![Sensata Technologies logo]

| NMS300 Series
Digital Readout

USER MANUAL

sensata.com/newall

NEWALL

Contents

Specification

Electrical

EU Directive 73/23/EEC (Low Voltage Directive)
BS EN 55022:1998 Class B
BS EN 55024:1998

Input to Power Supply Unit (Supplied)
100-240V (47-63Hz)
External switch-mode - Output voltage 15VDC
Input Voltage to NMS300 15-24VDC ±10%
Conforms to Low Voltage Directive

Physical

Height 160mm (6.3")	Depth 38.2mm (1.5")	Mounting Bolt: M10
Width 270mm (10.63")	Weight 1.5kg (3.3lb)	

Environment

Climatic Range	Storage Temperature	-20°C to 70°C
	Working Temperature	-10°C to 50°C
	Working Humidity	95% R.H. at 31°C
IP-Ingress Protection	IP40 Stand Alone	

Accreditation

CE

Disposal

At the end of its life, please dispose of the NMS300 system in a safe manner applicable to electrical goods

Do not burn

The casework is suitable for recycling. Please consult local regulations on disposal of electrical equipment

Input and Resolution

Only Spherosyn 300 or Microsyn 300 encoders can be used with the NMS300 DRO

Resolutions

Spherosyn 300	**Microsyn 300**
5µm (0.0002")	2µm (0.0001")
10µm (0.0005")	5µm (0.0002")
20µm (0.001")	10µm (0.0005")
50µm (0.002")	20µm (0.001")
	50µm (0.002")

Newall Measurement Systems Limited reserves the right to make changes to this specification without notice

Mounting options

Standalone Mount Options
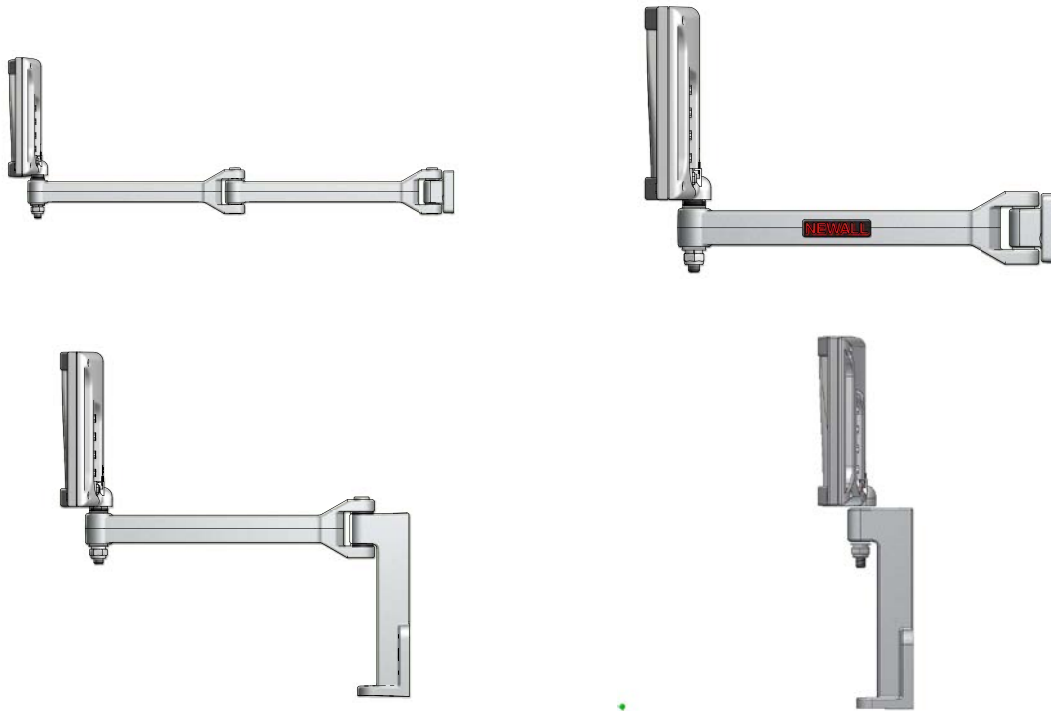
Swivel Mount Option

Panel Mount Option

210.00 ± 2.50

120.00 ± 2.50
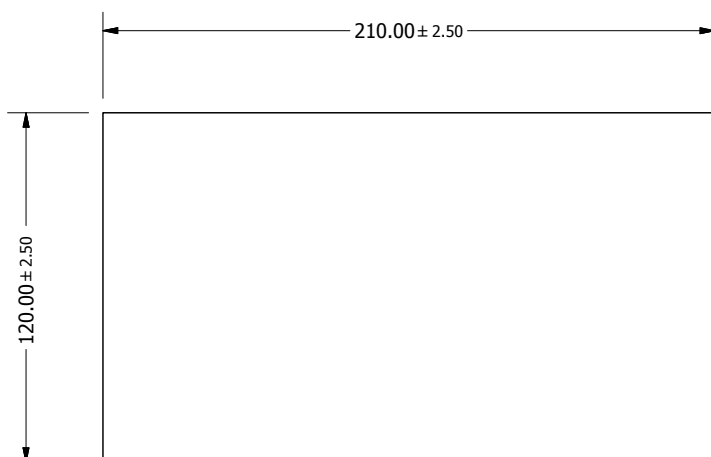
Connection details

The NMS300 is only compatible with Newall Spherosyn 300 and Microsyn 300 encoders.

It is important to ensure that:

✔ Secure all the cables to prevent the connectors from dropping into hazardous positions (for example the floor or coolant tray) when they are unplugged.

✔ Route all cables to prevent them from being caught on moving parts.

✔ The NMS300 is grounded to the machine, using the braided grounding lead provided, before the machine supply is turned on.

✔ The power has been disconnected, before the encoder(s) are connected.

Do not connect this unit directly to the mains supply.

If an encoder connected to the NMS300 travels over 3.2m an error code (20000) will be displayed in the X axis and the other axes will go blank. See the trouble shooting guide for further details on page 34.

Connections

Encoder input connection 2 or 3 according to model

External PSU input

Cabinet equipotential terminal for grounding to machine

Display and keypad

Understanding The Display

Axis 1 ⟶ 950.355
Axis 2 ⟶ 100.250
Axis 3 ⟶ - 156.755
Message display ⟶

mm   Abs   Zero

NEWALL
NMS300

Understanding The Keypad
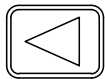
◁	Axis selection key	Zero Set	Switches between zero and axis pre-set modes
Numeric keys (7 8 9 / 4 5 6 / 1 2 3 / . 0)	Numeric keys	Abs Inc	Switches between absolute and incremental modes
ent / =	Enter key	Inch mm	Switches between inch and mm display
ce	Clear key	↰	Back / undo key
◁ ▷	Navigation keys	☰	Menu key
F1 F2 F3 F4	Function keys		Calculator mode
		1/2	Centre find
		+ π / x - +	Calculator functions
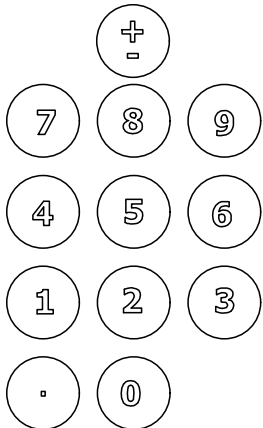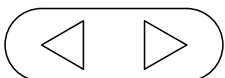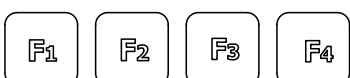
Setting up the unit

How to enter setup

▤ ◁ ▷ **DRO SETUP** ent / = **CODE** ④ ⑧ ⑥ ②

SETUP LANGUAGE → **EnG Gb** ◁ → **EnG us** | **dEutsch**
                                              FrAncAis | **itAliAno**
                                              EsPAnoL

▷

SETUP DRO TYPE → **GEnEric** ◁ → **MiLL**
                                         LAthE

▷

SETUP RES → **0.005** ◁ → **000.2**
                                 0.01
                                 0.02
                                 0.05
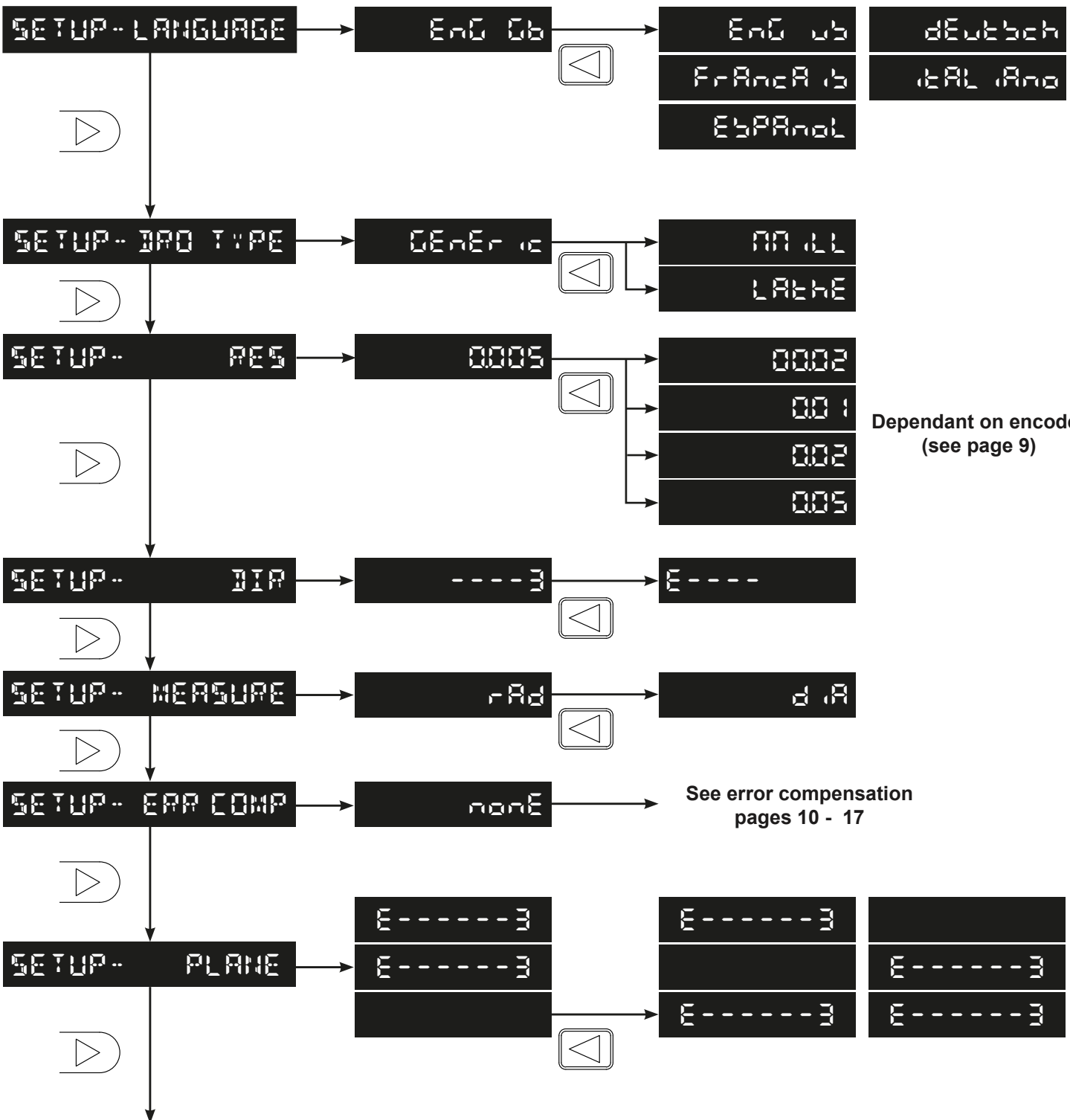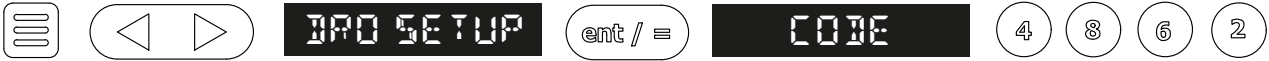
Dependant on encoder (see page 9)

▷

SETUP DIR → **- - - -3** ◁ → **E- - - -**

▷

SETUP MEASURE → **rAd** ◁ → **diA**

▷

SETUP ERR COMP → **nonE** → **See error compensation pages 10 - 17**

▷

SETUP PLANE → **E- - - - - -3** ◁ → **E- - - - - -3** |
                  E- - - - - -3 | | **E- - - - - -3**
                                           E- - - - - -3 | **E- - - - - -3**

▷

Setting up the unit

SETUP ·· FUNC → FUNC ·· ARC → on → oFF

ent / = ▷ ◁

FUNC ·· DIGIFIND → on → oFF

▷ ◁

FUNC ·· FEED → on → oFF

▷ ◁

FUNC ·· LINE → on → oFF

▷ ◁

FUNC ·· PCD → on → oFF

▷ ◁

FUNC ·· POCKET → on → oFF

▷ ◁

FUNC ·· SDM → on → oFF

▷ ◁

FUNC ·· TAPER → on → oFF

▷ ◁

↩ FUNC ·· TOOL → on → oFF

◁

SETUP ·· FEED → M inutes → seconds

▷ ◁

SETUP ·· BRIGHT → M id → h iGh → Low

▷ ◁

SETUP ·· BEEP → on → oFF

▷ ◁

SETUP ·· SLEEP → 0 → user defined, use numeric keypad to enter value in whole minutes → ent / =

▷ ◁

SETUP ·· RESET → no → YES

ent / = ◁

↩ to exit setup and return to menu, or ☰ to exit setup and return to measurement display

Setting up the unit

Language Setup
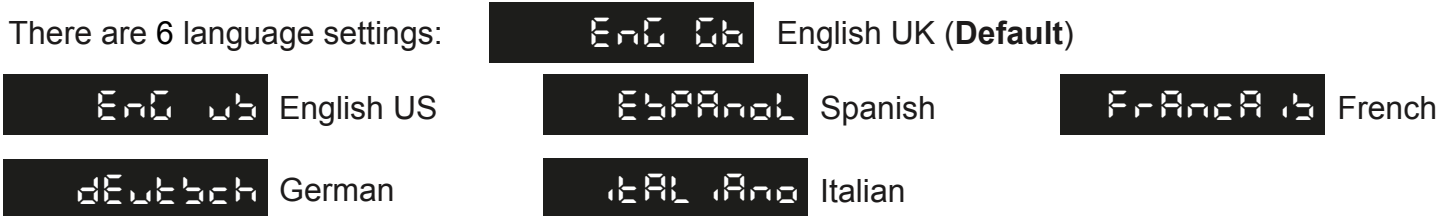
This setting enables the user to choose the language that is required to be displayed in the NMS300 display.

There are 6 language settings: `EnG Gb` English UK (**Default**)

`EnG uS` English US   `ESPAnoL` Spanish   `FrAncA iS` French

`dEutsch` German   `itAL iAno` Italian

Press the axis select key [◁] next to the 'X' axis to cycle through options

Type Setup

This setting enables the user to choose the machine type that the NMS300 operates with. This is important as the machine type defines the default functions for the *functions keys* and *function menu*.
There are 3 settings to choose from:

`GEnEr ic`	`MM iLL`	`LAthE`
Generic (all functions)	Mill (mill functions)	Lathe (lathe functions, X axis set to DIA)

	Generic			Mill			Lathe
F1	= Tool function		F1	= PCD function		F1	= Tool function
F2	= PCD function		F2	= Line function		F2	= Taper function
F3	= SDM function		F3	= SDM function		F3	= SDM function
F4	= Digifind Function		F4	= Digifind Function		F4	= Digifind Function

Note: The function keys can be manually set to any function desired, see the *function keys* section

Encoder Resolution Setup

The resolution settings available for each axis depend on the encoder type and the inch/mm setting

|	Display		Spherosyn300	Microsyn300
µm	mm	in		
2	0.002	0.0001		✓
5	0.005	0.0002	✓	✓
10	0.01	0.0005	✓	✓
20	0.02	0.001	✓	✓
50	0.05	0.002	✓	✓

Press the axis select key [◁] next to the 'X', 'Y' or 'Z' axis to cycle through the options

Setting up the unit

Direction of Travel Setup

This setting allows the user to match the NMS300 to the actual direction of travel of any of the 3 axes fitted to the machine.

The two settings available for each axis are `- - - - 3` and `3 - - - -`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis to cycle through the options

Example:

If the current setting is `- - - - 3` **and the travel is positive from right to left, changing the**

setting to `3 - - - -` **will reverse the direction to measure positive from left to right**

Radius / Diameter (measure setup)

The radius /diameter function allows the user to display actual (radius) or twice-actual (diameter) measurements for each axis.

This function is generally used in turning applications, such as the cross travel on a lathe where the diameter reading is displayed rather than the radius.

There are two setting for each axis:

Radius `rAd`

Diameter `dIA`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis to cycle through the options

Error Compensation

The digital readout (DRO) system helps to improve productivity. It decreases the number of scrapped parts, as there is no concern about making mistakes related to counting the revolutions on the dials. The DRO system also helps to eliminate some errors related to ball-screw backlash.

The DRO system will operate to its published accuracy, provided all components are in working order and properly installed. Field calibration is not necessary.

Accuracy problems with machined parts may be caused by machine error, DRO system error, or a combination of both. The first step in determining the source of error is to check the DRO system. To do this compare the movement of the Newall reader head to the position reading shown on the display. A high accuracy standard, such as a laser interferometer is required. A dial indicator can be used to check short distances, but a laser provides the best results. If a dial indicator must be used, be sure it is the highest available accuracy.

Setting up the unit

Error Compensation Continued

To check the accuracy of the DRO system:

1. Place the target of the laser or the needle of the dial indicator directly on the Newall reader head. It is absolutely critical that the readings are taken directly from the Newall reader head. If a dial indicator must be used, be sure that the needle of the indicator is perpendicular to the reader head and not angled. If readings are taken anywhere else on the machine, machine errors may distort the results.

2. When the reader head moves, the movement registers on the laser / indicator and DRO display.

3. Set the laser / dial indicator and DRO position displays to 0.

4. Make a series of movements and compare the position readings between the laser / dial indicator and the DRO display. If the readings match within the accuracy specified, it proves that the DRO system is operating properly. If this is the case, proceed to the next step: evaluating the machine errors. If the readings do not match, the DRO system must be repaired before proceeding with error compensation.
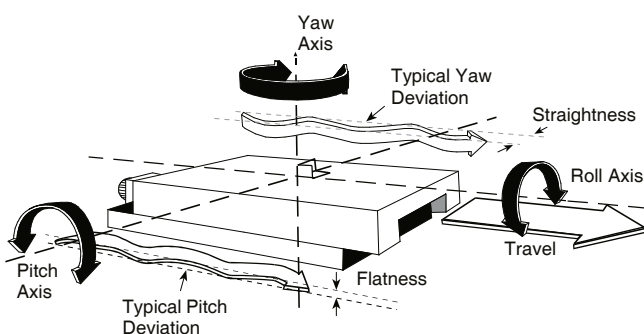
To evaluate machine errors:

1. Put the laser target / dial indicator on the part of the machine where the machining is done.

2. Make a series of movements and compare the position readings between the laser / dial indicator and the DRO display. The difference between the laser / dial indicator reading and the reading on the DRO display is the machine error.

3. Plot the machine error along the entire axis of travel to determine the nature of the error. If it is a linear error, use linear error compensation. If the error is not linear, use segmented error compensation.
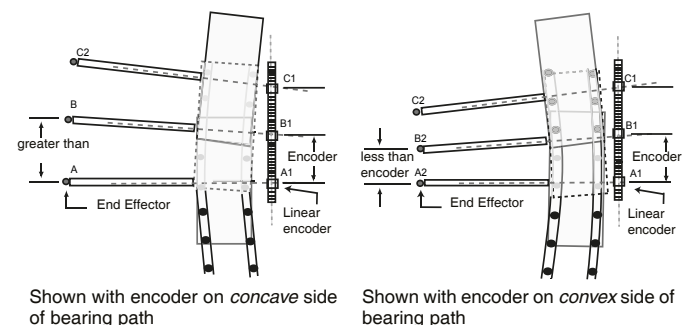
Types of Machine Error

There are many types of machine error, including pitch, roll, yaw, flatness, straightness, and Abbé error. The diagrams below demonstrate these errors.
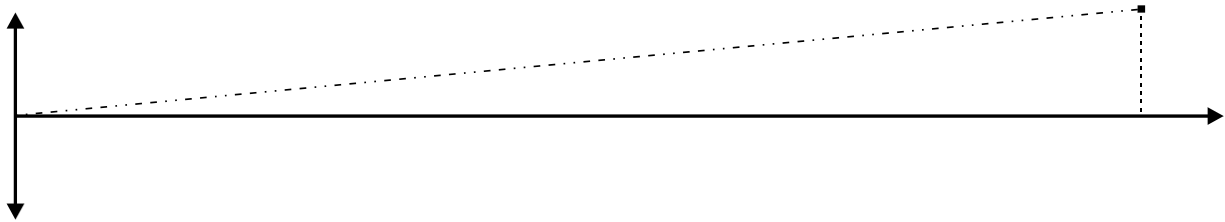
Way errors

Abbé error

Shown with encoder on *concave* side of bearing path

Shown with encoder on *convex* side of bearing path

Setting up the unit

Linear Error Compensation

In this mode, a single constant correction factor is applied for each axis for all displayed measurements. Calculate the correction factor, and specify it in parts per million (ppm).

When following the procedure ensure that a stepped standard is used, and approach each edge from the same direction; or if each edge must be approached from opposite directions, then subtract the width of the tool or measuring probe from the value displayed on the NMS300.
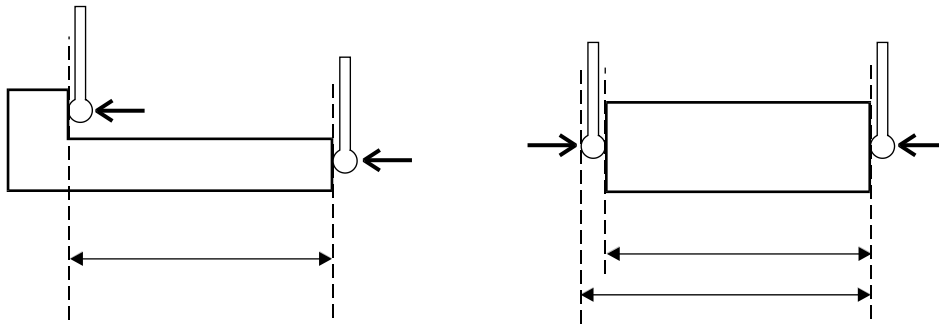
Linear Error Compensation Setup

This setting allows the setup of compensation factors for linear errors. There are two methods of entering compensation values **Teach mode** and **Program mode**.
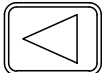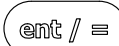
Teach Mode

Teach mode is an easier way of calculating linear errors by using the NMS300 to automatically calculate the error. This is achieved by comparing the actual measurement and the physical movement. The procedure to do this is shown below.

Navigate to the Error compensation selection screen `SETUP- ERR COMP`

The default value for each of the axis is `nonE`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires linear compensation the message display will show `CMP 1-        NONE` (CMP 1 = X axis, CMP 2 = Y axis & CMP 3 = Z axis)

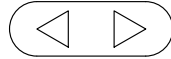◁ ▷ until the message display shows `CMP 1-    LINEAR` (ent / =)
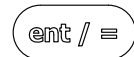
Setting up the unit

| `0` | last compensation value calculated / used |

| `LIN 1-    TEACH` | ◁ ▷ to choose teach rather than program   ent / ≡ |

| `0.000` | encoder position (start point) |

| `TCH 1-    START` | ent / ≡ |

| `1000.000` | encoder position (end point) |

| `TCH 1-      END` | ent / ≡ |

| `TCH 1-  MOVEMENT` | enter the actual measurement using the numeric keypad   ent / ≡ |

| `1000.500` | value entered in previous step |

| `TCH 1-  MOVEMENT` | ent / ≡ |

| `-500` | Linear compensation value (ppm) |

| `TCH 1-   ACCEPT` | ent / ≡ |

| `-500` | |

| `LIN 1-    TEACH` | |
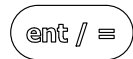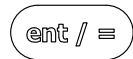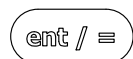
⮌ to exit setup and return to menu, or ☰ to exit setup and return to measurement display

Setting up the unit

Program Mode

Program mode allows the linear compensation to be calculated manually and then entered as a PPM value into the NMS300 display.
The procedure to do this is shown below:

To illustrate the calculation an example is being used where the standard distance is 500.000mm and the measured distance is 500.200mm.
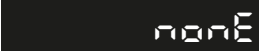
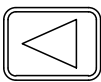Correction factor = error / actual x 1,000,000
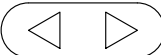Correction factor = (500.000 - 500.200) / 500.000 x 1,000,000
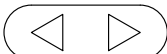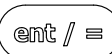Correction factor = -400 PPM

To enter this value into the display:
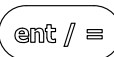
Navigate to the Error compensation selection screen `SETUP·· ERR COMP`

The default value for each of the axis is `nonE`

Press the axis select key [◁] next to the 'X', 'Y' or 'Z' axis that requires linear compensation the message display will show `CMP 1··    NONE` (CMP 1 = X axis, CMP 2 = Y axis & CMP 3 = Z axis)

[◁ ▷] until the message display shows `CMP 1··    LINEAR` (ent / ≡)

`0` last compensation value calculated / used

`LIN 1··   PROGRAM` [◁ ▷] to choose program rather than teach (ent / ≡)

`PRG 1··        PPM` enter the calculated PPM using the numeric keypad (ent / ≡)
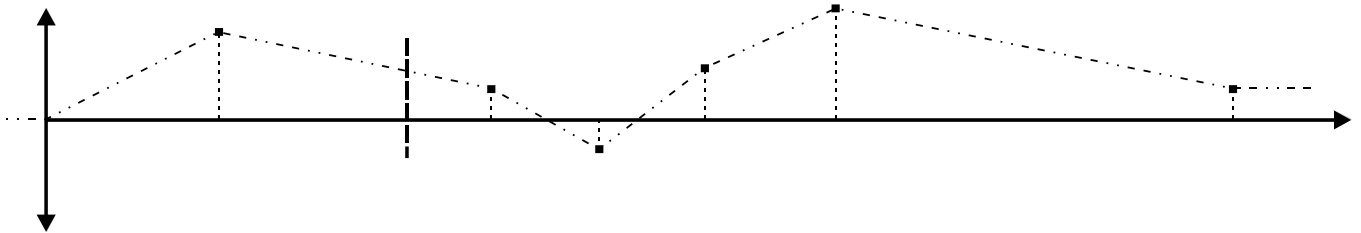
`-400`

`PRG 1··        PPM`

[⏎] to exit setup and return to menu, or [≣] to exit setup and return to measurement display

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Setting up the unit

Segmented Error Compensation

The scale travel is broken down into as many as 200 user-defined segments, each with their own correction factor, measured against a high-accuracy standard. The following parameters need to be identified:

Each Correction Point is measured with respect to the Starting Point - zero - which is usually set close to one end of the scale. The Reference Point can be set anywhere along the scale, and does not need to coincide with either the absolute datum or any of the correction points.
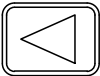However, it may be convenient to make the absolute datum and the reference point the same.
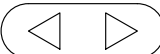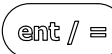Always approach the Starting Point, Correction Points and Reference Point from the same direction. If not, then the size of the tool or probe will render the measurement inaccurate.

Teach Mode

Navigate to the Error compensation selection screen `SETUP-- ERR COMP`

The default value for each of the axis is `nonE`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires segmented compensation the message display will show `CMP 1-- NONE` (CMP 1 = X axis, CMP 2 = Y axis & CMP 3 = Z axis)

◁ ▷ until the message display shows `CMP 1-- SEGMENTS` (ent / ≡)

Note: When segmented error compensation teach is started the previous values set are deleted (Set to 0)

`SEG 1-- TEACH` ◁ ▷ to choose teach rather than program (ent / ≡)

`0.000` encoder position (ref point)

`TCH 1-- SET REF` (ent / ≡)

`0.000` encoder position (zero point)

`TCH 1-- SET 0` (ent / ≡)

Setting up the unit

`2.000` encoder position (position 1)

`TCH 1- GOTO 001` (ent / ≡)

`TCH 1- MOVEMENT` enter the actual measurement using the numeric keypad (ent / ≡)

`2.150` value entered in previous step

`TCH 1- MOVEMENT` (ent / ≡)

`0.150` compensation value

`TCH 1- ACCEPT` (ent / ≡)

`TCH 1- CONTINUE` (ent / ≡) continue to position 2

(⤺) to exit setup and return to menu, or (≡) to exit setup and return to measurement display

When segmented compensation is enabled it is necessary to move to a start / reference point when the unit has had its power cycled. The below message will be shown on the NMS300 display when this is required.
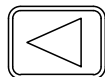
`rESEt` (◁)
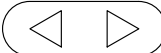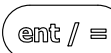
`RESET-SEGMENTS`

Setting up the unit

Program Mode

Navigate to the Error compensation selection screen `SETUP·· ERR COMP`

The default value for each of the axis is `nonE`

Press the axis select key `◁` next to the 'X', 'Y' or 'Z' axis that requires segmented compensation the

message display will show `CMP 1··      NONE` (CMP 1 = X axis, CMP 2 = Y axis & CMP 3 = Z axis)

`◁  ▷` until the message display shows `CMP 1··  SEGMENTS` `ent / ≡`

`SEG 1··    PROGRAM` `◁  ▷` to choose program rather than teach `ent / ≡`

`2.000` correction point position

`0.150` correction value (compensation)

`PRG 1··  SEG 001` `ent / ≡`

Note: Pressing `ce` will delete both correction point position and correction value (Set to 0)

`◁  ▷` to move to segment 2 and the repeat the process above

`↰` to exit setup and return to menu, or `☰` to exit setup and return to measurement display
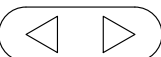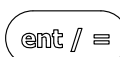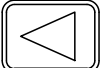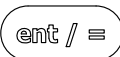
When segmented compensation is enabled it is necessary to move to a start / reference point when the unit has had its power cycled. The below message will be shown on the NMS300 display when this is required.
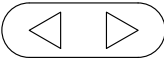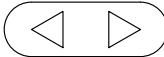
`rESEt` `◁`

`RESET·· SEGMENTS`

Delete Mode

The example below has the X axis chosen in the segmented error compensation menu, repeat the below process with another axis selected to delete the segmented compensation in that axis.

segmented
compensation `◁  ▷` `SEG 1··    DELETE` `ent / ≡`   `no` `◁`
menu

`SEG 1··      SURE`

`YES`

`ent / ≡`

`SEG 1··      SURE`   **Important note:** this will delete all the current data in the X axis

Setting up the unit

Plane Setup

This setting defines the machining face of the work piece, for example; on a turret mill it would typically be the X Axis and the Y Axis. This setting is used by the mill functions.

⌐-------┐	⌐-------┐	◁
⌐-------┐	◁	⌐------┐
◁	⌐-------┐	⌐-------┐
SETUP¬ PLANE	SETUP¬ PLANE	SETUP¬ PLANE
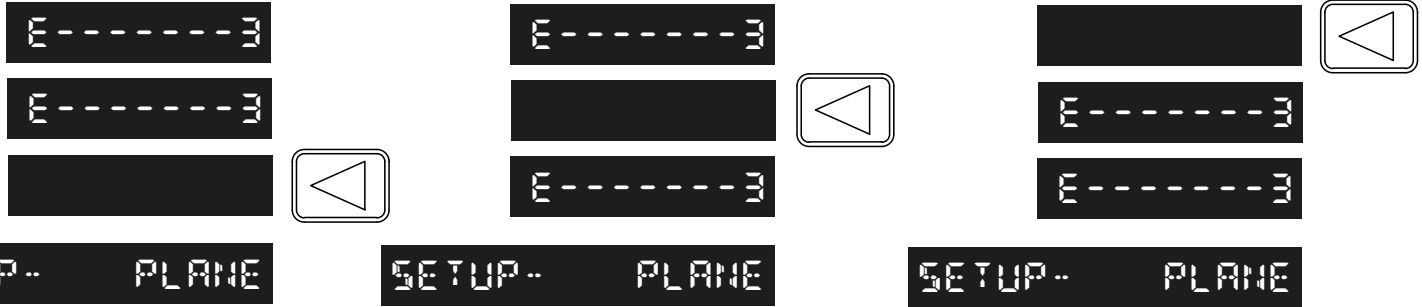
⮌ to exit setup and return to menu, or ☰ to exit setup and return to measurement display

Functions Setup

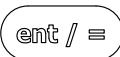Allows the user to enable or disable Mill / Lathe functions. Some functions may already be turned off/on due to the type setup being set to Mill or lathe.

SETUP¬ FUNC   ent / ≡

Function on   on ◁   to cycle between options

Function off   oFF
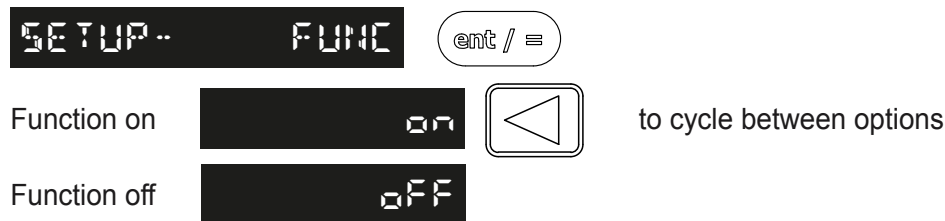
◁ ▷ to navigate though the functions available as per the below:

FUNC ¬ ARC	Arc contouring function
FUNC ¬ DIGIFIND	Digifind reference function
FUNC ¬ FEED	Feed rate function
FUNC ¬ LINE	Line hole function
FUNC ¬ PCD	Pitch Circle Diameter / bolthole function
FUNC ¬ POCKET	Pocket or island milling
FUNC ¬ SDM	Sub datum memory
FUNC ¬ TAPER	Taper turning
FUNC ¬ TOOL	Tool offsets

Setting up the unit

Feed Setup
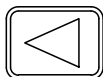
`ΓΓ inutE5` ◁ to change between minutes and seconds

`SETUP·· FEED`

Settings available are: in/minutes, in/second, mm/minutes & mm/second

`5Econd5`

[Inch – mm] to change from inches to millimetres in conjunction with this function

`SETUP·· FEED`

Brightness Setup
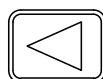
`ΓΓ id` ◁ The default brightness is medium

`SETUP·· BRIGHT`

`h iGh` ◁ Setting to high brightness increases the display brightness to its maximum

`SETUP·· BRIGHT`

`Lo88` Setting to low brightness decreases the display brightness to its minimum

`SETUP·· BRIGHT`

Tone / Beep Setup

This setting enables or disables an audible tone coming from the unit when a button is pressed.

`on` ◁ The default setting is on

`SETUP·· BEEP`

`oFF` Once turned off no audible tone will be made

`SETUP·· BEEP`

Setting up the unit

Sleep Setup

This setting enables the user to define an automatic sleep mode after a period of time. The user either leaves the default setting at 0 which deactivates the sleep mode, or inputs a value (in whole minutes) for when the sleep mode is initiated after no operation of the NMS300.

To exit sleep mode, simply move an axis or press any key.

```
              0
SETUP~    SLEEP
```
0 disables the sleep function

```
             15
SETUP~    SLEEP
```
sleep function active after 15 minutes

Once the required value is entered via the numeric keypad, press (ent / ≡) to accept the value

Reset Setup

This setting enables the NMS300 to be reset to its default parameters.

WARNING:: Enabling this setting will erase any data that was previously stored in the functions and settings of the readout.

```
SETUP~     RESET
```
Navigate to this message display in settings
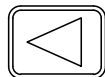
```
             no
RESET~     SURE
```
◁ Confirm that a reset is required by pressing the axis key

↰ to exit setup and return to menu, or ☰ to exit setup and return to measurement display

```
            YES
RESET~     SURE
```
(ent / ≡)

Standard functions

Press the [Abs/Inc] key to toggle between absolute and incremental modes.

The NMS300 has a dedicated key to switch the positional displays between absolute (abs) and incremental (inc) measurements. The current display mode is indicated at the bottom of the screen as shown on the right.

Abs

[Abs/Inc]

Absolute (abs) mode has been selected

Inc

[Abs/Inc]

Incremental (inc) mode has been selected

Using incremental mode

In Incremental mode the DRO displays the position relative to the last position. This is also known as point-to-point use. In this mode set the value for each axis, or zero it to create an Incremental datum. This does not effect the machine's Absolute datum that is configured in Absolute mode.
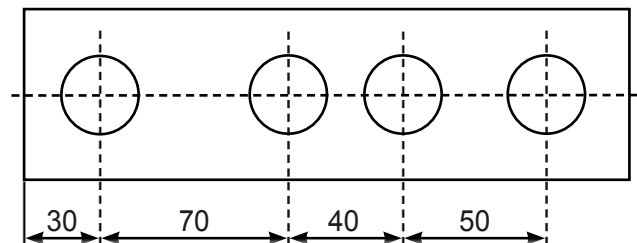
Using absolute mode

In Absolute mode the DRO displays the positions of all the axes with respect to a fixed datum. The datum is set by entering an axis position when in Absolute mode.
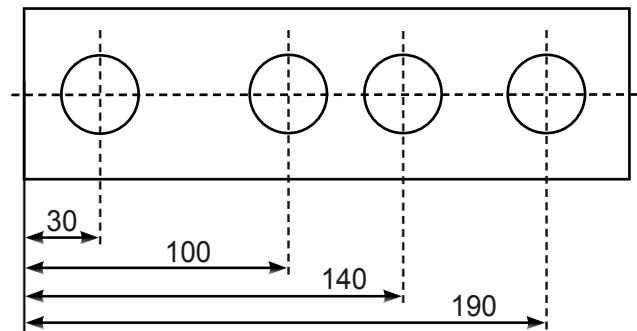
Example of absolute and incremental use

Set absolute zero at lower left corner of the part

0.000
0.000

move to first position in ABS (hole A)

30.000
30.000

move to second position in ABS (hole B)

150.000
100.000
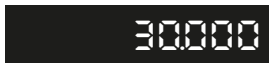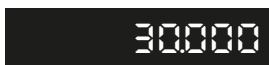
switch to incremental mode and zero the display

0.000
0.000

make an incremental move to hole C

0.000
50.000

switch to absolute mode

150.000
150.000
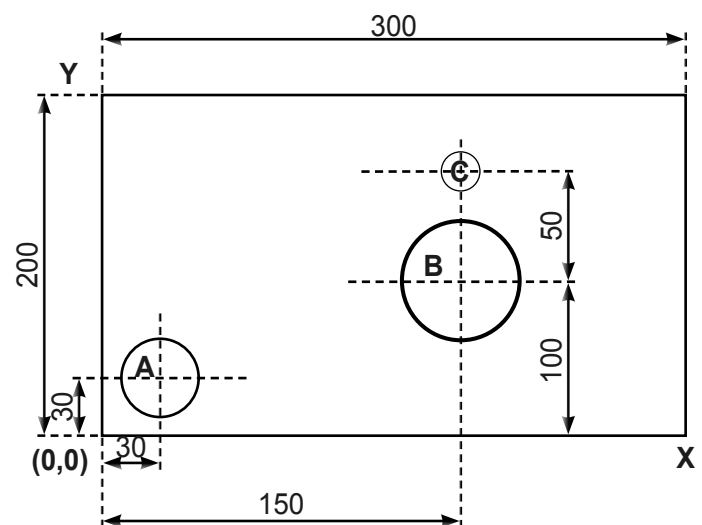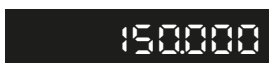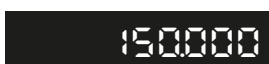
Standard functions

Inch and mm modes

Press [Inch/mm] to toggle between Inch and mm measurement modes.

The NMS300 has a dedicated key to switch the positional displays between imperial (inch) and metric (mm) measurements. The current display mode is indicated at the bottom left of the screen as shown right.

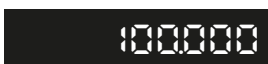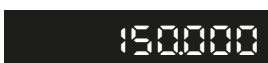**mm**   [Inch/mm]   Metric (mm) mode has been selected

In   [Inch/mm]   Imperial (In) mode has been selected

Zero and pre-set an axis

Press [Zero/Set] to toggle between set and zero modes.

The NMS300 has a dedicated key to switch the operation of the axis selection key between zero and set modes. The currently selected mode is indicated at the bottom right of the screen as shown.

Set   [Zero/Set]   Set mode has been selected

Zero   [Zero/Set]   Zero mode has been selected

- -

Using set mode

With the set mode selected, the select axis key prompts a numeric entry into the desired axis.
Once the correct value has been selected, it can be set into the axis by pressing the enter key. This can be seen in the example on the right.

`0.000` [◁]

`0`

(±) (1) (4) (5) (·) (2) (3) (ent / =)

`- 145.230`

- -
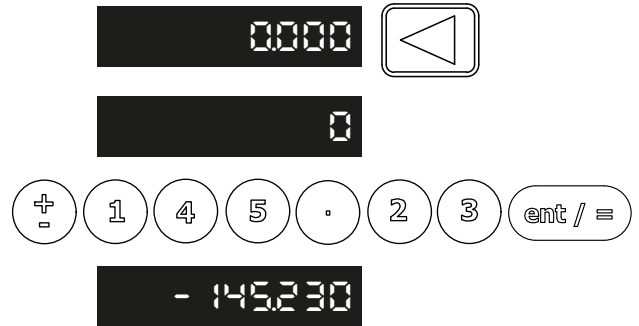
Zeroing an axis in set mode

With set mode selected, it is possible to zero an axis conveniently by holding down the axis select key for at least 3 seconds. This allows the user to zero an axis but stay in the pre-set mode. Use of this feature can be seen in the example on the right.

`- 145.230`

[◁]

`0.000`

- -
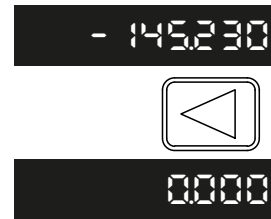
Using zero mode

With zero mode selected, this enables the select axis keys to zero each axis independently. This can be seen in the example on the right.

`- 145.230`

[◁]

`0.000`

Standard functions
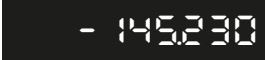
Undo function

The NMS300 stores the last 10 positions / numeric inputs, which can be accessed using the undo ⟳ feature.

Example 1 - non movement

display shows `- 145.230` input a value `95.520`

an incorrect figure has been accepted but the dimension shown previously is required.

press ⟳ display now shows `- 145.230`

Example 2 - movement

input a value `5.000` move to that point, display now shows `0.000`

input a value `10.000` move to that point, display now shows `0.000`

Press ⟳ once, display now shows `- 10.000` this is the position of the second point

Press ⟳ again, display now shows `- 10.000` this is the position of the starting point

Important note: the undo key is also used for returning to the previous menu structure when in the readout settings and functions.

Half function / centre find

Press ½ to initiate the half function.

The NMS300 has a dedicated key to half the value in any axis. This is achieved by pressing the half key and then selecting the required axis to have the value halved. Example shown on the right.

½

`100.000` ◁

`50.000`
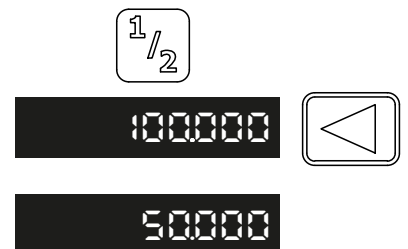
Standard functions

The NMS300 has multiple ways of accessing functions, via the main menu & the function keys.

Functions Menu

[≡] [◁ ▷] **FUNCTION MENU** [ent / ≡]

MENU ·· TOOL Generic & Lathe

MENU ·· PCD Generic & Mill

MENU ·· LINE Generic & Mill

MENU ·· ARC Generic & Mill

MENU ·· POCKET Generic & Mill

MENU ·· SDM Generic, Mill & Lathe

MENU ·· TAPER Generic & Lathe

MENU ·· FEED Generic, Mill & Lathe

MENU ·· DIGIFIND Generic, Mill & Lathe

Once the correct function has been located press [ent / ≡] to select the function (set parameters / use)

Setting Function keys

[≡] [◁ ▷] **DEFINE FN BINS** [ent / ≡]   **Pcd** / **FUNC ·· FUNC 1** [◁]

to select different function

[◁ ▷] to select different function key

LinE / **FUNC ·· FUNC 2**

[⇆] to save and return to menu, or [≡] to save and return to measurement display
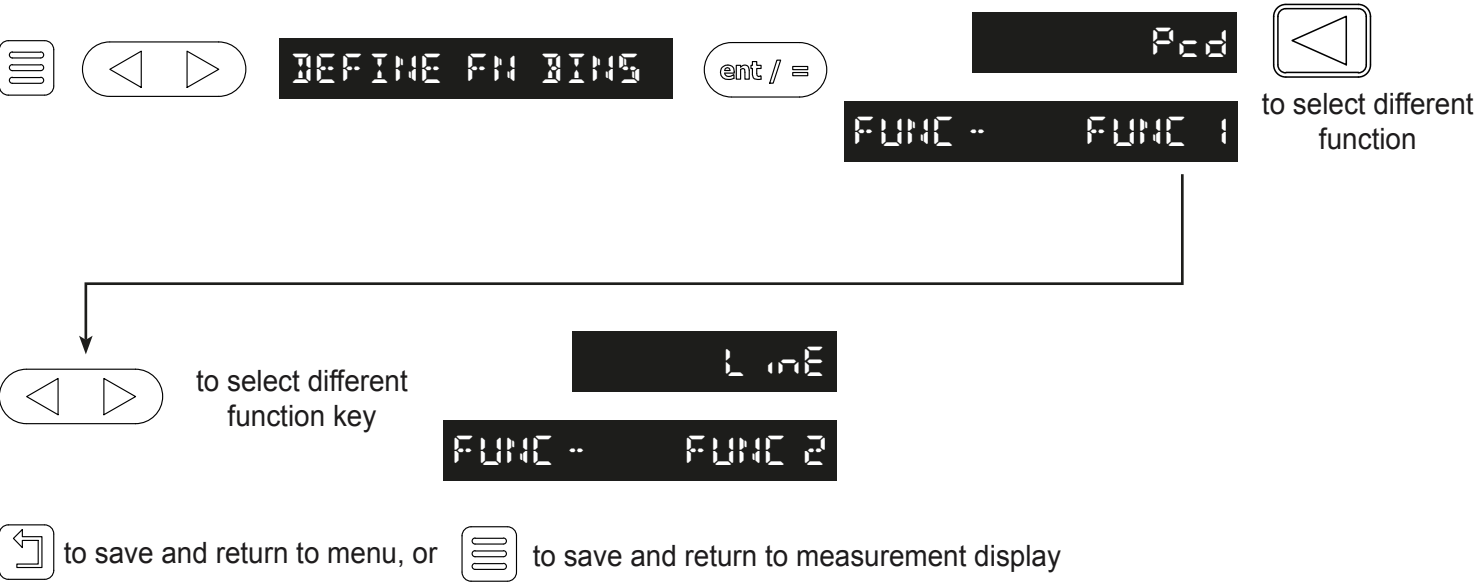
Standard functions

Quick Setting Function Keys

It is possible to set the function keys without having to go though the menu structure, this enables the function keys to be defined quicker if they need to be changed more often.

long press F1 or F2 or F3 or F4

Pcd

FUNC ··   FUNC 1

to select different function

⮐ or ent / = or ☰ to save and return to measurement display
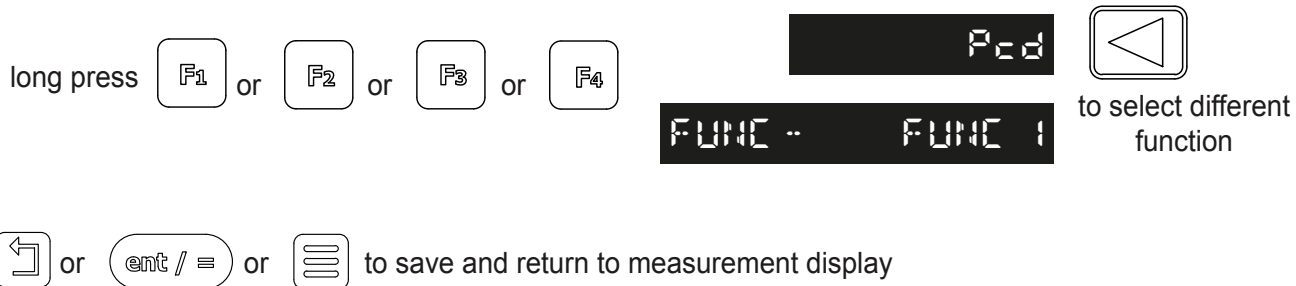
Using Function keys

Before being able to use a function key it must be assigned to a function as per the above instructions, this may have been completed by setting the unit to a machine type in the setup.

F1 or F2 or F3 or F4   set the parameters and/or use the function selected
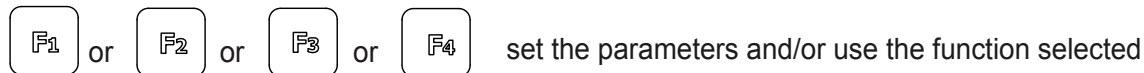
Digifind / reference function

The NMS300 comes equipped with Digifind, a feature unique to Newall digital readout products. Digifind eliminates the risk of losing position and datum Set-Up. With Digifind, precise Set-Up of a work-piece is carried out only one time.
When the NMS300 is powered on, it displays the position at power off, compensated for any movement of a Spherosyn encoder up to 0.2500" (6mm) and a Microsyn encoder up to 0.1000" (2.5mm) in either direction since the unit was last used. If the machine has moved beyond 0.2500" (6mm) - Spherosyn [0.1000" (2.5mm) - Microsyn], Digifind allows a quick means to find the datum if lost.
A mark must be made on both a stationary part and moving part of the machine. The marks must be aligned and will serve as the machine "home" position.
The mark must be indelible, and it must allow the operator to move the machine to within a 0.2500" (6 mm) - Spherosyn [0.1000" (2.5mm) - Microsyn] band around the mark at any time. Alternatively, use a convenient reference point on the work-piece.

Standard functions

To use digifind one of the function keys must be assigned to the digifind function - see the section function keys

Setting the reference

Press the function key that has been assigned to digifind, (in this example the digifind has been assigned to the F4 key).
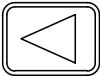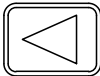
`F4`   ◁ ▷   `DIGI··   SET REF`   `ent / ≡`   `ST RF·· SEL AXIS`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires the reference setting.

Finding the reference

If the reference is lost at anytime it is possible to 'find' the reference again. Position the machine to within 6mm (0.2500")
band for Spherosyn and 2.5mm (0.1000") band for Microsyn. Press the function key that has been assigned to digifind, (in
this example the digifind has been assigned to the F4 key).

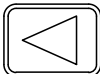`F4`   ◁ ▷   `DIGI·· FIND REF`   `ent / ≡`   `FD RF·· SEL AXIS`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires the reference to be found.

Finding zero

If the datum is lost at anytime it is possible to 'find' the datum again. Position the machine to within 6mm (0.2500") band for
Spherosyn and 2.5mm (0.1000") band for Microsyn. Press the function key that has been assigned to digifind, (in this exam-
ple the digifind has been assigned to the F4 key).

`F4`   ◁ ▷   `DIGI··   FIND 0`   `ent / ≡`   `FD 0·· SEL AXIS`

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires the reference setting.

The NMS300 can store up to 200 SDM (Sub-Datum) positions, or machining steps into the memory. Using SDM allows the
operator to work to zero by calling up stored dimensions, instead of "working up" to drawing dimensions. This eliminates the
need to constantly refer to the drawing, and reduces the possibility of scrapping parts due to misread dimensions. It also
speeds up positioning because the operator works to zero.
The SDMs are stored as co-ordinates relative to the current absolute / incremental datum position. If the absolute / incre-
mental datum position changes, the SDMs will "shift" to the new datum.
Once a repetitive sequence of co-ordinates is entered into SDM, the co-ordinates can be recalled at any time. The positions
remain in memory until altered by the operator. Simply assign any SDM number 1 - 200 to each machining step. When ma-
chining, call up each step (SDM) number and work to zero.
There are two ways to store Sub datums, Teach mode and program mode. See example on the next page:

To use sub datums one of the function keys must be assigned to the sub datum (SDM) function - see the section function
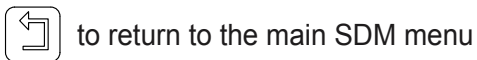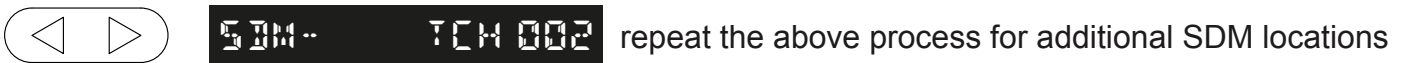keys

Standard functions

Teach Mode

To use sub datums one of the function keys must be assigned to the sub datum (SDM) function - see the section function keys

Press the function key that has been assigned to sub datums, (in this example the sub datum has been assigned to the F3 key).

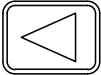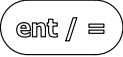| F3 | ◁ ▷ | `SDM··    TEACH` | ent / ≡ | `SDM··    TCH 001` |

Move the axis 'X', 'Y' and/or 'Z' to the 1st location   ent / ≡   `SDM··   CAPTURED`

◁ ▷   `SDM··    TCH 002`   repeat the above process for additional SDM locations

⤺   to return to the main SDM menu

Program Mode

Press the function key that has been assigned to sub datums, (in this example the sub datum has been assigned to the F3 key).

| F3 | ◁ ▷ | `SDM··    PROGRAM` | ent / ≡ | `SDM··    PRG 001` |

Press the axis select key ◁ next to the 'X', 'Y' or 'Z' axis that requires the position setting, enter the

dimension using the numeric keypad.   ent / ≡

Note: Pressing ce will delete all offset values displayed (Set to 0)

◁ ▷   `SDM··    PRG 002`   repeat the above process for additional SDM locations

⤺   to return to the main SDM menu

Delete Mode

Press the function key that has been assigned to sub datums, (in this example the sub datum has been assigned to the F3 key).

| F3 | ◁ ▷ | `SDM··    DELETE` | ent / ≡ | `no` | ◁ |

`SDM··    SURE`

`YES`

ent / ≡

`SDM··    SURE`   **Important note:** this will delete all the current data in all SDM's

Standard functions
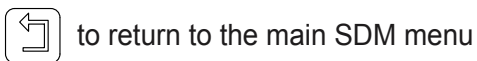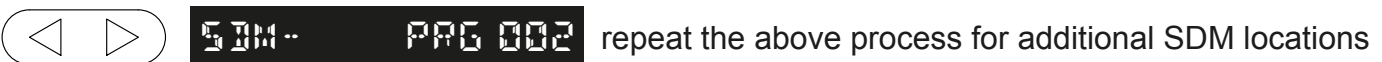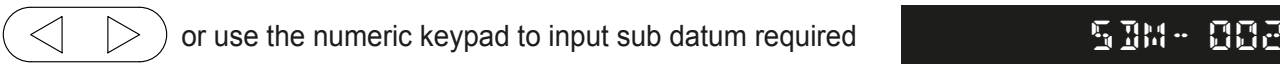
Use Mode

Press the function key that has been assigned to sub datums, (in this example the sub datum has been assigned to the F3 key).

| F3 | ◁ ▷ | SDM⁻   USE | ent / ≡ | SDM⁻ 001 |

| ◁ ▷ | or use the numeric keypad to input sub datum required | SDM⁻ 002 |

↰ to exit SDM use and return to SDM menu, or ☰ to exit setup and return to measurement display

The function can also be exited by pressing the function key that has been assigned to sub datums

Feed rate function

To use the feed rate function one of the function keys must be assigned to feed - see the section function keys

Press the function key that has been assigned to feed, (in this example feed has been assigned to the F2 key).

| F2 | FEED⁻   0 |

Important note: the feed rate will be shown for the fastest moving axis

Mill functions

PCD / bolt hole circle

To use PCD / bolt hole circle one of the function keys must be assigned to the PCD function - see the section function keys
Press the function key that has been assigned to PCD, (in this example the PCD has been assigned to the F2 key).

The NMS300 calculates positions for a series of equally spaced holes around the circumference of a circle. The message display prompts the user for various parameters it needs to do the calculations.

Once the NMS300 completes the calculations, the axis displays show the distance to each hole. The operator works to zero for each hole location. See example below.

| F2 | `125.250` `99.700` | Enter centre co-ordinate (see using set mode P20) |

`PCD-    CENTRE`   (ent / ≡)

`150.000` Enter diameter value (see using set mode P20)

`PCD-    DIAMETER`   (ent / ≡)

`5` Enter the number of holes (see using set mode P20)

`PCD-    HOLES`   (ent / ≡)

`18` Enter the start angle (see using set mode P20)

`PCD-    ANGLE`   (ent / ≡)

Important note: The PCD will be calculated from the 3 O'clock position, anti-clockwise. Enter the angle as a negative value if it is given as clockwise from the 3 O'clock position.

`PCD-    GO` At any stage the (◁ ▷) keys will move back and forth through the above menus to

make any further adjustments, if the settings are OK then press (ent / ≡)

`- 196.580` `- 122.880` `PCD-HOLE    1`

Navigate through the sequence of holes by using (◁ ▷)
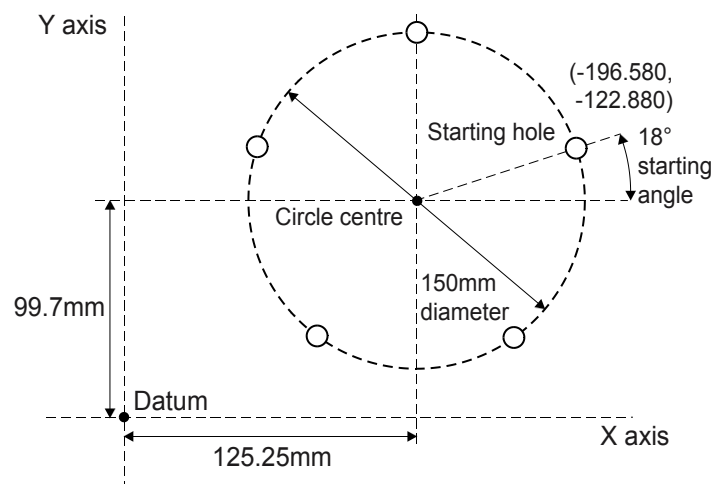
Alternatively use the numeric keypad to select the hole required.

The maximum number of holes for this function is 999

⌐ to exit PCD use and return to PCD menu, or

≡ to exit PCD and return to measurement display

The function can also be exited by pressing the function key that has been assigned to PCD

Y axis

(-196.580, -122.880)

Starting hole

18° starting angle

Circle centre

150mm diameter

99.7mm

Datum

X axis

125.25mm

Mill functions

Line hole

To use line hole one of the function keys must be assigned to the line hole function - see the section function keys
Press the function key that has been assigned to line hole, (in this example the line hole has been assigned to the F3 key).

The NMS300 calculates positions for a series of equally spaced holes in a line. The message display prompts the user for various parameters it needs to do the calculations.
Once the NMS300 completes the calculations, the axis displays show the distance to each hole. The operator works to zero for each hole location. See example below.

F3

```
       180.500
       200.000
LINE··      START
```
Enter starting co-ordinate (see using set mode P20)

(ent / ≡)

```
       350.000
LINE··      LENGTH
```
Enter total length of line (see using set mode P20)

(ent / ≡)

```
             9
LINE··      HOLES
```
Enter the number of holes (see using set mode P20)

(ent / ≡)

```
            20
LINE··      ANGLE
```
Enter the start angle (see using set mode P20)

(ent / ≡)
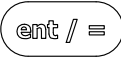
```
LINE··         GO
```
At any stage the (◁ ▷) keys will move back and forth through the above menus to make any further adjustments, if the settings are OK then press (ent / ≡)

```
     - 180.500
     -200.000
LINE·HOLE      1
```

Navigate through the sequence of holes by using (◁ ▷)

Alternatively use the numeric keypad to select the hole required.

The maximum number of holes for this function is 999

[icon] to exit line hole use and return to line hole menu, or

[icon] to exit line hole and return to measurement display

The function can also be exited by pressing the function key that has been assigned to line hole

Mill functions

Arc contouring

To use arc contouring one of the function keys must be assigned to the arc contouring function - see the section function keys
Press the function key that has been assigned to arc contouring, (in this example arc contouring has been assigned to the F4 key).

The NMS300 calculates positions for a series of equally spaced holes in an arc. The message display prompts the user for various parameters it needs to do the calculations.
Once the NMS300 completes the calculations, the axis displays show the distance to each hole. The operator works to zero for each hole location. See example below.

F4	ARC- CENTRE	Enter centre co-ordinate (see using set mode P20)	3.35000 / 2.36000 ent / ≡
	ARC- START	Enter start co-ordinate (see using set mode P20)	2.25000 / 4.82600 ent / ≡
	ARC- END	Enter end co-ordinate (see using set mode P20)	5.35000 / 4.17400 ent / ≡
	ARC- RADIUS	Enter the radius of the arc (see using set mode P20)	2.70000 ent / ≡
	ARC- TOOL DIA	Enter the tool diameter being used (see using set mode P20)	0.50000 ent / ≡
	ARC- MAX CUT	Enter the maximum cut required (see using set mode P20)	0.15000 ent / ≡
	ARC- CUT TYPE	Enter the cut type required (see using set mode P20)	int ent / ≡

ARC- GO At any stage the ◁ ▷ keys will move back and forth through the above menus to

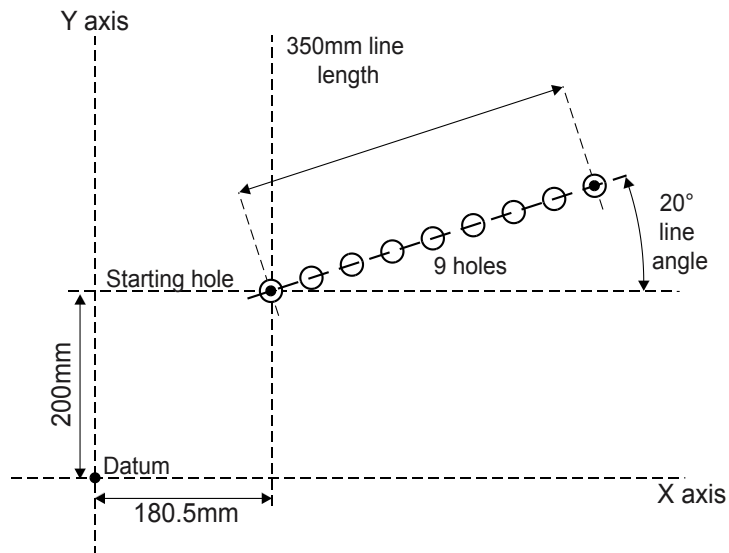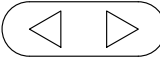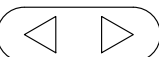make any further adjustments, if the settings are OK then press ent / ≡

-2.3520
-4.5974
ARC-HOLE 001

Navigate through the sequence of holes by using ◁ ▷

Alternatively use the numeric keypad to select the hole required.

The maximum number of holes for this function is 999

⬑ to exit line hole use and return to line hole menu, or

☰ to exit line hole and return to measurement display

The function can also be exited by pressing the function key that has been assigned to line hole

Y axis
0.15" max cut
4.826"
0.5" tool diameter
Ending point
4.174"
2.7"
2.36"
Radius Arc centre Internal cut
Datum
X axis
2.25" 3.35" 5.35"

Mill functions

Pocket / Island Milling

To use pocket milling one of the function keys must be assigned to the pocket milling function - see the section function keys
Press the function key that has been assigned to pocket milling, (in this example pocket milling has been assigned to the F1 key).

The NMS300 calculates positions for each corner of pocket / island required. The message display prompts the user for various parameters it needs to complete the calculations.
Once the NMS300 completes the calculations, the axis displays show the distance of each corner from the datum.
The operator works to zero to complete a circumference cut of the pocket / island. See example below.

F1	`350.000`	Enter centre co-ordinate (see using set mode P20)
	`400.000`	
	`PCNT-    CENTRE`	`ent / ≡`

| `200.000` | Enter height of the pocket / island required (see using set mode P20) |
| `PCNT-    HEIGHT` | `ent / ≡` |

| `200.000` | Enter width of the pocket / island required (see using set mode P20) |
| `PCNT-    WIDTH` | `ent / ≡` |

| `8.000` | Enter the tool diameter being used (see using set mode P20) |
| `PCNT-    TOOL DIA` | `ent / ≡` |

| `int` | Enter the cut type (see using set mode P20) |
| `PCNT-    CUT TYPE` | `ent / ≡` |

`PCNT-        GO`   At any stage the ◁ ▷ keys will move back and forth through the above menus to

make any further adjustments, if the settings are OK then press `ent / ≡`
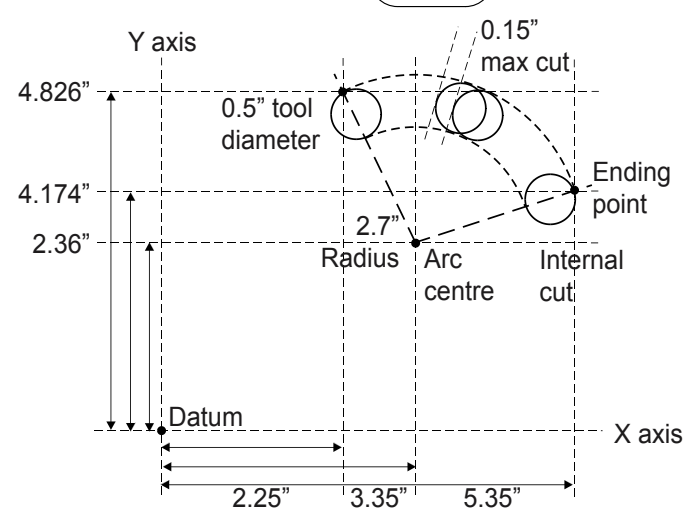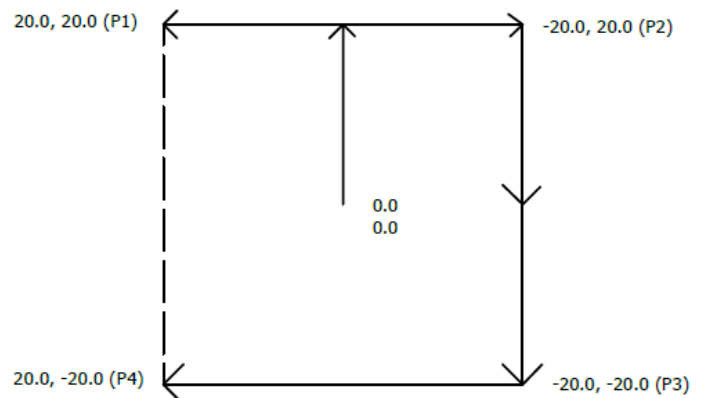
`-254.000`
`-304.000`
`PCNT-POINT    1`

Navigate through the sequence of corners by using ◁ ▷

Alternatively use the numeric keypad to select the corner required.
The number of pocket points will always be 4 it is expected the user
will reach point 4 and move on to point 1 to complete the pattern

⟲ to exit line hole use and return to line hole menu, or

≣ to exit line hole and return to measurement display

The function can also be exited by pressing the function key that has been assigned to line hole

```
20.0, 20.0 (P1)                          -20.0, 20.0 (P2)


                              0.0
                              0.0

20.0, -20.0 (P4)                        -20.0, -20.0 (P3)
```

Lathe functions

Tool Offsets

To use tool offsets one of the function keys must be assigned to the tool offset function - see the section function keys
Press the function key that has been assigned to tool offsets, (in this example tool offsets has been assigned to the F1 key).

The NMS300 can store up to 50 tool offsets, this large number allows tools to be grouped where more than one set is used. For convenience, it is highly recommended that tools are physically marked with their corresponding tool number. There are multiple ways to set tool offsets, teach mode, program mode and quick edit mode.
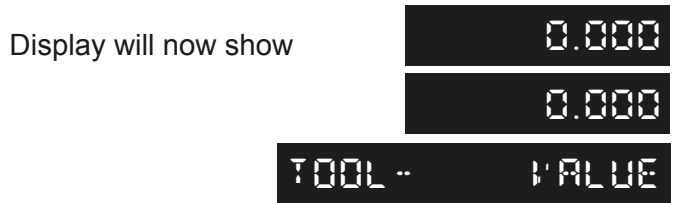**Note:** Once tools are enabled they stay enabled even when other functions are used

Teach Mode

[F1] [◁ ▷] `TOOL ·· TEACH` [ent / ≡] `TOOL ·· TCH 01` [◁ ▷]

to select different tool

take a skim cut with X and/or a face cut with Z [ent / ≡] to capture all axes `TOOL ·· CAPTURED`

Note: to capture a single axis press the axis select key instead of the enter key

Display will now show
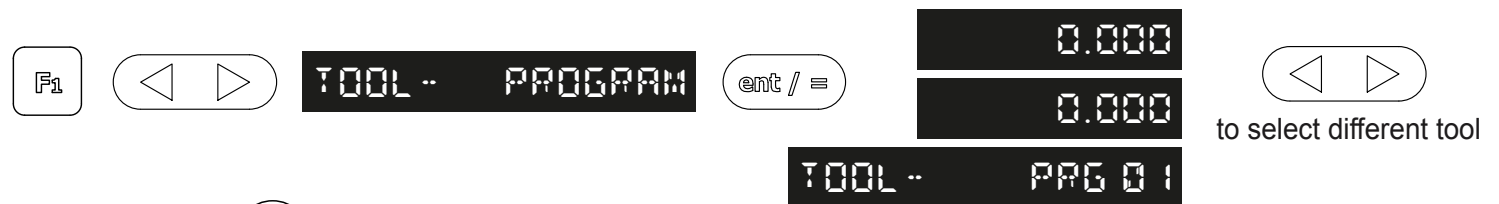
`0.000`
`0.000`
`TOOL ·· VALUE`

Note: at this point the tool can be moved away from the part

Measure the part with an accurate gauge and enter this value into the relevant axis (see using set mode P20)

Repeat the process above for all other tools required

[↩] to return to the previous tools menu, or [≡] to exit tools menu and return to measurement display

Program Mode

[F1] [◁ ▷] `TOOL ·· PROGRAM` [ent / ≡]

`0.000`
`0.000`
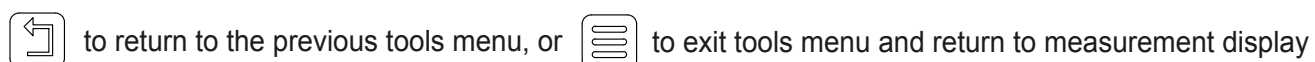`TOOL ·· PRG 01`

[◁ ▷]

to select different tool

Note: Pressing [ce] will delete all offset values displayed (Set to 0)

take a skim cut with X and/or a face cut with Z

Note: at this point the tool can not be moved away from the part
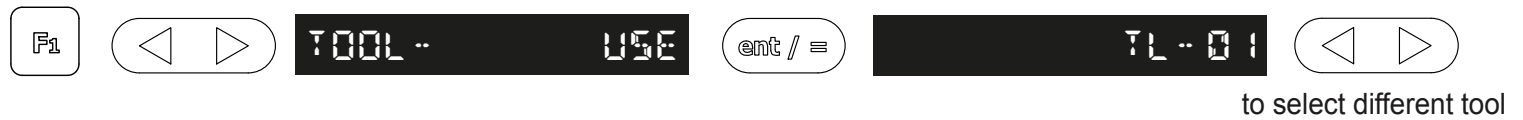
Measure the part with an accurate gauge and enter the difference between the measured diameter and the readout value into the relevant axis (see using set mode P20)

Repeat the process above for all other tools required

[↩] to return to the previous tools menu, or [≡] to exit tools menu and return to measurement display

Lathe functions

Use Mode

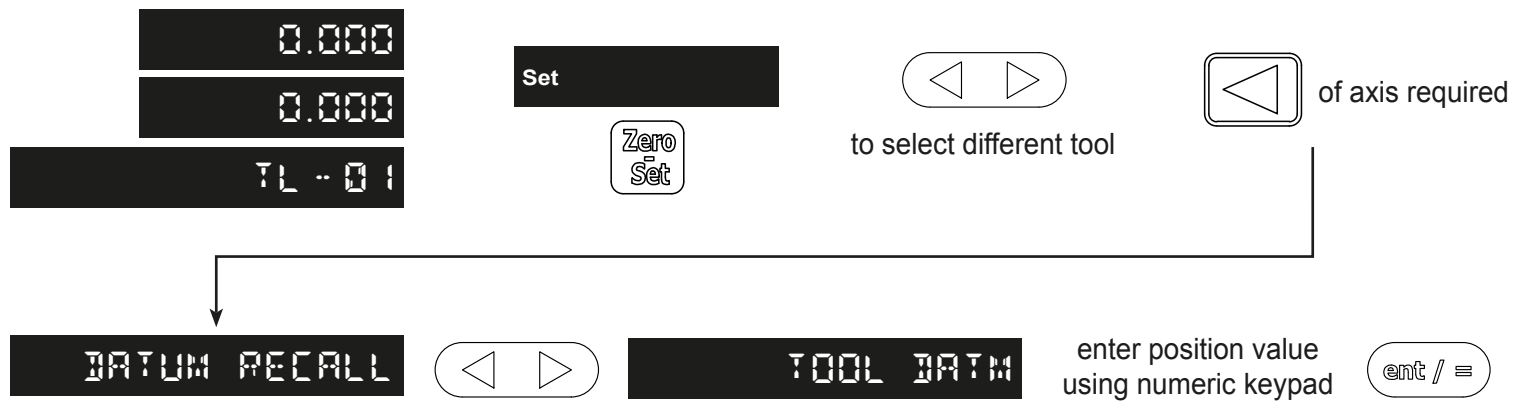F_1 → ◁ ▷ → `TOOL ·· USE` → ent / ≡ → `TL ·· 01` ◁ ▷

to select different tool

Note: Different tools can be selected by entering the tool number required using the numeric keypad

Quick Edit Mode

While in the using tool offsets mode tools can be edited / created quickly, without having to go back though the tool program or teach modes. The procedure to do this is demonstrated below:

`0.000`
`0.000`
`TL ·· 01`

Set
Zero Set

◁ ▷
to select different tool

◁ of axis required

`DATUM RECALL` ◁ ▷ `TOOL DATM` enter position value using numeric keypad ent / ≡

Repeat the above process for other axes or tools

Delete Mode

This function is designed to delete **ALL** the tool offsets, if one tool is to be changed quick tool edit should be used.

F_1 → ◁ ▷ → `TOOL ·· DELETE` → ent / ≡ → `no` / `TOOL ·· SURE` ◁
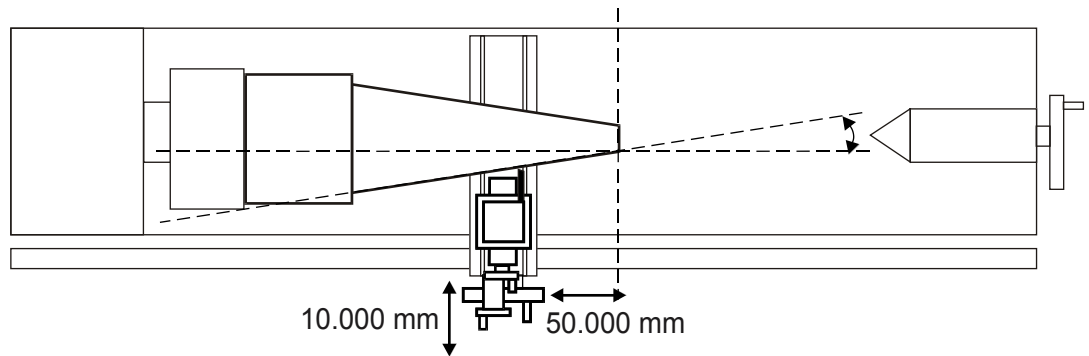
`YES`
`TOOL ·· SURE` ent / ≡

Lathe functions

To use taper one of the function keys must be assigned to the taper function - see the section function keys
Press the function key that has been assigned to taper, (in this example taper has been assigned to the F2 key).

The taper function shows the angular displacement of the displayed (X,Z) position.

F2   touch tool to one end of the taper and zero both axes, then touch the tool on the other end of the taper.

```
            10.000
            50.000
TAPER    11.30993
```


10.000 mm   50.000 mm

Trouble shooting guide

Symptom	Solution
The display is blank	• The NMS300 maybe in sleep mode. Press any key to exit sleep mode • Check that the power supply is correctly connected to a working mains outlet • Check that the power supply cables are not damaged • Check that the power supply voltage is 15 - 24Vdc ±10%
The display works, but resets from time to time without any keys being pressed.	Either the supply voltage is too low, or the power supply or mains supply has an intermittent fault. • Check that the power supply voltage is 15 - 24Vdc ±10%. • Check that all the connections are secure.
The display works, but gives erratic readings, the last digit jitters or the measurements jump to new figures unexpectedly.	There may be a poor earth (ground) connection. Both the NMS300, and the machine on which it is installed, must have proper earth (ground) connections. There may be a problem with the encoder.
The unit does not respond to any key presses.	Disconnect the NMS300 from its power supply, wait 15 seconds and then reconnect.
'NO Sig' / 'SIG FAIL' or '1.x' appears in the display.	This indicates that the unit is not receiving a proper signal from the encoder. • Check that the encoder connections are secure. • Check that there is no damage to the connectors or to the encoder. • Switch the NMS300 off and back on again. • Swap the encoder to another axis to confirm whether the encoder or the NMS300 is at fault.
Readings are incorrect.	• Check the Encoder Type to ensure it is correct. • Check the Radius / Diameter setting. The Diameter setting causes the axis to read double. • Check the Error Compensation factors. • If using the Segmented Error Compensation, verify the datum position. • Swap the encoder to another axis to confirm whether the encoder or the NMS300 is at fault. • Check that there is no damage to the encoder or its cable. • Check that the encoder is fixed firmly and aligned correctly, as described in the Spherosyn / Microsyn Installation manual. • Check that there is no binding on the scale. With the scale brackets slightly loosened, you should be able to slide the scale back and forth with minimal resistance. • If a Spherosyn300 scale is in use, check that the scale is not bent, by removing it and rolling it on a flat surface.
2.1 appears in the display	• This indicates that the encoder has travelled further than the maximum allowed travel This type of error can only be cleared by cycling the power to the NMS300.

If the solutions suggested above do not solve the problem, contact Newall for further instruction.

To swap encoders to trace a fault:
1. Check that the two axes are set to the correct encoder types.
2. Disconnect the NMS300 power supply.
3. Disconnect the encoder from the malfunctioning axis and move to a working axis.
4. Reconnect the NMS300 power supply and turn on.
If the fault stays with the same encoder, then the encoder is at fault. If the fault does not follow with the encoder the NMS300 is at fault.

Providing the machine has not been moved more than 6.3mm (0.25") for a Spherosyn300 encoder or 2.5mm (0.1") for a Microsyn300 encoder, switching the power off and back on again does not lose the datum position.

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CONTACT US

Americas
Newall Electronics Inc.
1803 OBrien Rd
Columbus, OH 43228
Tel: +1 614 771 0213
sales@newall.com
newall.com

Rest of World:
Newall Measurement Systems, Ltd.
Business Park, Unit 1 Wharf Way
Glen Parva, Leicester LE2 9UT
United Kingdom
Tel: +44 (0) 116 264 2730
sales@newall.co.uk
newall.co.uk

sensata.com/newall