DIGITAL READOUTS

D80

Operation Manual

(Version 1.0)

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1. System parameter setting

1. System parameter setting

Select the [⚙] after turning on the DRO to enter the system parameter setting.The system parameter setting includes the axes parameter setting,DRO setting,RPM setting,Axes summing setting,shortcut key setting,factory reset setting.

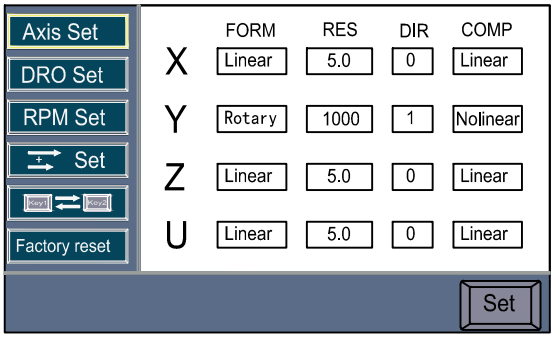
1.1 Axes parameter setting.

This includes **FORM**-–Encoder type selection(Linear stands for linear encoder, Rotary stands for the rotary encoder),**RES**-–resolution setting(the resolution of linear encoder or rotary encoder setting),**DIR**---counting direction setting(0 stands for positive counting,1 stands for negative counting),**COMP**---compensation type(Linear stands for linear compensation,Nonlinear stands for nonlinear compensation).

Note:The fixed resolution for linear encoder are0.1μm, 0.2μm,0.5μm,1μm,2μm, 2.5μm, 5μm, 10μm, 50μm.The resolution of rotary encoder supports as min.10 lines, max.999999 lines.

Step 1,Enter the axes setting:

Choose the [⚙] after entering the system parameter setting.Use the [↑][↓] to choose the [Axis Set] .Press [ENT] to enter the axes setting.Select the corresponding target to set by pressing the [↑][↓][←][→] The parameter behind the X indicates the current parameter of X axes.



Axes parameter setting

Step 2 Encoder type selection(FORM):

After entering the encoder type selection, select the linear encoder(LINEAR) or rotary encoder(Rotary) by pressing the [Set] ,After selecting well,press the [↑][↓][←][→] to proceed the setting of other parameter setting.Press [C] to save and return.

Step 3 Resolution setting of linear encoder(RES):

When the encoder type set as the linear encoder(Linear),the resolution can be set from the fixed0.1μm, 0.2μm, 0.5μm, 1μm, 2μm, 2.5μm, 5μm, 10μm, 50μm.Which resolution need to be set should depend on the resolution of the linear encoder.Press [Set] to set.After setting well,press [↑][↓][←][→]to proceed other parameter.Press [C] to save and return.

Step 4 Resolution setting of rotary encoder(RES).

When the encoder type set as the rotary encoder(Rotary),the resolution need to be set should depend on the corresponding rotary encoder's lines.For example,when the rotary encoder is 1000 lines,press [Input] to input by using the number keys.After inputting,press [ENT] to save.And then press [↑][↓][←][→] to proceed other parameter setting.Press [C] to save and return.

Step 5,Counting direction setting(DIR）

The counting direction can be set as 0 or 1,0 stands for the counting direction of the corresponding axes is positive.1 stands for the counting direction of the corresponding axes is negative.Press Set to set.After setting well,press ↑ ↓ ← → to proceed other parameter setting.Press C to save and return.

Step 6 Compensation setting (COMP)

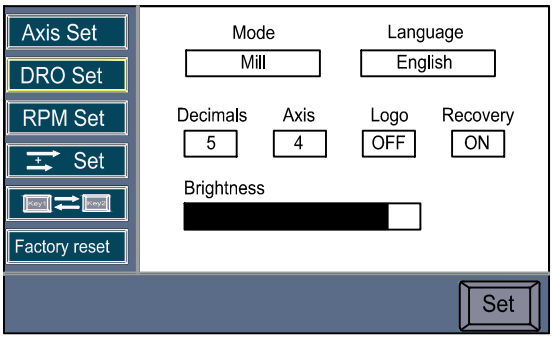
The compensation can be set as linear compensation(Linear) or Nonlinear compensation(Nonlinear),Choose the option from the two types according to the need. Press Set to set.After setting well,press ↑ ↓ ← → to proceed the other parameter setting.Press C to save and return.

1.2 DRO Setting

DRO setting includes machine mode selection(Milling,Lathe,Grinder,EDM), Language setting,decimals setting under inch mode (optional for 4 and 5),Axes number setting,Logo on/off,Data recovery of Zeroing on/off,Brightness setting.

Step 1,Entering the DRO setting:

Select the ⚙ to enter the system parameter setting.By pressing the ↑ ↓ to choose the DRO Set ,then press the ENT to enter the axis number setting. Press the ↑ ↓ ← → to choose the setting target.



DRO Setting

Step 2,Machine mode setting (Mode):

D80 is available for 4 modes which are Milling,Lathe,Grinder,EDM.Users can choose the one which is suitable for the machine.Press Set to proceed the setting.

Step 3 Language setting(Language):

There will be several languages preset,users can choose the suitable language for them.Press Set to proceed the setting.

Step 4,Decimals setting under Inch mode(Decimals)

When the D80 is under Inch mode,the decimals are optional for 4 or 5,users can set according to their using habit. Press Set to proceed the setting.The defaulted number is 5.

Step 5,Axes number setting(Axis):

The axes number of D80 are available for 5 as the maximum.User can set according to the real usage.For example,when the D80 is purchase with 4 axes,user can set the axes number to 1,2,3 or 4 axes to display.Press Set to proceed the setting.

Step 6,Logo setting.

The Logo displayed on the DRO can be switched to on or off.Press Set to proceed the setting.

Step 7,Data Recovery of Zeroing ON/OFF(Recovery):

When the data recovery of zeroing is in the statues of ON,press the zero button for the corresponding axes,the value will be cleared.Press the zero button of the

corresponding axes again,the cleared value will be recovered.When this function is in the statues of OFF,the value cannot be recovered if pressed the zero button for the corresponding axes.Press Set to proceed the setting.

Step 8,Brightness setting (Brightness):

Entering the interface of brightness setting,Press Set to proceed the setting.

Step 9,Exit the DRO setting.

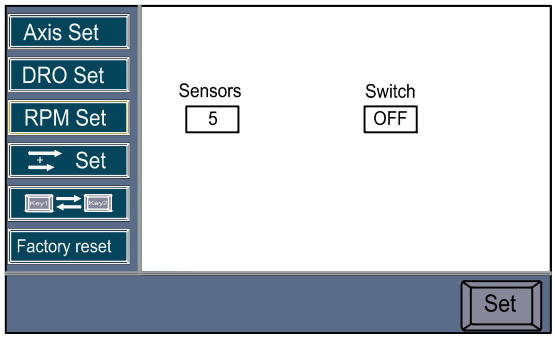
When the parameter setting is done,press the C to return.The system will save those settings automatically.

1.3 RPM Setting

The rotational speed measurement function is available on the D80.There are two parameters can be set,one is the pulse number generated from the spindle which do one complete circle movement.The other is to turn on or turn off the RPM function(Switch).

Step 1,Entering the RPM setting interface.

Select the to enter the system parameter setting,then choose the RPM Set to enter the RPM setting. Choose the setting target by press the ← → .



RPM Setting

Step 2,Pulse number setting of RPM (Sensors):

RPM pulse number indicates the pulse number which generated from one complete circle movement of the spindle.This parameter should be set according to the number of magnet chips installed on the spindle.For example,there are 5 magnet chips on the spindle,therefore the pulse number here should be set as 5.Press the Input to proceed the setting.The pulse number can be set as maximum as 200.

Step 3,Switch on or off the RPM.

User can switch on or off the RPM function according to the machining need.Press the Set to proceed the setting.

Step 4,Exit the RPM function.

When the parameter has been set well,press the C to return.The system will save the settings automatically.

1.4 Axes value combination setting.

User can combine any 2 axes value together.

Step 1,Entering the axes value combination setting.

Select the to enter the setting.Choose the setting target by press the ← → .

Step 2,Example of X axes setting:

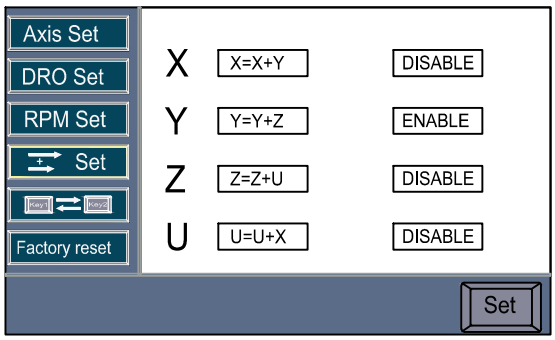
Take the combining of X and Y axes value as the demonstration.Enter the axes value combination to select the first widget,and then press Set to set the X axes to be X=X+Y,after setting well,we need to activate of the axes value combination of X axes.

Press [Set] again to set the second widget to be ENABLE statues.This setting applys to other axes setting for this function.After setting well, press [C] to return.

Step 3,Quick opening of Axes value combination function:

To do the quick opening of axes value combination of X axes,press [X] first,and then press [⇄] when the DRO is under the counting mode.

When the X axes has been set as OFF,this operation will be failure.



Axes value combination setting

1.5 Shortcut key setting.

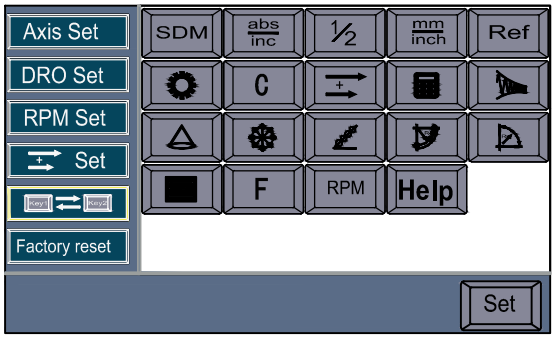
When the DRO is under counting mode,the shortcut keys' position can be adjusted for the convenience of operating.

Step 1,Entering the shortcut key setting

Select the [⚙] to enter the system parameter setting,choose the [Key1 ⇄ Key2] by pressing the [↑] [↓] .Press the [ENT] to enter the shortcut key setting.

Step 2,Adjusting the position of the icon

Select the target which need to be adjusted by pressing [↑][↓][←][→]. Press [Set] to confirm the target,and then adjust its position by pressing [↑][↓][←][→].After setting well,press [C] to return.



Shortcut key setting

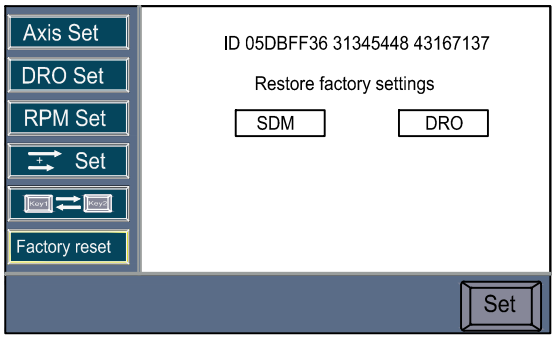
Note：When the DRO is in the interface of shortcut key setting,the icons of the first line will be display on the first page in the counting mode.The icons of the second line will be display on the second page.The icons of third line will be display on the third page.

1.6 Factory Reset.

In factory reset,there are ID Checking,Clear 200 groups of SDM coordinates and factory reset.

Step 1,Enter the factory reset

Select the [⚙] to enter the system parameter setting,choose the [Factory reset] by pressing the [↑] [↓] .And then press [ENT] to enter the factory reset.



Factory Reset

Step 2,ID Checking

When entering the factory reset interface,there is ID of this DRO displaying with 24 decimals.Every DRO has only one corresponding ID.

Step 3,Clear the all SDM coordinates.

To clear the 200 groups of SDM coordinates,choose the SDM,press the Set to enter the clear the all SDM coordinates.Press ← → to proceed the setting.Choose YES and press ENT to clear the all SDM coordinates.It may take around 1 minute to clear,please do not turn off the DRO during this process.

Step 4,DRO Factory Reset:

This setting is to clear all the data saved in the DRO.Choose DRO and press Set to enter the factory reset interface.Press ← → to proceed the setting.Choose Yes and press ENT to confirm the factory reset. It may take around 1 minute ,please do not turn off the DRO during this process.

2. Basic functions

2. Basic functions

2.1 Zeroing, data recovery

Function: Operator could zero the displayed coordinate at any position.

Example 1: Zero the displayed value of X axis at the current position.

Press [X0] key to zero the displayed data of Y axis;

Press [Y0] key to zero the displayed data of Z axis;

Data recovery

Function: Recover the data which has been zeroed by mistake at any position.

Example 2: Realize the data recovery of X axis.

Press [X0] key to recover the displayed data of Y axis;

Press [Y0] key to recover the displayed data of Z axis;

Note:If the data recovery has been switched off,the data is not able to be recovered.Please switch it on in the system parameter setting.

2.2 Display in Metric/British units

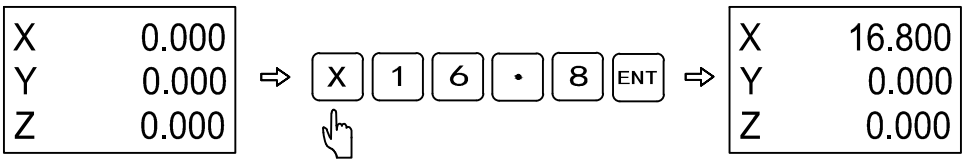
Function: Display the location size in Metric (mm) or British (inch) units.

Press [mm/inch] to do the conversion between INCH and MM.

2.3 Input coordinates

Function: Enable the operator to set the current position at any value.

Example 1: Set the position of the current X axis as 16.800 .



2.4 1/2 function

Function: DRO provides automatic centre find function which divides the current displayed position by 2 and sets the zero point at the centre of work piece.

1/2 Function for X axi

Press [X] once,and then press [1/2] to half the value.

1/2 Function for Y axi

Press [Y] once,and then press [1/2] to half the value.

2.5 ABS/INC Coordinates

Function: DRO provides two sets of standard coordinate display value, namely ABS (absolute) and INC (relative) coordinates. The operator could store the reference zero point of work piece at ABS coordinate, and convert ABS coordinate to INC coordinate for machining. Zeroing at any position at INC coordinate won't affect the

length value relative to the reference zero point of work piece at ABS coordinate, which shall be stored during the whole machining process and could be checked whenever necessary.
We can switch the ABS and INC coordinate by pressing the 

.

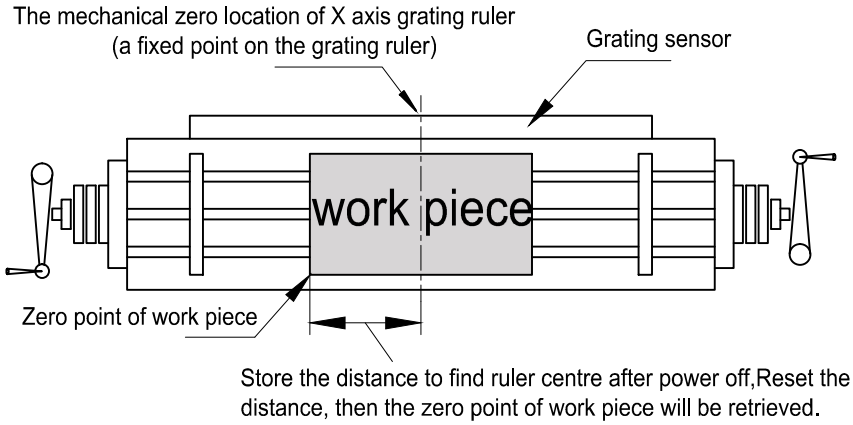
2.6 Power Off Memory Function

In case of sudden powering off during machining process, DRO provides data storage module which could store the coordinate and data before powering off. When DRO is powered on again, all the data before powering off will recover automatically.

2.7 Ruler storage function:

Function: In daily machining process, we often encounter such situations as power failure or machining couldn't be finished in one day. If losing the machining zero point, we have to retrieve the zero point of work piece which is troublesome. What's more serious is that there's always errors in retrieving the zero point of work piece by touching, which may cause errors to the parts machined afterwards. DRO provides ruler storage function. It stores the zero point of work piece by using the zero location of grating ruler, which enables the operator to find the zero point easily after power off without retrieving the zero point by touching.

Example: Take the X axis for example:



Note: The ruler storage function in our DRO is the most advanced and easiest to use in the DRO market. Each time the operator uses functions which may affect the zero point such as Zeroing, finding centre and inputting coordinate under ABS coordinate, DRO will store the distance between zero point of work piece and ruler centre. So the operator only need operate under the ABS coordinate to set the origin before either switching on the DRO or machining (the work piece hasn't been clamped onto the table). Through which the DRO will record the zero location of the ruler. Then DRO will deal with other storage processes without bothering the operator.

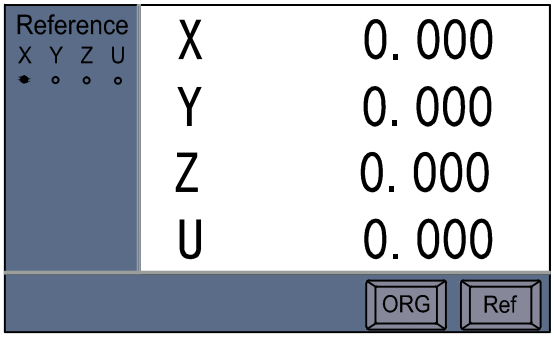
2.7.1 Ruler storage function (set the origin):

Function: When machining a complex work piece, its zero point couldn't lose under the cases of power off or failing to finish machining in one day. In this case we could set the origin under the ABS coordinate state of DRO to store the origin of the work piece into DRO. DRO will memorize the distance between the zero point of new work piece and ruler centre during all the operations of resetting the work piece's zero point under ABS coordinate such as Zeroing, finding centre and inputting coordinate so as to retrieve the work piece's zero point after power off or closing ruler.

Set the origin

Press [Ref] to enter the scale storage function.Select the target axes which need to be set by pressing [←] [→].Press [Ref] to enter the setting origin.Move the scale until find its origin,at this moment,the screen will display the success to remind.Press [C] to return.

Note:When the dot below the scale storage is solid,it indicates this origin of this axes has been set.When the dot is hollow,it indicates the origin of this axes has not been set.



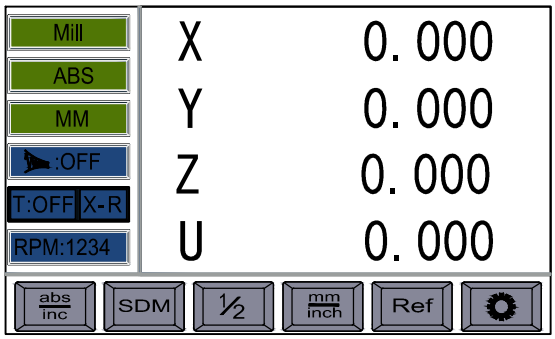
Interface of scale storage

2.7.2 Retrieve the work piece's origin:

Function: When machining a complex work piece, the zero point gets lost because of sudden power off. After the power is connected, we couldn't keep on machining until we retrieve the work piece's zero point. Note that we couldn't move the machine by this time. When DRO's self-checking finishes, press [abs inc] key back to ABS coordinate (not necessary if DRO is already under ABS coordinate when switched on). By this time we need to record the data of X, Y and Z axis under the current ABS mode. Detailed operating steps are shown below.

Step 1: Record the data of X, Y and Z axis under ABS mode when DRO completes self-checking:

Example: If DRO completes switch-on self-checking under ABS mode X axis is 12.500 Y axis is 18.230 Z axis is 5.800 .



Main interface

Note: DRO couldn't deal with the data of X, Y and Z axis automatically, so they need to be recorded to find the zero point.

Step 2: Enter REF function and select the function of retrieving the work piece's origin: Find back the origin:

Press [Ref] to enter the scale storage function.Select the target axes which need to be set by pressing [←] [→].Press [OGR] to enter the finding back the origin.Move the scale until find its origin,at this moment,the screen will display the success to remind.Press [C] to return.This operation also apply to find back the origin of Y,Z and U.

Note: Select REF for ruler storage function (find the grating ruler's zero location) Select OGR for retrieving the work piece's coordinate origin (retrieve the work piece's coordinate origin)

Step 3: After searching the work piece's origins on X, Y and Z axis, turn the machine under ABS coordinate state. When the coordinates of X, Y and Z axis are the ABS coordinates recorded at power-on self-checking, this point is the one when machining stopped at last power off and we could go on machining the unfinished work piece.

Note: Retrieve the work piece's origin. The data couldn't be recovered until the origin is set before machining.

2.8 200 sets of auxiliary zero location:

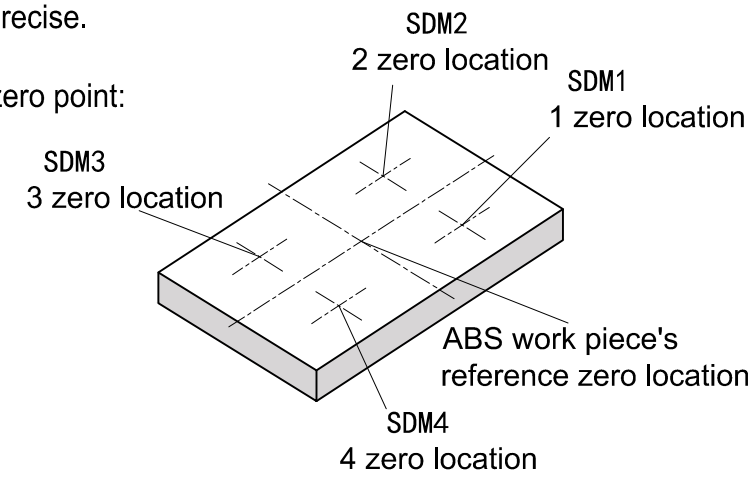
Function:

Typical grating DRO only provides two groups of coordinates, namely ABS/INC. But in most of the daily machining occasions, operators always find it not enough, especially in die machining or small batch machining. The DRO provides 200 sets of auxiliary zero location (SDM) function to compensate for the shortage of the ABS/INC function. But SDM is not just a simple additional INC coordinate, it has the following difference compared to ABS/INC.

1. INC zero location is completely independent. Regardless of any change in ABS zero location, INC zero location will never change. But the zero location of SDM is relative to ABS, which means when ABS zero location changes, all the SDM zero locations shall change correspondingly.
2. The distance of SDM relative to ABS coordinate could be entered by keys directly, which is both fast and precise.

Applications of SDM in sub zero point:

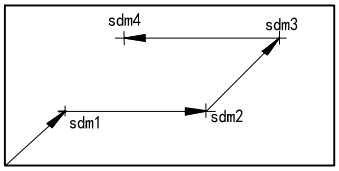
Operators could set each sub zero location on the work piece in the SDM auxiliary zero location coordinates.



Press ⬅ key or ➡ key to convert to SDM auxiliary zero location directly without returning to ABS coordinate.

Applications of SDM in small batch machining

SDM function could store batch of working point positions in SDM zero location. Operators could enter all the working points to the DRO at once. Alternatively, operators could also input the working points into SDM of DRO when machining the first work piece. Afterwards they only need to adjust the reference zero location of the subsequent work pieces in ABS coordinate. As the SDM zero locations correspond to these of ABS, all the working point shall recur by SDM zero locations.



ABSzero

Reference of work piece (0.000)

Input the required coordinate value under SDM state according to SDM or press ⬅ and ➡ keys to turn to each SDM auxiliary zero location. Move the machine until each SDM coordinate displays 0, which is the position of each working point.

2.9 Linear compensation

Function: Linear error compensation function is used to correct the system errors of the grating ruler measurement system linearly.

Note: the calculation formula of correction coefficient is:

Correction coefficient S = （L - L1）/（L / 1000）mm/m

L: Stands for the actual measured length (mm)

L1: Stands for the displayed value (mm) on the DRO

S: Stands for correction coefficient (mm/m) (+ indicating lengthening and – indicating shortening)

Compensation range: - 1.9 mm/m to + 1.9 mm/m

Example: The actual length of the machine's X axis table is 1000.000mm and the displayed value on the DRO is 999.880mm. The correction coefficient is calculated as follows:

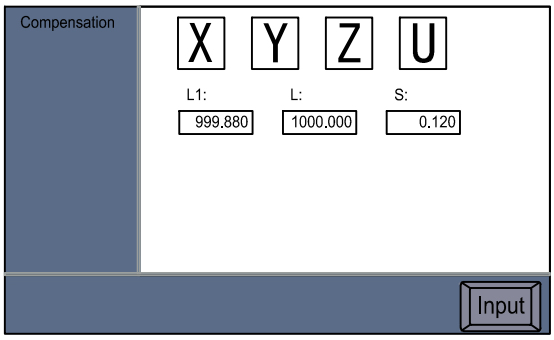
S = （1000.000 - 999.880）/（1000.000 / 1000.000）= 0.120

Set the linear compensation coefficient according to the following operation (Note: Set the compensation method as linear compensation in the system parameter setting section firstly. The detailed operations are described in system parameter setting section.)

Step 1:Entering the linear compensation

Press [C] to enter the linear compensation.Select the X axes by pressing [←][→] .After selecting well, press [ENT] to enter the linear compensation.

Note:When any axes need to be done the linear compensation.The corresponding compensation way in system parameter setting need to set as the linear compensation(linear).



Linear compensation

Note: The linear compensation operation of Y axis or Z axis resembles that of X axis.

2.10 Non linear compensation

Function:

Non linear compensation enables the operator to input non linear error compensation value in the DRO by which way the DRO could compensate all kinds of errors of the machine. Non linear compensation function of DRO could improve the accuracy of the machine greatly if only the positions of the machine have a high repeatability. This function is particularly applicable to the machine tools which have a high requirement on accuracy, such as grinding machine, boring machine etc.

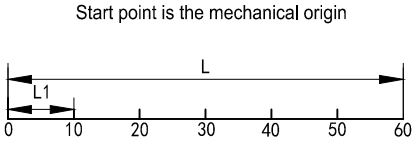
Operating principles:

Non linear compensation adopts a fixed position provided by the REF position in the grating ruler as the absolute zero point of the machine. CPU of the DRO will compensate the readings according to the input error list in the parameter setting section. The software of the DRO could provide non linear error compensation function on X, Y and Z axis. Each axis has a maximum compensation value of 40 points. Note that non linear and linear compensation couldn't be used simultaneously.

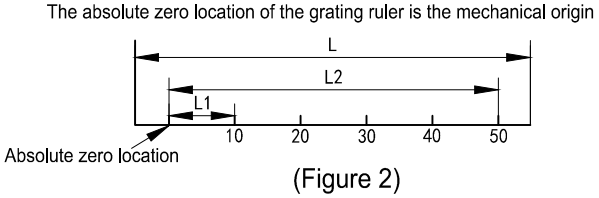
This DRO has two methods for non linear error compensation:

1、Take the start point as the mechanical origin to make error compensation. (Figure 1)

2、Take the first absolute zero point of the grating ruler as the mechanical origin to make error compensation. (Figure 2)

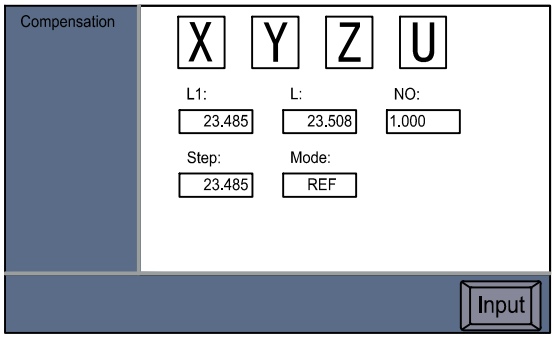


(Figure 1)



(Figure 2)

L:Measuring length of scale
L1:Compensation part length
NO:Compensation parts number
Step:The effective compensation distance
Mode:Compensation type



Non linear compensation

1、Parameters are set as follows:
(The operation method for X, Y and Z axis is the same).

Step 1:Set the compensation way to be nonlinear(nonlinear) in system parameter setting.

Step 2:Move the scale to one end and zero the value,Then enter the absolute coordinate(ABS).

Step 3: Press [C] to enter the nonlinear compensation,select the X axes and press [ENT] to input the corresponding value.

Step 4:Select the NO by pressing [←] [→] ,press [Input] to input the compensation parts. Press [ENT] to save after inputting well.

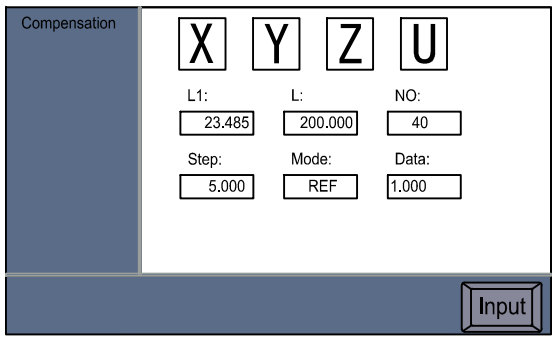
Step 5:Select the step by pressing [←] [→] .Press [Input] to input the length of every compensation part.Press [ENT] to save after inputting well.

Step 6:Select the starting point(Nonlinear compensation takes the zero point as the starting point.There are two type of zero point available.One is the Mode:LEFT which is the left end of the scale.The other is Mode:REF which is the mechanical zero point under ABS state.Choose the starting point,press [←] [→] to switch the mode,then press [Set] to choose the starting point type.)

Type A (Left),starting point is from the left end of scale,select the mode as the LEFT,and press [ENT] to confirm and enter the state to find the starting point.Move the corresponding scale to the most left end and press [X0] to clear the value,it will automatically enter the compensation after clearing.

Type B(REF,mechanical zero point under ABS)Select the mode as the REF , press [ENT] to confirm and enter the state to find the zero point.Move the corresponding scale until find its zero point,it will automatically enter the compensation after finding the zero reference point.

L1:the current value of the corresponding scale.
L:the actual measuring length of the scale （=NO*Step）
NO:Compensation part number
Step:the length of each compensation part
Mode:starting point
Data:the current value of the corresponding scale



Non linear compensation

Step 7:Input the adjusted value part by part,and then press [ENT] to enter the next part.
Data: Display the current value of the corresponding axes.L:Adjusted value.
First we need to get the real measurement of the compensation part.This requires much more accuracy measuring tool such as block gauge or laser interferometer.After getting the real measurement,move the the scale to the position which is the real measurement from the starting point,then press [ENT] to enter the setting of next part.
Note: When the data becomes to red,this indicates that the adjusted value is beyond allowed adjusted range.The adjusted value should not exceed 0.2%.If break out,then the compensation will become ineffective.
2、Method of cancelling non linear compensation value:
Non linear compensation value could only be used to the DRO, grating ruler and machine when they are set together. When a grating ruler or DRO whose compensation value has been set on a certain machine is moved to another machine, this non linear compensation value is incorrect. In this case we should cancel or reset the non linear compensation value.
The method of cancelling is：
According to the non linear compensation set method indicated above, input the compensation part as 0 when prompted to initialize all the compensation parameters. At present all the compensation parameters set before will be invalid and the current compensation value is zero.
3、Method of retrieving the mechanical origin
When it was power off during grating ruler movement or grating ruler moved without power on, we have to find the mechanical origin again before booting. Because when the machine is moved under power off, the origin of the machine coordinate couldn't match the value on the DRO. If we don't retrieve the mechanical origin, such dislocation will be brought into the subsequent user coordinate system, as the non linear compensation value is set based on wrong mechanical coordinate when calculating the user coordinate, which brings errors to display coordinate.
Set the mechanical origin as follows:
Enter non linear compensation after booting. When inputting compensation part number and compensation length, make no change and press [ENT] key directly to skip. Then we come to select the compensation start point, select Mode:REF （ABS zero location）. slide the X axis grating ruler to find the zero location until DRO gives out a sound. System has entered the compensation interface automatically then press [C] key to exit non linear compensation.

Note:
The work origin could only be retrieved when the start point of non linear compensation is set at the ABS zero location. If set the leftmost as the ABS zero location, the work origin couldn't be retrieved. At this time we have to reset the non linear compensation. The following method is recommended for setting non linear compensation: set the compensation start point as ABS zero location. The user searches the mechanical origin after each booting to guarantee the consistency of the mechanical origins.

2.11 Calculator Function

You may encounter with the situation that some numerical value needs to be calculated in working. The DRO has the built-in calculator function which includes the simple arithmetical operations such as addition, subtraction, multiplication and division and the calculation such as trigonometric function, anti-trigonometric function and square root, etc.

Introduction about the function keys:

 Calculation function key: Press this key to enter the calculation function. While, you could exit the calculation function by pressing this key.

 Calculate the square root.

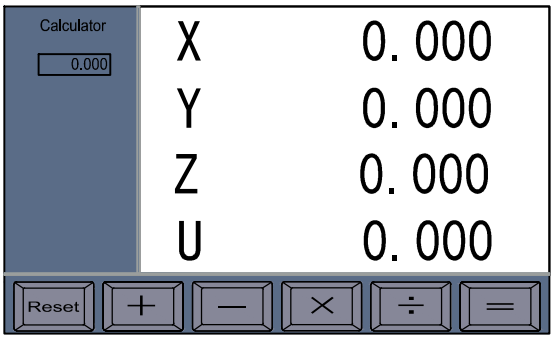
 Anti-trigonometric function calculation: Press this key and then press the trigonometric function key to restore the trigonometric function.

 Trigonometric function key.

 Delete the input and delete the last calculation result; C can be used to delete the current digit.

X, Y and Z Data axis transferring: you may transfer the calculated value to X axis, Y axis and Z axis.

Note:Press  to enter the calculator.The position of function keys can be changed by pressing ↑ ↓ .



Calculator Function

2.12 Digital filtering function

Function introduction:

The vibration of the grinding machine in grinding process causes the display on the DRO changing repeatedly and fast, which leads to visual discomfort of operator. Special function of grinding machine in the DRO has digital filtering function known as “Debouncing function”. During the vibration of the grinding machine, the function could prevent the DRO from changing fast to avoid visual confusion.

The operator could adopt digital filtering function according to the following procedures during grinding process.

Step 1:Press  to enter the digital filtering function.

If the DRO entered the digital filtering function,the 

will appear on the left widget of the DRO.

Step 2:Press  again to exit the digital filtering function.

If the DRO exited from the digital filtering function,the 

will disappear from the widget.

Note:The digital filtering function is only available under ABS,INC and SDM state.If other functions has been activated,then this function will be ineffective.

2.13 Feed rate

During the machining,the DRO enable the user to check any axes' feed rate(moving speed of the scale),the unit of the feed rate is mm/min

To check X axes feed rate,press X and then press F .

To check X axes feed rate,press Y and then press F .

To check X axes feed rate,press Z and then press F .

To inactivate the feed rate,Press F .

3. Special Function

PLD Function

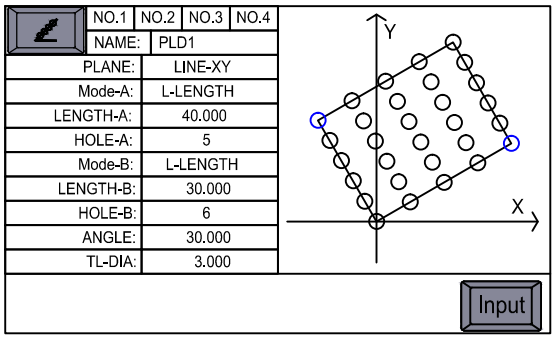
3.1 PLD Function

(Applicable to the machine tools: milling machines and Electric Discharge Machines)

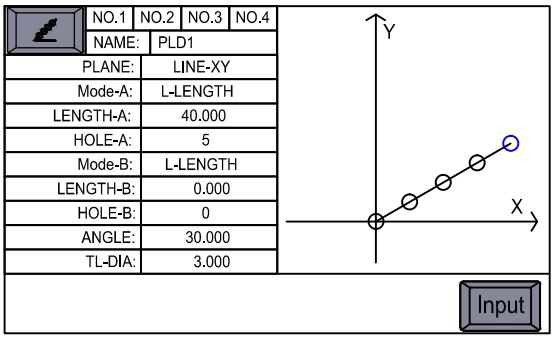
We have two ways to realize the PLD function.

Way 1: Length way (L-LEN, the distance from the starting hole center to the ending hole center)

Way 2: Step way (L-STEP, the distance between two adjacent holes)



Array line holes machining



Oblique line holes machining

PLD input parameters:

L-LEN:NO.1-NO.4 In PLD function,we can set four groups of data.Every group has no interference with each other.

Name - - - - No.1-No.4 the drawing name setting

PLANE - - Plane selection (XY YZ XZ)

Mode-A - - - machining type L-STEP pitch-row length L-LENGTH oblique line overall length(The paramter of oblique line hole machining type)

LENGTH-A - length of oblique line.If choosing the L-STEP,this indicates the length between two holes.If choosing L-LENGTH,this indicates the overall length of the oblique line (The paramter of oblique line hole machining type)

HOLE-A-- number of holes(The paramter of oblique line hole machining type)

Mode-B - - - machining type L-STEP pitch-row length L-LENGTH oblique line overall length(The paramter of array line hole machining type)

LENGTH-B - length of oblique line.If choosing the L-STEP,this indicates the length between two holes.If choosing L-LENGTH,this indicates the overall length of the oblique line (The paramter of array line hole machining type)

HOLE-B-- number of holes(The paramter of array line hole machining type)

ANGLE - oblique line angle (as shown in figure A)

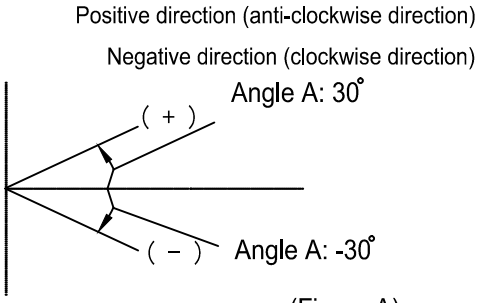
TL-DIA - - - Diameter of tool (with purpose for reviewing of drawing.This parameter has no effect on real machining)

3.1 PLD Function

Example: as shown in the right figure

Figure A:

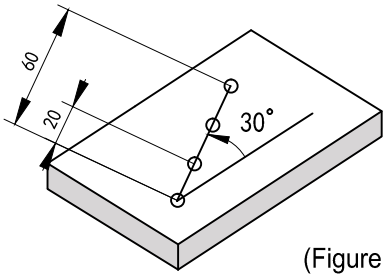
The angle refers to the position direction of the oblique line on the coordinate plane. The anti-clockwise direction is the positive direction, and the clockwise direction is the negative direction.



(Figure A)

Figure B:

oblique line: 60mm
oblique line angle: 30mm
pitch-row: 20mm
holes: 4



(Figure B)

Example 1: PLD machining

Step 1:Firstly,move the tool to the position of the starting hole.Press [edit] to enter the PLD function.

Step 2:Choose the machining drawing No.1-No.4By pressing [←] [→]to choose,after choosing well,press [↓] to enter the drawing name setting.

Step 3:Drawing name setting (NAME) Press [Input] to set the drawing name,choose the letter by pressing [↑] [↓] [←] [→] .Choose the digit by press the digit button,then press [Input] to input.After setting well,press [ENT] to save.

Step 4:Select the machining plane(PLANE)Select the machining plane by pressing[↑] [↓] . Press [Set] to set the machining plane.

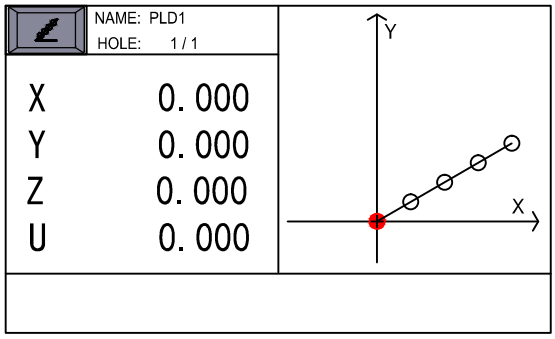
Step 5:The selection of PLD machining type(Mode-A):Press [Set] to set the machining type,here we choose the length way.

Step 6:Input the length,set the length to be 40mm(LENGTH-A)Press [Input] to enter the inputting mode.Press digits button to input.After inputting well,press [ENT] to save.

Step 7:Input the machining holes.Here we set the holes to be 5(HOLE-A)

Step 8:Set the LENGTH-B and HOLE-B to be 0.Cause here we take the oblique line holes machining as the example, thus these two parameters for array line holes machining need to be set as 0.

Step 9:Input the angle.Here we set it as 30 degree(ANGLE)



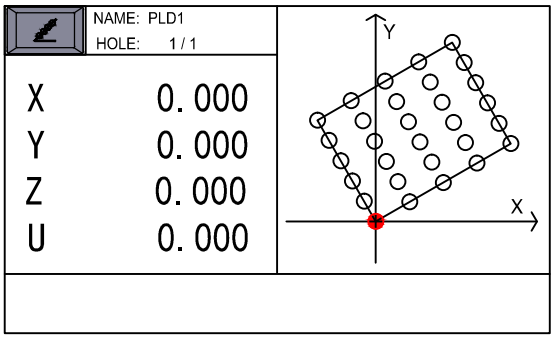
The state of oblique line hole machining

Step 10:Input the diameter of the tool.Here we set it to be 3mm(TL-DIA)
The parameter of tool's diameter has no effect on the real machining.It is only for he reviewing of the machining drawing.
Step 11:After setting well all those parameter.There will be a machining drawing displayed on the screen which is draw according to the parameter input.If it matches the real drawing,then press [ENT] to enter the machining state.
Step 12:Machining state
After entering the machining state,there will display the drawing name and current number of the machining hole.On the left,the screen will display the value of each axes.On the right,the screen will display the machining drawing,the red point indicates the current position of the tool.Press [←] to enter the machining of next hole.Move the axes until the corresponding value to be zero,this indicates the tool has reached the the position of the second hole.When moving the corresponding axes,the tool position (red point) will also change.After machining well,press [C] to return.

Example 1: The state of array line hole machining
Step 1:Firstly,move the tool to the position of the starting hole.Press [PLD] to enter the PLD function.
Step 2:Choose the machining drawing No.1-No.4By pressing [←] [→]to choose,after choosing well,press [↓] to enter the drawing name setting.
Step 3:Drawing name setting (NAME) Press [Input] to set the drawing name,choose the letter by pressing [↑] [↓] [←] [→] .Choose the digit by press the digit button,then press [Input] to input.After setting well,press [ENT] to save.
Step 4:Select the machining plane(PLANE)Select the machining plane by pressing [↑] [↓]. Press [Set] to set the machining plane.
Step 5:The selection of PLD machining type(Mode-A):Press [Set] to set the machining type,here we choose the length way.
Step 6:Input the length,set the length to be 40mm(LENGTH-A)Press [Input] to enter the inputting mode.Press digits button to input.After inputting well,press [ENT] to save.
Step 7:Input the machining holes.Here we set the holes to be 5(HOLE-A)
Step 8:The selection of PLD machining type(Mode-B):Press [Set] to set the machining type,here we choose the length way.
Step 9:Input the length,set the length to be 30mm(LENGTH-B)Press [Input] to enter the inputting mode.Press digits button to input.After inputting well,press [ENT] to save.
Step 10:Input the machining holes.Here we set the holes to be 6(HOLE-B)
Step 11:Input the angle.Here we set it as 30 degree(ANGLE)
Step 12:Input the diameter of the tool.Here we set it to be 3mm(TL-DIA)
The parameter of tool's diameter has no effect on the real machining.It is only for he reviewing of the machining drawing.
Step 13:After setting well all those parameter.There will be a machining drawing displayed on the screen which is draw according to the parameter input.If it matches the real drawing,then press [ENT] to enter the machining state.

Step 12:Machining state

After entering the machining state,there will display the drawing name and current number of the machining hole.On the left,the screen will display the value of each axes.On the right,the screen will display the machining drawing,the red point indicates the current position of the tool.Press ← to enter the machining of next hole.Move the axes until the corresponding value to be zero,this indicates the tool has reached the the position of the second hole.When moving the corresponding axes,the tool position (red point) will also change.After machining well,press C to return.



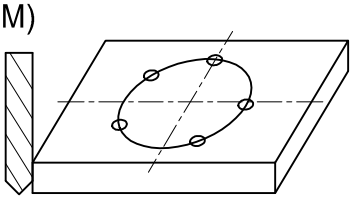
The state of array line hole machining

PCD Function

3.2: PCD Function

(Applicable to machine tools: milling machines and EDM)

This function is used for dividing the arc equally, such as the equally distributed holes on the drilling flange.



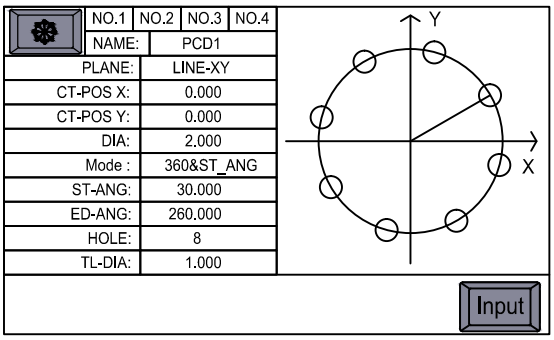
Function:

The DRO offers the tool positioning function of drilling equally divided holes on the circumference. Operators only need to input the relevant machining parameters according to the provided information, then the system will calculate the position coordinates of holes immediately and set the hole position to zero point (0.000, 0.000) temporarily. Operators only need to input the following six parameters.

L-LEN:NO.1-NO.4 In PCD function,we can set four groups of data.Every group has no interference with each other.
Name - - - - No.1-No.4 the drawing name setting
PLANE - - Plane selection (XY YZ XZ)
CT-POS X - - Center of a circle X coordinates
CT-POS Y - - Center of a circle Y coordinates
Mode - - - - Machining model
DIA - - - - - arc diameter
ST-ANG - - - starting angle (angle of 1st hole position)
ED-ANG - - - ending angle (angle of the last hole position)
No HOLE - - - hole number
TL-DIA - - - - - Diameter of tool (with purpose for reviewing of drawing.This parameter has no effect on real machining)

Mode specification:PCD is optional for 3 modes to be set.

Example:Here we drill holes on one workpiece with 3 modes.Select the machining plane as XY.Set the coordinate of center point to be X=0,Y=O,diameter of arc to be DIA=2mm,starting angle to be ST-ANG=30°,end angle to be ED-ANG=260°,number of holes to be HOLE=8.



Mode 1:Drawing reviewing.

Mode 1 Mode:360&ST-ANG

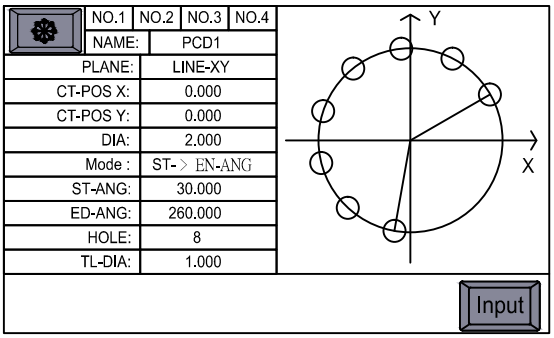
Take the hole laid on the corresponding starting angle as the first hole,the DRO will automatically calculates the position of the 8 holes which are equally divided on the circumference.

Note:the end angle under this mode is meaningless.

3.2 PCD Function

Mode 2 Mode: ST-> EN-ANG

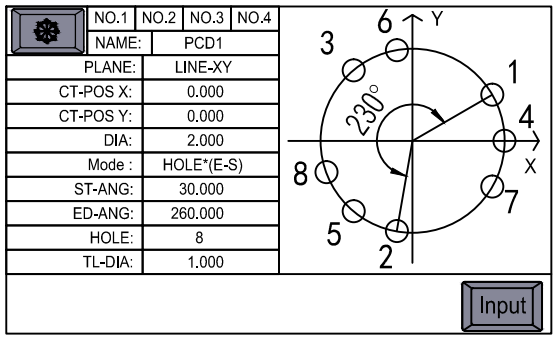
The DRO calculates the position of the 8 holes which are equally divided in the range which is from starting angle to the end angle.



Mode 2:Drawing reviewing.

Mode 3 Mode: HOLE*(E-S)

Drill the holes with the same angle from each other.The angle between two holes is from the end angle (ED-ANG) to starting angle (ST-ANG).



Mode 3:Drawing reviewing.

Step 1: Find the central position of the work piece, and Set the tool.Press the key to enter the PCD function.

Step 2:Choose the machining drawing No.1-No.4By pressing ← → to choose, after choosing well,press ↓ to enter the drawing name setting.

Step 3:Drawing name setting (NAME)

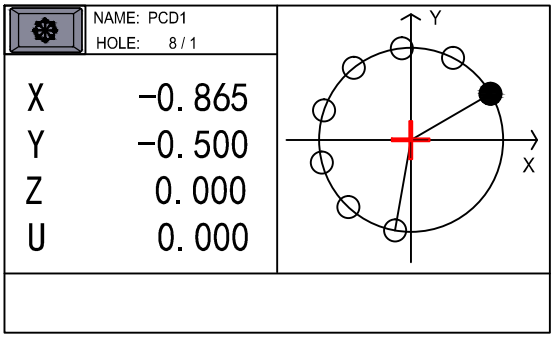
Press Input to set the drawing name, choose the letter by pressing ↑ ↓ ← → . Choose the digit by press the digit button,then press Input to input.After setting well,press ENT to save.

Step 4:Parameter setting

Select the parameter which need to be set by press ↑ ↓.Press Set to set the corresponding parameter,and press Input to do the data inputting.

Step 5:Enter processing interface

After entering the machining state, there will display the drawing name and current number of the machining hole.On the left,the screen will display the value of each axes.On the right,the screen will display the machining drawing,the red point indicates the current position of the tool.Press ← to enter the machining of next hole.Move the axes until the corresponding value to be zero,this indicates the tool has reached the the position of the second hole.When moving the corresponding axes,the tool position (red point) will also change.After machining well,press C to return.



Machining state

Smooth R Function

3.3 Smooth R function

(Milling (DRO)

Function:

When a milling machine is used, especially in the process of machining a mold, arc often needs to be machined on a work piece. If the arc surface is complex, or a lot of round angles need to be machined, or the arc or round angle needs to be accurately machined, a CNC milling machine should be utilized.

But in the daily machining process, only a simple arc surface or a round angle is needed with no requirements for the precision of the arc or round angle (particularly in the process of machining molds). If there is no CNC milling machine in the production line, the best way is to machine it with a manual milling machine as it saves time and efforts, compared to outsourcing it. In the past, an operator used to calculate the tool positioning in arc machining with a scientific calculator, but this method was time-consuming and liable for errors.

DRO provides a simple and easy positioning function for arc cutting tool, so the operator can perform arc machining in the shortest time. But before you decide to use smooth R function or CNC machining, please bear the following points in mind to make sure smooth R yields the best performance.

The R function group in DRO contains two R functions: smooth R function and simple R function.

Smooth R function:

Smooth R function is a function for full-functional arc machining. The operator can use the smooth R function to machine all types of most complex arc, even an arc to be connected to another arc (commonly known as R-to-R).

Advantages of smooth R function:

Smooth R function can be used to machine the most complex arc or even for complex machining in R-to-R.

Disadvantages of smooth R function:

Operation is complex and the operator needs to know the basic coordinate system in order to calculate the start point, the end point and the center.

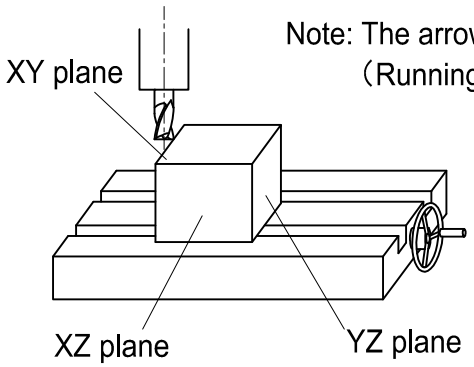
Understand the coordinate system:

An operator who has no CNC programming experience or who has not used the DRO R function before may have difficulty in mastering the concept of coordinate system. Coordinates are a pair of numbers used to determine positions.

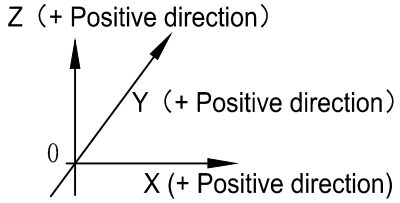
When using the DRO R function, the center coordinates of the arc surface, and the coordinates of the start point and those of the end point must be input to inform DRO about the geometric parameters of the arc surface to be machined.

In the process of installing a DRO, professional customer service installers will generally set the display orientation in the same direction as the machine axis. In a general milling machine, the dial direction is shown as below. Therefore, the DRO display direction will normally be set as follows.

3.3 Smooth R Function

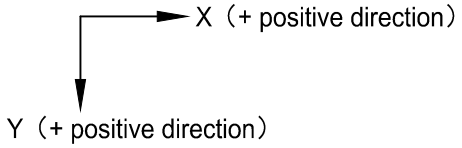


Note: The arrow indicates the positive direction of the coordinate
（Running direction of the tool relative to the table ）

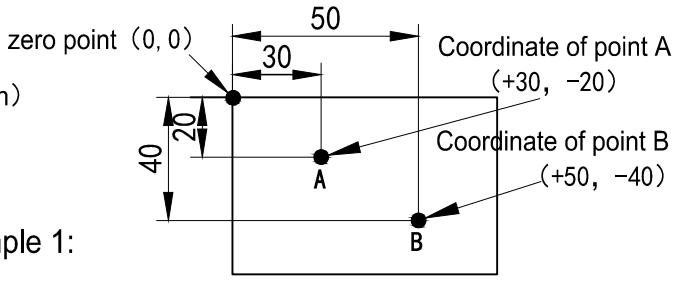


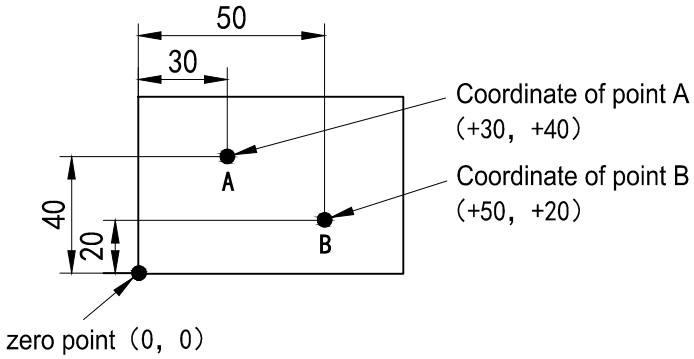
What are coordinates?

Coordinates are used to indicate positions. During plane machining, each set of coordinates contains two values, respectively corresponding to the distances from the zero point on the plane. The following is a simple example.

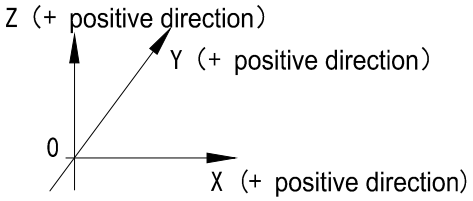


Example 1:



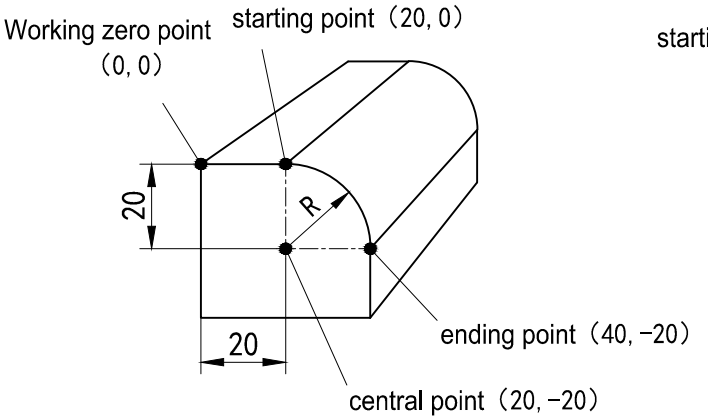


Example 2:

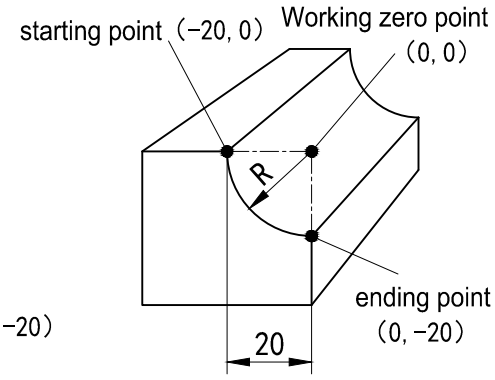


3.3 Smooth R Function

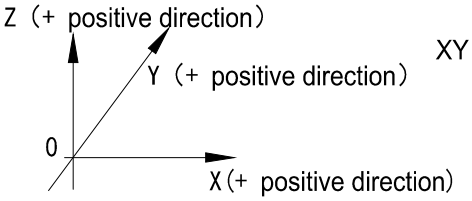
Example 3:

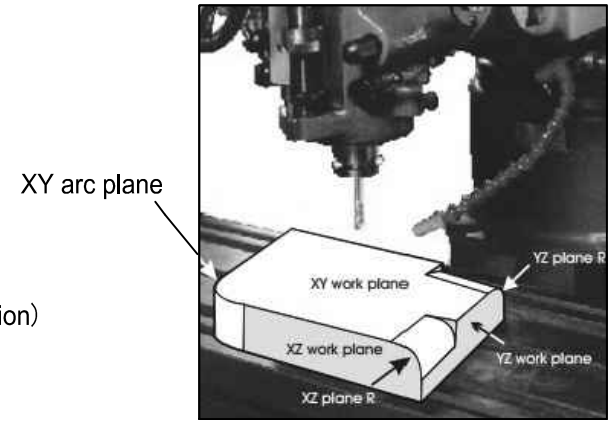


Example 4:

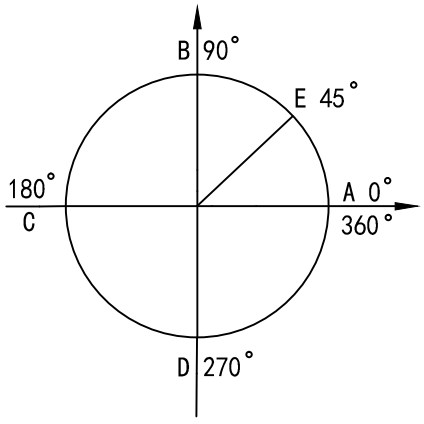


During the machining process, the coordinate of the machine tool are shown in the figure below, and the indication of the machining plane is shown in the figure.





The definition of the angle and direction:



AB arc (from A to B: the starting angle A is 0°, and the ending angle B is 90°)
(from B to A: the starting angle B is 90°, and the ending angle A is 0°)

ED arc (from E to D: the starting angle E is 45°, and the ending angle D is 270°)
(from D to E: the starting angle D is 270°, and the ending angle E is 45°)

3.3 Smooth R Function

Smooth "R" Arc Function:

Procedure for using the smooth arc machining function:

Load and clamp the work piece, tool setting as shown in figure A, figure B and figure C, and then zero every axis (set the position point of the tool setting to zero).

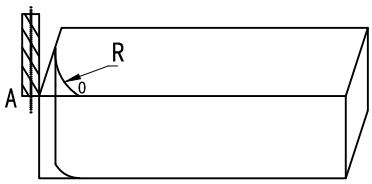


Figure A

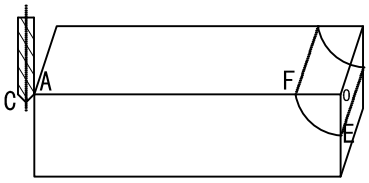


Figure C

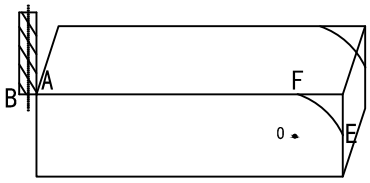


Figure B

Step 1: Press the key to enter the smooth R arc function.

L-LEN:NO.1-NO.4 In Smooth R function,we can set four groups of data.Every group has no interference with each other.

Name - - - - No.1-No.4 the drawing name setting

PLANE - - Plane selection (XY YZ XZ)

CT-POS X - - Center of a circle X coordinates

CT-POS Y - - Center of a circle Y coordinates

DIA - - - - - - - diameter of the tool

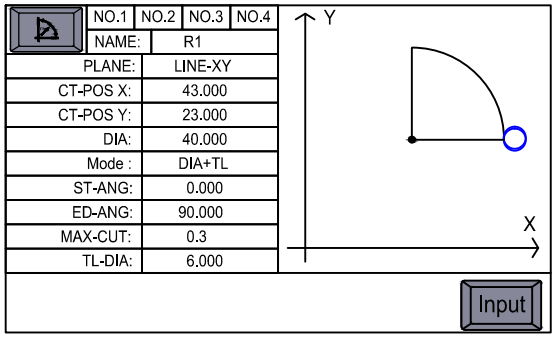
Mode - - - - - Select the machining place to be concave or convex.

ST-ANG - - - starting angle

ED-ANG - - - end angle

MAX-CUT- - maximum cutting amount

TL--DIA - - - - diameter of the tool



Smooth R Function

Example 1 :take the shown in the machining drawing as example

The workpiece size are shown in the below figure.

1.zero the tool setting.

2.select smooth R mode.

3.Select XY plane for machining arc (LINE-XY)

4.Input the coordinate of circle center CT-POS=(43.23)

5.Input arc diameter DIR=40.000

6.Input the arc machining lane

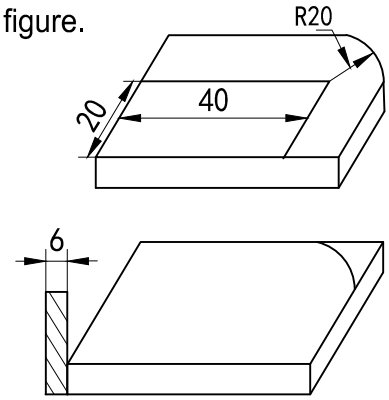
Mode = DIA+TL(Select the convex to machine)

7.Input the ST-ANG=0

8.Input the ED-ANG=90

9.Input the MAX-CUT-0.3

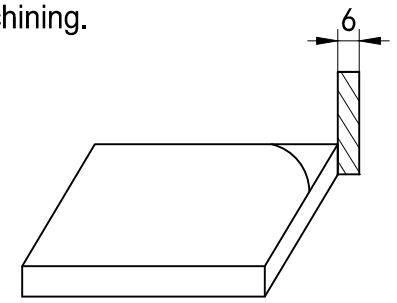
10.Input the TL-DIA=6.000



（Figure A）

3.3 Smooth R Function

The following is the operation figure for smooth R arc machining.



（Figure B）

Step 1: Zero the tool setting

Step 2:Press [△] to enter the Smooth R Function.

Step 3:Choose the machining drawing
No.1-No.4By pressing [←] [→] to choose,
after choosing well,press [↓] to enter
the drawing name setting.

Step 4:Drawing name setting (NAME)
Press [Input] to set the drawing name,
choose the letter by pressing [↑] [↓] [←] [→] .
Choose the digit by press the digit button,then
press [Input] to input.After setting well,press [ENT] to save.

Step 5:Select the XY plane as the machining plane (LINE-XY) Press [Set] to set the machining type.

Step 6:Input the coordinate of circle center.
If setting the tool as figure A CT-POSX=43 CT-POS Y=23
If setting the tool as figure B CT-POS X=23 CT-POS Y=23

Step 7:Input arc diameter DIA = 40, and press [Input] to do the data inputting.

Step 8:Select the convex as the machining plane Mode = DIA+TL
Press [Set] to set the machining type.

Step 9:Input the starting angle ST-ANG=0

Step 10:Input the end angle of the arc ED-ANG=90

Step 11: Input the maximum cutting amount MAX-CUT=0.3

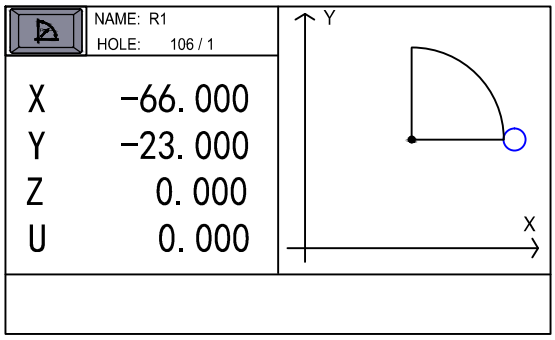
Step 12 :Input the tool diameter TL-DIA=6.000

Step 13:After setting well of above parameter,press [ENT] to enter the machining interface,and it will display the fist point which will be machined.

Step 14: Move the machine tool until the axis displays zero,i.e.the R starting point

Step 15: Press [←] [→] to display the position of each machining point,and move the machine tool until the axis displays zero,i.e.the position of each point of R arc.

Step 16:Press [C] to exit the smooth arc function anytime.



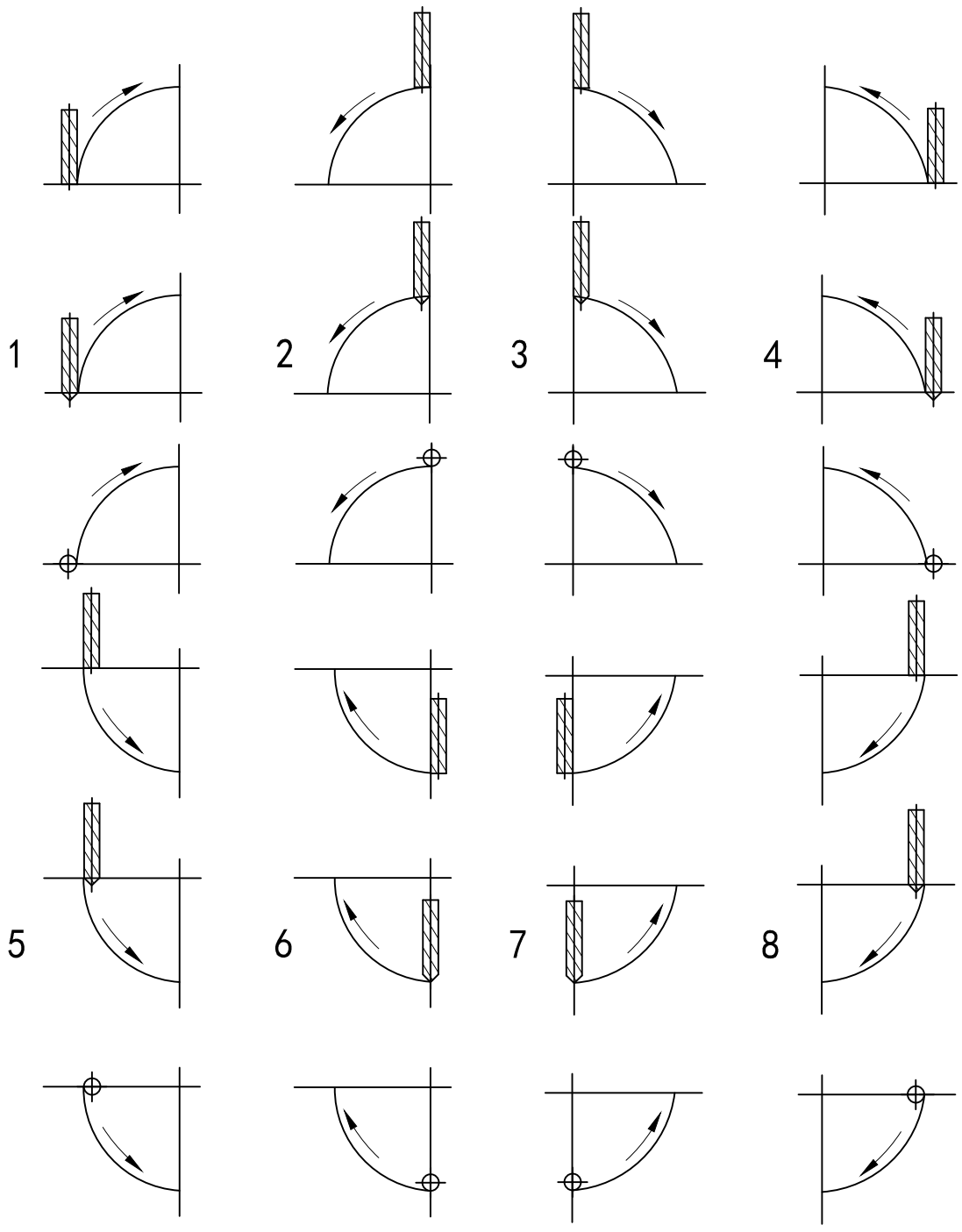
If set the tool as figure B

Simple R function

3.4: Procedures for using simple R function

(Applicable to: Milling DROs)

Function: If you are not familiar with the concept of plane coordinate, you may have difficulty of using the smooth R arc function. If very simple arcs are needed for machining and there is no high requirement for the smoothness, the simple R arc calculation function can be used at this moment. Generally, the arc machining mainly includes the following 8 types, and the flat end milling cutter or arc milling cutter is used for the machining.



3.4 Simple R function

Procedure for using simple R function:

Place the tool directly opposite to the starting point of the arc, and press the key to enter R arc calculation function. Please refer to figure (1) for the method to place the tool directly opposite to the starting point of the arc.

L-LEN:NO.1-NO.4 In Simple R function,we can set four groups of data.Every group has no interference with each other.

Name - - - - No.1-No.4 the drawing name setting

PLANE - - Plane selection (XY YZ XZ)

CT-POS X - - Center of a circle X coordinates

CT-POS Y - - Center of a circle Y coordinates

Radius - - - - - Arc radius

Mode - - - - - Select the machining placeto be concave or convex.

Quadrant - - - Select the machining quadrant

Direction- - - clockwise(0) anticlockwise(1)

MAX-CUT- - maximum cutting amount

TL--DIA - - - - diameter of the tool

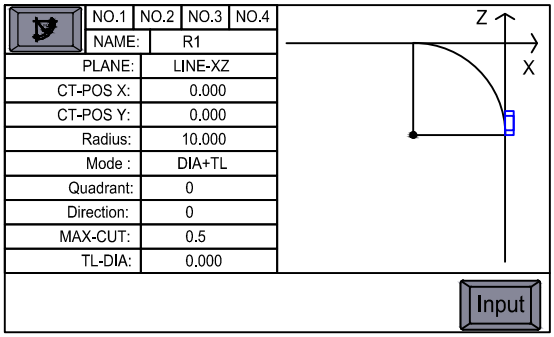


Figure A

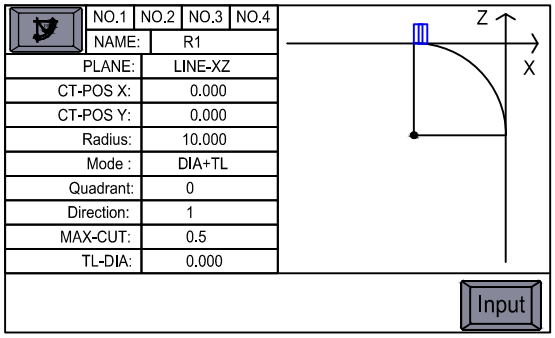
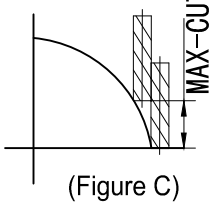
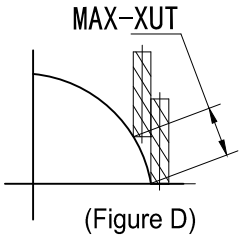


Figure B

In machining the arcs on XZ and YZ planes, "MAX-CUT" in the simple R function refers to the amount of feed for every step as shown in figure (C).The MAX-CUT can be changed during the machining process. When machining the arc on XY plane, "MAX-CUT" refers to the cutting amount of every tool. As shown in figure (D), the cutting amount for every tool is equal.

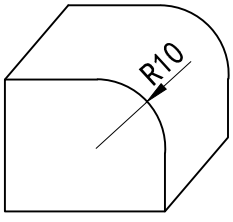


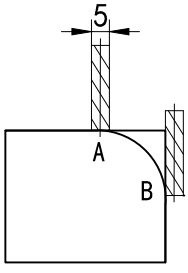
(Figure C)



(Figure D)

Example 1: Take machining the arc shown in the figure as example:





3.4 Simple R function

Step 1: Place the tool directly opposite to the starting point (A or B) of the arc, then press the [ ] key to enter ARC function.

Step 2:Choose the machining drawingNo.1-No.4By pressing [←] [→] to choose,after choosing well,press [↓] to enter the drawing name setting.

Step 3:Drawing name setting (NAME) Press [Input] to set the drawing name, choose the letter by pressing [↑] [↓] [←] [→] .Choose the digit by press the digit button,then press [Input] to input.After setting well,press [ENT] to save.

Step 4:Select the XZ plane as the machining plane (LINE-XZ) Press [Set] to set the machining type.

Step 5:Input the arc radius R=5, and press [Input] to do the data inputting.

Step 6:Select the machining plane as convex Mode = DIA+TL,Press [Set] to set the machining type.

Step 7:Select the machining quadrant Quadrant = 0 ,Press [Set] to set the machining type.

Step8:Press [Set] to choose the simple R machining type

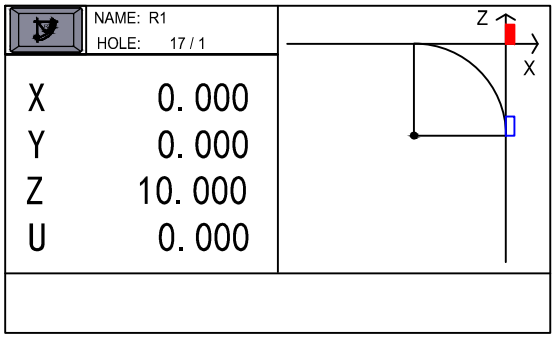
If take the A as the starting point and set the direction=1 to proceed the machining in the clockwise direction(shown in figure A)

If take the B as the starting point and set the direction=0 to proceed the machining in the anticlockwise direction(shown in figure B)

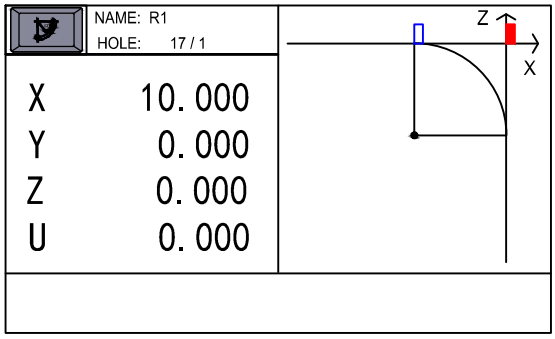
Step 9: Input the maximum cutting amount MAX-CUT=0.5

Step 10: Input the diameter of the tool TL-DIA=0

Step 11:After setting well these parameter,press [ENT] to enter the machining interface.



Take A as the starting point（0，0）



Take B as the starting point（0，0）

Step 12:Press [←] [→] to display the next point for former point.Turn the machine tool until displaying zero.

Step 13: Press [C] to exit simple R function at any time.

Rectangle Chambering

3.5 Rectangle Chambering

(Applicable to: milling machine)

Machining the work-piece chamber shown in figure A,the chambering function may be used.Operators can operate conveniently following the prompts.Shown in figure B,the machining starts from the chamber center and proceeds along the direction indicated by the arrow.The completion of the machining is shown in figure C.

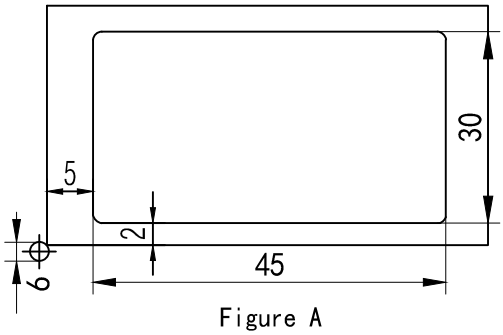


Figure A

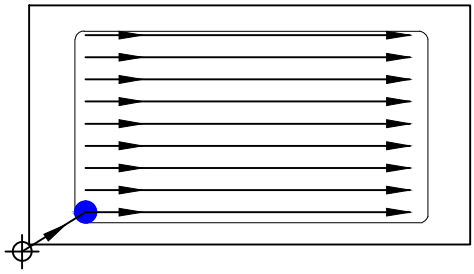


Figure B

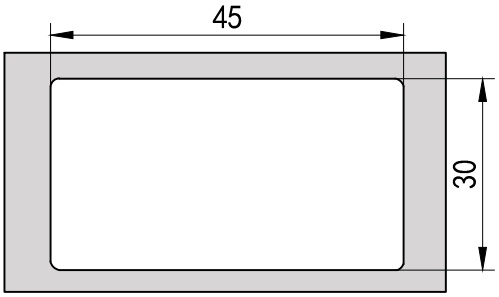


Figure C

L-LEN:NO.1-NO.4 In Rectangle Chambering function,we can set four groups of data.Every group has no interference with each other.

Name - - - - No.1-No.4 the drawing name setting

PLANE - - Plane selection (XY YZ XZ)

CT-POS X - - X axes coordinate of chamber position

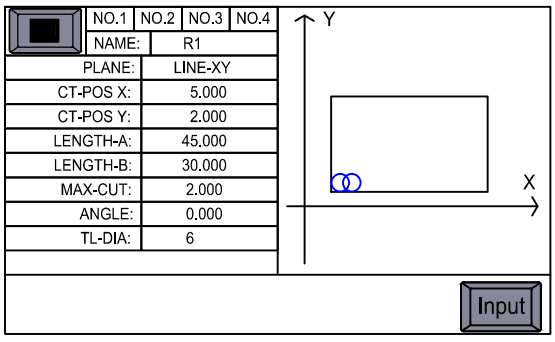
CT-POS Y - - Y axes coordinate of chamber position

LENGTH-A--The side length A of the rectangle

LENGTH-B--The side length B of the rectangle

ANGLE --The rotated angle of rectangle

TL--DIA - - - - diameter of the tool



The parameter setting of rectangle chambering

3.5 Rectangle Chambering

Example: For machining the work piece shown in figure A, the operating procedures are as follows

Step 1: Set the tool according to the position shown in figure A, and zero, then press the key to enter the chambering function.

Step 2:Choose the machining drawingNo.1-No.4By pressing ← → to choose,after choosing well,press ↓ to enter the drawing name setting.

Step 3:Drawing name setting (NAME) Press Input to set the drawing name, choose the letter by pressing ↑ ↓ ← → .Choose the digit by press the digit button,then press Input to input.After setting well,press ENT to save.

Step 4:Select the XY plane as the machining plane (LINE-XY) Press Set to set the machining type.

Step 5:Set the X axes coordinate of chamber position to be CT-POS X=5,press Input to input.

Step 6:Set the Y axes coordinate of chamber position to be CT-POS Y=2,press Input to input.

Step 7:Set the side length A of the rectangle to be LENGTH-A=45,press Input to input.nput.

Step 8:Set the side length B of the rectangle to be LENGTH-B=30,press Input to input.nput.

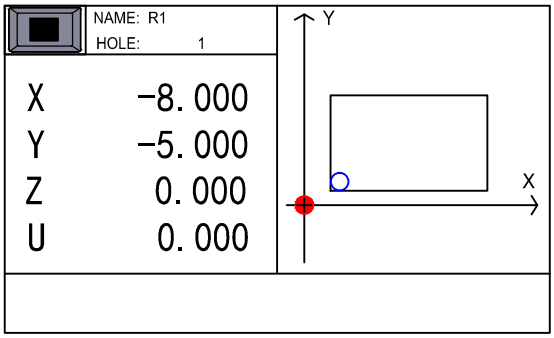
Step 9:Set the maximum cutting to be MAX-CUT=2,press Input to input.

Step 10:Set the rotated angle of rectangle to be ANGLE=O,press Input to input.

Step 11:Set the diameter of the tool to be TL=DIA=6,press Input to input.

Step 12:After inputting well,press ENT to enter the machining state.

Step 13:Press ← → to display the next machining postion,and move the machine tool following the prompts until X axes and Y axes display zero.Press C to exit the chambering function.

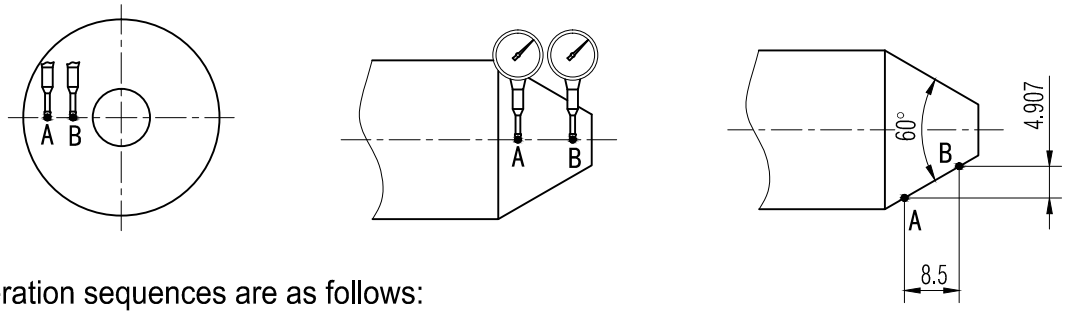


The interface of rectangle chambering

Taper measuring

3.6 Taper measuring

The function is used to turn tapered work piece and could measure the taper of the work piece in machining.



Operation sequences are as follows:

As shown in the figure, make the contact of the lever indicator to contact position A on the work piece surface and press until the lever indicator points to zero.

Step 1: Press [△] key to enter taper measuring function.
Step 2:Select the plane to be LINE-XY by pressing [←] [→] .
Step 3:Move the table to make the measuring tool such as the dial indicator touch the point A on the work-piece until the dial indicator turn to be zero.Press [ENT] to find the position of point B.
Step 4:Move the table to make the measuring tool such as the dial indicator touch the point B on the work-piece until the dial indicator turn to be zero
Step 5:Press [ENT] to calculate.(Shown in figure C)

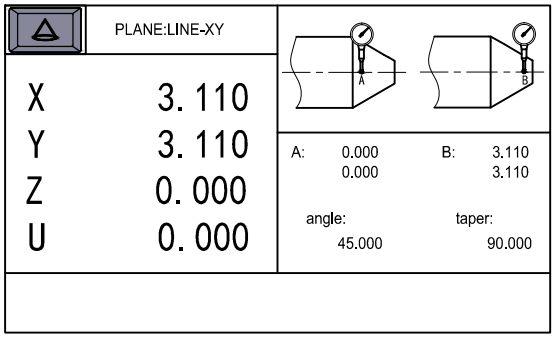


Figure C

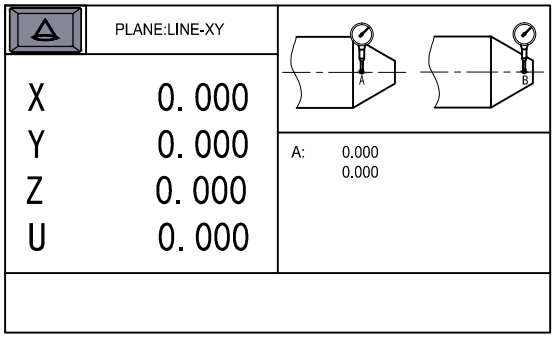


Figure B

Point A - - The coordinate of point A

Point B - - The coordinate of Point B

Step 6:Press [C] to exit the taper measuring function.

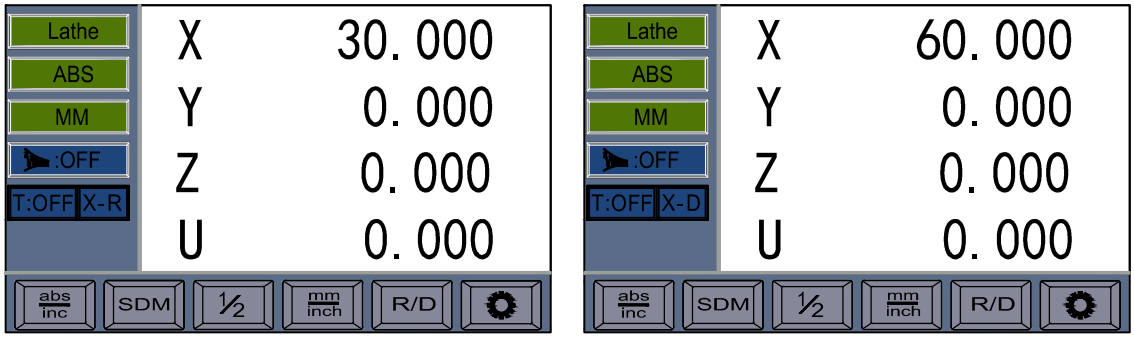
Diamete/radius Conversion

3.7 Diamete/radius Conversion

(Applicable to: Lathe)

Function Introduction:

When the DRO has been set as the lathe mode,press R/D to change the X axes to be diameter.Press R/D again to change the X axes to be radius



Radius Diameter

Note：When the DRO is used as a lathe meter, only the X axis has radius/diameter conversion and Y and Z axis don't have this function.

Vectoring

3.8 Vectoring(suitable for lathe which has the rotatable tool post)

Vectoring function is used for displaying combined movement of either X – Z axis pair or Y– Z axes pair taking into consideration angle between Y and Z i.e. α. The resulting combined movement is displayed on X and Y axis.

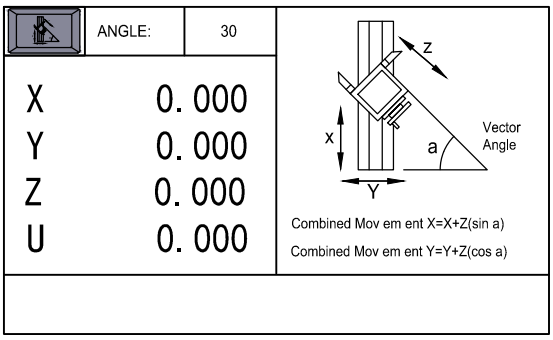
Step 1,Press  to enter the vectoring function.

Step 2,Press 

to input the rotated angle of the tool post.

Step 3:Move the Z axes,then the combined movement of XZ will display on X axis,the combined movement of YZ will display on Y axes.

Step 4,Press [C] to exit the vectoring function.



The interface of the vectoring function.

TOOL Storeroom

3.9. TOOL Storeroom

Function introduction:

Various tools are needed to turn different work pieces or their surface, so we have to load/unload tools and set tools. To save the operator's time, the lathe function of the DRO is provided with the function of 16 sets of tool magazine.

Note: The function of 16 sets of tool magazine could only be used together with a tool post on the lathe. Don't use this function without a tool post to avoid errors in machining.

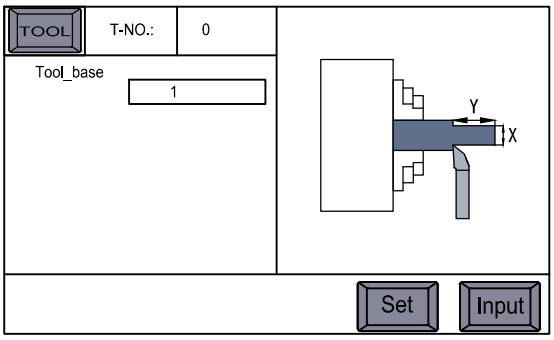


Figure A

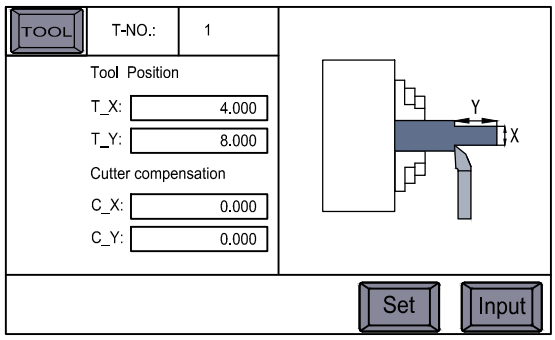


Figure B

Basic settings:

1.The parameter of tool setting.

T-NO. - - Tool No.(Shown in figure A)(It can save 16 tools as maximum.When the T-NO.=0,it indicates the DRO entering the setting of base tool and turn off the tool function.

Tool-base - -checking and setting the base tool(shown in figure A)

T-X- - the X axes of the tool from the center point of the work-piece(shown in figure B)

T-Y- - the Y axes of the tool from the center point of the work-piece(shown in figure B)

C-X- - the compensation of tool,this is the compensated value after tool abrasion.

C-Y- - the compensation of tool,this is the compensated value after tool abrasion.

2.Set a base tool on the center point in INC coordinate.

Here we need to fix the work-piece on the holder first,and enter the TOOL function to select one tool as the base tool(shown in figure A).Use the base to machine the work-piece to be smooth,and then measure out the value of X and Y for work-piece.And input this value to the base tool T-X and T-Y(shown in figure C).Then the base tool setting is done.

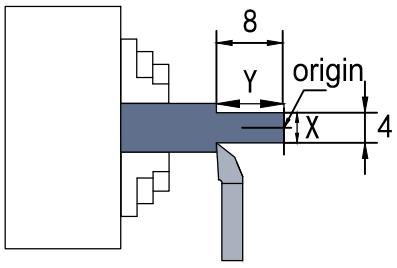


Figure C

3. Set the second tool according to the base tool.Input the measured value of T-X and T-Y of the second tool(shown in figure E).We can use the same way of the base tool to measure the second tool.This setting apply to the following tool.

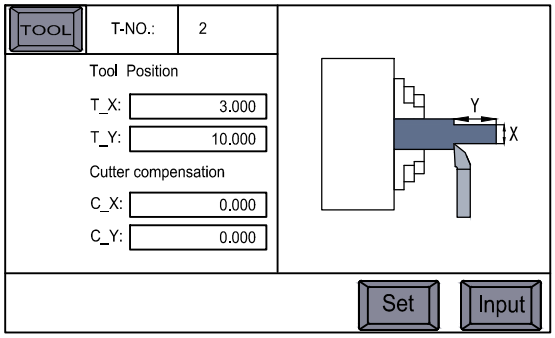


Figure D

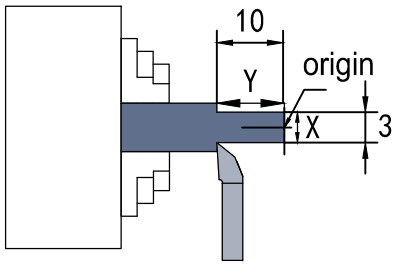


Figure E

4. Save the tool No. and the corresponding distance which is relative to the base tool into the DRO.
5. During the machining,operator can input the tool No. which will be used,then the DRO will display the distance between the target tool and the base tool.Move the corresponding axes until the value of X and Y to be zero.
6. When need to machine another batch of work-piece,there is no need to determine the tool again.Fix the work-piece to the holder,and set the origin of the base tool again.Then other tools will be adjusted automatically.
7. Change the base tool.If any err of the base tool happened during the machining,we can select another tool as the base tool.There is no need to determine the position of other tools.Replace the former base tool,and determine the position of this new tool,then this new tool will be taken as a normal tool instead of the base tool.

8.Tool compensation.

If there is any damages on the tool during the machining.We can measure out the damaged value of the tool,and input this value to C-X and C-Y.The compensation will be made by the DRO at then.

Tool setting

Step 1:Press TOOL to enter the tool function.

Step 2:Base tool setting.Set the first tool as the base tool.

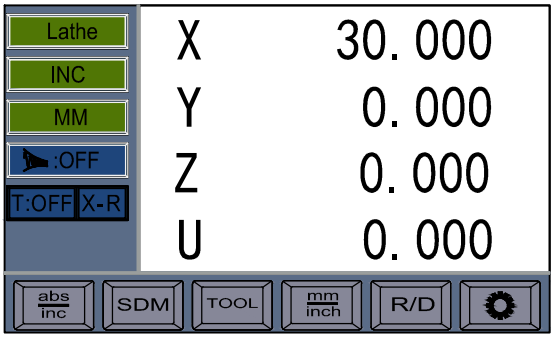
Press ← → to set the tool No. as 0(T-NO.=0).Then enter the base tool setting,Press Input to enter the tool setting.Press Set to input the tool No. .After inputting well,press ENT to save.(shown in figure A).

Step 3:After the setting of the base tool,press ← → to select the No.1 tool.Press Set to proceed the setting.Select the corresponding parameter by pressing ↑ ↓.And press Input to proceed the setting. (Shown in figure B)

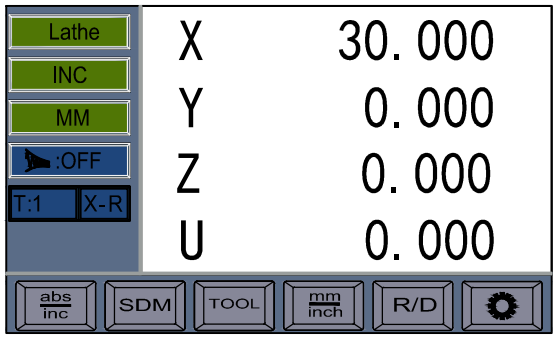
Step 4:No.2 tool setting.Press ← → to switch the tool to No.2 and then input the corresponding parameter(Shown in figure D).

Step 5:After setting well all the tool step by step,then user can switch the tool very fast.
Press TOOL to enter the tool function. Press the digits to select the target tool,then the DRO will switch the tool to the target one.Meanwhile it can be switched by press Input to input the tool No..

Step 6:Log off the tool function.
Press TOOL to enter the tool function.And press 0 or press Input and then 0 to Log off the tool function.



Tool function off



Tool function off

Note:Operator can zero the value when the base tool is under using in INC coordinate.It cannot be zeroed for any other tool.

Congruous Output Function of EDM

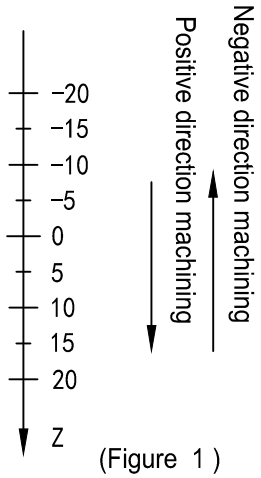
3.10 Congruous Output Function of EDM

(Applicable to EDM DRO)

1. Function introduction:

This function is used for the specialized machining by the electric discharge machine (i.e. EDM). When the target value on Z axis of the EDM equals the current value, the DRO will output a switch signal to control the EDM to stop the depth machining.

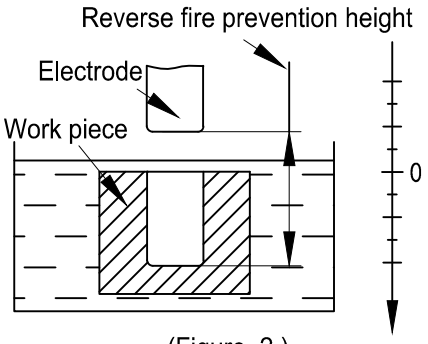
The setting for Z axis direction of D60-3E type DRO is shown in figure 1, i.e., the depth is larger, the coordinate value displayed by Z axis is larger. Since the machining is started, as the depth increases gradually, the value displayed by Z axis increases gradually.



(Figure 1)

According to the set direction on the Z axis, the machining direction includes the positive direction and negative direction. When the electrode drops, the machining direction is from upper to lower part, and the DRO value will increase. We call the machining direction as "positive direction machining" which is the normal direction. When the electrode rises, the machining direction is from lower to upper part, and the DRO value will decrease. We call the machining direction as "Negative", namely, "negative direction machining" (as shown in figure1).

The D80 DRO with EDM function also has the function of "reverse fire prevention height" which is not offered by other similar DROs. This function is one kind of intelligent safety protection device of position following and detecting. When the carbon deposition occurs on the electrode surface in the process of positive direction machining, especially in the long-time machining or round-the-clock machining without supervision by people, the carbon deposition will increase gradually along the reverse direction without being cleared up by people. Once the electrode exceeds the liquid level, the fire may tend to break out to cause the damage. This “reverse fire prevention height” function is set for this problem. If the “reverse fire prevention height” is set, the DRO will give a warning and an alarm when the height enhanced by the electrode exceeds the height (i.e., the reverse fire prevention height) between electrode and the machined plane depth. Meanwhile, the output signal will shut down the EDM automatically to completely eradicate the chance of fire breaking out. (See figure 2)



(Figure 2)

3.10. Congruous Output Function of EDM

2. Specific Operations:

1: Before machining, set the parameters of "reverse fire prevention height", "exit mode", "machining direction" and "EDM mode".

2: Firstly move the main axis electrode of Z axis to make it touch the work piece reference, and then zero Z axis or set the number.

3: Press the Input key, and input the depth value for machining (the depth value will be displayed on X axis), such as 10.00, then press the ENT key to confirm. After the confirmation, press the ENT again to exit "DEPTH" and enter "EDM" state for machining.

4: "The target value of the machining depth" will be displayed on X axis. will be displayed on "Dpeth" axis. The value on "Dpeth" axis is the machined depth value of the work piece.will be displayed on Z axis. Note: The value on Z axis is the value of position where the main axis electrode of Z axis is located.

5: After the machining is started, the value displayed on "Dpeth" axis will get on for the target value gradually. If the electrode rises and drops repeatedly at this moment, the value displayed on Z axis will change accordingly. However, the value displayed on "Dpeth" axis will not change and always indicate the machined depth value.

6: When the value displayed on Z axis equals the target value, the limit switch will close, and the EDM will stop machining, also, the information screen will display "FINISH". According to the setting made by the operators, there have two exit modes: I. Automatic mode. Exit the EDM machining state automatically and restore the displaying state before machining. II. Pause mode. The screen always shows " END", and it need to press the C key to exit and restore the original displaying state.

3.EDM parameter introduction

Zero all axis' value before entering EDM function.Then press EDM to enter the parameter setting interface.

L-LEN:NO.1-NO.4 In EDM function,we can set four groups of data.Every group has no interference with each other.

Name - - - - No.1-No.4 the drawing name setting

DIR - - - Machining direction

POSITIVE indicates the positive machining direction.

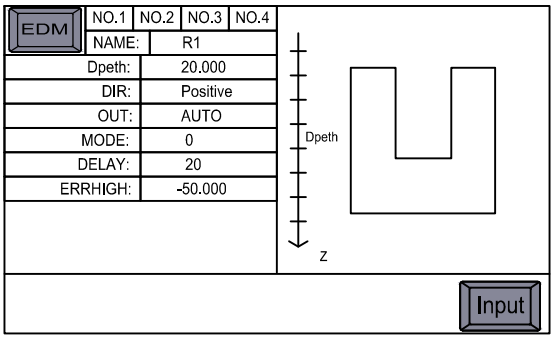
NEGATIVE indicates the negative machining direction.

Press Set to set.

OUT - - Setting for exit mode

STOP indicates the stop mode.

AUTO indicates the automatic mode Press Set to set



EDM Setup interface

3.10. Congruous Output Function of EDM

MODE - - - EDM machining mode.

Press the Set key to select MODE 0. The output states of the relay in MODE 0 are as follows:

a. When the power is off, the relay coil is OFF.
b. When the CPU is not initialized, the relay coil is OFF.
c. When the normal state output of booting is 1, the relay coil is ON.
d. When EDM function outputs 0 in operation, the relay coil is ON.
e. When EDM outputs 0 in depth, the relay coil is OFF.

Press the Set key to select MODE 1. The output states of the relay in MODE 1 are as follows:

a. When the power is off, the relay coil is OFF.
b. When the CPU is not initialized, the relay coil is OFF.
c. When the normal state output of booting is 0, the relay coil is OFF.
d. When EDM function outputs 1 in operation, the relay coil is ON.
e. When EDM outputs 0 in depth, the relay coil is OFF.

DELAY - -Post-set time,the unit is 0.1 second(when the model is set as the exit automatically OUT-AUTO).This time can be set.Press Input to proceed the setting.

ERRHIGH - reverse fire prevention height.

The machining defaulted by the DRO is the positive direction machining. As in example 1 and example 2, you should set the positive direction machining as the machining at first in the positive direction machining; as the work piece shown in the machining figure (F), you should set the negative direction machining as the machining direction before machining in the negative direction machining. Otherwise, after entering the machining, the DRO will identify that the machining has been completed and exit the machining.

4. Examples of Positive Direction Machining

Example 1: Machining the work piece as shown in Figure (A) , The work piece and electrode are shown in figure (B). Please set the positive direction machining as the machining direction at first.

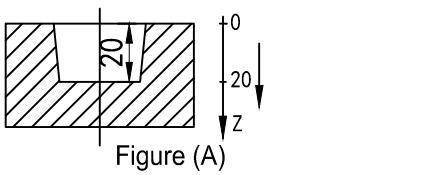


Figure (A)

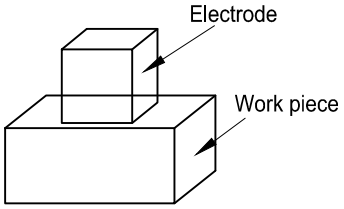
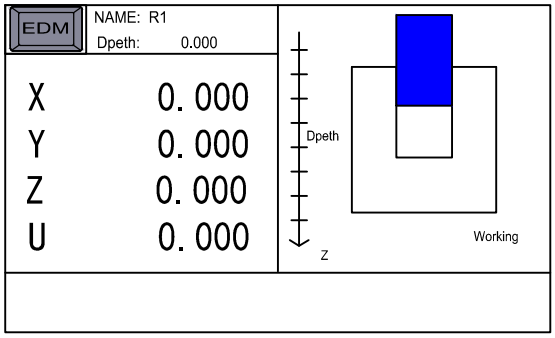


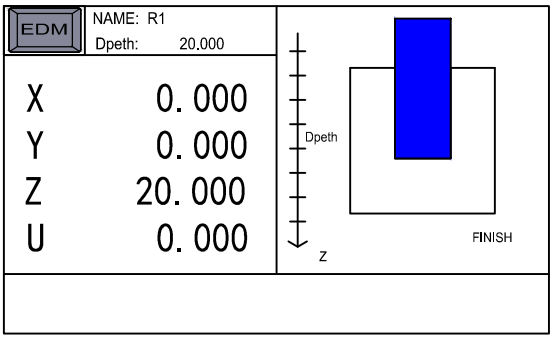
Figure (B)

3.10. Congruous Output Function of EDM

Step 1: As shown in figure (B), move the main axis electrode to make it touch the work piece and then press the [X], [Y] and [Z] keys to zero.
Step 2: Press the [EDM] key to enter the machining.
Step 3: Set the machining depth. DEPTH = 20
Step 4:Set the machining direction as positive DIR=POSITIVE
Step 5:Set the exit mode as the automatic OUT=AUTO
Step 6 :Set the EDM mode MODE=0
Step 7:Set the post-set time as DELAY=20
Step 8 :Set the reverse fire prevention height ERRHIGH=-50
Step 9:After setting well of the above parameter,press [ENT] to enter the machining interface.
Step 10: When the value displayed on Z axis equals the target value, the limit switch will close; the information window on the right will display " FINISH" for 2 seconds, then back to the state before machining.



EDM machining interface



EDM machining finish

Example 2: Machining the work pieces as shown in Figure (C)
Please set the positive direction machining as the machining direction at first.

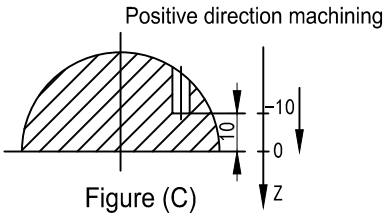


Figure (C)

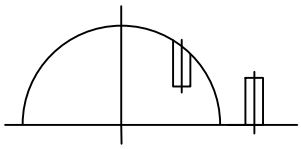


Figure (D)

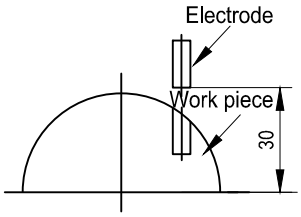
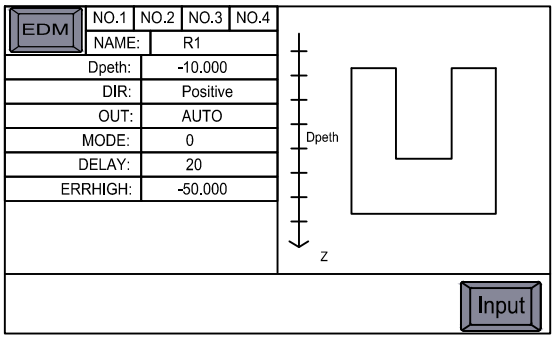


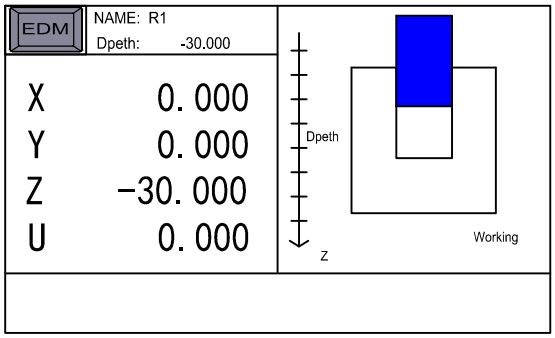
Figure (E)

Step 1: As shown in figure (B), move the main axis electrode to make it touch the work piece and then press the [X], [Y] and [Z] keys to zero.
Step 2: Press the [EDM] key to enter the machining.
Step 3: Set the machining depth. DEPTH = -10
Step 4:Set the machining direction as positive DIR=POSITIVE
Step 5:Set the exit mode as the automatic OUT=AUTO
Step 6 :Set the EDM mode MODE=0
Step 7:Set the post-set time as DELAY=20
Step 8 :Set the reverse fire prevention height ERRHIGH=-50
Step 9:After setting well of the above parameter,press [ENT] to enter the machining interface.

Step 10: When the value displayed on Z axis equals the target value, the limit switch will close; the information window on the right will display " FINISH" for 2 seconds, then back to the state before machining.



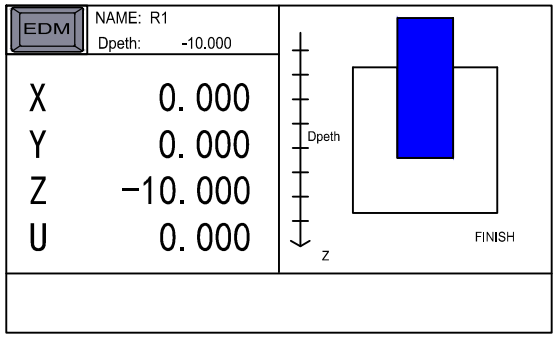
EDM setting interface



EDM machining interface

5. Examples of Negative Direction Machining

Example 3: Machining the work pieces as shown in Figure (F) ,Please set the negative direction machining as the machining direction.



EDM machining finish

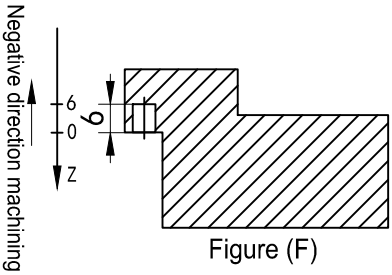


Figure (F)

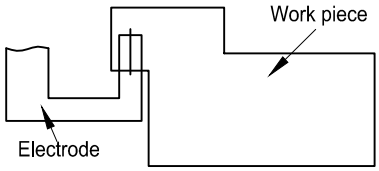
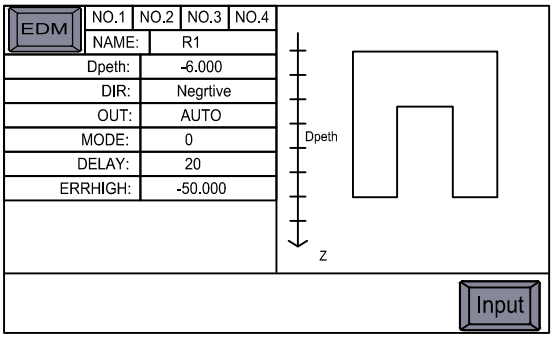


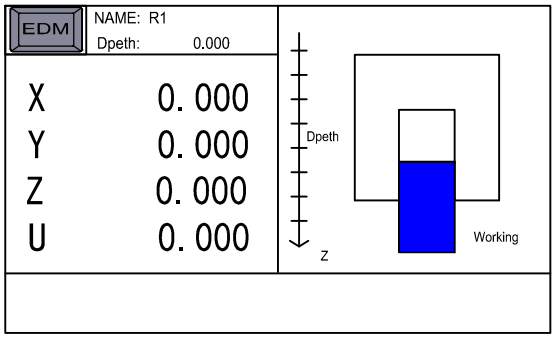
Figure (G)

Step 1: As shown in figure (B), move the main axis electrode to make it touch the work piece and then press the [X], [Y] and [Z] keys to zero.
Step 2: Press the [EDM] key to enter the machining.
Step 3: Set the machining depth. DEPIH = 6
Step 4:Set the machining direction as positive DIR=NEGRTIVE
Step 5:Set the exit mode as the automatic OUT=AUTO
Step 6 :Set the EDM mode MODE=0
Step 7:Set the post-set time as DELAY=20
Step 8 :Set the reverse fire prevention height ERRHIGH=-50
Step 9:After setting well of the above parameter,press [ENT] to enter the machining interface.
Step 10: When the value displayed on Z axis equals the target value, the limit switch will close; the information window on the right will display " FINISH" for 2 seconds, then back to the state before machining.

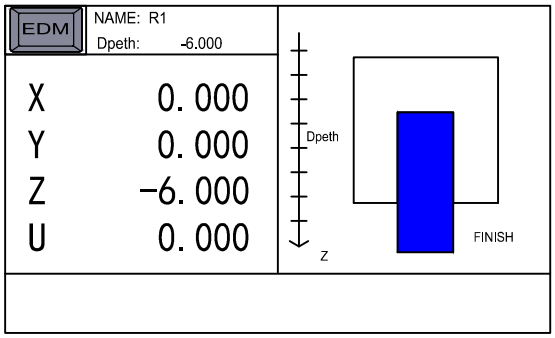
3.10. Congruous Output Function of EDM



EDM setting interface



EDM machining interface



EDM machining finish

6. Use PCD Function together with EDM Function

In PCD function, the DRO can call the EDM function to complete the EDM machining for the PCD. The specific operation procedures are as follows:

1) Press the key to enter the PCD function to set parameters (please refer to the PCD function setting). After setting all parameters, press the EDM key to enter the PCD machining. When displaying the position coordinate of the first machining, move the table to make the electrode aligning the first machining hole.

2） Press the EDM key to input the EDM parameter setting and machining state (refer to the EDM parameter setting for the EDM parameter setting method), and input the machining depth for EDM machining. After the machining is completed, press the EDM key to exit EDM machining and enter the PCD machining. Press the key to display the position coordinate of the second hole. Move the table to make the electrode aligning the next machining hole.

7. Use PLD Function and EDM Function Cooperatively

In PLD function, the DRO can call the EDM function to complete the EDM machining for the PLD. The specific operation procedures are as follows:

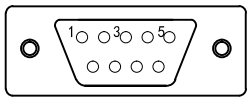
1) Press the key to enter the PLD function to set parameters (please refer to the PLD function setting). After setting all parameters, press the ENT key to confirm entering the PCD machining. The position of first machining hole is displayed in coordinate. Then move the table to make the electrode aligning the first machining hole.

2） Press the EDM key to enter the EDM parameter setting and machining state (refer to the EDM parameter setting for the EDM parameter setting method), and input the machining depth for EDM machining. After the machining is completed, press the EDM key to exit EDM machining and enter the PLD machining. Press the ← key to display the position coordinate of the second hole. Move the table to make the electrode aligning the next machining hole.

8. EQUAL OUT port of rear base plate

The output of EQUAL OUT is the relay output and the contact capacity is: 1.0A30VC, 0.5A125VAC, 0.3A60VDC.

9-pins Socket Pin Number	Signal type	9-pins lead
1	OFF (NC Port)	Black
3	COM (Common Port)	Yellow
5	NO (NO Port)	Red

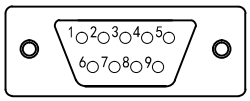


4. Appendix

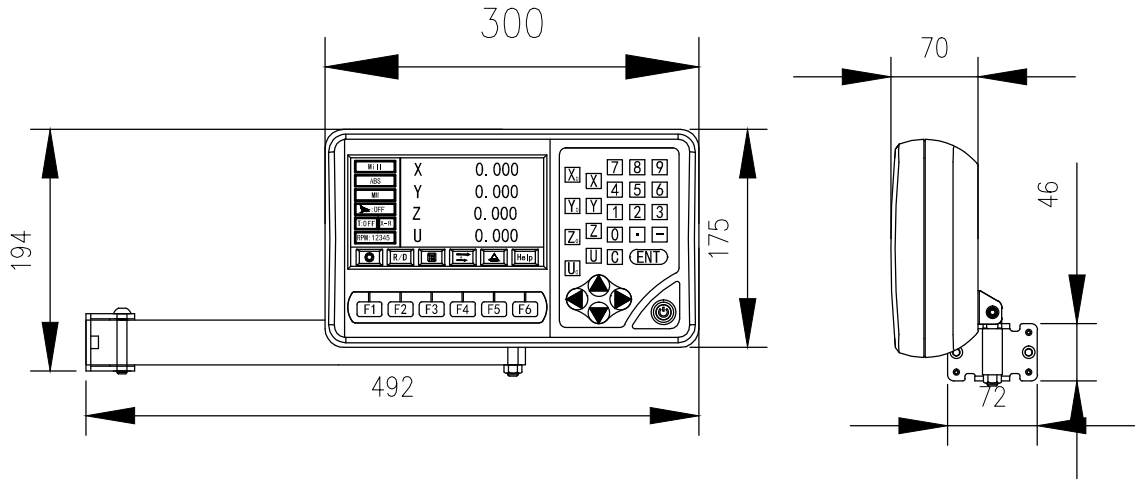
4.1 Notices for Usage:

1. Supply voltage: AC 80 V - - 260 V, 50 - - 60 Hz
2. Power: 15 W
3. Display mode:7 inches true color LCD screen.
4. Operating temperature: -10℃- - 60℃
5. Storage temperature: -30℃- - 70℃
6. Relative humidity (RH): <90% (25)>
7. Axis to be displayed : 1 axis, 2-axis , 3-axis , 4-axis , 5-axis
8. Input signal allowed by the DRO: TTL square wave / RS422
9. Allowable input signal frequency: < 2 MHz
10. Length resolution: 0.1 um, 0.2 um, 0.5 um, 1 um, 2 um, 2.5 um, 5 um and 10 um
11. Minimum resolution of angle display: 0.0001/ pulse
12. Weight: 2.2 KG
13. Volume size: 300 x175 x 70 (mm)
14. Interface definition of the grating ruler: (DB 9-pins socket)

Pin	1	2	3	4	5	6	7	8	9
signal	A-	0V	B-	Shield	R-	A	+5V	B	R



4.2 Installation Figure



4.3 Troubleshooting

The following troubleshootings are just the preliminary methods. If the problems still exist, please do not dismantle the DRO by yourself, but contact our company or the dealers for help in time.

Faults	Fault Causes	Solutions
The DRO doesn't display anything	1. The power is not on ? 2. The power switch is not closed ? 3. The supply voltage is not appropriate 4. The internal supply of the grating ruler is in short circuit.	1. Check whether the power line and power plug are plugged in. 2. Close the power switch. 3. Make sure the supply voltage between 85V-265V. 4. Pull out the connector of the grating ruler.
One axis of the DRO doesn't count	1. Operate the machine after swapping with the grating ruler of another axis. 2. Some special functions of the DRO are being used.	1. If counting, it's the fault of the grating ruler; if not, it's the fault of the DRO. 2. Exit the special function
The counting of DRO is not accurate (it can't zero)	1. The grating ruler isn't installed according to the requirements or the accuracy is not enough. 2. After being used for a long time, the vibration of the machine tool makes the fixed reading head or the screws loosen. 3. The accuracy of the machine tool is not good. 4. The DRO resolution isn't consistent with the grating ruler.	1. Reinstall the grating ruler and adjust the level. 2. Tighten all the fixed screws. 3. Overhaul the machine tool. 4. Reset the DRO resolution.
The counting of DRO is in error,The displayed operation distance isn't consistent with the actual distance	1. The machine tool and the DRO shell are not connected to earth. 2. The accuracy of the machine tool is not good. 3. The running speed of the machine tool is too fast. 4. The grating ruler isn't installed according to the requirements and the accuracy is not enough. 5. The DRO resolution isn't consistent with the grating ruler. 6. The operating size unit is not consistent with the displayed Metric/British units. 7. The linear error compensation setting of the DRO is not appropriate. 8. The grating ruler exceeds the operating range of length or the read head is broken.	1. Connect the machine tool and the DRO shell to earth. 2. Overhaul the machine tool. 3. Reduce the running speed of the machine tool. 4. Reinstall the grating ruler and adjust the level. 5. Reset the DRO resolution. 6. Switch the displayed Metric/British units. 7. Reset the linear error compensation of the DRO. 8. Repair the grating ruler.

Faults	Fault Causes	Solutions
The grating ruler doesn't count	1. The grating ruler exceeds the operating range of length or the read head is broken. 2. The read head of grating ruler rubs the ruler shell leading to the aluminum scraps accumulated. 3. The gap between the read head of grating ruler and the ruler body is too wide. 4. The metal tubes of the grating ruler are damaged, which causing the short circuit or disconnection in internal wiring.	1. Repair the grating ruler 2. Repair the grating ruler 3. Repair the grating ruler 4. Repair the grating ruler
The grating ruler doesn't count sometimes	1. The small box of the grating ruler is separated from the steel ball. 2. The grating glass in the read head of the grating ruler is abraded. 3. There is dirt on the grating glass in the shell of the grating ruler. 4. The elasticity of small box spring in the read head of the grating ruler is not enough.	1. Repair the grating ruler 2. Repair the grating ruler 3. Repair the grating ruler 4. Repair the grating ruler