EL 300

Operational Manual

Digital Readout System

For

Machine Tool

electronica

Table of Contents

1. Introduction

Congratulations on purchasing **EL300 series Digital Readout System (DRO)** from Electronica Mechatronic Systems. Our DRO incorporates the latest state of the art technology; giving you world class features which help in improving productivity, reducing rejection and at the same time giving ease of operation to user with its ergonomic design.

Some of the key features of EL300 series DRO are:

- Adaptability to various types of machines, old and new, simple and complex.
- Ease of installation.
- User friendly operations.

Note: Please familiarize yourself with the contents of this Operators manual to benefit from all features provided by EL300 DRO.

Electronica Mechatronic Systems (I) Pvt. Ltd. Reserves the right to change specifications without prior notice.

2. DRO Specifications

Mains Supply	90…..265 VAC 50/60 Hz
Fuse Rating	800mA Slow Blow 20mm
Power Consumption	20 Watts Maximum
Storage Temperature	-20ºc to 70ºc
Operating Temperature	0ºc to 45ºc
Relative Humidity	20% To 85% Non-Condensing
Dimensions (mm) (*excluding earth stud)	152 X 267 X 82 Height X Width X *Depth
Net Weight	Approx 1 Kg
Encoder Input	RS422
Encoder Connector Type	9-Pin D-Type Female
Auxiliary Connectors	15-Pin D-Type Female For Auxiliary Outputs (Optional) 9-Pin D-Type Male for RS232C (Optional) USB B type connector
Encoder Resolution Supported	0.1/0.2/0.5/1/2/5/10/20/50 Micron
Display	7 Digits with +/- indicator 7 Segment LED
Quantization Error	+/- 1 Digit
Standard Compliance	EMC and Low Voltage Compliance BS EN 61326 RoHS

CE

ISO 9001:2008
COMPANY

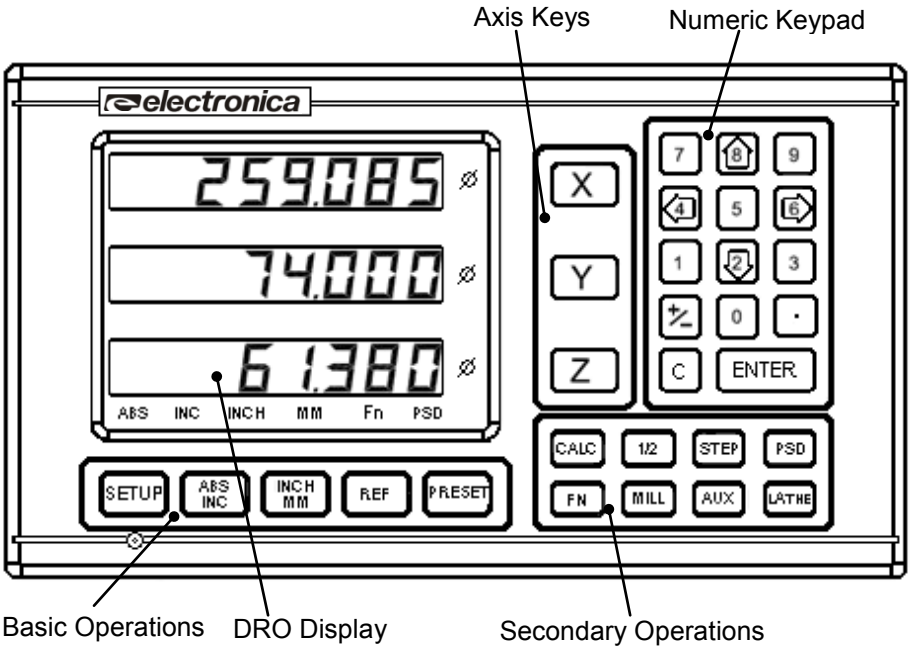
3. Read Before Proceeding

- The EL300 DRO is sophisticated electronic equipment and should be carefully handled to avoid any damage.
- The rated supply to DRO should be within specified limits and should not be exceeded under any circumstances. Doing so may cause irreversible damage to DRO.
- DRO should be opened by authorized person only as this will invalidate the warranty of the unit.
- Equipotential Point (Ground) should be provided to avoid erratic operations of DRO.
- Cable routing of DRO and encoders should not be routed through or nearby high capacity switching/inductive load or where it can cause danger.
- EL300 DRO is standard compliant with
  - EMC Directive EN61326 Standard 61326-4-2, 61326-4-4, 61326-4-11, 61326-4-5, CISPR 16-1 and 16-2.
  - RoHS compliant.
- **Warranty will be considered void if and not limited to**
  - Failing to meet manufacturers specified supply conditions.
  - Abusive handling.
  - Environmental conditions outside of Manufacturers specifications.
  - Manipulation, tampering of electronics.
  - Replacement of original parts with other parts than specified by manufacturer.
  - Used with encoders other than those supplied by the manufacturer.
- **Disposal**

At the end of its life the EL300 DRO system should be disposed of in a safe an environmentally sympathetic manner as applicable to local legislation. The casework and other components may be suitable for recycling. DO NOT BURN.

4. Getting Started

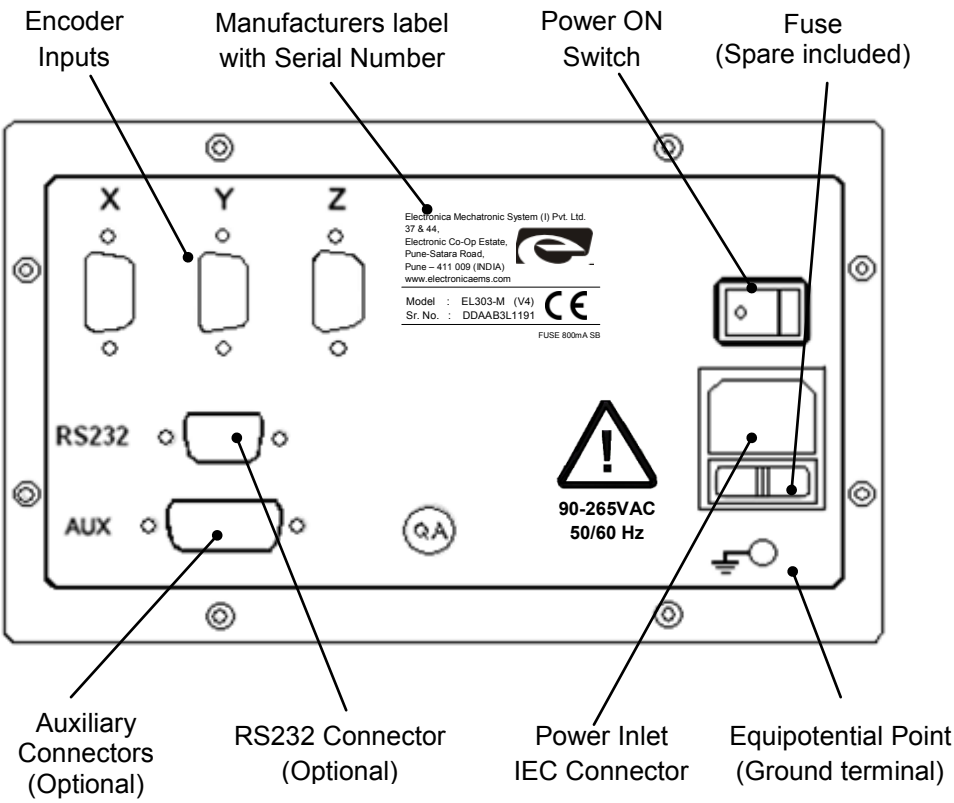
4.1. Front View



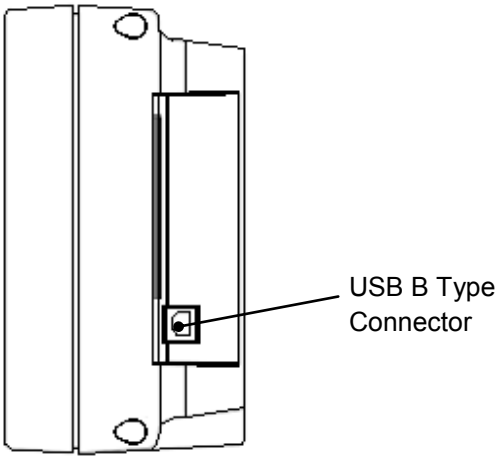
Note:

1. The FN key is used to select from list of functions available under MILL, LATHE and AUX keys. The MILL, LATHE and AUX key executes last selected function directly instead of showing the list.
2. In Lathe Model Y axis is referred as Z axis and Z axis is referred as Z' axis.
3. Fn LED will glow when any function under Mill, Lathe or Aux key is executing.

4.2. Rear View



R. H. SIDE VIEW



4.3. Keyboard layout

Symbols	Description	
	Setup	BASIC OPERATION
	ABS / INC	
	Inch / mm	
	Reference	
	Preset	
	Numeric Keys	NUMERIC KEYBOARD
	Toggle Sign	
	Decimal Entry	
	Enter	
	Cancel	
	Toggle Keys	
	Navigation Keys	

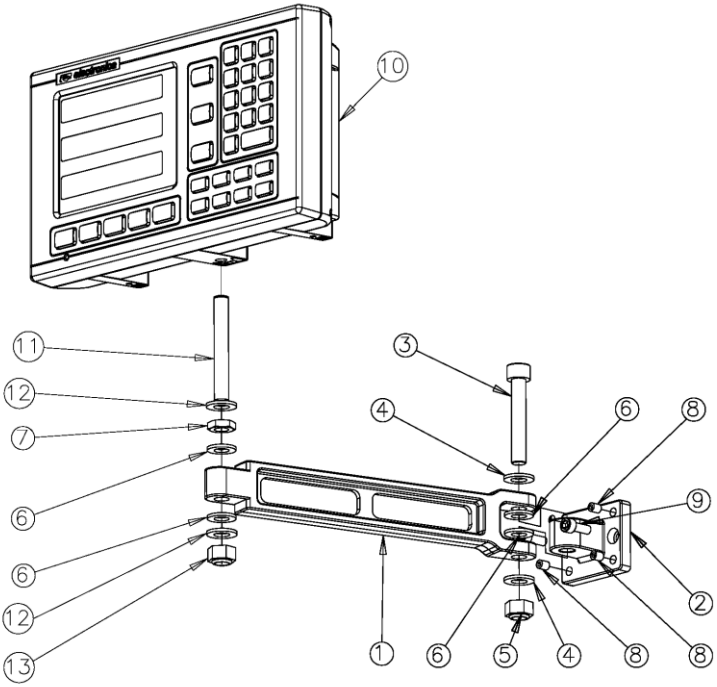
CALC	Calculator Function	SECONDARY OPERATIONS
1/2	Half Function	
STEP	SDM Function	
FN	Function Key	
AUX	Auxiliary Key	
MILL	Mill Key	
LATHE	Lathe Key	
X Y Z	Axis keys	AXES KEYS

5. Installation

5.1. Mounting Options

Following are the possible options for mounting of EL300 DRO.

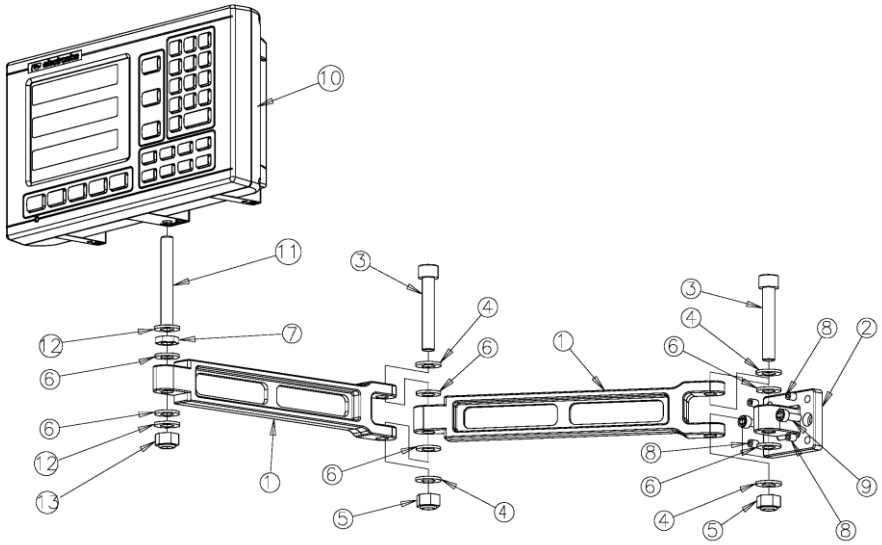
- Single Arm DRO mount (Code No. 0114-03-0110)



No.	Description	Qty.
1	Fork arm	1
2	End Bracket	1
3	M10 X 60mm Allen head screw	1
4	M10 punched washer	2
5	M10 Nylock nut	1
6	Nylon spacer M10	4
7	M8 Lock nut	1

No.	Description	Qty.
8	M6 X 8 Allen grub	4
9	M6 X 16mm Allen head screw	2
10	EL300 Series DRO	1
11	M8 X 50 Stud	1
12	M8 Plain Washer	2
13	M8 Nylock nut	1

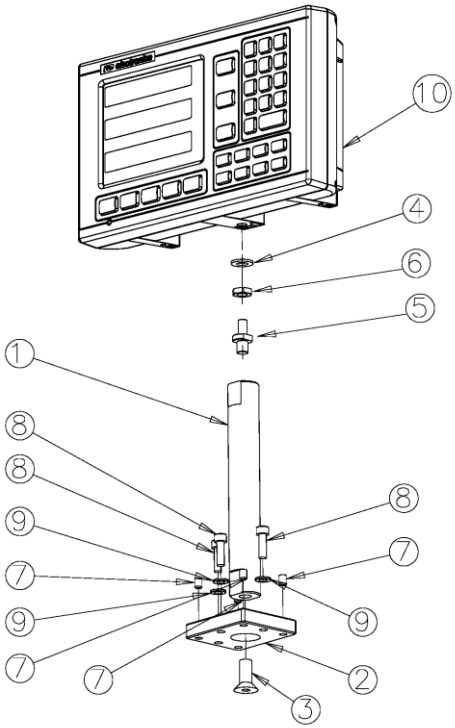
Double Arm DRO mount (Code No. 0114-03-0120)



No.	Description	Qty.
1	Fork arm	2
2	End Bracket	1
3	M10 X 60mm Allen head screw	2
4	M10 punched washer	4
5	M10 Nylock nut	2
6	Nylon spacer M10	6
7	M8 Lock nut	1

No.	Description	Qty.
8	M6 X 8 Allen grub	4
9	M6 X 16mm Allen head screw	2
10	EL300 Series DRO	1
11	M8 X 50 Stud	1
12	M8 Plain Washer	2
13	M8 Nylock nut	1

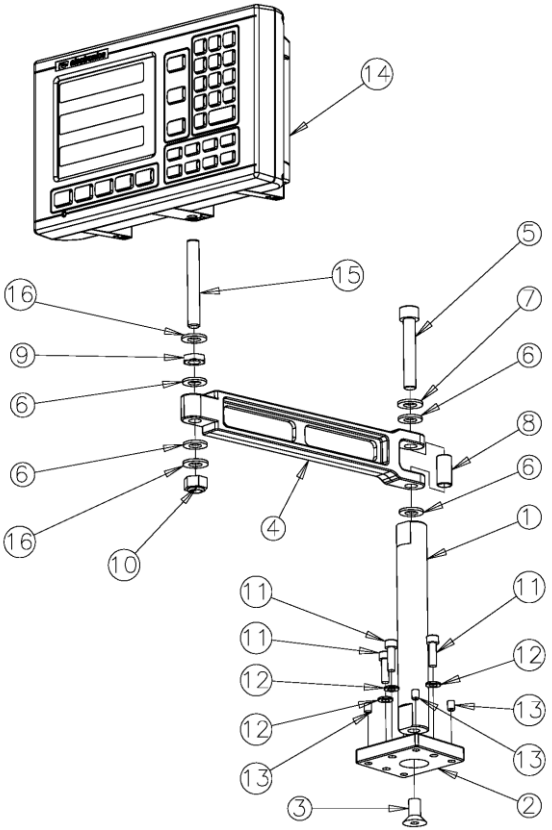
DRO Lathe mount stand (Code No. 0114-03-0140)



No.	Description	Qty.
1	Bar for Lathe stand	1
2	Base plate for Lathe Stand	1
3	M10 X 20mm CSK	1
4	M8 Punched Washer	2
5	Duel threaded stud for EL300 DRO	1

No.	Description	Qty.
6	M8 Lock nut	2
7	M6 X 8 Allen grub	4
8	M6 X 20mm Allen head screw	3
9	M6 punched washer	3
10	EL300 Series DRO	1

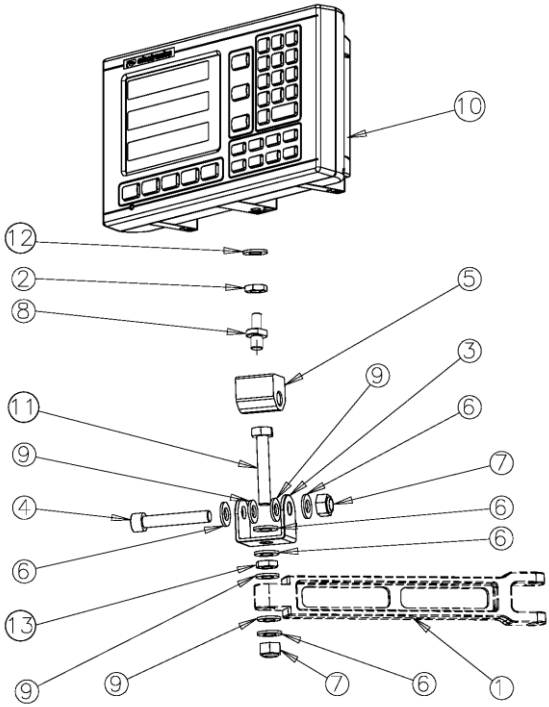
DRO Lathe mount stand with Single ARM (Code No. 0114-03-0150)



No.	Description	Qty.
1	Bar for Lathe stand	1
2	Base plate for Lathe stand	1
3	M10 X 20mm Allen CSK	1
4	Fork Arm	1
5	M10 X 60mm Allen head screw	1
6	Nylon Spacer M10	4
7	M10 punched washer	1
8	Spacer between fork	1

No.	Description	Qty.
9	M8 Locknut	1
10	M8 Nylock Nut	1
11	M6 X 20mm Allen head screw	3
12	M6 punched washer	3
13	M6 X 8 mm Allen grub	4
14	EL300 Series DRO	1
15	M8 X 50 Stud	1
16	M8 punched washer	2

DRO Swivel mount (Code No. 0114-03-0130)



No.	Description	Qty.
1	Fork arm	1
2	M8 Lock nut	1
3	Swivel bracket	1
4	M10 X 60mm Allen head	1
5	Swiveling block	1
6	M10 Punched Washer	5
7	M10 Nylock nut	2

No.	Description	Qty.
8	Duel threaded stud for EL300 DRO	1
9	Nylon Spacer	4
10	EL300 Series DRO	1
11	Hexagon Bolt M10 X 60	1
12	M10 Punched Washer	1
13	M8 Lock nut	1

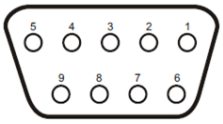
5.2. Power Supply

The EL300 DRO series uses a Switch mode power supply inside which covers the universal power input range i.e. 90VAC to 265VAC / 50 to 60 Hz. Ensure the input power is within the specifications before powering the unit.

The power supply to the DRO should not be given from the same source as that of any high capacity switching / inductive loads to avoid interference.

Ensure proper Equipotential point (Ground) connection is provided to the DRO to avoid any erratic operations.

5.3. Encoder Connections



Pin Number	Output Signal
1	ABS*1
2	/ABS
3	VCC (+5V)
4	Shield*2
5	GND (0V)
6	Phase A
7	Phase /A
8	Phase /B
9	Phase B

Note:

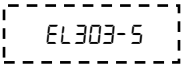
*1 - ABS is Reference Mark.

*2 – Ensure proper shielding of the encoder cables for proper functioning of the encoder and the DRO.

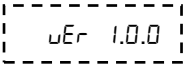
Encoder Cable should be properly routed as per manufacturers' guidelines. Cable should not be routed near any inductive loads to avoid electrical noise interference. It should be routed away from the machine moving parts to avoid any damage.

5.4. Power UP

Switch ON the power switch located on the back of the DRO. The DRO will display the power UP message momentarily as shown below



Displays the DRO model

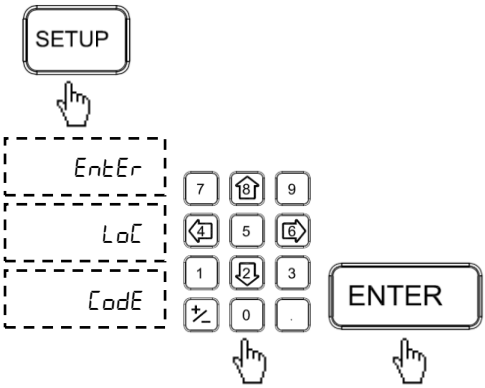


Displays the current Software version

Power up message can be bypassed by pressing the C key.

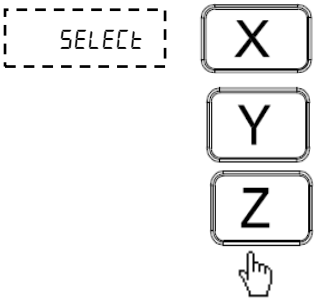
6. Setup

6.1. Enter Setup



Pressing setup key will open Setup menu on DRO.

Enter correct password “95147” and press Enter key.



Pressing appropriate axis key will allow configuration of individual axis.

With help of navigation keys up/down you can choose parameters as shown in table 6.2.

With the help of navigation keys left / right you can choose the settings of each parameter.

Note: Entering wrong password three times will display message rSt dro and in this case user need to restart the DRO.

6.2. Setting Parameters

Following parameters are available for Setting

Display	List of Parameter	Settings for Parameter
L inEAr AnGULAr	Counting mode*7	**Linear** / Angular
SC 5.0	Scale resolution*7	0.1/0.2/0.5/1/2/**5**/10/20/50 µ
dP 5.0	Display resolution*7 (Linear)	0.1/0.2/0.5/1/2/**5**/10/20/50 µ
dd.ōō dd.ōō.SS dd.dEC	Display resolution*7 (Angular)	Degrees-Minutes/ **Degrees-Minutes-Seconds/** Degrees-Decimal
Cont roL our	Angle display mode *5 (Angular)	**Continuous** / Roll over
inCh ōō inCh ōō	Measurement Unit (Linear)	Imperial measurement only/ Metric measurement only/ **Imperial or Metric measurement**
rAd d iA	Measurement mode*7 (Linear)	**Radial** / Diametric
LEFt r iGht	Counting direction	**Left** / Right
CAL ib	Calibration type (Section 6.3)	Press ENTER for DRO calibration
EnF oFF EnF on	Encoder fail warning*2	On / **Off**
AUH Fn	Auxiliary function*1 (Section 10)	Press ENTER for Auxiliary Function Menu
SEr iAL SEr Con	Data transmission mode*1	Serial or **Serial Continuous**
dro F dro t	Touch probe function*1 (Section 10.1)	**DRO F** / DRO T type
Prb dLY	Probe Delay*1 (Section 10.1.1)	**1** to 60 seconds

PULSE Cont	Six O/P signal*[1]	Pulse / **Continuous**
tAPEron	Taper On*[1]	**X** / Y / Z axis
Ad it ion	Addition axis pair*[1]	**X - Z axis** / Y - Z axis
LoC oFF LoC on	Keypad Lock*[3]	On / **Off**
SLEEP t	Sleep Timer*[4]	Press ENTER to set sleep timer, **0** (Never Sleep)/ 5 to 120 minutes
End	End	Press ENTER to exit from setup

Next press will return you to SELECt. Press C to exit.

Note:

*1 - Model dependant parameters.

*2 - The measuring system error message is displayed when the encoder cable gets disconnected from the DRO or it is damaged along the length. The error message is displayed on corresponding axis display as no SiG.

*3 - With keypad lock, all key operations except set up are locked. This helps in not losing the datum point because of wrong reset operation.

*4 - The display is switched off for the time in sleep timer, with any key operation the display gets 'ON'.

*5 - In Angular mode, if continuous mode angle is display in positive and negative format on zero crossing, and in Rollover mode, angle values are rolled to 0 at 360 degree.

*6 - Polar, Vectoring and Summing are the modes where the respective resultant values can be viewed in polar system and combined movement of selected axes respectively.

*7 - It is apply for individual axis.

6.3. Error Compensation

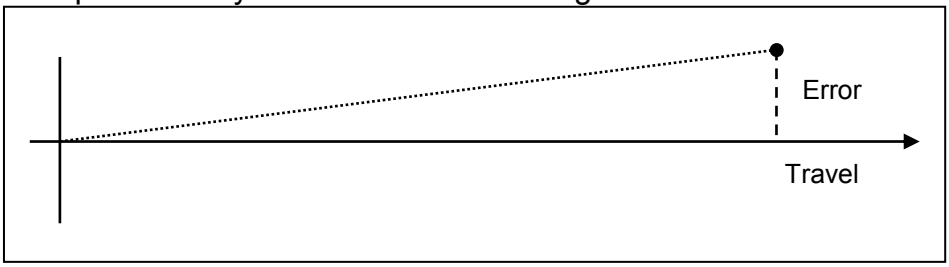
Error compensation is required during DRO installation as there are errors due to ball screw pitch error or deflection & tilting of axes. The error can be also because of measuring system.

This error can either be linear or non-linear. These errors can be determined either with the help of reference measuring system or a slip gauge.

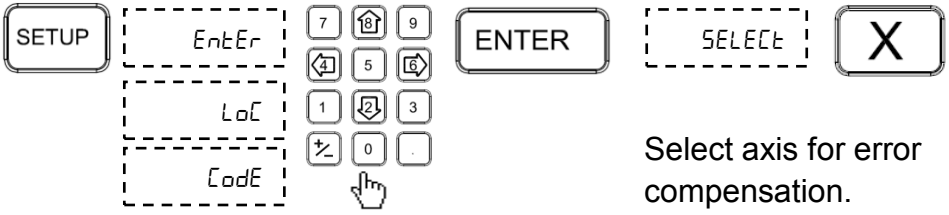
6.3.1. Error Compensation for linear Axis

6.3.1.1. Linear Error Compensation (LEC)

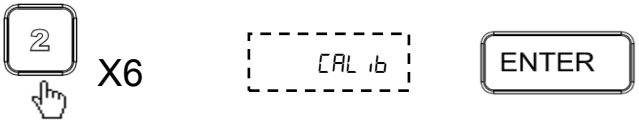
Linear error compensation can be applied, if the results of the comparison with a reference standard show a linear deviation over the whole measuring length. In this case the error can be compensated by the calculation of a single correction factor.



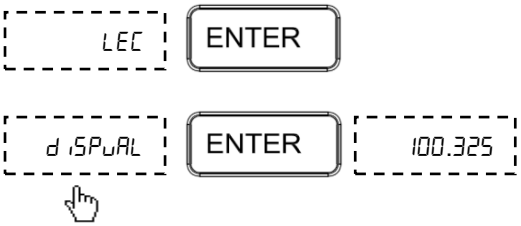
Navigation to Calibration Menu



Select axis for error compensation.

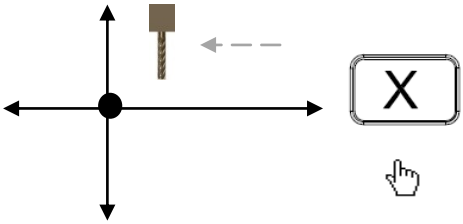


Linear Error Compensation

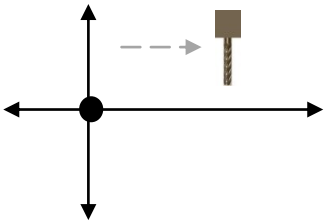


Enter Linear Error Compensation (LEC) menu.

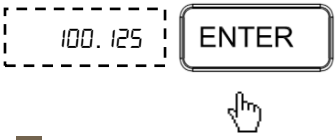
Enter display value menu.

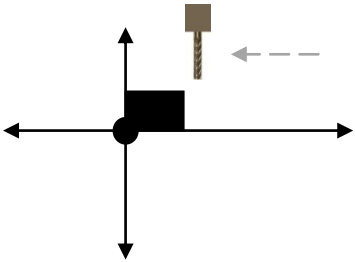


Set the machine at datum point (starting point) and press the axis key to reset the axis.

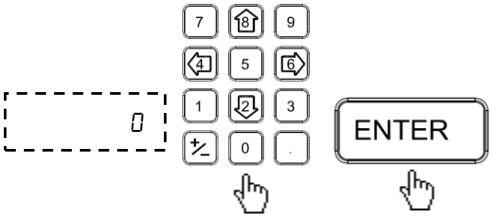


Move the axis away from datum point to put the slip gauge at datum point



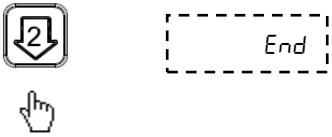


Move the axis to touch the slip gauge. The display value is the measured length of the slip gauge and press. ENTER



Input the reference value of slip gauge in **millimeter (mm)** and press ENTER

Now the DRO shows the calibration factor. Press Enter key to read the Compensation factor.

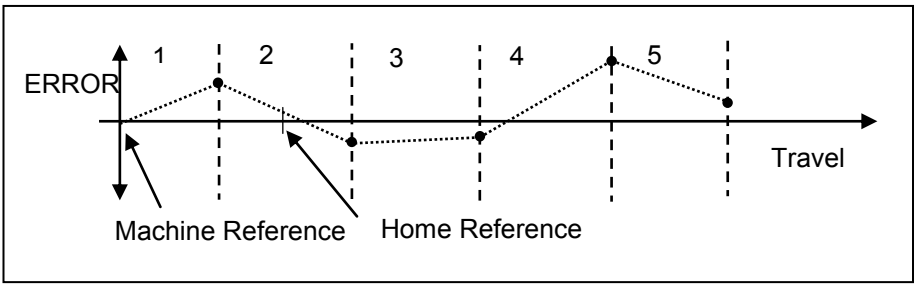


Navigate to end and press enter key to exit from setup.

Now linear error compensation is stored and applied.

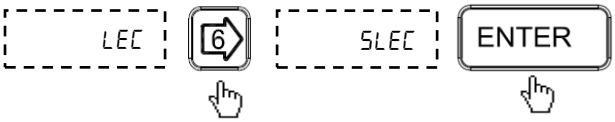
6.3.1.2. Segmented Error Compensation (SLEC)

Segmented Linear Error Compensation (SLEC) is used when the results of the comparison with a reference standard shows non-linear error. In SLEC the entire axis travel is divided into as many as 99 user defined segments. The error in each segment is compensated with a single correction factor. Each correction point is measured with respect to the starting point. This starting point is usually set close to the end of the scale. This starting point can coincide with the absolute datum point.



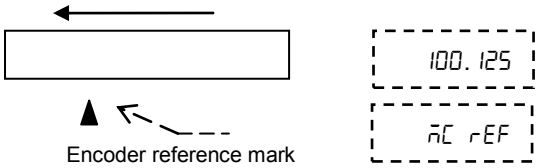
6.3.1.2.1. Auto Mode

Select the Calibration menu under setup as per Section 6.3.1.1 then select SLEC option as follows:

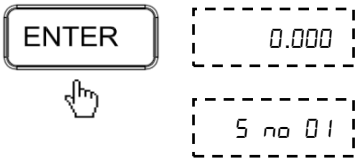


Set the machine slide near encoder reference and then select SLEC menu.

Last digit of axis display is blinking which indicates that this axis is ready for sensing the reference mark.

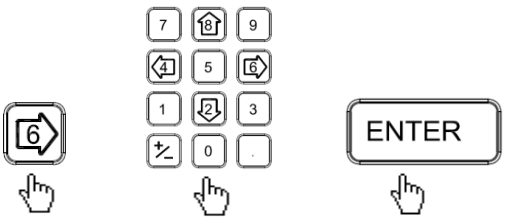


Move the machine to cross reference mark and reach the start point of the first segment.



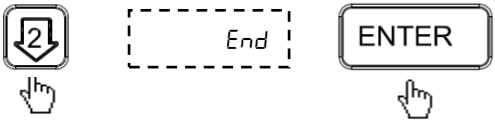
Press Enter key. This will set the machine reference at the start of first segment.

For more information on machine reference see Section 7.7.2.



Now reach the end of the first segment. Press the key. (Input the length of the segment as measured by standard.) Repeat this step for all segments.

After completing all segments navigate using key to save changes.

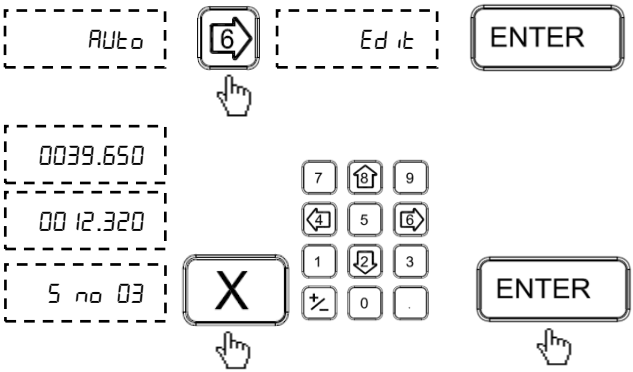


Navigate to End and press enter key to exit from setup mode. This indicates that calibration is complete.

6.3.1.2.2. Edit Mode

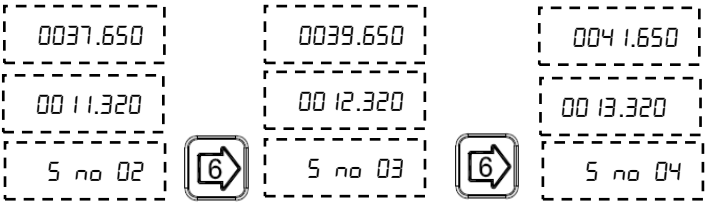
Edit mode allows user to check and edit the error compensation values for each segment after setting up in Auto mode.

Select Segmented Linear Error Compensation (SLEC) menu as per Section 6.3.1.2.1.



Enter edit mode.

Pressing axis key will select the axis for which the value is to be edited. Using numeric keypad enter the correct value.



Using left and right keys user can go through all segments.

After completing editing, navigate to mode with down arrow key and press ENTER. Then exit by pressing ENTER again.

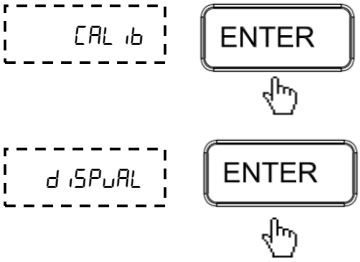
Note: After exiting from setup machine reference needs to be recalled so as to apply Segmented Linear Error Compensation (SLEC).

6.3.2. Error Compensation for Angular DRO

For error compensation of angular axis measurement, select the angular counting mode parameter in setup as mentioned in Section 6.2. With down arrow key select error compensation menu.

6.3.2.1. 360° Rotation method

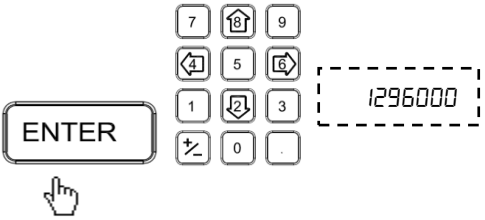
Select Angular mode for measurement in setup and navigate to Calibration menu as per Section 6.3.1.1.



Enter calibration menu.

Press ENTER to display value. Set the machine at datum point (Stationary point) and press axis key to reset the axis.

Move the machine to complete one rotation of table. It is highly recommended to place a marker so as to complete one round accurately.



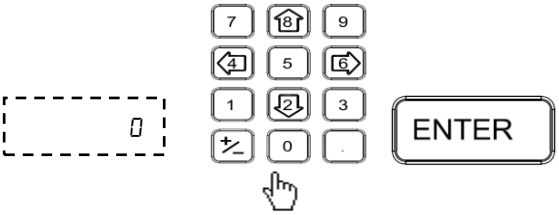
Enter value of 360º in terms of seconds i.e. 1296000.

Save changes and exit to counting screen.

6.3.2.2. Pulses Per Revolution (PPR) method

Enter calibration menu as per Section 6.3.1.1

Select PPR menu.



Enter PPR value of encoder and press enter.

Save changes and exit to counting screen.

7. Primary functions

7.1. Absolute / Incremental display (ABS / INC)

The ABS INC key toggles between the Absolute / Incremental position display.

Absolute mode displays the position of all axes from a fixed datum.

The incremental mode displays each position relative to the last position. This is also known as point to point use.

The LEDs indicate the current selection of mode.

Note: At the beginning of each working session, set the datum in absolute mode, and then switch the DRO to incremental mode .By using the DRO in this way you can return the machine to its absolute datum at any time, simply switching back to Absolute mode.

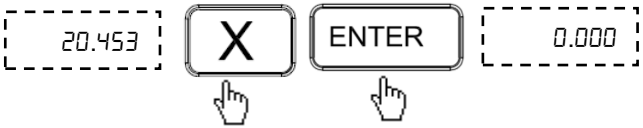
7.2. Inch Metric Display (Inch / mm)

The INCH MM key toggles between the Inch units (inch) or the millimeter units. (mm)

The LEDs indicate the current mode of display.

7.3. Axis Reset

This function is used to Zero the axis.

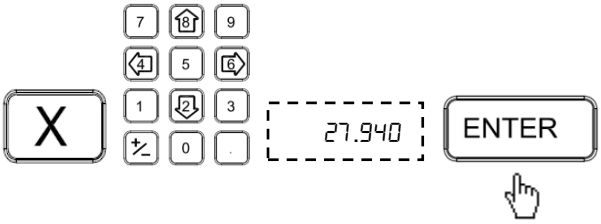


Pressing axis key (X / Y / Z) followed by Enter key will reset the respective axis.

When axis reset function is activated in ABS mode, it will redefine the datum of the travel, and then it is not possible to restore the old datum.

7.4. Axis Set

This function is used to set the axis with a known value.



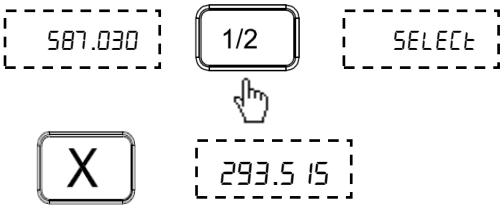
Select axis key (X / Y / Z). Enter the numeric value to preset the selected axis. Confirm with enter key.

Incorrect numeric entry can be cancelled one by one using C.

Using this in ABS mode will alter the datum of that axis, so it will not be possible restore the old datum.

7.5. Half Function

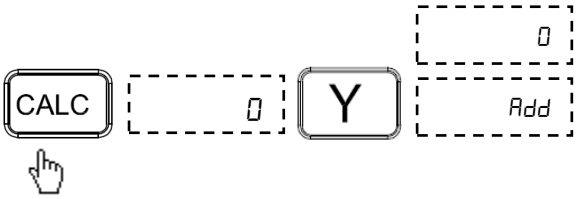
This function is used to find the center of a work piece by halving the displayed distance on the selected axis.



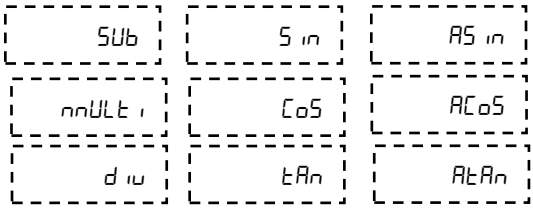
Pressing 1/2 key followed by axis key will half value of axis.

It is recommended to use this function in INC mode. Using this in ABS mode will alter the datum of that axis.

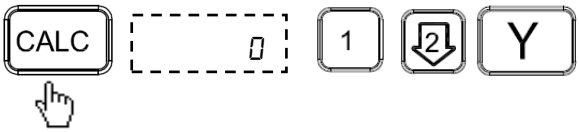
7.6. Calculator



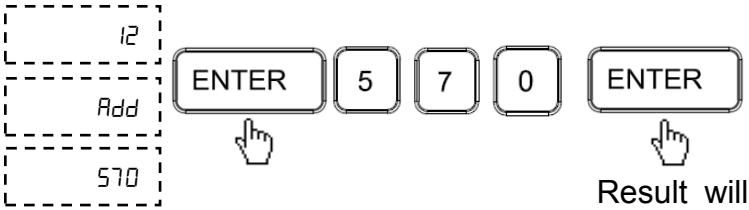
Pressing Y axis key will toggle between all available mathematical functions such as addition, subtraction, multiplication, division, sine, cosine, tan, $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$. The value enter for calculation is displayed on X Axis.



7.6.1. Illustrated example



After selecting desired operation enter values and press enter.



Result will be displayed on X axis.

Press calculator key again to exit calculator mode.

7.7. Setting of Reference

This function allows user to set a machine zero point. With this machine zero point users can restore the work coordinates even if the machine is moved when the DRO is in OFF condition. Generally each encoder has reference marks present at every specified interval. These reference marks are used to recall the same datum point every time.

This function works only in ABS mode. If tried to use in INC mode, the DRO is automatically forced to ABS mode and then the function executes.

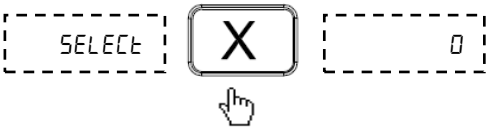
There are two Positions which can be set as datum point (Home function):

- Reference point of measuring system.
- Machine Reference Mark.

7.7.1. Reference Point

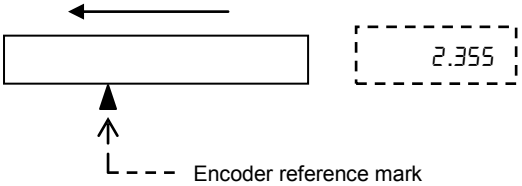
In this function, the Datum is set at the reference mark on the encoder.

Enter referencing menu.



Select appropriate axis for referencing.

Blinking zero next to selected axis will indicate that DRO is now waiting for the encoder reference mark. Move the machine to select the reference mark.



After crossing reference mark DRO will start counting. Reference mark is now set

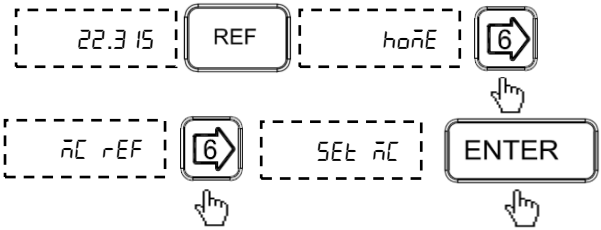
Note: It is highly recommended to mark an indicator on encoder so as to use the same reference mark while finding the datum point.

7.7.2. Machine Reference Function

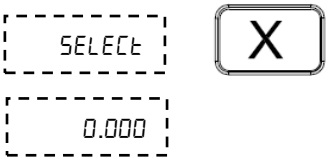
Machine referencing is used when datum is not at the reference mark on encoder but at a fixed distance from reference mark.

7.7.2.1. Setting of Machine Reference

Before setting the machine reference, make sure to perform homing as discussed in Section 7.7.1.



Move the machine to the required machine reference position. Then navigate to Set Machine Reference menu and press Enter key to confirm position.

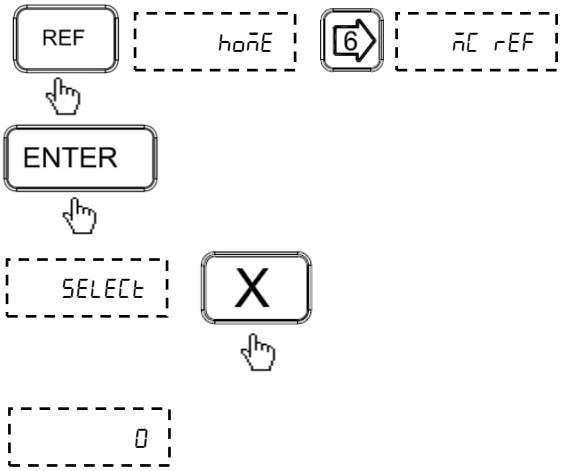


Select the axis for which machine reference is to be set

Display now will show zero on selected axis. This indicates that selected point is set as machine reference for that particular axis.

Note: In machine reference function, the absolute datum is at a fixed distance from reference mark of an encoder. It is marked permanently on the machine.

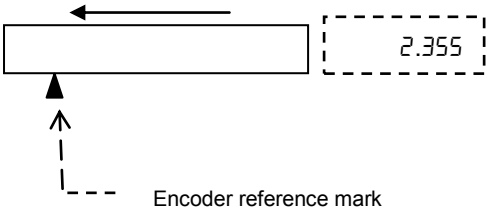
7.7.2.2. Recall Machine Reference



Select reference mode and navigate using left / right arrow keys to machine reference menu. Confirm with enter key.

Select axis for which machine reference is to be recalled.

Blinking zero next to selected axis will indicate that DRO is now ready to set reference. Move slide towards selected reference mark indicator.



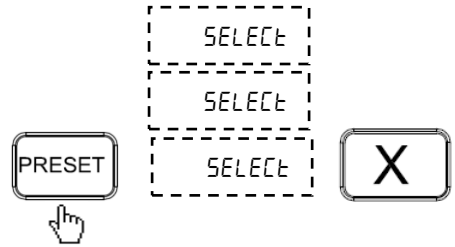
After crossing reference mark DRO will start counting.

This indicates that machine reference is now recalled.

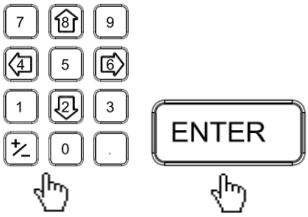
8. Secondary Functions

8.1. Preset

Preset function allows user to set **Distance-to-Go** to reach next position. Preset function also includes Near Zero Warning function (see Section 8.3).

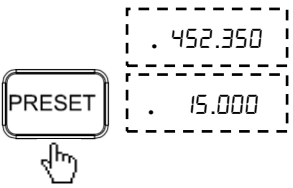


Press PRESET key and select the axis key.



Input the numeric value press Enter to confirm.

Repeat above steps for remaining axis.



Press preset again to execute the function.

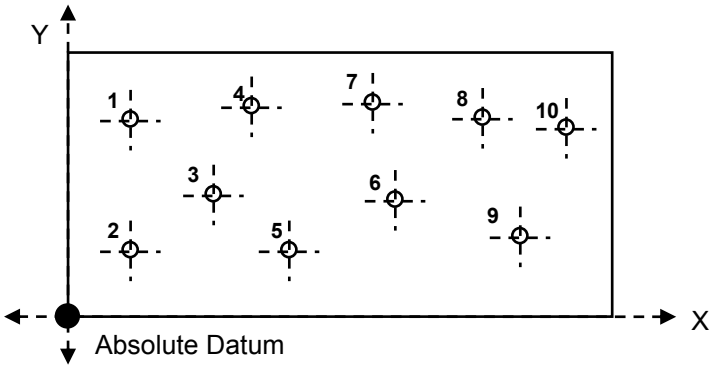
DRO will display **Distance-to-Go**.

Note: During preset mode DRO counting is changed to incremental and thus the datum is not disturbed.

This function also provides near zero warning alarm (see section 8.3.)

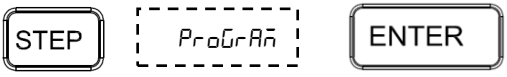
8.2. Sub Datum Memory (STEP Function)

This feature allows the DRO to store up to **1000 machining sub datum points** in memory. Each sub datum store coordinates for all 3 axes (X, Y, and Z). In operation, the datum of the machine is replaced by each sub datum in turn, allowing the operator to work to zero for each sub datum instead of having to constantly refer to printed list of coordinates.

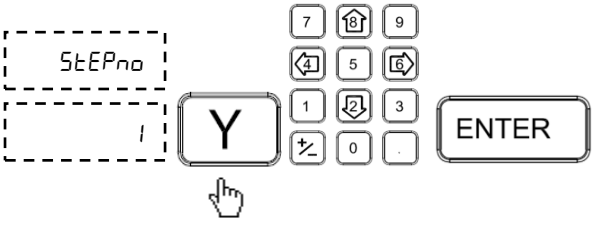


There are three options under SDMs.

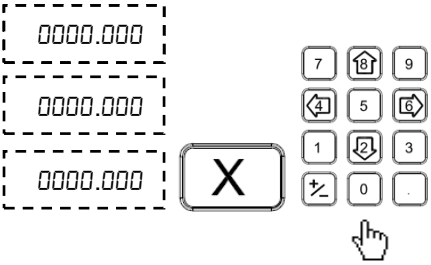
8.2.1. Program Mode (ProGrAm)



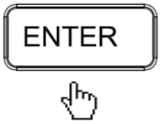
Select STEP menu and Program mode. Press enter to confirm.

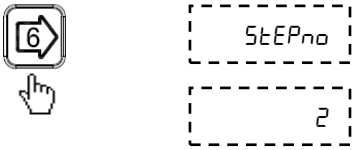


As a standard step number 1 is displayed. This can be edited by pressing Y axis key and entering the required step number.



Select the required axis and enter the values for the selected step. Press ENTER to confirm value.





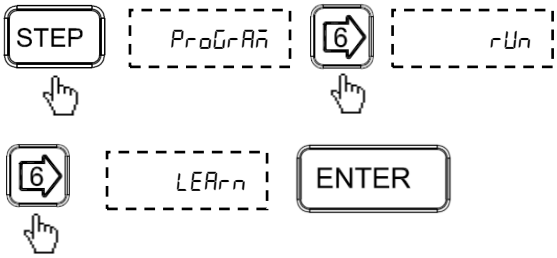
Press 6 key to go to next step. With right and left key user can select previous/next step. To go any step directly after pressing 6 press Y key and then step number which user want to go and press ENTER key.

Press 8 to see current step number Press Up arrow key again to exit

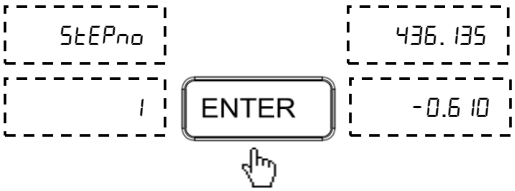
In this manner, you can enter all steps.

Press C key to exit.

8.2.2. Learn Mode (LEARn)

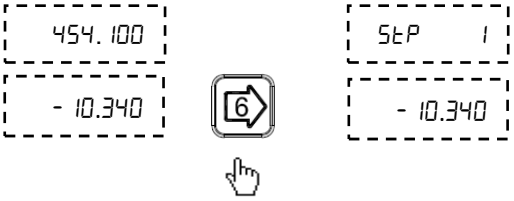


Select Step mode and navigate to 'Learn' menu with left / right arrow key.



Enter the required step number on Y axis display.

Press ENTER to confirm.

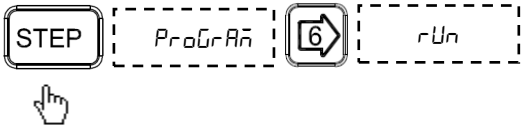


Move to the position to be stored as sub datum for all the axes and press 6. This will show the current step number. By pressing the 6 again will store the position and go to the next step.

Use above steps to complete all required locations. Maximum 1000 steps can be stored.

Press C key to exit.

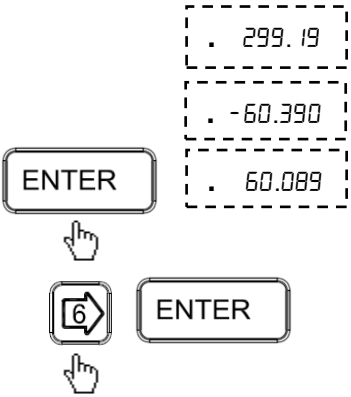
8.2.3. Run Mode (rUn)



After selecting Step mode Select run program from program menu with navigation.

In run menu display will show step number one. Enter the required step number by pressing Y and with numeric value.

Press ENTER to confirm.



Pressing ENTER will display distance to go for the selected step no.

Press 6 key to go to next step.

This can be repeated for all the step nos.
Press C key to exit.

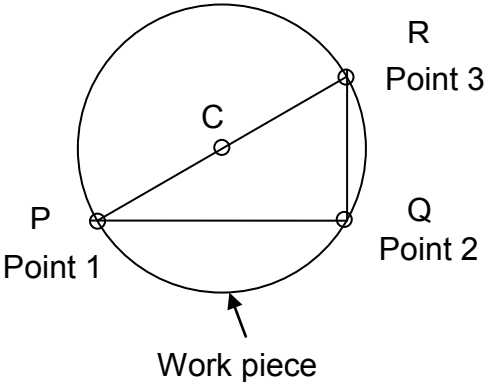
8.3. Near Zero Warning

EL300 DRO features a unique Near Zero Warning function which alerts user once the slide is within 50 microns of the set value.

This function is automatically enabled in the following functions:

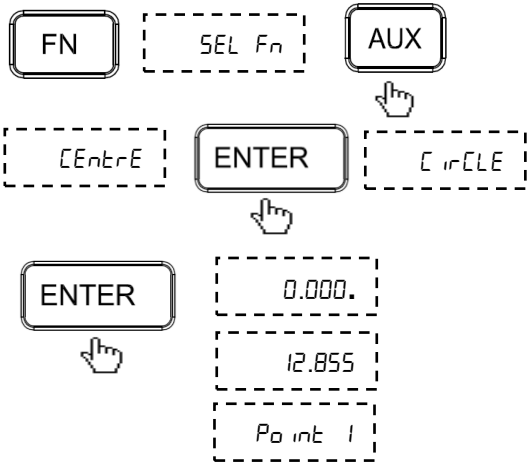
- Preset function
- Sub Datum Memory (STEP)
- All milling specific functions.

8.4. Center of Circle

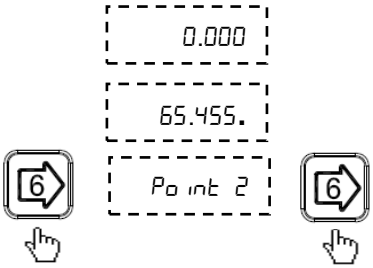


Center Of Circle function allows user to find center of a circle by locating three points on the circle.

Distance to the center from current location is shown on DRO display as **Distance-to-go**.



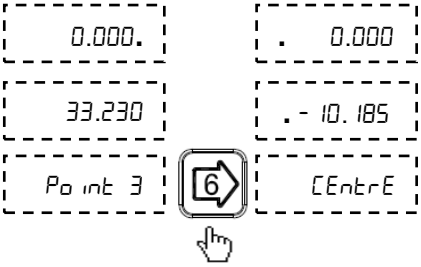
Press function key to select Center of Circle menu, press enter key to confirm.



Move to first point on circle.

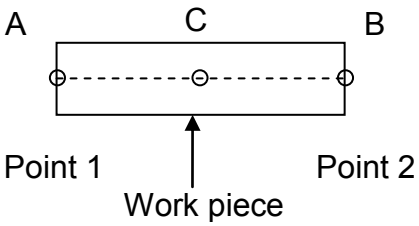
Pressing 6 will store value.

Repeat this step for remaining points.



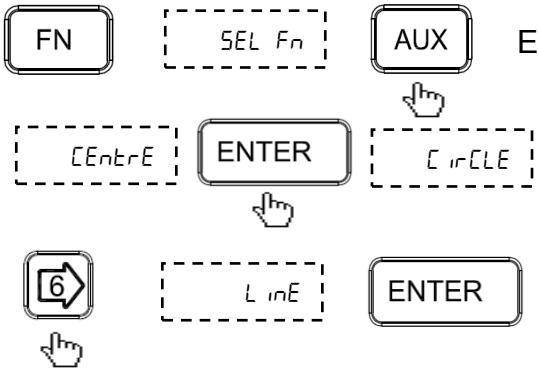
After storing all three points pressing 6 will display **Distance-to-go** to center of circle.

8.5. Center of Line

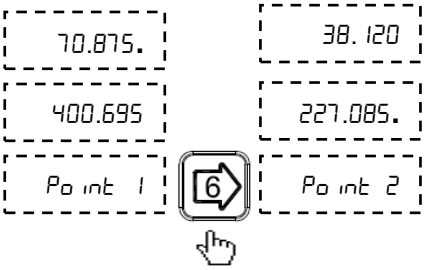


Center Of Line function allows user to find center of a line by locating end points of the line.

Distance to the center from current location is shown on DRO display as **Distance-to-go**.



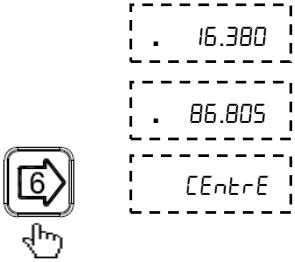
Enter Center of Line menu



Move to first point on line.

Pressing [6] will store value.

Repeat this step for second point.

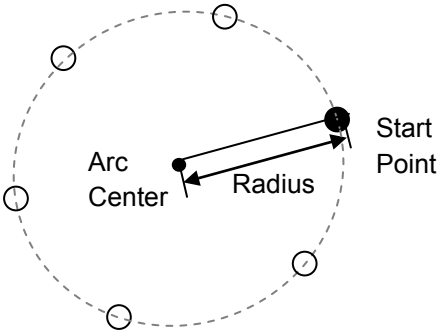


After storing both points pressing [6] will display **Distance-to-go** to center of line.

9. Machine Specific Functions

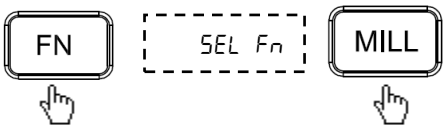
9.1. Milling Machine Specific Functions

9.1.1. Circular Bolt Hole Function (PCD)

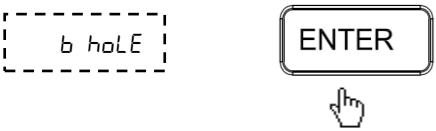


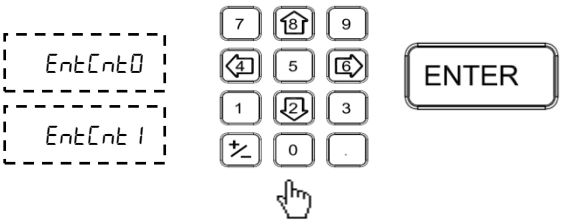
Circular Bolt-Hole function (also known as PCD) allows user to generate a pattern of holes along the perimeter of circle. After taking data from user such as co-ordinates of centre, radius, starting angle and number of holes the table of required points is automatically generated and user is shown distance required to travel to each hole.

9.1.1.1. Procedure

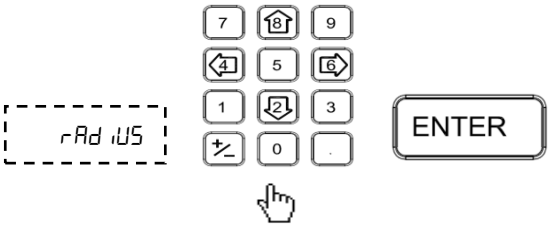


Enter Bolt-Hole function.

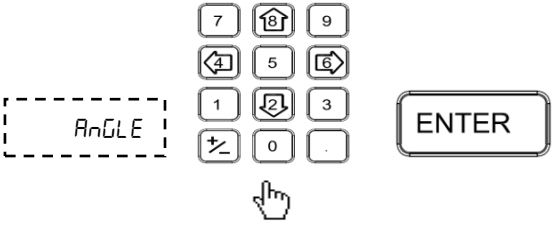




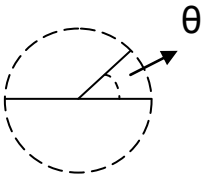
Enter **X** (ENTCNT0) and **Y** (ENTCNT1) axis **co-ordinates of Centre** of circle.

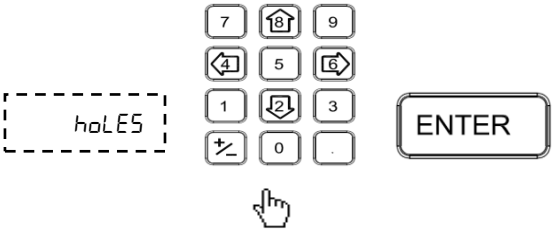


Enter **radius of circle.**

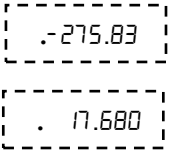


Enter **starting angle** this angle is with positive X-axis.

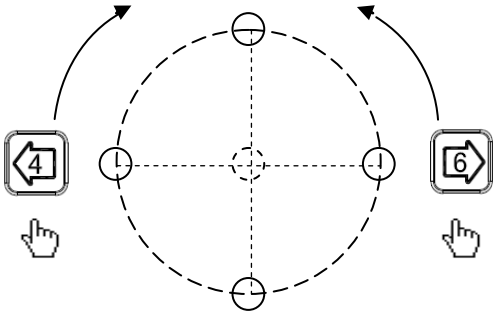




Enter total **number of holes.**



DRO will display the **Distance-to-Go** to the first hole.



Circular Bolt Hole pattern generated.

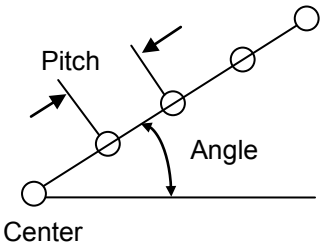
9.1.1.2. Additional Options Available

Press 4 **or** 6 key to know **through Distance-to-Go** for each point. Continue to drill the remaining holes in the same way.

Press 18 key to see **current hole number** Press it again to exit.

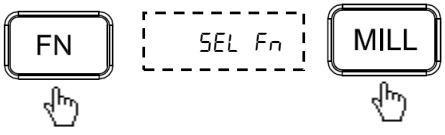
Press 2 key to **jump to specific hole.**

9.1.2. Angle Hole Function

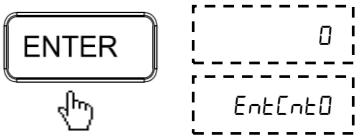


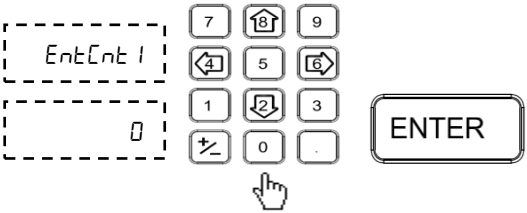
Angle Hole function allows user to create an equality spaced pattern of holes in linear direction at a specified angle with respect to X-axis. After taking data from user such as co-ordinates of starting point, radius of first hole from the centre, angle with respect to X-axis and number of holes, the table of required points is automatically generated and user is shown distance required to travel to reach particular hole.

Procedure

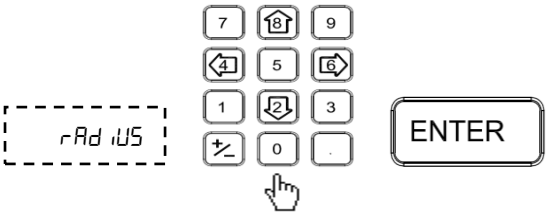


Enter Angle Hole function.

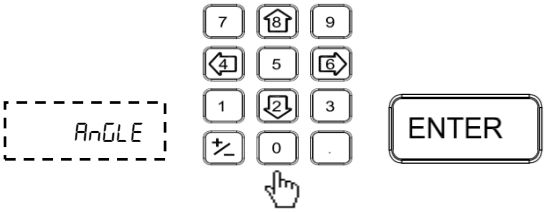




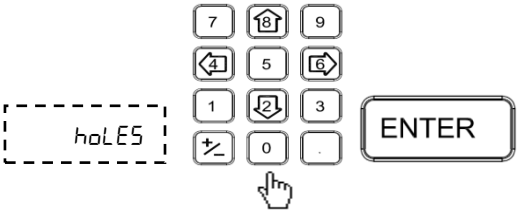
Enter **X** (ENTCNT0) and **Y** (ENTCNT1) axis **co-ordinates of Centre** of arc.



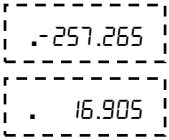
Enter **pitch** between two holes.



Enter **angle of line** with positive X axis between two holes.



Enter total **number of holes.**



DRO will display **Distance-to-Go** till first hole.

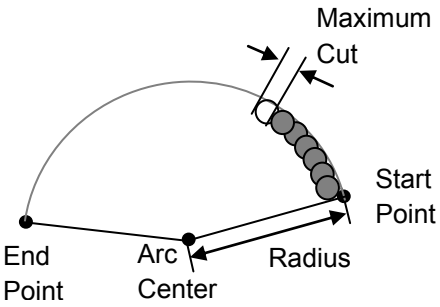
9.1.2.1. Additional Options Available

Press **4** **or** **6** key to **cycle through Distance-to-Go** for each step.

Press **8** **key to see** current **step number.** Press it again to exit.

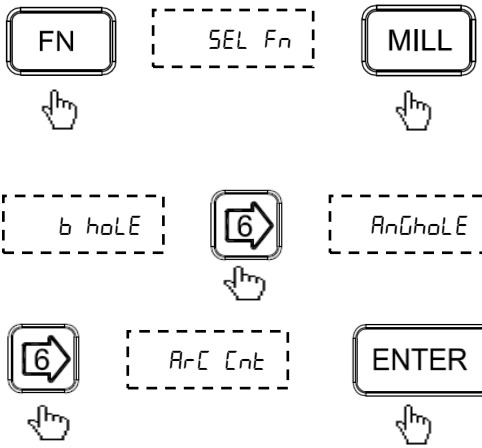
Press **2** key to **jump to specific step.**

9.1.3. Arc Contouring Function



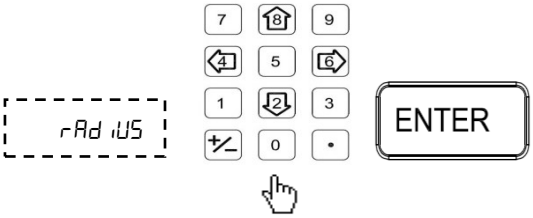
Arc contouring function allows user to create pattern of holes in successive step size along an arc.

9.1.3.1. Procedure

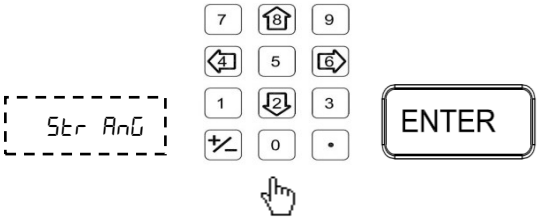


Enter arc contouring function.

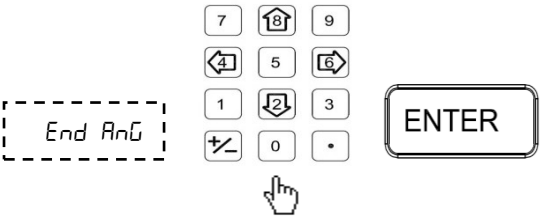
Enter **X** (ENTCNT0) and **Y** (ENTCNT1) axis **co-ordinates of Centre** of arc.



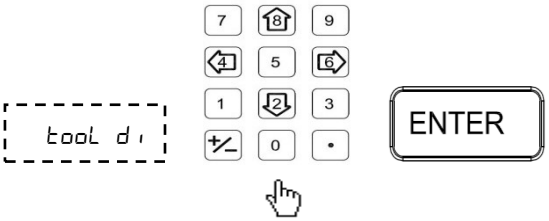
Enter **radius of arc.**



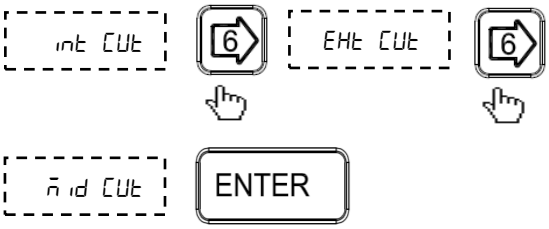
Enter **starting angle**.



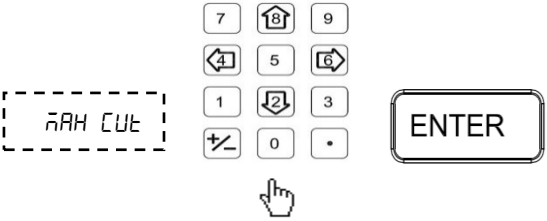
Enter **ending angle**.



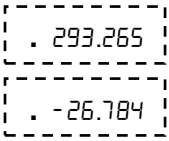
Enter **tool diameter**.



Select type of cut i.e. internal cut, external cut or mid cut. Right toggle key will cycle through all available options.

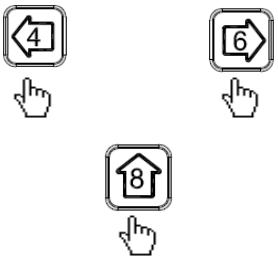


Enter Maximum cut or step size.



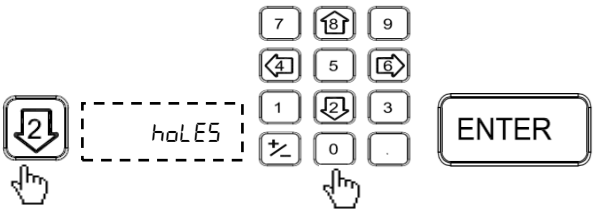
DRO will display **Distance-to-Go** till first hole.

9.1.3.2. Additional Options Available



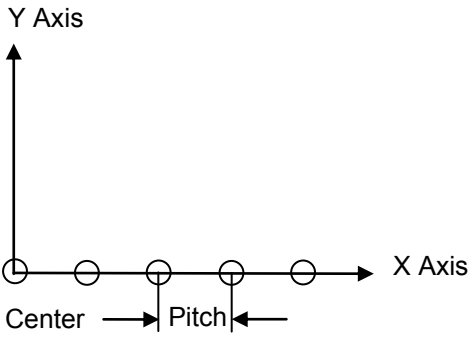
Press 4 **or** 6 key to **cycle through Distance-to-Go** for each step.

Press 8 **key to see** current **step number.** Press 8 key again to exit.

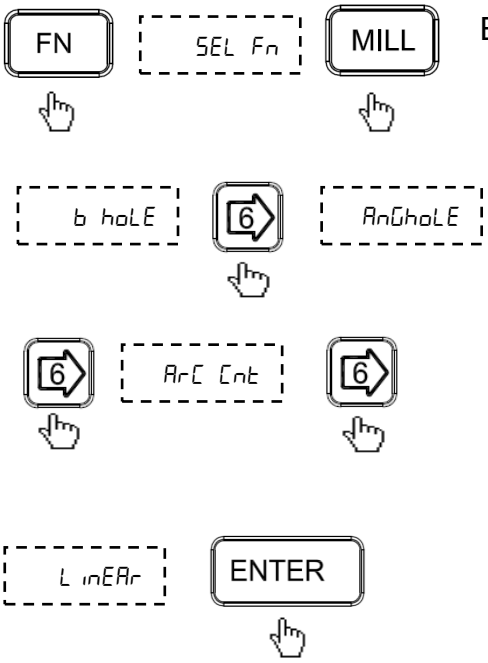


Press 2 key to **jump to specific step.**

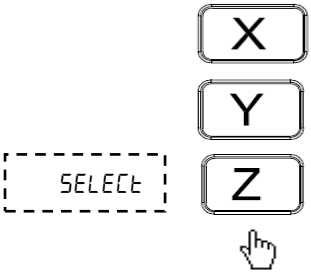
9.1.4. Linear Bolt Hole



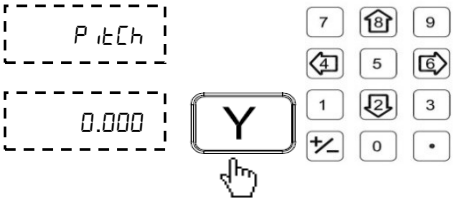
Linear Bolt Hole function allows user to create an equality spaced pattern of holes in linear direction. After taking data from user such as axis and pitch, the table of required points is automatically generated and user is shown distance required to travel to reach particular hole.



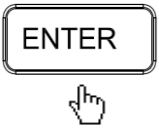
Enter Linear Bolt Hole menu.

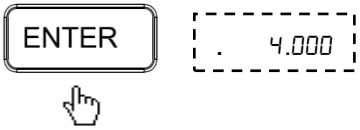


Select axis along which Linear Bolt Hole pattern is to be generated.



Reset axis by pressing axis key. Enter the required pitch and press ENTER to confirm value.

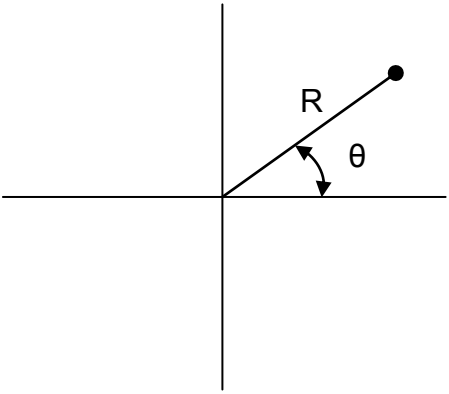




Pressing ENTER again will return DRO to counting mode and Distance-to-go will be displayed till first hole.

After reaching first hole pressing 6 will show **Distance-to-go** till next hole.

9.1.5. Polar Co-ordinates

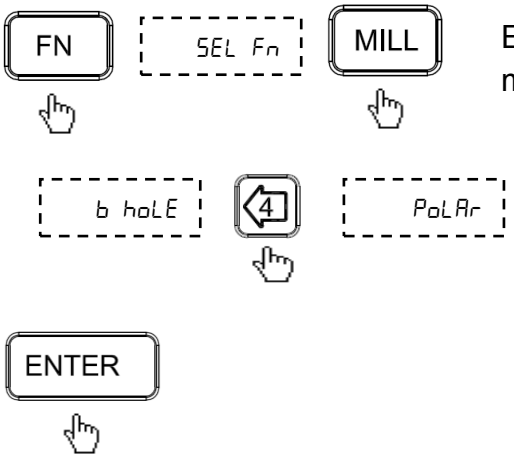


Polar Co-ordinates function allows user to measure distance in Polar Co-ordinate measuring system.

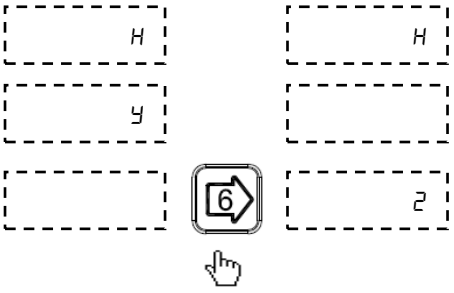
Here one axis is used to display radius (**R**) and other is used to display angle (**θ**) as shown in table below.

If user wants to set axis value, it should be perform prior entry in this function.

Plane	Radius (R)	Angle (θ)
X - Y	X Axis	Y Axis
X - Z	X Axis	Z Axis
Y - Z	Y Axis	Z Axis

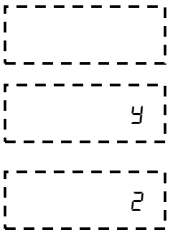


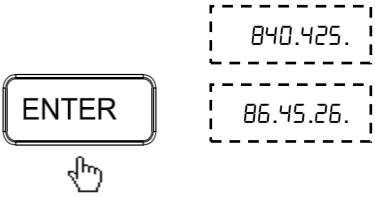
Enter Polar Co-ordinates menu.



Select desired axis pair

Pressing 6 will cycle through available axes pairs.

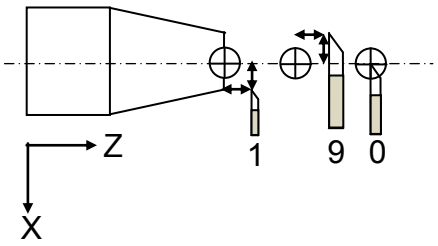




Press ENTER DRO will return to counting mode.

9.2. Lathe Machine Specific Functions

9.2.1. Tool Offset

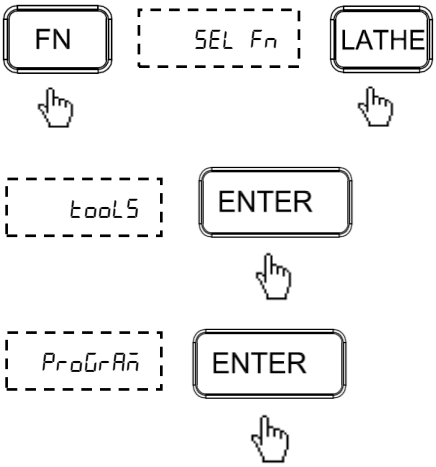


Tools differ in length as well as in diameter, making compensation in slide movement necessary to accommodate the dimensional variation of the tools. This compensation is known as the tool offset. Once the tool offset is established, the slide movement is automatically adjusted according to the value that is set. EL300 series DRO supports 6 such tool offsets. While in this mode DRO operates in ABS mode.

There are two options under Tool Offsets

9.2.1.1. Tool Offset Program Mode

Procedure



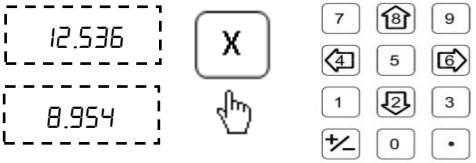
Enter Tool Offset Mode.

Confirm Program mode.

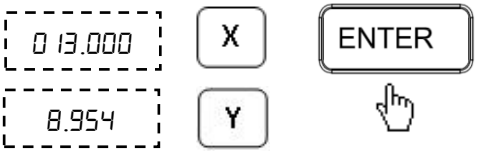
Enter Tool number.

Take the slim cut along outside diameter of the part or touch the tool to the surface of the part (if cylindrical)

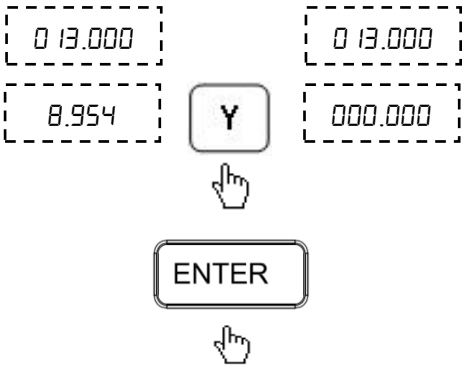
Move the tool away from the part without disturbing x axis and measure the Diameter of the part



Press X axis key and enter Diameter of the part and press Enter



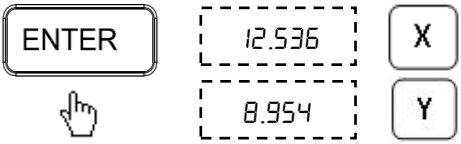
Take the facing cut or touch the end of the part with the tool. Move the tool away from the part, without moving the Y axis



Press Y axis key and press Enter to zero the axis.

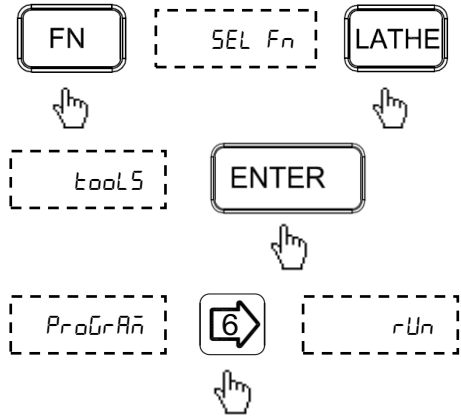
Now Tool Offset Datum is established.

Press Left arrow key to move to next tool offset calculations.



Follow above procedure for setting tool offset for the remaining tools.

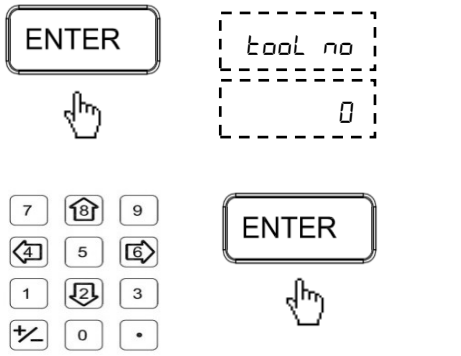
9.2.1.2. Tool Offset Run Mode



Enter tool offset mode, press function key, then LATHE key.

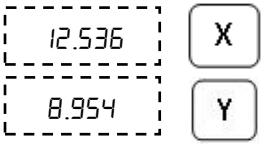
Press Enter key to confirm the Tools Offset mode.

Press Enter key to confirm the Run mode.



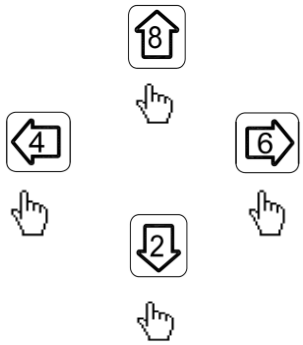
Enter tool number and press Enter Key.

Now display shows last reading changed while tool offset calculation plus tool offset value of the entered tool number.



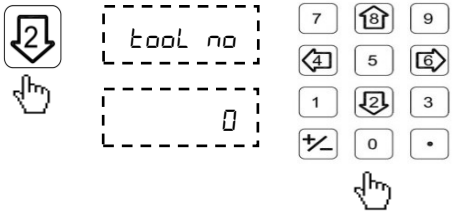
This is a mode in which you can execute other functions like Taper, Addition, Vector, Steps, Half, etc.

9.2.1.3. Additional Options available in Run Mode

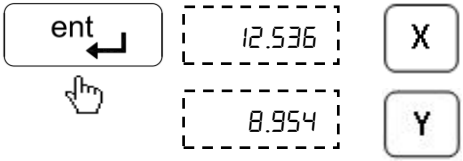


In tools Run Mode menu, left and right arrow keys can be used to select different tool offsets.

Press 8 key to see current tool number Press Enter key to exit.



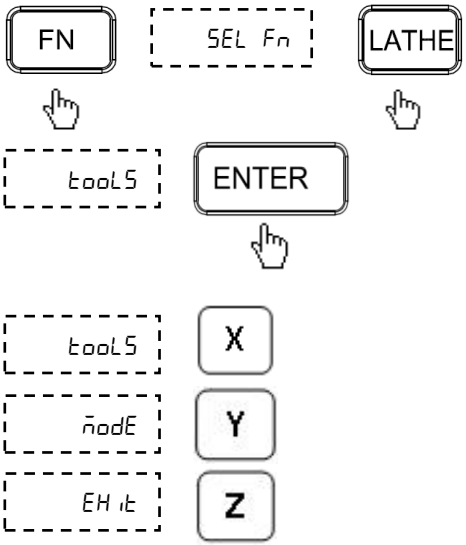
In tools Run mode menu using 2 key new tools offset value can be enter bye numeric keys



Press Enter key to confirm Tool No.

Now display shows last reading changed while tool offset calculation plus tool offset value of the selected tool no.

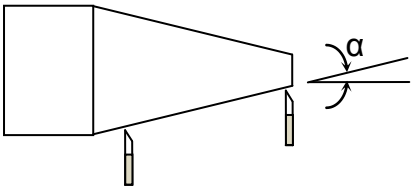
*9.2.1.4. **Exit from Tool Offset Mode***



Press Enter key to exit from Tool offset mode.

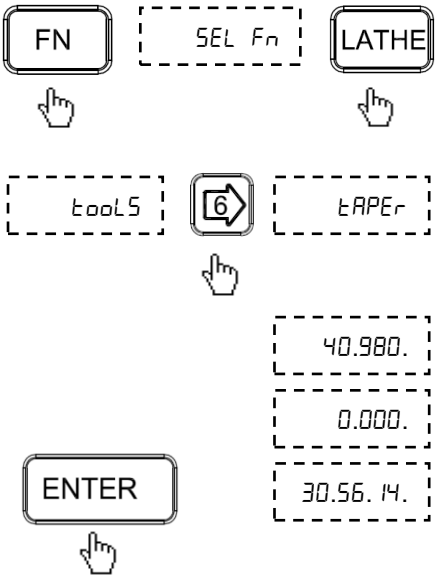
"Tools mode Exit" message will flash on screen and DRO will come in normal counting mode.

9.2.2. Taper function



Taper function allows user to calculate taper of the job. Measurements carried out in Taper function are Radius of taper and Angle θ° of taper. Taper on axis setting is available in DRO setup menu. This will select where to display taper angle. See Section 6.2

9.2.2.1 Procedure



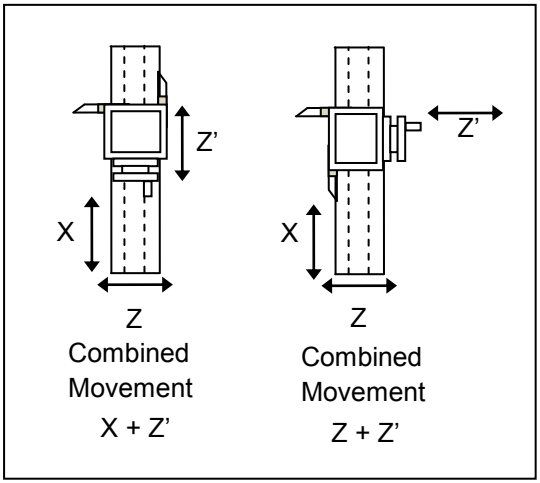
Enter Taper.

Taper calculation is displayed on DRO display.

Following table illustrates Radius and Angle display relation

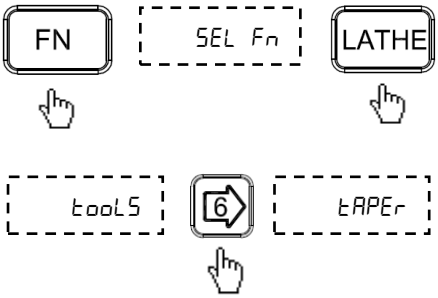
Taper ON axis	Radius (R)	Angle (θ°)
X axis	Y axis	X axis
Y axis	X axis	Y axis
Z axis	X axis	Z axis

9.2.3. Axes Summing function

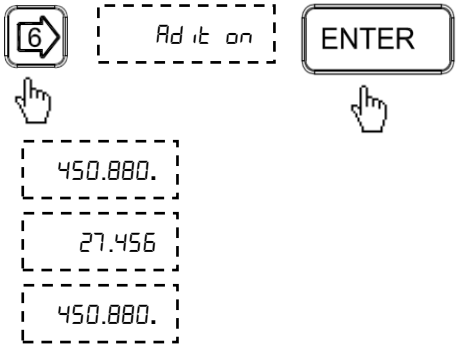


Axes Summing function is used to display combined movement of either X – Z' axes pair or Z – Z' axes pair. The summing axis pair can be displayed either on X axis or Z axis. Summing pair axis configuration setting is available in DRO setup menu. See Section 6.2

9.2.3.1 Procedure



Enter Summing pair function.

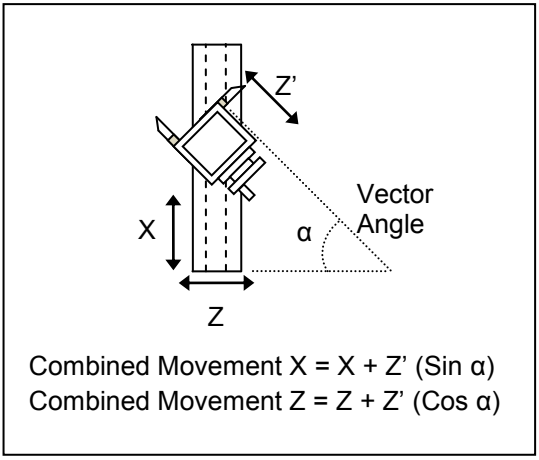


Summing pair result is displayed on DRO display.

Following table illustrates Summing axis pair and display relation.

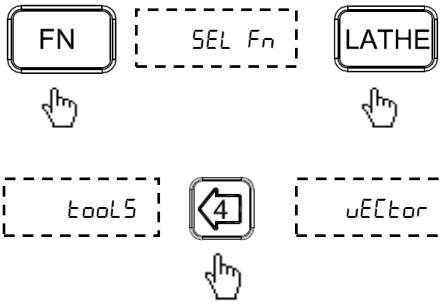
Summing axis pair	Combined movement displayed on axis
X axis & Z' axis	X axis
Z axis & Z' axis	Z axis

9.2.4. Vectoring function

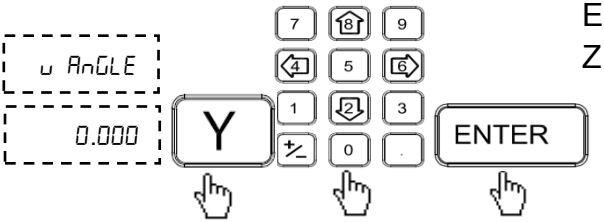


Vectoring function is used for displaying combined movement of either X – Z' axis pair or Z – Z' axis pair taking into consideration angle between Z and Z' i.e. α. The resulting combined movement is displayed on X and Z axis.

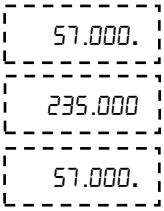
9.2.4.1 Procedure



Enter Vector function.



Enter angle between Z and Z' axis.



Resulting combined movement will be shown on DRO display.

Following table illustrates combined movement and display relation

Combined Axis Movement	Combined Movement displayed on
X + Z' (Sin α)	X Axis
Z + Z' (Cos α)	Z Axis

9.3. EDM Machine Specific Functions

9.3.1. Circular Bolt Hole Function (PCD)

See Section 9.1.1

9.3.2. Angle Hole Function

See Section 9.1.2

9.3.3. Arc Contouring Function

See Section 9.1.3

9.3.4. Linear Function

See Section 9.1.4

9.3.5. Polar Function

See Section 9.1.5

9.3.6. Pre-Set Depth (PSD) Function

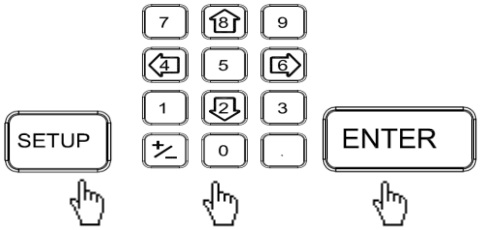
PSD feature is used to control relay at a pre-defined depth setting. This feature is widely used in Electric discharge machines (EDM) where sparking process has to be stopped after reaching a required predefined value.

This feature is available only for Z-axis in case of 3 axes DRO and on X axis in case of 1 Axis DRO.

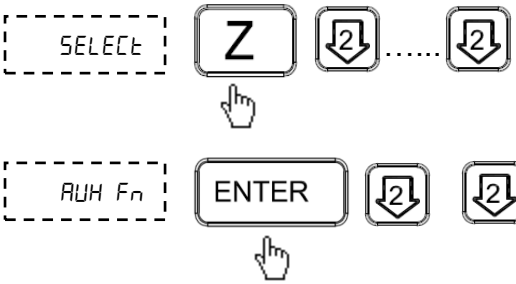
PSD is also sometimes referred as Single Output function.

9.3.6.1. Setting for Time Delay

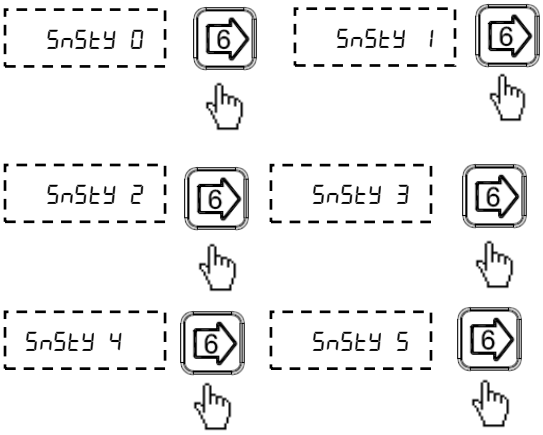
There are five pre-defined delay settings available which can be set as follows:



Enter setup menu by entering LOC code.



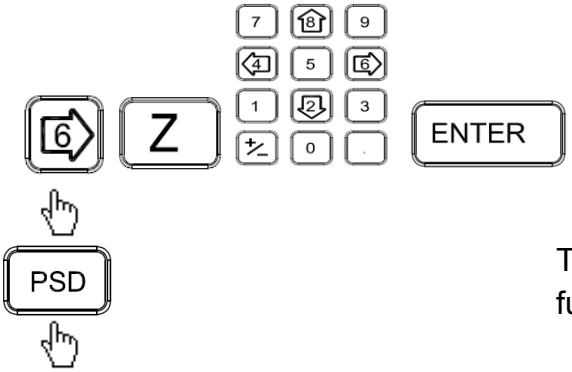
Note that this option is available only on Z axis for 3 axes DRO and on X axis in case of 1 axis DRO.



Select sensitivity level by using left and right keys.

Sensitivity Count	Time Delay in seconds In mm mode	Time Delay in seconds In Inch mode
SNSTY0 (SnStY 0)	0.000	0.000
SNSTY1 (SnStY 1)	0.118	0.210
SNSTY2 (SnStY 2)	0.236	0.420
SNSTY3 (SnStY 3)	0.354	0.630
SNSTY4 (SnStY 4)	0.472	0.840
SNSTY5 (SnStY 5)	0.590	1.050

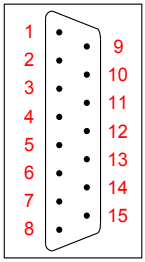
9.3.6.2. Using PSD Function



Enter preset distance to travel for Z axis.

To execute PSD function press PSD key.

9.3.6.3. Pin Connection details:



Pin No.	Description	Pin No.	Description
1	**Relay NC**	**9**	**Relay NC**
2	**Relay Pole**	**10**	**Relay Pole**
3	**Relay NO**	**11**	**Relay NO**
4	**-**	**12**	**-**
5	**Ext. SW +**	**13**	**-**
6	**-**	**14**	**Ext. SW**
7	**-**	**15**	**-**
8	**-**	**-**	**-**

- The external switch (Pin no. 5 and 14) has the same functionality as PSD key on keyboard.
- Relay contact ratings: 24 V at 2A current maximum.
- PSD ON will activate the relay connecting the Relay NO and Pole.

10. Auxiliary Functions

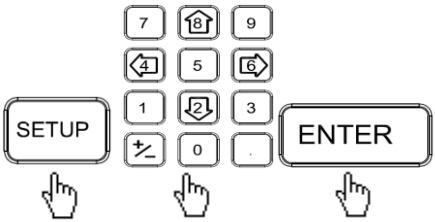
10.1. Touch Probe Functions

Touch probe also called as Contact probe is a device which gives a trigger signal when it comes in contact with the work-piece. The EL300 DRO uses this trigger signal to execute certain functions which helps the operator to set an axis or measure a work-piece.

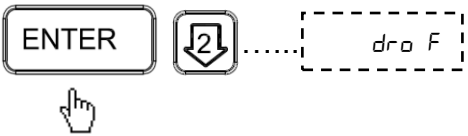
Probe functions are categorized into following categories:

10.1.1. Basic settings:

- DRO Type: The DRO can be configured as “DRO T” and “DRO F” in setup mode. The “DRO T” mode flashes the probe message on trigger. And the “DRO F” freezes the coordinates on trigger.

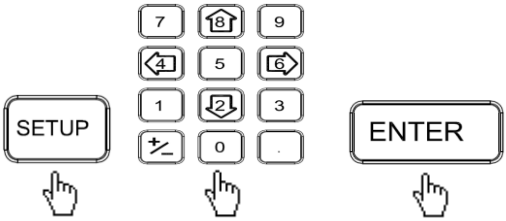


Enter setup menu by entering LOC code.

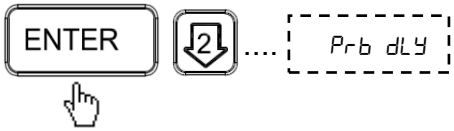


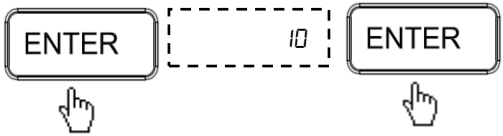
Toggle using 4 and 6.

Probe Delay: This delay is provided to avoid multiple probe trigger during measurement. The user can set value between 1 second to 60 seconds.

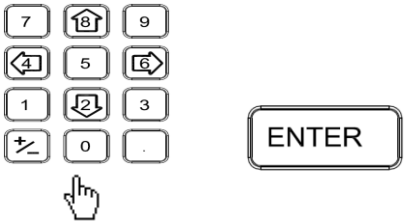


Enter setup menu by entering LOC code.



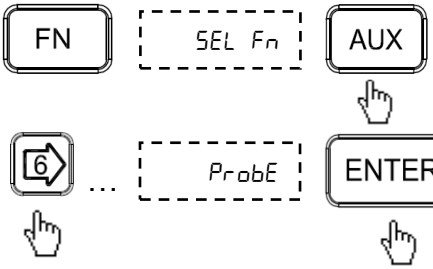


Previous delay value is displayed.

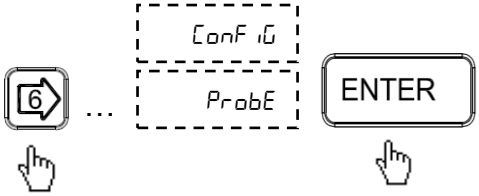


Enter new delay.

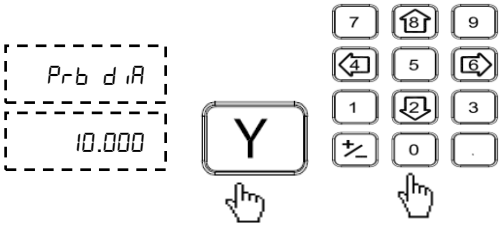
Probe Diameter and length: Before using the other probe functions make sure that the probe diameter and length are entered.



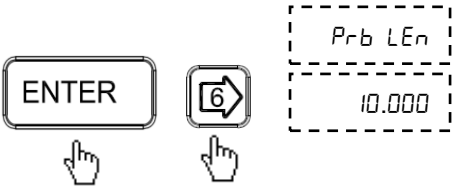
Enter Probe menu.



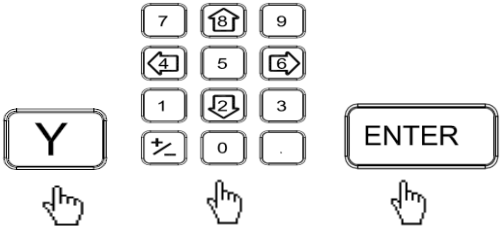
Enter Probe configuration menu.



Enter Probe diameter.



Probe Length message.

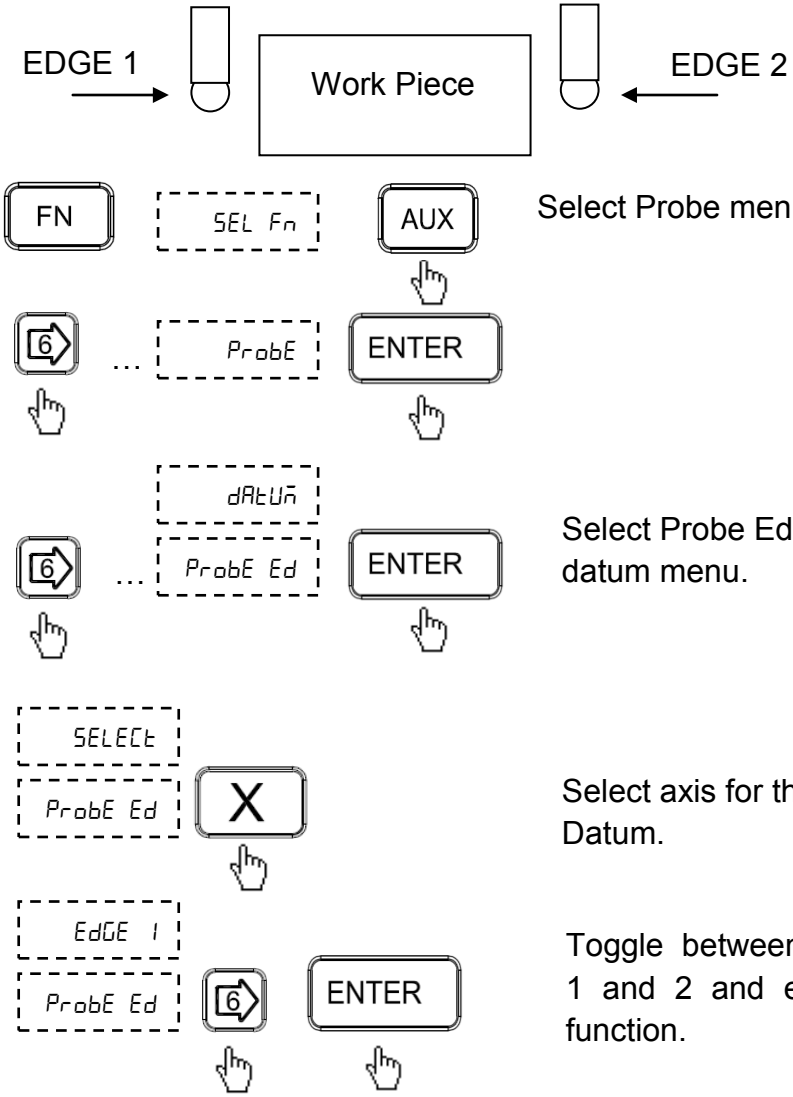


Enter Probe Length.

Press C key to come normal counting mode.

10.1.2. Special probe functions:

- Datum function: The co-ordinates of the datum can be set by probing edges or surfaces and capturing them as datum.
- Datum by edge: Here the DRO sets the datum at the trigger point of the work piece.



Select Probe menu.

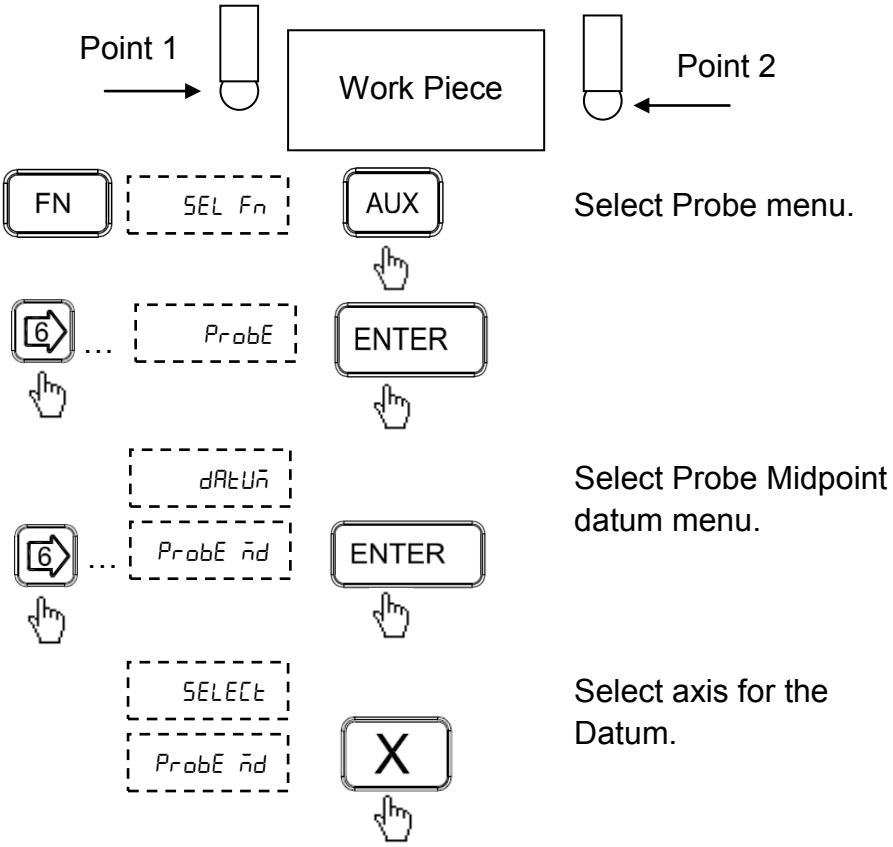
Select Probe Edge datum menu.

Select axis for the Datum.

Toggle between Edge 1 and 2 and execute function.

The DRO receives the trigger pulse from the probe and sets the datum accordingly. (After the trigger pulse the DRO waits for the user to set the axis at the datum point). When trigger pulse is sensed user can enter the desired co-ordinates of the datum.

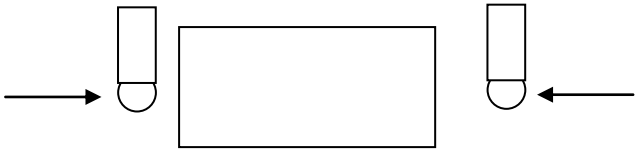
Datum by midpoint: Here the DRO sets the datum at the midpoint of the two triggered points.



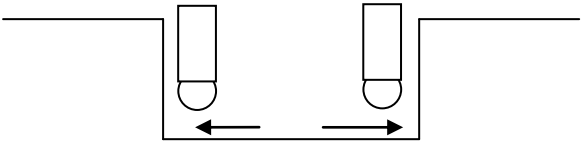
Move the probe towards work piece edge 1 till the DRO receives first trigger pulse. Move the probe towards work piece edge 2 till the DRO receives second trigger pulse. Enter the co-ordinates of the midpoint as datum on selected axis.

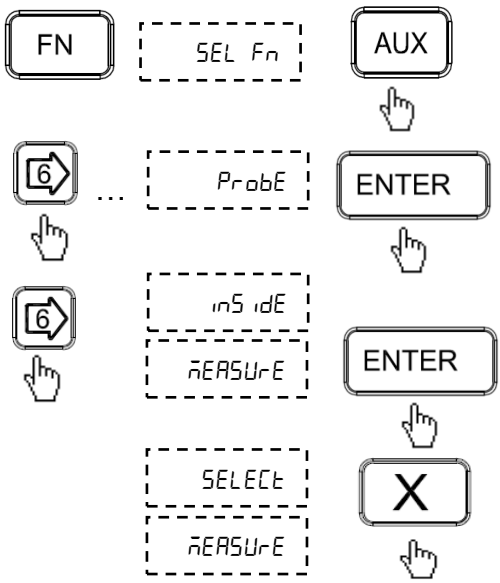
Inside / Outside Measurement: This function is used to measure work piece center and width.

Outside Measurement



Inside Measurement





Select Probe menu.

Select inside or outside measurement.

Select axis for measurement.

Move the probe towards work piece edge 1 till the DRO receives first trigger pulse. Move the probe towards work piece edge 2 till the DRO receives second trigger pulses. The display shows co-ordinates of the center and width of the work piece on the selected axis. +/- key used to freeze the display.

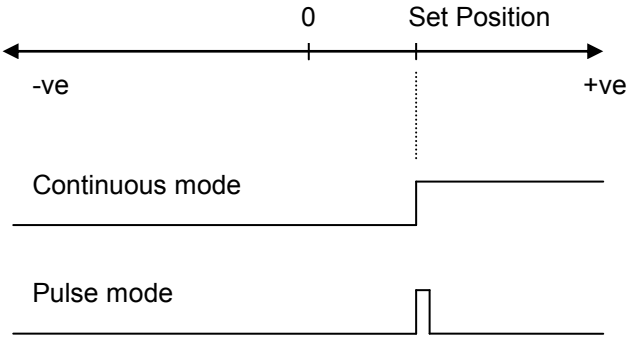
For pin connection of probe refer Section 10.2.4.

10.2. Six Output Functions

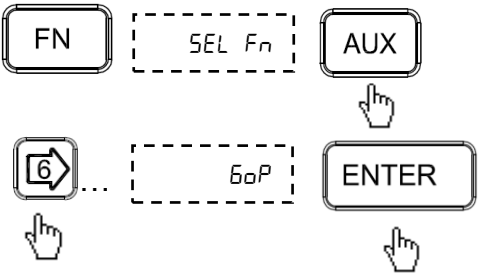
There are six optically isolated outputs.

User entered position for six outputs are stored in DRO; however at any point of operation user has flexibility to edit values using Program function.

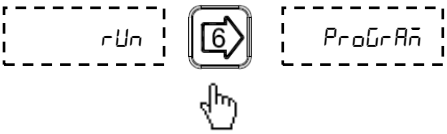
In continuous mode if current tool position is greater than the entered value then respective output remains high, and when it is less the corresponding output remains low. However in case of pulse mode, only pulse is obtained whenever tool passes the set position in either direction. Here the pulse width is variable. User can select a value between 50 milliseconds to 2000milliseconds.



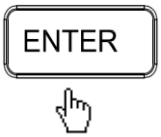
10.2.1. Program Six output (ProGrAm)

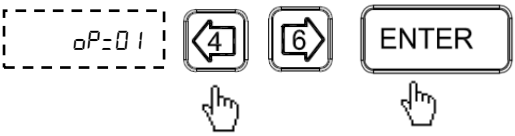


Enter Six Output menu.

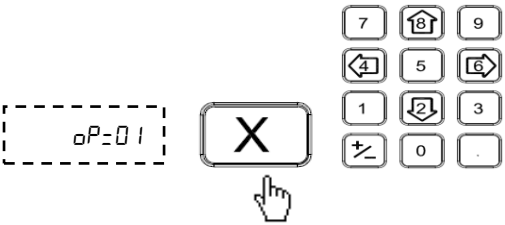


Enter program menu.

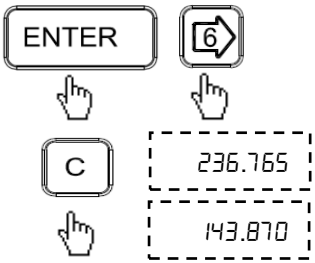




Select total number of outputs using left and right key.



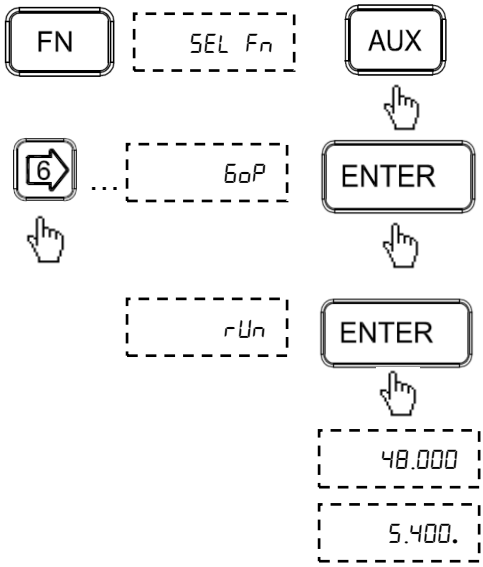
Enter position for each output at the respective axis.



Repeat this step for all outputs.

Press C to exit to DRO display screen.

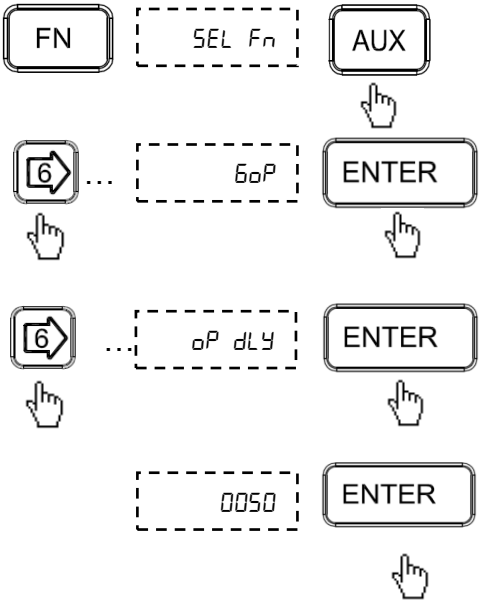
10.2.2. Execute six output (rUn)



Program runs as per positions specified by user.

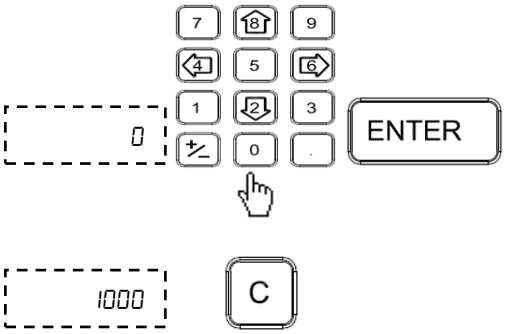
The decimal point on the last digit of the axis indicates that the “six output” is active for that axis.

10.2.3. Programming Pulse width Delay



Enter programmable pulse width delay menu.

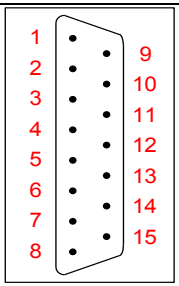
Press ENTER to edit delay of pulse width.



Press ENTER to confirm delay entry.

Press C to exit to DRO display screen.

10.2.4. Pin Connections

Pin No.	Description		Pin No.	Description
1	**Ext. +24V**		**9**	**O/P 1**
2	**O/P 2**		**10**	**O/P 3**
3	**O/P 4**		**11**	**O/P 5**
4	**O/P 6**		**12**	**Ext. GND**
5	**-**		**13**	**-**
6	**-**		**14**	**-**
7	**Probe switch**		**15**	**-**
8	**Ground**		**-**	**-**

Electrical Output specifications:

- Outputs are open collector.
- Maximum current rating 500mA max.
- Output voltage rating 24V max.

Note: "six output" function is not available in EDM version DRO.

10.3. Serial Communication Functions

EL300 allows two modes of serial communication continuous mode and on request transfer. In continuous mode the current displayed counts are transmitted to PC and can be viewed on Terminal Software.

The Following results are shown on Terminal screen.

0010.005 ARMX 0086.980 ARMY 0000.000 ARMZ

Symbol	Meaning
A	Absolute readings
I	Incremental
R	Radial
D	Diametric
X/Y/Z	Axes
M	MM
N	Inch

The Terminal Settings should be as under

Setting options	Values
Communication port	Com1 / Com2
Baud rate /Bits Per second	9600
Date Bits	8
Parity	None
Stop bits	1
Flow Control	None

On request mode the current displayed counts are transferred to PC by pressing ENTER key and can be viewed with EL300 PC Side Utility software (Refer Software Utility Guide for details). If there is a communication error between DRO and PC, DRO displays “Pc fail” message. Press C key to exit the function.

11. Troubleshooting

11.1. Self Diagnostics Mode

EL300 DRO features self diagnostics mode which checks for following areas.

- Memory corruption
- Display function
- Keyboard functioning

Self diagnostics mode is enabled by pressing [.] during startup message. First it will enter in memory diagnostic mode.

If no fault is found the display will show 

Press [ENTER] key to enter into display diagnostic mode. Here DRO will check seven segment display and LED indications.

Press any key to stop display diagnostic and proceed with keyboard diagnostic. Here DRO will display the pressed key.

To exit Self diagnostics mode press [C] key twice.

11.2. Troubleshooting Guidelines

Problem Observed	Guidelines
No display / Display glows momentarily	• Mains supply should be ○ L – N : As specified ○ N – E : < 3Vrms ○ L – E : As specified • Check if switch is working by observing glowing light inside switch. • Check if fuse is intact. If not, replace with spare fuse provided.
No counting by DRO	• Check if encoder connections are properly connected. • Swap encoders to confirm if problem lies with DRO. • Check for calibration factor. It should be set to zero. • Try switching DRO Off and tuning it On again after 1 min.
Counting observed even if there is no movement in any axis	• Ensure that supply is within specified limits. • Check if earth connection is provided. • Check voltage between Neutral and Earth. It should be less than 3V. • Ensure that cable routing is proper and away from high capacity inductive load. • Ensure that encoder armor is intact and properly routed. • Check for voltage fluctuation.
DRO counting gives unexpected results	• Check calibration factor and if required recalibrate DRO.
Display shows 8888888	• Check for display functionality.
Erratic behavior of DRO	• Try switching DRO Off and turning it back on after 1 min. • Check if keypad is locked. • Try resetting DRO to default settings.

For any additional assistance contact your nearest service center.

12. List of Display Text

uEr	VER
SELECt	SELECT
L inEAr	LINEAR
AnGULAr	ANGULAR
SC	SC
dP	DP
rAd	RAD
d iA	DIA
r iGht	RIGHT
LEFt	LEFT
CAL ib	CALIB
LEC	LEC
SLEC	SLEC
d iSPuAL	DISPVAL
CAL FAC	CAL FAC
EnF on	ENF ON
EnF oFF	ENF OFF
AUH Fn	AUX Fn
SEr iAL	SERIAL
SEr Con	SER CON
dro F	DRO F
dro t	DRO T
Prb dLY	PRB DLY
LoC oFF	LOC OFF
LoC on	LOC ON
SLEEP t	SLEEP T
SAu ChG	SAV CHG
End	END
hoñE	HOME
ñC rEF	MC REF
SEt ñC	SET MC
tooLS	TOOLS
ProGrAñ	PROGRAM
rUn	RUN

LEArn	LEARN
StEPno	STEPNO
ProbE	PROBE
CEntrE	CENTRE
PoLAr	POLAR
6oP	6OP
dAtUñ	DATUM
Prob Ed	PROB ED
Prob ñd	PROB MD
inS idE	INSIDE
ñEASUrE	MEASURE
oUtS idE	OUTSIDE
ConF iG	CONFIG
b hoLE	B HOLE
C irCLE	CIRCLE
ArC	ARC
EntCnt	ENTCNT
rAd iUS	RADIUS
Str AnG	STR ANG
End AnG	END ANG
hoLES	HOLES
ArC Cnt	AR CNT
tooL d i	TOOL DI
int CUt	INT CUT
EHt CUt	EXT CUT
ñ id CUt	MID CUT
ñAH CUt	MAX CUT
AnGhoLE	ANGHOLE
P itCh	PITCH
AnGLE	ANGLE
ññ	MM
inCh	INCH
inVAL id	INVALID
oP dLY	O/P DELAY

tAPEr	TAPER
Ad iton	ADITON
uECtor	VECTOR
u AnGLE	V ANGLE
Add	ADD
SUb	SUB
nnULt i	MULTI
d iu	DIV
S in	SIN
CoS	COS
tAn	TAN
AS in	ASIN
ACoS	ACOS
AtAn	ATAN
rSt dro	RST DRO

13. DRO Models

Description	Ordering Code No.
EL301-S, 1 Axis Simple without Options	EL3P-11-0000
EL302-S, 2 Axis Simple without Options	EL3P-21-0000
EL303-S, 3 Axis Simple without Options	EL3P-31-0000
EL302-L, 2 Axis Lathe without Options	EL3L-21-0000
EL303-L, 3 Axis Lathe without Options	EL3L-31-0000
EL302-M, 2 Axis Mill without Options	EL3M-21-0000
EL303-M, 3 Axis Mill without Options	EL3M-31-0000
EL302-C, 2 Axis Special without Options	EL3C-21-0000
EL303-C, 3 Axis Special without Options	EL3C-31-0000
EL311-S, 1 Axis Simple with Options	EL3P-11-1110
EL312-S, 2 Axis Simple with Options	EL3P-21-1110
EL313-S, 3 Axis Simple with Options	EL3P-31-1110
EL312-L, 2 Axis Lathe with Options	EL3L-21-1110
EL313-L, 3 Axis Lathe with Options	EL3L-31-1110
EL312-M, 2 Axis Mill with Options	EL3M-21-1110
EL313-M, 3 Axis Mill with Options	EL3M-31-1110
EL312-C, 2 Axis Special with Options	EL3C-21-1110
EL313-C, 3 Axis Special with Options	EL3C-31-1110
EL391-E, 1 Axis EDM	EL3E-11-1000
EL393-E, 3 Axis EDM	EL3E-31-1000

Code No: 0073-14-0902
Revision Date: 22th Oct, 2010

Factory:
Electronica Mechatronic Systems (India) Pvt. Ltd.,
37/44, Electronic Co-operative Estate,
Pune-Satara road, Pune – 411009
Maharashtra, India
Phone: +91 (020) 2422 4440, 2422 9398,
Fax: +91 (020) 2422 1881
Email: **info@electronicaems.com**
Web: **www.electronicaems.com**