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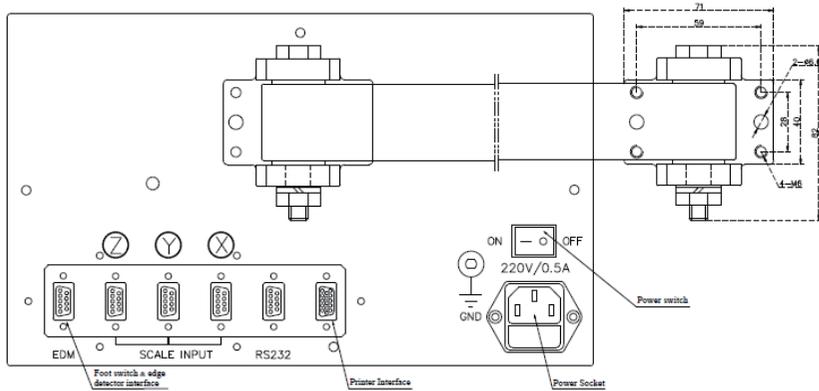
OPERATION MANUAL

Model ISP-AZ3020
Erect Image Profile Projector

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VIDEO OF PRODUCTS.



Back Panel



Instructions On Keys

	Sign	Name	Function
1	X Y Z	Zero Key	Zero the displayed value of the assigned axis
2	1/2	Data divided by two	Divide the displayed value of the assigned axis by two
3	INC ABS	Toggles between incremental and absolute modes	Select one of the two modes
4	INCH MM	Toggles between inch and millimeter	Toggle the displayed value between inch mode and millimeter mode
5	POL CART	Toggles between polar and Cartesian coordinates	Toggle the displayed value between Polar coordinate and Cartesian coordinate
6	EDGE +	Toggles between edge and crosshair modes	Toggle the operation between edge mode and crosshair mode
7	AUTO MANU	Toggles between automatic and manual modes	Toggle the operation between automatic mode and manual mode
8	PROG	Program key	Carry out the operation related to user program

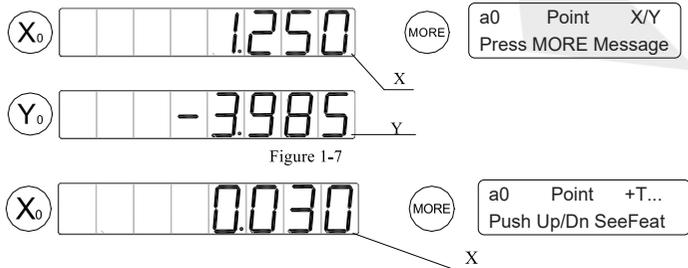
9	PRESET	Preset key	Carry out the operation related to presetting
10	STORE	Store key	Store the operation
11	RECALL	Recall key	Recall the stored features
12	PRINT	Print key	Carry out the operation of printing
13	SETUP	Setup key	Set the system parameters
14	ENTER YES	Enter key	Enter the operation
15	CANCEL NO	Cancel key	Cancel the numbers entered last time
16	FINISH	Finish key	Finish the operation
17	QUIT	Quit key	Quit the operation
18	0 9	Numerical key	Enter number
19	.	Decimal point	Enter decimal point
20	+ -	Positive sign and negative sign	Negate the inputted number
21	↑ ↓	View key	View the features or the function table
22	MORE	MORE key	View more information of a certain feature
23	Original point key	Original point key	Define the original point or offset the coordinate
24	×	Point feature key	Measure or construct points
25	Line feature key	Line feature key	Measure or construct lines
26	Circle feature key	Circle feature key	Measure or construct circles
27	Distance feature key	Distance feature key	Measure or construct distances
28	Angle feature key	Angle feature key	Measure or construct angles
29	Skew key	Skew key	Electronically aligns part for accurate measurement

Information Of Features

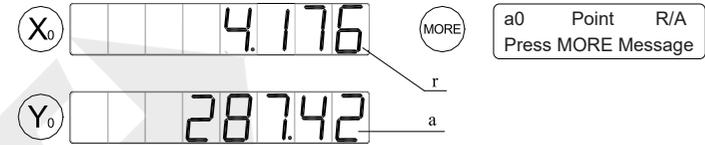
Features refer to a range of point, line, circle, distance, angle, rectangle and screw. In Cartesian and Polar coordinate, the displayed information of these features seems a little different, and the difference focuses on the position of the feature that the feature displays. In the following, we will only take the information of point for example and briefly introduce the displayed information in Cartesian and Polar coordinate. As to the other features, we will introduce their information only in Cartesian coordinate, and the displayed information in Polar coordinate can be gained according to the toggles of the Cartesian format and Polar format. Here it is very necessary to explain +T and -T. As to different features, +T and -T are endowed with different meanings. As to point feature, -T doesn't exist while +T indicates the farthest distance between the targeted point and the resulting point. As to line feature, +T indicates the farthest distance from the targeted point which is located over the upper right of the line to the line, and -T indicates the farthest distance from the targeted point which is located below the lower left of the line to the line. As to circle feature, +T indicates the farthest distance from the targeted point that is outside the circle to the circumference of the circle, and -T indicates the farthest distance from the targeted point that is inside the circle to the circumference of the circle.

Point

a) In Cartesian coordinate, the displayed information of the Point covers the current position of X and Y, together with the +T value. The displayed information as in Fig.13 indicates that it is an existing point feature. In Cartesian coordinate, its current position can be expressed as (1.250,-3.985). The second line displayed in the LCD window implies that if you press 'more', you can view other information of the point feature. Press the 'more' key, and the message is displayed as in fig



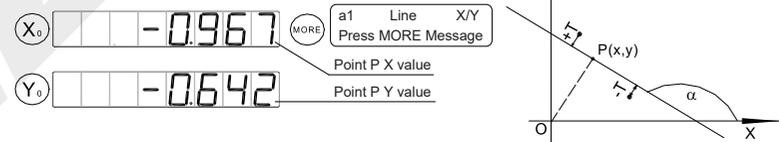
b) In Polar coordinate, the information of the point is displayed as in Fig. The displayed value of the X axis indicates the distance from the very point to the origin, and the displayed value of the Y axis indicates the value of the included angle that was made by the positive direction of X axis and the line that was constructed by the very point and the origin. The +T value of the point is as same as the former.



Line

The feature of line includes three pages of information.

1) The information of the point which is the nearest to the origin on the line. The message displayed in the LCD indicates that a1 is a temporary feature, and the position of the point is shown as in Fig.



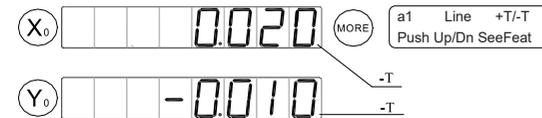
2) Press

'more', and the message is displayed as in Fig. The displayed value on the X axis indicates the value of the included angle that was made by the line and the positive direction of X axis.



3) Press

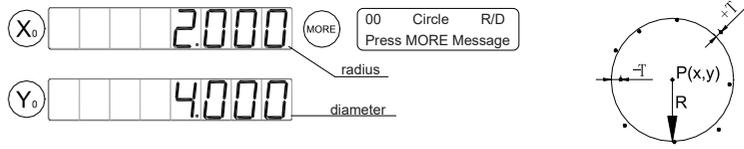
'more', and the message is displayed as in Fig. The displayed values of the X and Y axes imply the linearity of a1.



Circle

The circle feature includes three pages of information.

1) The information of the center point is displayed as in Fig., and 00 displayed in the LCD window indicates that the circle is a permanent feature. The point P is shown as in Fig.



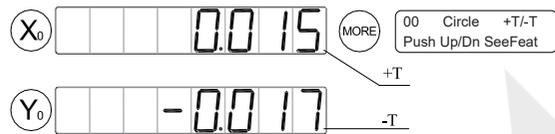
2) Press

'more', and the message is displayed as in Fig. The displayed values of the X and Y axes imply the value of the center of the circle.



3) Press

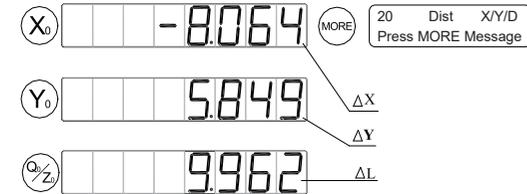
'more', and the information is displayed as in Fig. The X and Y axes displayed values indicates the degree the circle being approximate to a perfect circle.



Distance

The feature of distance includes three pages of information.

1) The first page of information is displayed as in Fig, and the number 20 displayed in the LCD indicates that the feature is a permanent feature.

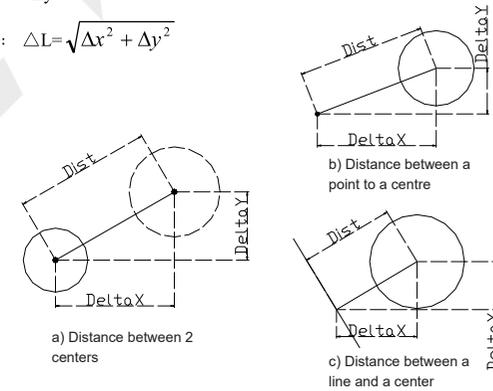


More details are displayed as in Fig. In this figure, the circle b) and c) respectively indicates the real meaning of the distance from the point to the circle and from the line to the circle.

X window : Δx

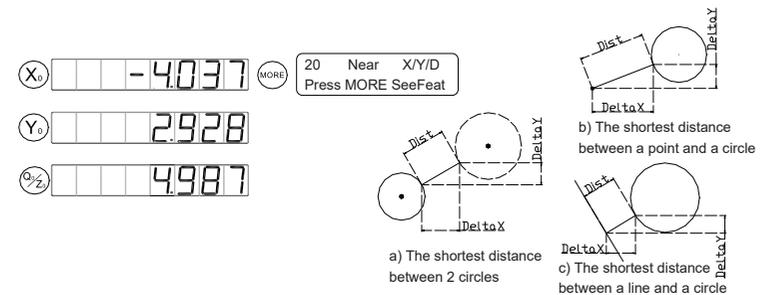
Y window : Δy

Z window : $\Delta L = \sqrt{\Delta x^2 + \Delta y^2}$



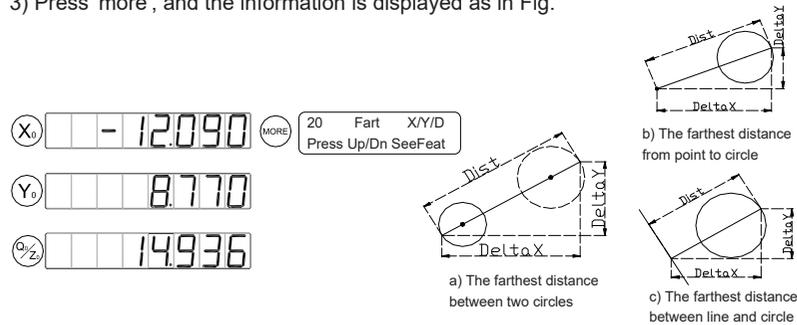
2) Press

'more', and the information is displayed as in Fig.



The displayed values on X, Y and Z axes respectively present the difference which is made by the two nearest points of the two features in the X direction and Y direction ((a) DeltaX, DeltaY) Meanwhile, the values also represent the actual distance between the two nearest points of the two features. Fig. (b) and (c) respectively represent the nearest distance from the point to the circle and from the line to the circle.

3) Press 'more', and the information is displayed as in Fig.

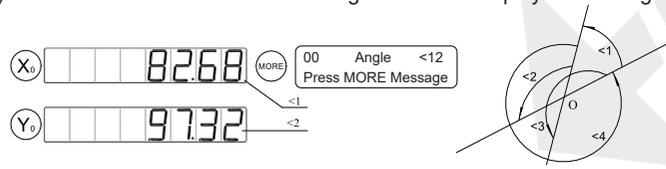


The displayed values on X, Y and Z axes respectively represent the difference which is made by the two farthest points of the two features in the X direction and Y direction. ((a) DeltaX DeltaY) Meanwhile, the values also represent the actual distance between the two farthest points of the two features. ((a) dist) (b) and Fig.(c) respectively represent the farthest distance from the point to the circle and from the line to the circle.

Angle

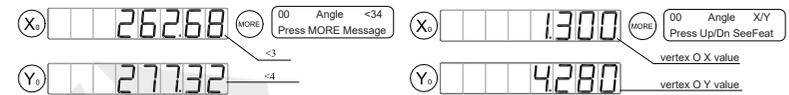
The feature of angle includes 3 pages of information.

1) The information of the measured angle's value is displayed as in Fig.



The information 00 displayed in the LCD indicates that the feature is a permanent feature. The X axis displayed value is the value of ∠1 (the value of the angle to be measured). The Y axis displayed value is the value of ∠2 (the supplementary angle of ∠1).

2) Press 'more', and the information is displayed as in Fig. The X axis displayed value indicates that ∠3 = 180 + ∠1. The Y axis displayed value indicates that ∠4 = 360 - ∠1.



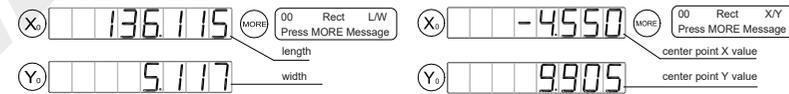
Information2 of Angle Feature

Information3 of Angle Feature

3) Press 'more', and the information is displayed as in Fig. The displayed values of X and Y axes imply the current position of the vertex of the angle.

Rectangle

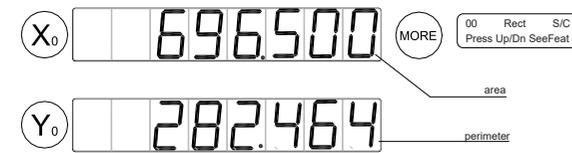
The feature of rectangle includes three pages of information.1) The length and width of the rectangle is displayed as in Fig.The displayed information 00 in the LCD indicates that the feature is a permanent feature. The Xaxis displayed value represents the length of the rectangle while the Y axis represents the width.



Information1 of Rectangle Feature

Information2 of Rectangle Feature

2) Press 'more', and the information is displayed as in Fig. The X and Y axes displayed values indicate the current position of the center point of the rectangle.



Information3 of Rectangle Feature

3) Press 'more', and the information is displayed as in Fig. The X and Y axes displayed values respectively represent the area and perimeter of the rectangle(For the time being, the data doesn't exist).

Getting Stared

Place the demonstration slide on your comparator. Perform each step of this demonstration in the order that it is presented. Feel free to repeat any section until you are proficient with the concepts and the methods used.

Applying Power

To apply power, press the power switch located at the back panel of the enclosure and the DRO is ON, and it will initialize and display the power-up screen. Then the LCD screen displays 'Please Waiting...' when the DRO is reading some important data, such as parameters of status last power down, three axes counter etc. If an axis or all axes have been set to Segment Linear Error Correction, then the LCD displays the message as in Fig. Which remind you to move the axis near the RI point and press the 'YES/ENTER' key to search axis' RI. Of course if you are sure that the axis has not been moved since last power down, you needn't to search RI. Press the QUIT key and return to the normal status.

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Move Near RI..

Probing Method

Points can be probed by using crosshairs or optical edge detector. If the probing method is not desired, select the desired probing method by pressing the 'EDGE' key.

The rod must be set up for the proper axis orientation. For the purpose of this demonstration, we suppose that if you move the crosshairs to the right, the X count will increase from 1 to 2 to 3 and not from -1 to -2 to -3. The same holds true for the Y axis. If you move the crosshairs up, the count will increase from 1 to 2 to 3. Move the crosshairs to the right. The number in the X display should increase. If it does not, that's to say the X axis needs to be reversed. Test the Y axis by moving the crosshair up. The number in the Y display should increase. If it decreases, that's to say the Y axis needs to be reversed. Move anti-clockwise the Z/Q axis, the number in the Z/Q display should increase. If it decreases, that's to say the Z/Q axis needs to be reversed. If you find that neither axis needs to be reversed, skip the paragraph about Reversing the Axes Direction and continue with Targeting Points. The user should better not reverse the setup that has been well done. If you find that one or both axes need reverse direction, perform the following steps: a. Press the 'SETUP' key on the Front Panel. 'Special measure' appears in the message window.

b. Press the  or  key until 'Axis Direction...' appears in the message window. c. Press the YES/ENTER key to enter the sub menu. 'Reverse X: NO' appears in the message window. d. Press the ENTER/YES key to reverse the axis (if the X Axis needs to be changed).

- e. Press the  or  key. 'Reverse Y: No' appears in the message window.
- f. Press the 'YES/ENTER' key to reverse the axis (if the Y Axis needs to be changed).
- g. Press the  or  key. 'Reverse Q: No' appears in the message window.
- h. Press the ENTER/YES key to reverse the axis (if the Q Axis needs to be changed).
- i. Press the 'FINISH' key, and "AXIS DIRECTION..." appears in the message window.
- j. Press the 'FINISH' key again to exit the Setup Menu. "Current Position" appears in the message window.

Repeat the axis orientation procedure located on a previous page to verify that the axes are reading correctly.

Targeting Points

You may have read this paragraph before but it deserves repeating because it is important that you know how to properly target a point.

'Targeting a point' is the process of telling that you wish to capture a particular point in the current measurement calculation.

In this section of this manual you will be using an edge detector or crosshairs. With the DRO in the Auto Edge configuration you only need to cross an edge of the part you are measuring. For each crossing you will hear a 'beep'; if you are in a measuring routine you will see the point entered.

If you are in the manual edge mode, for one thing, align the crosshairs on the feature you are measuring (such as the circumference of the circle) and then press the 'YES/ENTER' key.

Polar Coornate

Polar coordinate simultaneously computes the straight-line distance from the current datum to any point, and the angle that the line makes with the positive direction of X 'POL/CART' axis. Follow this procedure to see how it works.

If the message window reveals X and Y instead of R, A, therefore, press the 'POL/CART' key to select Polar coordinate.

Notice the entries in the Feature List that had X and Y labels, and you'll find that they have been changed into R and A. The X, Y points (which were measured relatively to the current datum), become R, A Points, which were also measured from the current datum. Use the  or  key to find a feature with an R, A component, and then look at the DRO Windows to see how the information of the feature is displayed in Polar coordinate. Press the 'POL/CART' key to return to Cartesian coordinate. Both the Feature Axes Windows and the Feature List display the information in an X, Y format.

Don't let polar measurements confuse you. The polar coordinates merely change the way the information is shown, it is still the same information, just as 1 inch and 25.4 millimeters are two different ways of expressing the same length.

In Cartesian measurements the distance is expressed with a pair of coordinates X and Y. This is the coordinate we are most familiar with. In a Polar coordinate we express a distance by using a pair of coordinates r and a. These represent the radial (straight line) distance and the angle magnitude.

Surveyors use polar coordinates all the time. When land is surveyed in the plot that is not defined by Latitude and Longitude (a version of Cartesian measurement) for all the corners of the property. Rather, it is defined by polar measurement. The survey will read "from boundary marker X23 (the origin) northeast 36°52' for a distance of 65.1 feet". This is polar measurement, where distances are denoted by traveling some distance in some direction from an origin. The surveyor used north as 0°, but north is not a standard direction when it comes to comparators so we use the positive X axis as our 0° line.

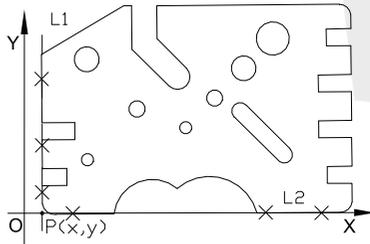
Scientific convention dictates that we use the counter anti-clockwise direction (right hand rule) to measure angles. So if you swing from the positive X axis around to the positive Y axis, the angle will increase.

Polar measurements can be very useful for things like point-to-point distance measurements (when the line isn't aligned with the X or Y axes of the part) and quick angle measurements.

Setting The Datum For Measurements

The system simultaneously uses 2 reference datum for measurement. One is fixed (absolute) while the other can be redefined (incremental) during the measurement session to make incremental measurements. Reference points for absolute and incremental measurements can be set by zeroing the absolute (datum 1) and incremental (datum 2) datum.

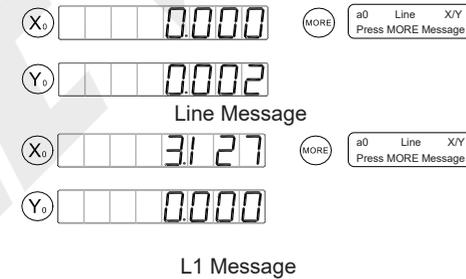
Absolute measurements are those referred to the absolute datum. The absolute datum is defined as the origin (0, 0), and should be set at the beginning of each measurement session. In the following example, the absolute datum will be set at the constructed intersection (point P of Fig.) of the horizontal skew line and an edge on the Y axis of the part and the X windows and Y windows display the current position, and the LCD windows indicate the present measurement is line measurement.



a. Press  the key. The Probe Line screen will be displayed. (Fig.)

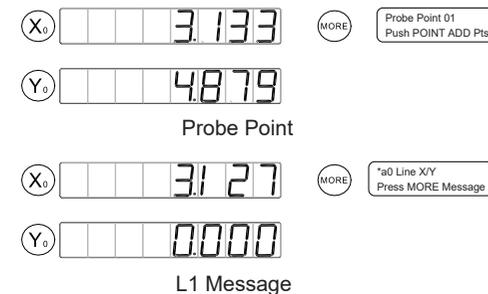


b. Target a minimum of 2 points along the L2. Press the  key after targeting each point. When all points have been entered, the Line Screen will show the actual orientation of the line.



c. Repeat step a, b to measure the line L1 as in Fig. Its message is displayed as in Fig.

d. Press the  key. The Probe Point screen is displayed.



e. Press the  or  key, and find vertical line L1. Press the  key to select L1. A checkmark (*) will appear next to the line number in the feature list indicating its inclusion in the construction.

f. Press the  or  key to find the horizontal line L2. Press  key to select L2



Line Message



Point Message

g. Press the  key to construct the point. A point will be constructed at the intersection of the vertical line and the horizontal line. The point (defined as a0) will be added to the feature list and its location will be shown on the Point screen.

The two lines used to construct the point and the other messages of the point can be obtained in the message window by pressing the  or  key

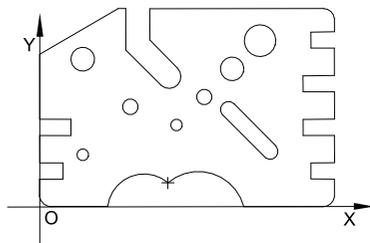


h. Press the  key to set the datum at the constructed point of intersection of the line L1 and L2, and the LCD screen displays the message as in Fig.

i. Press the  or  key to find the point a0 and press the  key to select it. The readout will automatically set the datum to the constructed point.

Point Measurement

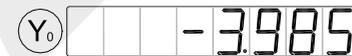
Points are easiest to probe or construct because they require very little interaction between the user and the rod. Follow these steps to measure several points on the part, as shown in the Fig.



a. Press the key. 'Probe Point 01' is displayed in the message window. If the message window displays 'Point 00', that's to say, the rod is in Backward Annotation status. After each point has been probed the LCD will display 'Point 01', 'Point 02' etc. If in Forward Annotation, the message window will display 'Probe Point #' (default point setting and count down with each point entry). The operator may override the default setting by pressing the key to increase the number of points. The # represents the number of points wanted to probe. For purposes of this demonstration we will assume that from here on the DRO is in forward annotation.

b. Press the 'YES/ENTER' key to target a point on the part. The number of points will minus by 1 automatically after pressing the 'YES/ENTER' key every time. The point will be entered into the point storage list. (The 'FINISH' 'ENTER/YES' 'CANCEL/NO' and 'QUIT' keys are active.)

c. Repeat step b until the expected number is reached. The measurement will be ended automatically, at the same time "a0 Point X/Y" is displayed in the message window.



Point Message



Point Message

d. Press the 'MORE' key to see another message

Average Point The average point or 'multi-point point' is a way to obtain more accuracy in point measurements by targeting the point several times and then averaging all the positions entered when generating the POINT feature. As in other multipoint measurements, up to 50 points may be entered. Average points (up to 50) may also be constructed by entering features containing positional information from the feature list. Construction is not allowed when you probe a feature. Refer to the last paragraphs in this section for construction information.

When the number is reached, the rod will calculate the feature and display it as "a0". When you measure a point, you will see X/Y in the message window. The X and Y data displayed in the axes windows represents the X and Y distance from the current datum to the selected point. Press the 'MORE' key, the +T data is displayed in the X axis window.

Line Measurement

Targeting the points between 2 and 50, calculate the line which best fits those points. Let's measure the line formed by the part's skewed axis and the left face as shown in Fig. The line feature's parameters are illustrated as in Fig.

- a. Press the  key to measure a line. In this example, Forward Annotation is available and thenumber of required data points for the line feature (3) is shown in the message window. If backward Annotation is used, no requirement will be noted but the number of points entered will be counted.
- b. Move the part to place the crosshairs over the first point on the line and press 'YES/ENTER' key. The location of the targeted point will be shown in the window and thenumber of required points will be reduced.

X₀ 6.848 (MORE) 02 More Points

Y₀ 0.000
location of targeted Point

X₀ -25040 (MORE) a0 Line X/Y Press MORE Message

Y₀ -0.351
Line Measurement

- c. Repeat step b. until all the points are targeted and entered. The line feature data will be displayed in the window. Press the 'MORE' key to view another message

X₀ 12357 (MORE) a0 Line <... Push Up/Dn SeeFeat

Line Message

X₀ 0.020 (MORE) a0 Line +T/-T Push Up/Dn SeeFeat

Y₀ -0.010

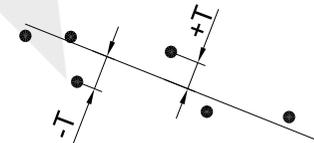
Line Message

- e. Press 'MORE' key to see another message.

When the rod calculates a line, it also computes the X, Y point on the line which lies closest to the Datum. However, this point, like all other points, is displayed relative to the current datum (either Absolute or Incremental). Pressing the 'MORE' key will display the angle information. The angle entry in the message window represents the angle the line makes with the positive X axis of the Reference Frame.

Then press the 'MORE' key to view +T and -T. The +T data is displayed in the X axis window and the -T data in the Y axis window.

These +T/-T numbers tell how close the worst 'outside' and 'inside' points were to the best-fit construction. The +T measurement shows you where the 'worst outside point' was; -T shows where the 'worst inside point' was located.



The mean of +T/-T

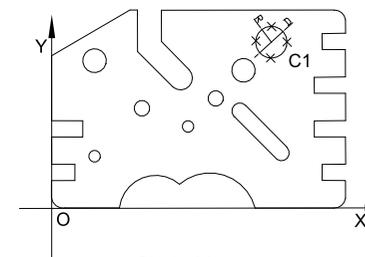
The +T and -T meaning for this feature is as follows:

+T: Straight-line distance from worst point (on side of line away from the current datum) to best-fit line.

-T: Straight-line distance from worst point (on side of line facing the current datum) to best-fit.

Circle Measurement

The ISP-AZ3020 enables you to make very precise calculations about any circle or arc of circle. Given anywhere from 3 to 50 points, can calculate the circle's center and radius. For example, use the large circle in the demonstration part and follow these steps:



Circle Measure

- a. Press the key  to measure a circle. The message is displayed as in Fig. In this example, Forward Annotation was used and the number of required data points for the circle feature is 3 points. If Backward Annotation was used, no requirement would be noted but the number of points entered would be counted.
- b. Move the stage to place the crosshairs over the first point on the perimeter of the circle and press the key. The location of the targeted point will be shown as in Fig. And the number of required points will be reduced.

X_0 -6.186 (MORE)

Y_0 -20.125
Probe Circle

X_0 18.281 (MORE) 01 More Points

Y_0 -20.125
Probe Circle

- c. Move the stage to place the crosshairs over the second point on the perimeter of the circle and press the 'YES/ENTER' key. The new location will be shown as in Fig. And the number of required points will be reduced again.
- d. Continue the process until all of the points have been targeted and entered. When all of the required points on the perimeter of the circle have been entered, the Circle Feature will be added to the feature list, meanwhile, its feature number and its data is displayed as in Fig.

X_0 19.474 (MORE) a0 Circle R/D
Press MORE Message

Y_0 38.947
Circle Message

X_0 6.047 (MORE) a0 Circle X/Y
Press MORE Message

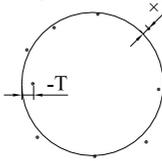
Y_0 -4.975
Circle Message

- e. Press the 'MORE' key to view the other message.
- f. Press the 'CART/POL' key to see the center of the circle displayed as a vector displacement from the datum with its displacement angle from the positive X axis.

X_0 7.831 (MORE) a0 Circle R/A
Press MORE Message

Y_0 32056

Circle Message in Polar Mode



Circle Message

- g. Press the 'MORE' key to view the coefficients/form data. The +T data is displayed in the X axis window while the -T data in the Y axis window. If the number of the probed points is greater than 3, then the value is greater or less than zero, else their value is zero. The +T/-T value meaning is as follows (Fig.62):
- +T: Distance from worst point outside best-fit circle to best-fit circle.
 - T: Distance from worst point inside best-fit circle to best-fit circle.

Constructions

Feature construction is the process of combining existing features to generate a new feature. A feature must either be totally constructed or totally probed; it cannot be generated by combining a construction and probing points. There is a comprehensive list of all feature constructions allowed. The list giving for each subtopic represents the components of the construction.

TYPE	YIELD
INTERSECTION	line-line, line-circle, circle-circle, Returns intersection points
EXTRACT	center of circle; point of line
OFFSET	points, parallel lines, and circles.
RELATIONSHIP	distances and angles.
SYMMETRIC	midpoints, bisector lines.
PERPENDICULAR	line-points.
COMPLEMENT BUILD	point-distance, point angle.

The following chart provides a comprehensive list of allowed constructions. To use the chart, first determine the type of feature that you wish to construct, press the corresponding key for the feature you are going to calculate, then enter one or two previously measured features you are using for the construction of a new feature. For instance, if you wish to find the point of intersection of two lines, first you press the key and then enter the two lines from the feature list.

Chart Of Construction Feature

1) Construct point

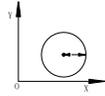
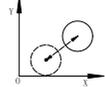
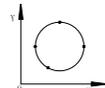
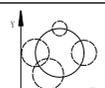
Construct type	Figure	Operate step	Remark
Two lines		1. Press  key to designate the type of constructing result. 2. Select two lines.	If the two lines are parallel, no point of intersection is get.
A circle and a line		1. Press  key to designate the type of constructing result. 2. Select a line and a circle.	The number point of intersection maybe is one, or two. It is maybe no one, also.
Construct type	Figure	Operate step	Remark
Two circles		1. Press  key to designate the type of constructing result. 2. Select two circles.	The number point of intersection maybe is one, or two. It is maybe no one, also.
Two points		1. Press  key to designate the type of constructing result. 2. Select two points.	
A circle and a point		1. Press  key to designate the type of constructing result. 2. Select a circle and a point.	
A circle		1. Press  key to designate the type of constructing result. 2. Select a circle.	Extract the centre of a circle
A rectangle		1. Press  key to designate the type of constructing result. 2. Select a rectangle.	Extract the centre of a rectangle

2) Construct line

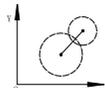
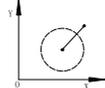
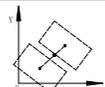
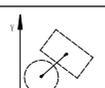
Construct type	Figure	Operate step	Remark
Two lines		1. Press  key to designate the type of constructing result. 2. Select two lines.	

Construct type	Figure	Operate step	Remark
Two circles		1. Press  key to designate the type of constructing result. 2. Select two circles.	
Many points		1. Press  key to designate the type of constructing result. 2. Select many points.	
A rectangle and a point		1. Press  key to designate the type of constructing result. 2. Select a rectangle and a point.	
A rectangle and a circle		1. Press  key to designate the type of constructing result. 2. Select a rectangle and a circle.	
Two rectangles		1. Press  key to designate the type of constructing result. 2. Select two rectangles.	
A point and a line		1. Press  key to designate the type of constructing result. 2. Select a point and a line.	
Construct type	Figure	Operate step	Remark
Two lines		1. Press  key to designate the type of constructing result. 2. Select two lines.	
A distance and a line		1. Press  key to designate the type of constructing result. 2. Select a distance and a line.	
A angle and a line		1. Press  key to designate the type of constructing result. 2. Select an angle and a line.	The line is the result of X axis rotating a designated angle and passing the designated point.

3) Construct circle

Construct type	Figure	Operate step	Remark
A distance and a point		1. Press  key to designate the type of constructing result. 2. Select a distance and a point.	The designated point is the centre of the circle and the distance is the radius of the circle.
A distance and a circle		1. Press  key to designate the type of constructing result. 2. Select a circle and a distance.	Move the circle a designated distance.
Many points		1. Press  key to designate the type of constructing result. 2. Select many points.	
Many circles		1. Press  key to designate the type of constructing result. 2. Select many circles.	

4) Construct distance

Two points		1. Press  key to designate the type of constructing result. 2. Select two points.	
Two circles		1. Press  key to designate the type of constructing result. 2. Select two circles.	Include the distance, the closest and farthest distance.
Construct type	Figure	Operate step	Remark
A circle and a point		1. Press  key to designate the type of constructing result. 2. Select a circle and a point.	Include the distance, the closest and farthest distance.
Two rectangles		1. Press  key to designate the type of constructing result. 2. Select two rectangles.	
A rectangle and a circle		1. Press  key to designate the type of constructing result. 2. Select a circle and a rectangle.	Include the distance, the closest and farthest distance.

Record User Programs

Initiate the programming process:

1. Press the 'PROG' key to record a program. The LCD screen displays the message as in Fig.
2. Press the   key until the LCD screen displays the message as in Fig.
3. Press the 'YES/ENTER' key to create a program. First you must input a program ID number with its range from 0 ~ 9.
4. Input the ID number 0, and then press the 'YES/ENTER' key. At this time the DRO is back to the normal status, the light above the 'PROG' key will blink, which indicates that is in the record mode. Clear skew settings and features:
5. Press the  key for about 3 seconds to exit the skew status. Meanwhile you will hear 2 beeps as the system exits the previous skew status.
6. Press the 'SETUP' key to enter setup mode. The LCD will display the message as in Fig.
7. Press the   key until the LCD displays the message as in Fig.
8. Press the 'ENTER/YES' key and come to the submenu to clear the features and the program. The LCD displays the message as in Fig.
9. Press the 'ENTER/YES' key to clear all temporary features. You will be asked to confirm your intention. Press the 'ENTER/YES' key to clear all temporary features.
10. Then clear all the permanent features. The operation is as identical as step 8 and step 9.
11. Press the 'FINISH' key twice to exit the setup. Skew the new part:
12. Mount the new part on the stage, and then move the stage to a position for convenient part targeting, and press key to skew the part. The light above the key is blinking continuously, and the message is displayed as in Fig.
13. Probe and enter a minimum of 2 points to skew the part. The part skew settings will be displayed in the LCD window. The light above the key is ON and not blinking. And the DRO will return to the normal status after the part was skewed. Set datum point:
14. Move the stage to place the crosshairs to a fit position. Then press the X 0 and Y 0 keys to zero the axes and set new datum point.

Run program?

Special Measure
Push Up/Dn Seek

Skew axis

Record program?

Clear...
Push Up/Dn Seek

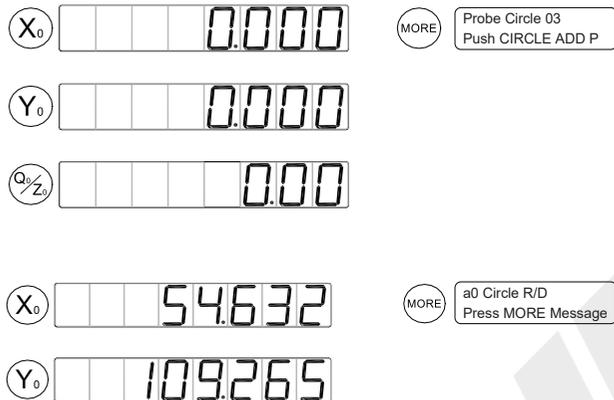
Prg Num:

Clr Temp. Feat. ?



Measure A Circle

15. Press the  key. The messages and current location are displayed as in Fig.



16. Probe and enter a minimum of 3 points to measure the circle feature, and the messages are displayed as in Fig.

Measure A Line

17. Press the  key. The messages and the current location of the measuring line are displayed as in Fig.



18. Probe and enter at least 2 points to measure the line feature. And the feature's data is displayed in the message window.

Construct A Distance With A Line And A Circle

19. Press the  key to measure a distance. And 2 points are needed to enter.
20. Press the  or  key to select the circle and the line measured. Then press the 'FINISH' key."/>

Running A Program

In the user program, the sequences of the key-presses include all the steps that are essential to complete a part measurement, and they are listed as follows:

Make a mark near the reference point on the part.

Mount the part on the stage.

Run the program

Run the program:

1. Press the 'PROG' key to run a program. The LCD screen displays the message as in Fig.
2. Press the 'YES/ENTER' key to run the program. First you must input a program ID number with its range from 0 to 9.
3. Input the ID number 0, and then press the 'YES/ENTER' key. The DRO starts to run the program0; it will quit the skew settings and clear all the features at first, and then skew a new part. The user program will stop when the new part was skewed and it waits for the user to target points. The message is displayed as in Fig.
4. Program runs to skew the part.
5. The displayed value of X and Y axes are automatically zeroed.
6. Measure a line on the part.
7. Measure a circle on the part.
8. Get the distance between the line and the circle.

Run program?

Prg Num:

Probe Line 02
Push LINE ADD Pts

Editing Programs

When a new program is tested, some adjustments might be added to increase measurement accuracy or efficiency. Also, existing programs can be edited to accommodate new (similar) parts. Programs can be easily edited to insert or delete program steps. Editing a program may involve some or all of the following procedures:

- ☒ Display the program steps.
- ☒ Expand a program to show details and change program steps.
- ☒ Insert new program steps.
- ☒ Delete program steps.
- ☒ Delete programs.

Display program steps:

1. Press the 'PROG' key to run a program. The LCD screen displays the message as in Fig.
2. Press the   key until the LCD screen displays the message as in Fig.
3. Press the 'ENTER/YES' key to edit the program. now you must input a program ID number with its range from 0 to 9.
4. Input the ID number 0, and then press the 'ENTER/YES' key. The message is displayed as in Fig. The number "000" indicates the step of the program and next to the number is the action the program will run.
5. Press the  or  key to show another program steps. A list of the program 0 is as follows

Run program?

Edit program?

Prg Num

000 Program

Step number	Program action	Explanation
000	Program	Indicate it is the user program
001	0	Indicate the user program number
002	Skew	Cancel previous skew settings
003	Skew	Skew a new part
004	Enter?	Probe a data point, and wait for the operator to
		press the  key
005	Enter?	Probe another point
006	Setup	Enter the Setup menu
007	Down	Step into the next menu
008	Enter	Enter the Clear features and program routine
009	Enter	Clear all temporary features
010	Enter	Confirm whether they are cleared
011	Finish	Quit submenu
012	Finish	Quit main menu
013	X0	Zero X axis
014	Y0	Zero Y axis
015	Circle	MMeasure a circle
016	Enter?	Probe a data point
017	Enter?	
018	Enter	
019	Line	Measure a line
020	Enter?	Probe a data point, and wait for the operator to
021	Enter?	press the  key
022	Offset	Measure a distance
023	Down	Press the  key to display current feature's message
024	Enter	Select current feature displayed
025	Down	Find the next feature
026	Enter	Select the feature found
027	Finish	End the selected features
028	End Program	End the user program

Insert New Program Steps

New program steps can be inserted in front of any program step. The process of inserting a new step consists of selecting the insertion point, recording the new steps and pressing the 'FINISH' key. In the example below a line measurement is added to the end of the program created earlier.

6. Press the  or  key to move to the fifteenth step, the LCD displays the message as in Fig.
7. Press the 'PROG' key to insert a special key. The message is displayed as in Fig.
8. Press the  or  key until the LCD displays the message as in Fig. Then press the 'ENTER/YES' key to insert the special action in the step. So when the program runs to this step, it will await the operator to press the 'ENTER/YES' key. At this time the LCD displays the message in Fig. That's to say, the new step has been inserted between step 015 and step 016 with its present No.016, naturally, the original step 016 moves backward to 017, and 017 to 018 until the movement of 028 to 029.
9. Press the 'FINISH' key to save the newly added step and quit editing the program.

015 Enter?

Special Key?

Finish Record?

Wait Enter?

016 Enter?

Delete Program Step

10. Edit the user program 0 and the LCD displays the message as in Fig.
11. Press the  or  key to find the step 16, the LCD displays the message as in Fig.
12. Press the 'NO/CANCEL' key to delete this program step, and each of the back steps moves one step forward orderly, and one is decreased from the total number of the steps.
13. Press the 'FINISH' key to quit editing program with saving the program.

016 Enter?

Encoder Resolution

The unit of the entered resolution is millimeter (mm).

Example: Set the resolution of Y-axis to 5µm.

- 1) Enter supervisor setup.
- 2) Press the  or  key until the message is displayed as in Fig.
- 3) Press the 'YES/ENTER' key. The message is displayed as in Fig.
- 4) Press the  or  key to browse the submenu until "X Resolution?" is displayed in the message window.
- 5) Press the 'YES/ENTER' key, the message is displayed as in Fig. And you should input a value.
- 6) Input new resolution for Y-axis (e.g. 0.005).
- 7) Press the 'YES/ENTER' key to confirm new resolution for Y-axis, and the DRO will return to the submenu item.

Encoder Reso ...
Push Up/Dn Seek

X Resolution?
Push Up/Dn Seek

Value: 0.000000

Z/Q-axis can be configured for linear scale or rotation encoder display. If you want to configure rotation encoder for the Z/Q-axis, you must set the resolution of the Q-axis correctly.

The resolution of the Q-axis setup is not identical to the X and Y axes. First, you have to clear the default setup and return to the normal status, and then zero the Q-axis displayed value.

Third, rotate the encoder for a circle. Do remember the Q-axis displayed value (e.g. 1228.67), finally, when you come to the resolution setup, you just have to enter the displayed value and you can get the Q-axis resolution.

- 1) Enter Supervisor setup.
- 2) Press the  or  key until the message is displayed as in Fig.
- 3) Press the 'YES/ENTER' key. The message is displayed as in Fig.
- 4) Press the  or  key until the message is displayed as in Fig.
- 5) Press the 'YES/ENTER' key, and then input the number (e.g. 1228.67) that has been calculated.

Encoder Reso . . .
Push Up/Dn Seek

X Resolution ?
Push Up/Dn Seek

Q Resolution ?
Push Up/Dn Seek

Observe : 1228.67

Setup RI Mode

RI Mode directly affects the searching for the RI point. Its function is to avoid the errors that the Linear Scale will move after the system is shut up which cause the displayed value is not accurate after the system is processing. There are 8 kinds of RI modes in total from Mode1 to Mode8, and the default mode is Mode1.

- 1) Enter Supervisor setup.
- 2) Press the  or  key until the message is displayed as in Fig.
- 3) Press the 'YES/ENTER' key and come to the submenu as in Fig.
- 4) Press the  or  key to browse the items until the message is displayed as in Fig.
- 5) Press the 'YES/ENTER' key and come to the submenu until the message is displayed as in Fig.
- 6) Press the  or  key to browse the submenu and confirm a mode you want.
- 7) Then press the 'YES/ENTER' key to select this mode. The message is displayed as in Fig. In this example we select 8 mode.
- 8) Press the 'FINISH' key to return to the normal status.

Set RI Mode . . .
Push Up/Dn Seek

Set X RI mode . . .

Set Y RI mode . . .

1 mode

* 8 mode

Language Selection

- 1) Enter Setup Menu.
- 2) Press the  or  key to browse the setup menu.
- 3) Press the 'ENTER/YES' key and come to the submenu as in Fig.
- 4) Press the  or  key to enter the submenu.
- 5) Press the 'ENTER/YES' key when the message is displayed as in Fig. And English is selected. If you press the 'ENTER/YES' key as the message is displayed as in Fig. Chinese is selected.
- 6) Press the 'FINISH' key to return to the normal status.

語言/Language...
Push Up/Dn See

中文 Chinese
Push Up/Dn Select

*英文 / English
Push Up/Dn Select

Instrument Usage

ISP-AZ3020 series $\Phi 300$ mm digital measuring projector is a precise and excellent effective measuring instrument integrating optics, mechanics and electronics. It is used broadly in the workshop of the trades such as mechanic, meter, electronics and light industry, as well as the laboratories, metric room of the academes, research institutions, measurement-inspecting department etc. This instrument can sufficiently inspect various kinds of surface and profile of complicated workpiece, such as template, cam, tread and gear, perform milling cutter including machine tools and parts.

Instrument Specification

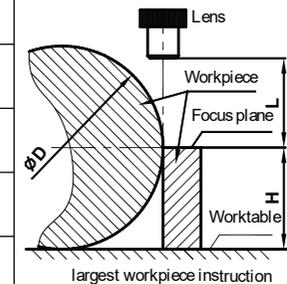
Screen size (mm): $\Phi 312$, used range $> \Phi 300$

Screen rotary range: $0\sim 360^\circ$

Resolution: 1' or $0.01''$

lens (L, H, D please refer to Fig) (Size unit: mm)

Magnification	10× (optional)	20× (optional)	50× (optional)	100×(op- tional)
Object view	$\Phi 30$	$\Phi 15$	$\Phi 6$	$\Phi 3$
Working distance L	77.7	44.3	38.4	25.3
Maximum height H	90	90	90	90
Maximum diameter D	180	125	110	55

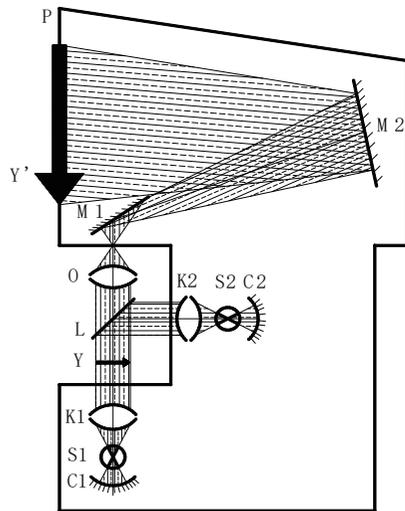


Instrument Working Principle

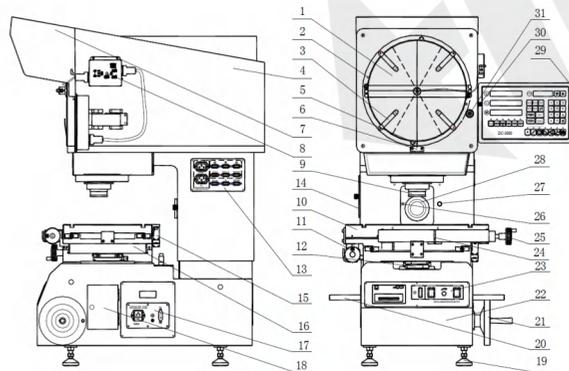
The working principle of the digital profile projector is shown as Fig below. The workpiece Y to be measured is put on the worktable. Irradiate it by the transmissive illumination or reflecting illumination, it is magnified by lens O and imaging Y' (upside-down with Y) after be reflected onto the frosted glass of the projection screen P through M1 and M2. If the reflective mirror M1 is replaced by the positive image system, Y' will be the positive image with Y. This would be more convenient for users to measure. ISD-AZ3020 series is called "erect image" projector.

Y' can be measured on the screen by the standard glass scale. And we also can measure it by comparing with a magnified standard presetting picture. Divide the measured data by the magnification, and then we get the size of the workpiece. Furthermore, you can use the table to measure Y by the digital measuring system. And you also can use the angle measuring system to measure the angle of the workpiece.

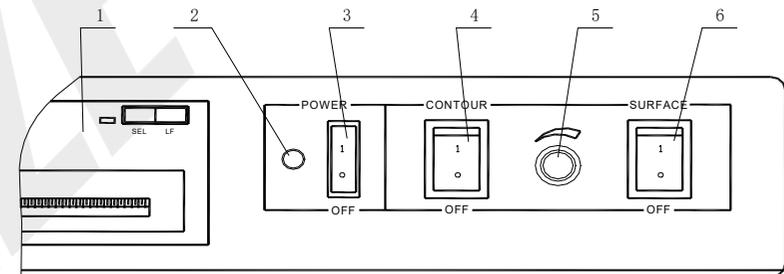
S1 is the transmissive illumination while the S2 is the reflective illumination. And K1 is transmissive condenser while the K2 is the reflective condenser. The illuminations must be used separately. This is determined by the properties of the workpiece. The semi-reflective mirror L can be only used to conjugate the reflective illumination.



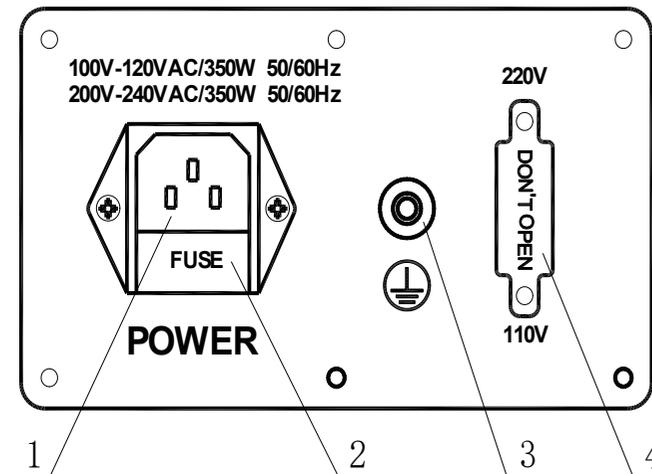
Structure



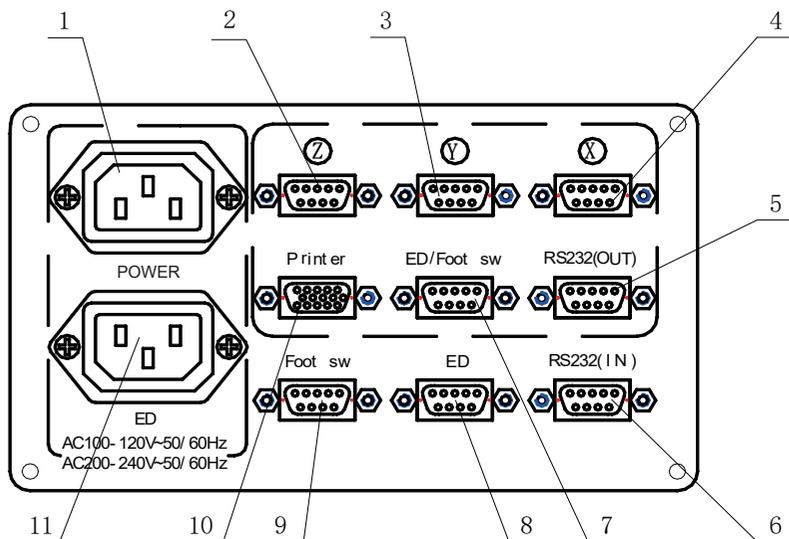
- | | | |
|---|--------------------------------------|-------------------------------|
| 1. Projection screen | 2. Screen rotating handle | 3. Spring fixture |
| 4. Projection box | 5. Zero calibration board | 6. Screen zero mark |
| 7. Light cloak | 8. Edge detector | 9. Lens |
| 10. Worktable | 11. Y axis handwheel | |
| 12. Transmissive illumination pusher | 13. Signal exchange board | |
| 14. Big door | 15. X axis linear scale | 16. Y axis linear scale |
| 17. Power board | 18. Small door | 19. Horizontal adjusting bolt |
| 20. Carrying handle | 21. Lift handwheel | 22. Main body |
| 23. Operating panel | 24. X axis fast handle | |
| 25. X axis handwheel | 26. Handle for Reflective condenser | |
| 27. Adjusting handle for reflective light | 28. Reflective condenser. | |
| 29. ISP-A5000 Multi-functional data processing system | | |
| 30. Screen-locking handwheel | 31. Screen rotating adjust handwheel | |



- | | | |
|-------------------------------------|-----------------------------|----------------------|
| 1. Mini-printer (optional) | 2. Power indicator light | 3. Main Power switch |
| 4. Transmissive illumination switch | 5. Illumination adjust knob | |
| 6. Reflective illumination switch | | |



1.Input Power 2.Fuse of power 3.GND 4.Voltage Switch cover



- 1. Power
- 2. Angle encoder connector
- 3. Y Linear scale connector
- 4. X Linear scale connector
- 5. Computer RS232 connector
- 6. RS232 connector
- 7. Footswitch and RS232 connector
- 8. Edge detector connector (It's used when the Footswitch and Edge detector are used at the same time)
- 9. Footswitch connector
- 10. Printer connector
- 11. Spare power

Uncover And Fixing

Unclose all of the packages, take out the manual of the instrument and read this chapter before operating.

Unscrew the four fixing bolts of the baseboard. Move the instrument to the pre-set work stage. The stage must be enough firm; it must have the ability to support a weight more than 350Kg.

Put on the four horizontal adjusting bolts and adjust them to make sure the instrument horizontal. (You can put the level on the worktable to inspect).

The screen of the instrument should avoid being irradiated by windows or strong light source for it would decrease the contrast of the screen.

Take out the connecting board on the worktable which is used for fixing the X axis and Y axis. Now the worktable can be moved by the hand-wheel or the handle.

The power supply can be switched either 220V or 110V.

Instrument Operation

Adjustment for resuming state

1) Take out the lens, and then turn on the transmissive illumination. If the image of the filament is illegibility or does not on the center of the screen, please do as following:

2) Open the small door on the right of the instrument, unscrew the bolts, and then move the whole set of the illumination module up and down. On the screen, the image of the filament would change form illegibility to clear.

3) When the filament is almost clear (it needn't be too clear) and is on the center of the screen, please fix the bolts and put on the lens. Now the adjustment is completed.

Replacing the lamps (refer to Fig below)

1) Open the big door on the right of the instrument.

2) Unscrew the bolts (1) and take out the whole illumination module.

3) Take out the halogen lamp (8).

4) Put on the new lamp (Please hold the lamp by matting a paper or soft cloth).

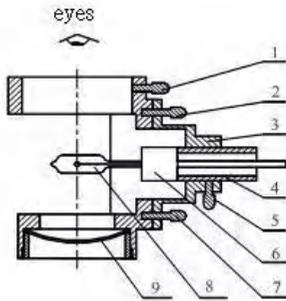
5) Observe the filament and the image which is reflected from the concave mirror (9) by eyes from the top. If they are not superposition, please:

6) Draw the lamp holder (4) side to side. Make the filament and its image overlap at the right-and-left way. Then screw the bolts (5).

7) Unscrew the bolts (2) and (7). Make the adjusting set (3) to be the vertical of the paper, and then move it parallel or obliquely until the filament and its image overlap at the vertical of the paper. Then screw the bolts (2) and (7).

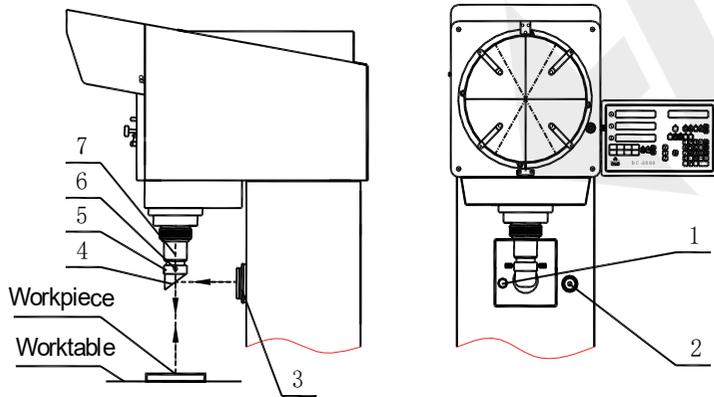
8) Fix the whole illumination module back to the instrument again.

Actually, it needs not so lot steps to replace the lamps, only step (1), (3) and (4) are available because of all lamp holders are pre-adjusted before leaving factory. The filament will not be departure from the optical-axis obviously if the specification of the lamp is correct



The adjustment of the reflective illumination (refer to Fig below)

- 1) The method of replacing the lamps is the same as "Replacing the lamps"
- 2) Install the holder of half lens (4) on the lens (6). Let the mirror faces the reflective condenser (2). Then turn on the reflective illumination.
- 3) Please unscrew the handle (1) and move the reflective condenser (2) up and down. Then screw the handle (1) when the reflective condenser (2) is as high as the half lens (3).
- 4) Put the workpiece onto the worktable. Make sure it is within the reflective illumination range. The image of the workpiece appears on the screen after focusing.
- 5) You can rotate the drawtube of the reflective condenser (2) according to the size of the workpiece to change the area of the light range. The image of the workpiece becomes lighter as the light range becomes smaller.



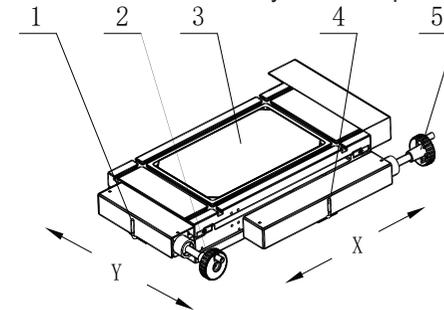
1. Adjusting handle of reflective condenser
2. Condenser -locking screw
3. Reflective condenser
4. Half lens
5. Holder of the half lens
6. Fixing bolts of the holder
7. Lens

Worktable operation(refer to Fig below)

After turn on the main power, the coordinate value of X axis and Y axis appears on the multi-functional data processing system ISP-AZ3020 series. The value changes following the movement of the worktable. The positive and the negative value of the X, Y coordinate can be set through setting the parameters of the ISP-AZ3020 series as your favorite.

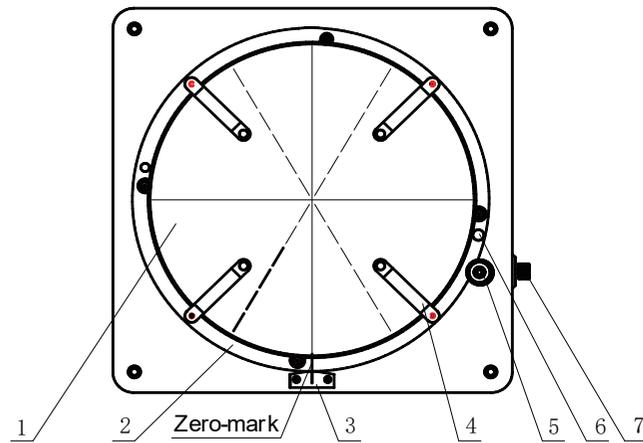
The movement of X and Y axes: besides being driven through the hand-wheel, the X and Y axes can also be dragged by the fast handle . And the handwheel is used for focusing and lifting the worktable. Please turn the handlewheel when using the X and Y axes to measure. And please be sure to turn it smoothly and softly.

When you use the X and Y axes to measure, usually you should move the worktable side to side for several times after focusing. That would be more convenient to measure because the worktable is running into measuring state from the still state. Please return the X and Y axes to the symmetrical position after measuring.



Projector screen operation(refer to Fig below)

1. Projection screen
2. Projection screen frame
3. Zero calibration board
4. Spring fixture
5. Screen rotating adjust handwheel
6. Screen rotating handle
7. Screen-locking screw



Turn on the main power. The rotating angle value of the screen will appear on the ISP-AZ3020 series. The value of angle can be displayed in DD (centigrade) format or DMS (degree-minute-second) format through setting the parameter of ISP-AZ3020 series previously. For example: $3^{\circ}36'00'' \Leftrightarrow 3.60^{\circ}$.

When the locking screw is unscrewed (7), the screen can quickly move circlewise by dragging the small handle (6), or slowly move by turning the rotating adjust handwheel (5). And slowly movement should be used when measuring angles.

The four spring fixtures on the projection screen (4) can be used to nip the magnified standard picture or the glass scale, which is used for the profile comparison measurement.

When the white line on the screen aims at zero mark, the level line on the screen is parallel with the X coordinate. Please adjust the edge of the workpiece to parallel with the level line so that you can begin the X coordinate measurement now.

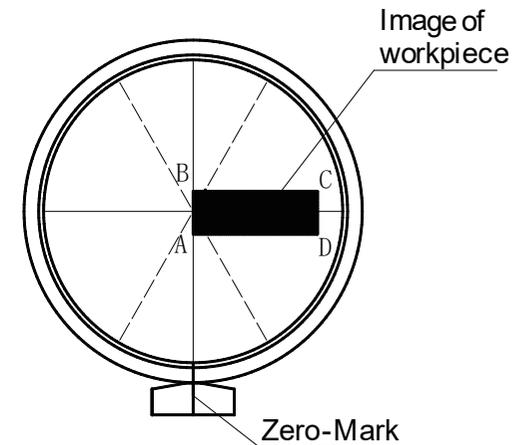
There are some standard graduation lines such as 30° , 60° , 90°or 45° , 90°on the screen. They can be used to measure these special angles through comparison. Therefore you can take the angle measuring system to measure the angles just by counting the deviation between them.

Measurement Method

Coordinate measurement: Include One-dimensional measuring and Two-dimensional measuring

One-dimensional measuring (refer to Fig below)

- 1) Put the workpiece onto the worktable and focus it after choosing the suitable lens.
- 2) Turn the projection screen to the zero mark, and then aim the white line of the screen frame at the zero mark.
- 3) Adjust the workpiece parallel with the measuring axis. BC is parallel with the X axis.
- 4) Move the worktable to aim the measuring edge AB at the vertical graduation line of the screen. Zero the value of the X coordinate.
- 5) Move the X axis to aim the other edge of the workpiece CD at the vertical graduation line of screen. The value of the X axis is the size of AD edge.



Two-dimensional measuring (refer to Fig below)

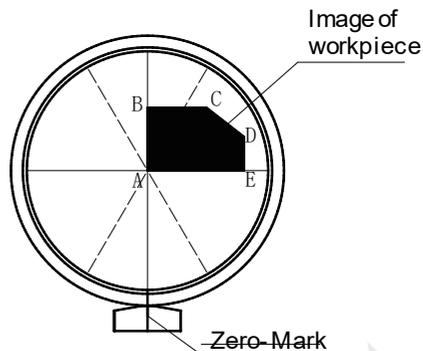
- 1) Aim the zero line of the projection screen at the zero mark.
- 2) Put the workpiece onto the worktable. Please choose a bigger magnification of the lens and adjust the focus.
- 3) Adjust the measuring edge to be parallel respectively with X axis and Y axis. For example: $AE \parallel X$, $AB \parallel Y$.
- 4) Move the worktable to aim the image point A of workpiece to the cross graduation point of the screen. Zero the value of X axis and Y axis.

5) Move the worktable again. Aim the image point C or D to the cross graduation points. Now the value of the X axis is the measured value of BC or AE. And the value of the Y axis is the value of AB or DE.

6) Through the SKEW function of the multi-functional data processing system ISP-AZ3020 series the position of the workpiece can be put arbitrarily without any precise adjustment. Only need to aim the worktable to the A, B, and C or D on the cross graduation point respectively, you

would get the length to be measured. This operation is a time-saved and efficient way. The details please refer to the ISP-AZ3020 series manual.

7) Connecting the RS232 port and the computer. The professional software M2D (optional) can process the data automatically and draw out the profile of parts. The result of measurement and drawings can be output through the printer. These can enhance the ability and upgrade the effect of the measurement. And the workpiece can also be put on the worktable arbitrarily without any precise adjustment.



Angle measurement(refer to Fig below)

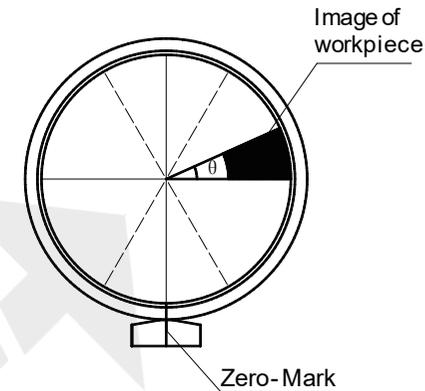
Put the workpiece onto the worktable. Select the lens base on the size of the workpiece and then focus.

Aim the vertex of the angle to the cross of the screen.

Turn the screen and aim a random graduation line at one edge of the angle to be measured, and then zero the Q axis.

Turn the screen again. Aim the line at the other edge of the angle to be measured. Now the displayed value of Q axis is the measured value of the angle θ .

Through the graduation lines on the screen which have an angle of 30° , 60° , 90° or 45° , 90° ... (With a precision $1'$) to the level graduation line, you can measure these special angle values by the comparing measurement.



Measure by comparing with the “magnified standard picture”.

This method is suitable for the large amount or complicated situation. Please take the following steps:

1) Choose the lens basing on the size of the workpiece. Design a magnified picture with the same magnified-times as the lens. Please product the picture with a transparent plastic material which has little contractibility. On the picture you can draw out the limit of tolerance. For example, if the size of workpiece is $\Phi 25$, you can choose the $10\times$ lens and draw a picture with the proportion of 10:1. The following standard magnified pictures are ready-made: circle-arcs, angles, gears, screws and grids.

2) Nip the standard magnified picture on the screen by the four spring fixtures.

3) Put the workpiece onto the worktable. Then focus it. Move the X-Y axes of the worktable to make sure that the workpiece overlaps the standard magnified picture.

4) It is regular if the deviation between the image and the picture is within the limit of tolerance. Otherwise it is irregular. The deviation can be measured by the X /Y coordinate.

Use the glass ruler (optional) with the resolution of 0.5mm to measure the image of the workpiece on the screen directly; the data which is smaller than 0.5mm can also be measured by the X/Y coordinate. Then divided by the magnified times of the lens, the last result is the size of the workpiece.

Instrument Maintenance

Digital measuring projector is a precise instrument integrating optics, mechanics, electricity and computing technique. It should be maintained properly and frequently. A good maintenance can prolong the longevity and keep the precision.

The instrument should be placed in the dry and clean room with the temperature of $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$, and the humidity under 60%. It can avoid that the surface of the optic parts are moldy, the metal parts are rusted, or the dust fall in rails. This can avoid affecting the precision of instrument and the imaging quality of the optic system.

The surface of optic parts should be kept clean and mustn't be touched by finger. Dust on the surface can be cleaned by soft brush. If there is too much dusts that affect the normal operation, please wipe it softly by the defatted cotton or the lens-cleaning paper dipped with some toluene or the mixture of ethanol and ether.

Please don't touch the projection screen while operating because it is a frosted glass. It would be unclear because the surface will be covered by dust and oil after longtime using. Users can wipe the whole screen gently by the clean wet gauze dipped with some neutral detergent. Then you should wipe the screen with clean wet gauze for several times to get rid of the detergent. Be cautious please don't dip with too much water for fear that would drop down to the worktable which would cause rusted of the metal. Or you can cover a plastic pellicle on the worktable previously. You can call your dealer to do it if it is too much difficult for you.

Regarding the exposed metal of the instrument, it should be wiped with the aviation gasoline termly or after used, and then daubed with the rust-proof grease to avoid being rusted.

The lens, the worktable and the other accessories of the instrument have a high assembling and calibrating precision. Do not uncloset any of the adjusting screws and tightening screws without dealer's permission. You can ask the dealer for inspection if the instrument is out of order. The malfunction or the lose-precision of the instrument would not be considered as warranty if that is resulted for the users unclosing them without any permission.

Whether the cold fans work properly relates to the orderly work of the instrument and the longevity of lamps. Users should pay attention to such a problem and contact the dealer at once when the instrument is out of order.

Regarding the precision of the worktable, it has already been applied the error compensation by the data processing system ISP-A5000 series within the producing process. Do not change the value of the error compensation and corresponding parameters without any permission. Otherwise that maybe causes the malfunction and incorrect precision of the instrument.

Please turn off the illuminations of the instrument after work. Do not turn on all of the reflective illumination and transmissive illumination at the same time unless necessary. Besides saving energy, it is also propitious to keep the well state of the instrument and prolong the longevity of the lamps.