DEPP

GRATING DIGITAL READOUT (DRO) SYSTEM

D100 Series User Manual

Dear DEPP Digital Readout system user:

Thank you so much for purchasing DEPP Digital Readout(DRO) device, offering us an opportunity to provide service for you. We make our best to produce the most stable Digital Readout . DEPP Digital Readout with high stability and reliability is convenient and easy to operate, making you enjoy the excellent performance and reliable quality.

DEPP products, such as ball-gird Digital Readout and grating Digital Readout, high-precision length measuring platform, high-precision height measuring instrument, have been widely applied in machine tool movement, positioning measurement and product inspection, thus to increase efficiency of production and processing and improve the quality of the product. We know deep down that DEPP Digital Readout user's satisfaction is our objective. We hope this user manual will assist you a lot in using our company's products. **Integrity, innovation, quality, service** is our purpose, so whenever or wherever you need, we will, with all our heart, constantly strive to provide all-directional and professional service for you.

Thank you again for using DEPP Digital Readout product, and we hope have more opportunities to provide service for you.

Sincerely with best wishes!

Hangzhou Depp Measuring Equipment Co., Ltd.

Please read carefully following security considerations before use:

* Please open the carton to check for damage when you receive it. If there is any damage, please contact timely with the company or the agent to change.
* This Digital Readout uses AC100-240V, 50-60HZ power supply , if there is any damage occurred in the process of use, please do not try to open Digital Readout to repair it by yourself, which may threaten to your life for there is high voltage.
* The power line that is used must be the standard power line for DEPP Digital Readout. Please do not put any object on power line. When arranging the power line, it must be far away from mobile device, metal filing, cooling liquid and heat source.
* This Digital Readout must be well earthed when using. A special grounding interface is in the rear part of the meter. The power plug with ground pin also needs to be well earthed.
* The location for installing Digital Readout must be safe and convenient to operate. It is not appropriate to install it beside mobile device or cooling pipe and heating pipe. Ventilation around Digital Readout shall be ensured
* In the thunderstorm weather, pull out the plug of Digital Readout if possible.
* If you do not need to use the DRO for a long time, please turn off the power switch.
* Turn off the power of Digital Readout before connecting with grating linear scale. Only Grating linear scale or rotary encoder can be connected to DRO with a DB9 plug and remember to fasten anchor screw.
* The DB9 plug of RRO outputs DC 5V voltage,which supplies for grating linear scale .

Specification for D100 series of DRO

External dimension: Width:265mm   Height：155mm   Thickness：65mm
Input voltage: AC100-240V   50-60HZ
Maximum power: 15W
Working temperature: 0℃-45℃
Storage temperature: -20℃-70℃
Relative humidity: <80%
Weight: 1.25kg
Number of axis: 2,3
Grating linear scale interface: DB9 (hole)
Signal input: 5V TTL level
Resolution ratio of Digital Readout: 0.1,0.2,0.5,1,2,5,10um
Rotary encoder: 200-360000 loops
Output interface (Optional):   RS232 DB9(hole)

CONTENTS

I .Appearance introduction

1. 1 Front view

D100-2 2-axis Grating Digital Readout

X axis window
Y axis window
Reset key
Axis selecting key

DEPP D100

Half
Circumferential Oblique lines hole
Arc processing
coordinate switch
Auxiliary Absolute/Relative

Number key

Up and down key
Clear
Comfirm firm
Domicile point
In/mm switch

D100-3 3-axis Grating Digital Readout

X axis window
Y axis window
Z axis window
Reset key
Axis selecting key

DEPP D100

Half
Arc processing
Circumferential Oblique lines hole
Auxiliary Absolute/Relative coordinate switch

Number key

Up and down key
Clear
Comfirm firm
Domicile point
Absolute/Relative coordinate switch
In/mm switch

1. 2 Rear view

D100-2 2-axis Grating Digital Readout

power switch
AC110V-220V power
earth wire

DB89 signal input of grating linear scale

RS232

D100-3 3-axis Grating Digital Readout

power switch
AC110V-220V power
earth wire

DB9 signal input of grating linear scale

RS232
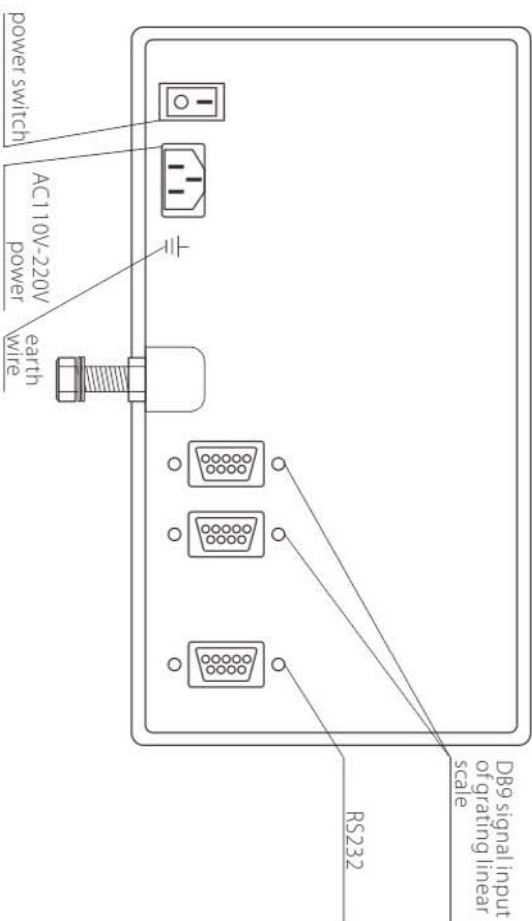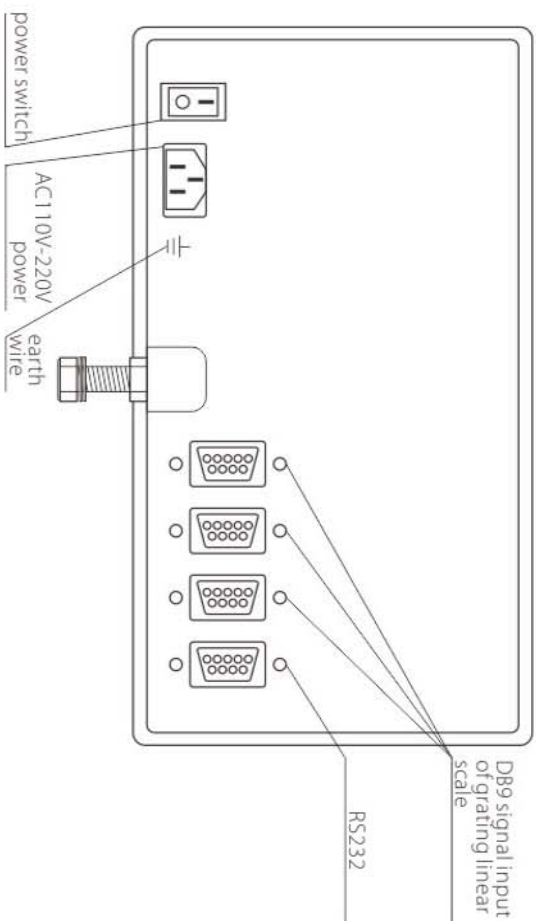
1.3 Installation drawing of Digital Readout

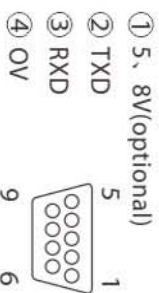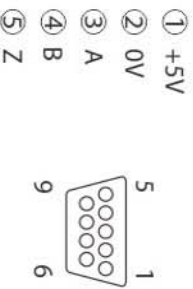## a. Mosaic open(Width/Height)

262mm

152mm
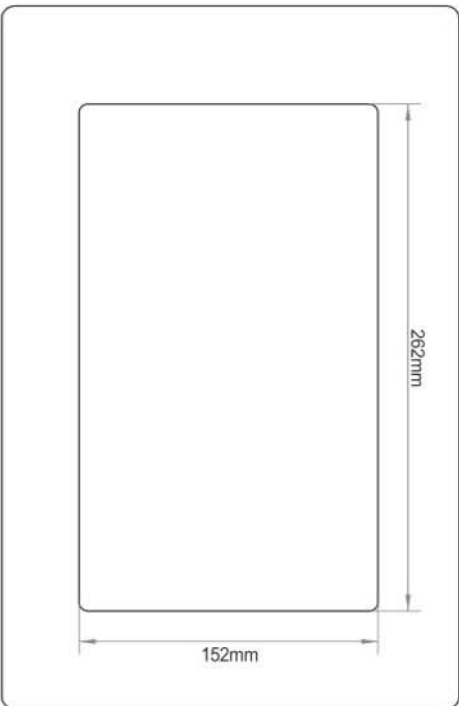
b. Installation method

Remove four screws which fixed on the back of Digital Readout, combine the front cover and back cover on the mosaic opening that need to install.

c.

1. Definition of grating linear scale input

① +5V   5
② 0V   1
③ A   9
④ B   6
⑤ Z

2. Definition of RS232 output

① 5、8V(optional)   5
② TXD   1
③ RXD   9
④ 0V   6

1.4 Key description

Key sembol	Key name	Function description
X_0 Y_0 Z_0	Reset	Reset
X Y Z	Setting number	Setting number
½	Half	Divide show value of given axis by 2
ABS INC	Absolute/Relative coordinate switch	Switch between ABS coordinate and INC coordinate
IN MM	IN/MM switch	Switch the unit of the displayed value
0 ~ 9	Number	Enter numerical value
.	Domicile point	Enter domicile point
±	Plus-minus sign	Enter plus or minus
CE	clearing	Clear error operating
ENT	Confirm	Confirm each input operation
◯	Circumferential hole	Machining of equally-spaced holes in circumference
◣	Oblique lines hole	Machining of equally-spaced holes in oblique line
SDM	Auxiliary coordinate	100 group auxiliary coordinate
∧ ∨	Up and down key	Up and down selection key
CAL	Calculator	Enter /Exit calculator function
R	Arc processing	Arc processing function
SHIFT	Calculator function key	Enter into the calculator function and then use it

II. Operation instructions

2.1 Turn on

Function introduction:

Turn on the power, the Digital Readout will inspect itself. Sub display window shows the version number of the software in proper order. Once the self-inspection is finished, the DRO enters into normal display state. When working normally, it will record:

a. Digit position during the machining of ABS/INC coordinates.

b. Remember SDM processing coordinate.

c. Exit the function of circumferential hole ,arc processing and oblique line hole.

2.2 Reset

Function introduction:

When Digital Readout is in normal display state, reset the display value of the axis to zero. With "Reset", you can set current coordinate to show machining datum point.

Note:

a. When circumferential hole function is enabled and the Digital Readout cannot be reset, now you should back first to normal display state.

b. In ABS/INC coordinate, it can be reset.

Eg. 1 the current coordinate origin is set in 0 point in workpiece as shown in right picture.
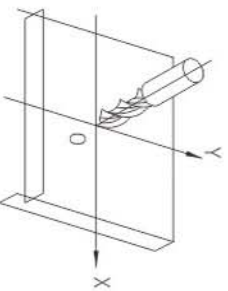
Operating steps:

a. Normal display state.

b. Move worktable to make machine tool aligned with 0 point.

c. Press X_0 ,reset current display value in X window to zero.

d. Press Y_0 ,reset current display value in Y window to zero.

2.3 Preset value for X, Y, Z axis

Function introduction:

When Digital Readout is in normal display state, set display value of target position of certain axis.

Note:

a. when circumferential hole function is enabled and the Digital Readout cannot be reset, now you should back first to normal display state.

b. In ABS/INC coordinate, it can set values.

c. The range of setting a value: from minimum display value to maximum display value of a axis.

For example:

Machining from fig. a to fig. b, and reference point is set in C point, as shown in right. Take rightward direction as positive.
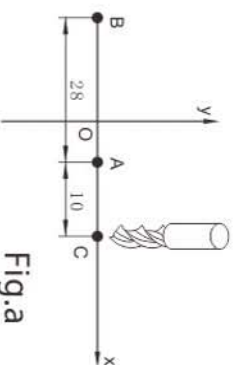

Fig.a
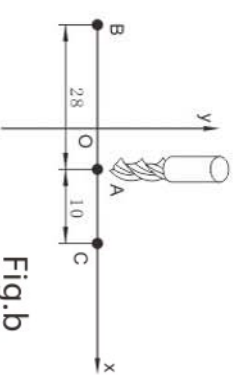
Fig.b

Operating steps:

a. Move worktable to direct at A point.

b. Make Digital Readout back to normal display state.

c. Press X , it shows "0" in X window, and is ready to input data.

d. Input 1 0 $\pm$, if enter the wrong number , press CE to re-input numerical value.

e. Press ENT , to confirm the data entered.

f. Keep feed cutting, until it shows -28.000 in X window, and it is machined to B point.

g. Preset value for Y and Z axis in the same way.

2. 4 Automatic parting in the middle of coordinate

Function introduction:
Divide display value by 2; with this function, set the zero point in the middle of workpiece.

For example:
There is a rectangular workpiece as shown in the figure; please set the coordinate origin in the middle of the workpiece.

Operating steps:

a. Fix the workpiece on the worktable. AB side is aligned with X axis and AD side is aligned with Y axis;

b. Digital Readout backs to normal display state; move the machine, and make milling cutter direct at A point; press X and press ENTER to confirm it then reset X axis; press Y and press ENTER to confirm it then reset Y axis;
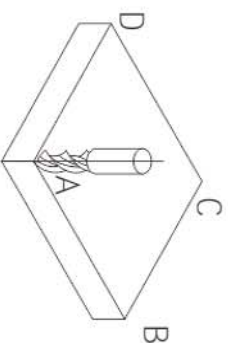
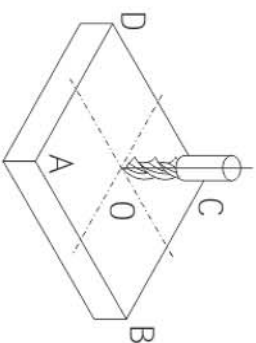| 0.0000 |
| 0.0000 |

c. Move the machine, and make milling cutter direct at C point; Press ½ X to finish the parting in the middle of X axis; press ½ Y to finish the parting in the middle of Y axis;
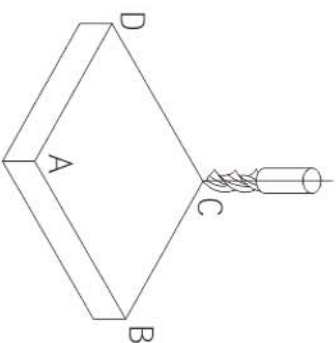
| 6.0000 |
| 6.0000 |

↓

| 3.0000 |
| 3.0000 |

d. Move the machine until to a point where display values in X axis and Y axis are both "0.0000", and this is the central point of the workpiece.

2. 5 MM/INCH switch

Function introduction:
Switch the unit between "MM" (metric system) and "IN" (British system)
Operating method:
Press directly IN/MM to switch between metric system and British system.

2. 6 ABS/INC/SDM coordinates

Function introduction:
ABS   absolute coordinate
INC   relative coordinate
SDM   auxiliary coordinate
D100 series of Digital Readout provides three kinds of coordinate-ABS/INC/SDM, among which SDM coordinate is 100 groups (SDM01-SDM100).

1: set zero point of workpiece in the origin of ABS coordinate;
2: if ABS coordinate origin is changed, the relative distance of SDM coordinate origin and INC coordinate origin will not be changed;
3: resetting ABS/INC coordinate origin has no effect on SDM coordinate.

Operating method:
1: Switch between ABS coordinate, INC coordinate and SDM coordinate
Only in normal display state, can you switch the coordinate; press ABS/INC to switch between ABS coordinate and INC coordinate; press SDM to switch to SDM coordinate.

2: When SDM coordinate is active, it will show "SDM?" if entering sub display window to remind you to choose a group (1-100). There are totally 100 groups coordinate can be entered. Then press ENT to confirm it.

3: If the SDM coordinate mode is active, the system will automatically enter SDM coordinates after a restart due to shutdown,the Digital Readout will remember the last SDM coordinate that used,but it will exit the function of circumferential hole and arc processing.

4: If you need to switch between ABS and INC ,you first need to exit the function of circumferential hole and arc processing .

2. 7 Circumferential hole function

Function introduction:

D100 series of Digital Readout provides the function of circumferential hole, which can be applied in machining of XY, XZ, YZ plane and drilling hole in circumference. If the axis with grating ruler are less than 2, this function will not be available for you, and if you press ◯, it will show "SIG ERR".

Press ◯, the sub display window of Digital Readout meter will remind operator to input parameters:

SEL.PLANE Select XY, XZ, YZ plane that need to be drilled (skip this step if it is a 2-axis Digital Readout or there are only 2 axes with grating linear scale)

CENTER Set center coordinate of the circle

DIAMETER Diameter of the circle

ST.ANGLE Start angle of the circle (that is, the position of the first hole)

ED.ANGLE End angle of the circle (that is, the position of the last hole)

HOLES Set the number of holes

For example: drill circumferential holes in XY plane, take the coordinate (30.02, 28.5) which means X is 30.02mm and Y is 28.5mm as the center of the circumference; the diameter is 30mm and make 5 holes; start angle of the first hole is 20° and end angle of the last hole is 200°.

a. Press ◯ to enable PCD circumferential hole function.

b. The sub display window shows "SEL. PLANE" meaning you need to select the plane; press ENT to confirm it; and then press ⌄ or ⌃ to select XY plane (no such selecting function for 2-axis meter), and press ENT to move to the next step;

c. There are values shown in X, Y axis, and sub display window shows C which means that you need to input new PCB center zero point coordinate since what show in X,Y, Z axis now is the previous data entered. Press X 3 2 . 0 2 to and then press ENT to confirm the entry. press Y 2 8 . 5 to and then press ⌄ to move to next step;

d. The sub display window shows "DIAMETER" meaning you need to enter the diameter of the circle; X axis shows the previous data entered; press ⌄ to move to next step; press X 3 0 and then press ENT to confirm the entry; now press ⌄ to move to next step;

e. The sub display window shows "ST.ANGLE" meaning you need to enter the the angle of the first hole; X axis shows the previous data entered; press X 2 0 and then press ENT to confirm the entry; now press ⌄ to move to next step; you still can press ⌃ to back to previous page andrevise the parameter you have set before.

f. The sub display window shows "ED.ANGLE" meaning you need to enter the the angle of the last hole; X axis shows the previous data entered; press X 2 0 0 and then press ENT to confirm the entry; now press ⌄ to move to next step;

g. The sub display window shows "HOLES" meaning you need to enter the the number of holes; X axis shows the previous data entered; press X 5 and then press ENT to confirm the entry; now press ⌄ to move to next step;

h. The sub display window shows "PCD-01" representing the first hole. X, Y axis display window will show the value; move the machine tool until X, Y axis display window show the value 0.000, and this is the position of the first hole.

i. The sub display window shows "PCD-02" representing the second hole. X, Y axis display window will show the value; move the machine tool until X, Y axis display window show the value 0.000, and this is the position of the second hole. You can press ⌄ to enter the third one and also can press ⌃ to back to the first hole.

j. Press ◯ to exit circumferential hole function.
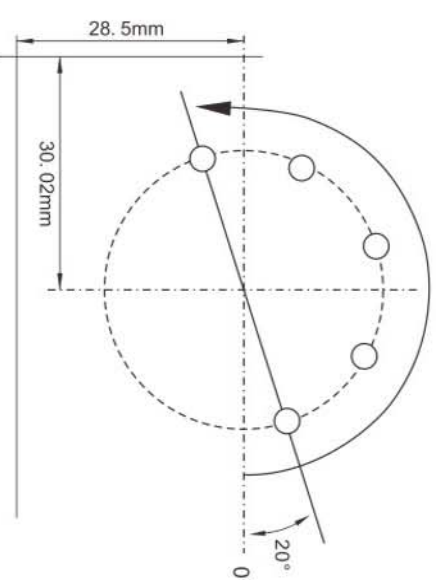
2. 8 Oblique line hole function

If the axis with signal is less than 2, this function will not be available for you, and if you press ⊿, it will show "SIG ERR".

SEL.PLANE	Select machining plane
CENTER	Set start point
LENGTH	Set the length of oblique line
ANGLE	Set the angle of oblique line
HOLES	Set the number of holes
LINE-xx	The xxth hole

Eg. In XY plane, start point is (10.000, 20.000)mm; the length of oblique line is 50mm, angle is 45°, the number of holes is 5.

SEL.PLANE a. Press ⊿ to enable oblique line hole function. If the axis with signal is more than 2, you will need to select machining plane (if it is a 2-axis Readout or 2 axes with signal in 3-axis meter, it will automatically skip this step). Press ENT and then press ∨ or ∧ to choose a plane, next press ENT to move to the next step.if no need to select plane, you can press ∨ to move to the next step.

CENTER   b. Press X 1 0 ENT to input X coordinate of start point; press Y 2 0 ENT to input Y coordinate of start point; press ∨ to move to the next step.

LENGTH   c. Press X 5 0 ENT to set the length of oblique line, press ∨ to move to the next step.

ANGLE   d. Press X 4 5 ENT to set the angle of oblique line, press ∨ to move to the next step.

HOLES   e. Press X 5 ENT to set the number of holes, press to complete it, and oblique line hole function will be active.

LINE-xx   f. Press ∨ or ∧, the sub display window shows "LINE-xx," "01" representing the first hole.

Move X, Y axis to make display window show the value 0.000, and this is the first hole. Press ∨, it will show "LINE-02", repeat previous step until the last hole is machined. Press ⊿ to exit oblique line hole function.

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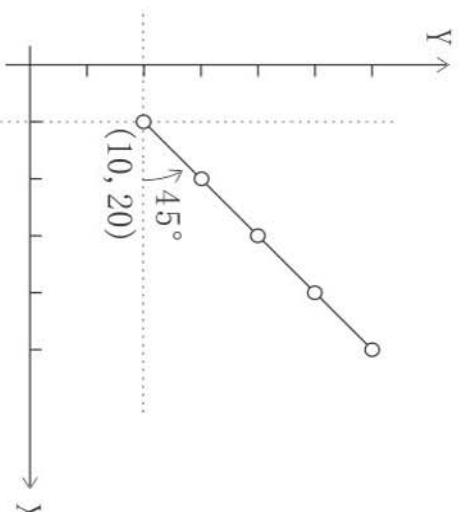
2. 9 Arc processing

When processing a mold, it usually needs to process arc. In the case of processing simple object with small production, it may be a waste to process it with numerical control machine. Thus D100 provide a function of processing simple arc, so that the single piece machining can be conveniently and quickly done on universal milling machine. Control parameter "MAX CUT" is used to control the smoothness of arc while the cutting volume is equal. The smaller the MAX CUT is, every time the cutting volume is smaller, arc machining smoother and machining time longer; while the bigger the MAX CUT is, every time the cutting volume is bigger, arc machining more rough and machining time shorter.

A.XZ, YZ plane machining

There are 8 ways of arc processing XZ, YZ plane, as shown below;

Flat milling cutter or arc milling cutter can be used when machining. When using flat milling cutter to process the arc, the cutting tool diameter should be set as 0.000;

1 2 3 4
5 6 7 8

convex arc machining (T+TOOL)	concave arc machining (T-TOOL)
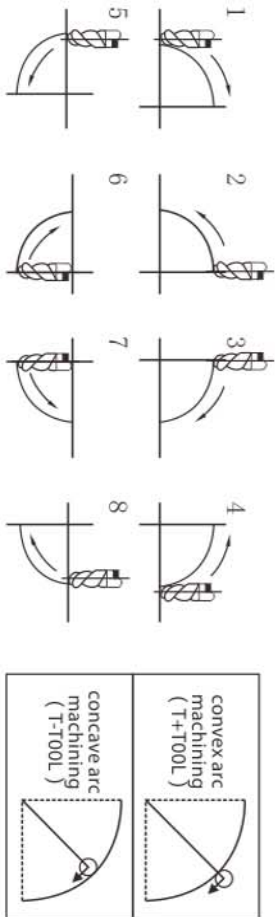
B. XY plane machining

There are also aforementioned 8 ways when machining XY plane. The cutting tool is vertical to machining plane. Every machining way is divided into concave arc machining and convex arc machining. Therefore, it needs to choose cutting tool compensation way when machining XY plane: convex arc machining (T+TOOL), concave arc machining (T-TOOL). Set cutting tool radius according to actual value when processing XY plane, no matter what kind of cutting tool is used.

Please entry following parameters when carrying out arc machining:

TYPE 1-8 arc forms

T+TOOL/T-TOOL

Choose between T+TOOL/T-TOOL

(this parameter is specific to XY plane machining)

Radius of arc to be machined

Cutting tool diameter

MAX CUT machining arc length of every time

Example 1

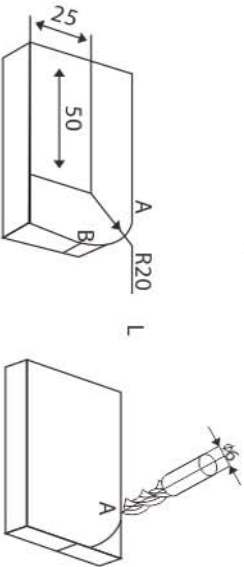As shown, arc AB of 90° needs to be machined, starting from A and ending in B.

Parameters set as follows:

Machining plane: XY

R machining mode: 3

T+TOOL mode

Radius: 20mm

Cutting tool diameter: 6mm

MAX CUT: 0.5mm

Operating steps:

1.In normal display state, set MM/INCH as MM.

2.Move the machine ,making lathe tool direct at A; reset X, Y axis.

3.Enter into arc machining: press [A], entering into arc machining. If parameter has been input, then press [ENT].

4.Select machining plane: press [X], [ENT], selecting XY plane, and then enter into machining mode selection.

Note: press [v][^], selecting XYZ plane; press [ENT] to confirm it.

5.Machining mode selection: sub window shows "TYPE 1-8", Y window shows previous machining mode; press [3], [ENT], choosing machining mode 3. And then go to select convex arc machining or concave arc machining.

6.T+TOOL mode selection: press [+], [ENT], selecting convex arc machining, and then go to arc radius input.

Note: press [+], T+TOOL to choose convex arc machining; press [−], T-TOOL to choose concave arc machining.

7.Arc radius input: sub window shows "RADIUS", and Y window shows the previous set radius; press [1][0][ENT] in due order to finish it.

Note: if entry radius is 0, the system will prompt an error, and make user re-input the value.

8.Cutting tool diameter input: sub window shows "TOOL DIA", and Y window shows the previous cutting tool diameter; press [4][ENT] in due order, then diameter input is finished;

9.Every time's machining arc length input: sub window shows "MAX CUT", and Y window shows the previous machining arc length; press [0][.][5][ENT] in due order, and then go to machining arc.

Display	Label
0 0 0 0	SDM 003
0000 / 0000	SEL-PLANE
---- / ----	SIMAR XY
1	TYPE 1-8
	TYPE 1-8
	T- TOOL
	T+ TOOL
10.000	RADIUS
4.000	TOOL DIA
	TOOL DIA
1000	MAX CUT
05	MAX CUT

Note: if arc length entered is 0, the system will prompt an error, and make user to re-input the value.

10.Machining arc: sub window shows "ARC-1". The first point has been finished when the value shown in X window and Y window is "0.000"; next press [v] to process the second point, and then repeat previous operation until "ARC-39" shows in sub window; press [^] or [v] to switch between each point;

11.Machining finished. Press [⊠] to exit.

press [^] or [v] to switch between each parameter when setting parameters.
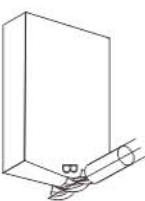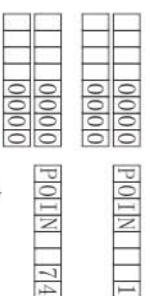
Example 2
Machining FE arc as shown it the right picture, starting from E. Set parameters as follows:
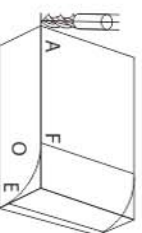Machining plane: XZ
Machining mode: 4
Arc radius: actual value
Cutting tool diameter: 0 (flat cutting tool)
Machining arc length: user defined

Example 3
Machining DE arc as shown it the right picture, starting from E. Set parameters as follows:
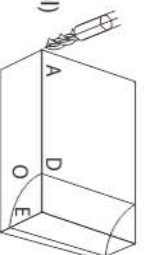Machining plane: XZ
Machining mode: 6
Arc radius: actual value
Cutting tool diameter: actual value (round-nose cutting tool)
Machining arc length: user defined

Example 4
Machining DE arc as shown it the right picture, starting from D. Set parameters as follows:
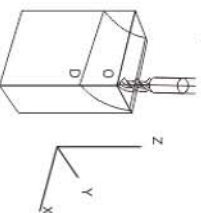Machining plane: XZ
Machining mode: 7
Arc radius: actual value
Cutting tool diameter: actual value (round-nose cutting tool)
Machining arc length: user defined

For D100, Z axis is not installed, so [^] or [v] needs to be used to simulate the position of Z axis. [^] means moving to the previous machining point, [v] means moving to next machining point.

Steps:
1.Set Z axis boring circulation in SETUP with default value of 2.5mm.

2.First direct machine at Z position of R starting point before machining, and now set Z axis position as "0.000";

3.During machining, sub window shows simulating height of Z axis, representing the simulating height when current machining point stop machining;

As is shown, when machining XZ plane, X window displays X axis position. When the X shows value"0.0000", the machining in X direction is done; the first two bit in Y window shows the number of turns of boring ring, and the last 5 bit shows the scale of boring ring, representing that the machining to that number of turns and scales is enough for current machining point;

If machining YZ plane, Y window displays Y axis position. When the Y shows value"0.0000", the machining in Y direction is done; the first two bit in X window shows the number of turns of boring ring, and the last 5 bit shows the scale of boring ring, representing that the machining to that number of turns and scales is enough for current machining point.

2.10 Calculator function

1.Entry and exit calculator function
In normal display state, press [CAL] to entry calculator function.
After entry calculator function, press [CAL] ,back to normal display state.

2.Calculation examples
Eg. 1: 100+10*2-100/2
[1][0][0][+][1][0][×][2][−][1][0][0][÷][2][=]

Eg. 2 :10+2*sin-1(-0.5)
[1][0][+][2][×][0][.][5][+/−][SHIFT/sin⁻¹/sin][=]

Note:1. If input the wrong number, please press [CE] to re-input the number.
2.if any mistake encountered in calculation, for instance, the number"0"is used as divider, or carry out arcsine, cosine calculation when absolute value is larger than 1, the system will activate a false alarm. At this moment, press [CE] to re-input the number;
3.The absolute value of input data and result shall not be larger than 9999999 or smaller than 0.000001, otherwise it cannot be shown.

3.Computing result transfer
After finishing calculation,
Press [X0] ,the result will show in X axis;
Press [Y0] ,the result will show in Y axis;
Press [Z0] ,the result will show in Z axis;
Note: the numerical value that exceeds the display range cannot be transferred.

4.Transfer current value displayed in X, Y, Z axis to calculator
In calculator function,
Press [X] ,the value displayed in X window will be transferred to calculator;
Press [Y] ,the value displayed in Y window will be transferred to calculator;
Press [Z] ,the value displayed in Z window will be transferred to calculator.

2.11 Linear compensation

1.Enter into setup menu;
2.In "ERR COMP", set corresponding axis as "LINE";
In "ERR SET", press [X] , [Y] , [Z] , or [X0] , [Y0] , [Z0] to choose the axis you want to set.
Enter correction factor K, and press [ENT] to confirm the entry.
The range of correction factor must be 0.95<K≤1.05
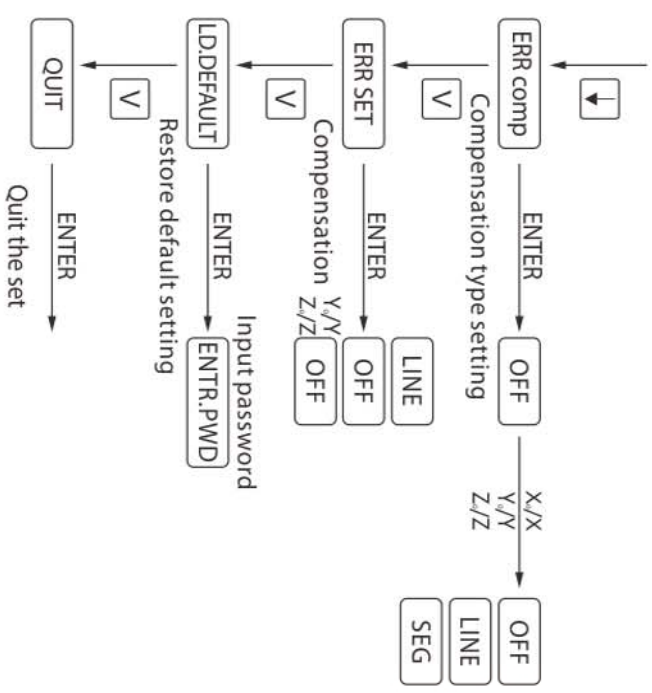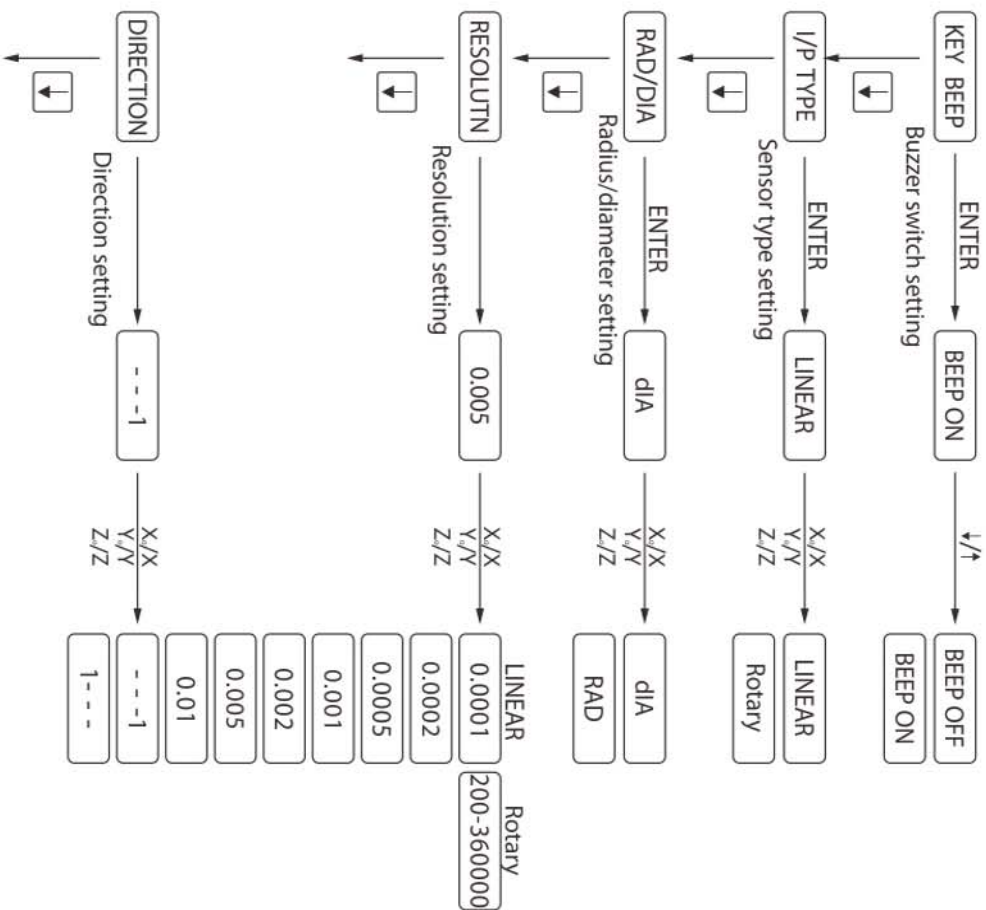Correction=standard value/display value

Note: exit linear compensation function before you measure and calculate correction factor K.

When closing linear compensation function, if the Digital Readout shows a value of 999.970mm for a workpiece whose actual length is 1000.000mm, then the correction factor K will be:
K=1000.000/999.970=1.000030

IV. Failure handling

Troubleshooting and handling

Failures	Maintenance methods
No display when turning on the power	1.Check the power for loose and check the fuse for damage. 2.Check for supply voltage of Digital Readout whether it is AC100V~240V. 3.Check for ground wire if it is well and correctly earthed. 4.If you still cannot solve the problem, please contact with DEPP Group.
The power is turned on, and the figure in the display does not change with the movement of the machine tool	1.Check connecting line of grating linear scale for loose(semi-connecting). 2.Check connecting line of grating linear scale for damage.
The power is turned on, and the figure in one of the axis display does not change with the movement of the machine tool while the other is displayed normally.	1.Check for the plug of the abnormal axis at the rear part of the DRO and see if it is loose; and check the wire connecting Digital Readout and grating linear scale. 2.Change the plug of grating linear scale with that of another axis, and move the machine tool to see if it is normal; if yes, the Digital Readout is damaged, please contact with DEPP Group. 3.Change the plug of grating linear scale with that of another axis, and move the machine tool to see if it is normal; if no,grating linear scale is damaged, please contact with DEPP Group.
Operating keys failure	1.Seriously unreasonable keys pressing, please switch Digital Readout off and restart it. 2.The keys are damaged.
The DRO installed on machine tool dose not show the value correctly.	1.Check the I/P TYPE set of the grating linear scale. 2.Check the RAD/DIA set. 3.Check the RESOLUTN set. 4.Check if the IN/MM model is normal. 5.Check if the compensation set(ERR Comp or ERR SET) is normal.