



**HEIDENHAIN**



**User's Manual**

**ND 730**

**ND 770**

**Position Display Units  
for Lathes**

**Position display  
(ND 730 only two axes)**

- Select coordinate axis  
(ND 730 only X and Z)
- Select axis-based operating parameters

**Status display:**

SET = Set datum

REF = Blinking:

Traverse reference marks

Lighting:

Reference marks have been traversed

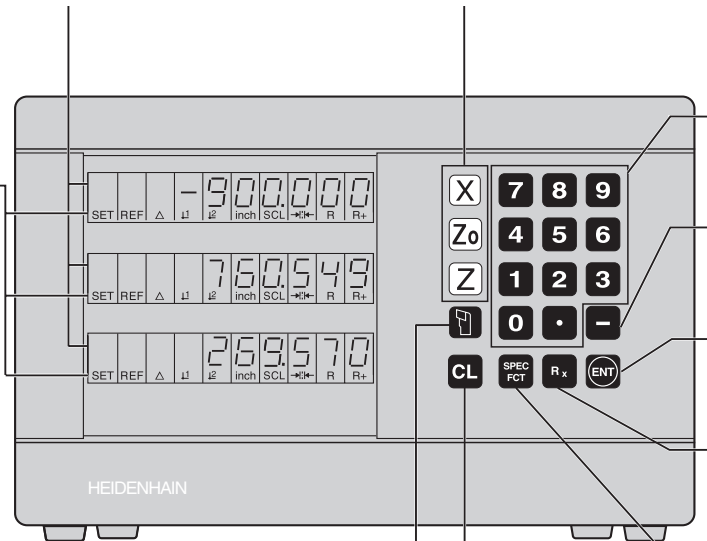
$\Delta$  = Distance-to-go

Inch = Inch display

SCL = Scaling factor

R = Radius/diameter display

T = Tool selected



**Numerical input**

- Change sign
- Call last dialog
- In parameter list:  
Change parameter
- Confirm entry
- Scroll forwards in parameter list

**Select radius/diameter display  
in X axis**

- Select special functions
- Scroll forwards in special functions list

- Tool compensation
- Scroll backwards in special functions list
- Scroll backwards in parameter list

- Abort entry
- Reset operating mode
- Reset selected axis to zero  
(if activated via P 80)
- Select parameter:  
CL plus two-digit number



This manual is for ND display units with the following software numbers or higher:

<b>ND 730 for two axes</b>	<b>AA00</b>
<b>ND 770 for three axes</b>	<b>AA00</b>

## About this manual!

This manual is divided into two parts:

### Part I: Operating Instructions:

- Fundamentals of positioning
- ND functions

### Part II: Installation and Specifications:

- Mounting the display unit on the machine
- Description of operating parameters

# Part I Operating Instructions

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## Fundamentals



You can skip this chapter if you are already familiar with coordinate systems, incremental and absolute dimensions, nominal positions, actual positions and distance-to-go!

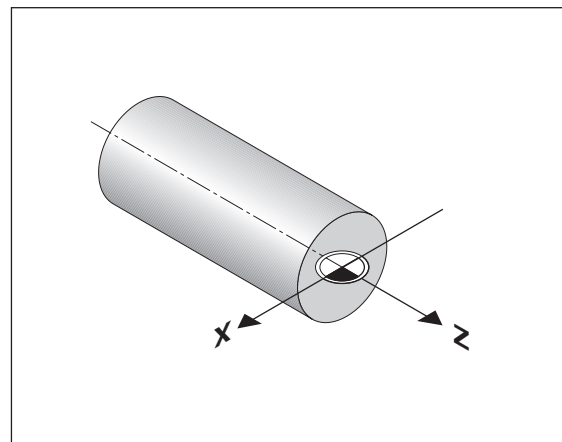
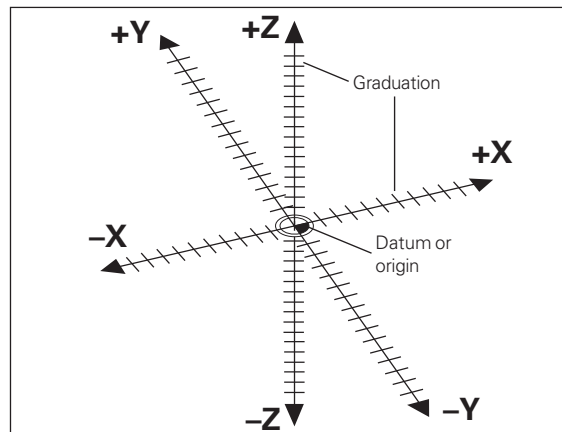
### Coordinate system

To describe the geometry of a workpiece, a rectangular or *Cartesian*<sup>1)</sup> coordinate system is used. The Cartesian coordinate system consists of three mutually perpendicular axes X, Y and Z. The point of intersection of these axes is called the **datum** or origin of the coordinate system.

Think of the axes as scales with divisions (usually in millimeters) that allow us to fix points in space referenced to the datum.

To determine positions on a workpiece, the coordinate system is “laid” onto the workpiece.

With lathe work (i.e. rotationally symmetrical workpieces), the Z axis moves along the axis of rotation, and the X axis moves in the direction of the radius or diameter. The Y axis can be disregarded since it would always have the same values as the X axis.

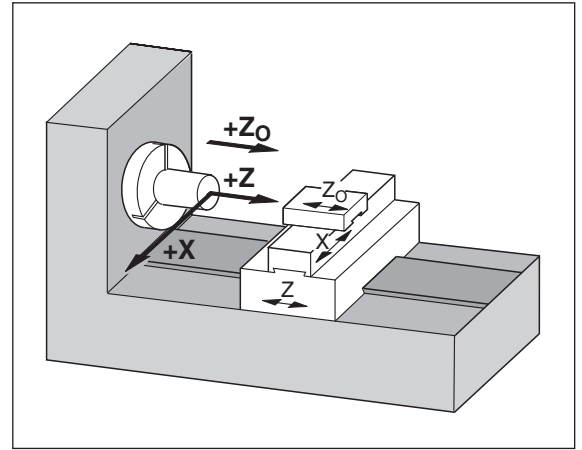


<sup>1)</sup> Named in honor of the French mathematician and philosopher René Descartes (1596 to 1650)

### Cross slide, saddle and top slide

On conventional lathes, the tool is mounted on a slide that moves in the direction of the X axis (the cross slide) and in the direction of the Z axis (the saddle).

Most lathes have a top slide above the saddle. The top slide moves in Z axis direction and is designated  $Z_0$ .



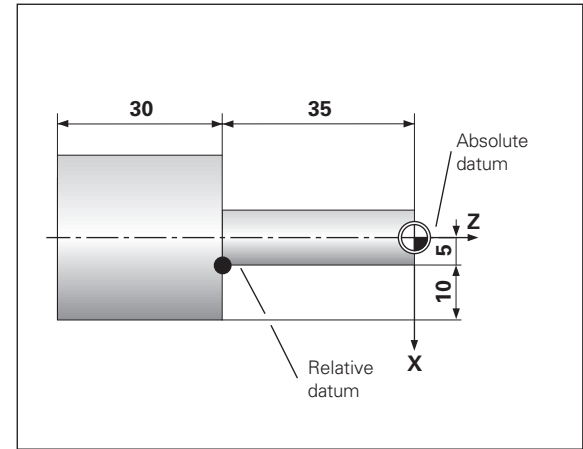
## Datum setting

The workpiece drawing is used as the basis for machining the workpiece. To enable the dimensions in the drawing to be converted into traverse distances of machine axes X and Z, each drawing dimension requires a datum or reference point on the workpiece (since a position can only be defined in relationship to another position).

The workpiece drawing always indicates **one** absolute datum (the datum for absolute dimensions). However, it may contain additional, relative datums.

In the context of a numerical position display unit, *datum setting* means bringing the workpiece and the tool into a defined position in relation to each other and then setting the axis displays to the value which corresponds to that position. This establishes a fixed relationship between the actual positions of the axes and the displayed positions.

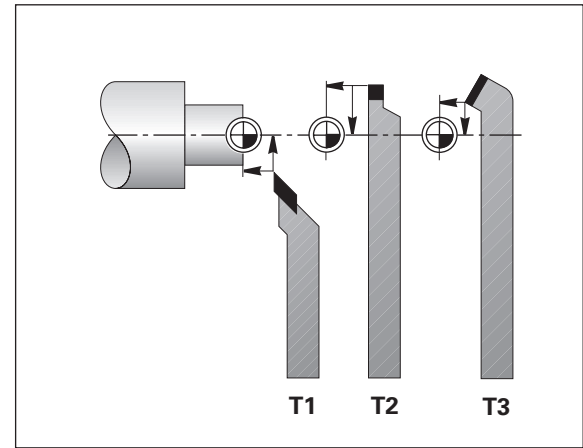
With the ND, you can set one absolute datum point and as many as 9 relative datum points (tool datums), and store them in nonvolatile memory.



## Tool datums (tool compensation)

Your display unit should show you the absolute position of the workpiece, regardless of the length and shape of the particular tool being used. For this reason you must determine the tool data and enter it. First touch the workpiece with the cutting edge of the tool and then enter the associated display value for that position.

You can enter tool data for up to 9 tools. When you have set the absolute workpiece datum for a new workpiece, all tool data (= relative datum points) are referenced to the new workpiece datum.



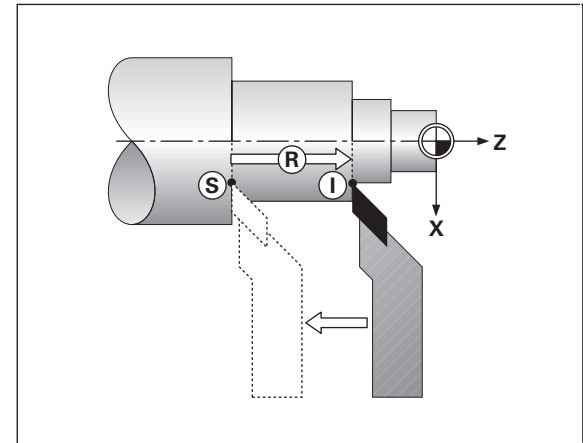
## Nominal position, actual position and distance-to-go

The positions to which the tool is to move are called the **nominal** positions (Ⓢ). The position at which the tool is actually located at any given moment is called the **actual** position (Ⓛ).

The distance from the nominal position to the actual position is called the distance-to-go (Ⓜ).

## Sign for distance-to-go

When you are using the distance-to-go display, the nominal position becomes the relative datum (display value 0). The distance-to-go is therefore negative when you move in the positive axis direction, and positive when you move in the negative axis direction.



## Absolute workpiece positions

Each position on the workpiece is uniquely defined by its absolute coordinates.

**Example** Absolute coordinates of position ①:

$$X = 5 \text{ mm}$$

$$Z = -35 \text{ mm}$$

If you are working according to a workpiece drawing with absolute dimensions, you are moving the tool **to** the coordinates.

## Relative workpiece positions

A position can also be defined relative to the previous nominal position. The datum for the dimension is then located at the previous nominal position. Such coordinates are termed **relative coordinates** or chain dimensions. Incremental coordinates are indicated by a preceding **I**.

**Example** Relative coordinate of position ② referenced to position ①:

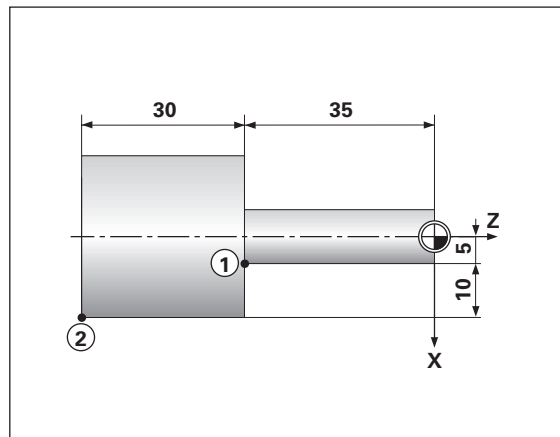
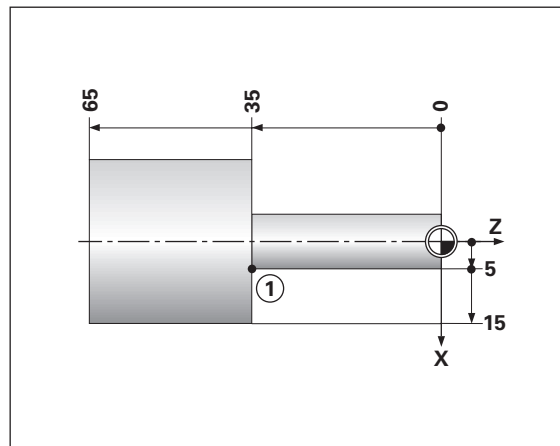
$$IX = 10 \text{ mm}$$

$$IZ = -30 \text{ mm}$$

If you are working according to a workpiece drawing with incremental dimensions, you are moving the tool **by** the dimensions.

## Sign for incremental dimensioning

A relative dimension has a **positive** sign when the axis is moved in the positive direction, and a **negative** sign when it is moved in the negative direction.

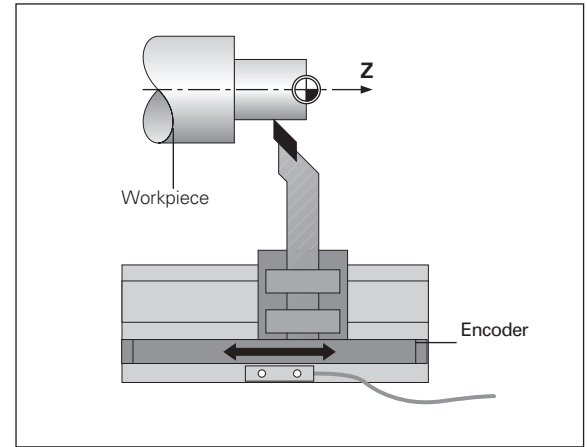




## Position encoders

The position encoders on the machine convert the movements of the machine axes into electrical signals. The ND display unit evaluates these signals, determines the actual position of the machine axes and displays the position as a numerical value.

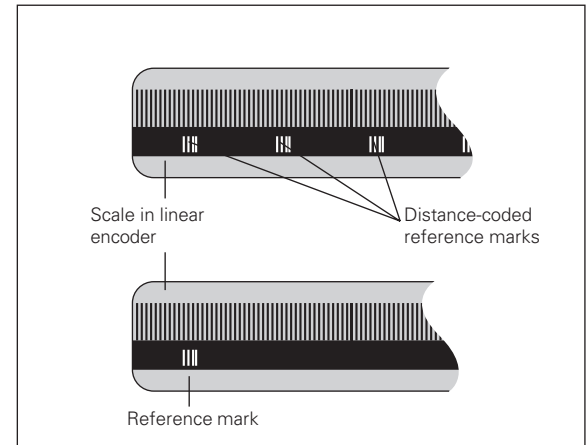
If the power is interrupted, the relationship between the machine axis positions and the calculated actual positions is lost. The reference marks on the position encoders and the REF reference mark evaluation feature enable the ND to quickly re-establish this relationship again when the power is restored.



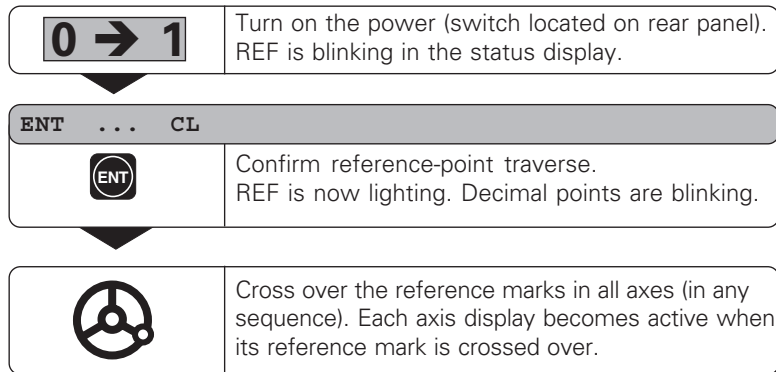
## Reference marks

The scales of the position encoders contain one or more reference marks. When a reference mark is crossed over, a signal is generated identifying that position as a reference point (scale datum = machine datum).

When this reference mark is crossed over, the ND's reference mark evaluation feature restores the relationship between axis slide positions and display values as you last defined it by setting the datum. If the linear encoders have **distance-coded** reference marks, you need only move the machine axes a maximum of 20 mm to restore the datum.



## Switch-On, Reference-Mark Traverse



Crossing over the reference marks stores the last relationship between axis slide positions and display values for all datum points in nonvolatile memory.

Note that if you choose not to cross over the reference marks (by clearing the dialog ENT ... CL with the CL key), this relationship will be lost if the power is switched off or otherwise interrupted!



You must cross over the reference marks if you want to use the multipoint axis error compensation function. (See "Multipoint Axis Error Compensation")

## Selecting Radius or Diameter Display

Your ND can display positions in the cross slide as a diameter or as a radius. Drawings of lathe parts usually indicate diameters. When you are turning the part, however, you infeed the tool in the cross slide axis in radius values.

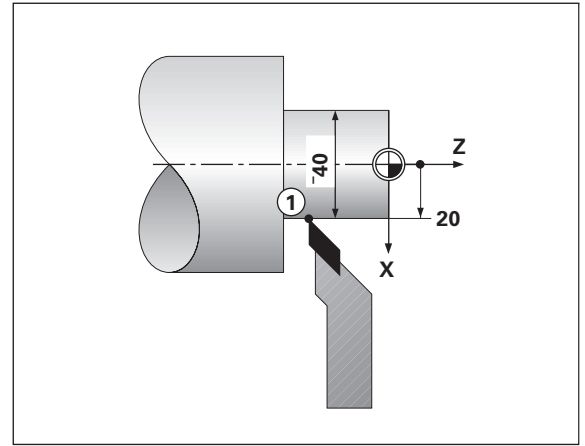
**Example:**      Radius display position ①       $X = 20 \text{ mm}$   
                    Diameter display position ②       $X = 40 \text{ mm}$

### To switch the display:

► Press 



When radius display for the X axis is selected,  $R_X$  lights up.  
When diameter display is selected,  $R_X$  goes out.



## Separate Value/Sum Display (ND 970 only)

### Separate value display

In this mode the positions of the saddle and top slide are displayed separately. The position displays are referenced to the datum points that you set for the  $Z_0$  and  $Z$  axes. When an axis slide moves, only the position display for that axis changes.

### Sum display

In this mode the position values of both axis slides are added together. The sum display shows the absolute position of the tool, referenced to the workpiece datum.

<b>Example</b>	Separate value display:	$Z = +25.000 \text{ mm}$
		$Z_0 = +15.000 \text{ mm}$
	Sum display:	$Z_S = +40.000 \text{ mm}$



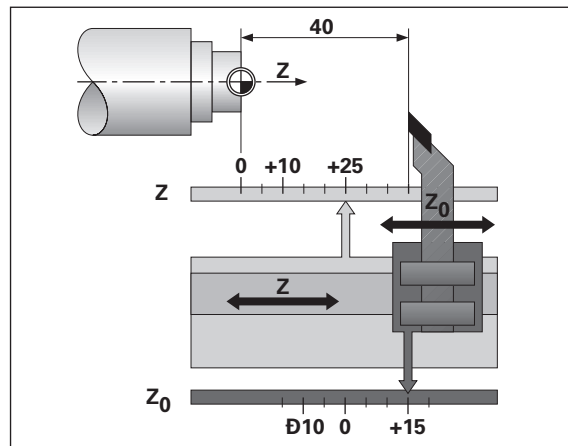
The sum display will only show correct values if the actual position values of both axis slides were correctly added and entered (with sign) when setting the datum for the "sum."

### To switch the display

- Sum display: Press the keys  $Z_0$  and  $Z$  at the same time.
- Separate value display: Press the key  $Z_0$ .



When the ND 770 displays sums, the  $Z_0$  display is switched off.



## Datum Setting

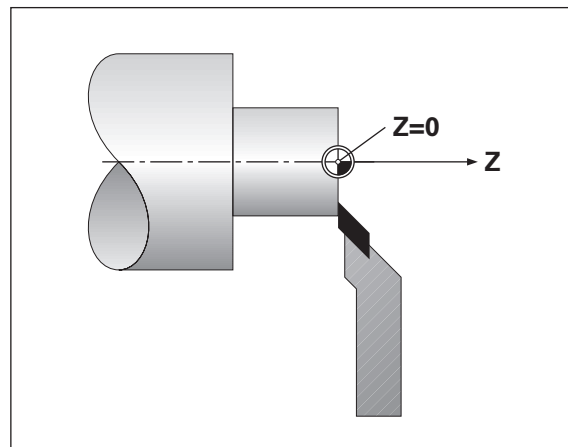


- If you want datum points to be stored in nonvolatile memory, you must first cross over the reference marks.
- Note that the correct value to be entered for the datum in the X axis depends on whether you have selected radius or diameter display.

With the ND 730/ND 770 position displays, you can set **one** absolute workpiece datum and data for up to 9 tools (relative datums).

### Setting the absolute workpiece datum

When you enter a new value for the absolute workpiece datum, all tool data are then based on the new workpiece datum.



Touch the workpiece end face with the tool.

Z


Select the axis, SET begins to blink


0 ENT


Enter the position of the tool tip, e.g. 0 mm.  
Confirm with ENT.

Enter further axes in the same way.




## Entering tool data (relative datums)


	Select tool, T begins to blink.
---	---------------------------------

<b>3</b> 	Enter tool number, e.g. 3, and confirm with ENT.
--	--


	Touch the workpiece with the tool.
---	------------------------------------


	Select Special Functions.
---	---------------------------


  	Select the Tool Set function. The decimal point beside "T" and the decimal points beneath it begin to blink.
---	--


<b>TOOL SET</b>	
<b>Z</b> <b>0</b> 	Select the axis (for example Z), enter the position of the tool tip (for example 0 mm), and confirm with ENT.

⋮

	Touch the workpiece or turn the first diameter.
--	---

<b>X</b> <b>2</b> <b>0</b> 	Select the axis (for example X), enter the position of the tool tip (for example 20 mm), and confirm with ENT.
---	--

	To set additional tools, change the tool, select a new tool number and enter the data for the next tool.
---	--








 or <b>CL</b>	End the function.
--	-------------------

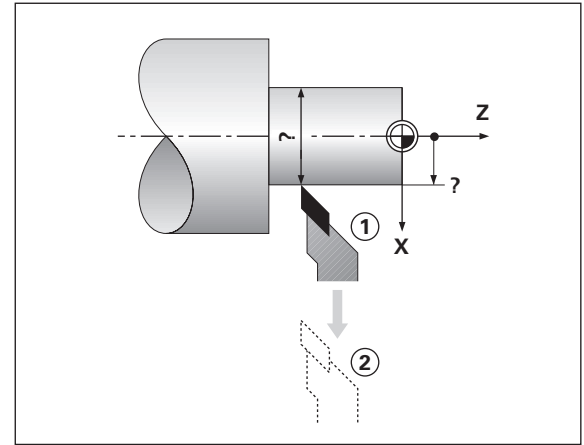


When you work with the sum display, also set the tool data when the sum display is active (ND 770 only)!

## Holding Positions

If you want to measure the workpiece after turning the first diameter, your display unit has to capability to “freeze” (hold) the actual position before you retract the tool.

	Turn the first diameter, for example in the X axis.
	Select Special Functions.
 	Select the Hold Position function.
<b>POS . HOLD</b>	
e.g.  	Select the axis whose position is to be held and confirm with ENT.
	Retract the tool. The X axis display remains stopped. Measure the workpiece.
⋮	



▼  
e.g. **1** **2** **ENT** Enter the measured position, for example 12 mm,  
and confirm with ENT. The display shows the  
current tool position.










▼  
**SPEC**  
**FCT** or **CL** End the function.

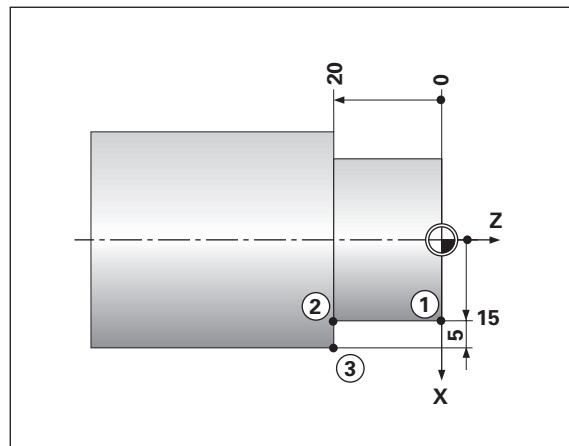


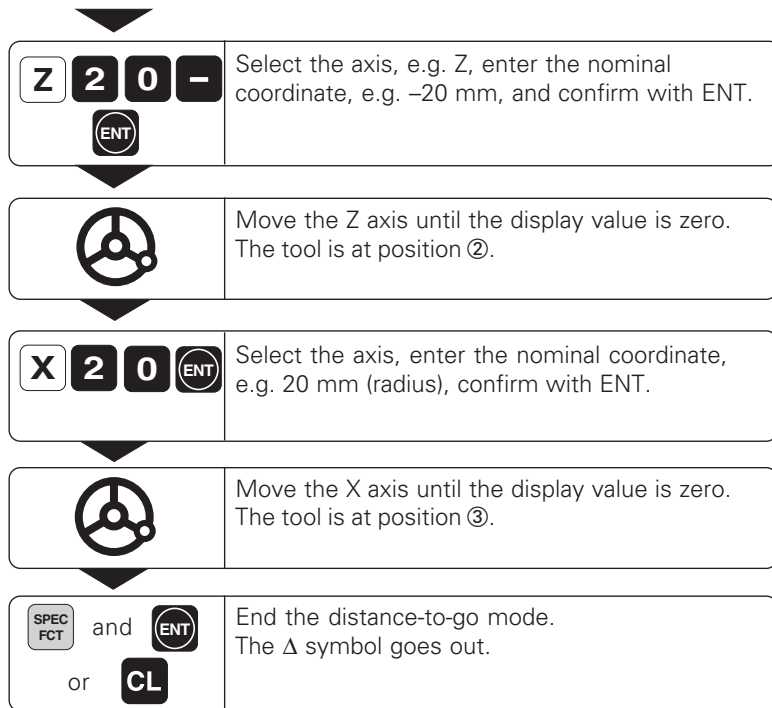
## Moving the Axes with the Distance-To-Go Display

Normally, the display shows the actual position of the tool. However, it is often more helpful to display the remaining distance to the nominal position (distance-to-go). You can then position simply by moving the axis until the display value is zero.

### Application example: Finish turning a shoulder by traversing to zero

	Select Special Functions.
 or 	Select Delta Mode.
<b>DELTA MODE</b>	
	Confirm the distance-to-go, $\Delta$ lights up.
   	Select the axis, e.g. X, enter the nominal coordinate, e.g. 15 mm (radius), confirm with ENT.
	Move the X axis until the display value is zero. The tool is at position ①.
⋮	



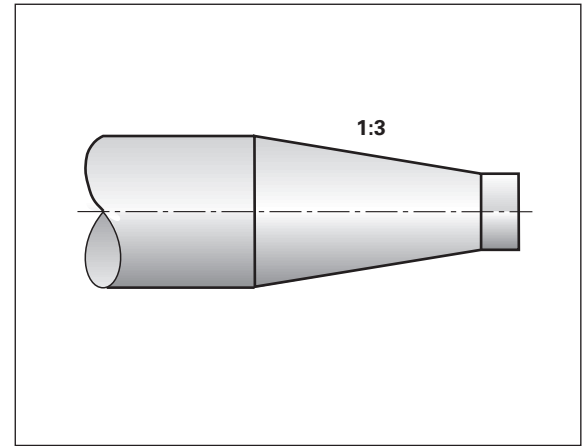
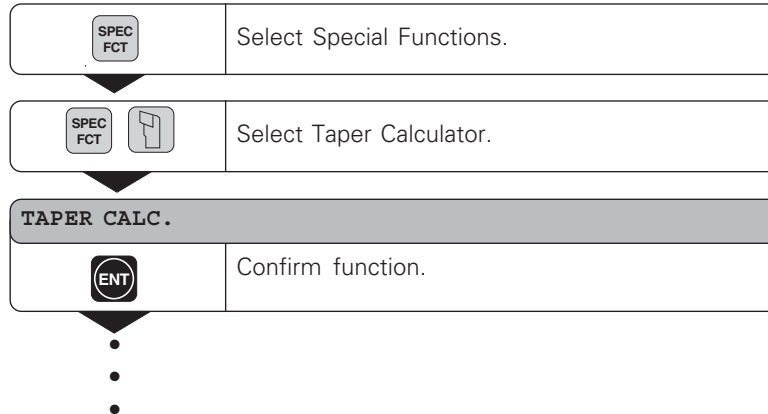


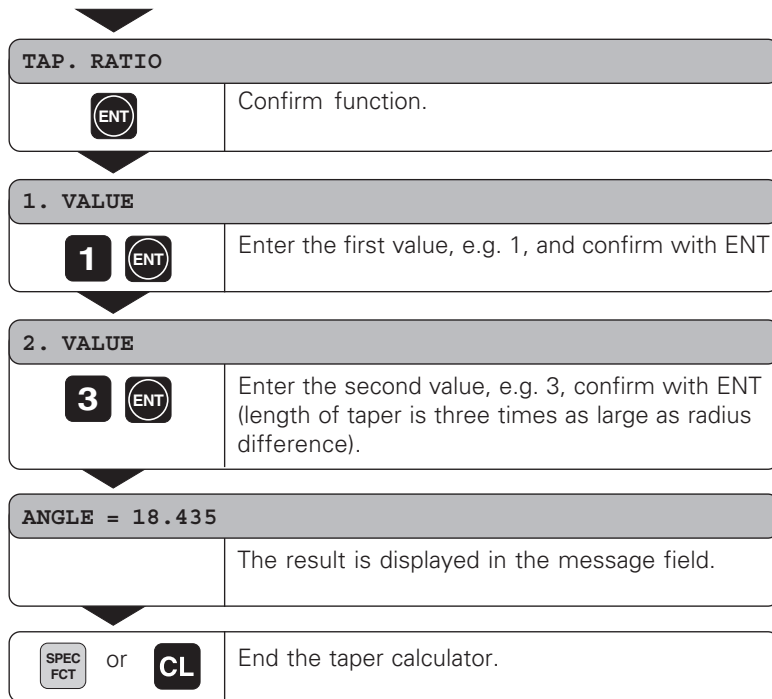
## Taper Calculator

The taper calculator enables you to calculate the angle for the top slide. There are two possibilities:

- Calculation from the taper ratio:
  - Difference between the taper radii to the length of the taper
- Calculation from two diameters and the length:
  - Starting diameter
  - Final diameter
  - Length of the taper

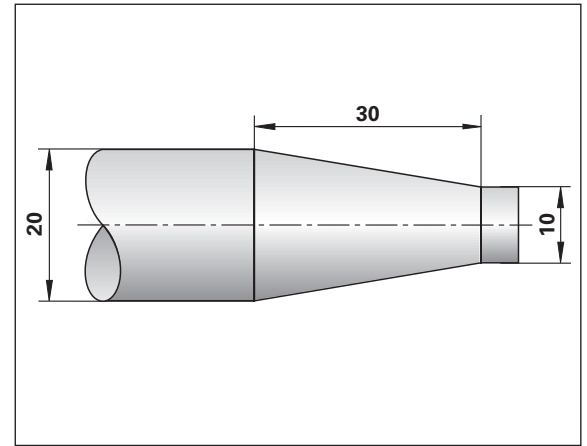
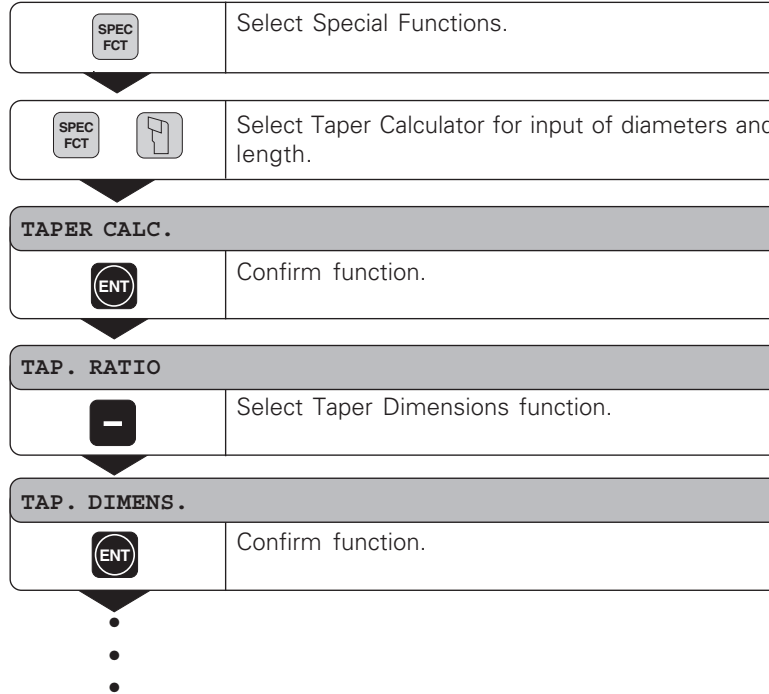
### Calculation from the taper ratio





You can change entered values later by selecting them with the ENT key or the TOOL key.

## Calculation from two diameters and the length



  
DIA. RIGHT1 0 

Enter value, e.g. 10 mm, confirm with ENT.

DIA. LEFT

2 0 

Enter value, e.g. 20 mm, confirm with ENT.

LENGTH

3 0 

Enter value, e.g. 30 mm, confirm with ENT.

ANGLE = 9.462

The result is displayed in the message field.



or



End the taper calculator.



You can change entered values later by selecting them with the ENT key or the TOOL key.

## Error Messages

Message	Cause and Effect
<b>SIGNAL X</b>	The encoder signal is too weak. The scale may be contaminated.
<b>ERR. REF. X</b>	The spacing of the reference marks as defined in P43 is not the same as the actual spacing.
<b>FRQ. ERR. X</b>	The input frequency for this encoder input is too high. This can occur when the scale is moved too fast.
<b>ERR. MEMORY</b>	Checksum error! Check the datum, operating parameters and compensation values for multipoint axis-error compensation. If this error recurs, contact your service agency.

### To clear error messages

When you have removed the cause of the error:

- press the CL key.

## Part II Installation and Specifications

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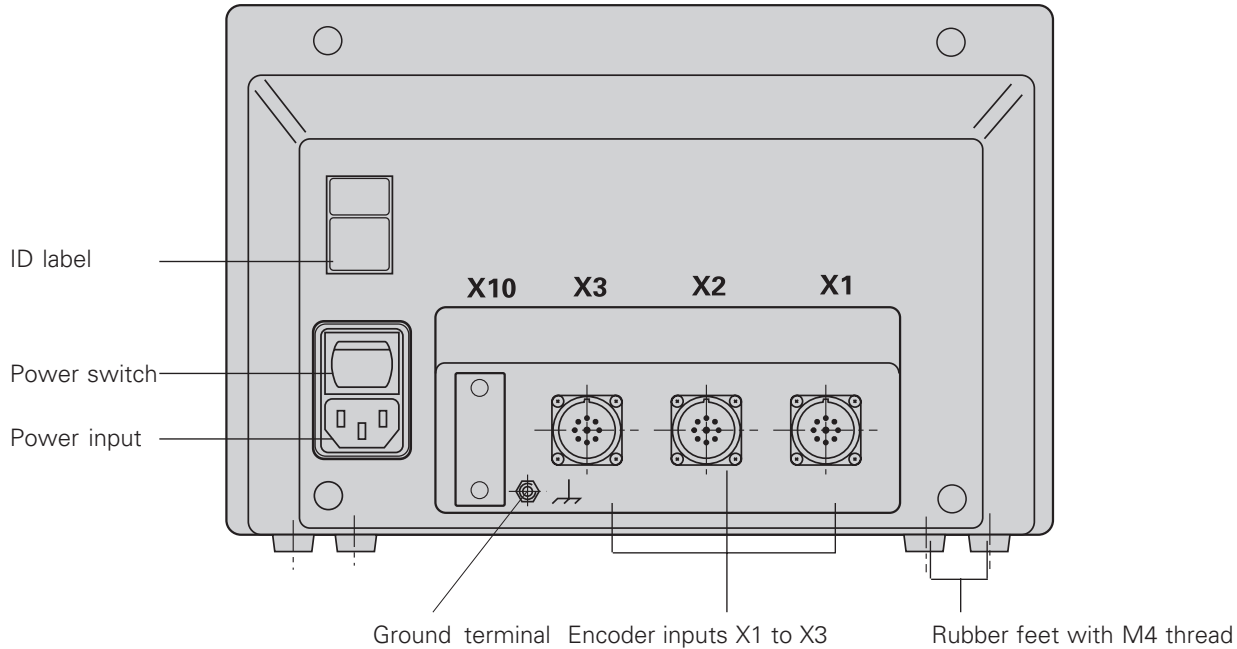
## Items Supplied

- **ND 730** for 2 axes  
or
- **ND 770** for 3 axes
- **Power connector** Id. Nr. 257 811-01
- **User's Manual**

## Optional Accessories

- **Tilting base** for mounting on underside of housing  
Id. Nr. 281 619-01

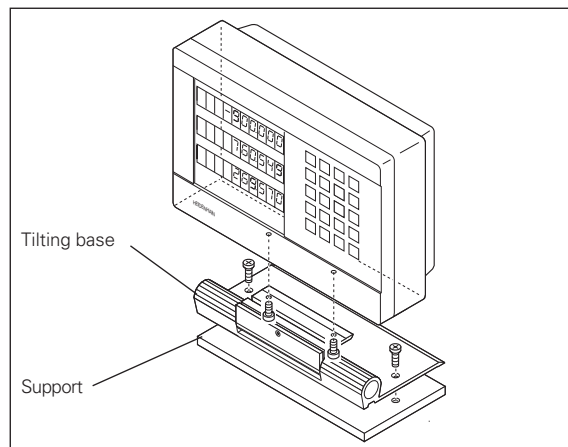
## Connections on Rear Panel



Connections X1, X2, X3 meet the regulations for safe separation from line power according to EN 50178!

## Mounting

To mount the display unit on a support, use the M4 threaded holes in the rubber feet. You can also mount the display unit on the optional tilting base.



## Power Connection

Hot leads (L) and (N)

Protective ground (⊕)



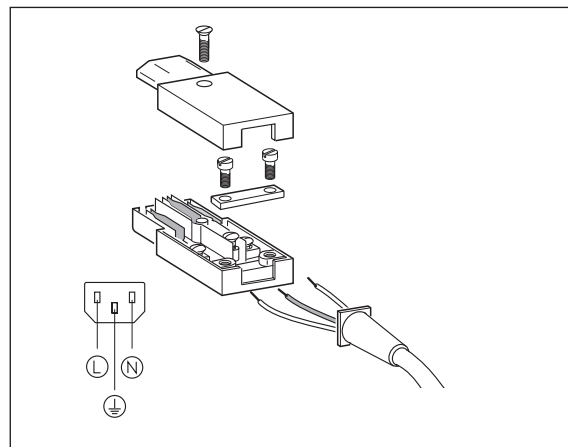
- **Danger of electrical shock!**

Connect a protective ground. This connection must never be interrupted.

- Unplug the power cord before opening the housing.



To increase the noise immunity, connect the ground terminal on the rear panel to the central ground point of the machine (minimum cross-section: 6 mm<sup>2</sup>).



The display unit will operate over a voltage range of 90 Vac to 260 Vac. A voltage selector is not necessary.

## Connecting the Encoders

Your display unit will accept all HEIDENHAIN linear encoders with sinusoidal output signals (7 to 16  $\mu\text{A}_{\text{pp}}$ ) and distance-coded or single reference marks.

### Assignment of the encoder inputs for the ND 730

Encoder input X1 is for the X axis

Encoder input X2 is for the Z axis

### Assignment of the encoder inputs for the ND 770

Encoder input X1 is for the X axis

Encoder input X2 is for the Zo axis

Encoder input X3 is for the Z axis

### Encoder monitoring

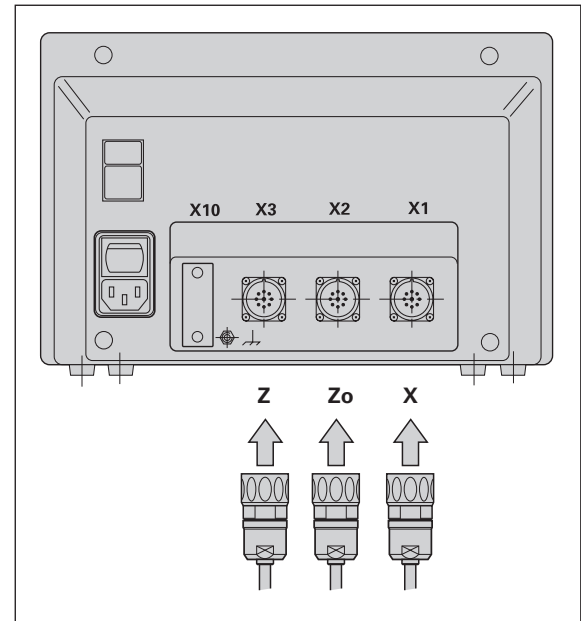
Your display unit features a monitoring system for checking the amplitude and frequency of the encoder signals. If it detects a faulty signal, one of the following error messages will be generated:

```
SIGNAL X  
FRQ. ERR. X
```

Encoder monitoring can be activated with parameter 45.

If you are using linear encoders with distance-coded reference marks, the encoder monitoring system also checks whether the spacing of the reference marks as defined in parameter P43 is the same as the actual spacing on the scales. If it is not, the following error message will be generated:

```
ERR. REF. X
```



## Operating Parameters

Operating parameters allow you to modify the operating characteristics of your display unit and define the evaluation of the encoder signals. Operating parameters that can be changed by the user are called user parameters, and can be accessed with the SPEC FCT key and the dialog PARAMETER (user parameters are identified as such in the parameter list). The full range of parameters can only be accessed via the dialog "CODE" and input of the code number 95148.

Operating parameters are designated by the letter P and a number. Example: **P11**. The parameter designation is shown in the X display when a parameter is selected with the TOOL and ENT keys.

The parameter setting is shown in the Z = ND 730/  
Zo = ND 770 display.

Some operating parameters have separate values for each axis. Such parameters have an additional index number from 1 to 3 with the **ND 770** and from 1 to 2 with the **ND 730**.

**Example:** P12.1 scaling factor, X axis  
P12.2 scaling factor Zo axis (only ND 770)  
P12.3 scaling factor, Z axis

The operating parameters are preset before the unit leaves the factory. These factory settings are indicated in the parameter list in **boldface type**.

## Entering/changing operating parameters

### Calling operating parameters

- Press the SPEC FCT key
- Press SPEC FCT or TOOL until "PARAMETER" is displayed in X.
- Confirm with ENT.
- If you wish, use the TOOL key to select the dialog for entering the code number **95148** to access the full range of operating parameters.

### Scrolling through the operating parameter list

- Scroll forwards: Press the ENT key.
- Scroll backwards: Press the TOOL key.

### Changing parameter settings

- Press the minus key or enter the value and confirm with the ENT key.

### Correcting an entry

- Press CL. This restores the old value.

### Exiting the operating parameters

- Press SPEC FCT or CL.

**List of operating parameters****P1 Unit of measurement** <sup>1)</sup>

Display in millimeters	MM
Display in inches	INCH

**P3.1 to P3.3 Radius/diameter display** <sup>1)</sup>

Display position value as radius	<b>RADIUS</b>
Display position value as diameter	DIAMETER

**P11 Activate scaling factor** <sup>1)</sup>

Scaling factor active	SCALING ON
Not active	<b>SCALING OFF</b>

**P12.1 to P12.3 Enter scaling factor** <sup>1)</sup>

Enter a scaling factor separately for each axis:	
Entry value > 1: workpiece will "grow"	
Entry value = 1: workpiece will remain the same size	
Entry value < 1: workpiece will "shrink"	
Input range:	0.111111 to 9.999999
Factory setting:	<b>1</b>

**P30.1 to P30.3 Counting direction**

Positive counting direction with positive direction of traverse	<b>DIRECT. POS</b>
Negative counting direction with positive direction of traverse	DIRECT. NEG

**P32.1 to P32.3 Subdivision of the encoder signals**

1024 / 1000 / 800 / 512 / 500 / 400 / 256 / 200
128 / 100 / 80 / 64 / 50 / 40 / <b>20</b> / 10 / 8 / 5 / 4 / 2 / 1 / 0.8 / 0.5 / 0.4 / 0.2 / 0.1

**P33.1 to P33.3 Counting step**

0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9
0 - 2 - 4 - 6 - 8
0 - 5

**P38.1 to P38.3 Decimal places**

1 / 2 / 3 / 4 / 5 / 6 (up to 8 with inches display)
---

**P40.1 to 40.3 Define axis error compensation**

Axis error compensation not active	<b>CORR. OFF</b>
Linear axis error compensation active	CORR. LIN
Multipoint axis error compensation active	CORR. ABS
(See "Multipoint Axis Error Compensation")	

<sup>1)</sup> User parameter

**P41.1 to P41.3 Linear axis error compensation**

Linear axis error compensation is activated via parameters 40.1 to 40.3.

Input range [ $\mu\text{m}$ ]:  $-99999$  to  $+99999$

Default setting:  $0$

**Example:** Displayed length  $L_a = 620.000$  mm  
Actual length (as determined for example with the VM 101 from HEIDENHAIN)

$L_a = 619.876$  mm

Difference  $\Delta L = L_a - L_d = -124$   $\mu\text{m}$

Compensation factor k:

$k = \Delta L/L_d = -124$   $\mu\text{m}/0.62$  m = **-200** [ $\mu\text{m}/\text{m}$ ]

**P43.1 to P43.3 Reference marks**

One reference mark SINGLE REF.

Distance-coded with 500 • SP 500 SP

Distance-coded with 1000 • SP **1000 SP**

Distance-coded with 2000 • SP 2000 SP

Distance-coded with 5000 • SP 5000 SP

(SP = signal period)

**P44.1 to P44.3 Reference mark evaluation**

Evaluation active **REF. X ON**

Evaluation not active REF. X OFF

**P45.1 to P45.3 Encoder monitoring**

Amplitude and frequency monitoring active **ALARM ON**

Amplitude and frequency monitoring not active ALARM OFF

**P48.1 to P48.3 Activate axis display**

Axis display active **AXIS ON**

Axis display not active AXIS OFF

**P80 Function of CL key**

Reset with CL CL...RESET

No reset with CL CL.....OFF

**P98 Dialog language<sup>1)</sup>**

German	<b>LANGUAGE</b>	<b>D</b>
English	LANGUAGE	GB
French	LANGUAGE	F
Italian	LANGUAGE	I
Dutch	LANGUAGE	NL
Spanish	LANGUAGE	E
Danish	LANGUAGE	DK
Swedish	LANGUAGE	S
Finnish	LANGUAGE	FI
Czech	LANGUAGE	CZ
Polish	LANGUAGE	PL
Hungarian	LANGUAGE	H
Portuguese	LANGUAGE	P

<sup>1)</sup> User parameter

## Linear Encoders

### Setting the display step with linear encoders

The display step depends on the:

- Subdivision (P32)
- Counting step (P33)
- Decimal places (P38)

#### Example

Linear encoder with signal period 10  $\mu\text{m}$

Required display step ..... 0.000 5 mm

Subdivision (P32) ..... 20

Counting step (P33) ..... 5

Decimal places (P38) ..... 4

The tables on this page and the next pages will help you selecting your parameters.

### Display step, signal period and subdivision for linear encoders

Display step		Signal period [ $\mu\text{m}$ ]								
		2	4	10	20	40	100	200	12 800	
[mm]	[inch]	P32: Subdivision								
0,000 005	0,000 000 2	400	-	-	-	-	-	-	-	-
0.000 01	0.000 000 5	200	-	-	-	-	-	-	-	-
0.000 02	0.000 001	100	-	-	-	-	-	-	-	-
0.000 05	0.000 002	40	80	-	-	-	-	-	-	-
0.000 1	0.000 005	20	40	100	200	-	-	-	-	-
0.000 2	0.000 01	10	20	50	100	-	-	-	-	-
0.000 5	0.000 02	4	8	<b>20</b>	40	80	-	-	-	-
0.001	0.000 05	2	4	10	20	40	100	-	-	-
0.002	0.000 1	1	2	5	10	20	50	100	-	-
0.005	0.000 2	0.4	0.8	2	4	8	20	40	-	-
0.01	0.000 5	0.2	0.4	1	2	4	10	20	-	-
0.02	0.001	-	-	0.5	1	2	5	10	-	-
0.05	0.002	-	-	0.2	0.4	0.8	2	4	256	-
0.1	0.005	-	-	0.1	0.2	0.4	1	2	128	-
0.2	0.01	-	-	-	-	-	-	-	64	-



Parameter settings for HEIDENHAIN linear encoders with 11  $\mu\text{A}_{pp}$  signals

Model	Signal period [ $\mu\text{m}$ ]	Reference marks	Millimeters				Inches			
			Display step [mm]	Subdi- vision	Count	Decimal places	Display step [inch]	Subdi- vision	Count	Decimal places
CT MT xx01 LIP 401A/401R	2	single	0,0005	4	5	4	0,00002	4	2	5
-/single		0,0002	10	2	4	0,00001	10	1	5	
			0,0001	20	1	4	0,000005	20	5	6
			0,00005	40	5	5	0,000002	40	2	6
			<i>Recommended only for LIP 401</i>							
			0,00002	100	2	5	0,000001	100	1	6
			0,00001	200	1	5	0,0000005	200	5	7
			0,000005	400	5	6	0,0000002	400	2	7
LF 103/103C LF 401/401C LIF 101/101C LIP 501/501C	4	single/5000	0,001	4	1	3	0,00005	4	5	5
				0,0005	8	5	4	0,00002	8	2
			0,0002	20	2	4	0,00001	20	1	5
			0,0001	40	1	4	0,000005	40	5	6
LIP 101		single	0,00005	80	5	5	0,000002	80	2	6
			<i>Recommended only for LIP 101</i>							
			0,00002	200	2	5	0,000001	200	1	6
			0,00001	400	1	5	0,0000005	400	5	7
MT xx	10	single	0,0005	20	5	4	0,00002	20	2	5
			0,0002	50	2	4	0,00001	50	1	5
			0,0001	100	1	4	0,000005	100	5	6
<b>LS 303/303C</b> <b>LS 603/603C</b>	20	single/1000	0,01	2	1	2	0,0005	2	5	4
			0,005	4	5	3	0,0002	4	2	4

Parameter settings for HEIDENHAIN linear encoders 11  $\mu\text{A}_{pp}$  (continued)

Model	Signal period [ $\mu\text{m}$ ]	Reference marks  P 43	Millimeters				Inches			
			Display step [mm]	Subdi- vision	Count	Decimal places	Display step [inch]	Subdi- vision	Count	Decimal places
LS 106/106C LS 406/406C LS 706/706C	20	single/1000	0,001	20	1	3	0,00005	20	5	5
ST 1201			0,0005	40	5	4	0,00002	40	2	5
LB 302/302C LIDA 10x/10xC	40	single/2000	0,005	8	5	3	0,0002	8	2	4
			0,002	20	2	3	0,0001	20	1	4
			0,001	40	1	3	0,00005	40	5	5
			0,0005	80	5	4	0,00002	80	2	5
			<i>Recommended only for LB 302</i>					0,000001	200	1
	0,0001	400	1	4	0,0000005	400	5	6		
LB 301/301C	100	single/1000	0,005	20	5	3	0,0002	20	2	4
			0,002	50	2	3	0,0001	50	1	4
			0,001	100	1	3	0,00005	100	5	5
LIM 102	12800	single	0,1	128	1	1	0,005	128	5	3
			0,05	256	5	2	0,002	256	2	3

**Example:**

Your encoder: LS 303 C, desired display step: 0,005 mm (5  $\mu\text{m}$ ), parameter settings: P01 = mm,  
P43 = 1 000, P32 = 4, P33 = 5, P38 = 3

## Multipoint Axis Error Compensation



If you want to use the multipoint axis error compensation feature, you must

- Activate this feature with operating parameter P40 (see "Operating Parameters")
- Traverse the reference marks after switching on the display unit.
- Enter compensation value table

Your machine may have a non-linear axis error due to factors such as axis sag or drivescrew errors. Such deviations are usually measured with a comparator measuring system. This allows you to determine, for example, the screw pitch error [ $X = F(X)$ ] for the X axis.

An axis can only be corrected in relation to **one** axis causing the error. You can create a compensation value table for each axis, with each table containing 16 compensation values. The compensation value table is selected with the SPEC FCT key and the dialog "PARAMETER/CODE". All of the input values required for the multipoint compensation are requested via dialog.

To determine the compensation values (e.g. with a VM 101), the REF display must be selected after selecting the compensation-value table.

**R<sub>x</sub>**

Select REF display.

## Entries in the compensation value table


- Axis to be compensated: X, Zo or Z  
(Zo only ND770)
- Axis with error: X, Zo or Z  
(Zo only ND770)
- Datum for the axis to be corrected:  
Here you enter the point starting at which the axis with error is to be corrected. This point indicates the absolute distance to the reference point.






Do not change the datum point after measuring the axis error and before entering the axis error into the compensation table.








- Spacing of the compensation points  
The spacing of the compensation points is expressed as  $2^x$  [ $\mu\text{m}$ ]. Enter the value of the exponent  $x$  into the compensation value table.  
Minimum input value: 6 (= 0.064 mm)  
Maximum input value: 20 (= 1052.672 mm)  
23 (= 8388.608 mm)
- **Example:** 900 mm traverse and 15 compensation points:  
results in 60.000 mm spacing between points.  
Nearest power of two:  $2^{16}$  [ $\mu\text{m}$ ] = 65.536 mm  
Entry in compensation value table: 16
- Compensation value  
You enter the measured compensation value (in millimeters) for the displayed compensation point. Compensation point 0 always has the value 0 and cannot be changed.



## To select comp. value table and enter an axis correction



	Select Special Functions
---	--------------------------

 or 	Select the Parameter function if required, by repeatedly pressing the TOOL key.
--	---




PARAMETER	
	Select dialog for entering the code number.




CODE	
      	Enter 105296 and confirm with ENT.







AXIS X	
 	Select the axis to be corrected, e.g. X, confirm with ENT.



X = FCT. X	
 	Enter the axis causing the error, e.g. X (screw pitch error), confirm with ENT.



⋮

DATUM X	
  	Enter the active datum for the error on the axis to be corrected e.g. 27 mm, and confirm.

SPACING X	
  	Enter the spacing of the compensation points on the axis to be corrected, e.g. 2 <sup>10</sup> μm (equals 1.024 mm), and confirm.



27.000	
     	Select compensation point no. 1, enter the associated compensation value e.g. 0.01 mm, and confirm.



28.024	
 	Enter all further compensation points. If you press the MINUS key, the number of the current compensation point is shown in the X display.


 or 	Conclude entry.
---	-----------------



## Deleting a compensation value table


	Select Special Functions.
---	---------------------------



 	Select the Parameter function.
---	--------------------------------

PARAMETER	
 	Select the dialog for entering the code numebr.

CODE	
<div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">1</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">0</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">5</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">2</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">9</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;">6</div> <div style="border: 1px solid black; padding: 2px 10px; margin: 2px;"></div> </div>	Enter 105296 and confirm with ENT.

AXIS X	
 	Select the compensation value table, e.g. for Z axis, and delete the table.

DELETE Z	
	Confirm with ENT, or cancel with CL.

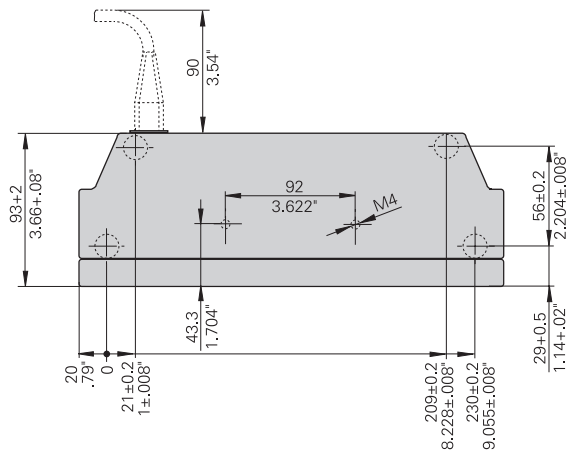
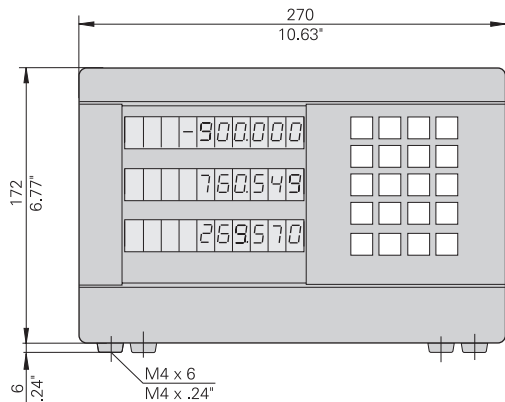
 or 	Conclude entry.
--	-----------------

## Specifications

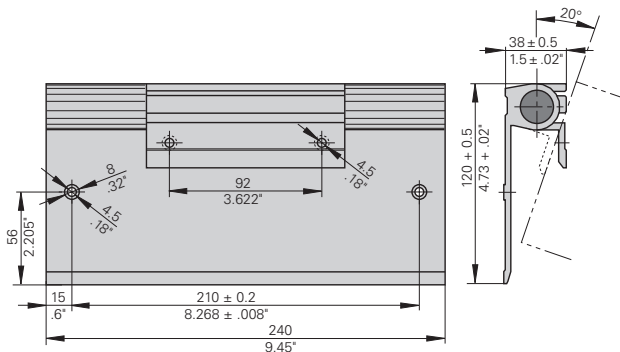
<b>Housing</b>	ND 730/ND 770 Bench-top design, cast metal Dimensions (W • H • D) 270 mm x 172 mm x 93 mm
<b>Operating temp.</b>	0° to 45° C (32° to 113° F)
<b>Storage temp.</b>	-20° to 70° C (-4° to 158°F)
<b>Weight</b>	Approx. 2.3 kg
<b>Relative humidity</b>	<75% annual average <90% in rare cases
<b>Power supply</b>	90 Vac to 260 Vac 48 Hz to 62 Hz
<b>Power consumption</b>	15 W
<b>Protection</b>	IP40 according to EN 60 529

<b>Encoder inputs</b>	For encoders with 7 to 16 $\mu$ APP Grating period 2, 4, 10, 20, 40, 100, 200 $\mu$ m and 12.8 mm Reference-mark evaluation for distance-coded and single reference marks.
<b>Input frequency</b>	Max. 100 kHz with 30 m (66 ft) cable
<b>Display step</b>	Adjustable (see "Linear Encodes")
<b>Tool datums</b>	9 (nonvolatile)
<b>Functions</b>	<ul style="list-style-type: none"> <li>- Distance-to-go display</li> <li>- Radius/diameter display</li> <li>- Separate value/sum display (only ND 770)</li> <li>- Hold position</li> <li>- Set absolute datum</li> <li>- Taper calculator</li> <li>- Scaling factor</li> </ul>

Dimensions in mm/inches



Tilting base



# HEIDENHAIN

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## **DR. JOHANNES HEIDENHAIN GmbH**

Dr.-Johannes-Heidenhain-Straße 5

**83301 Traunreut, Germany**

☎ + 49/86 69/31-0

FAX + 49/86 69/50 61

e-mail: [info@heidenhain.de](mailto:info@heidenhain.de)

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☎ **Service** + 49/86 69/31-12 72

☎ TNC-Service + 49/86 69/31-14 46

FAX + 49/86 69/98 99

e-mail: [service@heidenhain.de](mailto:service@heidenhain.de)

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<http://www.heidenhain.de>

## **HEIDENHAIN (G.B.) Limited**

200 London Road, Burgess Hill

West Sussex RH15 9RD, Great Britain

☎ (014 44) 24 77 11

FAX (014 44) 87 00 24