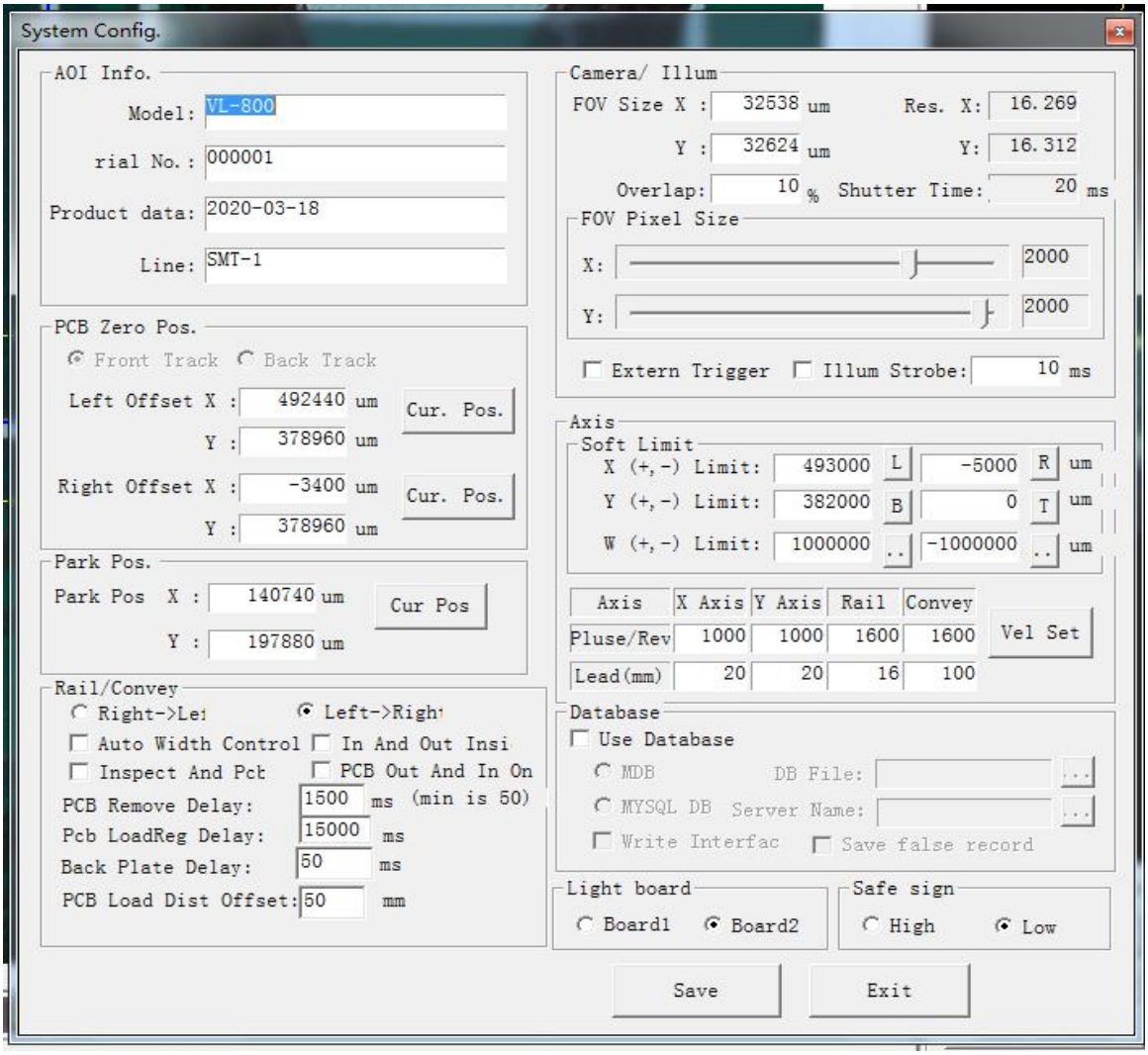



导出
退出
样式
NG报表
偏移
丝印不良
溢出
少锡
短路
虚焊
漏焊
锡珠
短路
漏焊
偏移
少锡
丝印不良
锡珠
虚焊
溢出


导出
退出
样式
NG报表
8 短路
5 漏焊
55 偏移
12 少锡
53 丝印不
5 锡珠
8 虚焊
46 溢出
短路
漏焊
偏移
少锡
丝印不良
锡珠
虚焊
溢出

Chapter X System Parameter Settings

In [Editing Mode], open [System Composition] in [System Configuration] in the menu bar, as shown in the following figure:



Front rail/rear rail: setting the zero position of the front and rear rails respectively.

Left offset: setting the position of the lower left corner when creating a new program.

Right offset: setting the position of the lower right corner when creating a new program.

Park position: the position of the machine to be inspected.

Rail/convey:setting the plate feeding direction of the rail.

Right board entry: right board entry and left board exit.

Left board entry: left board entry and right board exit.

Automatic rail width adjustment: the monorail and the lower cover can be automatically adjusted according to the track width saved by the program.

In and out insi: matching with the previous board entry direction to achieve in and out in the same direction.

Same-side inspection: matching with the previous board entrance direction and simultaneous entrance and exit in the same direction to achieve one-way entrance and exit and inspection in the same direction.

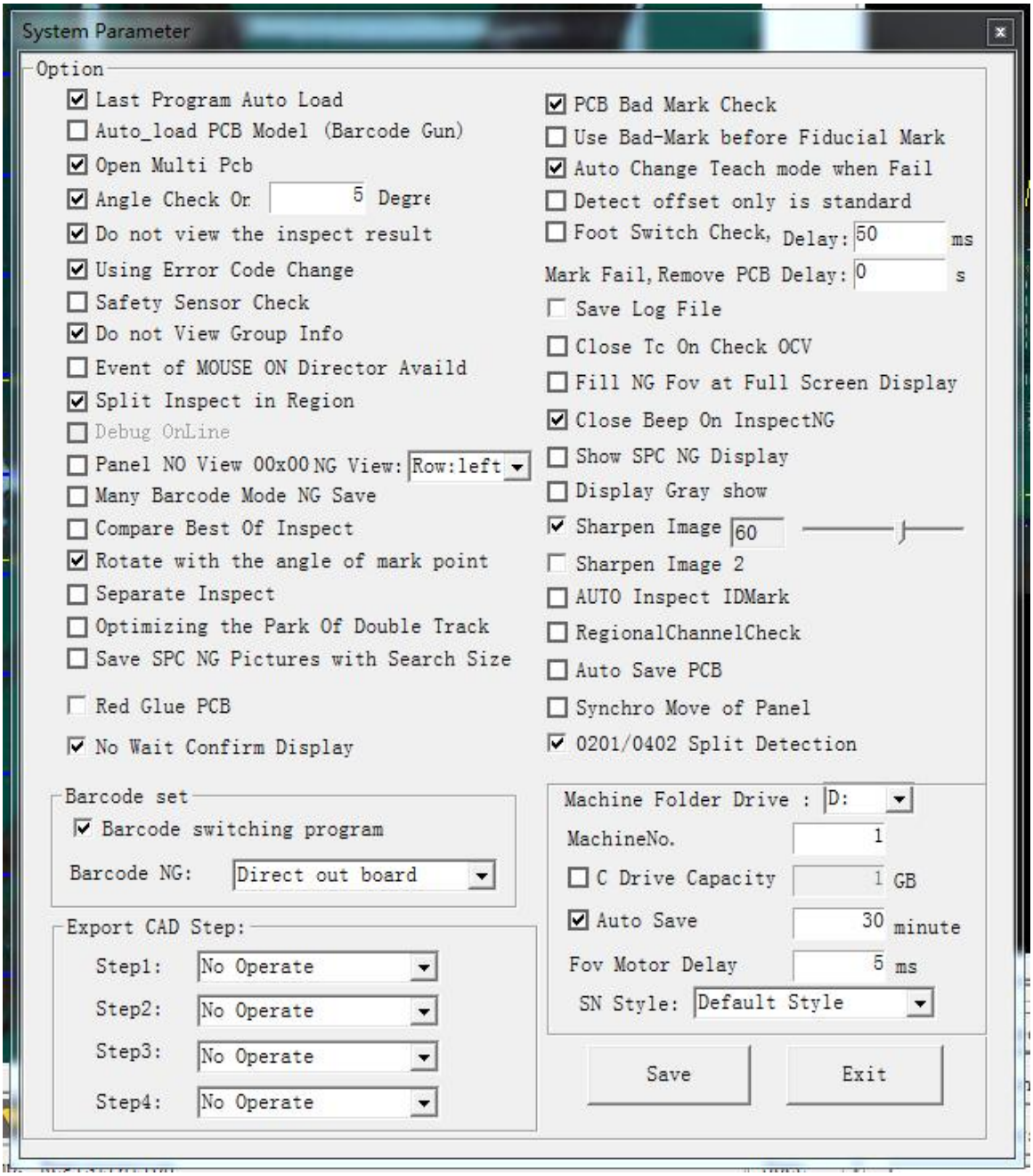
Speed setting: enter the running speed setting of the camera by opening [Speed Setting] alone.

FOV pixel size: the size of each image captured by the camera, in pixels.

Software limit: the limit of X.Y axis

Database: storage path of SPC data.

Open [System Technical Parameters] in the [System Configuration] in the menu bar under [Editing Mode], as shown below:



This interface shows some basic options for AOI equipment, as introduced in the following part:

Last Program Auto Load: prompting {Open the Previous Program} at startup

Auto_load PCB Model (Barcode Gun): different boards will be tested after matching the opened program according to the barcode after scanning.

Open Multi PCB: used for collinear inspection of various PCB boards, and distinguished by ID Mark.

Do not view the inspect results: when meeting NG PCB during the test, if the user wants to display NG on the screen but doesn't want the NG interface to pop up, the user can check [Do not View the Inspect Results].

Use user-defined NG code: the system itself has set some NG codes for NG category, but it is usually not applicable. The user should check [Use User-defined NG Code]

Safety Sensor Check: used to close and open the safety light curtain.

Do not View Group Info: in editing mode, if multiple groups are added to an inspection frame, the system will pop up the images of each group at the bottom of the screen. If the user doesn't want to pop up this window, check [Do not View Group Info].

Spilt display mode: used for displaying false alarms according to the arrangement sequence of spilts when checking false alarms by BGA.

Many Barcode Mode NG Save: when each spilt of PCB has barcode, it can be stored according to barcode of single spilt.

Rotate with the angle of mark point: whether the image of a single FOV rotates with the rotation angle of Mark point.

Separate inspect: when checked, FOV photographing and inspection are separated, and it is not necessary to wait for the inspection operation to be completed before taking the next image. At the same time, there will be cases where the result will be produced after the operation is completed, such as delay after the image of the whole PCB is taken.

Optimizing the Park of Double Track: this option is used by double-track AOI, and it is not necessary to return to the park position for inspection when the front and rear tracks are switched, which can speed up the inspection.

Save SPC NG Pictures with Search Size: when checked, SPC will save images with search range size.

Red Glue PCB: used when editing red glue board program.,After checking, the default inspection option of bonding pad is [Glue Overflow], which speeds up the program.

No Wait Confirm Display: in inspection mode, if the user chooses not to wait for result confirmation, and has not confirmed and closed NG result window in time, the next PCB result will not cover the current unconfirmed result window under normal circumstances. But if the user wants subsequent inspection results to cover the current result window in time, the user can check [No Wait Confirm Display].

PCB Bad Mark Check: if users need to use skip area, they need to check the function "PCB Bad Mark Check".

Only inspect the offset according to the standard: for the area method inspection frame, the user can

select to inspect its actual rotation angle by checking [Inspect Angle Offset]. If it exceeds the set allowable rotation angle, it will be reported NG. Selecting this function will slightly increase the inspection time.

Save log file: if special system problems need to be eliminated, the user can choose to save the log file and hand it over to the supplier for technical analysis.

Close Beep On InspectNG: if the user's machine is equipped with sound, the user can choose to turn off or turn on the sound effect. This equipment is generally not applicable.

Automatic double track recognition: this option is used for double track online machine. When the double track calling program is checked, it will prompt the use track of the current program. During the inspection, it is unnecessary to inspect ID Mark and directly call the inspection program according to the track, thus saving the inspection time.

Automatically save PCB thumbnail: when saving PCB data, the thumbnail of each board will be saved.

Synchro Move of Panel: when checked, if moving the component frame of PCB, the same component frame on other spilts will also move at the same time.

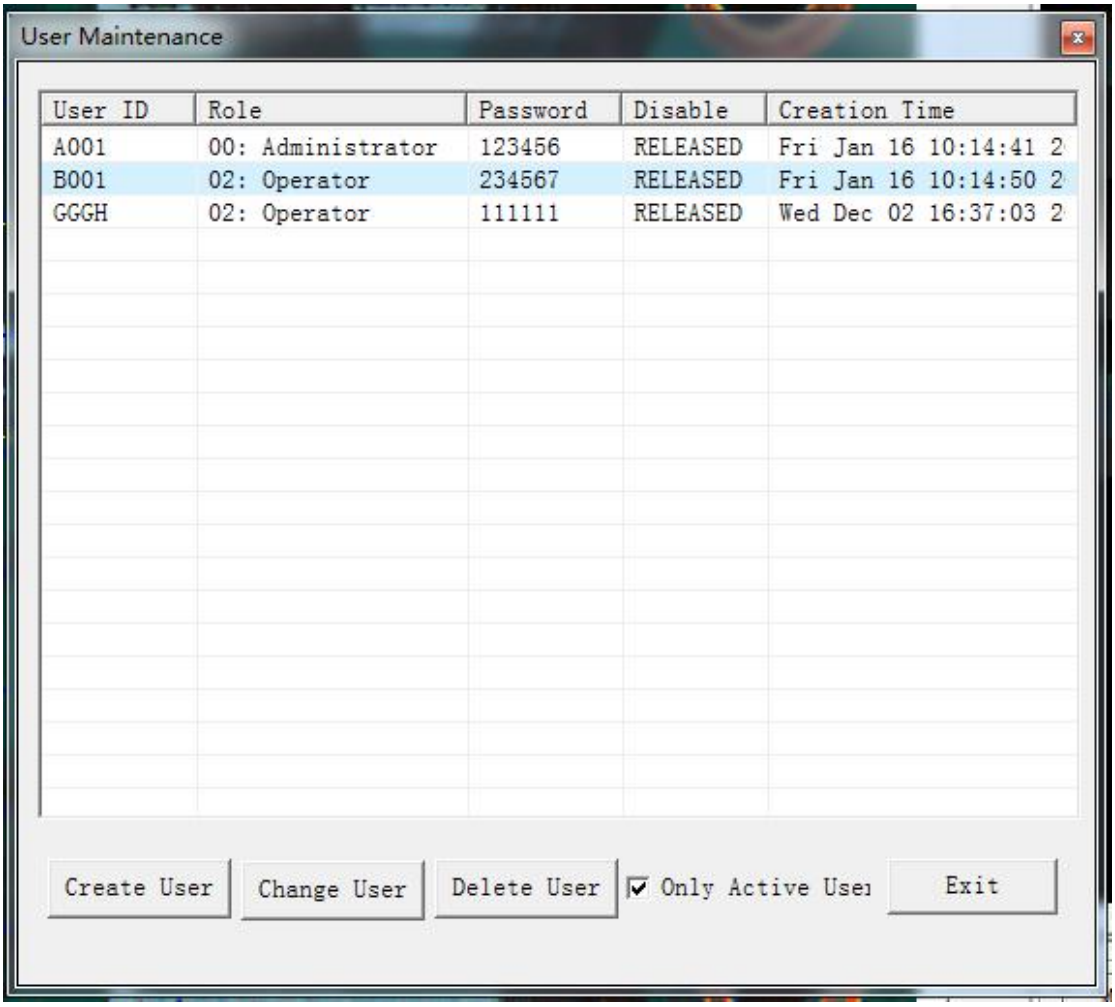
0201/0402 split inspection: when checked, [split inspection] will be automatically checked when [0201] and [0402] frames are used for making frames during program editing.

Machine Folder Drive: the user can choose to set the operating system drive letter and folder number of the program file storage. For example, if D and 1 are selected, the program files will be stored under D:\Machine_1\, and stored hierarchically according to the model and file name.

Auto Save: the system automatic saving time setting can remind users to save program files within a fixed time, so as to avoid the loss of the program being edited when the machine is shut down due to special software and hardware reasons.

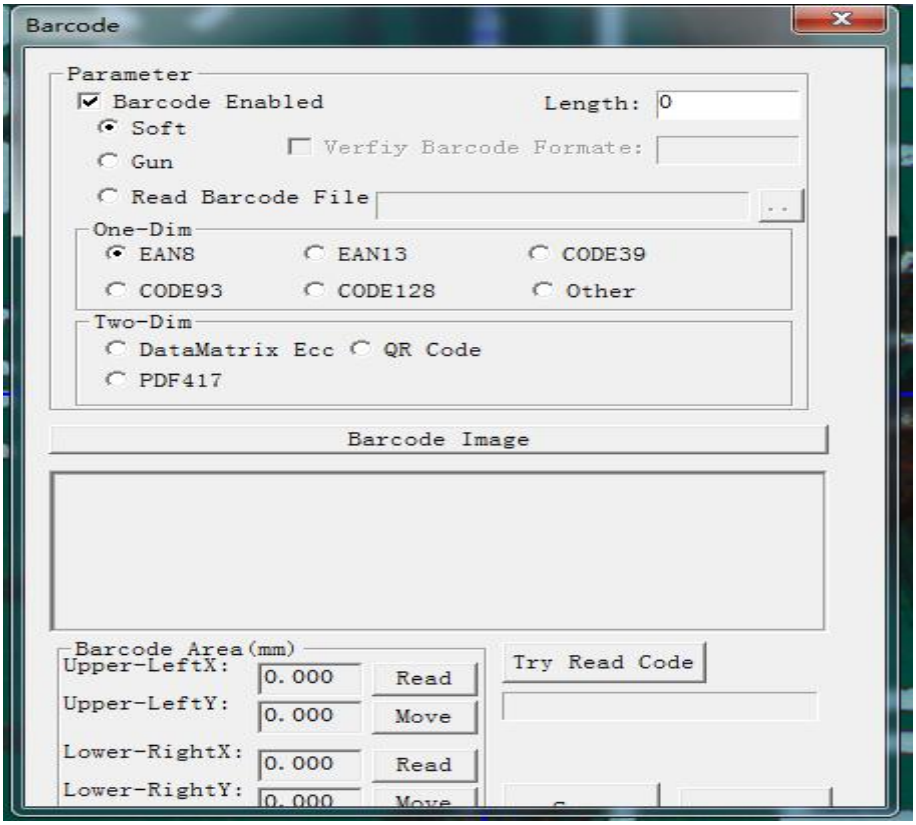
Mode: the system also provides special mode settings for non-standard system users, which can be ignored by standard system users.

In [Editing Mode], open [User Management] in [System Configuration] in the menu bar, as shown below:



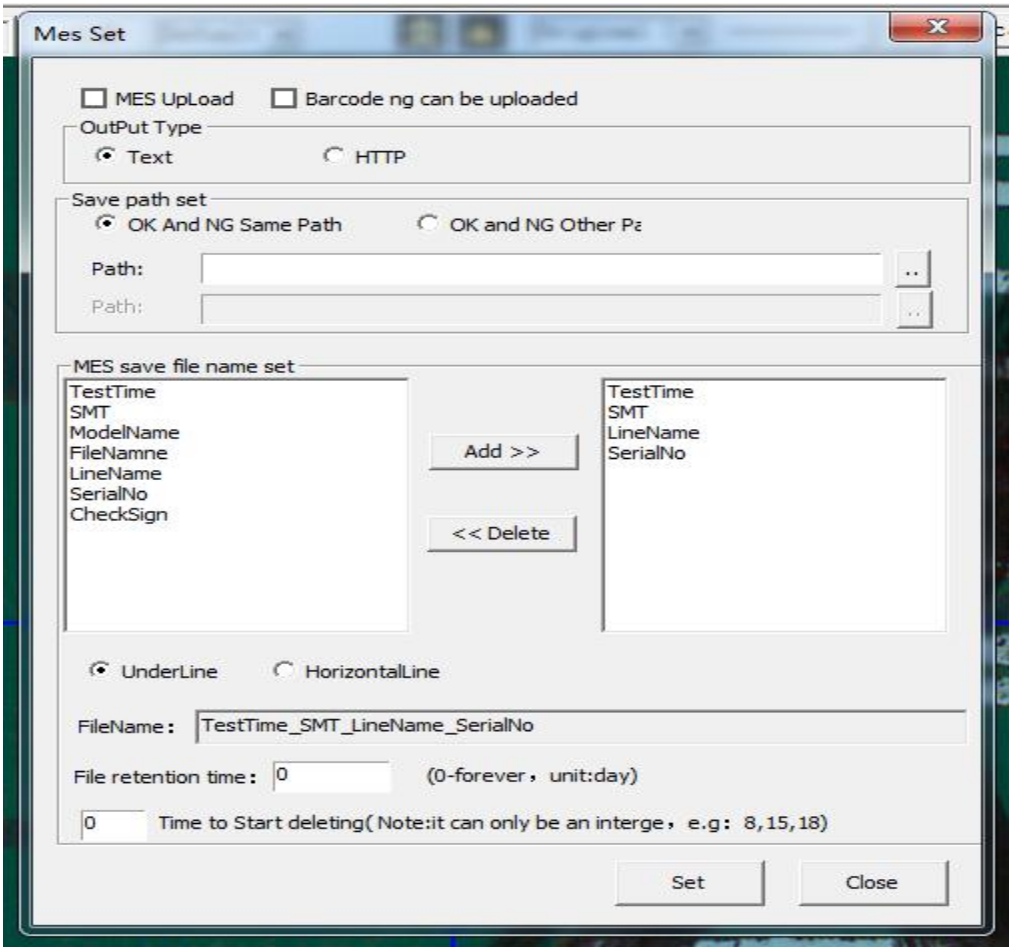
In the sub-interface, you can set the login user's authority and password. The authority is divided into [Administrator], [Programmer] and [Operator], and the password can be modified in [User Maintenance].

In the [Editing Mode], open [Bar Code Settings] in [Substrate Configuration] in the menu bar, as shown below:



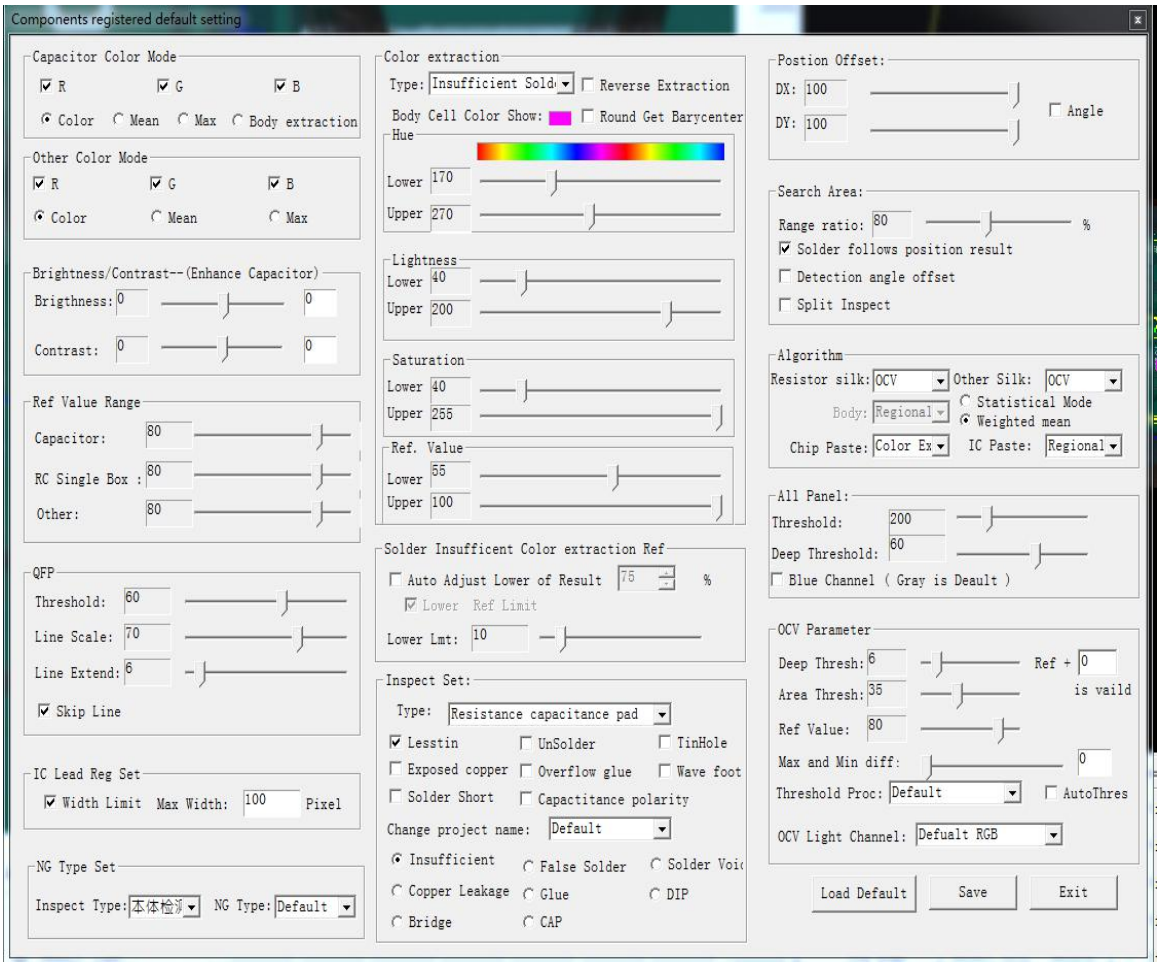
In this interface, you can set the bar code format and bar code area after checking [Start Bar Code], and the test data will be saved according to the bar code during the later test.

In the [Editing Mode], open [MES Settings] in [Substrate Configuration] in the menu bar, as shown below:



The format and path of MES upload can be set after [MES Upload] is checked in this interface.

In the [Editing Mode], open [Register Default Settings] in [Base Board Configuration] in the menu bar, as shown in the following figure:



In this interface, users can set the default value of each type of component frame when editing the program, and can modify the value according to their own needs to improve the efficiency of program editing.

Chapter XI Common Equipment Faults and Troubleshooting Methods

1. Shake during machine operation

Reason and solution: the level of the machine is not adjusted properly. Use a level meter to adjust the level of the machine and tighten the screws fixing the foot cup.

The steps for adjusting the machine level are as follows:

① Suspend the four legs of the machine

② Adjust the level of the left and right of the machine

③ Adjust the level of the back and forth of the machine (only one foot in front should be adjusted. An area can be fixed with 3 points), put down the suspended foot cup of the machine and tighten the screws for fixing the foot cup.

2. Electric shock when touching the machine

Reason and solution:

The ground wire of the machine has poor contact or is not grounded, and induced electricity with a certain voltage will be released through the servo driver during the operation of the machine.

This problem can be solved by grounding protection. The specific method is to lead a wire from the rear cover screw of the machine and connect it to the dedicated ground wire of the workshop. (Note: do not confuse or misconnect electrostatic wires with ground wires)

3. The machine makes the sound of "beeping" for a long time.

Reason and solution:

Computer hardware failure. Check whether the memory module is firmly inserted and reinsert it after pulling it out. Or, the computer maintenance personnel check for other faults.

4. The system prompts that X axis or Y axis cannot be moved when running the program

Reason 1: poor interface contact of motion control card.

Solution: close the program, pull out the interface of the motion control line, check whether there is any blockage or deflection at the interface, and reconnect after eliminating the problem.

Reason 2: poor contact at X or Y filter or falling off.

Solution: close the power supply and open the machine casing to confirm whether there is any poor contact.

Reason 3: loose wiring of the motion control card.

Solution: open the back cover of the machine, use a multimeter to inspect, and lock the loose part.

5. Black screen of display

Reason: the display power supply is not turned on or the signal line is not connected properly

Solution: check the power and signal lines of the monitor.

6. The component frame offsets when moving the camera left and right or back and forth

Cause: lens calibration is not accurate.

Solution: calibrate the lens. Select a clear character or positioning hole on the surface of the currently inspected PCB for lens calibration. There should be no similar pattern near the calibration area, otherwise the calibration result will be inaccurate.

7. Too many misjudgments in normal inspection

Reason 1: the component frame offsets

Solution: ① Check whether the PCB is fixed and fix the PCB and fixture.

② Make the machine return to the calculation starting point to inspect whether the coordinates of the components offset as a whole. Then, reset the coordinate starting point.

Reason 2: incoming materials are changed (stand-by materials are used)

Solution: re-register a standard with new components and include the component standard and the newly-built standard into the same group.

Reason 3: inadequate learning and debugging lead to false report.

Solution: debug a few more boards.

8. Missing judgment of component

Reason 1: the component has no registered standard

Solution: register standard for the component and optimize the lens.

Reason 2: there is no lens optimization after adding components.

Solution: optimize the lens

Reason 3: the error range of the standard linked to the component is too large.

Solution: reduce the error range of the component standard by reducing the error multiple or re-register a standard to replace the component standard.

9. Constant offset or reversal of several components during inspection

Reason 1: the component frame has offset.

Solution: move the lens to the position of the component and pull the component frame

straight.

Reason 2: the incoming materials of components have been changed or the silk screen has been changed.

Solution: re-register a new standard for current component and include it and the component standard into the same group.

10. Missing inspection of IC pin short circuit

Reason 1:there is no short circuit inspection frame for IC pin.

Solution: carry out short circuit inspection on the standard of this component in the standard library.

Reason 2: the threshold of short circuit inspection is too large.

Solution: reduce the short circuit inspection threshold of components in the standard library.

11. Inspection failure because Mark point identification fails

Reason 1: PCB is not fixed properly.

Solution: lock the fixture for the PCB to fix the board.

Reason 2: PCB is not placed in the direction of thumbnail.

Solution: place the PCB in the direction of the thumbnail.

Reason 3: program debugging error.

Solution: check the inspection model name and call in the correct test program.

Reason 4: the component Mark point was not selected well. Or, the Mark point was oxidized on PCB and the color difference is too large.

Solution: cancel all Mark points and select other points to set Mark points.

12. The inspection cannot run normally after the exchanges of the programs made by two machines.

Reason: it is impossible to ensure that the mechanical origin of each machine is in the same position during the machine manufacturing process, and the coordinate origin for programming corresponds to the mechanical origin.

Solution: reset the origin of coordinates after the exchanges of the programs made by two machines, and then realign the position of the component frame for the exchanged programs. However, the program exchange between the two machines is only applicable to the PCB inspection program files that can be shared between the machines with the same board feeding direction and track direction and the same inherent resolution of the lens.

13. The host is not powered on

Cause: power socket failure.

Solution: use a multimeter to determine if there is voltage at the power input. If there is no voltage, it indicates that there is no power input, and the power supply needs to be replaced.

Chapter XII Repair and Maintenance of Equipment

12.1 To ensure the normal operation of the equipment and prolong its service life, please perform the following regular maintenance work:

a) At the end of the day, turn off the power supply of the computer and equipment, and suck the dust on the equipment table surface with a vacuum cleaner. If there is no vacuum cleaner, dry towel can be used to wipe off the board dust and the like from the bench surface. Note: do not blow the surface with an air gun. The dust and debris will be blown into the top of the equipment and will attach to the screw rod, guide rail or lens, which will affect the accuracy and service life of the equipment. If metal debris is blown into the electrical appliance, there may be short circuit and fire.

b) Wipe the dirt on the equipment surface with towel. Note: do not use organic solvent (such as board washing water) to wipe the surface of the equipment, otherwise the paint on the surface of the equipment will be damaged.

c) Maintain the screw rod and guide rail every month. Clean the old oil with clean white cloth, and then evenly brush the oil on the surface of the screw rod and guide rail with No. 10 or No.11 oil brush. Note: grease and lubricating oil must be of good quality. Otherwise, the surface friction on the screw rod or guide rail will be increased, thus shortening the service life of the screw rod and guide rail and affecting the accurate positioning of the machine. Recommended: Germany OKS Super Grease OKS422, or referring to the grease used in mounter maintenance.

d) Clean the filter cotton on the left side of the industrial computer panel every 1 month. Note: filter cotton should be dried after cleaning and then put back in place.

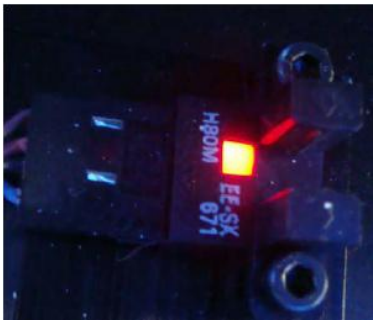
e) Check the light source every 3 months. Since the brightness of LED lamps may change slightly after half a year, the light source needs to be inspected once to ensure normal inspection.

f) Calibrate the camera every three months. Since the camera keeps moving every day, it is necessary to check whether the camera screws and lens screw are fixed properly and whether the calibration value is within the acceptable range.

12.2 Detailed inspection process of each component

1) Determining whether each groove-shaped photoelectric sensor works normally

There is one X-axis and one Y-axis on this equipment, and there are two groove-shaped photoelectric sensors in the width direction of the track. If paper is put into or taken out of the groove, the signal lights will normally be on or off.



2) Determining whether the PCB photoelectric sensor works normally

The equipment is equipped with a photoelectric sensor at the rail inlet end, the left baffle cylinder, the right baffle cylinder and the outlet end respectively. Under normal conditions, when a PCB passes through the rail, the signal lamp color will changes.

3) Determining whether the mechanical limit switch works normally

There is a mechanical limit switch at the end of the X axis and Y axis of this equipment, which can be checked and confirmed by multimeter. Under normal conditions, both ends of the connecting line are in conducting state. When the axis runs to the end, the mechanical limit is pressed to disconnect both ends of the connecting line. If the mechanical limit switch is damaged, a spare part installed in the side-by-side position can be used for replacement.

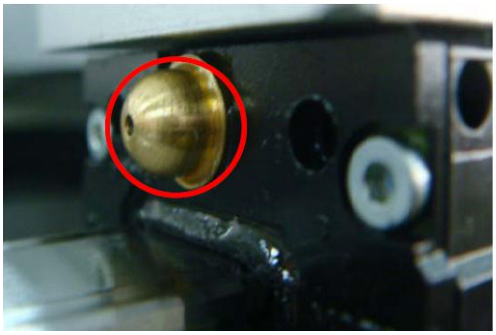
4) Lubrication and maintenance of screw rod and guide rail parts

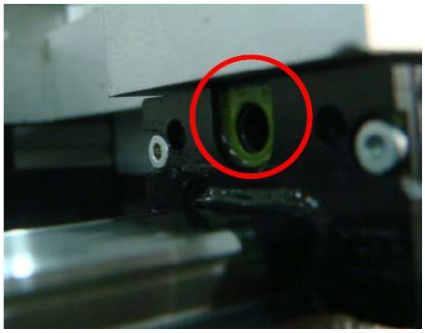
Screw rod and guide rail are the main transmission components of the equipment operation. Their maintenance is the most important part to ensure the transmission and positioning accuracy of the equipment. During the annual major maintenance, special attention should be paid to removal of old oil and dust and application of new oil. It is recommended to use the German super lubricating grease OKS-422. The specific operation steps are as follows:

Step 1: use cloth strips to wipe off the old oil on the screw rod/guide rail.

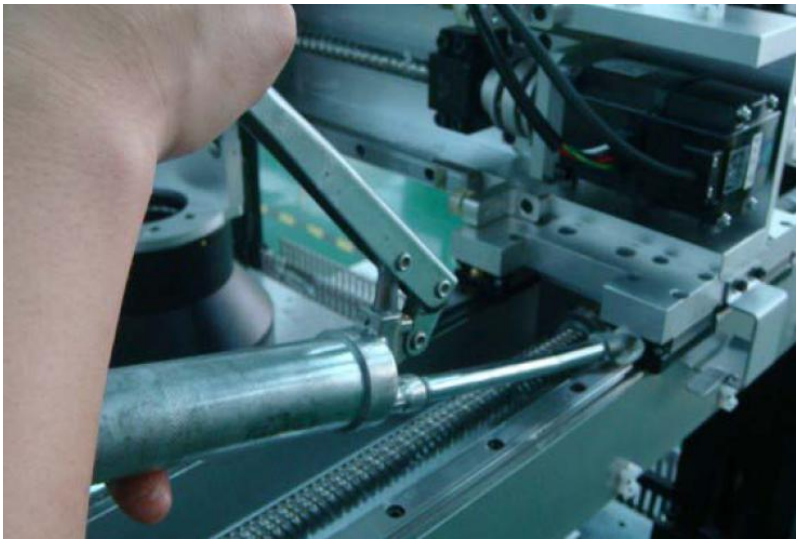
Step 2: apply grease evenly on the surface of the screw rod with a special oil gun, and push the X/Y axis to move back and forth to absorb the grease.

Step 3: if the slide block on the guide rail has an oil nozzle protection cover, take it off before filling.





Step 4: insert the oil injection gun head into the oil injection nozzle of the sliding block and press it tightly. Gently press the pressure rod of the oil injection gun to evenly inject grease into the sliding block, and make the sliding block slide back and forth on the guide rail to evenly apply the grease.



12.3

3. Confirmation form of check process/results

	No.	Check content	Inspection result	Responsible person	Remarks
Hardware part	1	Check whether the power supply is well wired and grounded.			
	2	Check whether the power supply and signal wiring on the back of the host are in good contact. Lay emphasis on motion control card and image collection card.			
	3	Check whether the camera fixing screws re firm.			
	4	Check whether the light source connection is stable and whether the light source will flash when shaking the light source line.			
	5	Check whether the light source casing will collide with the machine housing; use the mirror to check if there is any unlit LED inside the light source.			
	6	Check whether the track screws are tight and whether the width adjustment function is normal.			
	7	Check whether the buttons on the machine panel are normal.			
	8	Check whether the main power switch of the equipment works normally and whether it is fixed and locked.			
	9	Check whether the camera cover is properly installed.			
	10	Repeatedly lift and lower the flip cover of the display to observe whether there are abnormal image display and other abnormal situations.			
	11	Check whether the host is fixed and locked by screws.			
	12	Check and clean the filter screen at the front end of the industrial control			

		computer.			
	13	Check whether the display works normally, whether the buttons are operated effectively, and whether there are scratches on the surface, etc.			
Software part	14	Clear the hard disk files that are not necessary for the equipment and store the files in categories.			
	15	Open the machine condition monitoring window to check whether the origin signal, limit signal and in-place signal of the X axis and Y axis are normal.			
	16	Check whether the working regions of the X axis and Y axis are all within the visual range of the camera.			
	17	Check whether the aperture and focus adjustment screw on the camera lens are locked.			
	18	Start and exit the program to see whether AOI software can be started normally and whether there is any error.			
	19	Open the light source brightness inspection window and use the color paperboard to adjust the light source to the standard value.			
	20	Take a PCB for lens calibration.			
	21	Use PCB to make a simple program: check whether the standard registration is normal and whether the inspection frame will offset during the inspection.			
	22	If fixture is used, check whether the fixture and clamp plate is normal (whether the plate is firmly fixed).			
	23	Check whether the equipment system backup is normal			
Abnormal situation, handling and					

results	
Remarks:	1. In the table, ○ indicates normal situation, and " x " indicates abnormal situation 2. In case of any abnormality, the abnormal situation, handling and results must be filled in and signed by the responsible department head for confirmation.
Equipment maintainer:	Approved by: Reviewed by: