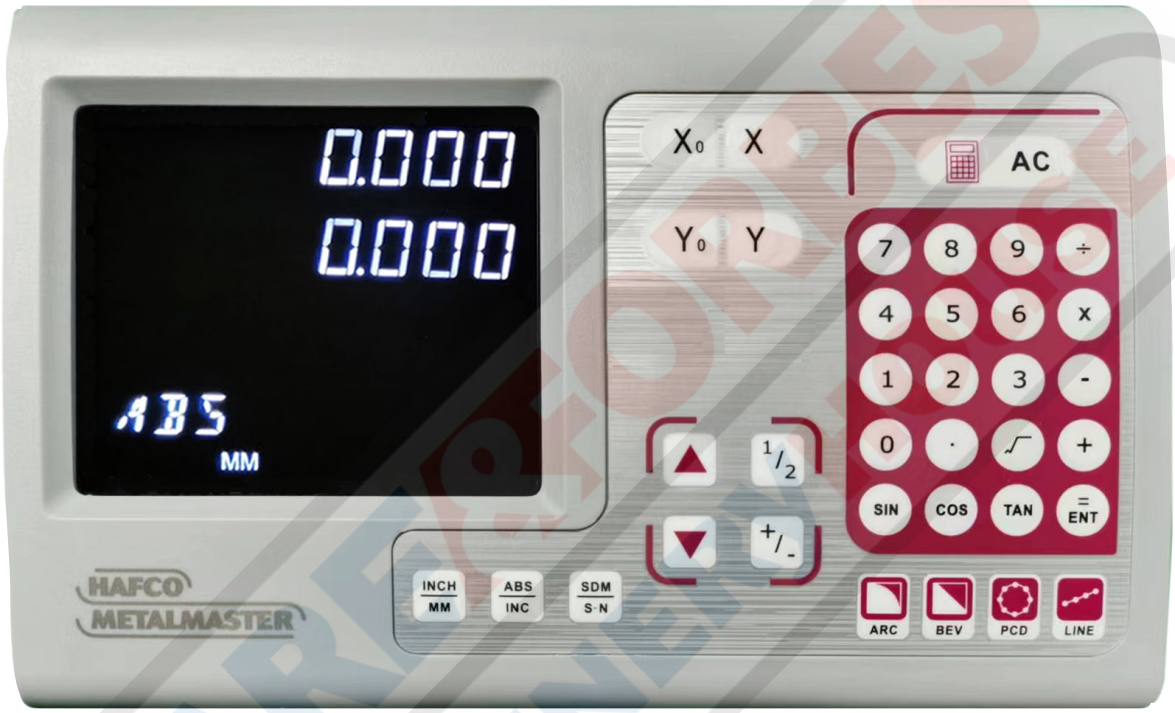
HAFCO METALMASTER

# INSTRUCTION MANUAL




## DIGITAL READOUT

Models

XH600-2, XH600-3

Order Code D5201, D5203

| | |
|---|---|
| Edition No | : XH600-1 |
| Date of Issue | : 03/2023 |

## MACHINE DETAILS

| | |
|---|---|
| **MACHINE** | Digital Readout |
| **MODEL NO.** | XH600 |
| **SERIAL NO.** | |
| **DATE OF MANF.** | |

DISTRIBUTED BY

MACHINERYHOUSE

www.machineryhouse.com.au
www.machineryhouse.co.nz

***NOTE:***
***This manual is only for your reference. At the time of the compiling of this manual every effort to be exact with the instructions, specifications, drawings, and photographs of the machine was taken. Owing to the continuous improvement of the HAFCO METALMASTER equipment, changes may be made at any time without obligation or notice. Please ensure the local voltage is the same as listed on the specification plate before operating any electric machine.***

## POWER SUPPLY

The PROTECTIVE EARTH CIRCUIT of the mains supply, MUST BE CONNECTED to the protective earth terminal of the DRO through the supply cord.
The supply cord must be secured with cable ties to avoid from dropping into a hazardous position, for example the floor or coolant tray, when disconnected from the DRO.
The supply cord must be routed away from moving parts, swarf, coolant or sources of heat.

## MOUNTING

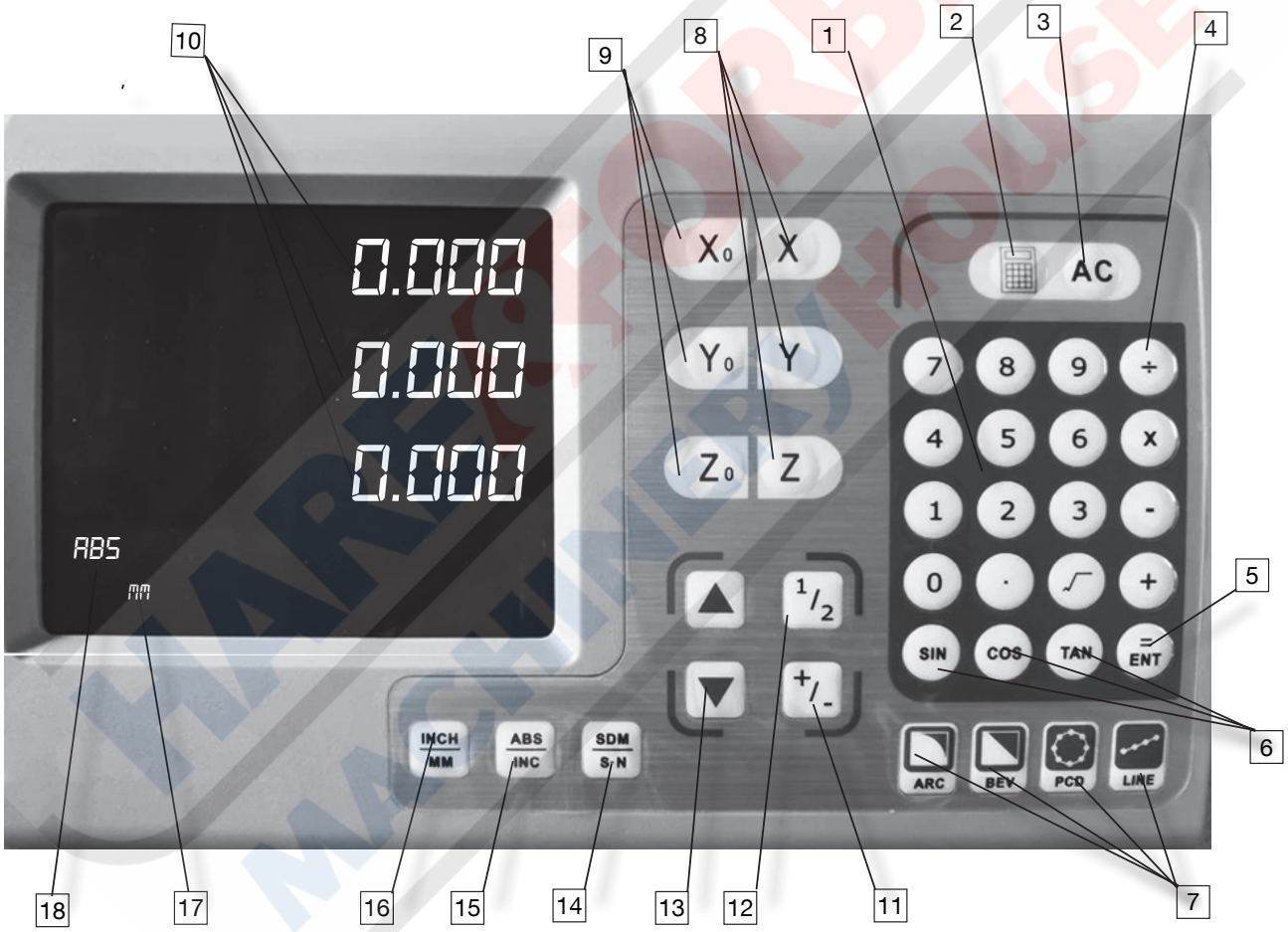
Select the location of the installation with due regard of safety and ease of operation. Keep the DRO away of moving parts and coolant spray. To ensure correct operation of the DRO, make sure that the DRO is correct grounding. The DRO may require grounding if different power circuits are used. Grounding diagram can be found on page 52

## CONTENTS:

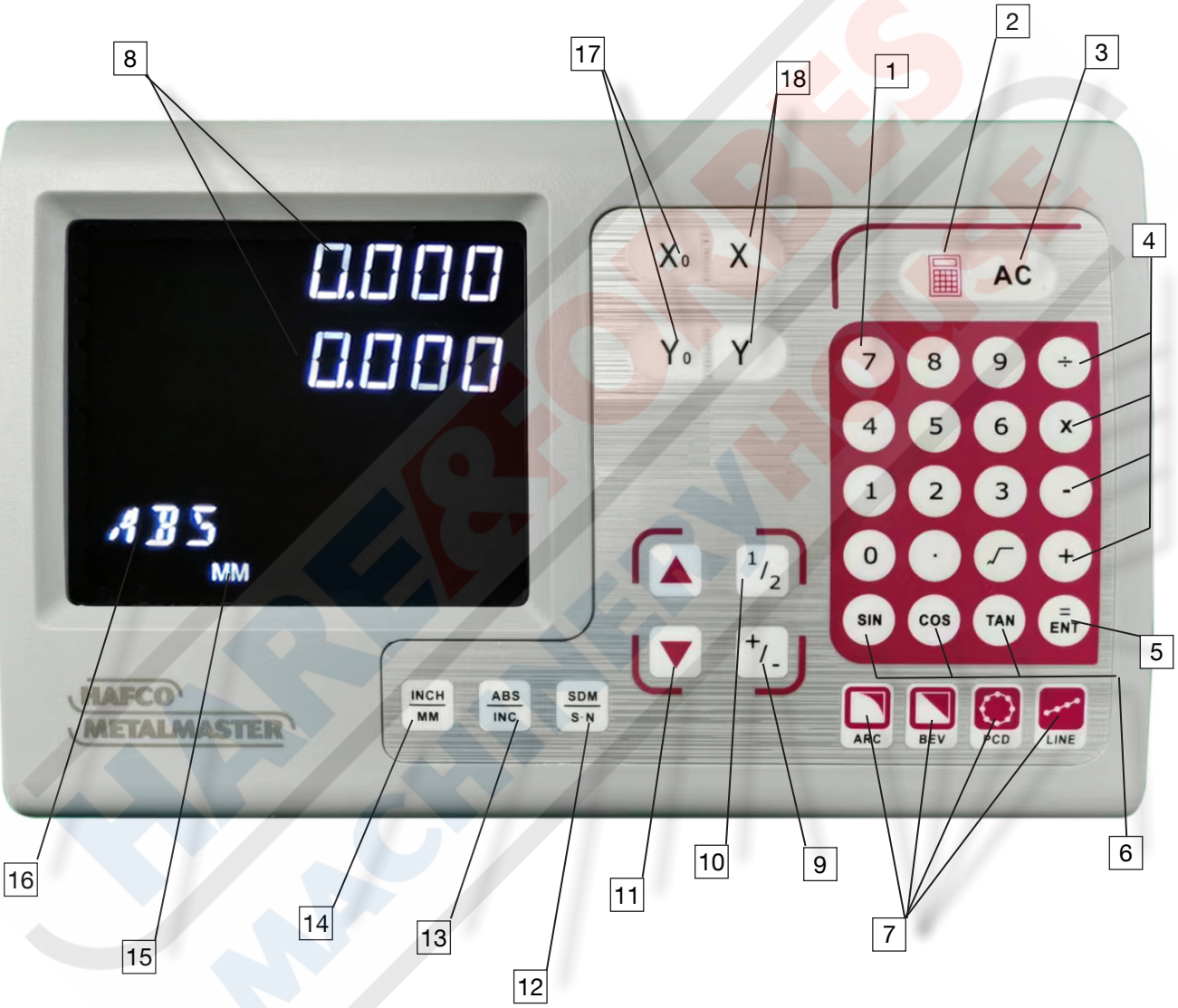
## Chaper 1 IDENTIFICATION

### 1.1 XH600-3 FRONT PANEL 3 AXIS

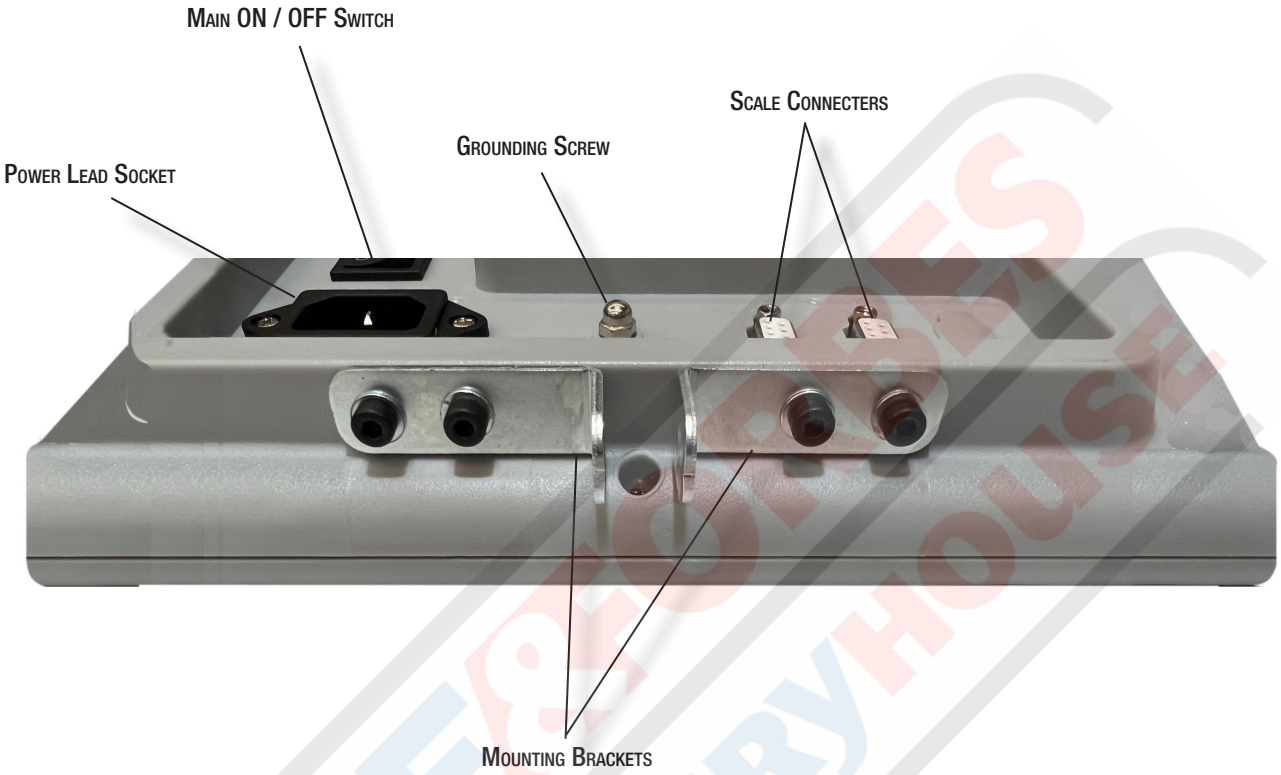
Become familiar with the names and locations of the controls and features shown below to better understand the instructions when mentioned later in this manual.



## 1.1 XH600-2 FRONT PANEL 2 AXIS



## 1.1 REAR PANEL




## OPTIONAL ACCESSORIES

Optional Lathe Mounting Kit
Order Code D5204

Optional Mill Mounting Kit
Order Code D5206

## 1.1 IDENTIFICATION SUMMARY

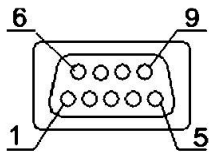
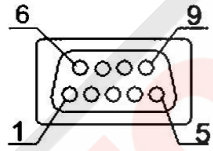
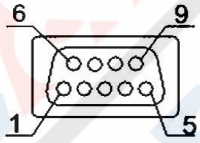
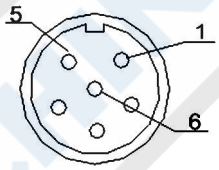
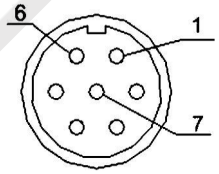
Become familiar with the names and locations of the controls and features shown on previous pages to better understand the instructions if mentioned later in this manual.

| | |
|---|---|
| **1** | Number, decimal point key |
| **2** | Calculator key |
| **3** | Reset key for calculator |
| **4** | Operation key (Add, sub, multiple and divide) |
| **5** | Key to confirm operation |
| **6** | Trigonometric function key |
| **7** | Four special function key (Simple R cutting function, Process a slope, Process holes displayed equally on a circle, Process holes displayed equally on a line) |
| **8** | Select axis to operate |
| **9** | Zero selected axis |
| **10** | X/Y/Z Display window |
| **11** | Enter +/- sign |
| **12** | Display half value of an axis |
| **13** | Scroll up or down to select |
| **14** | Function shift key (in state of calculator, calculate anti-trigonometric function. In display state of SDM coordinate, enter the state of input of SDM coordinate) |
| **15** | Toggle between ABS/INC coordinate |
| **16** | Toggle display unit between metric and inch |
| **17** | Indicates either metric or inch selected |
| **18** | Message window |

## 1.2 DESCRIPTION OF KEY FUNCTIONS

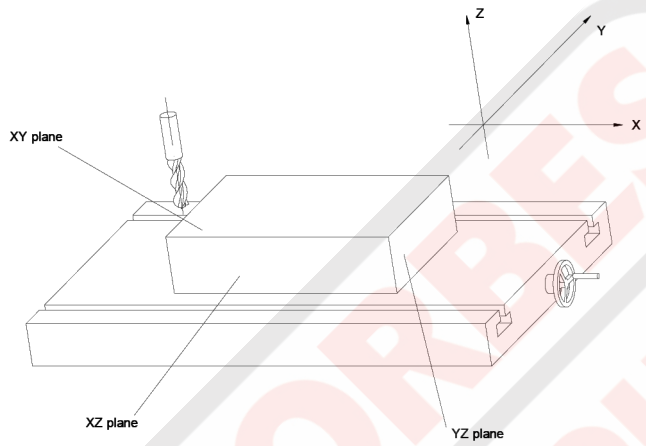
| | KEY MARK | KEY NAME | FUNCTION |
|---|---|---|---|
| 1 | X0 Y0 Z0 | X/Y/Z-Zero | Zero selected axis. |
| 2 | X Y Z | Axis Selection | Select axis to operate. |
| 3 | INCH MM | Inch/Metric Switch | Toggle display unit between metric and inch |
| 4 | 1/2 | Center Finding | Displays half the value of an axis. |
| 5 | ABS INC | ABS/INC Switch | Toggle between ABS/INC coordinate. |
| 6 | SDM S-N | SDM Switch | 1. Calculate inverse trigonometric function in calculating function.<br>2. Enter No. of SDM coordinate. |
| 7 | 0 ~ 9 | Numeric Keys | Enter number. |
| 8 | . | Decimal Point | Enter decimal point. |
| 9 | +/- | +/- Sign | Enter +/- sign. |
| 10 | = ENT | Enter | Confirm operation. |
| 11 | AC | Clear all | Cancel incorrect operation. |
| 12 | | Calculator | Enter or quit calculating state. |
| 13 | SIN COS TAN | Trigonometric Function | Calculate trigonometric or inverse trigonometric. |
| 14 | + - x ÷ | Add: Subtract: Multiple: Divide | Operate adding: Subtracting: multiplying: dividing. |
| 15 | | Radical Sign | Square root or square equations |
| 16 | PCD | BHC | Process holes displayed equally on a circle. |
| 17 | LINE | BHL | Process holes displayed equally on a line. |
| 18 | ARC | ARC | Simple R cutting function |
| 19 | BEV | SLOPE | Process a slope. |
| 20 | ▲ ▼ | Item Selection | Scroll up or down to select. |

## 1.3 INTERFACE

| No. | Interface Type | Schematic Diagram | Pin | Signal |
|---|---|---|---|---|
| 1. | 9-core TTL Interface |  | 1/3/5 | Null |
| | | | 2 | 0V |
| | | | 4 | Error Signal |
| | | | 6 | A |
| | | | 7 | +5V |
| | | | 8 | B |
| | | | 9 | R |
| 2. | 9-core EIA-422-A signal interface |  | 1 | -A |
| | | | 2 | 0V |
| | | | 3 | -B |
| | | | 4 | Error Signal |
| | | | 5 | -R |
| | | | 6 | A |
| | | | 7 | +5V |
| | | | 8 | B |
| | | | 9 | R |
| 3. | EDM signal interface |  | 1/4/5/ 7/8/9 | Null |
| | | | 2 | Common Terminal |
| | | | 3 | Normal Close |
| | | | 6 | Normal Open |
| 4. | 6-core signal interface |  | 1 | 0V |
| | | | 2 | A |
| | | | 3 | B |
| | | | 4 | R |
| | | | 5 | +5V |
| | | | 6 | PE Earth Wire |
| 5. | 7-core signal interface |  | 1 | 0V |
| | | | 2 | 空 |
| | | | 3 | A |
| | | | 4 | B |
| | | | 5 | +5V |
| | | | 6 | R |
| | | | 7 | PE Earth Wire |

## 1.4 COORDINATE SYSTEM

XH600 DRO is an instrument which can measure the position of the work piece when processing. The coordinate system needs to be defined first, for more efficiency and accuracy.




On a vertical milling machine, the longitudinal travel of the table is parallel with the X axis, and cross travel is parallel with the Y axis. Z is parallel to the spindle and is parallel to the up-and-down travel.
Origin is a point along the axis that reads zero.
Positive direction of an axis is set as the number increases as you move away from the origin.
The value of one point position is the distance relative to the origin of the coordinate.
For a work-piece as Figure A, the value of each point position is as Figure B when point O is the origin of the coordinate.

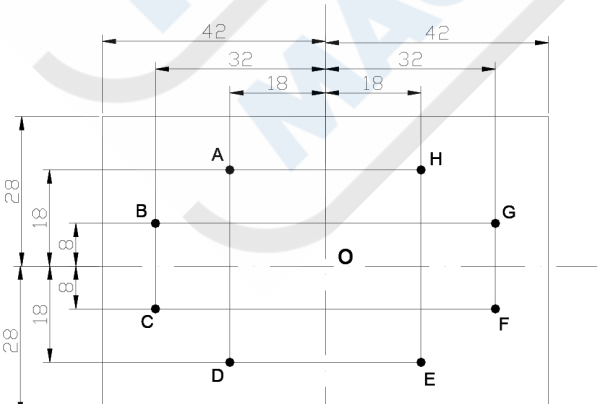



FIG A

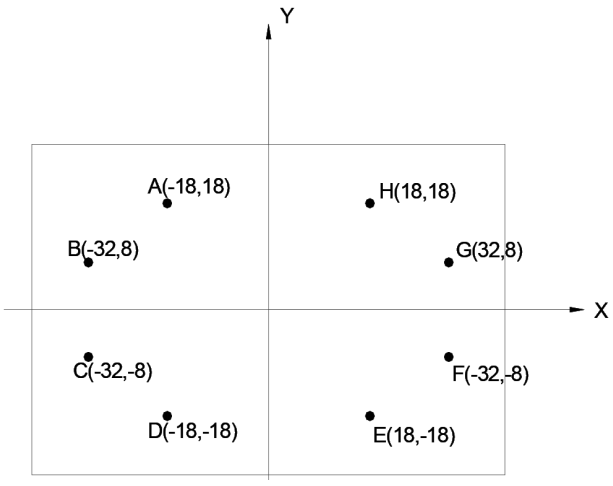



FIG B

# Chapter 2. BASIC OPERATION

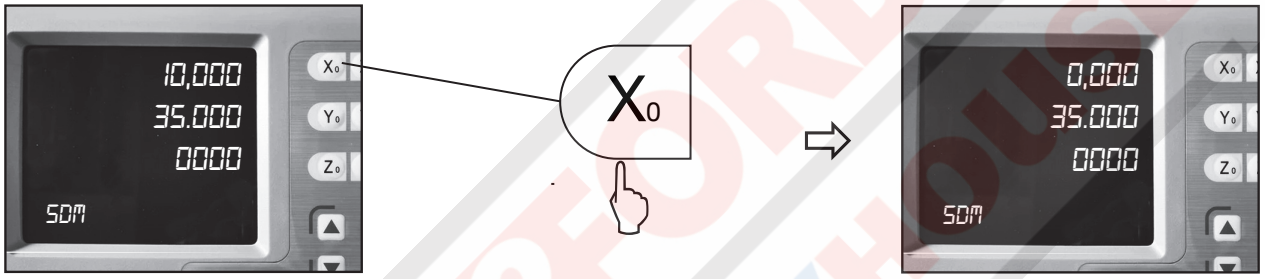
## 2.1 POWER ON

When the XH600 is Powered up it enters the normal display state, and memorizes the following parameters.

A. The scales position when the power was switched off.
B. The mode selection when powered off (ABS/INC/SDM)
C. The Metric/Imperial mode when switched off.

## 2.2 ZEROING THE AXIS

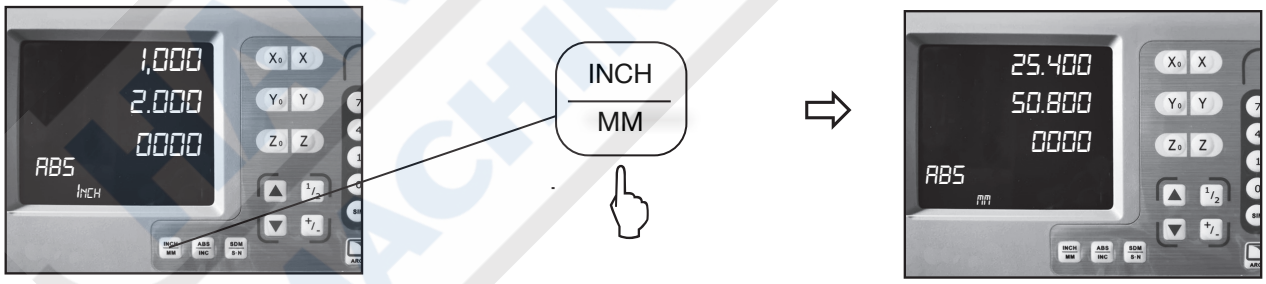
The purpose of this function is to set the current position for that axis to ZERO
Example : Setting the current X axis position to ZERO



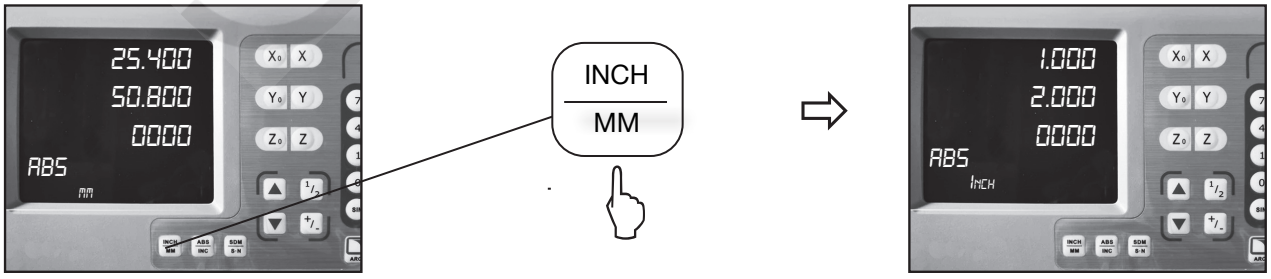

## 2.3 INCH / METRIC CONVERSION

The purpose of this function is to switch the display between Inch or Metric

EXAMPLE 1. INCH TO METRIC

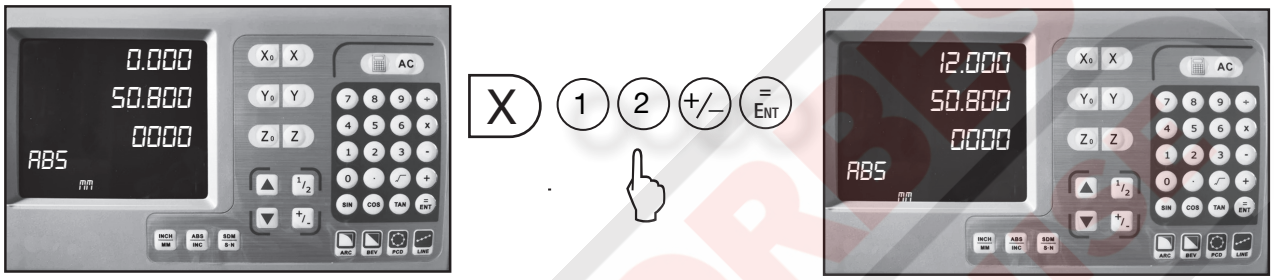



EXAMPLE 2. METRIC TO INCH



## 2.4 ENTER A DIMENSION IN AN AXIS

Function: Enter a value for an axis in normal display state.
NOTE: An Axis value can not be preset while the DRO is in other states (e.g. calculating function or special function).
Press the X and the X Axis will flash “0”, press the 1 and 2 and select “+” or “-” then press “Enter”. If the value is incorrect press AC to cancel and input again.




## 2.5 CALCULATING THE MID POINT

Function: Set the center of the work piece as datum by halving the displayed value.
To set the current X axis zero position at the centre of the work piece,

Step 1. Using an edge finder locate the edge at one end of the work piece, then zero the X axis.


Step 2. Using the edge finder locate the edge at the other end of the work piece.



Step 3. Press 1/2 then X to half the “X” axis display value.

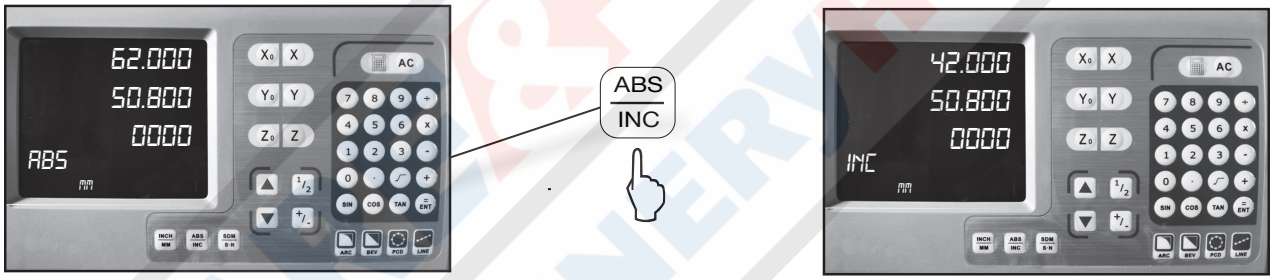
## 2.6 ABSOLUTE / INCREMENTAL / 200 GROUP SDM

An ABSOLUTE movement moves to a measurement distance from the ZERO POINT.
An INCREMENTAL movement is a measurement based on the current position. An incremental measurement does not take the parts zero point into consideration.
During machining operations, the operator can store the work piece datum ( ZERO position ) in ABS coordinate, then switch to INC coordinate to continue machining operations
Then the operator is free then to zero the axes or preset any dimensions into any axis in INC co-ordinate for any relative position machining. The work piece datum (work piece ZERO position ) is still kept in the ABS coordinate of the DRO.

Function: The XH600 series DRO has 3 display modes, absolute mode (ABS), incremental mode (INC) and 200 group Second Data Memory (SDM) with the range of 000 to 199.

1. Zero point of the work-piece is set at the origin point of the ABS coordinate,
2 The relative distance between datum of ABS and SDM remains unchanged when ABS datum is changed.
3. If one point in ABS is zeroed, the point in INC is zeroed automatically, yet if one point in INC is zeroed, the point in ABS will remain unchanged.

Example: Currently in ABS display coordinate, to switch to INC display coordinate




### A. Toggle between ABS/INC/SDM coordinates

These three display modes can be changed only in normal display state.

ABS to INC Press [ABS/INC]

INC to ABS Press [ABS/INC]

SDM to INC Press [ABS/INC] to enter ABS or INC, If in ABS: press [ABS/INC] again.

SDM to ABS Press [ABS/INC] to enter ABS or INC, If in INC: press [ABS/INC] again.

INC to SMD Press [SDM/S-N]

ABS to SDM Press [SDM/S-N]

### II Set A New SDM Number In SDM Mode

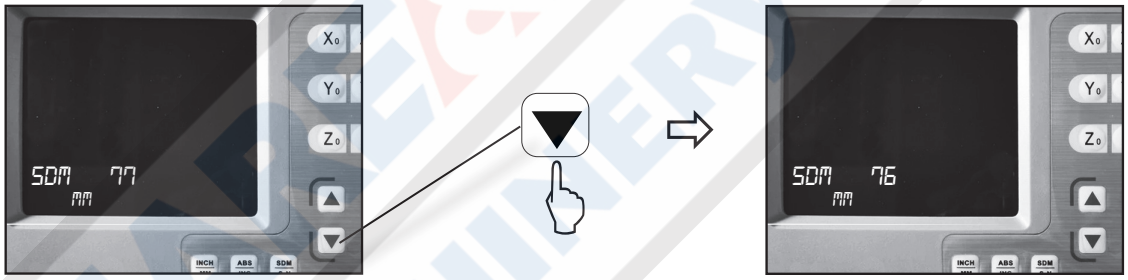

Steps:

1. Enter SDM mode;
2. Press SDM/S-N message window flashes, waiting for a new SMD input number.
3. Enter a new number. for example, enter 6 6
4. Confirm new SDM number, then the message window stops flashing and the SDM number is changed to 66.

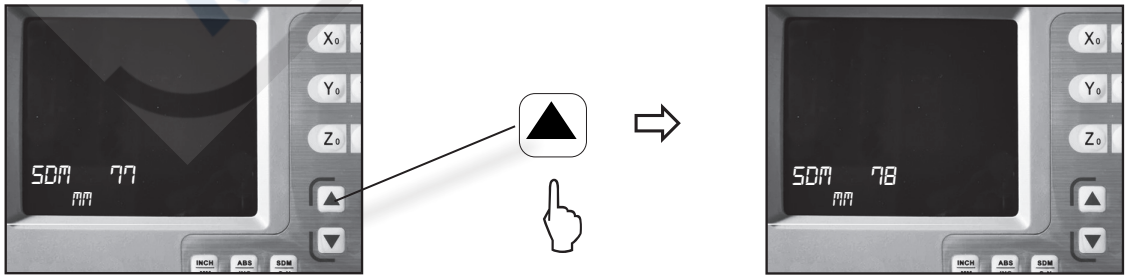
### III: Increase/Decrease The SDM Number.

Return the DRO to the normal display state with the SDM display mode, press ▼ to decrease the SDM number by 1.
Press ▲ to increase the SDM number by 1.

Example 1: If the current SDM number is 77, and the message window displays “SDM 77” Press ▼ then the message window will display “SDM 76” which means the current “SDM” number is “76”.




Example 2 :If the current SDM number is 77, and the message window displays “SDM 77” Press ▲ then the message window will displays “SDM 78” which means the current SDM number is 78.



## SETTING SDM COORDINATES FOR A WORKPIECE

If a work-piece as the figure at the bottom of the page is to be machined, the datum plane is E, and the coordinates can be set as the following steps below:

1. Return to the normal display state with ABS coordinate;

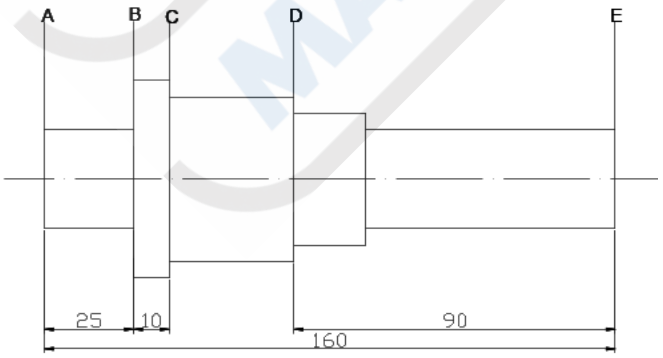
2. Move the machine table until the cutting tool is aligned with plane E, then zero X axis.

3. Move the machine table until the cutting tool is aligned with the plane D.
   Change SDM number to SDM 000, and press (X₀) to zero “X” axis.
   Then the Number “SDM 000” coordinate’s datum is set at plane D.

4. Move the machine table until the cutting tool is aligned with plane C, press (▲) to change SDM to SDM 001, and then press (X₀) to zero X axis, and the SDM 001 with the datum plane C is set.

5. Move the machine table until the cutting tool touches the plane B, the DRO will display as the right.

6. Move the machine table until the cutting tool touches the plane A, the DRO will display as the right.

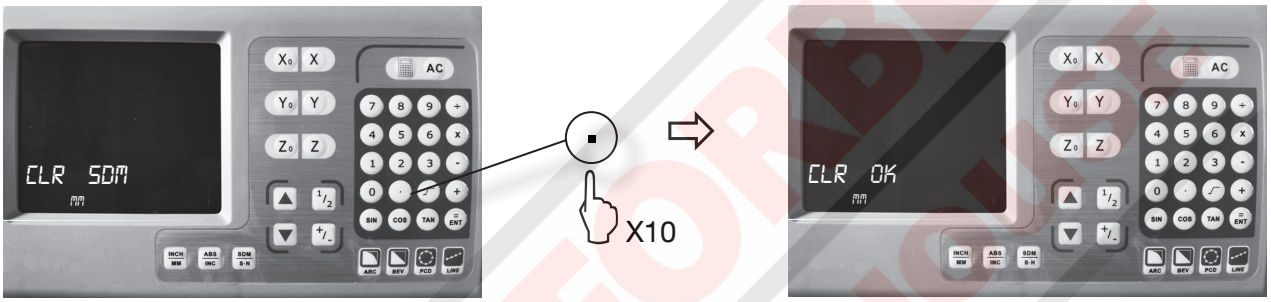



## 2.7 CLEAR ALL SDM DATUM

Function: To clear all the Datum of the SDM settings 0 – 199. After clearing, the display the value in the SDM coordinate will be equal to the value in the ABS coordinate.

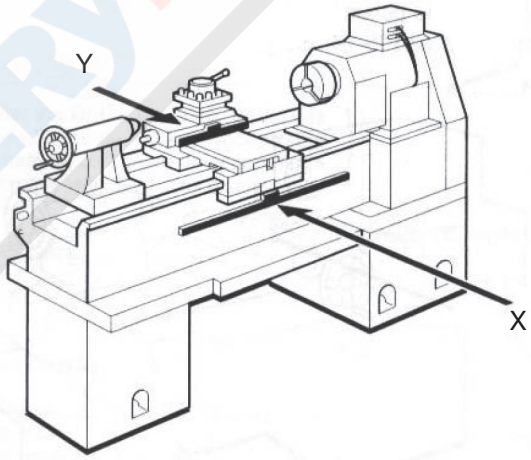
**Steps:**

1. Return normal display state;
2. Press (▪) simultaneously for 10 times, and the message window will display “CLR SDM” and flashes, which means it is now clearing. After a moment, the clearing will be completed and “CLR OK” will be displayed in message window temporary and the DRO will return to the normal display state.




## 2.8 LATHE FUNCTION

As per the image to the right, if two scales are installed in one axis, the position of the work-piece should be the sum of these two values (X+Y) in this direction. It is called lathe function.

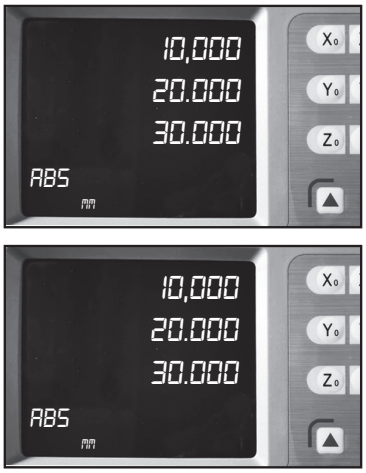



A. Lathe mode 0: normal display (the lathe function is disabled).
B. Lathe mode 1: X window value = the value of X axis position + the value of Y axis position.
C. Lathe mode 2: X window value = the value of X axis position + the value of Z axis position.
D. Lathe mode 3: Y window value = the value of Y axis position + the value of Z axis position.

**Steps:**

1. Set the lathe mode in initial system settings.
2. In normal display state press (Z+Z1 SIN) to enter lathe function.
3. In lathe state, press (Z+Z1 SIN) to exit the lathe function.

A. If in normal display state: the value of the position is as the right.
B. In lathe mode 3, the DRO will display as the following,
Y window display value = value of Y axis position + value of the Z axis position



## 2.9 VIBRATION FILTERING

Vibration filtering is especially useful for old and big machines in which the machine structure is not rigid enough to get a stable display during machining or moving, or when machining in one axis, the other axes may vibrate and hence the DRO display numbers are jumping around which may cause confusions and uncomfortable position visualization to the operator.
If the operator cannot see the display value clearly. The XH600 series DRO provides vibration filtering function to stabilize the digits display,

**Steps:**

1. Enter display value filter function In normal display state, press COS to enter the display value filter function.
2. To exit the display value filter function, press COS again

## 2.10 Enter/Exit Setup Display Settings

Press ENT to enter initial system setting after DRO powers on for 1 second, then “SETUP” displays in the message window.


Press ▲ or ▼ to select the item you want to change.
If you want to quit initial settings, press ▲ or ▼ until “EXIT” appears in message window and press ENT

## Chapter 3. SDM COORDINATES - 200 GROUPS

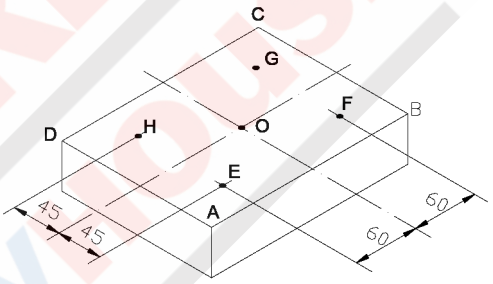
The **HAFCO METALMASTER** XH-600 DRO has three display modes.

1. Absolute mode (ABS),
2. Incremental mode (INC) and
3. 200 groups second data memory (SDM 0—SDM199).

ABS datum of the work-piece is set at the beginning of the processing and the 200 group SDM is set relative to ABS coordinate.

1. INC is independent of ABS, it won't follow any change in ABS datum ( zero point ) . However, all SDM coordinates are relative to ABS coordinate, all SDM positions are relative to ABS's zero, it will shift together with ABS zero position changes.
2. All SDM coordinate's relative distance to ABS can be entered directly into the DRO using the keypads. No need of any calculation or actual tool positioning in the machine.

Example: The ABS datum is the center point O, the point E, F, G, H needing processing are set as a datum of SDM 000 — SDM 003.

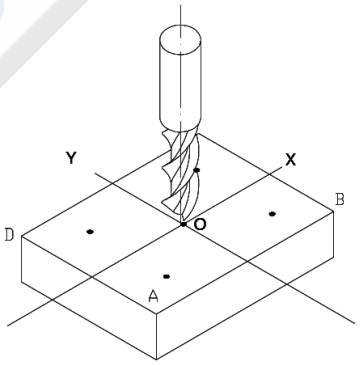



Two ways to set SDM coordinates:

1. Zeroing at the current point;
2. Presetting the datum of the SDM coordinate.

### 3.1 ZEROING AT THE CURRENT POINT

Set the center point of the work-piece as the origin of the ABS, then align the lathe cutting tool with point E, F, G, H by moving the machine table and zero them. It is the processing position where the "0.00" appears in the X window, Y window by moving the machine table whether in ABS or in SDM coordinate.



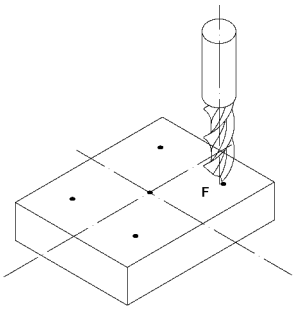

**Steps:**

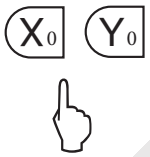
1. Set the center of rectangular point O as the datum of ABS. Make line AB parallel with X axis: line AD parallel with Y axis. When position lathe tool to point O
   Zero X axis and Y axis in SDM 000.
   Zero X axis and Y axis in SDM 001.
   Zero X axis and Y axis in SDM 002.
   Zero X axis and Y axis in SDM 003.

2. Set the point E as the datum of SDM 000.
   SDM 000: align the cutting tool with point E and zero X axis, and the Y axis. DRO displays as per the picture to the right.


### 3.1 ZEROING AT THE CURRENT POINT Cont.

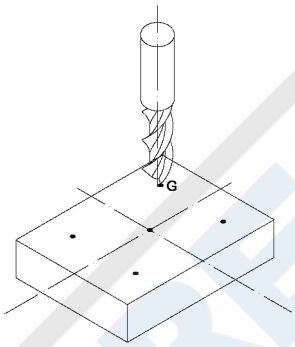
3. Set the point F as the datum of SDM 001.
   In SDM 001 and align the cutting tool with point F, then zero X axis, Y axis. DRO displays as per the right:

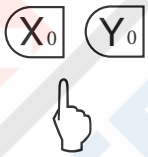




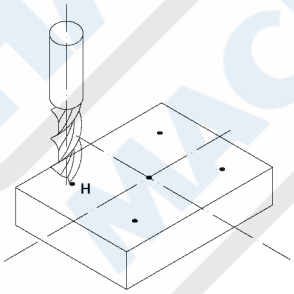
4. Set the point G as the origin of SDM 002.
   In SDM 002, align the cutting tool with point G, and zero the X axis, Y axis. DRO displays as per the right.

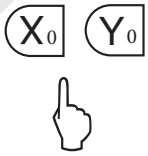




5. Set the point H as the origin of SDM 003.
   In SDM 003, align the cutting tool with point H, and zero the X axis, Y axis. DRO displays as per the right.





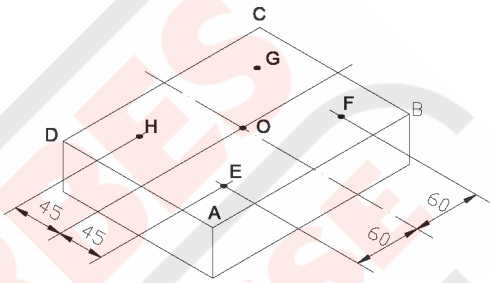
6. Machine the work-piece according to the preset SDM coordinates.

7. Machine another work-piece according to the same blueprint. You only need to set the center point as the datum of ABS. It is not necessary to set SDM coordinate again, as SDM can be set automatically. Point E, F, G, and H are the zero points of SDM 000, SDM 001, SDM 002, and SDM 003 respectively. Points can be machined when entering corresponding SDM coordinate and where “0.000” appears in the screen by moving the machine table. This function can save plenty of time where multiple pieces are to be machined

## 3.2 PRESET DATUM OF SDM COORDINATE

Compared with the way of zeroing at current point, another way, presetting SDM coordinate datum, can set the zero point of the SDM more accurately and quickly without moving the machine table.

As the figure showed right, center point is the datum of ABS, the position points E, F, G, H are (-60, -45), (60, -45), (60, 45), (-60, 45) in the ABS coordinate.




A. Enter SDM 000 and preset the position of point O as (60, 45), which means the point E is the datum of SDM 000.

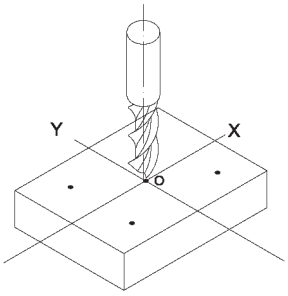
B. Enter SDM 001, preset the position of point O as (-60, 45), which means the point F is the datum of SDM 001;

C. Enter SDM 002 and set the position of point O as (-60, -45), which means that point G is the the datum of SDM 002.

D. Enter SDM 003, preset the position of point O as (60, -45), witch means that point H is the datum of SDM 003.

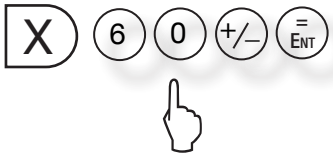
**Note:** The preset value is negative to the actual value of the position in ABS. If set “SDM DIR” as “1” in initial system settings, the caution is not necessary. The value DRO accepts, is equal to the negative of the enter value.

1. Set “SDM DIR” as “1” in initial system settings;
2. Set the center point of the work-piece as the datum of ABS; Line AB is parallel to X axis, line AD is parallel to Y axis. Move machine table; align the milling cutter with point O. The machine table remain still while presetting;





3. Set point E as the datum of SDM 000.
   Enter SDM 000.
   The position of point E is (-60, -45), press.

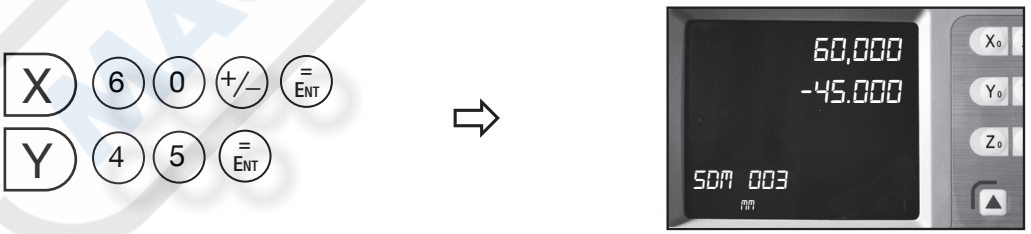



### 3.2 PRESET DATUM OF SDM COORDINATE Cont.

4. Set point F as the datum of SDM 001.
   Enter SDM 001.
   The position of point F is (60, -45), press


5. Set point G as the datum of SDM 002.
   Enter SDM 002.
   The position of point G is (60, 45), press


6. Set point H as the datum of SDM 003.
   Enter SDM 003.
   The position of point H is (-60, 45), press



# Chapter 4. SPECIAL FUNCTIONS

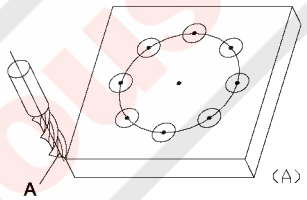
The Hafco Metalmaster XH600 series DRO has special functions as well as measuring and positioning.



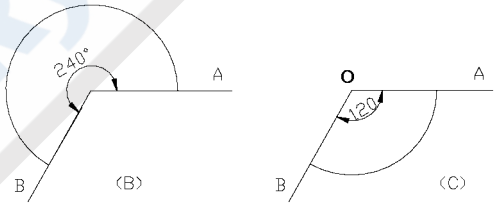
## 4.1 PITCH CIRCLE HOLE FUNCTION

Function description:
The XH600 series DRO has a Pitch Circle Hole Function. This function can simplify the pressing of multiple holes which are attributed equally around the circumference of a circle. The DRO will guide operator to enter the following parameters:

RADIUS: - Radius of circle
ST ANGLE: - Starting angle that the center of the first hole on the circle.
END.ANGLE:- Ending angle that the center of the last hole on the circle.
HOLE NUM:- Number of Holes.
DIRECT:- Angle direction.

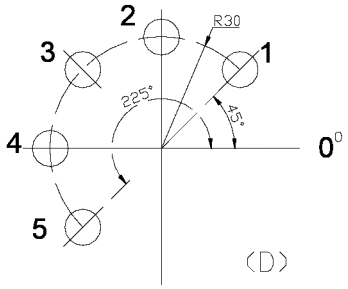



Angle has two directions: counterclockwise and clockwise. “0” indicates that it is counterclockwise from the ST.ANGLE to END.ANGLE; “1” indicates it is clockwise from ST.ANGLE to END.ANGLE. As the following figure, the ST.ANGLE is 0º, END.ANG is 240º.
The figure (B) illustrates the arc while angle direction is counterclockwise; figure (C) illustrates the arc while angle direction is clockwise.




As figure (D) illustrates, machine a hole every 45 deg from 45º ~ 225º. Parameters are as the following:

| | |
|---|---|
| RADIUS | 20 |
| ST.ANGLE | 45 |
| END.ANGLE | 225 |
| HOL NUM | 5 |
| DIRECT | 0 |

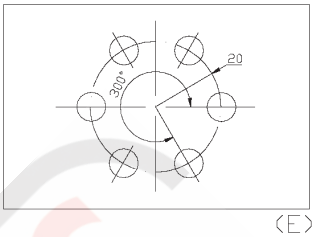



**Note:** If the ST.ANGLE equals the END.ANGLE, the holes are attributed equally around the whole circumference.

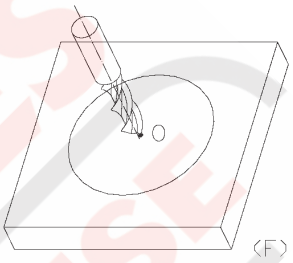
The positions of the hole center are calculated automatically after input of all parameters. Press ▲ or ▼ to choose the hole No. and move the machine table until the “0.000” appears in X and Y windows. This is the position to process a hole.

Example: Machine holes on circumference as the figure (E).

| | |
|---|---|
| RADIUS | 20MM |
| ST ANGLE | 0° |
| END ANGLE | 300° |
| HOL NUM | 6 |
| DIRECT | 0 |



(E)


(F)

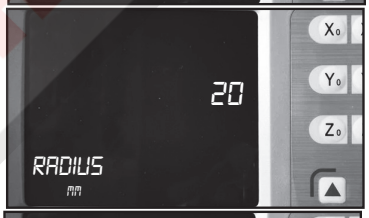
**Steps:**

1. Set the display unit to metric in normal state;
   Move the machine table until the cutting tool is aligned with the center of the circle, then zero X axis and Y axis.
2. Press PCD to enter Pitch Circle Hole function. If all parameters have been set, press ENT to process directly.
3. Input radius: Y window displays the formerly preset radius; message window displays “RADIUS”.

Press 2 0 ENT in turn.


**Note:** If “0” is entered as the radius, the DRO will request an input again. If an incorrect parameter has been entered and you haven’t pressed ENT press AC to cancel and input again.

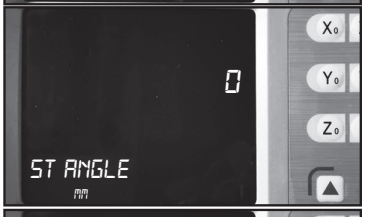
If you have pressed ENT and begin to enter another parameter, you should press ▲ to return to RADIUS set and input again. Other parameters can be dealt with in the same way.




4. Input The Start Angle

Message window displays “ST.ANGLE”; Y window displays the former preset starting angle.

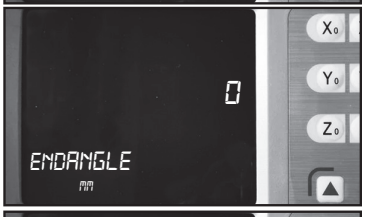
Press 0 ENT in turn.


5. Input The Ending Angle

Message window displays “END.ANGLE”; Y window displays the former angle.

Press 3 0 0 ENT in turn




6. Input The Number Of Holes.
Message window displays “HOLE NUM”; Y window displays the former number.
Press (0) (= ENT) in turn.

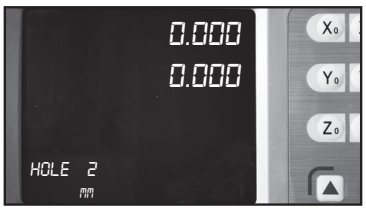

**Note**: If “0” or “1” is entered as the number of holes, the DRO will point out this mistake and requiure entering again.


7. Input angle direction.
Message window displays “DIRECT”, Y window displays the former preset direction.
Press (0) (= ENT) in turn.


8. Message window displays “HOLE 1”.
It is the position of the first hole to punch where the “0.000” is displayed in X window and Y window by moving the machine table.

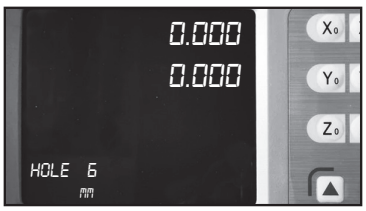

9. After finishing the first hole, press ▼
Message window displays “HOLE 2”.
Move the machine table, until “0.000” is displayed in the X and Y windows. This is the position of the second hole.

**Note:** Press ▲ or ▼ to change to the hole number.




10. Process the 3rd to the 6th holes in the same way.

11. After processing all holes, press PCD to return to the normal display state.




**Note:** In the course of the Pitch Circle Hole Function pressing (three axes display) or (two axes) Pitch Circle Hole Function temporarily and return normal display state in order to check the position. And press (three axes display) or (two axes display) again to return to the Pitch Circle Hole function.

## 4.2 BOLT HOLE LINE FUNCTION

Function: XH-600 series DRO provides BOLT HOLE LINE (BHL) function. This function can simplify the processing multiple holes whose centers are attributed equally on one line. The following parameters are needed to be entered.

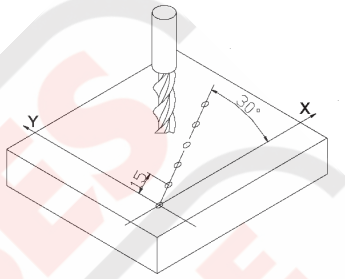
| | |
|---|---|
| LINE DIS | Line distance (distance between the center of first hole and the center of the last hole) |
| LINE ANG | Line angle (angle between the line and the positive X axis) |
| HOLE NUM | Number of holes |

## 4.2 BOLT HOLE LINE FUNCTION Cont.

The DRO will calculate the positions of the holes after the parameters have been entered or press ▲ to select the number of the hole and move the machine table is displayed in the "X" window. This will be position of the hole.

Example:

| | |
|---|---|
| LINE DIS | 150mm |
| LINE ANG | 30° |
| HOLE NUM | 6 |




**Steps**

1. Set display unit to metric and the shrinkage is not taken into consideration. Move the machine table until the machine tool is aligned with the center point of the first hole, and zero the X and Y axis.


2. Press LINE to enter Bolt Hole Line function. If all the parameters have been entered, press (=ENT) to start processing directly.


3. Input line distance. Y window displays the former preset line distance, and the message window displays "LINE DIS".
   Press (1) (5) (0) (=ENT) in turn


**Note:** If "0" is input as the line distance: the DRO will not accept the entry and remind the operator to input again.

4. Input line angle.
   The message window displays "LINE ANG". Y window displays the former preset line angle.
   Press (3) (0) (=ENT) in turn.


5. Input the number of hole.
   Message window displays "HOLE NUM", Y window displays the former preset hole number. Press (6) (=ENT) in turn, and processing begins.


**Note**: If "0" or "1" is entered as a hole number, the DRO will not accept the entry and remind the user to input again.

## 4.2 BOLT HOLE LINE FUNCTION Cont.


6. Message window displays “HOLE 1”.
   Move the machine table until “0.000”appears in X window and Y window, it is the center of the first hole to punch.

7. After finishing the first hole, press, ▼ and the message window displays “HOLE 2”.
   Move the machine table until “0.000” appears in X and Y window, and then you can punch the second hole at this point.

**Note:** Press ▲ or ▼ to move among the holes.

8. Process the holes 3rd – 6th in the same way.

9. Press LINE to return to the normal display state when the processing has finished.

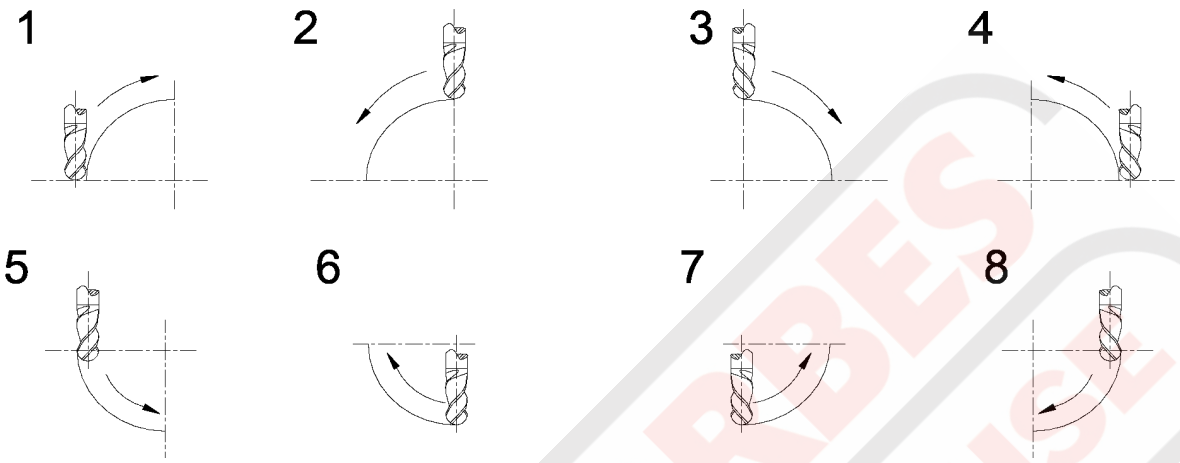
**Note:** In the course of Bolt Hole Line Function, you can press (three axes display) or (two axes display) to leave this function temporarily and return normal display of X, Y, Z axis in order to check the position which the DRO calculated. Then press (three axes display) or (two axes display) again to return BHL function.

## 4.3 ARC MACHINING

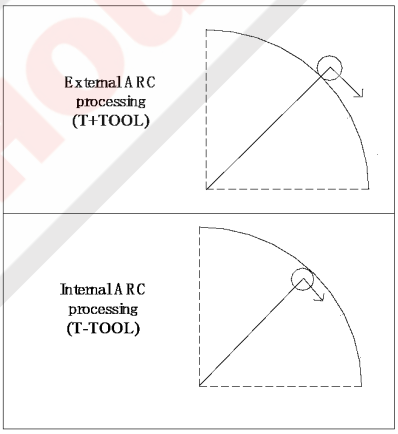
This function is only for XH600-2, XH600-3.
It is waste of time to use a numerical control lathe to process an arc in a simple product or small production run. This function makes it convenient to process an arc with a normal lathe. Parameter “MAX CUT” is the arc length for each process. The smaller the MAX CUT, the more smooth the arc plane and the longer processing time.

**A. Process XZ, YZ plane**
There are 8 modes as the following when processing arc in XZ or YZ plane:

### 4.3 ARC MACHINING Cont.




Tool compensation direction(when process XY plane)



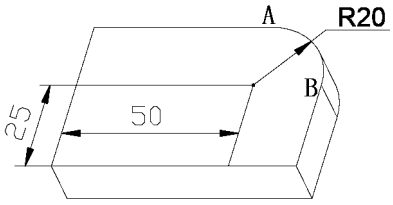

Milling cutter may be flat-bottomed or arc-bottomed. If flat-bottomed, set the tool diameter as 0.

B. Process XY plane.
The DRO provides the 8 modes (shown at the top of the page) in processing XY plane. The milling cutter is perpendicular to the machine plane. The DRO has internal Arc machining and external Arc machining for each type.

External T +TOOL.
Internal T - TOOL.

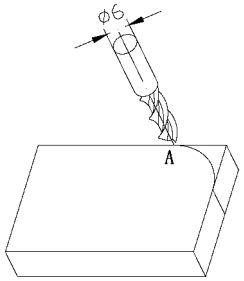
Set the tool radius according to the actual milling cutter when process the XY plane.

| | |
|---|---|
| TYPE 1 - 8 | Mode of the Arc machining |
| * T+TOOL / T-TOOL | Selection between T + TOOL / T - TOOL (This parameter is only for XY plane) |
| RADIUS | The radius of ARC that is to be processed |
| TOOL DIA | Tool diameter |
| MAX CUT | Feed step |




Example 1:
Process an arc AB of 90° from point A to point B as the figure.
Parameters are as per the following,

| | |
|---|---|
| Machine plane | XY |
| ARC mode type | 3 |
| T + TOOL | |
| RADIUS | 20° |
| TOOL DIA | 6mm |
| MAX CUT | 0.5mm |



### 4.3 ARC MACHINING Cont.

1. Set display unit is metric.
2. Move the machine table until the lathe tool is aligned with point A, then zero X axis and Y axis.
3. Enter Arc machining state.
   Press ARC to enter Arc machining state,
   If all parameters have been set, press = ENT to process directly.

4. Select machine plane,
   Press X = ENT to select XY.

**Note:** X Indicates XY Plane,
Y Indicates YZ Plane,
Z Indicates ZX Plane,

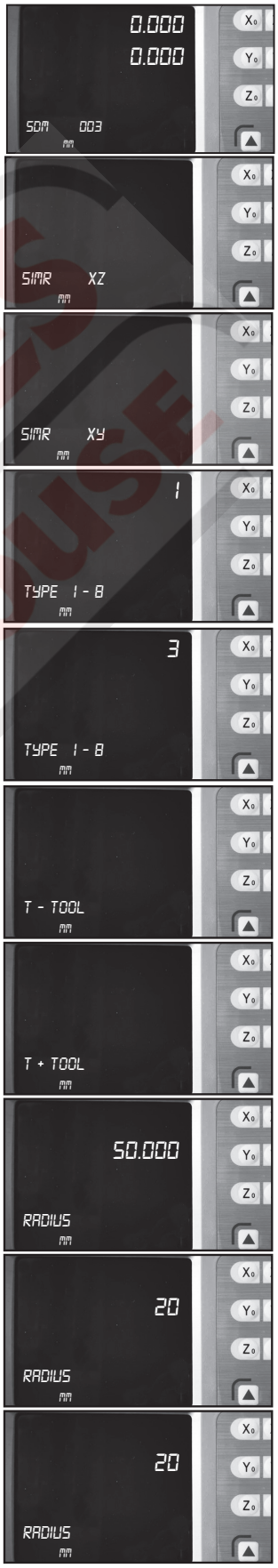
5. Select processing mode.
   Message window displays “TYPE 1-8”, and Y window displays the former processing mode.
   Press 3 = ENT in turn to select mode 3, and then enter ARC type.

6. Select T + Tool Mode.
   Press + = ENT to select the external Arc machining.

**Note:** + indicates T + TOOL mode (external Arc machining).
- Indicates T - TOOL mode (internal Arc machining).

7. Set Arc Radius.
   Message window displays “RADIUS”, and Y window displays the former arc radius.
   Press 2 0 = ENT in turn to enter the arc radius.

**Note:** If “0” as the arc radius is entered, the DRO will display an error message and wait for another number entry.



### 4.3 ARC MACHINING Cont.


**8. Set Tool Diameter.**

In the message window when “TOOL DIA” is displayed the Y window displays the former preset diameter.
Press (6) (= ENT) in turn to enter the tool diameter.

**9. Set The Feed Step.**

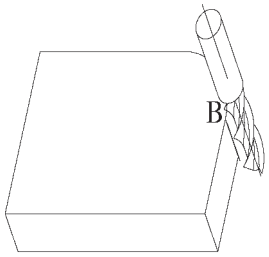
Message window displays “MAX CUT”.The Y window will display the former feed step.
Press (0) (.) (5) (= ENT) in turn to enter the feed step.

**Note:** If “0” is entered as the feed step, the DRO will not accept the and wait for a correct entry.

**10. Process ARC**

Message window displays “POIN 1”. Process when the “0.000” appears in X and Y window. Then when you have finished the first point, then Press (▼) to switch to the second point and repeat the same step to move through the feed points. Process in this way until the message window displays “POIN 74”. Pressing (▲) or (▼) can select any processing point.

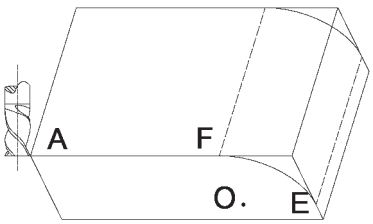
11. Press (ARC) to exit Arc machining after machining is over.




**Note:**

1. In the ARC process, pressing (three axes display) or (two axes display) allows you to leave this function temporarily. To return to normal display of X, Y, and Z axis in order or check the position the DRO has calculated. Press (three axes display) or (two axes display) to return to the ARC function.

2. Processing (▲) or (▼) can switch amongst the parameters in the course of the presetting parameter.




Example 2:

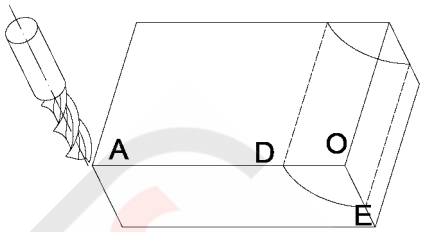
Process the ARC EF as the figure from point E to point F.
Parameters are set as following.

| | |
|---|---|
| Machine plane: | XZ |
| TYPE: | 4 |
| RADIUS: | Actual radius of the arc |
| TOOL DIA: | 0 (flat-bottomed tool) |
| MAX CUT: | Preset as per the operators input |

### 4.3 ARC MACHINING Cont.

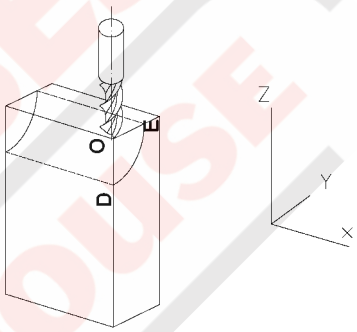
Example 3:
Process the ARC DE as the figure from point D to point E.
Parameters are as per the following.

| | |
|---|---|
| Machine plane: | XZ |
| TYPE: | 6 |
| RADIUS: | Actual radius of the arc |
| TOOL DIA: | Actual value (actual tool) |
| MAX CUT: | Preset as per the operators imput |




Example 4:
Process the ARC DE as the figure from point D to point E.
Parameters are as per the following.

| | |
|---|---|
| Machine plane; | YZ |
| TYPE: | 7 |
| RADIUS: | Actual radius of the arc |
| TOOL DIA: | Actual value (actual tool) |
| MAX CUT: | Preset as per the operators input |




**Note:** For XH600-2, The DRO is not installed with Z-axis, please press ▲ or ▼ to simulate position of the Z Axis. Press ▲ to simulate moving to the former process point, and emulate moving to the former process point, and press ▼ to simulate moving to the next process.

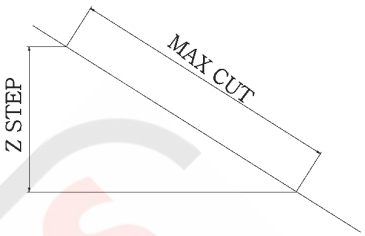
**Steps:**

1. Set “STEP MODE” as “Z STEP” in setup mode, and set Z-axis dial (default value is 2.5mm).
2. Before machining, align the tool with the beginning point Z of R, zero Z axis.
3. In the machining process, the message window displays simulate height of Z axis, which indicates simulate height of Z axis while machining.
   As per figure to the right , while machining XZ plane, X window displays the position of the X axis, X axis is finished when displaying “0.000” in X window.
   In the Y window, the former 2 numbers indicates the number of the dial, and the following 5 numbers indicate the scale number of the dial, which means that machining to this scale for the current point.


12 x 2.5+1=31

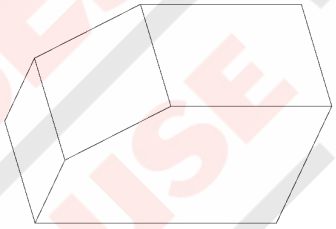
   While machining YZ plane, Y window displays position of Y axis, and when this window displays “0.000”, this indicates the machining is finished in the Y direction.
   In the X window, the former 2 numbers indicate the number of the dial, and the following 5 numbers indicate the scale number of the dial, which means that machining to this scale for the current point.

## 4.4 Slope Processing




This function is only for XH600-2, XH600-3.
Function:
This function can calculate the position of every processing point automatically in processing slope. Only the following parameters need to be inputted.

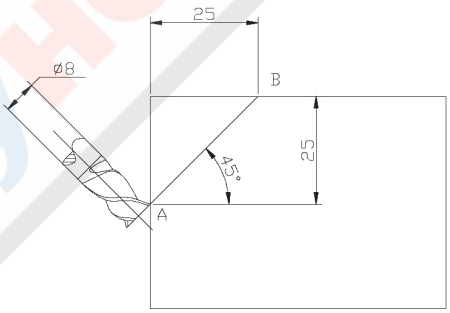
| | |
|---|---|
| INCLE: | Set machine plane XY, YZ or XZ plane |
| INCL.ANG: | The inclination angle of the slope |
| MAX CUT: | The slope length each time processing. |



**Note:**
Z STEP and MAX.CUT are defined as the figure.
The DRO will calculate the position of each processing on the slope automatically when all parameters have been input.
Press ▲ or ▼ to select the processing point and process until "0.000" appears in the window.

**Example 1.**
Process the slope AB as the figure. The parameters are as following.

| | |
|---|---|
| INCLE: | XZ |
| INCL.ANG: | 45° |
| MAX.CUT: | 12mm |




**Steps:**

1. Set display unit to metric
   Set the SLOP.MODE 1 in initial system settings.


**Note:** If the third parameter isn't Z STEP, set the SLOP.MODE 0.

   Move the machine table until the lathe tool is aligned with the starting point A, then zero X axis and Z axis.
   Press X0 , Z0 in normal display state.


2. Press BEV to enter the slop processing.
   Press = ENT to start processing directly if all parameter have been set.


3. Select machine plane.
   Press Z = ENT in turn to select the ZX plane.

### 4.4 SLOPE PROCESSING Cont.


Press (X) indicates XY plane.
Press (Y) indicates YZ plane.
Press (Z) indicates ZX plane.

4. Enter INCL.ANG.
   Message window displays “INCL ANG”. Y window displays the former INCL.ANG.

   Press (4) (5) (=ENT) in turn.

5. Enter MAX.CUT.
   Message window displays “MAX CUT”. Y window displays the former MAX.CUT.

   Press (1) (.) (2) (=ENT) in turn.

**Note:** If “0” is entered as MAX CUT, the DRO will not accept it and will wait for another data entry.

6. Processing.
   Message window displays “POIN 1”, Processes the slop when the “0.000” appears, then press (▼) to proceed to the next point.

7. Press (▲) or (▼) to advance or return to the another point.

8. Press (BEV) to return normal display state after processing is over.

**Note:** For XH600-2, the Z-axis is not installed, please press (▲) or (▼) to simulate position of the Z-axis, When (▲) is pressed, this simulates moving to the former process point, and when (▼) is pressed this simulates moving to the next process point.

**Steps.**

1. Set Z axis dial in the internal system setup;
2. Before machining, align the start point Z point with cutting tool, then set Z axis as “0.000”;
3. While machining XZ plane, X window displays position of the X axis. X axis is finished when “0.000” appears in the X window, In the Y window, the former 2 number indicates number of the dial, and the following 5 numbers indicate scale numbers of the dial, which means that machining to this scale for current point.
   While machining YZ plane, Y window display position of Y axis, and when this window dis plays “0.000”, which indicates the machining is finished in Y direction; In X window, the former 2 number indicates number of dial, and the following 5 number indicates scale number of dial, which means that machining to this scale for current point.

# Chapter 5. CALCULATOR FUNCTION

The XH600 provides an internal calculator for operations such as plus, minus, multiply and divide, which is convenient for the operator when processing work piece according to the drawing.

## 5.1 ENTER AND EXIT CALCULATOR FUNCTION

In normal display state: press  to enter calculator function
In calculator state: press  to exit calculator function.

## 5.2 CALCULATING EXAMPLE

Example 1: 123 + 76 × 58 - 892 / 63


Example 2: 358 + 456 × sin -1(-0.5)


**Note:**

1. If the incorrect data is entered, press AC to cancel and enter again.

2 An error may occur when calculating incorrectly, such as “0” being used as a divisor or proceeding an arcsine when absolute value is more than 1. In this case, the message window will display “ERR…” You can cancel this error message by pressing AC and entering the data again.

3. The absolute value of entered data and calculated result should be in the range of 0.000001 to 9999999, otherwise it cannot be displayed.

## 5.3 TRANSFERRING THE CALCULATED RESULTS TO SELECTED AXIS

After calculating is finished, user can:

Press $X_0$ to transfer the calculated result to the X axis. The X window will now display this value,

Press $Y_0$ to transfer the calculated result to the Y axis. The Y window will now display this value,

Press $Z_0$ to transfer the calculated result to the Z axis. The Z window will now display this value.

**Note:** The calculated data can not be transfered if it is out of the displays range.

## 5.4 TRANSFERRING WINDOW DISPLAY VALUE TO CALCULATOR

While still in calculator mode:

Press X to transfer the display value in X window to calculator.
Press Y to transfer the display value in Y window to calculator.
Press Z to transfer the display value in Z window to calculator.

# Chapter 6. INITIAL SYSTEM SETTINGS

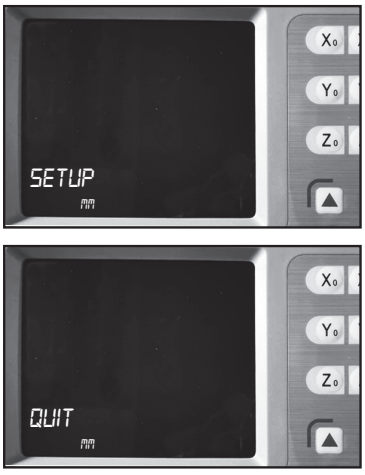
Function:
Set various parameters according to actual operation.

| | |
|---|---|
| SEL TYPE | Setting the number of linear scale |
| DIRECT | Setting positive direction for the counter |
| COM TYPE | Set the error correction type |
| R-D MODE | Radius/Diameter Mode |
| Z DIAL | Setting Z axis Dial |
| RESOLUTE | Set the grating ruler' s resolution |
| SDM DIR | Setting the input mode of SDM |
| SLOP.MODE | Setting the slope machining mode |
| AXIS.TYPE | Setting the type of axis |
| STEP.MODE | Select the step mode in ARC processing |
| ANGE.MODE | Select the angle display mode |
| ANGE.TYPE | Select the angle display type |
| ERROR | Enable / Disable error message display |
| LATH.MODE | Setting the lathe mode |
| DIS LEVE | Set the brightness display degree |
| DISP BIT | Set decimal point number |
| CLR ALL | Clearing all customer setting and return default setting. |
| QUIT | Exit internal system setting. |

**Note:** Any entry that has been changed (except "CLR ALL") will not been saved if you quit "SETUP" (initial system settings) without selecting "QUIT" first before exiting.

## 6.1 ENTER/EXIT SYSTEM SETUP SETTINGS

After the DRO powers up, press ENT and hold for approximately 1 second to enter the initial system setting. "SETUP" will then be displayed in the message window.
Press ▲ or ▼ to select the item you want to change.
When you want to quit initial settings.
Press ▲ or ▼ until "QUIT" appears in the message window and then press ENT



## 6.2 SETTING THE TYPE OF DRO

Because XH600 series DROs (two axes or three axes DRO) share the same software and their functions have some differences, the DRO type must be set before use. CLR ALL has no effect on type of DRO.

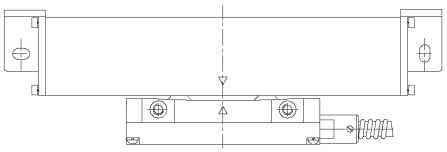

1. Enter “SETUP” and press ▲ or ▼ until “SEL TYPE” appears in the message window.

2. Press (=ENT) then Y window displays “2” or “3”.
   “2” means the DRO type is XH-600-2 two axis
   “3” means the DRO type is XH-600-3 three axis.

3. If you press (2) the “Y” window displays “2”
   If you press (3) the “Y” window displays “3”

4. Press (=ENT) to save the selection and exit this item.
   Press (AC) to cancel your operation and exit this item.

## 6.3 SETTING POSITIVE DIRECTION FOR COUNTER



If the linear scale is installed as the figure (facing operators):
Direction “0” means the display value will increase when scale moves from right to left and decrease when scale moves from left to right.
Direction “1” means the display value will increase when scale moves from left to right and decrease when scale moves from right to left.
The counting direction of the scale is set by the DRO and should not be changed. Default: 0


**Steps:**

1. Enter “SETUP” and then press ▲ or ▼ until DIRECT” appears in message window.


2. Press (=ENT) to enter direction setup.
   X window, Y window and Z window display “0” or “1” separately. “0” means the opposite counter direction for “1” , in other words, “0” means A signal exceed B signal and the counts increase during counting. Vice versa.
   Message window displays “SEL AXIS”, which means the next step is to select axis.

## 6.3 SETTING POSITIVE DIRECTION FOR COUNTER Cont.

3. Select axis
   Press [X] to change X axis counting direction.
   Press [Y] to change Y axis counting direction.
   Press [Z] to change Z axis counting direction.


4. Press [= ENT] to confirm your selection and exit.
   Press [AC] to cancel your change and exit.

## 6.4 SETTING THE ERROR CORRECTION TYPE

**Definition:**
Linear error: There is always an error between actual measure value and standard value. If it is distributed around the scale travel linearly, the error is defined as linear error. For example the scale valid length is 400mm. If the measure value is 400mm and the standard value is 400.040mm: There is a discrepancy of 0.040mm. If this is distributed around the scale linearly, there is a discrepancy of 0.10mm when the scale travels 100mm; a 0.020mm when the scale travels 200mm, and 0.03mm when the scale travels 300mm.

**Note:** The correction value on linearity is only set by the manufacturer, and the user should not modify randomly, as the measurement precision may be influenced.
There are two kinds of setting types for error correction;

1. Linearity error correction.
2. Non-linearity error correction.

Default 0

Steps:

1. Enter “SETUP” and then press [▲] or [▼] until “COMP.TYPE” appears in message window.


2. Press [= ENT] to enter error correction type setup.
   X window, Y window, and Z window displays the former linear error compensation coefficient separately.
   Message window displays “SEL AXIS” which indicates that the next step is to select axis.

## 6.4 SETTING THE ERROR CORRECTION TYPE Cont.

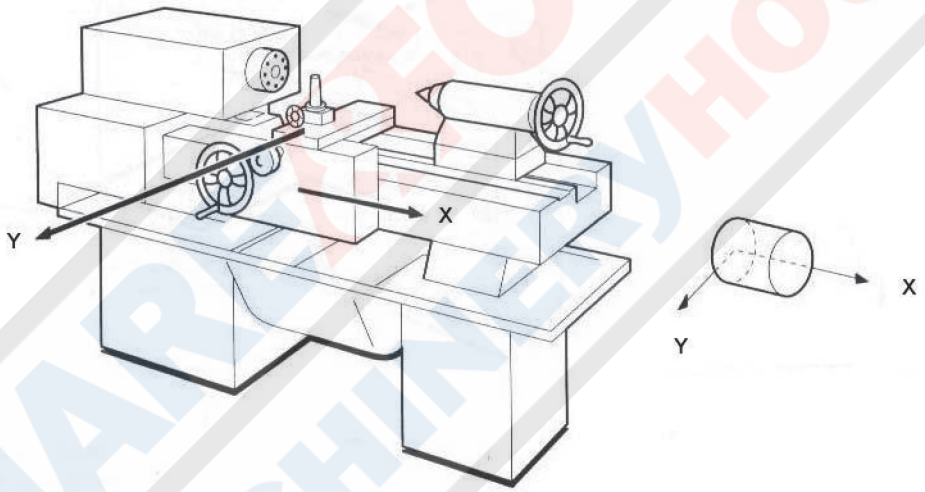
3. Select axis
   Press [X] to change X axis error correction type.
   Press [Y] to change Y axis error correction type.
   Press [Z] to change Z axis error correction type.



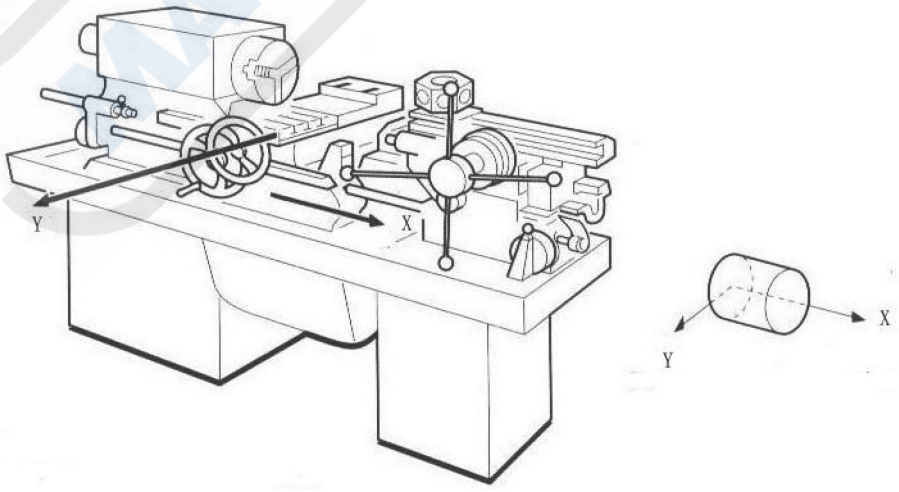
4. Press [= ENT] to confirm your selection and exit.
   Press [AC] to cancel your change and exit.

## 6.5 TOGGLE BETWEEN R/D DISPLAY MODE

### Centre Lathe

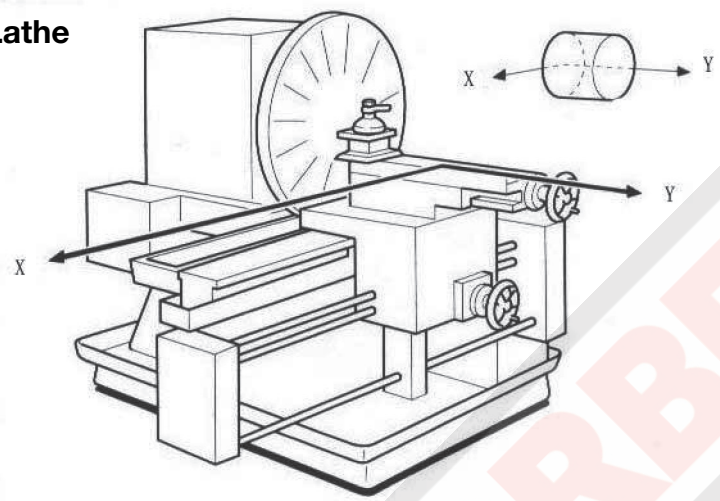



### Turret Lathe



## 6.5 TOGGLE BETWEEN R/D DISPLAY MODE Cont.

**Face Plate Lathe**




The machining process of a lathe is very different from the common vertical or horizontal machines like milling, boring or drilling machines.
The display value is the distance between lathe tool and the workpiece origin. This display mode is called “MODE R”. When turning a cylinder the given diameter measurement, is double the distance between the lathe tool and the workpiece datum. To use the DRO with the display showing the diameter, the DRO needs to be in “MODE D”.
The default mode of the DRO is “MODE R”.

**Steps.**

1. Enter “SETUP” and press ▲ or ▼ until the message window displays “R-D MODE”.


2. Press (=ENT)
   X window, Y window and Z window displays “0” or 1” separately. “0” is mode R, which means the display value equals the actual measurement. “1” is mode D where the display value equals double the actual measurement.
   Message window displays “SEL AXIS”, which indicates the next step is to select the axis.


3. Select axis
   In most cases the “Y” axis will be the axis that changes
   Press [X] to change the R/D mode of X axis.
   Press [Y] to change the R/D mode of Y axis.
   Press [Z] to change the R/D mode of Z axis.


4. Press (=ENT) to save the change and exit.
   Press (AC) to cancel the change and exit.

## 6.6 SETTING Z AXIS DIAL

The Z axis Dial should be set if the Z axis is emulated for XH600-2 and only X and the Y linear scales have been install. Z axis Dial means the distance the Z axis travels when the screw is rotated one revolution.
Default value: 2.5mm

How to set Z axis Dial to 2.4 mm.


1. Enter “SETUP”, then press ▲ or ▼ until the message window displays “Z DIAL”.


2. Press ENT
   Y window displays the former Z axis Dial.
   Message window displays “Z DIAL”.


3. Input the Z axis Dial.
   Press 2 ▪ 4 in turn to input Z axis Dial.
   If an incorrect data has been entered, press AC to cancel the entry and input again.
   If a minus number has been entered, the DRO will accept its absolute value instead.

4. Press ENT to confirm the setting and exit Z DIAL setup

## 6.7 SET THE SCALES RESOLUTION (RESOLUTION)

Different scales have different resolution. The XH600 DRO can connect with 10 kinds of scales, and these resolutions are 0.1μm, 0.25μm, 0.5μm, 1μm, 2μm, 5μm, 10μm, 20μm, 50μm, 100μm. The resolution must be set to match the linear scale. This parameter is set by the manufacturer and only should be changed if abosutly necessary.

Default resolution: 5μm
How to set the resolution of X axis, Y axis, Z axis to 1um.


**Steps:**

1. Enter “SETUP” and press ▲ or ▼ until “RESOLUTE” appears in the message window.


2. Press ENT
   The X window, Y window and Z window will display the former resolution of each axis separately. The message window displays “SEL AXIS”, which indicates the next step is to select the axis.

## 6.7 SET THE SCALES RESOLUTION(RESOLUTION) Cont.

3. Select Axis
   Press [X] to change the resolution of the X axis, then the data in the X window will flash.
   Press [Y] to change the resolution of the Y axis, then the data in the Y window will flash.
   Press [Z] to change the resolution of the Z axis, then the data in the Z window will flash.


4. Press [▲] or [▼] to scroll through 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 5 0.00, or 100.00.
   Press [ENT] to select “1.00” when it appears and return to “SEL.RXIS” state.
   Press [AC] to cancel your selection.


5. Set the resolution of Y axis: Z axis by repeating step 3-4.


6. Press to exit the “RESOLUTE” setup.

## 6.8 SETTING THE INPUT MODE IN SDM COORDINATE

The XH600 series DRO provides two data entry modes in trhe SDM coordinate:
MODE 0 (Normal entry mode): the data the DRO accepts equals the inputted data;
MODE 1 (Special entry mode): the data the DRO accepts equals the negative of the entered number

Example: Set SDM mode 1.

1. Enter “SETUP”, then press [▲] or [▼] until the message window displays “SDM DIR”.


2. Press [ENT]
   Y window displays the former SDM direction.


3. Press [1] to set the SDM direction 1.
   **Note:** Press [0] to set the SDM direction 0.

## 6.8 SETTING THE INPUT MODE IN SDM COORDINATE Cont.

4. Press (ENT) to confirm the setting and exit “SDM DIR”
   Press (AC) to cancel the change and exit “SDM DIR”.


## 6.9 SETTING THE SLOPE MACHINING PARAMETER

Parameters can be set in two ways for slope machining.

A. Set the steps of the second axis (Z STEP) in one plane, for XY plane.
   set the steps of the Y axis, for YZ plane and set the steps of Z axis XZ plane set.
B. Set MAX CUT


Default setting: the step of the second axis (Z STEP).

Set the slope machining parameter MAX CUT. STEPS:

1. Enter “SETUP” and press (▲) or (▼) window displays “SLOP.MODE”.


2. Press (ENT)
   The Y window displays the former parameter mode.
   Press (1) to select MAX CUT parameter mode.
   Note. Press (0) to select Z STEP parameter mode.


4. Press (ENT) to save the change and exit this item.
   Press (AC) to cancel your change and exit this item.


## 6.10 TOGGLE BETWEEN LINEAR SCALE AND ROTARY ENCODER

Both linear scales or a rotary encoder can be installed in any axis. The linear scale is used to measure distance; the rotary encoder is used to measure angles.
Default: linear scale.
Set rotary encoder in Z axis.

**Steps:**

1. Enter “SETUP” and press (▲) or (▼) until the message window displays “AXIS.TYPE”;

## 6.10 TOGGLE BETWEEN LINEAR SCALE AND ROTARY ENCODER Cont.

2. Press (ENT)
   X, Y, Z windows will display the former type.
   "LINEAR" means linear scale.
   "ENCODE" means rotary encoder.
   Message window displays "SEL AXIS", which means the next step is to select axis.


3. In this example the Z axis has been installed with a rotary encoder.
   Press [Z] until "ENCODE" is displayed in the Z window.


**Note:** Press [X] to change the X axis.
Press [Y] to change the Y axis.
Press [Z] to change the Z axis.

4. Press (ENT) to save the change and exit this item.
   Press (AC) to cancel your change and exit this item.

## 6.11 STEP MODE FOR ARC PROCESSING

In the ARC function, if the axis is not XY, you can setup the step mode. There are two modes. Mode 0 is Z STEP mode and Mode 1 is MAX CUT mode.
Default setting: Z STEP

Example: setting the mode as the STEP mode.
**Steps:**

1. Enter "SETUP" and press [▲] or [▼] until the message window displays "STEP.MODE".


2. Press (ENT)
   The Y window displays the former setting. "0" means Z STEP. "1" means MAX CUT.
   The message window displays "SEL MODE", which means selecting the step mode for ARC next step.

## 6.11 STEP MODE FOR ARC PROCESSING Cont.


3. Setting the mode as STEP mode.
   Press (1) then the Y window displays the changed mode.


4. Press (=ENT) to save the change and exit this item.
   Press (AC) to cancel your change and exit this item.

## 6.12 ANGLE DISPLAY MODE

XH600 provides 3 angle display modes. In Mode 1, the angle is in the range of 0° to 360°.
In mode 2, the angle is in the range of -360°to 360°.
In mode 3, the angle is in the range of -180° to 180°.


Default mode: MODE 1.

Example: Setting the Angle display mode to mode 3.

**Steps:**

1. Enter “SETUP” and press (▲) or (▼) until the message window displays “ANGL.MODE”.


2. Press (=ENT) then the Y window displays the changed mode.
   The message window will display “SEL MODE”, which means the next step is to select the angle display mode.


3. Set the angle display mode as mode 3.
   Press (3) then the X window displays the changed mode.
   The Y window will display the angle mode.


4. Press (=ENT) to save the change and exit “ANGL.MODE” setup.
   Press (AC) to cancel your change and exit “ANGL.MODE” setup

## 6.13 ANGLE DISPLAY TYPE

There are two angle display types for XH-600.
TYPE 0: indicate angle display is DD.
TYPE 1: indicate angle display is DMS.
Default value: TYPE 0°


Setting the angle display type to DMS.
**Steps:**

1. Enter “SETUP” and press ▲ or ▼ until the message window displays “ANGL.TYPE”.


2. Press ENT then the X window displays the former setup.
   The Y window displays the former angle mode is DD°.


3. Set the angle display mode as MODE 1.
   Press 1 then the X window displays the changed mode.
   The Y window will display the current mode as DMS.


4. Press ENT to save the change and exit “ANGL.TYPE” setup.
   Press AC to cancel your change and exit “ANGL.TYPE” setup

## 6.14 ENABLE / DISABLE ERROR SIGNAL

XH-600 serial DRO provides the function of checking whether the counting signal is normal or not. It can display the ERROR information if some error occurs in counting the signal. The user can enable or disable this function.
“0” means no error information will be displayed and the DRO continue to work when there is some error with linear scale or encoder:
“1” means error information will be displayed when error occurs.
Default setting: 0 (disable display error message).


Example: Enable display ERROR message.
**Steps:**

1. Enter “SETUP” and press ▲ or ▼ until the message window displays “ERROR”.


2. Press ENT the Y window displays the former “0” setup.

## 6.14 ENABLE / DISABLE ERROR SIGNAL Cont.

3. Press (1) to change it to enable error message.
   Press (0) to change to disable error message.


4. Press (ENT) to save the change and exit “ERROR” setup.
   Press (AC) to cancel your change and exit “ERROR” setup.


## 6.15 SETTING LATHE MODE

Lathe mode 0: Disable lathe function;
Lathe mode 1: X window display value = the position of X axis + the position of Y axis;
Lathe mode 2: X window display value = the position of X axis + the position of Z axis;
Lathe mode 3: Y window display value = the position of Y axis + the position of Z axis;
Default mode: disable lathe mode.

Setting the lathe to mode 3.

**Steps:**

1. Enter “SETUP” and press (▲) or (▼) until the message window displays “LATH.MODE”.


2. Press (ENT) then the Y window displays the former setup.


3. Set the new lathe mode.
   Press (3)

**Note:** Press (3) or (2) or (1) or (0) to change the lathe mode.


4. Press (ENT) to save the change and exit “LATH.MODE” setup.
   Press (AC) to cancel your change and exit “LATH.MODE” setup.

## 6.16 SET THE DISPLAY BRIGHTNESS GRADE

Function: The brightness displayed by the digital tube may be regulated based on the environment on user's site environment, Grade 0~7 is divided totally.


Default grade: 5

Setting the display brightness grade 3.

**Steps:**

1. Enter "SETUP" and press ▲ or ▼ until the message window displays "DSP.LEVE".


2. Press ENT then the Y window displays the former setup.


3. Press 3

**Note:** Press 7 to 1 to change the brightness grade.

4. Press ENT to save the change and exit "DSP.LEVE" setup.
   Press AC to cancel your change and exit "DSP.LEVE" setup.


## 6.17 SETTING THE NUMBER OF DISPLAY AXES

Function: The display is capable of setting the number of display axes on the coordinate interface based on the users needs, from 1 to 6.

Default number of display axes: 3.

Setting the number of X display axis to 4.


**Steps:**

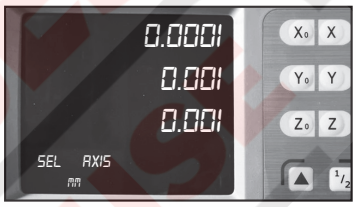
1. Enter "SETUP" and press ▲ or ▼ until the message window displays "DSP.BITS".


2. Press ENT number of X display axis to 4, then the Y window displays the former setup.

## 6.17 SETTING THE NUMBER OF DISPLAY AXES

3. Select axis
   Press [X] to change the number of display X axis, then data in X window flashes.
   Press [Y] to change the number of display Y axis, then data in Y window flashes.
   Press [Z] to change the number of display Z axis, then data in Z window flashes.


4. Press [▲] or [▼] to scroll through 0.1, 0.01, 0.001, 0.0001, 0.00001, 0.000001.
   Press [ENT] to select "0.0001" when it appears and return to "SEL.AXIS" state. Press [AC] to cancel your selection.




5. Set the number of display Y axis: Z axis by repeating step 3-4.


6. Press [ENT] to confirm the new set and exit.
   Press [AC] to cancel the new set and exit.

## 6.18 LOAD DEFAULT SETUP

Function: Clear all data except the linear compensation and DRO type. DRO will load default setup for all parameters. After loading default setup, user must search RI once to enable resuming ABS datum function; otherwise to resume the datum by RI is unable.

**Steps:**

1. Enter "SETUP" and press [▲] or [▼] until the message window displays "CLR.ALL".


2. Press [ENT] and message windows display "PASSWORD" indicating the operator to input password. At this moment, there are two selections:


   A. Press [AC] to quit "CLR ALL".
   B. Enter the correct password to clear all parameters and load default setup.

## 6.18 LOAD DEFAULT SETUP Cont.

3. Input the password.
   Press (4) (3) (2) (1) (ENT) in turn to load default value.
   The message window displays “CLEARING”, which means the data is clearing.


4. Return to the normal display state after loading default setup is finished.


The default setup for all parameters is as follows.

- Counting direction is mode 0;
- The R/D is mode R ;
- Z DIAL = 2.5mm;
- Resolution = 5μm;
- Input mode in SDM as 0, display value = input value;
- Lathe function is disabled;
- Slope machining parameter is Z step;
- Linear scale is installed for any axis;
- Angle display mode is mode 1: 0~360;
- Angle display type is 0: DD;
- ARC machining parameter is Z step.

## Chapter 7 LINEARITY ERROR CORRECTION

Function:
There is a error between the grating ruler's measuring value and standard value, if it is assumed that the shape of two measuring curves within grating ruler's travel range is consistent completely but isn't coincide, which is called as linearity error.
Linearity correction: compensate the linearity error so as to enable that the display value is equal to standard value.
NOTES: The linear compensation is set by the manufacturer. Changes should only be made after careful consideration as it could make the accuracy of linear scale worse.

Default coefficient: 0

Step 1: Enter into the parameters inside digital display meter and set the error correction type of corresponding axle is 0 (linearity compensation mode). (Specific setting methods refer to Chapter 6.4)
Step 2: Input the linearity error compensation system, Based on standard and digital display value, calculate the correct coefficients according to the formula.
The calculation of compensation coefficient.
Correction coefficient: S =(L-L')/(L/1000) mm/m.
L---actually-measured length, unit, mm.
L'---display value on the digital display meter, unit: mm.
S--- correction coefficient: mm/m, when it is "+", represent the growth; when it is "-", represent the shortening.
Compensation scope: -1.500 mm/m~+1.500 mm/m.
Example:
L' = 400.040mm
L = 400.000mm
Compensation coefficient S= (400.00 - 400.040) * 1000 / 400 = 0.1 Unit: mm/m.
Set linear error compensation: X axis is 0.1.

**Steps:**

1. Return to normal display status, Press [X] to preset display value of X axis, then data in X window flashes.


2. Press [INCH/MM] to set linear error compensation.


3. Press (0) (.) (1) (=ENT) in turn.
If incorrect number is entered, press (AC) to cancel and enter again.

4. Press (=ENT) to confirm your setting and exit the linear error compensation setup.

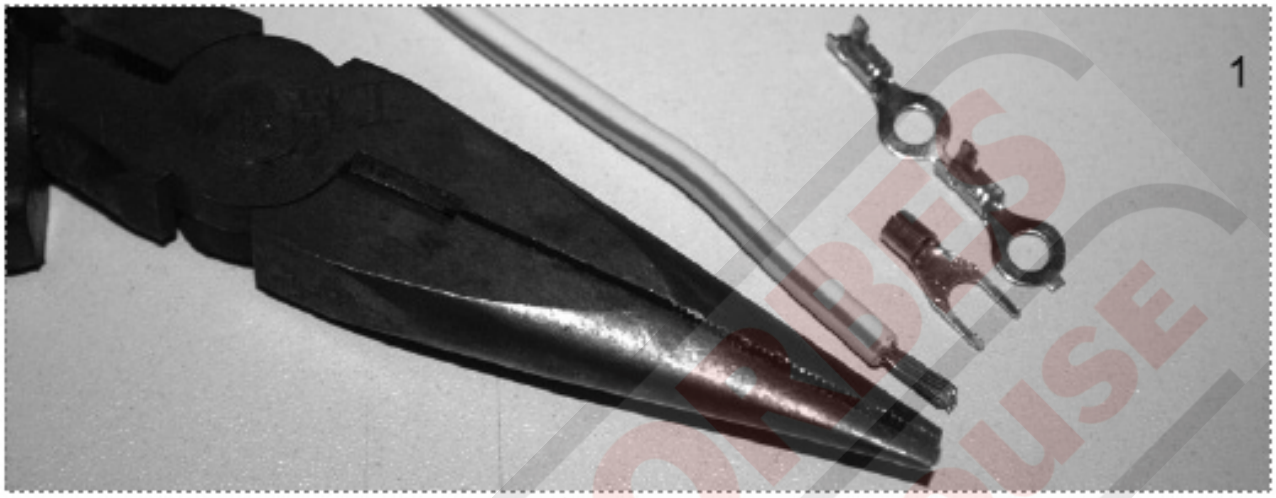
## Chapter 8 TROUBLE SHOOTING

Review the troubleshooting and procedures in this section if a problem develops with your equipment. If additional help with a procedure is required, then contact you distributor.
***Note: Make sure you have the model number, before calling.***

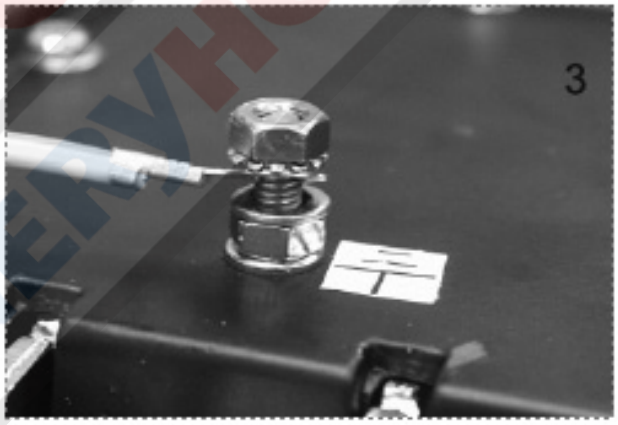
| Symptoms | Possible Cause | Possible Solution |
|---|---|---|
| No display | 1. Power source failure<br>2. Damage of fuse<br>3. Poor 220V power source wiring<br>4. Inappropriate power voltage. | 1. Power source access<br>2. Replace the fuse with identical specification<br>3. The power socket should be good.<br>4. Check the input voltage is within 100~240 volts |
| DRO Cover is charged | 1. Improper grounding between lathe and digital display.<br>2. Leakage of Electricity | 1. The lathe shell and digital display shell should ground properly.<br>2. Inspect the 240Vpower source |
| Display value is double | 1. Improper setting of the scales resolution<br>2. Some axle is set as diameter display mode | 1. Set the correct resolution rate<br>2. Set the radius mode display |
| No counting | 1. Improper contact between the scale and the reader head.<br>2. No signal output from a scale.<br>3. Failed counting function | Exchange with another axle and observe whether the counting is normal; if normal, then the scale has failed. If there is still no counting then the DRO has failed. Have the DRO meter repaired. |
| Display value is in disorder | 1: Disorderly system memory<br>2. Failure of the scale (grating ruler,) | 1. Implement the system's all clear.<br>2. Repair or replace the scale (grating ruler) |
| Incorrect counting | 1. Poor precision of the lathe<br>2. Too fast run speed of the lathe<br>3. Improper scale mounting<br>4. Improper resolution is set<br>5. Improper linear error compensation<br>6. Faulty scale | 1. Repair the lathe.<br>2. Reduce the movement speed of the scale.<br>3. Reinstall scale.<br>4. Set proper resolution.<br>5. Set proper linear error compensation.<br>6. Repair or exchange linear scale. |

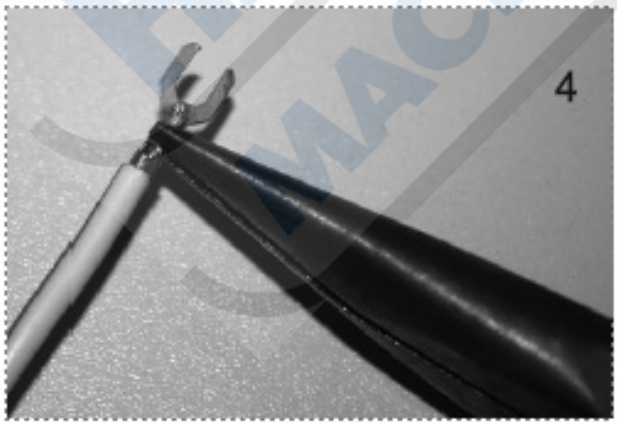
## GROUNDING DIAGRAM

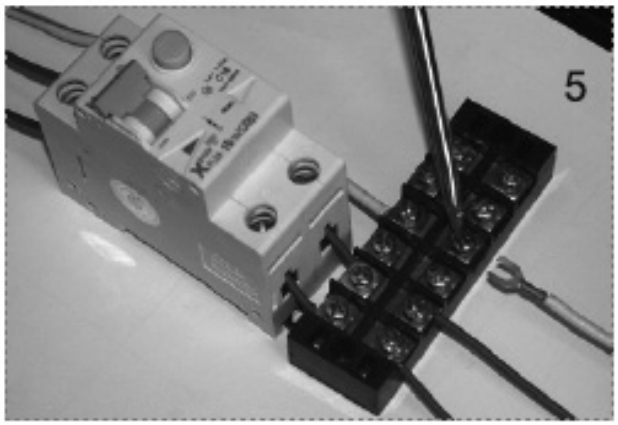
**ATTENTION:** To avoid possible Electrical Shock !! Please install the DRO's grounding to the earth terminal of a power socket which is protected by an Earth Leakage Circuit Breaker.








***WARNING!***

***Electricity is dangerous and could cause death***

***All electrical work must be carried out by a qualified electrician.***