Meister

DIGITAL READOUT SYSTEM

Position Measuring Instrument and Precision Glass Scale

TOP-10 USER'S MANUAL

2 and 3 Axis Digital Readout
for Milling Machines

Rev C, 2006

Copyrights Reserved

Automation Specialist
60 Kaki Bukit Place, #06-03 Eunos TechPark, Singapore 415979
Email: makuharik@gmail.com

CONTENT **Page**

1. Precautions i
2. Installation Guide / Technical specifications ii
3. Parameter Setup 1
4. Basic functions 2
5. Calculator functions 4
6. Shrink function 8
7. Bolt Hole Circle (PCD) 9
8. Holes on a Straight Line 12
9. 99 Sets of Auxiliary Co-ordinates 14
10. Simple-R (Radius) 16

Precautions

Ground the Digital ReadOut (DRO)

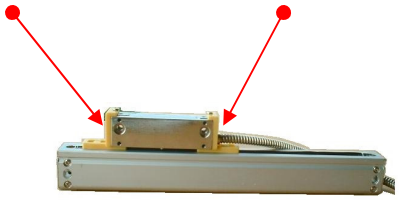
For safety and stability, we strongly recommend the user connect to earth ground (⏚) the FG terminal on the back of the digital readout before using it.

- ❑ Do not use the DRO under conditions of high temperature or high humidity.
- ❑ Do not use the DRO where there is a presence of a strong magnetic field.
- ❑ Clean the DRO with soft dry cloth.
- ❑ Do not try to clean the DRO and the linear scales with compressed air.

Please connect the AC power according to this standard:

AC Wiring Color Codes			
Conductor	**US 115V AC**	**US 230V AC**	**Europe 240V AC**
Ground	Green	Green	Green and yellow
Neutral	White	White	Light blue
Hot	Black	Black	Brown
Hot		Red	

REMOVE THESE BRACKETS ! used to hold the read head securely during shipping.



For technical assistance, please contact us: makuharik@gmail.com

A. Installation Guide

Do not install the TOP-10 DRO system where these conditions exist:

- In an environment full of chips, oil, water and/or dust.
- Temperatures outside the range of 32° F - 104° F (0° C - 40° C)
- Exposed to scorching sun or high temperature.
- Near equipment with high voltage or strong magnetic fields.
- Signal cable near the power source cable.

If the conditions above cannot be avoided, be sure to use shielding or conduit to minimize the interference.

Don't install the TOP-10 DRO system on where it is subject to shocks or strong vibrations. Install it in an area where it cannot be damaged by work pieces or electric sparks, and is easy to see and operate. It's better to screw the display to a bracket or use the heavy duty-mounting arm (which can be ordered through the agent or reseller)

B. Technical Specification of TOP-10

Number of axes: 2, 3

Resolution: 0.00020" / 0.005mm

Calculating range: -9998.990 to +9998.990

LED: 7 digits and a minus sign

Response speed: 198 feet/min (60 m/min)

Error: ±1 count

Power source: 110 ~ 220VAC, 50 ~ 60 Hz , 30VA

Temperature range:

In Service – 32° F ~ 104° F (0° ~ 40° C)
In Storage -- 68° - 158° F(20° ~ 70° C)

Relative Humidity: 95%, 77° F (25° C)

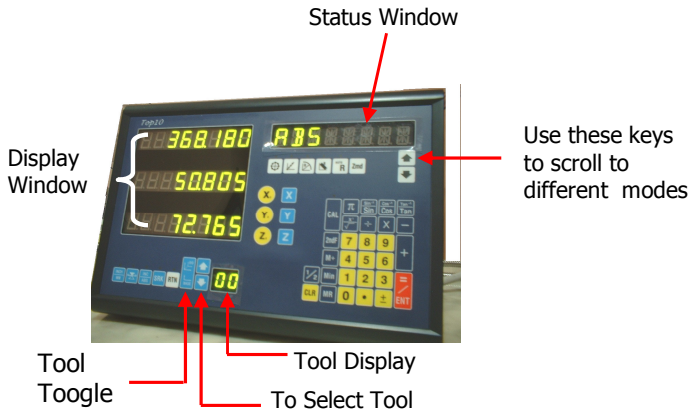
Pulse grating scale: DC 5Vdc *(12Vdc available upon special order).*

A,B ortho square wave pulse signal

Net Weight: 1.5 Kg

Dimension: 8.9" wide, 8.27" high, 3.74" deep , (227 width x 210 height x 95 depth mm)

1.0 Parameter Setup Routine



1.2. Panel Instructions

Display window: Displays for the X, Y and Z axes.

Status window: Displays calculator and operational mode status.

1.3. Parameter Setup Mode

When you power up, the status window will display the model number “TOP-10” and the display window will count the numbers “00000000” to “99999999” in running mode. Press the number “6” key when the DRO is doing a self test and the word “EXIT” will appear in the status window. You are now in the Parameter Setup Mode. Using the `UP’ or `DOWN’ arrow key located below the status window, the following operation modes can be set:

EXIT, BEEP ON/OFF, DIRECTE, LIN COMP, R OR D, RESOLUTE, SRK OFF/ON, ALL CLR, Z DIAL, DIAL INC

1.4. System Reset

To reset the system, select the `ALL CLR’ option. Then press the “ENT” key til the words “CLR OK” is displayed in the status window. Press the “UP” or “DOWN” arrow key again to scroll to `EXIT’. Confirm by pressing the “ENT” key to return to the normal mode.

1.5. Shrink Function Setup

Enter the Parameter Setup mode, and press the “UP” or “DOWN” arrow key to select “SRK OFF” or “SRK ON” option. Press the “ENT” key to switch between “SRK OFF” and “SRK ON”. To return to the normal mode, press the “UP” or “DOWN” key to “EXIT” and press “ENT” to confirm.

1.6. Enter Direction Setup

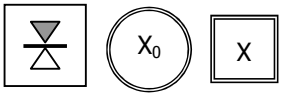
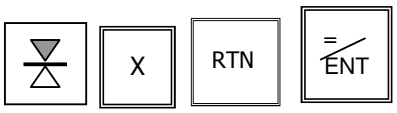
Enter the parameter setup mode and press the “UP” or “DOWN” arrow key to select parameter, “DIRECTE”. Press the “ENT” key to confirm, and the status window will change to “SEL AXIS”. Press X/Y/Z to select the axis. When done, press the “UP” or “DOWN” arrow key to select “EXIT”. Press “ENT” to confirm and return to the normal mode again.

2.0 Basic Functions

Function	Purpose	Operation	Display	Status Window
SET TO ZERO	**RESET THE DATA** to "0". Pressing the keys will delete the displayed data of the axis on the screen. The display becomes "0.000". ⓘ In the ABS mode, this operation will delete the work piece zero.	X axis X_0 Y axis Y_0 Z axis Z_0	0.000 0.000 0.000	ABS
ENTER, 'ENT' key	This key **STORES DATA** you have input to the DRO	a. Enter size: Enter the machining size of the work piece into the memory of the digital readout. b. The "ENT" key is also used for confirmation in other operations: - Calculate center, "1/2" function - Recall, "RTN" function - Preset dimension or Parameter setup - Mechanical zero position function. [=/ ENT]		
AXIS SELECTION key	This key is used to **ACTIVATE THE SELECTED AXIS** so that data can be entered and stored for use.	Take the X axis as an example: Press [X] key followed by "**1**" and "**4**". Next press "**ENT**" to confirm and the data is stored for the **X-axis**. The same steps are used for Y and Z axes.	0.000 14 14.000	NEW BASE ABS
CLR	**CLEAR DATA** key	If the input data is wrong, press "**CLR**" key to cancel. [CLR]	0.000	ABS
PRESET DIMENSION	To **INPUT DIMENSIONS** using the keypad. ⓘ In ABS mode, preset dimensions function will impact the work piece zero position.	For example: Select the X-axis. [X] Then use the keypad to enter the value X = 126.850. And press "ENT" key to confirm.	0.000 126.850 126.850	ENTER DIM ENTER DIM INC

Function	Purpose	Operation	Display	Status Window
Inch/ Metric Key	Switches between inches and metric. When the LED is **ON** the dimension in inches. When the LED is **OFF**, the dimension is metric.	Inch display INCHES / MM Metric display	1.000 25.400	
Radius/ Diameter	Switches between radius and diameter. When the LED is **ON**, diameter is displayed. When the LED is **OFF**, the radius function is displayed.	Press "X" key and enter radius = 12 and press "ENT" to confirm. = / ENT Press the "R/D" key and the LED is **ON**. Also the X axis display change to show the diameter. R / D Note: When LED is **ON** and the radius is entered, the display will automatically show the DIAMETER.	X 12.000 X 24.000	RADIUS ABS DIAMETER ABS
Absolute/ Increment coordinate	Absolute/ Incremental mode selection During this process, the incremental coordinate and the absolute coordinate can be switched at will. No manual calculation is needed, saving you time	When ABS/INC LED is **OFF**, the display is in Absolute Coordinate. INC ABS Press the "ABS/INC" key, the INC LED Is **ON**, the display is in Incremental Mode.		ABS INC

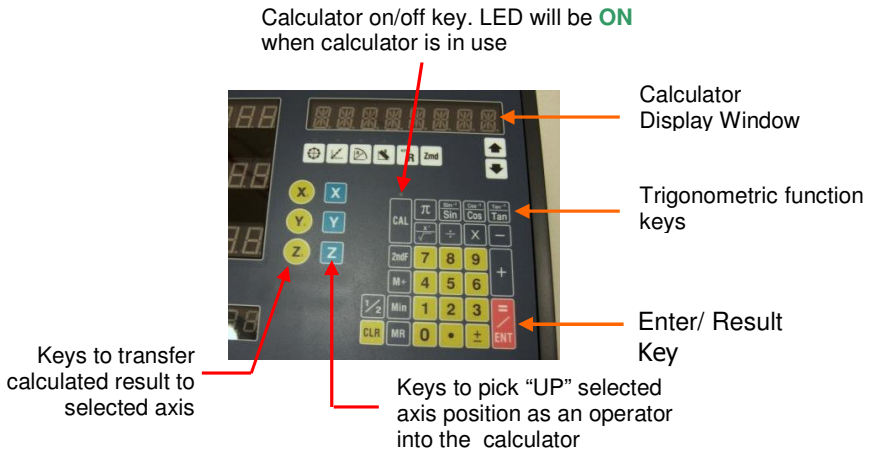
Function	Purpose	Operation	Display	Status Window
CALCULATE THE CENTER	Coordinate value will be **DIVIDED BY 2** ⓘ In the ABS mode, the work piece zero position WILL BE LOST.	Take the X axis as an example: Locate the edge finder at one end of the work piece, and zero the X axis display. Press X_0 Then locate the other edge of the work piece. Press ½ and data will be divided by 2. Press X key to transfer value to this axis.	0.000 348.960 174.480	INC INC 1/2 AXIS INC
RECALL, 'RTN' key	**RECALL PRIOR DATA** in the register. ⓘ Note: This is only used in the INC mode.	X-axis current display: 0.000 Select X axis: Press RTN key. RTN Recalled X axis data will be displayed. To confirm, press "ENT" key.	0.000 0 12.500 12.500	INC ENTER DIM RECALL INC

Function	Purpose	Operation	Display	Status Window
MECHANICAL ZERO POINT	Allows the user to find and **MEMORIZE THE SCALE'S ZERO POSITION** before proceeding. There is a fixed mark at one end of the scale housing. This function is to find work piece zero position after a power failure. This allows you to restore the position when needed.	1. To find mechanical zero position Press  Then move the table until the display stops counting. The Status Window display shows "STOP" and a continuous beep sound can be heard. Press "ENT" to confirm. The coordinate index will be memorized. 2. To search for work piece zero position, press these keys  and "ENT" to confirm Move the scale towards the mechanical zero position, and watch the display start counting. Keep moving the mill table until the DRO read zero, and this will be the work piece zero position.	0.000 30.000 33.670 30.000 0.000	FD. X REF STOP ABS

3.0 CALCULATOR FUNCTION

The calculator of TOP-10 not only provides normal mathematical calculations such as ADD, SUBSTRACT, MULTIPLY, DIVIDE, but also useful trigonometric calculation such as SIN, COS, TAN, SQR, SIN^{-1}, COS^{-1}, and TAN^{-1} that are frequently required during machining process.

Special **RESVLT TRANSFER** function not only can transfer all calculated results to the selected axis, but also can transfer the selected axes' position counting value into the calculator as an operator.



Put the TOP-10 in the calculator mode by pressing the "CAL" key. The LED light will be **ON** when the DRO is set to the calculator mode. All operations are the same as any other calculator.

Example of calculator functions:

3.1 Add/ Subtract: 78 + 9 – 11 = 76

7	8	+	9	-	1	1	=	DISPLAY
								76

3.2 Multiple/Divide: 78 X 9 / 11 = 63.8173

7	8	x	9	÷	1	1	=	
								63.8173

3.3 Trigonometric function: 100 X COS30° = 86.60156

1	0	0	X	3	0	COS	=	
								86.60156

3.4 Inverse trigonometric function: Sin^{-1} 0.5 = 30°

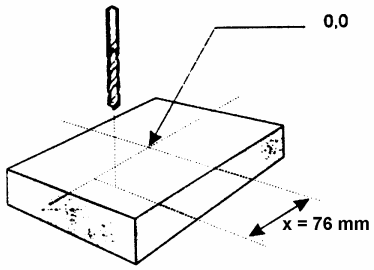
.	5	2nF	Sin^{-1}	=	
					30

3.5 Transfer the Calculated Result to the Selected Axis

Take an example: To transfer the calculated result 76 to X axis:

a) Press [X] key and the value “76” will be immediately displayed on the X-Axis

b) Move X axis until display = 0.000, then the calculated position “76” is reached.



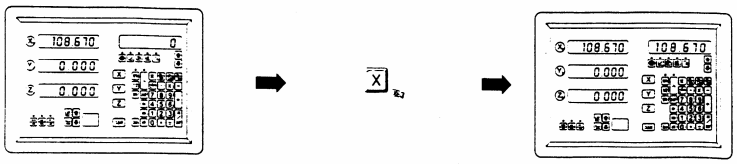
c) Pressing the CAL key, [CAL] will end the calculator function and return to normal mode.

3.6 Transfer X or Y or Z position as an operator into the calculator

Take an example: To transfer X = 108.670 to the calculator:

a) Switch to “CAL” function.

b) Press the [X] key and the value will immediately display in the Calculator Display Window.



4.0 Shrink Function

Plastic objects will shrink after the plastic is injected into the mold, so the mold must be enlarged or shrunk according to the shrinkage rate.

4.1 Set up shrinkage rate.

It is important to set the shrinkage rate correctly. The calculated result is obtained by multiplying the input data by the shrinkage rate.

ie - if shrink rate = 1.005, then axis display = data input x 1.005

4.2 Instruction:

Operation		Display	Status Display
a) Select shrink function "SRK" key. [SRK] Note: The LED will be **ON**.	X Y	 1.000	SHRINK
b) Enter shrinkage rate [1] [.] [0] [0] [5]	X Y	 1.005	SHRINK
c) Press "ENT" key to confirm preset value	X Y	 1.005	SHRINK
d) To end shrink function, press "SRK" key.		0.000 0.000	ABS

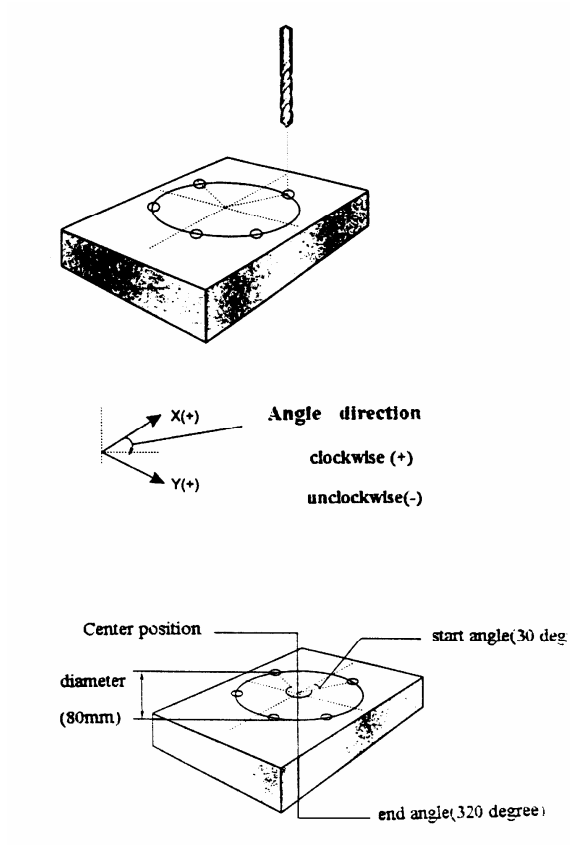
5.0 Bolt Holes Circle Machining (PCD)

The **Meister TOP-10 DRO** provides an easy method to machine bolt holes located around a circle. Simply enter a few parameters according to the step by step instruction in the STATUS DISPLAY WINDOW.

Center of the circle [CENTER]
Diameter [DIA]
Number of holes [NO. HOLE]
Start angle [ST. ANG]
End angle [END. ANG]

The TOP-10 DRO will calculate all the hole's position coordinates and temporarily set each of them to a ZERO X-Y coordinate (0.000, 0.000). When the user moves the work piece to the X and Y axes showing (0.000, 0.000) on the display, the hole's position is reached.

You can use the "UP" or "DOWN" arrow keys to select any one of the holes and move the work piece to that ZERO X-Y coordinate (0.000, 0.000). The drill position is now located.



Example

Center Coordinate [CENTER] X = 0.000,
Y = 0.000

Diameter [DIA] …….. 80.000 mm

Number of holes [NO. HOLES] ... 5

Start Angle [ST. ANG] …….. 30° (clockwise)

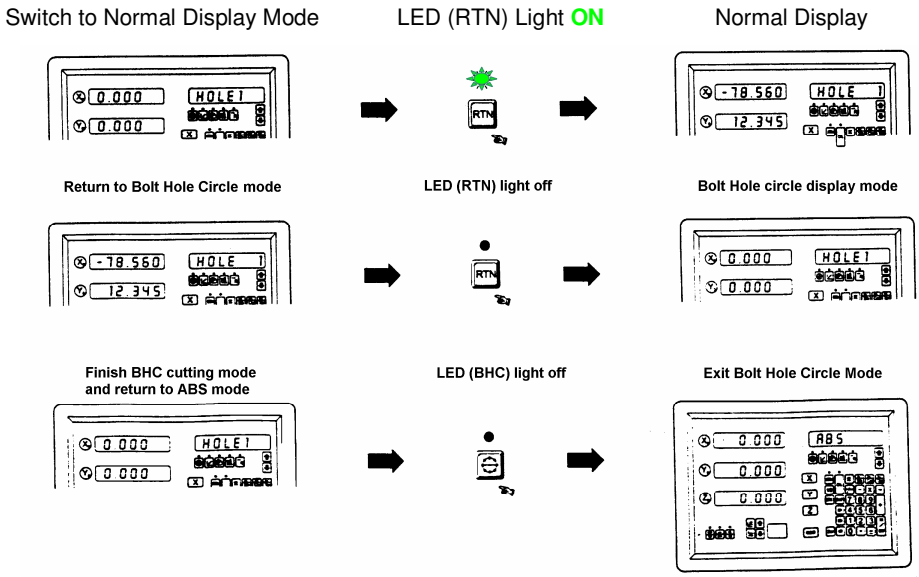
End Angle [END. ANG] …… 320° (clockwise)

Before starting the Bolt Hole Circle function, you must set the **WORK PIECE ZERO** position !!

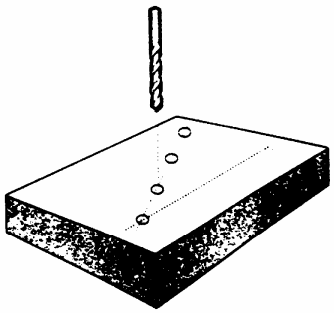
Operation		Display	Status Window
1. Set center of circle as the **WORK PIECE ZERO**			
▪ Move work piece until the cutting tool	X	0.000	ABS
points to the center of the circle.	Y	0.000	
Press [X] and [Y]	X	0.000	CENTER
and [⁘] keys	Y	0.000	
▪ * To confirm the X and Y center	X		
coordinates, press the "ENT" key.	Y	0.000	CENTER
* *You can skip this step*		0.000	

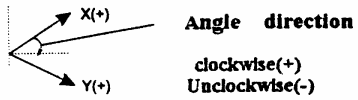
Operation		Display	Status Window
2. Next, press the “DOWN” arrow key.	X		DIA
The next instruction will appear in the status window display.	Y	0.000	
Enter diameter = 80	X		DIA
To confirm, press “ENT” key	Y	80.000	
Next, press “Down” arrow key			
3. Enter number of holes	X		NO. HOLE
No. of holes is 5	Y	5	
To confirm, press “ENT” key	X		NO. HOLE
Next, press “DOWN” arrow key	Y	5	
4. Enter the Start Angle	X		ST ANG
	Y	0.000	
Start angle is 30 degrees			
To confirm, press “ENT” key	X		ST ANG
Next, press “DOWN” arrow key	Y	30.000	
5. Enter the End Angle	X		END ANG
	Y	0.000	
End angle is 320 degrees			
To confirm, press “ENT” key	X		END ANG
Next, press “DOWN” arrow key	Y	320.000	
6. Selecting the cutting holes			
Use the “UP” or “DOWN” arrow keys to select any of the holes.	X	- 34.640	HOLE 1
EXAMPLE: Hole #1	Y	- 19.995	
Move the work piece until the X and Y axes display shows “0.000”.			
Now, the drill is over the hole location and you can start machining.			

At anytime you can return to normal ABS mode or temporarily **exit the BOLT HOLE CIRCLE operation by pressing the "RTN" key:**



6.0 Holes on a Straight Line Function

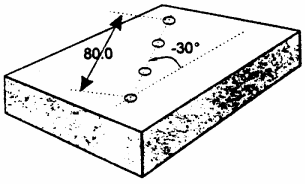




On the Meister TOP-10 DRO, drilling holes on a straight line is also a simple task using the SHL function. You simply enter the cutting parameters by following the step by step instruction indicated in the display window. The TOP-10 DRO will calculate those holes and store their temporary positions. Using them, you need only to move the work piece till the selected axis display is "0.0000" which means the hole position has been reached and you can drill the hole. The parameters to be entered are:

- Length of the line [LIN DIST]
- Angle of the line [LIN ANG] (a "+ angle" is for clockwise rotation from the 1st hole, a "- angle" is for counter-clockwise rotation)
- Number of Holes [No. of HOLE]

The length of the line (LIN DIST) is defined as a distance between the centers of the 1st and the last holes on the straight line.



Example:

Length of the Line [LIN DIST] … 80.000 mm
Angle of the Line [LIN ANG] … -30 counter-clockwise
No. of Holes: 4

Operation	Display	Status Window

1. Move the work piece so the cutting tool is positioned over the first hole. Set the first hole position as the work piece's zero position.
2. Press X_0 and Y_0 to set the zero position.

   X 0.000 ABS
   Y 0.000
3. Press this key to start using the SHL function.
4. Enter Length = 80.000 mm

   8 0

   X LIN DIST
   Y 80.000

   To confirm, press "ENT" key

   X LIN ANG

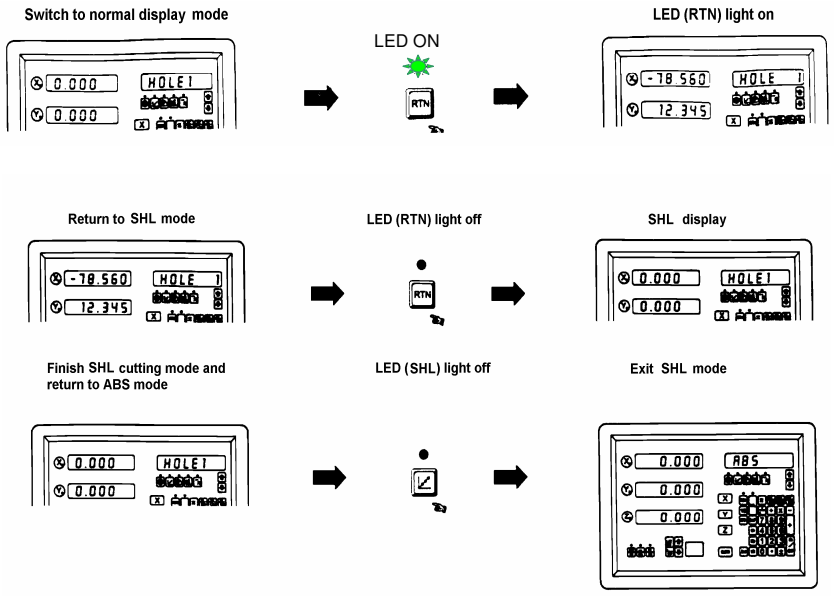
   Next, key in the parameter, *LIN ANG*

   Y 0.000

Operation	Display	Status Window
5. Enter angle = - 30 degree [3] [0] [±] To confirm, press "ENT" key. Next, enter the number of the hole into the DRO.	X Y - 30 Y X 0	LIN ANG NO. OF HOLE
6. Enter number of Holes = 4 [4] To confirm, press "ENT" key	X Y 4	LIN ANG

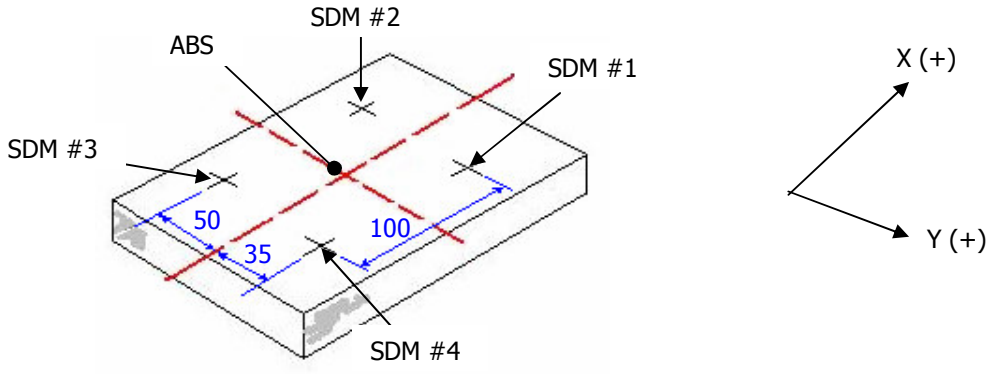
7. Now, use the "UP" or "DOWN" arrow keys to scroll through all the parameters to ensure that you have entered the correct values. If the values are correct, you are ready to start drilling the holes. Use the "UP" or "DOWN" arrow keys to select any one of the holes. Now move the work piece until the DRO displays "0.0000 in the Status Window. This means that the drill bit is now over the hole position and you can start machining.

AT ANY TIME YOU CAN **RETURN TO NORMAL MODE** (ABS mode) OR TEMPORARILY EXIT SHL MODE, BY FOLLOWING THESE STEPS:



7.0 99 Sets Auxiliary Co-ordinates (SDM co-ordinates)

The **TOP-10** stores 99 sets of auxiliary coordinates using this function (SDM). It is useful during batch machining of repeated work when work piece machining dimensions are from more than two X-Y coordinates.



All 99 sets of auxiliary co-ordinates are relative to ABS co-ordinates (BASE ZERO position, and will shift together with the ABS zero position as the zero position changes.

Example

To preset 4 sets of SDM co-ordinates (SDM1 to SDM4) on the above work piece, please follow these steps:

Operation	Display	Status Window
1. Set work piece ABS zero position. Move work piece until cutting tool reaches ABS zero position and clear the display to zeros by pressing X_0 and Y_0 keys.	X 0.000 Y 0.000	ABS **TOOL** Display: 0 0
2. Press **TOOL TOGGLE** Key and enter to SDM mode. 99	X 0.000 Y 0.000	SDM MODE **TOOL** Display: 0 1
3. Use the **BLUE** color "UP" arrow key (next to the **TOOL TOGGLE** Key) and the TOOL display window will show "01". Now enter these values of SDM#1 co-ordinates and press "ENT" to confirm.	X - 50.000 Y - 35.000	SDM MODE **TOOL** Display: 0 1

X	5	0	ENT
Y	3	0	ENT

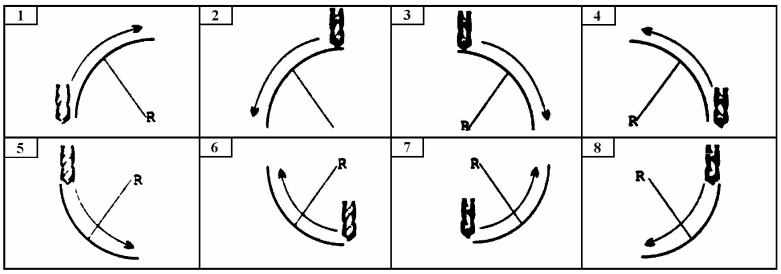
Operation	Display	Status Window
4. Next press the "UP" arrow key and the **TOOL DISPLAY WINDOW** will show "02". Enter these values of SDM #2 co-ordinates and press "ENT" to confirm.	X 0.000 Y 0.000	SDM MODE **TOOL** Display: 0 2
X 5 0 ENT Y 5 0 ± ENT	X - 50.000 Y 50.000	SDM MODE **TOOL** Display: 0 2
5. Next press the "UP" arrow key and the **TOOL DISPLAY WINDOW** will show "03". Enter these values of SDM #3 co-ordinates and press "ENT" to confirm.	X 0.000 Y 0.000	SDM MODE **TOOL** Display: 0 3
X 5 0 ± ENT Y 5 0 ± ENT	X - 50.000 Y - 50.000	SDM MODE **TOOL** Display: 0 3
6. Next press the "UP" arrow key and the **TOOL DISPLAY WINDOW** will show "04". Enter these values of SDM #4 co-ordinates and press "ENT" to confirm.	X 0.000 Y 0.000	SDM MODE **TOOL** Display: 0 4
X 5 0 ± ENT Y 3 5 ENT	X - 50.000 Y - 50.000	SDM MODE **TOOL** Display: 0 4

After all SDM#1 to SDM#4 co-ordinates' positions have been preset, you can use "UP" or "DOWN" arrow keys to select them.

8.0 Simple R

Cutting a 90º radius is very simple if you have a CNC machine. However, the TOP-10 DRO provides an easy method to perform 90º radius cuts using your conventional mill.

Here are common 8 types of radius, internal & external which can be done with the assistance of the TOP-10 DRO. Please refer to the chart on the front panel of the DRO for those 8 types of 90º radius.



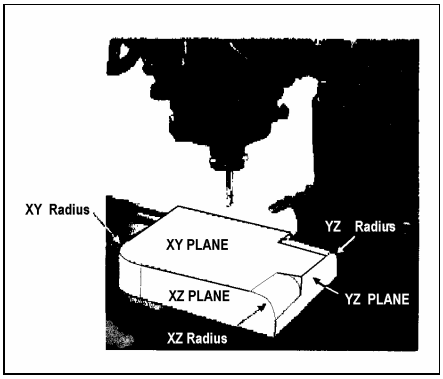
Simple-R: Type 1 - 8 choice for 90º radius cutting

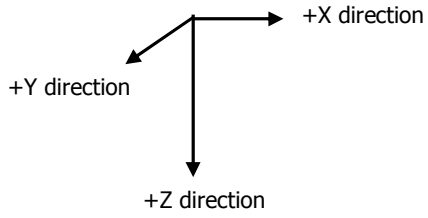
For milling a 90 radius arc using **Simple-R** function, the following cutting parameters are needed:

8.1 Cutting Planes

-- you must determine on which plane is the radius arc is to done and then select that plane: XY, YZ or XZ.

The diagram below shows where the planes are on the work piece.



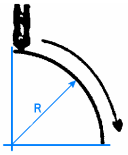


8.2 Type of Radius

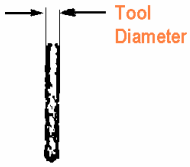
-- Select one of the types of radius as shown in the chart on the front panel of the digital readout display.

Types #1 to #4 are for milling of external radius and Type #5 - #8 are internal radius.

8.3 Radius, R



8.4 Tool Diameter

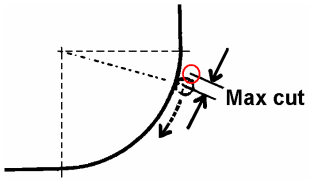


8.5 Tool compensation

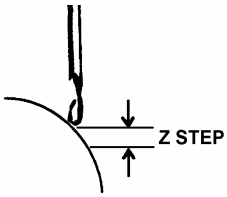
	External: R + Tool Diameter	**Internal: R -**Tool Diameter
XZ/YZ Plane –		
XY Plane –		

8.6 Max Cut (or Z-Step)

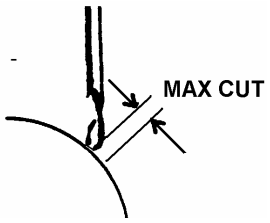
a) **XY Plane R (Plane Radius)**: -- when milling an R-radius on the XY Plane, the maximum cut between two interpolated points is the machining step increment and it is also the **MAX. CUT**.



b) **XZ/YZ Plane R** -- under normal conditions, the **Z-Step** increment is fixed and to be specified as the machining step increment.



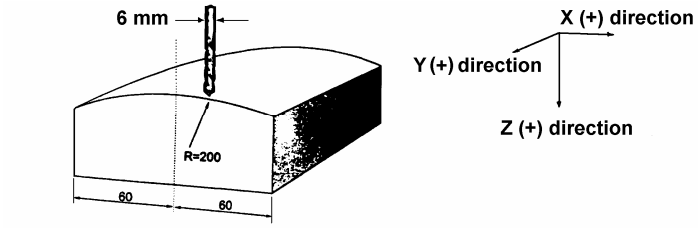
c) **XZ/YZ Plane R** – under Smooth-R option, the Z step or incremental step will be automatically calculated so that the maximum distance between each machining point is approximately the same.



------ MAX CUT = max. distance between interpolated points

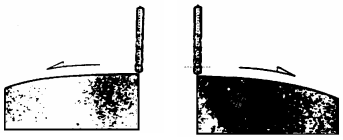
Example:

Milling a radius of R = 7.87" (200 mm) on the XZ plane of a work piece.



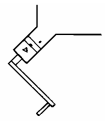
- Treat the work piece as if it is 2 parts by splitting it in the center. The 8 types of Simple-R are applicable to each half of the work piece.

Part #1:
Select 'Type 2' from the chart in the front panel of DRO.



Part #2:
Select 'Type 3' from the chart in the front panel of DRO.

- Position the cutting tool at the center of the work piece which is also the starting point of radius, R. Set the Z-dial on the milling machine to zero.



Z axis dial set to "0'

Once the cutter is in at the starting point of R and the mill machine Z-dial is set to zero, we can proceed to set "UP" the DRO.

Operation		Display	Status Window
• With the cutter at the starting position of R, press the [X] and [Y] to set both the X and Y axes to zero.	**X**	0.000	ABS
	Y	0.000	
• Then, enter into Simple-R mode, press [R] and the LED will be **ON**. To scroll press the [↓] key located below the **Status Window.** After each data entry / selection, please press the "**ENTER**" button to confirm.	X		SIM. R XY
	Y		
	X		SIM R XZ
	Y		
• Scroll till the **"SIMPLE-R XZ"** option is displayed, press "**ENTER**" to confirm.			
• Then press the [↓] key again to go to the next parameter. For Part #1, we will use the 'Type 2' simple-R. Enter the number 2 and press "**ENTER**"	X		TYPE 1 - 8
	Y	2	
• In the next parameter, enter radius, R = 7.87" (200 mm) Press "**ENTER**" key to confirm.	X		R
	Y	7.87" (200)	
• Next, the parameter is '**TOOL DIAMETER'.** Set the diameter at 0.236" (6.0 mm). Press **"ENTER"** key to confirm.	X		TOOL DIA
	Y	0.236 (6)	
• Now we have to enter the maximum step increment or '**Z-STEP'**. Let's set it at **0.5** to achieve a smoother surface finish.	X		Z STEP
	Y	0.5	
• Now, we are ready to start work on the work piece. Press the [↓] and start mill on the 1st point.	X	0.000	Z−203.00
	Y		