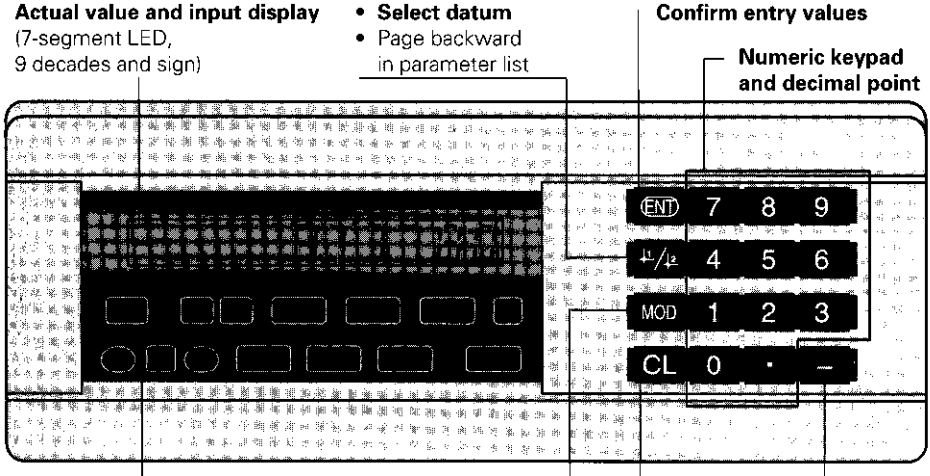
HEIDENHAIN

Working with the measured value display units

ND 281 NDP 281

For panel mounting



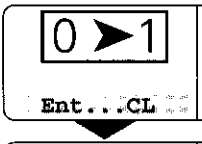
Indicator	Meaning
REF	Reference mark was crossed over – datum points are now stored in nonvolatile memory. **Blinking:** Waiting for operator to press ENT or CL.
in.	Position values displayed in inches.
⊥1 / ⊥2	Datum point 1 / Datum point 2 currently active.
PRINT	**Blinking:** Display value is being sent over the data interface, for example to a printer.
SET	**Blinking:** Waiting for operator to confirm entry values.
< / = / >	**Sorting mode:** Measured value less than lower limit / within tolerances / greater than upper limit.
MIN / MAX **DIFF / ACTL**	**Measuring series:** Minimum / Maximum / largest difference (MAX–MIN) / current measured value. **Blinking:** Waiting for confirmation of value to be displayed.
START	Measuring series in progress. **Blinking:** Waiting for start signal for measuring series.

The ND 281 and NDP 281 measured value display units are designed primarily for use with HEIDENHAIN **MT length gauges**.

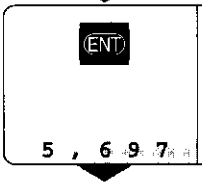
MT length gauges feature **one** reference mark. When the reference mark is crossed over, it generates a signal identifying that position as a reference point. After switch-on, simply crossing over the reference mark restores the relationship between axis positions and display values as it was last defined 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 suffices to re-establish the datum.

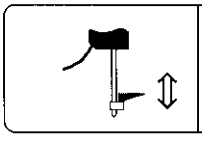
Switch-On



Turn on the power (switch located on rear panel).
- Display shows Ent . . . CL.
- REF indicator blinks.



Switch on reference mark evaluation.
- Display shows the value last assigned to the reference mark position.
- REF indicator glows.
- Decimal point blinks.

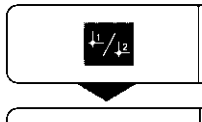


Cross over the reference mark.
Move the axis until the display becomes active and the decimal point no longer blinks.
The display unit is now ready for operation.

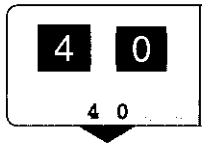
If you do **not** wish reference mark evaluation, press **CL** instead of ENT.

Setting the Datum

The datum setting procedure assigns a display value to a specific axis position.
The ND 281 and NDP 281 allow you to set two separate datum points.



Select datum 1 or 2.



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.

Measuring Series

The ND 281 display unit can calculate and display one of the following values from a measuring series:

- Smallest value (MIN)
- Largest value (MAX)
- Difference between largest and smallest value (DIFF)
- Last value measured (ACTL)

A new value is captured every 550 µs during a measuring series.

To start a measuring series:

➤ Press the **MOD** key repeatedly until the desired indicator starts blinking.
Example: to display the largest value, press MOD until MAX blinks.
➤ Confirm your selection by pressing ENT.
➤ Press MOD repeatedly until the START indicator blinks.
➤ Start the measuring series by pressing ENT.

You can switch between MIN, MAX, DIFF and ACTL:

➤ Press MOD repeatedly until the desired indicator blinks, then confirm with ENT. **Or**
➤ Use operating parameter P21 (see list of operating parameters).

Note:
When the trigger signal input for remote control of the measuring series is active (pin 6 of D-sub connector EXT), you **cannot** switch over the display as described here.

To abort a measuring series and restart:

➤ Press MOD until START blinks, then confirm with ENT.

To end a measuring series:

➤ Press MOD until the glowing indicator blinks, then confirm with ENT.

It is also possible to start a measuring series and switch over the display with a **trigger signal input on the D-sub connection EXT** (see that section).

Sorting and Tolerance Check Mode

In this mode, the display value is compared with an upper and a lower limit value. Status indicators and the trigger signal outputs on the D-sub connection EXT indicate whether the display value is less than the lower limit, greater than the upper limit, or between the two limit values.

Indicator	Meaning
=	Measured value is between the limit values
<	Measured value is less than the lower limit value
>	Measured value is greater than the upper limit value

Operating parameters for the sorting mode:

- P17: sorting on/off
- P18, P19: limit values

Data Output

There are three ways to output data:

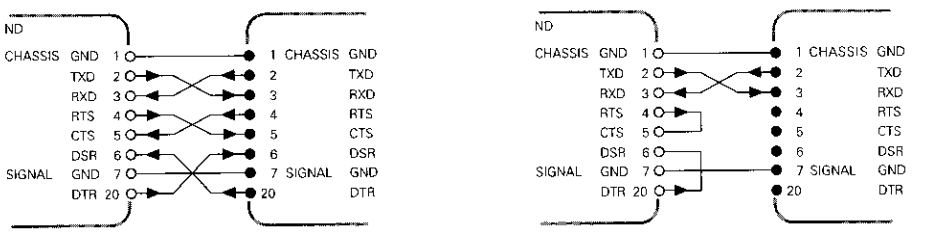
- ➤ Press the MOD key until the PRINT indicator blinks, and start data output with the ENT key; **or**
- ➤ Input the command Ctrl B over the RXD input; **or**
- ➤ Input a latch command over the D-sub connection EXT.

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 and 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	–3V to –15V	+3V to +15V
RTS, CTS, DSR, DTR	+3V to +15V	–3V to –15V

Data transfer format and control characters	
Format	ASCII code
Data word	1 start bit, 7 data bits, parity bit (even parity), 2 stop bits
Control characters	Start: STX, interrupt: DC3, resume: DC1
Sequence	• Sign • Numerical value with decimal point • Blank space • Unit (blank space = mm, " = inches, ? = error) • Comparison result (<, >, =; ? if P18 > P19) **or** blank space • Meas. series (S = MIN, A = ACTL, G = MAX, D = DIFF) **or** blank space • Carriage return • Line feed

Storage and transfer times

The duration of data transfer depends on the selected baud rate and the number of additional line feeds. The longest times will be encountered when a DIFF series is running.

Latch signal	**Ctrl B**	**EXT**(pulse)	**EXT**(contact)	**PRINT**
Storage time	≤ 1 ms	≤ 1 µs	≤ 5 ms	≤ 55 ms
Transfer time	≤ 58 ms	≤ 58 ms	≤ 63 ms	≤ 113 ms

D-Sub Connection EXT

Danger to internal components!
Voltage sources for external circuitry must conform to the recommendations in VDE 0160, 5.88 for low-voltage electrical separation.
Connect inductive loads only with a quenching diode parallel to the inductance.

Use only shielded cable!
Connect the shield to the connector housing.

	Pin	Function
Outputs	15	Meas. value > trigger limit A1 (P62)
	16	Meas. value > trigger limit A2 (P63)
	18	Meas. value > upper sorting limit (P19)
	17	Meas. value < lower sorting limit (P18)
	19	Error (see "Error Messages")
	14	Display value is zero
Inputs	2	Reset display to zero
	3	Preset display to value from P79
	25	Cross over reference marks
	4	Ignore reference signal
	5	Start measuring series
	6	Remote selection of display val. for meas. ser.
	7	Display minimum value from meas. series
	8	Display maximum value from meas. series
	9	Display MAX–MIN diff. from meas. series
	22	Latch (pulse)
	23	Latch (contact)

Pin	Function
1	0 V
10	0 V
12	Do not assign
13	Do not assign
11	Vacant
20	Vacant
21	Vacant
24	Do not assign

Display current meas. value **(ACTL)**: Inputs 7, 8 and 9 are not active, or more than one of these inputs is active.

Signal levels	Low		High	
Inputs	–0.5 V ≤ U ≤ 0.9 V	I ≤ 6 mA	3.9 V ≤ U ≤ 15 V	
Outputs	U ≤ 0.4 V	I ≤ 100 mA	U ≤ 32 V	I ≤ 10 µA

Description of input and output signals

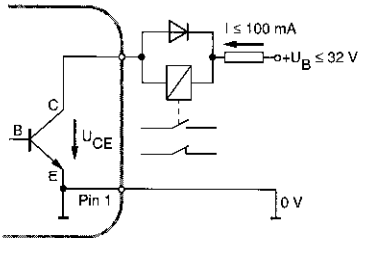
Input signals

- Internal pull-up resistor 1 kΩ
- Triggering by make contact against 0 V **or** Low level over TTL component
- Delay for Zero reset/Preset: $t_v \leq 2$ ms
- Minimum pulse duration for all signals: $t_{min} \geq 55$ ms

Output signals

- Open collector outputs, active Low
- Signal output delay: $t_v \leq 60$ ms
- Zero crossover signal minimum duration: $t_0 \geq 180$ ms

Note that these times will increase if functions are active (such as sorting).



Effect of Latch Signals

The effect of latch signals is defined in operating parameter P23.

Effect of latch signals	P23
Latch signal ignored	ACtL
Display is frozen when the latch signal is received and remains frozen until a new latch signal arrives	HOLd
Display is frozen while the latch signal is present	StOP

Error Messages

Message	Cause and effect
ERROR 01	Last measured value not yet latched[1]
ERROR 02	External device not ready for data transfer[1] (ERROR 02 only appears once)
ERROR 03	Data interface: Parity error or wrong transfer format[1]
ERROR 11	Overflow caused by external preset
ERROR 12	Value entered cannot be displayed after rounding
ERROR 13	Overflow, trigger limit 1
ERROR 14	Overflow, trigger limit 2
ERROR 15	Overflow, lower sorting limit
ERROR 16	Overflow, upper sorting limit
ERROR 50	Encoder signal too weak[1] (encoder may be contaminated)
ERROR 51	Input frequency too high for encoder input[1] (will occur for example when traverse speed too high)
ERROR 53	Internal counter overflow[1]
ERROR 55	Error while crossing over reference marks[1]
ERROR 80 ERROR 83 ERROR 84	Should any of these errors recur, contact your HEIDENHAIN service agency
ERROR 99	Check the operating parameters. If this error code continues to come up, contact your HEIDENHAIN service agency.
If **all decimal points light up**, the measured value is too large or too small. In this case, set a new datum **or** retract.	
If **all sorting indicators light up**, this means that the upper sorting limit is less than the lower limit.	

[1] These errors are significant for a connected device. The error signal (pin 19) at the D-sub connection EXT is active.

To clear error message ERROR **:**

When you have removed the cause of the error,

➤ press CL.

Operating Parameters

Operating parameters allow you to define the operating characteristics of the display unit and how the encoder signals are evaluated.

Operating parameters are designated by the letter P, a two-digit parameter number and an abbreviation. Examples: P01 inCH or P33 StEP.
A parameter designation appears in the display when you select a parameter – for example by paging through the parameter list. When the key is released, the display shows the current parameter setting.

Calling the operating parameters

To call the operating parameters **after switch-on**:

➤ Press MOD while ENt. . .CL is in the display.

To call the operating parameters **during operation**:

➤ Press and hold CL, then press MOD.
The first operating parameter (P01: mm/inch) appears in the display.

To go **directly** to a certain operating parameter:

➤ Press and hold CL, then 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 parameter list:

➤ Page **forward**: press MOD.
➤ Page **backward**: press the ┴1 / ┴2 key.
Any changes are automatically activated when you resume paging.

To change a parameter setting:

➤ Change the value with the minus key, **or**
➤ Enter the desired value directly, e.g. for P41 (SET blinks).

To correct an entry and display the parameter designation:

➤ Press CL

To exit the operating parameters:

➤ Press ENT.
This activates all changes made.

Operating Parameter List

Parameter	Meaning	Function / Effect	Setting
P01 inCH	**Unit of measurement**	Display in millimeters	OFF
		Display in inches	On
P17 CLSS	**Sorting mode**	Sorting on	CLSS On
***Class**ification*		Sorting off	CLSS OFF
P18 CLSS	**Lower sorting limit** (P18 must be less than P19)		
P19 CLSS	**Upper sorting limit** (P19 must be greater than P18)		
P21 StOr	**Value displayed for measuring series** MIN ACTL MAX DIFF		OFF
***Stor**age*			
P23 d ISP	**Display value with latching**	Display shows measured value	ACtL
***Disp**lay*		Frozen when latch signal received	HOLd
		Frozen while latch signal present	StOP
P30 d IF	**Counting direction**	Normal ***(Pos**itive)*	POS
***Dir**ection*		Inverse ***(Neg**ative)*	nEG
P32 SUbd	**Subdivision of encoder signals** 400, 320, 256, 200, 160, 128,		
***Subd**ivision*	100, 80, 50, 40, 20, 10, 8, 5, 4, 2, 1, 0.8, 0.5, 0.4, 0.2, 0.1		
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 places** 1 / 2 / 3 / 4 / 5 / 6 (up to 8 with inch display)		
***Dec**imal point*			
P41 COMP	**Linear error compensation**[1] – 99 999 < P41 < + 99 999 [µm/m]		
***Comp**ensation*			
P43 rEF	**Reference marks**	One reference mark	SINGLE
		Distance-coded with 500 • GP (GP = grating period)	500
		Distance-coded with 1000 • GP (e.g. for LS 303 C / LS 603 C)	1000
		Distance-coded with 2000 • GP	2000
P44 rEF	**Reference mark evaluation**	Evaluation	rEF On
		No evaluation	rEF OFF
P45 ENCd	**Encoder monitoring**	No monitoring ***(Alarm Off)***	ALAr. OFF
Encoder		**C**ontamination	ALAr. C
		Frequency	ALAr. F
		Contamination and frequency	ALAr. CF

Operating Parameter List – cont'd.

Parameter	Meaning	Function / Effect	Setting
P50 U24	**Baud rate** bAUd	110, 150, 300, 600, 1200, 2400, 4800, 9600	
P51 U24	**Additional line feeds** L inEFd. ***(Linefeed)***	0 to 99	
P62 A1	**Trigger limit 1**	Enter numerical value	
P63 A2	**Trigger limit 2**	Enter numerical value	
P79 PrSt ***Preset***	**Value for datum point**	Enter value for datum point setting over external switching inputs or with ENT key	
P80 SEt	**Preset display**	No zero reset/preset with CL/ENT	SEt OFF
		Reset to zero with CL ***(Set Zero)***, no preset with ENT	SEt ZERO
		Zero reset with CL and preset with ENT to value in P79	PrESEt
P82 nESG ***Message***	**Display after switch-on**	[ENt. . .CL] message displayed	nESG On
		[ENt. . .CL] message not displayed	nESG OFF
P85 rEF	**External REF**	REF over D-sub connection EXT	EHt. On
		No REF over EXT connection	EHt. OFF
P86 Mod ***Mode***	**First status indicator after MOD is pressed** [START] [PRINT] [MIN] [ACTL] [MAX] [DIFF]		

1) Determine entry value for P41

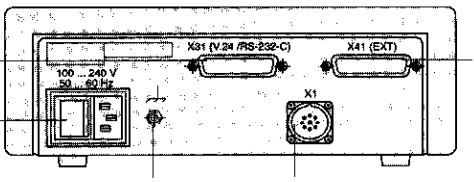
Example: Displayed measuring length L_d = 620.000 mm
Actual length (determined with, for example, the VM 101 comparator system from HEIDENHAIN) L_a = 619.876 mm
Length difference $\Delta L = L_a - L_d = -124$ µm
Comp. factor k: $k = \Delta L / L_d = -124$ µm / 0.62 m = **–200** [µm/m]

Parameter Settings for HEIDENHAIN Linear Encoders

Model	Signal period [µm]	Reference marks	P43	Display step (unit: P01) mm	Display step (unit: P01) inches	The following settings apply for **mm**: Subdivision P32	Count. mode P33	Decimal places P38
LIP 40x	2	one	single	0.001	0.00005	2	1	3
				0.0005	0.00002	4	5	4
				0.0002	0.00001	10	2	4
				0.0001	0.000005	20	1	4
				0.00005	0.000002	40	5	5
				0.00002	0.000001	100	2	5
LIP 101	4	one	single	0.001	0.00005	4	1	3
VM				0.0005	0.00002	8	5	4
				0.0002	0.00001	20	2	4
				0.0001	0.000005	40	1	4
				0.00005	0.000002	80	5	5
LIF 101	4	one	single	0.001	0.00005	4	1	3
LF 401				0.0005	0.00002	8	5	4
				0.0002	0.00001	20	2	4
				0.0001	0.000005	40	1	4
MT	**10**	**one**	**single**	0.001	0.00005	10	1	3
				0.0005	0.00002	20	5	4
LID	10	one	single	0.0002	0.00001	50	2	4
		dist.c.	2000	0.0001	0.000005	100	1	4
LS 103	10	one	single					
LS 405		dist.c.	1000					
ULS/10								
LS 106	20	one	single	0.01	0.0005	2	1	2
LS 406		dist.c.	1000	0.005	0.0002	4	5	3
LS 706				0.002	0.0001	10	2	3
ULS/20				0.001	0.00005	20	1	3
				0.0005	0.00002	40	5	4
LIDA 190	40	one	single	0.002	0.0001	20	2	3
LB 101				0.001	0.00005	40	1	3
				0.0005	0.00002	80	5	4
LIDA 2xx	100	one	single	0.01	0.0005	10	1	2
LB 3xx				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

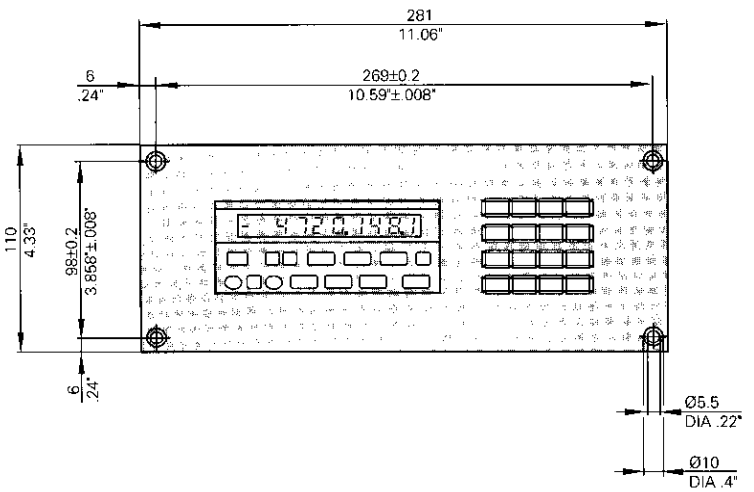
Example: Set parameters for any encoder
Linear encoder with signal period s = 10 µm
Desired display step a = 0.000 1 mm
Subdivision P32 = **0.001 • s / a** = 100
Counting mode P33 = 1 (display counts 1, 2, 3, ...)
Places after decimal point of a: P38 = 4

ND 281: Rear Panel



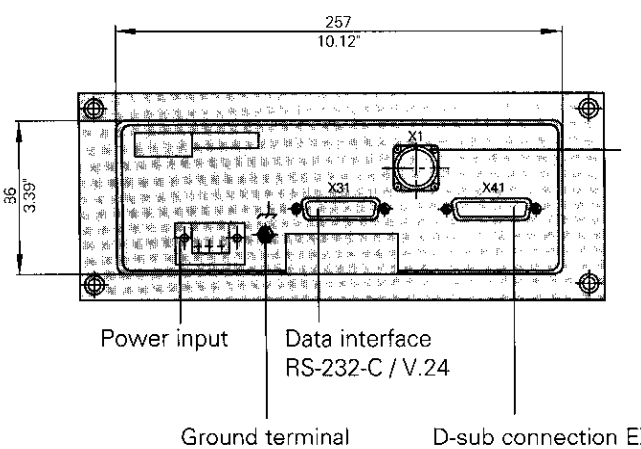
The X1, X31 and X41 interfaces comply with the recommendations in VDE 0160, 5.88 for separation from line power.

NDP 281: Front and Rear Panel



Dimensions:

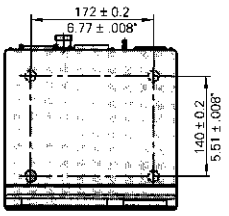
Cutout for front panel: 259+0.5 • 88+0.5 mm
Mounting depth minimum 297 mm



ND 281: Installation

You can mount the display unit to a flat surface with M4 screws.

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



Power Supply and Connection

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

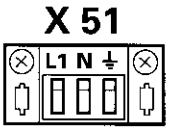
Danger to internal components!
Do not engage or disengage any connections while the unit is under power.
Use only original replacement fuses.

Primary-clocked power supply, tolerates overvoltage in accordance with VDE 0160, 5.88. Overvoltage tolerance class 2.
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 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 281
The ND 281 has a socket for a power plug on its rear panel.

Power connection – NDP 281
The NDP 281 has a clamp (X 51) on its rear panel.



Ambient Conditions

Temperature range	Operation: 0°C to +45°C (32°F to 113°F) Storage: –30°C to +70°C (–32°F to 158°F)
Rel. humidity	Annual average: < 75%; maximum: < 90%
Weight	1.5 kg

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