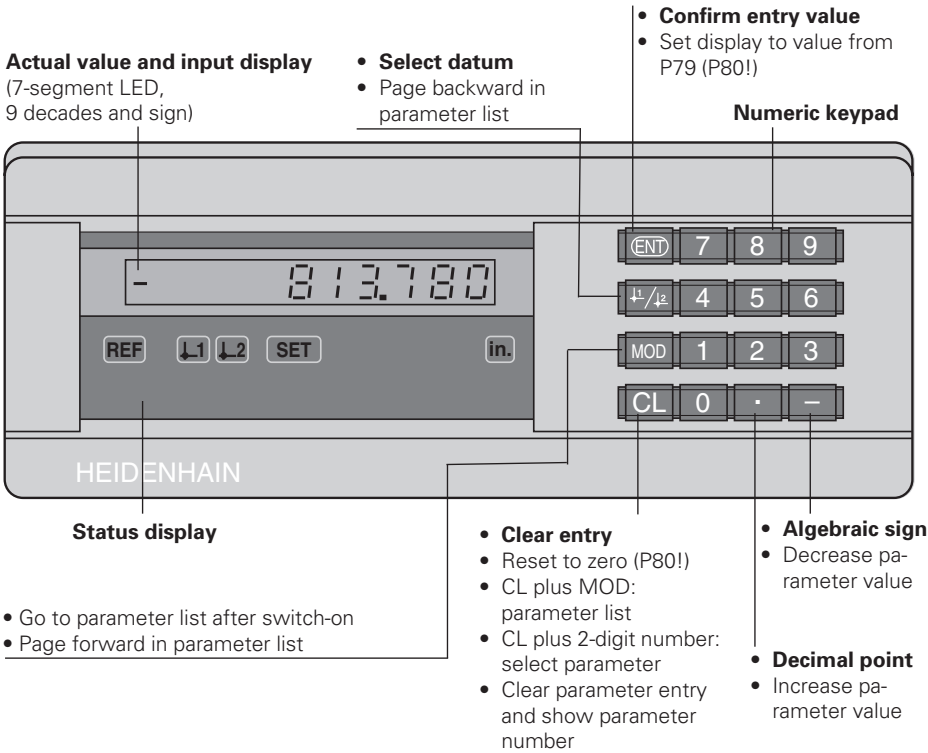
HEIDENHAIN

Working with the measured value display unit

ND 221



Indicator	Meaning
REF	If decimal points are blinking: Display is waiting for the reference mark to be crossed over. If decimal points are not blinking: Reference mark was crossed over – datum points are now stored in nonvolatile memory. **Blinking:** Waiting for operator to press ENT or CL.
in.	Position values displayed in inches.
⊥1 / ⊥2	Datum 1 / Datum 2 currently active.
SET	**Blinking:** Waiting for operator to confirm entry values.

The ND 221 is designed primarily for use with HEIDENHAIN **MT Length Gauges**. MT gauges feature **one** reference mark. When the reference mark is crossed over, it generates a signal identifying that position as a reference point.

After switch-on, simply crossing over the reference mark re-establishes the relationship between axis positions and display values as it was last defined by datum setting.

It is also possible to use other photoelectric linear encoders (see "Parameter Settings for HEIDENHAIN Linear Encoders"). These encoders have one or more reference marks, which may also be *distance-coded*. With distance-coded reference marks, a maximum traverse of only 20 mm after switch-on suffices to re-establish the datum.

Switch-On

0 ➤ 1 Ent...CL	**Turn on the power** (switch located on rear panel) • Display shows Ent...CL. • REF blinks.
ENT 5 , 6 9 7	**Switch on reference mark evaluation** • The display shows the value last assigned to the reference mark position. • REF indicator glows. • Decimal point blinks.
⇕	**Cross over reference mark** Move the axis until the display becomes active and the decimal point no longer blinks.

If you do **not** wish reference mark evaluation, press **CL** instead of ENT.

Setting the Datum

The datum setting procedure assigns a display value to a specific axis position. The ND 221 allows you to set two separate datum points.

↓1/↓2	**Select datum** 1 or 2.
4 0 4 0	**Enter a value**, such as 40.
ENT	**Confirm entered value.**

You can switch from one datum to the other at any time.
Use datum 2 when you want to display incremental dimensions.

Operating Parameters

The parameters are divided into "user parameters" and "protected operating parameters," which can only be accessed by entering a code number.

User parameters
User parameters are operating parameters that you can change **without** entering the code number: They are designated P00 to P30, P50, P51, P79, P86

Calling user parameters
To call user parameters **immediately after switch-on**:
➤ Press the MOD key as long as [ENt. . .CL] is visible in the display.

To call user parameters **during operation**:
➤ Press and hold the CL key, then press MOD.
To go **directly** to a specific user parameter:
➤ Press and hold the CL key, then press the first digit of the parameter number.
➤ Release both keys and press the second digit.

Protected operating parameters
Before you can change protected operating parameters you must enter the **code number 95 148** through [P00 CODE] : They **remain** accessible until you switch off the position display.

To page through the parameter list
➤ **Forward** paging: Press the MOD key.
➤ **Backward** paging: Press the ⊥1 / ⊥2 key.
By paging on, you automatically enter any change you've made in a parameter.

To change operating parameters
➤ Increase the parameter value with the decimal point key, **or**
➤ Decrease the parameter value with the minus key, **or**
➤ Enter the numerical value for the operating parameter, e.g. for P41 ([SET] blinks).

To correct your entries and show the parameter designation
➤ Press the CL key.

To exit the operating parameters
➤ Press ENT. All changes made become effective.

Operating Parameter List

Parameter	Meaning	Function / Effect	Setting
P00 CODE	Enter **code number 95 148** to change a protected operating parameter.		
P01 INCH	**Unit of measure**	Display in millimeters	OFF
		Display in inches	ON
P30 dIr ***Dir**ection*	**Counting direction**	Normal (***Pos**itive*)	POS
		Inverse (***Neg**ative*)	NEG
P32 SUBd ***Subd**ivision*	**Subdivision of encoder signal period** 400, 320, 256, 200, 160, 128, 100, 80, 50, 40, 20, 10, 8, 5, 4, 2, 1, 0.8, 0.5, 0.4, 0.2, 0.1		

Operating Parameter List — *continued*

Parameter	Meaning	Function / Effect	Setting
P33 StEP	**Counting mode**	0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 0	1
		0 - 2 - 4 - 6 - 8 - 0	2
		0 - 5 - 0	5
P38 dEC ***Dec**imal point*	**Decimal places** 1 / 2 / 3 / 4 / 5 / 6 (up to 8 with inch display)		
P41 COMP ***Comp**ensation*	**Linear error compensation**[1] – 99 999,9 < P41 < + 99 999,9 [µm/m]		
P43 rEF	**Reference marks**	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	5000
P44 rEF	**Reference mark evaluation**	Evaluation	rEF On
		No evaluation	rEF OFF
P45 EnCd ***Encod**er*	**Encoder monitoring**	No monitoring (***Alarm Off***)	ALAr. OFF
		Contamination	ALAr. C
		Frequency	ALAr. F
		Contamination and frequency	ALAr. CF
P50 U24	**Baud rate** bAUd 110, 150, 300, 600, 1200, 2400, 4800, 9600		
P51 U24	**Additional line feeds** L. inEFd. 0 to 99 (***Linefeed***)		
P79 PrSt ***Pres**et*	**Value for datum**	Enter numerical value for datum setting with the ENT key	
P80 SEt	**Reset/Preset**	No zero reset/preset with CL/ENT	SEt OFF
		Zero reset with CL (***Set Zero***), no preset with ENT	SEt zEro
		Zero reset with CL and preset with ENT to value in P79	PrESEt
P82 MESG ***Mess**age*	**Display after switch-on**	ENt. . .CL message displayed	MESG On
		ENt. . .CL message not displayed	MESG OFF
P86 MOd ***Mod**e*	**Inhibit PRINT function**	PRINT inhibited	PrInt OFF
		PRINT not inhibited	PrInt On

[1] **Determine entry value for P41**

Example: Displayed measuring length L_a = 620.000 mm
Actual length (determined with, for example, the VM 101 comparator system from HEIDENHAIN) L_t = 619.876 mm
Length difference $\Delta L = L_t - L_a = -124$ µm
Compensation factor k:
$k = \Delta L / L_a = -124$ µm / 0.62 m = **–200** [µm/m]

Parameter Settings for HEIDENHAIN Linear Encoders

Model	Signal period [µm]	Reference marks	P 43	Display step (unit: P01) mm	Display step (unit: P01) inches	The following settings apply for **mm**: Subdivision P32	Count. mode P33	Decimal places P38
CT MT xx01	2	one	single	0,0005	0,00002	4	5	4
				0,0002	0,00001	10	2	4
LIP 401		none	-	0,0001	0,000005	20	1	4
		one	single	0,00005	0,000002	40	5	5
				Recommended only for LIP 401				
				0,00002	0,000001	100	2	5
				0,00001	0,0000005	200	1	5
				0,000005	0,0000002	400	5	6
LF 103 LF 401 LIF 101 LIP 501	4	one dist.c.	single 5000	0,001	0,00005	4	1	3
				0,0005	0,00002	8	5	4
				0,0002	0,00001	20	2	4
				0,0001	0,000005	40	1	4
LIP 101		one	single	0,00005	0,000002	80	5	5
				Recommended only for LIP 101				
				0,00002	0,000001	200	2	5
				0,00001	0,0000005	400	1	5
MT xx	10	one	single	0,0005	0,00002	20	5	4
				0,0002	0,00001	50	2	4
				0,0001	0,000005	100	1	4
LS 303 LS 603	20	one dist.c.	single 1000	0,01	0,0005	2	1	2
				0,005	0,0002	4	5	3
LS 106 LS 406 LS 706	20	one dist.c.	single 1000	0,001	0,00005	20	1	3
				0,0005	0,00002	40	5	4
ST 1201		none	-					
LB 302 LIDA 10x	40	one dist.c.	single 2000	0,005	0,0002	8	5	3
				0,002	0,0001	20	2	3
				0,001	0,00005	40	1	3
				0,0005	0,00002	80	5	4
				Recommended only for LB 302				
				0,0002	0,00001	200	2	4
				0,0001	0,000005	400	1	4
LB 301	100	one dist.c.	single 1000	0,005	0,0002	20	5	3
				0,002	0,0001	50	2	3
				0,001	0,00005	100	1	3
LIM 102	12800	one	single	0,1	0,005	128	1	1
				0,05	0,002	256	5	2

Example: Set parameters for any encoder
Linear encoder with signal period s = 10 µm
Desired display step a = 0.000 1 mm
Subdivision P32 **= 0.001 • s / a =** 100
Counting mode P33 = 1 (display counts 1, 2, 3 ...)
Decimal places of a: P38 = 4

Data Output

There are two ways to output data:

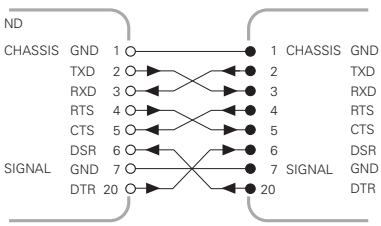
- ➤ PRINT function: Press MOD (this method can be inhibited with operating parameter P86); **or**
- ➤ Enter the command STX (CTRL B) over the RXD input.

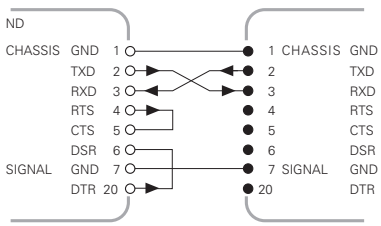
A **connecting cable** (to a PC, for example) is available from HEIDENHAIN (Id.-Nr. 274 545 ..); cable length up to 20 m (66 ft).

Operating parameters for data output: P50, P51

Wiring, pin layout

Connecting cable is either **completely** wired (left) or only **partially** wired (right).





CHASSIS GND: Chassis Ground; **TXD:** Transmitted Data; **RXD:** Received Data; **RTS:** Request To Send; **CTS:** Clear To Send; **DSR:** Data Set Ready; **SIGNAL GND:** Signal Ground; **DTR:** Data Terminal Ready

Signals	Signal level "active"	Signal level "not active"
TXD, RXD	–3 V to –15 V	+3 V to +15 V
RTS, CTS, DSR, DTR	+3 V to +15 V	–3 V to –15 V

Data transfer format and transmission control characters	
Format	ASCII code
Data word	1 start bit, 7 data bits, parity bit (even parity), 2 stop bits
Control characters	Call measured value: STX (CTRL B), interrupt DC3 (CTRL S), resume DC1 (CTRL Q) Enquire error message: ENQ (CTRL E)
Sequence	• Sign • Numerical value with decimal point • Blank space • Unit (blank space = mm, " = inches, ? = error) • 2 blank spaces • Carriage return • Line feed

Storage and transfer times

The duration of data transfer depends on the selected baud rate and on the number of additional line feeds.

Latch signal	Storage time	Data transfer time
STX (CTRL) B	≤ 1 ms	≤ 23 ms
PRINT	≤ 22 ms	≤ 44 ms

Error Messages

To clear error message error **:**

When you have removed the cause of the error,
➤ press CL.

Message	Cause and effect
error 01	Last measured value not yet latched
error 02	External device not ready for data transfer (error 02 only appears once)
error 03	Data interface: Parity error or wrong data transfer format
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 the scale is moved too quickly)
error 53	Internal counter overflow
error 55	Error while crossing over reference marks
error 80 error 83 error 84 error 86	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 HEIDENHAIN service agency.
error 99	Erase the operating parameters.

If **all decimal points light up**, the measured value is too large or too small.
In this case, set a new datum **or** retract.

Distance-To-Go Mode

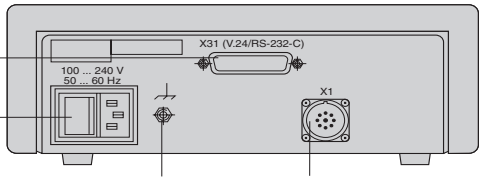
The standard setting for the display unit is to show the encoder position value. Particularly on machine tools and for tasks in automation, however, it can be very helpful for the display to instead show the distance remaining to a manually entered nominal position. You can then position the tool by simply moving the axis to the display value zero. **Code number 246 582** provides access to distance-to-go mode.

Display	Meaning
delta off	No distance-to-go display
delta on	Distance-to-go display

"Traverse to zero" with distance-to-go display

➤ Select datum 2.
➤ Enter the nominal position.
➤ Move the axis to zero.

Rear Panel



RS-232-C/V.24 data interface

Power switch

Ground terminal

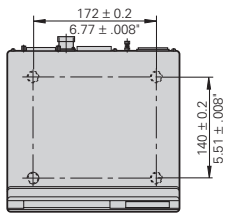
Input for HEIDENHAIN linear encoder with sinusoidal output signals (7µA_{PP} to 16 µA_{PP}), connecting cable max. 30 m (98.5 ft), maximum permissible input frequency 100 kHz

Interface X1 complies with the recommendations in EN 50 178 for separation from line power.

Installation

You can fix the display unit to a mounting surface with M4 bolts.

The units can also be stacked. Adhesive inserts (included in delivery) prevent them from sliding.



Power Supply and Connection

Danger of electrical shock!
Unplug the power cord before opening the housing.
Connect a protective ground. This connection must 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 typ. 8 W **Line fuse** F 1 A (in unit)
Minimum cross-section of power line: 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)

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	1.5 kg

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