

ISP-A6000/A6000E

## Profile Projector- operation Manual



www.insize.com

ISP-A6000/A6000E

V2

<https://m.insize.com/page-75-1803.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.

**Attention**

- ◆ Do not touch the optical components directly with your hands.
- ◆ Please disconnect the power when replacing the light bulb and fuse.
- ◆ Do not disassemble the instrument yourself to avoid damage.
- ◆ This machine does not have an explosion-proof structure and should not be used in flammable gas environments.
- ◆ Do not open the shell of the instrument ,unplug the linear scale before the power is off.

**Maintenance**

Digital measuring projector is a precise instrument integrating optics, mechanics, electricity and computing technique. It should be maintained regularly. A good maintenance can prolong life of instrument and maintain its precision.

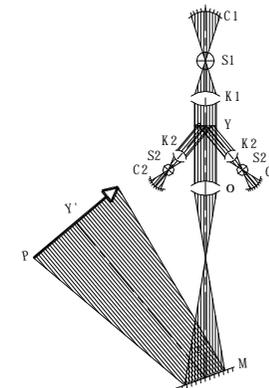
**Introduction**

This instrument is a high precision and high efficiency optical measuring instrument integrating optics, mechanics and electronics. It is widely used in the field of machinery, instrument, meter, electronics, and light industry as well as the measuring chamber and laboratory of universities and institutes, research institutes and metrological verification department. This instrument can efficiently measure the geometric dimension and profile of various complicated shaped workpiece.

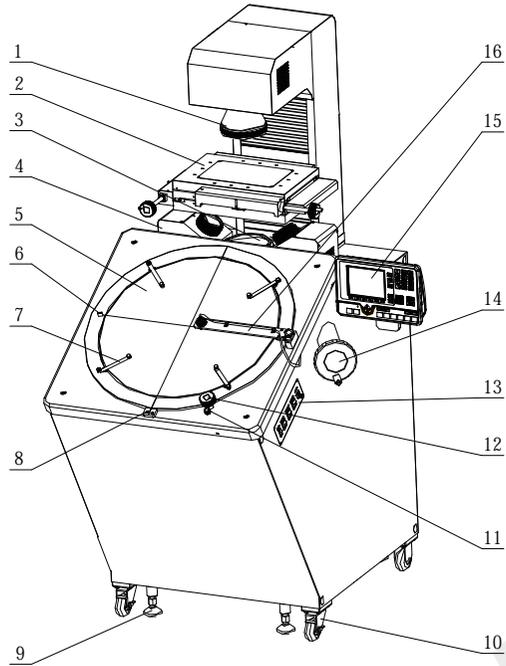
- 1 The working principle of the instrument is shown as graph 1. The workpiece Y is put on the workbench. Illuminated by transmission or reflection light, it is magnified by lens O and is enlarged to real image Y', which is reflected via reflector M onto the frosted glass of projection screen P. The direction of the image on the projection screen P is opposed to that of the workpiece.

Y' can not only be measured on the projection screen by the standard glass scale but also can be compared with premade standard magnified photo. The measured figure divides the magnification is the size of the workpiece. Y' can also be measured by digital measuring system. The angle of the workpiece can be measured by the rotary angle display system of the projection screen.

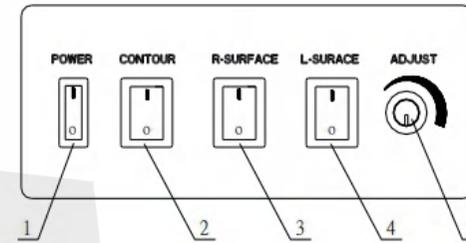
S1 is transmission lighting source, K1 is transmission condenser, S2 reflection lighting source, C1 and C2 represent spherical reflector, K2 reflective condenser.



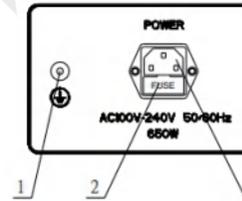
2 The structure of the instrument is shown below:



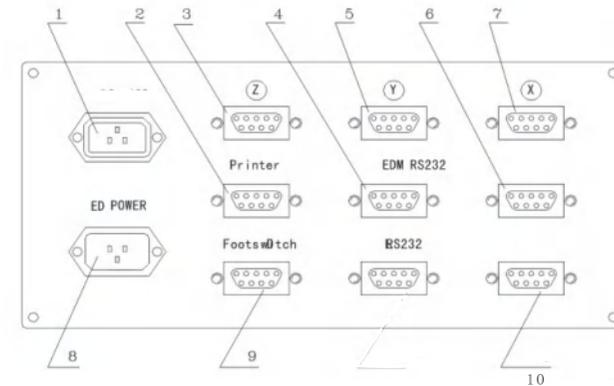
1. Transmission illusion and supplementary lens 2. Workbench 3. Objective 4. Reflection illumination and supplementary lens 5. Projection screen 6. Screen rotary handle 7. Spring fixture 8. Screen zero mark 9. Horizontal adjusting bolt 10. Trundle 11. Screen locking screw 12. Screen rotation handwheel 13. Switch panel 14. Workbench ascending and descending handwheel 15. Display 16. Edge detector(optional)



1. Main power switch 2. Transmission light switch 3. Right reflection light switch 4. Left reflection light switch 5. Transmission light dimming knob



1. Grounding terminal 2. Fuse 3. Main power socket



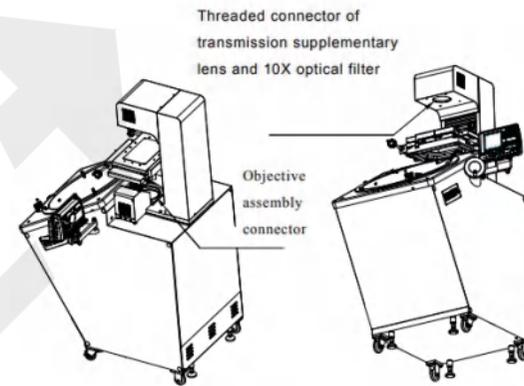
1. Electric box power 2. Printer adapter 3. Angle encoder connector 4. Footswitch connector 5. Y Linear scale connector 6. RS232 connector 7. X Linear scale connector 8. Edge Finder Power Supply 9. Foot switch interface 10. Computer RS232 interface

### Uncovering and installation

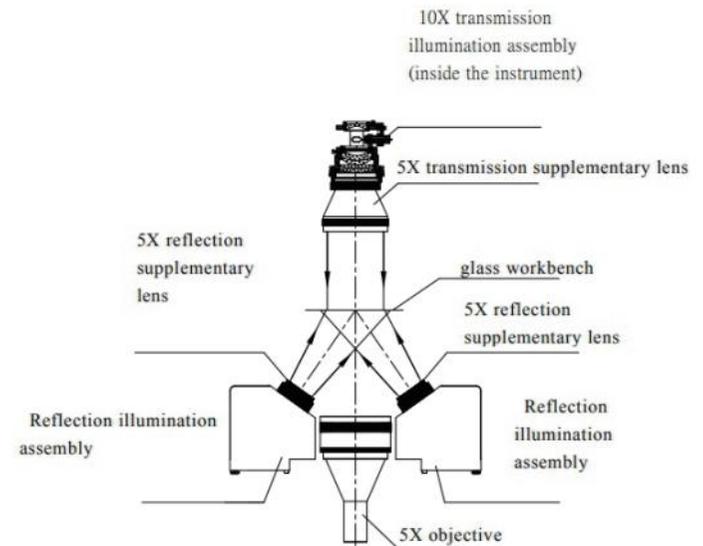
- a. Unclose the packing case, find the instruction book and read this chapter before installation
  - b. Take off the four fixing bolts
  - c. Uplift the four footings to a certain height, and take out the four rubber pads
  - d. Align the two slop woods with the trundles
  - e. The net weight of the instrument is 360kg, therefore at least 4 persons are needed to hold the four handling handles and push the instrument off the wooden packing baseboard
  - f. Rotate clockwise the ascending and descending handle of the workbench until the workbench uplifts at least 20mm. Take the two ejector rods from the threaded hole.
- Remark: Do not forcibly rotate anticlockwise the ascending and descending handle before the two ejector rods are taken out otherwise the support frame of the workbench will deform**

### Instrument operation

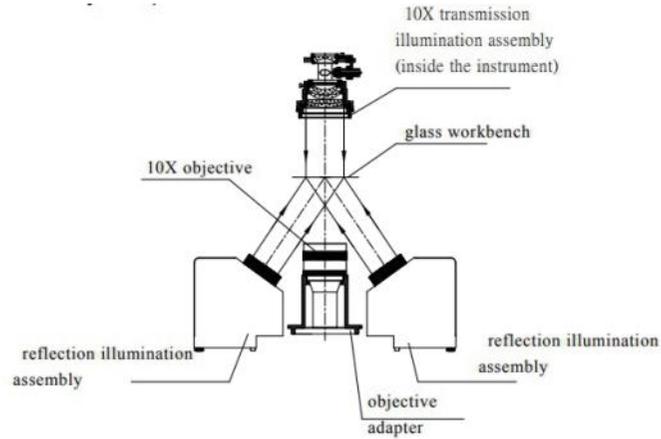
- 1 Installation of objective and supplementary lens  
 Assembly connector of objective and supplementary lens is shown as below:



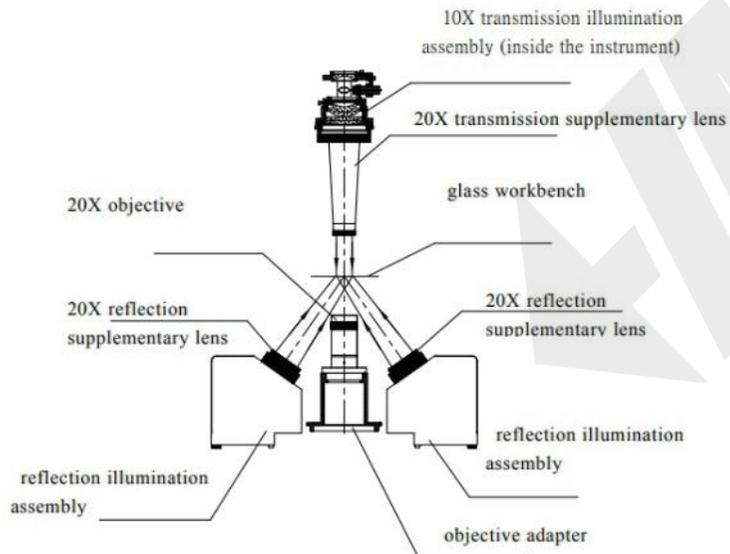
- 2 5X objective and transmission and reflection supplementary lens are shown as below:



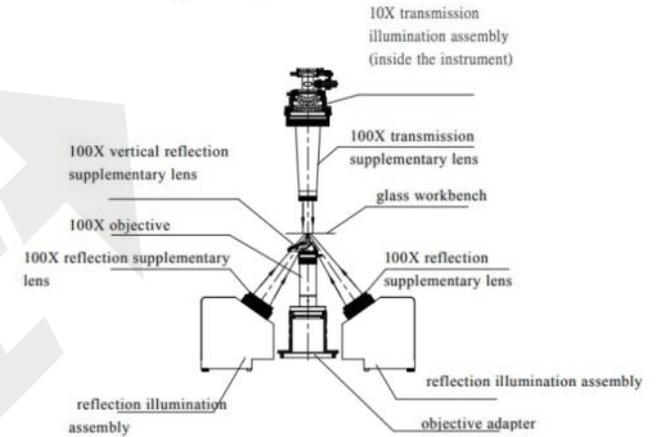
- 3 10X objective and reflection illumination are shown as below (Remark: transmission and reflection supplementary lens are unnecessary for 10X objective) :



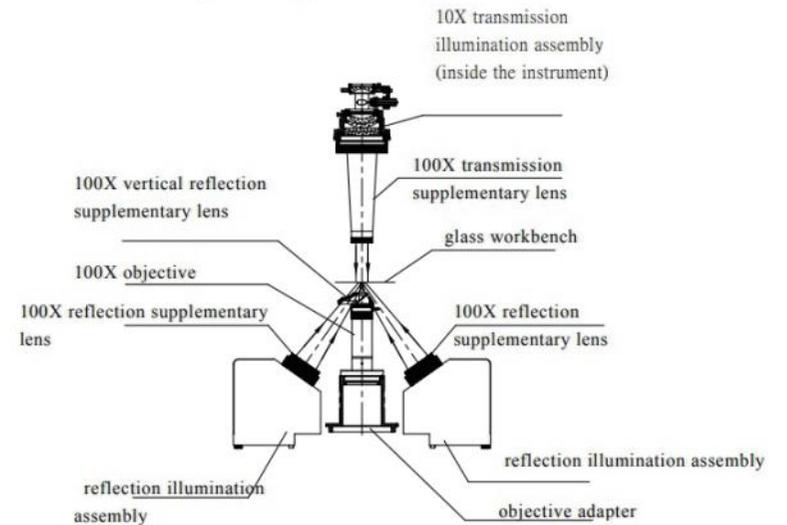
- 4 20X objective, transmission and reflection supplementary lens are shown as below:



- 5 50X objective, transmission and reflection supplementary lens, and vertical reflection supplementary lens are shown as below



- 6 100X objective, transmission and reflection supplementary lens, and vertical reflection supplementary lens are shown as below



Combination use of objective and supplementary lens  
 According to customer 's requirement, 5X, 10X, 20X, 50X and 100X five kinds of objective are optional. Relevant transmission and reflection supplementary lens are required to be in combination used with the objective except 5X objective which does not need transmission and reflection supplementary lens.

**Objective installation:**

The objective is located under the workbench so the workbench shall be uplifted high enough before mount the objective. 5X objective can be mounted directly into the objective mounting connector, while for 10X,20X,50X and 100X objective, the objective shall be put into a general objective adapter before putting into the connector.

**Transmission supplementary lens installation:**

Screw the transmission supplementary lens into the general threaded connector as shown in the graph.(Transmission supplementary lens is unnecessary for 10X objective)

**Reflection supplementary lens installation:**

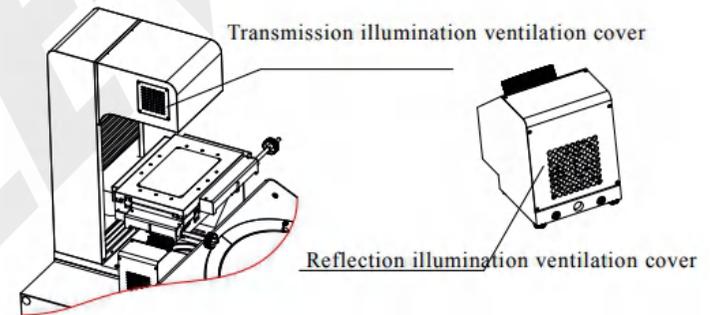
Mount the reflection supplementary lens into the general reflection illumination connector. The lens shall be mounted on both sides of the instrument (Reflection supplementary lens is unnecessary for 10X objective).

**Vertical reflection supplementary lens installation:**

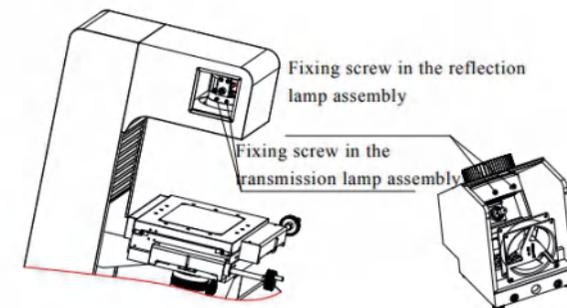
Only 50X and 100X objective are equipped with vertical reflection supplementary lens in order to have better illumination effect. This lens is often used to illuminate the workpiece which has smooth surface. Make sure relevant reflection supplementary lens is mounted prior to install the vertical reflection supplementary lens. Put the vertical reflection supplementary lens into the front part of the relevant objective, make certain the light reflected by the reflection supplementary lens can reach the interior reflector. Secure the locking screws.

- 7 Change and adjustment of illuminating lamp  
 Change and adjustment occur when the lamp burned out or for regular inspection. The original position of the lamp may change under circumstance of transportation and moving. In this case, it is necessary to adjust the lamp. 24V 150W halogen lamp is used in both the transmission and reflection illumination of this instrument. Change and adjust the transmission and reflection illumination lamp according to below procedure:

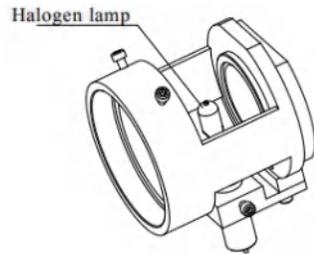
1. Uncover the ventilation cover (as shown below)



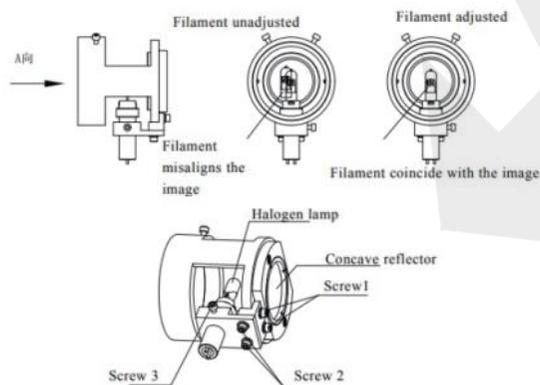
Loosen the two fixing screws in the transmission or reflection lamp assembly (The screws can be screwed out 20mm, it is unnecessary to take them off), move the lamp assembly upward or downward 20mm or so and the assembly can be taken out. (as shown below):



3. Lamp assembly is shown as below (the structure of transmission and reflection lamp assembly is similar). Push the burned lamp upward and take it out. Mount the new lamp (Wrap the lamp with clean soft cloth or white paper. Do not take the lamp with naked hand in order to avoid smudge).

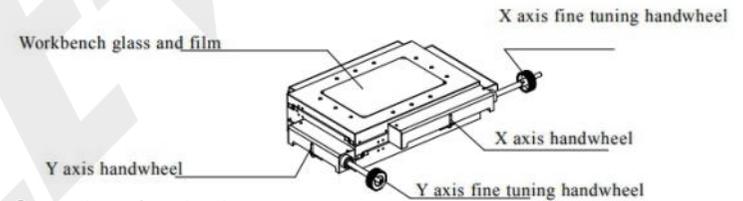


4. Filament control is show as below. Adjustment of lamp is to adjust the filament to make the size and position of the filament and its virtual image formed by the concave reflector completely coincide. Look at the filament from perspective A shown as below, the filament and its virtual image is not in alignment before adjustment. Loosen screw 1 then the filament can be moved leftward and rightward. Loosen screw 2 then the filament can be moved back and forth. Loosen screw 3 then the filament can be moved upward and downward. Adjust the three screws until the filament and its image are coincided.



5 Secure tight the screws after adjustment. Put the lamp assembly back to the original position and tighten the two fixing screws.

8 Use of the workbench is shown as below:  
Focusing of the workpiece can be achieved by adjusting the height of the workbench. The workbench can be uplifted and moved downward by adjusting the ascending and descending handwheel (Item 14 in graph 2). Two coordinate measurement can be obtained by adjusting X and Y axis. The adjustment of Xaxis can be gotten by adjusting the X axis handwheel and X axis fine tuning handwheel. The adjustment of Y axis is similar to that of X axis. The travel of the X and Y axis can be accurately shown on the digital display via the linear scale on both X and Y axis.



9 Operation of projection screen:  
Projection screen can be rotated by moving screen rotary handle and quick handle.  
The cross line in the projection screen is used for calibration and edge detection. The distance between two graduation lines is 10mm, the tolerance is 0.01mm. There are standard 30°X, 60°X and 90°X graduation lines, the tolerance of the angle is 10". The graduation lines can be used as criterion of measurement. The rotated angle can be displayed on the display. Tighten the locking screw and the projection screen can be fixed in a specific angle. In profile measurement, enlarged film of the profile of various part can be made. Magnification of the enlarged film shall be consist with that of the objective. For instance, 10X film is to be used for 10X objective. Pin the enlarged film with the spring fixture. When the graduation line in the zero calibration board aligns with the graduation mark in the frame of the projection screen, then the graduation line in the projection screen is parallel to the moveable X and Y line.

10 Usage of Edge Finder (ISP-A6000E Standard):  
Edge detector can locate specific dot in the profile. By so doing deviation caused by the operation can be eliminated. Installation and operation of the edge detector please refer to the work instruction for reference.

**Measurement method**

There are two measurement methods of the projector:  
Profile measurement and coordinate measurement

**Profile 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:

Choose the lens basing on the size of the work piece. Design a magnified picture as the same magnified-times as the lens. Please use the transparent plastic material with little contractibility. On the picture you can draw out the limit of tolerance. For instance, if the size of work piece is 25, you can choose the 10X lens and draw a picture with the proportion of 10:1.

The following standard magnified pictures are available: circle-arcs, angles, gears, screws and grids.

Nip the standard magnified picture on the screen by the four spring fixtures. Put the work piece onto the worktable. Then focus it. Move the X axes table and lifting the Z axes bracket to make sure that the work piece overlaps the standard magnified picture.

It is qualified if the deviation between the image and the picture is within the limit of tolerance. Otherwise it is unqualified. The deviation can be measured by the X-Z coordinate.

Use the glass ruler (optional) with the resolution of 0.5mm to measure the image of the work piece on the screen directly, the data which is smaller then 0.5mm can also be measured by the X-Z coordinate. Then divided by the magnified times of the lens. The last result is the size of the work piece.

**Coordinate measurement**

**One-dimensional measuring** Put the work piece onto the work table or the vertical work table and focus it after chose the suitable lens.

Turn the projective screen to the zero mark, the white line of the screen holder aim at the zero mark.

Adjust the work piece parallel with the measuring axis. (See Fig.10) BC is parallel with X axis.

Move or lifting the work table, make the measuring edge AB aim at the vertical graduation line of the screen. The value of the X coordinate is set zero.

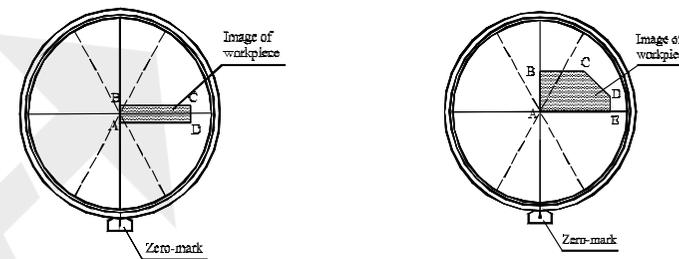
Move the X axis. Make the other edge of the work piece CD aim at the vertical graduation line of screen. What X axis shows is the size of AD edge.

**Two-dimensional measuring**

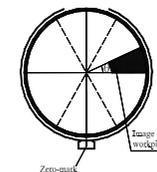
Aim the zero line of the projective screen at the zero mark.

Put the work piece onto the work table. Please choose a bigger times of the lens and adjust the focus. Adjust the measuring edge to be parallel respectively with X axis and Z axis.

See AE//X, AB//Y



Move the X axis and lifting the Z axis . Aim the image point A of work piece on the cross graduation point of the screen. The value of X axis and Y axis is set zero. Move and lifting the work table again. Aim the image point C or D on the cross graduation points. Now the value of the X axis is the measurement value of BC or AE. while the value appears on the Z axis is the value of AB or DE. Use the SKEW function of the multi-functional data processing system software. The position of the work piece can be put arbitrarily without any precise adjustment. Only need to move the worktable to aim the A, B, C or D on the cross graduation point respectively. You can measure out the length concerned. This operation is a time-saved and efficient way. The details can be seen in software manual.Angle measurement.Put the work piece onto the worktable. choose the lens base on the size of the work piece then focus it. Adjust the tip of the angle into the graduated center of the screen.Turn the screen and aim at one edge of the measuring angle with a random line.



Turn the screen again. Aim the line at the other edge of the measuring angle. Now the value displayed is the value of the measured angle  $\theta$ . With the lines on the screen which show 30°, 60°, 90°... ( the precision is 1’). You can take the measurement comparing with these special angle value.

**Description**

**1 Key functions:**

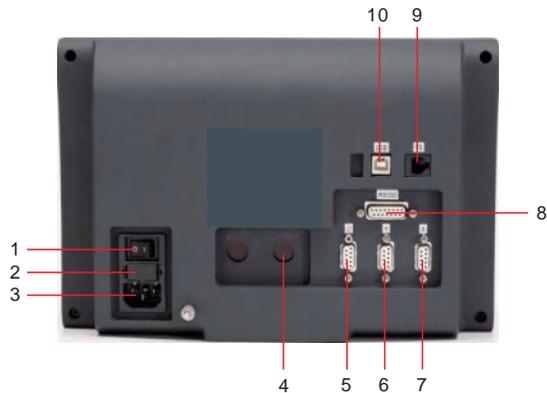


- 1. LCD Display
- 2. Soft Keys
- 3. LCD Standby On / Off Key
- 4. Feature Measurement Keys
- 5. Help Keys
- 6. Arrow Keys For Navigation
- 7. Utility Keys
- 8. Numeric / Function Keys
- 9. Coordinate And Unit Switch Buttons
- 10. Axis Reset Keys

- 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

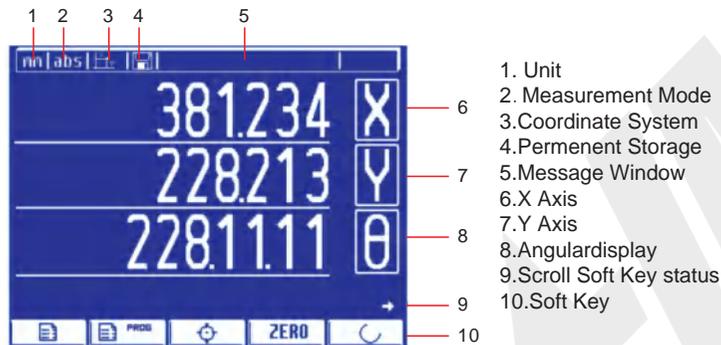
- Cross Hair measurement
- Automatic Edge Detector measurement (ISP-A6000E)
- Counter clock wise direction
- Clock wise direction
- Degree Decimal mode (90.0000°)
- Degree Minutes Seconds display mode (90°.00'.00")
- Contrast level increase
- Contrast level decrease
- Select
- Exit
- Open
- Yes
- No
- On (Disable)
- Off (Enable)
- Auto edge detection setup (ISP-A6000E)
- 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 Distance between two circles or lines
- Nearest Distance between two circles or lines
- 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:



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, 50 $\mu$ m).
- ◆ Display Resolution: Sets the display resolution(0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\mu$ m).
- ◆ 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 $^{\circ}$ ).
- ◆ 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.

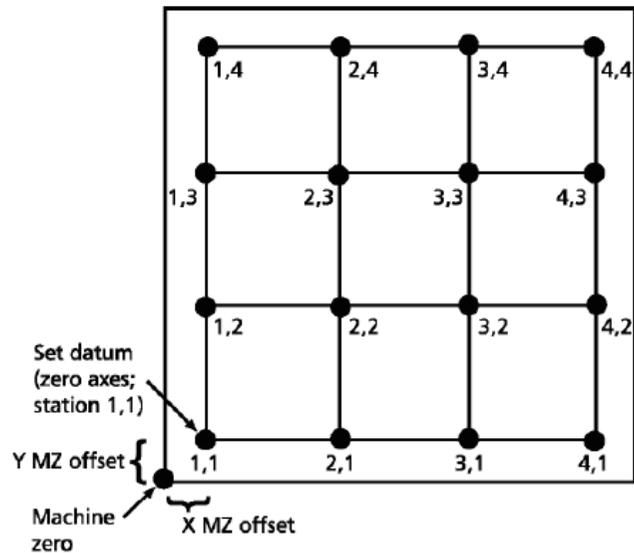
### Axis Calibration

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.

L Compensation	
Standard Value	0.000
Observed Value	0.000

- 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

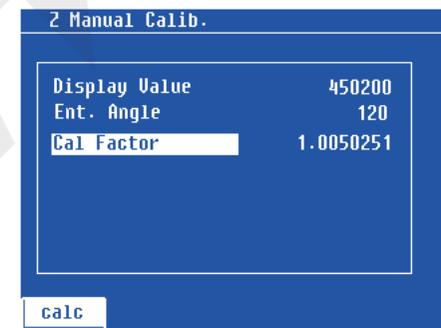
Here the Machine reference can be set for the selected axis. The standard reference output from the encoder is used for referencing. This is used only in case Segmented Linear compensation is to be selected.

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.

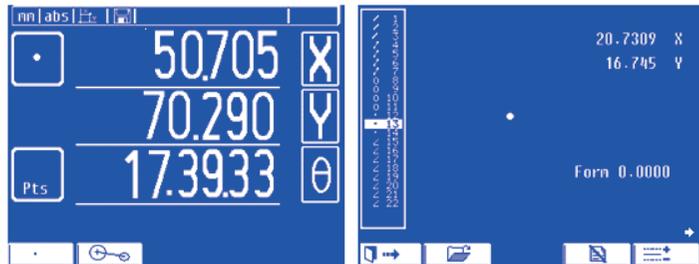


- 2 Auto Calibration of Z axis: User can calibrate the angular axis automatically by selecting the { **Auto** } key. The DRO waits for two complete rotations of the encoder and then calculates the calibration factor by calculating the counts between the two reference marks on the encoder. To calibrate 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:

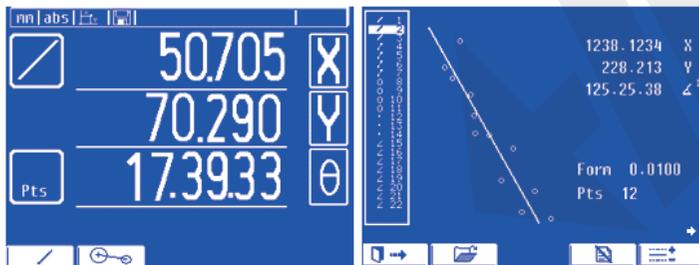
- ◆ Press [  ] key to measure a point.
- ◆ Now move the X-Y table near to the desired point. Match cross hair on the point and press [  ] key.
- ◆ Take more points or if sufficient points are taken press [  ] key.



### 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 [  ] key. Now in similar manner probe sufficient points to form a best fit line.
- ◆ And then press [  ] key.

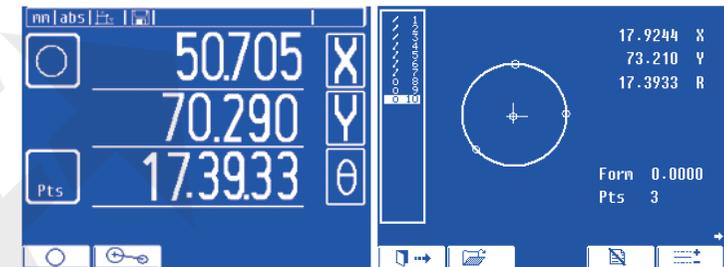


### 3 Circle Measurement:

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

- ◆ Press [  ] key to measure a circle.

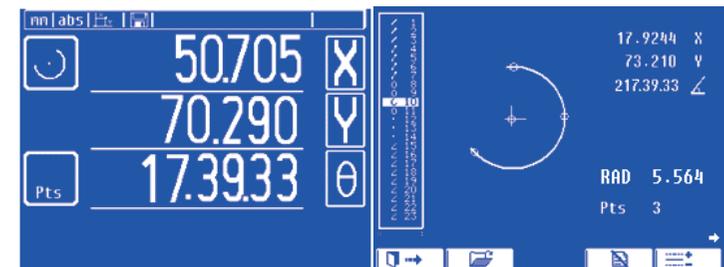
- ◆ Now target a point on the circle and match cross hair on it. Press [  ] key.
- ◆ Now in similar manner probe sufficient points to form a best fit circle. And then press [  ] key.



### 4 ARC Measurement:

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

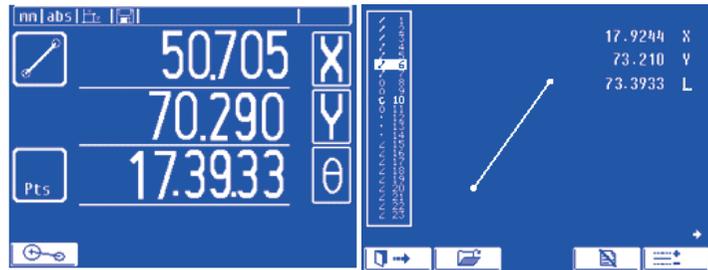
- ◆ Press [  ] key to measure a circle.
- ◆ Now target a point on the Arc and match cross hair on it. Press [  ] key.
- ◆ Now in similar manner probe sufficient points to form a best fit arc. And then press [  ] key.



### 5 Distance Measurement:

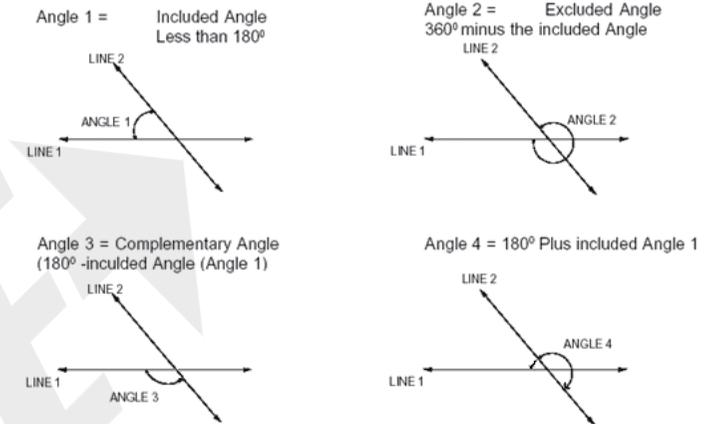
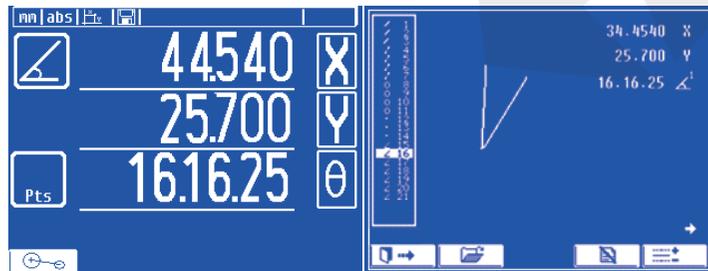
Using this feature distance between two points can be measured.

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

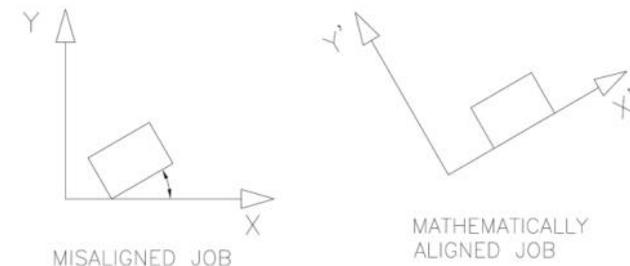


- 6 Angle Measurement:**  
 Angles can be measured by probing points between two lines. In this mode the DRO automatically prompts the user to measure 1st line and the 2nd line. Each line can be measured by probing between 2 to 20 points. Accuracy of this measurement is increased if more number of points 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.



- 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.

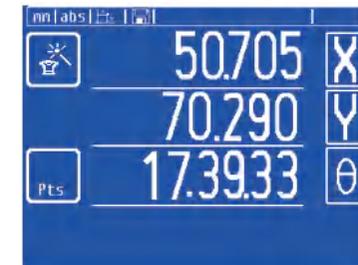


- ◆ Pressing [quit] key will exit from skew mode. The DRO will prompt to cancel skew. Now on the DRO functions in normal mode.



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 [ ] 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".



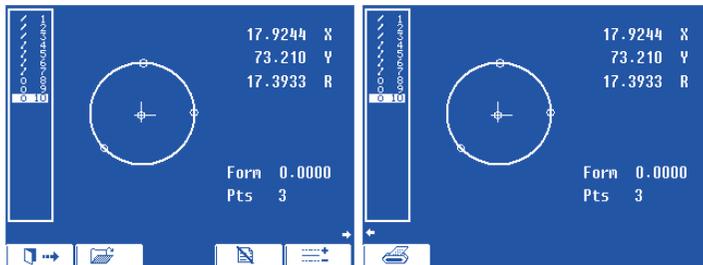
If we want to probe the feature again without pressing feature key, we have to press [ ] key again.

If we press [ ] 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).

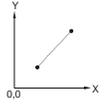
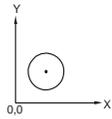
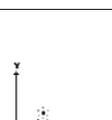
- 10 Construction:
- Feature construction is the process of combining existing features to generate a new feature. New feature can be constructed using existing features that were measured or constructed. The result of construction is displayed in the result window. Also the user can see the constructed 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.

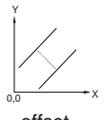
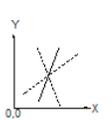
- ◆ Press key which displays the list of measured features.

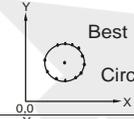
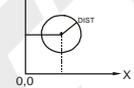
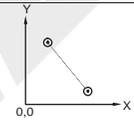


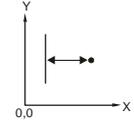
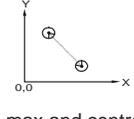
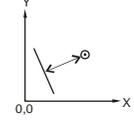
- ◆ Scroll using the navigation keys and press key to select the feature. On pressing the will select the previous result automatically.
- ◆ Press key to complete the construction and calculate the result. Different types of construction:

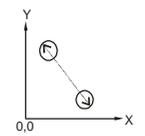
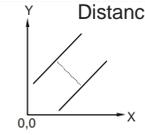
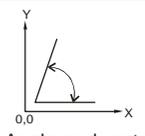
TO GET A POINT	PRESS	THEN SELECT	RESULT
<p>Intersection of two lines</p>	Key	Line 1 and Line2	Point of Intersection of two Selected Lines.
<p>Intersection of a line and circle</p>	Key	The Line and Circle	One Point of intersection line and circle.
<p>Intersection of two circles</p>	Key	The two Circles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

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

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

TO GET A CIRCLE	PRESS	THEN SELECT	RESULT
	 Key	Combination of multiple circle or points	A best fit circle passing through centers of selected features.
A Best fit Circle			
	 Key	The point and a distance	A Circle with given point as centre and radius equal to given Distance.
Calculated Circle			
	 Key	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
	 Key	Two points, a point and line, a point and circle, a line and circle	Perpendicular distance between selected features.
A Straight line distance			
	 Key	Two circles	Distance between centers of two selected circles.
min, max and centre distance between two circle centers			
	 Key	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.

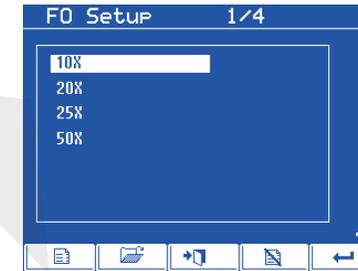
### Edge Detector(For ISP-A6000E)

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 [  ] 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.



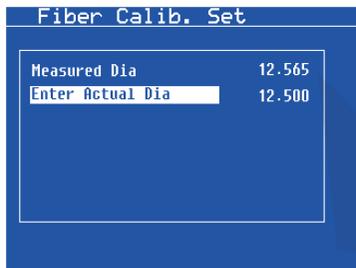
The Setup depends on the magnification and the light intensity. DRO allows the user to save up to 10 magnifications. These magnifications can be recalled any time when the magnification on the machine is changed. Following soft keys are available on this screen:

-  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:



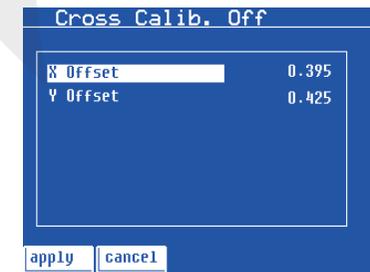
- ◆ Screen Gain (<10000) – This sets the gain of the amplifier. The gain depends on the magnification and the light source. Adjust this such that the Screen intensity on light region displays counts above 3000 counts to 4000. In case of higher magnifications where the counts doesn't reach the required 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.
- \*NOTE: Every time the light intensity changes it is recommended to teach light and dark region to the DRO for proper measurements. No need to change the gain of the system.
- ◆ 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.
- NOTE: It is mandatory to calibrate the type of job either bore or shaft prior to measurements using F.O. Edge detection.
- 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.

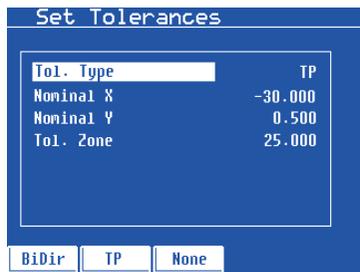


- 3 Save the changes and exit Edge detector calibration.
- 4 Measurements using Edge Detector mode:  
For performing feature measurements using Edge detector, select Edge mode by pressing { **Edge** } soft key in DRO mode. Now press any feature key and probe points using Edge detector. Rest procedure 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 .5.000 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 {  } key and then Press {  } 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 {  } 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 {  } 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 maintenance

Digital measuring projector is a precise instrument integrating optics, mechanics, electricity and computing technique. It should be maintained regularly. A good maintenance can prolong life of instrument and maintain its precision.

- 1 In order to maintain image quality and measurement accuracy, the instrument should be placed in a dry and clean room with a temperature of  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and humidity under 60% to avoid the instrument going mouldy, rusty and dust falling into guide rail of the instrument.
- 2 The surface of optic parts should be clean and can not be touched by finger. A soft brush can be used to clean the dust on the surface of the parts. Dirt and stains can be softly wiped with degreasing cotton or lens paper soaked with a little xylene or mixed solution of ethyl alcohol and diethyl ether.

- ③ The projection screen is made of frosted glass which shall not be touched as far as possible. The screen is likely to be covered with dust, oil stain after longtime use and impact sharpness of the screen. User can wipe the whole screen softly with clean gauze soaked with a little neutral detergent. When the dirt and stain is wipe, a clean dry gauze can be used to get rid of the detergent. Be careful that do not use too much liquid for fear the liquid can drop on the metal panel and result in rusty. User can also cover the instrument with plastic film beforehand. If the user thinks it is s difficult job, the manufacturer can be asked to do it.
- ④ The exposed metal surface of the instrument should be wiped clean with aviation gasoline after use and covered with anticorrosive grease.
- ⑤ The objective and moveable components of the workbench require high precision of installation and calibration. All the screws related to function of tightness and adjustment can be dismantled by the user. The manufacturer can be called for overhaul of the instrument. If the damage concerning malfunction and precision degradation is caused by the user, the instrument is not under warranty.
- ⑥ Cooling fan impacts directly normal use of the instrument and lifespan of the lamp. User should often pay attention to the fan and report the manufacturer if anything improper found.
- ⑦ Manufacturer has already input error compensation parameter into ISP-A6000 digital measuring system. User can not change the error compensation parameter and other inherent set value otherwise the precision and normal use of the instrument will be impacted.
- ⑧ Turn off the power after use. Do not turn on transmission and reflection illumination at the same time unless necessary. By so doing, energy can be saved and the instrument can be in good condition and prolong the life of the span as well.