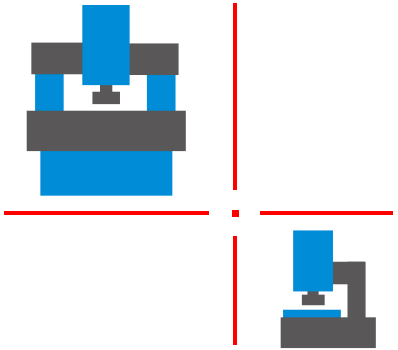
Video measuring software manual



V4.1-2016-12-01

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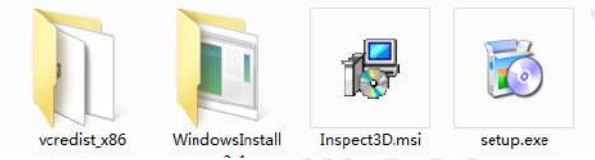
Chapter 1 Software installation and startup

1. Software installation

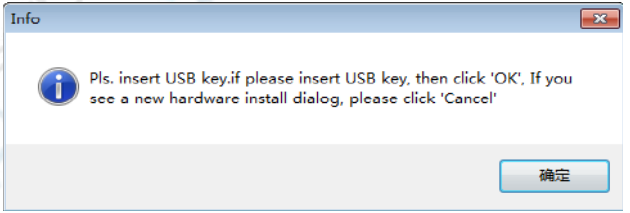
Step 1 : Insert the software installation CD into the CD-ROM drive.

Step 2 : Open the drive icon, double-click the Setup.exe file in the root directory to start the installation。



Step 3 : Click the "Next" button step-by-step.

Step 4 : After the main program is installed, the dongle driver will be installed au-tomatically。



Step 5：Click the "OK" button to complete the installation。

Step 6：Click the "Close" button to exit the installation。

Step 7：According to your needs, you may also need to install the following device drivers。

① Motion controller (card)

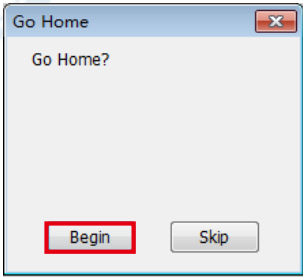
② light source

③ Video capture card (camera)

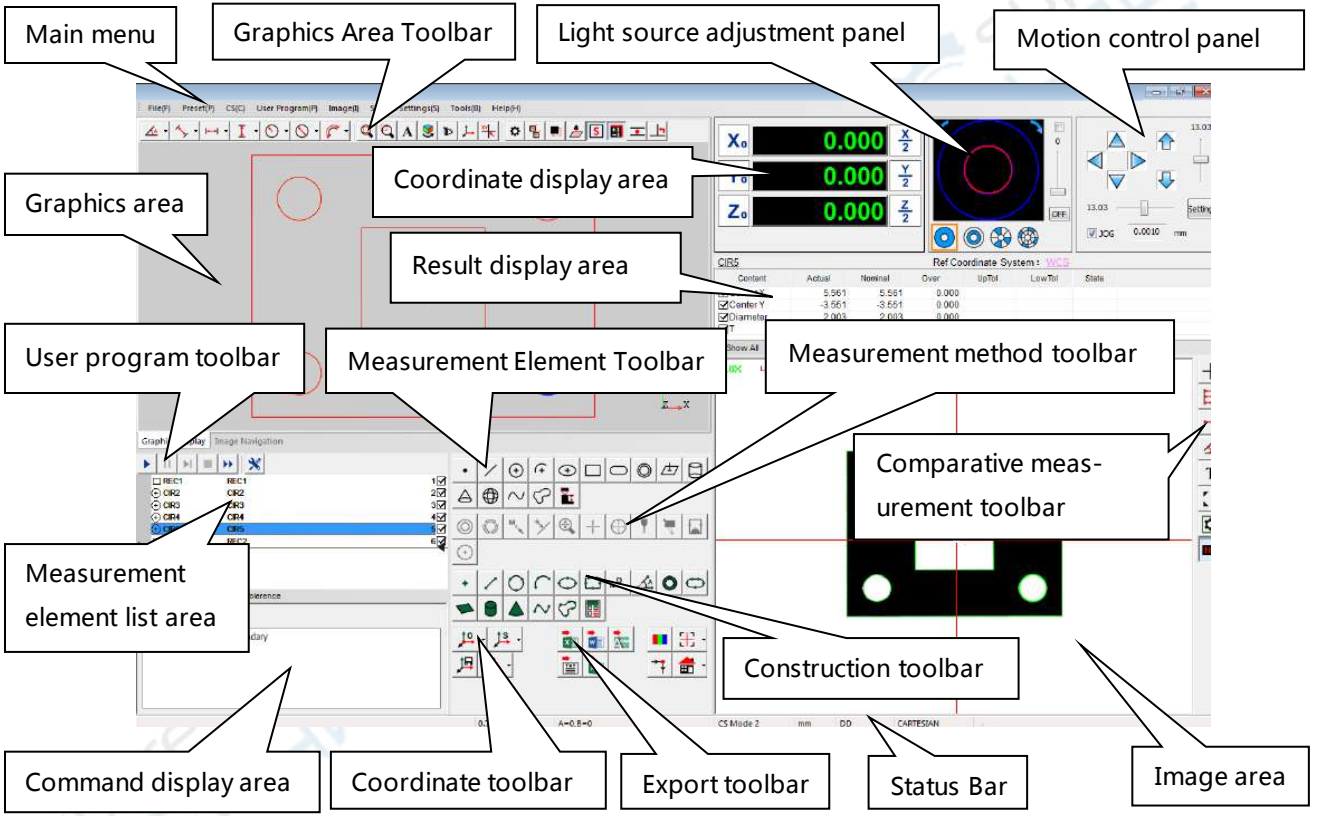
Install the above device drivers according to its instructions or under the guidance of the equipment service personnel.

2. Software startup

After the software is installed successfully, insert the USB key into the computer USB interface, open the power switch of the image measuring instrument, double-click the software icon on the desktop, the software will start. When the software pop up the "Go Home" dialog box as shown below. Be sure to confirm there are no obstacles on the worktable of the machine or around it, and then click the "Begin" button to find the Home Position of the image measuring instrument. The software will automatically enter the main interface after it has found the Home Position. (**Note: Here the Home Position refers to the mechanical coordinate origin of the image measuring instrument. You should find the Home Position when the software pops up "Go Home" dialog box.)**



Chapter 2 The Software interface



Main menu : Store the main functions and not commonly used functions of the software. In order to keep the interface clean, many not commonly used functions can be found in the main menu.

Image area : Area for displaying the image and measuring operation.

Graphics area : The results of the measurements are displayed in the form of geometric graphics, 2D and 3D graphics are supported in this area, it is also known as "CAD area".

Graphics toolbar : Mark dimensions on the geometric graphics and observe the geometry.

Coordinate display area : Display the XYZ triaxial scale coordinate data.

Motion control panel : Control the XYZ triaxial movement. (Note: The manual version of this software without this panel)

Light source adjustment panel : Adjust the brightness of the contour light, surface light, coaxial light and open the laser indicator.

Comparative measurement toolbar : Measure the image with comparative measurement method.

User program toolbar : The stopping, running, and setting operations of the user program are carried out in this toolbar。

Measurement element list area : Display the extracted geometric elements, such as points, lines, circles, and so on.

Result display area : Display the measurement results of each selected element, such as "size", "tolerance", etc.

Command display area: display the name of the element and the coordinate system.

Measurement element Toolbar : Select the type of element to be measured, such as point, line, circle, arc, etc.

Measurement method toolbar : Select the measurement method for each element to be measured.

Construction toolbar : Construct the composite elements with the existing elements.

Coordinate toolbar : Create and save coordinate systems。

Export toolbar : Export the resulting data.

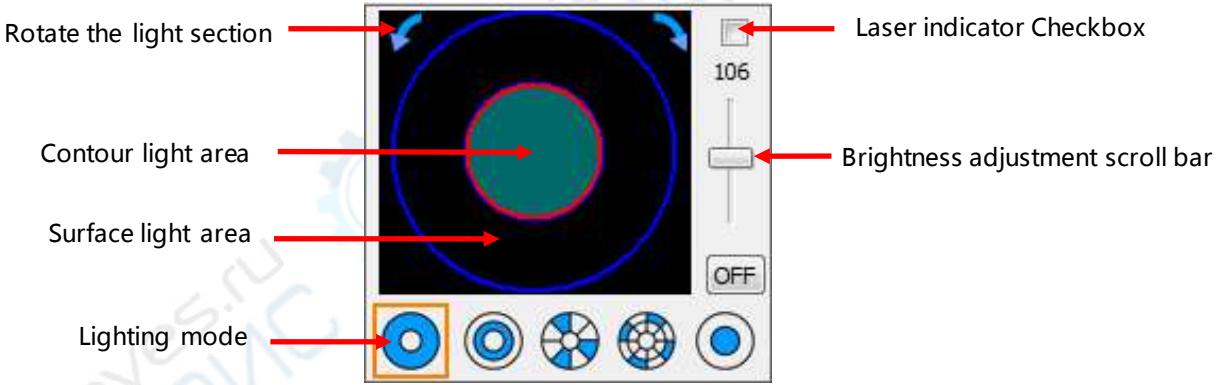
Status Bar : Display the status of the program, as well as display some tips and other information.

In addition, the map area and the scan area are in the same position as the graphics area

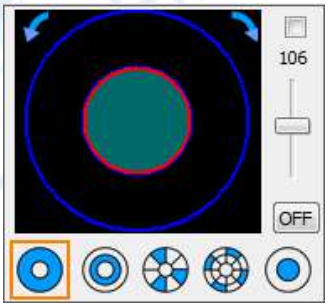
Chapter 3 light adjustment and lens focusing

1. Light adjustment

The software supports a variety of lighting modes. The corresponding adjust operation takes effect only when the instrument is equipped with a corresponding light source and the light source must support the corresponding lighting mode. The light source control panel is as follows:



The following contents describes the brightness adjustment methods of the contour light, coaxial light, and surface light. The surface light supports the "5-ring 8-section" lighting mode.

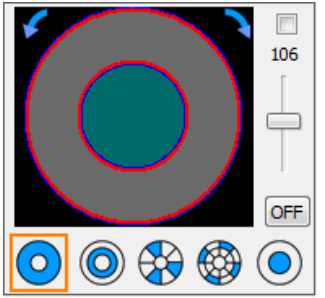


(1) Adjusting the contour light :

→Select the full lighting mode

→Click inside the small circle

→Drag the brightness adjustment scroll bar



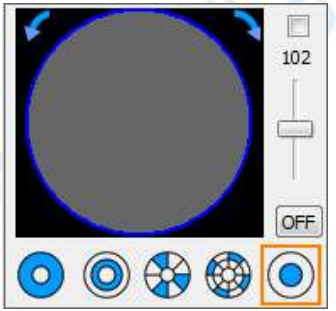
(2) Adjusting the surface light all bright :

→Select the full lighting mode

→Click the ring area

→Drag the brightness adjustment scroll bar

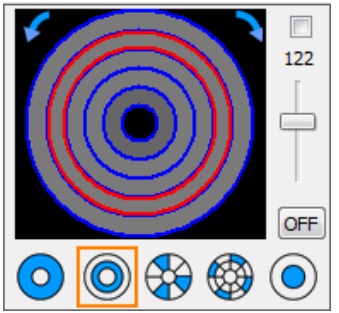
(3) Adjusting coaxial light :



→Select coaxial lighting mode

→Drag the brightness adjustment scroll bar

(4) Adjusting the brightness of a ring of the surface light :



→Select the ring lighting mode

→Click on a ring

→Drag the brightness adjustment scroll bar

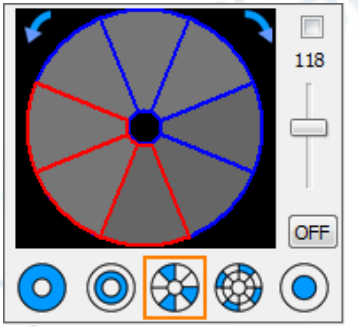
(5) Adjusting Some Sections of the surface light :

→Select the section lighting mode

→Click some sections

→Drag the brightness adjustment scroll bar

(Note: Click the left or right arrows to turn the selected sections clockwise or counterclockwise.)



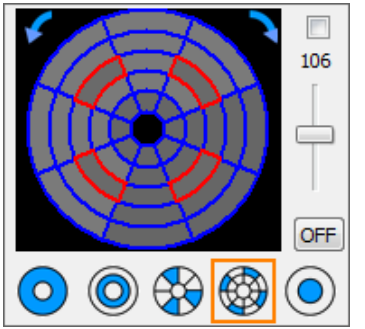
(6) Adjust some segments of the surface light :

→Select the section lighting mode

→Click some segments

→ Drag the brightness adjustment scroll bar

(Note: Click the left or right arrows to turn the selected segments clockwise or counterclockwise.)



2. Lens focusing

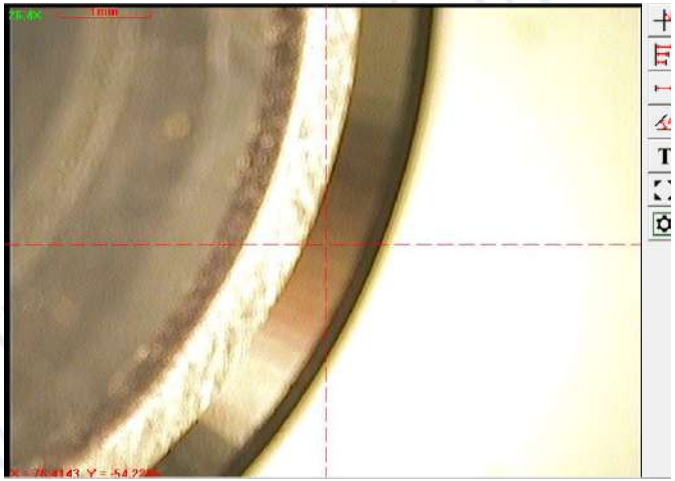
(1) Manual focus

The manual focus is to lift the Z-axis manually and determine whether the image is clearest by observation of human eyes.

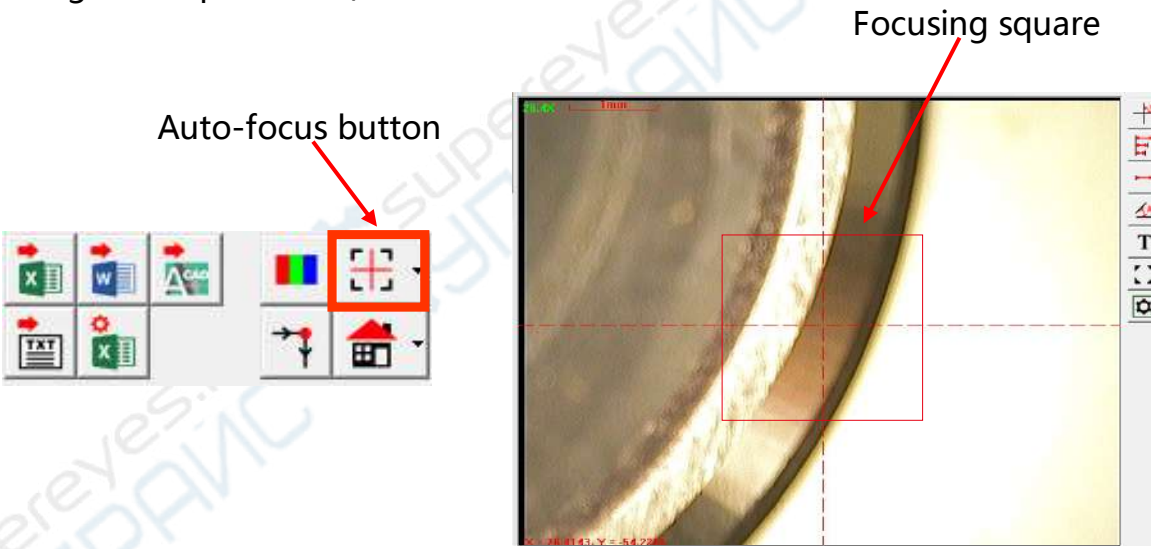
(2) auto-focus (The auto-focus function is only used for CNC image measuring instruments)

The auto-focus function refers to automatically finding the clearest position of the image by the software. Steps are as follows:

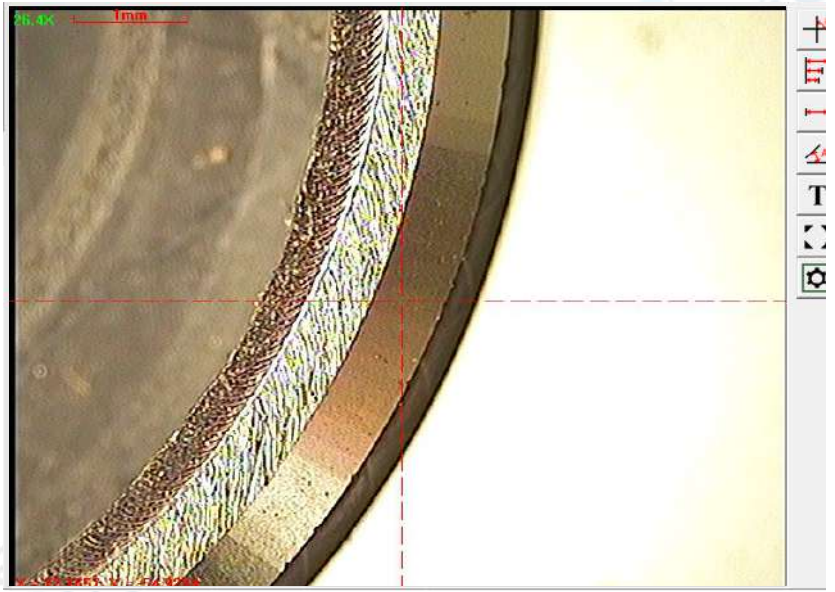
Step 1: Move the local area of the measured workpiece to the software image area. When measuring the surface of the workpiece, you need to open the surface light, if you only want to measure the contour feature of the workpiece, you do not have to turn on the surface light, then move the Z-axis in to roughly focus the image clearly.



Step2: Click the auto focus button , Then there will be a red focusing square in the image area. Move a section contour or a surface feature into the focusing square. (You can also hold down the left mouse button in the focusing square and drag the mouse to move the square to the location you want to focus on, or place the mouse cursor on the edge of the square and drag the mouse to change the square size.)



Step 3: Click the left mouse button outside the focus box, the software will control the machine automatically move the Z-axis, and eventually stay in the clearest position.

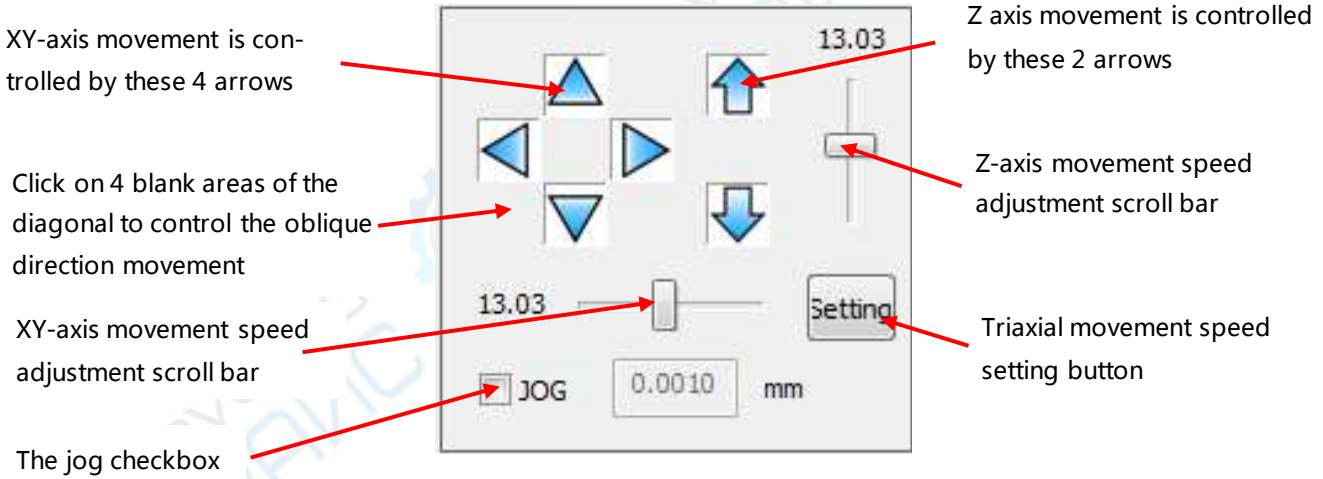


Chapter 4 Motion Control

The motion control is only used for the CNC image measuring instrument, the manual image measuring instrument can skip this chapter.

1. Motion control panel.

The movement of the machine worktable can be controlled by the motion control panel. As shown below:

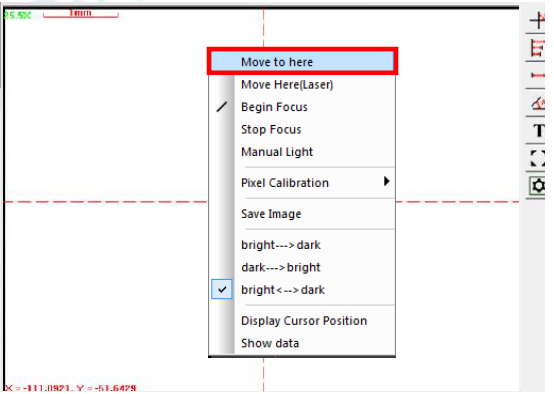


2. Using the image area to control the movement

Method 1: Hold down the middle mouse button at any position in the image area, and drag the mouse in any direction. You can move the worktable in the direction of the arrow.

Method 2: Right-click at any pixel point of the image area, select the "Move to here" menu option, and you can move this point to the center of the image area.

Method 1

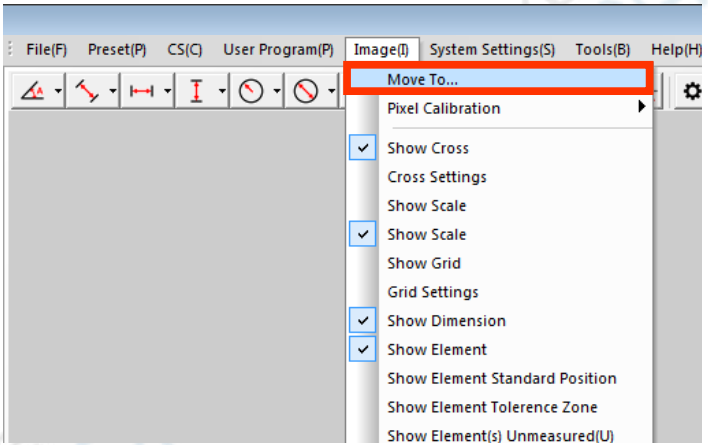


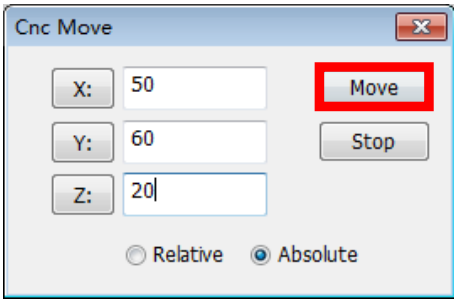
Method 2

3. Moving to a specified coordinate point

Step 1: Select the"Image→ Move to ..." In the main menu.

Step 2: Enter the coordinate values of a point in the popup dialog box, and then click the "Move" button, and you can move this point to the center of the image area. the "Relative" option represents that the the movement is relative to the current position, and the "Absolute" option represents that the move-ment is relative to the machine origin.

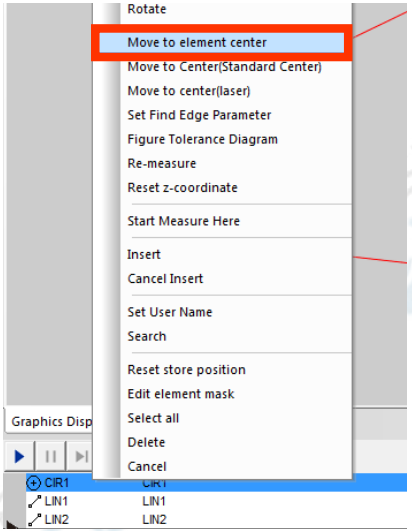


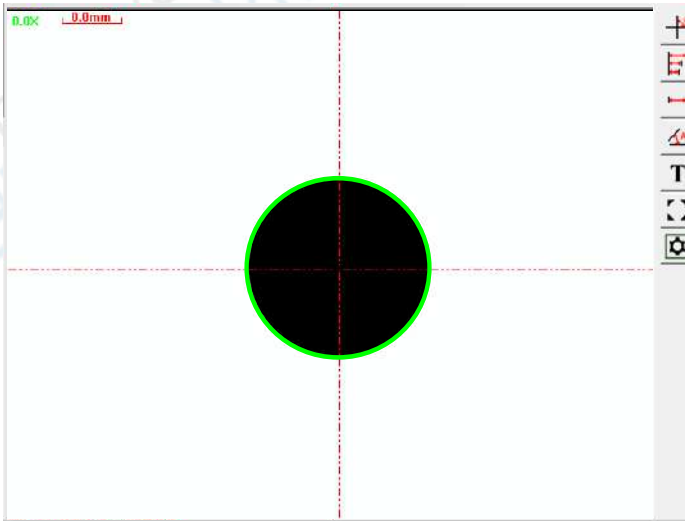


4. Moving to the element center

Step 1: Right-click an element in the element list area or right-click an element in the graphics area.

Step 2: Select the "Move to Element Center" menu option to move the center of this element (such as the center of the circle, line etc.) to the center of the image area.

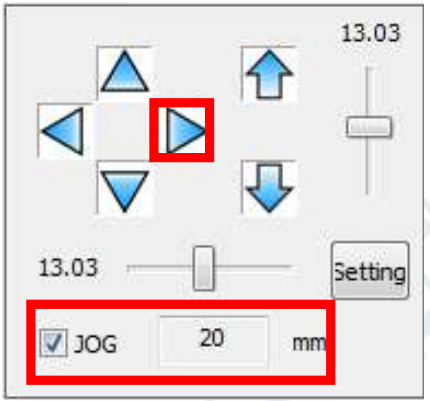


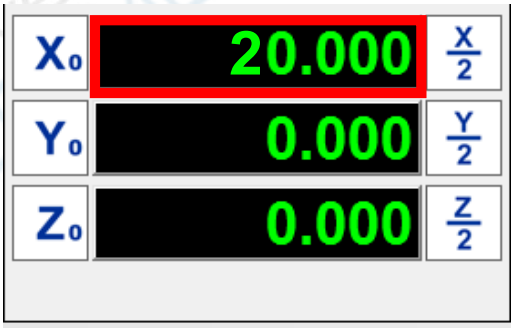


5. Coordinate axis jog

Step 1: Select the jog checkbox and enter the jog distance in the motion control panel.

Step 2: Click the arrow of the axis that you want to move, and the machine will move the jog distance in the direction of this axis.



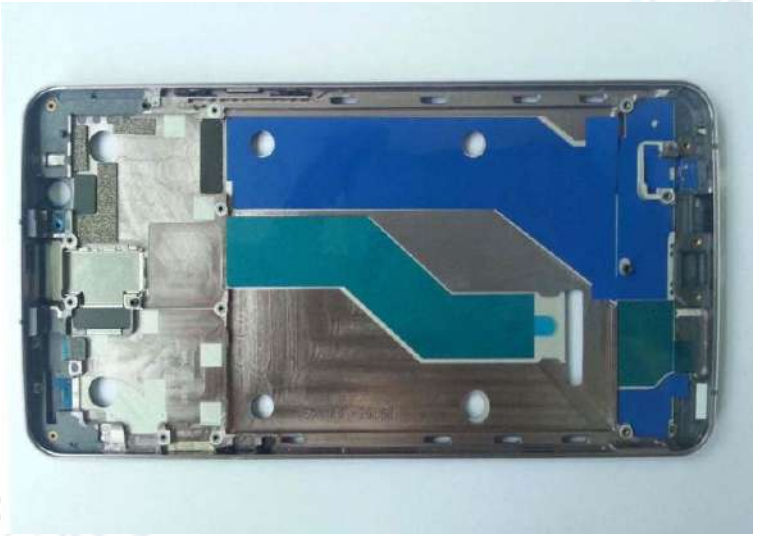


6. The image navigation function

You can get a picture of the workpiece (especially the large size workpiece) by the way of scanning or taking pictures, and make the pixels of the picture correspond to the coordinate points of the actual workpiece, then you can quickly locate the position of the workpiece by taking the picture as an image navigation, right-click at any point on the picture in the image navigation window, and select the "move here" menu option, the machine will automatically move this point of the workpiece image to the center of the image area.

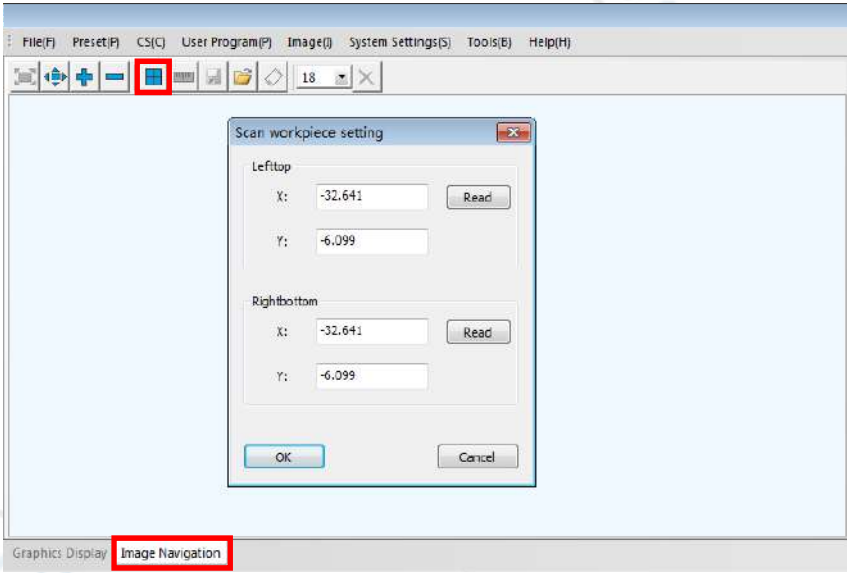
The image navigation function is usually used for the large-size workpieces and the workpieces with a lot of similar features.

For example, the size of the following mobile phone shell is large, and there are a lot of elements to be measured in it. For easy locating, you can make a navigation picture of this shell.

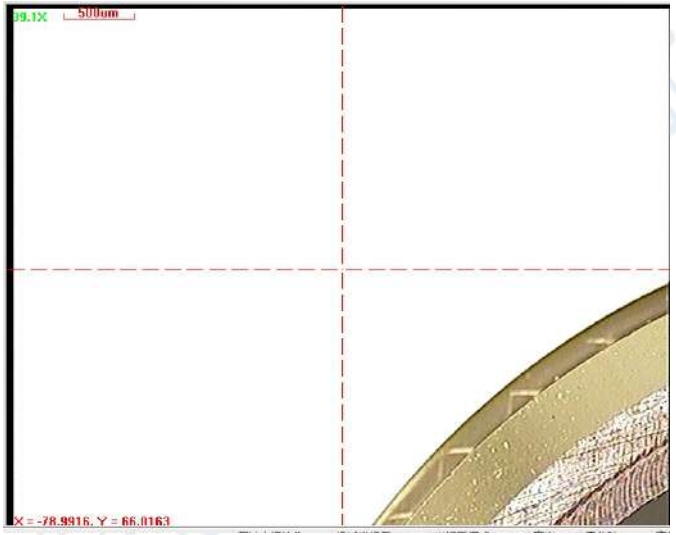


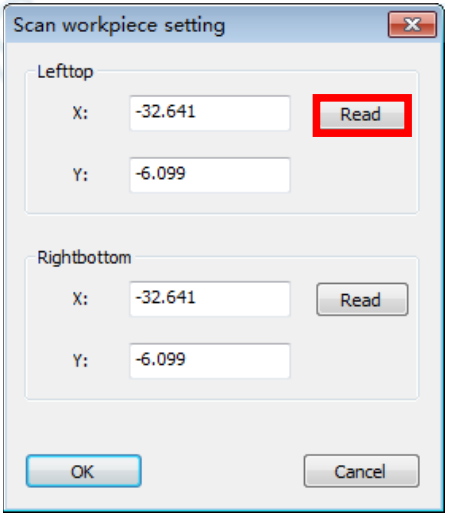
(1) Making a picture with integral scanning

Step 1: Click the "Image Navigation" tab under the graphics area, switch to the image navigation window, click the "scan workpiece" button, and then it will pop up the "Scan Workpiece Setting" dialog box.

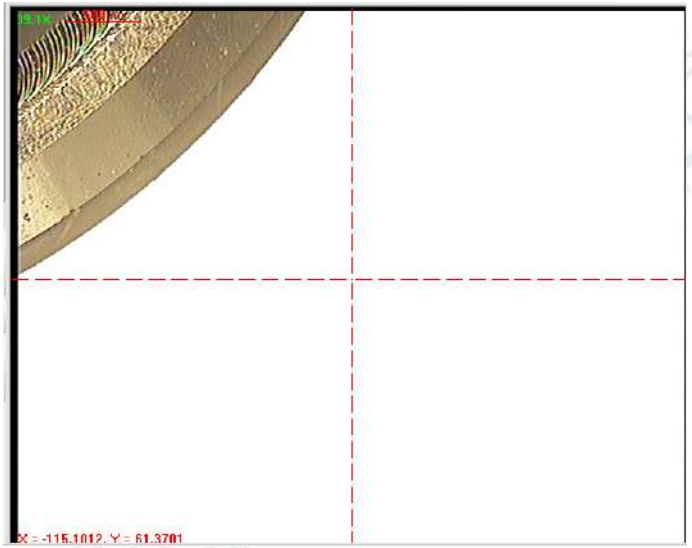


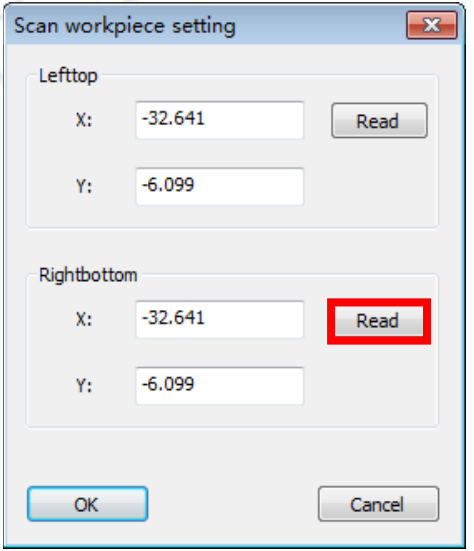
Step 2: Move the top left corner of the workpiece image to the center of the image area. Click the "Read" button at the top of the dialog box to read the coordinates of the top left corner of the navigation picture (**Note: Do not close the "Scan workpiece Settings" dialog box now**).



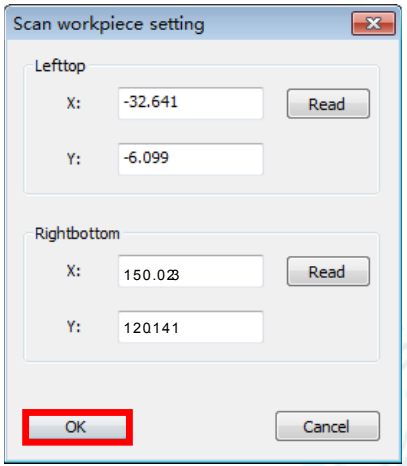


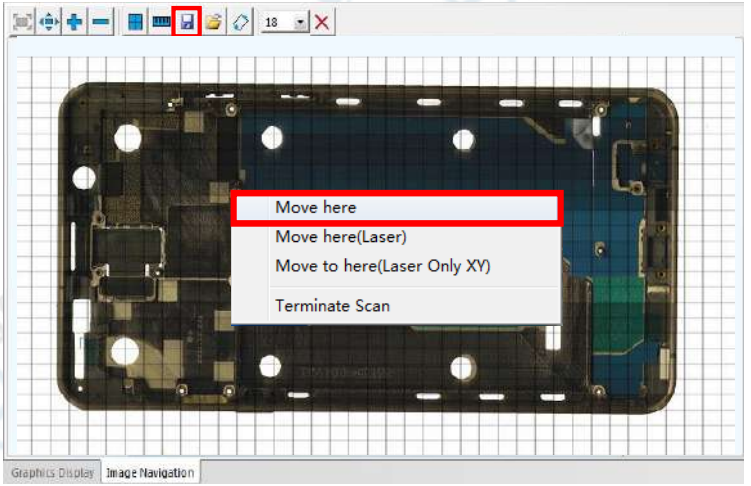
Step 3: Move the bottom right corner of the workpiece to the center of the image area, and then click the "Read" button at the bottom of the dialog box to read the coordinates of the bottom right corner of the navigation picture.





Step 4: Click the "OK" button in the dialog box, and the machine will start to scan the workpiece automatically. After the scanning is complete, you can get the whole picture of the workpiece



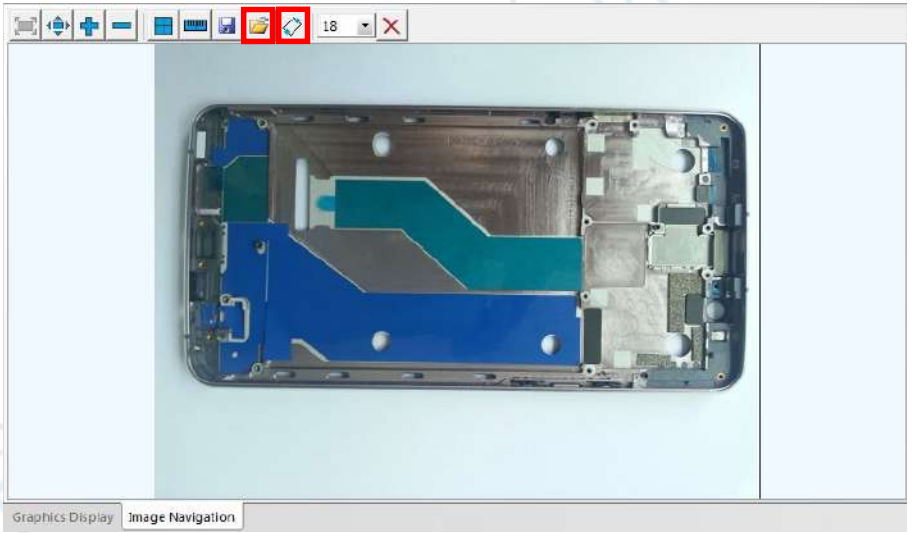


Step 5: Click the right mouse button at any point of the navigation picture, select the "Move Here" menu option, the image area will be automatically positioned to that point. Click the "Save" button at the top of the image navigation window to save the navigation picture.

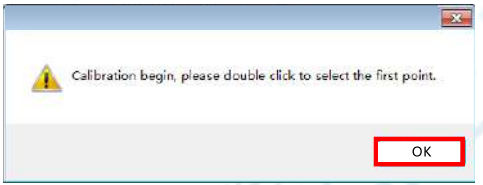
(2) The navigation picture calibration:

Any picture can be used as a navigation picture after it is calibated. Try to choose the sharp points in the picture to calibrate.

Step 1: Click the "Open" button in the image navigation window to open the picture document you want to calibrate, and then click the "Calibrate" button.



Step 2: Click the "OK" button in the pop-up dialog box, move the first sharp point on the workpiece to the intersection of the cross lines in the image area, then double-click the corresponding point of the picture in the image navigation window.



The first sharp point

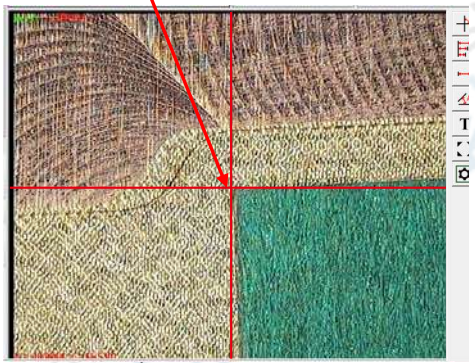


image area

double-click the corresponding point

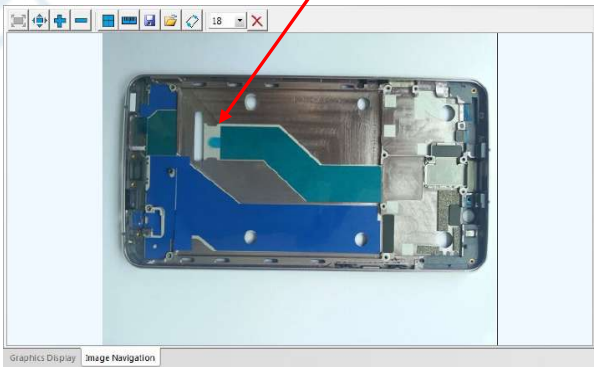
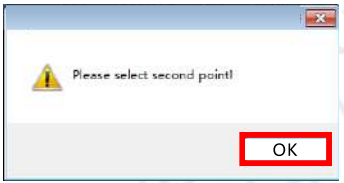
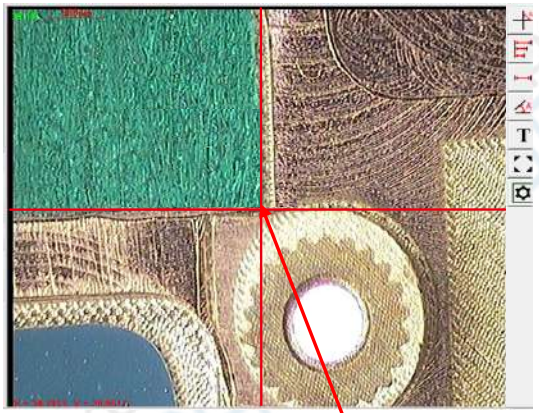


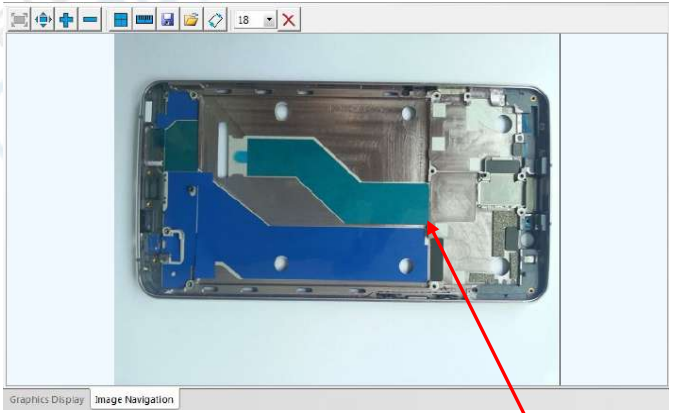
image navigation window

Step 3: Continue to click the "OK" button in the pop-up dialog box, move the second sharp point on the workpiece to the intersection of the cross lines in the image area, and then double-click the second corresponding point in the image navigation window.



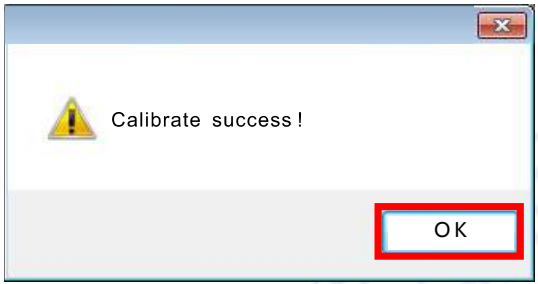


the second sharp point



double-click the corresponding point

Step 4: Click the "OK" button in the dialog box to complete the calibration.



Note: when the position of the workpiece is been changed relative to the worktable, you can also use the above calibration steps making the navigation picture pixels and the actual workpiece coordinates to re-correspond.

Chapter 5 Pixel Calibration

1. Pixel calibration instructions

(1) Definition: Pixel calibration refers to establishing the correspondence between the pixel size of the computer display and the actual size.

(2) The necessity of pixel calibration :

① Calibration must be performed before the first measurement, otherwise the measurement results may be incorrect.

② The different magnifications of the lens correspond to different pixel calibration data, and you must perform the corresponding pixel calibration before measuring at a certain magnification.

③ Pixel calibration must be performed after the CCD camera or lens are replaced or loosened.

(3) Pixel calibration type :

① **Four circles calibration :** The four circles calibration means that the same standard circle is moved to the four quadrants of the cross lines in the image area for calibration.

② **One circle calibration :** The one circle calibration means that a standard circle is moved to the center of the image area for calibration.

(4) Operation method :

① **Manual calibration :** When performing calibration, manually move the standard circle and manually capture the contour of the circle image. (Usually used for the manual image measuring instrument).

② **Automatic calibration :** Automatically move the standard circle and automatically capture the contour of the circle image. (Usually used for the CNC image measuring instrument).

(5) Pixel calibration standard：

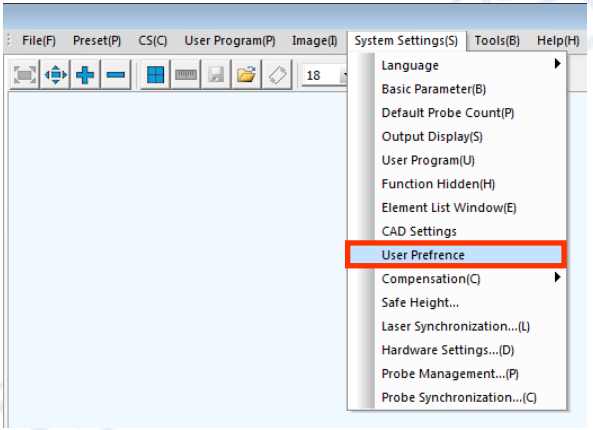
Please use the calibration standard provided by the supplier of the image measuring instrument to calibrate, such as a glass calibration sheet.

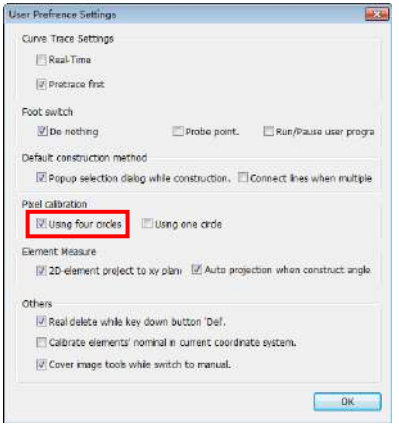
Note: Usually the manual machine uses the manual-four-circle calibration, the CNC machine uses the automatic-four-circle calibration, the one-circle calibration is used for the machine that its worktable is not movable or no linear scales.

2. Pixel calibration steps

(1) The following describes the four circle pixel calibration method at the 0.7X magnification. Please distinguish the difference between the manual machine and the CNC machine.

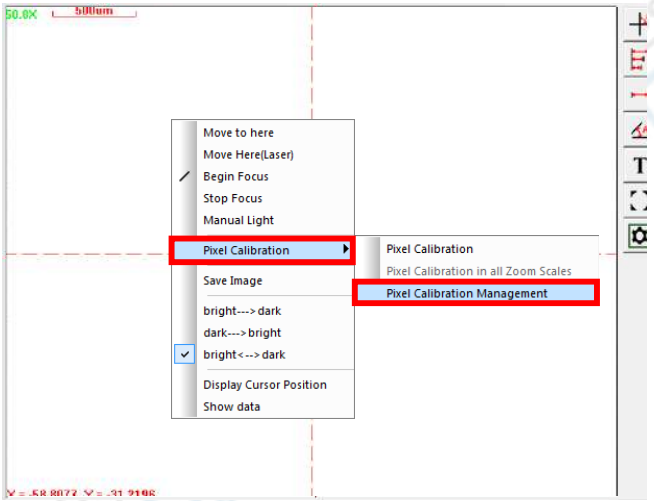
Step 1: Select the pixel calibration type: Select the "System settings→User Preferences" in the main menu, and select the calibration type in the popup dialog box. In general, please select the "Using four circles " option for the measuring instrument that its XY-axis with linear scales.

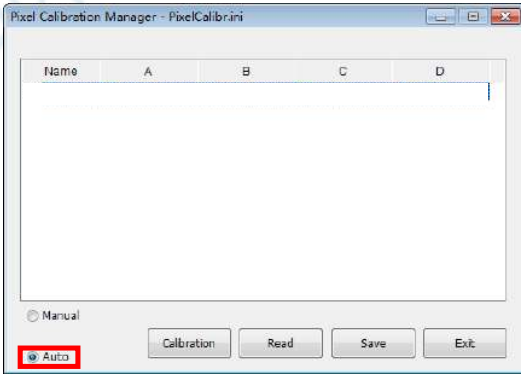




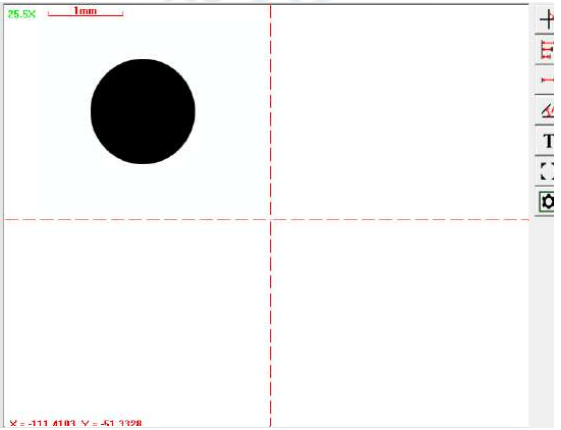
Step 2: Select the pixel calibration method: Right-click in the image area, and select the "Pixel Calibration→ Pixel Calibration Management" menu option, and then Select "Manual" or "Auto" calibration in the dialog box.

(Note: Please select the "Auto" item for the CNC machine, and the manual version software is no this option.)

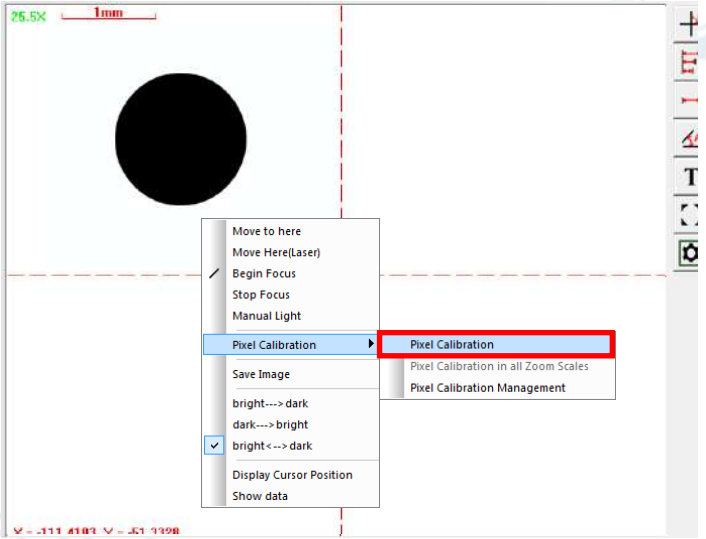




Step 3: Focusing and dimmer: Adjust the zoom lens to the 0.7X magnification, select a standard circle on the glass calibration sheet, move the circle to one quadrant of the image area and lift the Z-axis to focus it. **(Note: In order to ensure the accuracy of the calibration, the circle should not be too small or too large, its image size like the following figure is better, it is recommended to turn off the surface light, and adjust the contour light source to the appropriate brightness, so it can enhance the contrast of the standard circle contour, and make the image more clearly.)**



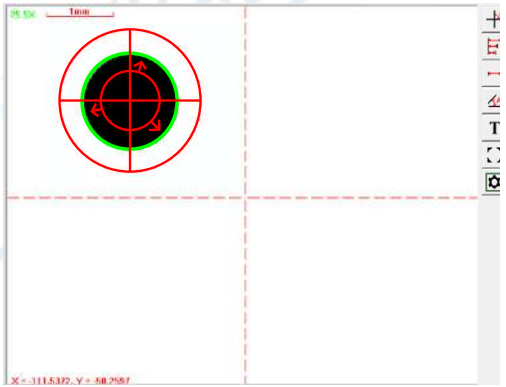
Step 4: Right-click anywhere in the image area and select the "Pixel Calibration→ Pixel Calibration" in the pop-up menu.



Step 5: Move the circle and capture the edge: Please select one of the following two methods according to the machine is a CNC image measuring instrument or a manual image measuring instrument.

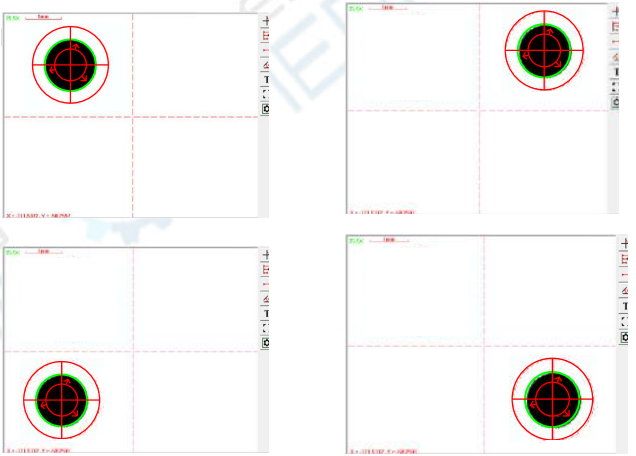
Method 1: For the CNC image measuring instrument

When you select the "pixel calibration" menu option, the red Find-Edge -Tool will appear automatically on the standard circle, and then double-click the left mouse button inside the Find-Edge-Tool or press the space bar or the Enter key on the keyboard, the software will automatically move the standard circle image and automatically capture the edge of the standard circle image.

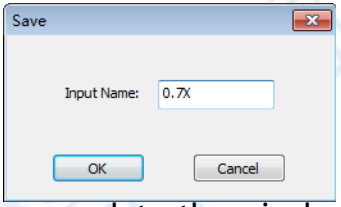


Method 2: For the manual image measuring instrument

You need to manually move the standard circle image and manually capture the edge of the circle image, click the left mouse button at three different points on the circumference (or hold down the left mouse button and drag the cursor), there will be a Find-Edge-Tool appear, make the edge of the standard circle be located between the inner and outer circles of the Find-Edge-Tool, double-click the left mouse button on the standard circumference to complete the edge capture operation in the first quadrant. Manually move the standard circle to to the other three quadrants to complete the same ope



Step 6: Save the calibration data: The software will automatically pop up the save dialog box after the capture edge operation is complete, enter the calibration name in the dialog box, for easy identification, it is recommended to use the current magnification of the zoom lens as the calibration name, such as 0.7X, 1.0X, 2.0X, 4.5X and so on. Enter the name and click the "OK" button to complete the pixel calibration.



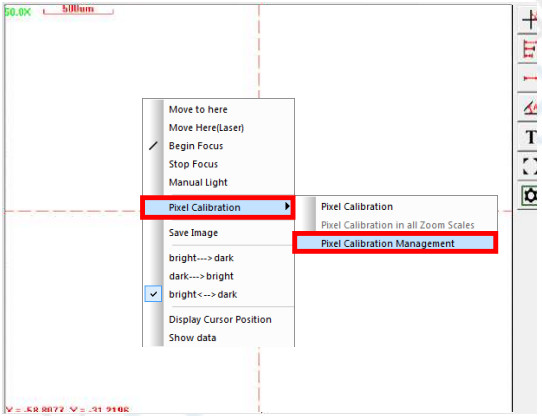
Step 7: Use the same steps to complete the pixel calibration at the other magnification

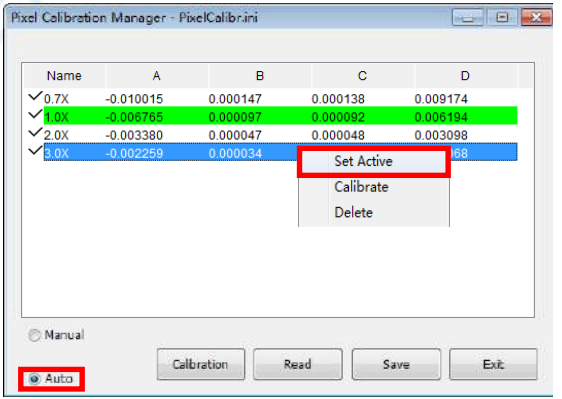
(2) One circle calibration :

The one circle calibration steps are similar to the above steps. One circle calibration generally selects a larger standard circle and places the circle in the center of the image area. It is used for the image measuring instrument that its worktable is not movable or no linear scales.

3. Pixel calibration management

Click the right mouse button in the image area and select the "Pixel Correction→Pixel Calibration Management" menu option to open the "Pixel Celebration Management" window. The window list area lists the calibration data items. The green item is the current calibration data, you can double-click any item to activate it as current, or right click on the item and activate it in the pop-up menu, or recalibrate and delete the item. The save button is to save all items to a folder, the read button is to import the saved calibration data and use it.





Chapter 6 Element measurements

Elements include the point, line, circle, arc, ellipse, rectangle, slot, ring, open curve, closed curve and the other geometric elements.

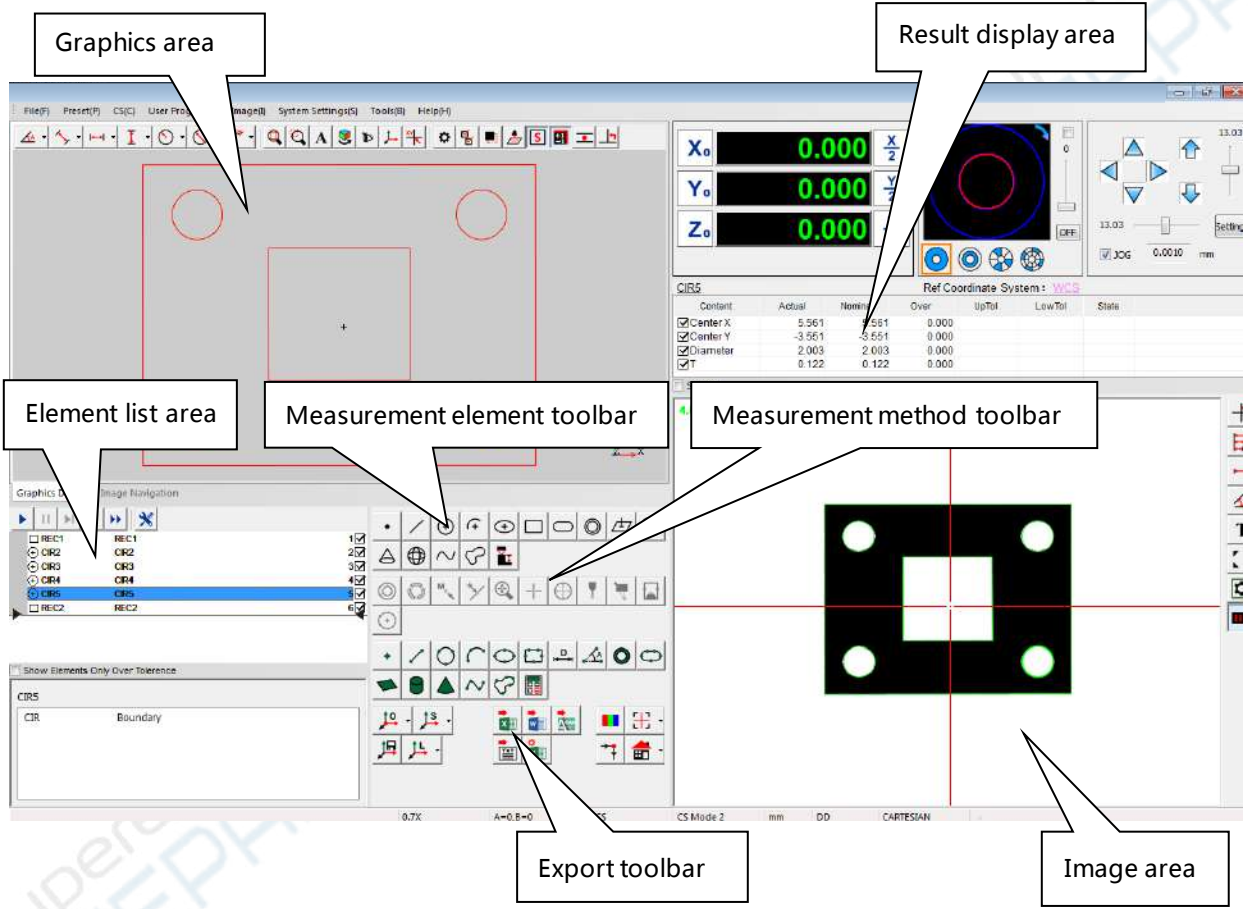
1. Steps of element measurement

Step 1 : In the Measurement element toolbar, click a certain element button, and then click a method button in the Measurement Method Toolbar.

Step 2 : Use the mouse to capture points or edges in the image area.

Step 3 : Select the extracted element in the "element list area" and view the element measurement results in the "result display area".

Step 4 : Use the Export Toolbar to export the measurement result data.


Graphics area
Result display area
Element list area
Measurement element toolbar
Measurement method toolbar
Export toolbar
Image area

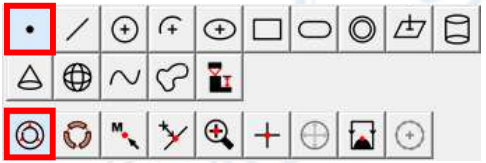
2. Element measurement method

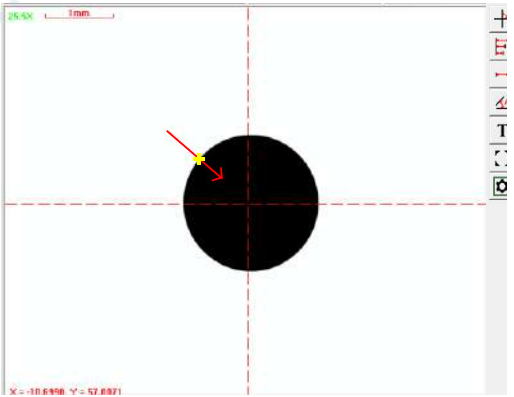
(1) The measurement methods of a point

① Extracting a point with the line intersection method

Step 1: Select the "Point" element button and the "Boundary" method button.

Step 2: Click the left mouse button in the image area, there will appear a line with arrow, and make the line intersect with image contour, and double-click the mouse on the line (you also can press the spacebar or the enter key on the keyboard) to complete the operation.

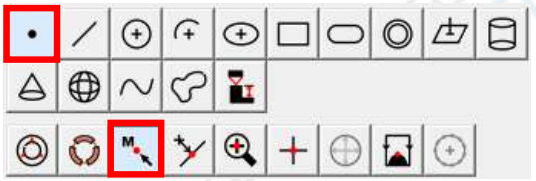


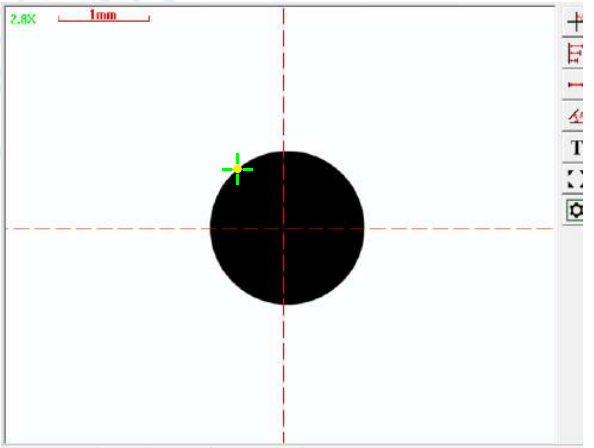


② Extracting a point with mouse clicking

Step 1: Select the "Point" element button and the "mouse" method button.

Step 2: Move the cross cursor to the edge of the image in the image area. When the color of the cross cursor changes, click the left mouse button (you can also press the spacebar or the Enter key on the keyboard) to complete the operation.

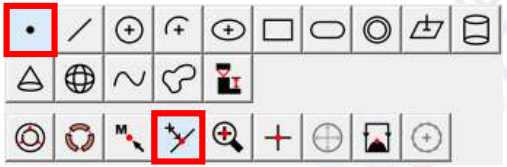


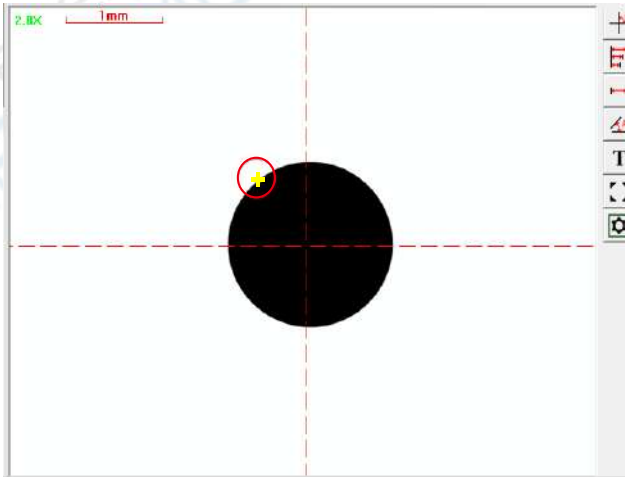


③ Extracting the closest point to the mouse cursor

Step 1: Select the "point" element button, and the "near " method button.

Step 2: Move the mouse cursor near the edge of the image in the image area, click the left mouse button, and a circular Find-Edge-Tool will be appeared, and then you can extract the closest point to the mouse cursor on the edge of the circle.





④ Extracting a point by magnifying the image

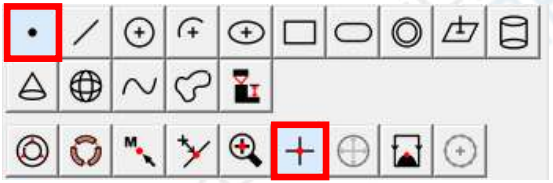
Step 1: Select the "Point" element button, and the "Zoom" method button.

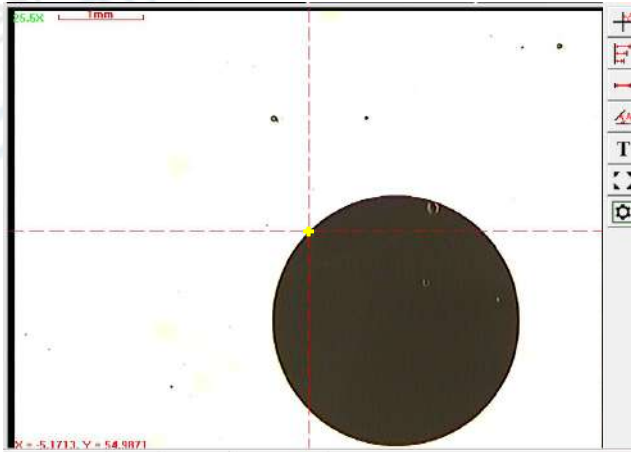
Step 2: There will be a red square in the center of the image area, and popup the zoom window at the same time, move the red square to the local area that you want to magnify. This local area is magnified 3 times in the zoom window, holding down the left mouse button and drag the image in order to make the image contour intersect with small cross cursor, double-click the left mouse button in the zoom window to complete the operation.

⑤ Extracting a point with the cross lines

Step 1: Select the "Point" element button, and the "Cross" method button.

Step 2: You can move the the edge of the image to the intersection of the cross lines. When the color of the cross lines changes, double-click the left mouse button (You also can press the spacebar or the Enter key on the keyboard) to complete the operation.



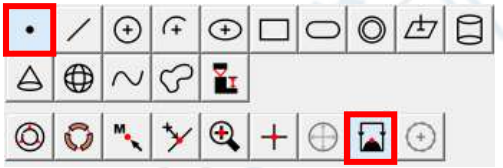


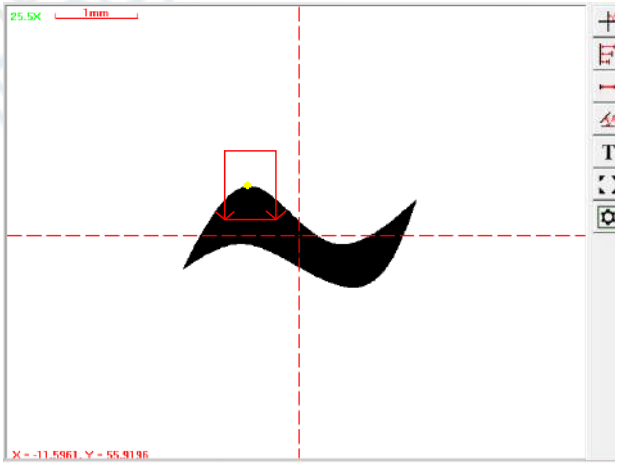
⑥ Extracting the peak point

The peak point refers to the highest point or the lowest point in a direction。

Step 1: Select the "Point" element button, and the "Peak Point" method button.

Step 2: Click the left mouse button at two different points near the image contour, and then drag the mouse and click the left button to determine the direction of the Find-Edge-Tool, double-click the left mouse button in the Find-Edge-Tool, you can extract the peak point in this direction.



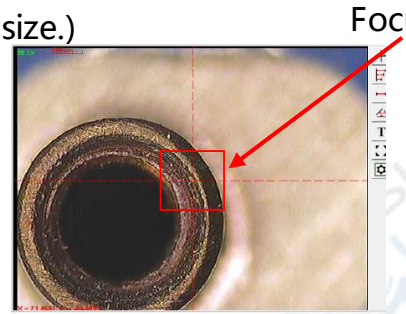


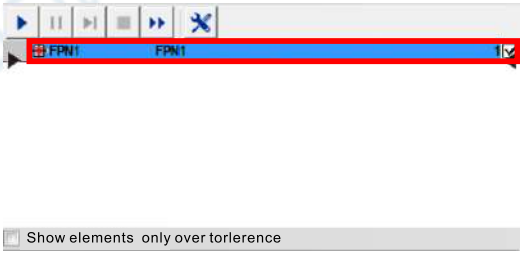
⑦ Extracting a point with autofocus method

This method can extract a point in the intersection of the cross lines of the image area with autofocus method, it is usually used to measure a plane flatness or the height between two steps.

Step 1: Select the "Focus Plane" element button and the "Boundary" method button, there will be a red focusing square in the center of the image area.

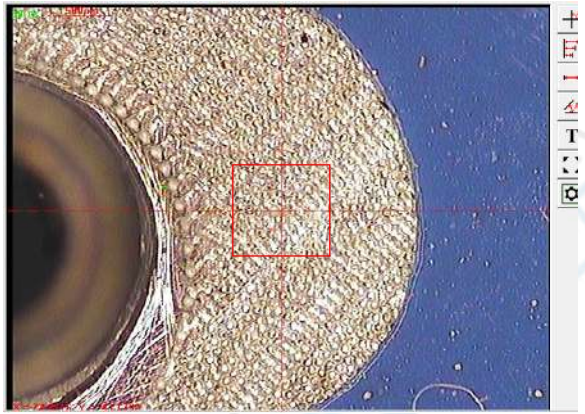
Step 2: Move a surface of the workpiece into the red focusing square, and then lift the Z-axis to make the surface is roughly focused , double-click the left mouse button to extract the first focusing point of this surface. (You can also hold down the left mouse button in the focusing square and drag the mouse to move the square to the position you want to focus on, or place the mouse cursor on the edge of the square and drag the mouse to change the square size.)





Use the same method to extract other focusing points. You can construct a plane with all these focusing points.(Element construction see **Chapter 7**) select this plane element in the element list area, You will see its flatness value in the result display area.

Step 3: Move the the second surface of the workpiece into the red focusing square, and then lift the Z-axis to make the second surface is roughly focused, double-click the left mouse button to extract the a focusing point of this surface.



Use the same method to extract other focusing points. You can construct a plane with all these focusing points.(Element construction see **Chapter 7**), select this plane element in the element list area, You will see its flatness value in the result display area.

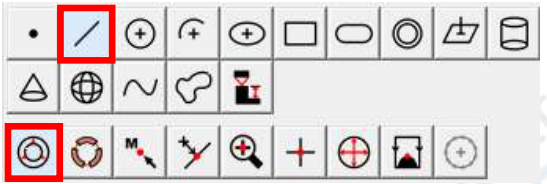
Step 4: To get the height value between these two plane, you can construct the distance between them. (How to construct the distance see **Chapter 7**)

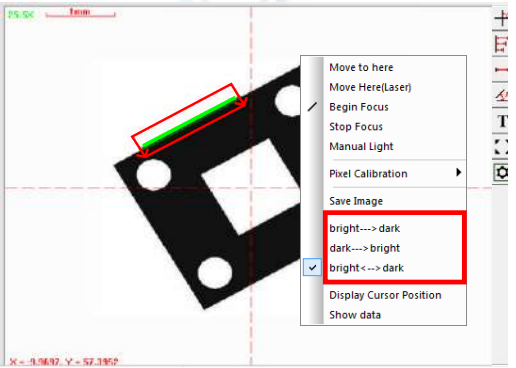
(2) Extracting a straight line

① Extracting a straight line by capturing the entire edge

Step 1: Select the "Line" element button and the "Boundary" method button.

Step 2: Hold down the left mouse button and drag the cursor in the direction of the image edge, draw a rectangular Find-Edge-Tool, double click the left mouse button in the Find-Edge-Tool (you can also press the spacebar or the enter key on the keyboard) to complete the operation.(Note: The aorrow of the Find-Edge-Tool indicates the direction of scanning, The edge judgment is based on the gray value of the pixels, the direction includes from bright to dark, from dark to bright, and from the bright and dark at the same time, you can click the right mouse botton outside the Find-Edge-Tool and select the scanning direction in the pop-up menu, and you can also click the middle mouse botton in the Find-Edge-Tool to change the scanning direction .)




Move to here
Move Here(Laser)
Begin Focus
Stop Focus
Manual Light
Pixel Calibration
Save Image
bright---> dark
dark---> bright
bright<--> dark
Display Cursor Position
Show data

② Extracting a straight line by capturing Multiple segments

The method of capturing multiple segments is often used to measure the line that its image range is beyond the image area.

Step 1: Select the "Line" element button and the "Subsection" method button, and set the number of the segments, and select the "Auto" check box.

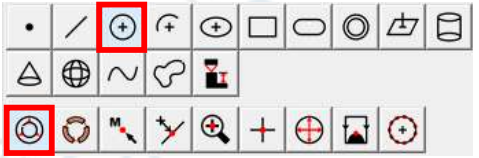
Step 2: Hold down the left mouse button and drag the cursor in the direction of the image edge, double click in the Find-Edge-Tool (you can also press the spacebar or the enter key on the keyboard) to extract the first segment, and move other segments of the measured edge into the image area and extract it by the same method, you will be able to complete the operation.

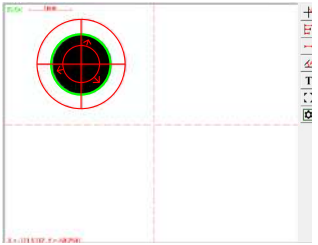
(3) Extracting a circle

① Extracting a circle by capturing the entire boudary

Step 1: Select the "Circle" element button and the "Boundary" method button.

Step 2: hold the left mouse button and drag the cursor in the measured circle center (you can also click three different points on the edge of the measured circle), draw a ring Find-Edge-Tool, The arrow of the Find-Edge-Tool indicates the direction of scanning , you can hold down the left mouse botton in the Find-Edge-Tool and drag the cursor to move it, or resize it by dragging the inside and the outside circle of the tool. Make the measured contour edge is between the inner and outer circles of the tool, and double-click left mouse botton in the tool (You also can press the spacebar or the enter key on the keyboard) to complete the operation.



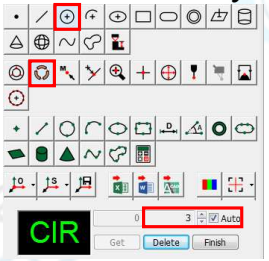


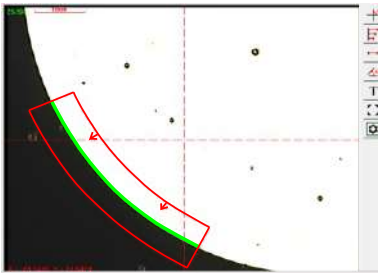
② Extracting a circle by capturing Multiple segments

This method is mainly for large circles that its image size is larger than the image area.

Step 1: Select the "Circle" element button and the "Subsection" method button, and set the number of segments, and select the "Auto" check box.

Step 2: Move one segment arc contour edge of the measured circle into the image area, double click the left mouse botton at two different point of the arc, and then the Find-Edge-Tool will appear, adjust the tool size and shape to fit to the arc contour, double click in the Find-Edge-Tool (you can also press the spacebar or enter key on the keyboard) to extact the first arc segment, move other segments of the measured circle into the image area and extract it by the same method, and you will be able to complete the operation.

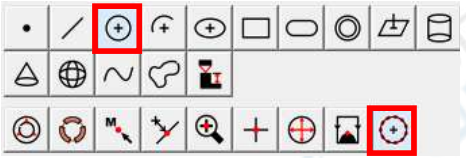


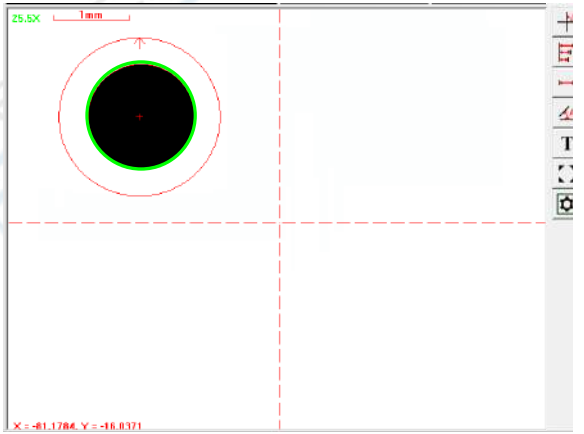


③ Extracting a circle by the “contour” method

Step 1: Click the "Circle" element button and the "Contour " method button.

Step 2: Double click the left mouse botton in the Find-Edge-Tool to complete the operation.

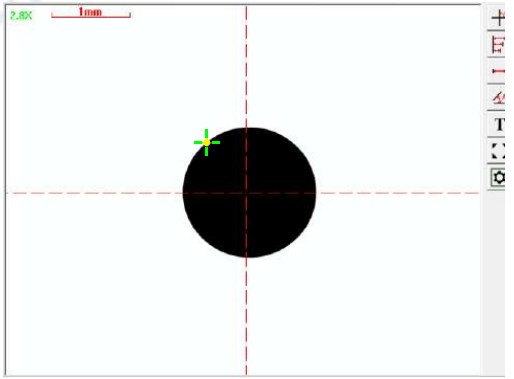




④ Extracting a circle by capturing Multiple points

Step 1: Click the "Circle" element button and the corresponding method button of extracting points, set at least 3 points, and select the "Auto" checkbox.

Step 2: Move the cursor to the contour of the circle to be measured in the image area. When the color of the cursor changes, click the left mouse button (you can also press the space bar or the Enter key on the keyboard) to complete to extract the first point, then use the same method to extract other points.



(4) Extracting an arc

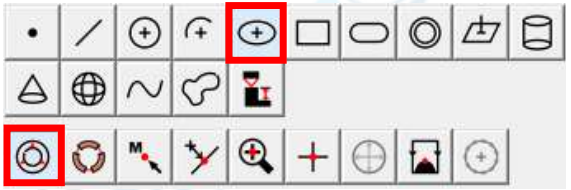
The method of extracting an arc is similar to the circle. Please follow the above steps.

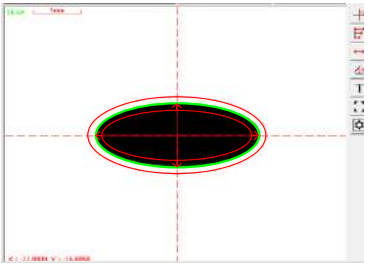
(5) Extracting an ellipse

① Extracting an ellipse by capturing the entire boudary

Step 1: Select the "Ellipse" element button and the "Boundary" method button.

Step 2: Click the left mouse button on the two vertices of the long axis of the ellipse to be measured, and then move the cursor in the direction of the short axis. Double click the left mouse button when the tool is basically fitted to the ellipse profile (You can also click the left mouse button and then press the space bar or the Enter key on the keyboard) to complete the operation。



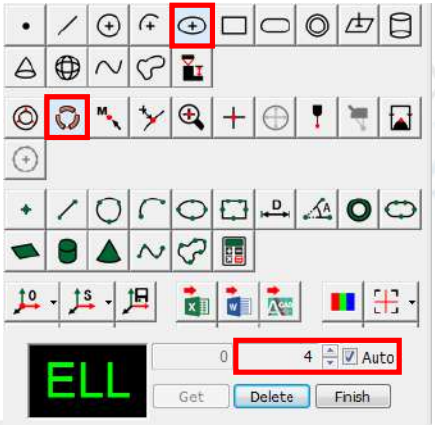


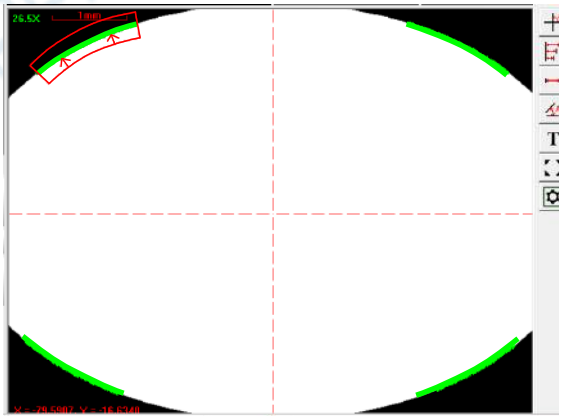
② Extracting an ellipse by capturing Multiple segments

This method is mainly used for the large ellipse that its image size is larger than the image area.

Step 1: Click the "Ellipse" element button and the "Subsection" method button, set at least 4 segments, and select "Auto" checkbox.

Step 2: Extract the measured ellipse according to the number of segments you have set. You can move the outside segments into the image area to extract them.

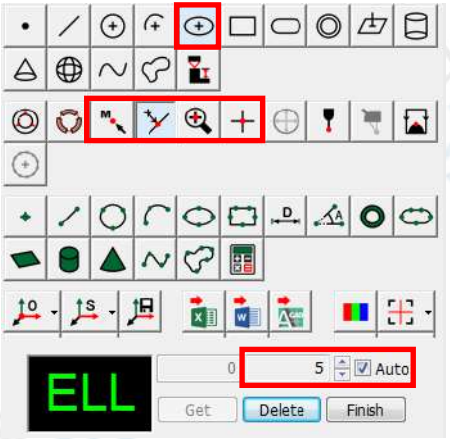


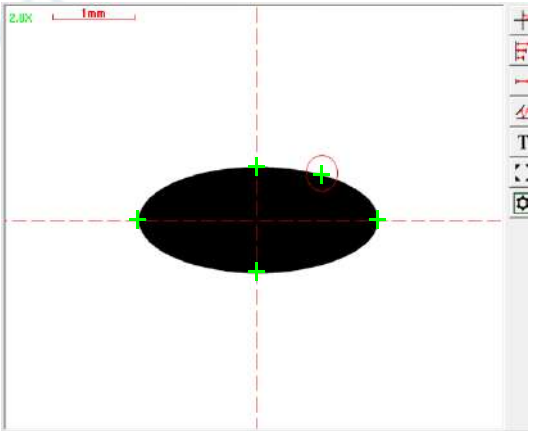


③ Extracting an ellipse by capturing Multiple points

Step 1: Click the "Ellipse" element button and the corresponding method button of extracting points, set at least 5 points, and select the "Auto" checkbox.

Step 2: Extract points on the contour of the ellipse according to number of the points you have set. It is recommended that these points include the four vertices of the ellipse. (Note: Click the left mouse button when the color of the mouse cursor changes)



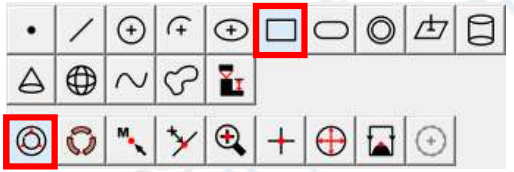


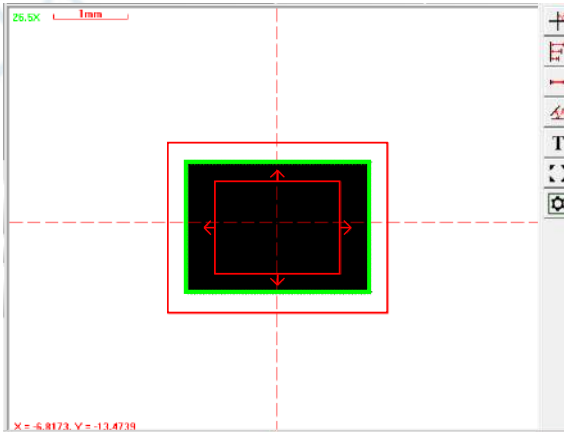
(6) Extracting a rectangle

① Extracting a rectangle by capturing the entire boudary

Step 1: Select the "Rectangle" element button and the "Boundary" method button

Step 2: Click the left mouse button on two vertices of any side of the measured rectangle, and move the cursor to the opposite edge and double click the left mouse button (you can also press the space bar or the enter key on the keboard) to complete the operation.



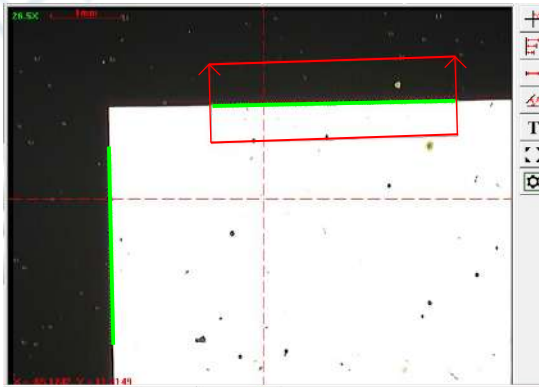


② Extracting a rectangle by capturing Multiple segments

This method is mainly used for the large rectangle that its image size is larger than the image area.

Step 1: Click the "Rectangle" element button and the "Subsection" method button and set at least 4 segments. Select "Auto" checkbox.

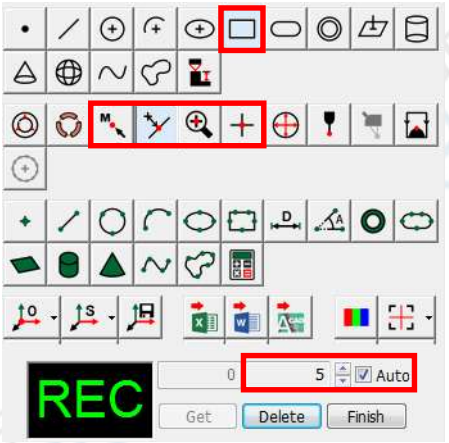
Step 2: Move one or two sides of the measured rectangle into the image area, extract them, then move the other sides into the image area and extract them (Note: All sides of the rectangle must be extracted).

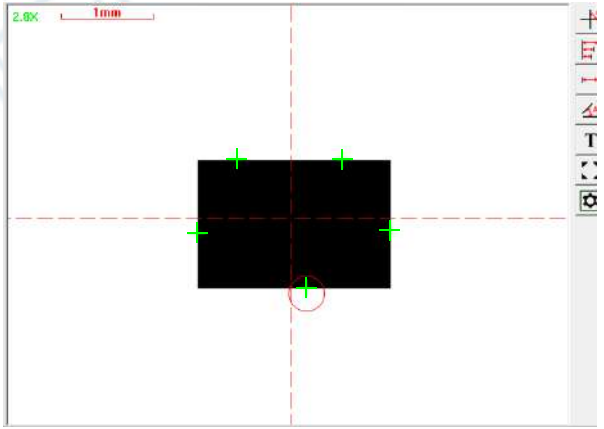


③ Extracting a rectangle by capturing Multiple points

Step 1: Click the "Rectangle" element button and the corresponding button of extracting points, set at least 5 points, and select the "Auto" checkbox.

Step 2: Click the left mouse button on either side of the measured rectangle and extract two points on this side, and then extract a point on each side of the remainning sides.(Note: click the left mouse button when the color of the mouse cursor changes)



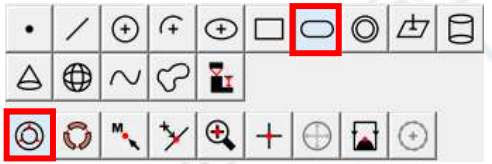


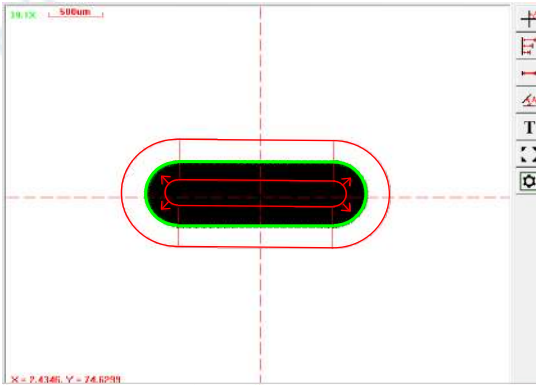
(7) Extracting a slot

Extracting a slot by capturing the entire boudary

Step 1: Select the "Slot" element button and the "Boundary" method button

Step 2: Click 3 points on one arc of the slot, then a slot Find-Edge-Tool will appear, make the tool size and direction fit to the measured contour, double click the left mouse button in the Find-Edge-Tool (You can also press the space bar or the enter key on the keyboad) to complete the operation.



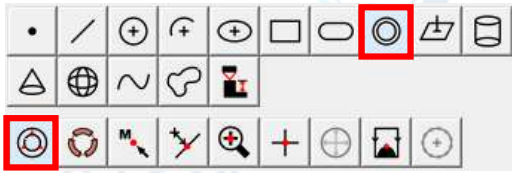


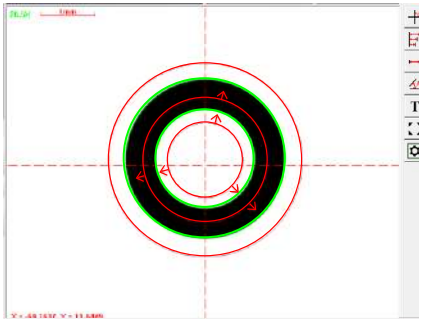
(8) Extracting a ring

Extracting a ring by capturing the entire boudary

Step 1: Select the "Ring" element button and the "Boundary" method button.

Step 2: Click three different points on the inner circle or the outer circle of the ring image, then the ring Find-Edge-Tool will appear, you can put the cursor on one circle of the tool and drag the mouse to change its size, make the inner and outer circle contour of the measured ring image is clamped between the three circles of the tool, double click the left mouse button in the tool (You can also press the space bar or the enter key on the keyboad) to complete the operation.

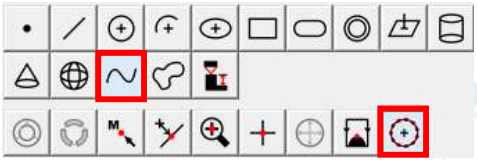


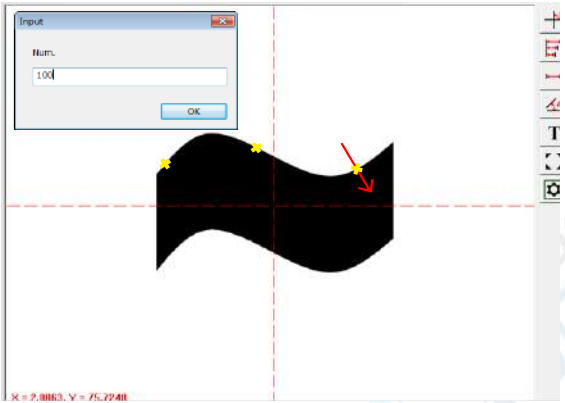


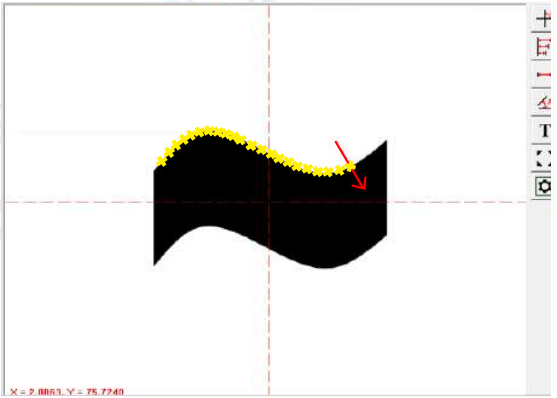
(9) Extracting an open curve

Step 1: Click the "Open Curve" element button and the "Contour" method button.

Step 2: Click the left mouse button and drag the cursor near the measured contour to draw a line with arrow, make the line intersect with the measured contour, and click the left mouse button again, put the cursor on the arrow and double click the left mouse button to extract the first point. Extract the second point and the third point in the same way. Enter the total number of the points to be extracted for the open curve in the pop-up dialog box and click the OK button to complete the operation. You can also pre-set the total extraction points number of the open curve in the "User prefrence settings" dialog box(See **Chapter 12**).(note:The first point above is the starting point of the open curve, the second point is the direction, and the third point is the end point)





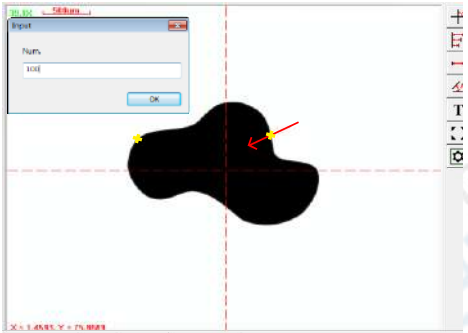


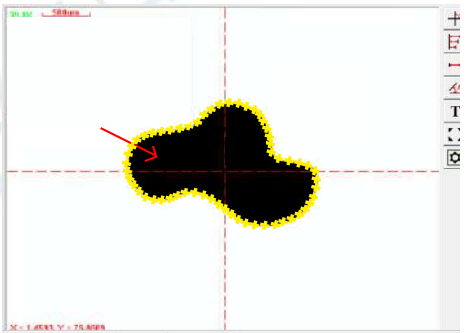
Note: The above method can also be used to extract the open curve that its image size is larger than the image area. The open curve measurement is the quickest and most effective method to measure the length of an irregular curve. You can obtain the length value of the curve in the result display area.

(10) Extracting a closed curve

Step 1: Click the "Close Curve" element button and the "Contour" method button.

Step2: Use the above method of extracting the open curve to extract the starting point and the direction point of the closed curve. And you will obtain the closed curve.

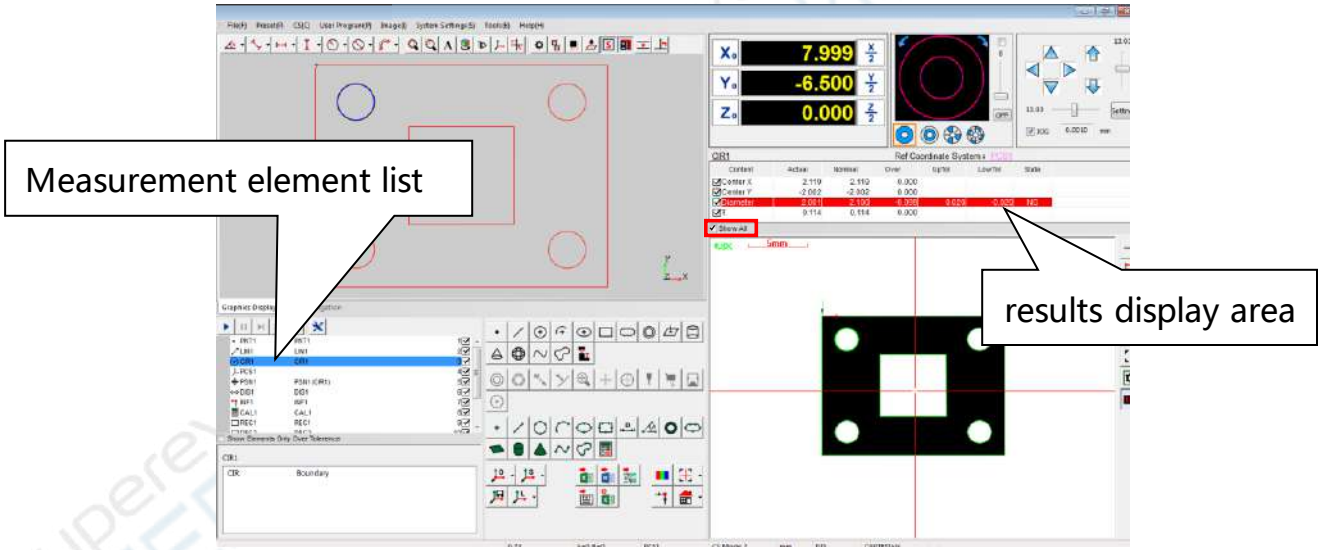




Note: This method can also be used to extract the closed curve that its image size is larger than the image area. The closed curve measurement is the quickest and most effective method to measure the length and area of an irregular close curve, and also be used to measure the equivalent diameter of a flexible circle (such as a rubber O-ring).

3. Result data viewing and tolerance settings

The element list area lists the number and names of all measured elements in the order of the measurement operation, click on the name of the element to view its results in the result display area. By default, only part of the results of the element is displayed, and you can check the "show all" check box in the lower left corner of the results display area to display all the results data.



The results data includes actual values, nominal values, error values, upper tolerances, lower tolerances, and states.

Actual values : The Value obtained by actual measurements.

Nominal values : The Standard values marked in the drawing. The nominal value is manually entered by the user.

Error values : The error value= The actual value – The nominal value.

Upper tolerance : The difference between the upper limit size and the nominal size.

Lower tolerance : The difference between the lower limit size and the nominal size.

State: According to whether the actual value is out-of-tolerance, there are two states : OK or NG, the entries will be used red to alert when the state is NG.

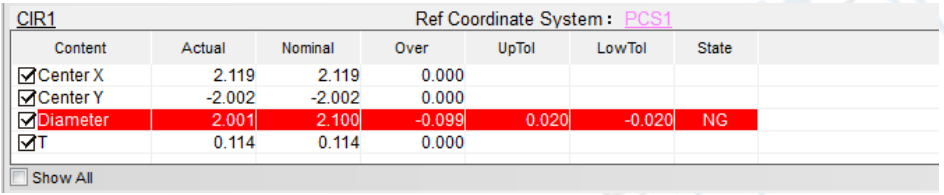
(2) The tolerance settings

Including the upper tolerance settings, the lower tolerance settings, the shape tolerance settings and the position tolerance settings.

① The Upper and lower tolerance settings

You only need to enter the values of the upper and lower tolerance in the result display area. The software will determine whether the size is OK or NG according to

whether the error is out of the tolerance range. The NG entries will be automatically displayed in red, as shown below:



CIR1 Ref Coordinate System: PCS1

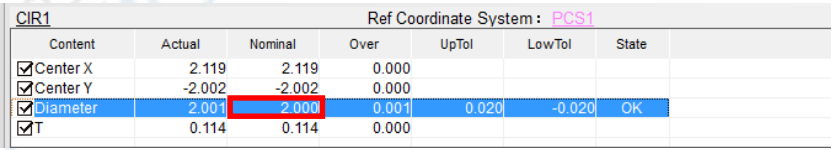
Content	Actual	Nominal	Over	UpTol	LowTol	State
Center X	2.119	2.119	0.000			
Center Y	-2.002	-2.002	0.000			
Diameter	2.001	2.100	-0.099	0.020	-0.020	NG
T	0.114	0.114	0.000			

Show All

② The shape tolerance settings

Shape tolerance: including the straightness, roundness, flatness, cylindricity, etc.

You only need to enter the required range of the tolerance zone in the nominal value box, as shown in the following figure. For example, entering 2.0 in the nominal value box, the software will automatically calculate the error every time when the user program is running, and automatically determine whether the actual value is OK or NG. The NG entries will be automatically displayed in red, as shown below:



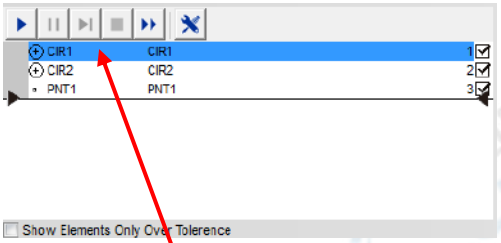
CIR1 Ref Coordinate System: PCS1

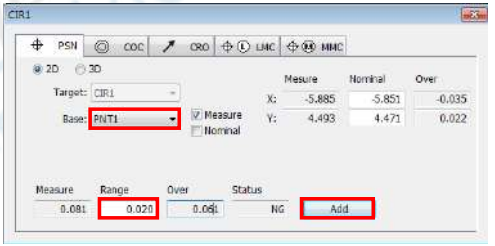
Content	Actual	Nominal	Over	UpTol	LowTol	State
Center X	2.119	2.119	0.000			
Center Y	-2.002	-2.002	0.000			
Diameter	2.001	2.000	0.001	0.020	-0.020	OK
T	0.114	0.114	0.000			

③ The position tolerance settings

Position tolerance: Including the position, symmetry, perpendicularity, parallelism, inclination, circular runout, total runout, etc.

As shown in the figure below, double-click an element in the element list area, and then pop up the position tolerance setting dialog box. For example, selecting the "PSN" tab to set the position tolerence.

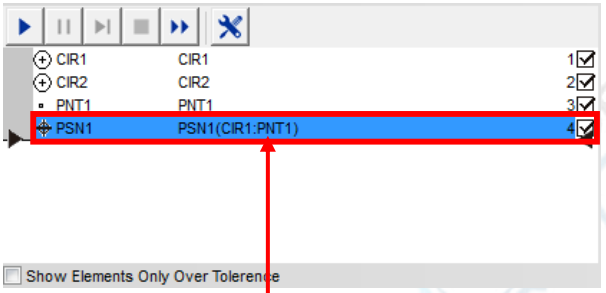


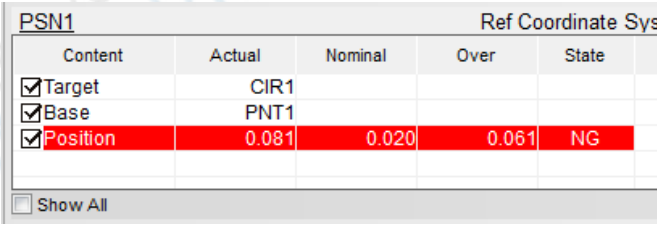


Select the "PNT1" as the reference datum, that is the position tolerance of the "CIR1" relative to the "PNT1", and then enter the tolerance range "0.02" , click the "Add" button, the position tolerance will be added to the element list area. (Or you do not

select the datum element, but manually enter the theoretical coordinate values of the "CIR1" center in the nominal value box. That is the position tolerance of the "CIR1" relative to its own theoretical position)

The software will automatically calculate the error every time when the user program is running, and automatically determine whether the actual value is OK or NG, the NG entries will be automatically displayed in red.





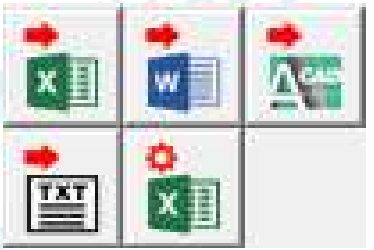
The Position tolerance has been added to the element list area

You can follow the same steps to set other tolerances, the definition of all the tolerance see the "mechanical design manual"

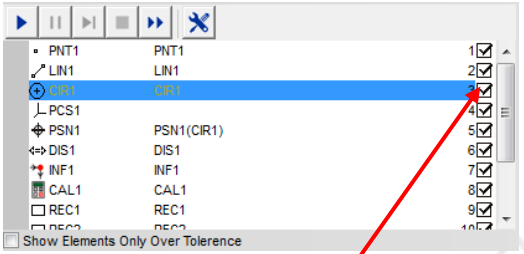
4. Exporting the measurement results data

(1) Result data export toolbar

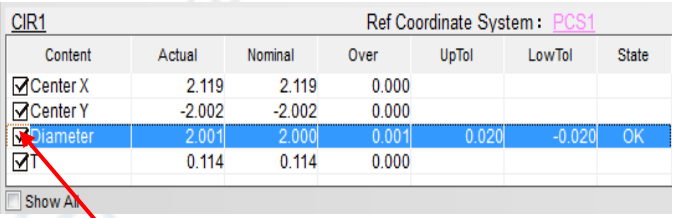
The software supports the EXCEL, WORD, TXT, DXF, IGS format document exporting. The EXCEL or WORD applications must be installed before you export the EXCEL or WORD documents. Click the EXCEL and WORD exporting button will automatically start the corresponding application. The DXF format documents is opened with AutoCAD or the other graphics software. The document exporting toolbar is as follows:



The user can set whether to export the measurement results of an element, and can also set whether to export one item of an element results, as shown below:



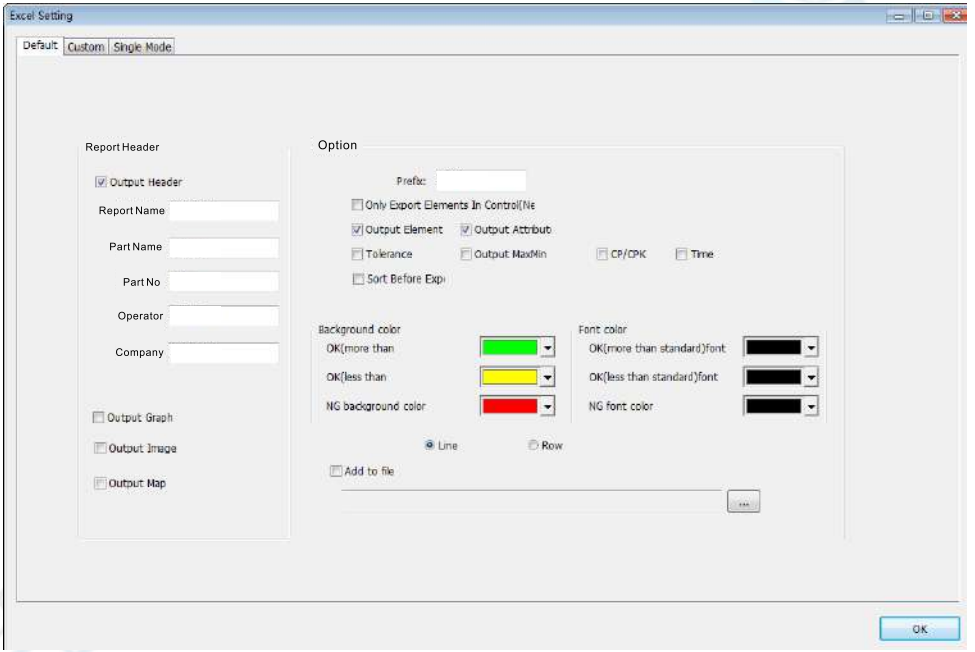
The element will be not exported after you have canceled the "√"



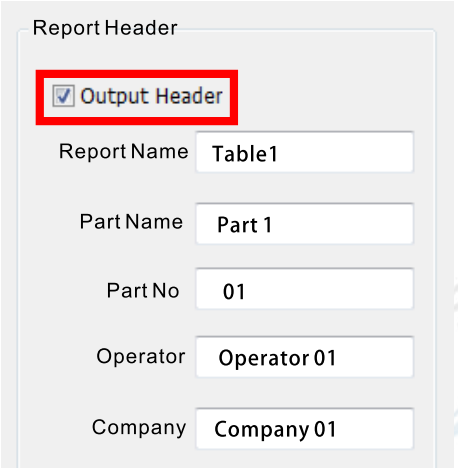
The item will be not exported after you have canceled the "√"

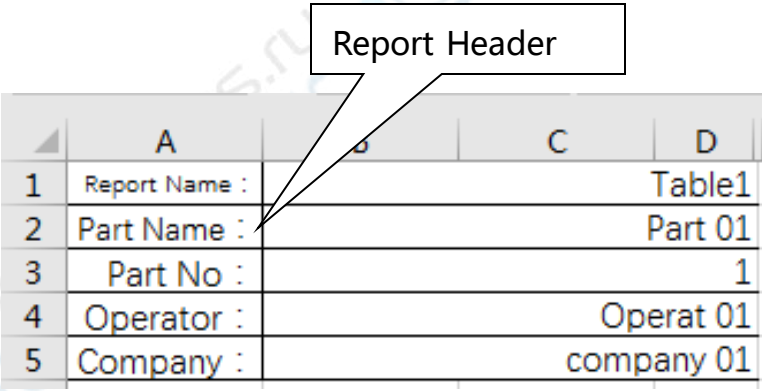
(2) The EXCEL document export settings

Because of the diversification of the EXCEL table requirements, the software support the EXCEL document settings, click the EXCEL export settings button on the export toolbar and pop up the following dialog box.

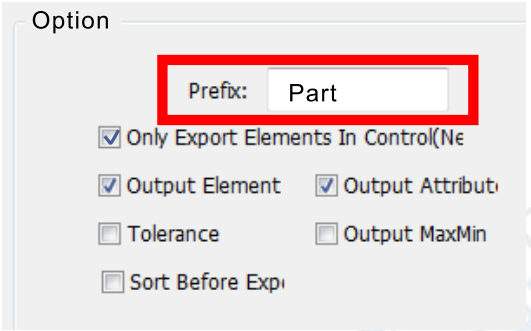


① **The table header settings :** Check the "Output Header" option to output the table header to the EXCEL document, you can also enter the report name, part name, part No, operator and company.



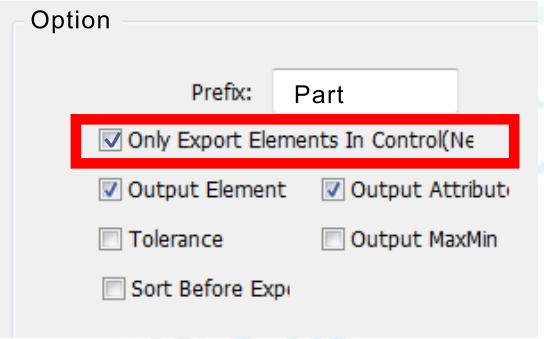


② **The part prefix:** If you enter the prefix "part", it will automatically generate the part name as "part1" "part2" "part 3"...in the table when the software export the reasults data to the EXCEL document. as shown bellow:



	A	B	C	D	E	F
7						
8	Content	CIR1-Diameter	CIR2-Diameter	CIR3-Diameter	CIR4-Diameter	OK/NG
9	Nominal	2.001	2.008	2.005	3.013	
10	Part1	2.001	2.008	2.005	3.013	OK
11	Part2	2.001	2.008	2.005	3.013	OK
12	Part3	2.001	2.008	2.005	3.013	OK
13	Part4	2.001	2.008	2.005	3.013	OK
14	Part5	2.001	2.008	2.005	3.013	OK
15	Part6	2.001	2.008	2.005	3.013	OK

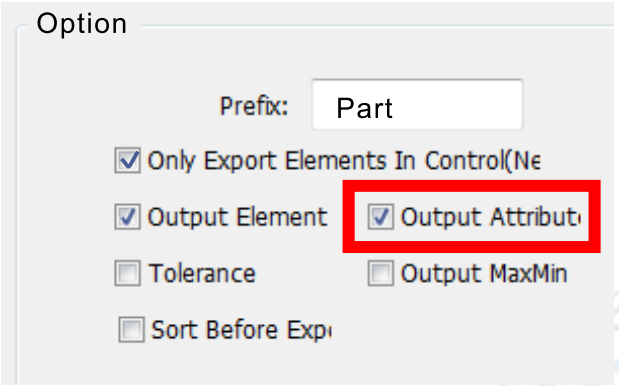
③ **Only export elements in control :** If you check this option, it will only export the elements have been set the upper and lower tolerance, and the other elements in the element list will not be exported.

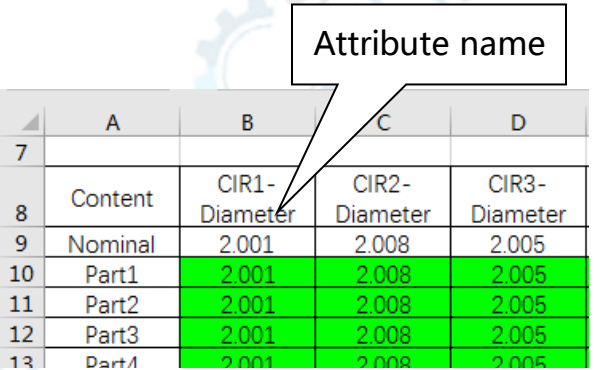


CIR1 Ref Coordinate System : WCS

Content	Actual	Nominal	Over	UpTol	LowTol	State
Center X	-5.883	-5.883	0.000			
Center Y	4.491	4.491	0.000			
Diameter	2.001	2.001	0.000	0.030	-0.030	OK
T	0.117	0.117	0.000			

④ **Output Attribute name :** If you check this option , it will output the attribute name to the EXCEL document table such as diameter, circle, roundness etc.





	A	B	C	D
7				
8	Content	CIR1-Diameter	CIR2-Diameter	CIR3-Diameter
9	Nominal	2.001	2.008	2.005
10	Part1	2.001	2.008	2.005
11	Part2	2.001	2.008	2.005
12	Part3	2.001	2.008	2.005
13	Part4	2.001	2.008	2.005

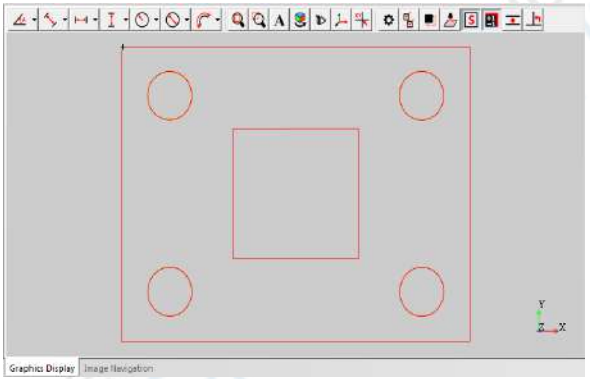
⑤ You can export other options according to your actual needs, such as graphics, image, map, tolerance, CP/CPK, time, maximum value and minimum value, and so on. The "line" and "row" option are set the sort orders of the elements list, and the "add to file" option is set to append the current results data to an existing EXCEL document.

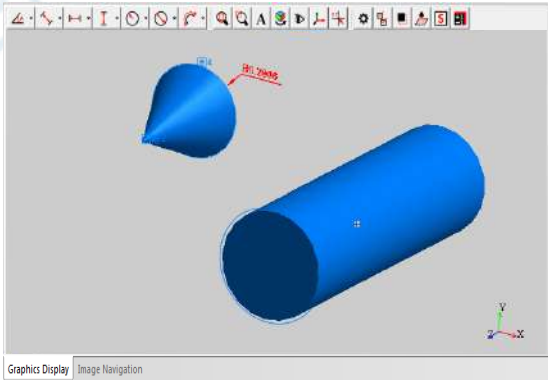
5. Graphics area and element dimensions

(1) Importing and exporting graphics

① The graphics area displays the element graphics that have been measured, or the elements generated by the method of constructing or presetting.

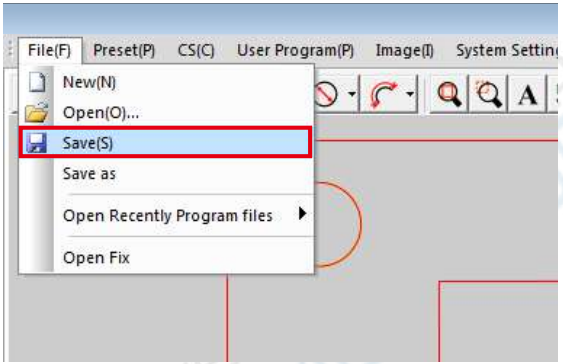
② The graphics area can display the 2D and 3D graphics. The software supports the DXF format document importing and exporting, and support the IGS format 3D document exporting. The exporting of the CAD drawing can also be used for reverse engineering.





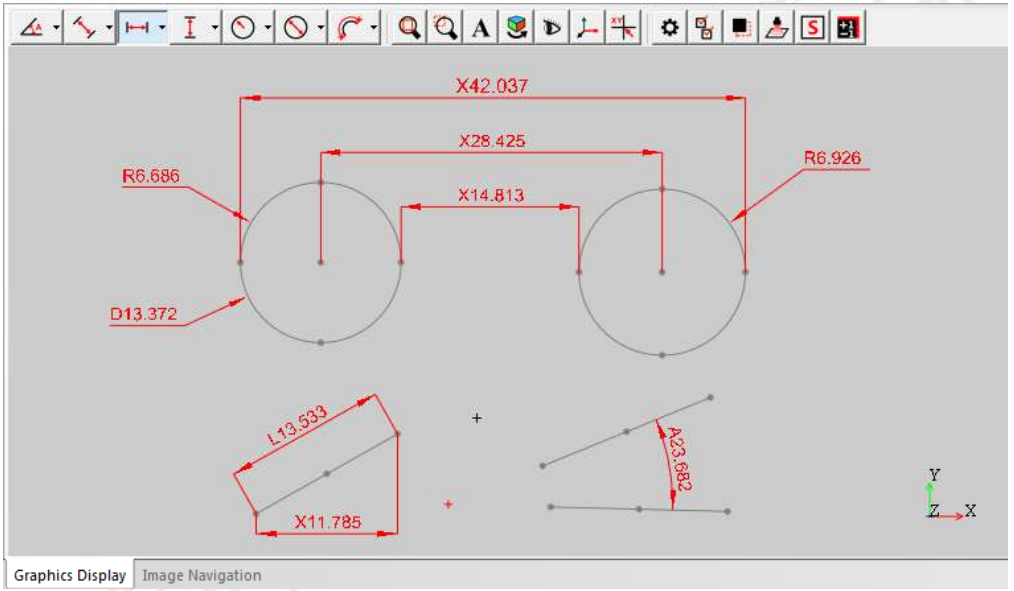
③ **CAD drawing exporting:** Select "File →Save" in the main menu, and select the dxf or igs format documents in the pop-up dialog box, Click the Ok button to complete the CAD drawing exporting ,You can also directly click the CAD export button on the Export toolbar to copmlete the operation.

CAD importing: Select "File→ Open" in the main menu to import the dxf format document.



(2) element dimensions

The dimension toolbar is shown below：



① Select the element to be dimensioned, and then click the corresponding button on the graphics toolbar to display the element dimensions. If you want to mark the dimensions between the elements, both elements should be selected at the same time and click the corresponding dimension button on the graphics toolbar. You can hold down the left mouse button and drag the dimension.

② You can click the triangle symbol on the right side of the dimension button and select whether to mark this type dimensions automatically.

③ If the user program is running, the software will automatically update the dimension values.

④ You can rotate, zoom in, hide the Geometric graphics in the graphics area, or perform the other operation by using the functions of the graphics toolbar。

Chapter 7 Element Construction and Presetting

1. Element Construction

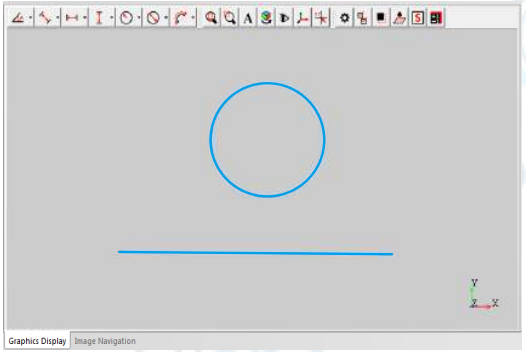
(1) The definition and use of the element construction

The element construction is to generate a new geometry element with the Existing geometry elements.

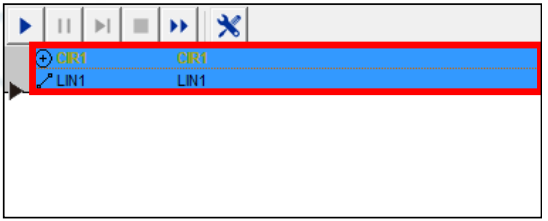
For example, generating a line with 2 Existing points, generating a circle with 3 Existing points, In additon, the element construction is often used to generate the element that can not be measured directly, such as the distance, the angle, and so on. The construction elements are usually used in some auxiliary measurements, for example, using the construction elements to establish the coordinate system. The element construction toolbar is as follows:

(2) The steps of the element construction

Take constructing the following vertical line from the center of the circle to the line as an example:

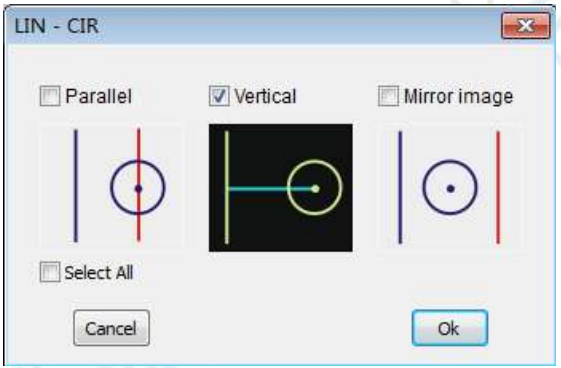


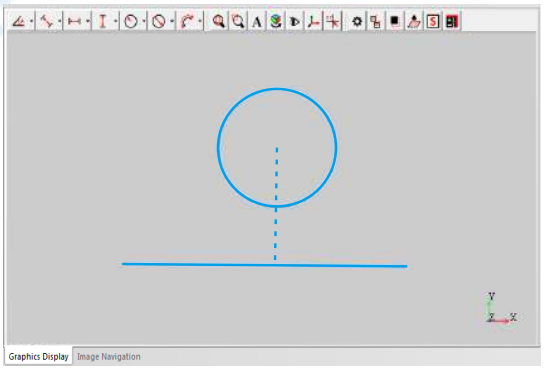
Step 1: Hold down the "ctrl" key on the keyboard, and then select all the elements to be used to construct in the element list area. (You can also select al these elements in the graphics area)



Step 2: Click the corresponding construction button on the Construction toolbar。

Step 3: If the element has a variety of construction methods, it will pop up the construction method dialog box, check the required method, then click the OK button to complete the operation.



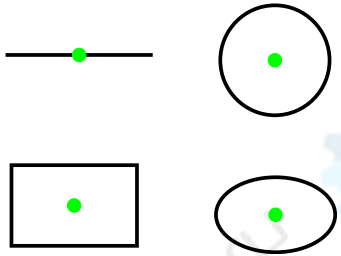


(3) Element construction method

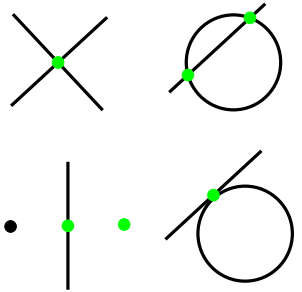
According to different elements, the construction methods includes extraction, intersecting, tangent, vertical, parallel, mirror, translation, composition, symmetry and so on. The following describes some methods of the element construction

① Constructing points

The common methods of constructing points are as follows:



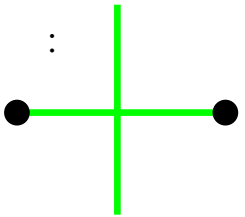
Construct the center point of an element



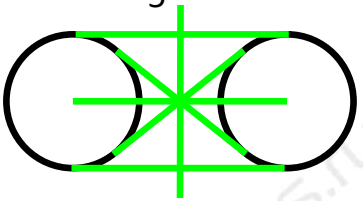
Construct the intersection point, the symmetry point, the vertical point, or the tangent point of the associated elements

② Constructing lines

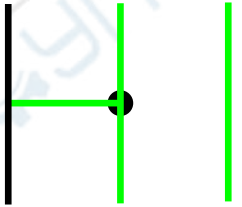
The common methods of constructing lines are as follows:



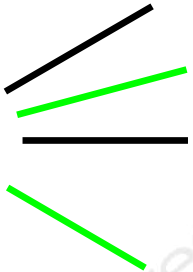
Construct the connection and symmetrical line of two points



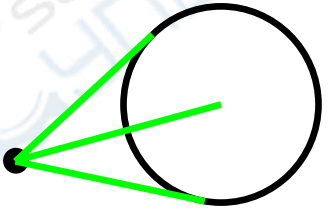
Construct the internal common tangent, external common tangent, center connection of two circles



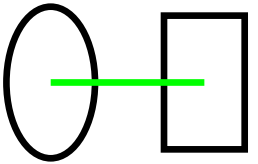
Construct the parallel line, vertical line, and mirror line with a point and a line



Construct the angular bisector and angular mirror line of two lines



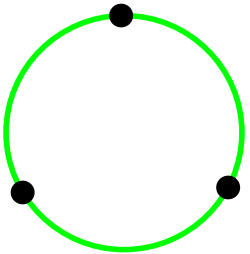
Construct the tangents and connection from a point to a circle center



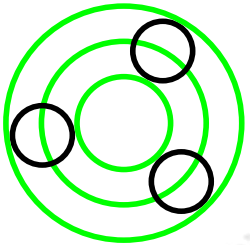
Construct the connection of two element centers

③ Constructing circles

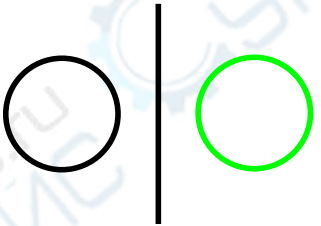
The common methods of constructing circles are as follows:



Construct the circle with three points



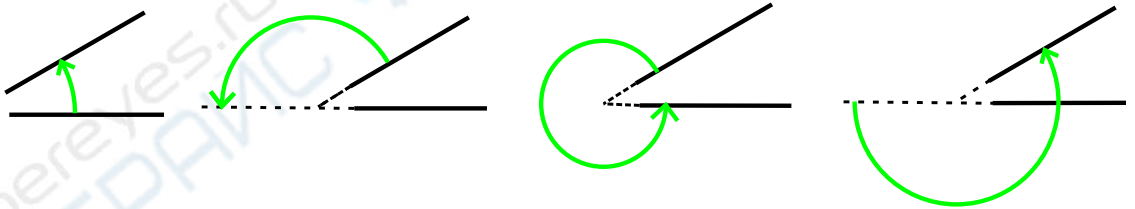
Construct the distribution circle, the excircle and the incircle with at least 3 circles



Construct a mirror circle with a circle and a line

④ Constructing angles

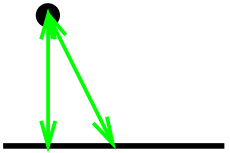
You can construct the following angles with two lines:



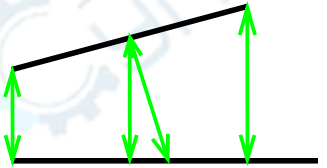
⑤ Constructing distances

The common methods of constructing distance are as follows:

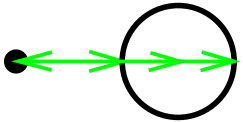
Construct the distance between two points



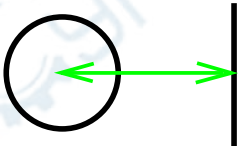
Construct a vertical distance from point to line or the distance to the midpoint of the line



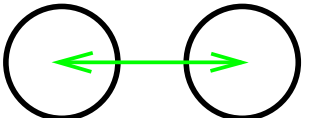
Construct the midpoint distance and the endpoint distance between two lines



Construct the center distance, and the nearest or the longest distance From a point to a circle



Construct the vertical distance from a circle to a line

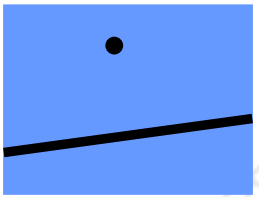


Construct the center distance between two circles or any two elements

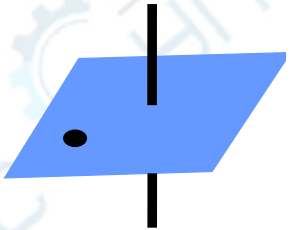
⑥ Constructing a plane

The common methods of constructing a plane are as follows:

Construct a plane with three points

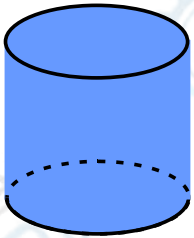


Construct a plane through a point and a line

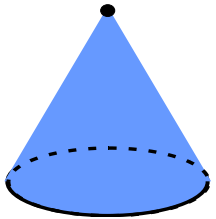


Construct a plane through a point and perpendicular to a line

⑦ Constructing cylinders and cones



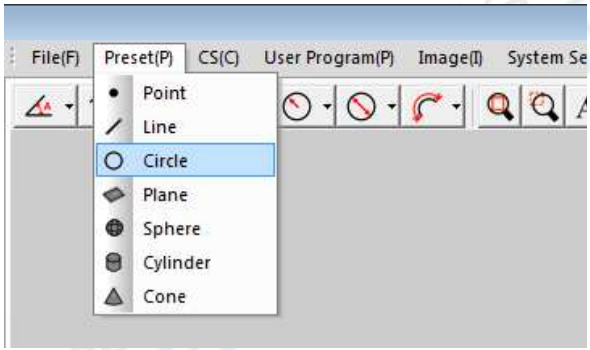
Construct a cylinder with two circles that are not on the same plane

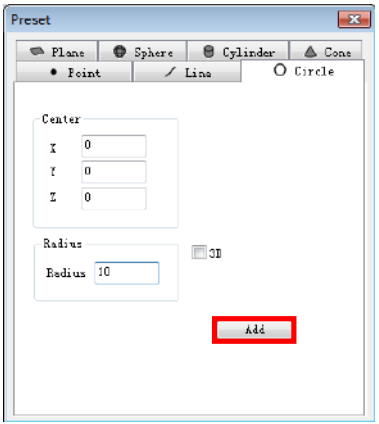


Construct a cone with a circle and a point outside the circle plane

2. Element Presetting

Element preseting refers to manually inputting parameters to generate an element. For example, generating a point by manually entering the coordinates of the point, generating a circle by manually entering its center coordinates and radius. The software supports to preset the point, line, circle, plane, cylinder, cone, and sphere. Select the "preset" menu option, and select the element you want to preset, then enter the parameters in the preset dialog box, you can generate the element in the graphics area. Element preseting is also mainly used in some auxiliary measurements or comparative measurements.





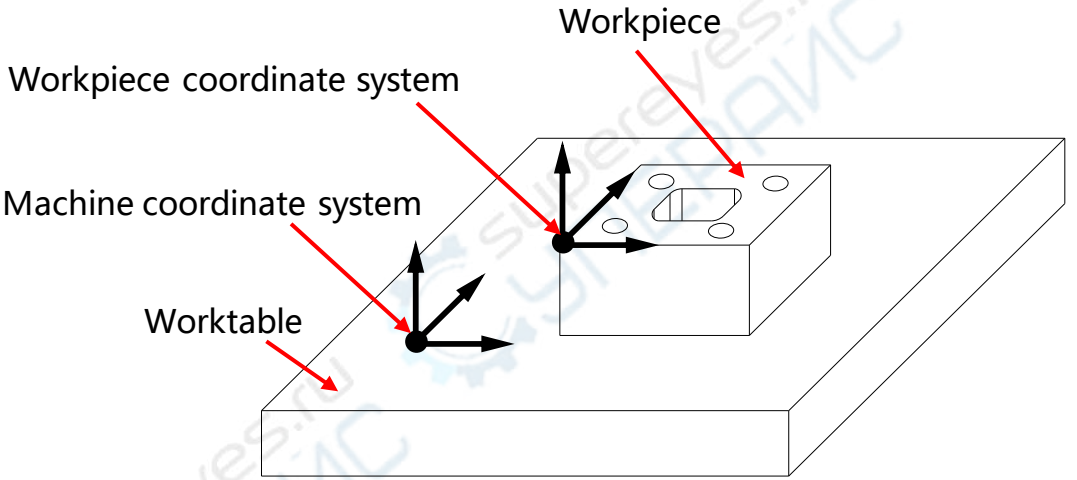
Chapter 8 Coordinate System

There are two kinds of coordinate system in the image measurement: the machine coordinate system and the workpiece coordinate system, which are all right handed Descartes Cartesian coordinate system。

1. Definition of the coordinate system

Machine coordinate system: The origin of the machine coordinate system is a fixed point relative to the machine worktable. When the three motion axes stop at the origin position, the machine coordinate origin and the detection center of the image measuring instrument coincide with each other. The machine coordinate system is the measuring datum. It is fixed and can not be changed.

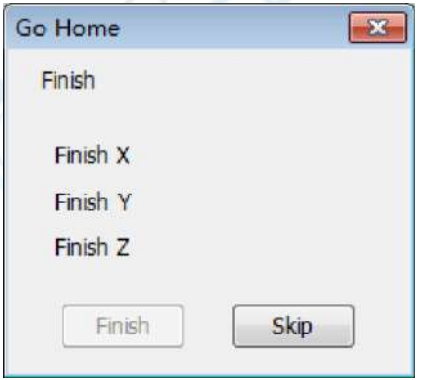
Workpiece coordinate system: The origin of the workpiece coordinate system is a datum point on the workpiece. You can arbitrarily create or change the workpiece coordinate system as required。



2. Creating coordinate system

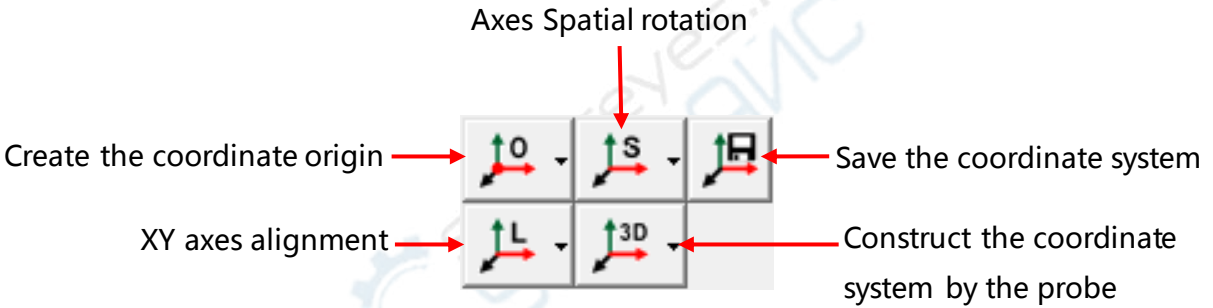
(1) Establishing the machine coordinate system (Go Home)

The machine coordinate system is inherent, you does not need to create the machine coordinate system. It will prompt to find the Home Position as follows when the software is opened. The machine coordinate system is automatically established after the Home Position was found.**(Note: Here finding the Home Position is to find the origin of the machine coordinate system)**



(2) Coordinate toolbar

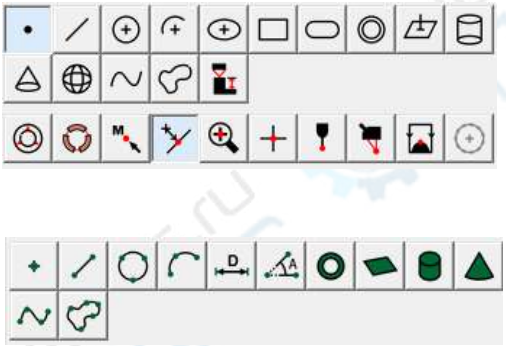
The coordinate toolbar is as follows

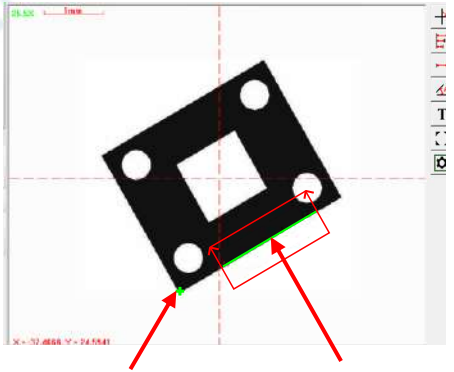


(3) Steps to create a workpiece coordinate system

① The XY plane of the workpiece coordinate system used by the user is usually parallel to the XY plane of the machine coordinate system, in this case, the steps to create a workpiece coordinate system are as follows:

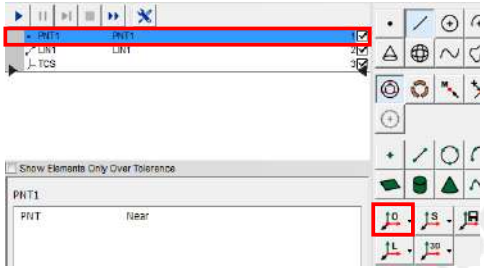
Step 1: Extracting or constructing the elements used to create the coordinate system. These elements include the element to establish the coordinate origin and the element to establish the axis direction. Fox example, extracting a datum point and a datum line as follows:

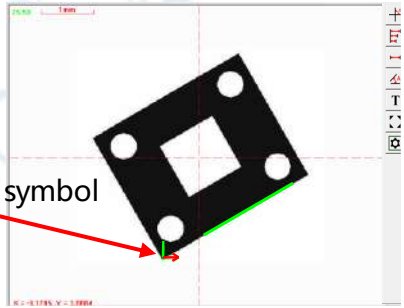




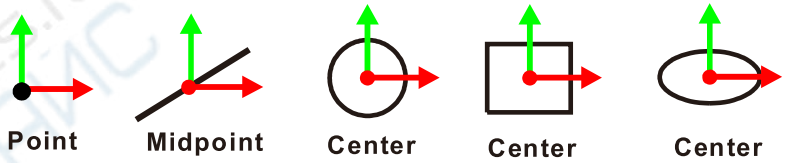
Extract a datum point Extract a datum line

Step 2: Establishing the workpiece coordinate system origin : Select the "PNT1" element in the element list area as shown below, click the button on the coordinate toolbar, and then the coordinate symbol will appear immediately in the position of "PNT1"。

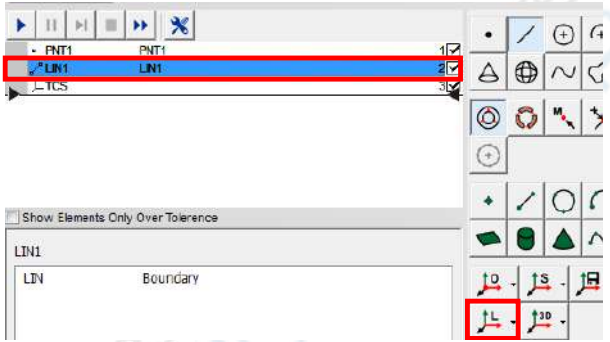


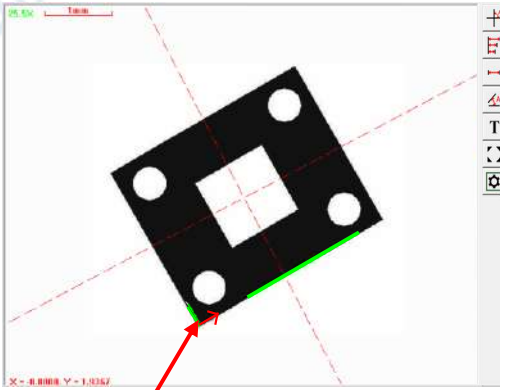


The element used to create the coordinate origin can be a point or other geometric elements. The software will take a point or automatically extract the center points of other geometric elements as the coordinate origin. as shown below:



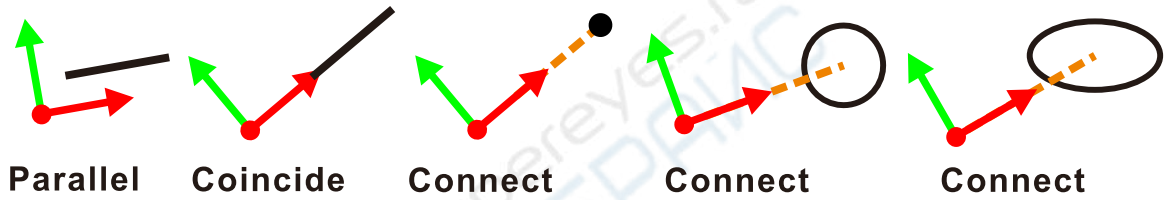
Step 3: Axis alignment: Select the "LIN1" in the element list, click the button on the coordinate toolbar, The software will make the direction of a coordinate axis parallel to the "LIN1". The X-axis color of the coordinate symbols is red, and the Y-axis color is green. By default, the software align the axis that its angle is relatively smaller with the "LIN1", it may be the X or Y axis. You can also click the triangle symbol on the right side of the button to chose to align the X axis or the Y axis.



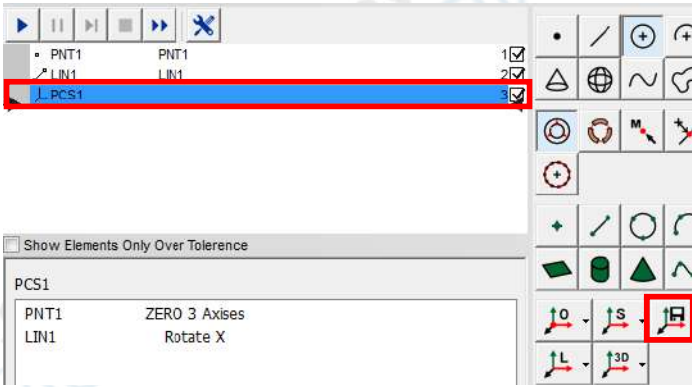


The coordinate is aligned

The element used to align the coordinate axis can be a line or other geometric elements. The software will make the direction of a coordinate axis parallel to the line or coincide with the connection between the coordinate origin and the center points of other geometric elements, as shown below:



Step 4: Save the coordinate system. Click the button on the coordinate toolbar to save the coordinate system, then the "TCS" coordinate element in the element list area immediately becomes the "PCS" element (Note: The "TCS" coordinate is a temporary coordinate system, it must be saved after it has been established, otherwise the temporary coordinate system can be lost when you do other operatons.



② The steps to create the three-dimensional coordinate system

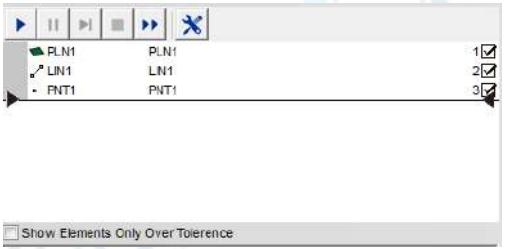
There are two methods as follows:

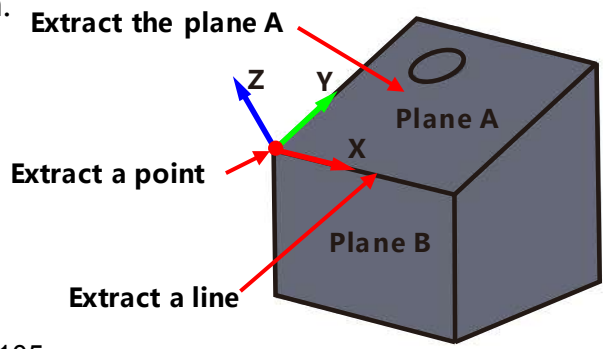
Method 1: Extract elements to construct a three-dimensional coordinate system with image, laser or probe. Take the following 3D model as an example, the steps are as follows:

Step 1: Extracting a datum plane: Extract the plane A directly with the probe or laser, or construct the plane A with the points extracted by focusing measurement.

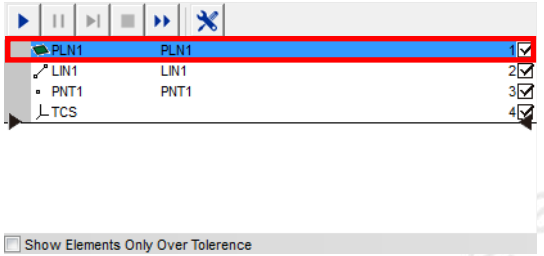
Extracting a line element: You can first extract the plane B, and then construct a line with the plane A and plane B.

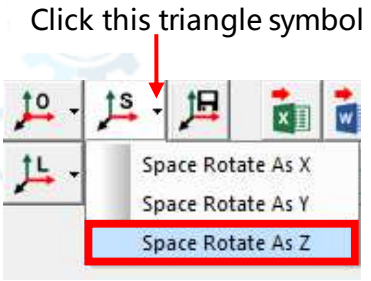
Extract a point element: You can extract the point by the method of projection or element construction.



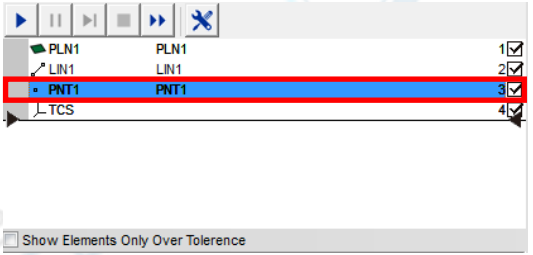


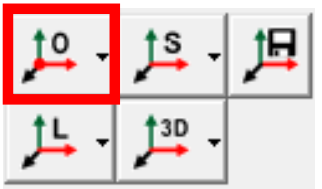
Step 2 : Space coordinate axis alignment. Select the plane that has been extracted in step 1, and then click the triangle symbol on the button , and select the "Space Rotate as Z" in the pop-up menu.



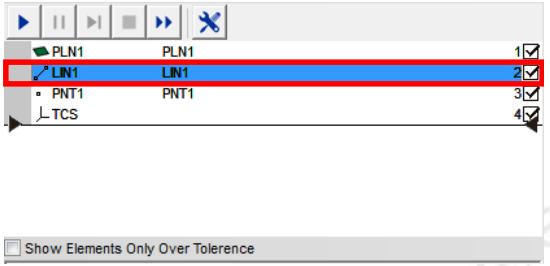


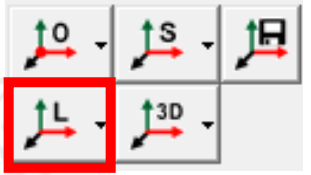
Step 3 : Estabishing the coordinate origin. Select the point extacted in step 1 in the element list, and then click the button on the coordinate toolbar to establish the position of the coordinate origin。



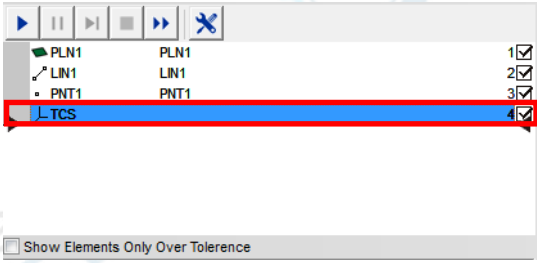


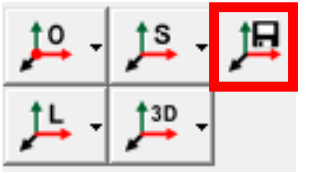
Step 4 : The second coordinate axis alignment. Select the line extracted in step 1 in the element list, and then click the button on the coordinate toolbar to align the second coordinate axis。





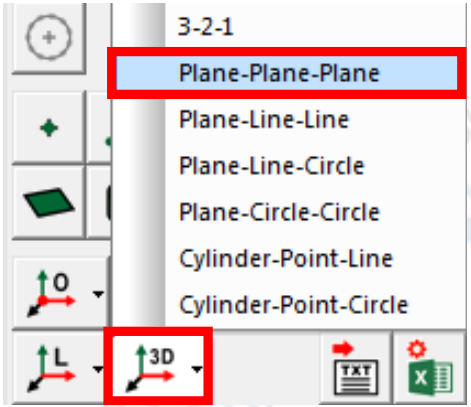
Step 5 : Save the cooridinate system. Select the "TCS" in the element list, and then click the button on the coordinate toolbar, and the workpiece coordinate system is created sucessfully.

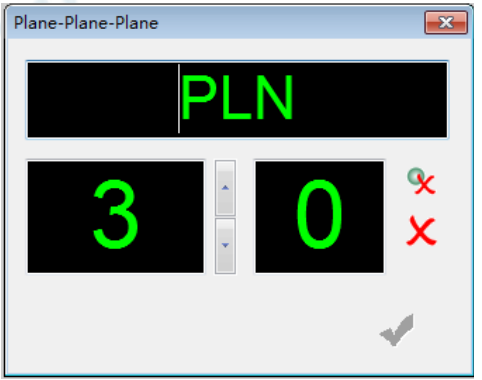




Method 2 : The method creating a three-dimensional coordinate system Specifically for the probe measurement.(Note: The probe measurement see **Chapter 11**)

Click the button on the coordinate toolbar, select the elments combination type used to create the coordinate system in the pop-up menu according to actual requirements, and extract the required elements in order with the probe in the pop-up dialog box.





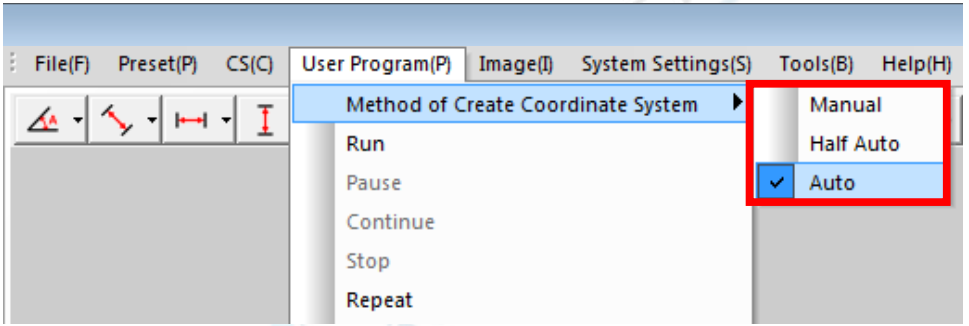
(3) The multilevel coordinate systems

The multilevel coordinate systems refer to creating new coordinate systems base on the current workpiece coordinate system. Some easily deformed or bent workpieces can be measured by creating multilevel coordinate systems. For example, creating the workpiece coordinate system "PCS 2" base on the current "PCS 1", and then creating the workpiece coordinate system "PCS 3" base on the current "PCS 2" …

(4) How to create the coordinate system when running the user program

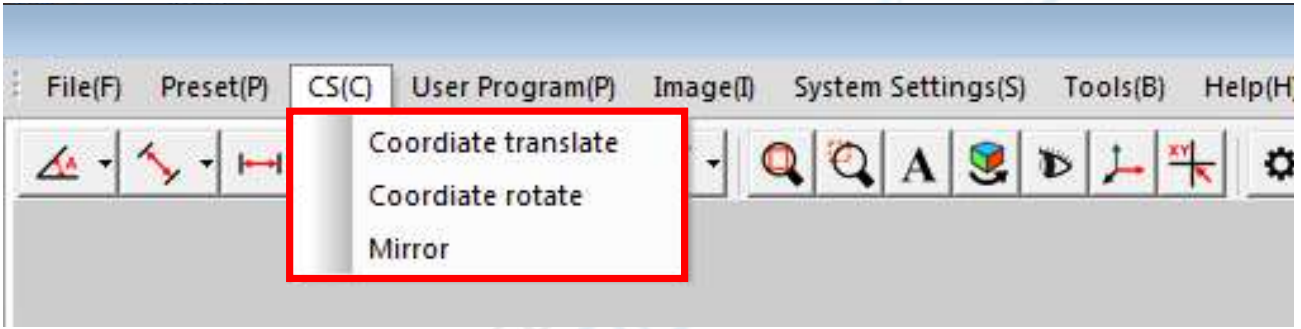
Every time when the software executes the user program, it will extract the elements to be used to create the coordinate system with the Find-Edge-Tool that draw by the user . There are 3 element extraction methods: “manual”, “half auto”, and “auto”. You can select the “User program→Method of create coordinate system” in the main menu to choose one of these 3 methods. In the batch measurement, if the position of the workpiece have been changed greatly relative to its original position, in order to prevent the elements used to create the coordinate

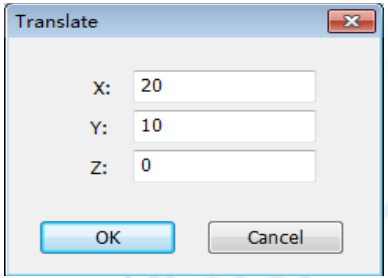
system out of the area of the Find-Edge-Tool, you can choose the “manual” menu option ; When the workpiece is precisely positioned by the fixture, Its position changes little, ane the elements can not be out of the area of the Find-Edge-Tool, in this case, you can choose the “Auto” or the “half auto” menu option.

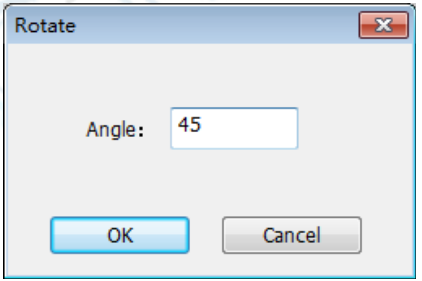


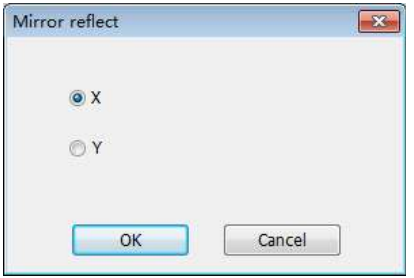
3. Coordinate rotation, translation, and mirror.

You can select the "CS" menu option to translate, rotate, and mirror the workpiece coordinate system. As shown below:









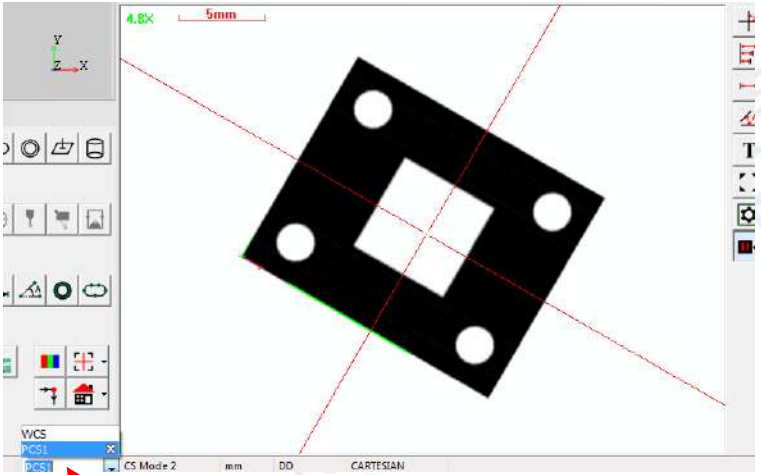
4. Workpiece coordinate system transformation

(1) coordinate system transformation

You can click the status bar below the software interface to transform the coordinate sytem, The coordinate system can be transformed to the machine coordinate system or any workpiece coordinate system. The coordinate system shown in the status bar is the "Current Coordinate System", and the coordinate display area displays the current coordinate data. The coordinate data color is green when the current coordinate system is the machine coordinate system, otherwise the coordinate data color is yellow. All measurements are based on the current coordinate system.

The date of the mechine coordinate is green

The date of the workpiece coordinate is yellow

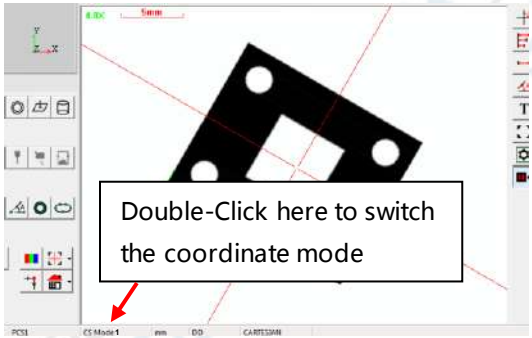


Click here to transform the current coordinate system

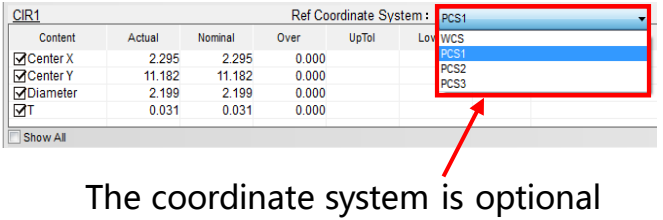
(2) Coordinate system mode

The software displays the measurement results data in two coordinate system modes: the "Coordinate mode 1" and the "Coordinate mode 2", which can be switched by double-clicking on the status bar.

Coordinate mode 1: In this mode, the reference coordinates of the results data can be selected. When you want to observe the results of a certain element in any coordinate system state, you can first choose the "coordinate mode 1" in the status bar, and then click the the reference coordinate system in the upper right corner of the result display area.

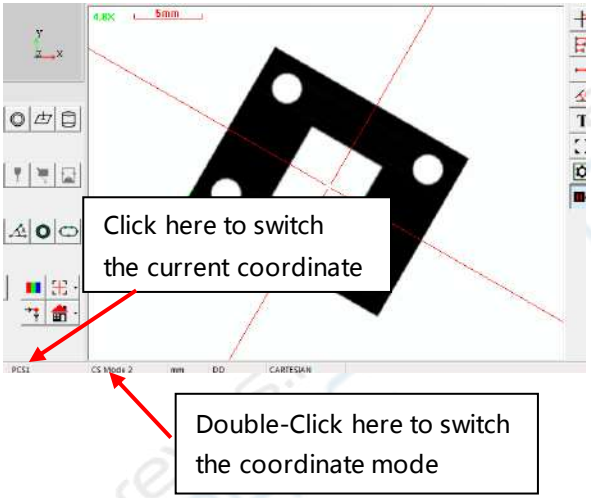


coordinate mode 1

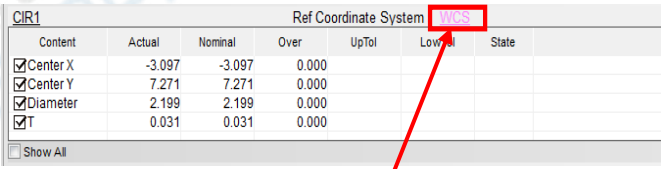


The coordinate system is optional

Coordinate mode 2: In this mode, the reference coordinate system of all elements is fixed to the current coordinate system and can not be arbitrarily selected. When you want the results data of all elements to be displayed in a certain coordinate system, you can first switch this coordinate system to the current coordinate system, and then choose the "coordinate mode 2" in the status bar.

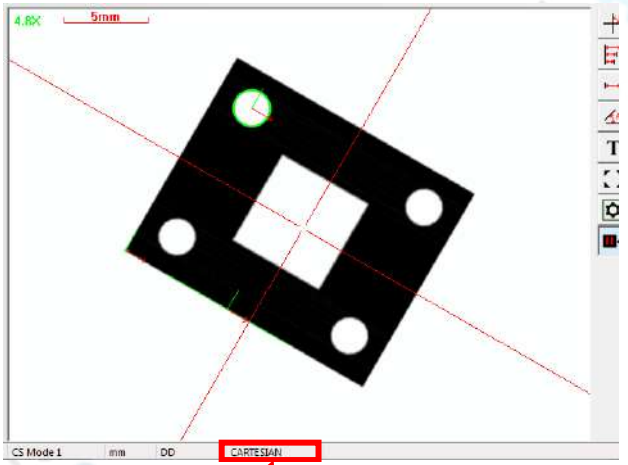


coordinate mode 2



The coordinate system is fixed to the current coordinate system

The workpiece coordinates can also be transformed between the Cartesian coordinate and the polar coordinate. You can double-click the position as shown below in the status bar to transform them.

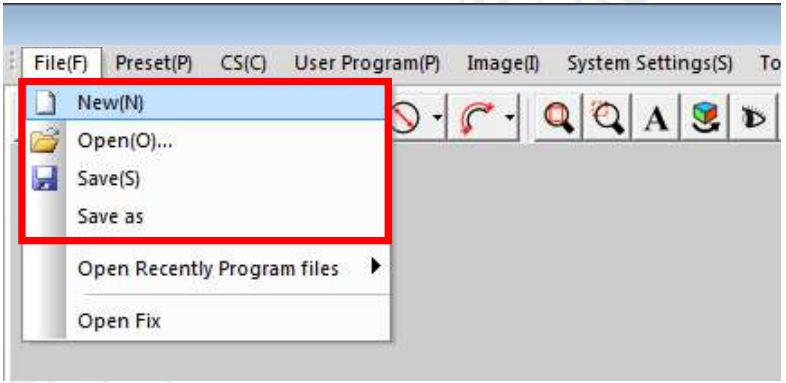


transformation between the Cartesian coordinate and the polar coordinate

Chapter 9 User Program

1. Creating, opening, and saving user programs

You can select the "File → New" menu option to create a new user program, and you can also choose to open the exsisting user program, or save the current user program to a folder. The extension of the user program is ".ins"



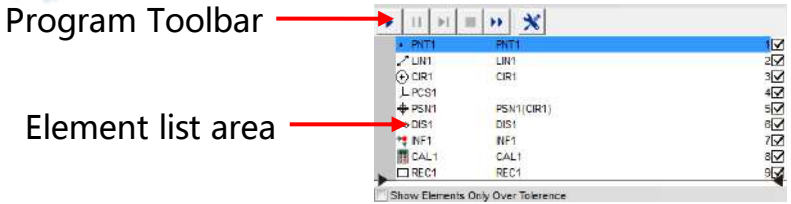
2. Creating, executing and modifying the user program

(1) Creating the user program

The software records the steps of the measuring, constructing, and moving operation in sequence, and generates the elements. These elements displayed in the element list area in sequence, and the user program is automatically created.

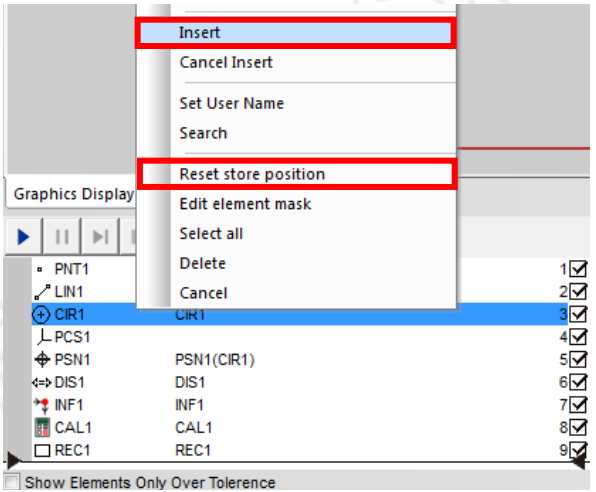
(2) Executing the user program

You can execute the user program by clicking the Run, Pause, Continue, Stop, and Repeat button on the User Program toolbar. The software automatically measures the elements in the element list area one by one when executing the program. You can also set whether the measurement results to be automatically exported at the end of the program execution (How to automatically export the results see the user program settings described later)



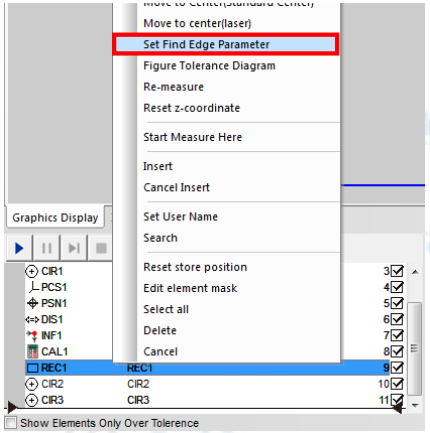
(3) Modifying the user program

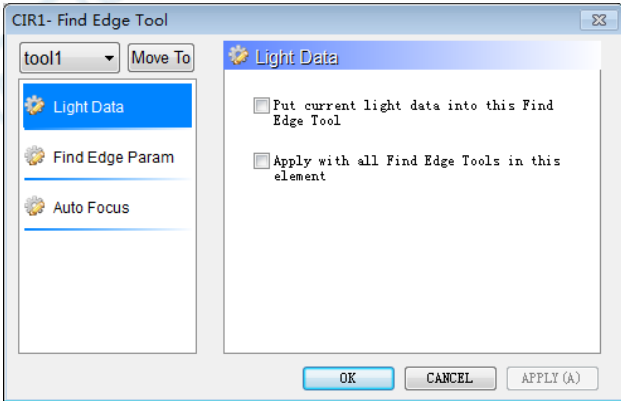
Click on the right mouse button on a certain element in the element list area, you can insert an element or a step in the list by selecting the "insert" menu option, or selecting "Reset store position" to change the position of the element in the list, thus to change the order of the program. You can also make other changes to the user program.



3. The Find-Edge-Tool settings

You can set the Find-Edge-Tool parameters of an element in the program. Such as the light source parameters, the edge parameters, and whether to autofocus. When using the "subsection" method to measure the elements, you can also set the Find-Edge-Tool of each segment. Click on the right mouse button on an element in the element list area, chose the "Set Find Edge parameter" menu option, open the dialog box as follows:





You can make the following settings in the "Find Edge Tool" Settings dialog box

(1) Light source data :

You can overwrite the current light source data of a certain "Find-Edge-Tool" with the surface brightness value and contour brightness value that hase been set on the "light source adjustment panel", or overwrite the light source data of all elements.

(2) Find Edge parameter :

You can set the threshold, precision, and burr size of the "Find-Edge-Tool" for the selected element.

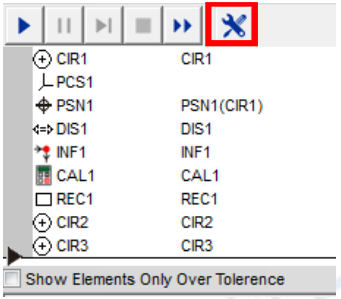
(3) Auto focus:

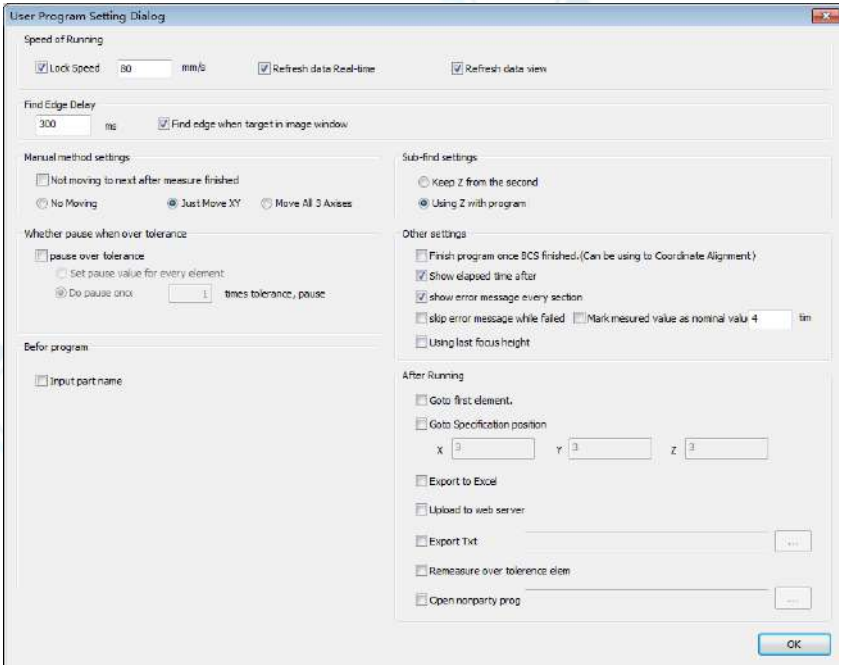
You can set whether to autofocus in the position of a certain Find-Edge-Tool, and you can also reset the size of the Find-Edge-Tool.

(4) When using the "subsection" method to measure the elements, you can select the "Apply to all tools in this element" option, and you can also choose to set the other Find-Edge-Tools of this element by clicking the drop-down triangle on the top right corner of the dialog box.

4. User program settings

Click the "program settings" button on the User Program toolbar to open the "User Program Settings dialog". As shown below:





Some options in this dialog box is discribed as follow:

(1) Speed of running : The speed of the movement between the elements when the program is running, and you can lock this speed to a certain value.

(2) Find Edge delay : How long to start extracting the element after the machine movement is stopped.

(3) Export to EXCEL: It will automatically export the EXCEL report after the program was finished each time.

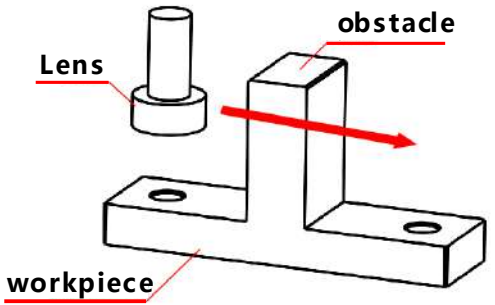
(4) Go to first element : The center of the image area will return to the original position after the program was finished.

(5) Go to specifacation position : The center of the image area will move to a certain coordinate position after the program was finished.

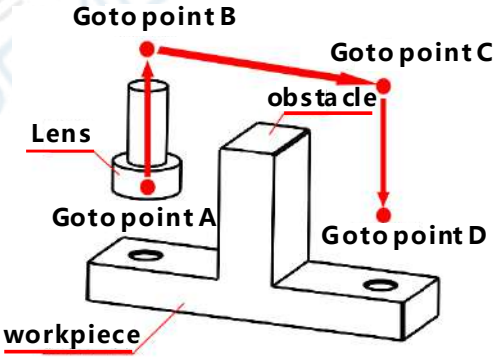
You can also check other options to set the user program.

5. The "Goto Point"

When moving from one element to the next element, the default movement trajectory is the shortest straight line between these two elements. The collision must occur if there is an obstacle between these two elements. So the Goto points must be set on the movement trajectory to avoid the collision. As shown below:

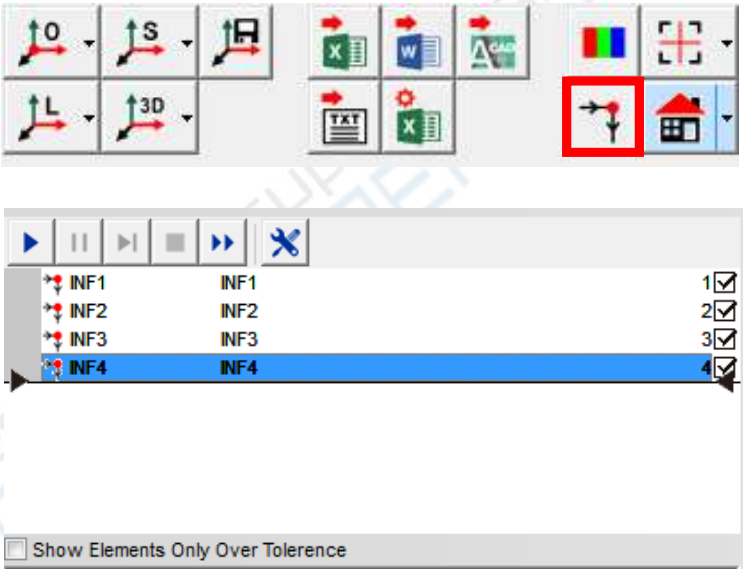


Error: There are no Goto points



Correct: The Goto points have been inserted

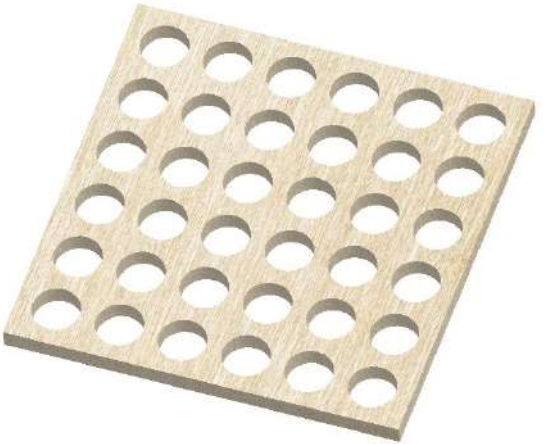
The steps of setting Goto points are as follows: To make the lens bypass the obstacle from the point A to the point D, you must move the lens along the point in the order of A→B→C→D, and click the Goto point button at each position of A,B,C,D. All the Goto points will be shown in the element list area. The machine will move along the Goto points when the program is running



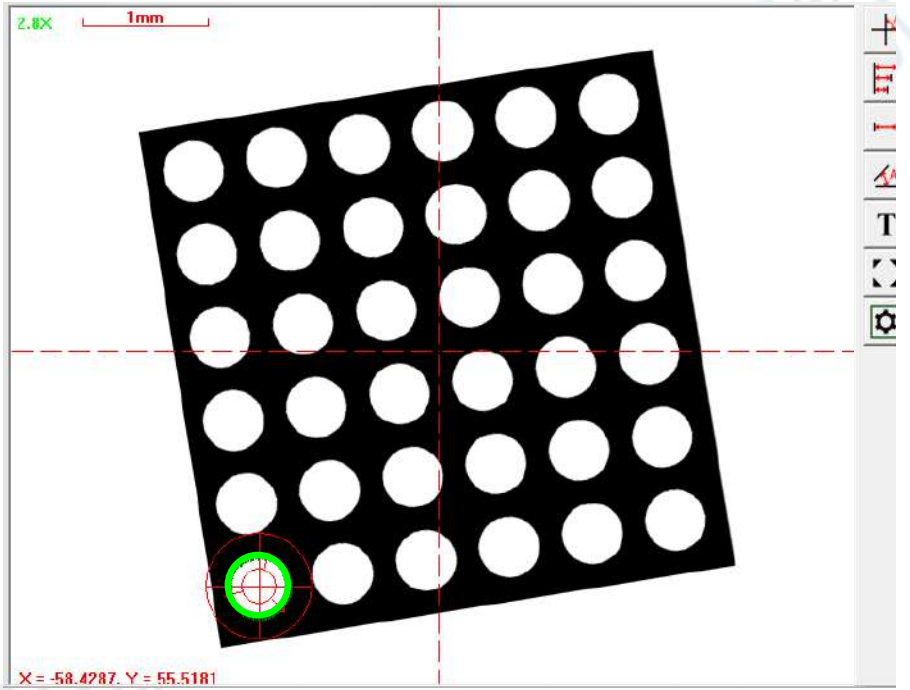
Chapter 10 Practical measurement functions

1. The elements translation and matrix

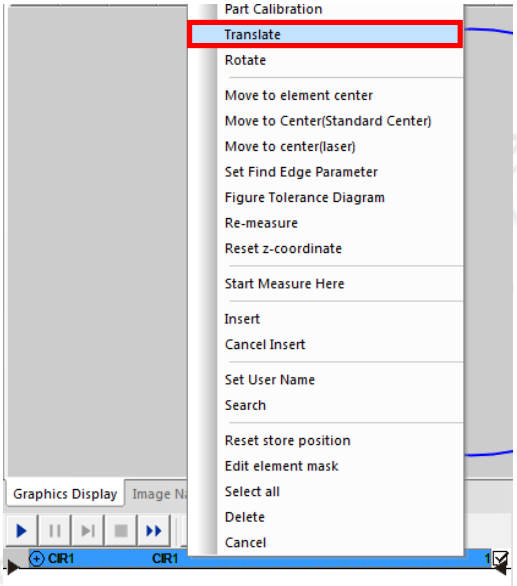
When there are many equidistant elements on the workpiece, you can first extract one of these elements, and then generate the remaining elements by using the element translation or element matrix function. It can save a lot of time to extract the elements. Take measuring the holes of the following workpiece as an example.

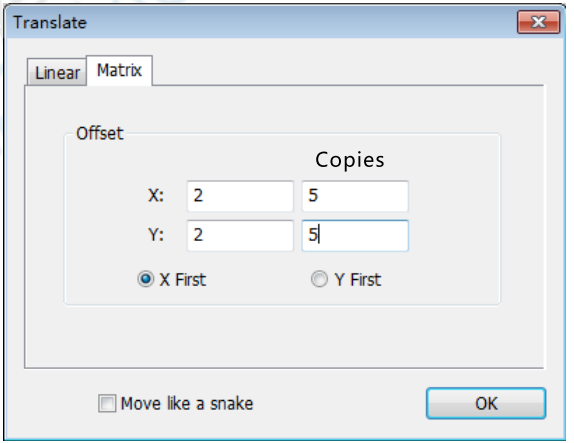


Step 1: Extract the first hole in the lower left corner of the workpiece image.

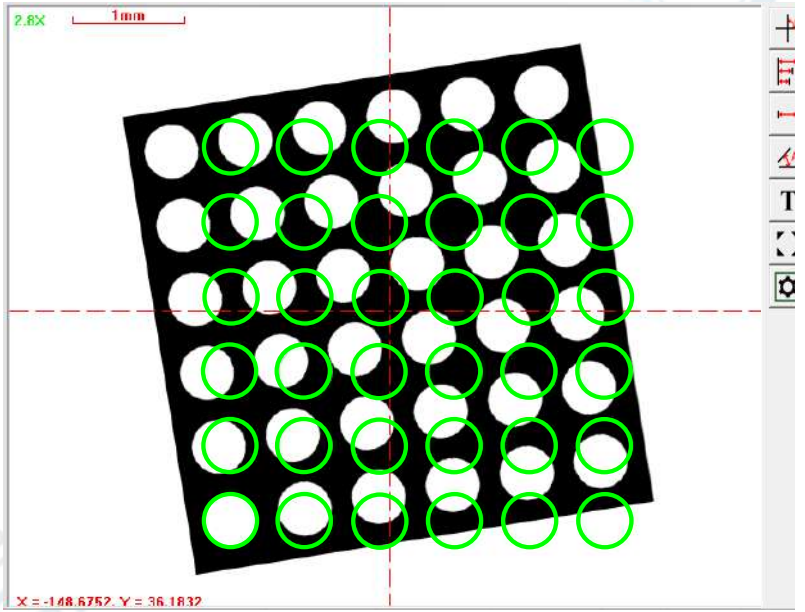


Step 2: Click the right mouse button on the circle element in the element list area, select the "Translate" menu option, select the matrix tab in the "Translate" dialog box, enter the offset value of the matrix and the number of copies , click the OK button to complete the operation. (Note: The number of copies does not include the original element).

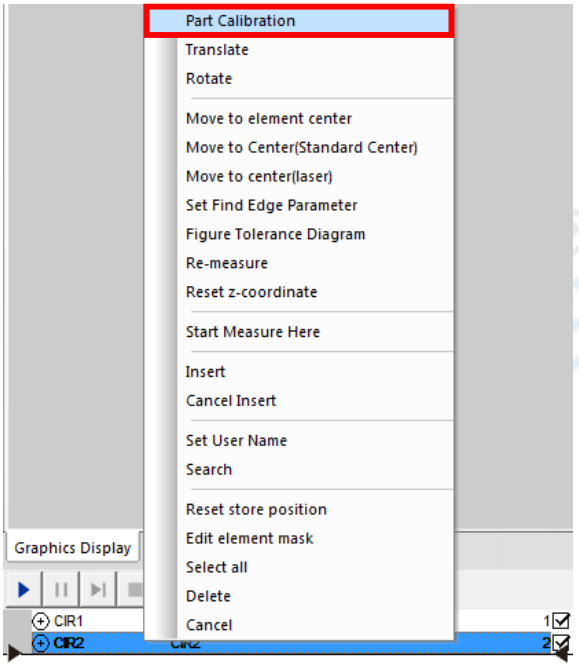


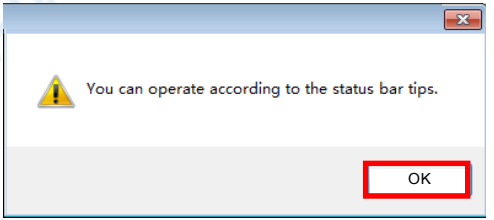


Because the location where the workpiece is placed is uncertain, the matrix circles may not coincide with the circles on the workpiece image, so you need to align the matrix graphics and the actual workpiece image.

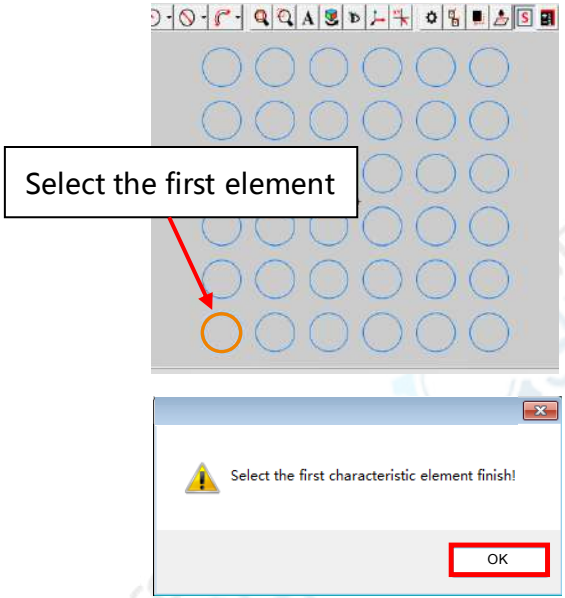


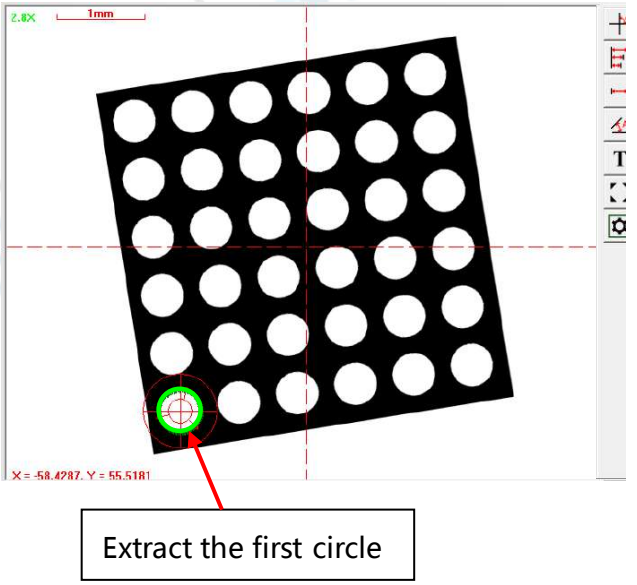
Step 3: Right-click any element in the element list area. Select the "part calibration" menu option, and then click the “OK” button in the pop-up dialog box.



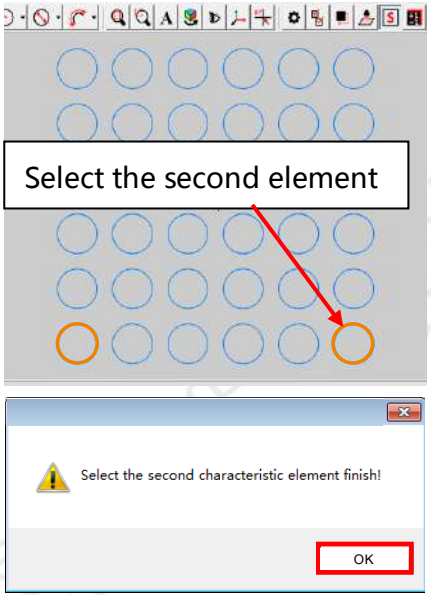


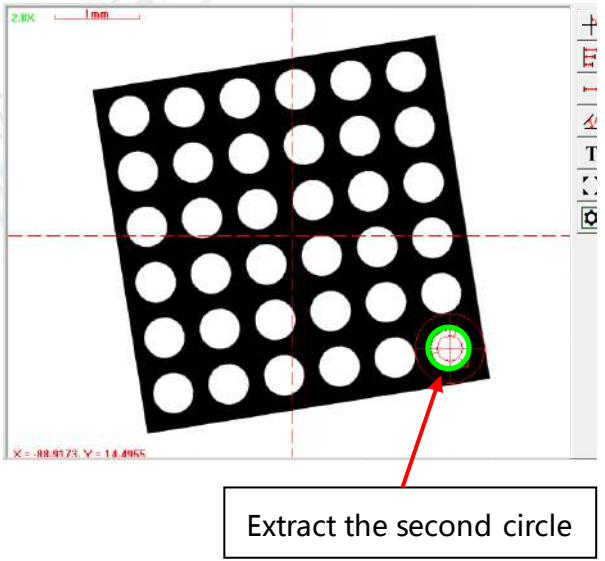
Step 4: According to the prompt of the status bar in the lower left corner of the software interface, select the first element in the graphics area as shown below. Click the OK button in the pop-up dialog box. Then according to the prompt of the status bar, extract the first corresponding circle in the image area.



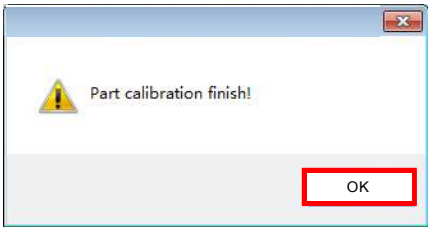


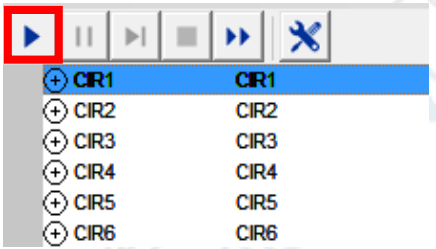
Step 5: According to the prompt of the status bar in the lower left corner of the software interface, select the second element in the graphics area as shown below. Click the OK button in the pop-up dialog box. Then according to the prompt of the status bar, extract the second corresponding circle in the image area.

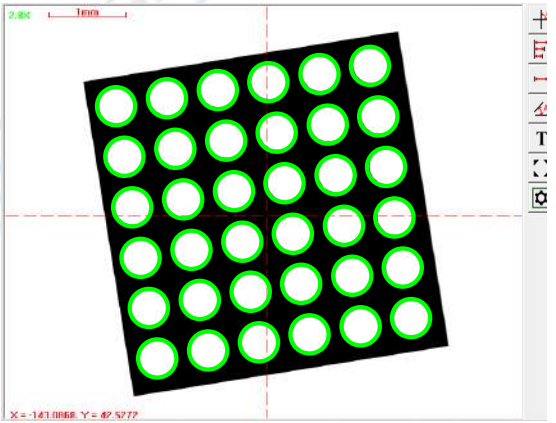




Step 4: Click the OK button in the pop-up dialog box to complete the alignment. And the matrix graphics and the actual workpiece image is aligned. Click the Run button on the user program toolbar to automatically measure each circle element on the workpiece image.







The above translation and matrix functions apply only to the equidistant matrix elements. If the element array is not equidistant, you can use the method of importing CAD drawing to measure it, described as follows:

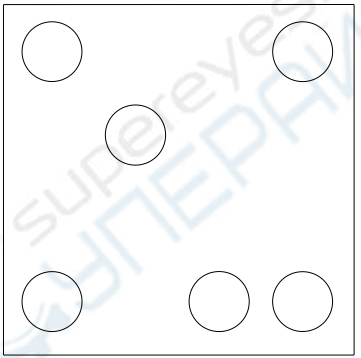
2. Comparative measurement with the CAD drawing

The software supports the method of using the CAD drawing as a template to measure the workpiece. It can be used in the coordinate measurement or the comparative measurement. This function is applicable to the workpiece of any shape in the range of the instrument measuring.

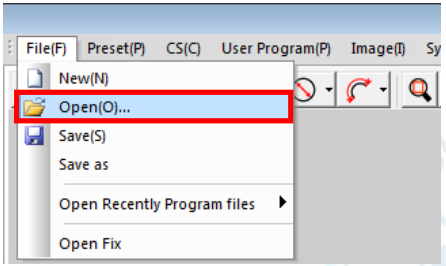
Because the location where the workpiece is placed is uncertain, the CAD drawing may not coincide with the image contour, so you need to align the CAD drawing and the image contour. In addition, according to the different datums of the comparative measurement, it is divided into two ways: The entity datum alignment and the virtual datum alignment.

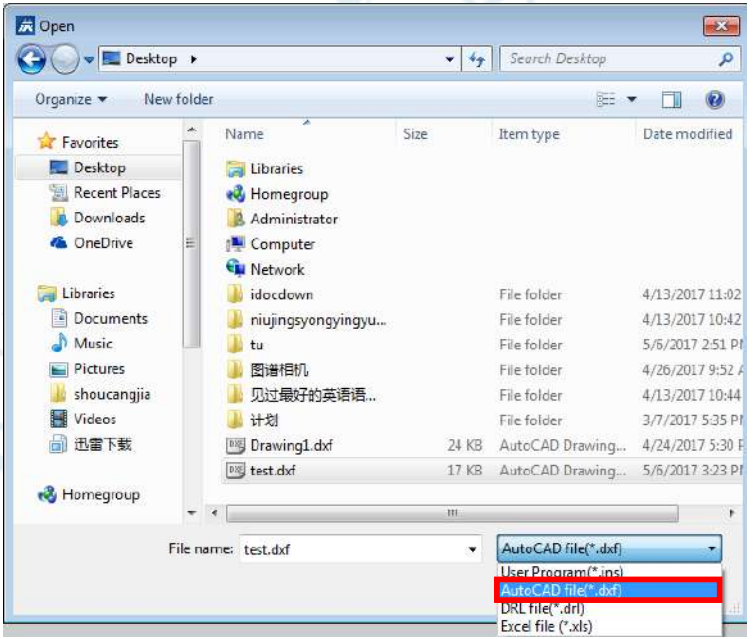
(1) Measuring base on the entity datum

Step 1: Draw the standard drawing of the workpiece with the CAD software and save it as a dxf format document. As shown below：

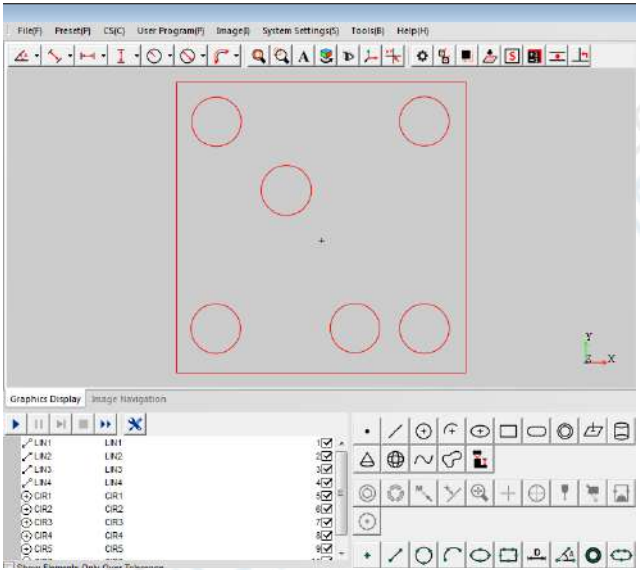


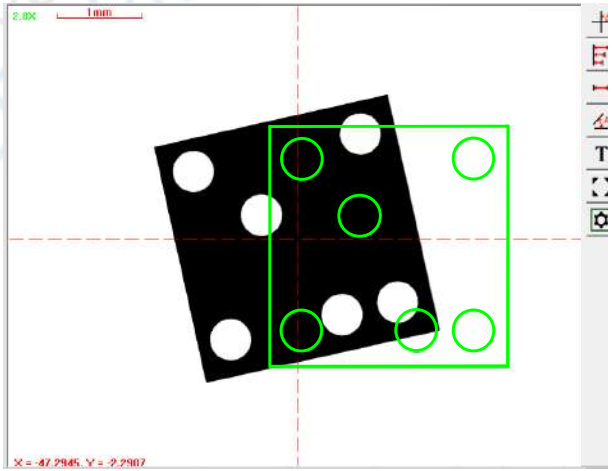
Step 2: Click the "File → Open" in the main menu, select the dxf file type in the pop-up dialog box, and select the corresponding file that you want to import,and then click the Open button to import the CAD drawing into the graphics area.



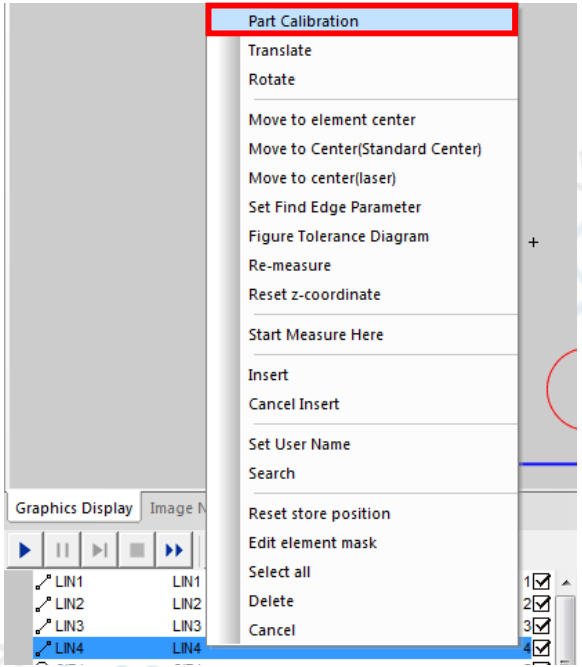


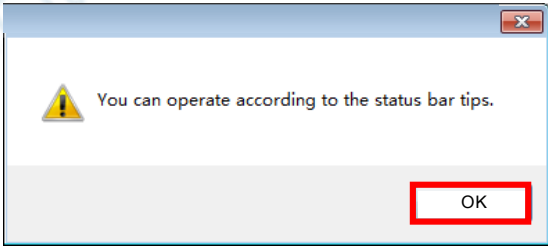
Note: The software can automatically identify the points, lines, arcs, circles, and curves of the CAD drawing, and display these features in the element list area one by one in the form of elements. Because the location where the workpiece is placed is uncertain, the CAD drawing may not coincide with the image contour, so you need to align the CAD drawing and the image contour. As shown blow:



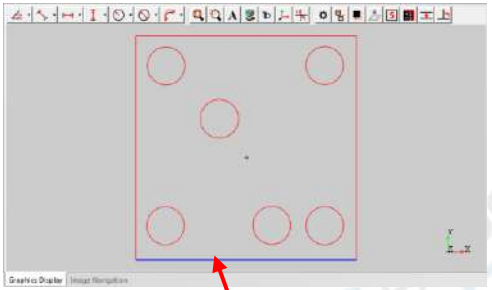


Step 3: Align the CAD drawing and the actual workpiece image. Right-Click any element in the element list area, select "Part Calibration" menu option, and then click OK button in the pop-up dialog box.

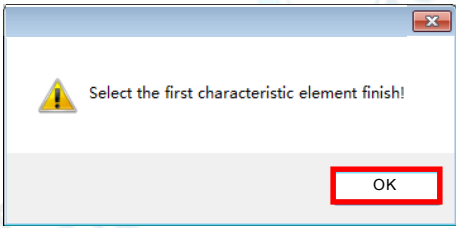


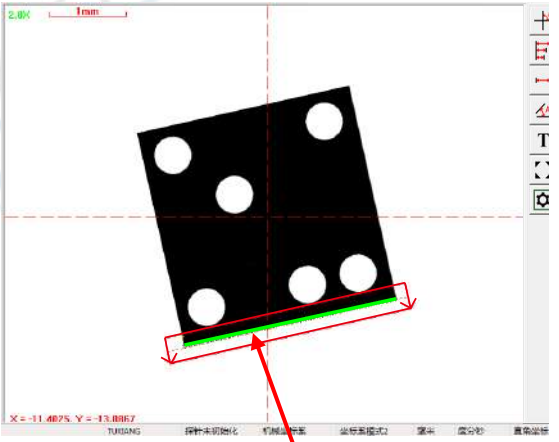


Step 4: According to the prompt of the status bar in the lower left corner of the software interface, select the first element in the graphics area as shown below. Click the OK button in the pop-up dialog box. Then according prompt of the status bar, extract the first corresponding line in the image area.



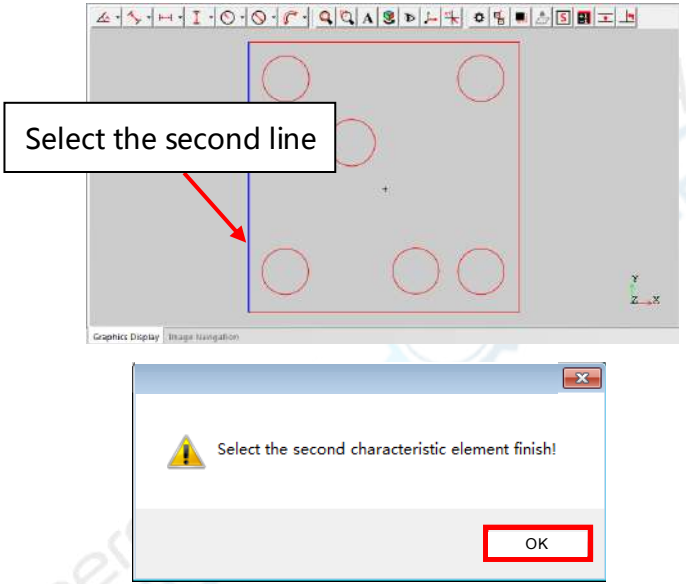
Select the first line

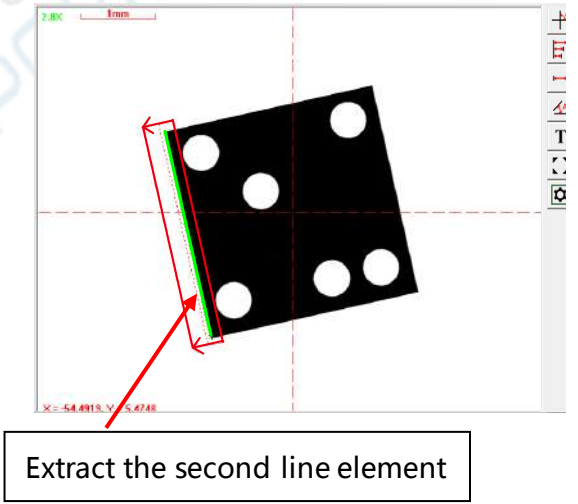




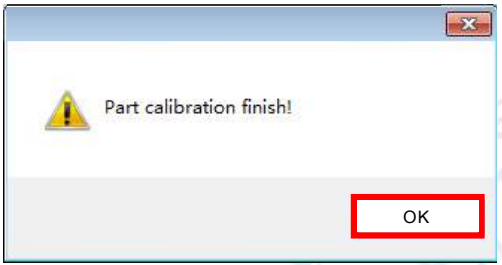
Extract the first line element

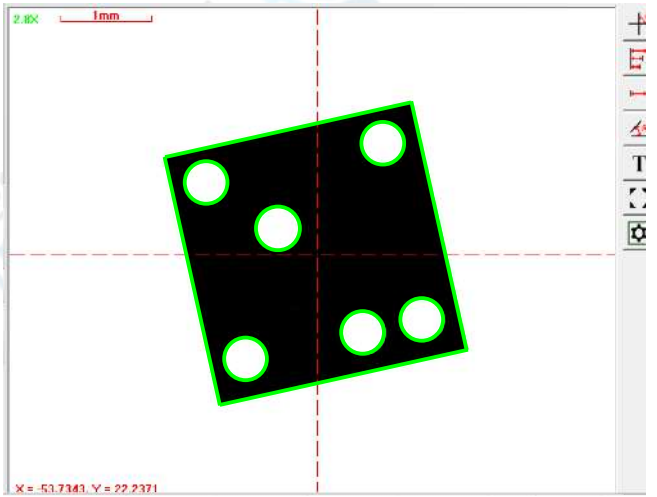
Step 5: According to the prompt of the status bar in the lower left corner of the software interface, select the second element in the graphics area, click the line element with the mouse as shown below. Click the OK button in the pop-up dialog box. Then according prompt of the status bar, extract the second corresponding line in the image area.



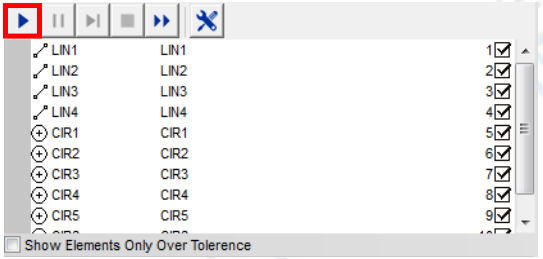


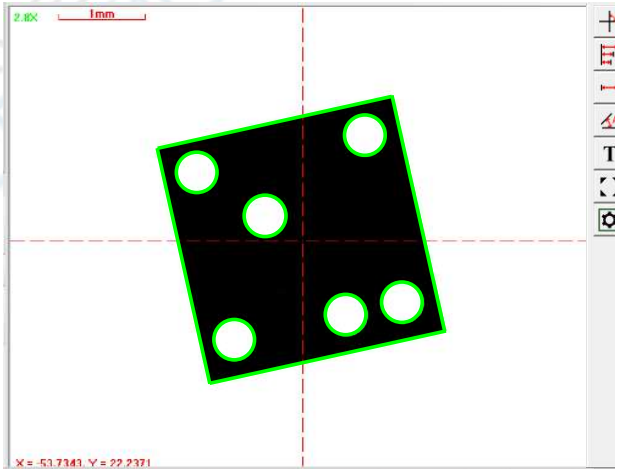
Step 6: Click the OK button in the pop-up dialog box to complete the alignment of the CAD drawing and the workpiece image contour.





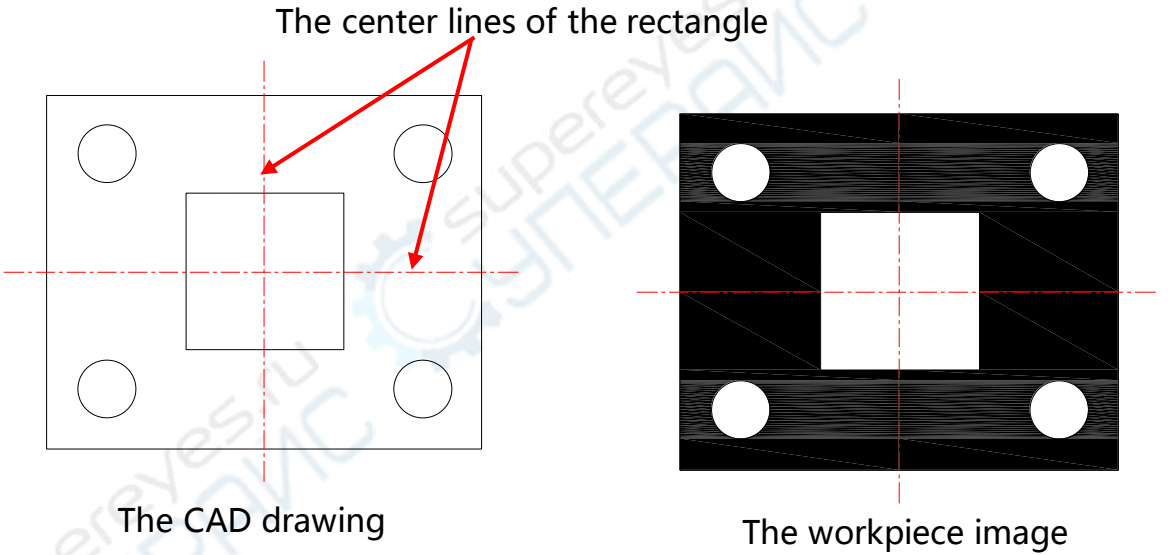
Step 5: You can perform comparative measurement for the workpiece after the alignment, and if the contour feature is outside the image area, you can move the feature into the image area for observation. Or you can also perform the coordinate measurement for the workpiece by clicking the "run" button on the user program toolbar.





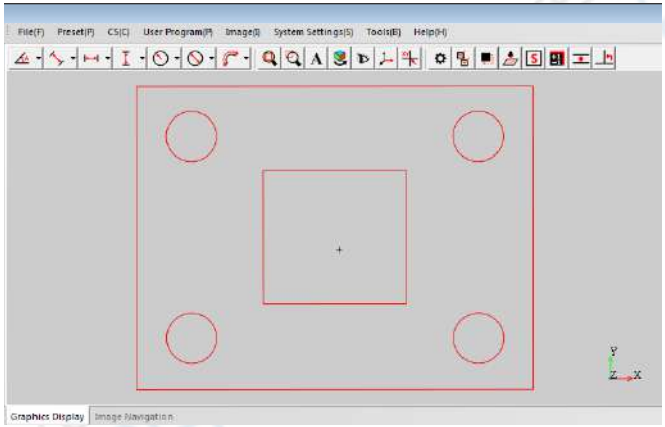
(2) Measuring base on the virtual datum

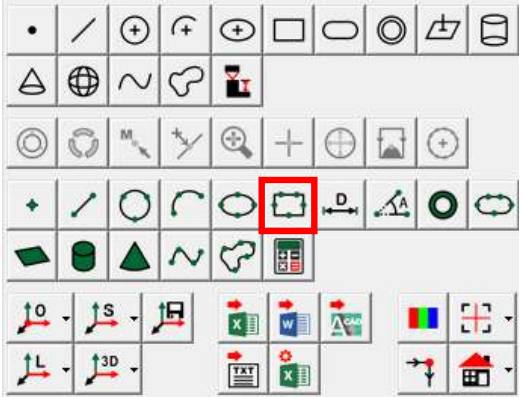
In some condition, the the user required perform the comparative measurement base on the virtual datum. Take the following workpiece as an example, you must create the virtual datum in order to observe whether the 4 circles are symmetrical to the center lines of the rectangle



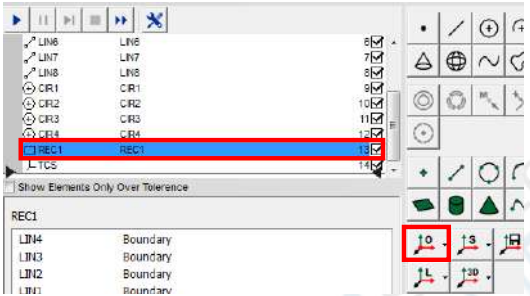
Because they are virtual datums, so you need to establish the virtual datum by using the construction method, that is to create the workpiece coordinate system with the construction element. Then align the CAD drawing and the workpiece. The steps are as follows:

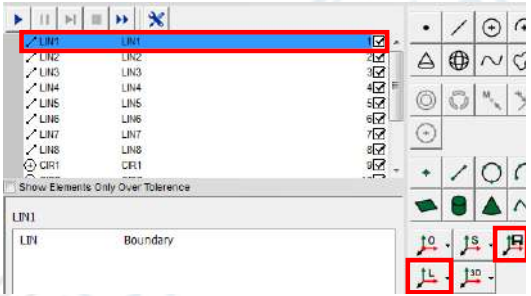
Step 1: Hold down the "ctrl" button on the keyboard, select the four sides of the imported drawing to construct a rectangle.

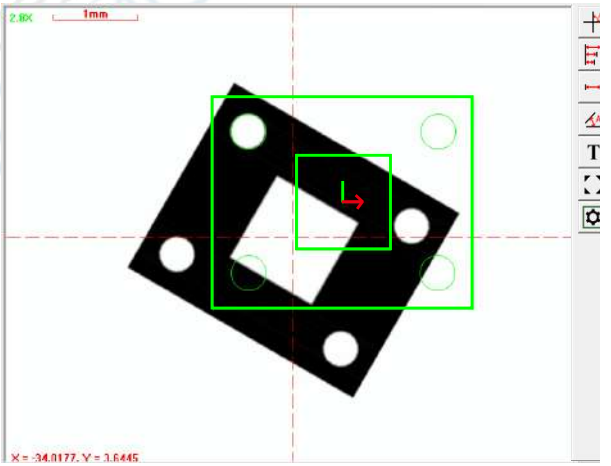




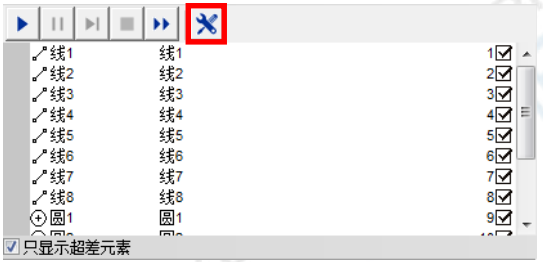
Step 2: Create a coordinate system with the rectangle, and align the coordinates with one edge of this rectangle, save the coordinate system. Then the coordinate system is created in the center of the rectangle, the X-axis and the Y-axis of the coordinate system can represent two symmetrical center lines.

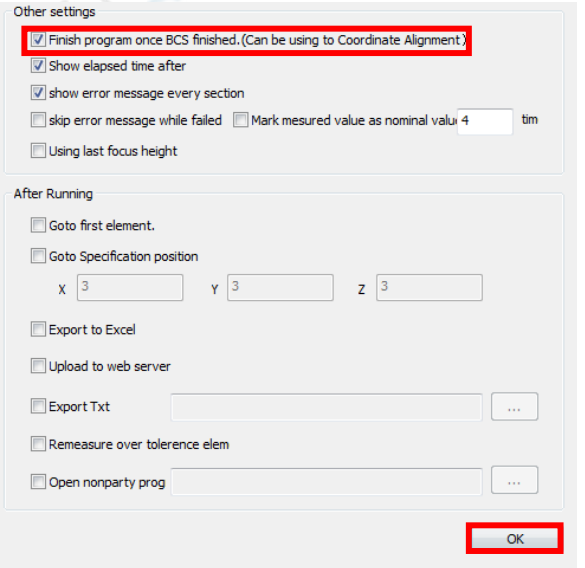




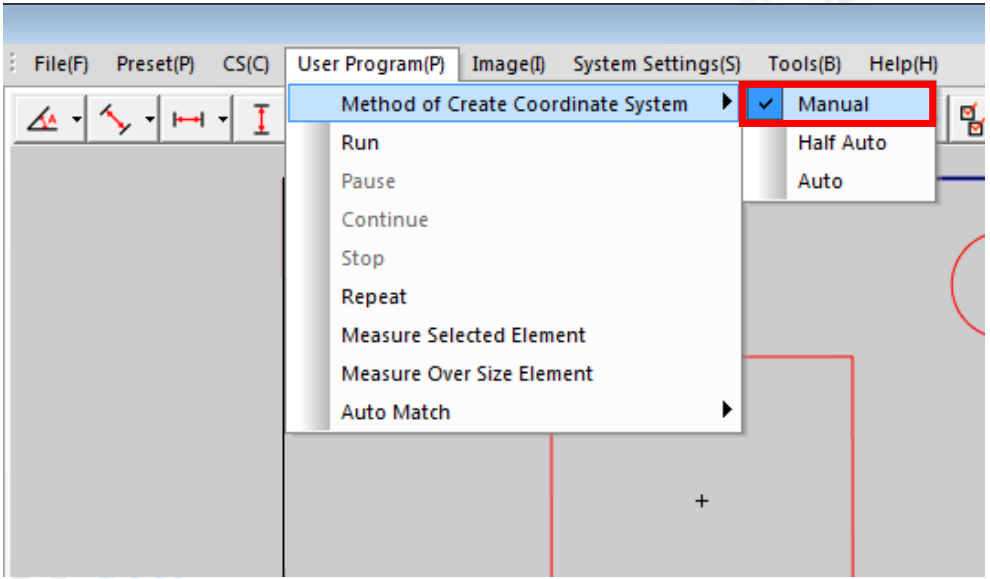


Step 3: Align the coordinates of the CAD drawing and the workpiece. In order to perform coordinate alignment without performing the coordinate measurement, you need to click the "Program Setting" button on the user program toolbar and check the "Finish program once BCS finished" option in the dialog box, and then click the OK button to exit the user program setting.

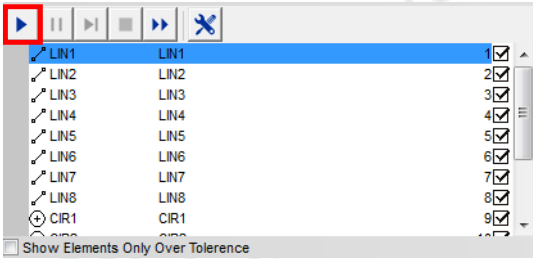


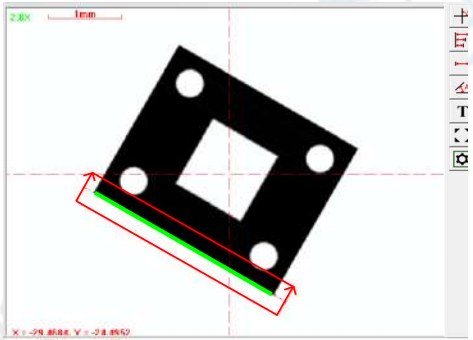


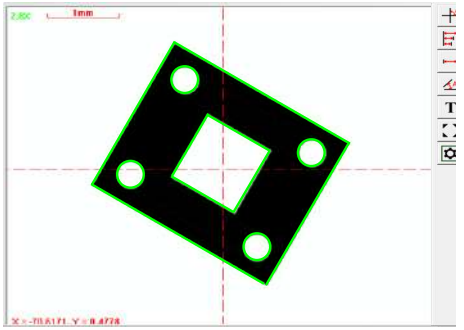
Step 4: Select the "user program→method of create coordinate system→manual" in the main menu, and the method of creating coordinate is set to manual when the program is running.



Step 5: Click the "Run" button on the user program toolbar, and then measure the corresponding contour line for constructing the rectangle in the image area in the order of the element list area. After the measurement is finished, the program will automatically align the CAD drawing and the workpiece image contour, and then you can perform the comparative observation.





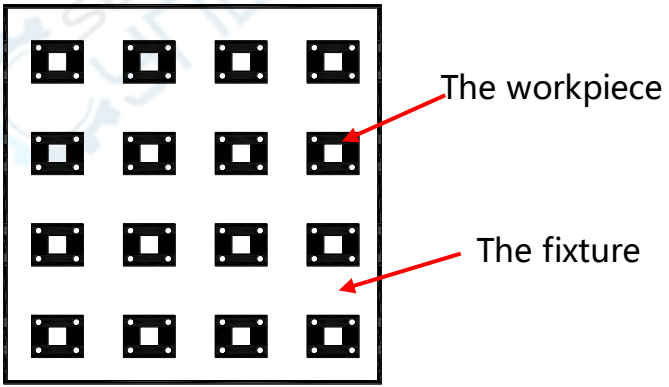


3. The fixture array and the macro array

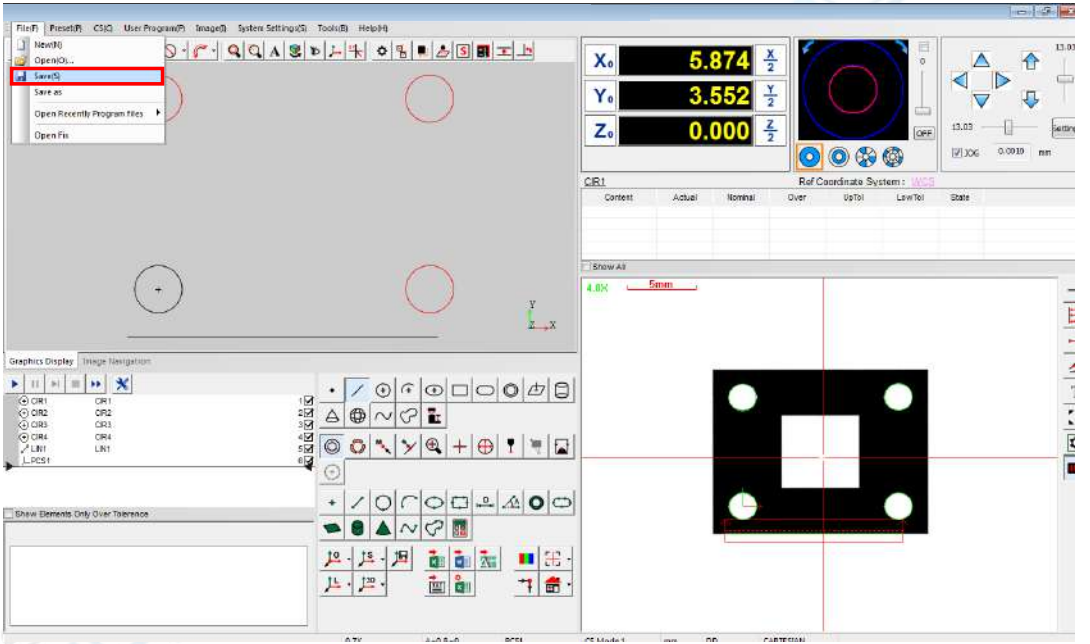
These two functions are used for the CNC image measuring instrument, the manual image measuring instrument can skip this section.

(1) The fixture array measurement

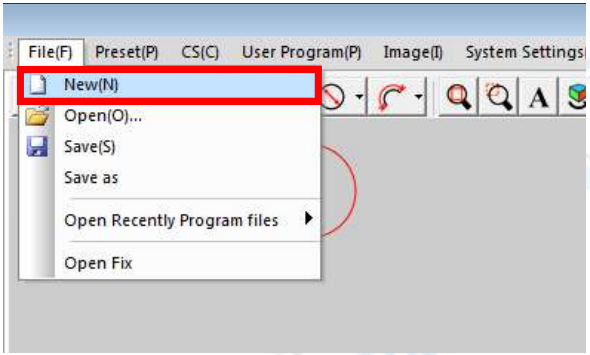
In batch mearement, a lot of the same workpieces placed on a fixture are basically equidistant, you can measure one of the workpieces first and then use the fixture array measurement function to measure all the workpieces on the fixture. You can save time greatly and simplify the user program by using this fuction. As shown below:



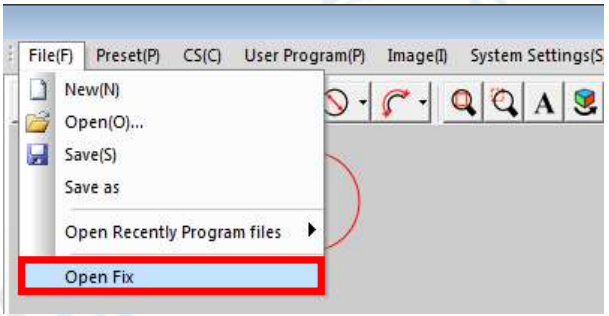
Step 1: Create the workpiece coordinate system based on the first workpiece on the fixture (Accroding to the actual need you may not need to create the workpiece coordinate system), then extract the measured elements, and save the user program.

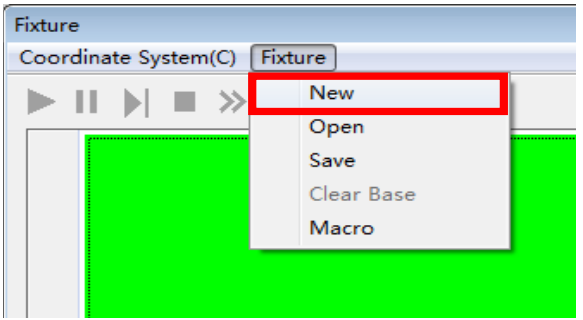


Step 2: Select the "File→New" in the main menu and then create a new user program.

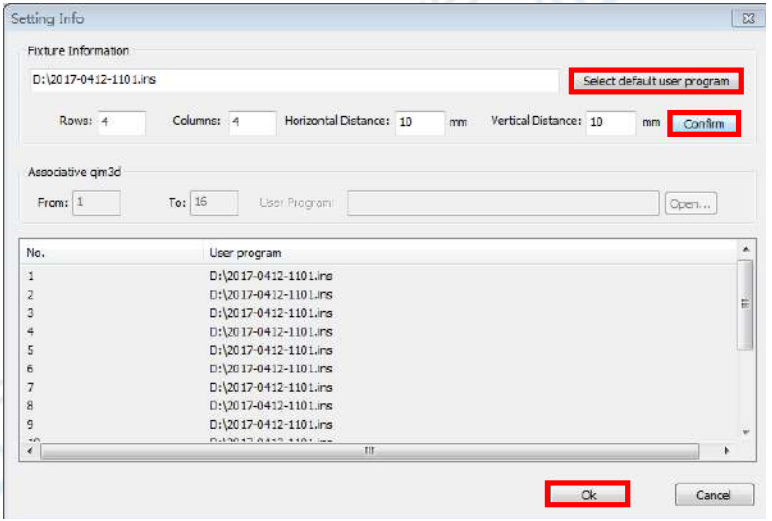


Step 3: Select the "File→Open Fix" in the main menu, then select the "Fixture→New" menu option in the pop up fixture window.

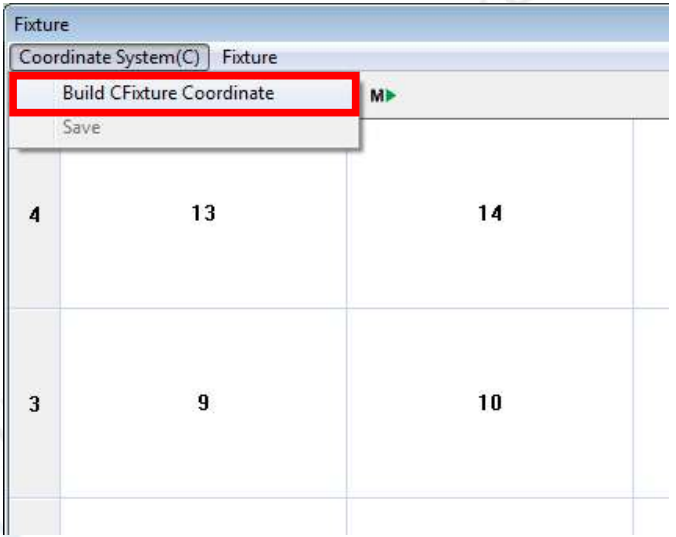




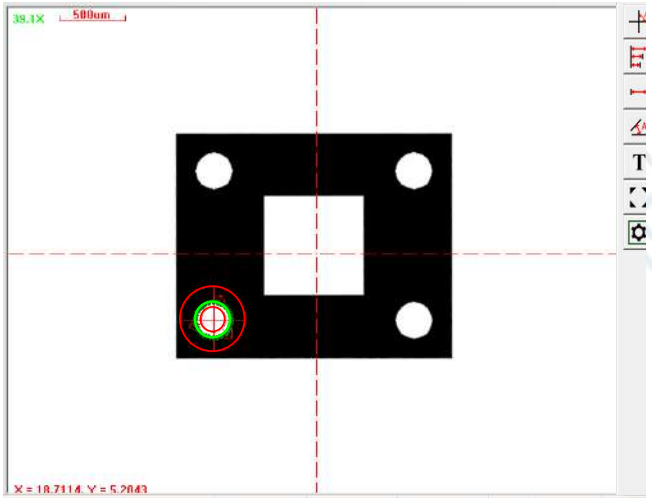
Step 4: Click the "Select default user program" button in the fixture array setting dialog box, select the user program has been saved in Step 1, enter the number of the rows and columns, and enter the horizontal and vertical distance between the workpieces, and then click the “confirm” button to complete to set the fixture array, click the OK button to generate the fixture array program.

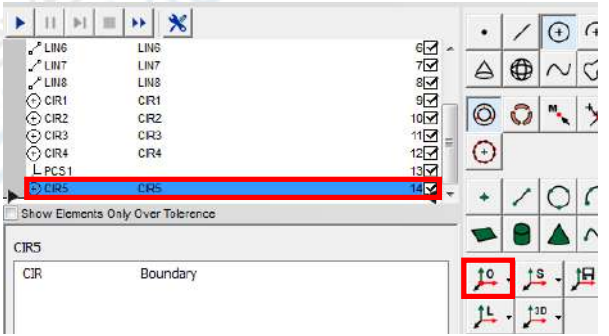


Step 5: Because the location where the fixture is placed is uncertain, you need to align the coordinates of the created array and the actual fixture array. Select the "Coordinate system→Build fixture Coordinate" menu option in the fixture window.

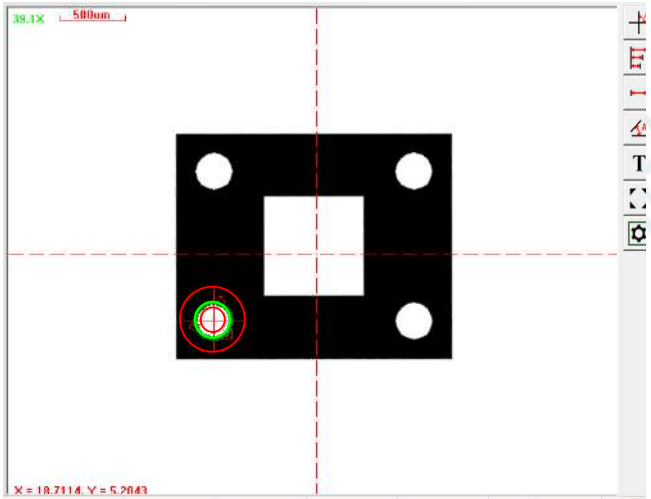


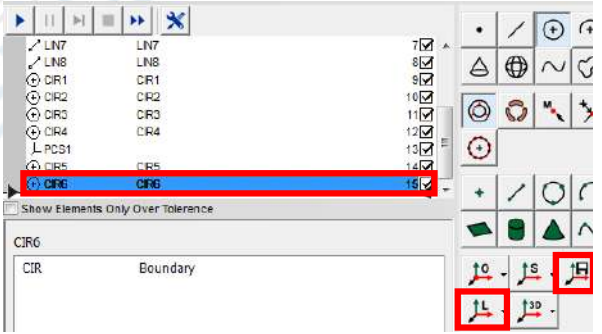
Extract an element in the image area, as shown below, you can extract a circle, and then click the circle in the element list area, click the button on the coordinate toolbar, so that the origin of the coordinate system is built on the the center of the circle.



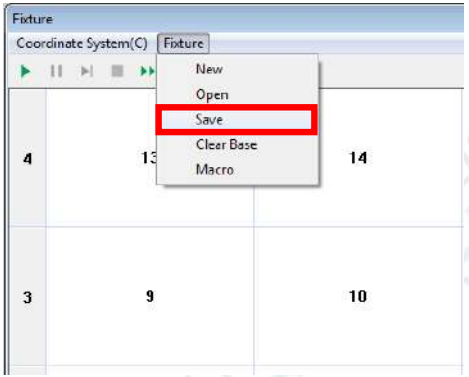


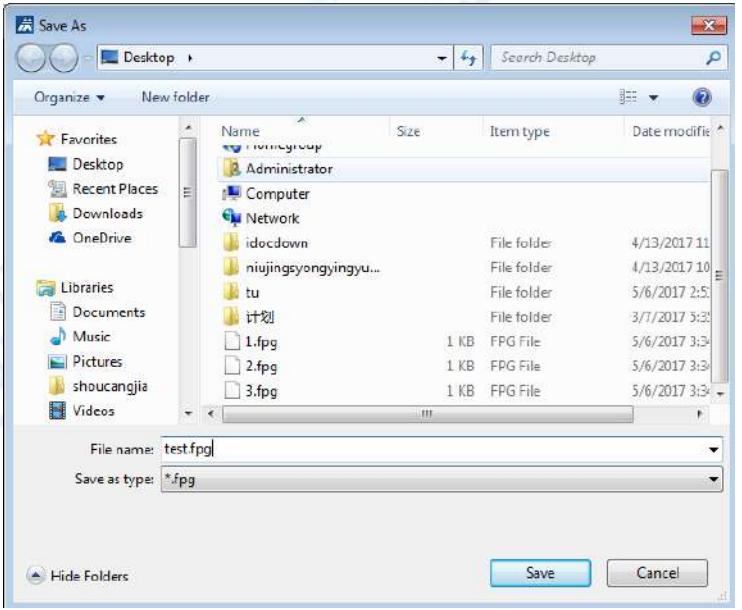
Move the image area as far as possible from the first workpiece, and then extract the same element in the same position of another workpiece, select the circle in the element list area and click the button. Finally, click the button on the Coordinate toolbar to save the coordinate system. Finally the direction of the created array and the actual workpiece are aligned.



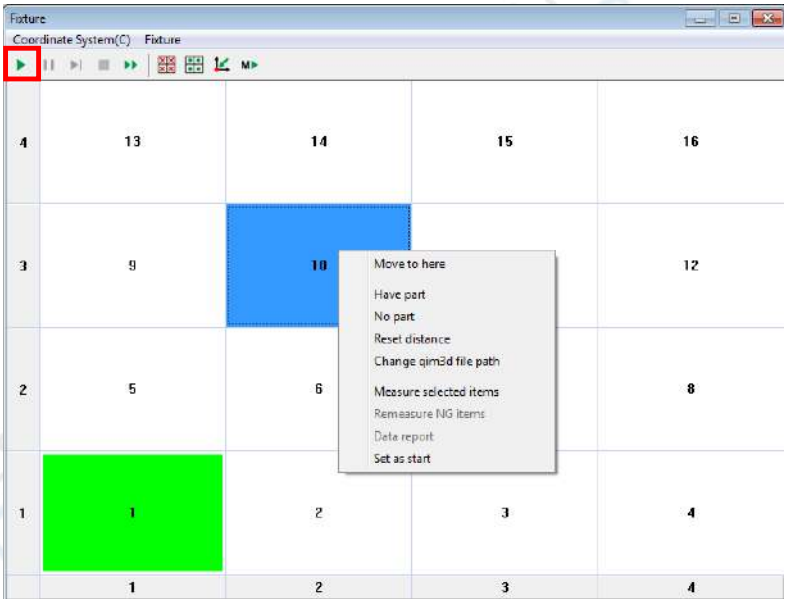


Step 6: Save the fixture array. Select the "Fixture→Save" menu option in the fixture window to save the fixture array program to a file. The extension of the fixture array file is “fpg” .



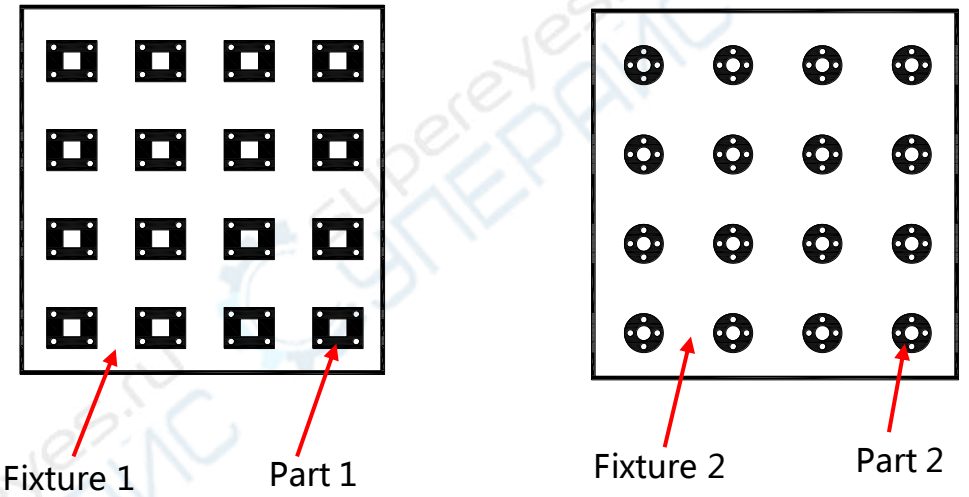


Step 7: Running and editing the array program. Click the Run button on the array toolbar to measure the workpiece on the fixture one by one. Right click on any workpiece number in the fixture array window, and then select a certain option in the pop-up menu, such as setting to Skip this position if there is no part, or reset the distance to fit to the actual position of the part and so on.



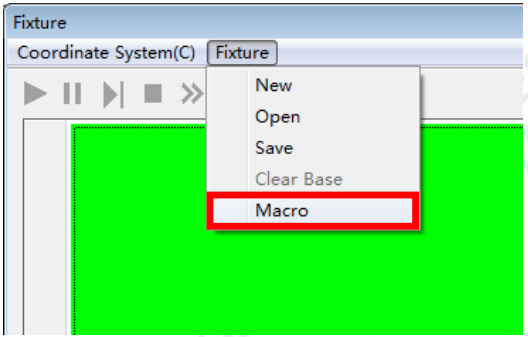
(2) The macro array measurement

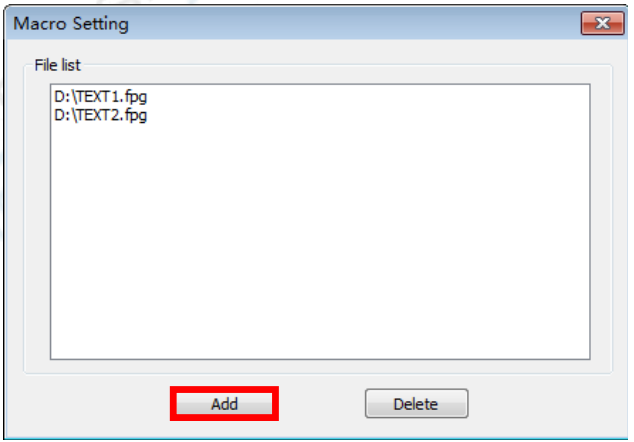
The macro array measurement is used in the multiple fixtures measurement, You can replace the fixture without stopping the machine when the measurement of the workpieces on a fixture is finished. This function can greatly reduce the time and improve efficiency. Take the following two fixtures as an example.



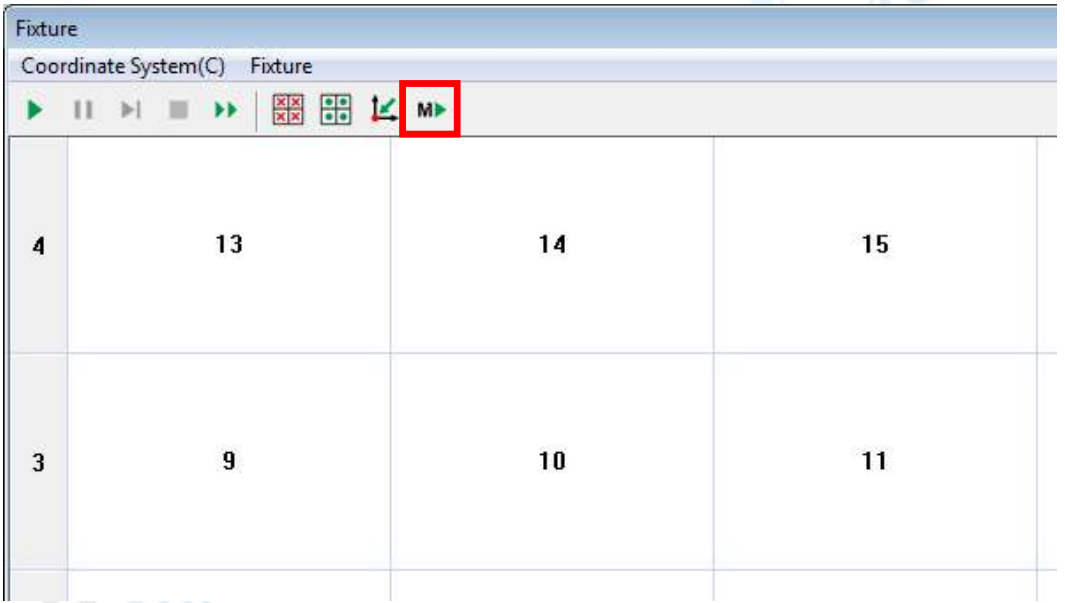
Step 1: Follow the above steps of the fixture array measurement, create and save the abave two fixture array programs for abave two fixtures.

Step 2: Open the fixture window, Select the "Fixture→ Macro" menu option, click the "Add" button in the pop-up dialog box, and add the two array files that have been save in step1 to the list area.





Step 3: Close the "Macro Setting" dialog box when you have finished adding the array files, click the “Run macro” button on the array toolbar. The program will control the machine to measure the workpieces on all fixtures.

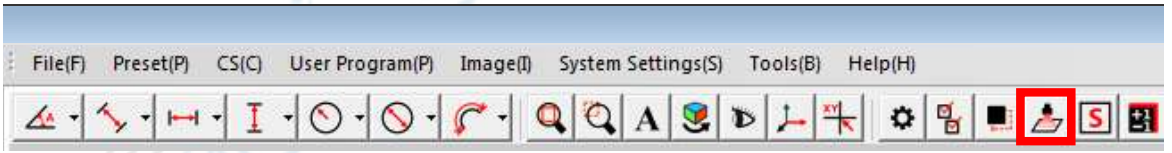


4. The scanning function

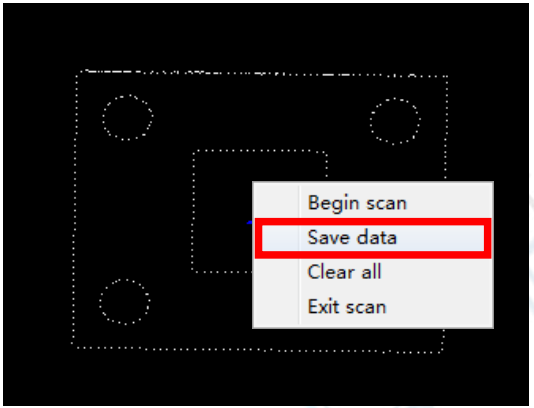
The scanning function is to generate point clouds by scanning the workpiece image contour. It can be used for reverse engineering. There are 3 methods described as follows:

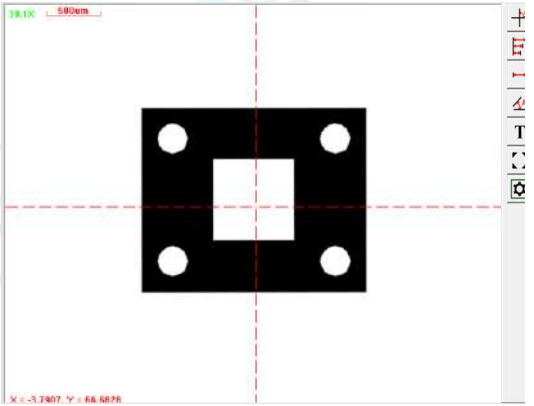
Method 1: If the image size of the workpiece is small, it can be imaged entirely inside the image area, the scanning steps are as follows:

Step 1: Click the "scan" button on graphics area toolbar. In order to reduce the miscellaneous points, it is recommended to turn off the surface light before scanning and illuminate with the contour light.



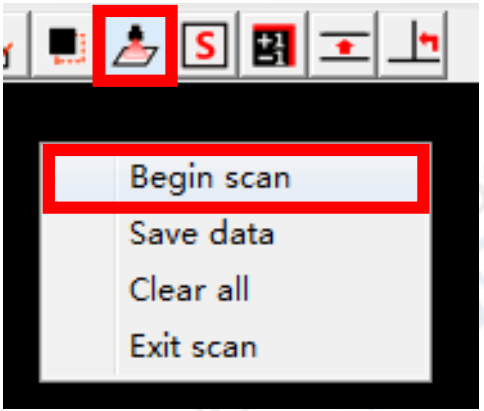
Step 2: Double-click in the image area to get the workpiece contour of the point clouds, and right-click in the graphics area and select the "save data" menu option to save the contour as a dxf format document.

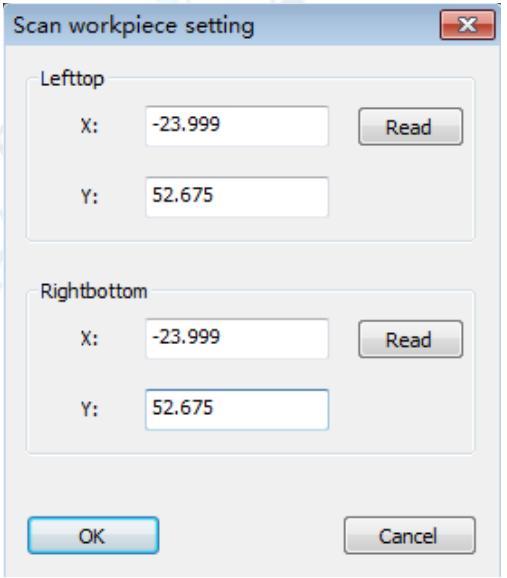




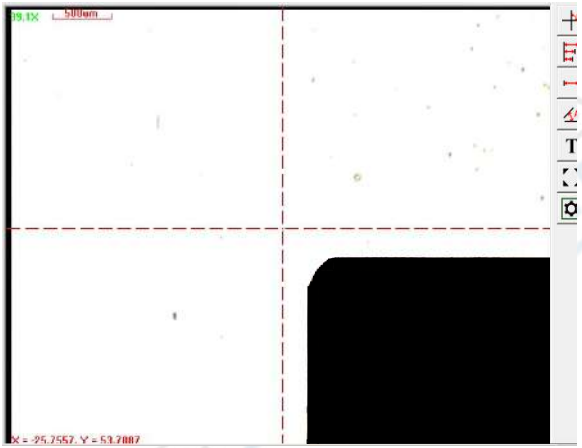
Method 2: If the image size of the workpiece is larger than the image area. it can not be imaged entirely inside the image area. Take the following workpiece as an example, the scanning steps are as follows:

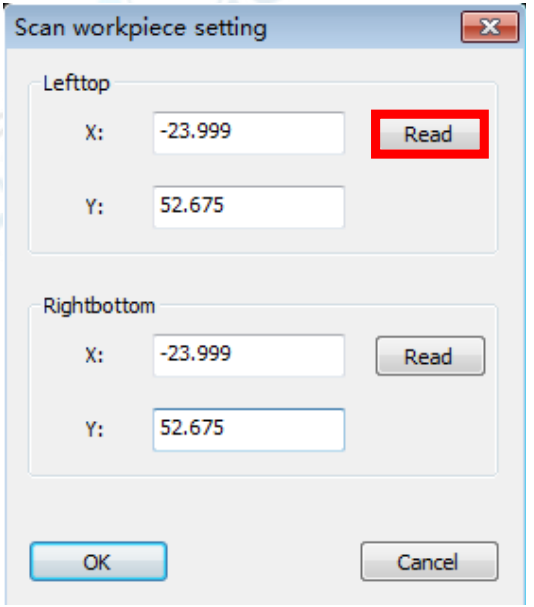
Step 1: Click the "Scan" button on graphics area toolbar, and click the right mouse button in the graphics area and select the "Begin Scan" menu option, and the "Scan workpiece Settings" dialog box is displayed.



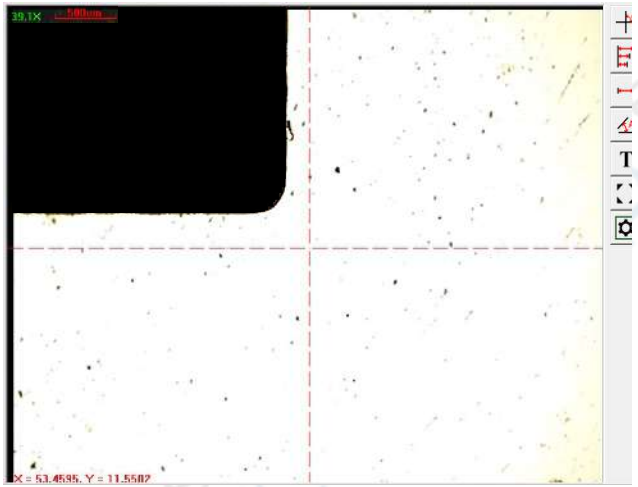


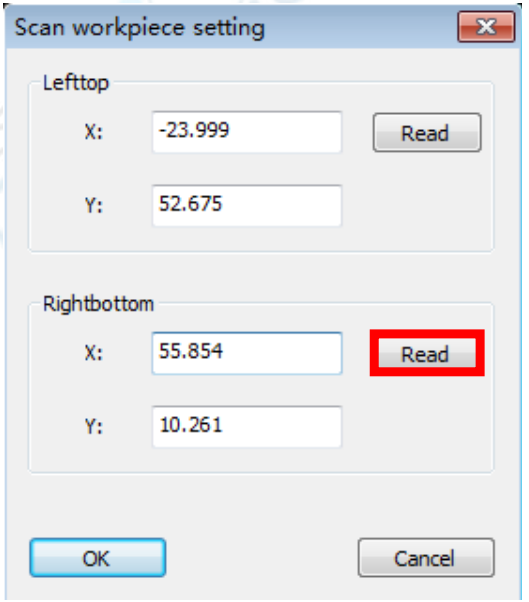
Step 2: Move the top left corner of the workpiece to the center of the image area and click the "Read" button at the top of the dialog box. (**Note: Do not close the dialog box now.**)



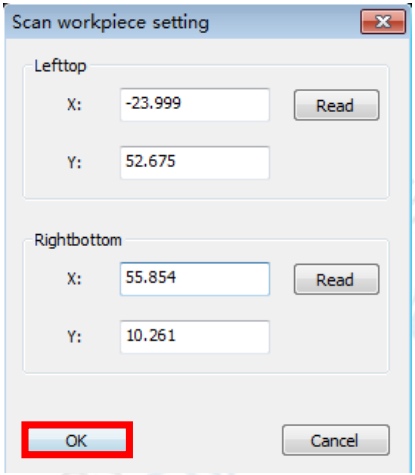


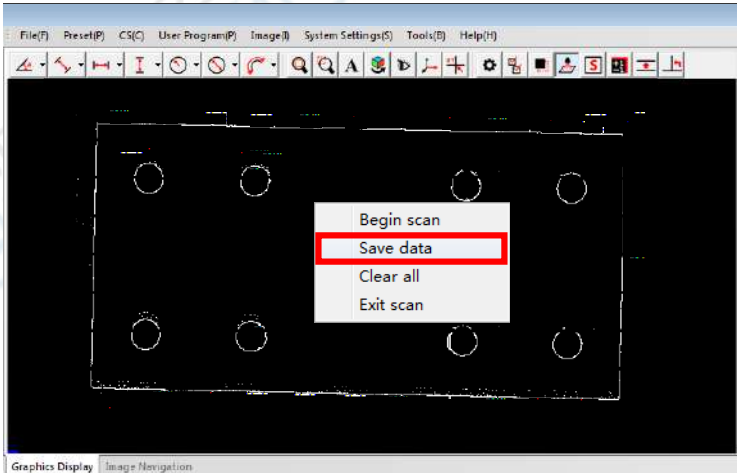
Step 3: Move the bottom right corner of the workpiece to the center of the image area and click the "Read" button at the bottom of the dialog box.





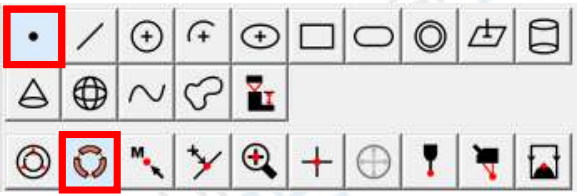
Step 4: Click the OK button, the software will control the machine to perform the jigsaw scanning for the workpiece, after the scanning is complete, you will get the point clouds contour of the workpiece in the graphics area. Click the right mouse button in the graphics area and select the "Save data" menu option to save the contour as a dxf format document.

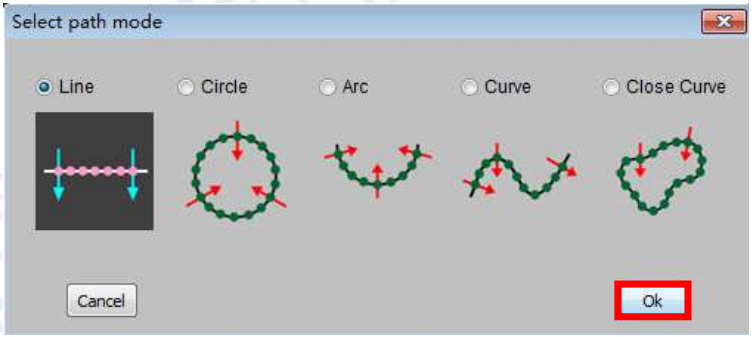




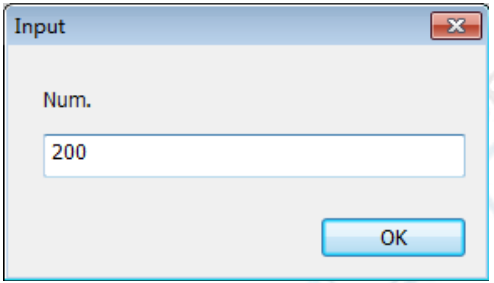
Method 3: Scanning any shape contour with the point scanning function.

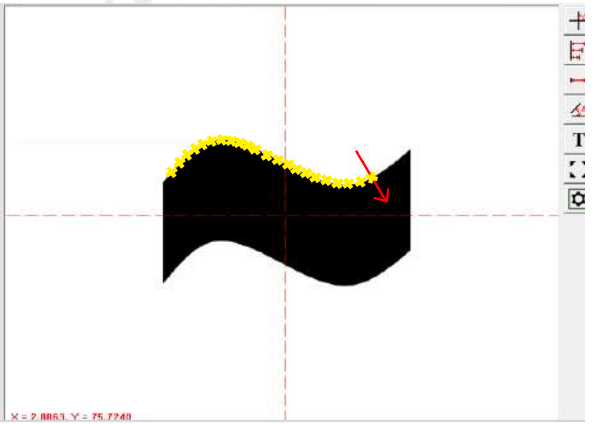
Step 1: Click the "Point" element button and the "Subsection" method button, Pop up the "Select path mode" dialog box, select the corresponding element type of the measured image contour, as shown below, such as the straight line, circle, arc, open curve, closed curve. Click the "OK" button to complete the operation.





Step 2: Extract the starting point and the direction point with line intersection method. Enter the number of points to be extracted in the pop-up dialog box, and the software will automatically scan the image contour.





The following describes the ways of extracting points according to different elements.

Straight line scanning: Scanning a straight line need to extract 2 points. The first point is the starting point, the second point is the end and direction point.

Circle scanning: Scanning a circle need to extract 3 points. The first point is the starting point, the second point and the third point are the points on the circle.

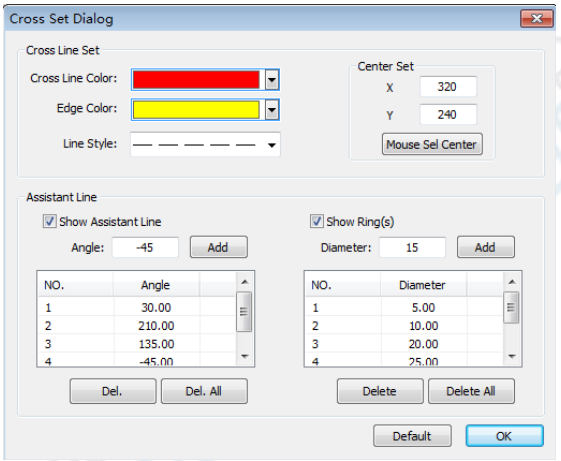
Arc scanning: Scanning an arc need to extract 3 points. The first point is the starting point, the second point is the direction point, and the third point is the end point.

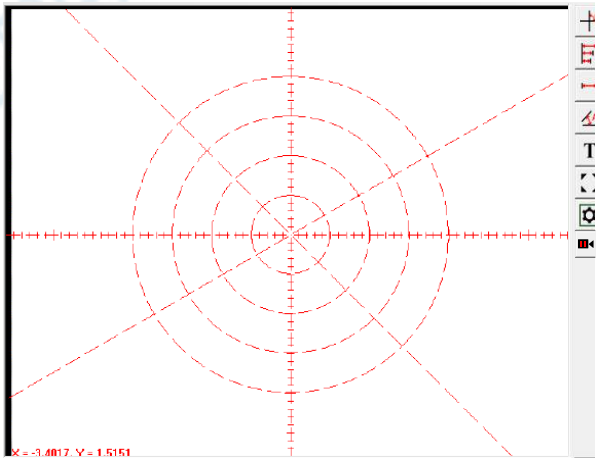
Open curve scanning: Scanning an open curve need to extract 3 points. The first point is the starting point, the second point is the direction point, and the third point is the end point.

Closed curve scanning: Scanning a closed curve need to extract 2 points. The first point is the starting point,and the second point is the direction point.

5. Comparative measurement with auxiliary lines and rings

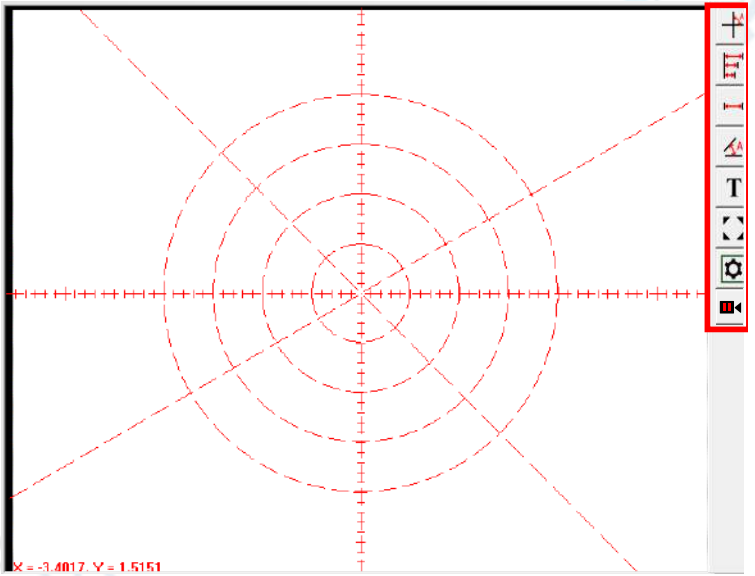
Choose the "Image→Cross settings" in the main menu , check the "Show assistance line" or " Show ring(s)" option in the Cross Set dialog, and enter the value of the angle or diameter. You can generate auxiliary lines or rings in the image area, you can compare the actual workpiece contour with the standard auxiliary lines or rings. In addition, you can also compare the actual workpiece contour with the standard graphics created by the constructing or presetting method.





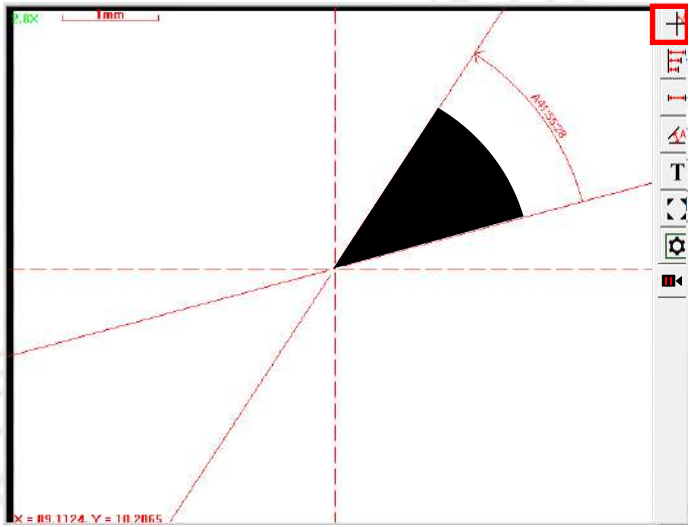
6. The comparative measurement toolbar

You can observe the length, angle, distance and other features by the comparative measurement toolbar . As shown below:



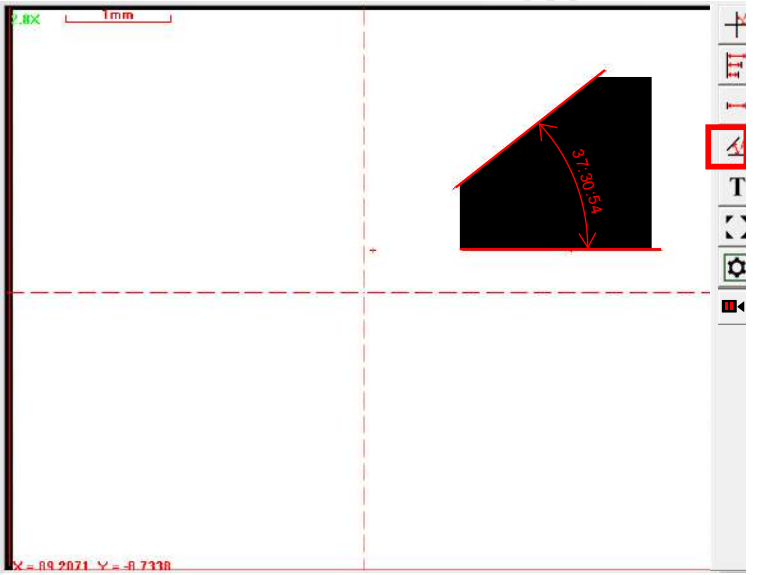
(1) Quick angle observation

Click on the "Quick angle " button, there will appear two dynamic angle lines on the cross lines in the image area, hold down the left mouse button and drag these two dynamic angle lines to coincidence with two edges of the measured angle. This function is only applicable to the angle that its vertexa is at the center of the image area (You can also move the vertexa of the angle to the center of the cross line).



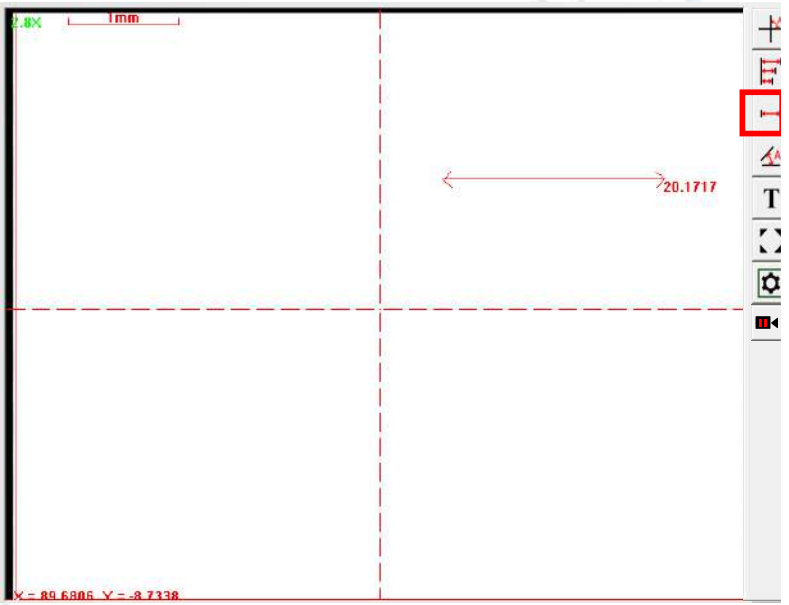
(2) Measuring by drawing two angle lines

Click the "Angle" button, draw two lines on the two edges of the angle in Anti-clockwise order, you can see the angle value between the two lines. This function is applicable to the angle at any position.



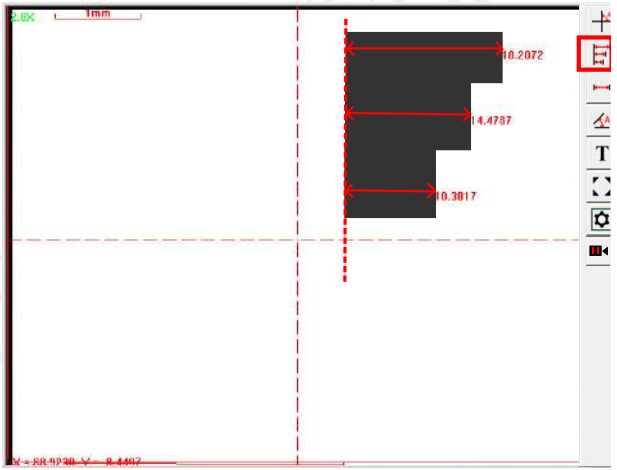
(3) Two point distance

Click on the " distance from 2 point " button, and then click the left mouse button on any two pixel points in the image area, you can measure the distance between these two pixel points.

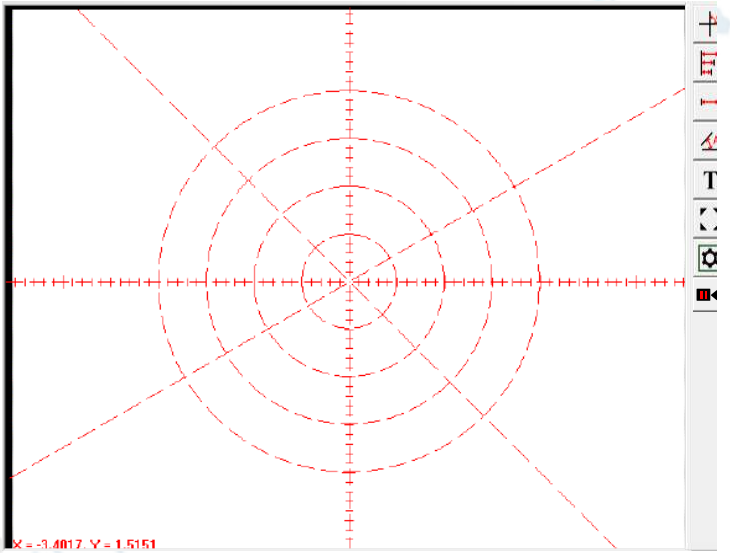


(4) Distance from a line to points

Click the "Distance from a line to points" button, click two points on the datum edge of the measured image in the image area, a dashed datum line will appear, move the cursor to a step of the measured image, click the left mouse button, you can pull out the dimension, And then move the cursor to the other steps to pull out the other dimensions. This function is used to measure the height of different features based on the same datum.

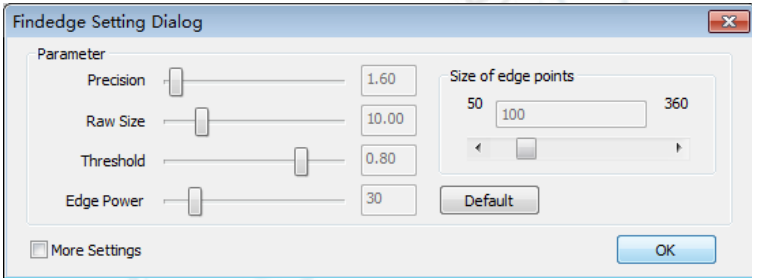


(5) Other functions of the comparative measurement toolbar



Freeze image: Click the "Freeze up" button , the image will be frozen, you can measure the frozen image.

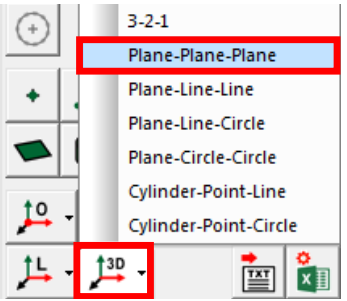
Find Edge Settings: Click the "Find Edge Settings" button ,You can set the Parameters of the Find-Edge-Tool in the pop up dialog box.



Chapter 11 The probe measurement function

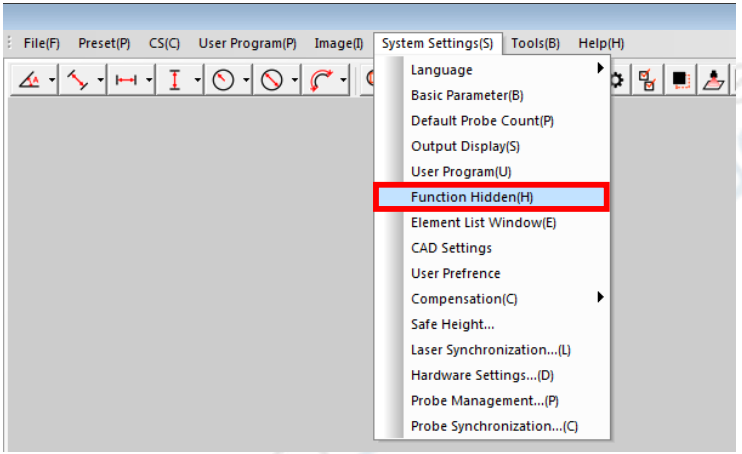
The software probe measurement function is powerful. It can measure the two-dimensional and three-dimensional element features, such as the height, plane, cylinder, cone, ball, and ring. It supports 7 methods to build the three-dimensional coordinate system, and also support the synchronization of the image measurement and the probe measurement. The probe measurement program can be run like the CMM software program, and its programming is more convenient. The probe function button is in the measurement method toolbar, as shown below:

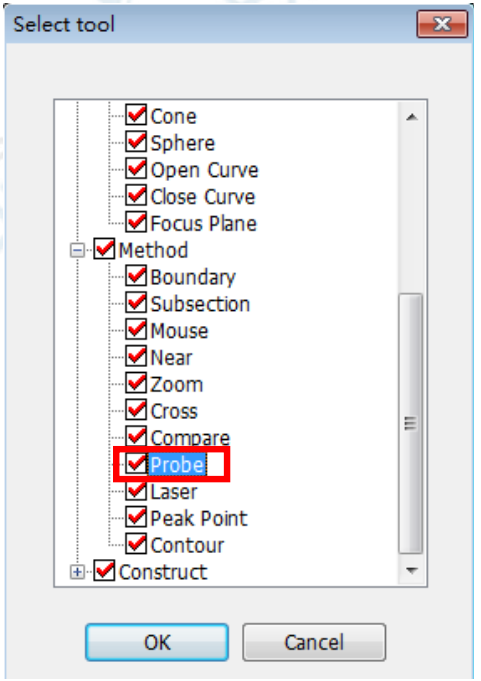
The probe measurement method button



Methods of building coordinate system with probe

If the probe button is not on the measurement method toolbar, you can select the "System settings→Function Hidden" in the main menu, and check the "probe" option as shown below:

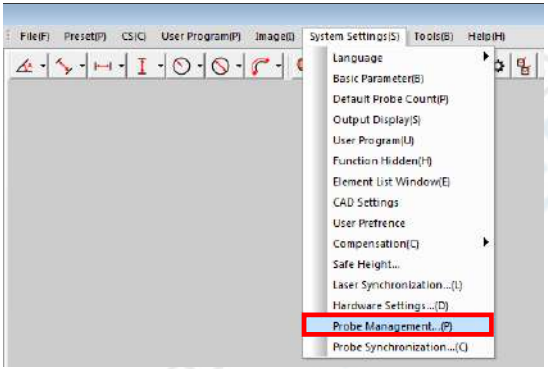


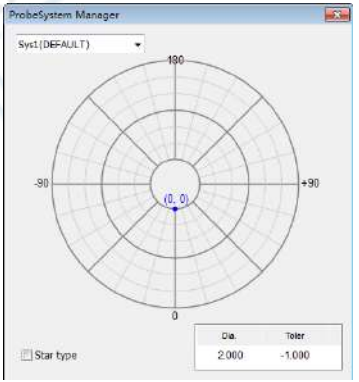


1. Probe calibration

The probe system must be calibrated before using it, you can use the standard block gauge, standard sphere, or standard ring to calibrate the probe system.

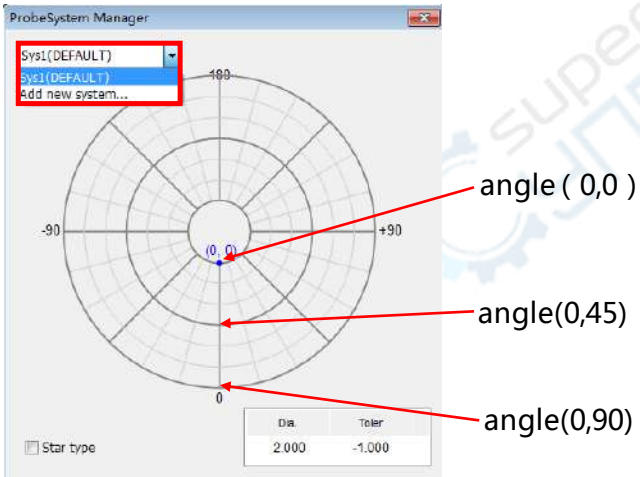
Step 1: Select the "System settings→probe management" in the main menu, pop up the Probe System Management dialog box, as shown bellow:

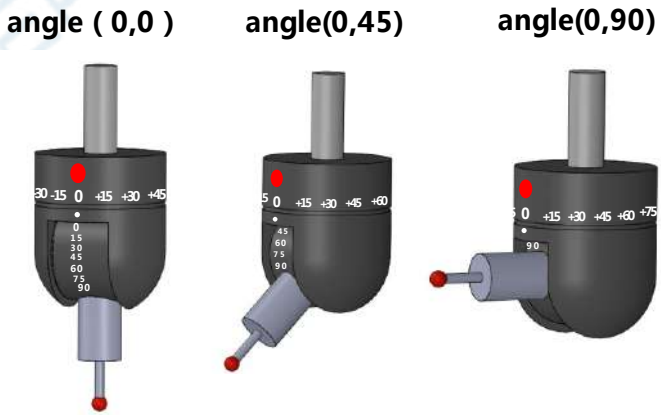




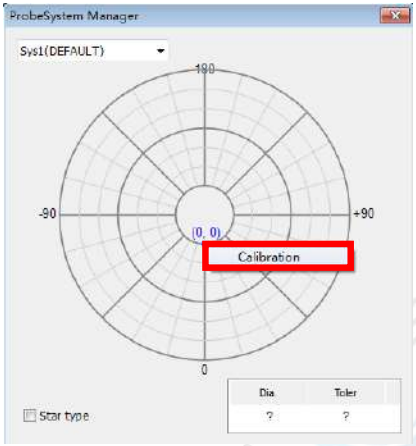
Each grid point of the schematic diagram represents a different angle state of the probe. You can click on the corresponding grid point to calibrate it according to the current angle state of the probe. If the probe angle can not be changed, you only need to click the grid point(0,0) to calibrate the probe system.

If the probe system is changed, for example, the probe body or the stylus is replaced, or the angle of the probe system is changed, in these cases you should recalibrate the probe system, or you can click the triangle symbol on the top left corner of the dialog box, and select the “add new system…” option to create a new probe system and calibrate it. You can also check the “star type” option to calibrate the star probe system. As shown below: The different grid points correspond to the different angel state of the probe system.

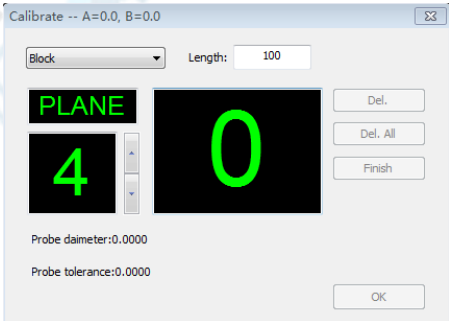




Step 2: Click the left mouse button on a grid point, for example, clicking the grid point(0,0) to calibrate the simple probe system, and select the calibration standard in the pop-up calibration dialog box.



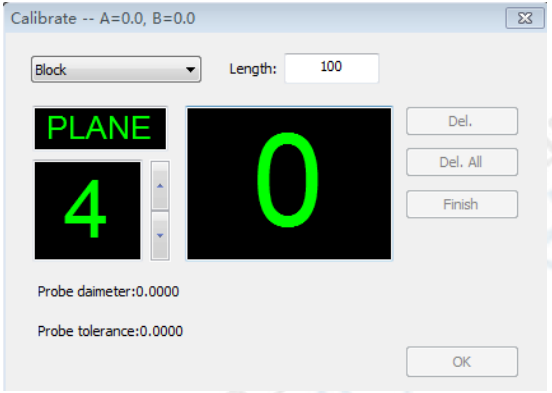
The simple probe

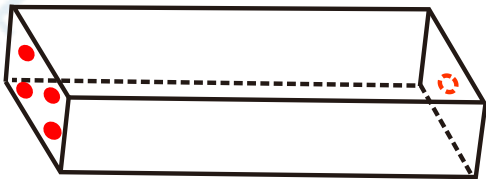


The software supports 3 kinds of calibration standards: the standard block, sphere, and ring. The probe calibration operations with them are discribed as follows:

(1) Calibrating with the standard block:

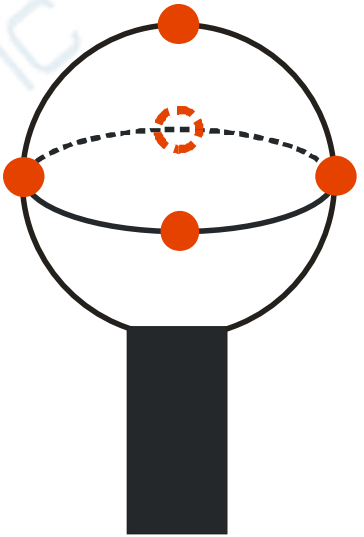
When the calibration standard is a block, enter the actual length value of the block, and take at least 4 hits on one suface of the block, and take one hit on the opposite surface, click the Finish button to complete the calibration, and then click the OK button to exit the dialog box.





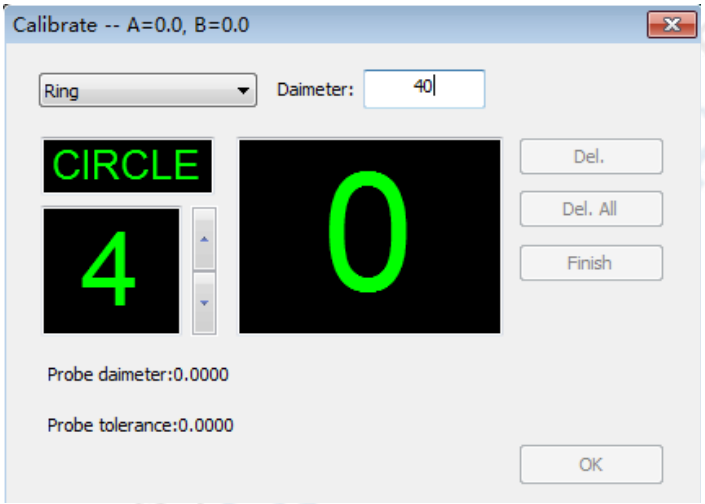
(2) Calibrating with the standard sphere:

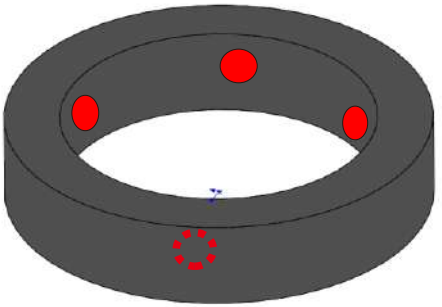
When the calibration standard is a sphere, enter the actual diameter value of the sphere ,and take 5 hits on the suface of the sphere according to the positions of the following figure, click the Finish button to complete the calibration, and then click the OK button to exit the dialog box.



(3) Calibrating with the standard ring:

When the calibration standard is a ring, enter the actual diameter value of the ring, and take 4 hits on the standard suface of the ring according to the positions of following figure, click the Finish button to complete the calibration, and then click the OK button to exit the dialog box.

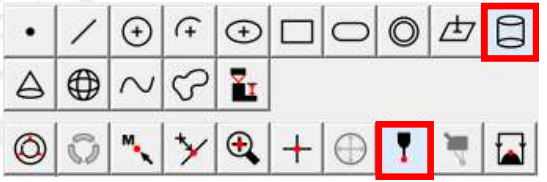




2. Probe measurement steps

The following takes measuring the cylinder as an example to describes the probe measurement steps:

Step 1: Click the "Cylinder" element button and the "Probe" method button, pop-up cylinder probe measurement dialog box.



Definitions:

Approach distance :

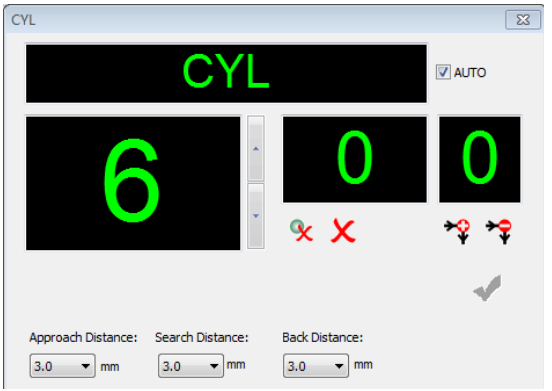
The probe movement distance of approaching slowly to the measuring point before it takes a hit

Seach distance :

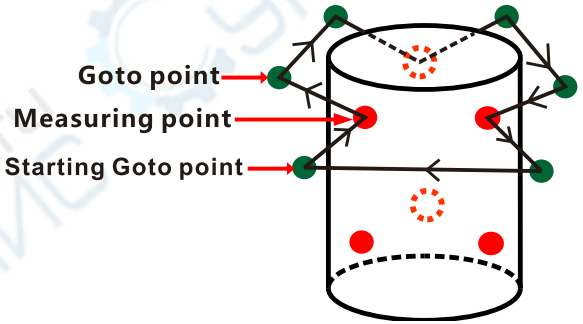
The seach range near the measuring point.

Back distance :

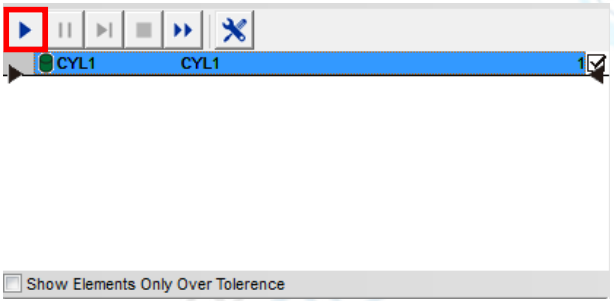
The probe movement distance returning from the measuring point.



Step 2: Set the measuring points number of the cylinder to 6, you can also click the Upper or lower triangle symbol to increase or reduce the number. Take 3 measuring points as an example. You must set the Goto points if the probe movement may cause a collision. As shown below, the probe move from the start point. The red points are measuring points, and the green points are Goto points, The arrow direction represents the direction of the probe movement trajectory. Take a hit at the position of the measuring point ,and click the "Add " button to add the Goto point at the position of the green points, the software will record all these points. And then get the other 3 measuring points by the same method discrabed above. and you can also click the "delete" button to delete the unsatisfactory points



Step 3: It will automatically display the "cylinder" element in the element list area when the point collection is complete, click the run button to automatically measure the cylinder with the probe

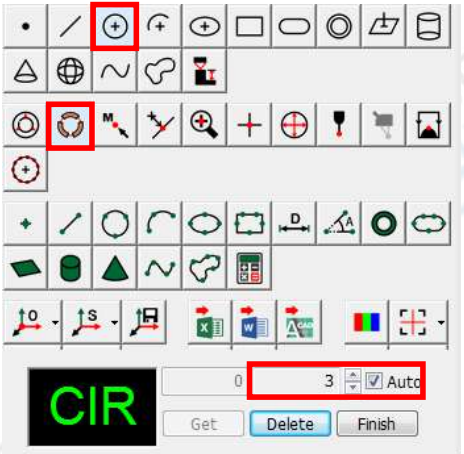


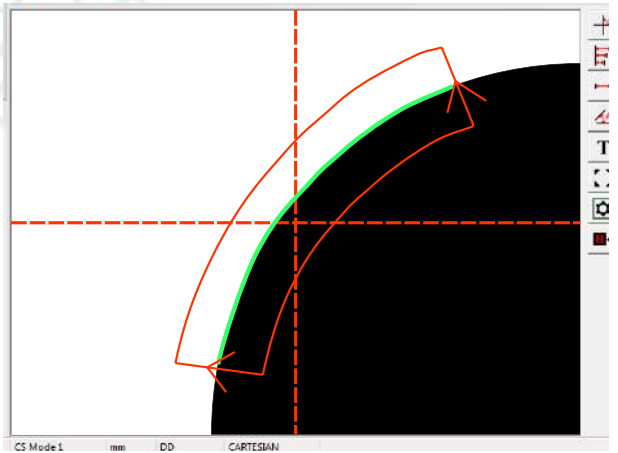
3. Synchronization of the probe and the image

The synchronization of the probe and image means that the measurement results should be the same whether you measure the same element with the probe or with the Optical imaging system. You can decide whether or not to synchronize according to actual needs.

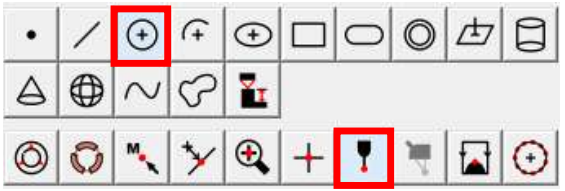
For the synchronization of the probe and image, you need to measure the same circle and the same plane with the Optical imaging system and the probe. The following introduces the synchronization steps by measuring the same standard cylinder diameter and the same plane on the cylinder.

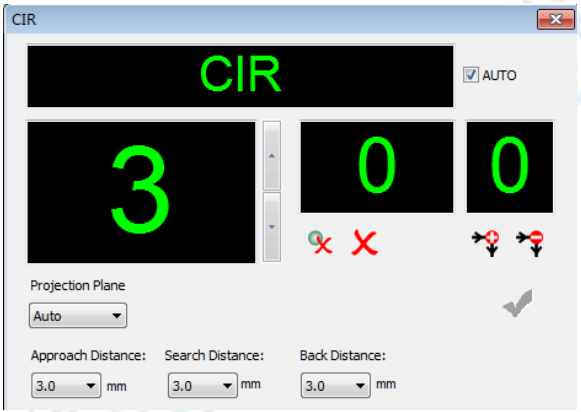
Step 1: Measure the "image circle". Click the “Circle” element button and “Subsection” method button, focus the top plane of the standard cylinder, and extract the circle element with the optical imaging system.

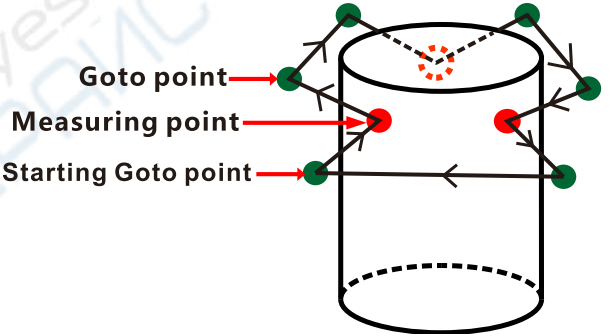




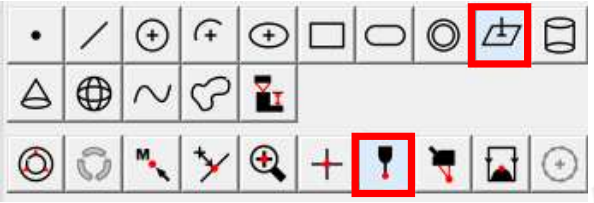
Step 2: Measure the "Probe circle". Click the “Circle” element button and the “Probe” method button, measure the cylindrical surface with the probe

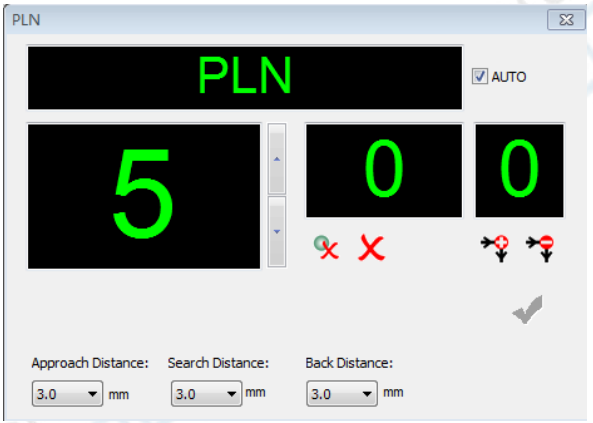


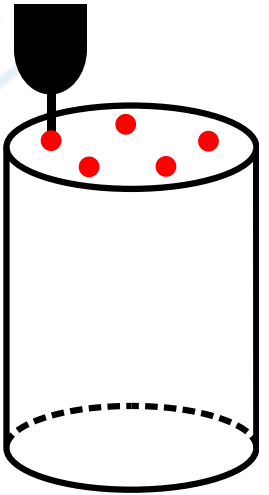




Step 3: Measure the "Probe plane". Click the “Plane” element button and the “Probe” method button, measure the cylinder top plane with the probe.

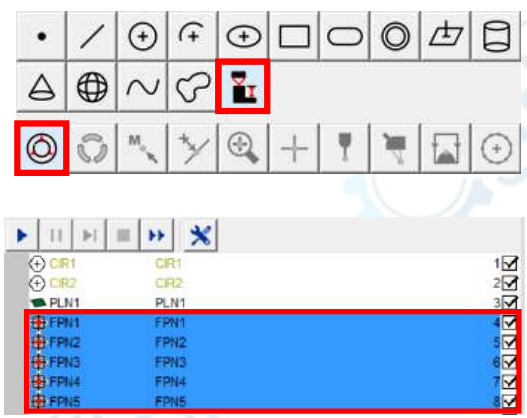


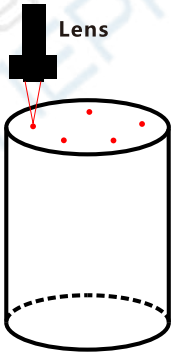




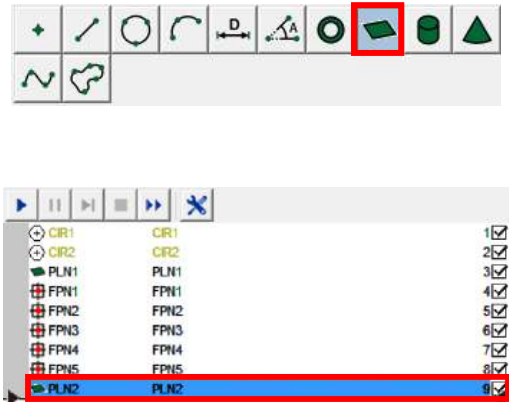
Step 4: Measure the "Focus plane". Click the "Focus plane" button and the "Boundary" method button. Measure the cylinder top plane with the auto focusing method (Note: This step can be omitted when there is no chamfer on the edge of the standard cylinder, that is the plane of the "image circle" is the top plane of the cylinder.)

Extracting points with autofocus method

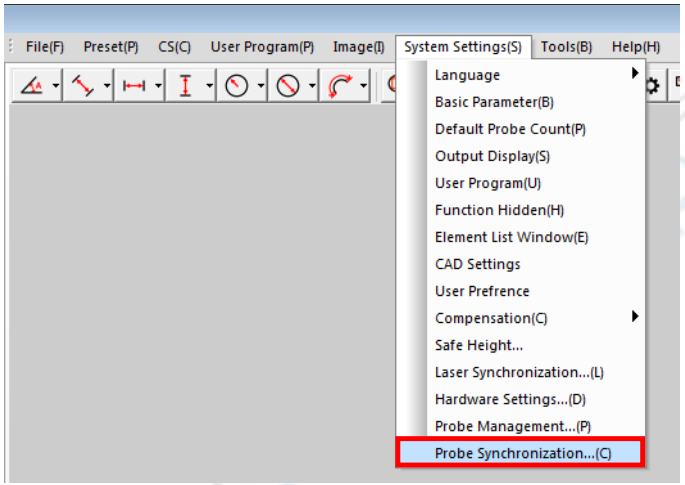


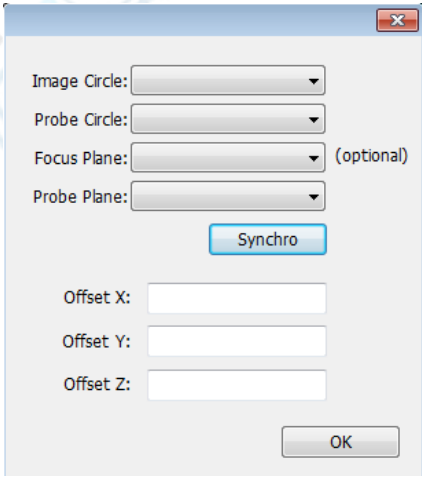


Constructing the focus plane with all the points have been measured

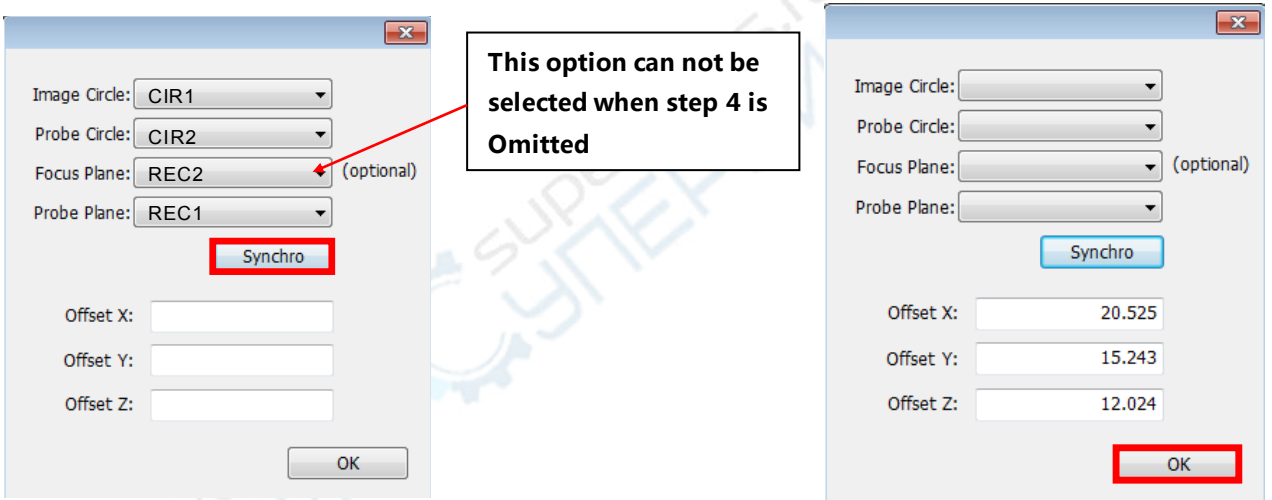


Step 5: Select the "System Settings→Pobe synchronization" in the main menu, pop -pup the synchronization dialog box.





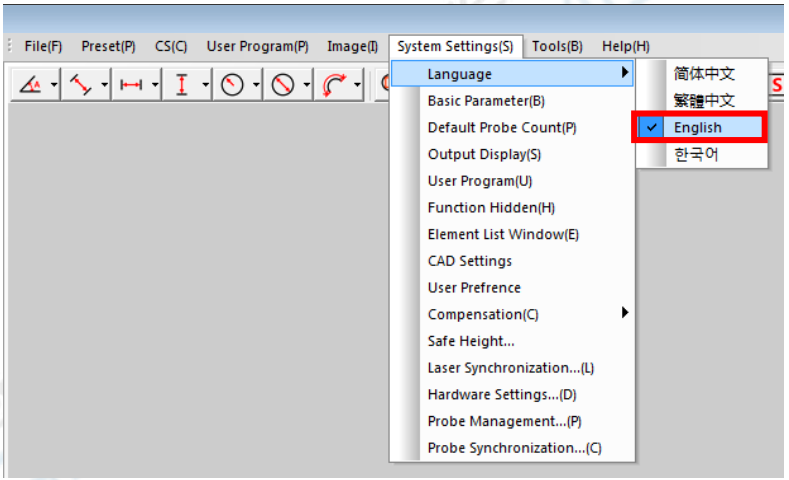
Step 6: Select the corresponding circle and plane have been extracted in the dialog box, click the "Synchro" button to complete the synchronization. If you know the offset values between the optical imaging system center to the stylus center, you can also enter the offset values and click the OK button to complete the synchronization.



Chapter 12 Other parameter settings

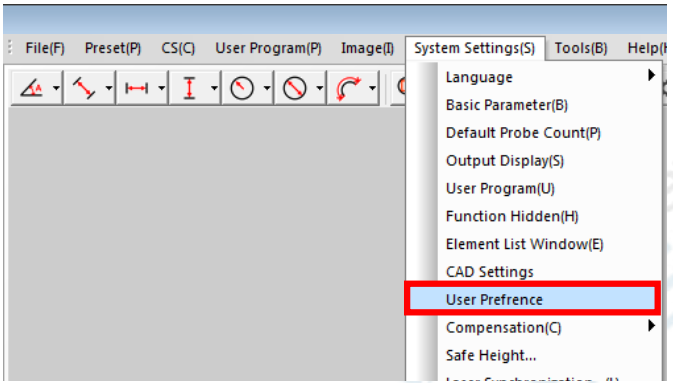
1. Language switching

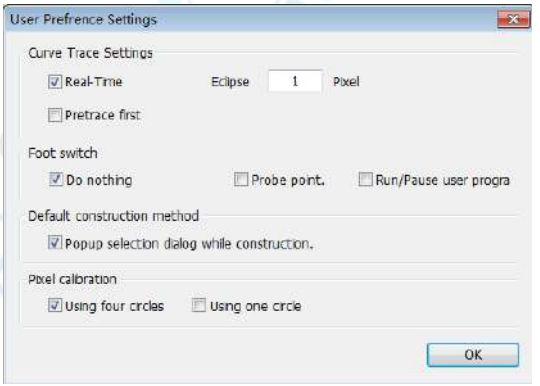
Select the "System settings→ Language" in the main menu, you can select one of the languages of the software interface, the software supports 4 languages: Simplified Chinese, Traditional Chinese, English, and Korean.



2. User prefrence settings

Select the " System settings→User prefrence" in the main menu, you can set Partial functions according to your prefrence. Instructions are as follows





Curve trace settings : This option is used for extracting the open curve and the close curve by contour scan method(See chater 6(9)). If you check the "Real-Time" option, the software will automatically caculate the points number and generate the curve with these points, otherwise you should enter the points number if you check the "pretrace first" option

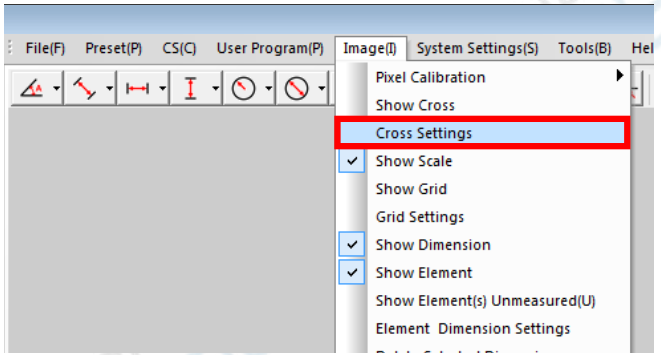
Foot switch : Set the action when the foot switch is depressed.

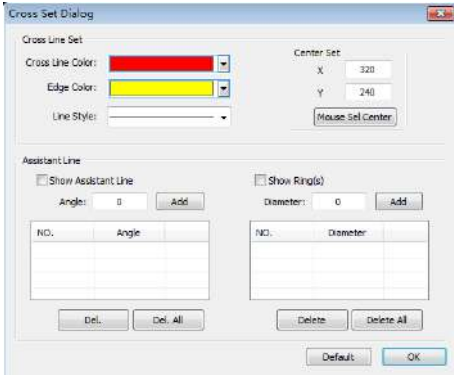
Default construction method : Choose to construct the element by the default method, or by selecting the method in the construction method dialog box.

Pixel calibration type : Choose to use the 4 circles pixel calibration or the one circle pixel calibration

3. Cross lines settings

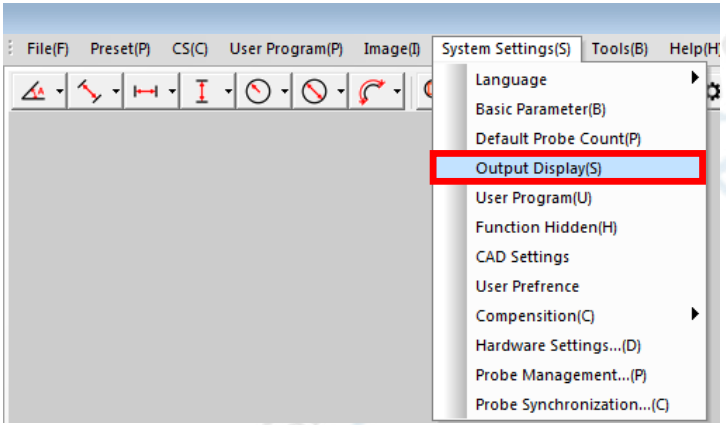
Select the "image→Cross settings" in the main menu, you can set the parameters of the cross lines in the cross set dialog box

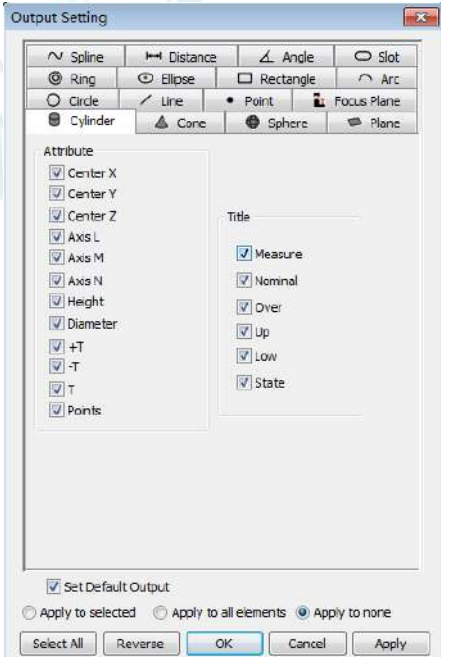




4. Output display settings

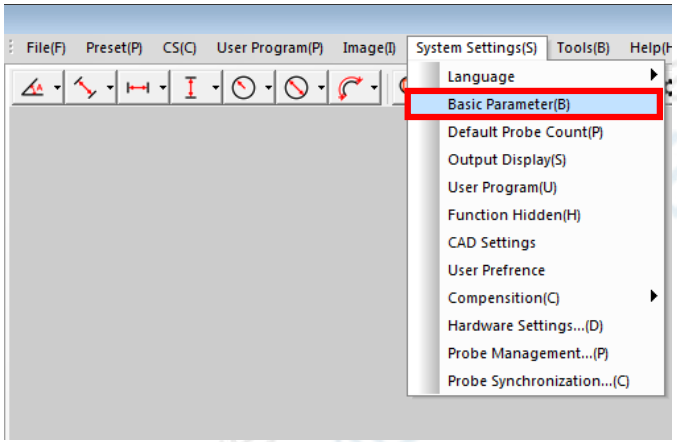
Select the "System Settings→Output Display" in the main menu, you can set to display which item of the elements in the result display area by default, and whether to output one of these items by default.

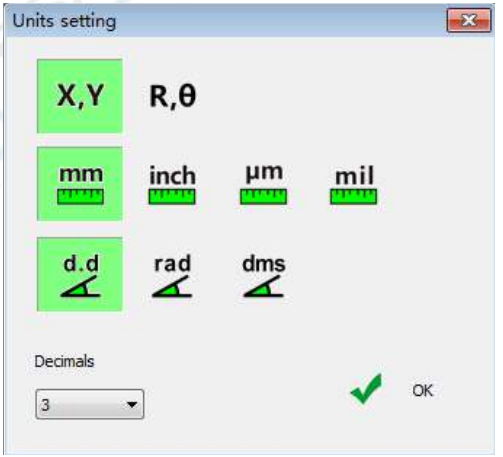




5. Basic parameters settings

Select the "system settings→basic parameters" in the main menu, you can set the coordinate type, unit, angle type, and the number of decimal the places in the "units setting" dialog box. You can also double-click the corresponding position of the software status bar to set the first three parameters.





Note: Please do not arbitrarily set other parameters are not introduced, just keep them by default.