Operation Manual

Digital Readout Counter : IAP3X-Pearl v3

AccuDRO
support@accudro.com
1-877-407-3515

CONTENTS

A. INTRODUCTION

As a result of extensive Research and Development at *INNOVATIVE AUTOMATION PRODUCTS*, the 'IAP pearl' series of DRO counters are the most comprehensive, reliable, economical and user friendly DRO's available in the market today. This DRO is the latest model of DRO with all world-class features packaged in this compact unit with following advantages & applications.

ADVANTAGES: -

1. Greater positional accuracy.
2. Increased production safety.
3. Easy assembly & functioning.
4. Increased production.
5. Less operator fatigue.
6. Most economical DRO in the market.

APPLICATIONS: -

The **IAP 3X-pearl** DRO can be fitted on conventional machines, either old or new such as,

-Sparking machine
-Center Lathe
-Milling Machine
-Surface Grinder
-Cylindrical Grinder
-Boring Machine
-Special purpose machines etc.
-Floor type boring
-wood working machine
-planomiller
-calibration slides and many more.

B. Keyboard

KEY	MEANING
	**Key Preset mode**
	**Center of circle**
	**Bolt hole / drill on arc key**
	**Axis half key**
	**Function key**
	**Inch / mm selection key**
	**Radius / diameter selection key**
	**Increment / absolute selection key**
	**Run mode key**
	**Tool offset key**
	**Drill on line / matrix/ frame and numeric key 6.**
	**Skew the plane and numeric key 7**

	**Job clock function and numeric key 8**
	**Polar / Cartesian mode and numeric key 9**
	**Special function key**
	**Datum selection and numeric key 2**
	**Relay output function and numeric key 3**
	**Feed rate function and numeric key 4**
	**Calculator function and numeric key 5**
	**Escape Key**
	**Home mode and numeric key 1**
	**Probe function and numeric key 0**
	**Step function and numeric decimal point key “.”**
	**Numeric key “+/-”**
	**Enter key**
	**Axis key**

	**Axis key Y**
	**Axis key Z / Q**

C. SPECIFICATIONS

Input Voltage	**80 TO 290VAC 50HZ**
Power Consumption	**10VA**
Humidity	**85 % at 45ºC Non-condensing.**
Temperature	**0ºC to 50ºC**
Vibrations	**1g, 10Hz to 50Hz**
Enclosure	**280 x 150 x 73.5 mm**
Weight	**2.3 kg**
Maximum count	**+/- 99999.000 mm**
Resolution	**0.1,0.5,1, 5, 10 , 50, 100 Micron (Micrometer)**
Display	**‘7’ segment 14.2mm Green (Count display). LCD- 16 Alpha Numeric character, 2 line (Interactive message display)**
Quantization Error	**+/- 1 Digit**

D. FRONT PANEL & BACK PANEL

1. FRONT PANEL:-

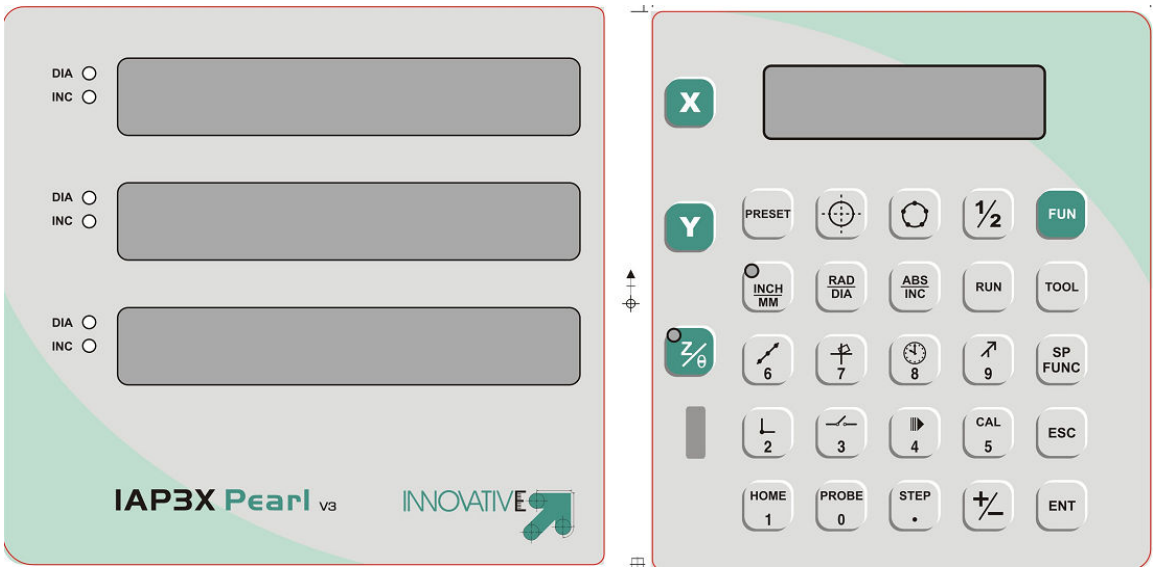
IAP3X-Pearl $_{V3}$ has a keyboard with positive – touch keys. Keyboard houses common indications for all axes, namely INCH/MM and separate indication for ABS/INC, RAD/DIA, and DEG/DMS.

The Display consists of three rows of 7 segments LED for the axis count display. LCD of 16 Alphanumeric character of two lines for interactive message display. When count value is negative then axis count display indicates negative (-) sign & positive (+) when blank. The negative sign if floating for better representation of negative values. The third axis display is multiplexed for “Z” and “C” axis and can

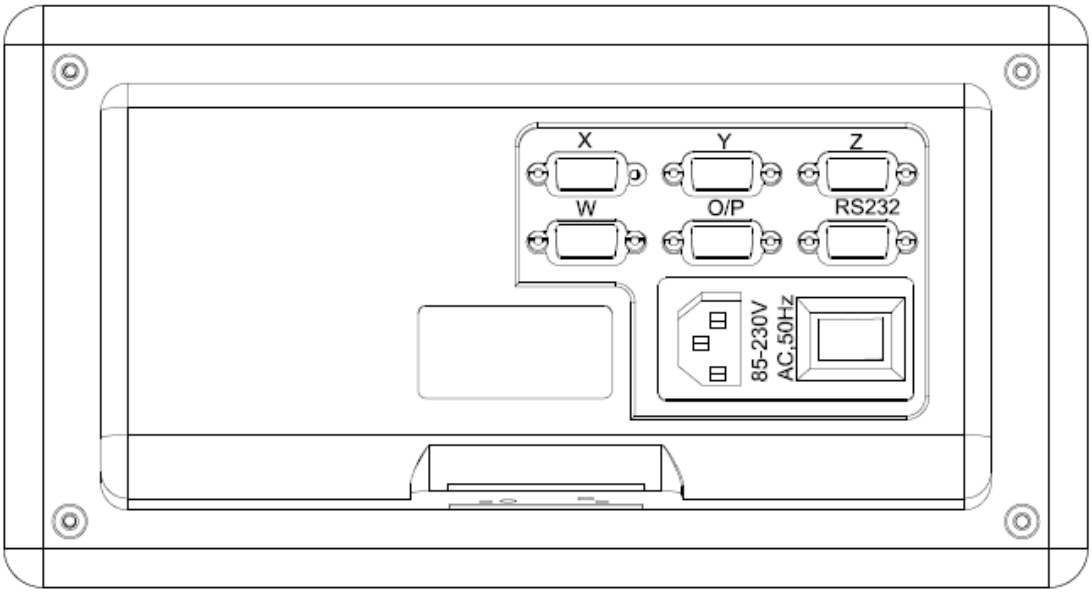
be toggled using long pressing .....  (.... mean long press the key or press

Hold the key for few seconds)

FRONT PANEL OF IAP3X-pearl v3



2. BACK PANEL OF IAP3X-pearl



E. Setting up the DRO / Engineering mode

This mode is used to configure the DRO to user's need and requirement. This is a special mode and is generally intended to use by person adverse to DRO and its manual. We shall refer this mode as "Setup mode" hence forth.

To set the DRO for first time, please read the following points.

1. To start the setting mode, press and hold the FUN key and simultaneously turn the DRO power ON.

   OR
   You could also enter into Setup mode any time during the normal operation by long pressing FUN key.

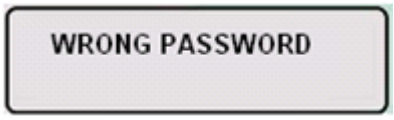
This function will ask for password.

Display shows

Use numeric keys to enter the password. Password is "654321"

and press ENT

If the password entered is wrong display shall show for a second



and go back for password reentry.

Correct password shall turn the function on

Press ESC to quit function mode,

On entering function mode display shows
Press the respective axis key for which you have to set the parameters. Then follow the key sequence (flow chart given) to edit and modify the parameters

Press the respective axis key for which you have to set the parameters. Then

2. It is necessary to read the complete procedure of setting the DRO before its implementation.
3. After entering in the Engineering mode the display shows the last stored parameters (or the factory set parameters if using for the first time after purchase). Referring the key sequence you can make new settings.
4. To save the new settings press the 

key.
5. Press the 

key to bring DRO out of the engineering mode and normal counting mode will be enabled.
6. Press 

key to advance to next function
7. Press 

key to scroll through different sub menus of the selected function.

Brief information about the different parameters in the Engineering mode

Pearl $_{v3}$ series of DRO consists of following modes which need to be set before use to optimize the quality of work done with the help of this DRO. There are in all 30 different menus / functions in set up mode.

1. UNIT SELECTION
2. MODE SELECTION
3. COUNTING DIRECTION
4. MEASUREMENT TYPE
5. ANGULAR MODE
6. ENCODER RESOLUTION
7. DISPLAY RESOLUTION
8. LINEAR CORRECTION FACTOR
9. NON LINEAR (SEGMENTED) CORRECTION FACTOR
10. ANGULAR CORRECTION FACTOR
11. NON ANGULAR CORRECTION FACTOR
12. SCALE FACTOR
13. PLANE FOR CIRCLE MODE
14. PLANE FOR ARC MODE
15. PLANE FOR LINE MODE
16. PLANE FOR MATRIX FUNCTON
17. PLANE FOR FRAME FUNCTION
18. PLANE FOR SKEW FUNCTION
19. BAUD RATE SELECTION
20. SENSITIVITY SELECTION
21. APPROACH WARNING
22. RELAY OUTPUTS
23. REFRESH RATE
24. RELAY CONTINUOUS/DISCONTINUOUS
25. PRESCALAR
26. CONSTANT SURFACE SPEED
27. RELAY CYCLIC MODE
28. SERIAL OUTPUT
29. FACTORY SETTINGS
30. LANGUAGE CHANGING MODE

Note *: Changes to these menus are applicable for the only axis you have selected. Rests are applicable for all axes.

1. Setting measurement unit selection: (function-00)

DRO can be configured in either inch (imperial) or mm (metric) unit of measurement. Each individual axis can be configured to measure in inch or mm unit. This can be changed with the help of 

Once mm or inch unit is selected, the DRO permanently remains in this mode

and the on line conversion by pressing the 

key is disabled for all axes.

Inch-mm indicates that the on line unit conversion mode is enabled and the DRO can toggle the unit of measurement by pressing the `inch/mm' key.

In this case the unit of measurement at power ON is same as that of unit during the last power OFF.

Pressing plus minus gives following options

Press 

after you select the above sub menu.

Note: Changes to this menu are applicable for all axes.

2. Setting the measurement mode selection: (function-01)

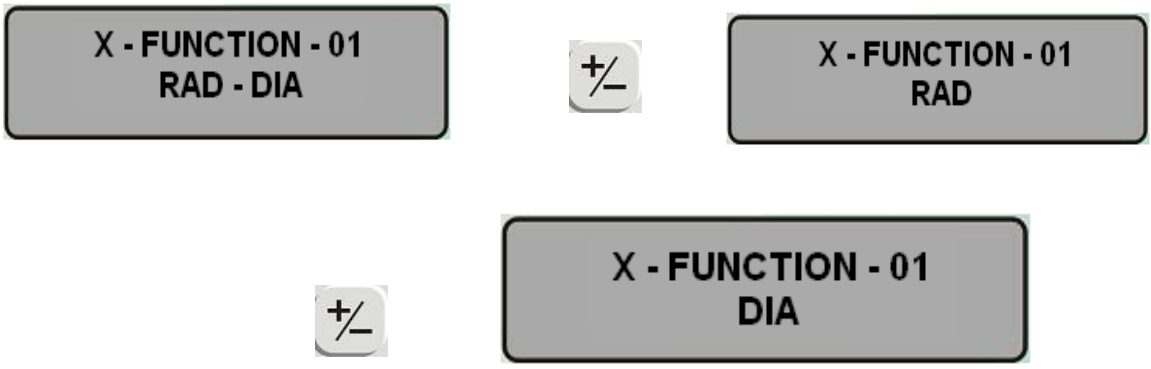
DRO can be configured to operate either in Rad (radial measurement) or in Dia (diametric measurement) mode of measurement.

Once Rad or Dia mode is selected, the DRO permanently remains in this mode and the on line conversion by pressing the RAD DIA key is disabled for this particular axis.

Rad-Dia indicates that the on line measurement conversion mode is enabled and the DRO can toggle the mode of measurement by pressing the RAD DIA key.

In this case the mode of measurement at power on is same as that of mode during the last power off.

Different sub menus are as



Press ENT after you select the above sub menus.

Note: Changes to this menu are applicable for only axis you have selected (axis x in above example).

3. Setting counting direction:(function-02)

The direction of the slider can be set as per requirement. The user can toggle between `pos – neg‘ or `neg – pos‘ direction, rather this menu changes the direction of quadrant for a particular axis.

Press ENT after you select the above sub menus.

Note: Changes to this menu are applicable for only axis you have selected (axis x in above example).

4. Measurement type:(function-03)

This function is used to set a particular axis in linear or angular mode.

Setting angular will put the selected axis in angular measurement.
Selecting particular axis to angular mode will block the linear functions related to that particular axis or related to that axis. Same is applicable for linear selection.

Press 

after you select the above sub menus.

Note: Changes to this menu are applicable for only axis you have selected (axis x in above example) and partially applied to other axis..

5. Angular type:(function-04)

This menu is used to put the selected axis to display angular values in either degrees or degree.minutes.seconds format

If selected dd.mm.ss the led on front panel shall glow.

Press 

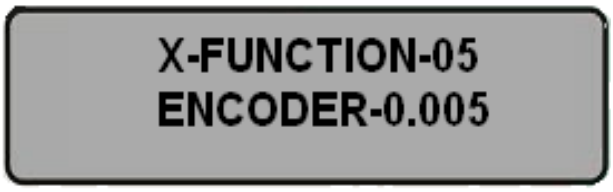
after you select the above sub menus.

Note: Changes to this menu are applicable for only axis you have selected (axis x in above example).

6. Setting encoder resolution: (function-05)

The following different encoder resolutions can be set:

0.0001mm,0.0005mm,0.001mm,0.005mm,0.010mm,0.025mm,0.050mm, 0.100mm. This specification is dependent on what is the resolution of the linear scale
you connect to the DRO.



Scroll through above options using +/− key.

Press ENT after you select the above sub menus.

Note: Changes to this menu are applicable for only axis you have selected (axis x in above example).

7. Setting display resolution: (function-06)

The following different display resolutions can be set:

0.0001mm ,0.0005mm,0.001mm,0.005mm,0.010mm,0.050mm,0.100mm
This menu shall only set the display resolution.

Scroll through above options using +/− key

8. Linear correction factor: (function -07)

There may be some error in the actual reading and that displayed by the DRO. This error is due to the non linearities the machine tool or the weight of job loaded causing the machine table to sag. The DRO counter can be calibrated to compensate the machine error by a factor called as correction factor. This can be set using CF set procedure.

The correction factor can be set between any values

0.0000001 to 9.9999999
That is the actual reading can be multiplied by this factor to show final reading on the DRO display.

There are two diffract procedures for set this factor.

a. You could directly edit the correction factor to set a value

Error = standard reading /actual reading

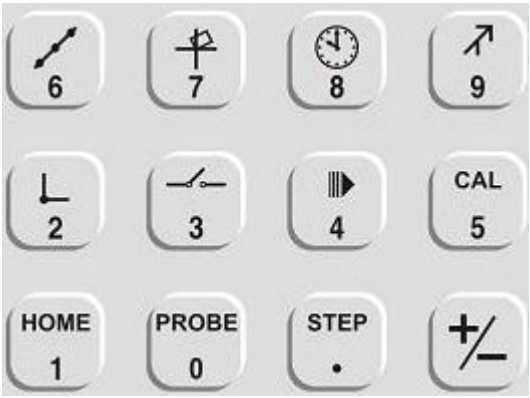
This error value is directly feed in to the dro using numeric keys.

Step 1.On arrival to function 7 press 

7 segment display of the selected axis now shows the present correction factor. The factor is unity on factory setting.

Step2: Use numeric keys to enter the new value

Note: value cannot be “0”



Step3: Press 

Display now shows

Step 4 Press 

Now the initial correction factor if any will be set to 1 for the selected axis and the DRO now goes into normal counting mode with the function display showing

Step 5

Place the master (slip) of known value on the table parallel to the axis you need to calibrate. Say the length of slip is 80mm

Reset the axis you have selected by pressing 

and 

at one end of your master

Step 6

Move the slide to other end of the master the value on X axis shown is say

Press  --------  ------- 

The LCD display shall show

Step 7

Enter the value of master (80.000mm) in this example

9. Non linear correction factor NLCF: (function -08)

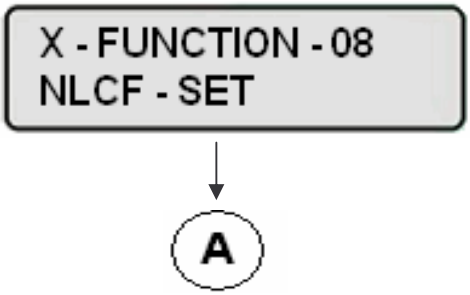
The non linear correction factor is used to find out counting error in machine. It can be evaluate by using this function machine. This function is only available on the reference marks scales. If you want to defined non linear correction factor then it will be applied to the reference marks of scale have been crossed.

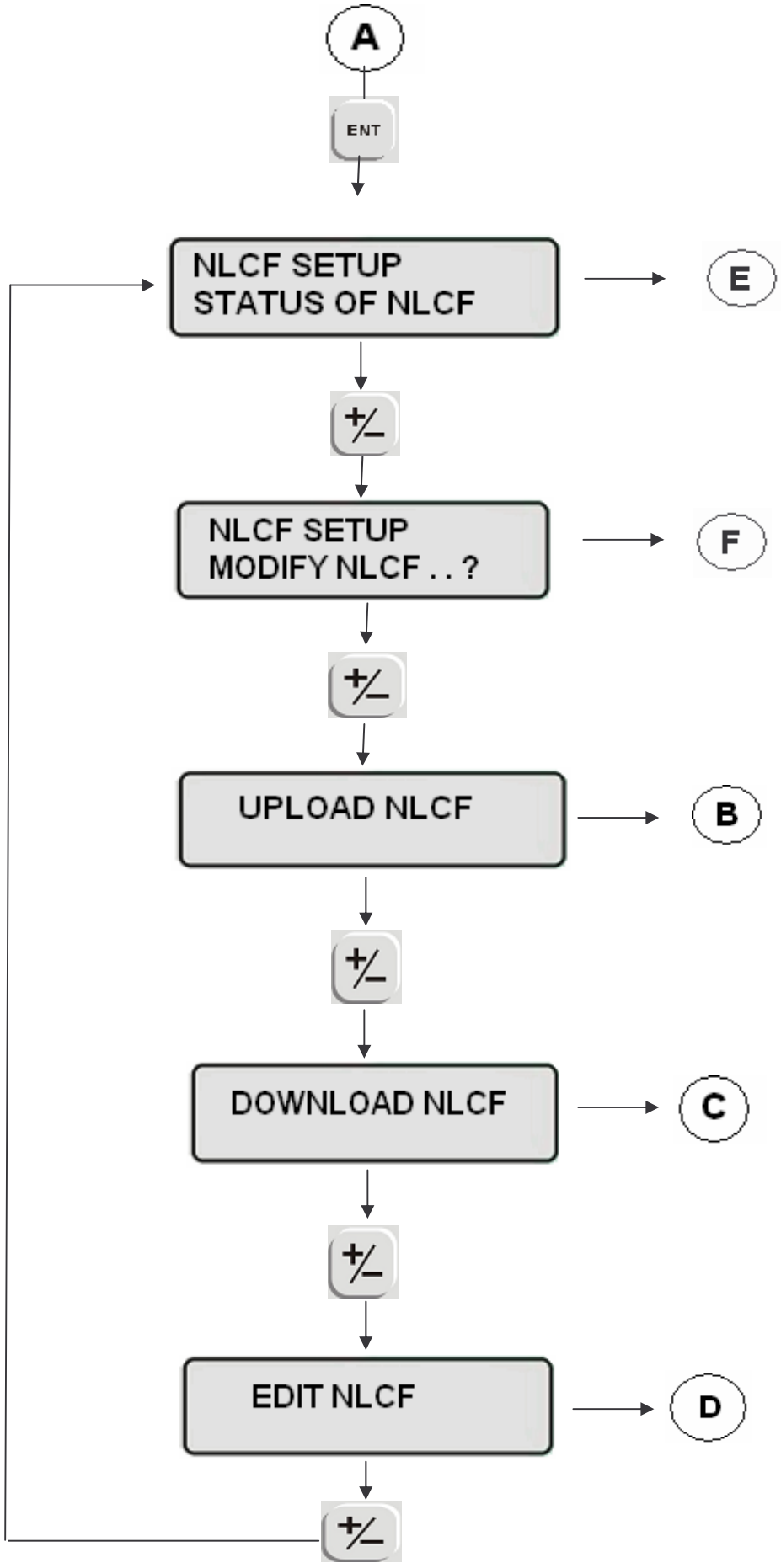
This function should be applied, if the results of scales are compared with reference standard show an alternating or oscillating deviation. It should be required correction value are calculated and modified value is entered. It entered in steps. It has 200 steps per axis.

If you apply this function, errors can be reduced and increases it's accuracy.

Step1: On arrival to function 08

The display shall show




A
ENT
NLCF SETUP
STATUS OF NLCF
E
+/-
NLCF SETUP
MODIFY NLCF . . ?
F
+/-
UPLOAD NLCF
B
+/-
DOWNLOAD NLCF
C
+/-
EDIT NLCF
D
+/-

Status of nlcf :-

Then press 

Now display shows

(If nlcf is not effected)

(If nlcf is effected)

It is toggled by using 

key.

Before modifying nlcf, deactivate nlcf otherwise dro will malfunction.

Note: - Before activativating nlcf ensure that nlcf values are entered.

Entry of nlcf :-

Step 4: Press 

Display shows homming, which you have to select respective axis such as X,Y,Z or Q (e.g X axis is selected) then move the slide up to reference mark crossed and display shown X axis reading.

Now move the slide up to starting point then display shall show

Step 5: Press 

Display shall shows momentary

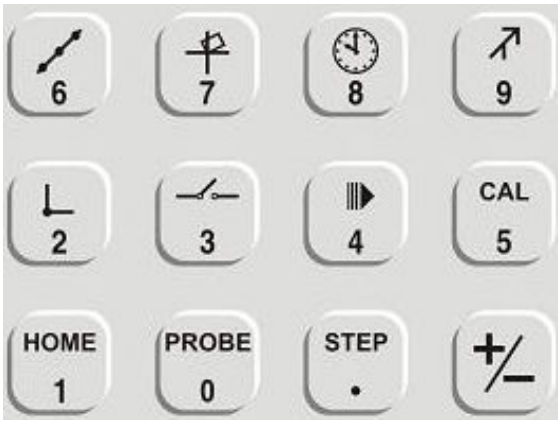
After that display show

Step 6: Take observed reading for respective axis by moving slide. It is shown in display.

Press 

Display show

Enter value by using numeric keys.



Enter the slip value, showing the respective axis (e.g. 11.000)

Now, Display shall show

In this way, steps can be added**.** Its maximum limit is +/-128.If you want to negative steps then press  key.

Display show

The same procedure of step 01 can be follow as above.

Step: 7 To effect of NLCF press 

Now display show

Then press 

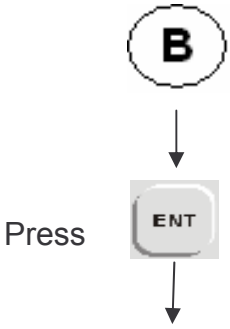
Display show

Now switch OFF DRO and switch ON and going to machine reference is essential.

Upload nlcf :-

This function gives the facility to take the backup of nlcf steps which have been loaded into DRO using modify nlcf function.

Step 1



DRO starts to send observed value and standard value on serial port.
DRO transmits these values in following format.
It first transmits ‘S’ character to indicate that transmitting is going to start.
After it transmit data as follow,

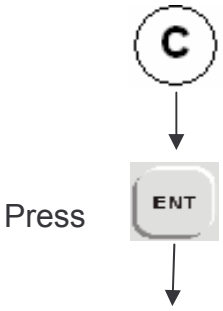
XXX.XXX(Observed value)**one tab space** XXX.XXX(Standard value)<new line>
XXX.XXX(Observed value)**one tab space** XXX.XXX(Standard value)<new line>

After transmitting all data, it transmits <CR> to indicate that all values are transmitted.

Then it goes to DOWNLOAD NLCF function.

DOWNLOAD NLCF :-

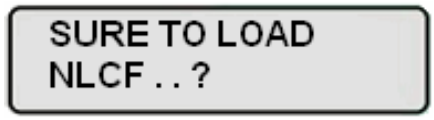
Step 1



NLCF values are downloading from computer to DRO by using DPTOOLS – v2 software.

Step 3 Press 

Now display show



Then press 

Display show

Now switch OFF DRO and switch ON and going to machine reference is essential.

OR

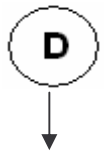
If you want to quit the function then press 

key, then go to next function i. e. EDIT NLCF

Step 4

Edit nlcf :-

This function is used for modifying observed value or standard value.



Press ENT

Now display shows

SELECT STATION
STATION - 001

Select station by using numeric keys.

Step 5 Press ENT key

Display shall shows

EDIT OBSERVED
VALUE . . . . . .

Now enter observed value by using numeric keys

Step 6 Press ENT

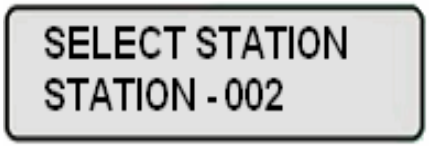
Display shows

EDIT STANDARD
VALUE . . . . . .

Then enter standard value by using numeric keys.

Step 7 Press ENT

Display shall show

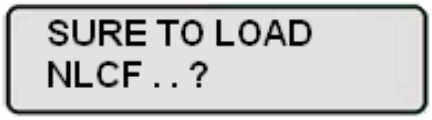


Then go to select next station. For example display shows, STATION – 002

Step 8 After modifying the values

Press ESC key.

Now display shows



Then press ENT

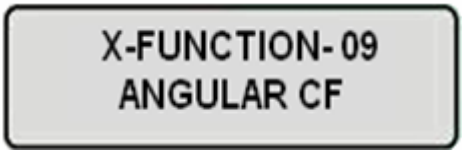
Display show

Now switch OFF DRO and switch ON and going to machine reference is essential.

10. Angular correction factor: (function 09)

This function is used to calibrate the system if placed in angular mode.

Display shows



There are two methods to set a particular angular encoder.

1. Mode 1: used when a particular PPR of the encoder is not known (PPR is pulses per rotation), OR fine tunning angular errors.
2. Mode 2: Direct PPR entry.

Mode 1

Step 1:

Press 

Display shows

Display for selected axis shows zero,

Step 2

Move the selected rotary axis with a known angle (against some angular master) In this case we consider it to be 360 degree I .e 1296000 seconds.

You could press respective axis key any time to reset the count in between

E.g. press  once to reset count on x axis back to zero.

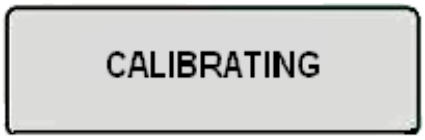
Suppose you rotate the angular axis by 360 degrees but the actual count displayed is 1295800

I.e there is error of 200 seconds, it shall show 1296000
(This might be an error or the PPR is not properly set.)
PPR is pulses per rotation generated by the encoder.

Step3:

Press 

Display shows



This specifies enter the master angle value (1296000 seconds is 360 degree, is the master in this example)

Use Numeric entry to reenter the master if it is different. Numeric keys in this case behave in right entry mode and ensure you enter the new angular master properly.

Note: changes made to this function are applicable to this axis only

Step 4:

Press 

The axis is now calibrated and moves forward to next engineering function.

Mode 2:

Step 1:

Press 

Display shows

Display for selected axis shows zero,

Step 2

Long press axis key (key ..... 

) in this case (..... means you have to press and hold axis key for few seconds)

Display shows

Step3 

Use Numeric entry to enter the PPR of the encoder.

Suppose your encoder is of resolution 1024 CPR

PPR is 1024 * 4 = 4096

so enter 4096

this means total 4096 pulses will create a master reading that is 1296000 seconds.

Step 4

Press 

Display shows

This specifies enter the master angle value (1296000 seconds is 360 degree, is the master in this example)

Use Numeric entry to reenter the master if it is different. Numeric keys in this case behave in right entry mode and ensure you enter the new angular master properly.

Step 5

Press 

The axis is now calibrated and moves forward to next engineering function.

Note: changes made to this function are applicable to this axis only

11. Non angular correction factor: (function 10)

Non angular correction factor should be applied, if the results of comparison with reference standard value and observed value of the machine. The value is showing the respective axis as per your requirement to define in function 04 (angular mode). In this function error value can be find out and modified value can be entered by using following procedure then machine starts in normal counting mode. It means the error value between two entered adjacent corrections points is calculated with angular interpolation.

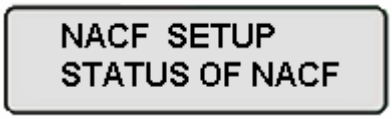
Note: - Before applying NACF function, the function 03 (measurement type) in angular mode and function 04 (angular type) in either degrees or degree - minutes-seconds format. After that calibrate the respective axis such as X, Y or Z by using function 09 (angular correction factor)

Step 1 On arrival to function 10

Now display shall show

Step 2 Press 

After that display shall show



Then it will be check the status of NACF, display shows current status of NACF

Step 3 Press ENT

Now display shows

NACF DEACTIVATED +/- NACF ACTIVATED

It is toggled by using +/- Key.

Step 4 Press

Now display shows

NACF SETUP
MODIFY NACF ..?

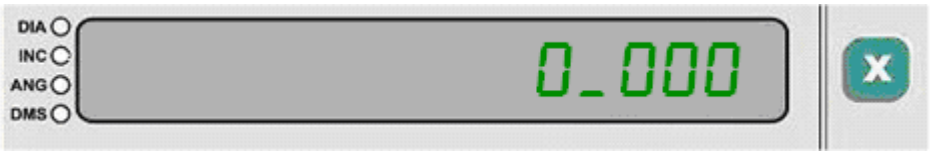
After that press ENT

Display shall show

INNOVATIVE PEARL
HOMMING X AXIS

Then move the selected rotary axis up to reference point has been crossed.

Display for selected axis shows (e.g. X-axis is selected)



After that move the selected rotary axis up to the starting position of the angle, then display shall show some value.
For example display shows an angle 0.990 degree.

Step 5 Press ENT key.

Now display shall momentary

NACF SETUP
NACF - PROGRAMMED

After that display shows

NACF SETUP
STEP - 001

In example display showing value

Step 6 Press STEP key.

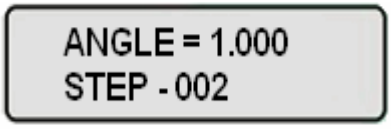
Display shows

NACF SETUP
ENTER DEGREE

Now enter the master angle value in degrees
In above example , axis showing a master angle value.

Step7: Press 

Then display showing the value entered in step 001 and next step can be added.



In this way you can enter maximum 225 steps in selective axis.

Step 8 : After that it should apply effect of NACF escape the NACF

Then press 

key.

Now display shall show momentary.

After that display shows

When you have to load NACF then press 

Now display shows

Switch off DRO and switch on DRO, then DRO is going to machine reference mode i.e. normal counting mode.

12. Scale factor: (function 11)

Scale factor may be used to grow or shrink scale part. By setting appropriate value of this factor, error due to environment (e.g. temp, humidity etc.) can be minimized.

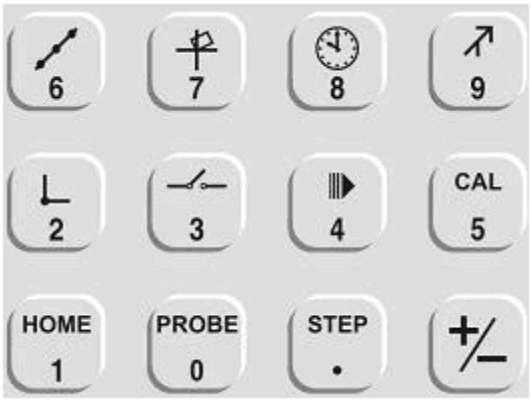
A scale factor of 1.0 creates a job of exact size. A scale factor greater than 1.0, grows the part and scale factor less than 1.0 shrink the part. If scale factor is -1.0 will get mirror image of the part of same size.

Scale factor can be entered in the range between -9999.9999 to 9999.9999 using numeric keys.

Step 1 : On arrival of function 11 press 

7 segment display of the selected axis now shows the present scale factor. The scale factor is unity on factory setting.

Step 2: Use numeric keys to enter the new value.
Note – value cannot be “0”.



Enable / Disable Scale Factor –

Enable and disable of scale factor can be done in main window i.e. the position while DRO is switched ON and not in setup mode.

To Enable scale factor ,

Long press  key.

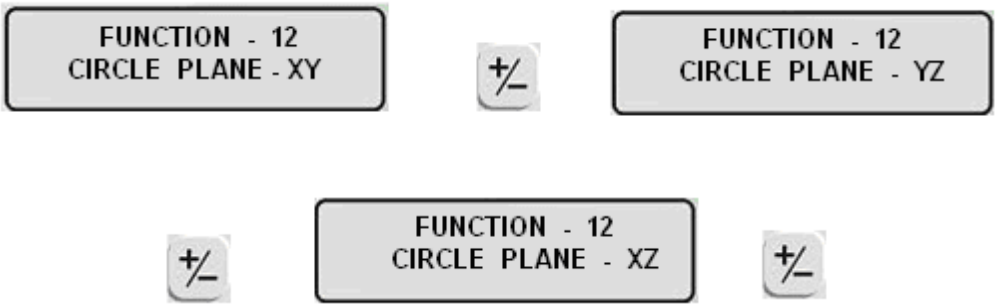
Display shows

After completing, scale factor will be ON.

To disable scale factor long press  key.

Now display shows

13. Circle plane: (function 12)

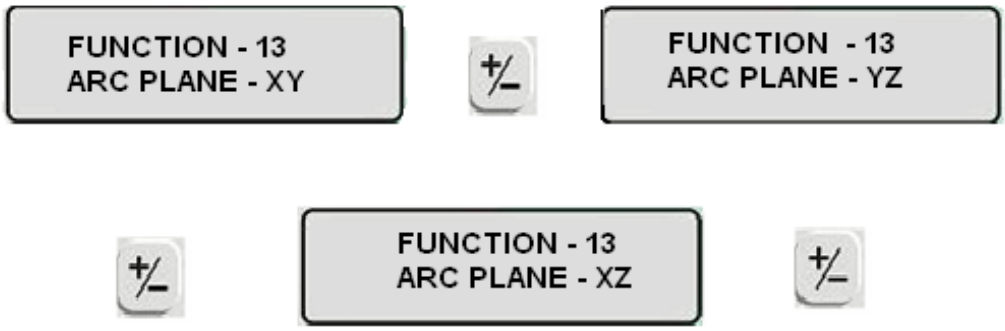


use  to scroll between different plane options

This mode signifies the plane of operation for center of circle function.
1.Selecting XY plane will probe (X,Y) coordinates for center of circle
2.Selecting YZ plane will probe (Y,Z) coordinates for center of circle
3.Selecting ZX plane will probe (Z,X) coordinates for center of circle

Press  to confirm the setting and advance to next function.

14. Arc plane : (function 13)



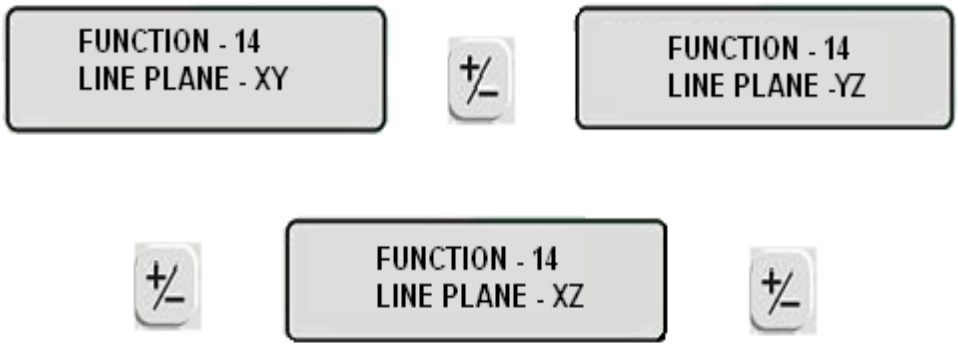
use +/- to scroll between different plane options

This mode signifies the plane of operation for “Bolt hole mode” and “Drill on a Arc mode “function.

1. Selecting XY plane will probe (X,Y) coordinates for Bolt hole mode” and “Drill on an Arc mode “function.
2. Selecting YZ plane will probe (Y,Z) coordinates for Bolt hole mode” and “Drill on an Arc mode “function.
3. Selecting ZX plane will probe (Z,X) coordinates for Bolt hole mode” and “Drill on an Arc mode “function.

Press ENT to confirm the setting and advance to next function.

15. Line plane : (function 14)



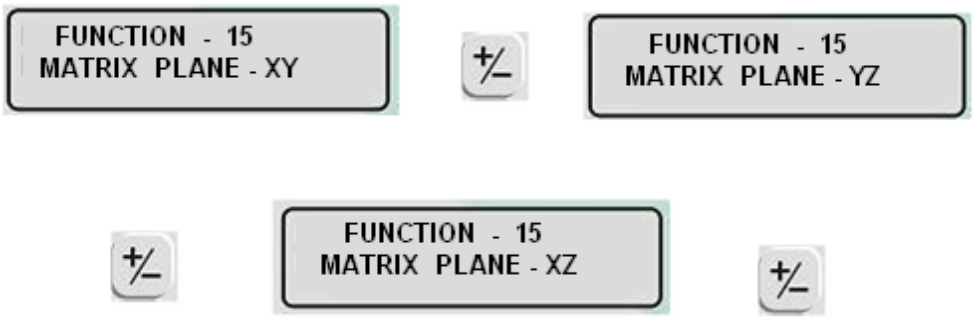
use +/- to scroll between different plane options

This mode signifies the plane of operation for “Drill on a Line mode” function.

1. Selecting XY plane will probe (X,Y) coordinates for “Drill on a Line mode”.
2. Selecting YZ plane will probe (Y,Z) coordinates for “Drill on a Line mode”.
3. Selecting ZX plane will probe (Z,X) coordinates for “Drill on a Line mode”.

Press ENT to confirm the setting and advance to next function.

16. Matrix plane : (function 15)



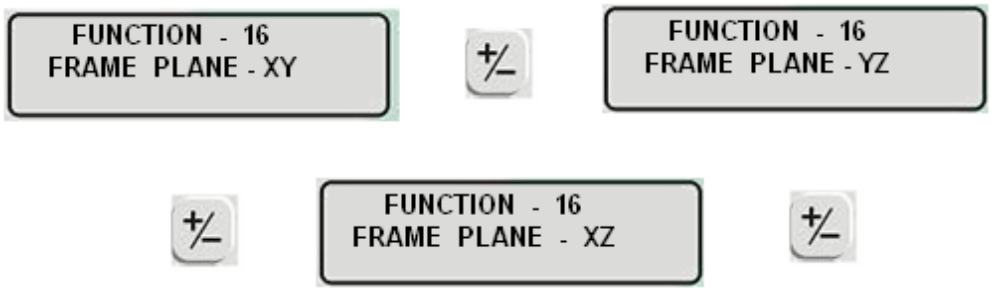
use +/- to scroll between different plane options.

This mode signifies the plane of operation for "Drill on a Matrix mode "function.

1. Selecting XY plane will probe (X,Y) coordinates for "Drill on a Matrix mode" function.
2. Selecting YZ plane will probe (Y,Z) coordinates for "Drill on a Matrix mode" function.
3. Selecting ZX plane will probe (Z,X) coordinates for "Drill on a Matrix mode" function.

Press ENT to confirm the setting and advance to next function.

17. Frame plane : (function 16)



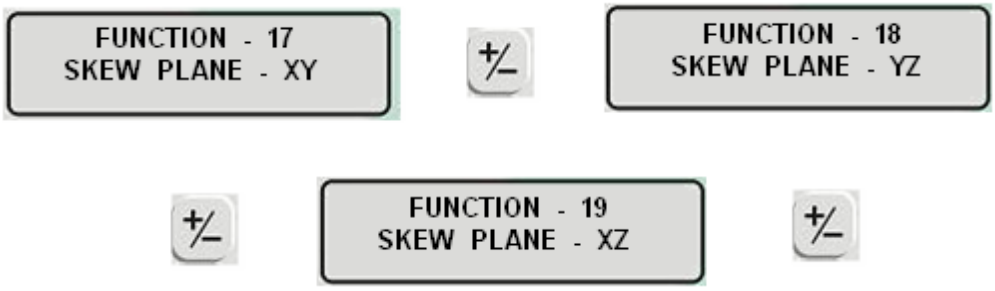
use +/- to scroll between different plane options

This mode signifies the plane of operation for "Drill on a Frame mode "function.

1. Selecting XY plane will probe (X,Y) coordinates for "Drill on a Frame mode" function.
2. Selecting YZ plane will probe (Y,Z) coordinates for "Drill on a Frame mode" function.
3. Selecting ZX plane will probe (Z,X) coordinates for "Drill on a Frame mode" function.

Press ENT to confirm the setting and advance to next function.

18. Skew plane : (function 17)



use +/- to scroll between different plane options

This mode signifies the plane of operation for "Skew" function.
1. Selecting XY plane will probe (X,Y) coordinates for "Skew" function.
2. Selecting YZ plane will probe (Y,Z) coordinates for "Skew" function.
3. Selecting ZX plane will probe (Z,X) coordinates for "Skew" function

Press ENT to confirm the setting and advance to next function.

19. Baud rate : (function 18)

This function is used to set baud rate settings for communication on RS232 connection to the PC.

Different baud rate settings available are :

1. 2400-N-8-1 (2400 bits per sec , no parity , 8 bit data , 1 stop bit)
2. 4800-N-8-1
3. 9600-N-8-1
4. 19200-N-8-1

use +/- to scroll between different baud rate options

Press ENT to confirm the setting and advance to next function.

20. Sensitivity : (function 19)

This setting is used in conjunction with relays.

1. Relay one output : This setting is used to delay the changeover of relay by time defined by sensitivity after actual set point has crossed. This is required when the DRO is used on Spark erosion machines(EDM) . This facilitates delayed turn off of EDM machine after the required depth is achieved. This helps in removal of carbon deposition which could led to wrong machine cut off. Refer one-op function for more details. This is an optional output.
2. Relay six output : in this mode in pulse type output mode sensitivity settings define the time for the relay output pulse generated on crossing of set point. Refer six output function for more details.

Different sensitivity settings are

1. 0.15 sec
2. 0.20 sec
3. 0.25 sec
4. 0.30 sec
5. 0.35 sec
6. 0.40 sec
7. 0.45 sec
8. 0.50 sec
9. 0.55 sec
10. 0.60 sec
11. 0.65 sec
12. 0.70 sec
13. 0.75 sec
14. 0.80 sec
15. 0.85 sec
16. 0.90 sec
17. 0.95 sec
18. 1 sec
19. 1.50 sec
20. 2 sec
21. 2.50 sec
22. 3 sec
23. 3.50 sec
24. 4 sec
25. 4.50 sec
26. 5 sec

Total 26 different settings are available.
Display shows last set value on this function , change can be done using

Key.

Press 

to confirm the setting and advance to next function.

21. Zero approach setting : (function 20)

This feature is useful while working in the preset / bolt-hole / run modes during these modes, when the count approaches or nears to the zero count from any direction, the buzzer starts to beep indicating the zero approach. This zero approach can be selected and set within the following set values.
0.1mm, 0.2mm, 0.3mm and 0.4mm

use  to scroll between different Zero approach options

Press  to confirm the setting and advance to next function.

Note: In preset mode zero approach beeps the buzzer when the selected preset axis count is in the zero approach band, where as in drill on line, matrix, arc, bolt hole, frame functions the buzzer beeps when both axis in the defined plane are in zero approach band. For run mode the no of axis that would together result in beep is selectable.

22. Output selection : (function 21)

This function is used to set either select output mode or one output mode.

Six output : Total 6 relays can be active . These are not a real time outputs.
One output : Total one relay can be active , used with EDM machines and is real time.

use  to scroll between different relay output options

Press  to confirm the setting and advance to next function.

23. Refresh rate : (function 22)

This function is used to set the display refresh.

If the machine slides are having some play or the machine tends to vibrate on application of mechanical cut the last one or to digits (LSB) of the count tends to jump between the least count continuously (example last digit toggles 5-0-5-0) which caused irritation to the user or instability in probing points. This can be eliminated using refresh settings.

This sets the time after which the display will be refreshed.

Different available options are

1. 25 Milli seconds (display shall update after every 0.025 seconds)
2. 50 Milli seconds
3. 75 Milli seconds
4. 100 Milli seconds
5. 200 Milli seconds

use +/- to scroll between different display refresh options

Press ENT to confirm the setting and advance to next function.

24. Relay continuous / discontinuous : (function 23)

Two modes are available

1. Relay continuous : In this mode there is no need to press 3 key for turning the 6 relay function on. It is always on after the power is turned on and cannot be disabled. Relays will operate as per their settings.
2. Relay discontinuous : You need to press 3 key every time the power is turned on to put the DRO in 6 output function. Pressing ESC key shall terminate 6 output function.

use +/- to scroll between different above two options

Press ENT to confirm the setting and advance to next function.

25. Prescaler : (function 24)

This is a very useful mode. It is related to the counter filter clock frequency.
If the DRO is into a noisy electrical environment the count tends to run unnecessarily without moving the actual slide. This is due to electrical interference in the power line. This can be reduced using prescalar settings. Reducing the prescalar frequency could reduce the noise problem but will reduce the maximum frequency (speed of counting) of the DRO

different available options are

1. Prescalar 1 – 2.5Mhz (internar hardware frequenty)
2. Prescalar 2 - 3Mhz
3. Prescalar 3 – 5Mhz
4. Prescalar 4 – 7.5Mhz

use +/- to scroll between different prescaler options

Press ENT to confirm the setting and advance to next function.

26. Constant surface speed (function 25)

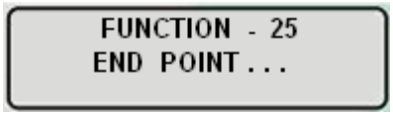
This function is used for achieving same result by varying speed of object.

Press 

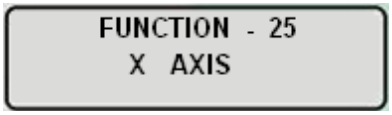
if function 25 is arrived.

Display shows

Enter the starting point using numeric keys. After entered of starting point display shows as follows.



Then select axis.



Use 

key to change axis.

Press 

to confirm the setting and advance to next function.

Voltage varies from starting point to end point.

27. Relay cyclic mode (function 26)

This function is useful only when six relay output function is enabled.
If this function is on then relay's functions depends on previous relay's status.

E.g. Relay 2 will be 'Turned on' on his setting point only when relay 1 is ON.
If this function is off then relay will 'Turned ON' according to their settings.

Use  to toggle this function.

Press  to confirm the setting and advance to next function.

28. Serial output (function 27)

This function is used to out all axes data on serial port.
There are two settings.

1. Serial auto – If this function is set in auto mode then data of all axes will send after switch on of Dro. Dro will send this data continuously.
2. Serial manual – If this function is set in manual mode then data of all axes will sent by Dro only after getting 's' character on serial port.

Use  to toggle this function.

Press  to confirm the setting and advance to next function.

Data will be as follows -

‘XLARM 1.2350\r’
‘YLARM 0.2515\r’
‘ZLARM 15.4780\r’
‘QLARM 0.0000\r’

E.g.

XLARM 1.2350

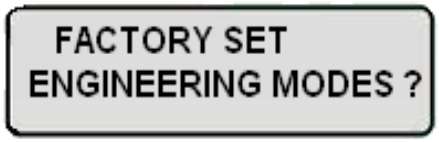
X - X axis			
L - Linear		G - Angular	
A - Absolute	I - Increment	R - Degree Format	S - Degree, minute, sec
R - Radius	D - Diameter		
M - MM	N - Inch		

29. Factory settings :(function28)

This function is used to set the DRO to factory defaults.

Press ENT to confirm the setting

User is requested to wait for a movement till the unit clears all special modes and block memory and than the display shows



Press ENT if you require to erase Correction Factor , Resolution , and

Scale factor.

Otherwise press ESC

Some useful functions of function mode.

Accessing Engineering mode /function mode in normal counting mode:

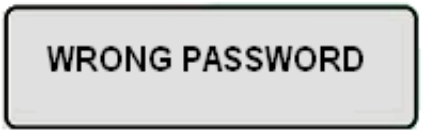
Press and hold (long press ..... FUN)

Display shows

use numeric keys to enter the password . Password is “654321”

and press ENT

If the password entered is wrong display shall show for a second



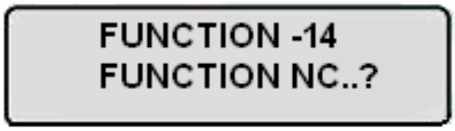
and go back for password reentry.

Correct password invokes function mode / engineering mode.

Jumping directly to particular function:

When in function mode press 

display shows



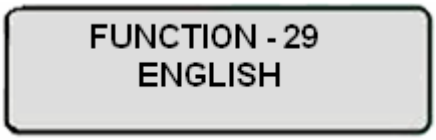
Enter numeric keys to select particular function from engineering mode directly

and press 

30 . LANGUAGE CHANGING MODE : (function29)

Step 1: On arrival to function 29

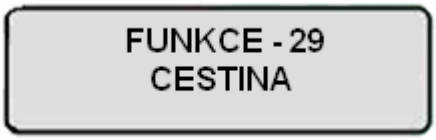
Display shall show



Step 2: If you want to change the language

Press +/- key.

After that display shall show



31. Reference Mode: (function30)

This function gives authority to reference DRO while switched ON. It is always good practice to go for referencing whenever DRO is switched ON to locate exact position.

Step 1: On arrival to function 30,

Display shall show

It is toggled by using +/- key.

Step 2:

If you select Ref at start –YES, DRO will go in referencing (homming) mode whenever DRO is switched ON next time.

Now display shows

Step 3:

If you select Ref at start – No .Now Dro will be going to power fail counting mode.

F. BASIC FUNCTIONS

This chapter guides you through all basic modes of DRO like

1. Z axis to C axis selection and vice versa
2. Datum Selection
3. Resetting datum
4. Modifying datum values
5. Inch/mm
6. Rad / Dia
7. Abs/Inc
8. Home and machine referencing
9. Preset mode
10. Polar Cartesian mode

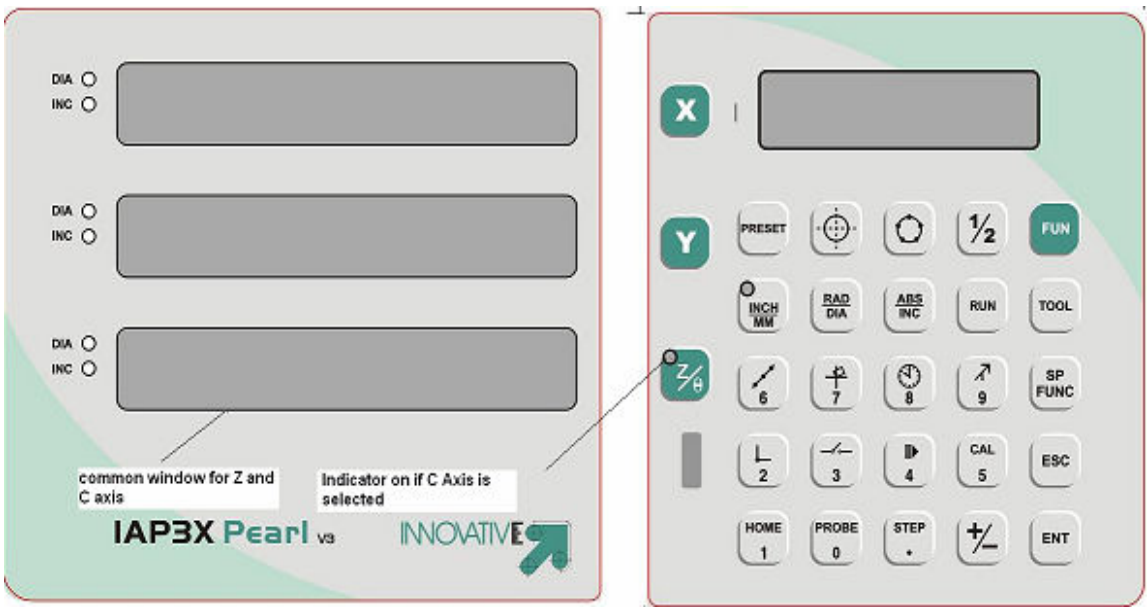
1. Z to C axis selection:

V3 series of DRO are 4 axis readouts with only 3 display windows. Third axis is

multiplexed between Z and C axis. The red indicator in the key 

is on if C axis is selected and any functions related to third window are diverted to C axis unless until specified. Selection is done by **LONG** pressing the ..... 

(Long pressing is press and hold the key for few seconds)



2. Datum selection:

This model is equipped with 6 different datums. Datum means you could define 5 different origin points. This is helpful for multiple job operations on single machine. ”Datum 0” is hardware datum and used to zero the pearl V3 hardware counters to zero on Homming or Machine referencing. **Users are requested not to work on datum zero**. You could zero datum zero at any point resetting datum procedure described later in this chapter. All special functions are not applicable for datum zero

Datums can be selected as

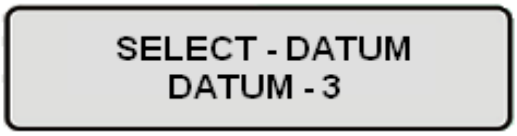
Step 1 : Press key 

LCD display now shows

Step 2: Press any key from numeric keys 0 to 5 to select datum 0 to datum 5

Say if you press key 

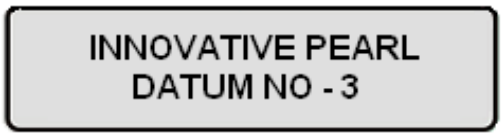
LCD display shows



Step 2: Press 

key .

Now the system goes to normal counting mode with datum 3 as reference. I.e all changes , functions will effect only datum 3 all other datums shall remain as they are.
e.g.: resetting x will reset datum 3 only.



Note:
Datum zero is Machine datum and is normally recommended that you set this datum using HOMMING / MACHINE REFERENCE mode (refer this sub topics for more details) Many modes like LCF and NLCF (linear correction factor and non linear correction factor) use only datum zero and force the system to datum 0 when selected. User shall ensure that the machine zero is reached every time the machine is turned on as all slide corrections are applicable from this datum wrongdoing zero of datum 0 shall result in errors in readings.

Users are cautioned to carefully pay attention to the datum the job is set and the datum the work is done (setting of job and actual work shall be done on the same datum).wrong datum selection in between may led to rejection in job.

Datum key can be locked any time by long pressing 

This shall avoid any unwanted datum change during operation with the job.

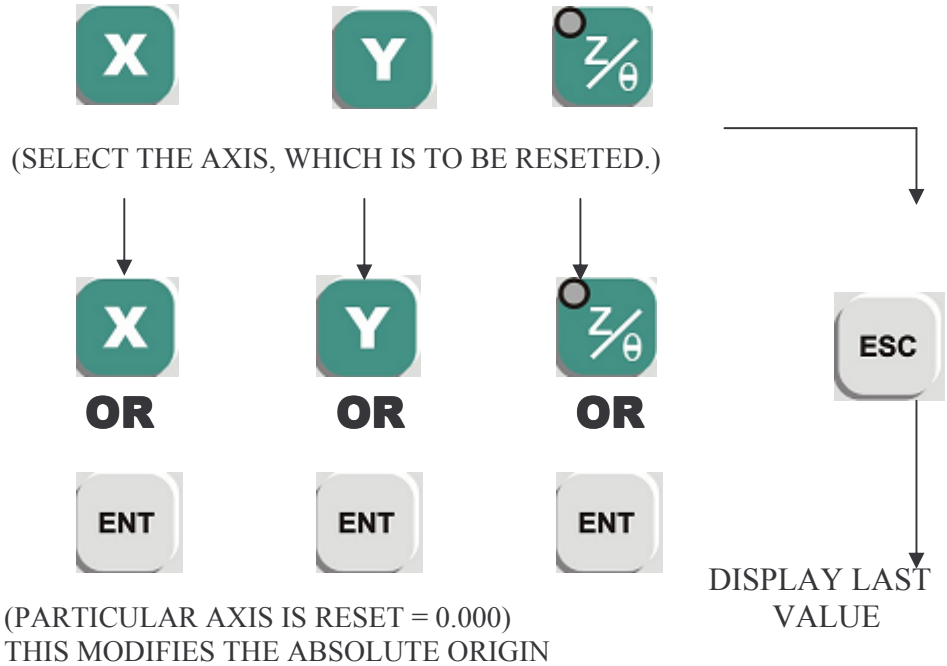
Long pressing ..... 

shall display

3. Resetting datum:

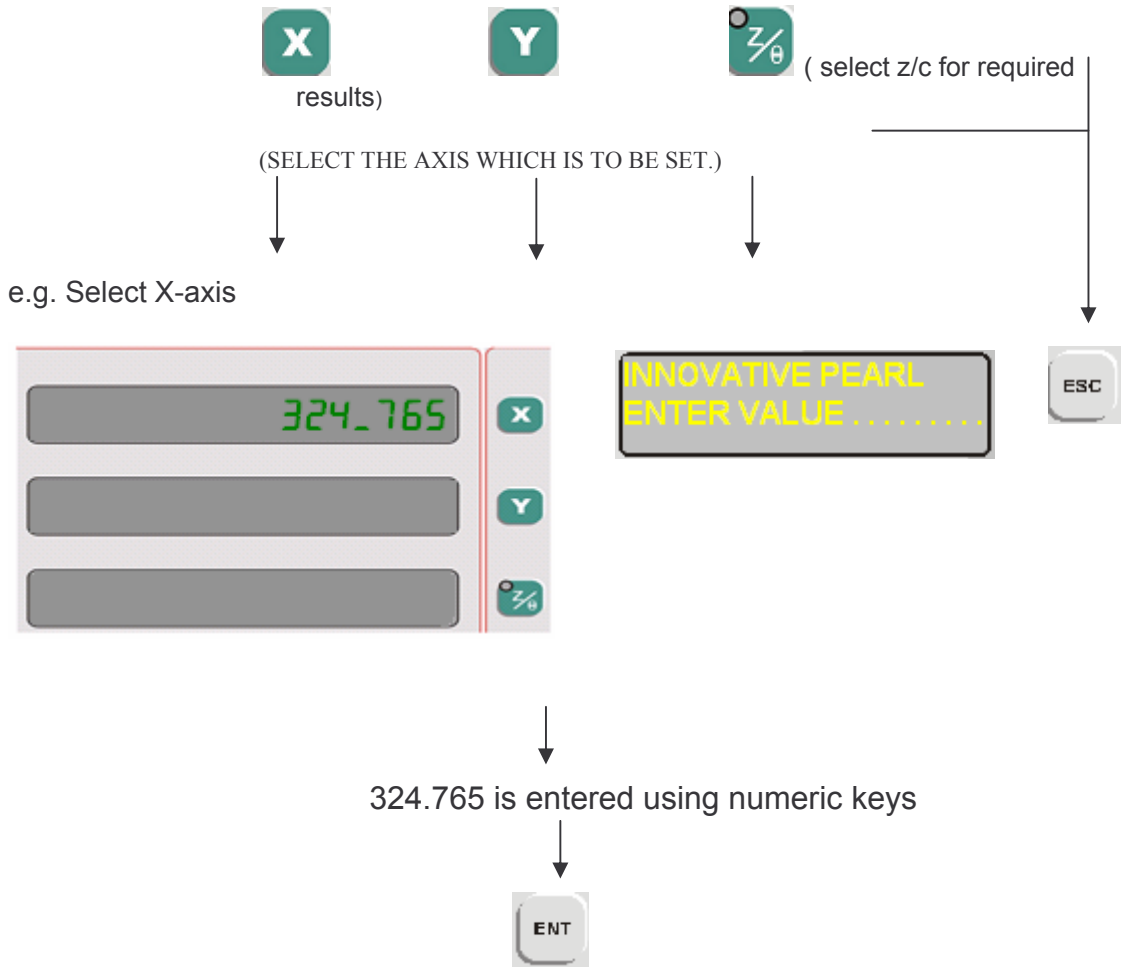
This function is used to reset selected datum to zero. Datum 0 is the absolute machine datum and resetting this shall be normally avoided. Datum zero is set by either homing/machine referencing operation during startup of DRO with the help of index pulse generated by the linear scale. Refer homing / machine referencing section of this chapter for more details

But any way any datum can be set at any time to zero (for selected axis) using this mode.



4. Modifying datum values:

This function is used to set any value for the datum (except datum 0). This directly modifies the datum value and accordingly datum new origin is defined. All datums are in reference to datum 0.
(suppose you need to enter 324.765 for datum)



New value is set for the particular axis for particular datum

Note: use ESC key to terminate the function and return to main

5. INCH / MM conversion mode:

This function is used to convert the DRO count from metric to imperial unit of measurement and vice-versa. Using this function all the axes can be toggled between either of the units.

TO TOGGLE THE UNIT OF INDIVIDUAL AXIS

Press 

will force the system in mm mode ,press again 

to force system in inch mode (Red indicator on the key signifies the system in inch mode)

Note – You cannot toggle the unit if it is locked from engineering mode. Refer engineering mode chapter of this manual for more details.

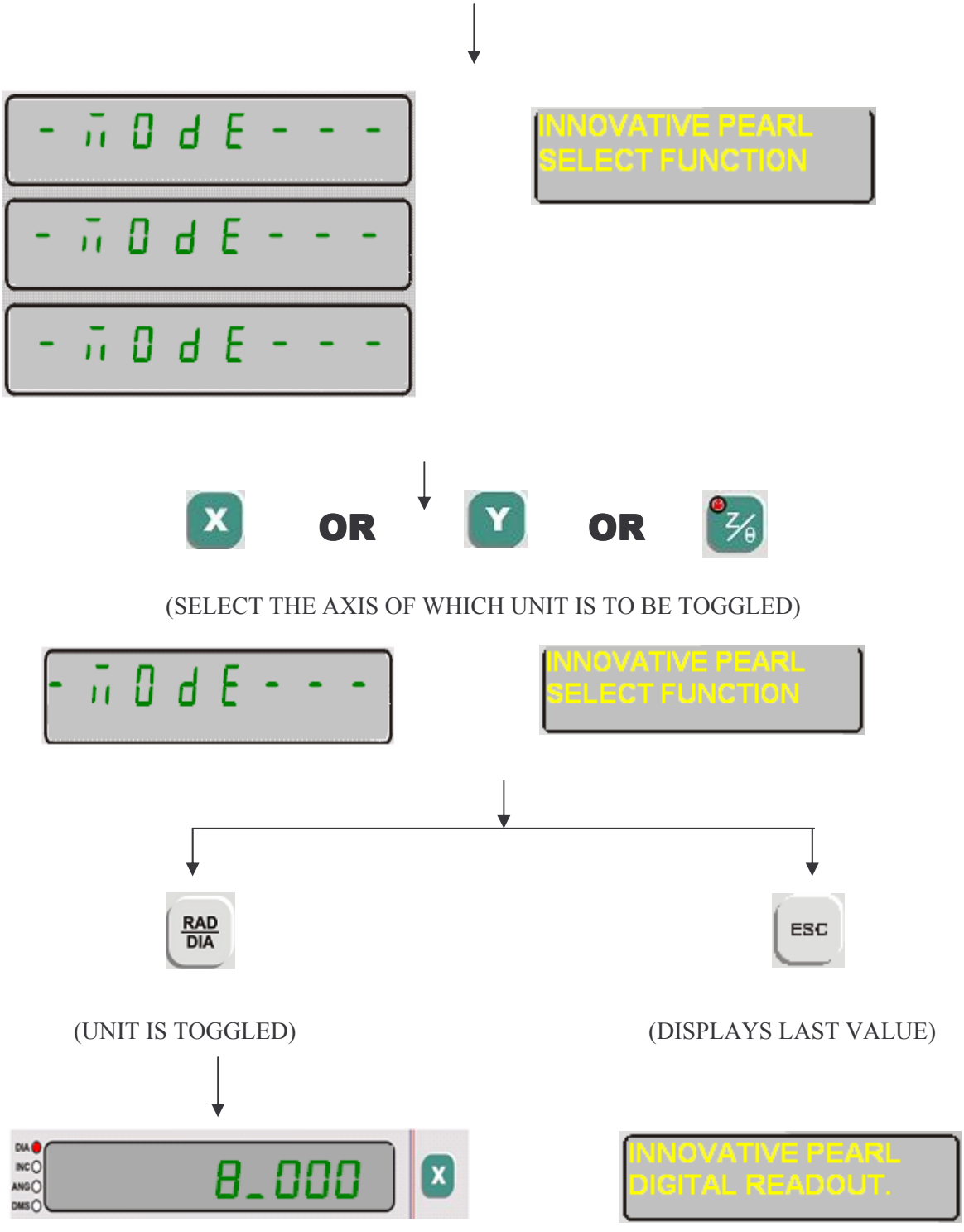
6. RADIUS / DIAMETER CONVERSION MODE:

This function is used to convert the DRO count from radius to diameter mode of measurement and vice-versa. Using this function individual axis or all the axes can be toggled between either of the measurement modes. Dia mode is to multiply the reading of selected axis by 2 to display double the actual value. This mode is generally used for cross axis of lathe machines.

A. changing mode of any individual axis

Suppose the x axis display shows 4.000mm and in radius mode

To toggle the measurement mode of individual axis



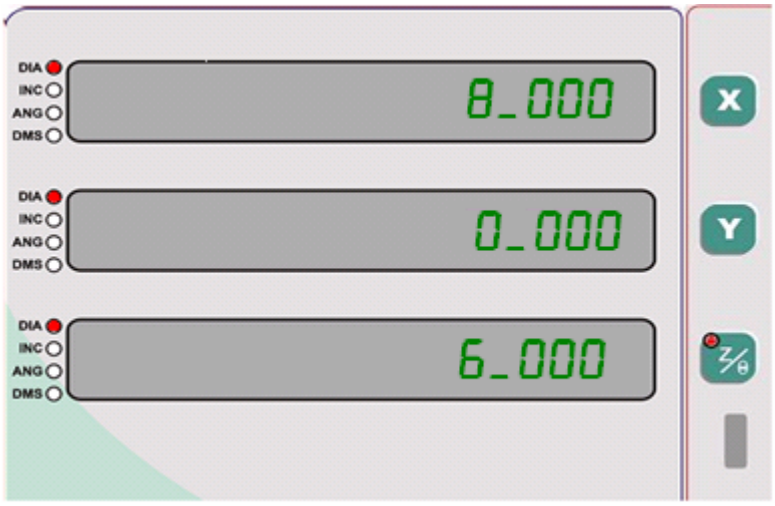
Dia led reflects that the selected axis is in dia mode
Value is 8.000 (4.000 * 2 mm)

A. changing mode directly of all axes

This mode is used to toggle all axes together into radius or dia mode

Directly pressing RAD DIA shall force all axes in dia mode and pressing it back again shall

force all axes back to radius mode,



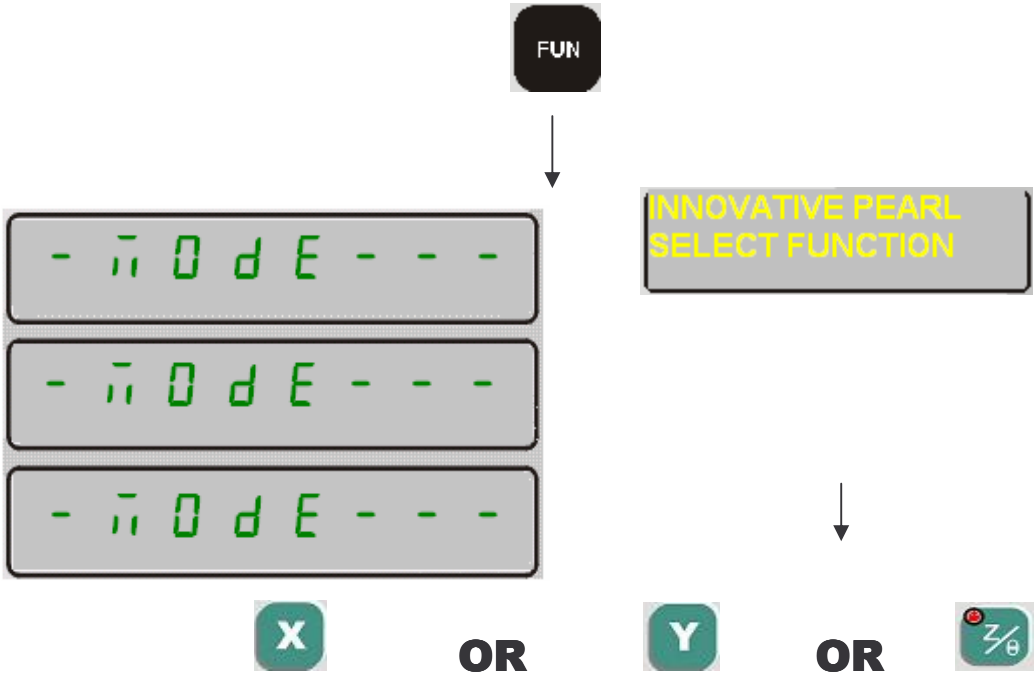
But is any of the axis is locked either in rad or dia mode (refer function 02 of engineering mode for locking mode of individual axis) the direct conversion mode is turned off.

7. INCREMENTAL / ABSOLUTE CONVERSION MODE:

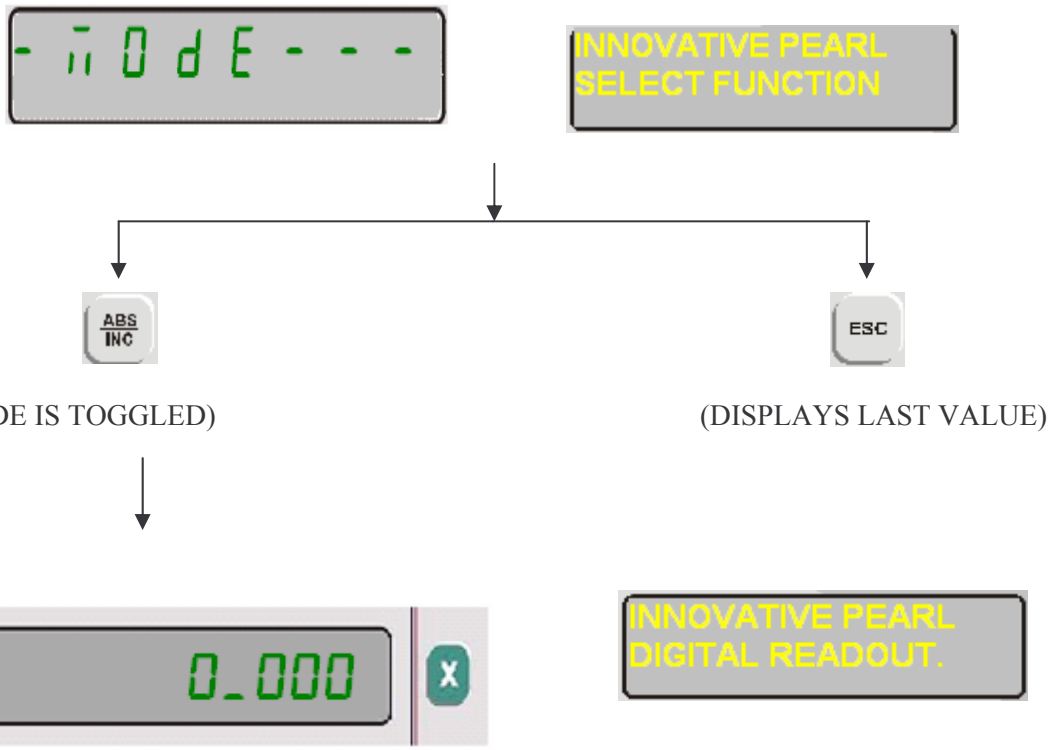
This function is used to toggle the DRO count from incremental to absolute origin of measurement and vice-versa. Using this function individual axis or all the axes can be toggled between either between incremental or absolute origin.

A: Putting individual axis in to Inc to Abs and vice versa

TO TOGGLE THE **INC / ABS** ORIGIN OF INDIVIDUAL AXIS



(SELECT THE AXIS OF WHICH UNIT IS TO BE TOGGLED)



B: Putting all axis into inc from absolute and vice versa

Directly pressing 

shall force all axes in inc mode and pressing it back again shall

force all axes back to abs mode.

8. HOMMING AND MACHINE REFRENCE:

SETTING THE REFERENCE
NEED OF REFERENCING:

Innovative DRO'S has a built in function to save the reading at power OFF and retrieve the same at power ON.
But if the slide has moved after the power has turned OFF, the true position of the slide is lost, so here comes the need to reference the datum.
The operator has to set a reference machining/settings on a predefined location on the selected axis. These predefined points are called abs marks, which need to be present on the measuring scale you are using .Besides the non linear correction factor is applied to the datum's with reference to some point on the slide which can be any time retrieved using homing or machine reference.
There are two ways of referencing

- In Home function mode, the datum 0 will be set to 0.00 on sensing of first reference (marker) pulse in any direction.
- In machine reference mode, datum 0 is set to a predefined value on sensing the reference pulse.

All other datums are in reference to datum 0.

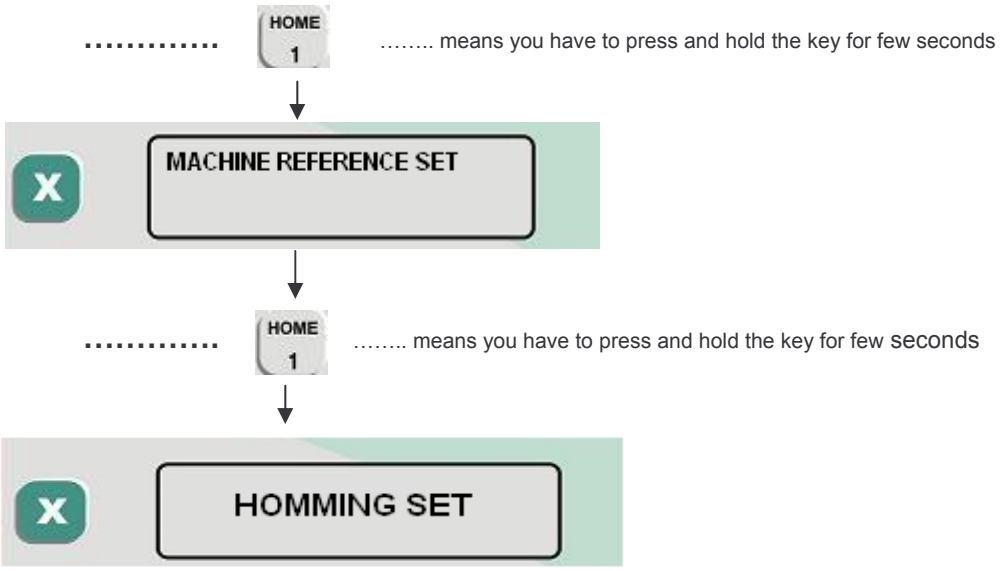
The operator moves the slide to cross the abs/reference/marker pulse and all the points on work piece are referenced from this abs pulse.
Note: electrical specifications of reference signal shall match to the signals shown in the chapter waveforms later in this manual.

Homing of machine reference is automatically called on turning power up of the DRO.

A. Selection of home or machine reference:

Both functions use only one key I .e . HOME 1

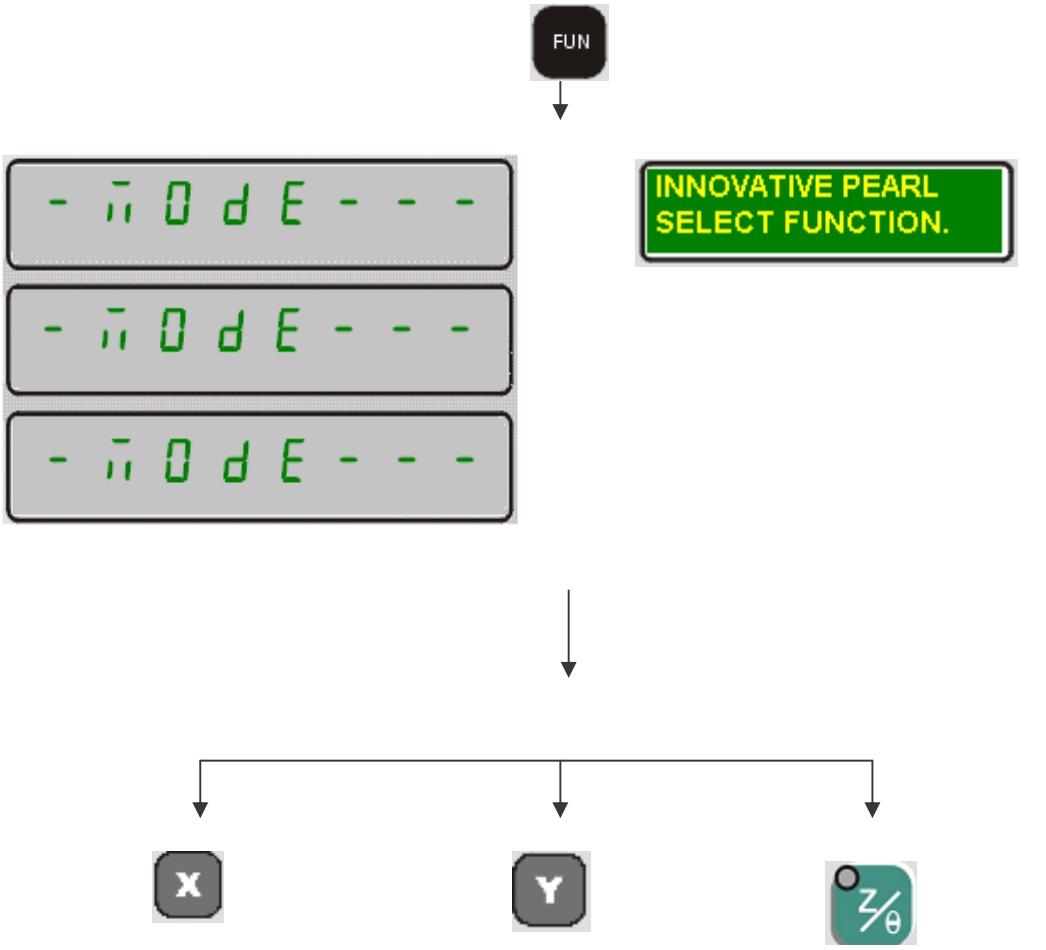
long pressing HOME 1 key shall toggle between home and machine reference



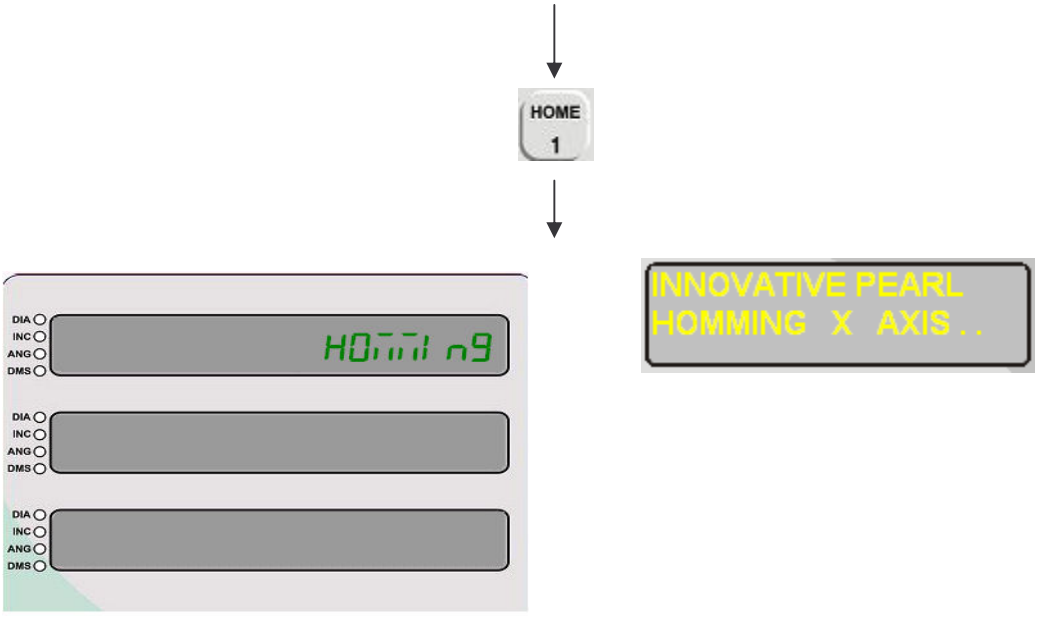
B. HOME FUNCTION:

Note: Always sense the marker pulse in one direction for better accuracy.

FLOW CHART:



SELECT AXIS YOU NEED TO PERFORM HOMMING



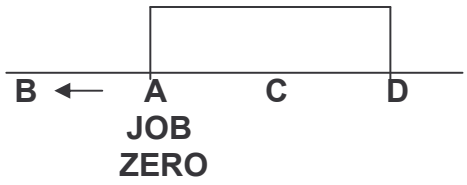
Display for selected axis shows Homing till the marker pulse for the axis is sensed (you have to move a selected axis to sense the reference pulse. here the particular axis becomes Zero.
Physically decide any one reference pulse (there are reference pulses every 50mm throughout the length for innovative make scales) out of many and use the same every time.

MACHINE REFERENCE:

The function is analogous to Home mode, except that home will Zero the axis and datum 0 and machine reference will load a preloaded value.

Machine reference value is distance of job Zero from Home Zero. To find and store reference, ref fig below

C. Programming machine reference



Assume that Tool is at position C. A - D is job length; B is nearest point outside the job at which the linear transducer gives abs pulse o/p.

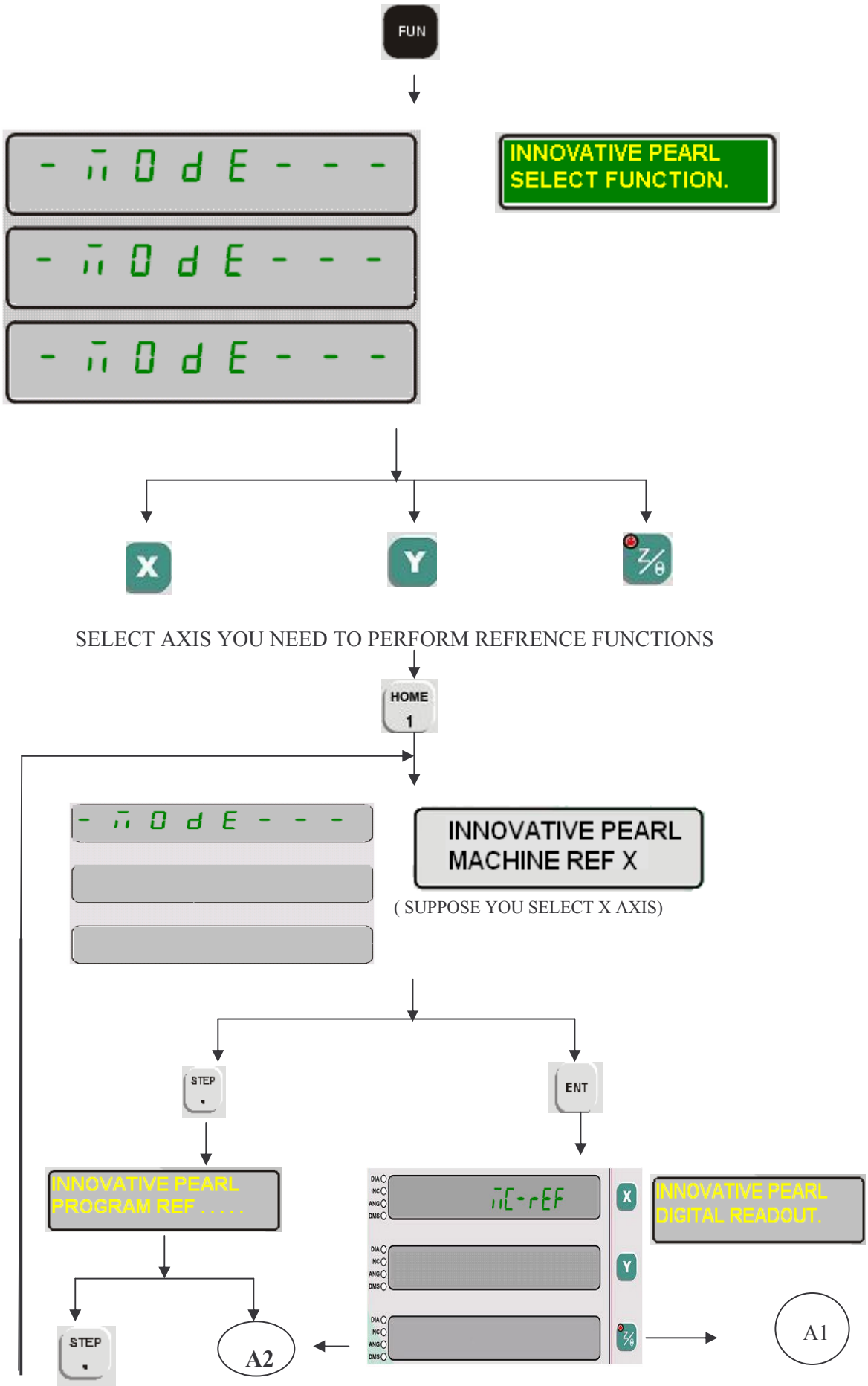
- Move the slide (Tool) near to A (preferably between A & B)
- Execute Home function as discussed before. (in sub section of this chapter)
- Move the slide towards point B to get abs pulse; here the display for axis will show 0.000.
- Move the slide to point A; here the counter will show some reading (say 11.00). This is the machine reference value. I.e. is the job is 11.000 mm away from reference pulse or if A is to be the 0 point reference pulse is -11.000mm before point A.

- Follow the step below to set this value.
-

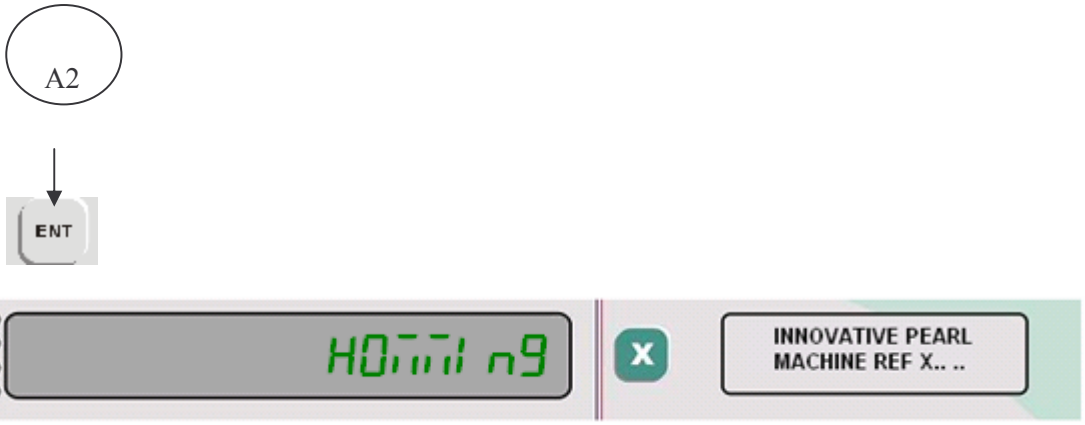
Note :First you need to program the reference and than use the machine referencing mode

*Ensure you put the system in machine reference mode before going further.

FLOW CHART:


FUN
- MODE - - -
- MODE - - -
- MODE - - -
INNOVATIVE PEARL
SELECT FUNCTION.
X
Y
Z/θ
SELECT AXIS YOU NEED TO PERFORM REFRENCE FUNCTIONS
HOME
1
- MODE - - -
INNOVATIVE PEARL
MACHINE REF X
(SUPPOSE YOU SELECT X AXIS)
STEP
ENT
INNOVATIVE PEARL
PROGRAM REF . . . . .
NC-REF
INNOVATIVE PEARL
DIGITAL READOUT.
STEP
A2
A1

SETTING MACHINE REFERENCE:

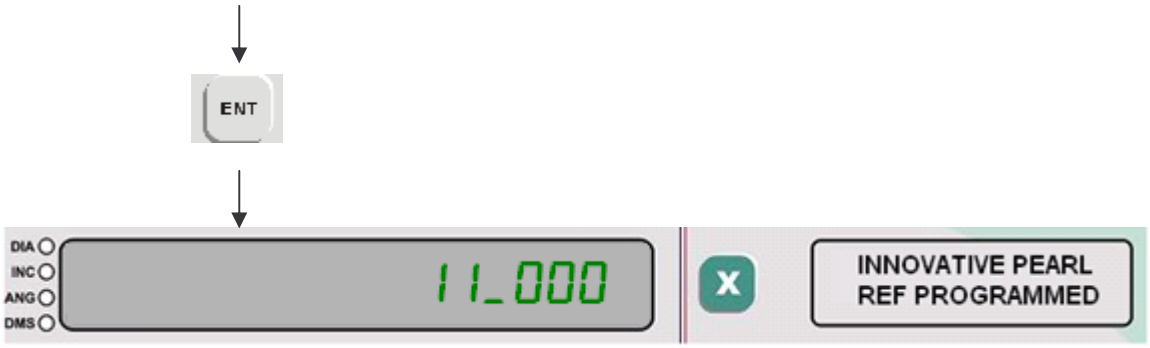


Now move the slide to home x axis to zero (point b in above example).

Now display shows (when you cross point b) zero at point b

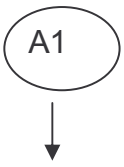
-Travel towards point a

- At point a the value (in reference to this example) 11.000mm



Now reference is set as -11.000

C.2: Effecting machine reference:



In machine reference programming mode here the values of the axis you have already selected is Preset as a reference value for the machine Referencing (i.e. 11.000 is set as reference value)

This is Machine Referencing mode.

Move the slide to cross the abs pulse (Here point B)

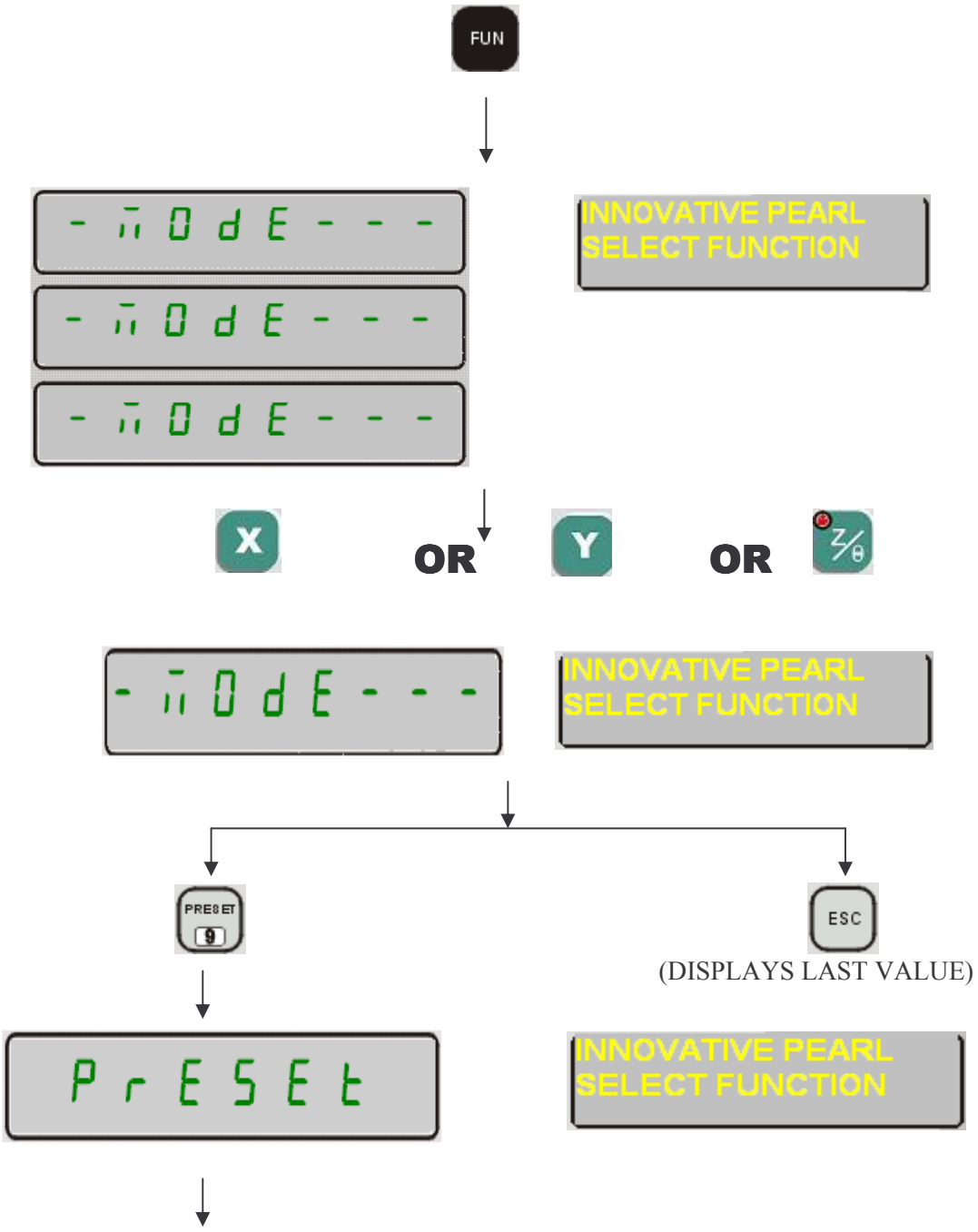
Now as the abs/marker pulse is sensed the display shows -11.000, that as you reach point A in ref to the figure you will get 0.000 at point A.

This states you can retrieve zero at point a with ref to fig every time you execute a machine ref

9. PRESET MODE:

This function can be used to enter the distance to be approached and allow the DRO to display the value in zero approach mode i.e. in down counting form. The preset mode once entered can terminate by pressing the esc key, then DRO return to normal counting mode.

FLOW CHART:



Enter the point value you want to target say 4mm .ENTER 4.000 using numeric keys and press 

Display shows

Now the X axis of the unit shall down count to 4 mm. The buzzer will start beeping as the target approaches zero value within +/-0.4mm .
The zero approach buzzer setting can be changed using engineering mode.

All other functions are blocked when preset is on.
The main display now shows

same can be repeated for all other axis.

Press 

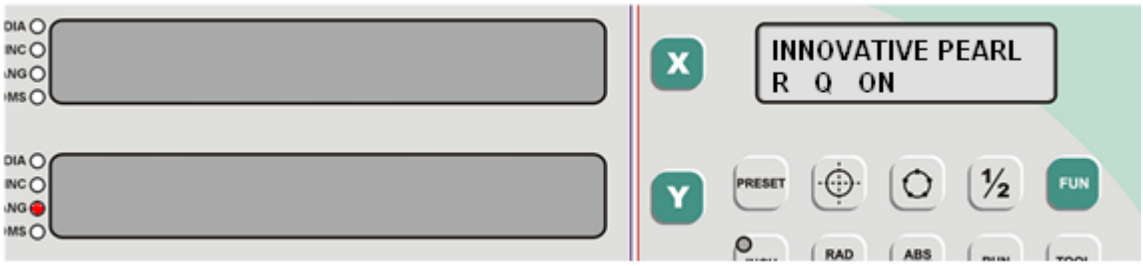
to quit from preset mode

10.Polar / Cartesian mode:

This mode is used to set X and Y axis in either polar mode or Cartesian mode.
Polar mode : reading is displayed a (R,Q) where R is radius from datum the point bears and Q is Theta.
Cartesian mode : This is a standard mode where point is represented as (x, y) I.e the x distance the point bears from datum and the y distance from datum.

Press 

display toggles between polar / cartetion mode.. Y axis ang led is on in polar mode and signifies y display is angular mode. The angle display format can be configured using function 4in engineering mode (dd.dec or dd-mm-ss format) display shows in polar mode.



G.SPECIAL FUNCTIONS

Different special functions V3 provides are

1. Bolt hole/ pcd function
2. Drill on a arc
3. Center of circle
4. Half
5. Drill on a line
6. Drill of a matrix
7. Drill on a frame
8. Taper turning
9. Taper calculator
10. Skew a part
11. Run programming mode
12. Tool offset
13. Job clock
14. Feed rate
15. Calculator
16. Vectoring
17. Relay outputs
18. Angular pcd
19. Summing
20. Serial software
21. Touch probe

1. BOLT HOLE MODE / PCD DRILLING:

This mode is used create the co-ordinates of the holes on the PCD of a circle. This is of great use in PCD drilling of holes. The user should give the data such as x origin, y origin, circle radius, no. Of holes (divisions) and starting angle of first hole. Maximum 1000 holes are possible. The holes are defined from no. “000” to “999”. The co-ordinates of the selected hole are displayed on the lcd message display while the distance between the tool and the Hole center is shown on x and y-axis displays. The user should move the slide to make the x and y axis down count to zero to reach the required center. This mode works as simulated preset mode. While moving the slide down to zero count, when both the x and y axes are in the zero approach region, the DRO start to beep indicating that the center of hole is approaching.

Bolt hole pattern can be generated in three different planes using v3 model of innovative dro systems.
1.Plane XY
2.Plane YZ
3.Plane XZ

The operation plane can be defined using function 13 in engineering mode. Refer chapter “Engineering modes” for more details.
Below find the flow sequence for bolt hole mode in XY plane .other planes are respective.

FLOW-CHART: -

Drill on bolt hole and drill on arc are multiplexed on the same key.select bolt hole function initially.

Step 1: Press 

Display shows

INNOVATIVE PEARL
BOLT HOLE MODE

Step 2 : Press 

Display shows

Press 

to go back to bolt hole

Step 3 : Select bolt hole

Press 

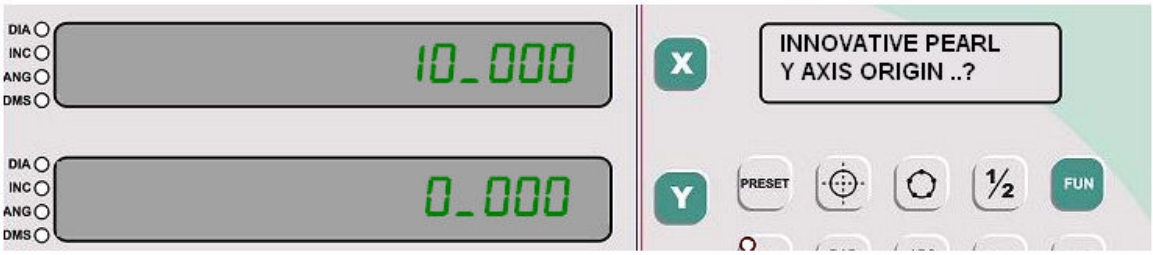
Display shows .This is last value you have entered for axis X origin of the pcd you need to drill. (Y origin in case of YZ plane and).

Refer chapter example for programming data and its meaning.

Step 4 : Use numeric keys for entering the origin value. Suppose you enter 10.000mm

Step 5: Press ENT

Display shows



This is last value you have entered for axis Y origin of the pcd you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 6 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

Step 7: Press ENT

Display shows

(DISPLAYS LAST VALUE OF NO.OF HOLES)

STEP 8: enter no of hole you need to drill on the pcd and

Press ENT

Step 9

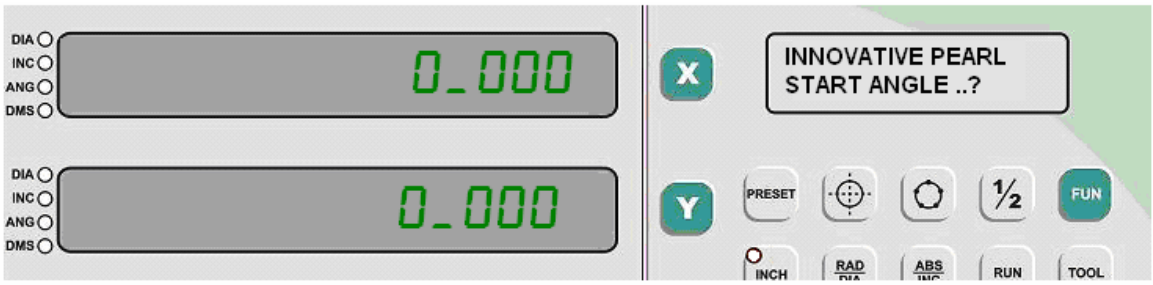
Display shows last stored value for radius of pcd circle .

Use numeric keys to enter Radius of new pcd circle

Step 10:

Press 

Display shows last value of starting angle

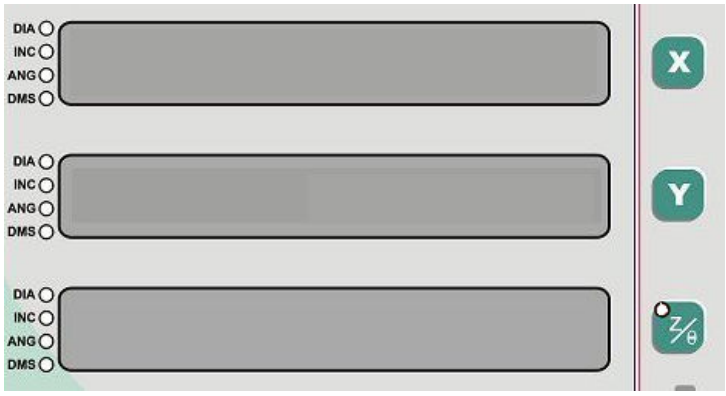


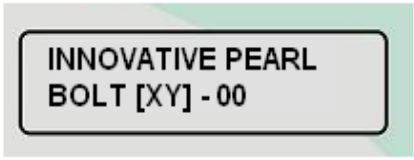
Use numeric keys to enter new start angle.

Step 11.

Now you are ready with all parameters for executing a bolt hole /pcd function

Display shows



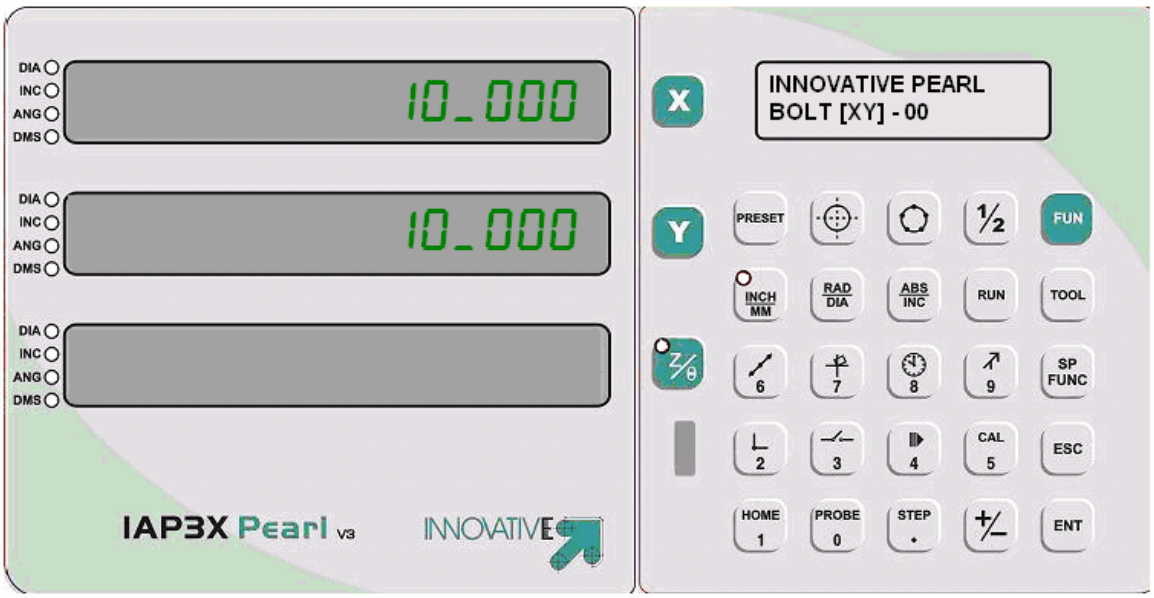


This specifies you are to execute bolt no 00 in plane xy

Use numeric keys to modify the bolt no if you require. You could use 

key
To advance the bolt no by 1.

And Press ENT



Dro is now targeting BOLT 00 in x y plane. It shows CURRENT HOLE NO

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the BOLT-HOLE mode and return to normal mode) Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

2.DRILL ON ARC:

This mode is similar to bolt hole function .In bolt hole the no of holes distributed throughout 360 degrees with equal angular distance. In "Drill on ARC "function you could restrict the no of hole to a specified angle of arc.

The parameters you need to program are:

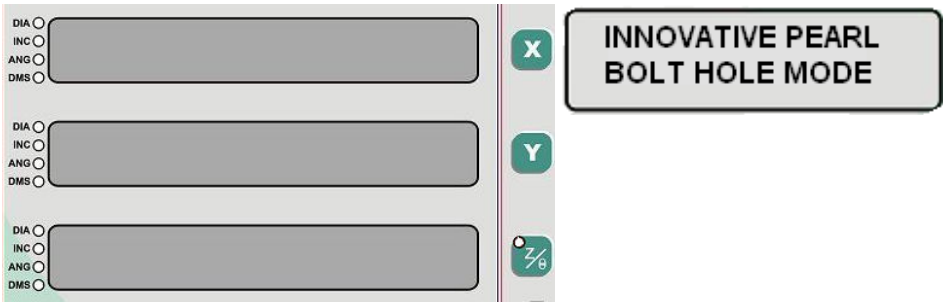
1. Axis one origin
2. Axis two origin
3. No of holes
4. Radius of Arc
5. Start angle
6. End angle
7. Clockwise / Anticlockwise

As in bolt hole mode the difference is only is programming of end angle. The operation of plane either XY or YZ or XZ can be programmed from function 13 of engineering modes. Refer chapter " Engineering mode " for more details.

FLOW-CHART: -

Step 1: Press 

Display shows



Step 2 : Press 

Display shows

Press 

Step 3 : Select drill on arc

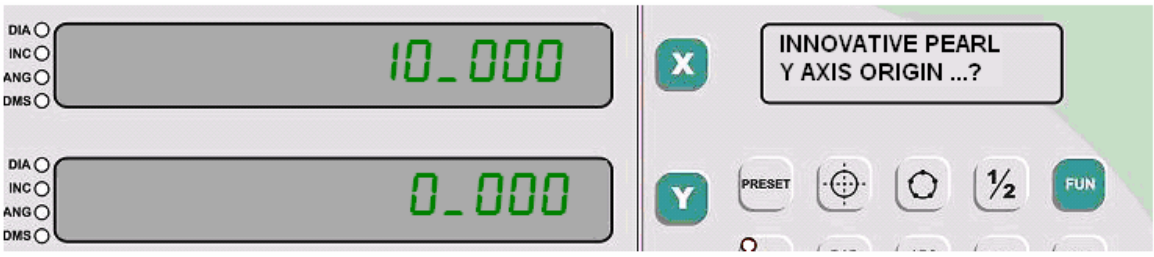
Press 

Display shows .The last value you have entered for axis X origin of the arc you need to drill. (y origin in case of YZ plane and)

Step 4: Use numeric keys for entering the origin value. Suppose you enter 10.000mm

Step 5: Press 

Display shows



This is last value you have entered for axis Y origin of the arc you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 6 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

Step 7: Press 

Display shows

(DISPLAYS LAST VALUE OF NO.OF HOLES)

Step 8 : Enter no of hole you need to drill on the arc and

Press 

Step 9:

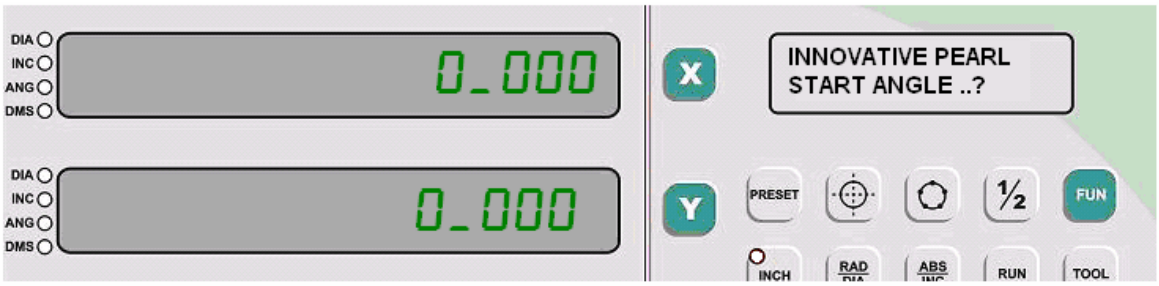
Display shows last stored value for radius of arc .

Use numeric keys to enter Radius of new arc

Step 10:

Press 

Display shows last value of starting angle



Use numeric keys to enter new start angle.

Step 11:

Press 

Display shows

Use numeric keys to enter new end angle.

FORMULA USED TO CALCULATE DEGREE BETWEEN HOLES = (END ANGLE – START ANGLE) / NO OF HOLES.

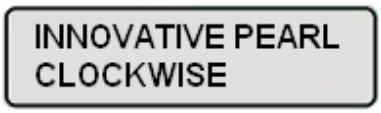
Step 12

Press ENT

Display shows

This is setting used to change the orientation of Arc

Press +/– to change to clockwise if required

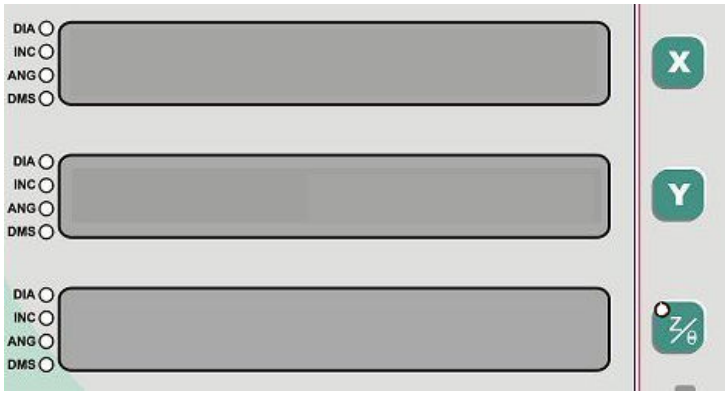


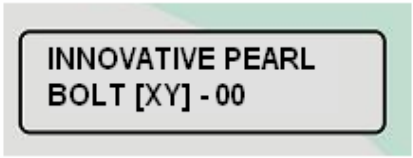
Step 13.

Press ENT

Now you are ready with all parameters for executing a **Drill on a Arc** function

Display shows

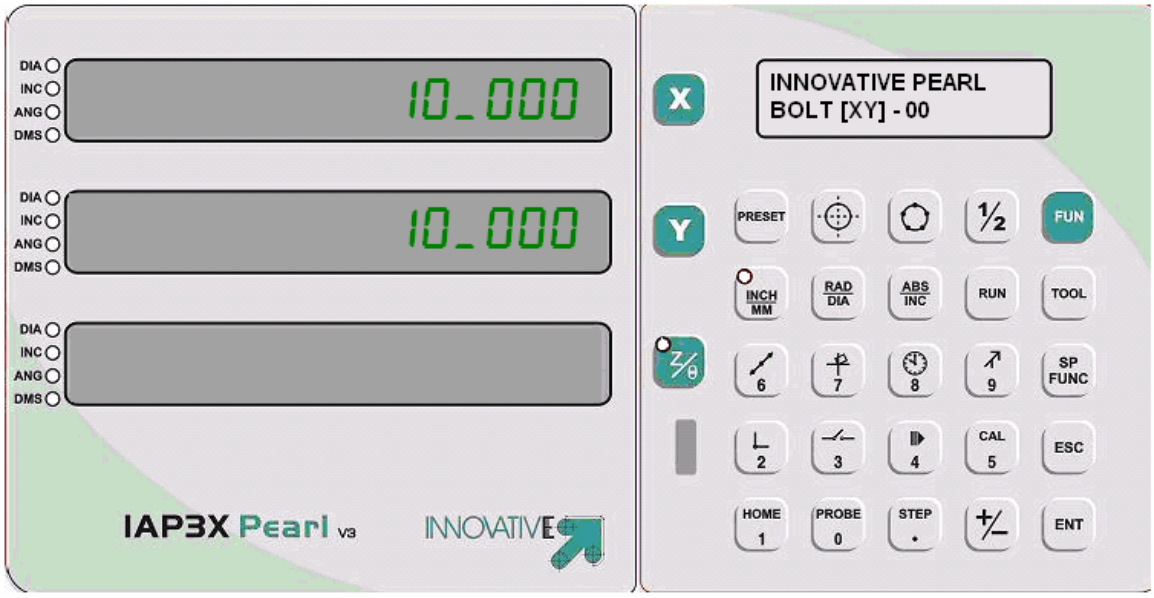




his specifies you are to execute bolt no 00 in plane XY

Use numeric keys to modify the bolt no if you require. You could use +/– key
To advance the bolt no by 1.

And Press ENT



Dro is now targeting BOLT 00 in x y plane . It shows CURRENT HOLE NO

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the drill on arc mode and return to normal mode) Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press ESC key to terminate Drill on Arc function

3. CENTER OF CIRCLE MEASUREMENT:

This function is used to measure center of circle by giving any three or more points on the circle. The centering mode once entered can terminate by pressing the ESC key, then DRO return to normal counting mode.

This function can work in different plane
1.XY plane
2.YZ plane
3.XZ plane (optional)

selection of plane depends on settings in function no 12 of "Engineering mode". Refer chapter "engineering modes " for more details.

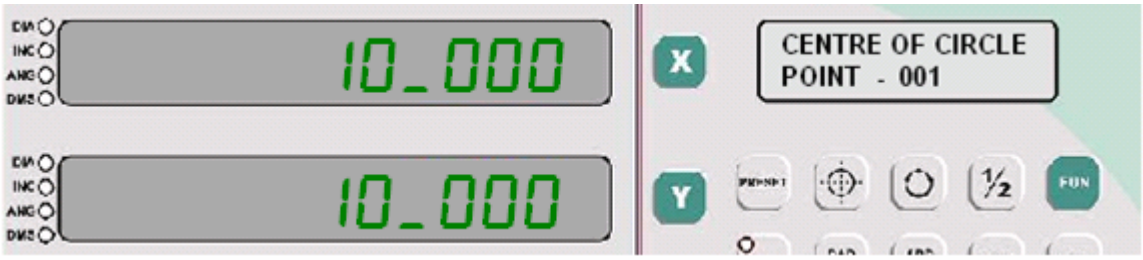
- **note center of circle requires minimum 3 points and maximum 100 points**

Step no 1:

we assume plane XY for further discussion. Other planes behave in the respective way.

Press 

Display shows

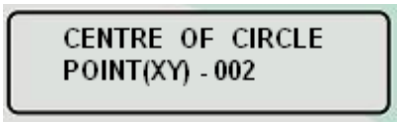


You need to target the X and Y slide to point 1 on the circle ID or OD

Step 2

Press 

point 1 is stored internally and display advances to



Step 3

You need to target the X and Y slide to point 2 on the circle ID or OD and

press 

Repeat step 3 till minimum 3 points maximum 100 points.

It is a better practice to probe the points distributed throughout the 360 degrees of the circle for better accuracy.

Probing points greater than 8 will invoke a state of art Innovative software algorithm which will illiminate 25% maximum of wrong points (or points with more deviation factor) and will result into a best fit circle from probed best points.

Step 4

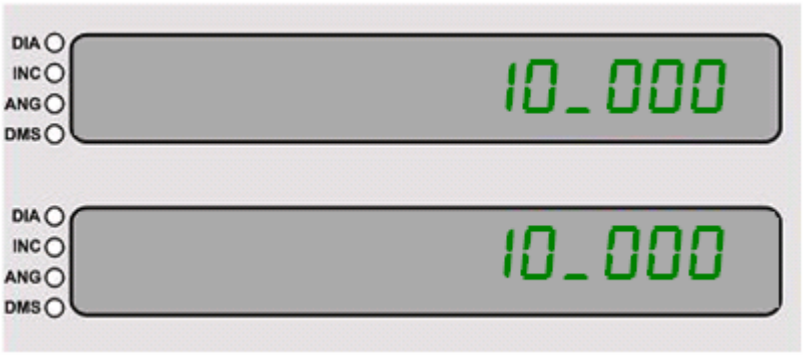
Press 

on complition of probing points.

Step 5

Display shows

Green display shows the distance from the center of circle. The selected Datum is set to zero at the center of circle



Moving the respective slides to zero will position the machine at center of circle

Note : press ESC key to terminate Center of circle any time in between the probing is in practice.

An error message CENTER OF CIRCLES POINTS COLLINER is displayed if the targeted points are collinear for few seconds and the DRO gets back in normal counting mode.

4. HALF:

This function can be used to half co-ordinates of any selected axis for selected datum. This feature can be used to find out the center of any particular job.

Step 1 : Press FUN

Step2 : Press X (select the axis key you want to half)

Step3 : Press ½

(Now the selected axis (X in this case) display will show half of the previous reading. Now move the slide towards zero until the display shows `0.000'. This is the center point of the job along x-axis.) Similarly repeat the procedure for other axes

5.Drill on a line :

This function is used to drill hole at specified distance on a line .This line of drills can be in any of 3 planes specified below.

1. XY Plane
2. YZ Plane
3. XZ Plane

The plane can be selected using function 14 of Engineering mode. Refer chapter " engineering mode" for more details.

There are 2 different techniques to program drill on line parameters.

Mode 1: in this mode the user shall give the following parameters

- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- Number of holes user needs to drill
- Length of line.
- Angle with respect to X axis (Y axis in case of YZ plane)

Mode 2:

- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- X axis end point coordinate (Y axis in case of YZ plane)
- Y axis end point coordinate (Z in case of YZ and XZ plane)
- Number of holes

Refer chapter "Examples" for more details

Mode 1:

Step 1

Press 

Display shall show

Step 2

Press 

Display shows

Step 3: Press  to change the mode of programming if required,

presently we select mode 1.

Step 4: Press 

Display shows the last value you have entered for axis X origin of the arc you need to drill. (y origin in case of YZ plane and)

Step 5: Use numeric keys for entering the origin value. Suppose you enter 10.000mm

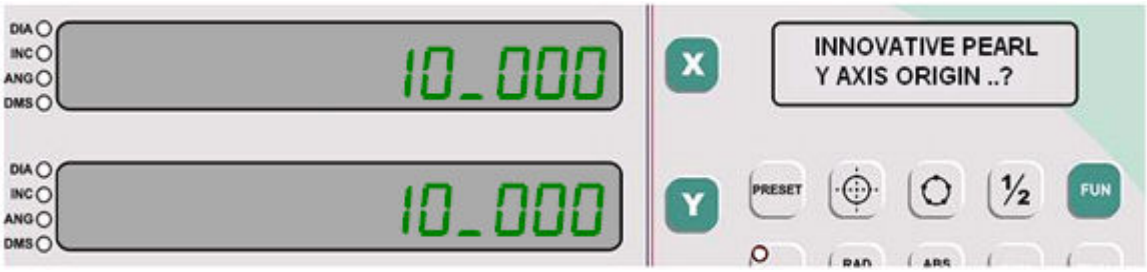
(system shall ask for y axis in case of YZ plane)

Step 6: Press 

Display shows

This is last value you have entered for axis Y origin of the line you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 7 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.



Step 8: Press 

Display shows

Step 9 : Enter no of hole you need to drill on the line and (DISPLAYS LAST VALUE OF NO.OF HOL

Press 

Step 10:

Display shows last stored value for Length of line .

Use numeric keys to enter new length of line

Step 11:

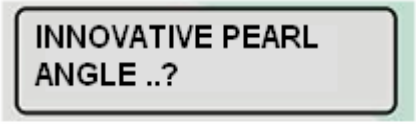
Press 

Display shows last stores value of angle of line

Use numeric keys to enter new start angle.

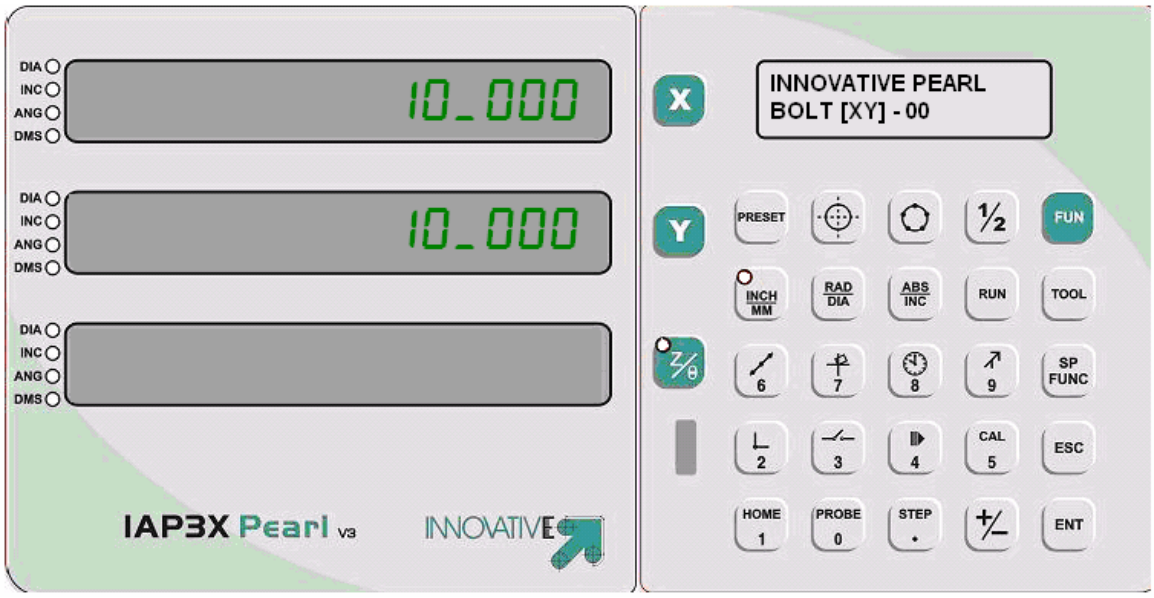
Step 11:

Press ENT



Use numeric keys to enter new angle the line shall make with reference to x axis (for XY and XZ) plane and Y axis in case of YZ plane.

And Press ENT



Dro is now targeting Hole 00 in x y plane . It shows CURRENT HOLE NO

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

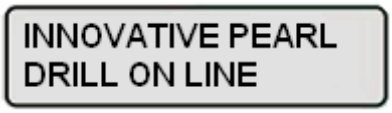
Note : press ESC key to terminate Drill on Line function

Mode 2:

Step 1

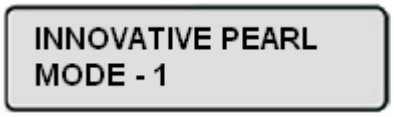
Press 

Display shall show



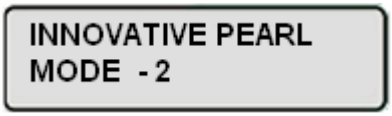
Step 2 Press 

Display shows



Step 3 Press  to change the mode of programming if required ,

presently we select mode 2 .



Step 4 Press 

Display shows .The last value you have entered for axis X origin of the arc you need to drill. (y origin in case of YZ plane and)

Step 5: Use numeric keys for entering the origin value. Suppose you enter 10.000mm

(system shall ask for y axis in case of YZ plane)

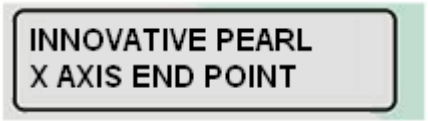
Step 6: Press 

Display shows

This is last value you have entered for axis Y origin of the line you need to drill.
(Z origin in case of YZ plane and XZ plane)

Step 7 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

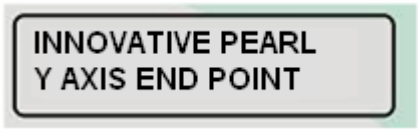
Step 8: Press 

Display shows 

Use numeric keys for entering the end point. Suppose you enter 10.000mm
(system shall ask for y axis in case of YZ plane)

Step 9: Press 

Display shows



Use numeric keys for entering axis end point. Suppose you enter 10.000mm (Z axis in case of YZ plane and XZ plane)

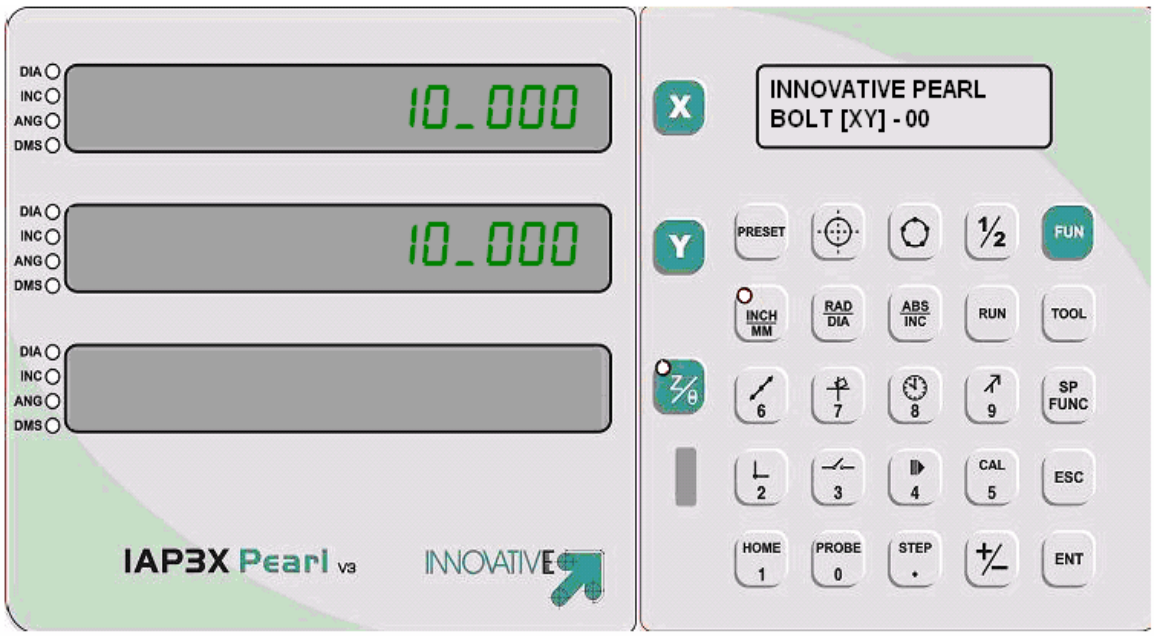
STEP 10 :

Press 

Display shows

(DISPLAYS LAST VALUE OF NO.OF HOLES)

Press 



Dro is now targeting hole b 00 in x y plane . It shows CURRENT HOLE NO

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter "Examples "for more clear explanation.

Note: Press 

key to terminate Drill on Line function.

6. Drill on a matrix

This is another useful mode where you could create a mesh of holes.

This function is used to drill hole at specified distance on a matrix plane .This matrix of drills can be in any of 3 planes specified below.

1. XY Plane
2.YZ Plane
3.XZ Plane

The plane can be selected using function 15 of Engineering mode. Refer chapter " engineering mode" for more details.

There are 2 different techniques to program drill on matrix parameters.

Mode 1: in this mode the user shall give the following parameters

- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- Length of matrix.
- Width of matrix
- No of columns
- No of Rows
- Angle made with base axis

Mode 2:

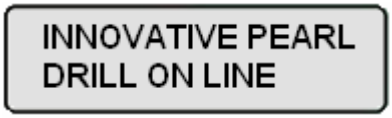
- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- Segment length
- Segment Width
- No of columns
- No of Rows
- Angle made to base axis

A. Mode 1:

Step 1

Press 

Display shall show

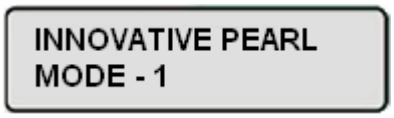


Step 2

Press 

Display shows

Step 3 : Press 



Press  to change the mode of programming if required ,

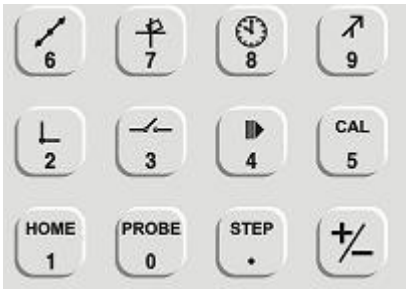
presently we select mode 1 .

Step 4 : Press 

Display shows .The last value you have entered for axis X origin of the matrix you need to drill. (Y origin in case of YZ plane and)

Step 5 : Use numeric keys for entering the origin value. Suppose you enter 10.000mm

(System shall ask for Y axis in case of YZ plane)



Step 6: Press 

Display shows

This is last value you have entered for axis Y origin of the matrix you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 7 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

Step 8: Press 

Display shows

Display shows last value of length of matrix. Use numeric keys to enter new value

STEP 9

Press 

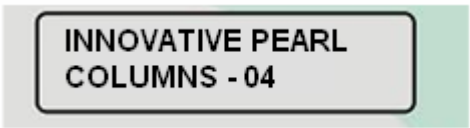
Display shows

Display shows last value of width of matrix. Use numeric keys to enter new value

Step 10

Press 

Display shows last stored value for number of columns



Use numeric keys to enter new number of columns(range is from 00 to 99)

Step 11

Press 

Display shows last stores value of number of rows

INNOVATIVE PEARL
ROWS - 04

Use numeric keys to enter new number of rows (range 00 to 99).

Step 12

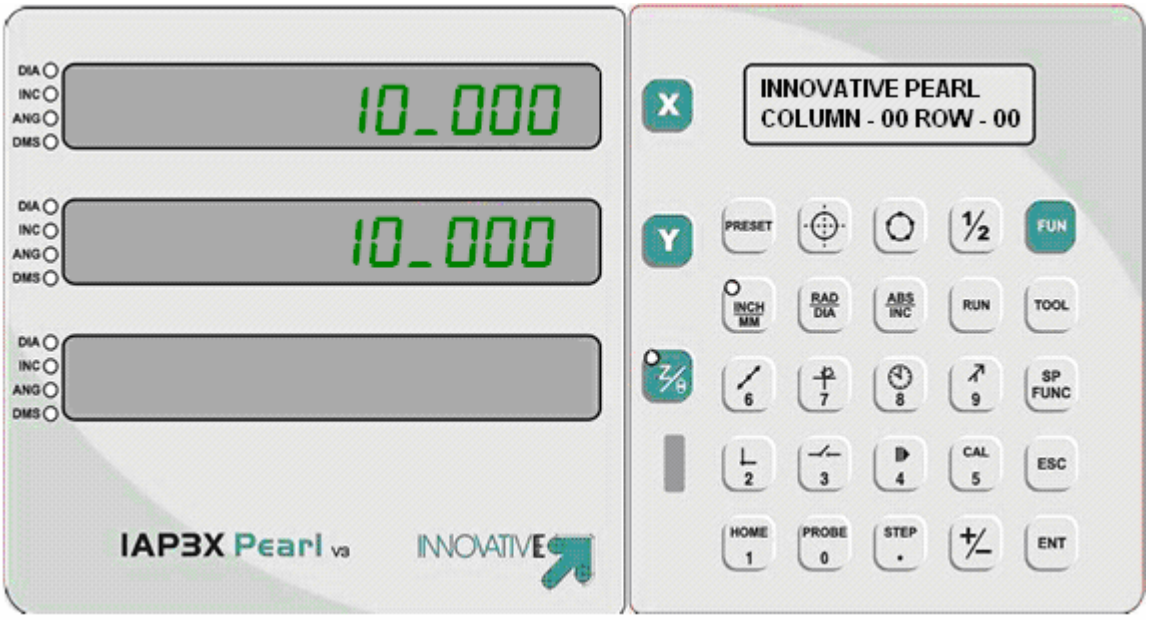
Press 

INNOVATIVE PEARL
ANGLE..?

Use numeric keys to enter new angle the matrix shall make with reference to x axis (for XY and XZ) plane and Y axis in case of YZ plane.

Step 13 And Press 

Display shows



Dro is now targeting hole at COLUMN 00 AND ROW 00 in x y plane .

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press ESC key to terminate Drill on matrix function

Step 14

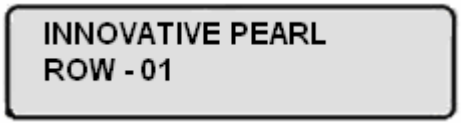
:

Press +/- to advance column no by one.

Use numeric keys to modify the column if you required.

Press STEP key to change rows

display show



Press +/-

to advance Row no by one.

Use numeric keys to modify the Row if you required.

And Press ENT

To target hole selected by columns and rows

(Press ESC key to terminate the function and return to normal mode)

Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter “ Examples “ for more clear explanation.

Note : press ESC key to terminate Drill on matrix function

B. Mode 2:

Step 1

press 6

Display shall show

INNOVATIVE PEARL
DRILL ON LINE

Step 2

Press STEP

Display shows

INNOVATIVE PEARL
DRILL ON MATRIX

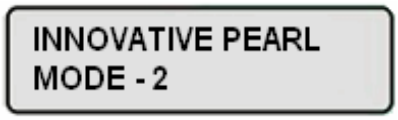
Step 3

Press ENT

INNOVATIVE PEARL
MODE - 1

Step 4

Press  key, now display shows



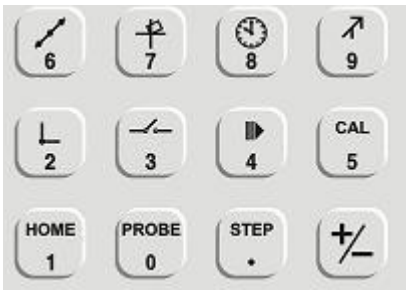
Step 5

Press 

Display shows, the last value you have entered for axis X origin of the matrix you need to drill. (Y origin in case of YZ plane and)

Step 6: Use numeric keys for entering the origin value. Suppose you enter 10.000mm

(system shall ask for Y axis in case of YZ plane)



Step 7: Press 

Display shows

Step 8 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

This is last value you have entered for axis Y origin of the line you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 9

Press ENT

Display shows

INNOVATIVE PEARL
SEGMENT LENGTH

Display shows last value of segment of matrix. Use numeric keys to enter new value.

Note : segment length is distance between two columns.

Step 10

Press ENT

Display shows

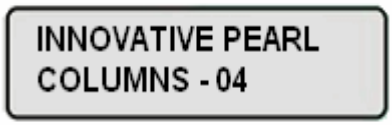
INNOVATIVE PEARL
SEGMENT WIDTH

Display shows last value of segment width of matrix. Use numeric keys to enter new value
note : segment width is distance between two rows.

Step 11

Press 

Display shows last stored value for number of columns

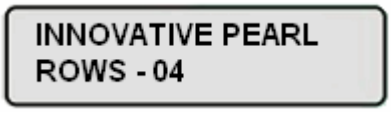


Use numeric keys to enter new number of columns(range is from 00 to 99)

Step 12

Press 

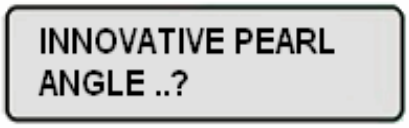
Display shows last stores value of number of rows



Use numeric keys to enter new number of rows (range 00 to 99).

Step 13

Press 

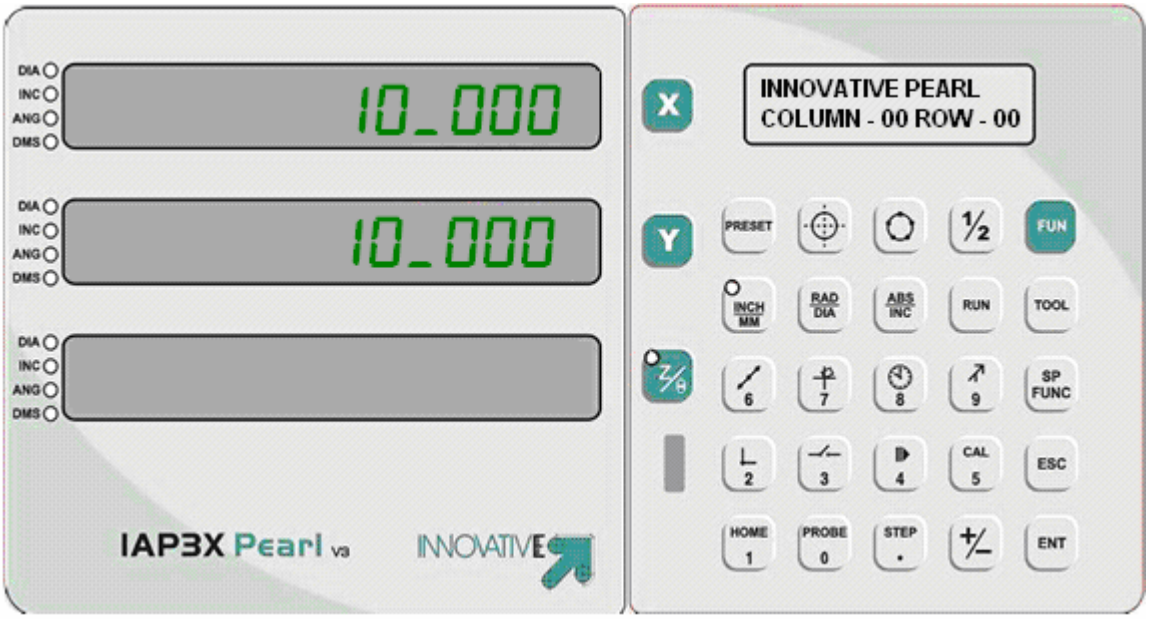


Use numeric keys to enter new angle the matrix shall make with reference to x axis (for XY and XZ) plane and Y axis in case of YZ plane.

Step 14

And Press 

Display shows



Dro is now targeting hole at COLUMN 00 AND ROW 00 in x y plane.

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press ESC key to terminate Drill on Matrix function

Step 15:

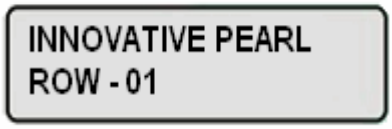
Press +/−

to advance column no by 0ne

Use numeric keys to modify the column if you required.

Press STEP key to change rows

display shows



Press +/-

to advance Row no by one

Use numeric keys to modify the Row if you required.

And Press ENT

To target hole selected by columns and rows

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press ESC key to terminate Drill on matrix function

7. Drill on a frame:

This is one another useful mode where you could create a mesh of holes.

This function is used to drill hole at specified distance on a frame plane .This frame of drills can be in any of 3 planes specified below.

1. XY Plane
2. YZ Plane
3. XZ Plane

The plane can be selected using function 16 of Engineering mode. Refer chapter " engineering mode" for more details.

There are 2 different techniques to program drill on frame parameters.

Mode 1: in this mode the user shall give the following parameters

- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- Length of matrix.
- Width of matrix
- No of columns
- No of Rows
- Angle made with base axis

Mode 2:

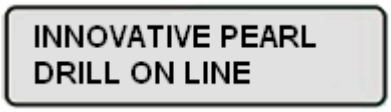
- X origin of the start point of the line (Y in case is YZ plane)
- Y origin of the start point of the line (Z in case is YZ plane and XZ plane)
- Segment length
- Segment Width
- No of columns
- No of Rows
- Angle made to base axis

A. Mode 1:

Step 1

Press 

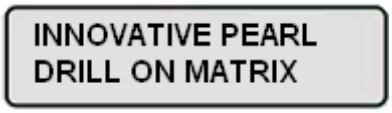
Display shall show



Step 2

Press 

Display shows



Step 3

Press 

Display shows

Step 4

Press 

Press 

to change the mode of programming if required ,

presently we select mode 1

Step 5

Press 

Display shows .The last value you have entered for axis X origin of the matrix you need to drill. (Y origin in case of YZ plane and)

Step 6: Use numeric keys for entering the origin value. Suppose you enter 10.000mm

(System shall ask for Y axis in case of YZ plane)

Step 7: Press 

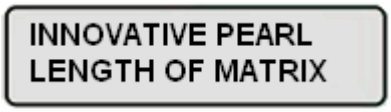
Display shows

This is last value you have entered for axis Y origin of the matrix you need to drill. (Z origin in case of YZ plane and XZ plane)

Step 8 :Use numeric keys for entering the origin value. Suppose you enter 10.000mm.

Step 9: Press 

Display shows

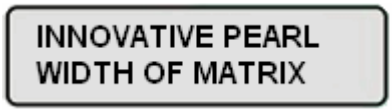


Display shows last value of length of matrix. Use numeric keys to enter new value

Step 10

Press 

Display shows

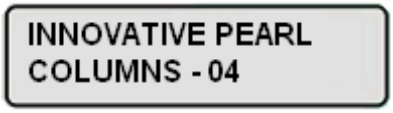


Display shows last value of width of matrix. Use numeric keys to enter new value

Step 11

Press 

Display shows last stored value for number of columns

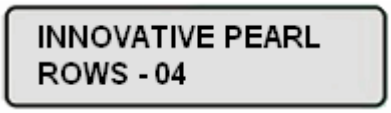


Use numeric keys to enter new number of columns(range is from 00 to 99)

Step 12

Press 

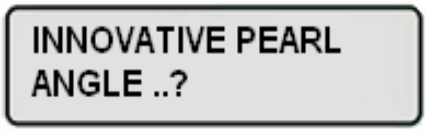
Display shows last stores value of number of rows



Use numeric keys to enter new number of rows (range 00 to 99).

Step 13

Press 

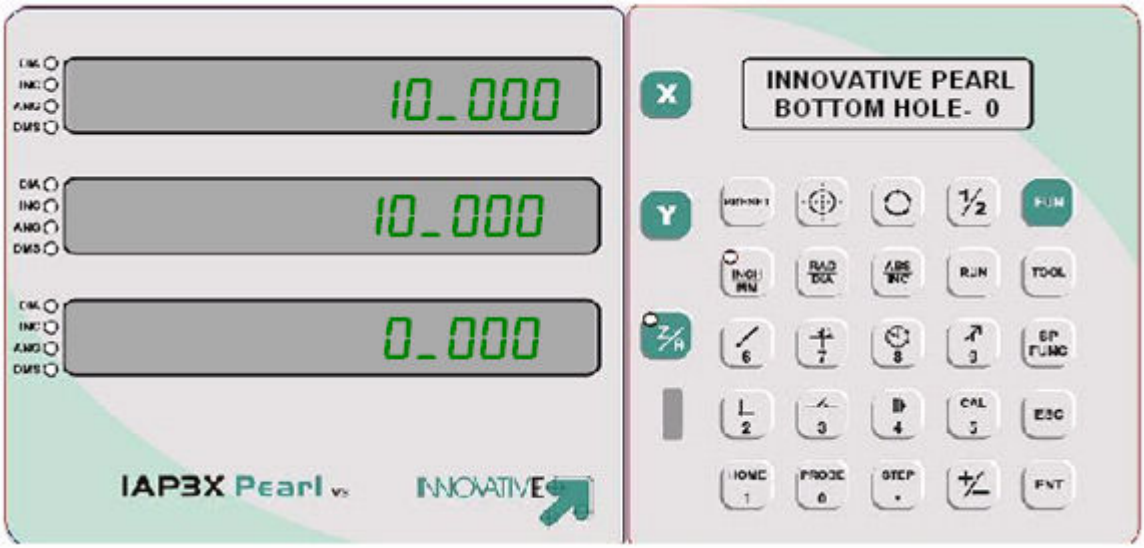


Use numeric keys to enter new angle the matrix shall make with reference to x axis (for XY and XZ) plane and Y axis in case of YZ plane.

Step 14

And Press 

Display shows



Dro is now targeting hole at COLUMN 00 AND ROW 00 in x y plane.

(Distance to go (zero approach) to x & y origins of center of displayed hole no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed hole no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press ESC key to terminate Drill on frame function

Step 15:

Press +/−

To change side of frame. It changes as follows.

1. ARM – TOP (Last row)
2. ARM – RIGHT (Last column)
3. ARM – LEFT (First column)
4. ARM – BOTTOM (First row)

Press STEP key to hole no on selected arm.

Display shows

Press 

to advance hole no by one.

Use numeric keys to modify the hole if you required.

And Press 

To target hole selected by columns and rows

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Note : press  key to terminate Drill on frame function.

8. Taper turning

This function gives the facility of turning the job with taper. It has maximum limit of 0-999 steps for fine turning. This line of drills can be in any of 3 planes specified below.

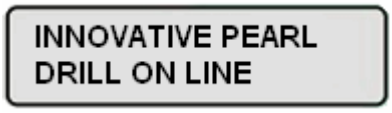
1. XY Plane
2. YZ Plane
3. XZ Plane

The plane can be selected using function 14 of Engineering mode. Refer chapter " engineering mode" for more details.

Step 1

Press 

Display shall show



Step 2

Press 

Display shows

INNOVATIVE PEARL
DRILL ON MATRIX

Step 3

Press 

key.

Display shows

INNOVATIVE PEARL
DRILL ON FRAME

Step 4

Press 

Now display shows

INNOVATIVE PEARL
TAPER TURNING

Step 5

Press 

Display shall show

Enter X – axis origin. (e.g. X- 0.000)

Step 6 :

Press 

Now display shows

Enter Y- axis origin.(e.g. Y- 0.000)In case of XY plane.
The plane can be selected as per your requirement. If you wan to change the plane then you can use function 14 of 'Engineering mode'

Step 7

Press 

Now display shows

Enter steps by using numeric keys. It should be enters maximum 000 - 999 steps .

For example Step = 005 is entered

Step 8

Press 

Display shows

Enter length of taper.

For example length of taper= 5.000

Step 9

Press 

Now display shall show

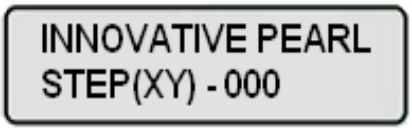
Enter angle in degree.

e. g. 45 degree angle will be entered.

Step 10

Press 

Display shall show



Enter steps by using numeric keys or by pressing 

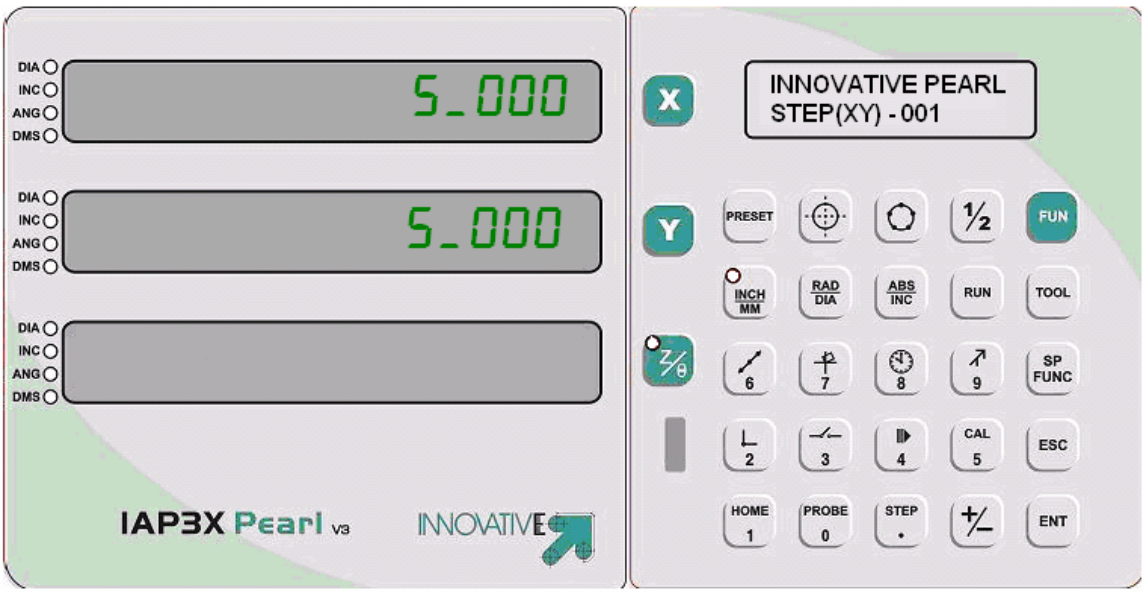
key.

Step 11

Press 

Now display shows the coordinate of the step , which you have to be entered.

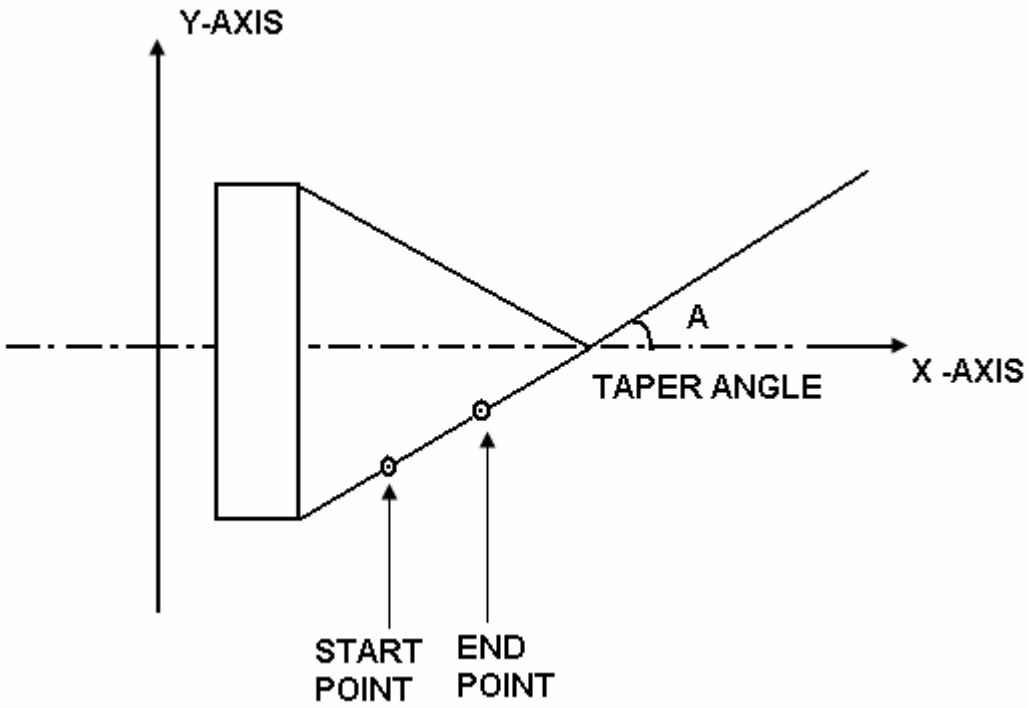
For example, Display shows co-ordinates of step 001



9. TAPER CALCULATOR:

This function calculates taper angle of part hence it is necessary to define two point's of parts profile. The angle is showing the corresponding axis in plane. There are 3 planes should be defined in this functions, such as XY, YZ OR XZ plane. The angle in between starting position of the machine and the ending I.e You have to required position of the plane, it is known as taper angle. In this function also defines two points start point and end point, then it can be measure the taper angle.

The following figure shows the taper calculation in XY plane.



The fig shows the start point and end point can locate in XY plane.
A is the taper angle.

In above fig shows

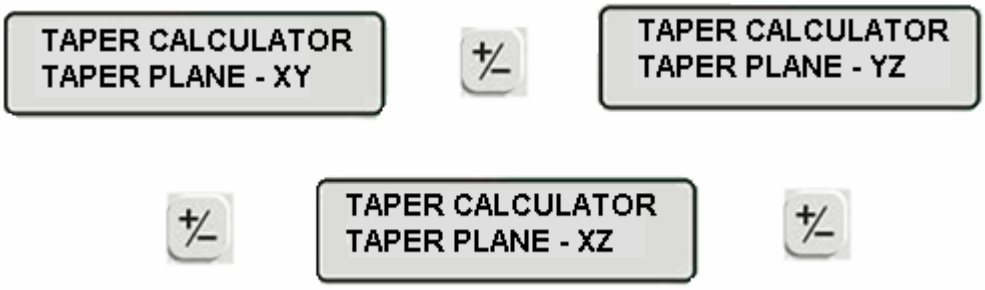
Start point :- X = 10 , Y = 10

End point :- X = 25 , Y = 25

Calculated taper angle = 45 degree.

Step : 1 Long press ½ key .

Now display shall show



If you want to change taper plane then use +/- key to select

Different plane, such as XY, YZ , OR XZ .

Step : 2 Press ENT key.

Display shows

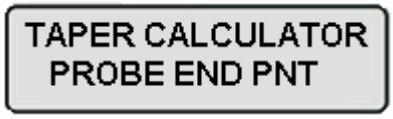
After that move the slide up to fixed start point , then display showing it's value.

(e.g In XY plane X = 10.000 , Y = 10.000)

Step: 3 Press 

Key.

Now display shall show



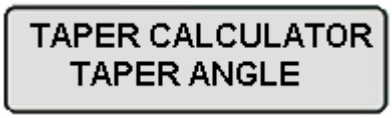
Then move the slide up to the end point of the job, display showing it's value.

(e.g. In XY plane X = 25.000 , Y = 25.000)

Now display shall show

Step : 4 Press 

Display shows



After that display shall show calculated taper angle. It is in degrees.

(E.g. in above example display showing taper angle = 45 degree.)

10.SKEW A PART (WORKPIECE ROTATION):

Skew function is used to convert machine co ordinates to part co ordinates and it is apply for the misalignment. The part is not properly aligned to the co-ordinate measuring system. This improper aligned part generates inaccuracies in measurements. Hence to remove these inaccuracies the parts needs to be skewed. The part is mounted on the measuring system to measure skew line by probing a straight edge of known.

When probing the line you can use minimum of 2 points and maximum 100 points, remember that more points means greater accuracy.

Step 1 : Press skew 

key.

Now display shall show

Then press 

Display shows

Use 

key to change the skew of plane in quadrant 2, 3, OR 4.

Then press 

key.

Display shows

Step 2 Press 

Now display will show

SKEW THE PLANE
PROBE X-AXIS - 00

Then probe the points in the X – axis.

Then display showing respective axis value which you have to probing the points.

Step 3

Press 

key.

Display shall show

SKEW THE PLANE
PROBE X- AXIS - 01

(Display showing new value in example)
Then enter new value

Note : Auto filtration of wrong points starts after 8th points , so place minimum 2 or above points for better results. It should be maximum 100 points placed.

Step 4 Then press 

Display shall show

In this way ,the above showing x axis example value can be probes in selecting y axis. It should be probes minimum 2 points and maximum 100 points.
If you enter less than 2 points ,now display shall show

Step 5 Press 

Now display shall show

In this way you can check plane is skewed.
After that you can directly checked plane is skewed by using following procedure

Step 1 Long press  key.

Display shall shows current status of plane

It is toggled by using  key.

11: RUN (PROGRAMMING MODE):

This is a block program mode where user can store different co ordinates of the machine axes and recall them when required. This mode is used for variety of jobs where variety of drills if to be dome in variety of co ordinates.
Normally referred as program block.
V3 has a huge program memory (more than any other DRO available in the market today).It is equipped with 3 program blocks.

1. Block 1 - 1000 no's of co ordinate memory for X, Y, Z and C axes.
2. Block 2 - 500 no's of co ordinate memory for X, Y, Z and C axes
3. Block 3 - 500 no's of co ordinate memory for X, Y, Z and C axes

Program memory is split in three different blocks purposefully to ease memory management for the user who needs to store different job programs. .

There are three different modes in run mode.
1.Job learn
2.Program block
3.Run program

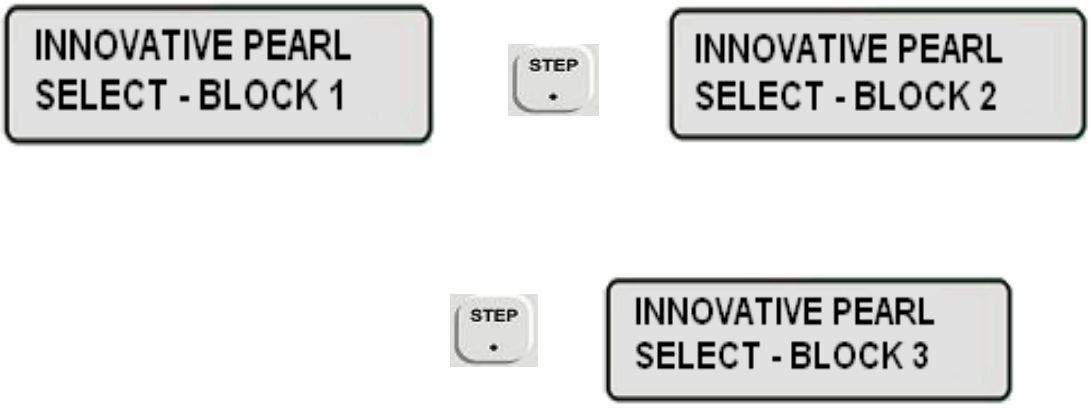
Step 1.

Press 

Display shows

Use 

key to scroll between three different blocks.



Step 2

Press 

when you select the block to be used

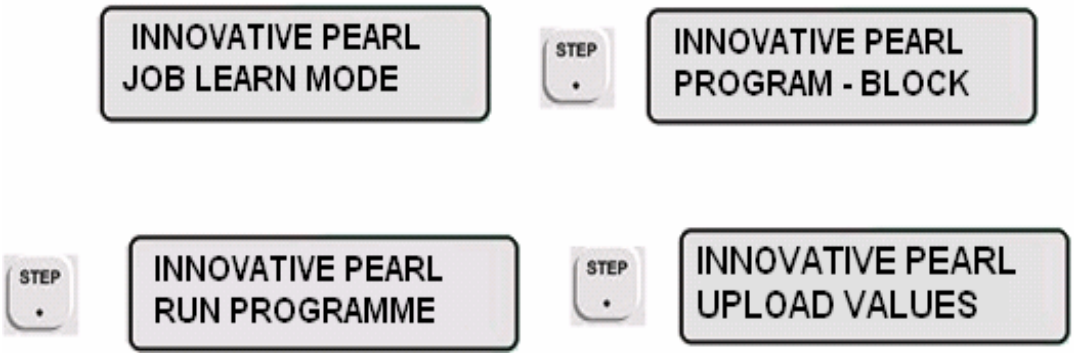
Note : block1 is of 1000 program steps, 2 of 500 and 3 of 200 program steps.

Step 3

Here there are three different modes again
A. Job learn mode
B. Program block
C. Run program

Any of the options can be selected using 

Key.



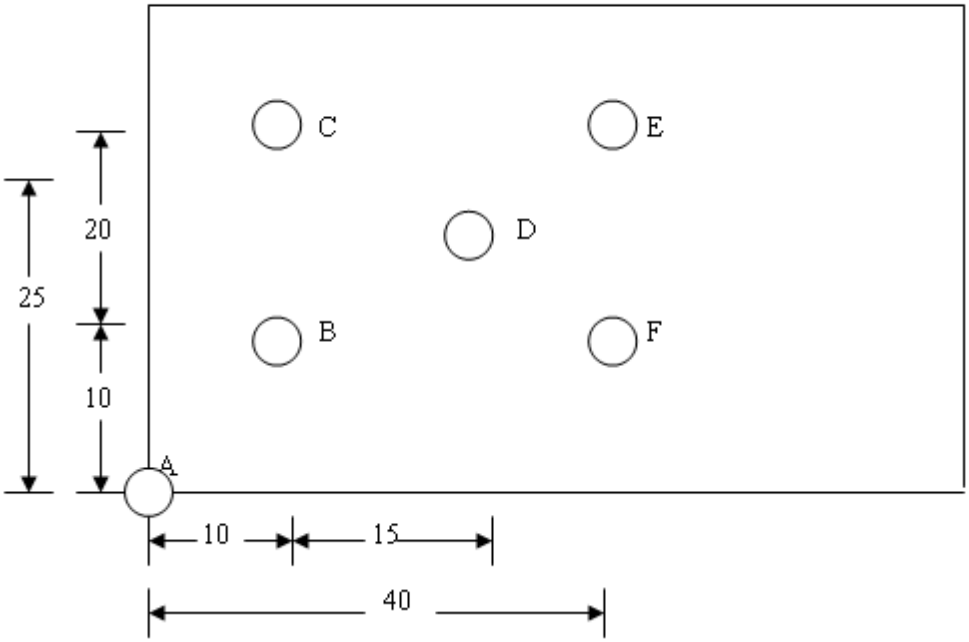
Select particular option and press 

Further we shall discuss each of sub topics separately.

A. Job learn mode:

This is a mode for programming the block of memory. This mode is best used for reverse engineering where a master job is present and is placed on the machine. You need to load the job on the machine. Set the datum prior to start job learning. Position the spindle or positioning pin on hole no one and teach the co ordinates of hole to the unit using the following procedure.
Refer examples for better understanding the function.

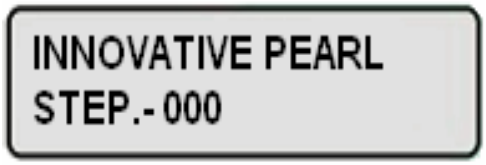
EXAMPLE:



Step 4.

On selecting Job learn mode from the above section in step 3

display shows



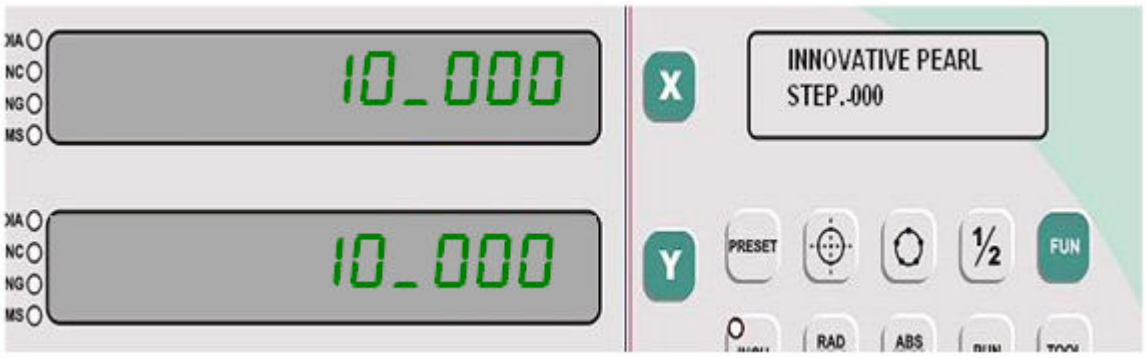
Note : Ensure you set datum point A (ref above example) on the job prior to start of job learning

And press 

Step 5

Move the slide to target point to point B.

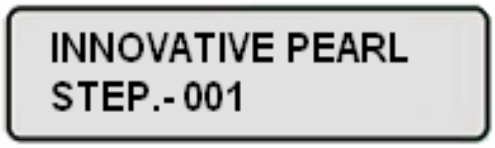
Display shows



Now at this point press 

Point (10 ,10 , Z, Q) is programmed in to block 1 step 1. Z ,Q coordinates are programmed as they were and are not required in this case example hence they are mentioned as Z and C .

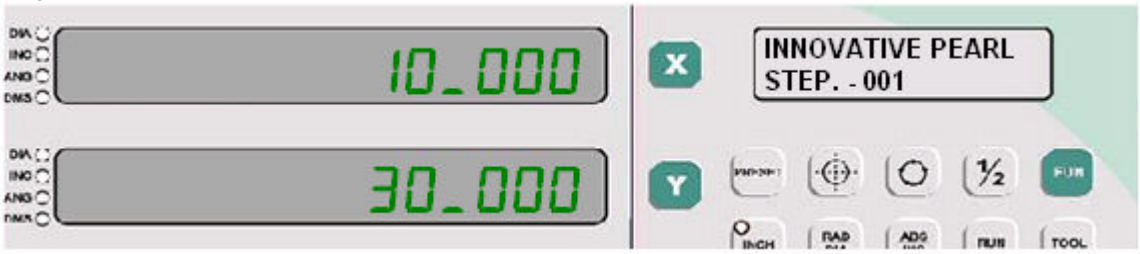
Now the Unit advances to step 1 and shows



Step 6.

Advance the slide (X and Y) to position “C” which is 30mm on y axis and 10 mm on x axis away from point “A”.

At point c the unit shows



Now at this point press 

Point (10 ,30 , Z, C) is programmed in to block 1 step 2. Z ,Q coordinates are programmed as they were and are not required in this case example hence they are mentioned as Z and Q .And so on you could program all the points

Step 7

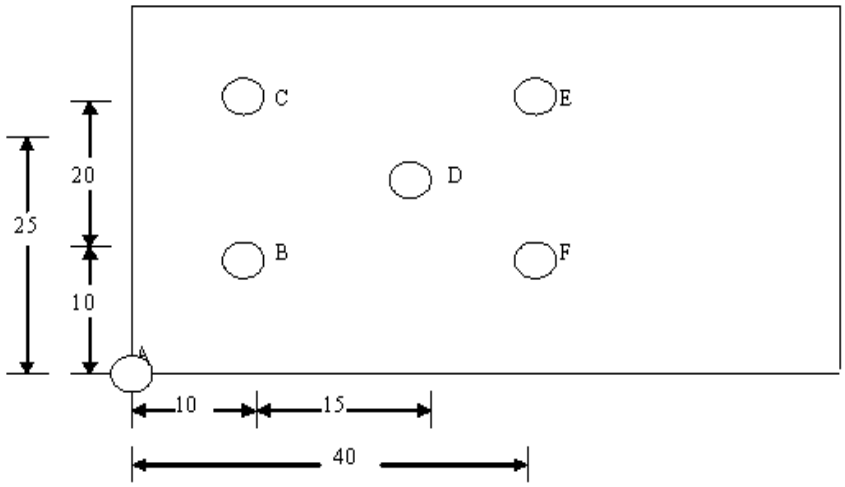
press ESC at the end of job programming and the display returns to normal

counting mode. Your job is been programmed and can be executed using run program mode.

B. Program Block

This is another way of programming the block . This is direct entry mode and can be used if you have drawing of the job to be programmed and not the job physically.

EXAMPLE:



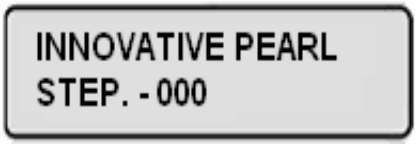
CONSIDER THE SHOWN EXAMPLE ABCDEF ARE THE POINTS TO BE DRILLED. PROGRAMING FOR WHICH IS GIVEN BELOW.

STEP NO.		ABS PROGRAMMING		INC PROGRAMMING	
NO.	NAME	X	Y	X	Y
1	A	ABS 0.000	ABS 0.000	ABS 0.000	ABS 0.000
2	B	ABS 10.000	ABS 10.000	INC 10.000	INC 10.000
3	C	ABS 10.000	ABS 30.000	INC 0.000	INC 20.000
4	D	ABS 25.000	ABS 25.000	INC 15.000	INC -5.000
5	E	ABS 40.000	ABS 30.000	INC 15.000	INC 5.000
6	F	ABS 40.000	ABS 10.000	INC 0.000	INC -20.000

Steps 1 to 3 are described previously at the beginning of this sub topic and are assume that you have selected Program block function. With reference to the same example refer the table , you could find text representation of the example.

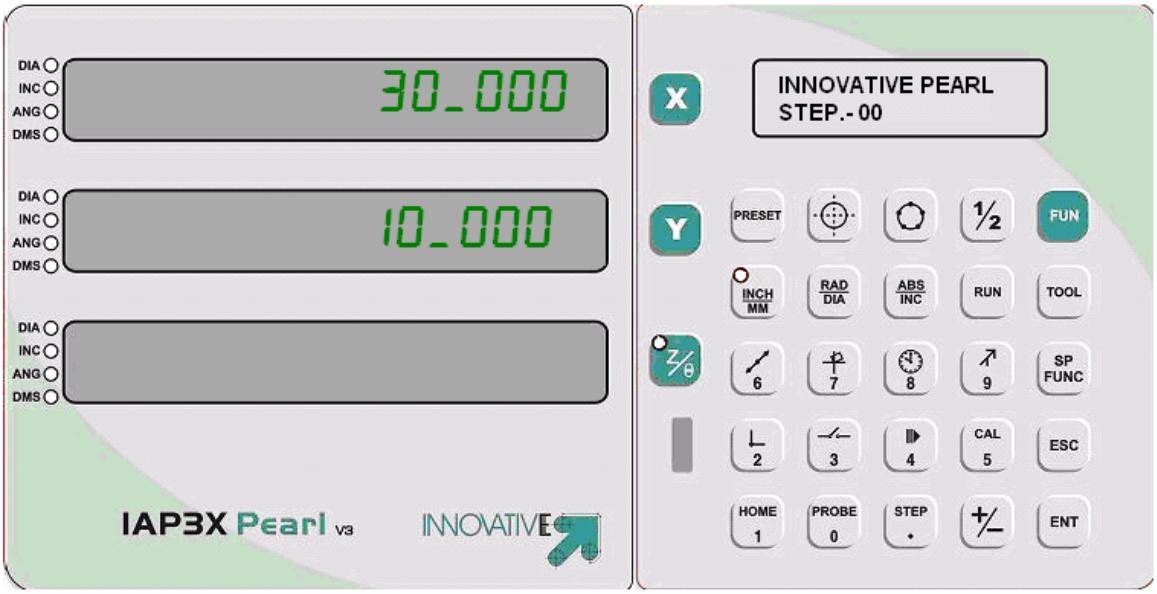
Step 4.

On selecting program learn mode from the above section in step 3 display shows



And press 

Display shows previously programmed values for block 1 step 1 for all axes

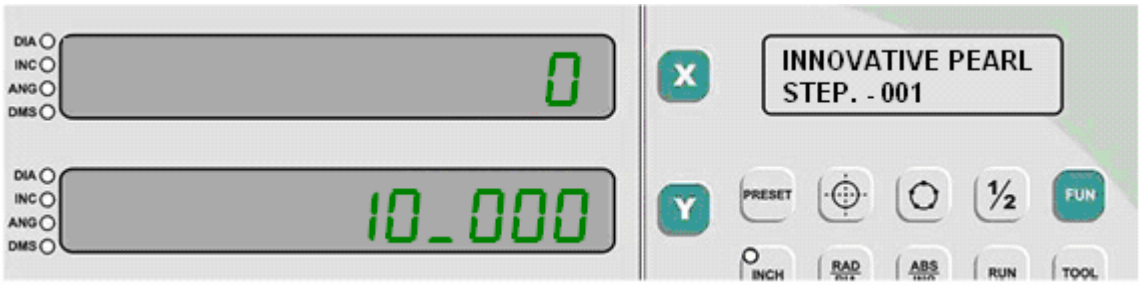


Previous values are X= 10.000 , Y=30.000. Referencing to table first point is point A
which is X=0 and Y=0.

Step 5

Press 

Display shows



Use numeric keys to enter new value (0.000 in this case)

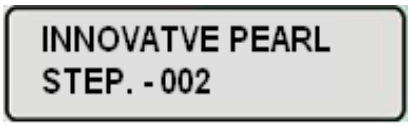
and press 

similarly press 

and use numeric keys to enter new value (0.000 in this case)
Also enter new values for other axis is required.

Step 6. Press  to advance to next step

display shows



Here you could program next point in increment to previous point or in absolute to origin.

Example point C can be programmed as absolute (10,30) or increment (0,20) with reference to point B. If you need to increment program point c press 

on step 2 all leds of increment will turn on

Now if you enter X=0 and Y = 20 will be entered actually as X=10 , Y=30 internally . (10,30) are absolute distances from origin point A where (0, 20) are distance point C is from point B

Step 7

Repeat step 5 and 6 until points are programmed.
Ensure INCEREMENT / ABSOLUTE MODES are properly selected.

Step 8

press 

at the end of job programming and the display returns to normal

counting mode. Your job is been programmed and can be executed using run program mode.

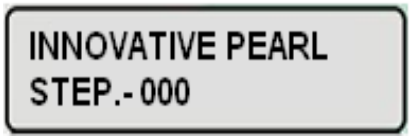
C . Run program

This function is particularly used for executing the block memory which is programmed using above to methods.

Select "Run Program" using step 1 to 3 described previously.

Step 4

display shows



And press 

the unit now shows the distance from the programmed point 1 and down counts to zero on moving of slides . On zero of all axes the machine has approached the point or step 1 from the datum.

The datum setting during programming and running the programme shall be same to achieve desired results.

(Distance to go (zero approach) to x & y origins of center of displayed step no. are displayed on x and y axis. Travel the slide to make both x & y-axis zero. This point is the center of displayed step no.**)**

(Press ESC key to terminate the function and return to normal mode)
Buzzer starts a beep sound as the slide (x and y) come within zero approach band.

Refer Chapter " Examples " for more clear explanation.

Step 5 :

Note : press 

key to terminate Run function

Use numeric keys to modify the step no if you require. You could use 

key
To advance the step no by 1.

And Press

Step 6

Repeat step 4 and step 5 until the job is complete.

Note : press 

key to terminate Run function

Note: All other functions are blocked during run mode is executing.

D. Upload Values

This function is used to transmit run mode values on serial port i.e to PC. Dptools_v2 software captures all these values.

Select “Upload values” using step 1 to 3 described previously.

Step 4: Display shows

And press 

Run mode values of selected block will start to transmit. If Block 1 is selected then 1000 values will transmit otherwise 500 values will transmit.
Data will transmit as follows –
First “S” character will transmit to indicate that transmitting will start.
Then,

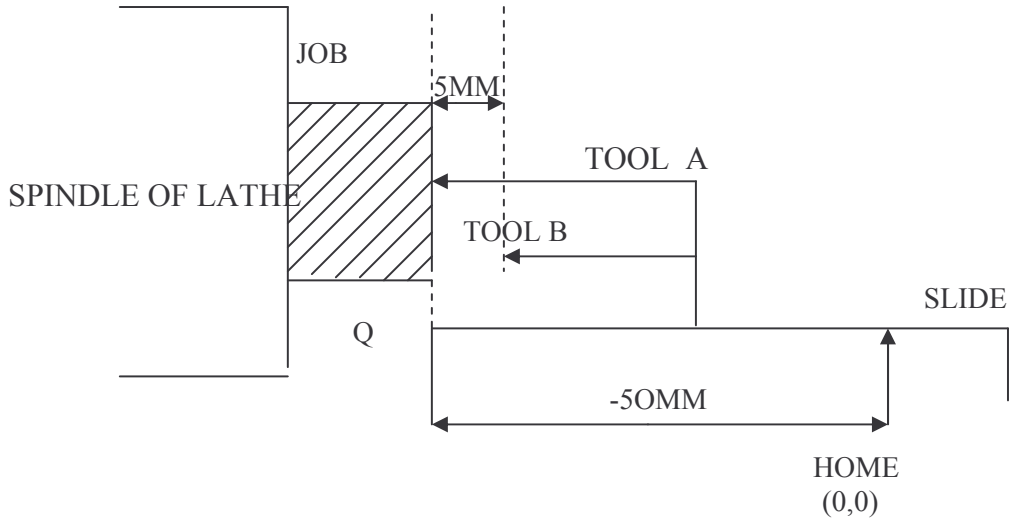
xxx.xxx (x data)	xxx.xxx (y data)	xxx.xxx(z data) (new line)
xxx.xxx (x data)	xxx.xxx (y data)	xxx.xxx(z data) (new line)

After completing values, <CR> will transmit to indicate that transmitting is completed.
After completion of data display shows,

12. TOOL OFFSET:

This mode is specifically used with caption/turret lathes where you have different tools to carry out different operations on single job.

EXAMPLE:



Consider you home the axis and find '0' as shown. Position of tool away from origin is say -50mm for tool 'A'. Now you index the turret to tool 'B'. As tool lengths may vary, the tool 'B' will show a offset say tool offset = 5mm i.e. to touch the job it has to travel 5mm plus i.e. -55mm to achieve same result as tool 'A'. To adjust this offset we use tool-offset feature.

1. Execute home as fix some turret on slide.
2. Touch the tool 'A' to job.
3. Execute the tool-offset function & say zero.
4. Select tool 'B'.
4. Again touch tool 'B' to job & say zero.
5. Offsets of both are stored.
6. Similarly you can store 20 tool offsets.

How does it works:

Say at point Q reading for tool 'A' is -50mm for x-axis. You need to show zero, then offset is 0-(-50) = 50

So at Home pulse position when you invoke tool offset for tool 'A' you will find reading as +50 & by the time you touch the tool to job you will get zero.

Note: Do not change modes like RAD / DIA, INCH/MM of DRO once tool offsets are programmed.

There are basic 3 different sub functions in Tool function of this unit.

1. Modify offset
2. Calculate offset
3. Offset effect

First two methods are used to program the offset value for each axis and third type is to implement the offset.

Step 1

Press 

Step 2

Press 

Display Shows

Here use 

key OR numeric keys to select tool 1 to tool 20 for editing . In this discussion we consider tool 1

Now Press 

Step 3

Use 

key to scroll through three options

Display shows.

Press 

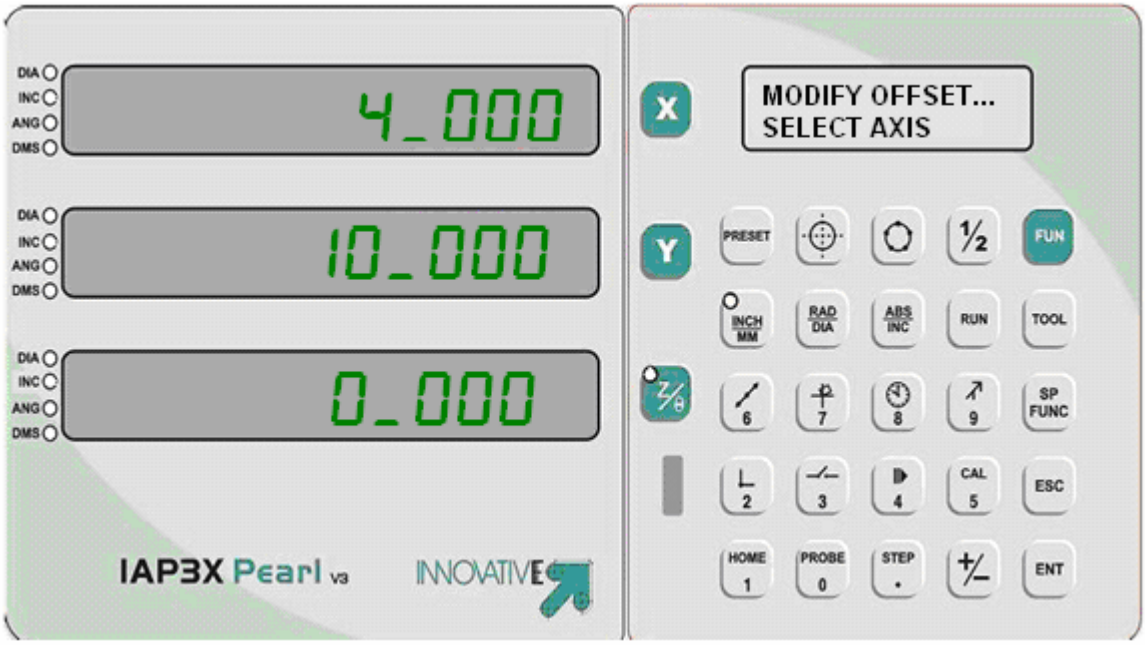
to quit Tool Function.

Step 5

On selection of particular option press 

1. Modify offset :

Display shows last tool offsets if programmed



Step 6

You have to select axis for which the offset is to be program.

Press  or  or  or 

Suppose you press 

Display shows

Enter the new tool offset I.e tool B is shorter by 5mm so enter new tool offset as 5mm.

Step 7

And press ENT

Similarly program tool offset for all other axis.

Press ESC to go back to step3

2. Calculate offset :

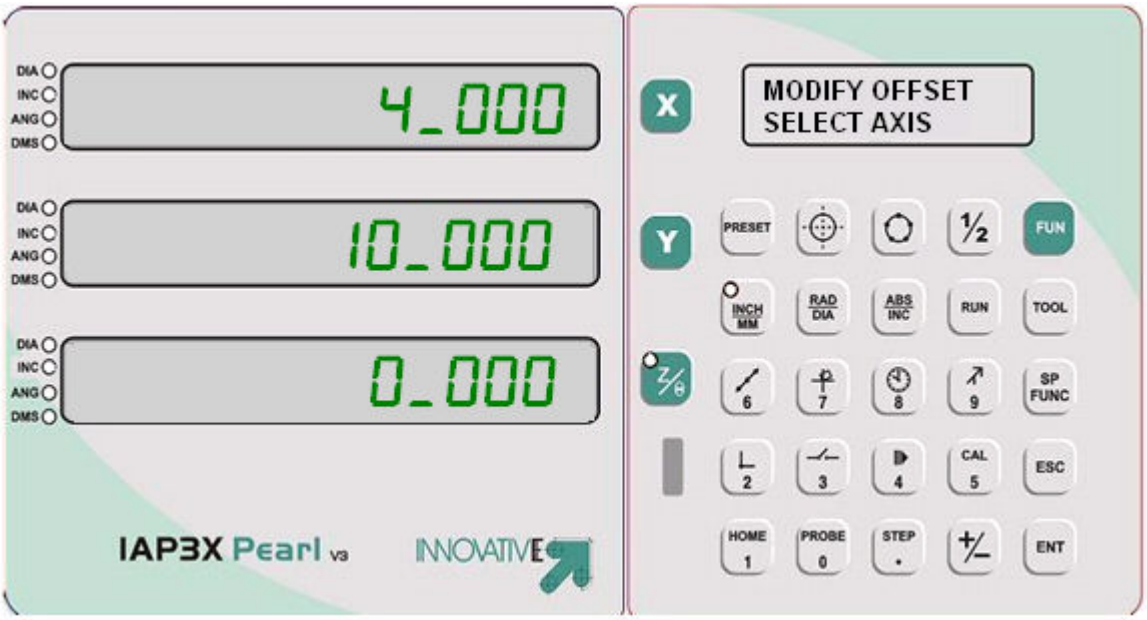
Step 6:

Suppose at using tool A (reference to given example) you have zeroed the datum at the surface of job. Now you change the tool and select Tool b which is shorter by 5mm so the slide needs to move 5mm further touch the job surface here the display shows

That means you need to add 5mm to X axis to make it zero.

Now further from step 1 to 5 select calculate offset

Display shows last tool offsets if programmed



Step 7

You have to select axis for which the offset is to be program.

Press X or Y or Z/θ or Z/θ

Suppose you press X

and enter 0.000 to X axis using numeric key entry

Display shows

Step 8

press ENT

Now display shows the new calculated offset I.e 5.000 mm

similarly calculate offset for all other axis

Step 9

And press 

Similarly program tool offset for all other axis.

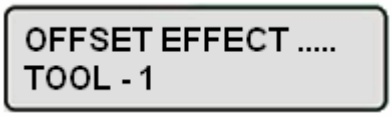
Press 

to go back to step3

3. Offset effect

This function is used to implement the programmed offset using any of the above 2 modes.

Step 6
On selection of offset effect from step 1 to 5 in above discussion
Display shows

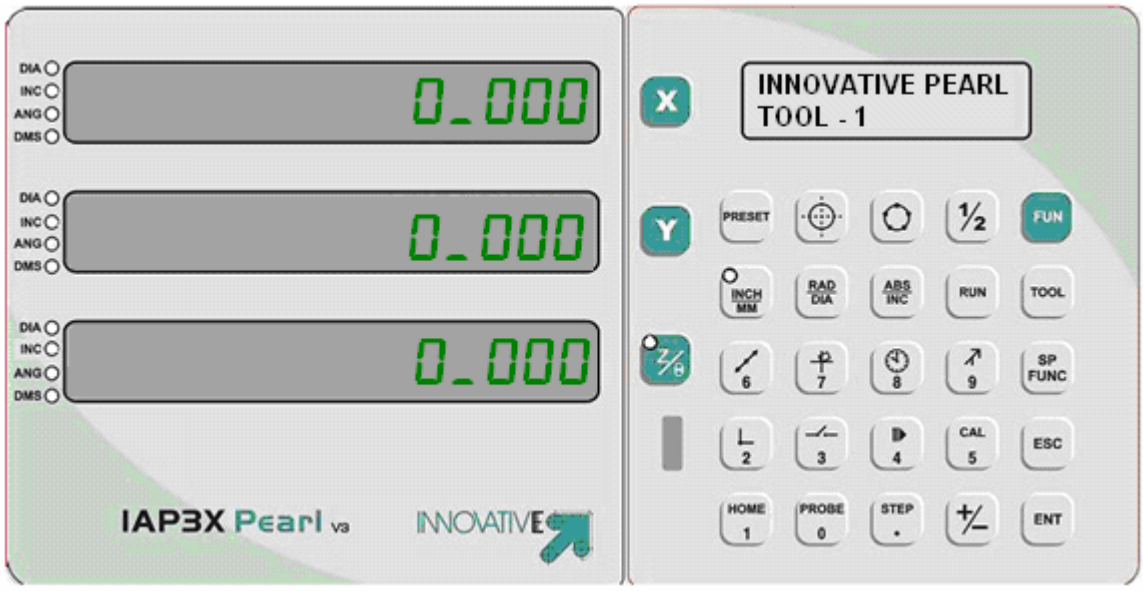


Step 7

Press 

Use numeric key to select any of programmed tool from 1 to 20
We select tool 1 . Now offset for tool one is effected.

Dro comes back to normal counting mode with offset effected (5 mm for tool b) shows



You could see X axis is now showing 0 mm instead of -5mm . 5 mm offset is added to -5mm to make it zero

Now the tool effect mode is active

Step 8:

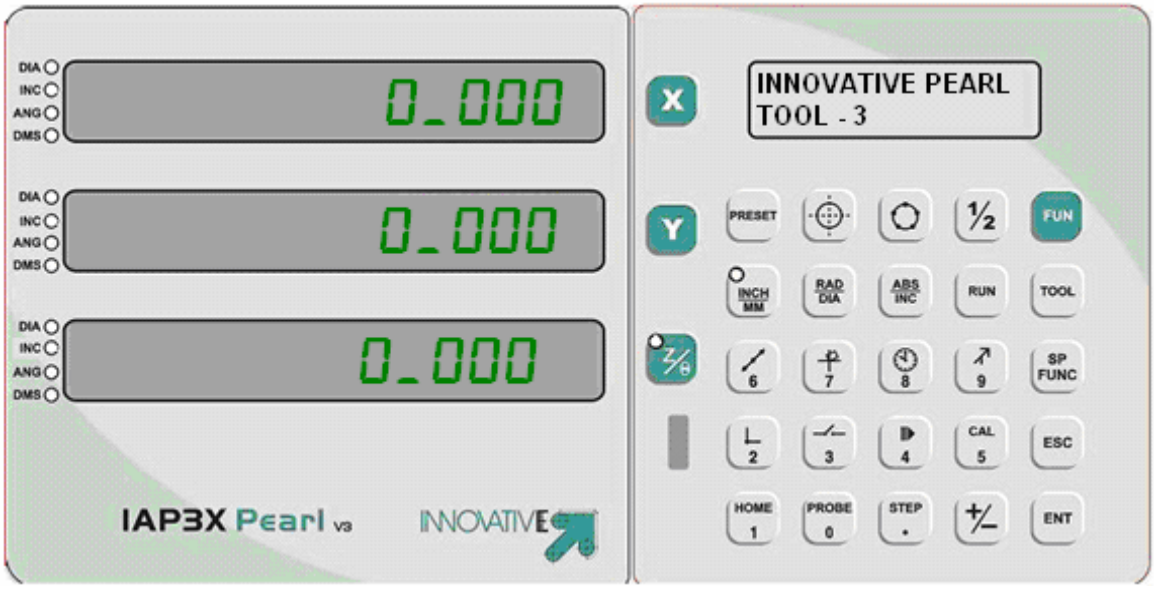
Press key +/- to change tool no if you have already programmed all

tools for fast effect of offsets for selected tool.

suppose you need tool 3

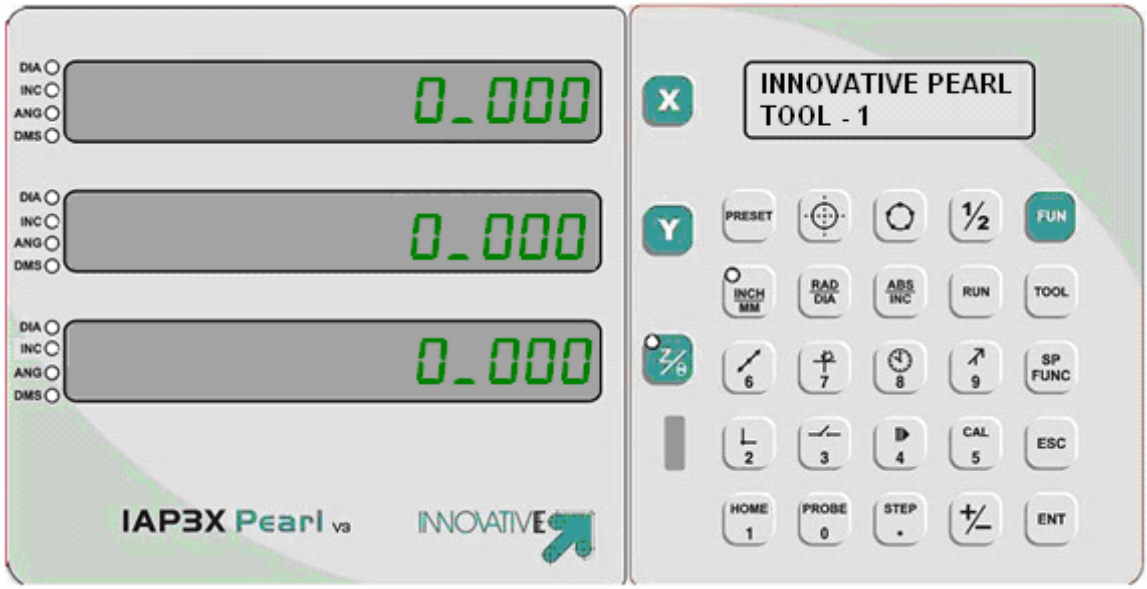
press numeric key 3 . here tool offset three is effected .

Display shows (in normal counting mode)



Direct effecting of tool:

Press TOOL and again TOOL in normal counting mode will force the system to effect tool one directly.



You could see X axis is now showing 0 mm instead of -5mm . 5 mm offset is added to -5mm to make it zero

Press +/- key to change tool no if you have already programmed all tools for fast effect of offsets of selected tools.

Press ESC to quit Tool Function.

All other functions are blocked if tool function is active.

13. JOB CLOCK:

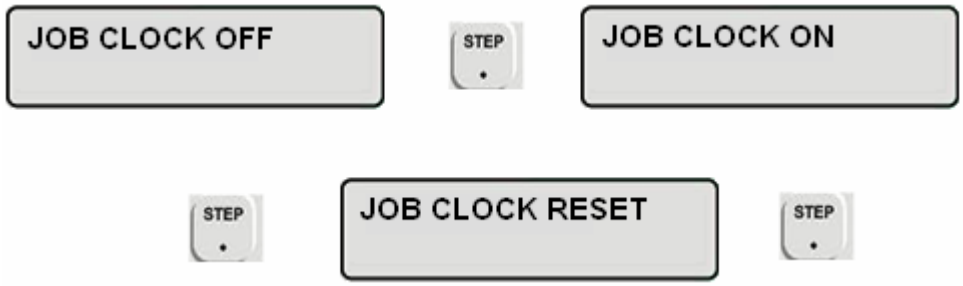
This is a special function used for calculating the time required for completing a particular job. This helps in calculating productivity and job rate.

There are 3 different sub menus.

1. Job clock ON
2. Job clock OFF
3. Job clock Reset

Press 8

Display shows



Use STEP key to scroll between the 3 options.

And press ENT on selection

1. Job clock Off

This function will turn the job clock off.

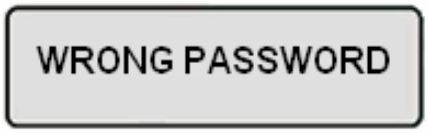
This function will ask for password before turning off the job clock

Display shows

use numeric keys to enter the password . Password is “654321”

and press ENT

If the password entered is wrong display shall show for a second

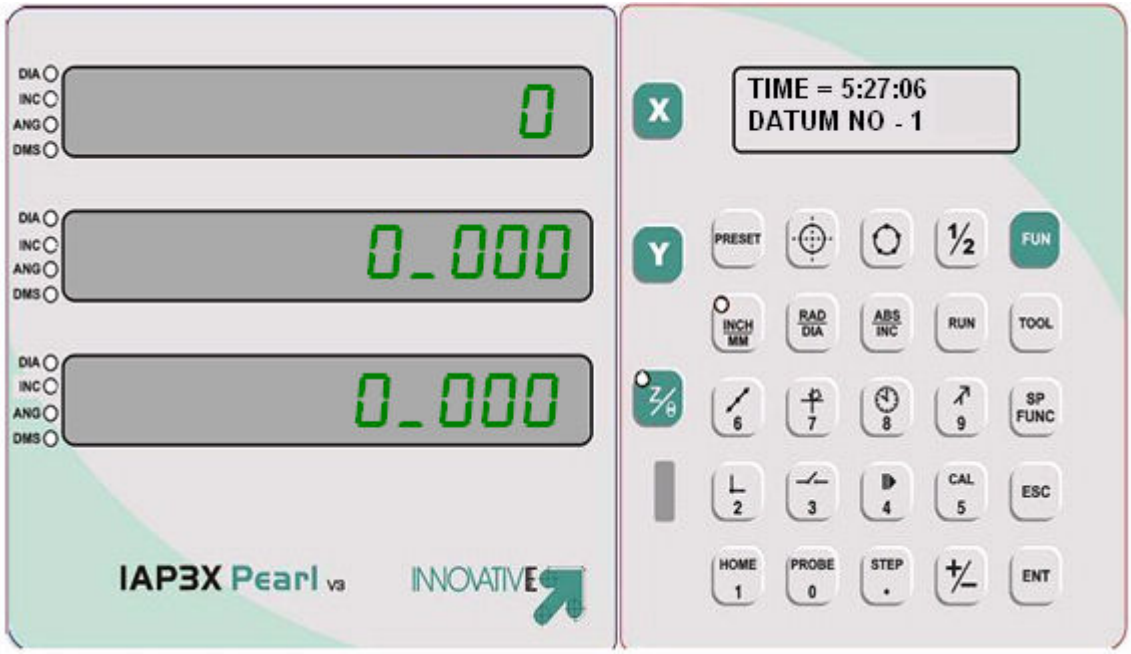


and go back for password reentry.

Correct password shall turn the job clock off and get back to normal display mode.

2. Job clock ON

This function will turn the job clock on. Job clock is always displayed on the top of display in normal counting mode.



3. Job clock reset

This function shall reset the job clock.

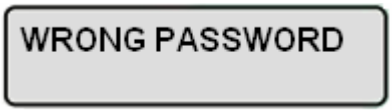
This function will ask for password before turning off the job clock

Display shows

use numeric keys to enter the password . Password is “654321”

and press 

If the password entered is wrong display shall show for a second



and go back for password reentry.

Correct password shall reset job clock off and get back to normal display mode.

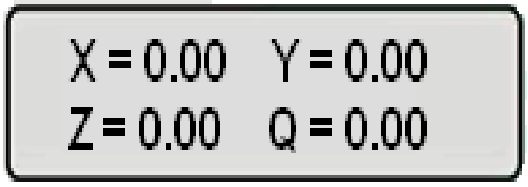
14. Feed Rate

This function is used to display the feeding rate the slide moves. Used to improve the cutter life in case of auto transmission of slides as cutting rate effects the cutter life.

Press 

display shows

For a movement and than displays the feeding rate.



This signifies that X travels 0.00 mm per seconds in case of linear and 0 RPM in case of angular mode. (this is at standstill) and will display some value on movement .similar is for all other axis.

Press 

to clear feed rate function.

Display shows

this is for a movement and gets back to normal counting mode.

15. Calculator Mode:

This Dro has a state of art calculator function preloaded to facilitate the user with some basic geometry calculations like addition , subtraction ,multiplication ,division , sine and cosine,

Step 1

Press 

Display Shows

Step 2

Use numeric entry to enter first no

Press 

Step 3

Display Shows

Press 

to scroll through addition , subtraction ,multiplication ,division , sine and cosine,

Step 4

Press 

on selection of function.

Step 5

For Sine and cosine result is displayed on the window

Press FUN to get back for new calculation I.e step 1 and ESC to exit calculator function.

For all other functions

Do enter second number using numeric entry and Press ENT

Result is displayed on the window

Press FUN to get back for new calculation I.e step 1 and ESC to exit calculator function.

16. VECTORING

Vectoring breaks down the movement of the compound axis into crossfeed or longitudinal axes.

When vectoring is used, the compound axis encoder must be assigned to the Z-axis display. The crossfeed component of movement of the axis will then be shown in X-axis display. The longitudinal component of movement of the axis will be shown Y-axis display.

Step 1 Long press TOOL key.

After that display shall show status of vectoring

Step 2 Press ENT

Now display shows current status of vectoring. I.e it will be off display shows OFF. By using +/- key it is toggled

VECTORING STATUS
VECTORING - OFF

After pressing +/- key vectoring status is changed.

Now display shall show

VECTORING STATUS
VECTORING - ON

Step 3: Press ENT

Now display shall show

VECTORING ANGLE

Then enter the vectoring angle in X-axis.

The axis showing an example, 45 degree angle is entered.

Press ESC to quit from the function.

If vectoring is ON then following message will display on LCD display in Main window for indication.

INNOVATIVE PEARL
VECTORING - ON

17. Relay outputs:

This is a function which facilitates the V3 to communicate with outside world with the help of its outputs.

There are in all 2 different modes of relay outputs

1. 1 Relay (mode 1)
2. 6 Relay

mode 2:

6 Relay :

There are **10 different relay** output setting can be programmed.

There are again 2 different modes of 6 Relay outputs.
1. Non cyclic mode
2. Cyclic mode.

1. **Non cyclic mode** :-

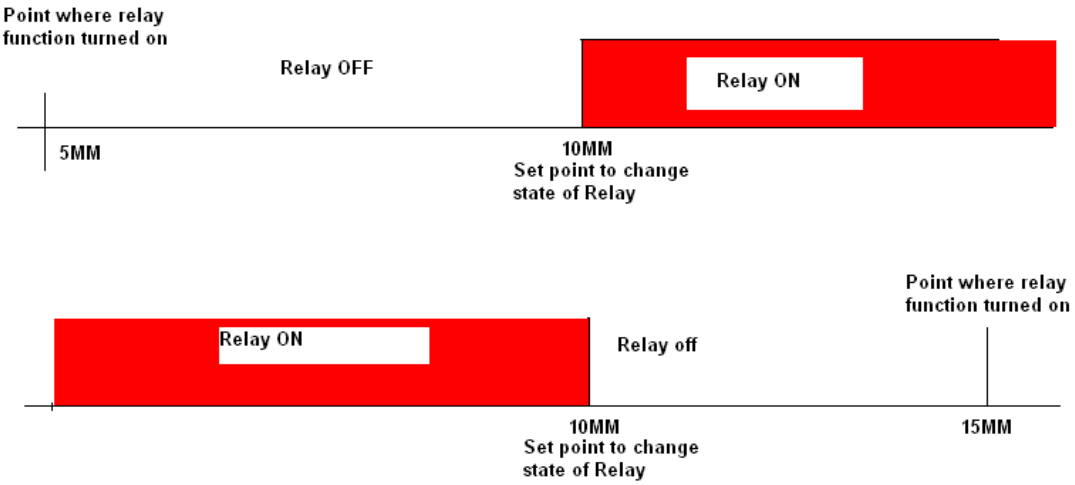
This function activates 6 different open collector outputs in different fashions

A. latch type
B. pulse type

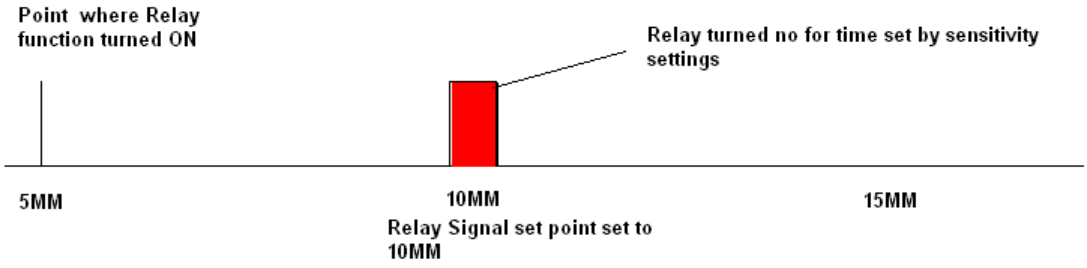
A. Latch type 6 relay outputs:

In this function , when invoked the relay is off , and once the set point is achieved for the programmed relay and selected axis the relay is turned on. The relay is turned off only when the set point is reachieved in reverse direction.

Refer the diagram below for better understanding



B. Pulse type
In this mode a relay pulse is generated every time the set point is achieved .The time for which the relay signal is turned on is set from sensitivity settings defined in
engineering mode function 19.



Any relay can be activated in any mode (latch or pulse) for any axis at any time. This is the beauty of this highly flexible mode.

2. Cyclic mode

This function is similar to the non cyclic mode only the difference is that relay 2,3,4,5 can be turned on only is the (n-1) relay is on and the set point for n th relay is achieved.

For e.g relay 2 can be activated if relay one is active and set point for relay 2 is achieved. If relay 1 is off the relay 2 could not be active.

This function activates 6 different open collector outputs in different fashions

A. latch type
B. pulse type

A. Latch type 6 relay outputs:

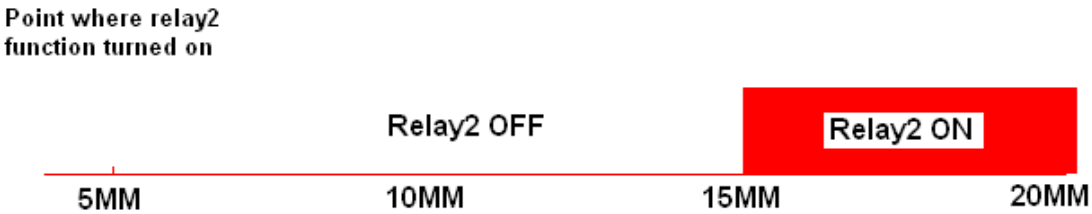
In this function, when invoked the relay is off, and once the set point is achieved for the programmed relay and selected axis, the relay is turned on. The relay is turned off only when the set point is reachieved in reverse direction. These conditions are sufficient for first relay only.
For all further relays one more condition is required additional to above conditions.
Condition is that the n-1 th relay should be ON during the achievement of nth relay set point.

Refer the diagram below for better understanding.

IF relay settings are as follows

Relay1 set point :- 10mm
Relay1 o/p type :- Level Type
Relay1 status :- On

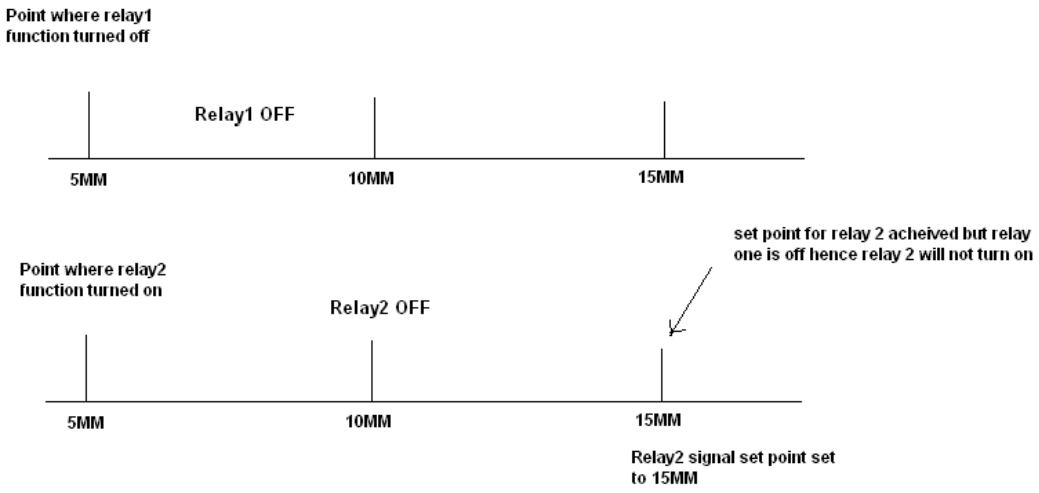
Relay2 set point :- 15mm
Relay2 o/p type :- Level Type
Relay2 status :- On



now if relay settings are

Relay1 set point :- 10mm
Relay1 o/p type :- Level Type
Relay1 status :- Off

Relay2 set point :- 15mm
Relay2 o/p type :- Level Type
Relay2 status :- On



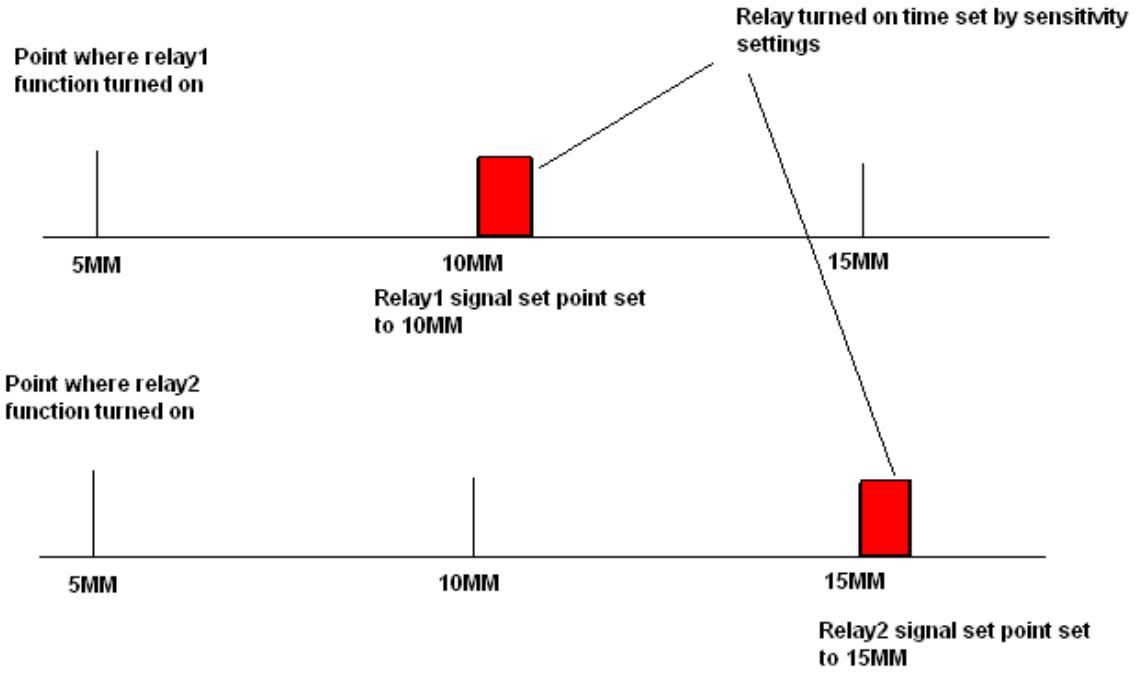
Relay2 can't turned on because relay1 is off. It will turn on only when relay1 is ON and relay2 set point is achieved.

B. Pulse type
In this mode a relay pulse is generated every time the set point is achieved .The time for which the relay signal is turned on is set from sensitivity settings defined in engineering mode function 19.

CASE 1
Relay settings are as follows

Relay1 set point :- 10mm
Relay1 o/p type :- Pulse Type
Relay1 status :- On

Relay2 set point :- 15mm
Relay2 o/p type :- Pulse Type
Relay2 status :- On



CASE 2
Relay settings are as follows

Relay1 set point :- 10mm
Relay1 o/p type :- Pulse Type
Relay1 status :- Off

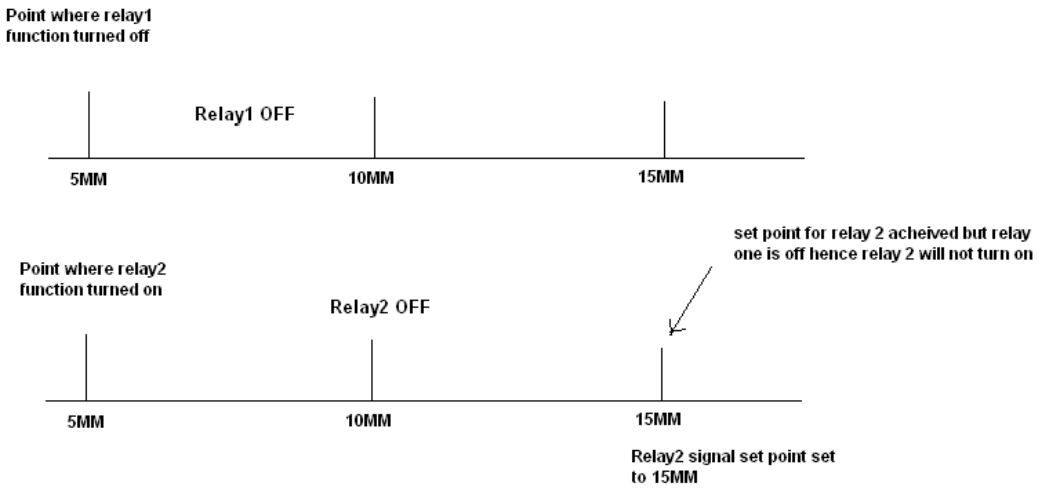
Relay2 set point :- 15mm
Relay2 o/p type :- Pulse Type
Relay2 status :- On

In case 1, relay 2 is turned on after set point is achieved and relay 1 is turned on.

In case 2, relay2 is not turned on though it's set point is achieved because of relay1 is turned off. Relay 2 will turned on after relay 1 is turned on.

Any relay can be activated in any mode (latch or pulse) for any axis at any time.

This mode can be turned on or off from cyclic mode settings defined in engineering mode function 26.



Note : This mode is used applications like moving slide 2 at end of slide 1 , moving slide 3 at end of slide 2 and so on

Programming of this mode can be done by following sequence.

Step 1

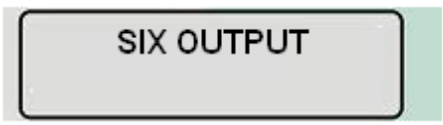
Press 

Display shows

Step 2

Press 

Display Shows



Step 3

Press 

Display shows

Step 4
Use numeric keys to select any one of ten programs.
Suppose we select program 1

Press 

Display shows

Step 5

Use numeric keys from 1 to 6 to select any one of six relays suppose we select relay 1

Press 

Display shows

Step 6

Press 

to scroll through different axis from X , Y ,Z ,and Q

The relay shall be activated for the selected axis and the set point.
Suppose we select X axis.

Step 7

Press ENT

Display shows the last point on x axis

use numeric keys to set a new value of set point for x axis where the relay shall change its state.

Suppose you enter 5.000

Display shall show

Step 8

Press ENT

Display shows

Use +/- key to change to output type

Step 9

Press ENT

Display shows

Use  key to change to status.

Status OFF – will never turn the relay on
Status ON 0 shall change status of relay on set point for selected axis.
Here on 5.000mm of X axis.

Press 

Relay 1 is now programmed and the unit now advances to relay 2.
repeat the above sequence for all relays.

use of numeric keys 1 to 6 will directly jump to particular relay at step 8,
use of  at step 8 will advance the relay no by one.

Step 11

After setting of all six relays

Press 

Relay program 1 is now programmed and the unit now advances to relay program 2.
Repeat the above sequence for all programs.
Use the numeric keys to directly jump to particular program,

Use of  will advance the program no by one.

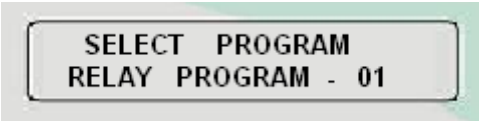
Relay mode activation.

The unit shall be put in relay functions to make all relay functions as per they are programmed.

Press  in normal counting mode to put the Dro in 6 output mode or is directly turned on power on depending on the function 20 of engineering mode.

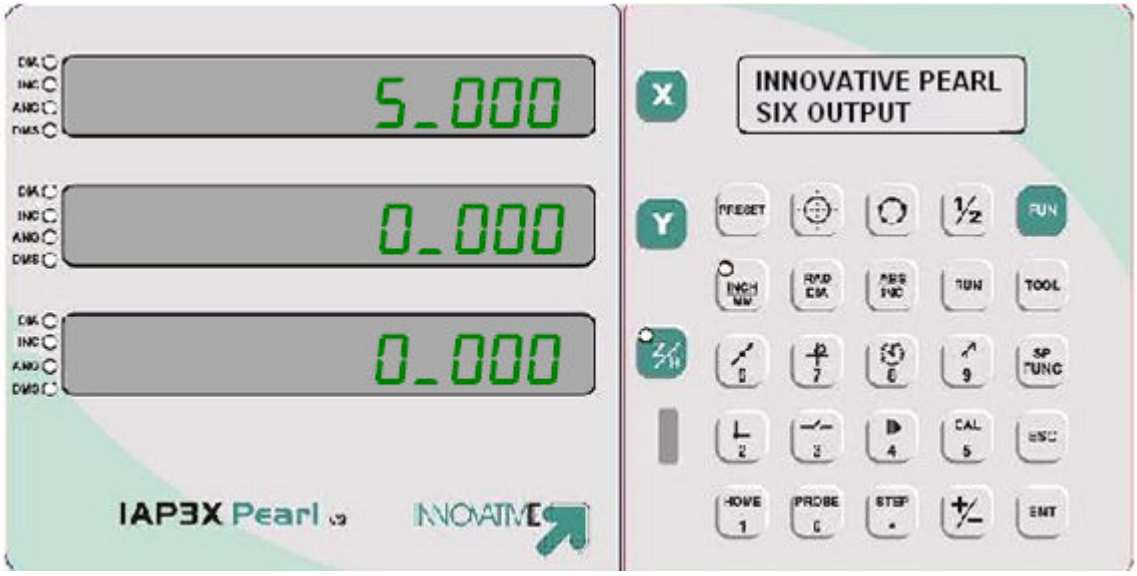
Relay Program activation
Long press in normal counting mode to put the Dro in selecting relay program which have to effect.

Display shows



Use numeric keys to select particular program.
Relays will operate accordingly settings of the selected program.

Display shows



Press ESC to exit six output mode.

18. ANGULAR PCD:

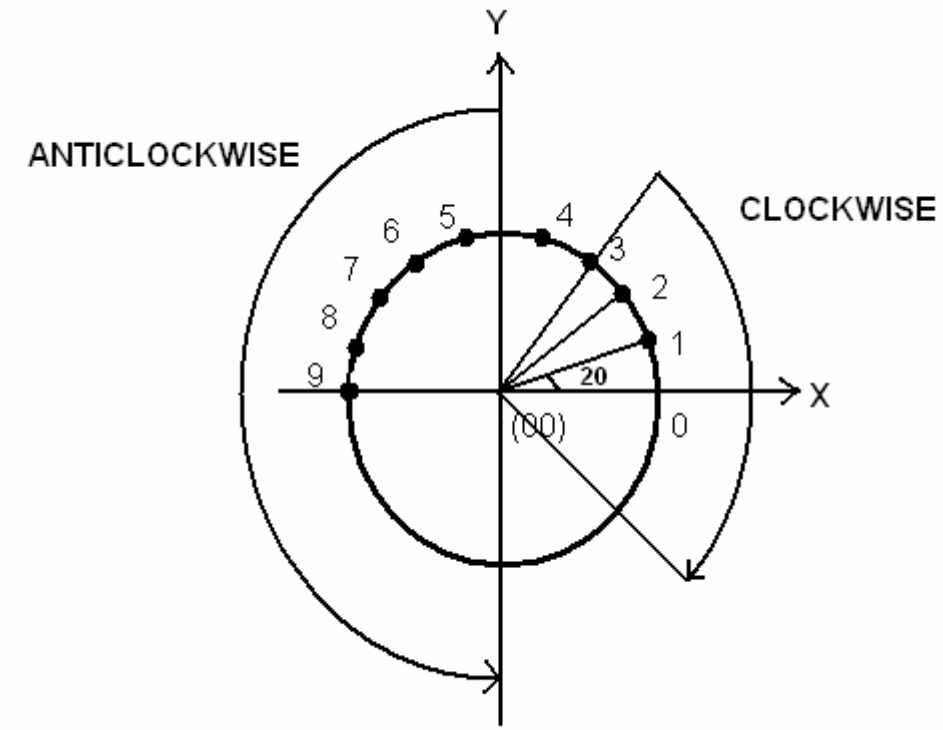
This function is used to create no of holes on the angular section. The user should give a data for respective axis such as x, y and z, then enter start angle , end angle, and total number of holes on the plane and it is clockwise or anticlockwise. After that lcd shows bolt number, that time respective axis enters the angle in degrees.

Note :- In this function first insure that , angular mode should be ON then work out this function

Figure shows the example of angular pcd

In this figure,

Start angle = 0 degree
End angle = 180 degree
It is in anticlockwise direction
No. of holes = 10



Step 1: Press 

Step2: Press 

(Select axis key you want to use this function)

Then press  key.

Now display shall show

Then start angle is entered in respective axis.

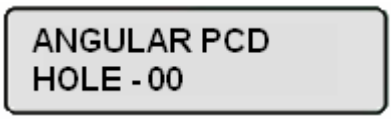
For example 0 degree angle entered in X - axis

Step 3: Press 

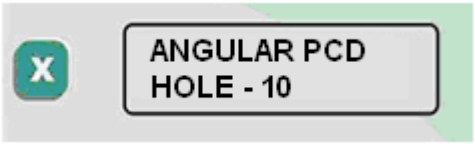
Now display shows

Step 4: Press ENT key.

Now display shall show



Then you want to enter numbers of holes in this function.



The respective axis shows the number of holes (e.g. Hole = 10)

Step 5: Press ENT

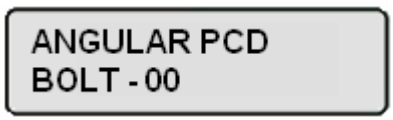
Display shows

You can enter holes either in clockwise or anticlockwise direction.

It is toggled by using +/- key.

Step 6 Press ENT

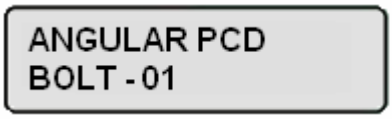
Now display shall show



The x axis showing e. g. BOLT – 00 and Angle – 0 degree

Step 7 Then press  key.

Display shall show



After that enter next bolt number and angle.

In example, axis showing Bolt- 01, Angle – 20 degree.

In this way follow above procedure to defined number of holes.

19. SUMMING

Summing function is useful to add movement of z' axis to the movement of x axis or z axis.

If compound axis is set to align with any of the axis then vectoring function will work as summing function.

Step 1: Long press 

key.

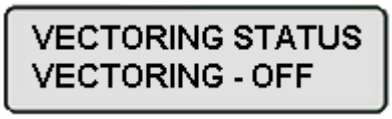
After that display shall show status of vectoring

Step 2: Press 

Now display shows current status of vectoring. I.e it will be off display

shows OFF. By using 

key it is toggled



After pressing 

key vectoring status is changed.

Now display shall show

Step3 : Press 

Now display shall show

Then enter the vectoring angle in X-axis.

The axis showing an example, 45 degree angle is entered.

20. SERIAL SOFTWARE

Requirement of software:

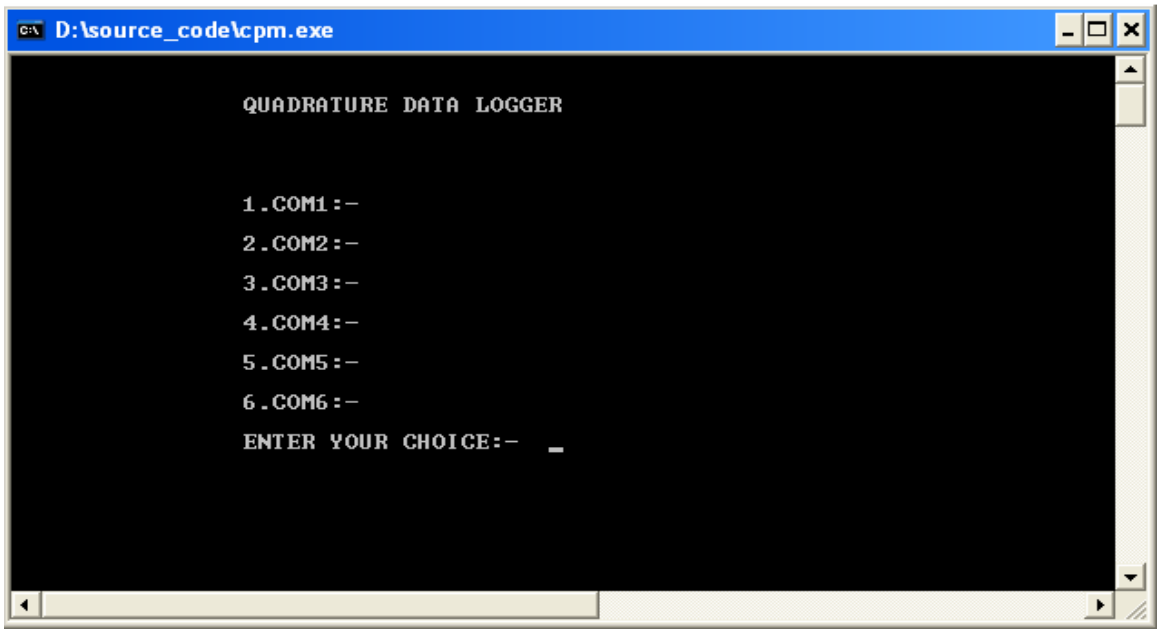
1. WINDOWS XP and onwards.
2. RAM - 256MB

This function should be applied only when serial output function (function 27) is in serial manual mode.

Switched ON DRO first

Then open the software 

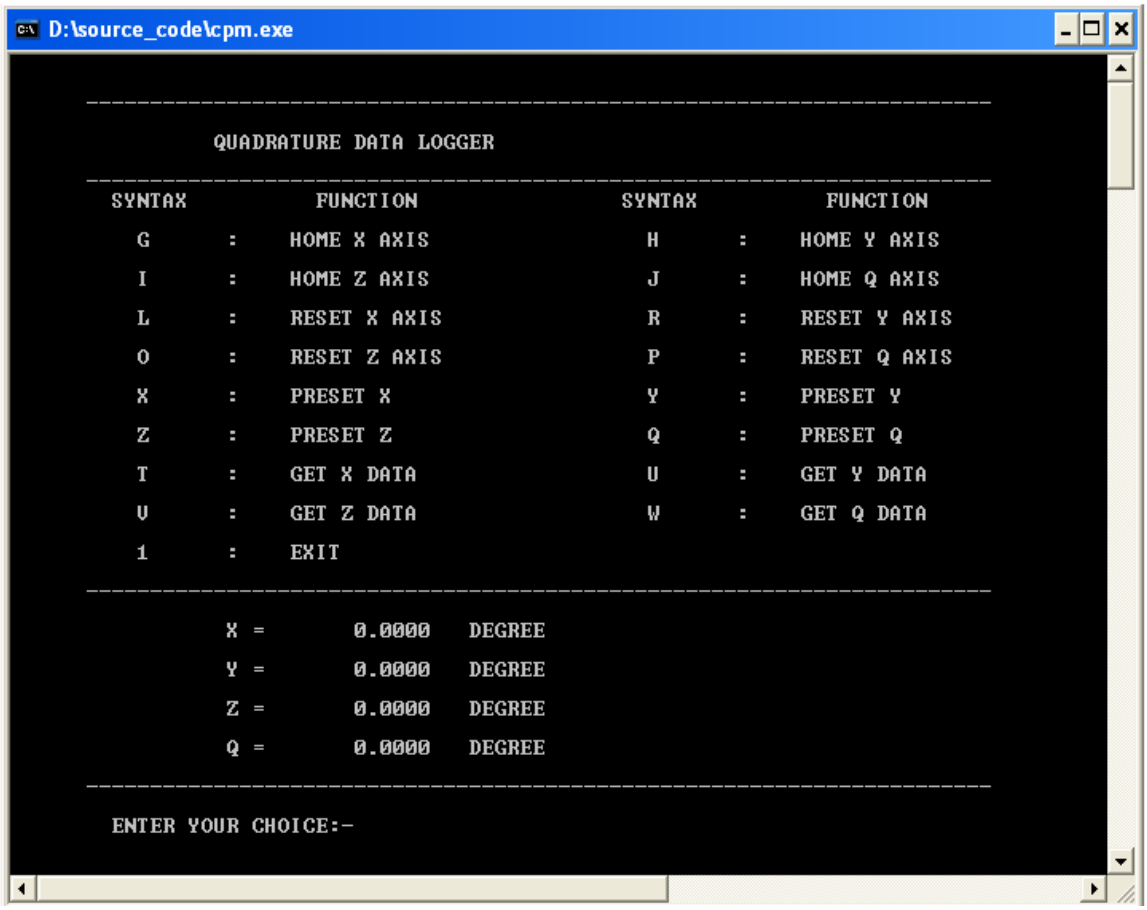
Double click on cpm icon, window displays as follows



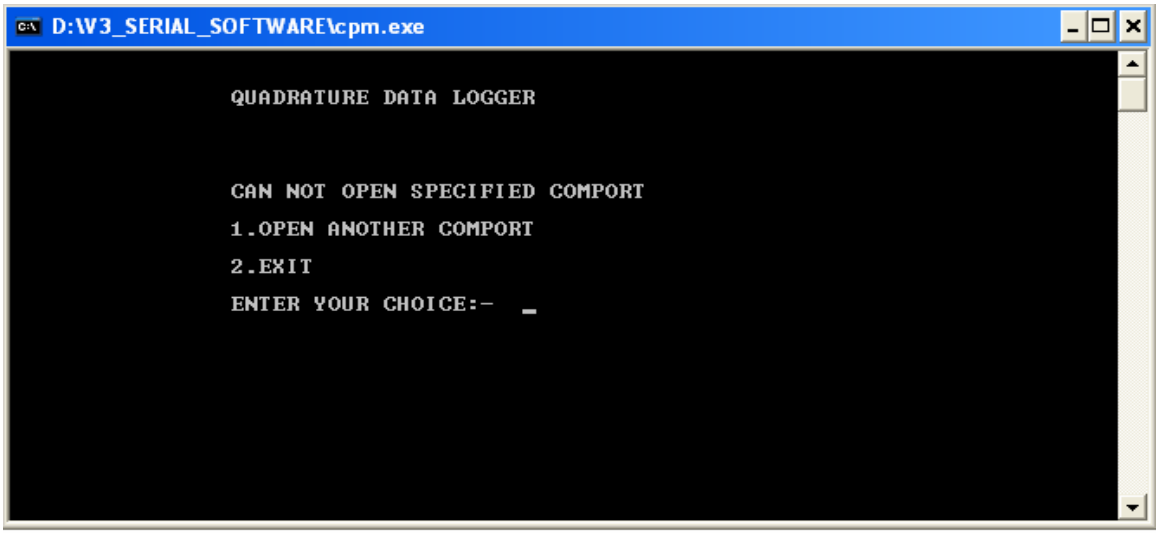
You can select comport by using numeric key. The specific key have been defined by specific comport.

Press 1 numeric key (if host computer has com1 as serial port), then window

Displays as follows



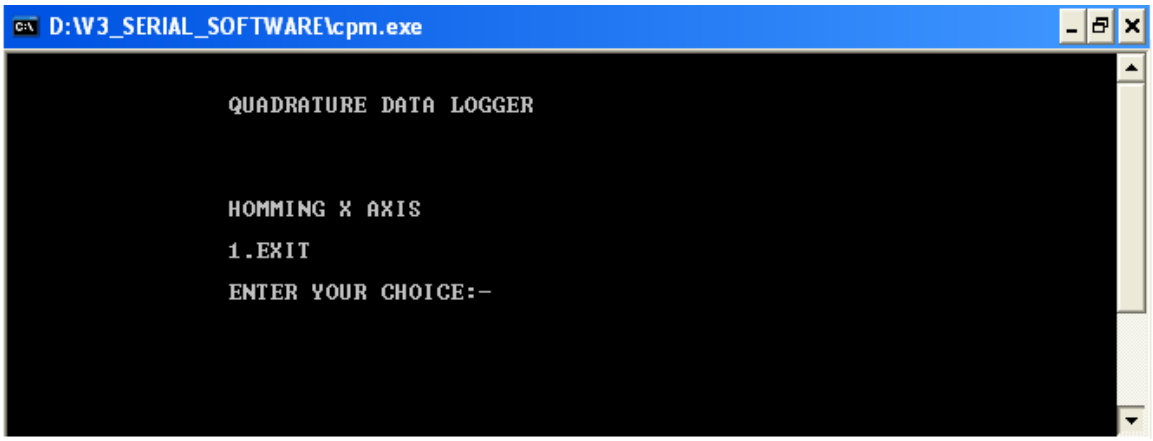
Otherwise screen will display message as follows



Press ‘2’ key, then exit this window and go to the comport window.

1. Homming -

For homming X axis press ‘G’ key, then software will send ‘G’ character to DRO or send ‘G’ character using hyper terminal.
Software will display message as follows-



Move the slide or encoder to home DRO. After successful homming DRO sends ‘y’ character on serial port which indicates that homming process is completed successfully.

Press 1 to exit from homming mode. Software sends ‘N’ character to DRO on serial port to tell that quit from homming mode without completing process. DRO sends ‘n’ character in reply to indicate that he has completed process.

Similarly homming is applied to Y, Z and Q axis.

For Homming X axis, send ‘G’ character.

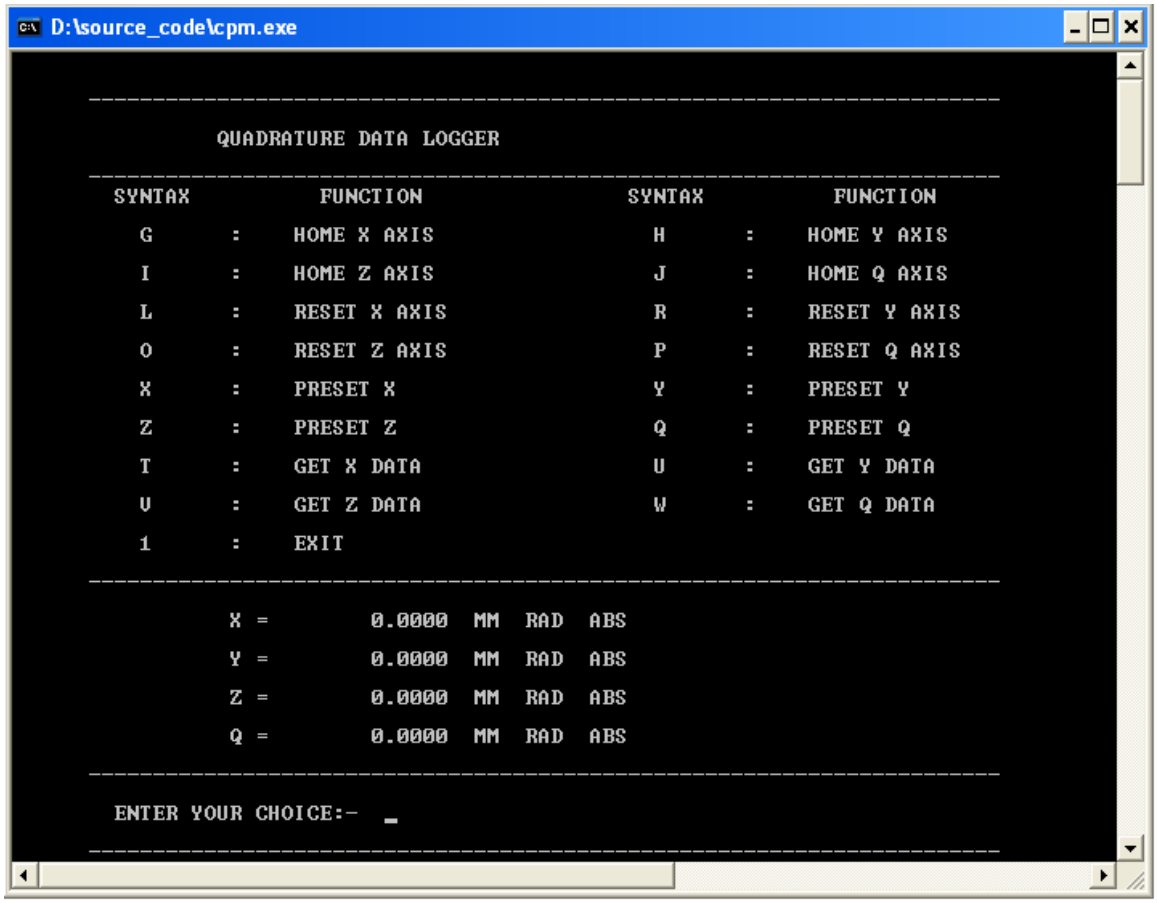
For Homming Y axis, send ‘H’ character.

For Homming Z axis, send ‘I’ character.

For Homming Q axis, send ‘J’ character.

2. Resetting -

For resetting X axis press ‘L’ key. Software sends ‘L’ character on serial port. After getting ‘L’ character on hyper terminal DRO resets X axis. X axis window of DRO displays 0.000 on hyper terminal.



In this way you can reset the particular axis by using above defined keys.

For Resetting X axis, send ‘L’ character.

For Resetting Y axis, send ‘R’ character.

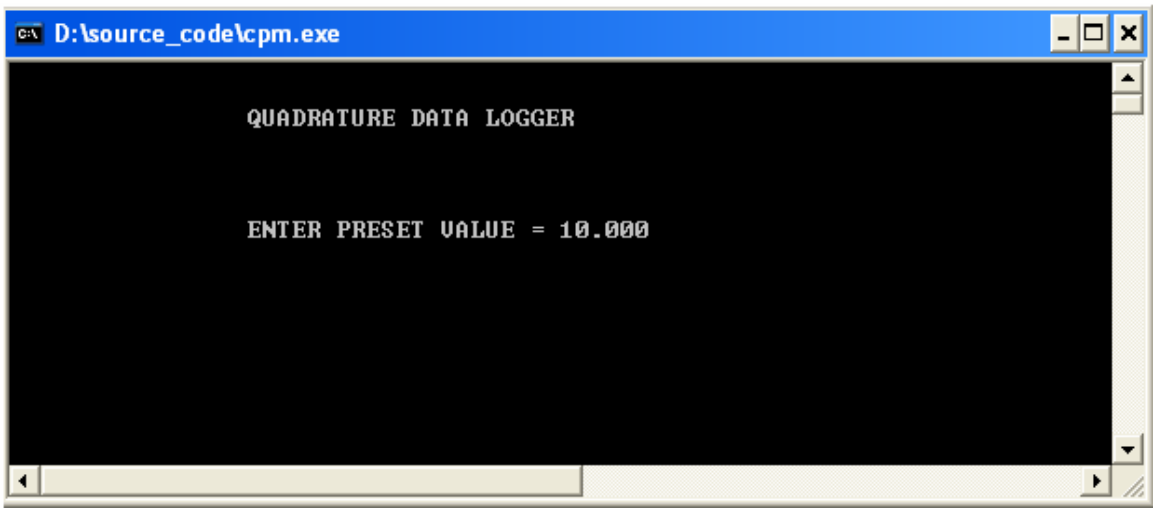
For Resetting Z axis, send ‘O’ character.

For Resetting Q axis, send ‘P’ character.

3. Presetting -

Press ‘X’ character to enter value on X axis.

After that enter preset value for X-axis.



Entered value will be assigned for particular axis on DRO.

Similarly enter preset value for Y, Z and Q axis by pressing ‘Y’,’Z’, and ‘Q’ key.

E.G.

Preset Value is -10.000

For Preset X axis, Send ‘X-10.0000\n’.

For Preset Y axis, Send ‘Y-10.0000\n’.

For Preset Z axis, Send ‘Z-10.0000\n’.

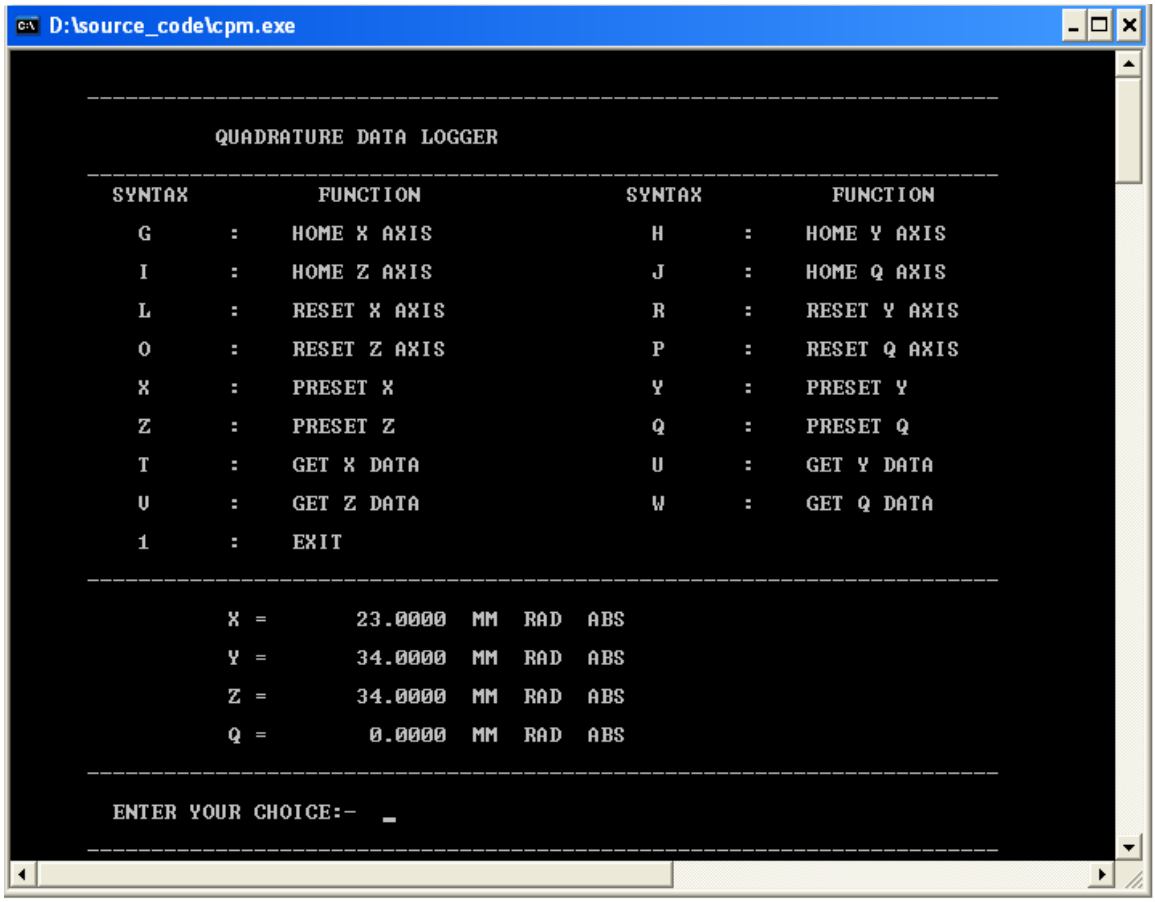
For Preset Q axis, Send ‘Q-10.0000\n’.

4. Get Data

To get X axis data press ‘T’ character. On pressing ‘T’ character software sends ‘T’ on serial port. In reply data sends as per request. Data format is explained in serial output (function 27) mode on page no. 40.

Press ‘T’ key.

E.g. X=23.000 MM RAD ABS
Data is display linear mode(MM ABS RAD)
If data is in angular mode it displays in degree or degree, minute, second format.



Similarly get data in Y,Z and Q axis.
e.g.

Y = 23.0000 MM RAD ABS
Z = 34.0000 MM RAD ABS
Q = 0.0000 MM RAD ABS

21. TOUCH PROBE

This function is used to reduce setup time and allow to perform geometric measurements.

Setting procedure of the touch probe

Probe selection : –

This function is used to select the probe from probe list and activate it as current probe. There will be total of 10 probes in probe list.

Step 1 Long press 

key.

Display shows

Select probe by using numeric keys. OR By using 

key probe can be incremented .It's maximum limit is 10 probes.

Step 2 To save new setting press 

key.

Step 3 Press 

key to advance to next function

Probing Method :-

There are two types of probing.

a) Auto – In this mode points will automatically probed whenever you touch the part with **Touch Trigger Probe** (E.G. Renishaw touch probe).

b) Manual – In this mode you have to touch the part first and then probe the point by pressing **PROBE** key.

Display shows

Step 4 :- Press  key.

Display shall show

By using  key to change probing method AUTO OR MANUAL

Probe Diameter : -

Step 3 Press  key

Display shows

Now display shows previous set diameter then enters new probe diameter value by using numeric keys.

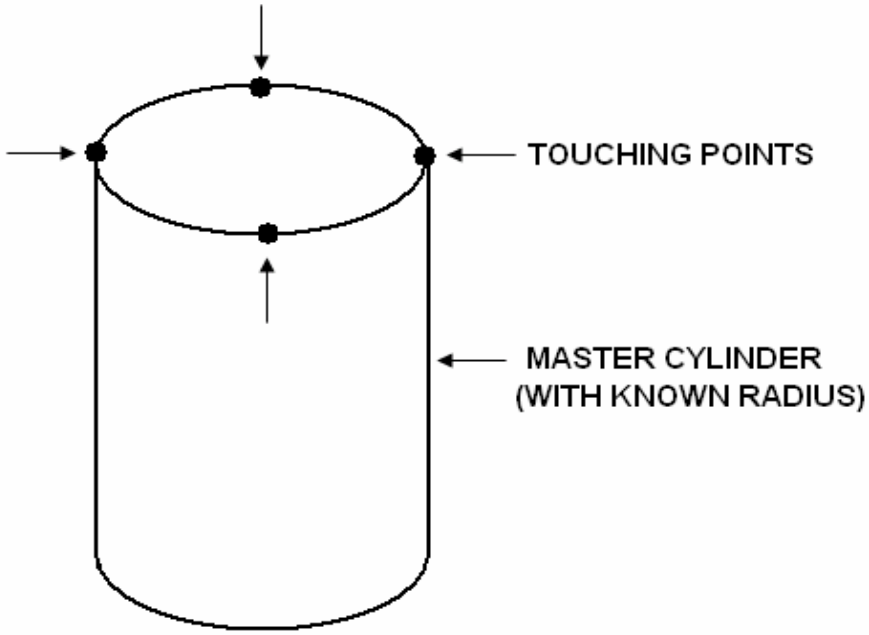
For example : To set probe diameter is 4.000

Step 4 :- Enter new diameter value using numeric keys.

Calibration of Diameter : –

This function is important for better measurement accuracy and orientation. This function calculates diameter of probe.

Following figure shows master cylinder.



Step 4 Press 

Display shows

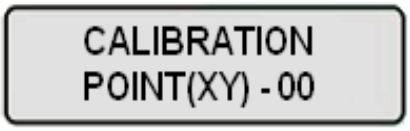
Then press 

Display shows

Place master circle (Cylinder) whose radius value is known. Enter this radius value using numeric keys.

Step 5 Press ENT

Display shows



Now take the minimum 3 and maximum 100 points by touching the cylinder and then press ENT

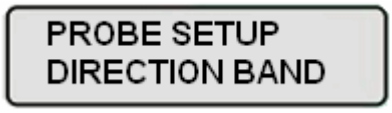
Calibration of probe is completed.

Direction Threshold –

Probe direction threshold is the distance the probe must travel in the same direction prior to making contact with a surface for a valid touch probe input. The direction threshold distance determines which side of the probe compensation is applied to.

Step 6 Press ENT

Display shows

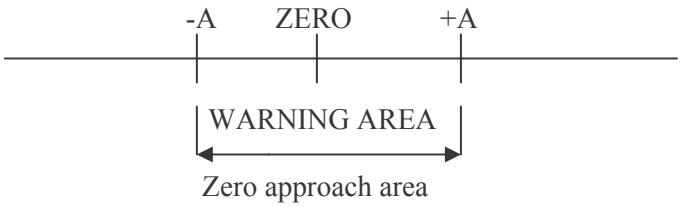


Then 7 segment display shows previous set value

To set value by using numeric keys.

H. SOME USEFUL TERMS AND FUNCTIONS

1. NEAR ZERO WARNING:



-A TO +A IS SELECTABLE FROM 0.1MM, 0.2MM, 0.3MM & 0.4MM

A beep indication is given when zero approach mode is activated. i.e. when target is reaching a beep indication is given from both positive as well as negative side.

This is known as warning area or zero approach area. This warning area is selectable. Any one setting from 0.1mm, 0.2mm, 0.3mm & 0.4mm can be selected. In diameter mode of operation this values are doubled.

2. TO FACTORY SET DIRECTLY:

This mode is a useful mode and is required when the system malfunctions and does not function correctly. Use of this function is cautioned as this will erase all the settings and corrections in applied.

To factory set directly switch off the DRO and keep pressing the

key and turn the power on.

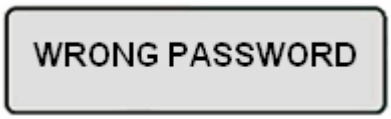
This function will ask for password before factory setting the unit.

Display shows

use numeric keys to enter the password . Password is “654321”

and press 

If the password entered is wrong display shall show for a second



and go back for password reentry.

Correct password shall turn the factory function on

User is requested to wait for a movement till the unit clears all special modes and block memory and than the display shows

Press 

if you require to erase Correction Factor , Resolution , and Scale factor.

Otherwise press 

The display shows

User shall turn the power of DRO OFF and turn it back again. To start with the factory default settings implemented. DRO is turn ON that time NLCF is deactivated .

3. SELF - TESTING MODE:

This is a program designed to detect any keypad or hardware failure. During this it checks 7segment display as well as the keypad and remote control. The keypad can be checked by pressing the keys. Meaning of key, which is pressed by the operator, will be displayed on the screen.

To enter self – testing mode, switch OFF the DRO & keep pressing the 

key and turn it on.

Display shows

All display segments and leds will lit one by one. Check weather any of the segments do not lit , only negative sign is displayed on the leftmost displays of all axis ,all other segments on the leftmost display are not connected hence not displayed. In case any other segment do not turn on contact Innovative authorized service station.

After the display testing in over

Display shows

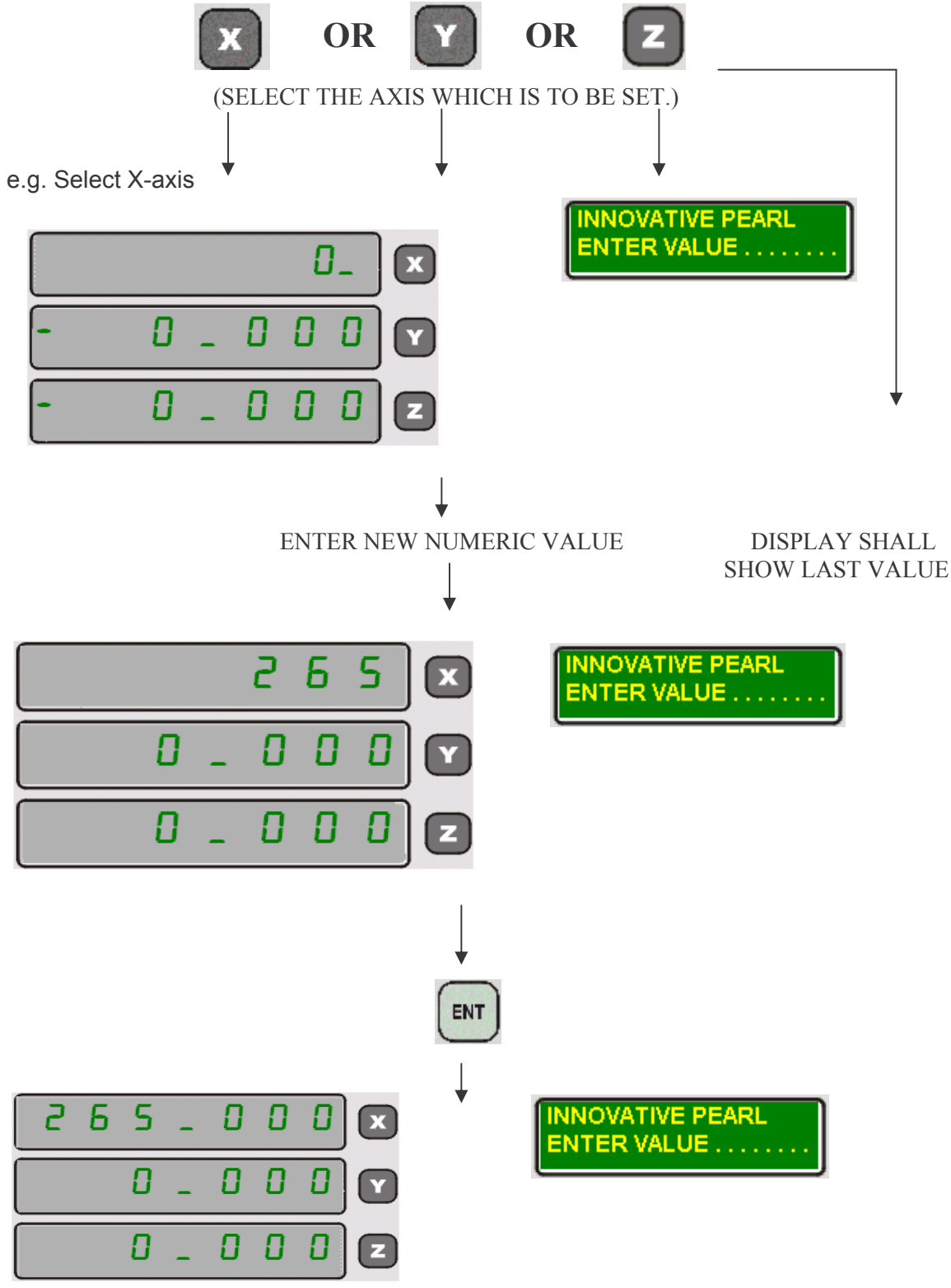
Press any key either on key pad or Remote controller the function assigned to that key is displayed on the display. If the function is not displayed there is a problem in the key and needs to be serviced.

After checking all keys, switch OFF the DRO to exit & next power ON will return DRO to normal counting mode.

I. EXAMPLES

1. ENTERING OR MODIFYING OR SETTING A VALUE:

This function is used to set any value for the absolute count. This directly modifies the absolute count and accordingly new origin is defined.



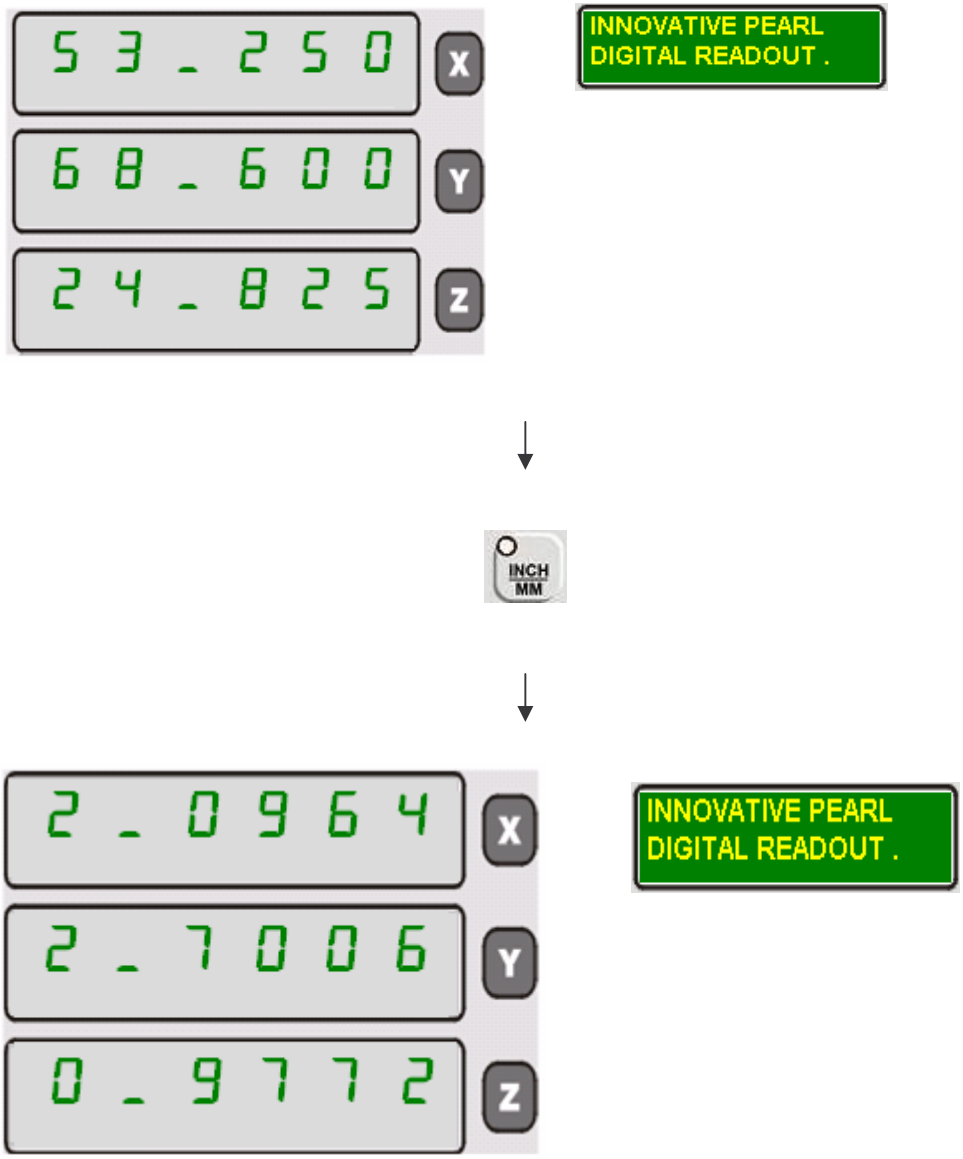
NEW VALUE IS SET FOR THE PARTICULAR AXIS.

2. INCH/MM CONVERSION MODE:

If the counter is in MM mode (INCH LED OFF), with the display of 25.400, it would change to 1.0000 after pressing the 

key, being the Equivalent of MM in INCH. **Then INCH / MM LED glows.**

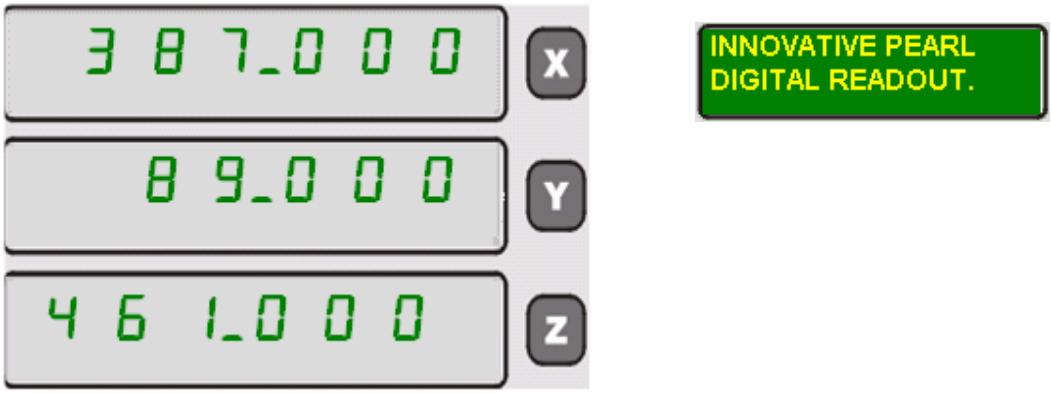
e.g.:-

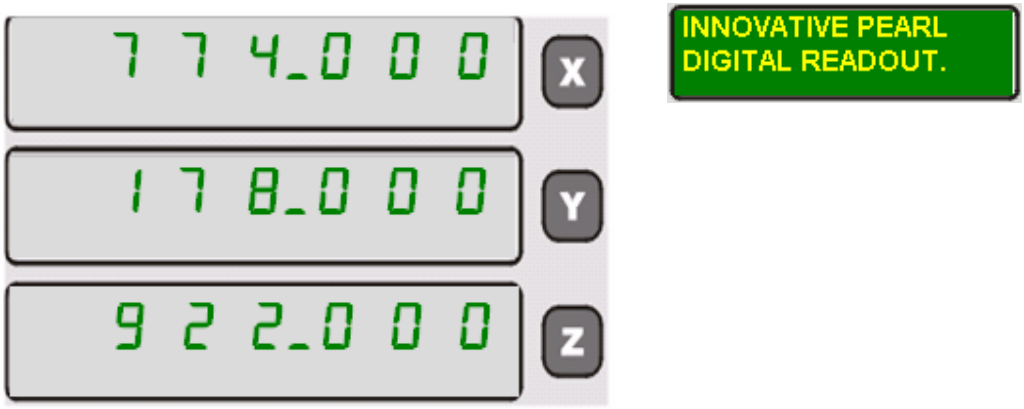


DRO will enter in INCH MODE & the inch LED glows.

3. *RAD/DIA CONVERSION MODE:*

If the DRO is in RAD mode then the display will show the last values.





After pressing RAD/DIA key DRO will again enter into RAD mode.

4. INCREMENTAL/ABSOLUTE CONVERSION MODE:

Use the 'ABS' mode of counting for a drawing dimensioned as in figure 1 and the 'INC' mode for a drawing dimensioned as in figure 2.

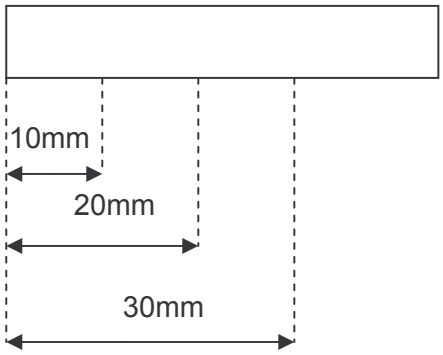


FIGURE 1
ABSOLUTE DIMENSIONING

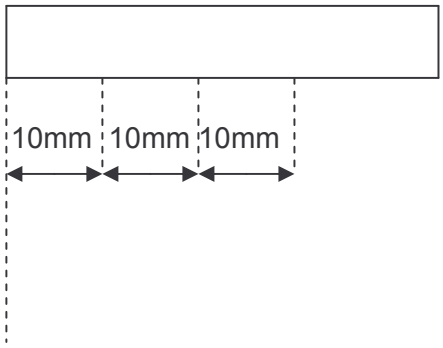


FIGURE2
INCREMENTEL DIMENSIONING

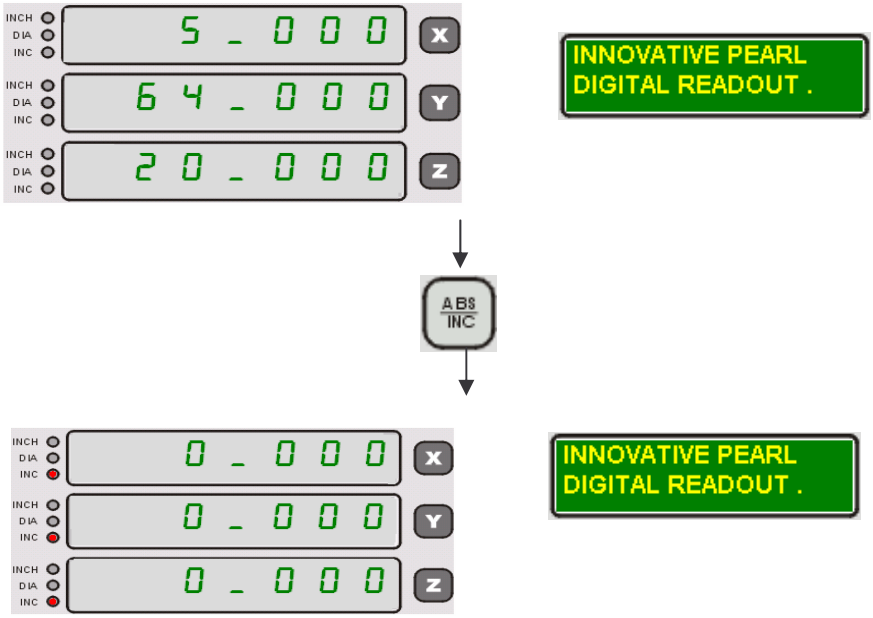
Here after traveling the first 10mm distance, press the ABS/INC key.

Counter is set to INC mode and display becomes 0.000.
Travel the next distance. Pressing the ABS/INC key once again will set the counter to ABS mode and displays 20.000.
The mode of counting will indicate appropriately by the INC LED.

After completing the operation, use the ABS/INC key to bring the DRO in ABS mode. The display will show the absolute distance from ORIGIN.

e.g.:-

The green display window shows last value.



The DRO is set to INC mode then INC LED will glow & the display becomes zero.

5. PRESET:

EXAMPLE:

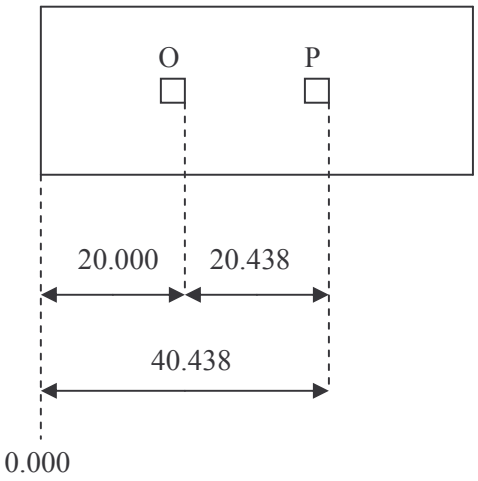


FIGURE 5

With the tool at point ‘O’ and the display 20.000, the requirement is to move the tool to point ‘P’, at a distance of 20.438 from point ‘O’.

Using the PRESET function activation procedure, enter 20.438 as PRESET Distance. The display will now show 20.438. Start moving the tool towards point ‘P’.

The count reduces signifying a virtual change of direction. When the display becomes 0.000, the PRESET distance been traveled and point P has been reached near Zero Warning is given here. To reference the axes to the origin again, press ESC key. The displays for X will now Show

6. BOLT HOLE MODE:

EXAMPLE:

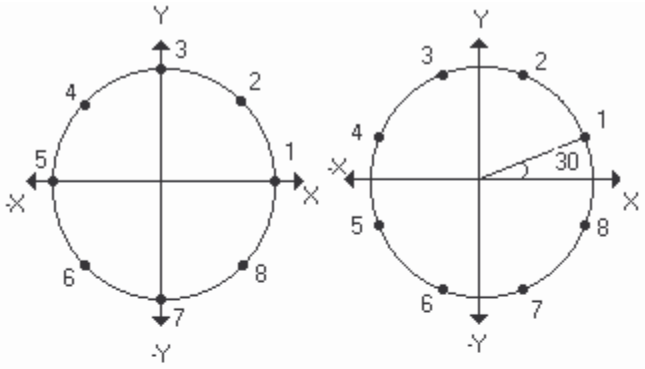


FIGURE 3 FUGURE 4

C IS CENTRE OF CIRCLE AS WELL AS ORIGIN

X = 0.000 , Y = 0.000

RADIUS = R = 5.000

ANGLE = 0.000 (FIG. 3)

ANGLE = 30.000 (FIG. 4)

HOLES = 8

7. CENTER OF CIRCLE MEASUREMENT:

EXAMPLE:

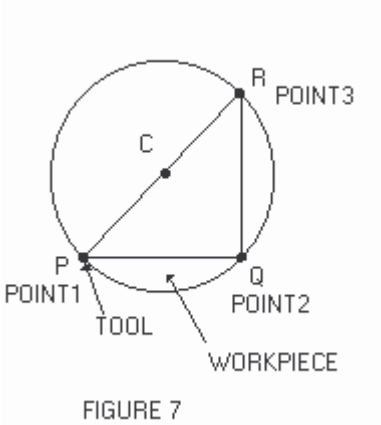


FIGURE 7

LINE PQ IS PERPENDICULAR TO LINE RQ

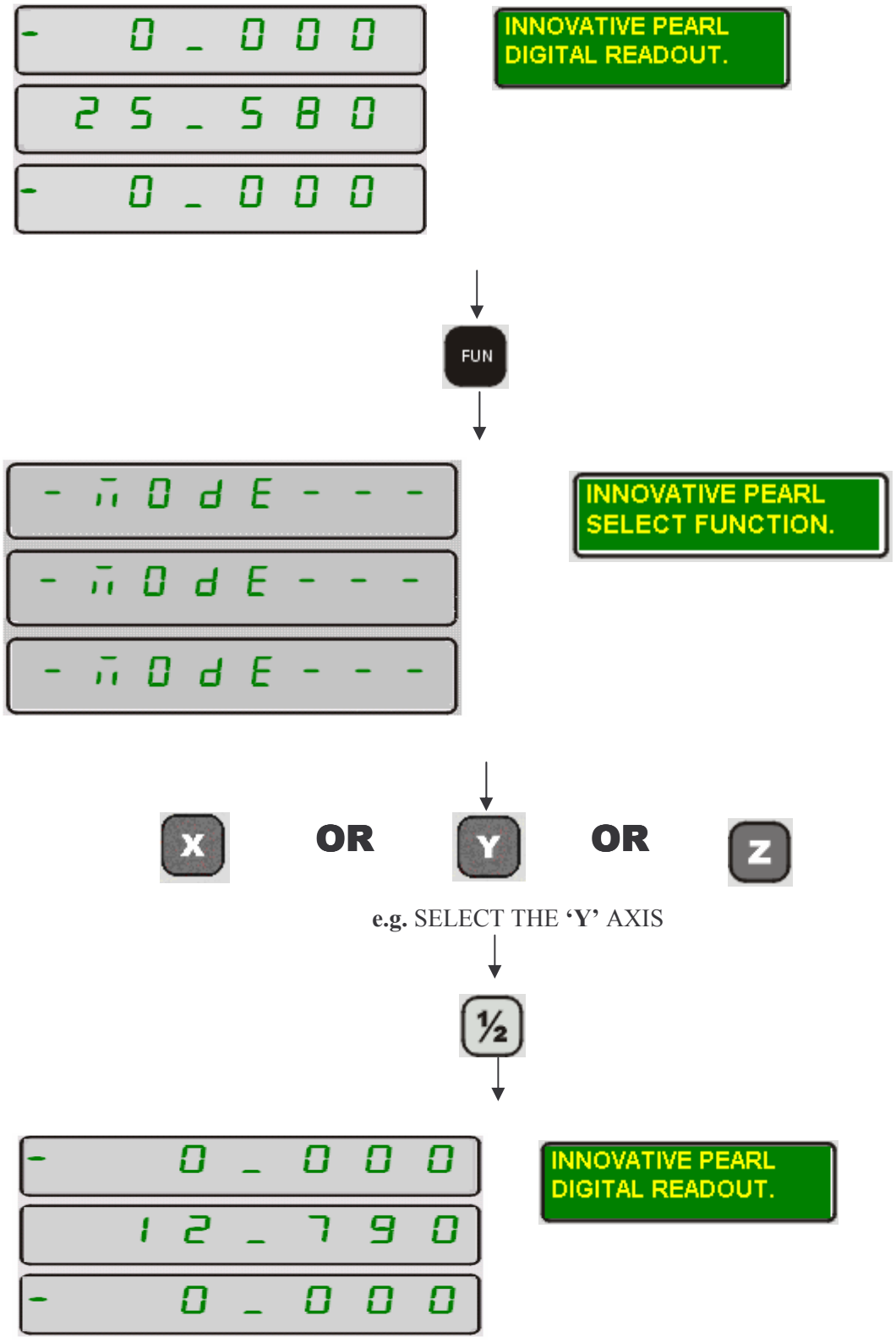
1. Invoke the center of circle function. (Refer key sequence)
2. Touch the tool at any one point of the circle (say p) and enter the co-ordinates by probing.
3. Then touch to second point (say q) and take the co-ordinates.
4. Then touch to third point (say r) and take the co-ordinates
5. DRO shows the distance to go to center. Down count to zero. Center of circle is reached.

Press esc to come out of function.

8. HALF:

e.g. consider we have to half co-ordinates of 'Y' axis.

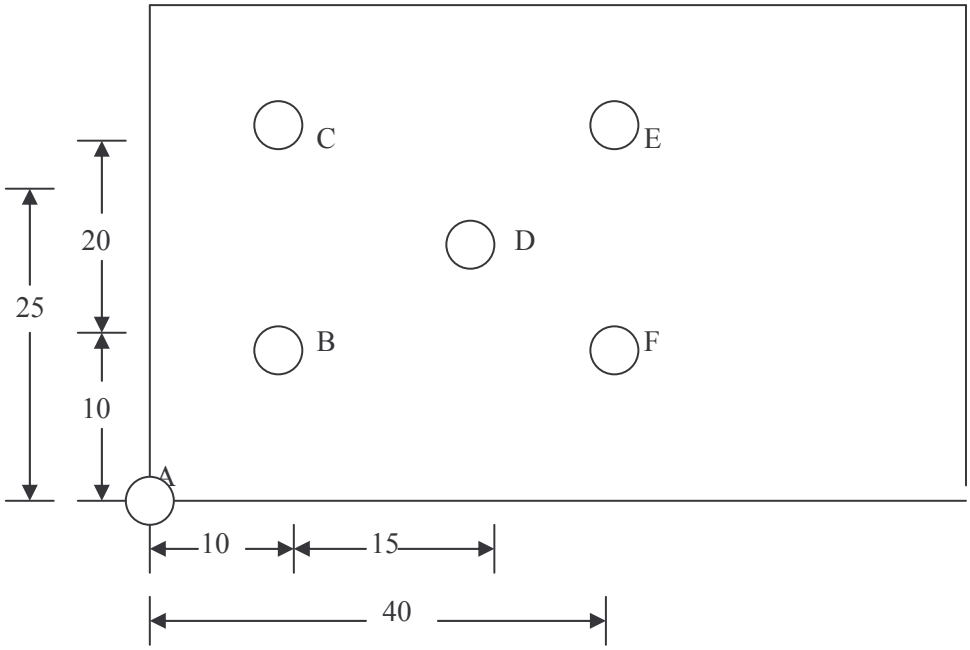
FLOW CHART:



(Now the display will show half of the previous absolute reading. Now move the slide towards zero until the display shows `0.000'. This is the center point of the job along x-axis.) Similarly repeat the procedure for other axes.

9. RUNMODE:

EXAMPLE:



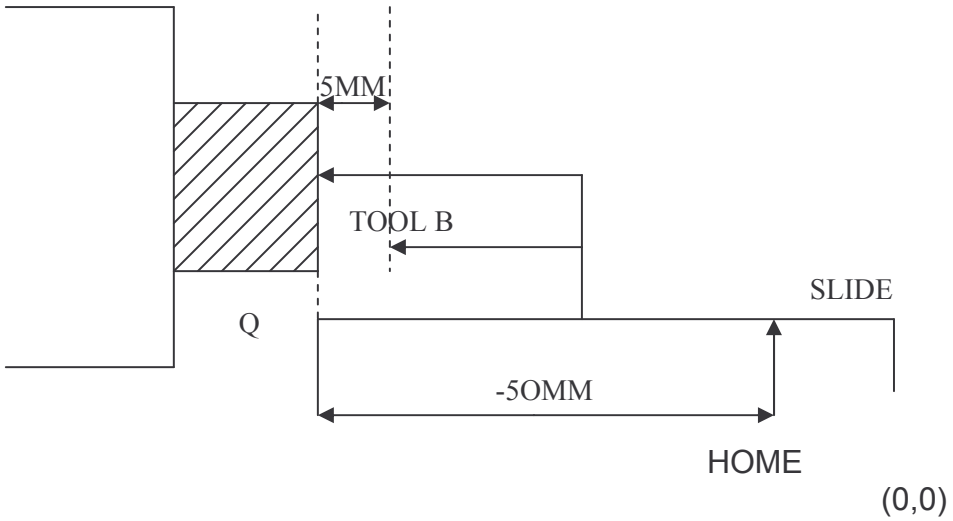
CONSIDER THE SHOWN EXAMPLE ABCDEF ARE THE POINTS TO BE DRILLED. PROGRAMING FOR WHICH IS GIVEN BELOW.

STEP NO.		ABS PROGRAMMING		INC PROGRAMMING	
NO.	NAME	X	Y	X	Y
1	A	ABS 0.000	ABS 0.000	ABS 0.000	ABS 0.000
2	B	ABS 10.000	ABS 10.000	INC 10.000	INC 10.000
3	C	ABS 10.000	ABS 30.000	INC 0.000	INC 20.000
4	D	ABS 25.000	ABS 25.000	INC 15.000	INC –5.000
5	E	ABS 40.000	ABS 30.000	INC 15.000	INC 5.000
6	F	ABS 40.000	ABS 10.000	INC 0.000	INC –20.000

In this way, maximum 100 steps can be programmed.

10. TOOL OFFSET:

EXAMPLE:



Consider you home the axis and find ‘0’ as shown. Position of tool away from origin is say -50mm for tool ‘A’. Now you index the turret to tool ‘B’. As tool lengths may vary, the tool ‘B’ will show a offset say tool offset = 5mm i.e. to touch the job it has to travel 5mm plus i.e. -55mm to achieve same result as tool ‘A’. To adjust this offset we use tool-offset feature.

7. Execute home as fix some turret on slide.

8. Touch the tool ‘A’ to job.

9. Execute the tool-offset function & say zero.

4. Select tool ‘B’.

10. Again touch tool ‘B’ to job & say zero.

11. Offsets of both are stored.

12. Similarly you can store 9 tool offsets.

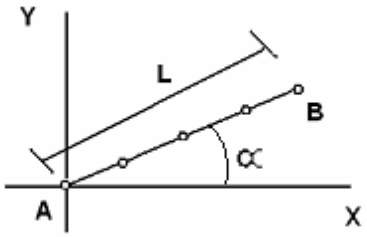
How does it works:

Say at point Q reading for tool ‘A’ is -50mm for x-axis. You need to show zero, then offset is 0-(-50) = 50

So at Home pulse position when you invoke tool offset for tool ‘A’ you will find reading as +50 & by the time you touch the tool to job you will get zero.

Note: Do not change modes like RAD / DIA, INCH/MM of DRO once tool offsets are programmed.

11. Drill on a line



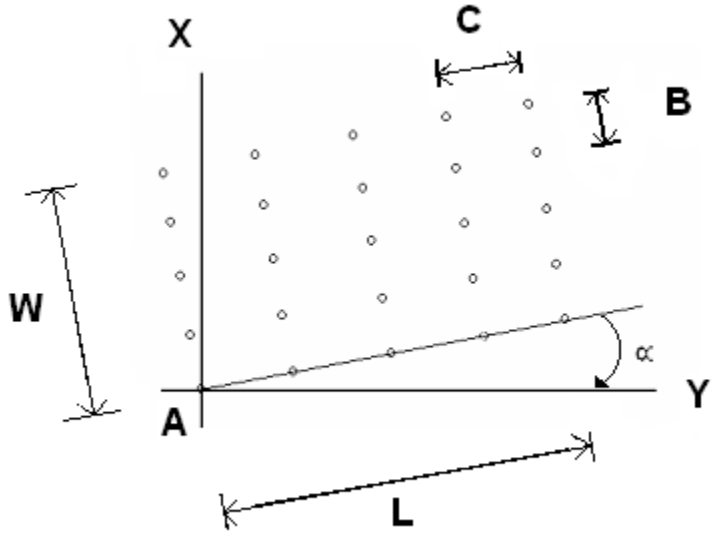
Parameters of above diagram for mode 1:

1. x axis origin of point A – 0.000
2. y axis origin of point A – 0.000
3. No. of holes – 05
4. Length of line (L) - 14.140 mm
5. Angle(alpha) - 45 degree

Parameters of above diagram for mode 2:

1. x axis origin of point A – 0.000
2. y axis origin of point A – 0.000
3. x axis end point of line B – 10.000
4. y axis end point of line B – 10.000
5. No. of holes - 05

12. Drill in a matrix



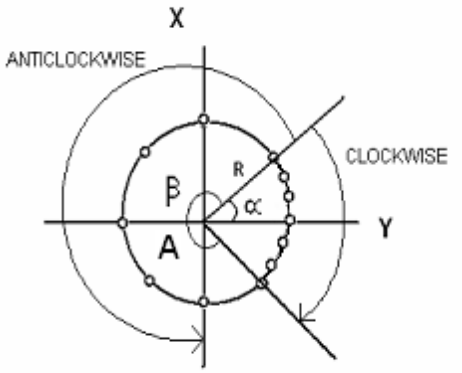
Parameters of above diagram for mode 1:

1. X axis origin point A – 0.000
2. Y axis origin point A – 0.000
3. Length of matrix – 5 mm
4. Width of matrix – 5 mm
5. No. of columns – 05
6. No. of rows – 05
7. Angle (alpha) - 10 degree

Parameters of diagram for mode 2:

1. X axis origin point A – 0.000
2. Y axis origin point A – 0.000
3. Segment length (C) – 1mm
4. Segment width (B) - 1 mm
5. No. of columns – 05
6. No. of rows – 05
7. Angle (alpha) - 10 degree

13.Drill on an arc

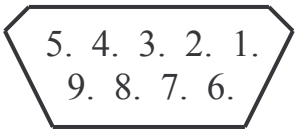


Parameters of above diagram are:

1. x axis origin of point A – 0.000
2. y axis origin of point A – 0.000
3. No. of holes – 7
4. Radius of arc (R) - 5mm
5. Start angle (alpha) - 45 degree
6. End Angle (beeta) - 315 degree
7. Clockwise / Anticlockwise – as per diagram.

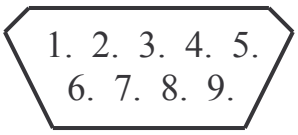
J. CONNECTOR DETAILS

INNOVATIVE DRO D'TYPE FEMALE CONNECTOR DETAILS (only for innovative scales)



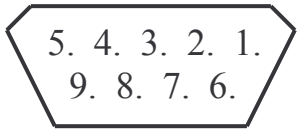
PIN NO.	SIGNAL
1	REF
2	/REF
3	VCC (+5V)
4	EARTH
5	GND (O V)
6	PHASE A
7	/PHASE A
8	/PHASE B
9	PHASE B

INNOVATIVE DRO 9 PIN D'TYPE MALE (SERIAL OUTPUT) CONNECTOR DETAILS



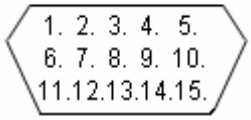
PIN NO.	SIGNAL
1	–
2	RX
3	TX
4	GND
5	–
6	–
7	–
8	–
9	–

CONNECTOR DETAILS FOR ONE RELAY OUTPUT 9 PIN D'TYPE FEMALE CONNECTOR



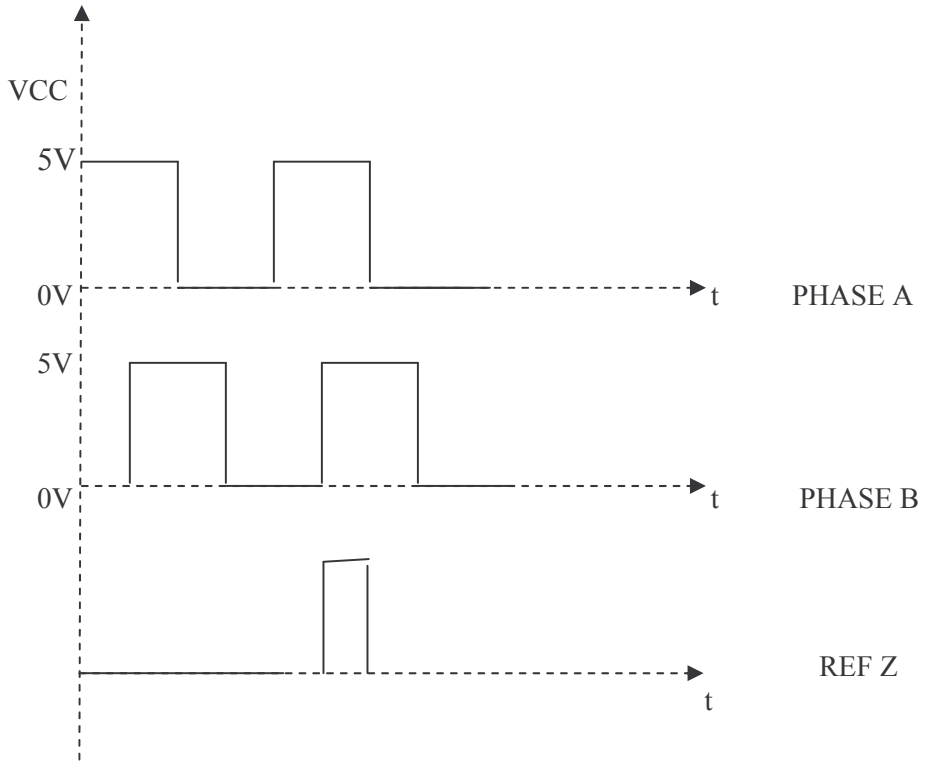
PIN NO.	SIGNAL
1	N.C.
2	N.C.
3	COMMON
4	COMMON
5	N.O.
6	-
7	-
8	-
9	N.O.

CONNECTOR DETAILS FOR SIX RELAY OUTPUT & TOUCH PROBE D 'TYPE MALE 15 PIN CONNECTOR



PIN NO.	SIX RELAY OUTPUT SIGNAL	TOUCH PROBE SIGNAL
1	RELAY 6	-
2	-	PROBE SWITCH
3	RELAY 5	-
4	-	-
5	RELAY 4	PROBE SWITCH
6	GND	-
7	GND	-
8	SHIELD	-
9	VCC(+24V)	-
10	VCC(+24V)	-
11	RELAY 3	-
12	-	LED ANODE
13	RELAY 2	-
14	-	LED CATHODE
15	RELAY 1	-

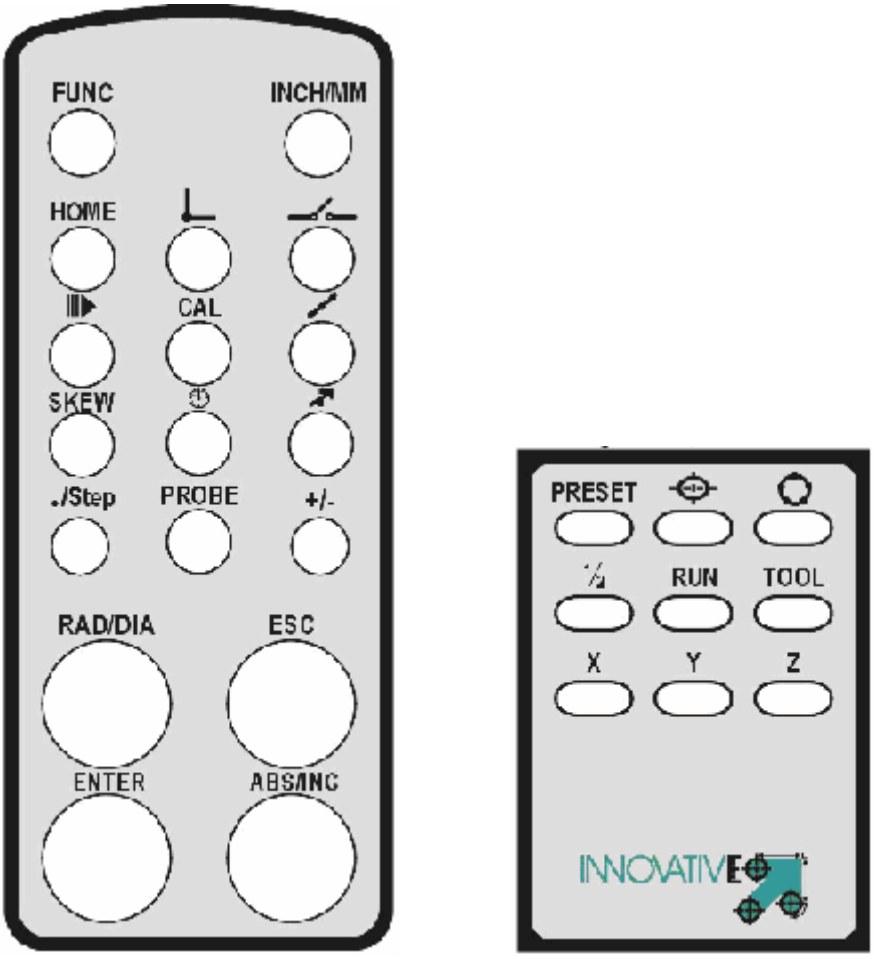
ELECTRICAL SPECIFICATIONS:



1. ELECTRICAL OUTPUT: 5V TTL

Remote controller

The system is equipped with an infra red remote control.



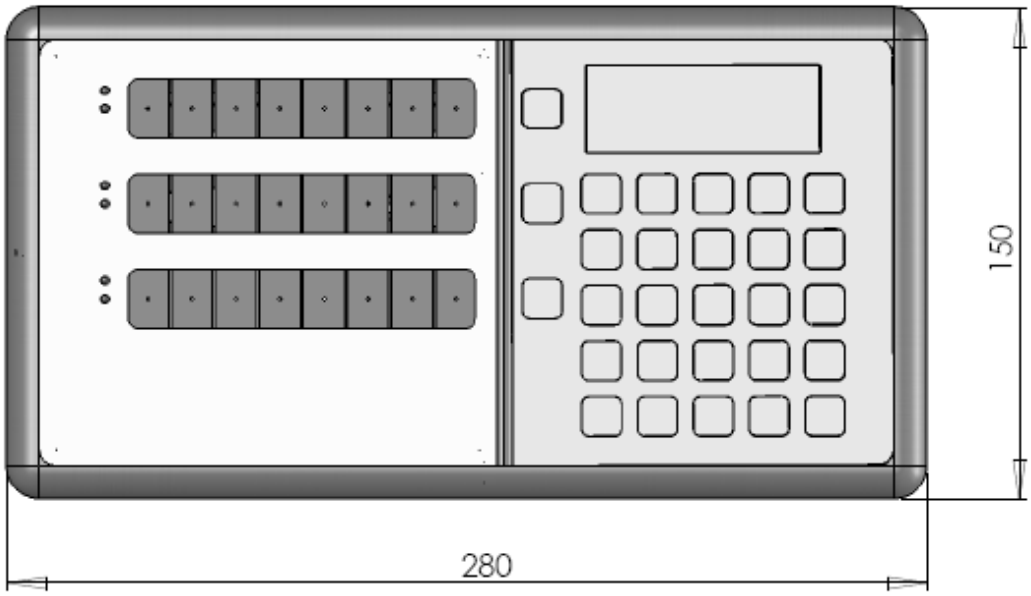
K. TROUBLE SHOOTING METHODS

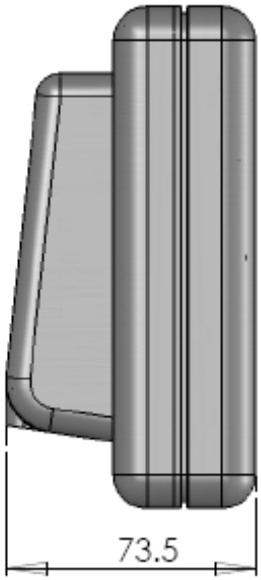
Guidelines to find the faults and take corrective action.

PROBLEM	CAUSE	REMEDY
1. Miscounting	1. Machine inaccuracy, in form of screw pitch error.	Check & set correction factor.
	2. Scale not installed properly.	Contact factory or authorized service station.
	3. Cable damaged.	Contact factory or authorized service station.
2. DRO display blank on power ON.	1. Power cable damaged.	Check / replace cable.
	2. Fuse on back panel blown.	Replace equivalent fuse.
3. Strange (incorrect) messages appear on display.	Due to incorrect information entered into DRO.	Factory reset the DRO.

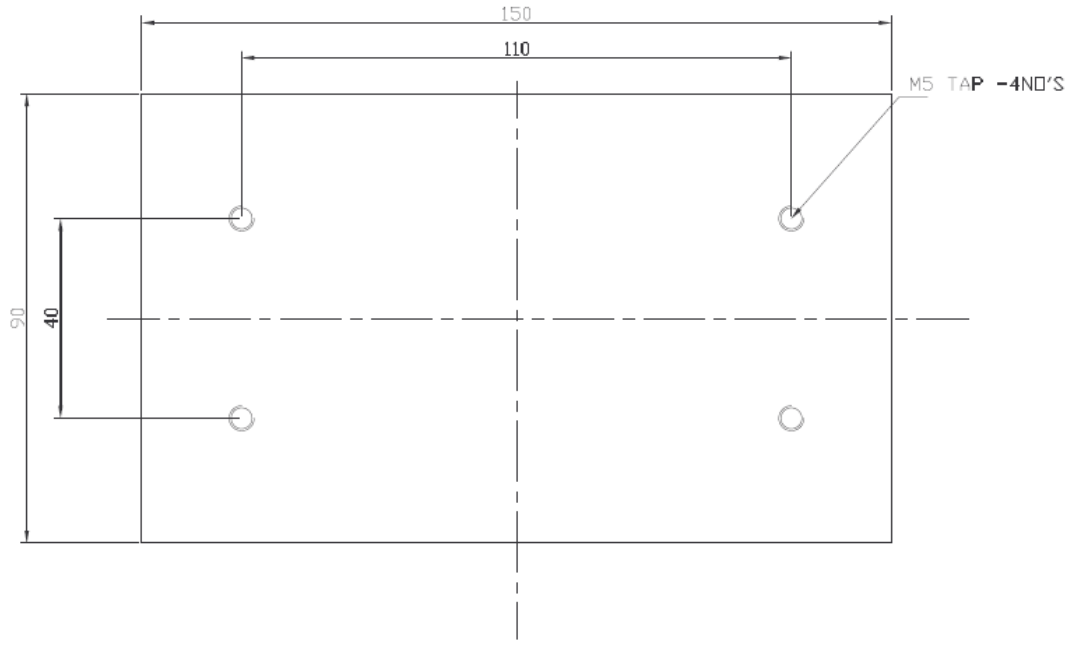
CAUTION: ALWAYS USE CVT (CONSTANT VOLTAGE TRANSFORMER) SO AS TO PREVENT DAMAGES TO DRO DUE TO POWER FLUCTUATIONS.

L. DIMENSION DETAILS OF DRO





MOUNTING HOLE DETAILS OF DRO



INNOVATIVE AUTOMATION PRODUCTS LIMITED WARRANTY:

This product is warranted against defects for 24 months from the date of purchase from authorized Innovative franchisees and dealers.

Within this period, we will repair it without charge for parts and labor. Warranty does not cover transportation cost, nor does it cover a product subjected to misuse or accidental damage, nor does it support damages due to lightning or very high power transients.

Except as provided herein, Innovative Automation Products make no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This warranty is limited to Digital Read Out (DRO) manufactured by us. The warranty on scale/sensor is subjected to the warranty given by its respective manufacturer.

✯ TEST CERTIFICATE ✯

MODEL:

SR.NO.:

DATE:

TESTED AS PER OUR COMPANY STANDARDS AND ALL TESTS FOUND TO BE SATISFACTORY.

FINAL INSPECTION DEPT.
INNOVATIVE AUTOMATION PRODUCTS

* APPENDIX *

INFORMATION OF 7 SEGMENT DISPLAYS

As the displays are in seven segments, so X & Y-axis display windows of the DRO will show the characters as below:

Actual character set	7 segment character set
.	_
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	A
B	b
C	C
D	d
E	E
F	F
G	9
H	H
I	1
J	J
K	H
L	L
M	⁻⁻
N	n
O	0
P	P
Q	9
R	r
S	5
T	t
U	U
V	u
W	⁻'
X	H
Y	y
Z	2

APPENDIX

ERROR CODES

MESSAGES	DESCRIPTION
Error 121	In bolt hole arc mode if start angle is greater than 360 degree.
Error 122	In bolt hole arc mode end angle is greater than 360 degree.
Error 123	Linear correction factor is greater than 10.
Error 124	Linear correction factor is negative.
Error 125	Scale factor is greater than 9999.9999.
Error 126	1.The setting of NLCF for positive value, when observed and standard value is less than or equal to zero. 2.The setting of NLCF for negative value, when observed value is greater than or equal to zero.
Error 128	In bolt hole mode, respective axis is in angular mode.
Error 129	Polar mode is ON in special function.
Error 130	In run mode diameter mode is locked.
Error 131	In calculator mode angle is greater than 360 degree.
Error 132	In linear correction factor setting mode radian mode is locked.
Error 133	If zero correction factor is entered.
Error 134	In linear correction factor setting mode observed value is zero.
Error 135	In non angular correction factor, if standard angle is greater than 360 degree.
Error 136	In non angular correction factor, if observed value is less than reentered value.
Error 137	In NACF, if degree entered is greater than 360 degree or if minutes entered are greater than 60 or seconds entered is greater than60.
Error 138	In taper plane calculator mode , if incorrect plane is selected.