DRO PROS 2L

OPERATORS MANUAL

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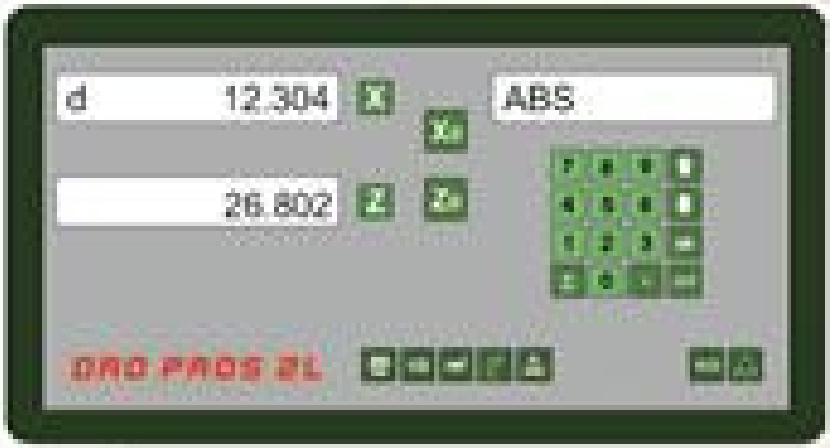


DRO PROS 2L CHEAT SHEET

Set current position to zero Z

Switch display between inches and metric

Switch between between Radius and Diameter mode: R/D

Set Current Position to a set value Z 7 2 . 4 Enter

Setting up the Cross Feed X 4 5 . 8 Enter

Finding the centerpoint of a workpiece

Position your tool against an edge Z Reposition against opposite edge 1/2 Z Move lathe to 0.0000

Switch between ABS and INC mode:

Find REF

ref Arrow until - "FIND REF" Enter Push Axis to find Z Move table until digits count

Recall 0

ref Arrow until - "RECALL 0" Enter Push Axis to find Z Move table until digits count

Tool Offset 1 ent

Cone Function ent

Parameters Setup

QUIT → AXIS NO. → DIRECTN → RESOLU → RAD/DIA → LIN COMP →

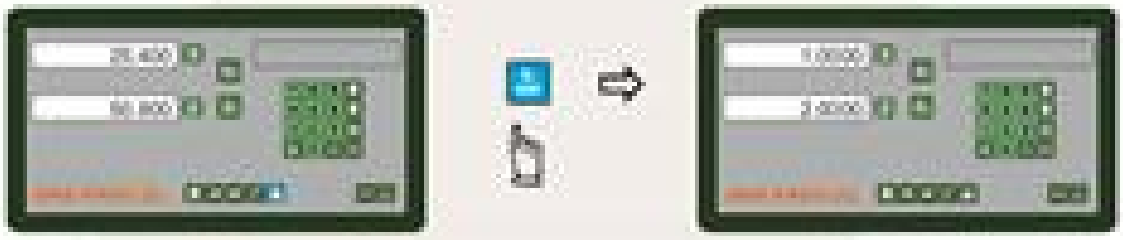
NL ERROR → Z DIAL → DIAL INC → R MODE → FLTR. PR → QUIT →

BASIC FUNCTIONS

Set current position to zero

Switch display from inches to metric

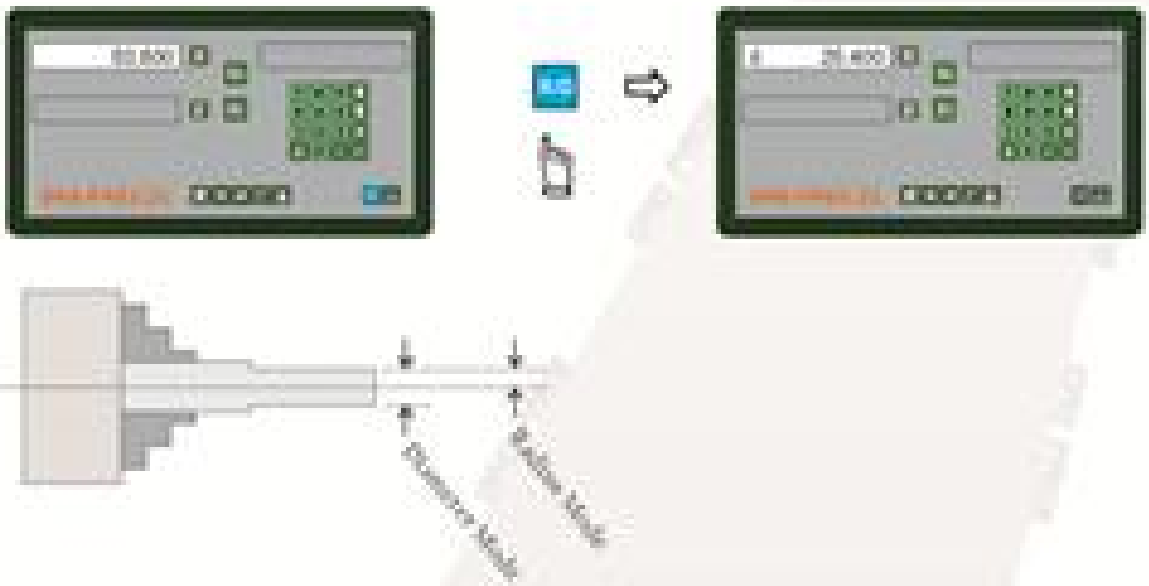
Switch display from metric to inches



Radius / Diameter Mode

Because machining on a lathe removes twice the depth of material as the actual cross feed movement, the lathe display offers radius / diameter mode. In the default "Radius" mode the display shows actual cross feed movement. However, when placed in "Diameter" mode (recommended for all lathe work) the display reads actual part diameter, even if subsequent cuts are made via the cross feed.

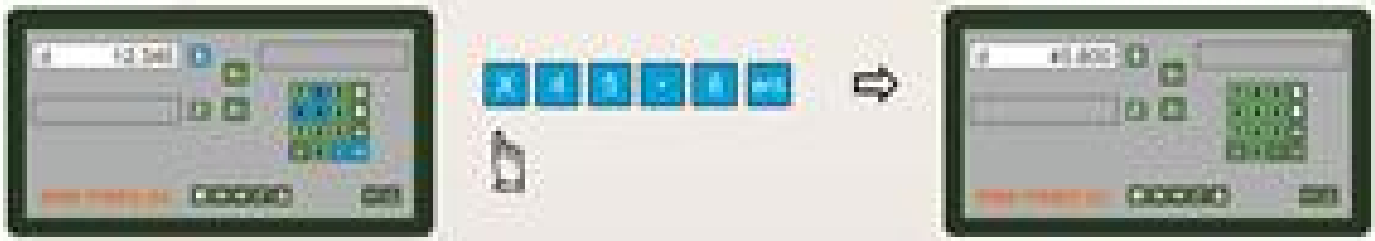
Currently in Radius mode, switching to Diameter mode:



Setting up the Cross Feed

Setting the cross feed to read actual part diameter is quick and easy. First, set your X axis to diameter mode as in the previous example. Second, make a slight cut across the surface of your part, then move the cutter well away from the workpiece. After the cut, make sure to only move the Z or carriage axis, not the X axis.

Now measure the diameter of your workpiece with a caliper. Next, entered the measured diameter into the readout by using the direct entry method.

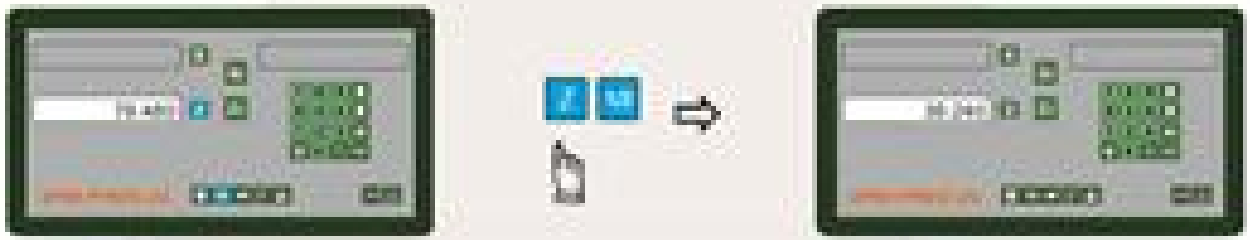


Finding the centerpoint of a workpiece

Step 1: Position your cutter against one edge of the workpiece, then zero the display.

Step 2: Reposition your tool against the opposite edge of the workpiece.

Step 3: Use the centerfind button to halve the display.



Step 4: Move the carriage until '0.000' is displayed, indicating the centerpoint of the workpiece.

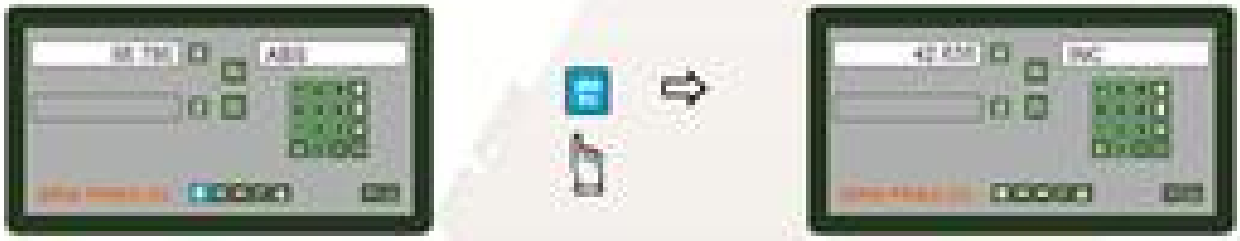
Absolute (ABS) versus Incremental (INC) coordinate systems

Two reference systems operate concurrently and independently of one another, the ABS (Absolute) reference system and the INC (Incremental) reference system. Zeroing either reference system does not zero out or alter the other systems zero reference. Both systems operate at all times, it matters not which coordinate system is selected or displayed. As the lathe is moved, both are continuously updated.

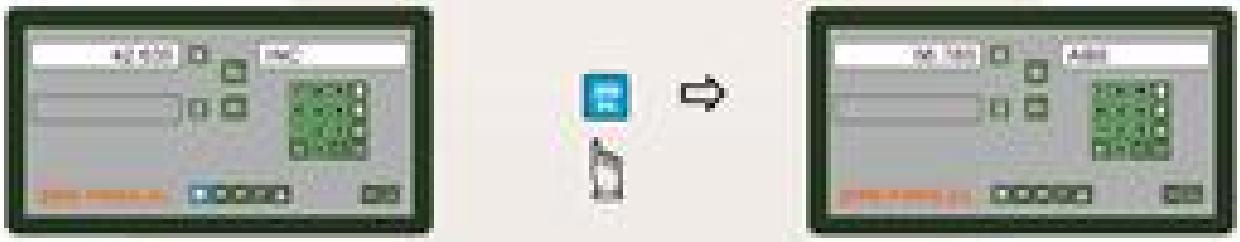
Typically Operators use the ABS coordinate system as the main reference system for their workpiece. Absolute zero (0.,0) is typically set to a workpiece corner. Most all subsequent points and measurements are defined from this absolute reference point.

The Incremental or INC grid is most useful for determining incremental distances. Just like the ABS system, it can be referenced or zeroed at any time without affecting the other coordinate system. Typically this system is reserved for determining incremental distances from ABS points or coordinates.

EXAMPLE 1: Currently in ABS Mode, to switch to INC mode:



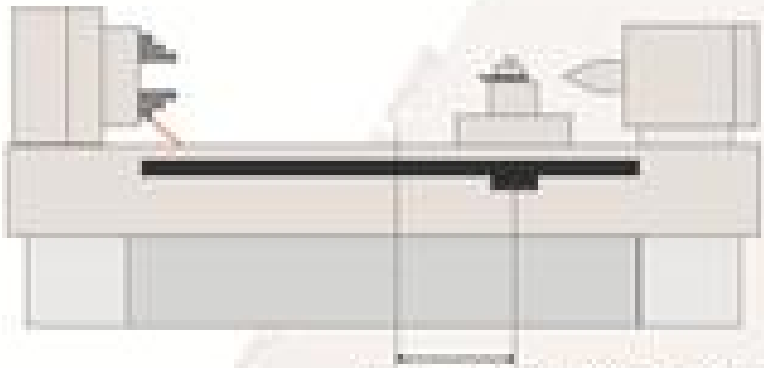
EXAMPLE 2: Currently in INC Mode, to switch to ABS mode:



Reference Datum Memory

Reference Datum Memory is a function that helps restore the workpiece zero point. Losing the reference zero point can happen if the machine is moved with the DRO unit powered off. Fortunately, the reference datum memory function allows the exact workpiece zero point to be "recaptured" very easily.

Every glass grating scale has a mid or reference point. When the Operator establishes a new Absolute or Incremental zero point, the DRO establishes a snapshot of the desired zero point versus the scales actual midpoint. While this is transparent to the Operator, the important thing is that this offset is permanently stored in the DRO's memory until a new zero point is set.



Distance between the scale mid or ref point and user selected zero point.

If for some reason the zero point is lost, as in the case when a DRO is moved without power, the exact zero point can still be recovered. All we need to do is simply recover the zero position by recapturing the stored distance from the ref point.

IMPORTANT NOTE: When a new ABS zero point has been established, the reader head must travel across the mid or ref point of the scale. This enables the DRO to "snapshot" the difference between the user selected ABS and the ref point, and enables the ref datum recall function.

The Reference Data Memory feature consists of two components:

Find Ref Function
Recall 0 Function

The **Find Ref Function** manually ensures the ref point or mid point of the scale has been captured. It ensures after resetting a new ABS zero point that the mid point on the scale has indeed been found and the Recall 0 Function will be available if needed.

The **Recall 0 Function** describes the steps necessary to recapture a lost zero point.

In other words, the **Find Ref Function** is accomplished before a power failure as a preventive measure to ensure the user selected zero point can be re-established.

The **Recall 0 Function** serves to re-establish a lost zero point after a power failure or if the mill is accidentally moved without power.

Any time a new zero point is stored, whether by setting a new ABS or INC zero, coordinate preset, or center find function, the DRO will automatically store the relative distance between ABS and the scales ref point. As long as at some point in time the reader head travels across the mid or ref point of the scale, the Reference Datum Memory Function is enabled. Whether the Operator crosses the mid point of the scale accidentally through the course of the work session or purposefully through the use of the 'Find Ref' function matters not, both 'methods' enables the DRO to 'recapture' the difference between the user selected ABS and the ref points, thereby enabling the ref datum memory function.

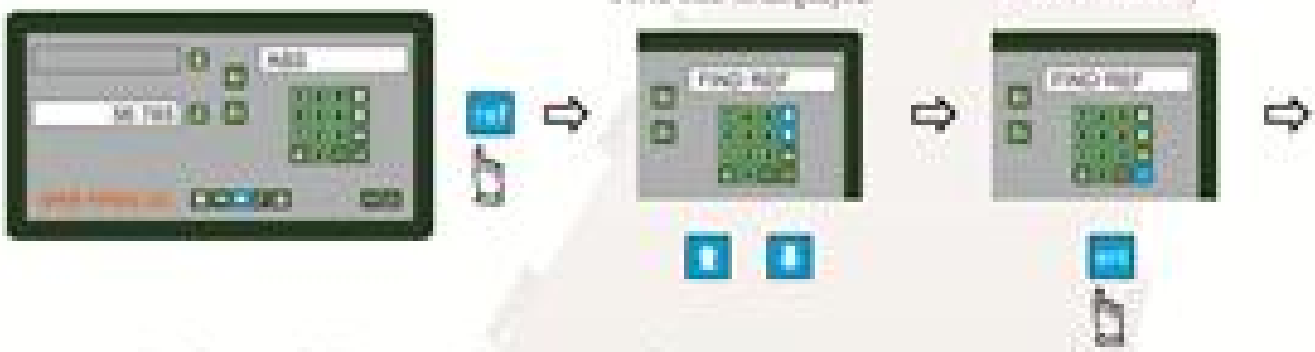
Find Ref Function

TASK: Use FINDREF function to manually capture a scales ref point in case Ref Datum memory is ever needed.

Step 1: Push the 'ref' function key on the front of the display

Arrow up or down until 'FIND REF' is displayed

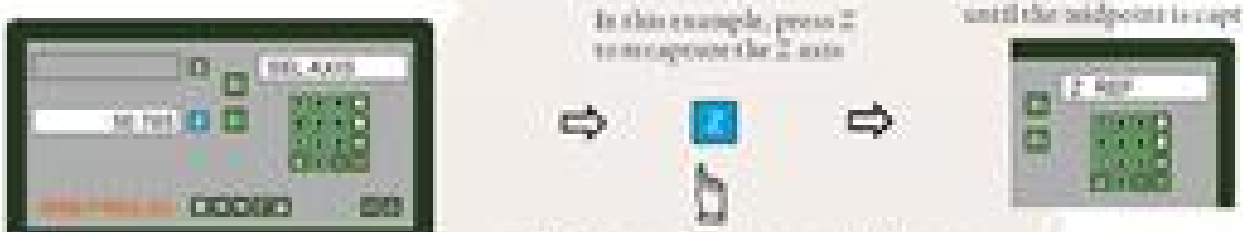
Push the enter key



Step 2: Select the axis which you're trying to recapture the zero point

In this example, press 'Z' to recapture the 'Z' axis

Note: 'Z REF' starts flashing until the midpoint is captured



(NOTE: Selecting 'ent' selects both axis)

Step 3: Move the machine across the center, or mid point of the scale, until the digits start counting again

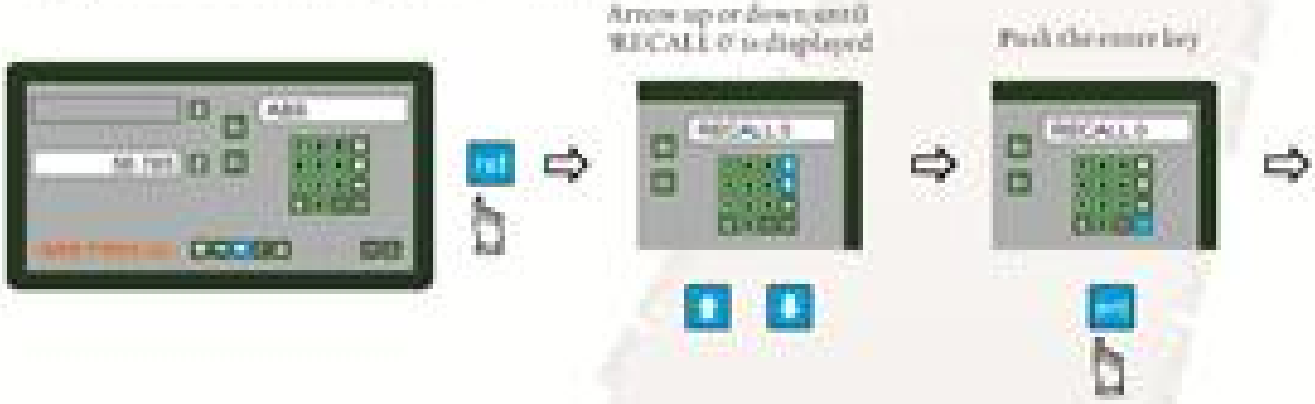
Move the machine such that the reader head crosses the mid point of the scale

As soon as numbers start counting on the display, the mid point has been established

Recall 0 Function

TASK: Use 'Recall 0' function to restore a scales lost zero point in case of power failure or operator error

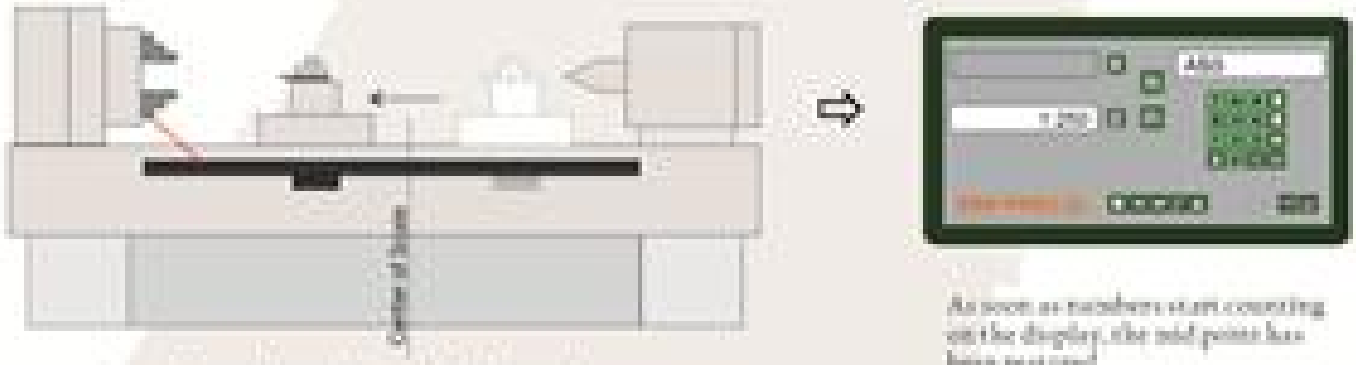
Step 1: Push the 'ref' function key on the front of the display



Step 2: Select the axis which you're trying to restore the zero point

(NOTE: Selecting 'ent' selects both axis)

Step 3: Move the machine across the center, or mid point of the scale, until the digits start counting again



Move the machine such that the reader head crosses the mid point of the scale

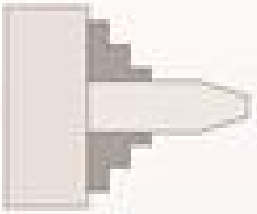
Tool Offset

As a supplement to the ABS and INC coordinate systems, the display offers a tool offset feature. For those lathes equipped with a quick change tool post, up to 199 tools can be programmed into the display. This enables the operator to quickly and precisely change tools as needed, without the need to readjust or compensate for the tool tip offset.

To switch from Tool1 coordinate system to Tool 9 coordinate system:

Cone Function

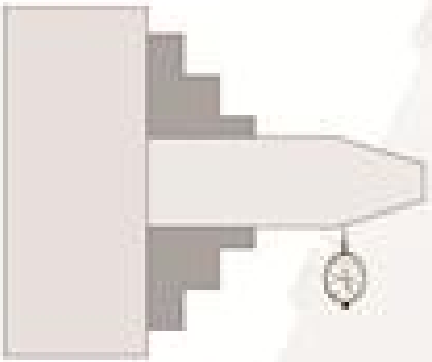
Cutting a tapered workpiece is a normal function performed on a lathe. Fortunately, the readout provides an easy to use method of cone measurement.



Although the top slide on most lathes is equipped with a very basic dial indicator for cutting tapers, it is typically not very accurate. In order to obtain a much higher degree of accuracy, it is recommended to always use the Cone Function of the readout.

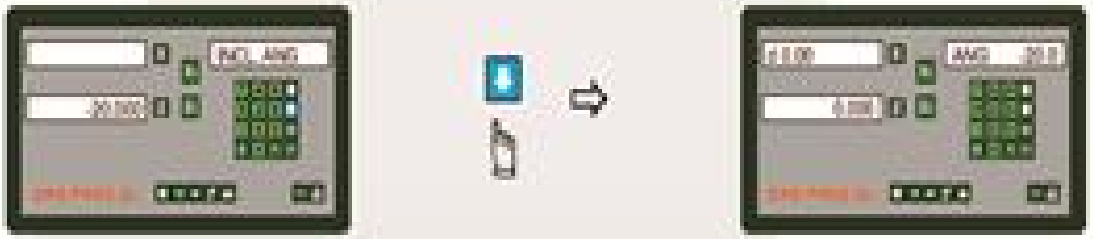
To start a 20 degree taper cut, first adjust the top slide of the lathe as accurately as possible to indicate 20 degrees. Of course, ensure enough material remains for fine-tuning a 20 degree line.

After the first cuts are completed, mount a dial indicator and zero the display per the following diagram.



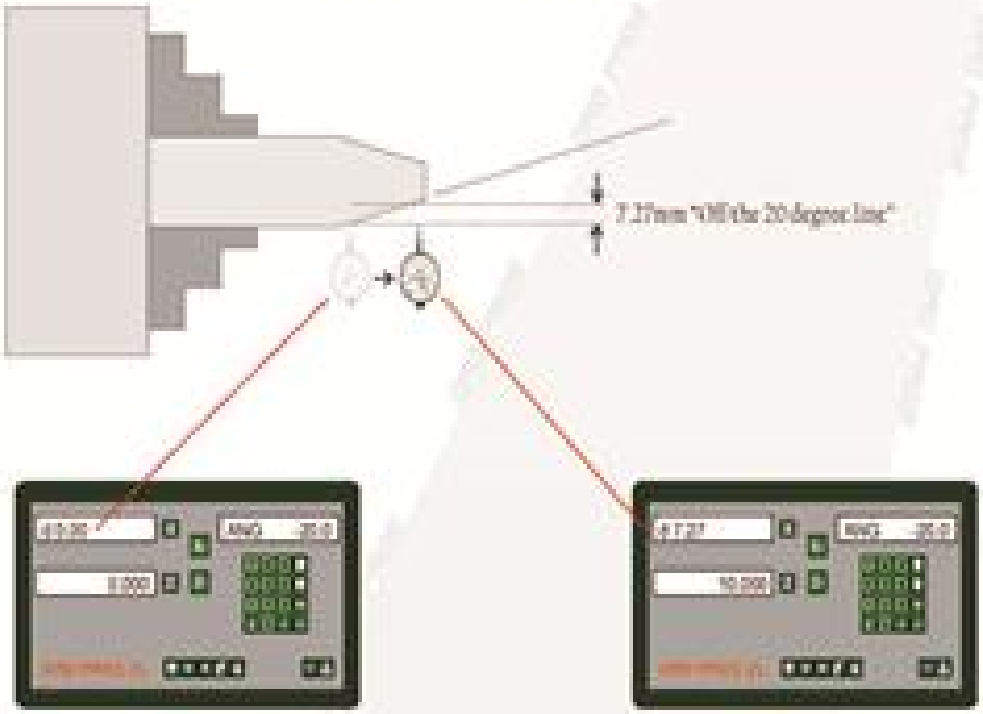
Next, enter the Cone Measurement function and enter -20 degrees as the angle.

Now, enter the Cone Function by pressing the down arrow key.



Cone Function

Now that you've entered the Cone Function, the X axis "zero point" will move along a 20 degree line. For example, after moving the carriage 10mm to the right, the display initially indicates the X axis is "off the line" 7.27mm.



Next, move the X axis so that the X axis display reads 0.000.

Now the dial indicator needle does not read exactly "0". The reading on the dial indicator is the error of the top slide angle. It indicates how far "off" a true 20 degree taper the part actually is. To make this cut a true 20 degree taper, you must readjust the top slide to correct for the conical error, recut the taper and repeat this procedure until the dial indicator reads exactly "0" when the display reads "0.000" also.

Parameters Setup

System Reset

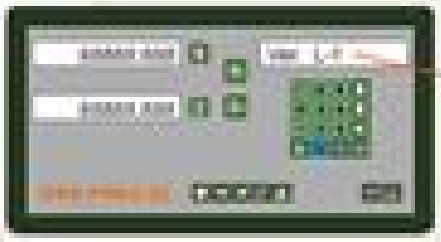
Every display is configured at the factory to run "out of the box". Normally, a total system reset will never be necessary. However, there may be a few instances where a reset of the system logic is desired. For example, if a number of users have set different system parameters and it's unknown what has been changed, or possibly a new user simply wishes to reset all settings back to the factory default. In any case, the method to change the display back to the default settings is as follows:

System Reset Procedure

Switch off the display.

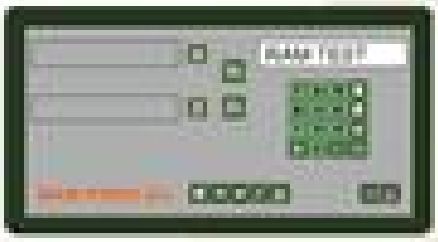
Switch on the display. As it powers up, the upper right message window displays the software version number, typically "VER. 1.1". As this message is displayed, press the number "8" key to reset the display to the factory default settings.

Immediately after power up, the display performs a self test ⇨

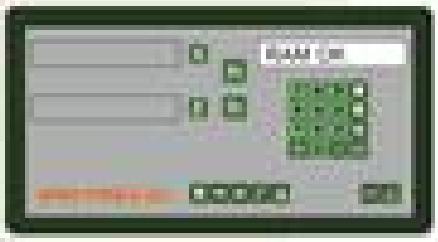


software version

As the software version is displayed, press the 8 key to reset the display to the factory default settings.

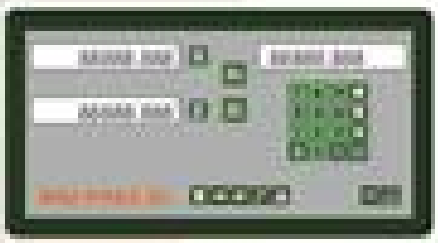


"RAM TEST" indicates memory test in progress



"RAM OK" indicates memory test in progress

"RESET" indicates memory test is complete



After the test is complete, the display proceeds to run an endless LED test to check for any missing LED segments. As soon as it is determined there are no missing segments, go ahead and shut off the display.

Parameters Setup

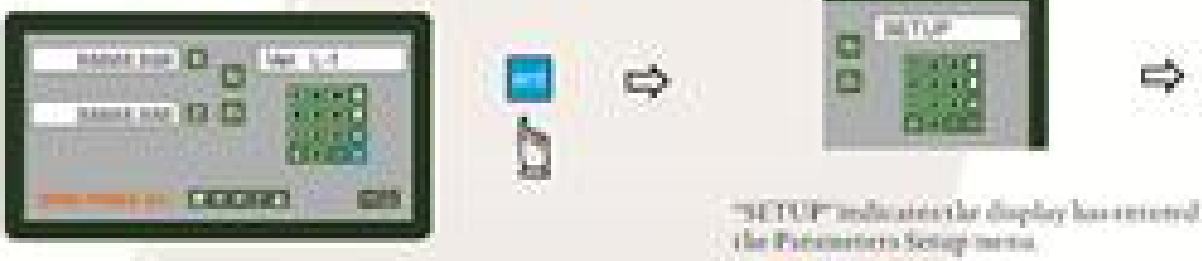
As mentioned before, every display is configured at the factory to run "out of the box". Entering and changing system parameters will not normally need to be accomplished. However, if a need arises, it is fairly simple and need only be accomplished once. For example, a common reason to enter the parameters setup menu would be to change the direction a scale is reading. Once set, the change in scale read direction is retained in permanent memory and need not be entered again, regardless of whether the machine is turned off again or not.

The Parameters Menu contains the following options:

AXIS NO	Enables the user to choose how many scale inputs are active.
DIRECTN	Permits the operator to change which direction the scale reads.
RESOLU	User selectable scale resolution.
RAD / DIA	Enables scales to read in either radius (RAD) or diameter (DIA) mode.
LIN COMP	Allows the operator to change / modify linear error compensation.
NL ERROR	Non- linear error compensation for propriety scale accuracy.
∑DIAL	Used only for machining an arc on a milling machine. Not for lathe use.
DIAL INC	Used only for machining an arc on a milling machine. Not for lathe use.
R MODE	Used only for machining an arc on a milling machine. Not for lathe use.
FLTR. FR	Filter function. Prevents distracting toggling of display, ie especially during grinding.
QUIT	Exits the Parameters Setup menu and saves any changes.

How to Enter Parameters Setup

Switch on the display. As it powers up, the upper right message window displays the version number, typically "VER. 1.1" or similar. As this message is displayed, press the "ent" key.



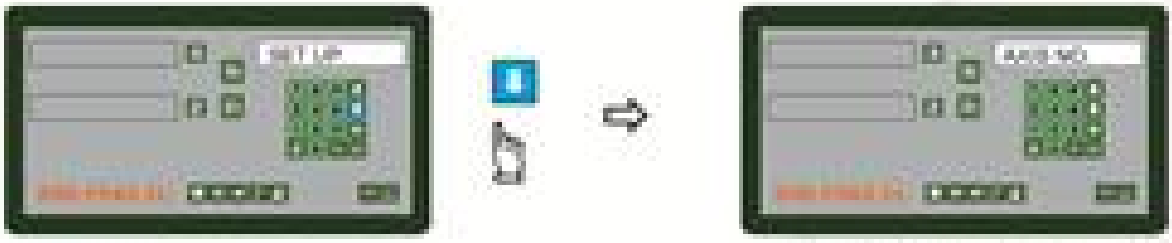
"SETUP" indicates the display has entered the Parameters Setup menu.

To scroll through the Parameters Setup menu, simply push the up or down arrow buttons.

(The Parameters Menu is a continuous, looping menu. Repeatedly pressing either the up or down arrow keys will eventually loop you through all of the available options.)

QUIT ⇔ AXIS NO. ⇔ DIRECTN ⇔ RESOLU ⇔ RAD/DIA ⇔ LIN COMP ⇔

NL ERROR ⇔ ∑DIAL ⇔ DIAL INC ⇔ R MODE ⇔ FLTR.FR ⇔ QUIT ⇔

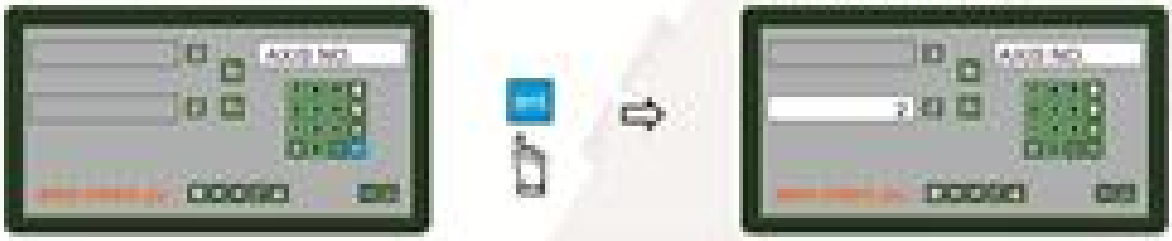


"AXIS NO." allows the operator to choose how many scales will be used.

Selecting Axis Number

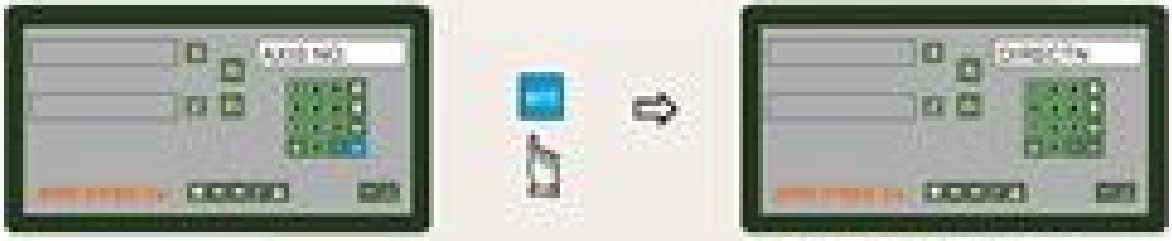
Press [ENT] to enter into the "Axis No." parameter setup

Note the default "2" displayed in the Z axis window



To change how many scales will be utilized, press 1 or 2 followed by the enter button. Note the default "2" displayed in the window will change to a "1" or "2" depending on your selection.

When you're finished selecting how many scales will be used, press the enter [ENT] button to exit from the Display Axis function and return to the main menu.

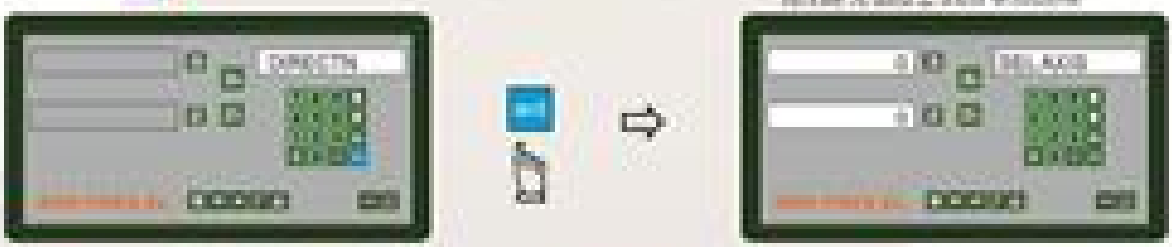


"DIRECTN" indicates the display is temporarily paused at the Direction parameter menu.

Changing Scale Read Direction

Press [ENT] to enter into the "Direction" parameter setup

Note the default "+" displayed in the X and Z axis window



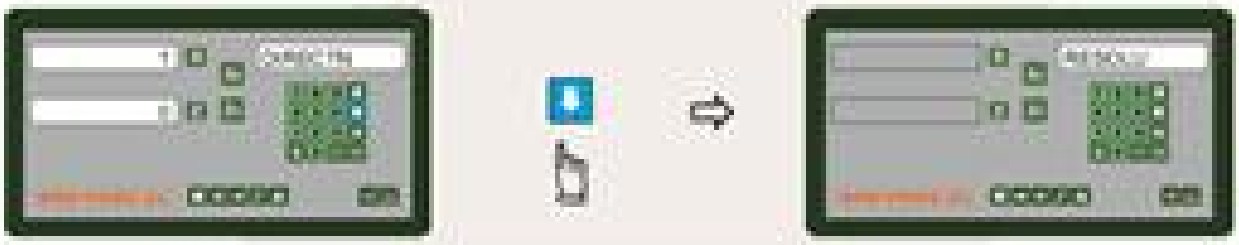
To change the direction a scale reads, press the corresponding X or Z axis button. Note the default "0" displayed in the window will change to a "1". Pressing the button again will change the display back to the default "0" and return the scale to the original direction of reading.

Press [X] or [XL] to change the X axis scale read direction.

Note the display changes from a "0" to a "1". This indicates the scale read direction has been changed.

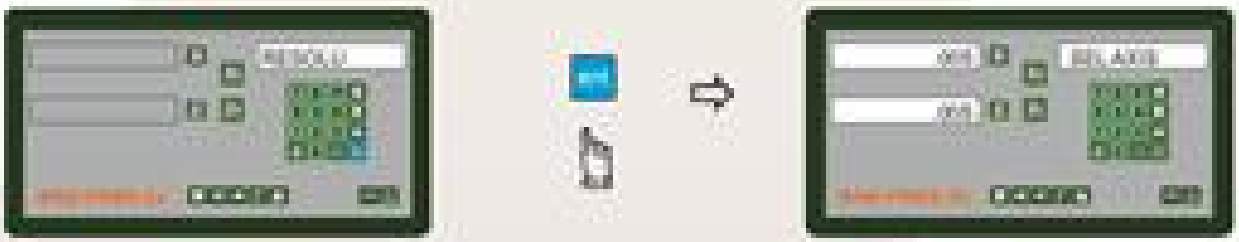
Now press [ENT] to exit from the direction function and return to the main menu.

Press [↓] to proceed to the next item in parameters setup, RESOLU, or Scale Resolution.

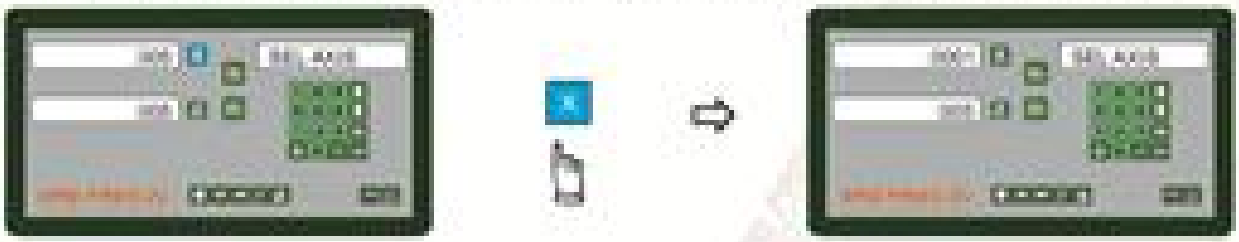


Scale Resolution

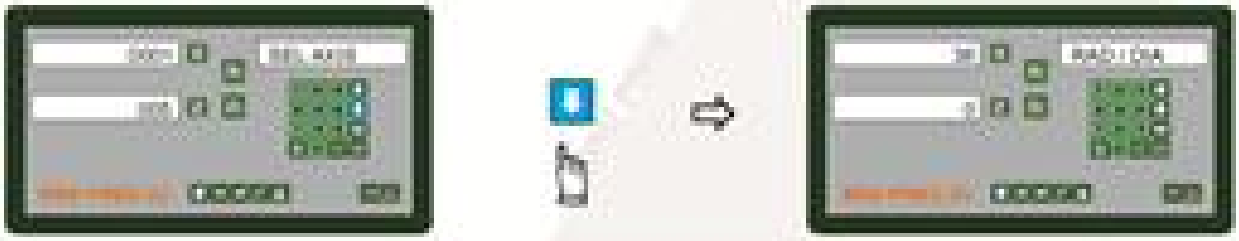
Press [ENT] to select the "RESOLU" or Scale Resolution function.



Scale resolution is selectable between either .005mm (.0002") or .001mm (.00005"). Selecting the X or Z keys toggles between these two values. In this example, we are setting the X axis to .001mm resolution.

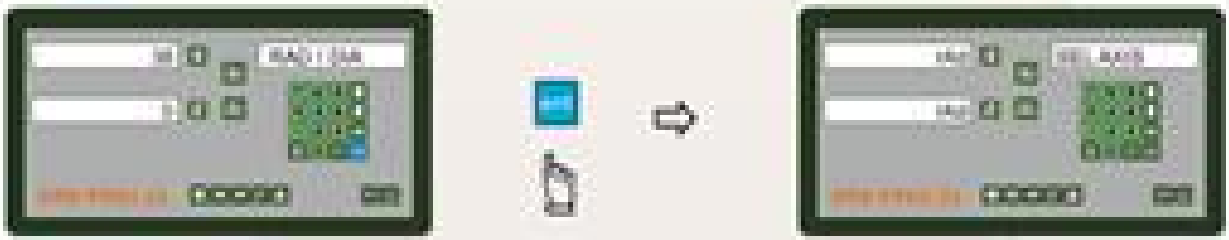


Press the down arrow key to exit from the Linear Error Compensation function and proceed to the next function, RAD / DIA or "Radius / Diameter".



Radius / Diameter (RAD / DIA) Function

Press  to select the RAD / DIA function.



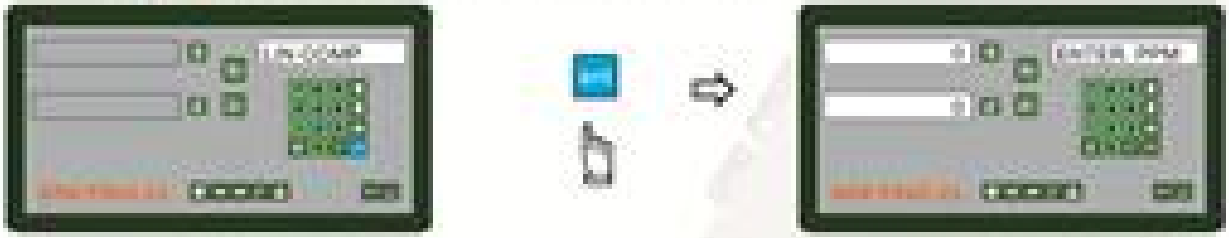
Pressing  or  changes the X axis scale from radius to diameter mode and back again.

Note the display changes from "rAd" to "dIA". This indicates whether the scale reads in either radius or diameter mode. Normally, radius is the default value. When finished choosing the scale mode, press the enter key to accept the selection.

Press  to continue from the Radius / Diameter function to the next function, "LIN COMP" or Linear Error Compensation.

Linear Error Compensation

Press [SET] to select the "LIN.COMP" or Linear Error Compensation function.



Linear compensation is specified in Parts Per Million (PPM). The method of calculation is as follows:

1. Measure the error using a step gauge or similar device, ie gauge block, of an accuracy level one grade higher than the measuring step. In other words, if you're measuring a 5 um scale, the measuring device resolution should be 1 um or better.

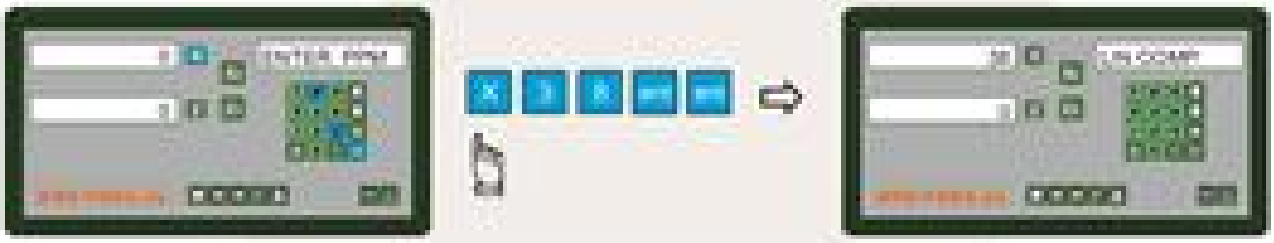
2. Record the error in microns (um). In this example, we recorded an error of 10um over a length of 500 mm.

3. Project the error over a 1 meter length (1,000mm). For this example, the projected error would be:

   10um x (1,000/500) = 18 um

4. Note the direction of error. For example, if the DRO display measured more or longer than the step gauge, the compensation value needs to be negative in order to reduce the displays value. In our example, the display indicated less than the step gauge, therefore our linear correction needs to be positive.

5. To enter a compensation value of 18 for our X axis, proceed as follows:



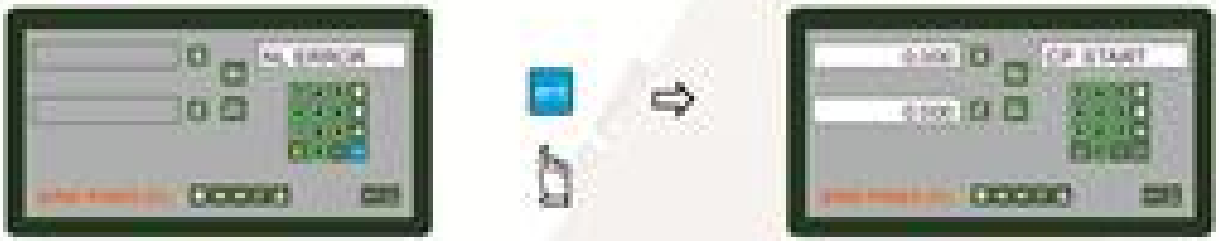
6. Congratulations, the Linear Error Compensation value of 18 has been entered!

Press [▼] to continue from Linear Error Compensation to the next function, "NL ERROR" or Non- Linear Error Compensation.

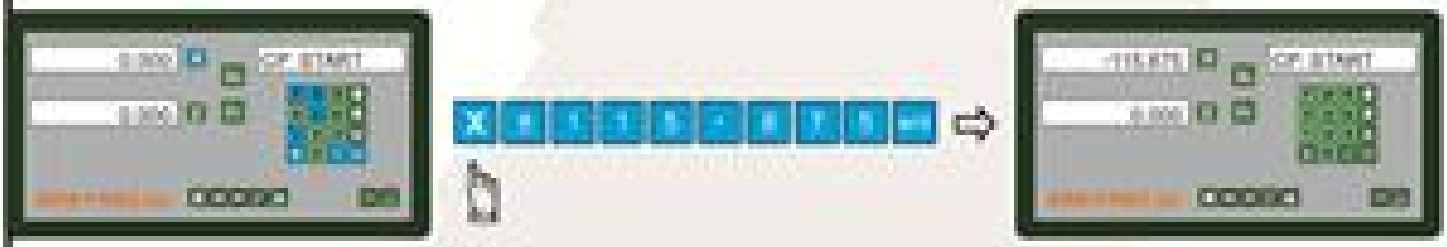
Non-Linear Error Compensation

Non-Linear error compensation is intended to maximize scale accuracy. All mechanical measuring systems are inherently flawed, however minutely. As a consequence of being physically manufactured, slight non-linear variances occur along the length of the scale. Non-linear error compensation attempts to compensate for these flaws by adding or subtracting a correction factor paired to the individual scale. By first measuring the scale against a known, extremely precise standard, an error "curve" is generated which defines the magnitude of error along the scale as a function of relative position. Once these values are input to the display, a non-linear error correction factor is automatically applied as the scale is moved, thereby greatly increasing scale accuracy.

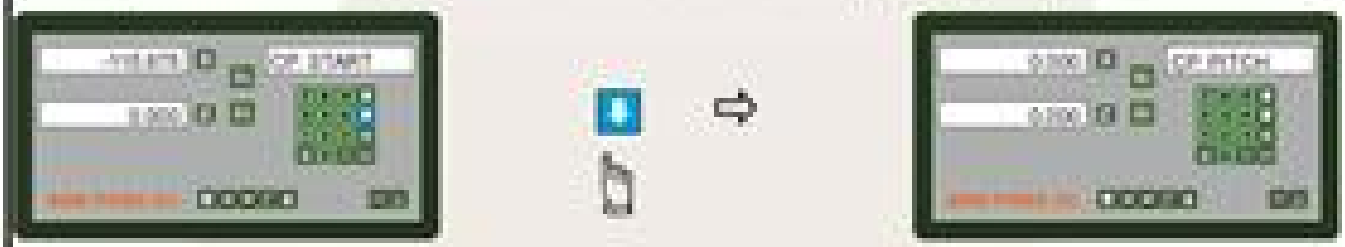
Press  to enter the Non-Linear Error function.



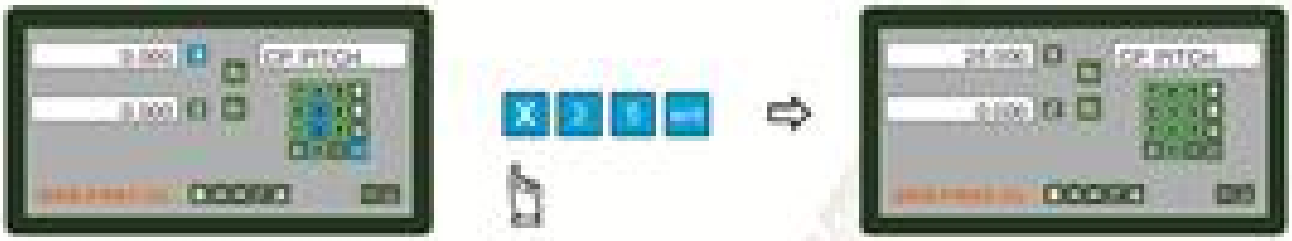
"CP START" represents the start position of where you began measuring the error, relative to the scale's reference mid point. In this case, the error calculations were started 119.875mm to the left of the scale's mid point, thereby making CP START = -119.875.



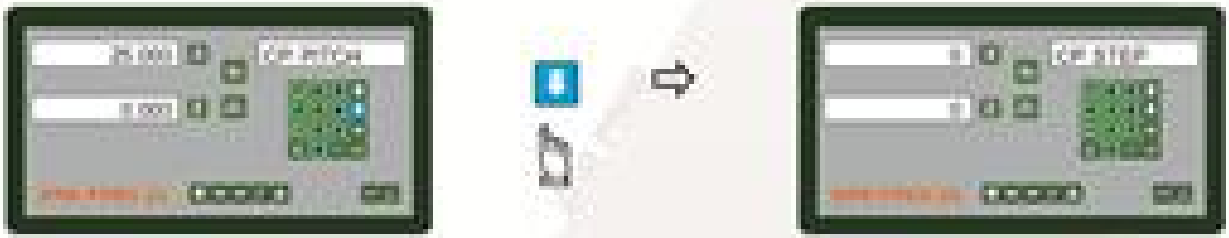
Next, press the down arrow key to move to "CP PITCH", which is the compensation profile pitch, or the transducer leg space.



In this case, the leg spacer is a standard 25mm. Enter that value.

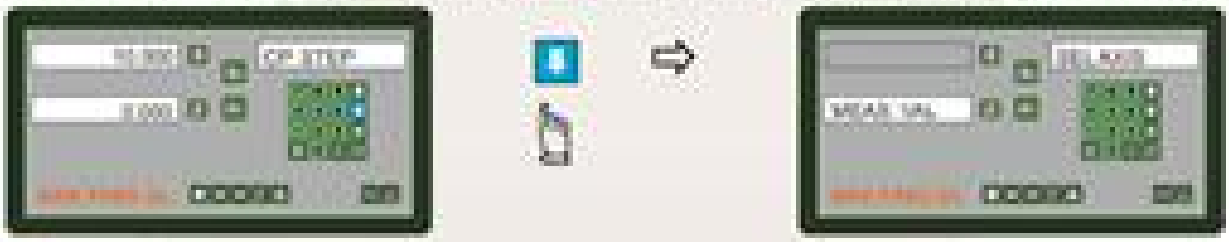


Next, press the down arrow key to move to "CP STEP", or compensation profile step.

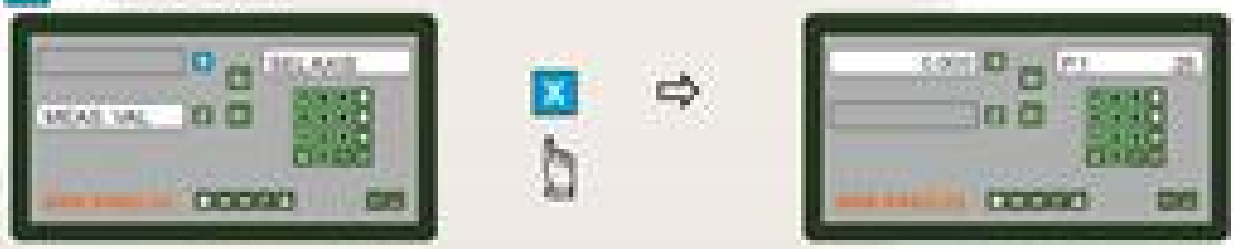


Compensation profile step is found by dividing the total distance traveled while measuring the error, divided by the pitch. In this case, it would be 200/25=10. Enter that value.

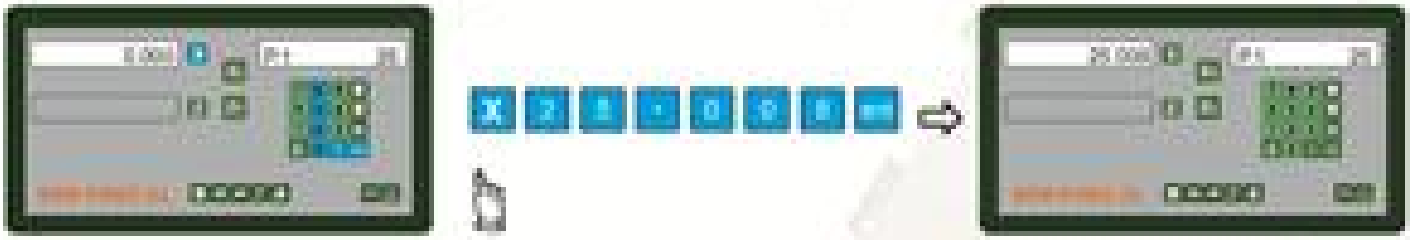
Next, press the down arrow key to move to "MEAS VAL", where you will be prompted to enter the precise measured values.



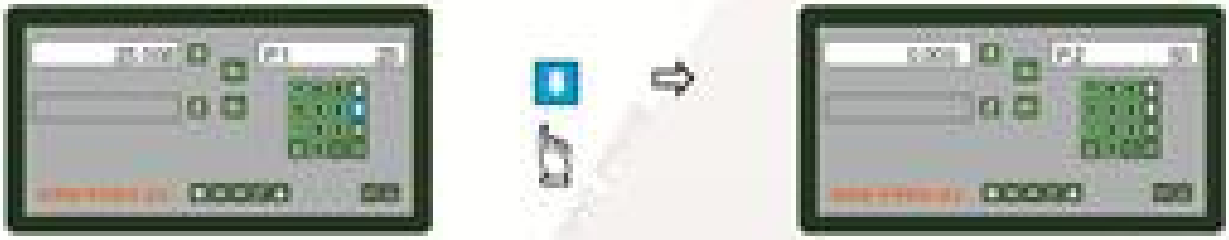
Press  to select the X axis.



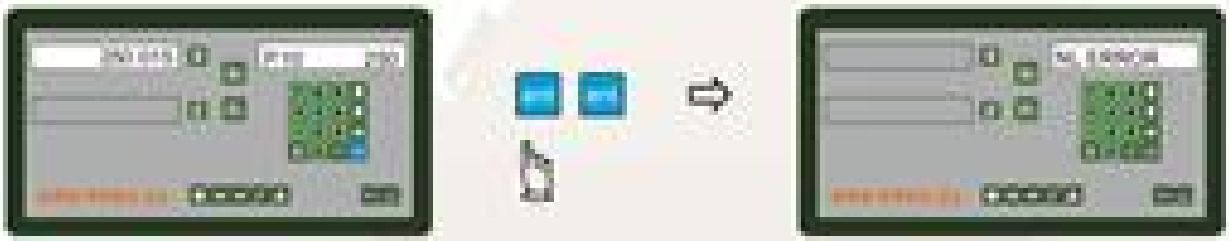
Now enter the measured value for each point. Our first measurement for point 1 was 25.008.



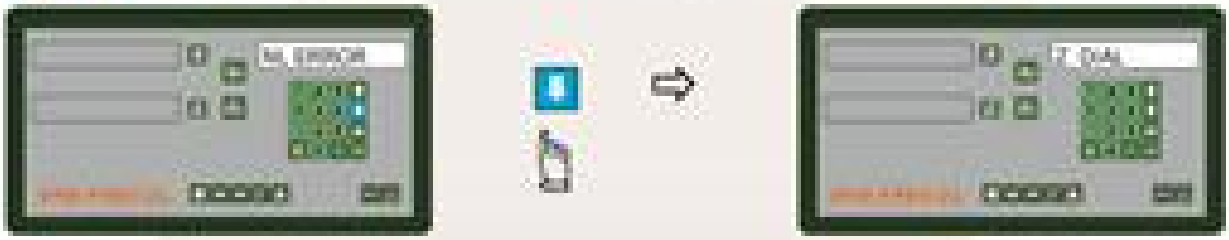
Arrow down for the next point.



Continue entering points until you reach your last correction point. In this example, it was P 10 - when finished inputting the value, press the "Enter" key two more times to return to the top menu.

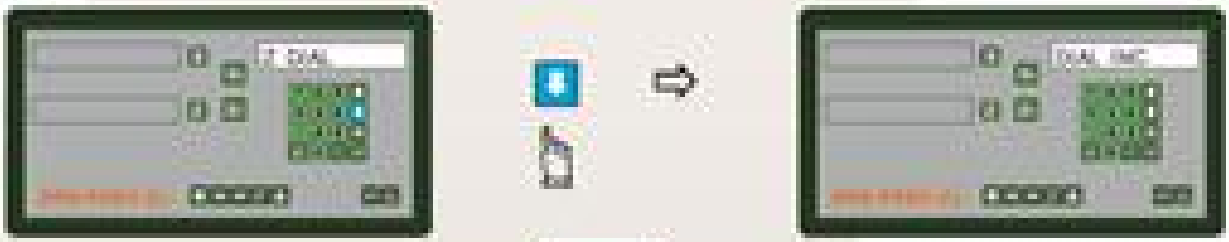


Press  to continue to "Z Dial", the next function in the Set Up menu.



Z DIAL Function

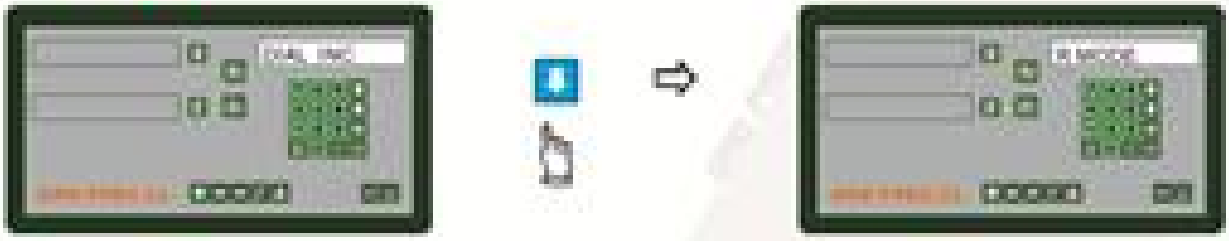
Used only for machining an arc on a milling machine. Not for lathe use.



Dial Increment

Used only for machining an arc on a milling machine. Not for lathe use.

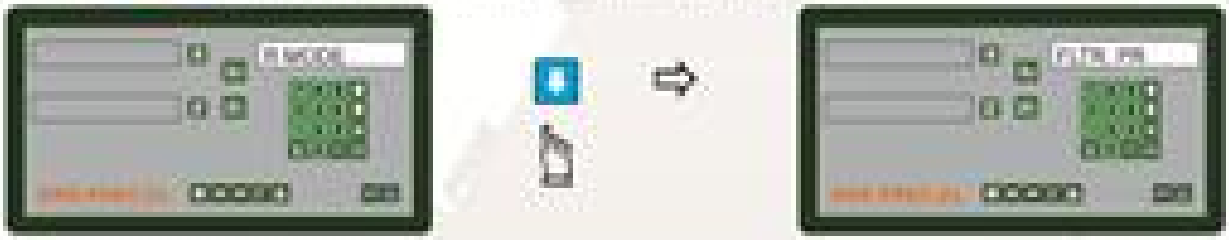
Press  to proceed to the next item in parameters setup, R MODE.



R Mode

Used only for machining an arc on a milling machine. Not for lathe use.

Press  to proceed to the next item in parameters setup, "FLTR. PR".



Filter Process

"FLTR. PR" or Filter Process allows the operator to reduce distracting display "toggling" due to the inherent vibration present in certain operations, such as grinding. Inputting a larger value further dampens or reduces the inherent flicker or toggling of the last digits on the display, which increases accuracy and reduces operator fatigue.

Press  to proceed to the next item in parameters setup, "QUIT".

Press the  button to exit from the Parameters Setup menu and save your changes.