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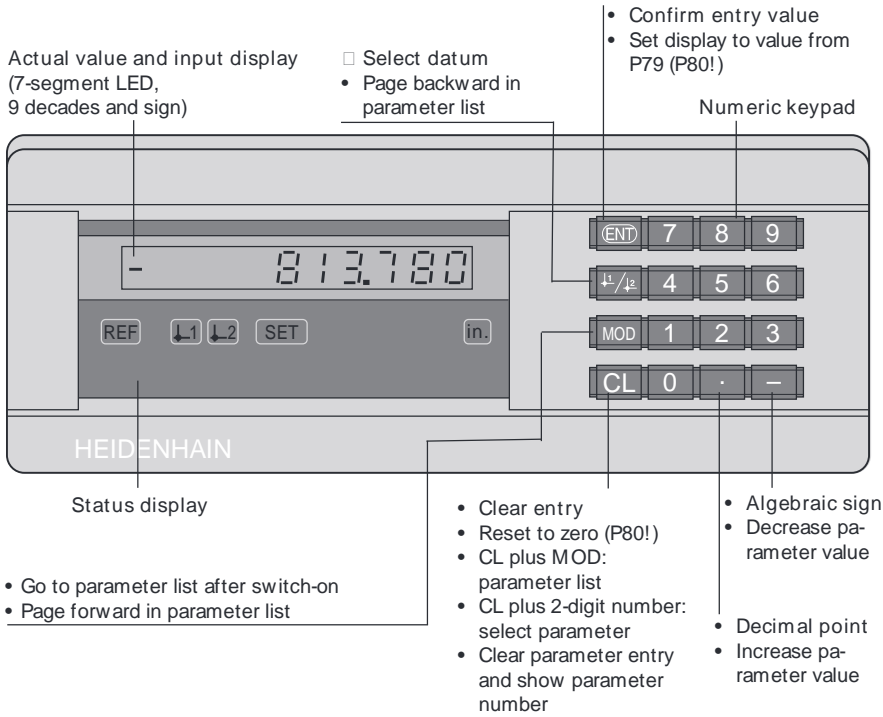
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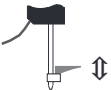
Indicator	Meaning
REF	If decimal points are blinking: Display is waiting for the reference mark to be crossed over. If decimal points are not blinking: Reference mark was crossed over—datum points are now stored in nonvolatile memory. Blinking: Waiting for operator to press ENT or CL.
in.	Position values 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

 Ent...CL	Turn on the power (switch located on rear panel) <ul style="list-style-type: none">• Display shows <code>ENE...CL</code>.• REF blinks.
 5 , 6 9 7	Switch on reference mark evaluation <ul style="list-style-type: none">• 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.

	Select datum 1 or 2.
 4 0	Enter a value, such as 40.
	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 $\uparrow 1 / \downarrow 2$ 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
<code>P00 CODE</code>	Enter code number 95 148 to change a protected operating parameter.		
<code>P01 INCH</code>	Unit of measure	Display in millimeters	<code>OFF</code>
		Display in inches	<code>ON</code>
<code>P30 DIR Direction</code>	Counting direction	Normal (<i>Positive</i>)	<code>POS</code>
		Inverse (<i>Negative</i>)	<code>NEG</code>
<code>P32 Subd Subdivision</code>	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 Decimal point	Decimal places	1 / 2 / 3 / 4 / 5 / 6 (up to 8 with inch display)	
P41 COMP Compensation	Linear error compensation ¹⁾	-99 999,9 < P41 < + 99 999,9 [$\mu\text{m}/\text{m}$]	
P43 REF	Reference marks	One reference mark	5 INCH
		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 Encoder	Encoder monitoring	No monitoring (Alarm Off)	ALARM OFF
		Contamination	ALARM C
		Frequency	ALARM F
		Contamination and frequency	ALARM CF
P50 U24	Baud rate BAUD	110, 150, 300, 600, 1200, 2400, 4800, 9600	
P51 U24	Additional line feeds L INFEED	0 to 99 (Linefeed)	
P79 PRSE Preset	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 Message	Display after switch-on	[ENT...CL] message displayed	MESG ON
		[ENT...CL] message not displayed	MESG OFF
P86 MOD Mode	Inhibit PRINT function	PRINT inhibited	PR INH OFF
		PRINT not inhibited	PR INH ON

1) Determine entry value for P41

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

Parameter Settings for HEIDENHAIN Linear Encoders

Model	Signal period [µm]	Reference marks	P 43	Display step (unit: P01)		The following settings apply for mm:		
				mm	inches	Subdi- vision	Count. mode	Decimal places
						P32	P33	P38
CT MT xx01 LIP 401	2	one	single	0,0005	0,00002	4	5	4
				0,0002	0,00001	10	2	4
		none one	- single	0,0001	0,000005	20	1	4
				0,00005	0,000002	40	5	5
				<i>Recommended only for LIP 401</i>				
		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 LIP 101	4	one dist.c.	single 5000	0,001	0,00005	4	1	3
				0,0005	0,00002	8	5	4
		one	single	0,0002	0,00001	20	2	4
				0,0001	0,000005	40	1	4
				0,00005	0,000002	80	5	5
<i>Recommended only for LIP 101</i>								
		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 ST 1201	20	one dist.c.	single 1000	0,001	0,00005	20	1	3
				0,0005	0,00002	40	5	4
		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
				<i>Recommended only for LB 302</i>				
		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 $s = 10 \mu\text{m}$
 Desired display step $a = 0.000 \text{ 1 mm}$
 Subdivision $P32 = 0.001 \text{ } \square s / a = 100$
 Counting mode $P33 = 1$ (display counts 1, 2, 3 ...)
 Decimal places of a : $P38 = 4$

Data Output

There are two ways to output data:

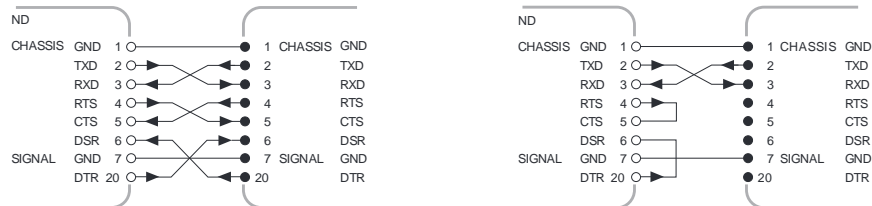
- ▶ PRINT function: Press MOD (this method can be inhibited with operating parameter P86); or
- ▶ Enter the command STX (CTRL B) over the RXD input.

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	<ul style="list-style-type: none"> • 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
<code>ERROR 01</code>	Last measured value not yet latched
<code>ERROR 02</code>	External device not ready for data transfer (<code>ERROR 02</code> only appears once)
<code>ERROR 03</code>	Data interface: Parity error or wrong data transfer format
<code>ERROR 10</code>	Incorrect input value
<code>ERROR 50</code>	Encoder signal too weak (encoder may be contaminated)
<code>ERROR 51</code>	Input frequency too high for encoder input (will occur for example when the scale is moved too quickly)
<code>ERROR 53</code>	Internal counter overflow
<code>ERROR 55</code>	Error while crossing over reference marks
<code>ERROR 80</code> <code>ERROR 83</code> <code>ERROR 84</code> <code>ERROR 86</code>	To clear the error message: Switch off the display unit. Should any of these error codes recur, contact your HEIDENHAIN service agency.
<code>ERROR 94</code>	Offset compensation values for encoder signals have been erased: contact your HEIDENHAIN service agency.
<code>ERROR 99</code>	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

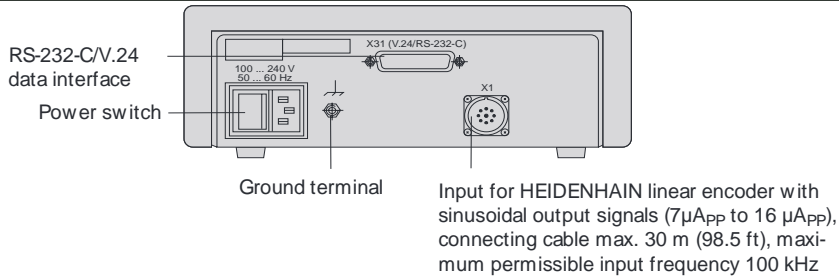
The standard setting for the display unit is to show the encoder position value. Particularly on machine tools and for tasks in automation, however, it can be very helpful for the display to instead show the distance remaining to a manually entered nominal position. You can then position the tool by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


Display	Meaning
<code>DELTA OFF</code>	No distance-to-go display
<code>DELTA ON</code>	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

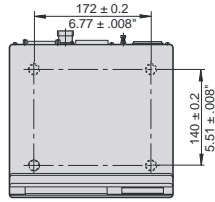


 Interface X1 complies with the recommendations in EN 50 178 for separation from line power.


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-locked 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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