

ISP-A1000E-E

## Profile Projector Operation Manual



www.insize.com

MN-ISP-A1000E-E

V0

<https://m.insize.com/page-75-145.html>

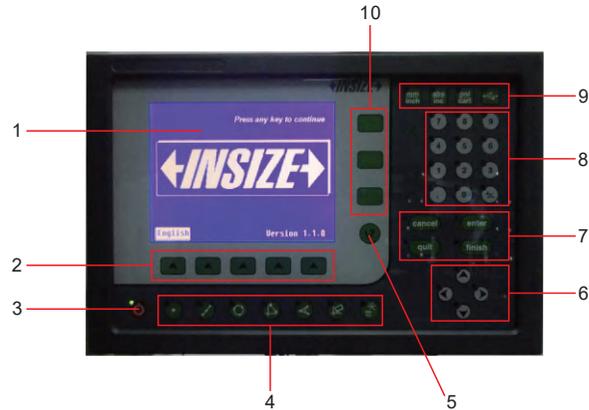


- EN -- Please scan the QR code or visit the website for operation manual.
- IT --- Scansiona il codice QR oppure visita il sito web per il manuale d'uso.
- CZ -- Pro návod prosím naskenujte QR kód nebo navštivte webovou stránku.
- ES -- Por favor, escanee el código QR o visite la página web para ver el manual de instrucciones.
- FR -- Veuillez scanner le QR Code ou visiter notre site web pour accéder aux manuels d'utilisation.
- DE -- Bitte scannen Sie den QR-Code oder besuchen Sie die Website für die Bedienungsanleitung.
- PT -- Para aceder ao manual de instruções, por favor, faça a leitura do código QR ou visite o nosso site.



## Description

### 1 Key functions:

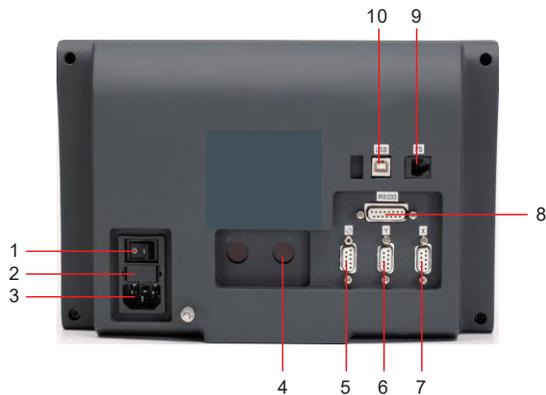


1. LCD Display
2. Soft Keys
3. LCD Standby On / Off Key
4. Feature Measurement Keys
5. Help Keys
6. Arrow Keys For Navigation
7. Utility Keys
8. Numeric / Function Keys
9. Coordinate And Unit Switch Buttons
10. Axis Reset Keys

- Inch / mm Key
- Absolute / Increment Key
- Polar / Cartesian Key
- Point Feature key
- Line Feature Key
- Circle feature key
- Distance Feature Key
- Angle Feature Key
- Skew Feature Key
- Wonder Feature Key
- Point create function
- Line create function
- Circle create function
- Arc create function
- Construct

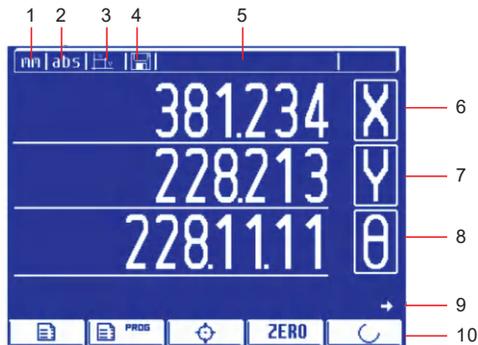
- Cross Hair measurement
- Automatic Edge Detector measurement (ISP-A5000)
- Counter clock wise direction
- Clock wise direction
- Degree Decimal mode (90.0000°)
- Degree Minutes Seconds display mode (90°.00'.00")
- Contrast level increase
- Contrast level decrease
- Select
- Exit
- Open
- Yes
- No
- On (Disable)
- Off (Enable)
- Auto edge detection setup (ISP-A5000)
- Engineering Setup
- View Results
- Delete Selected Result
- Delete all result
- Program menu
- Tolerance option
- Print Result Buffer
- Repeat Function
- Centre-Near-Far Key. Visible only when result is constructed Distance Either from two lines or two circles.
- Center Center Distance between two circles or lines
- Far Nearest Distance between two circles or lines
- Near Farthest Distance between two circles or lines

2 Back panel:



1. ON/OFF Switch 2. Spare Fuse (250VAC, 800mA) 3. Power Inlet Point 4. Connector for Edge Detector (Optional) 5. Rotary Encoder Input 6. Y Linear Encoder Input 7. X Linear Encoder Input 8. Printer Interface 9. Foot Switch connector 10. USB Connector

3 Layout of the Screen:



1. Unit  
 2. Measurement Mode  
 3. Coordinate System  
 4. Permanent Storage  
 5. Message Window  
 6. X Axis  
 7. Y Axis  
 8. Angular display  
 9. Scroll Soft Key status  
 10. Soft Key

Setup

The setup can be accessed by pressing the followed by key . The user will be prompted for password. The password is "98563". Use or key to scroll within the menu.



- ◆ No. of Axis: Selects the no. of axes to display.
- ◆ Annot Bck/ Annot Fwd: Selects Forward annotation or Backward annotation.
- ◆ Annotation points: This is used to set Annotation points for each measurements.
- ◆ Relational parameter: This is used for Wonder function.
- ◆ Sleep Mode Time(Min): DRO stand-by Time to save power.
- ◆ Key Beep Enable: Enables / disables beep on every key press.
- ◆ Program Lock: Enables / Disables new Programs.
- ◆ Persist Memory: Enables / Disables Permanent storage of result memory.
- ◆ Diagnostics: Keyboard diagnostic.
- ◆ Select Axis: Axis specific settings.
- ◆ Apply Comp X-axis: X axis calibration selection:  
 None – No calibration;  
 L.comp – Linear compensation;  
 S.Comp – Segmented error; compensation;  
 Grid – Grid Compensation.
- ◆ Apply Comp Y-axis: X axis calibration selection:  
 None – No calibration;  
 L.comp – Linear compensation;  
 S.Comp – Segmented error; compensation;  
 Grid – Grid Compensation.
- ◆ Edit User info: Enables user to set user information like Customer Name, Machine Name and Operator Name.
- ◆ Serial Communication: Enables the user to set the Serial communications parameters.

- ◆ Set Factory Settings: All the engineering settings are set to factory default parameters.
- ◆ Configure Footswitch: Enables the user to assign any key from keyboard to footswitch 1 and 2.

### X, Y Liner Setup

- ◆ Scale Resolution: Sets the scale (encoder) resolution (0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50µm).
- ◆ Display Resolution: Sets the display resolution (0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50µm).
- ◆ Axis Direction: Sets encoder counting direction.
- ◆ Machine ref: Sets machine reference for the axis.

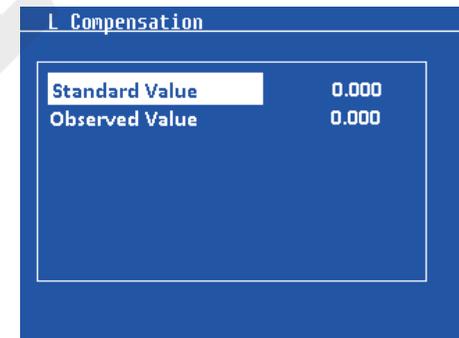
### Z Angular Axis

- ◆ Count per Revoln (CPR): In case of auto, the DRO calculates the counts between the two index marks and calculates the CPR automatically. In case of manual selection the user needs to enter the CPR value.
- ◆ Resolution (Deg): Selects the display resolution for the angular axis (0.5, 0.2, 0.1, 0.05, 0.01, 0.005, 0.001, 0.0005°).
- ◆ Axis Direction: Sets encoder counting direction (CW or CCW).
- ◆ Machine Ref: Sets machine reference for the axis.
- ◆ Count Mode: Selects the counting mode (Rollover or Continues).
- ◆ Display Mode: Selects the display units: DDMMSS or DDDEC.
- ◆ Axis Lock: Enables / Disables the angular axis position settings.

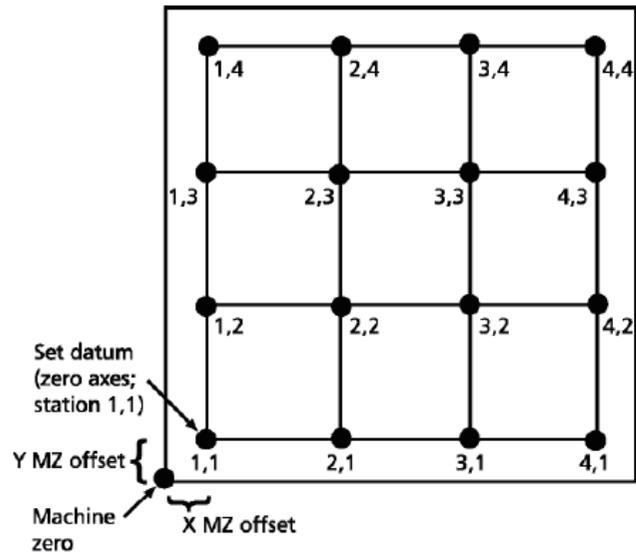
### Axis Calibration

Axis calibration is required to compensate for errors arising due to wear and tear in machine, encoder misalignment etc. Each axis can be calibrated for Linear Errors or Segmented errors as applicable.

- 1 Linear Error Correction (L. Comp/LEC): In this mode place a slip gauge of standard length on the X-Y table. Align it properly for calibration. Now bring cross hair to one of the edge of slip. Reset the axis. Now move the crosshair to other end of the slip and note down the display reading. Now enter the Linear compensation mode for that axis by selecting {L. Comp} at "Apply Comp X Axis". Enter the standard value as the slip value and the observed value using the numeric keys on keyboard. Press [Enter] to confirm. The DRO will calculate the linear calibration factor and stores into its memory. The user can edit this calibration factor by changing the observed value or the standard value in the same mode. After doing this you may check the axis performance by measuring different slips and confirm the accuracy.



- 2 Grid Calibration: It is also referred to as Non Linear Error correction (NLEC). In this the entire measurement area is divided into a grid. Each grid cell compensates for variation with its own error correction coefficient. It is mandatory to set the machine reference for each axis before NLEC. Specify the nominal and measured X and Y coordinates from the standard during the setup process. NLEC requires a repeatable machine zero defined on startup.



### Machine Reference

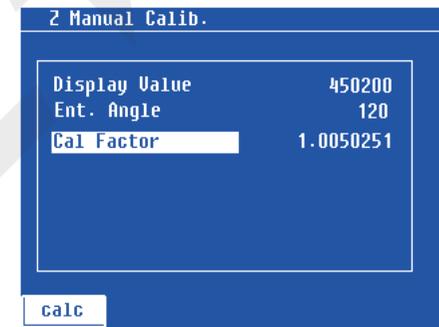
Here the Machine reference can be set for the selected axis. The standard reference output from the encoder is used for referencing. This is used only in case Segmented Linear compensation is selected.

Calibration Procedure:

- ◆ Keep the encoder position near to the desired reference on the encoder.
- ◆ Press { **←** } key in "Machine Ref." in axis settings. "Homing" Message is shown on the screen.
- ◆ Pass the reference mark on the encoder. Here the DRO will reset the axis on the reference mark.
- ◆ Go to the machine reference position and press { **Set** } key. Normally this is the start position of the segments

### Calibration procedure for Z (Angular) Axis

- 1 Manual Calibration of Z axis: User can calibrate angular axis manually by pressing manual softkey. Display value will show counts of respective rotation. User will enter angle of rotation in seconds. Now user can calculate calibration factor by pressing calc softkey. After calibration press [Enter] to save the calibration factor. Press [Cancel] if the user wishes to exit without saving.

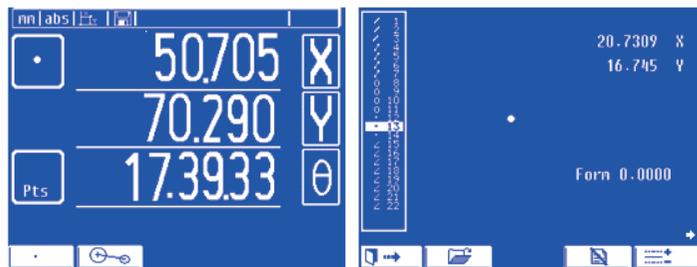


- 2 Auto Calibration of Z axis: User can calibrate the angular axis automatically by selecting the { **Auto** } key. The DRO waits for two complete rotations of the encoder and then calculates the calibration factor by calculating the counts between the two reference marks on the encoder. To calibrate the Z axis using auto mode requires only one condition that it must have only one reference mark for each rotation.

## Measurement

### 1 Point Measurement:

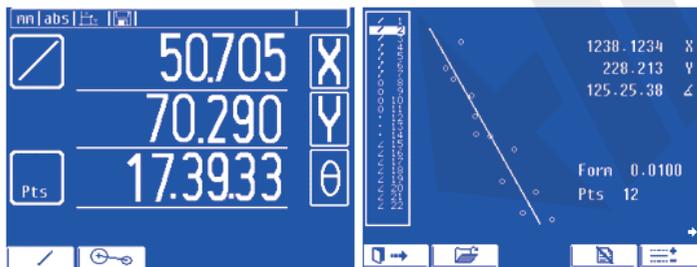
- ◆ Press [  ] key to measure a point.
- ◆ Now move the X-Y table near to the desired point. Match cross hair on the point and press [ **enter** ] key.
- ◆ Take more points or if sufficient points are taken press [ **finish** ] key.



### 2 Line Measurement:

A line can be measured by selecting between 2 to 20 points.

- ◆ Press [  ] key to measure a line.
- ◆ Now target a point on the line and match cross hair on it. Press [ **enter** ] key. Now in similar manner probe sufficient points to form a best fit line.
- ◆ And then press [ **finish** ] key.

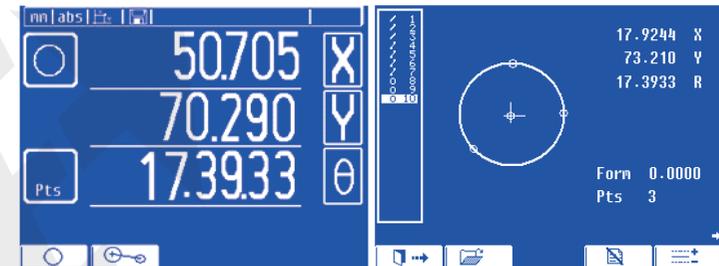


### 3 Circle Measurement:

A circle can be measured by selecting between 3 to 30 points.

- ◆ Press [  ] key to measure a circle.

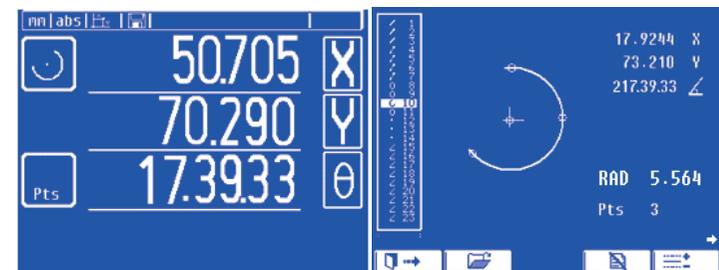
- ◆ Now target a point on the circle and match cross hair on it. Press [ **enter** ] key.
- ◆ Now in similar manner probe sufficient points to form a best fit circle. And then press [ **finish** ] key.



### 4 ARC Measurement:

An arc can be measured by selecting between 3 to 30 points.

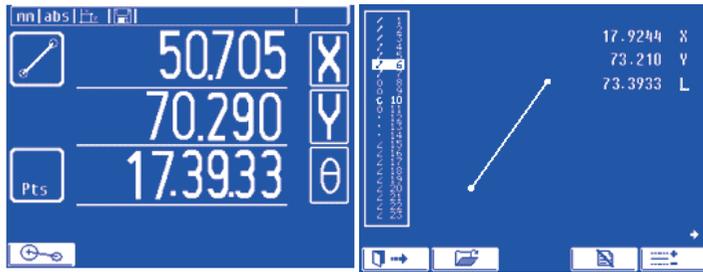
- ◆ Press [  ] key to measure a circle.
- ◆ Now target a point on the Arc and match cross hair on it. Press [ **enter** ] key.
- ◆ Now in similar manner probe sufficient points to form a best fit arc. And then press [ **finish** ] key.



### 5 Distance Measurement:

Using this feature distance between two points can be measured.

- ◆ Press [  ] key to measure distance between two points.
- ◆ Now target the required point and match cross hair on it. Press [ **enter** ] key.
- ◆ Now target the second point. And then press [ **finish** ] key. The distance between these two points will be displayed in the result screen.

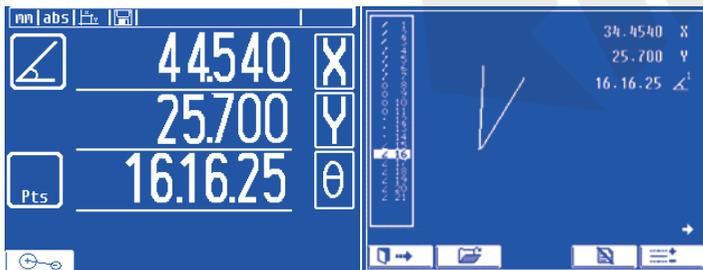


**6** Angle Measurement:

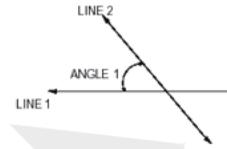
Angles can be measured by probing points between two lines. In this mode the DRO automatically prompts the user to measure 1st line and the 2nd line. Each line can be measured by probing between 2 to 20 points. Accuracy of this measurement is increased if more number of points are probed over greater distances.

After probing both the lines the angle between them is determined by using best fit algorithm. The measured angle can be displayed in 4 ways. The user can change the angle display using [ ] key of the 3rd axis. The four angle measurement types are as shown below.

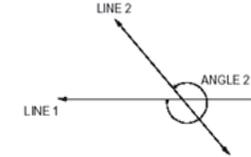
- ◆ Press [ ] key to measure angle. “Probe Line 1” message will be displayed.
- ◆ Now measure 1st line by targeting the required point and match cross hair on it. Press [enter] key.
- ◆ Now similarly target more points. And then press [finish] key to end probing line 1. “Probe Line 2” message will be displayed.
- ◆ Similarly probe line 2 and press [finish] key. The angle result screen will be displayed.



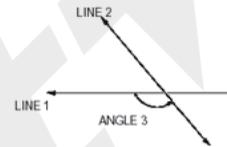
Angle 1 = Included Angle  
Less than 180°



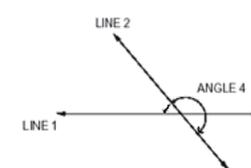
Angle 2 = Excluded Angle  
360° minus the included Angle



Angle 3 = Complementary Angle  
(180° - included Angle (Angle 1))



Angle 4 = 180° Plus included Angle 1

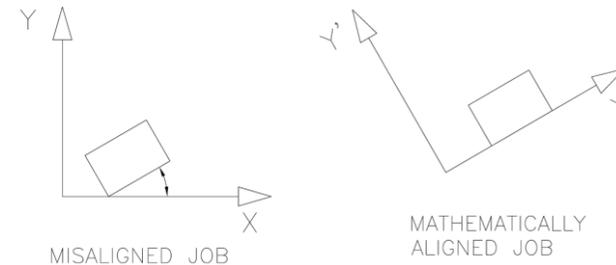


**7** Skewing the Job:

During measurement of any part for its dimensions, it is necessary to perfectly align the part on the co-ordinate measuring system. Any misalignment of part will result in inaccurate measurements.

The part to be measured cannot be aligned exactly with co-ordinate measuring system of machine. Therefore it is necessary to skew the Job prior to measurement.

The skew function converts machine co-ordinates to part co-ordinates by electronically compensating for part misalignment.



Note: As shown in the above figure, the part must be placed within 45 degrees of the machine's co-ordinate system

- ◆ Press [ ] key. Following screen will be displayed.



- ◆ Now probe line which is to be skewed. Use standard procedure for line measurement. Probing more points will increase the accuracy of skew measurement.
- ◆ Press [finish] key to complete skew measurement. The result screen is displayed as shown below. Any feature measurement done henceforth will be with respect to skewed co-ordinates. For indication of skew, the X and Y axis labels are represented as shown below.



- ◆ Pressing [quit] key will exit from skew mode. The DRO will prompt to cancel skew. Now on the DRO functions in normal mode.



Skewing the job is also possible from constructed features. The result of constructed feature should be a line, since skew is applied on a probed line. For example, if a line is constructed from a circle and a line. The result line is the skewed line. And all the measurements are with respect to this line.

8 Wonder Measurement:

Wonder feature helps to minimize key presses during feature measurement. Also it automatically detects which geometrical shape has been probed. This feature can be activated once or repeat.

If we press [feature key] key in normal counting mode. Now if we probe the points (without pressing feature key), and press [finish] key, the DRO will show the result of probed feature.

In SETUP MODE, there is one option, to set "Relational Parameter OFF" or "Relational Parameter ON".



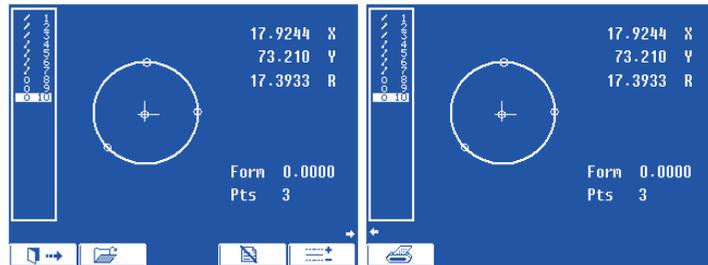
If we want to probe the feature again without pressing feature key, we have to press [feature key] key again.

If we press [feature key] key twice, symbol will be displayed on the DRO screen at right top corner. Now we can probe the features repeatedly without pressing feature keys.

Pressing [quit] key will exit from Wonder feature. To detect an angle, two main things must be considered while probing the points.

- 1) There are two limbs of angle and on both limbs; equal number of points must be probed.
- 2) On either limb, at least three points must be probed.

- 9 Result Buffer View: To view a results measured press  key. A graphical view of results will be displayed. Use up-down arrow keys to move next or previous results one by one or press  key to recall particular result.



-  : Exit from result buffer view.
-  : Visible only if result is Constructed Distance from two circle or two line results. Toggle between Centre-Near-Far distances.
-  : Delete result. Here the operator is prompted with two options
  -  : Delete current result;
  -  : Delete all results.
-  : Tolerance options for current result.
-  : Recall particular result.
-  : Print the result buffer via thermal printer(Optional).

- 10 Construction:  
 Feature construction is the process of combining existing features to generate a new feature.  
 New feature can be constructed using existing features that were measured or constructed.  
 The result of construction is displayed in the result window. Also the user can see the constructed feature graphically. Form is not applicable to constructed features, apart from that these features are same as any measured or probed feature.

Construction Procedure:

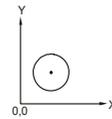
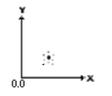
- ◆ Press the desired feature which is to be constructed.

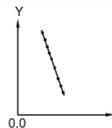
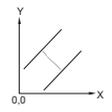
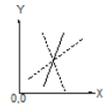
- ◆ Press  key which displays the list of measured features.

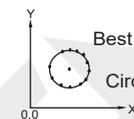
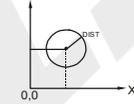
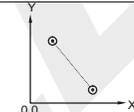


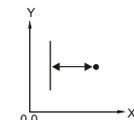
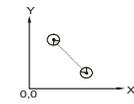
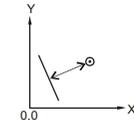
- ◆ Scroll using the navigation keys and press  key to select the feature. On pressing the  will select the previous result automatically.
- ◆ Press  key to complete the construction and calculate the result. Different types of construction:

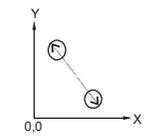
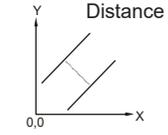
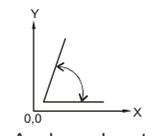
TO GET A POINT	PRESS	THEN SELECT	RESULT
 Intersection of two lines	 Key	Line 1 and Line2	Point of Intersection of two Selected Lines.
 Intersection of a line and circle	 Key	The Line and Circle	One Point of intersection line and circle.
 Intersection of two circles	 Key	The two Circles  *If there is no intersection then "No Intersection" will be displayed	One Point of intersection of two selected circles.
TO GET A POINT	PRESS	THEN SELECT	RESULT
 The point on a line closest to the datum	 Key	The Line	Point :- The intersect of the line and the perpendicular from datum to the line.

		A point and a distance	A point from given point with an offset equal to given distance.
An offset point			
		The Circle	Point Result at the Centre of selected Circle.
Center point of a circle			
		Multiple points	Average point Of selected point results.
Average point			

TO GET A LINE	PRESS	THEN SELECT	RESULT
		Combination of multiple circle or points	A best fit line Passing through centers of circle.
A Bestfit line			
		The line and a distance	A line parallel to given line at given distance apart.
An offset line (parallel line)			
		Any two lines	A line bisects the angle formed by two selected lines.
A bisector line			

TO GET A CIRCLE	PRESS	THEN SELECT	RESULT
		Combination of multiple circle or points	A best fit circle passing through centers of selected features.
A Best fit Circle			
		The point and a distance	A Circle with given point as centre and radius equal to given Distance.
Calculated Circle			
		The circle and a distance	Circle with radius equal to selected circle with centre offset by given distance.
An offset circle			

TO DETERMINE A DISTANCE	PRESS	THEN SELECT	RESULT
		Two points, a point and line, a point and circle, a line and circle	Perpendicular distance between selected features.
A Straight line distance			
		Two circles	Distance between centers of two selected circles.
min, max and centre distance between two circle centers			
		Two circles, a circle and a line, a circle and a point	Nearest distance between two selected features.
Nearest distance			

 <p>Farthest distance</p>	 Key	Two points, a point and line, a point and circle, a line and circle	Farthest distance between two selected features.
 <p>Distance between two lines</p>	 Key	Two Lines	Perpendicular distance between first line and a point on second.
 <p>The Angle and vertex of two lines</p>	 Key	The two lines. The vertex will appear as a point	The Angle formed by intersection of two selected line.

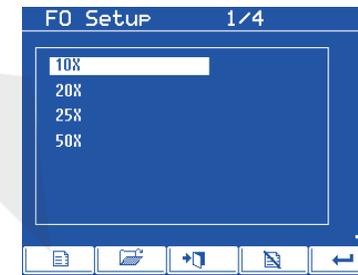
### Edge Detector(For ISP-A5000)

Optical Edge detection can be used with DRO to increase throughput rates, increase measurement accuracy, improve measurement consistency and reduce operator fatigue. In this mode after selecting a point the user is not required to press [ enter ] key but the point is probed automatically as the sensor travels from either Light to Dark or Dark to Light region.

- ◆ Fiber-optic cables cannot be bent to a radius less than one inch without degrading performance. Be careful to prevent bending or pinching the cables.
- ◆ Fiber-optic cables cannot be exposed to temperature higher than 70 degrees Celsius without degrading performance.
- ◆ Use of C.V.T. (Constant Voltage Transformer) is recommended for better performance of edge detection circuit as fluctuations may cause intensity variations on the screen.

1 Edge Detector Calibration: Before using Edge detector for measurements it is necessary to calibrate it. It is necessary to calibrate the DRO prior to this calibration. Mount the demonstration slide on to the X-Y table. In

DRO mode press  key to enter Edge detector calibration. Following screen will be displayed.



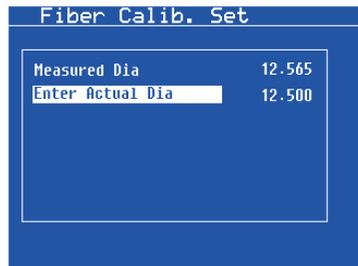
The Setup depends on the magnification and the light intensity. DRO allows the user to save up to 10 magnifications. These magnifications can be recalled any time when the magnification on the machine is changed. Following soft keys are available on this screen:

-  Using this option a new magnification setup can be saved. The user is asked to enter the name of magnification level by displaying the data entry screen. On entering the name the DRO displays FO setup.
-  Open the selected magnification setup. The DRO will display the Setup for the selected magnification as shown below:
-  Exit from the setup.
-  Delete the selected magnification setup.
-  Use the setup parameter for the selected magnification.
-  Using this the selected magnification level can be renamed.

Following are the FO Setup parameters and their significance:



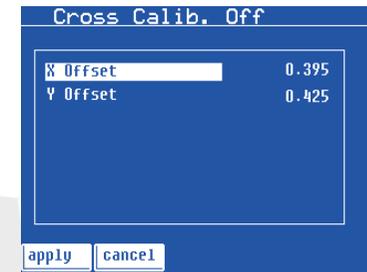
- ◆ Screen Gain (<10000) – This sets the gain of the amplifier. The gain depends on the magnification and the light source. Adjust this such that the Screen intensity on light region displays counts above 3000 counts to 4000. In case of higher magnifications where the counts doesn't reach the required value even if the gain is set to 100, then minimum of 2000 counts should be ensured for good results. Press { **Set** } key to set the gain value.
- ◆ Now bring the screen sensor in the light region and press { **teach** } key.
- ◆ Now move the screen sensor in to dark region. Press { **teach** } key to teach dark to the DRO. Here note that the counts in the dark region are less than that in the light region.  
Now perform Edge calibration. In this mode the selection is provided for bore or shaft measurements. If the user wants to check bore jobs he has to perform bore calibration using F.O. Edge detection prior to measurements.
- ◆ Now probe the circle as per procedure explained earlier. Press { **finish** } key to complete the measurement. Following screen is displayed.



Now enter the standard diameter of the circle. The DRO will calculate the calibration factor and apply it during the measurements by Edge detector.

- 2 Cross Calibration: The cross calibration function eliminates the difference between

Cross hair and mounted edge detector probe may have physical position offsets, hence to obtain accurate results; we must do the cross calibration process for every magnifications. If we don't execute cross cal, and if we probe a circle by cross hair and by edge detector, in both cases, we will get diameter equal but centre coordinates will be different. In this mode the user has to probe a circle using Edge detector and again probe the same circle using cross hair. The result of Cross calibration is displayed as shown below.



- 3 Save the changes and exit Edge detector calibration.
- 4 Measurements using Edge Detector mode: For performing feature measurements using Edge detector, select Edge mode by pressing { **Edge** } soft key in DRO mode. Now press any feature key and probe points using Edge detector. Rest procedure remains same as explained in Geometric Feature Measurement chapter.

### Tolerance

Tolerance helps users maximize productivity. A tolerance is an acceptable deviation from the nominal specification of a part. For example, a pin might have a nominal diameter of 5.000 mm. Without tolerance, only pins with a diameter of .5000 mm are acceptable. This means that pins that measure 4.999 mm or 5.001 must be rejected. With tolerance an acceptable deviation from the nominal specification is defined. For example, the diameter of 5.000 mm might have a tolerance of +/- .05. This means that pins as small as 4.950 mm and as large as 5.050 mm are acceptable.

- 1 Point Tolerance: Highlight the desired point feature from the result list. Press { **TP** } key and then Press { **TP** } key.



Enter the nominal values for X and Y co-ordinates. Also enter the tolerance zone. Tolerance zone is the radius within which the point should be located. If the point is located outside the zone, tolerance fails. Press { **BiDir** } key then enter the nominal values for X and Y co-ordinates. Also enter the +/- values for each nominal value. Limits allow the user to set upper and lower limits on a value. For example, a nominal value of 10.3250 might have an upper limit of 10.3260 and a lower limit of 10.3240. For example, if a part drawing gives a +/- tolerance of 0.005, simply enter 0.005 in the plus and minus fields. After set press { **Apply** } key. The result of tolerance Pass or Fail is shown for the selected feature.

- 2 Use the same way to set Tolerance for line, angle, circle and distance.

### Maintenance

- 1 The projector is a kind of precision optical instrument. Attention should be paid to its maintenance so as to guarantee the precision and lengthen life of the instrument. The instrument should be installed in a clean room, the temperature of which should be maintained at  $20^{\circ} \pm 5^{\circ}\text{C}$ . The relative humidity of the room should not exceed 60% so as to prevent the optical parts and reflecting mirror from molding and to keep the high quality of the image.
- 2 The surfaces of optical parts should be kept clean. They should not be touched with hands. If any dirt, oil fleck or dust are found on the surfaces, they should be removed with soft brushes, or they should be removed with clean linen or lens paper soaked in methyl benzol or in a mixture of alcohol and ether. Try to rub the optical surfaces as less as possible.
- 3 The instrument should not be operated with a big force. All bare metal surfaces of the instrument and the accessories should be wiped clean and coated with protection grease after operation.
- 4 When work-piece with larger diameter is to be measured, take down objectives 50x and 100x and place them into the accessory box.
- 5 Objectives, guides and condenser have higher precision. They should not be dismantled optionally. If it is necessary, they should be sent to the specialized factories for repair.

### Instrument Usage

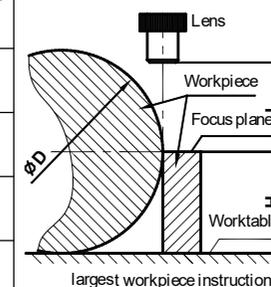
ISP-Z3015 series  $\Phi 300\text{mm}$  digital measuring projector is a precise and excellent effective measuring instrument integrating optics, mechanics and electronics. It is used broadly in the workshop of the trades such as mechanic, meter, electronics and light industry, as well as the laboratories, 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  $0.01^{\circ}$

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

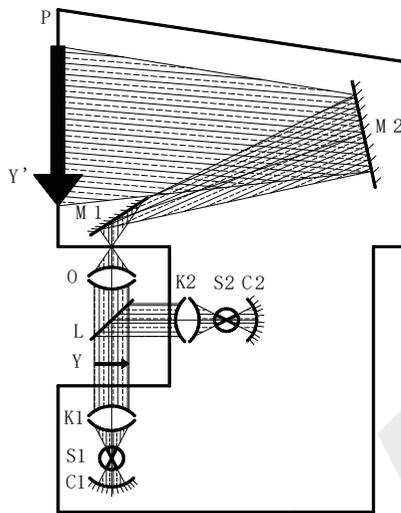


### Instrument Working Principle

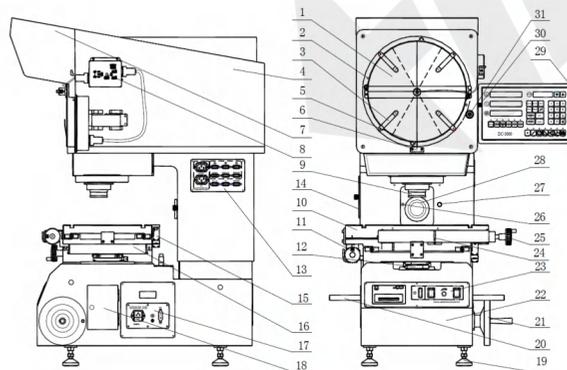
The working principle of the digital profile projector is showed as Fig below. The workpiece Y to be measured is put on the worktable. Irradiate it by the transmissive illumination or reflecting illumination, it is magnified by lens O and imaging Y' (upside-down with Y) after be reflected onto the frosted 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-Z3015 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.

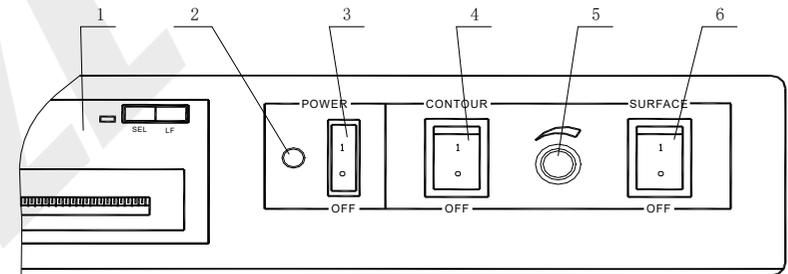
S1 is the transmissive illumination while the S2 is the reflective illumination. And K1 is transmissive condenser while the K2 is the reflective condenser. The illuminations must be used separately. This is determined by the properties of the workpiece. The semi-reflective mirror L can be only used to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



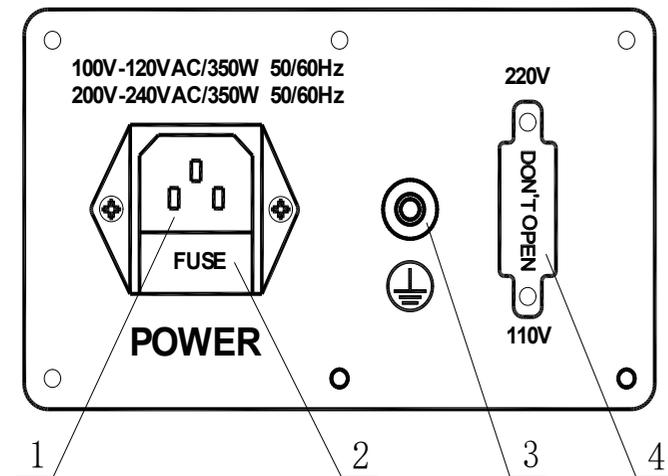
**Structure**



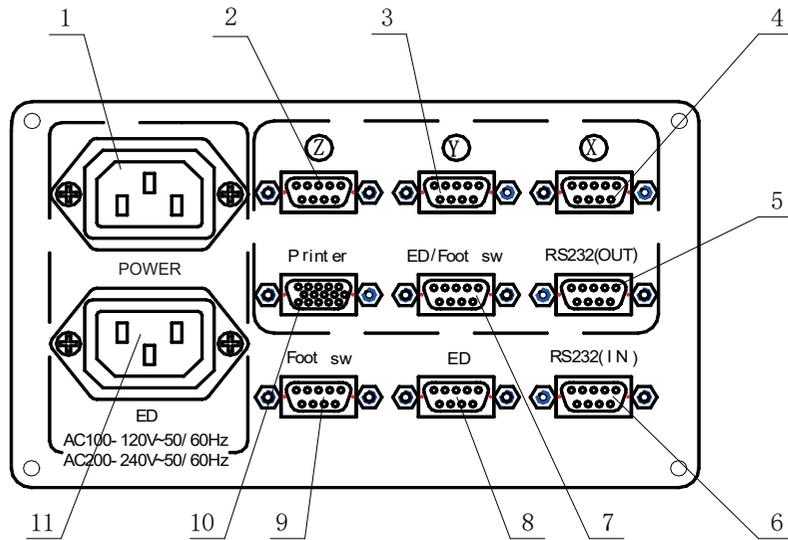
- 1. Projection screen      2. Screen rotating handle      3. Spring fixture
- 4. Projection box      5. Zero calibration board      6. Screen zero mark
- 7. Light cloak      8. Edge detector      9. Lens
- 10. Worktable      11. Y axis handwheel
- 12. Transmissive illumination pusher      13. Signal 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-Z3015 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 handwheel 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 from 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).

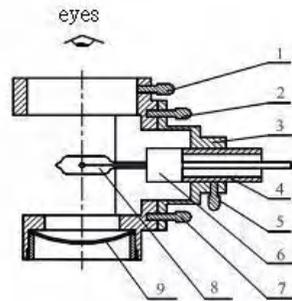
5) Observe the filament and the image which is reflected from the concave mirror (9) by eyes from the top. If they are not superposition, please:

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).

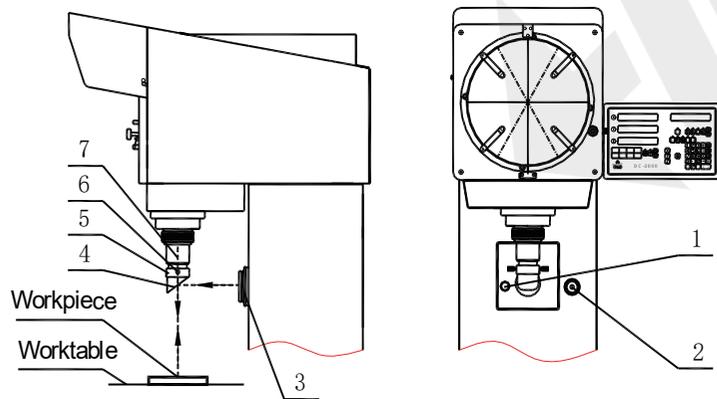
8) Fix the whole illumination module back to the instrument again.

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)

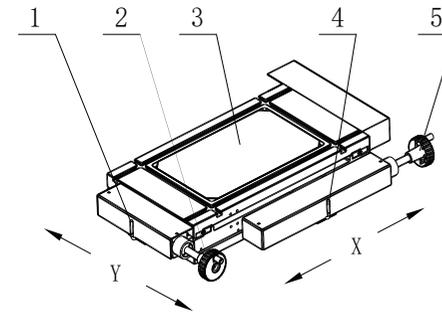
After turn on the main power, the coordinate value of X axis and Y axis appears on the multi-functional data processing system ISP-Z3015 series. The value changes following the movement of the worktable.

The positive and the negative value of the X, Y coordinate can be set through setting the parameters of the ISP-Z3015 series as your favorite.

The movement of X and Y axes: besides being driven through the handwheel, the X and Y axes can also be dragged by the fast handle . And the handwheel is used for focusing and lifting the worktable.

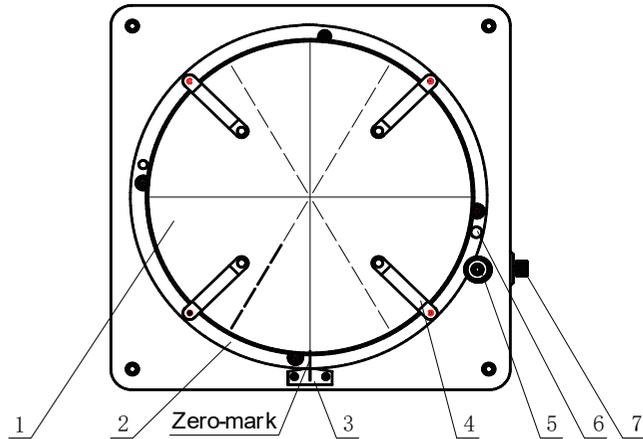
Please turn the handlewheel when using the X and Y axes to measure. And please be sure to turn it smoothly and softly.

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-Z3015 series. The value of angle can be displayed in DD (centigrade) format or DMS (degree-minute-second) format through setting the parameter of ISP-Z3015 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.

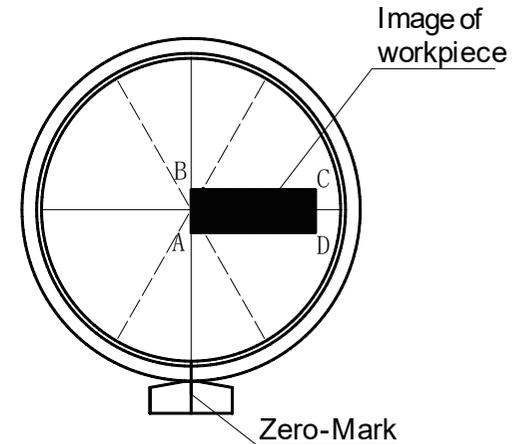
There are some standard graduation lines such as  $30^{\circ}$ ,  $60^{\circ}$ ,  $90^{\circ}$ .....or  $45^{\circ}$ ,  $90^{\circ}$ .....on the screen. They can be used to measure these special angles through comparison. Therefore you can take the angle measuring system to measure the angles just by 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.



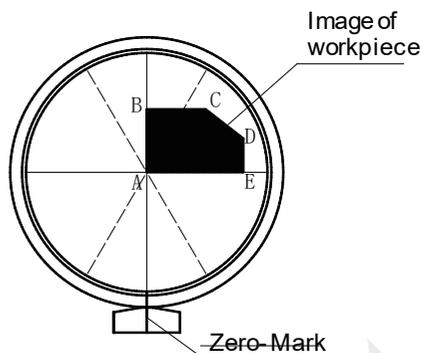
Two-dimensional measuring (refer to Fig below)

- 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-Z3015 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-Z3015 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)

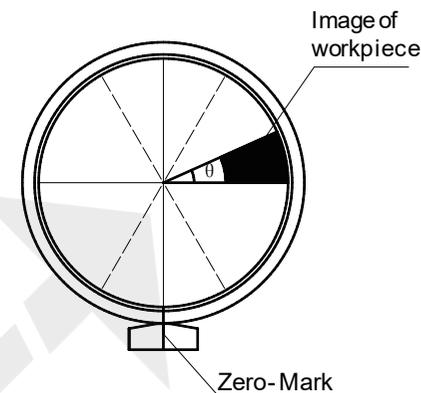
Put the workpiece onto the worktable. Select the lens base on the size of the workpiece and then focus.

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  $\theta$ .

Through the graduation lines on the screen which have an angle of  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$ ..... or  $45^\circ$ ,  $90^\circ$ ... (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 unclose 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-Z3015 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.