HEIDENHAIN

User's Manual

ND 710
ND 750

Position Display Units for Milling Machines

6/99

Position display
(ND 710 only two axes)

- **Select coordinate axes (ND 710 only X and Y)**
- **Select axis-specific operating parameters**

Status display:

SET = Datum setting
REF = blinking:
Traverse the reference points.
On continuously:
Reference points have been traversed.

Δ = Distance-to-go display

⊥1 ⊥2 Datum 1 or 2

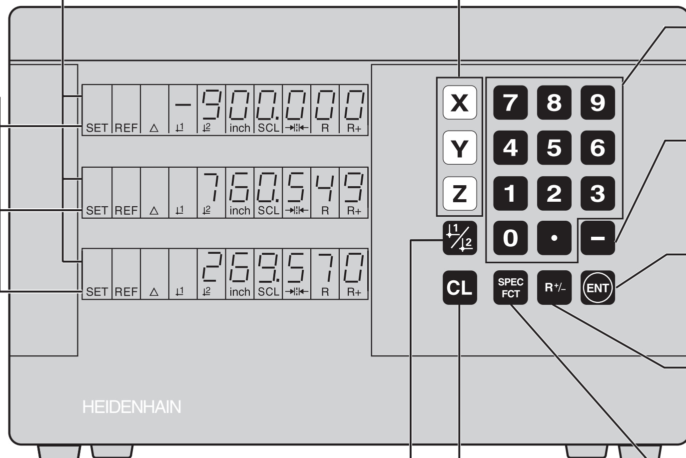
Inch = Display in inches

SCL = Scaling factor

->II<- = Touching the edge / centerline

R = Radius/diameter display

R+/– = Radius compensation



Numerical input

- **Change the algebraic sign**
- **Call the last dialog**
- **In the parameter list: change parameters**

- **Confirm entry**
- **In the parameter list page forward**

Call radius compensation of the current tool

- **Select special functions**
- **In the list of special functions page forward**

- **Select datum 1 or 2**
- **Page backward in the list of special functions**
- **Page backward in the list of parameters**

- **Cancel entry**
- **Reset the operating mode**
- **Zero the selected axis (if activated in P80)**
- **Select parameters CL plus two-digit number**

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

ND 710 for two axes	**AA00**
ND 750 for three axes	**AA00**

About this manual

This manual is divided into two parts:

Teil I: Operating Instructions

- Fundamentals of positioning
- ND functions

Teil 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.

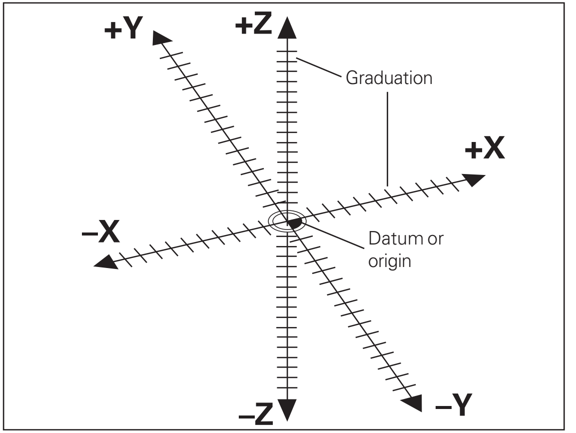
Coordinate system

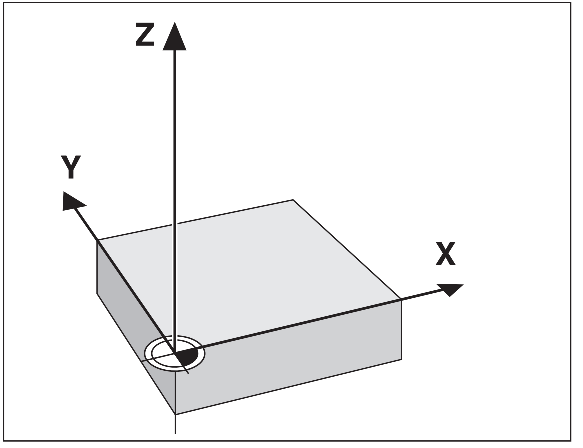
To describe the geometry of a workpiece, the *Cartesian** coordinate system is used. The Cartesian coordinate system consists of three mutually perpendicular axes X, Y and Z. The point of intersection of these axes is called the **datum** or origin of the coordinate system.

Think of the axes as scales with divisions (usually in millimeters) which 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.

The machine axes are parallel to the axes of the coordinate system. The Z axis is normally the tool axis.





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

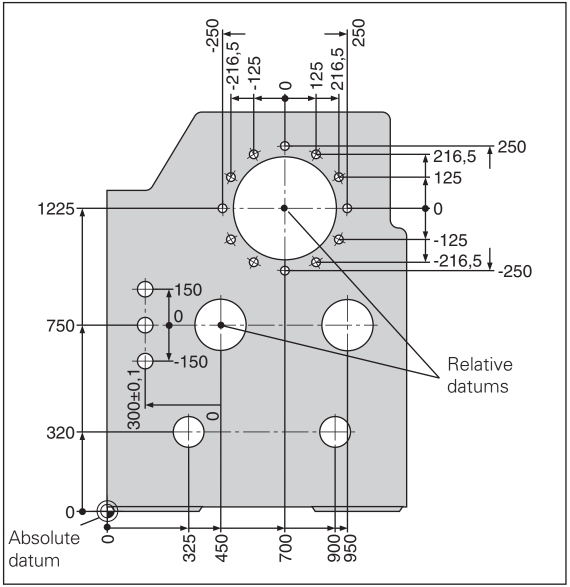
Datum setting

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, Y 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.

You can set 2 absolute datum points and store them in nonvolatile memory.



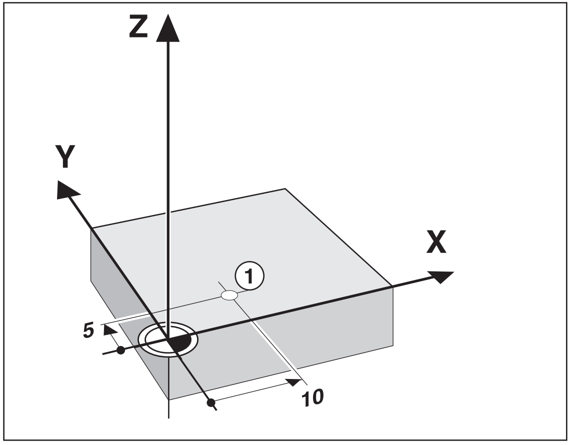
Absolute workpiece positions

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

Example Absolute coordinates of position ①:

X = 10 mm
Y = 5 mm
Z = 0 mm

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



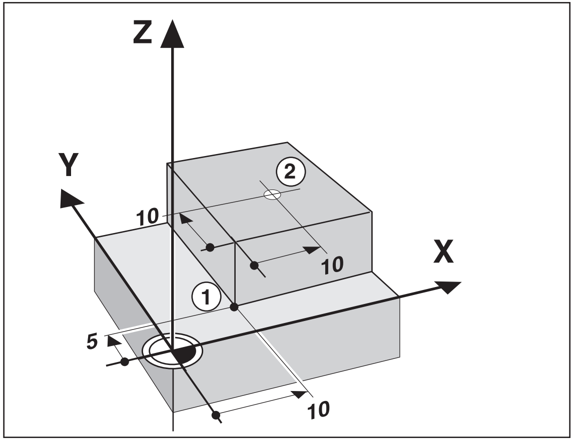
Relative workpiece positions

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
IY = 10 mm

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



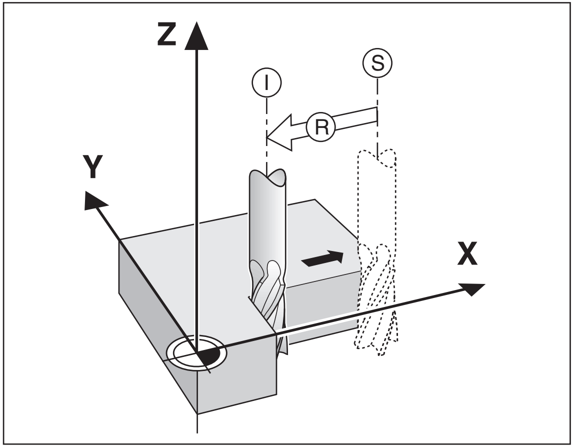
Sign for incremental dimensioning

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.

Nominal position, actual position and distance-to-go

The position to which the tool is to move is called the **nominal** position (Ⓢ). 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 (Ⓡ).



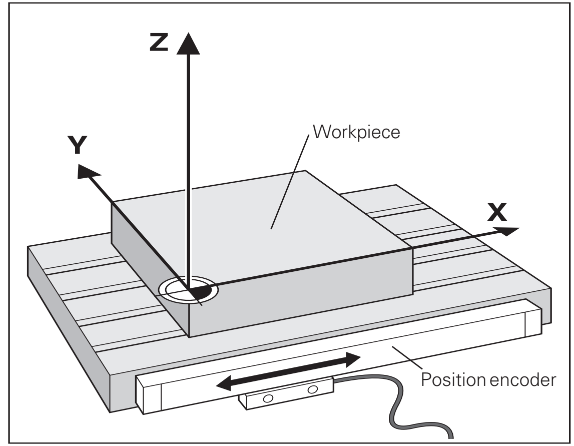
Sign for distance-to-go

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.

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.

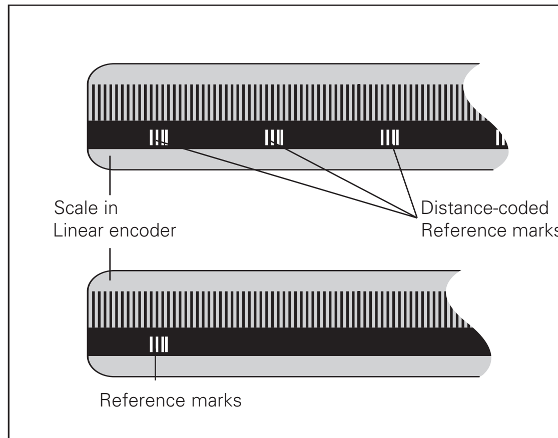
If the power is interrupted, the relationship between the machine axis positions and the calculated actual positions is lost. The reference marks on the position encoders and the REF reference mark evaluation feature enable the ND to quickly re-establish this relationship again when the power is restored.



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 which identifies that position as a reference point (scale datum = machine datum).

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



Switch-On, Traversing the Reference Marks

0 → 1	Turn on power (switch located on rear panel). REF and decimal points in status display blink.
ENT...CL	
ENT	Confirm reference traverse mode. REF remains on continuously. Decimal points blink.
	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 datum points 1 and 2 in nonvolatile memory.

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

> If you wish to use multipoint axis error compensation you must traverse the reference marks (see "Multipoint axis error compensation")!

Datum Setting

> If you want to save the datum points in nonvolatile memory, you must first cross over the reference marks.

Only after crossing over the reference marks can you set new datums or activate existing ones.

There are two ways to set datums:

Touch the workpiece with the tool and then set the desired datum (see example). You can also touch two edges and set the centerline between them as a datum. The tool data of the tool used for this are automatically considered (see "Tool Compensation").

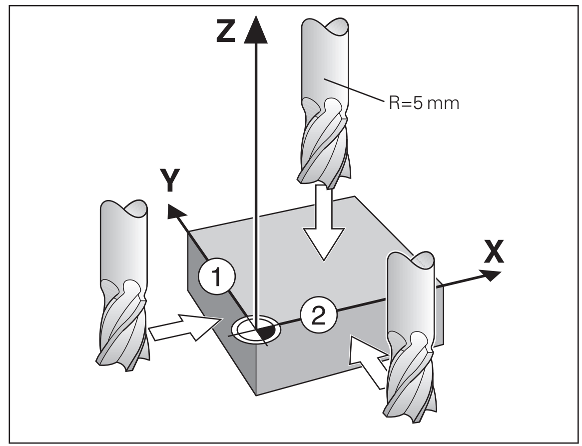
After you have set a datum it can be activated as follows:

	Select datum 1 or 2.

Datum setting with the tool

Example:

Working plane	X / Y
Tool axis	Z
Tool radius	R = 5 mm
Axis sequence for datum setting	X – Y – Z



Key	Action
⁞1/2	Select the datum number.
SPEC FCT	Select special functions.
SPEC FCT or ⁞1/2	Select "probing function."
PROBING	
ENT	Confirm selection.
PROBE EDGE	
ENT	Confirm "Probe edge."
X	Select X axis (if not already selected). SET lights up. Status display I<- blinks.
PROBE X (appears only briefly)	
	Touch workpiece edge ① with the tool.

Key	Action
ENT	X position is captured. SET blinks. Retract tool from workpiece. Status display I<- lights up.
0 ENT	Enter position value for the datum. Tool radius is automatically compensated.
Y	Select the Y axis. SET lights up. Status display I<- blinks.
PROBE Y (appears only briefly)	
	Touch workpiece edge ② with the tool.
ENT	Y position is captured. SET blinks. Retract tool from workpiece. Status display I<- lights up.
0 ENT	Enter position value for the datum in the Y axis. Tool radius is automatically compensated.

Z	Select the Z axis. SET lights up. Status display I<- blinks.
PROBE Z (appears only briefly)	
	Touch the top of the workpiece with the tool.
ENT	Z position is captured. SET blinks. Retract the tool from the workpiece. Status display I<- lights up.
0 ENT	Enter the position value for the datum in the Z axis.
SPEC FCT or CL	After setting the datum, exit the probing functions.

Tool Compensation

You can enter the axis, length and diameter of the current tool.

SPEC FCT	Select the special functions.
SPEC FCT or $\downarrow$1/$\downarrow$2	Select "tool diameter."

TOOL DATA	
ENT	Confirm tool data input mode.

TOOL DIAM.	
2 0 ENT	Enter the tool diameter, e.g. 20 mm, and confirm with ENT.

TOOL LENGTH		1)
5 0 ENT	Enter the tool length, e.g. 50 mm, and confirm with ENT.	

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•
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TOOL AXIS	
Z	Set the tool axis.

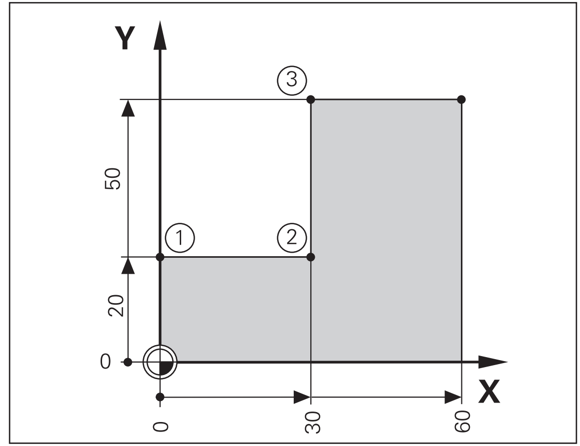
TOOL AXIS	
SPEC FCT or CL	Exit the special functions.

1) only by ND 750

Moving the Axes with Distance-To-Go Display

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

You can enter the absolute coordinates in the distance-to-go display. An active radius compensation will be considered.



Example: Milling a shoulder with distance-to-go

SPEC FCT	Select the special functions.
SPEC FCT or ↓1/↓2	Select "delta mode."
DELTA MODE	
ENT	Confirm your selection, Δ lights up.
Y 2 0 R+/- ENT	Select the axis, enter the nominal value, e.g. 20 mm, select radius compensation R+, confirm with ENT.

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	Move the machine axis to zero ①.
X 3 0 R+/- R+/- ENT	Select the axis, enter the nominal value, e.g. 30 mm, select radius compensation R–, and confirm with ENT.
	Move the machine axis to zero ②.
Y 5 0 R+/- ENT	Select the axis, enter the nominal value, e.g. 50 mm, select radius compensation R+, confirm with ENT.
	Move the machine axis to zero③
SPEC FCT ENT or CL	If appropriate, switch off the distance-to-go display.

Bolt Hole Circles and Bolt Circle Segments

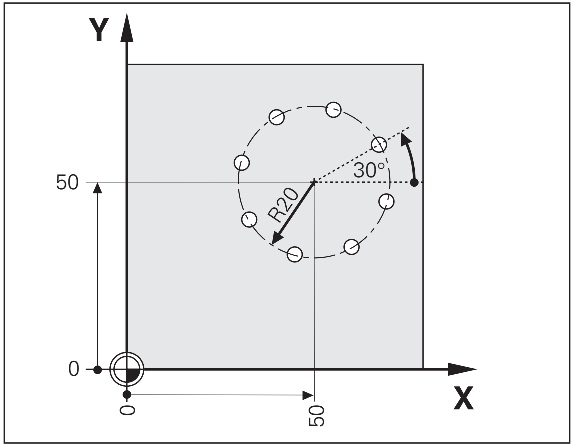
Your display unit enables you to quickly and easily drill bolt hole circles and bolt hole circle segments. The required data is requested in the message field.

Each hole can be moved to by traversing to display value zero. This requires entry of the following data:

- Number of holes (maximum: 999)
- Circle center
- Circle radius
- Starting angle for first hole
- Angle step between the holes (only for circle segments)
- Hole depth

Example

Number of holes	8
Coordinates of the center	X = 50 mm
	Y = 50 mm
Circle radius	20 mm
Starting angle	30 degrees
Hole depth	Z = –5 mm



SPEC FCT	Select the special functions.
SPEC FCT, 1/2	Select "bolt hole" circle.

BOLT HOLE

ENT	Confirm your selection.

FULL CIRCLE

if req. −, ENT	Confirm "full circle."

NUMB. HOLES

8, ENT	Enter the number of holes, e.g. 8. Confirm with ENT.

⋮

CENTER X

X 5 0, ENT	Enter the X coordinate of circle center, e.g. 50 mm, confirm with ENT.

CENTER Y

Y 5 0, ENT	Enter the Y coordinate of circle center, e.g. 50 mm, confirm with ENT.

RADIUS

2 0, ENT	Enter the radius of the bolt hole circle, e.g. 20 mm. Confirm with ENT.

START ANGLE

3 0, ENT	Enter the start angle for the first hole, e.g. 30°. Confirm with ENT.

⋮

HOLE DEPTH	
5 – ENT	Enter the total hole depth, e.g. –5 mm, and confirm with ENT.

START	
ENT	Start the display of the hole positions.

ENT ↓1/↓2	After the start, the distance-to-go mode becomes active (Δ symbol lights up). The hole number is shown briefly in the X axis. The individual holes are reached by traversing to zero. The holes can be selected with the ENT key or the ↓1 ↓2 key. The minus key shows the hole number again.
SPEC FCT or CL	Exit the bolt hole circle function.

Linear Hole Patterns

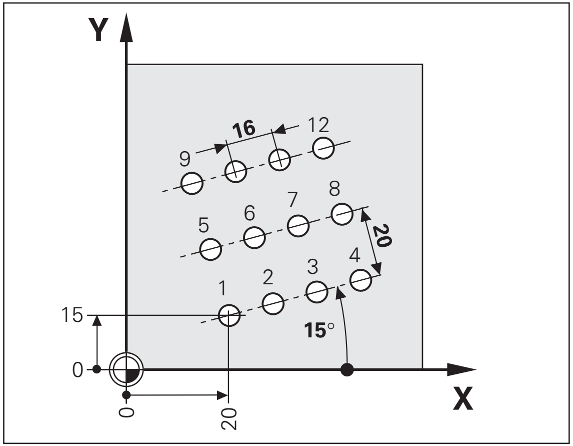
The linear hole pattern feature allows you to easily create rows of holes to cover an area. The required data are requested in the message field.

You can position to each hole by traversing to display value zero. The following data are required:

- Coordinates of the first hole
- Number of holes per row (maximum: 999)
- Spacing between holes
- Angle between the rows and the reference axis
- Hole depth
- Number of rows (maximum: 999)
- Spacing between rows

Example

Coordinates of the first hole	X = 20 mm
	Y = 15 mm
Number of holes per row	4
Spacing between holes	16 mm
Angle	15 degrees
Hole depth	Z = –30 mm
Number of rows	3
Spacing between rows	20 mm



SPEC FCT	Select special functions.

SPEC FCT, hole pattern key	Select "hole pattern."

LIN. HOLE	
ENT	Confirm "linear hole" pattern.

1ST HOLE X	
2 0 ENT	Enter the X coordinate of the first holes, e.g. 20, and confirm with ENT.

1ST HOLE Y	
1 5 ENT	Enter the Y coordinate of the first holes, e.g. 15, and confirm with ENT.

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•
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HOLES ROW	
4 ENT	Enter the number of holes per row, e.g. 4, and confirm with ENT.

HOLE SPACE	
1 6 ENT	Enter the spacing between holes in the row and confirm with ENT.

ANGLE	
1 5 ENT	Enter the angle, e.g. 15 degrees, and confirm with ENT.

HOLE DEPTH	
3 0 – ENT	Enter the hole depth, e.g. –30 mm, and confirm with ENT.

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•
•

NUMBER ROW	
3 ENT	Enter the number of rows, e.g. 3, and confirm with ENT.

ROW SPACE	
2 0 ENT	Enter the spacing of the rows, e.g. 20, and confirm with ENT.

START	
ENT	Start the display of hole positions.

ENT ↓1 / ↓2	The distance-to-go mode is now active (Δ symbol lights up). The holes number is shown briefly in the X axis. Move to the individual hole positions by traversing to the display value zero. Hole can be selected with the ENT key or with the ↓1 ↓2 key. Pressing the minus key shows the hole number again.

SPEC FCT or CL	Exit the linear hole patterns function.

Working with Scaling Factors

Scaling factors enable you to increase or decrease the display values based on the actual traverse distance. The display values are changed symmetrically about the datum.

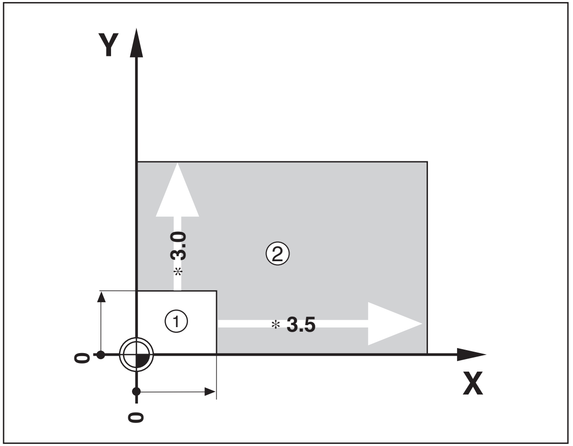
Enter scaling factors separately for each axis in parameter P12.

Parameter P11 activates and deactivates the scaling factors in all axes (see "Operating Parameters").

Example for enlarging a workpiece:

P12.1	3.5
P12.2	3.0
P11	ON

This results in a larger workpiece as shown in the illustration at right: ① is the original size, ② is with axis-specific scaling factors.



If a scaling factor is active, SCL lights up in the status display.

Error messages

Message	Cause and effect
`SIGNAL X`	Encoder signal is too small, e.g. when an encoder is contaminated.
`PROB. ERROR`	Before touching off on the workpiece, the tool must move by a distance of at least 0.2 mm.
`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`	Check sum error: Check the datum, operating parameters and compensation values for multi-point axis error compensation. If the error recurs, contact your service agency!

To erase error messages:
After you have removed the cause of error:

➤ Press the CL key.

Part II Installation and Specifications

Items Supplied

- **ND 710** for 2 axes
  or
- **ND 750** for 3 axes

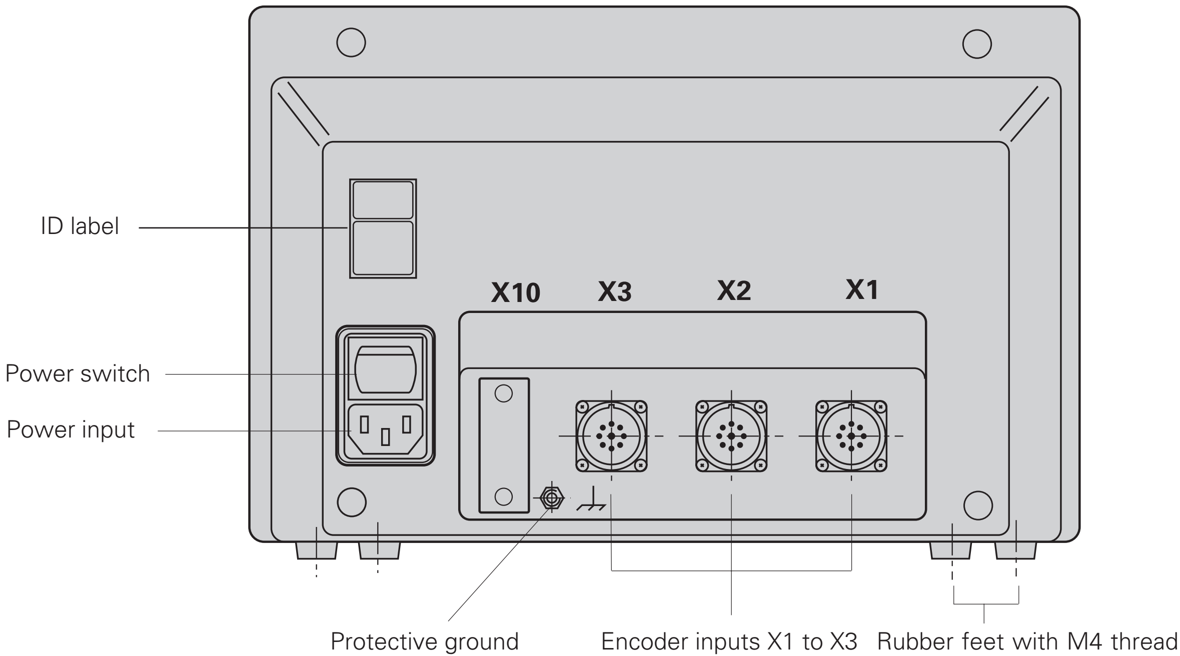
- **Power connector** Id. Nr. 257 811-01

- **User's Manual**

Optional Accessories

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

Connections on Rear Panel

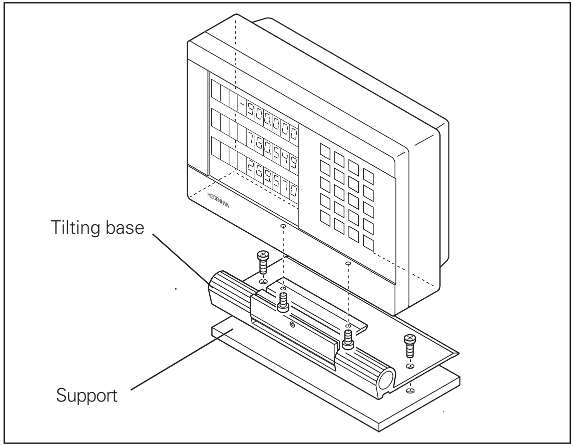


The interfaces X1, X2, X3 comply with the requirements for electrical separation according to EN 50178!

Mounting

ND 710/ND 750

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.

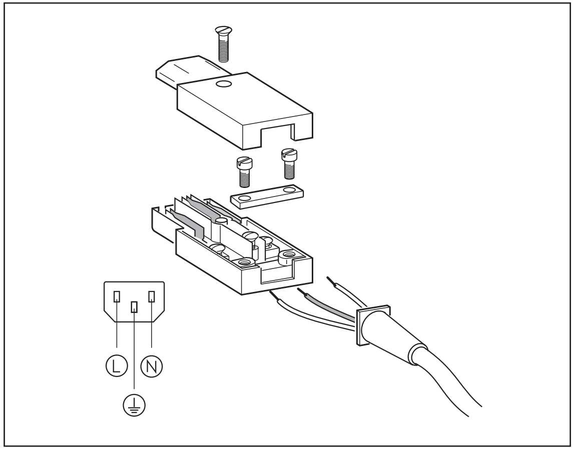


Power Connection

Power leads: Ⓛ and Ⓝ,
Connect protective ground to ⏚ !

- **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^2).



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

Connecting the Encoders

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

Assignment of the encoder inputs

Encoder input X1 is for the X axis
Encoder input X2 is for the Y axis
Encoder input X3 is for the Z axis (ND 750 only)

Encoder monitoring system

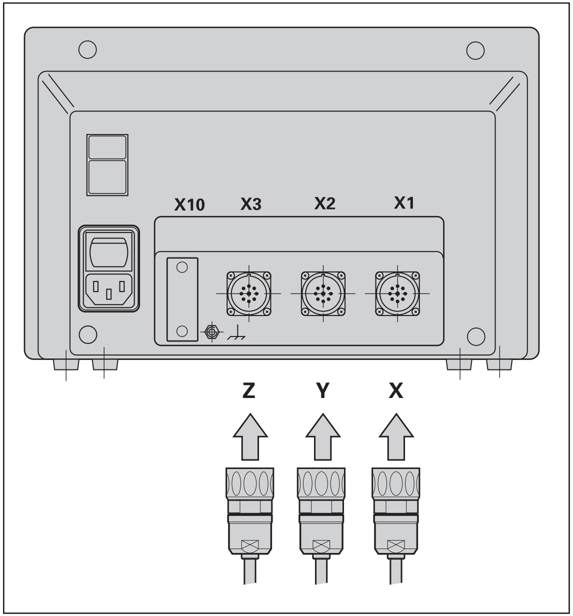
Your display unit features a monitoring system for checking the amplitude and frequency of the encoder signals. If it detects a faulty signal, one of the following error messages will be generated:

```
SIGNAL X
FRQ. X
```

Encoder monitoring can be activated with parameter P45.

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 through the dialog "CODE" and by entering 95148. Operating parameters are designated by the letter P and a number. Example: **P11.** The parameter designation is shown in the input field when you select it with the DATUM and ENT key in the X display. The parameter setting is shown in the Y display.

Some operating parameters have separate values for each axis. In the **ND 750,** these parameters are identified by an index of 1 to 3, and in the **ND 710** by an index of one to two.
Example: P12.1 scaling factor, X axis
P12.2 scaling factor, Y axis
P12.3 scaling factor, Z axis (ND 750 only)

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 the SPEC FCT key or 1 2 , until "PARAMETER" appears in the X display.
➤ Confirm your selection by pressing "ENT."
➤ If required, press the 1 2 key to enter the code number **95148** and access the complete list of operating parameters.

To page through the operating parameters

➤ Page forwards by pressing the ENT key.
➤ Page backwards by pressing the 1 2 key.

To change parameter settings

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

To correct an entry

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

To leave the operating parameters

➤ Press the SPEC FCT or CL key.

List of operating parameters

P1 Unit of measure [1]

Display in millimeters	MM
Display in inches	INCH

P3.1 to P3.3 Radius/diameter display [1]

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

P11 Activate scaling factor [1]

Active	SCALING ON
Not active	**SCALING OFF**

P12.1 to P12.3 Define 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:	0.100000 to 9.999999
Factory default setting:	**1.000000**

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

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

20 / 10 / 8 / 5 / 4 / 2 / 1 / 0.8 / 0.5 / 0.4 / 0.2 / 0.1

P33.1 to P33.3 Counting mode

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** (up to 6 with inch display)

P40.1 to P40.3 Select type of axis error compensation

No axis error compensation	**CORR. OFF**
Linear error compensation active, multipoint error comp. not active	CORR. LIN
Multipoint error compensation active, linear error compensation not active	CORR. ABS

[1] User parameter

P41.1 to P41.3 Linear axis error compensation

Input range (µm): –99999 to +99999
Factory 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]

P43.1 to P43.3 Reference marks

One reference mark	SINGLE REF.M.
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**
Not active	AXIS OFF

P80 Function of the CL key

Reset to zero with CL	CL...RESET
No reset to zero with CL	CL......OFF

P98 Dialog language [1)]

German	**LANGUAGE D**
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

[1)] User parameters

Linear Encoders

Selecting the display step with linear encoders

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

- Subdivision (P32)
- Counting mode (P33)
- Decimal points (P38)

Example

Linear encoder with a signal period of 10 µm

Desired display step .... 0.000 5 mm
Subdivision (P32) 20
Counting mode (P33) 5
Decimal places (P38) 4

The following tables will help you select the parameters.

Display step, signal period and subdivision for linear encoders

		Signal period [µm]						
Display step		2	4	10	20	40	100	200
[mm]	[inch]	P32: Subdivision						
0.000 1	0.000 005	20	–	–	–	–	–	–
0.000 2	0.000 01	10	20	–	–	–	–	–
0.000 5	0.000 02	4	8	20	–	–	–	–
0.001	0.000 05	2	4	10	20	–	–	–
0.002	0.000 1	1	2	5	10	20	–	–
0.005	0.000 2	0.4	0.8	2	4	8	20	–
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
0.1	0.005	–	–	0.1	0.2	0.4	1	2

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

Model	Signal period [µm]	Reference marks	Millimeters				Inches			
			Display step [mm]	Subdivision	Count	Decimal places	Display step [inch]	Subdivision	Count	Decimal places
		P 43		P 32	P 33	P 38		P 32	P 33	P 38
CT	2	single	0,0005	4	5	4	0,00002	4	2	5
MT xx01			0,0002	10	2	4	0,00001	10	1	5
LIP 401A/401R		-/single	0,0001	20	1	4	0,000005	20	5	6
LF 103/103C	4	single/5000	0,001	4	1	3	0,00005	4	5	5
LF 401/401C			0,0005	8	5	4	0,00002	8	2	5
LIF 101/101C			0,0002	20	2	4	0,00001	20	1	5
LIP 501/501C										
MT xx	10	single	0,0005	20	5	4	0,00002	20	2	5
LS 303/303C	20	single/1000	0,01	2	1	2	0,0005	2	5	4
LS 603/603C			0,005	4	5	3	0,0002	4	2	4
LS 106/106C	20	single/1000	0,001	20	1	3	0,00005	20	5	5
LS 406/406C										
LS 706/706C										
ST 1201		-								
LB 302/302C	40	single/2000	0,005	8	5	3	0,0002	8	2	4
LIDA 10x/10xC			0,002	20	2	3	0,0001	20	1	4
LB 301/301C	100	single/1000	0,005	20	5	3	0,0002	20	2	4

Example:
Your encoder: LS 303 C, desired display step: 0,005 mm (5 µm), 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 40 (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 (such as the HEIDENHAIN VM 101).

For example, you can determine the screw pitch error X=F(X) for the X axis.

An axis can only be corrected in relation to **one** axis that has an error. In each axis, a compensation value table with 16 compensation values can be generated. You can select the compensation table with the SPEC FCT key and the "PARAMETER\CODE" dialog.

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

R+/-	Select the REF.

Entries in the compensation value table

- Axis to be corrected: X, Y or Z (Z axis only with ND 750)
- Axis causing the error: X, Y or Z (Z axis only with ND 750)
- 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 (= 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

Keys	Action
SPEC FCT	Select special functions.
SPEC FCT or 1/2	Select "parameter" if required, by repeatedly pressing the 1 2 key.
PARAMETER	
ENT 1/2	Select dialog for entering the code number.
CODE	
1 0 5 2 9 6 ENT	Enter code number 105296 and confirm with ENT.
AXIS X	
X ENT	Select the axis to be corrected (e.g. X), and confirm with ENT.
X FCT. X	
X ENT	Enter the axis causing the error (e.g. X) (screw pitch error), and confirm with ENT.

Keys	Action
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, for example 2^{10} µm (equals 1024 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 1/2	Enter all further compensation points. If you press the minus key, the unit will show the number of the current compensation point in the X display.
SPEC FCT or CL	Conclude entry.

Deleting a compensation value table

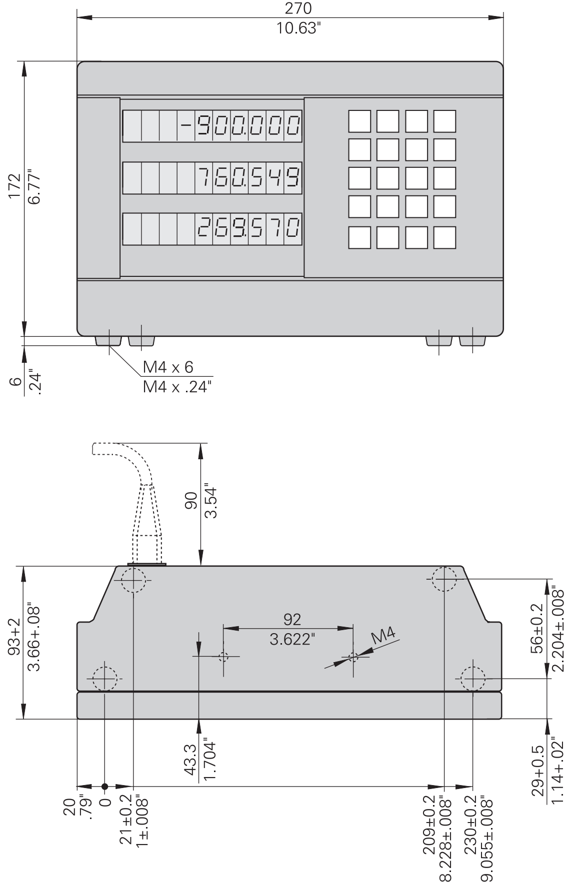
SPEC FCT	Select special functions.
SPEC FCT or 1/2	Select "parameter."
PARAMETER	
ENT 1/2	Select the dialog for entering the code number.
CODE	
1 0 5 2 9 6 ENT	Enter the code number 105296 and confirm with ENT.
AXIS	
Z CL	Select the compensation value table (e.g., for the Z axis), and delete the table.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

Specifications

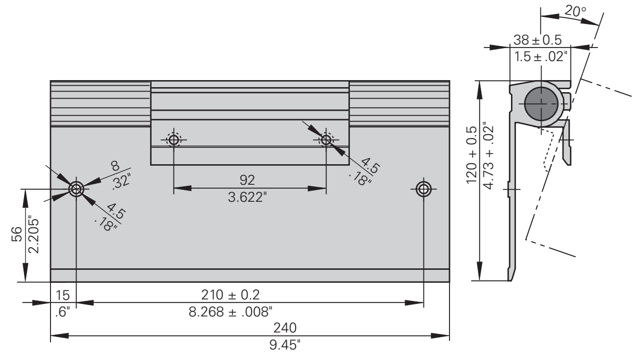
Housing	ND 710/ND 750 Bench-top design, cast-metal housing Dimensions (W • H • D) 270 mm • 172 mm • 93 mm
Oper. temperature	0° to 45° C (32° to 113° F)
Storage temperature	–20° to 70° C (–4° to 158° F)
Weight	Approx. 2.3 kg (5 lb)
Relative humidity	<75% annual average <90% in rare cases
Power supply	90 Vac to 260 Vac (–15% to +10%) 48 Hz to 62 Hz
Power consumption	15 W
Protection	IP 40 as per IEC 529

Encoder inputs	For encoders with 7 to 16 µAPP Grating period 2, 4, 10, 20, 40, 100, and 200 µm Reference mark evaluation for distance-coded and single reference marks
Input frequency	Max. 100 kHz for 30 m cable length
Display step	Adjustable (see “Linear Encoders”)
Datums	2 (nonvolatile)
Functions	– Tool radius compensation – Distance-to-go display – Touching off function with tool – Circular & linear hole patterns – Scaling factor

Dimensions mm/inches



Tilting base



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