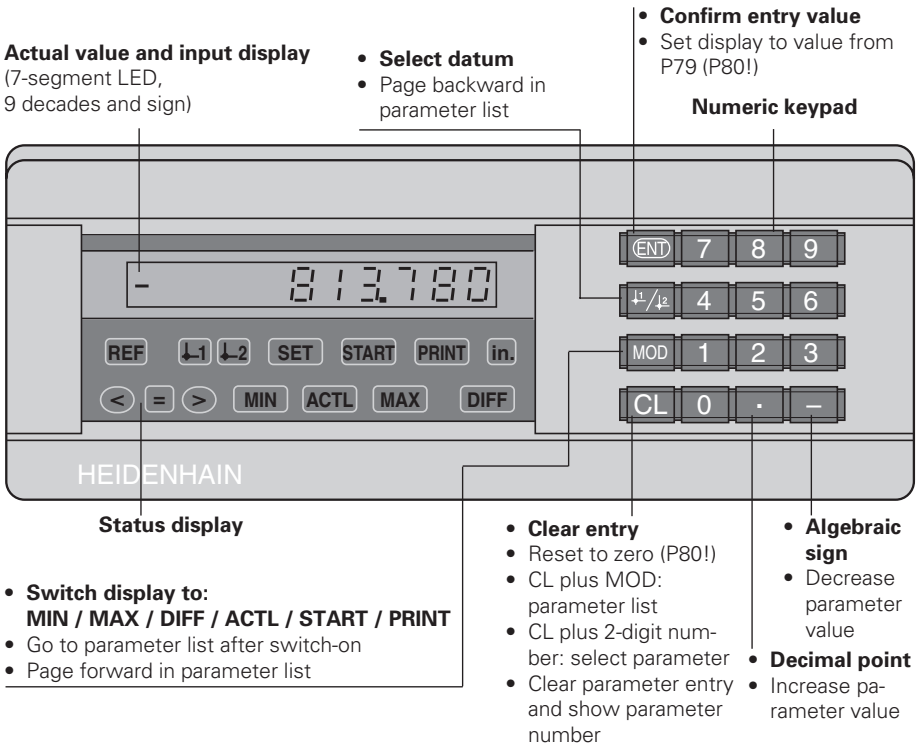
HEIDENHAIN

Working with the position display unit

ND 286



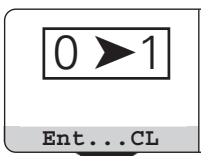
Indicator	Meaning
REF	If the decimal points have stopped blinking: Reference mark was crossed over – datum points are now stored in nonvolatile memory. **Blinking:** Waiting for operator to press ENT or CL.
in.	Position values displayed in inches.
⊥1 / ⊥2	Datum 1 / Datum 2 currently active.
PRINT	**Blinking:** Waiting for ENT for data output.
SET	**Blinking:** Waiting for operator to confirm entry.
< / = / >	**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 286 position display unit is designed for use with HEIDENHAIN linear or rotary encoders with square-wave output signals. These encoders have one or more reference marks, which may also be *distance-coded*.

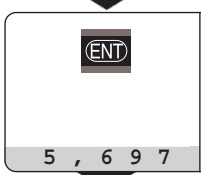
When a reference mark is crossed over, it generates a signal identifying that position as a reference point. After switch-on, simply crossing over the reference mark restores the relationship between axis positions and display values as it was last defined by datum setting.

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.
- Data interface shows ERROR 07



Switch on reference mark evaluation.
- 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 286 allows you to set two independent datums.

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 values.

Measuring Series

The ND 282 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 at any time:

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

Note:
When the switching input for remote control of the measuring series is active (pin 6 of D-sub connection 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 **switching input over 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 switching outputs at 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

Distance-to-go Mode

The standard setting for the display unit is to show the encoder position value.
Code number 246 582 provides access to the distance-to-go mode.

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

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

In distance-to-go mode the trigger outputs A1 (Pin 15) and A2 (Pin 16) change their meaning: they become symmetrical to the display value zero.

Data Output

There are four ways to output data:

- ➤ Press the MOD key until the PRINT indicator starts blinking (only possible with "slow" data output), and start data output with the ENT key; **or**
- ➤ Send measuring data to the data output periodically; **or**
- ➤ Input a latch command over the D-sub connection EXT; **or**
- ➤ Input a latch command over the BCD connection.

Interface mode (see operating parameter P53)

Slow: Output display values
Fast: Output instantaneous values referenced to datum 1 (MIN/MAX/DIFF display values are not output)

A **connecting cable** (to a PC, for example) is available from HEIDENHAIN (Id.-Nr. 206 420 ..); cable length up to 10 m (32.8 ft).
Operating parameters for data output: P23, P53 to P57

"AMP-CHAMP" connection (36-pin, female)

Pins				Assignment
2^0	2^1	2^2	2^3	
1	2	3	4	Decade 1
5	6	7	8	Decade 2
9	10	11	12	Decade 3
13	14	15	16	Decade 4
17	18	19	20	Decade 5
21	22	23	24	Decade 6
25	26	27	28	Decade 7
29	30	31	32	Decade 8

Pins	Assignment
33	Sign
34	Ready
35	Meas. val. output
36	0V

Output levels **Low**: U ≤ 0.4 V with I ≤ 6 mA **High**: U ≥ 3.8 V with I ≤ 2.6 mA
The output signals are TTL-compatible.

Latch levels **Low**: U ≤ 0.9 V with I_{max} ≤ 6 mA **High**: U ≥ 3.9 V; **or**
TTL levels (internal 10 kΩ pull-up resistor).

Signal transit times

The following table lists **approximate** signal transit times. If you use the slow data output and run functions such as measuring series or inch display at the same time, the actual transit times can be twice as long as those listed here.

Concurrent data output (P55 ACCL)			
Mode	**P53**	**Latch time**	**Data output after**
Fast	FAST	P54	Value from P54 / 2
Slow	SLOW	t ≤ 30 ms	t ≤ 8 ms

Data output after external latch (P55 STOP or HOLD)						
Mode	**P53**	**Min. pulse duration**		**Measured value stored after**		
		Pulse / BCD	Contact	BCD	Pulse	Contact
Fast	FAST	3 µs	7 ms	0.3 µs	1.1 µs	4.8 ms
Slow	SLOW	t ≥ 8 ms	t ≥ 13 ms	0.3 µs	1.1 µs	4.8 ms
		Data output		**Latch again after**		
				Pulse/BCD	Contact	
Fast	FAST	≤ 0.3 µs after internal latching		3 µs	7 ms	
Slow	SLOW	≤ 7.5 ms after internal latching		3 µs	7 ms	

D-Sub Connection EXT (25-pin, male)

Danger to internal components!
Voltage sources for external circuitry must conform to the recommendations in EN 50 178 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)
	17	Meas. value < lower sorting limit (P18)
	18	Meas. value > upper sorting limit (P19)
	19	Error (see *Error Messages*)
	14	Display value is zero
Inputs	2	Reset display to zero, clear error message
	3	Preset display to value from P79
	25	Cross over reference marks
	4	Ignore reference mark signals
	5	Start measuring series
	6	Remote selection of display val. f. 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	Pulse: output measured value
	23	Contact: output measured value
	24	Deactivate BCD data output

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

Display current measured 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

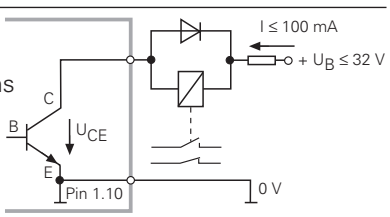
Description of input and output signals

Input signals

- Triggering by make contact against 0 V **or** Low level over TTL component
- Internal pull-up resistor 1 kΩ
- Min. pulse duration: t ≥ 30 ms, for fast reset/preset: t ≥ 30 µs
- Min. pulse interval: t ≥ 30 ms, for reset/preset: t ≥ 1,5 ms; for fast reset/preset: t ≥ 30 µs
- Delay for zero reset/preset: fast data output t_d ≤ 25 µs; slow data output t_d ≤ 2 ms

Output signals

- Open collector outputs, active Low
- Signal output delay: t_d ≤ 8 ms
- Zero crossover signal minimum duration, trigger output A1, A2: t_0 ≥ 180 ms



Note that these times increase if additional features are active (such as sorting).

Data Output and Display Freeze by Output Signal

The effect of a signal for measured value output is defined in operating parameter P55.

- ➤ **Concurrent display:** No output value freeze. The output describes the current measured value (ACTL).
- ➤ **Frozen display:** The output value is frozen and is updated with each signal for measured value output (HOLd).
- ➤ **Frozen/concurrent display:** The output value freezes only as long as the signal is present (StOP).

P23 defines whether the display shows the current measured value (ACTL) **or** the value at the data output (bCd).

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[1]
ERROR 04	Attempt to reset to zero or preset not permissible. The display is not reset or preset.
ERROR 10	Incorrect input value
ERROR 11	Overflow caused by external preset
ERROR 12	Value entered cannot be displayed
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 ERROR 85	To clear the error message: **Switch off the display unit.** Should any of these error codes recur, 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.	
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.

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, 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 P79 ([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	To change a protected operating parameter, enter **code number 95 148**.		
P01 INCH	**Unit of measurement**	Display in millimeters	OFF
		Display in inches	ON
P17 CLSS ***Cla**ssification*	**Sorting mode**	Sorting on	CLSS. ON
		Sorting off	CLSS. OFF
P18 CLSS	**Lower sorting limit** (ensure that P18 < P19)		
P19 CLSS	**Upper sorting limit** (ensure that P19 > P18)		
P21 STOr ***Stor**age*	**Value displayed for measuring series**	[MIN] [ACTL] [MAX] [DIFF]	OFF
P23 dISP ***Displ**ay*	**Display value**	Measured value (***Act**ual***)	ACtL
		Value at data output	bCd
P30 dIr ***Dir**ection*	**Counting direction**	Normal (***Pos**itive*)	POS
		Inverse (***Neg**ative*)	nEG

Parameter	Meaning	Function / Effect	Setting
P32 SUBd ***Subd**ivision*	**Subdivision of encoder signals** 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
P34 rEF	**External Interpolation of Encoder Signals** 1, 5, 10, 20, 50		
P38 dEC ***Dec**imal point*	**Places after decimal** 1 / 2 / 3 / 4 / 5 (up to 7 with inch display)		
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
P53 bCd	**Speed of data output**	Slow	SLOW
		Fast, storage rate: P54	FASt
P54 bCd	**Latch speed**	0.2 / 0.4 / 0.8 / 1.6 / 3.2 / 6.4 / 12.8 / 25.6 [µs]	
P55 bCd	**Data output from output signal**	Data output concurrent (***Actual***)	ACtL
		Frozen	HOLd
		Frozen/concurrent	StOP
P56 bCd	**Sign level**	Low = Minus (***Sign Low***)	SIGn LO
		High = Minus (***Sign High***)	SIGn HI
P57 bCd	**Behavior w/o latch signal**	Data output always active	tr IS. OFF
		Output high impedance (***Tristate***)	tr IS. On
P62 A1	**Trigger limit 1**	Enter numerical value	
P63 A2	**Trigger limit 2**	Enter numerical value	
P79 PrSt ***Preset***	**Value for datum**	Enter numerical value for datum setting via switching input or with the ENT key	
P80 SEt	**Display 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 ***Mes**sage*	**Display after switch-on**	ENt. . .CL message displayed	MESG On
		ENt. . .CL message not displayed	MESG OFF
P84 bCd	**Output of error signal**	Error signal sent to data output	Err0 On
		Error signal not sent to data output	Err0 OFF

Parameter	Meaning	Function / Effect	Setting
P85 REF	**External REF**	REF over D-sub connection EXT	EXT. ON
		No REF over EXT connection	EXT. OFF
P86 MOD ***Mod***e	**First status indicator after MOD is pressed** START PRINT MIN ACTL MAX DIFF		
P87 FSET ***Fast Set***	**Fast repeated external reset/preset**	Fast external reset/preset (setting of P53: FAST) REF mode, datum 2 and measuring series are not usable	ON
		No fast preset	OFF

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	Subdivision P32	Count. mode P33	Decimal places P38
LIF 121	2	one dist. c	single 5000	0,002 0,001 0,000 5	0,000 1 0,000 05 0,000 02	1 2 4	2 1 5	3 3 4
LIF 171	0,8	one dist. c	single 5000	0,001 0,000 2	0,000 05 0,000 01	0,8 4	1 2	3 4
	0,4			0,000 2 0,000 1	0,000 01 0,000 005	2 4	2 1	4 4
LIDA 17x	8	one dist. c	single 2000	0,002	0,000 1	4	2	3
	4			0,002 0,001	0,000 1 0,000 05	2 4	2 1	3 3
LIM 172	200	one	single	0,2 0,1 0,05	0,01 0,005 0,002	1 2 4	2 1 5	1 1 2
LS 176 LS 476 LS 776	4	one dist. c	single 1000	0,002 0,001	0,000 1 0,000 05	2 4	2 1	3 3
	2			0,002 0,001 0,000 5	0,000 1 0,000 05 0,000 02	1 2 4	2 1 5	3 3 4
LS 323 LS 623	20	one dist. c	single 1000	0,02 0,01 0,005	0,001 0,000 5 0,000 2	1 2 4	2 1 5	2 2 3
LT 171	4	one	single	0,002 0,001	0,000 1 0,000 05	2 4	2 1	3 3
	2			0,002 0,001 0,000 5	0,000 1 0,000 05 0,000 02	1 2 4	2 1 5	3 3 4
MT xx71	0,4	one	single	0,000 2 0,000 1	0,000 01 0,000 005	2 4	2 1	4 4
	0,2			0,000 2 0,000 1 0,000 05	0,000 1 0,000 05 0,000 02	1 2 4	2 1 5	4 4 5
ST 1271	4	none		0,002 0,001	0,000 1 0,000 05	2 4	2 1	3 3
	2			0,002 0,001 0,000 5	0,000 1 0,000 05 0,000 02	1 2 4	2 1 5	3 3 4

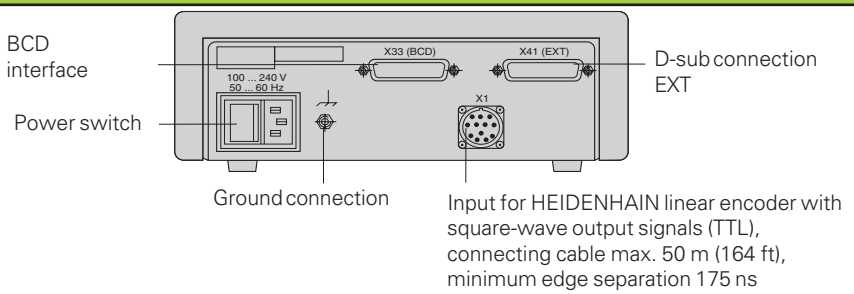
Example: Set parameters for any encoder; Linear encoder with signal period s = 4 µm; Desired display step a = 0.001 mm;
Subdivision P32 = **0,001 • s / a** = 4;
Counting mode P33 = 1 (display counts 1, 2, 3, ...);
Decimal places of a: P38 = 3;

For linear measurement using rotary encoders with square-wave output signals (e.g. ROD 426) on a **ballscrew,** calculate the signal period [µm] according to the following formula:

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

Enter the parameters **Subdivision, Counting mode** and **Decimal places** as for linear encoders.

Rear Panel

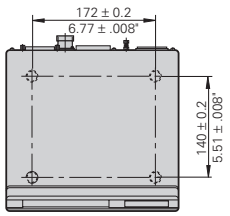


The X1, X33 and X41 interfaces comply with EN 50 178 recommendations for separation from line power.

Installation

The display unit can be mounted to a flat surface with M4 screws (see illustration at right).

Display 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 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)

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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