DIGITAL READOUTS

0peration Manual

XH Series Ver 1.0

Dear users:

Thank you for purchasing our digital readouts. The digital readout is applicable for the machines such as milleres, lathes, boring machines, grinding machines and EDM, etc. . . Read all the instructions in the manual carefully before use and strictly follow them. Keep the manual for future references.

Safety attention:

To prevent electric shock or fire, moisture or directly sprayed cooling liquid must be avoid. In case of any smoke or peculiar smell from the digital readout, please unplug the power plug immediately, otherwise, fire or electric shock may be caused. In such a case, do not try to repair it, please contact dealers or distributors.

Digital readout is a precise measuring device used with an optical linear scale. When it is in use, if the connection between the linear scale and the digital readout is broken or damaged externally, incorrect measuring values may be resulted. Therefore, the user should be careful.

Do not try to repair or modify the digital readout, otherwise, failure, fault or injury may occur. In case of any abnormal condition, please contact dealers or distributors.

If the optical linear scale used with the digital readout is damaged, do not use a linear scale of other brand. Because the performance, specification and connection of the products are different and can not be connected without the instruction are specialized technical personnel, otherwise, trouble will be caused to the digital readout.

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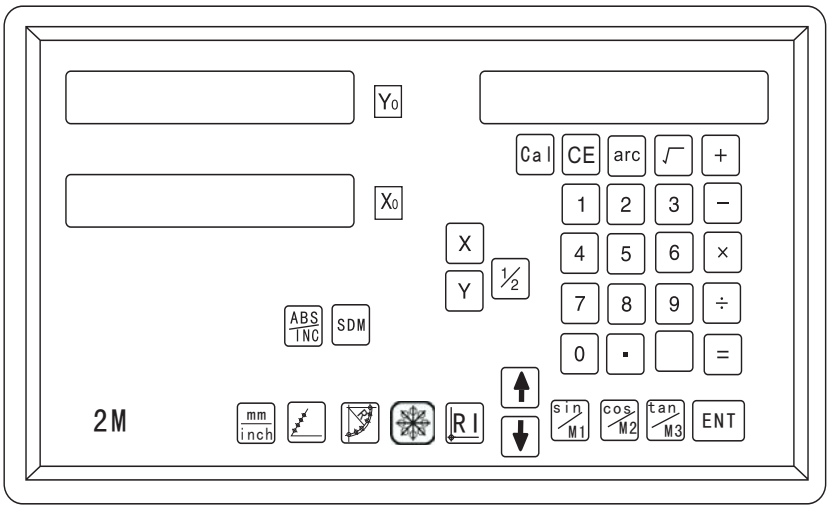
1. General Description:

Set the power switch to ON, the DRO enters to the self-check and intial state. The resolution will be displayed on the X, Y, Z LED windows , and the type of the DRO will be displayed on the left window. Mill 2 for 2 axes Milling Machine, Mill 3 for 3 axes Milling machine , Grind 2 for 2 axes Grind machine, Lathe 2 for 2 axes Lathe and Lathe 3 for 3 axes Lathe etc.

1.1 2M Panel



Applicable to: milling machine, boring machine, etc.

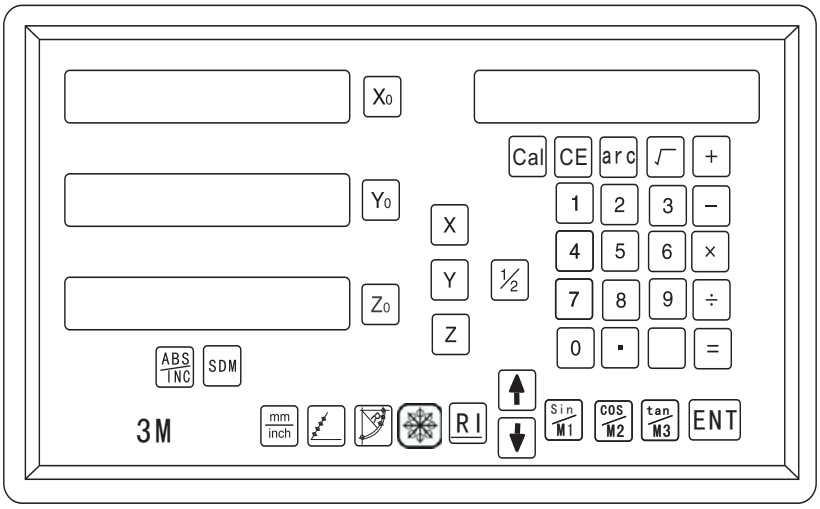
Basic Function:

1)Reset; 2) mm/inch Mode; 3)Enter Dimension; 4) 1 / 2 Function;
5)ABS/INC Mode; 6)Clear 200 sets SDM Datum; 7)Power-down Memory;
8)Sleeping Mode; 9)Ref Datum Memory Function;
10) Linear Compensation; 11) Non-Linear Error Compensation;
12) 200 Sets Sub Datum Function; 13) Parameter Setting;

Special Funtion:

1)Linear Drilling;
2)PCD Functing;
3) R Function;
4) Chambering;
5) Tool Compensation Function;
6) Machining of Oblique Plane;
7) Calculator;

1. 2 3M Panel



Applicable to: 3 axes milling machine, boring machine, etc .

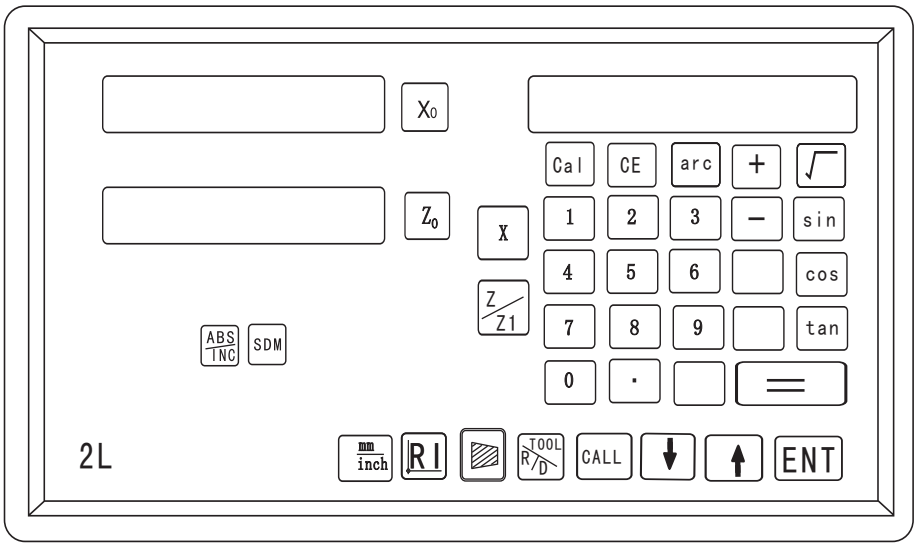
Basic Function:

1)Reset; 2) mm/inch Mode; 3)Enter Dimension; 4) 1 / 2 Function;
5)ABS/INC Mode; 6)Clear 200 sets SDM Datum; 7)Power-down Memory;
8)Sleeping Mode; 9)Ref Datum Memory Function;
10) Linear Compensation; 11) Non-Linear Error Compensation;
12) 200 Sets Sub Datum Function; 13) Parameter Setting;

Special Function:

1) Linear Drilling;
2) PCD Function;
3) R Function;
4) Chambering;
5) Tool Compensation Function;
6) Machining of oblique plane;
7) Calculator;

1.3 2L(2L2) Panel



Applicable to: 2 axes lathe,3 axes lathe(2L2).

Basic Function:

1)Reset; 2) mm/inch Mode; 3)Enter Dimension;

4)ABS/INC Mode; 5)Clear 200 Sets SDM Datum; 6)Power-down Memory;

7)Sleeping Mode; 8)Ref Datum Memory Function;

9) Linear Compensation; 10) Non-Linear Error Compensation;

11) 200 Sets Sub Datum Function; 12) Parameter Setting;

Special Function:

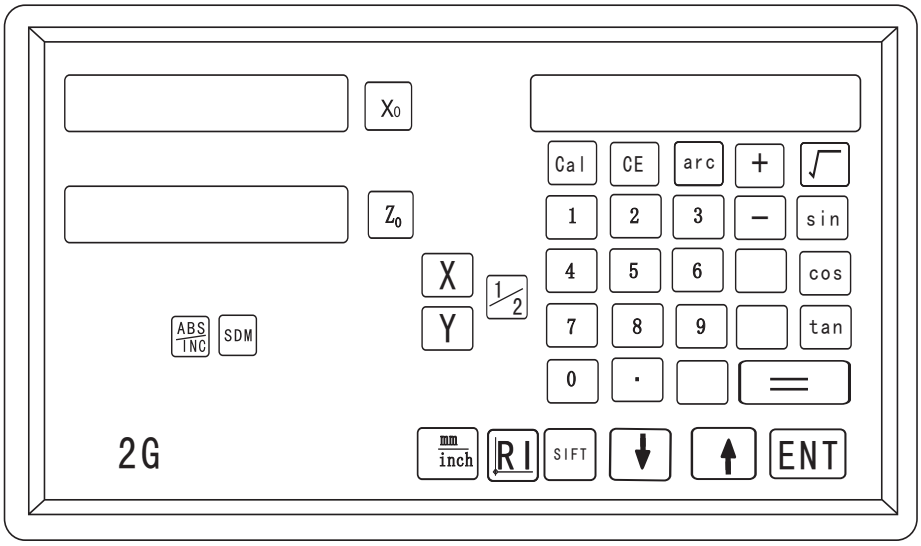
1) 200 Sets TOOL Base;

2) R / D Function;

3) Taper Function;

4) Z+Z1 Function(2L2)

1.4 2G Panel



Applicable to: 2 axes grinding machine.

Basic Function:

1)Reset; 2) mm/inch Mode; 3)Enter Dimension; 4) 1 / 2 Function;
5)ABS/INC Mode; 6)Clear 200 Sets SDM Datum; 7) Power-down Memory;
8)Sleeping Mode; 9)Ref Datum Memory Function;
10) Linear Compensation; 11) Non-Linear Error Compensation;
12) 200 Sets Sub Datum Function; 13) Parameter Setting;

Special Function:

1) Display Filter;

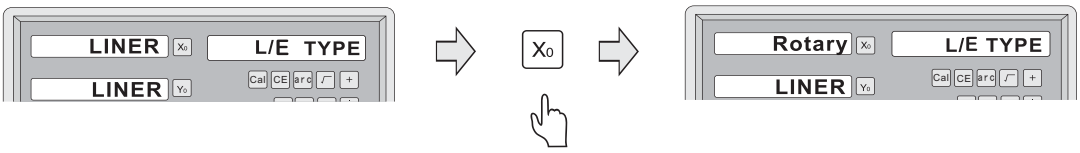
2. Parameter setting

Set the power switch to ON, the DRO enters to the self-check and initial state. The resolution will be displayed on the X, Y, Z LED windows , and the type of the DRO will be displayed on the left window: Miu 2 for 2 axes Milling Machine. Mill 3 for 3 axes Milling machine, Grind 2 for 2 axes Grind Machine , Lathe 2 for 2 axes Lathe, etc.

In the course of self-check, press the key [-] to access the system settings. In the system settings, the following system item will be set.

1) Encoder type, 2) Resolution, 3) Directing,
4)Compensation type (Linear or Non-Linear) settings.

Step 1: Select the encoder type:LINEAR encoder or Rotary encoder.

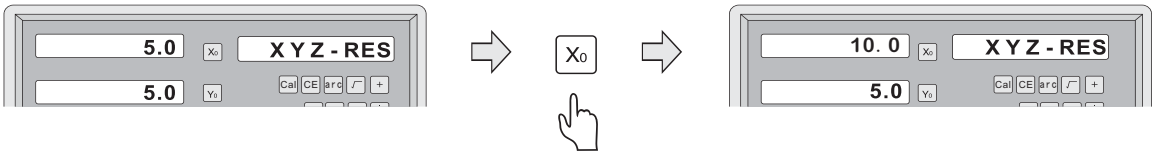


Press the key [X0] to toggle the X axis encoder type between LINEAR encoder or Rotary encoder . Press the key [Y0] for the Y axis and press the key [Z0] for the Z axis.

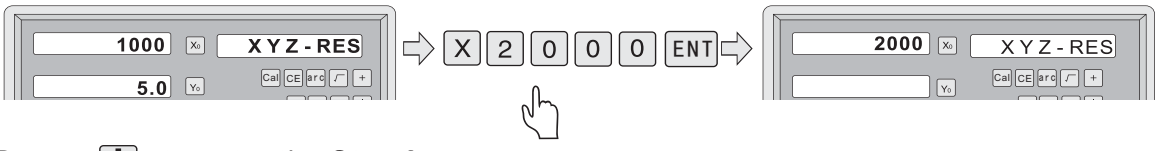
Press [↓] to enter the Step 2.

Step 2: Set the resolution for encoder

When selecting the LINEAR encoder , the resolution will be set as follows:
There are 7 types of resolution：0.1um、0.2um、0.5um、1um、2um、2.5um、5um、10um
Press [X0] for the X axis, the key [Y0] for the Y axis and the key [Z0] for the Z axis.



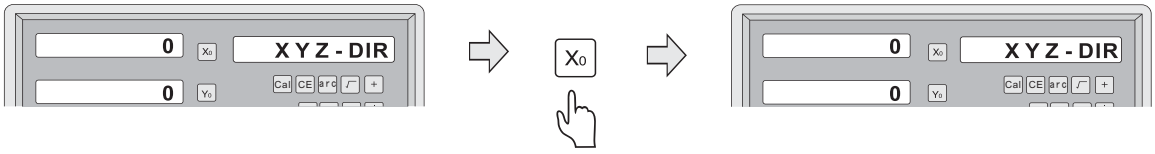
When selecting the rotary encoder, the resolution will be set as follows: input the rotary parameter.(**Note:If this parameter is input by positive number, the Display window will display by centigrade.If this parameter is input by Negative number, The display window will display by degree/minute/second.**)



Press [↓] to enter the Step 3.

2. Parameter Setting

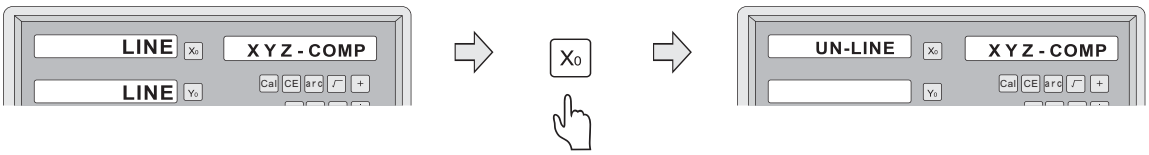
Step 3: Set the direction.



Press [X0] for the X axis, the key [Y0] for the Y axis and the key [Z0] for the Z axis.

Press [▼] to enter the Step 3.

Step 4: Set the compensation type (linear or non- linear).



LINE: the linear compensation; （Ref to linear compensation settings ）

Press [X0] for the X axis, the key [Y0] for the Y axis and the key [Z0] for the Z axis.

Press [·] to quit the parameter setting.

Step 5: Set decimal digits under inch system(usually set 4 digits)

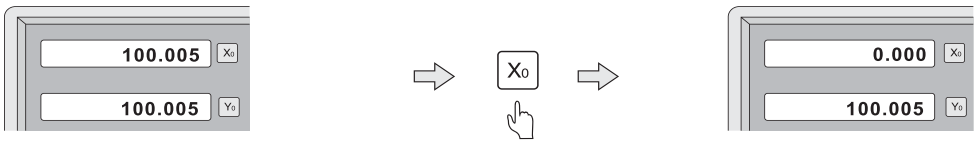
Press the key [·] to access the system setting.

3. Basic Functions:

3.1 Reset:

Function: Reset the current position for that axis by pressing the key [X0] or [Y0] or [Z0]

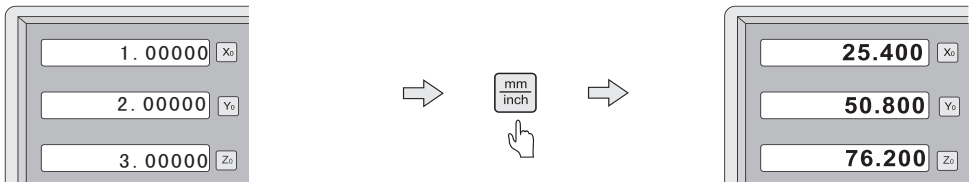
Example: Reset the current X position.



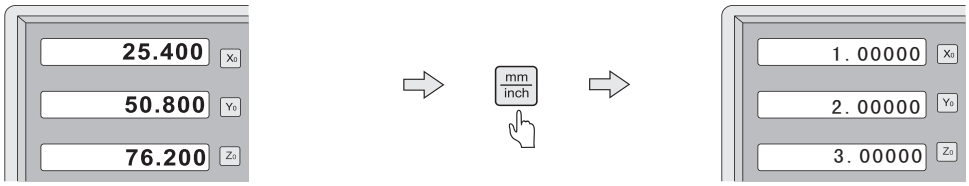
3. 2 Mm/inch Mode

Function: Toggle the display unit between inch and metric by pressing [mm/inch]

Example 1: Currently in inch display mode, toggle to metric display mode.



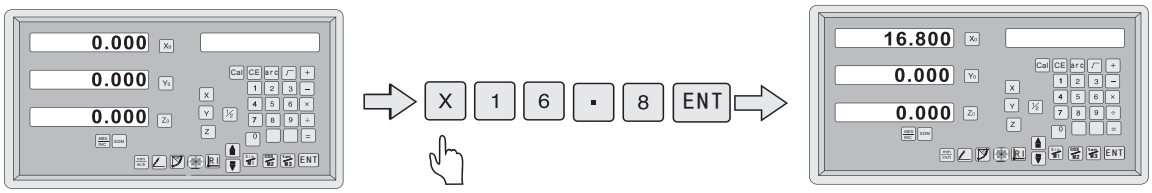
Example 2: Currently in metric display mode, toggle to metric display mode.



3.3 Enter Dimension

Function: Set the current position for that axis to an entered dimension.

Example: Set the current X- axis position to 16.8mm.

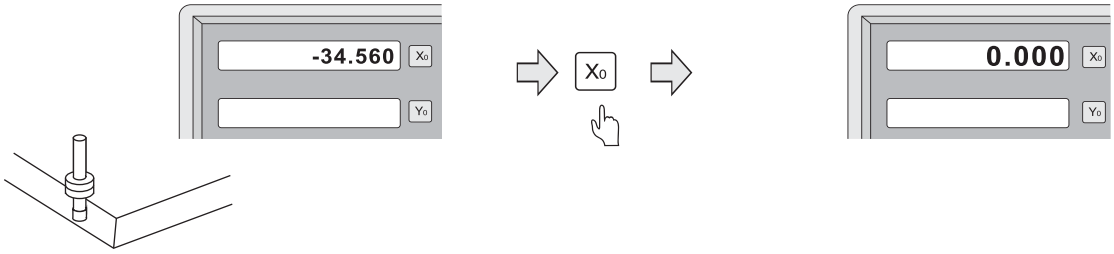


3.4 1 / 2 Function

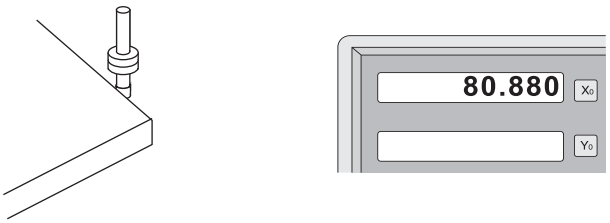
Function: Find the centre of the workpiece.

Example: Find the centre of the workpiece of X- axis.

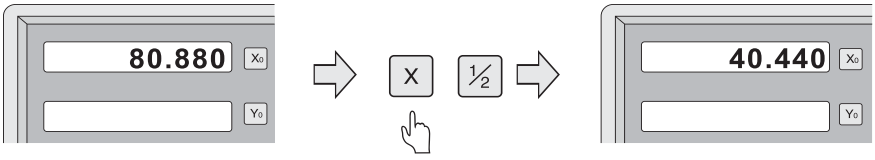
Step 1: Touch one side of the workpiece with the TOOL, then zero the X-axis.



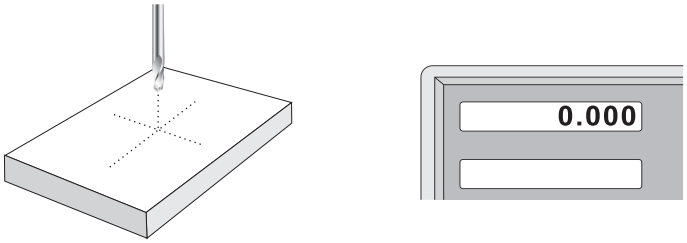
Step 2: Take the TOOL to the opposite side of the workpiece and touch it.



Step 3: Execute the workpiece centering of the X axis as follows:



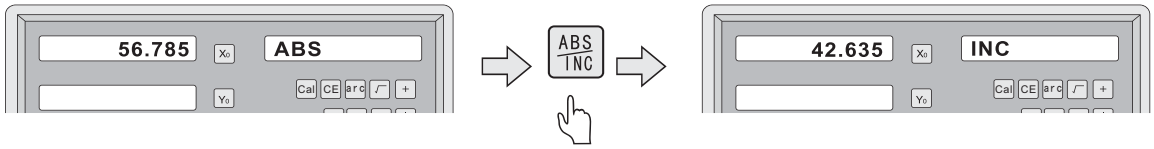
Step 4: Retract the axes until the displays read 0.000, the TOOL can be placed exactly at the center of the workpiece.



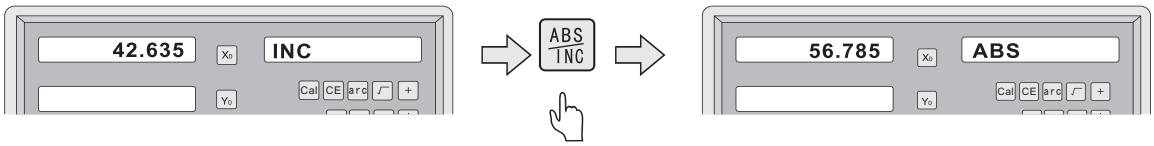
3.5 ABS/INC Mode

Description: There are two set of basic coordinates display, ABS (absolute) and INC (incremental) displays. During machining operations, operator can store the workpiece datum(zero position) in ABS coordinate, then switch to INC coordinate for continue machining operations. ABS and INC can be simply toggle by pressing [ABS/INC]

Example: Currently in ABS mode. Toggle to INC mode by pressing [ABS/INC]



Example: Currently in INC mode. toggle to ABS mode by pressing [ABS/INC]



3.6 Clear 200 Sets SDM Datum

In ABS Mode, reset the current position for that axis by pressing the key [X0] or [Y0] or [Z0].To continuously press the key [.] ten times will cause to clear all the datum for 200 Ssets SDM.

3.7 Power-down Memory

The memory is used to store the settings of the DRO and machine reference values when power is turn off.

3.8 Sleeping Mode

In not ABS Mode, pressing the key [RI] can turn off all the display and the DRO accessing to the Sleeping Mode, then pressing this key again will cause the DRO back to the working Mode. In the Sleeping Mode the DRO is still in working state and actually records the TOOL movement.

Example: In not ABS Mode, to access the Sleeping Mode by pressing the key [RI]

In Sleeping Mode, pressing the key [RI] to quit the Sleeping Mode.

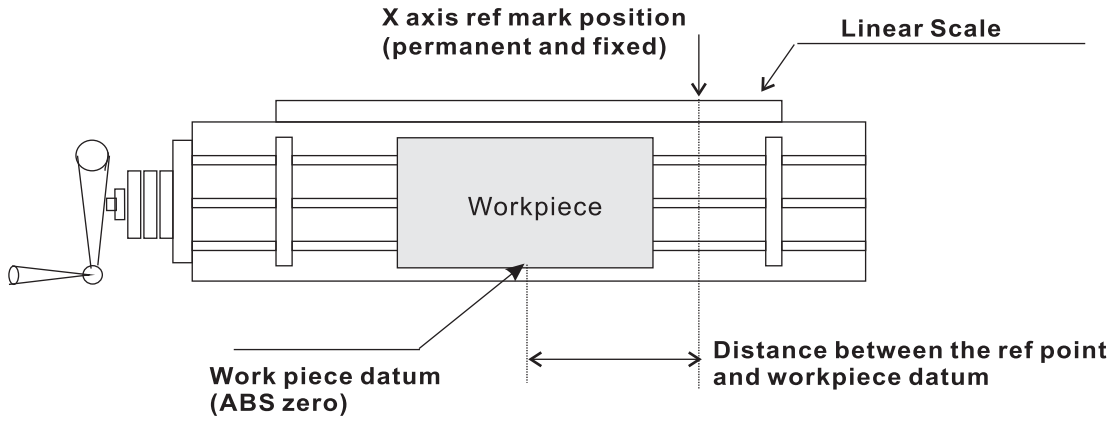
3.9 Ref Datum Memory Function:

During the daily machining process, it is very common that the machining cannot be completed within one work shift, and hence the DRO have to be switched off after work, or power failure happen during the machining process which is leading to lost of the workpiece datum (workpiece zero position), the re-establishment of workpiece datum using edge finder or other method is inevitably induce higher machining in accuracy because it is not possible to re-establish the workpiece datum exactly at the previous position. To allow the recovery of workpiece datum very accurately and no need to re-establish the workpiece datum using edge finder or other methods, every linear scale have a ref point location which is equipped with ref position to provide datum point memory function.

The working principal of the ref datum memory function are as follows.

Since the ref point of linear scale is permanent and fixed, it will never change or disappear when the DRO system is switched off. Therefore, we simply need to store the distance between the ref point and the workpiece datum(zero position) in NON-Volatile memory. Then in case of the power failure or DRO being switched off, we can recover the workpiece datum (zero position) by presetting the display zero position as the stored distance from the ref point.

Example: Store the X axis work datum.



After power failure, the workpiece datum can be recover by presetting this distance from the ref mark position.

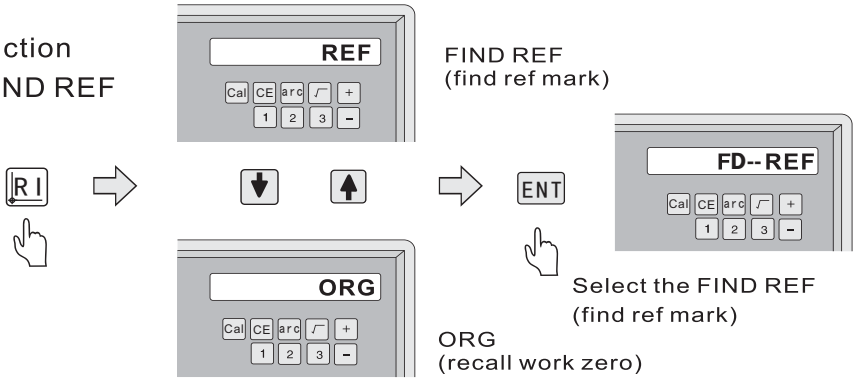
Operation: DRO provides one of the most easy to used ref datum memory function There is no need to store the relative distance between the ref mark and your work datum zero into DRO, when ever you alter the zero position of ABS coordinate, such as by zeroing, center find, coordinate preset or etc..., DRO will automatically store the relative distance between ABS zero and the ref mark location into the memory of DRO.

In daily operation, operator simply need to find the ref mark position whenever they switch on the DRO to let DRO know where the ref mark position is, then DRO will automatically do the work datum storage on its own whenever you alter the ABS zero position. In case power failure or the DRO switched off, the operator can recover the workpiece datum easily by the RECALL 0 procedure.

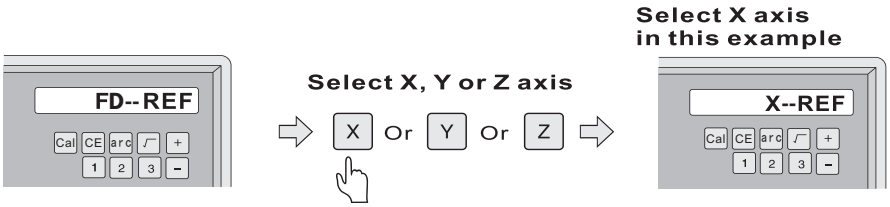
3.9.1 Find Ref: the DRO can automatically store the relative distance between the ref mark position and the ABS datum (zero position) whenever the operator alter the ABS zero position, such as zeroing, center find, coordinate preset or etc...

Therefore, DRO need to know where the ref position in prior to machining operation. In order to avoid the lost of work piece datum (zero position) during any accidential or unexpected events, such as power failure or etc..., It is highly recommend that operator find the ref mark position using the (FIND REF) function whenever they switch on the DRO.

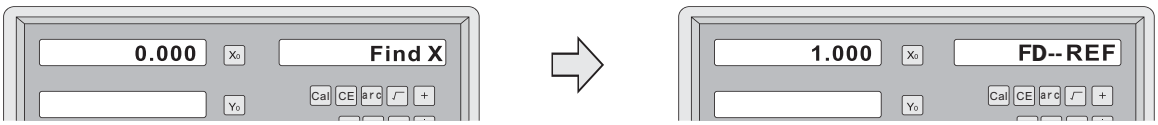
Step 1: Enter the Ref function and select the FIND REF (find ref mark)



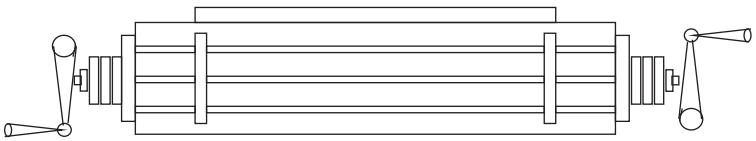
Step 2:Select the axis of which ref mark needed to be found



Step 3:Move the machine across the centra or the left or the right of the linear scale until the right window flashes FIND X , then display FD...REF. Press [Y] for FIND REF Y and the key [Z] for FIND REF Z.



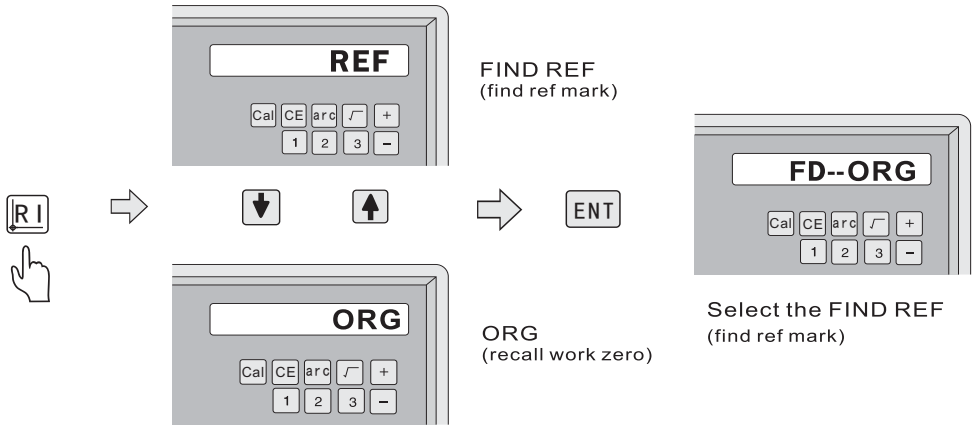
Move the machine across the ref mark point



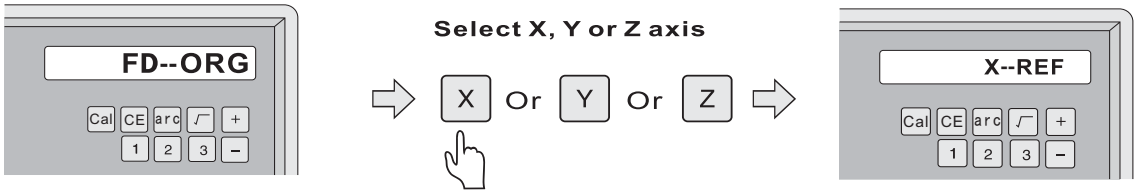
Step 4: Press [R I] to quit Ref function.

3.9.2 Recall Work Zero

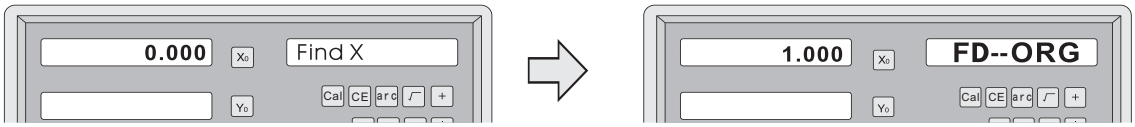
Step 1: Enter the ref function and select the FD ORG (recall workpiece zero)

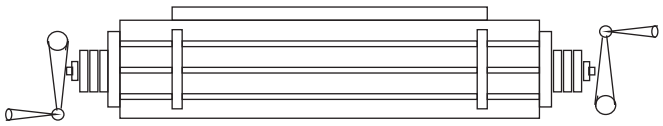


Step 2: Select the axis of which work datum(zero position) needed to be recovered



Step 3: Move the machine across the centra or the left or the right of the linear scale until the right window flashes FIND X , then display FD...ORG. Press Y for FIND ORG Y and the key Z for FIND ORG Z.





Move the machine across the ref mark point

Step 4: After find ORG X, Y and Z; move the machine to display value=(0.000), the TOOL is exactly located at the ABS zero.

3.10 Linear Compensation

Setting linear compensation to rectify the system error of the digital readouts system.

Rectifying coefficient S=（L-L1）（L1000）mm/m

L：the actual length value，unit: mm

L1：the display value，unit: mm

S: Rectifying coefficient. Unit: mm/m

Regarding the polarity, select a positive(+) compensation when displayed value is smaller than the actual length and negative(-) compensation when the display value is greater.

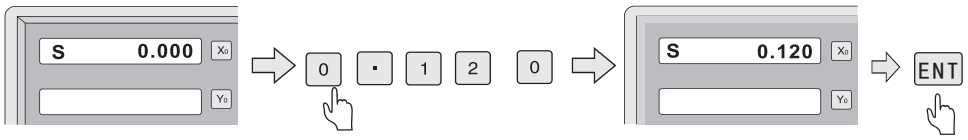
Compensation range: -1.500mm/m to +1.500mm/m

Example: the actual value is 1000mm and the display value is 999.98mm

S=（1000.000-999.880）÷（1000.000÷1000.000）=0.120

Step 1: Press [X] to select the x axis and press [mm/inch] to acces the setting linear compensation.

Step 2: Input rectifying coefficient 0.12 as follows:



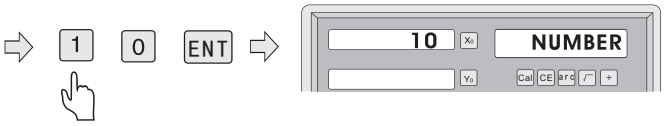
3.11 Non-Linear Error Compensation

First compensation type (Linear or Non-Linear) in parameter setting must be set Non-Linear.

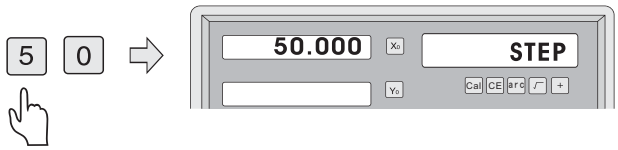
Step 1: Move the worktable to the left ,
and press the key [ABS/INC] to enter ABS display mode

Step 2: Press the Key [X] , then press [mm/inch] to enter parameter setting for Non-Linear compensation.

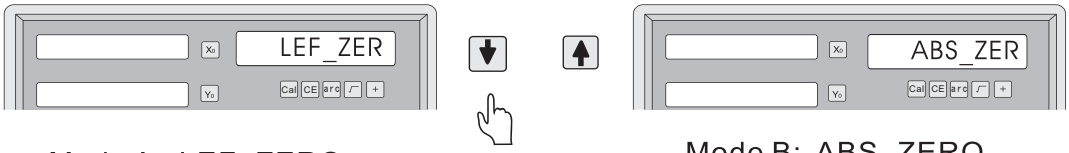
Step 3: Input the parameter number.



Step 4: Input the parameter step.
(For example : step = 50)



Step 5: Select the start point (there are two kinds of start point a. LEFT ZERO;
b. ABS Ref ZERO and can be selected by pressing key ↓ ↑



Mode A: LEF_ZERO

Mode B: ABS_ZERO

In Mode A (LEF_ZERO), the start point is find by pressing the key ENT

In Mode B (ABS_ZERO), the start point is find by moving the worktable.

The start point is the start point for calculation of Non- Linear compensation.

Step 6: Input compensation value.
X -axis display the value of the Digital Readout
Y-axis display the real value (input by the operator)
the error must be less than 10%.

Step 7: After input all parameter, the DRO automatically exit .

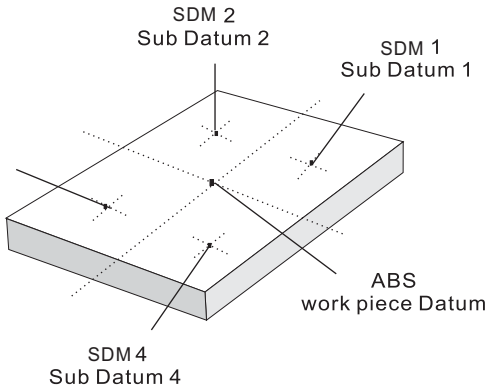
3.12 200 Sets Sub Datum Function:

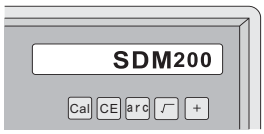
There are three kinds of coordinate systems. ABS Mode (1 set), INC Mode(1set) and SDM Mode (200 sets). It is a good way to store the datum of workpiece in ABS Mode and to machine in INC or SDM Mode. INC is independent of ABS, it is not relative to ABS datum.However, all SDM coordinate are relative to ABS coordinate, the SDM position will shift together with the ABS zero position change.

ABS Mode , INC Mode and SDM Mode are specially designed to provide much more convenience features to the operator to cope with the batch machining of repeative works and the machining of the workpiece machining dimensions from more than one datums.

Application to the workpiece that have more than one datum

Store all the subdatums of workpiece as per follows.



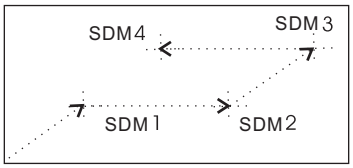


Go to the SDM directly by pressing the number of SDM in SDM state or pressing ↓ ↑

Application to the batch machining of repeative works

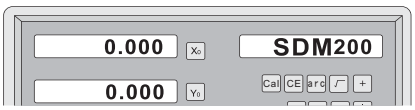
Because all SDM subdatums(0.000) are relative to ABS datum, therefore, for any repeative works, the operator just need to set up the first workpiece datum at ABS and store the machining position in SDMs.

For anymore repeative parts, just set up the 2nd, 3rd... workpiece zero at ABS, then all the machining positions will reappear.



ABS zero

Workpiece Datum(0.000)

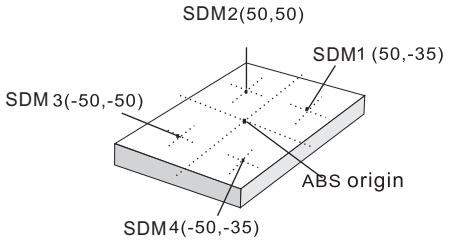


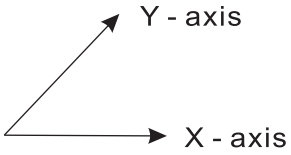
Go to the SDM directly by pressing the number of SDM in SDM state or pressing the key ↓ ↑

Move the TOOL to display= 0.000, then machining location reached.

Example:

There are four auxiliary zeros (SDM1 to SDM4), There are two methods to set the auxiliary zeros. One is zeroing when reaching position and the other is directly input SDM zero. The examples as follows, the SDM coordinates are all related to ABS zero.



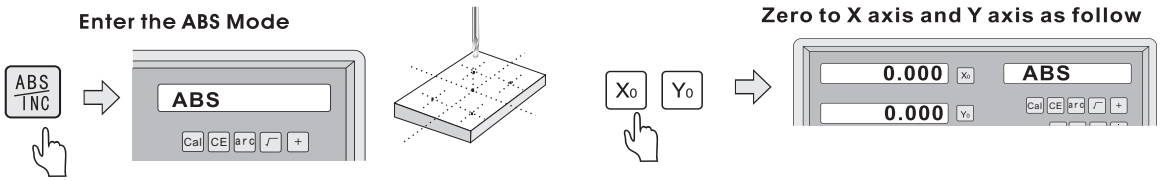


Method 1: Zeroing When Reaching Position

Move worktable to place the TOOL at the central point fo the workpiece, then enter display way of ABS. Zeroing, set ABS zero in the main reference point of parts.

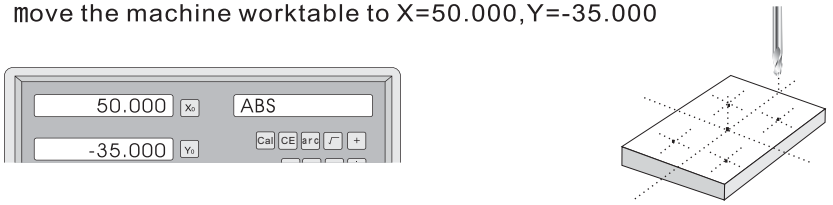
Step 1: Set the origin of ABS (the reference of the workpiece)

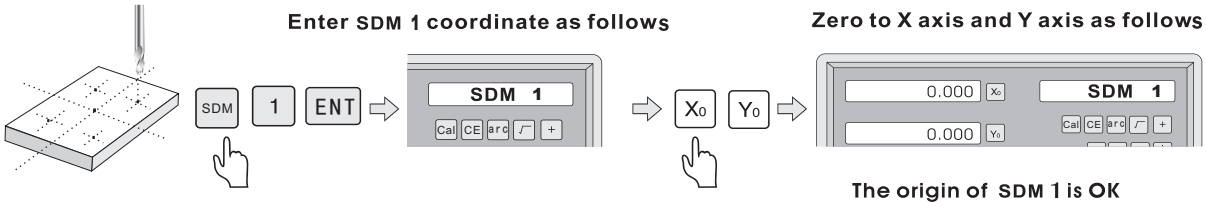
Move the machine worktable to place the TOOL at the origin of ABS



Step 2: Set the origin of SDM1

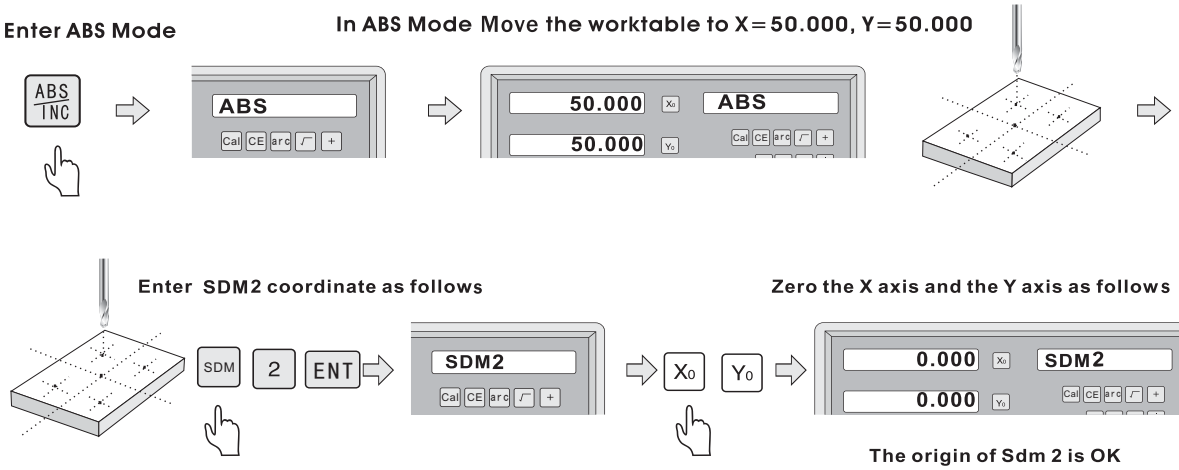
In ABS Mode, move the machine worktable to X=50.000,Y=-35.000



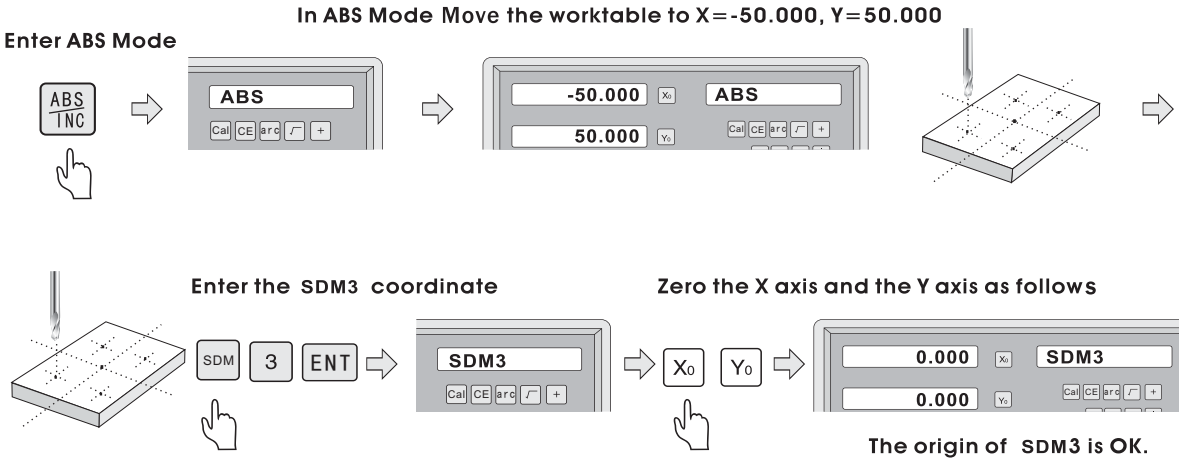


The origin of SDM 1 is OK

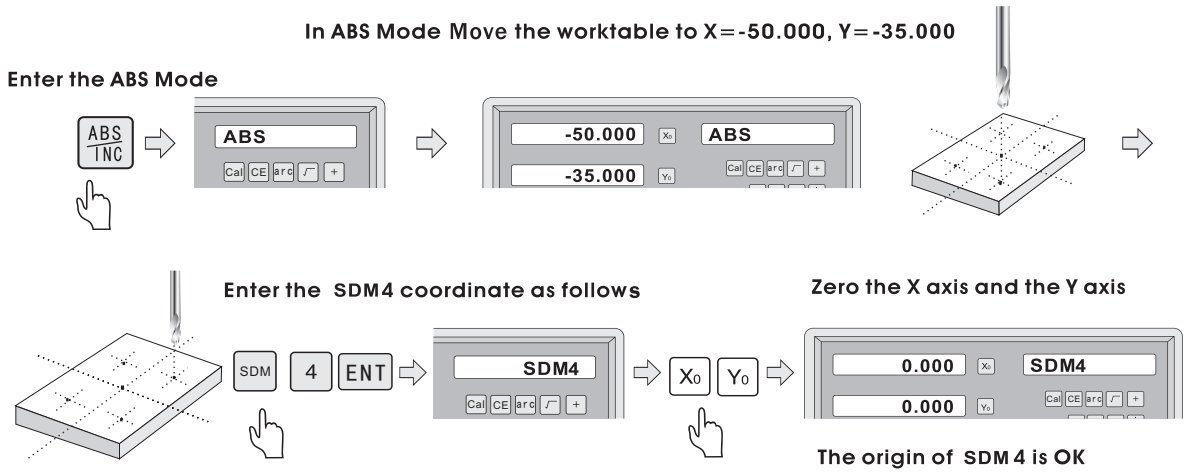
Step 3: Set the origin of SDM2



Step 4: Set the origin of SDM3



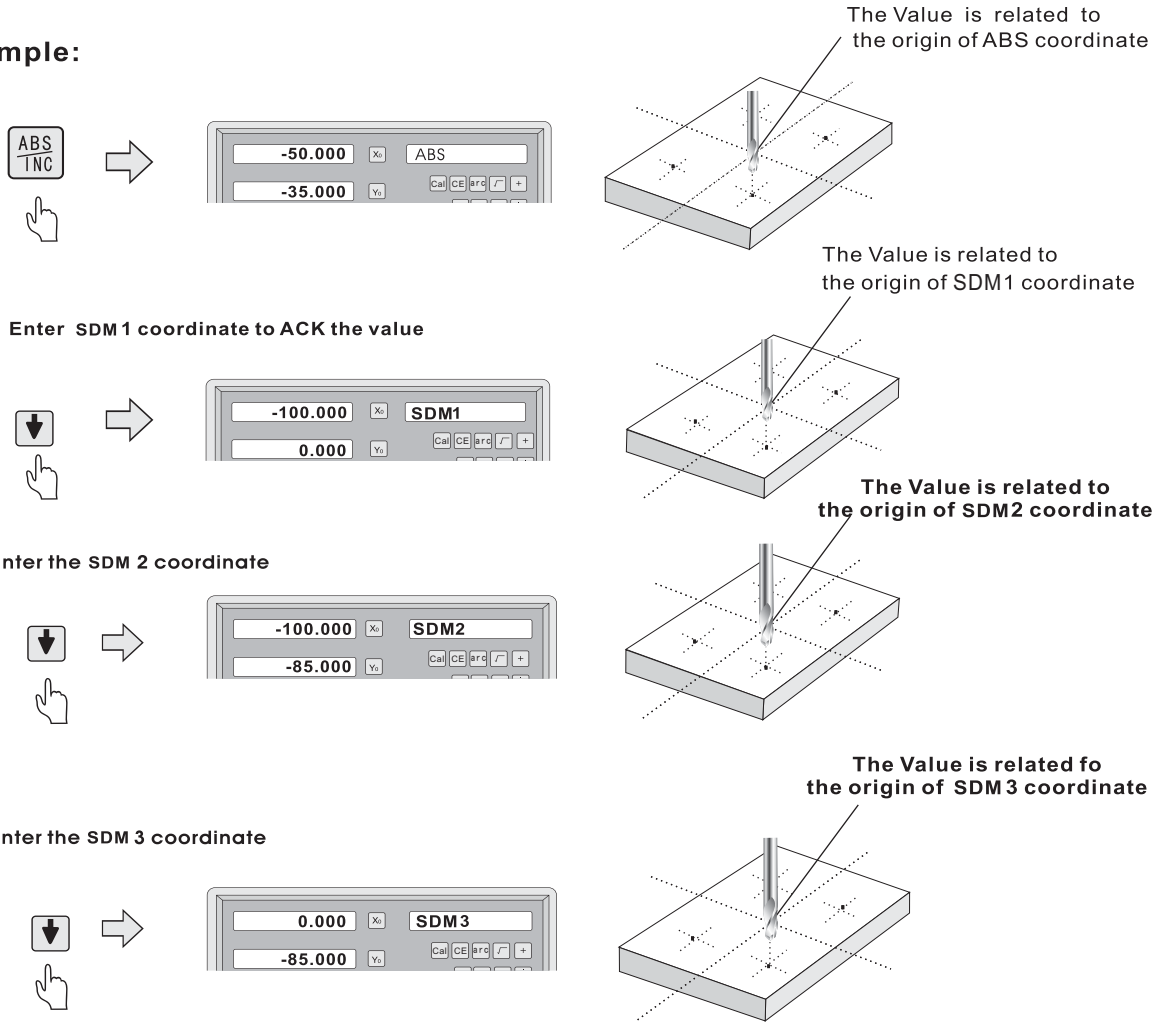
Step 5: Set the origin of SDM4



ACK the origin of SDM

Press ↓ ↑ to the SDM coordinates done and ACK the value.

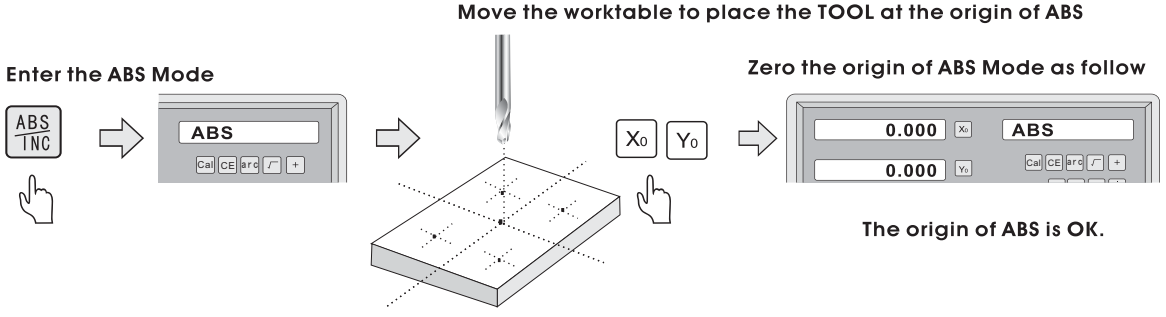
Example:



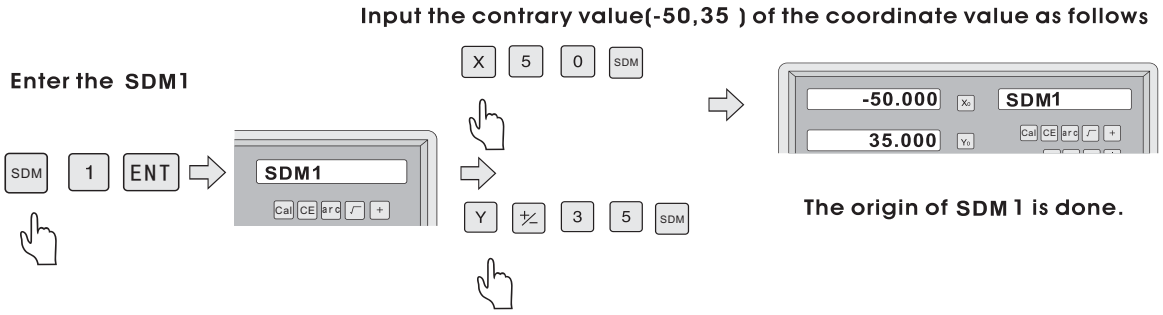
Method 2: Directly input

There are the same sample as method1. Firstly move the worktable to place the TOOL exactly at the origin of ABS, secondly enter the ABS mode as follows.

Step 1: Set the origin of ABS

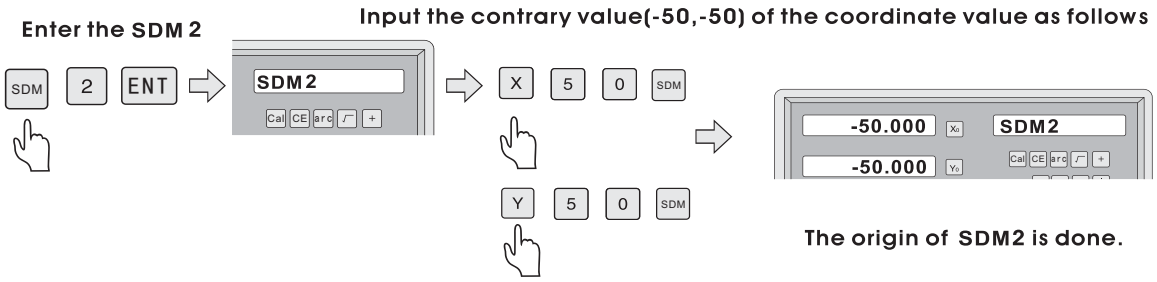


Step 2: Set the origin of SDM 1 coordinate.

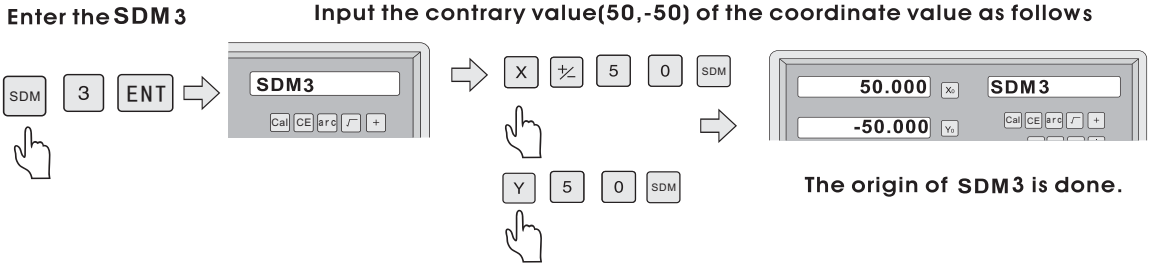


Note : The input value and the coordinate value is contrary.
Reason: The TOOL is at the origin of ABS Mode. As the input value is contrary to the coordinate, retract the axes until the displays read 0.000, the TOOL can be placed exactly at the origin of the SDM .

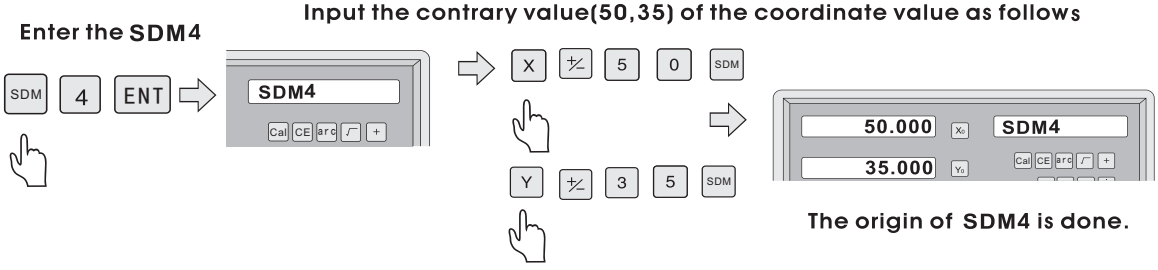
Step 3: Set the origin of SDM2



Step 4: Set the origin of SDM 3



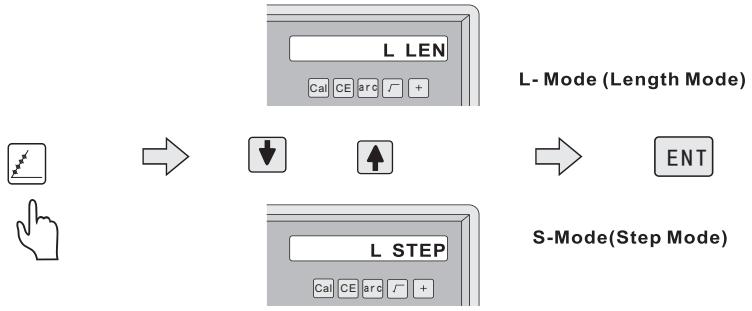
Step 5: Set the origin of SDM4



4. Special Functions

4.1 Linear Drilling

There are two modes to carry out the linear drilling



Input the following data

L-Mode: LENGTH--Length of oblique line--the distance of the centers of the starting hole to the ending hole

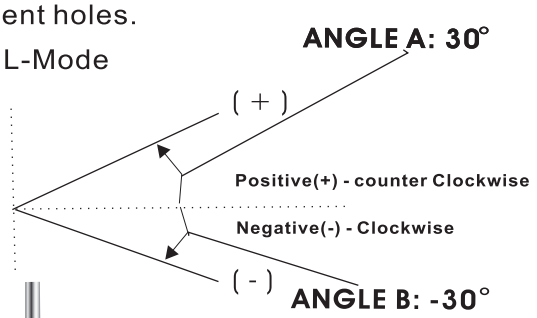
ANGLE -- It indicates the direction of oblique line on the coordinate plane. As the Fig, the intersection angle A is 30. The intersection angle B is -30.

No.Hole

S-Mode: STEP -- the distance of two adjacent holes.

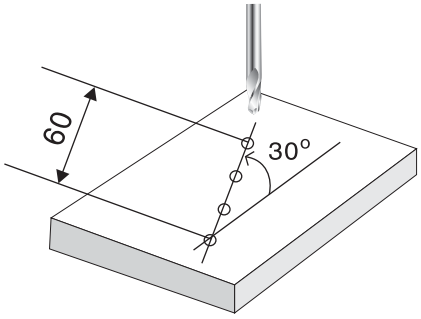
ANGLE -- the same as ANGLE of L-Mode

No.Hole

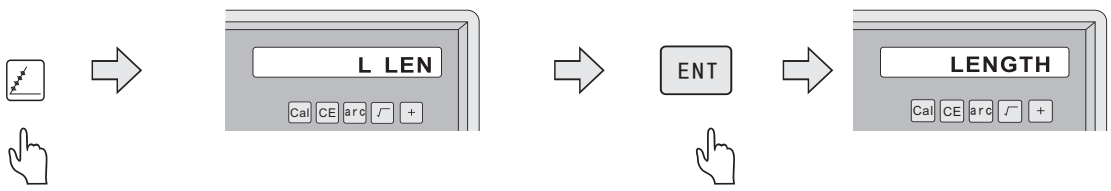


Example: As the left Fig.

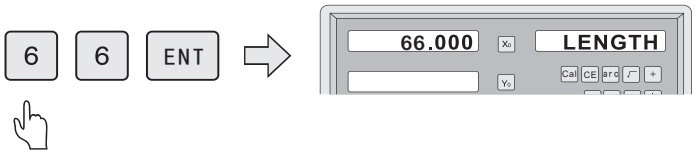
The length :60mm
The angle: 30
Hole number: 4



Step 1: Access the linear drilling by pressing and selecting the L-Mode

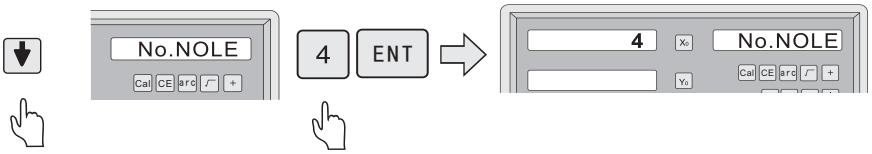


Step 2: Input the LENGTH:

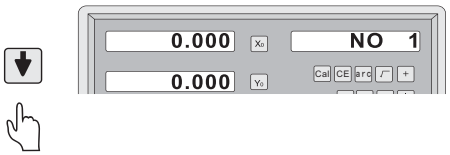


Step 3: Input the ANGLE:

Step 4: Input the number hole.



Step 5: **After all parameters are input, press [↓] for machining**



The display reading is the coordinate of the first hole

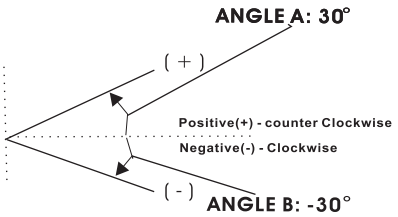
Press the key [↓] to display the position of next hole. Retract the axes until the displays read 0.000, the tool can be placed exactly at the position of the hole. Press [⌐] to quit the function at any time.

4.2 PCD Function

The Function of PCD hole positioning on circumference is used to distribute arc equally, such as boring hole on flange. The right window will show the parameter to be defined when selecting PCD function. The parameters to be defined are:

CT POS -- Central coordinate of arc
DIA -- Arc diameter
No.Hole -- Number of equipartition points
AT ANGLE -- Starting angle of arc to be distributed equally.
ED ANGLE -- Ending angle of arc to be distributed equally.

Note: The direction of starting angle and ending angle is shown as the right Fig



Take the machining of the work-piece in Figure as an example

Step 1: Press [❄] to enter PCD function and select the processing plane X-Y for 3 axes

(when using DRO for 2 axes, go to the next parameter without selecting processing plane)

4. Special Functions

The parameters of the example:

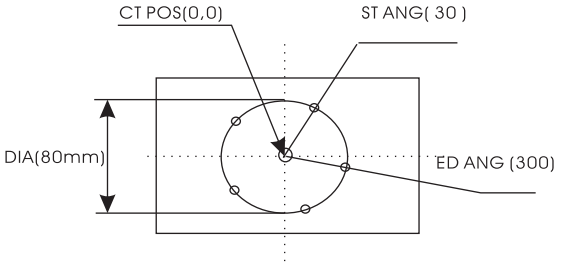
CT POS-----X=0.000, Y=0.000

DIA----------80mm

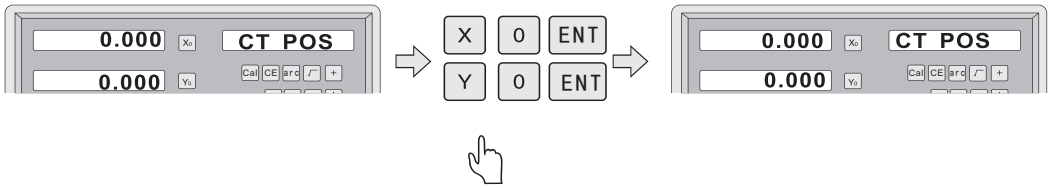
No.HOLE---5

ST ANG-----30

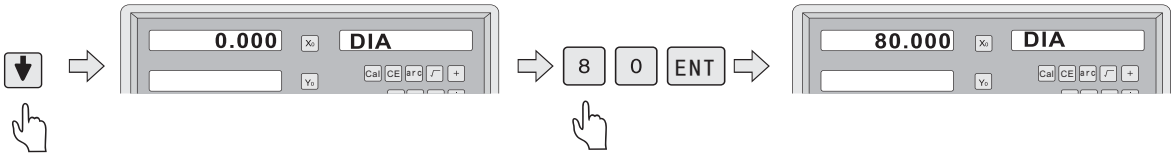
ED ANG----300



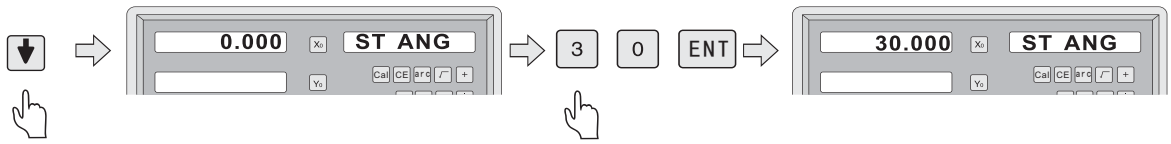
Step 2: Input the first parameter -- CT POS



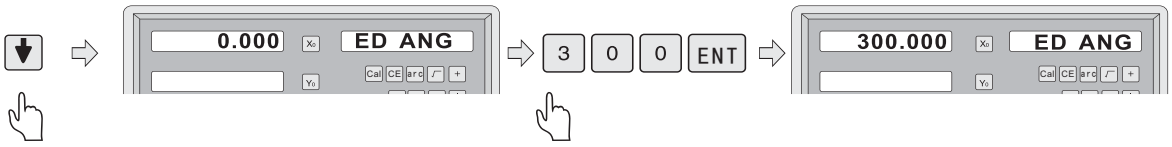
Step 3: Input the diameter (DIA)



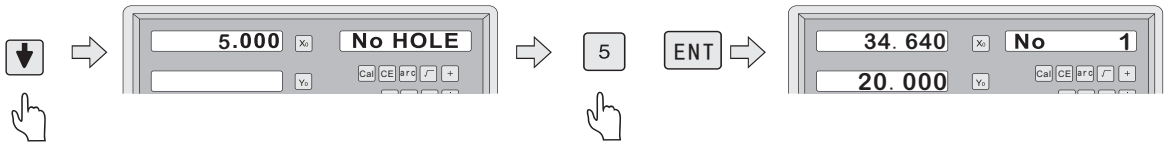
Step 4: Input the start angle of the first hole(ST ANG)



Step 5: Input the end angle of the end hole(ED ANG)



Step 6: Input the number of hole (NO.Hole)



Step 7: After all parameters are input, press the key for machining.

Press the key to display the position of the hole. Retract the axes until the display read 0.000, the TOOL can be placed exactly at the position of the hole.

Press to quit the function at any time.

4.3 R Function (Applicable to: milling machine, boring machine)

Two functions are available for the R function: the simple R Function and the smooth R function. Their advantages and limitations are as per follows.

Simple R function: Is aimed to machine only simple R or round corners, DRO provides the eight type of most frequently used R machining process.

Advantage: Very easy to use, operator does not even need to calculate the R parameters, just posit the TOOL at the start point and the type of machining, and then can start the R machining right away.

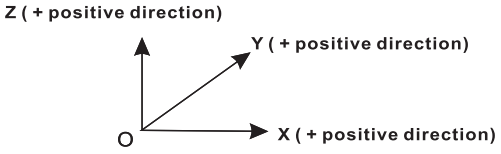
Limitation: Restricted to eight type of preset R only, cannot machine more complicated R such as intersected R.

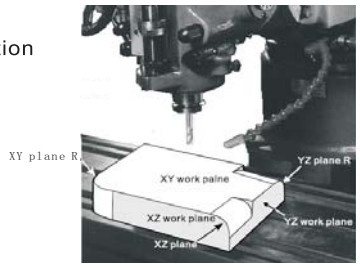
Press  to enter R function, then press  for selecting Smooth R Function or Simple R Function.

Before using the R Function, operators shall understand as follows.

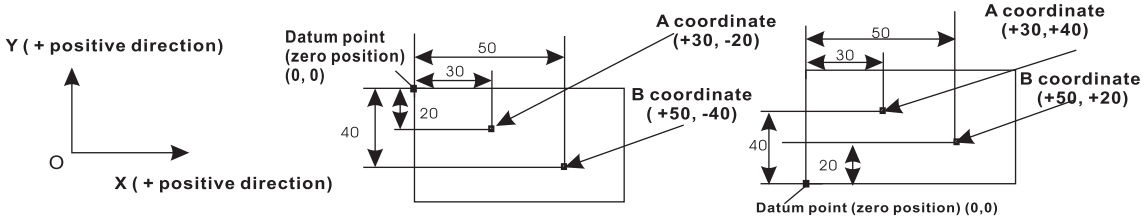
1) The coordinate system and the direction of X, Y and Z axis of the machine .
2) The angle and the polarity of angle.

During installation, normally the coordinate of the machine and the direction of X, Y , Z are as follows . The work plane is shown as the right Figure.

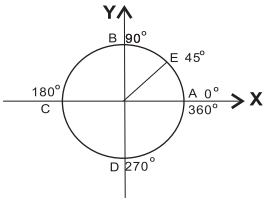




Example: Understand coordinate system.(On any of plate XY, XZ or YZ the coordinate of a point is the position relative to the zero on the plate)



Example: Understand the angle.(On any of plate XY, XZ or YZ both the start angle and end angle of R is calculated in counter-clockwise)



Arc AB (from A to B; the start angle A is 0, the end angle B is 90.)
(From B to A: the start angle B is 90, and the end angle A is 0.)

Arc ED (from E to D; the start angle E is 45, and the end angle D is 270.)
(from D to E: the start angle D is 270, and the end angle E is 45.)

4.3.1 Smooth R Function

Procedure for using the smooth R function:

Install and fix the workpiece in accordance with figures(A, B, C) and set the TOOL.

1. Move the TOOL to the start point and clear every axis.
   (make the TOOL setting position to the zero).
2. Press  to enter R function and press  to select the Smooth function:
3. Select work plan -XY, XZ or YZ plane R
   (ARC-XY, ARC-XZ, ARC-YZ)
4. Input the parameter CT POS :
   CT POS is refer to the position of the centre of an arc relative to that of the TOOL at TOOL setting and clearing.

   When plane XZ or YZ is machined

   As shown in figure (b). It refers to the position of point O at the centre of the arc relative to point B of the TOOL when a planar milling TOOL is used.
   As shown in figure (c), it refers to the position of point O at the centre of the arc relative to point C of the TOOL when an arc milling TOOL is used.

   When plane XY is machined

   As shown in figure (a), it refers to the position of point O at the centre of the arc relative to the central spindle of the TOOL

5. Input the parameter of R (the radius of the Arc)
6. Input the parameter of TL DIA (the diameter of the TOOL)
   Note: When Arc on plane XZ or YZ are machined: as shown in figure (b), a planar milling TOOL shall be used to machine R with point B as the machining point, and the diameter of the TOOL has no impact on the machining, so please input the TL DIA = 0.
7. Input the parameter of MAX CUT
   Note: For XY plane Arc, MaxCUT = max distance between interploated points.
   For XZ / YZ plane R:
   1) MAX CUT = max distance between interploated points in SMOOTH R function
   2) MAX CUT = Z STEP (fixed increment per step) in SIMPLE R function.

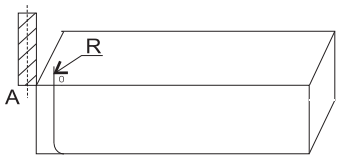


Figure A

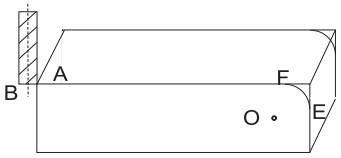


Figure B

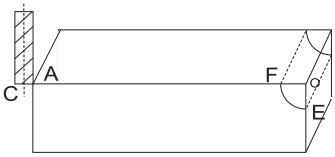


Figure C

8. Input the parameter of ST ANG (the angle of the start point of the Arc)
9. Input the parameter of ED ANG (the angle of the end point of the Arc)

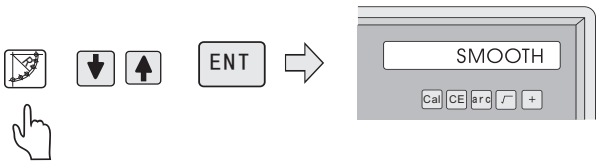
10. Press ↓ or ↑ to select R+TOOL(for outer Arc) or R-TOOL (for inner Arc)
As shown the right figure: R + TOOL for outer arc and R - TOOL for inner arc
11. After all parameters are input, Press the key ENT for machining.
The DRO will display the position for machining. Retract the axes until the displays read 0.000, machine the Arc point by point in accordance with the display.
Press ◢ to quit the function at any time.

	R + TOOL	R - TOOL
XZ/YZ plane R		
XY plane R		

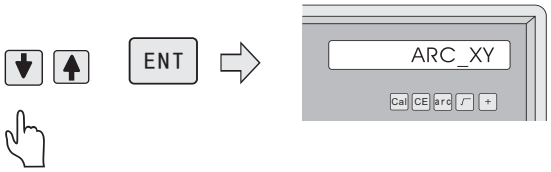
Example: (for SMOOTH R FUNCTION)
To machine an XY plane R, machining parameters as follows.

1.Move the TOOL to the start point and clear every axis.
(Make the TOOL setting position to the zero).
2. Select XY plane R
3. CT POS = (20, -20)
4. R = 20.000
5. TL DIA = 6.000
6. MAX CUT = 0.3
7. ST ANG = 0
8. ED ANG = 90
9. R + TOOL (outer arc machining)

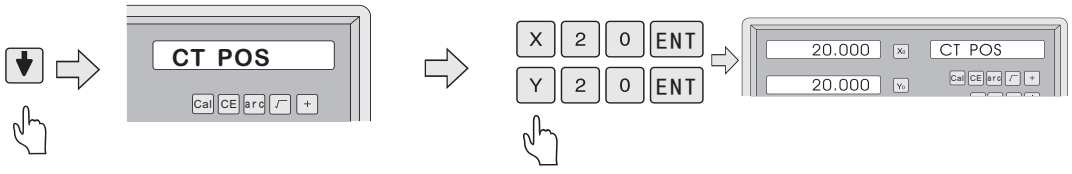
Step 1: Press ◢ to enter R function, select SMOOTH R function.



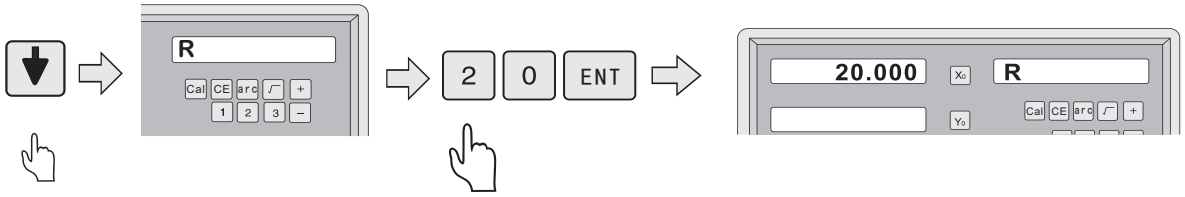
Step 2: Select work plane (ARC_XY) .



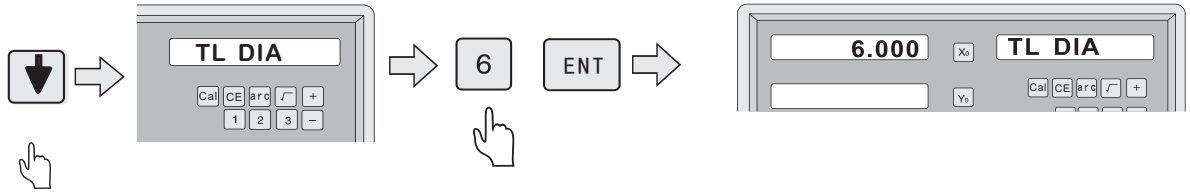
Step 3: Input CT POS
(the coordinate of the centre) .



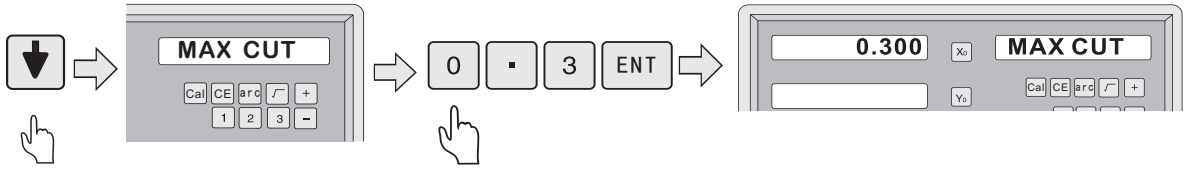
Step 4: Input R (the radius of R)



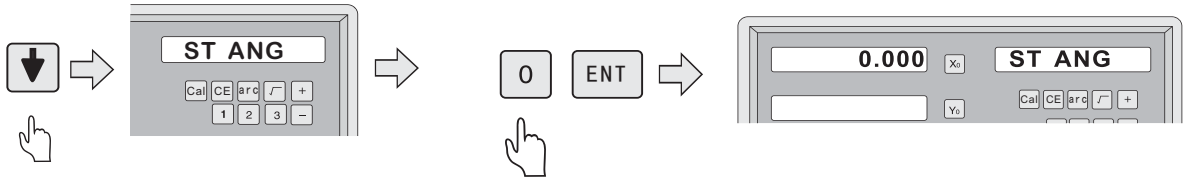
Step 5: Input TL DIA (the TOOL diameter)



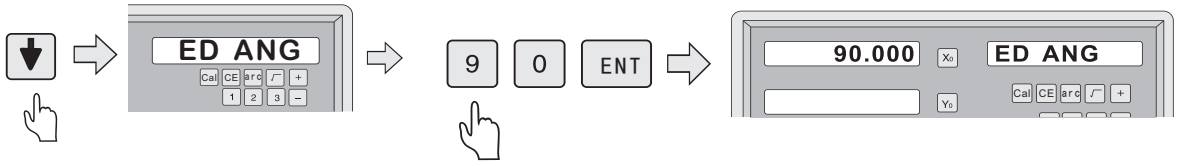
Step 6: Input MAX CUT.



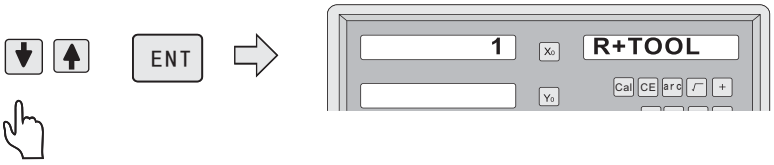
Step 7: Input ST ANG (the angle of the first point)



Step 8: Input ED ANG (the angle of the end point)



Step 9: Select the machining mode of the inner or outer arc.



Step 10: After inputting all parameters, press the key ⇩ for machining. The DRO will display the position of the first point. Move the machine TOOL until the axis is displayed as zero to get R starting point.

Press ⟋ to quit R function any time.

4.3.2 The Simple R Function

When the smoothness is not highly demanded, the SIMPLE R function is normally used for machining Arc. In the SIMPLE function there are only eight type of ARC used to machine. The operator just select the type of R and input the parameters of the radius of Arc , MAX CUT and outer Arc or inner Arc. In general, an arc may be machined by a planar slot TOOL or arc TOOL , the different between them in different work plane as shown as per follows.

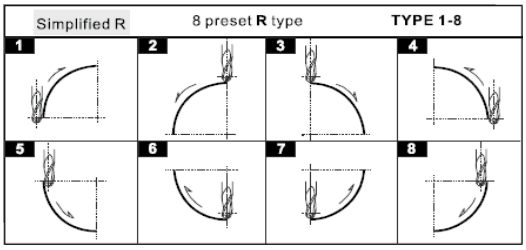


Figure 1:Using a planar slot TOOL for XZ/YZ plane Arc

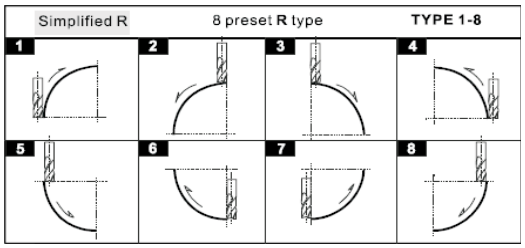


Figure 2: using a arc TOOL for XZ/YZ plane Arc

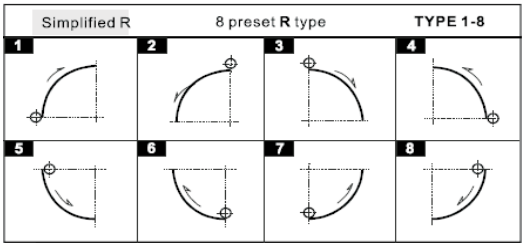


Figure 3: Using two Flute for XY plane Arc

Procedure for using the SIMPLE R function:

1. Make the TOOL over against the arc starting point (refer to the left figure) and clear every axis to make the TOOL setting position to the zero
2. Press to enter R function and press the key to select Simple R function.
3. Select R machining Mode which has been preset as type 1 to type 8.
4. Select XY, YZ or YZ as the machining plane. (ARC-XY, ARC-XZ, ARC-YZ)
5. Input the parameter of A . (the radius of the Arc)
6. Input the parameter of TL DIA. (the diameter of the TOOL)

   Note: (refer to step 6 of SMOOTH R Function) use a planar TOOL to machine arcs on plane XZ or YZ and input TL DIA = 0;

7. Input the parameter of MAX-CUT .

   Note: For XY plane Arc, MaxCUT = max distance between interploated points.

   For XZ / YZ plane R:

   1) MAX CUT = max distance between interploated points in SMOOTH R function

   2) MAX CUT = Z STEP (fixed increment per step) in SIMPLE R function

8. Press or to select R+TOOL (for outer Arc) or R- TOOL (for inner Arc)

   (Refer to step 10 of SMOOTH Function for outer arc and inner arc)

9. After all parameters are input, Press the Key ENT for machining..

   The DRO will display the position for machining. Retract the axes until the displays read 0.000, Machine the Arc point by point in accordance with the display.

Press to quit the function at any time.

Example: Machine the workpiece as shown Figure

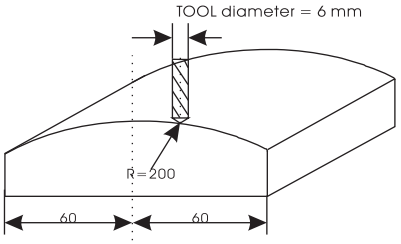
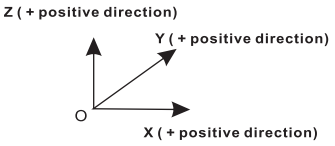
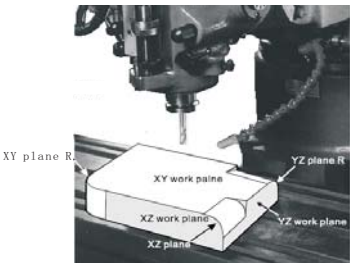


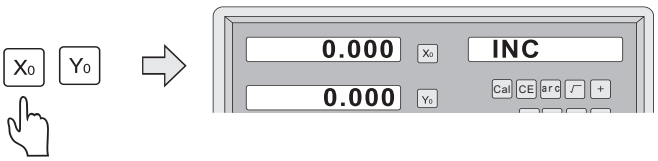
Figure 1:



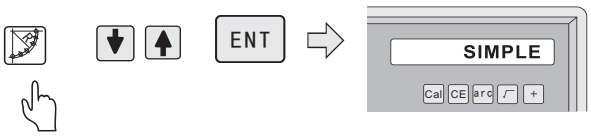


Divide the machining into two parts for using the SIMPLE R function

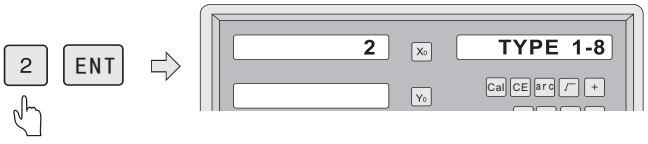
Step 1. Make the TOOL over against the arc starting point (refer to the figure) and clear every axis to make the TOOL setting position to the zero .



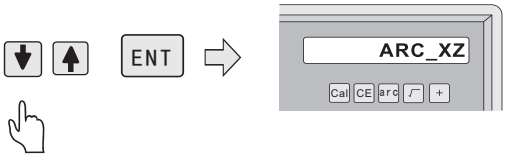
Step 2: Press to enter R function. press to select Simple R function as follows.



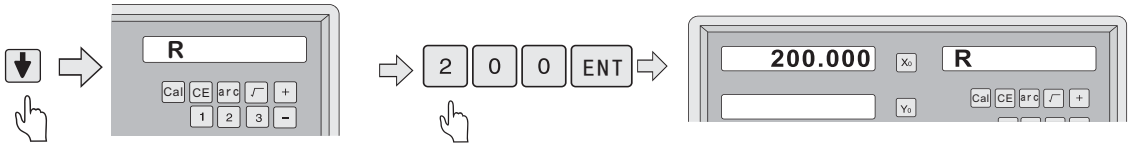
Step 3: Select preset R type.
(TYPE 2 for 1st part of workpiece)
(TYPE 3 for 2nd part of workpiece)



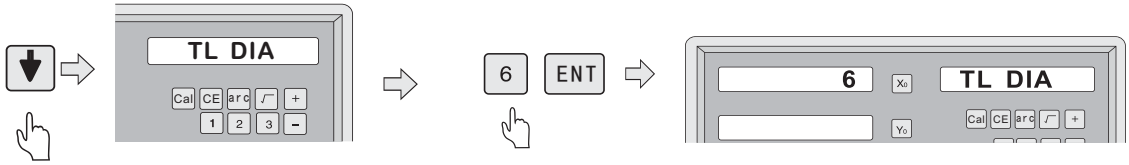
Step 4: Select the work plane (ARC_XZ)



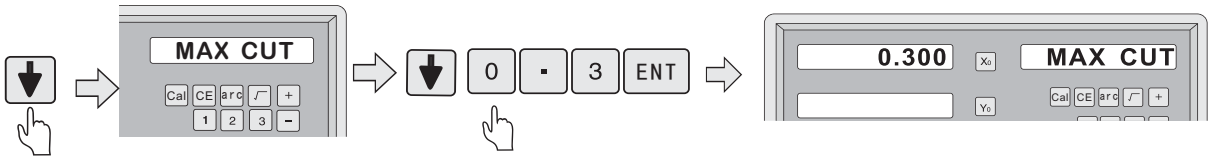
Step 5: Input R = 200.



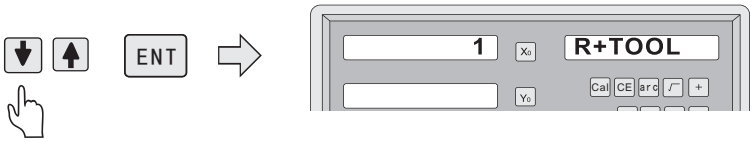
Step 6: Input the TL DIA = 6



Step 7: Input the MAX CUT = 0.3.



Step 8: Select the machining mode of the inner or outer arc.



Step 9: After inputting all parameters, press the key ENT for machining.

The DRO will display the position of the first point. Retract the axes until the displays read 0.000, Machine the Arc point by point in accordance with the display.

Press  to quit R function any time.

4. Special Functions

4.4 Chambering (applicable to: Milling machine, boring machine)

Enter chambering function. Input parameters: center coordinate chamber length、chamber width、TOOL diameter.

Example: Machining the part chamber shown in Figure A, align TOOL as Figure A.

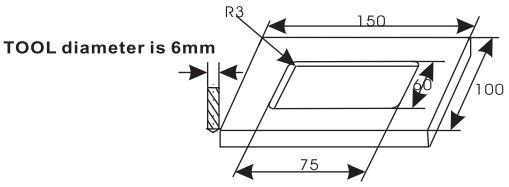


Figure A

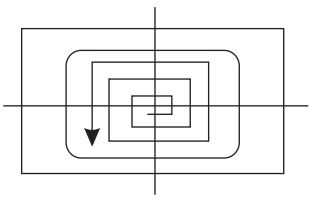
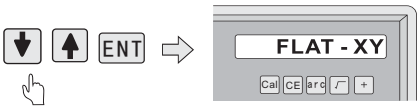
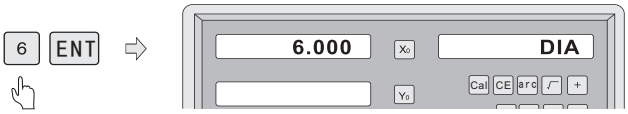


Figure B

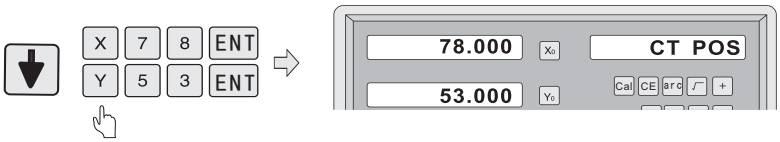
Step 1: Press [cos/M2] to enter the Chambering Function and to select work plane XY plane as the right.. (FLAT-XY, FLAT-XZ, FLAT-YZ).



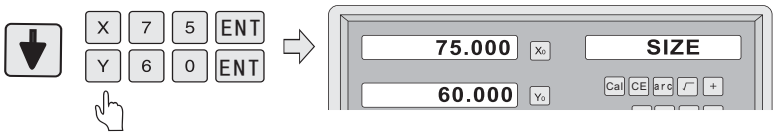
Step 2: Input the TOOL dimater



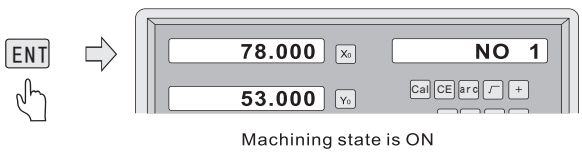
Step 3: Input the center coordinate:



Step 4: Input the size (the chamber length and the chamber width)



Step 5: After all parameters are input. Press [ENT] for machining.



Machining state is ON

Move the machine until the display of the axis is zero, ie, the position of the first point. Machine the first point . Display the next machining point by pressing [↓] . On the completion of machining, the right window shows OVER. Press [↓] , then system will goto the first position for the next workpiece.

press [cos/M2] to quit the Chambering Function.

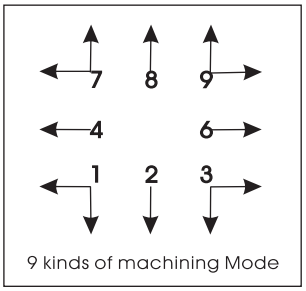
4.5 TOOL Compensation Function (Aapplicable to:milling machine)

Without TOOL compensation, the operator has to move the TOOL for an additional distance of the diameter of the TOOL along each side when machining the four 150 and 100 sides of a workpiece to finish machining the whole brim. The digital readouts shall automatically compensate when the TOOL compensation function is enable.

Note: the TOOL compensation is made in the direction of X-axis and Y-axis.

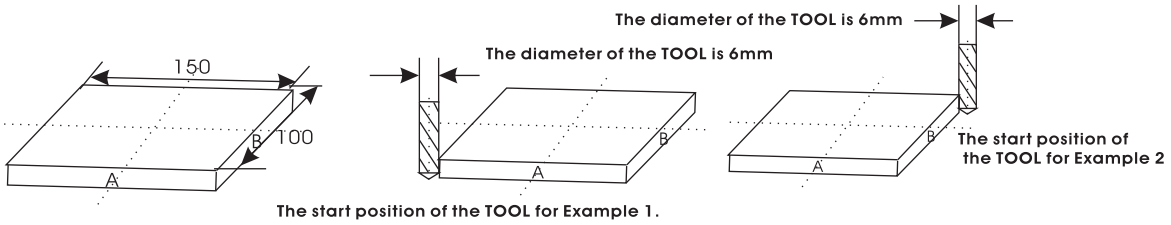
Procedures:

1) Enter the function of compensating the diameter of the TOOL.
2) Select one of the(four) preset machining modes.
3) Input the diameter of the TOOL.
4) Enter machining.



9 kinds of machining Mode

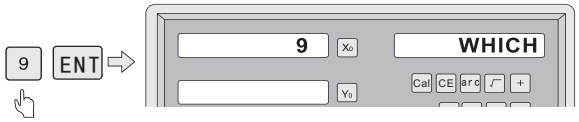
Example: As shown below. machining the plane A & B of workpiece shown in Figure.



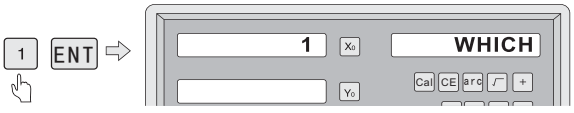
Step 1: Press [tan M3] to enter the TOOL compensation function.

Step 2: Input the machining mode.

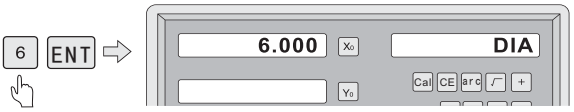
Example 1: Selsct the machining mode 9



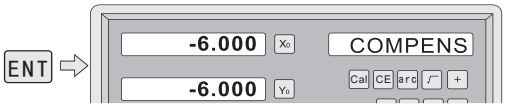
Example 2: Selsct the machining mode 1



Step 3: Input the diameter of the TOOL



Step 4: Press [ENT] to the machining mode.
Machining of 2 side planes can be done by moving the TOOL until X- axis is 150.000 and Y- axis is 100.000.
Press the key [tan M3] to quit the function.



Enter the machining
with the TOOL compensation Function
(Example 2 ; WHICH = 9)

4.6 Machining of Oblique Plane (applicable to: milling machine)

There are 2 ways available for machining oblique plane:

a) on the plane XY ; b) on the plane YZ, or XZ.

4.6.1. XY Plane

When the machining plane is on plane XY as the part shown in Figure 1, the angle of obliquity of the workpiece should be calibrated before the oblique plane is machined. Therefore , at this point the machining of oblique plane plays the role of calibrating the obliquity.

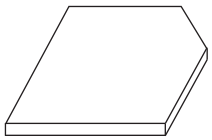


Figure 1

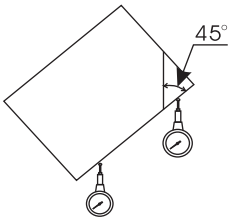


Figure 2

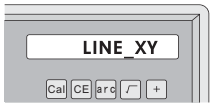
Procedure for Malibrating the Obliquity

First place the workpiece on the worktable as per the required angle of obliquity.

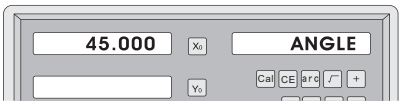
1) Enter the function of oblique plane.
2) Select the function of plane X Y .
3) Input the angle of obliquity.
4) Move the worktable until the measuring tool (such as a dial gauge) installed on the milling machine touches the obliquity-calibrating plane, adjust it to zero, and move the worktable for any distance in the direction of X-axis.
5) Move the worktable in the distance of Y- axis until the display turns to zero.
6) Change the angle of the work piece to make the workpiece touch the measuring tool and adjust it to zero.

For example: calibrate the obliquity of the workpiece to 45 degree shown in Figure 2.

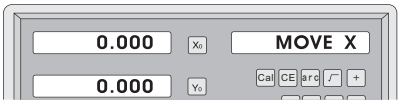
Step 1: Place the work piece on the worktable at the obliquity of about 45 degree. Press [sin/M1] to enter the Machining of Oblique Plane Function. Press [▼] [▲] [ENT] to select X Y plane



Step 2: Input the angle of obliquity.

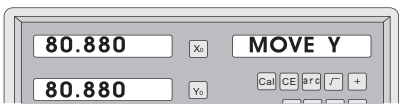


Step 3: Move the workpiece along the X- axis until the measuring tool touches the workpiece adjust it to zero, and move the worktable for any distance along the X- axis.



Step 4: Press [Y] , display the value of Y- axis. Move the workpiece along the Y- axis, change the angle of workpiece to make the obliquity-calibrating plane touch the measuring tool until it turns to zero. Move the worktable until Y- axis is displayed as zero.

Press [sin/M1] to quit at any time.



4.6.2 XZ or YZ Plane

When the machining plane is on plane XZ or YZ, the function of TOOL inclination can instruct the operator to machine the oblique plane step by step.

Procedures for using the function of cutter inclination:

When the machining plane is on plane XZ or YZ, first please calibrate the obliquity of the primary spindle nose and set the TOOL

1) Select the machining function
2) Input the starting point (ST POS)
3) Input the end point (ED POS).
4) Input the diameter of the TOOL (DIA).
5) Machining the oblique plane.

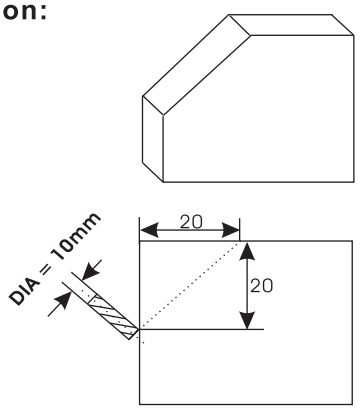


Figure 1

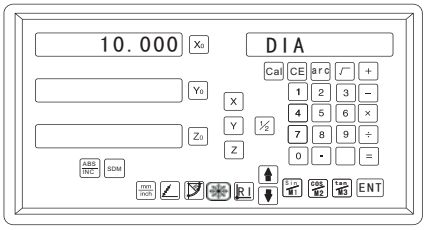
For example: machining the obliquity of the workpiece to 45 degree on X Z plane shown in Figure 1.

Step 1: Press [SID M1] to enter the machining of oblique plane function.

Press [↓] [↑] [ENT] to select X Z plane

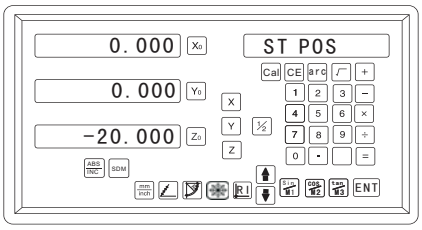
Step 2: Input the parameter DIA (the diameter of the TOOL)

1 0 ENT



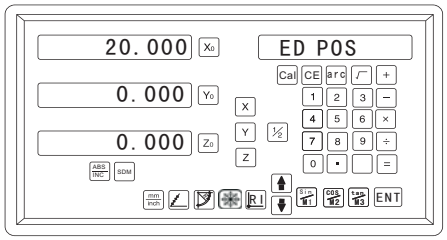
Step 3: Input ST POS (the starting coordinate)

X 0 ENT
Z +/- 2 0 ENT



Step 4: Input ED POS (the end coordinate)

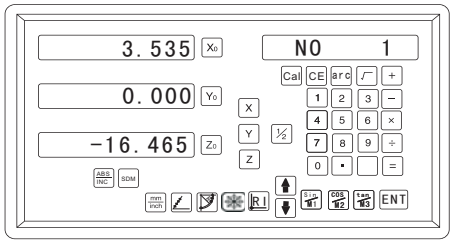
X 2 0 ENT
Z 0 ENT



Step 5: After input all parameters, press [ENT] to enter the machining state. AS shown right

The displayed value is the coordinate of the first point. Move the Machine TOOL until X- axis and Z- axis are all displayed as zero. Repeat it until over.

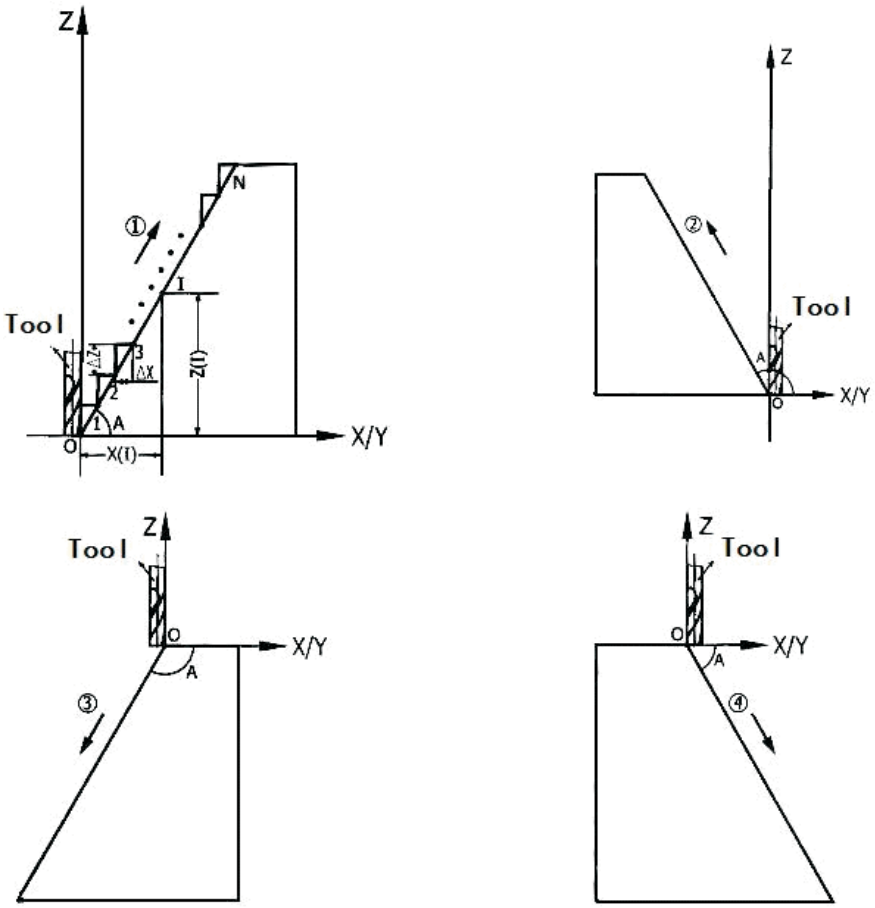
Press [SID M1] to quit this function at anytime.



4.7 M3 Function(2M)

The function is used to process erect bevct of Z axis.

There are 4 cases,as followe.

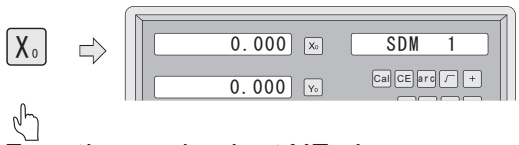


①ΔZ=0.1 A=60° ② ΔZ=0.1 A=120

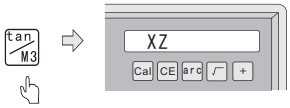
③ΔZ=-0.1 A=-120° ④ ΔZ=-0.1 A=-60

Steps(Take XZ as an example)

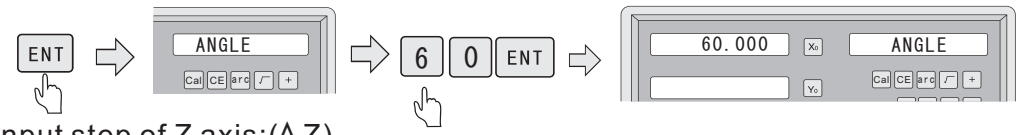
1)Move machine TOOL to it straightly align with the starting point:



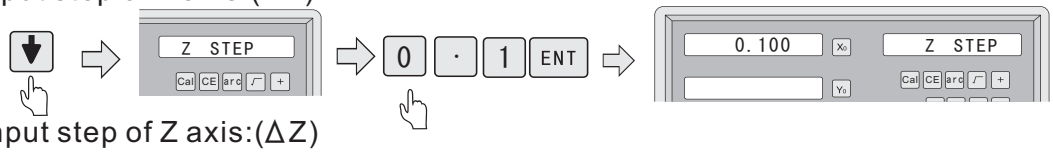
2)Enter M3 Function and select XZ plane.



3)Input angle of bevel:



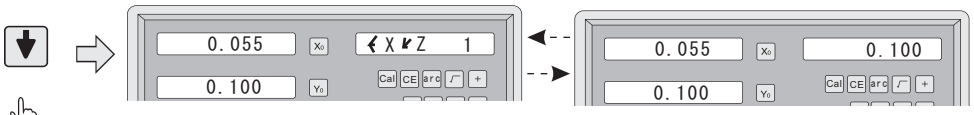
4)Input step of Z axis:(ΔZ)



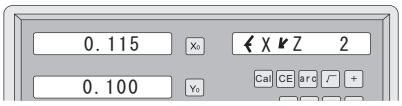
Input step of Z axis:(ΔZ)

NORE:The ΔZ value of each step is the same and display in Y axis.

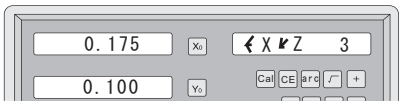
5) First point,move machine until X axis displays “0”and Z axis a positive distance of 0.1mm,then press ↓ next point:



6) Second point, move machine until X axis displays “0”and Z axis a positive distance of 0.1mm then press ↓ next point:



7) Third point, move machine until X axis displays “0”and Z axis a positive distance of 0.1mm then press ↓ next point:

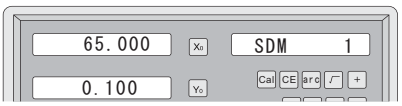


Last point

8) Last point, move machine until X axis displays “0”and Z axis a positive distance of 0.1mm :

9)Press tan/M3 to quit the function:

The DRO displays current vlue of X、Y.



10)Following formula ,verify the value:

Formula : $X_{(I)} = \frac{\Delta Z}{tgA} \times I \qquad \Delta X = \frac{\Delta Z}{tgA}$

$$Z_{(I)} = \Delta Z \times I$$

I: Step number

ΔX/ΔZ: Step value of X/Z axis.

$X_{(I)}/Z_{(I)}$: Shift of point I of X/Z axis.

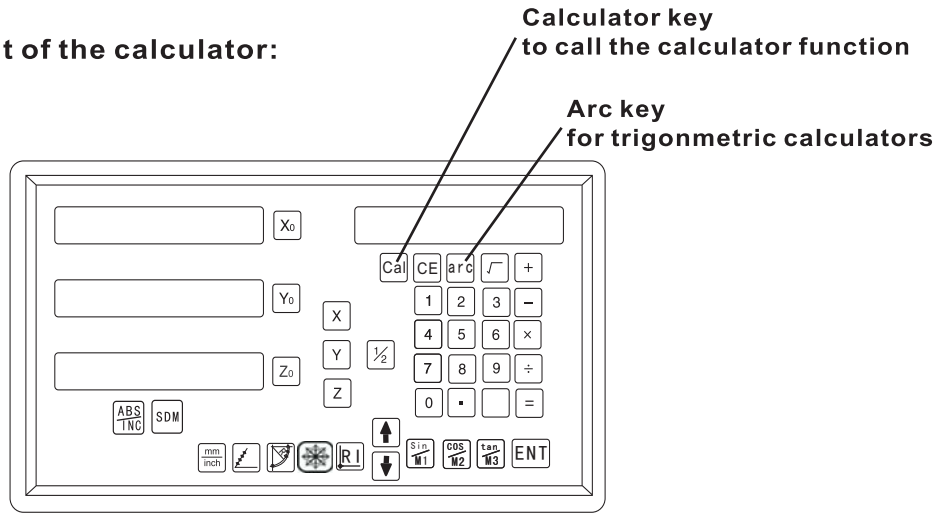
NOTE :The operation of YZ plane can be dealt with in the same way.

4.8 Calculator

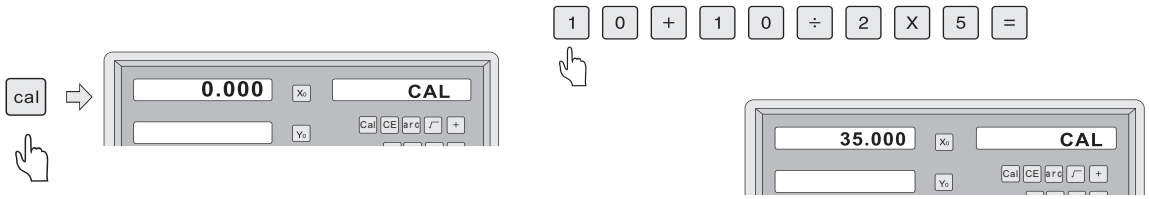
The Calculator not only provides normal mathematical calculations such as +, - , X , /, it also provide trigonmetric calculations such as SIN, Arc SIN, COS , Arc COS, TAN, Arc TAN SQRT etc.

The operations are same as the commerical calculators, easy to use.

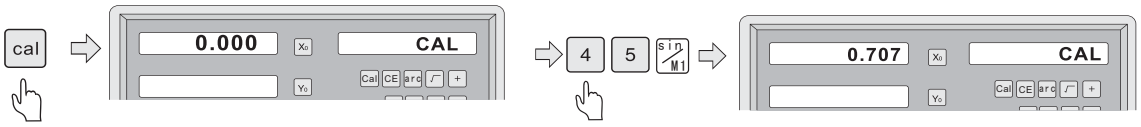
Key layout of the calculator:



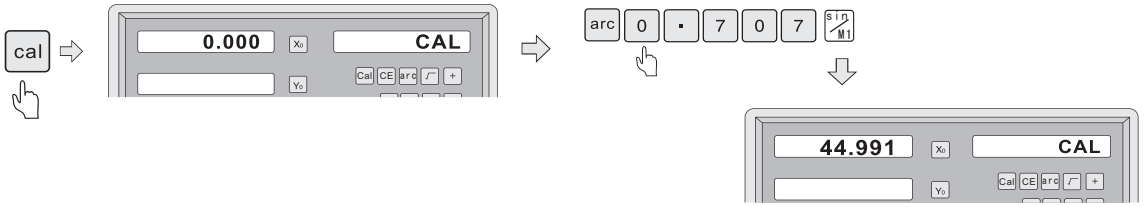
Example 1: 10+10÷2X5=35



Example 2: SIN45=0.707



Example 3: Arc Sin 0.707=44.991

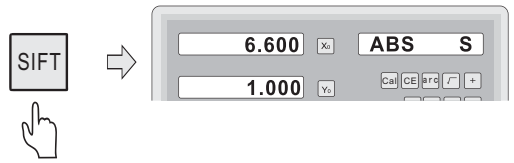


4.9 Machining Function of the Grinding Machine

4.9.1 Digital Filter

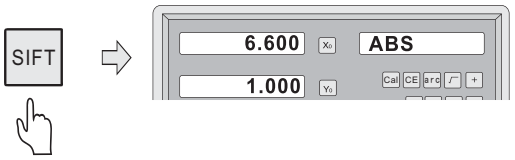
In grinding processing, the vibrating of grinding machine makes the display of readout change repeatedly and rapidly and it causes the uncomfortable vision of operators. The special readout 2G for grinding machine has the function of digit al filtering, that is the "Removing shutter functi on". In grinding processing, operator can use the function following the below operation.

Step1: Press the key SIFT to access the filter function.



S Mark is appears in the left of info window

Step2: Press the Key SIFT again to quit the filter function.



Note: The display value filtering function can be only used in the INC and ABS state.

4.10 Machining Function of Lathe

4.10.1 200 Set TOOL Base

It always needs different TOOL when processing different parts. For convenient operation, 2L and 3L digital readouts has the function of 200 sets TOOL base.

Note: Only when the lathe is equipped with the tool setting block , the 200 sets TOOL base can be used.

1. Set a datum TOOL. After tool setting, Zero X axis and Z axis, the set zero of absolute coordinate.
2. According to the size of TOOL and datum TOOL, determine the position of TOOL relative to zero of absolute coordinate and datum tool. As Figure 6-1 , the relative size of TOOL 2 is as follows X axis 25-30=-5, Z axis 20-10=10.
3. Save the TOOL number and the size into digital readout.
4. The number of TOOL can be input at random, the digital readouts will display the position of tool to absolute coordinate zero. Move lathe until X axis and Z axis both display zero.
5. TOOL base can save the 200 sets of the data of tools.
6. The TOOL base must be used in the opening state. The 200 sets TOOL Libs can be opened by continuously pressing the key [+/-] ten times until the right window flashes TL - OPEN and a mark display at the left of the right information window. The mark indicates that the operator can setup or revise the 200 sets TOOL base . Continuously pressing the key [+/-] ten times will cause the 200 sets TOOL base to be closed and the right window flashes TL - CLOSE and the mark disappear . When the mark disappears the 200 sets TOOL base can not be revised.

The operations for inputting TOOL data and calling TOOL is shown as follows.

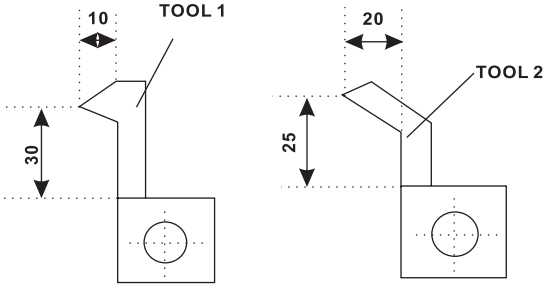


Figure 6-1

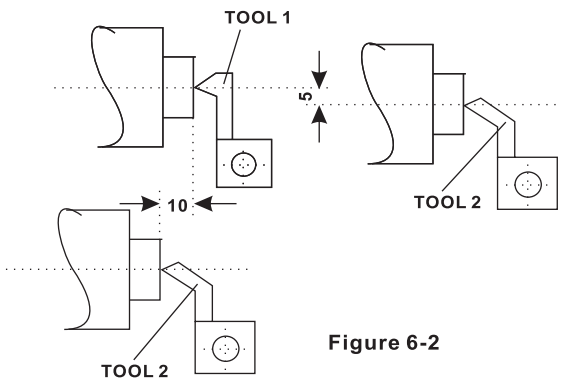
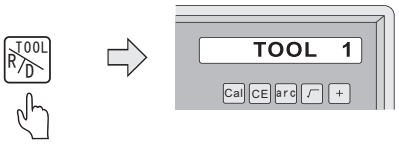


Figure 6-2

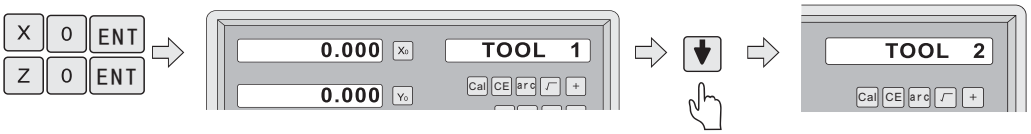
4. Special Functions

Step 1: In ABS state, input the data of the 200 sets TOOL base. To opening the 200 sets TOOL base by continuously pressing the key [±/-] ten time. A mark will appear at the left window of the right info window.

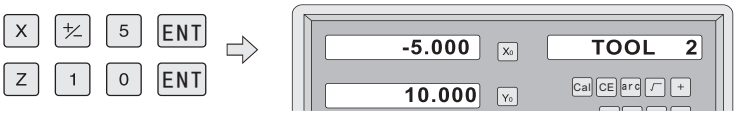
Step 2: Press [TOOL R/D] to access the inputting state.



Step 3: Input TOOL 1 data:



Step 4: Input TOOL 2 date



Step5: Press to continue to input the data of next tool. By pressing number and the key [ENT], the operator can directly input the special tool data. Press the key [TOOL R/D] to quit .

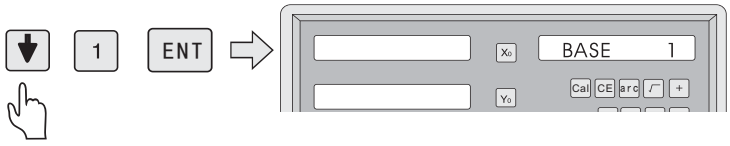
After TOOL base is setup, use the TOOL base according to the following operations. First mount the 2nd tool.

Step 6: To access the using state by pressing the key [CALL]

Step 7: Press the key [▲] [▼] to select the current mount tool,

Then press the key [ENT] to ACK and to selecting the base tool.

Step 8: Select the base TOOL.



Step 9: Press the key [CALL] to quit the function.

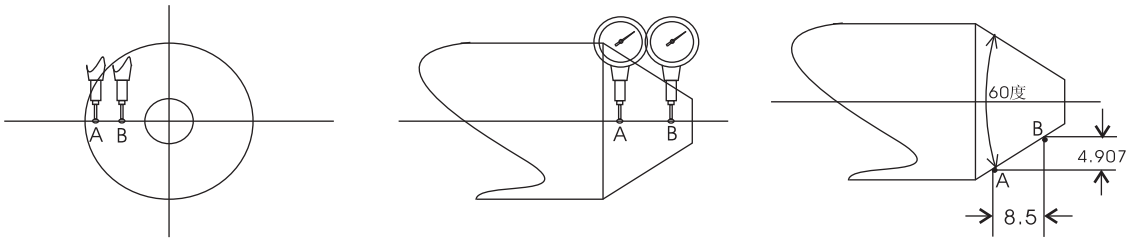
Move worktable until X and Z axis both display zero. Now the 2nd tool can be used

Note: When the base tool is used, the axis can be zeroed in ABS state .

When the others are used, the axis can only be zeroed in INC state.

4.10.2 Taper Function:

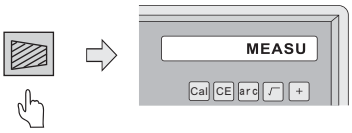
For lathing the workpiece with taper, the taper of the workpiece can be measured in processing.



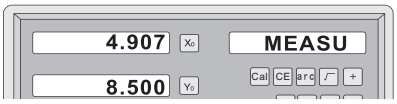
Operations:

As figure, contact surface A of workpiece with lever readouts and reset the lever readouts point to zero.

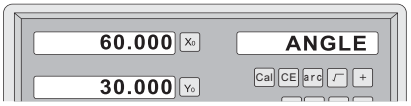
Step 1: To access the Taper Function by pressing the key 



Step 2: Move the lever readout to the surface B until the lever readouts points to "0".



Step 3: Press the key ENT to calculate, and press the key  to quit.



Z axis:Taper
Z axis:Angle

4.10.3 Display of Radius / Diameter Switching

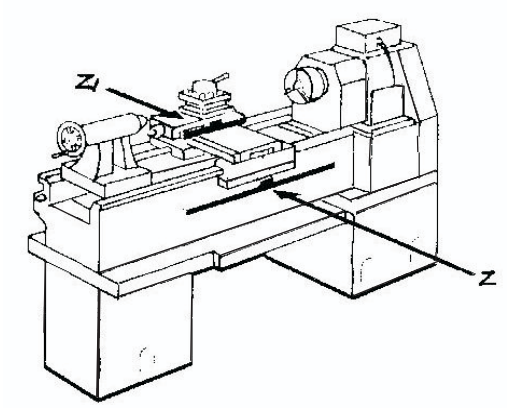
For 2 axes lathe and 3 axes lathe, press the key X , then press the key R/D TOOL
The display mode of X axis is switched between radius and diameter
When X axis for display of Diameter, A mark ◸ will appear at the left of the right information window, but when X axis for display of diameter , the mark ◸ disappear . Only X axis has the function of the diameter / radius transformation.

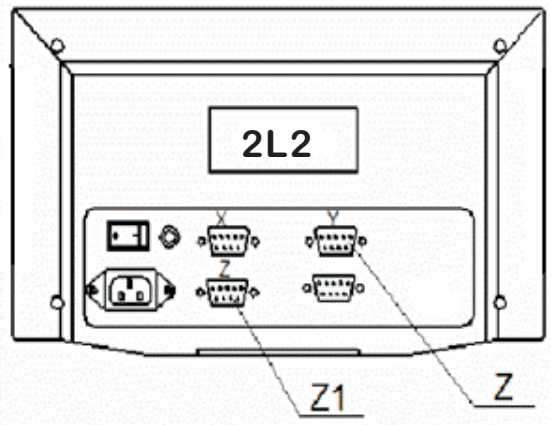
4.10. 4 About the 2L2

2L2 is a 3 axis digital readout specially used on lathe machines.
It is the same as that of 2L except that it adds a linear scale (Z1) to measure the position of the machine working stage.

See Picture I:

The lathe machine is equipped with two linear scales (Z and Z1) in the same direction, the position of the machine working stage will be decided by the displacement of the two linear scales (Z+Z1). The displacement value will be displayed in the Z axis display window. The Z1 axis of the display has no function of zero window and linear correction, the resolution will be set by Z axis and it is the same as that of Z axis. The counting direction will be set by Z1 axis. Adjust the mounting and counting direction of the reader heads and make the counting and moving direction of Z and Z1 the same, and then Z axis display window will show the moving position of the machine stage.





Picture I **Picture II**

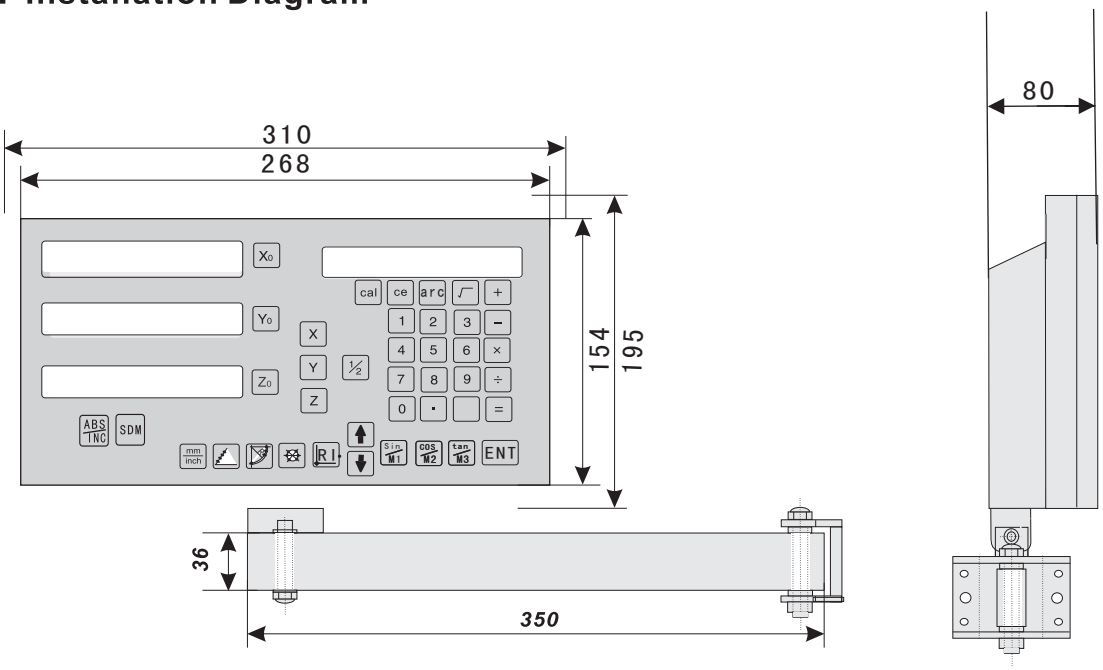
Please refer to the picture Ⅱ when connecting linear scales and DRO.

5. Appendix

5.1 Specifications of Digital Readout.

1)supply voltage: AC100V~240V;50Hz/60Hz
2)Power consumption: 7~15VA
3)Operation temperature: 0℃~45℃
4)Storage temperature: -30℃~70℃
5)Relative humidity: <90%(25±5℃)
6)Max coordinate number: 3
7)Readout allwable input signal: TTL sqare wave
8)Allowable input signal frequency: <600kHz
9)Resolution of digital display length: 0.1um、0.2um、0.5um、 1um、2um、
2.5um、5um、10um.
10)Max rasolution of digital angle: 0.0001/PULSE
11)Weight: 2.1kg
12)Dimensions: 310 195×80（mm）
13)Linear scale
Power supply: DC 5V
Signal: Outputs 2 channels of TTL square wave with a phase diffrence
Of 90° (with the ref mark signal)
Current : 50mA~100mA.

5.2 Installation Diagram



5. Appendix

5.3 Troubleshooting:

The following are the preliminary solutions for troubleshooting.
If there is still problem, please contact our company or agents for help.

Troubles		Solutions
No display	1. Power isn't connected 2. Power switch is off. 3. The range of power voltage is not right. 4. The inner power of linear scale is short.	1. Check power wire and connect the power 2. Turn on the power switch. 3. The range of voltage is in 80--260V 4. Unplug the connector of linear scale
One axis is not counting	1. Replace the linear scale of the other axis. 2. DRO is in special function	1. If count is normal, the linear scale has trouble; If abnormal, the DRO readouts has trouble. 2. Quit the special function.
Linear scale is not counting	1. Reading head is bad for using range exceeds. 2. Aluminum chips is in reading head of linear scale. 3. The span between the reading head and metal part of linear scale is large. 4. The metal parts of linear scale is damage.	1.Repair the linear scale 2. Repair the linear scale 3. Repair the linear scale 4. Repair the linear scale
Counting is error	1. Shell is poor grounding. 2. Low precision of machine . 3. Speed of machine is too rapid. 4. Precision of linear scale is low. 5. The resolution of DRO readouts and the linear scale is not match. 6. The unit (mm/inch) is not match. 7. Setting thelinear compensating is not arrest. 8. Reading head of the linear scale is damaged.	1. Shell is good grounding. 2. Repair the machine. 3. Reduce the speed of machine. 4. Mount the linear scale again. 5. Set the resolution of the DRO again. 6. Cover the unit of display mm/inch. 7. Reset the linear compensation. 8. Repair the linear scale.
The counting of the linear scale is not accurate	1. The mounting of linear scale does not demand the requirement, and the prcision is not adequate. 2. The screw is loosen. 3. Precision of machine is low. 4. The resolution of digital readouts and the linear scale is not match.	1. Mount the linear scale again and level it. 2. Lock all fixing screws. 3. Repair the machine. 4. Reset the resolution of digital readouts.
Sometimes the linear scale is not counting	1. The small car and steel ball is separated. 2. The glass of reading head is wearied. 3. The glass of reading head of the linear scale has dirt. 4. The elasticity of the steel wire is not adequate.	1. Repair the linear scale 2. Repair the linear scale 3. Repair the linear scale. 4. Repair the linear scale.