HEIDENHAIN

User's Manual

ND 730
ND 770

Position Display Units for Lathes

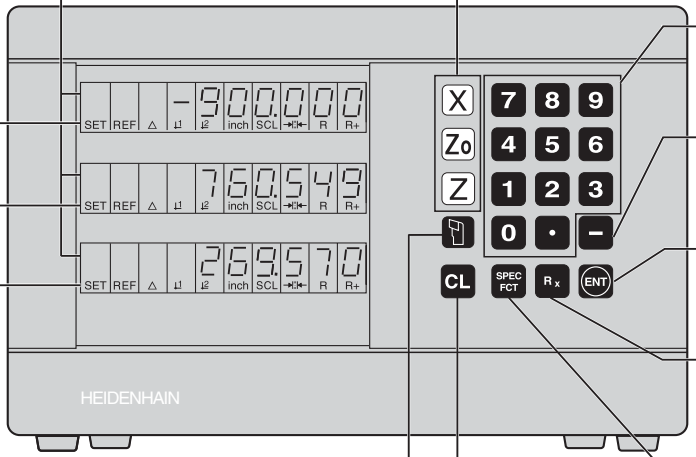
English (en)
10/2002

Position display
(ND 730 only two axes)

- **Select coordinate axes (ND 730 only X and Z)**
- **Select axis-specific operating parameters**

Status display:

SET = Set datum
REF = Blinking:
Traverse the reference points
On continuously:
Reference points have been traversed
Δ = Distance-to-go
Inch = Inch display
SCL = Scaling factor
R = Radius/diameter display
T = Selected tool



Numerical input

- **Change algebraic sign**
- **Call last dialog**
- **Change parameters in the parameter list**

- **Confirm entry**
- **Page forward in the parameter list**

Select radius/diameter display in X axis

- **Select special functions**
- **Page forward in the list of special functions**

- **Tool compensation**
- **Page backward in the list of special functions**
- **Page backward in the list of parameters**

- **Cancel entry**
- **Reset operating mode**
- **Zero the selected axis (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:

ND 730 for two axes	**246 271-07**
ND 770 for three axes	**246 271-07**

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

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!

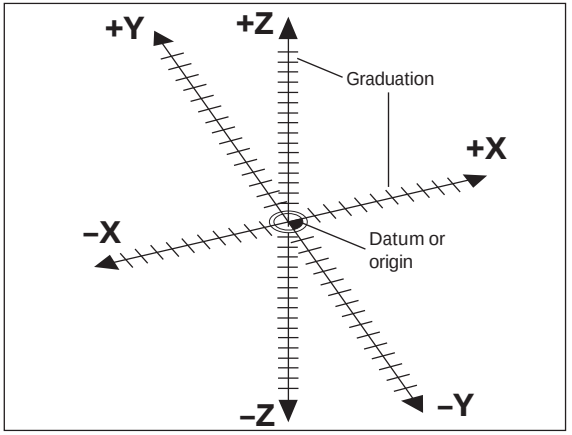
Coordinate system

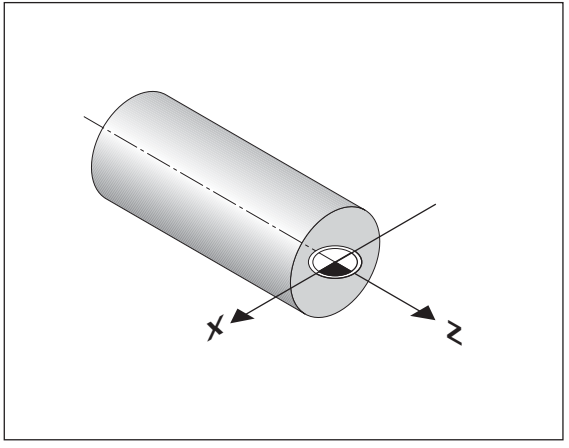
To describe the geometry of a workpiece, a rectangular or *Cartesian** coordinate system is used. The Cartesian coordinate system consists of three mutually perpendicular axes X, Y and Z. The point of intersection of these axes is called the **datum** or origin of the coordinate system.

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.



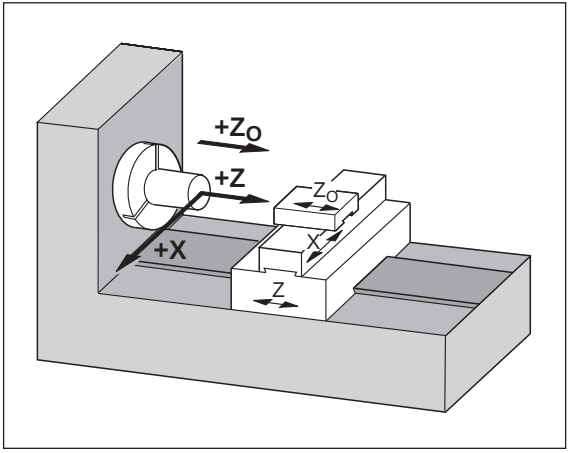


1) Named in honor of the French mathematician and philosopher René Descartes (1596 to 1650)

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 Zo.



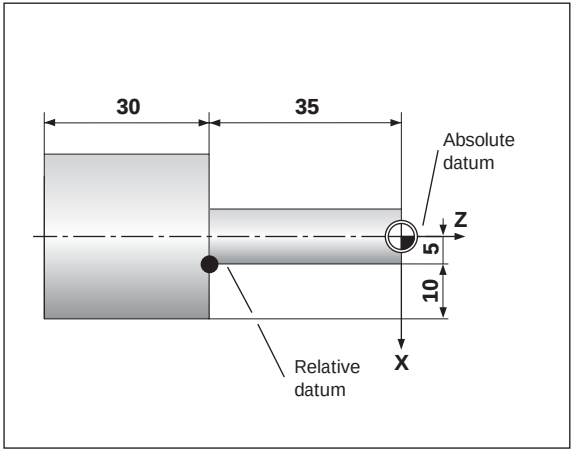
Datum setting

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.

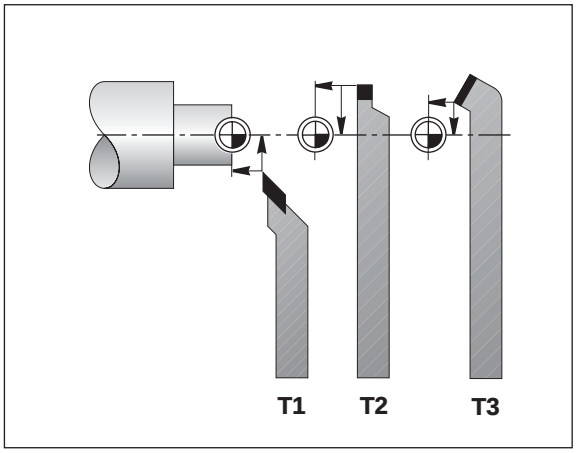
With the ND, you can set one absolute datum point and as many as 9 relative datum points (tool datums), and store them in nonvolatile memory.



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.



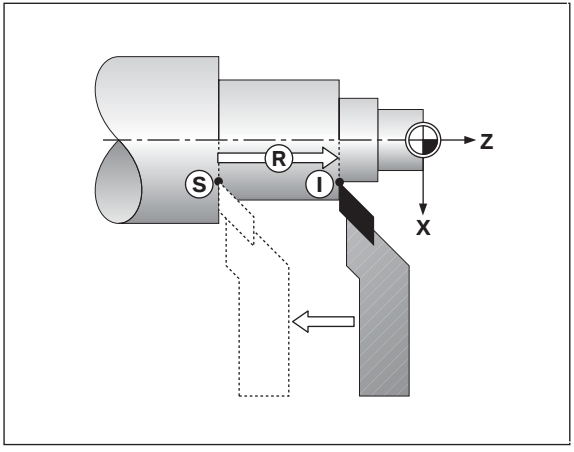
Nominal position, actual position and distance-to-go

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.



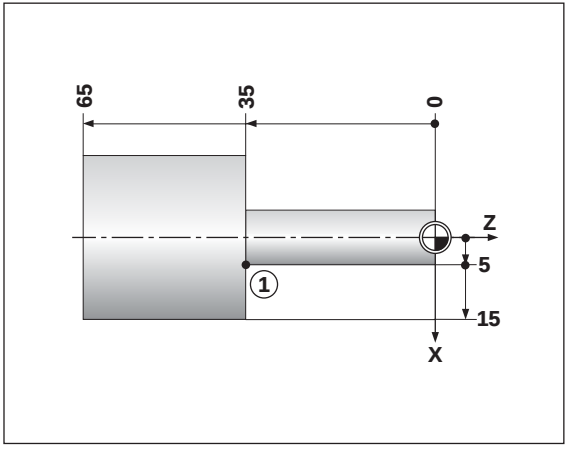
Absolute workpiece positions

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

Example Absolute coordinates of position ①:

X = 5 mm
Z = –35 mm

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



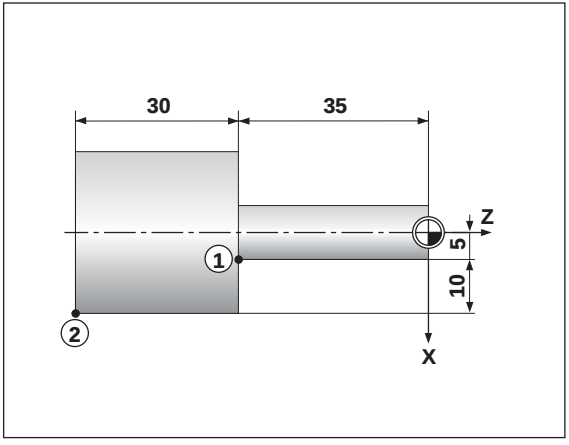
Relative workpiece positions

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 mm
IZ = –30 mm

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



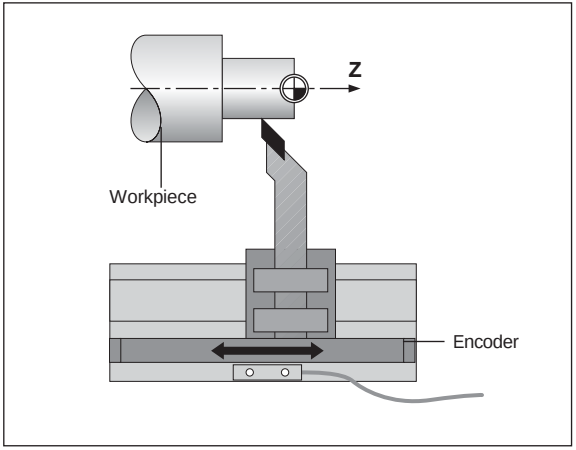
Sign for incremental dimensioning

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.

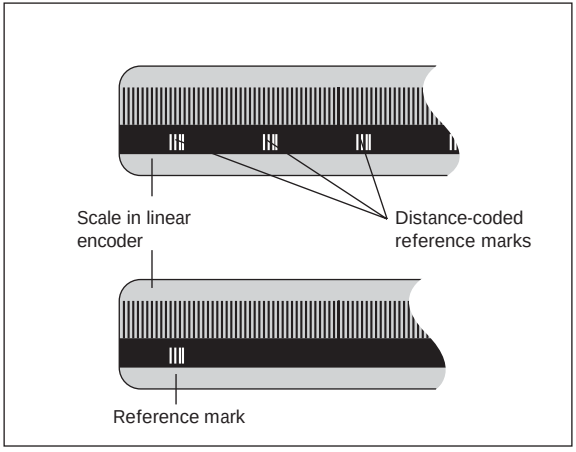
If the power is interrupted, the relationship between the machine axis position and the calculated actual position is lost. The reference marks on the position encoders and the REF reference mark evaluation feature enable the ND to quickly re-establish this relationship again when the power is restored.



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 these reference points are 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, Traversing the Reference Marks

0 → 1	Turn on the power (switch located on rear panel). REF starts blinking in the status display.
ENT ... CL	
	Confirm reference traverse mode. REF remains on continuously. Decimal points start blinking.
	Cross over the reference marks in all axes (in any sequence). Each axis display becomes active when its reference mark is crossed over.

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

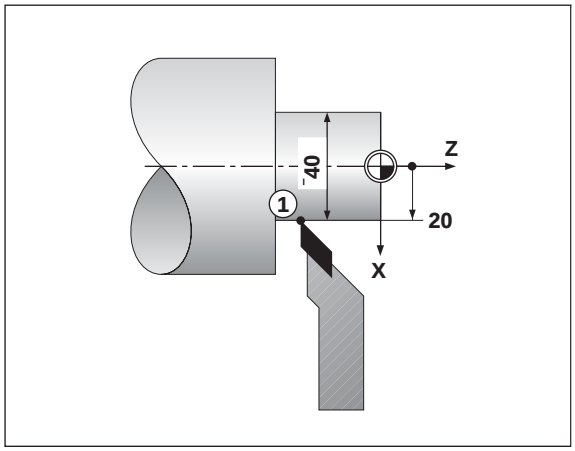
Your ND can display positions in the cross slide as a diameter or as a radius. Drawings of lathe parts usually indicate diameters. When you are turning the part, however, you infeed the tool in the cross slide axis in radius values.

Example: Radius display position ① X = 20 mm
Diameter display position ① X = 40 mm

To switch the display:

➤ Press R_x

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



Separate Value/Sum Display (ND 770 only)

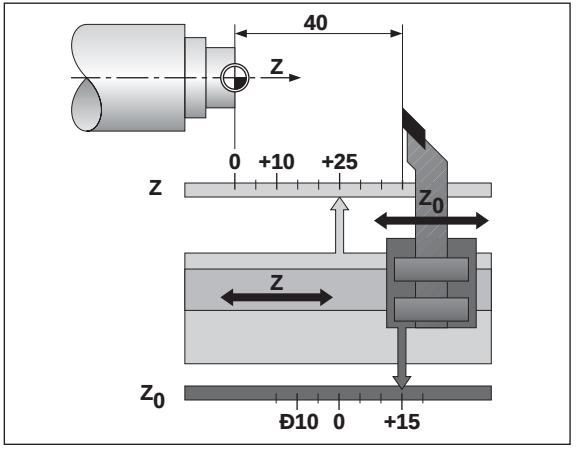
Separate value display

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 Zo 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.

Example	Separate value display:	Z	= +25.000 mm
		Zo	= +15.000 mm
	Sum display:	Z_S	= +40.000 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 Zo and Z at the same time.
- ➤ Separate value display: Press the key Zo.

When the ND 770 displays sums, the Zo 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.

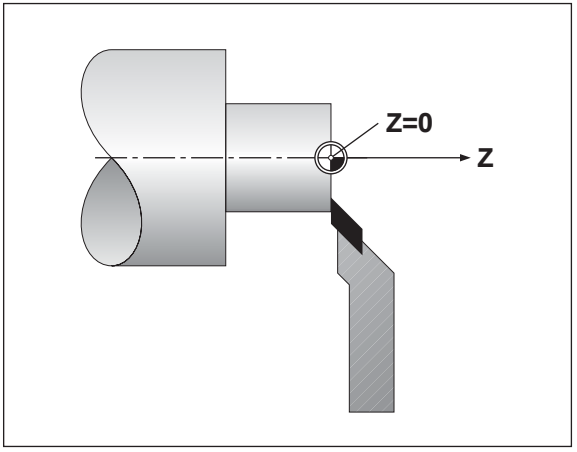
With the ND 730/ND 770 position displays, you can set **one** absolute workpiece datum and data for up to 9 tools (relative datums).

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 starts blinking.
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 starts blinking.
3 ENT	Enter tool number, e.g. 3, and confirm with ENT.
	Touch the workpiece end face with the tool.
SPEC FCT	Select the special functions.
SPEC FCT  ENT	Select the "tool setting" function. The decimal point next to "T" and the decimal points below "T" start blinking.

TOOL SET

Z 0 ENT	Select the axis (e.g. Z), enter the position of the tool tip (e.g. 0 mm), and confirm with ENT.
	Touch the workpiece or turn the first diameter.
X 2 0 ENT	Select the axis (e.g. X), enter the position of the tool tip (e.g. 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.
SPEC FCT or CL	Exit the special functions.

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 the capability to “freeze” (hold) the actual position before you retract the tool.

	Turn the first diameter, for example in the X axis.
SPEC FCT	Select the special functions.
SPEC FCT 	Select the "holding positions" function.
POS. HOLD	
e.g. X ENT	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.

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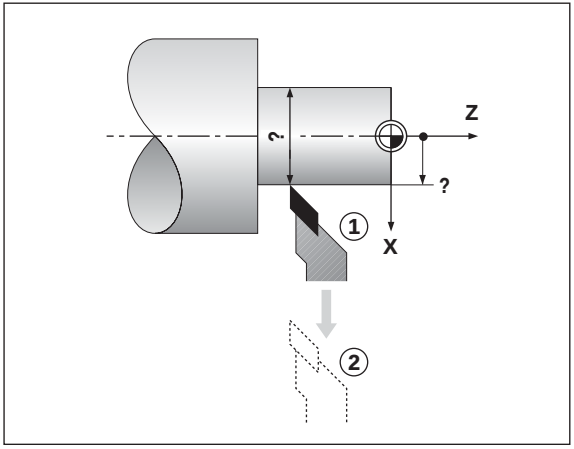


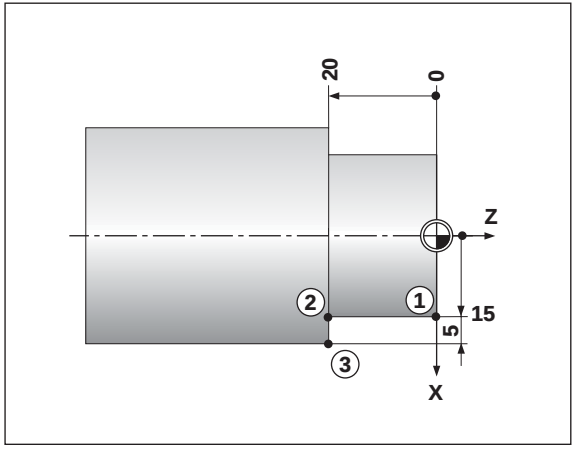
e.g. 1 2 ENT	Enter the measured position, for example 12 mm, and confirm with ENT. The display shows the current tool position.
SPEC FCT or CL	Exit the function.

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

SPEC FCT	Select the special functions.
SPEC FCT or	Select delta mode.
DELTA MODE	
ENT	Confirm the distance-to-go, Δ lights.
X 1 5 ENT	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.

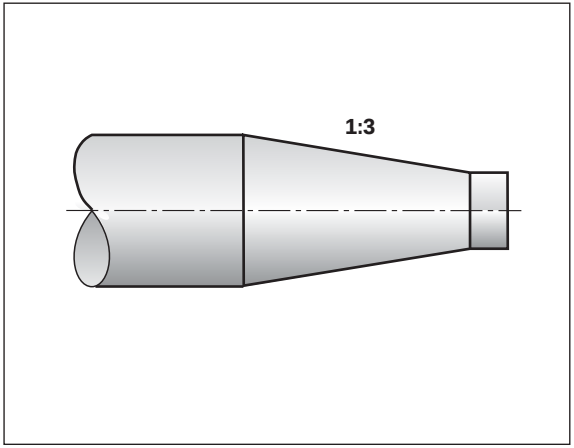


Z 2 0 – ENT	Select the axis, e.g. Z, enter the nominal coordinate, e.g. –20 mm, and confirm with ENT.
	Move the Z axis until the display value is zero. The tool is at position ②.
X 2 0 ENT	Select the axis, enter the nominal coordinate, e.g. 20 mm (radius), confirm with ENT.
	Move the X axis until the display value is zero. The tool is at position ③.
SPEC FCT and ENT or CL	Exit the distance-to-go mode. The Δ symbol goes out.

Taper Calculator

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

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



Calculation from taper ratio

SPEC FCT	Select the special functions.
SPEC FCT	Select the taper calculator.
TAPER CALC.	
ENT	Confirm the function.

•
•
•

TAP. RATIO

ENT — Confirm the function.

1ST VALUE

1 ENT — Enter the first value, e.g. 1, and confirm with ENT.

2ND VALUE

3 ENT — Enter the second value, e.g. 3, confirm with ENT (length of taper is three times as large as radius difference).

ANGLE = 18.435

The result is displayed in the message field.

SPEC FCT or CL — Exit the taper calculator.

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

Calculation from two diameters and the length

SPEC FCT	Select the special functions.
SPEC FCT +	Select the taper calculator for input of diameters and length.
TAPER CALC.	
ENT	Confirm the function.
TAP. RATIO	
−	Select the "taper dimensions" function.
TAP. DIMENS.	
ENT	Confirm the function.

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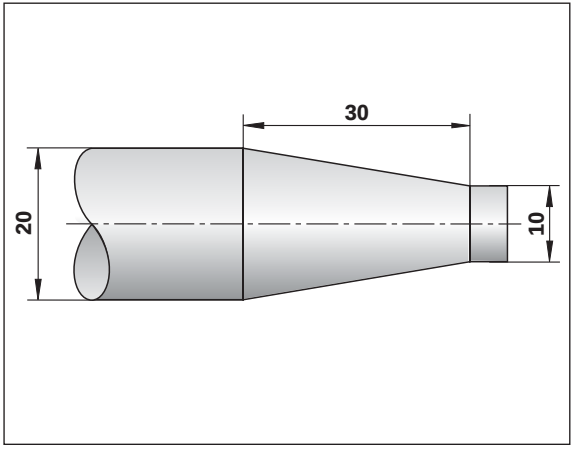


DIA. RIGHT

1 0 ENT	Enter value, e.g. 10 mm, confirm with ENT.

DIA. LEFT

2 0 ENT	Enter value, e.g. 20 mm, confirm with ENT.

LENGTH

3 0 ENT	Enter value, e.g. 30 mm, confirm with ENT.

ANGLE = 9.462

	The result is displayed in the message field.

SPEC FCT or CL	Exit 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
SIGNAL X	The encoder signal is too weak. The scale may be contaminated.
ERR. REF. X	The spacing of the reference marks as defined in P43 is not the same as the actual spacing.
FRQ. ERR. X	The input frequency for this encoder input is too high. This can occur when the scale is moved too fast.
ERR. MEMORY	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

Items Supplied

- **ND 730** for 2 axes
  or
- **ND 770** for 3 axes

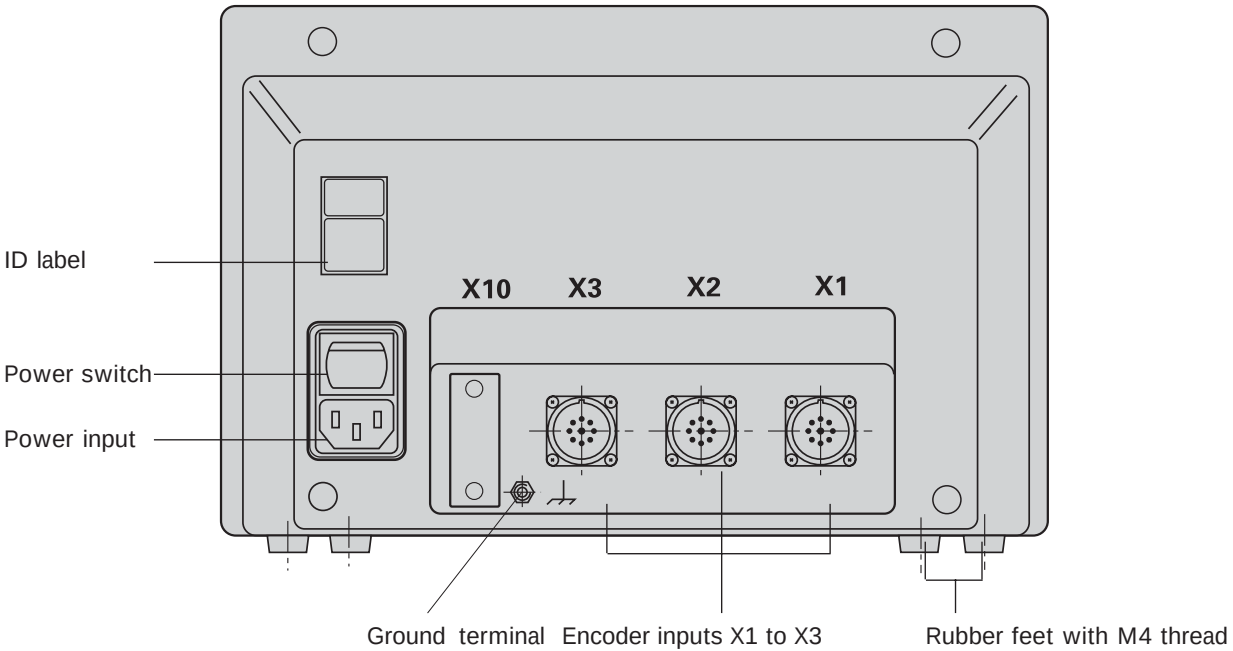
- **Power connector** Id. Nr. 257 811-01

- **User's Manual**

Optional accessories

- **Tilting base** for housing bottom
  Id. Nr. 281 619-01

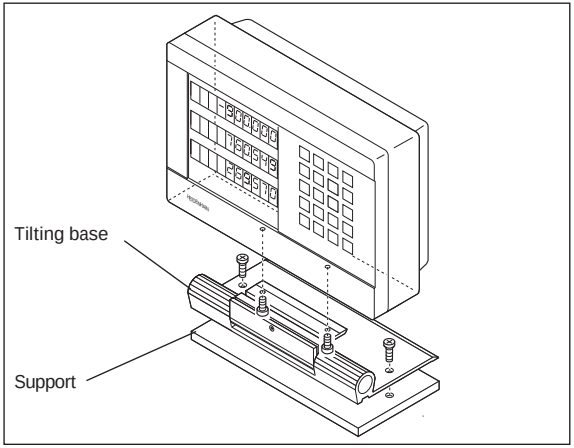
Connections on Rear Panel



Connections X1, X2, X3 meet the requirements for electrical separation 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.

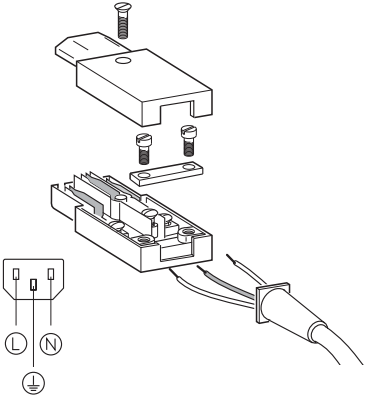


Power Connection

Power leads Ⓛ and Ⓝ
Connect protective ground to ⏚

Power supply: 100 Vac to 240 Vac (-15% to +10%)
50 Hz to 60 Hz (± 2 Hz)

A voltage selector is not necessary.



- **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 mm²).

Connecting the Encoders

Your display unit will accept all HEIDENHAIN linear encoders with sinusoidal output signals (11 to 16 μA_{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

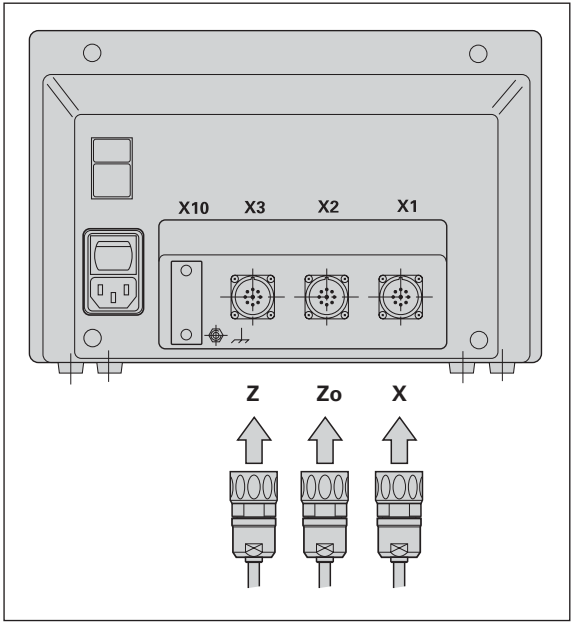
Your display unit features a monitoring system for checking the amplitude and frequency of the encoder signals. If it detects a faulty signal, one of the following error messages will be generated:

```
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 and changing operating parameters

To access the operating parameters

- ➤ Press the SPEC FCT key.
- ➤ Press SPEC FCT or TOOL until "PARAMETER" appears in the X display.
- ➤ Confirm with ENT.

To select protected operating parameters

- ➤ Press the TOOL key to select the P00 CODE user parameter.
- ➤ Enter the code number 95148.
- ➤ Confirm with the ENT key.

To page through the operating parameters

- ➤ Page forwards by pressing the ENT key.
- ➤ Page backwards by pressing the TOOL key.

To change parameter settings

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

To correct an entry

- ➤ Press the CL key: the old value reappears in the input line and becomes effective again.

To exit the operating parameters

- ➤ Press the SPEC FCT or CL key.

P00 CODE Enter the code number

9 51 48:	Change protected operating parameters
66 55 44:	Display the software version (in the X axis)
	Display the date of release (in the Y axis)
10 52 96:	Multipoint axis error compensation

P01 Unit of measurement [1)]

Display in millimeters	**MM**
Display in inches	INCH

P03.1 to P03.3 Radius/diameter display [1)]

Display position value as radius	**RADIUS**
Display position value as diameter	DIAMETER

P06 Select the sum display

Sum display default setting	SUM ON
Sum display selectable with the Z0 and Z keys	**SUM OFF**

P11 Activate scaling factor [1)]

Scaling factor active	SCALING ON
Not active	**SCALING OFF**

P12.1 to P12.3 Enter scaling factor [1)]

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
Default setting:	**1**

P30.1 to P30.3 Counting direction

Positive counting direction with positive direction of traverse	**DIRECT. POS**
Negative counting direction with positive direction of traverse	DIRECT. NEG

P31.1 to P31.3 Signal period of the encoder

Input range:	0.00000001 to 99999.9999 µm
Default setting:	**20 µm**

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 inch display)

P40.1 to 40.3 Define axis error compensation

No axis error compensation	**COMP. OFF**
Linear error compensation active	COMP. LIN
Multipoint error compensation active	COMP. MULTI

(See "Multipoint Axis Error Compensation")

[1)] 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 [µm]: – 99999 to + 99999
Default setting: **0**

Example: Displayed length L_d = 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 µm
Compensation factor k:
$k = \Delta L/L_d$ = –124 µm/0.62 m = **–200** [µm/m]

P42.1 to P42.3 Backlash compensation

Input range (mm): +9.999 to -9.999
Default setting: **0.000** = no backlash compensation

A change in direction might cause a clearance between rotary encoder and table. This is referred to as backlash. Positive backlash: The rotary encoder is ahead of the table. The distance traversed by the table is too short (entry of positive value). Negative backlash: The rotary encoder follows the table. The distance traversed by the table is too large (entry of negative value).

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	**REF. X ON**
No evaluation	REF. X OFF

P45.1 to P45.3 Encoder monitoring

Amplitude and frequency monitoring	**ALARM ON**
No monitoring	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

Set to zero with CL	CL...RESET
No set to zero with CL	CL.....OFF

P98 Dialog language [1)]

German	**LANGUAGE**	**DE**
English	LANGUAGE	EN
French	LANGUAGE	FR
Italian	LANGUAGE	IT
Dutch	LANGUAGE	NL
Spanish	LANGUAGE	ES
Danish	LANGUAGE	DA
Swedish	LANGUAGE	SV
Finnish	LANGUAGE	FI
Czech	LANGUAGE	CS
Polish	LANGUAGE	PL
Hungarian	LANGUAGE	HU
Portuguese	LANGUAGE	PT

[1)] User parameter

Linear Encoders

Setting the display step with linear encoders

To select a certain display step, you must define the following operating parameters:

- Signal period (P31)
- Counting mode (P33)
- Decimal places (P38)

Example

Linear encoder with signal period 20 µm

Required display step ..... 0.000 5 mm
Signal period (P31) 20
Counting mode (P33) 5
Decimal places (P38) 4

The following tables will help you select the parameters.

Parameter settings for HEIDENHAIN linear encoders with 11 μA_{PP} signals

Model	Signal period [µm]	Reference marks	Millimeters			Inches		
			Display step [mm]	Count	Decimal places	Display step [inch]	Count	Decimal places
	P 31	P 43		P 33	P 38		P 33	P 38
CT MT xx01	2	single	0.0005 0.0002	5 2	4 4	0.00002 0.00001	2 1	5 5
LIP 401A/401R		single	0.0001 0.00005	1 5	4 5	0.000005 0.000002	5 2	6 6
			Recommended only for LIP 401					
			0.00002 0.00001 0.000005	2 1 5	5 5 6	0.000001 0.0000005 0.0000002	1 5 2	6 7 7
LF 103/103C LF 401/401C LIF 101/101C LIP 501/501C	4	single/5000	0.001 0.0005 0.0002 0.0001	1 5 2 1	3 4 4 4	0.00005 0.00002 0.00001 0.000005	5 2 1 5	5 5 5 6
LIP 101		single	0.00005	5	5	0.000002	2	6
			Recommended only for LIP 101					
			0.00002 0.00001	2 1	5 5	0.000001 0.0000005	1 5	6 7
MT xx	10	single	0.0005 0.0002 0.0001	5 2 1	4 4 4	0.00002 0.00001 0.000005	2 1 5	5 5 6
LS 303/303C **LS 603/603C**	20	single/1000	0.01 0.005	1 5	2 3	0.0005 0.0002	5 2	4 4

Parameter settings for HEIDENHAIN linear encoders 11 µA$_{PP}$ (continued)

Model	Signal period [µm]	Reference marks	Millimeters			Inches		
			Display step [mm]	Count	Decimal places	Display step [inch]	Count	Decimal places
	P 31	P 43		P 33	P 38		P 33	P 38
LS 106/106C **LS 406/406C** **LS 706/706C**	20	single/1000	0.001 0.0005	1 5	3 4	0.00005 0.00002	5 2	5 5
ST 1201		-						
LB 302/302C LIDA 10x/10xC	40	single/2000	0.005 0.002 0.001 0.0005	5 2 1 5	3 3 3 4	0.0002 0.0001 0.00005 0.00002	2 1 5 2	4 4 5 5
			Recommended only for LB 302					
			0.0002 0.0001	2 1	4 4	0.000001 0.0000005	1 5	5 6
LB 301/301C	100	single/1000	0.005 0.002 0.001	5 2 1	3 3 3	0.0002 0.0001 0.00005	2 1 5	4 4 5
LIM 501	10240	single	0.1 0.01 0.05	1 1 5	1 2 2	0.005 0.0005 0.002	5 5 2	3 4 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 a 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 (such as the VM 101). 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 64 compensation values. The compensation value table is selected with the SPEC FCT key and the dialog "PARAMETER/CODE".

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

R_x	Select REF display.

The decimal point in the left display field indicates that the displayed values are referenced to the reference point. If the decimal point blinks, the reference marks have not been traversed.

Entries in the compensation value table

- Axis to be corrected: X, Zo or Z (Zo only ND770)
- Axis causing the 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 [µm]. 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} [µm] = 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.

Selecting the compensation table, entering an axis correction

SPEC FCT	Select the special functions.
SPEC FCT or TOOL	Select the parameter function, if required, by repeatedly pressing the TOOL key.
PARAMETER	
ENT	Select the dialog for entering the code number.
CODE	
1 0 5 2 9 6 ENT	Enter 105296 and confirm with ENT.
AXIS X	
X ENT	Select the axis to be corrected, e.g. X, confirm with ENT.
X = FCT. X	
X ENT	Enter the axis causing the error, e.g. X (screw pitch error), confirm with ENT.
DATUM X	
2 7 ENT	Enter the active datum for the error on the axis to be corrected e.g. 27 mm, and confirm with ENT.
SPACING X	
1 0 ENT	Enter the spacing of the compensation points on the axis to be corrected, e.g. 2^{10} µm (equals 1.024 mm), and confirm with ENT.
27.000	
ENT 0 • 0 1 ENT	Compensation point no. 1 is displayed, enter the associated compensation value, e.g. 0.01 mm, and confirm with ENT.
28.024	
ENT	Enter all further compensation points. If you press the MINUS key, the number of the current compensation point is shown in the X display.
SPEC FCT or CL	Conclude entry.

Deleting a compensation value table

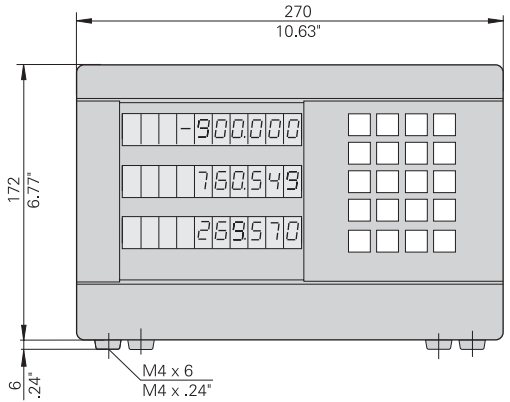
SPEC FCT	Select the special functions.
SPEC FCT	Select the parameter function.
PARAMETER	
ENT	Select the dialog for entering the code number .
CODE	
1 0 5 2 9 6 ENT	Enter 105296 and confirm with ENT.
AXIS X	
Z CL	Select the compensation value table, e.g. for Z axis, and delete the table.
DELETE Z	
ENT	Confirm with ENT, or cancel with CL.
SPEC FCT	Conclude entry.

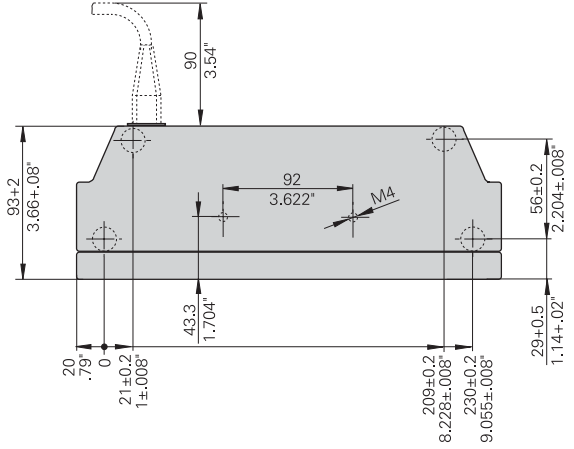
Specifications

Housing	ND 730/ND 770 Bench-top design, cast metal Dimensions (W • H • D) 270 mm x 172 mm x 93 mm
Operating temp.	0° to 45° C (32° to 113° F)
Storage temp.	–20° to 70° C (–4° to 158°F)
Weight	Approx. 2.3 kg
Relative humidity	<75% annual average <90% in rare cases
Power supply	100 Vac to 240 Vac (-15% to +10%) 50 Hz to 60 Hz (± 2 Hz)
Power consumption	15 W
Protection	IP40 according to EN 60 529

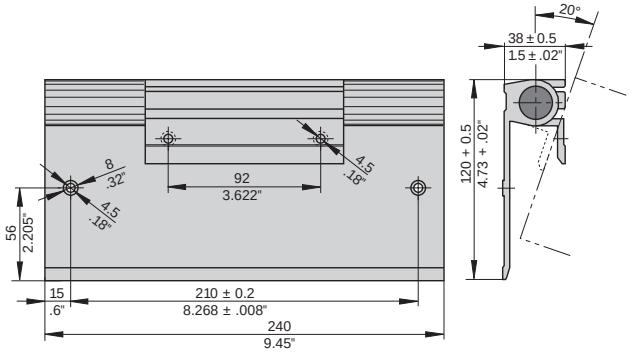
Encoder inputs	For encoders with 7 to 16 μA_{PP} Grating period 2, 4, 10, 20, 40, 100, 200 µm and 12.8 mm Reference-mark evaluation for distance-coded and single reference marks.
Input frequency	Max. 100 kHz with 30 m (66 ft) cable
Display step	Adjustable (see "Linear Encodes")
Tool datums	9 (nonvolatile)
Functions	– Distance-to-go display – Radius/diameter display – Separate value/sum display (only ND 770) – Hold position – Set absolute datum – Taper calculator – Scaling factor

Dimensions in mm/inches





Tilting base



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