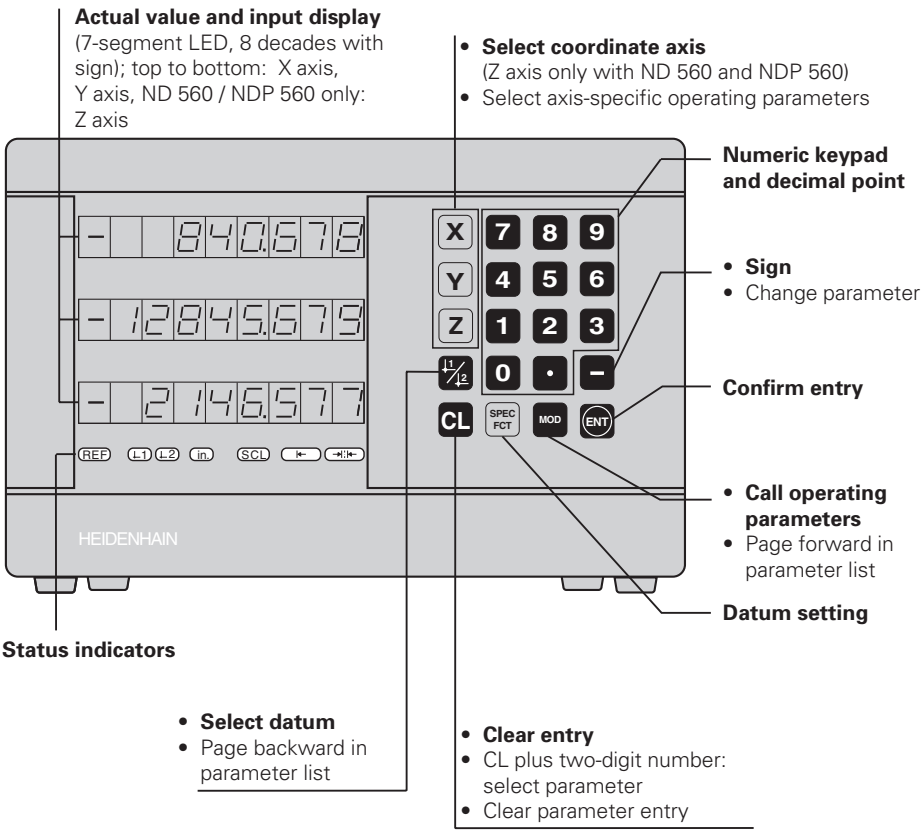
HEIDENHAIN

Working with the position display units

ND 520
For two axes

ND 560
For three axes

NDP 560
For panel mounting



Indicator	Meaning
REF	Reference mark crossed over – datum points are now stored in nonvolatile memory. **Blinking:** Waiting for confirmation from operator.
⊥1 / ⊥2	Datum point 1 / Datum point 2 currently active
in.	Position values displayed in inches
SCL	Scaling factor active
⊢	Set workpiece edge as datum. **Blinking:** Waiting for confirmation from operator.
→|⊢	Set centerline between two workpiece edges as datum. **Blinking:** Waiting for confirmation from operator.

The ND 520, ND 560 and NDP 560 are designed for use with HEIDENHAIN linear encoders with sinusoidal output signals.

The linear encoders have one reference mark or several (preferably distance-coded) reference marks. When a reference mark is crossed over, a signal is generated which identifies that position as a reference point.

After switch-on, crossing over the reference marks restores the relationship between axis slide positions and display values last established by datum setting. With encoders which have distance-coded reference marks, this requires a traverse of no more than 20 mm.

Switch-On

Turn on the power

➤ Switch on the display unit with the power switch on the rear panel.
The display shows `ENT. . .CL` and **REF blinks**.

Switch on reference mark evaluation

➤ Press ENT.
The display shows the value last assigned to the reference mark position.
REF glows and the **decimal point blinks**.

Cross over the reference mark in each axis

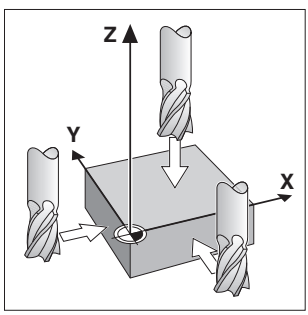
➤ Move the axes one after the other until the display becomes active and the **decimal point glows steadily**.

The display unit is now ready for operation.
If you do **not** wish reference mark evaluation, press **CL** instead of ENT.

Datum Setting

The datum setting procedure assigns a specific axis position to the associated display value.

You can set two separate datum points and switch from one to the other with the touch of a key. Use datum 2 when you want to display incremental dimensions.



Touching the workpiece

➤ Select the **datum**.
➤ Select the **coordinate axis** in which the tool moves (for example, the X axis).
➤ **Touch** the workpiece with the tool.
➤ Enter the **position** of the tool center using the numeric keypad (for example, X = –5 [mm]). A **minus sign** cannot be entered until at least **one digit** is in the display.
➤ Press **ENT**.
This stores the value for the tool position.

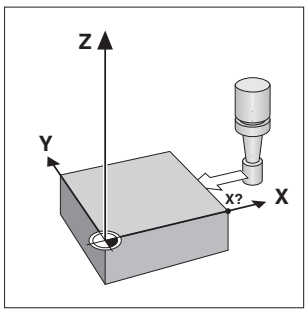
Follow same procedure for the other axes.

Datum Setting with an Edge Finder

The special functions of your display unit enable you to use a HEIDENHAIN **KT edge finder** to set a workpiece edge or the centerline between two workpiece edges as a datum. The position displays take into account the **edge finder diameter** which you entered in operating parameter **P25**.

If you are using the **NDP 560** (which has **no** edge finder input) or if you want to use the special functions with a **tool**, please see the instructions on the next page.

Workpiece edge as datum

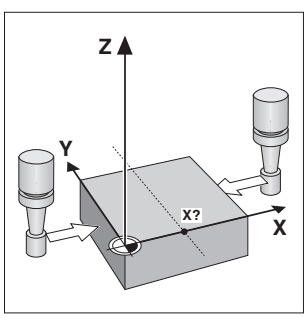


Workpiece edge as datum

- ➤ Select the **datum**.
- ➤ Press the **SPEC FCT** key once.
  The indicator "Workpiece edge as datum" blinks.
- ➤ Press **ENT**.
  The indicator glows steadily.
- ➤ Select the **coordinate axis** in which the tool moves. The selected axis glows more brightly.
- ➤ **Probe** the workpiece with the edge finder until the LEDs in the edge finder light up and the display shows the position of the workpiece edge.
- ➤ Enter the new **coordinate value** for the probed edge.
- ➤ Press **ENT**.
  The workpiece edge is set to the new value, and the display shows the position of the edge finder relative to the new datum.

This function ends automatically.

Centerline between two workpiece edges as datum



Centerline as datum

- ➤ Select the **datum**.
- ➤ Press the **SPEC FCT** key **twice**. The indicator "Centerline as datum" blinks.
- ➤ Press **ENT**.
  The indicator glows steadily.
- ➤ Select the **coordinate axis** in which the tool moves. The selected axis glows more brightly.
- ➤ **Probe** the workpiece with the edge finder until the LEDs in the edge finder light up and the decimal point blinks.
- ➤ **Probe** the second workpiece edge with the edge finder until the LEDs in the edge finder light up and the display shows the position of the centerline. The decimal point glows steadily.
- ➤ Enter the new **coordinate value** for the centerline.
- ➤ Press **ENT**.
  The centerline is now set to the new value and the display shows the position of the edge finder relative to the new datum.

This function ends automatically.

To cancel the datum setting function:

- ➤ When the indicator for the function is **blinking**: press **CL**
- ➤ When the indicator for the function is **glowing steadily**: press **SPEC FCT**

Datum Setting with a Tool

It is also possible to probe the workpiece with a **tool** instead of the edge finder. The functions for datum setting then differ as follows:

- The **tool diameter** is automatically taken into account during probing
- The position of the probed workpiece edge is **not** automatically stored.

Tool diameter:

➤ Enter the tool diameter in operating parameter P25.

To store the position of the workpiece edge when the tool is touching the edge:

➤ Press ENT.

Working with Scaling Factors

The ND 510 and the ND 550 can display the axis traverse lengthened or shortened by a **scaling factor.** You enter a scaling factor separately for each axis in the user parameter P12, then activate the scaling factor function with the user parameter P11. **SCL** is highlighted.

Error Messages

Message	Cause and effect
ERROR 09	Traverse distance with datum setting function (SPEC FCT) is too short
ERROR 10	Incorrect input value
ERROR 50	Encoder signal too weak (encoder may be contaminated)
ERROR 51	Input frequency too high for encoder input (will occur for example when traverse speed too high)
ERROR 52	Encoder signal to strong
ERROR 53	Internal counter overflow
ERROR 55	Error while crossing over reference marks
ERROR 80 ERROR 82 ERROR 83 ERROR 84	To clear the error message: **Switch off the display unit.** Should any of these error codes recur, contact your HEIDENHAIN service agency.
ERROR 94	Offset compensation values for encoder signals have been erased: contact your service agency.
ERROR 95	Compensation values for nonlinear axis error compensation have been erased
ERROR 97	Datums have been erased
ERROR 99	Erase the operating parameters.

If **all decimal points light up**, the measured value is too large or too small.
Set a new datum.

To clear error message ERROR

When you have removed the cause of the error,

➤ press **CL**.

Non-linear Error Compensation

To work with the non-linear error compensation it is necessary to
- activate the function via the operating parameter P40.
- traverse the reference marks after switching on.
- enter the compensation values in the table.

For every axis compensation values can be entered over 16 compensation points. To determine the compensation values with a comparator system from HEIDENHAIN, such as VM 101, you must select the REF display.

Selecting the Compensation Value Table

➤ Select the operating parameter P00 and enter the code number 105 296. Use the following keys for the entries:

Key	Function
MOD	Save input value and select next input parameter.
↓1 / ↓2	Save input value and select preceding input value.
SPEC FCT	Select REF display.
ENT	• Save entry. • Exit compensation value table.
CL	• Delete entry. • Delete all compensation values.

➤ Enter the parameters and compensation values as follows:

Display	Entry
CONTLPAR	Enter the axis to be compensated, e.g. X.
1 FUNCT	Enter the axis causing the error, e.g. X, i.e. X = F(X).
BASE 1	Enter the datum on the axis causing the error.
d ISt 1	Enter the distance of the compensation points on the error-causing axis, e.g. 14 (= 2^{14} µm = 16.384 mm). Minimum input value: 10 (= 1.024 mm) Maximum input value: 23 (= 8388.608 mm)
PT 1	Select compensation point No. 1. The compensation point number can be seen while pressing the MOD key. After letting go of the MOD key the coordinates of the selected compensation point can be seen in the upper line. Enter the compensation value in the lower line.
PT 2	Enter all following compensation points.

Delete all compensation values:

Display	Entry
CONTLPAR	Press key CL.
DELETE	Press key ENT. Compensation values are deleted.

Operating Parameters

User Parameters

User parameters are operating parameters that can be changed **without** entering the codes: P00 to P25

Axis assignment

Axis-specific parameters (those requiring separate entries for each axis) have **axis codes**: *1* for the X axis, *2* for the Y axis, and *3* for the Z axis.
The axis code is separated from the parameter number by a point.
In the operating parameter list, these parameters are set off with a superscript "**A**" and the parameter for the X axis is given (e.g., P12.1 SCL).
You select axis-specific operating parameters with the orange axis keys.

To access the operating parameters:

➤ Press MOD

To go directly to an operating parameter:

➤ Press and hold CL and press the first digit of the parameter number

➤ Release both keys and enter the second digit of the parameter number

To page through the operating parameters:

➤ **Page forward:** press MOD

➤ **Page backward:** press ↓1 /↓2

Any changes made are automatically activated when you resume paging.

To change a parameter setting:

➤ Change the setting with the minus key, **or**

➤ Enter the desired value directly, e.g. for P25

To correct an entry:

➤ Press CL

To exit the operating parameters:

➤ Press ENT

This activates all changes you made.

Operating Parameter List

Parameter	Meaning	Function / Effect	Setting
P00 CODE	**Code Number**	**95148:** protected operating parameter **105296:** select compensation value table	
P01	**Unit of measurement**	Dimensions in mm	INCH OFF
		Dimensions in inch	INCH ON
P03.1	**Radius-/diameter display**[A]	**Rad**ius	RADIUS
		Diameter	DIA
P11 SCL ***Scal**ing*	**Scaling factor**	Scaling factor active	ON
		Scaling factor inactive	OFF
P12.1 SCL	**Scaling factor** [A]	Enter a value for each axis separately 0,1 ≤ P12 ≤ 9,999 999	
P25 TOOL ***Tool***	**Tool diameter**	Enter the tool diameter 0 ≤ P25 ≤ 199,999 [mm]	

Operating Parameter List – cont'd.

Parameter	Meaning	Function / Effect	Setting
P30.1	**Counting direction** A	Normal (***Dir****ection:* ***Pos****itive*)	dIr POS
		Inverse (***Dir****ection:* ***Neg****ative*)	dIr NEG
P31.1	**Signal period of the encoder [µm]** A (***Per****iod*:) 2, 4, 10, 20, 40, 100, 200, 12 800		
P32.1	**Subdivision of the encoder signals** A (***Subd****ivision*:) 128, 100, 80, 64, 50, 40, 20, 10, 5, 4, 2, 1, 0.8, 0.5, 0.4, 0.2, 0.1		
P40.1	**Select error compensation**	Error compensation not active	CORR.OFF
		Linear error compensation active	CORR.LIN
		Non-linear error compensation active	CORR.NLS
P41.1 COM ***Com****pensation*	**Linear error compensation**[1] A – 99 999 < P41 < + 99 999 [µm/m]		
P43.1 REF	**Reference marks** A	One reference mark	SINGLE
		Distance-coded with 500 • SP (SP =signal period)	500
		Distance-coded with 1000 • SP (e.g. for LS 303 C / LS 603 C)	1000
		Distance-coded with 2000 • SP	2000
		Distance-coded with 5000 • SP	
P45.1 ENC ***Enc****oder*	**Encoder monitoring** A	Monitoring off (***Alarm Off***)	ALAR. OFF
		Monitoring on (***Alarm On***)	ALAR. ON
P48.1	**Axis display** A (***Axis***)	Display measured position	AXIS ON
		Do not display measured position / no encoder	AXIS OFF
P80 SET	**Function of the CL key**	Reset to zero with CL	ZERO
		No reset to zero with CL	OFF

[1] **Entry value for P41**
Example: Displayed measuring length: L_d = 620.000 mm
Actual length (as determined with a comparator system such as the VM 101 from HEIDENHAIN): L_a = 619.876 mm
Length difference: $\Delta L = L_a - L_d = -124$ µm
Compensation factor: $k = \Delta L / L_d = -124$ µm / 0.62 m = **–200** [µm/m]

Display step, signal period and subdivision for linear encoders

Display step		P31: Signal period [µm]							
		2	4	10	20	40	100	200	12 800
[mm]	[inches]	P32: Subdivision							
0.000 02	0.000 001	100	–	–	–	–	–	–	–
0.000 05	0.000 002	40	80	–	–	–	–	–	–
0.000 1	0.000 005	20	40	100	–	–	–	–	–
0.000 2	0.000 01	10	20	50	100	–	–	–	–
0.000 5	0.000 02	4	8	20	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	–
0.1	0.005	–	–	0.1	0.2	0.4	1	2	128
0.2	0.01	–	–	–	–	–	–	–	64

Parameter Settings for HEIDENHAIN Linear Encoders

Model and signal period [µm]		Reference marks	P43	Display step (unit: P01) mm	inches	Subdivision, P32
LIP 40x	2	one	single	0.001	0.000 05	2
				0.000 5	0.000 02	4
				0.000 2	0.000 01	10
				0.000 1	0.000 005	20
				0.000 05	0.000 002	40
				0.000 02	0.000 001	100
LIP 101 A	4	one	single	0.001	0.000 05	4
LIP 101 R				0.000 5	0.000 02	8
				0.000 2	0.000 01	20
				0.000 1	0.000 005	40
				0.000 05	0.000 002	80
LIF 101R	4	one	single	0.001	0.000 05	4
LIF 101 C		dist. cod.	5000	0.000 5	0.000 02	8
LIF 401		one	single	0.000 2	0.000 01	20
LIF 401 C		dist. cod	5000	0.000 1	0.000 005	40
LID xxx/LID xxx C	10	one/dist.cod.	single/2000	0.001	0.000 05	10
LS 103/LS 103 C	10	one/dist.cod.	single/1000	0.000 5	0.000 02	20
LS 405/LS 405 C				0.000 2	0.000 01	50
ULS/10				0.000 1	0.000 005	100
LS 303/LS 303 C	20	one/dist.cod.	single/1000	0.01	0.000 5	2
LS 603/LS 603 C				0.005	0.000 2	4
LS 106/LS 106 C	20	one/dist.cod.	single/1000	0.01	0.000 5	2
LS 406/LS 406 C				0.005	0.000 2	4
LS 706/LS 706 C				0.002	0.000 1	10
ULS/20				0.001	0.000 05	20
				0.000 5	0.000 02	40
LIDA 10x	40	one/dist.cod.	single/2000	0.002	0.000 1	20
LB 302				0.001	0.000 05	40
				0.000 5	0.000 02	80
LIDA 2xx	100	one	single	0.01	0.000 5	10
LB 3xx				0.005	0.000 2	20
LB 3xx C		dist. cod.	1000	0.002	0.000 1	50
				0.001	0.000 05	100
LIM 102	12800	one	single	0.1	0.005	128

Example: Linear encoder with signal period s = 20 µm
Desired display step a = 0.005 mm
Subdivision P32 **= 0.001 • s / a** = 4

Linear measurement with ballscrew and rotary encoder

If you are measuring linear distance with a ballscrew and rotary encoder, calculate the signal period as follows:

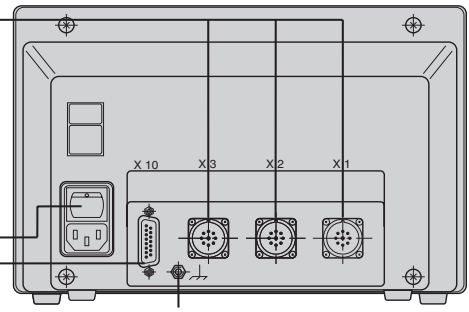
$$\text{Signal period } s = \frac{\text{Screw pitch [mm]} \bullet 1000}{\text{Line count}} \text{ [µm]}$$

ND 520/ND560: Rear Panel

Inputs for HEIDENHAIN linear encoders
(ND 520: 2, ND 560: 3)
with sinusoidal output signals
($7\mu A_{pp}$ to $16\ \mu A_{pp}$),
Connecting cable max. 30 m (98.5 ft),
Input frequency max. 100 kHz

Power switch

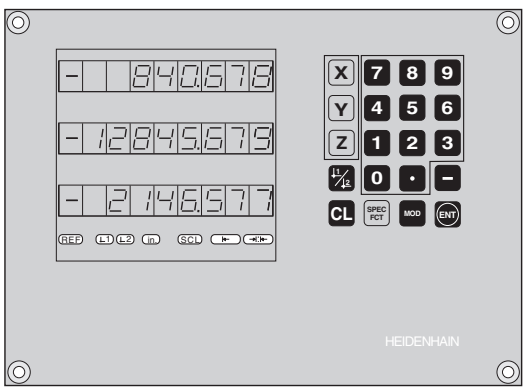
Edge finder input



Ground terminal

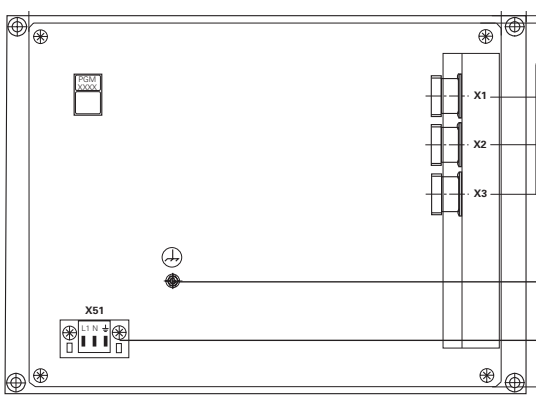
Interfaces X1, X2, X3 and X10 comply with the recommendations in EN 50 178 for separation from line power.

NDP 560: Front and Rear Panel



Front panel dimensions [mm]
259+0.5 x 198.5+0.5

Mounting depth min. 140 mm



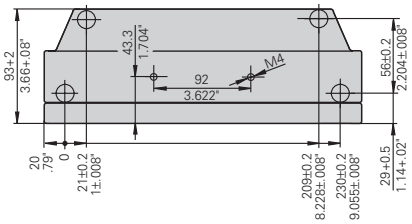
Inputs X1 to X3 for HEIDENHAIN linear encoders with sinusoidal output signals (see above)

Ground terminal

Power connection

ND 520/ND 560: Installation

The display unit can be mounted on a flat surface or on the tilting base from HEIDENHAIN (Id.-Nr. 281 619 01) with M4 screws.



Power Supply and Connection

Danger of electrical shock!
Unplug the power cable before opening the housing.
Connect a protective ground. This connection should never be interrupted.

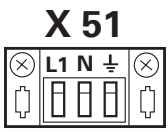
Danger to internal components!
Do not engage or disengage any connections while the unit is under power.
Use only original replacement fuses.

Primary-clocked power supply.
Voltage range 100 V to 240 V (–15% to +10 %), **Frequency** 48 Hz to 62 Hz,
Power consumption ND 520: 9 W, ND 560 and NDP 560: 12 W,
Line fuse F 1 A (in unit).
Minimum cross-section of power cable: 0.75 mm²

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)

Power connection – ND 520 and ND 560
The ND 520 and ND 560 have a socket on the rear panel for the power cable.

Power connection – NDP 560
The NDP 560 has a terminal (X 51) on the rear panel for the power connection.



Ambient Conditions

Temperature range	Operation: 0°C to +45°C (32°F to +113°F) Storage: –30°C to +70°C (–22°F to +158°F)
Rel. humidity	Annual average: < 75%; maximum: < 90%
Weight	2.5 kg

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