



Working with the measured value display unit

ND 231

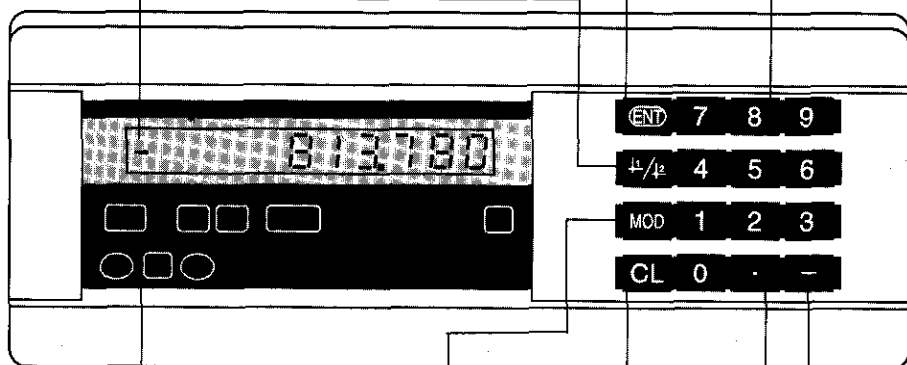
Actual value and input display

(7-segment LED,
9 decades and sign)

- Select datum
- Page backward in parameter list

- Confirm entry value
- Set display to value from P79 (P80!)

Numeric keypad



Status display

- Output measured value over data interface (P86!)
- Go to parameter list after switch-on
- Page forward in parameter list

- Clear entry
- Reset to zero (P80!)
- CL plus MOD: parameter list
- CL plus 2-digit number: select parameter
- Clear parameter entry and show parameter number

- Algebraic sign
- Decrease parameter value
- Decimal point
- Increase parameter value

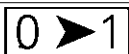
Indicator	Meaning
REF	If decimal points are blinking: Display is waiting for the reference mark to be crossed over. If decimal points are not blinking: Reference marks crossed over – datum points are now stored in nonvolatile memory. Blinking: Waiting for operator to press ENT or CL.
in.	Position values displayed in inches.
$\perp 1 / \perp 2$	Datum point 1 / Datum point 2 currently active.
SET	Blinking: Waiting for operator to confirm entry values.
< / = / >	Sorting mode: Measured value less than lower limit / within tolerances / greater than upper limit.

The ND 231 measured value display unit is designed for use with two HEIDENHAIN linear or rotary encoders with sinusoidal output signals.

Each encoder has one reference mark or several 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, crossing over the reference marks of both encoders restores the relationship between display values and axis slide positions last established by datum setting.

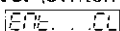
With distance-coded reference marks, a maximum traverse of only 20 mm after switch-on suffices to re-establish the datum.

Switch-On



Ent . . . CL

Turn on the power (switch located on rear panel).

- Display shows 
- REF blinks



5 , 6 9 7

Switch on reference mark evaluation.

- The display shows the value last assigned to the reference mark position.
- REF glows
- Decimal points blink

Cross over the reference marks in both axes.

Move **both** axes until the display becomes active and **no** decimal points blink.

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. The datum point refers to one of the two encoders or the sum or difference value (see "Selecting the display").

You can set two separate datum points.



Select datum point 1 or 2.



4 0

Enter a numerical value, such as 40.



Confirm your entry.

You can switch from one datum to the other at any time.

Use datum 2 when you want to display incremental dimensions.

Selecting the Display

You select the display for the ND 231 with

- switching inputs (see D-sub connection EXT) **or**
- operating parameter P06 (see list of operating parameters).

If you select the display over the switching inputs, operating parameter P06 has no effect on the display.

If none of the inputs is active for selection of the display (pins 6 to 9) or if more than one of these inputs is active, operating parameter P06 selects the display:

- Position of encoder X1: P06 = *R1*
- Position of encoder X2: P06 = *R2*
- Sum display: P06 = *R1 Add R2*
- Difference display: P06 = *R1 Sub R2*

Sorting and Tolerance Check Mode

In this mode the display value is compared with an upper and lower limit value. Status indicators and the switching 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. This only works when operating parameter P86 is set to *PRINT ON* (see operating parameter list)
- Input the command STX (Ctrl B) over the RXD input
- Input a latch command over the D-sub connection EXT.

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

Operating parameters for data output: P50, P51

Wiring and pin layout

Connecting cable is either **fully 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 levels "active"	Signal levels "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 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) • Sorting result (<, >, =, ? if P18 > P19) or blank space • Axis designation (1=X1, 2=X2, A=X1+X2, S=X1-X2) • 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.

Latch signal	STX (CTRL B)	EXT (pulse)	EXT (contact)	PRINT
Storage time	≤ 1 ms	≤ 1 μs	≤ 5 ms	≤ 33 ¹⁾ ms
Data transfer after	≤ 34 ¹⁾ ms	≤ 33 ¹⁾ ms	≤ 38 ¹⁾ ms	≤ 66 ²⁾ ms

¹⁾ These times will increase by 15 ms per compensated axis if linear compensation is active, and by another 28 ms if the comma position, counting mode and subdivision are different.

²⁾ This time will increase by 30 ms per compensated axis if linear compensation is active, and by another 56 ms if the comma position, counting mode and subdivision are different.

D-sub connection EXT



Danger to internal components!

Voltage sources from 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	Pin	Function
Outputs	15	Meas. value \geq trigger limit A1 (P62)	1	0 V
	16	Meas. value \geq trigger limit A2 (P63)	10	0 V
	17	Meas. value $<$ lower sorting limit (P18)	5	Do not assign
	18	Meas. value $>$ upper sorting limit (P19)	12	Do not assign
	19	Error (see "Error Messages")	13	Do not assign
	14	Display value is zero	11	Vacant
	2	Reset display to zero	20	Vacant
	3	Set display to value in P79	21	Vacant
	4	Ignore reference mark signals (encoder X1)		
	24	Ignore reference mark signals (encoder X2)		
Inputs	6	Display position of encoder X1		
	7	Display position of encoder X2		
	8	Display sum X1 + X2		
	9	Display difference X1 - X2		
	22	Pulse: Output the measured value		
	23	Contact: Output the measured value		
	25	Switch off or activate REF mode: (current REF condition is changed)		

Signal levels	Low		High	
Inputs	$-0.5 \text{ V} \leq U \leq 0.9 \text{ V}$	$I \leq 6 \text{ mA}$	$3.9 \text{ V} \leq U \leq 15 \text{ V}$	
Outputs	$U \leq 0.4 \text{ V}$	$I \leq 100 \text{ mA}$	$U \leq 32 \text{ V}$	$I \leq 10 \mu\text{A}$

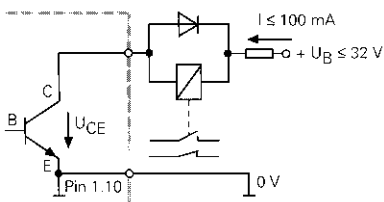
Description of input and output signals

Input signals

- Internal 1 k Ω pull-up resistor
- Triggering by make contact against 0 V or Low level over TTL logic device
- Delay for zero reset/preset: $t_d \leq 2 \text{ ms}$
- Min. pulse duration for all signals: $t_{\min} \geq 33^* \text{ ms}$

Output signals

- Open collector outputs, active Low
- Signal output delay: $t_d \leq 29 \text{ ms}^*$
- Duration of zero cross-over signal, trigger outputs A1, A2: $t_0 \geq 180 \text{ ms}$



* The indicated times will increase
 • by 15 ms per compensated axis if linear compensation is active
 • by 20 ms if comma position, counting mode and subdivision different
 • during external zero reset, preset, latching or data output.

Display Freeze by Measured Value Output Signal

The effect of the signal for measured value output on the display is defined in user parameter P23.

- ▶ **Concurrent display:** No display freeze. The unit shows the current measured value (*ACEL*).
- ▶ **Frozen display:** The display is frozen and is updated with each signal for measured value output (*HOLD*).
- ▶ **Frozen/concurrent display:** The display freezes only as long as the signal is present (*STOP*).

Error Messages

To clear error message

When you have removed the cause of the error,

- ▶ press **ERROR**

Message	Cause and effect
<i>ERROR 01</i>	Last measured value not yet latched*
<i>ERROR 02</i>	External device not ready for data transfer* (<i>ERROR 02</i> only appears once)
<i>ERROR 03</i>	Data interface: Parity error or wrong transfer format*
<i>ERROR 10</i>	Incorrect input value
<i>ERROR 11</i>	Overflow caused by external preset
<i>ERROR 13</i>	Overflow, trigger limit 1
<i>ERROR 14</i>	Overflow, trigger limit 2
<i>ERROR 15</i>	Overflow, lower sorting limit
<i>ERROR 16</i>	Overflow, upper sorting limit
<i>ERROR 17</i>	Sum or difference cannot be displayed
<i>ERROR 501</i>	Signal from encoder input X1 or X2 too small*
<i>ERROR 502</i>	(encoder may be contaminated)
<i>ERROR 511</i>	Input frequency for too high for input X1 or X2*
<i>ERROR 512</i>	(can occur when the traverse speed is too high)
<i>ERROR 53</i>	Internal counter overflow*
<i>ERROR 55</i>	Error while crossing over reference marks*
<i>ERROR 80</i>	To erase these error messages: Switch off the unit.
<i>ERROR 83</i>	Should any of these errors recur, contact your customer service agency.
<i>ERROR 84</i>	
<i>ERROR 85</i>	
<i>ERROR 99</i>	Check the operating parameters. If this error code continues to come up, contact your customer 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, the upper sorting limit is less than the lower sorting limit.

* 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, 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 $\pm 1 / \pm 2$ 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>	To change a protected operating parameter, enter code number 95 148 .		
<code>P01 INCH</code>	Unit of measure	Display in millimeters	<code>OFF</code>
		Display in inches	<code>ON</code>
<code>P05 DISP</code>	Select display mode	Display for encoder at X1	<code>P1</code>
		Display for encoder at X2	<code>P2</code>
		Sum display X1 + X2	<code>P1 Add P2</code>
		Difference display X1 - X2	<code>P1 Sub P2</code>
<code>P17 CLASS</code> Classification	Sorting mode	Sorting on	<code>CLASS ON</code>
		Sorting off	<code>CLASS OFF</code>
<code>P18 CLASS</code>	Lower sorting limit (ensure that P18 < P19)		
<code>P19 CLASS</code>	Upper sorting limit (ensure that P19 > P18)		

Parameter	Meaning	Function / Effect	Setting
P23 <i>dISP</i> Display	Display freeze with measured value output	Concurrent display, no freeze	
		Frozen display / update with signal	
		Frozen/concurrent display	
P30.* <i>dIR</i> Direction	Counting direction	Normal (Positive)	<i>POS</i>
		Inverse (Negative)	<i>NEG</i>
P32.* <i>SUBd</i> Subdivision	Subdivision of encoder signals 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		
P33.* <i>StEP</i> 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.* <i>dEC</i> Decimal point	Places after decimal 2 / 3 / 4 / 5 / 6 (up to 8 with inch display) As of hardware version .1- : -99 999.9 < P41 < +99 999.9 [$\mu\text{m}/\text{m}$]		
P41.* <i>COMP</i> Compensation	Linear error compensation¹⁾ -99 999 < P41 < +99 999 [$\mu\text{m}/\text{m}$] As of hardware version.1- : -99 999.9 < P41 < +99 999.9 [$\mu\text{m}/\text{m}$]		
P43.* <i>REF</i> Reference marks	One reference mark		<i>SINGLE</i>
	Distance-coded with 500 • GP (GP = grating period)		<i>500</i>
	Distance-coded with 1000 • GP (e.g. for LS 303 C / LS 603 C)		<i>1000</i>
	Distance-coded with 2000 • GP		<i>2000</i>
P44.* <i>REF</i> Reference mark evaluation	Evaluation		<i>REF ON</i>
	No evaluation		<i>REF OFF</i>
P45.* <i>ENCd</i> Encoder monitoring	No monitoring (Alarm Off)		<i>ALAR OFF</i>
	Contamination		<i>ALAR C</i>
	Frequency		<i>ALAR F</i>
	Contamination and frequency		<i>ALAR CF</i>
P50 <i>U24</i> Baud rate <i>bAUD</i>	110, 150, 300, 600, 1200, 2400, 4800, 9600		
P51 <i>U24</i> Additional line feeds <i>L LINEFd</i> (Linefeed)	0 to 99		
P62 <i>R1</i> Trigger limit 1	Enter numerical value		
P63 <i>R2</i> Trigger limit 2	Enter numerical value		
P79 <i>PRSt</i> Preset	Enter numerical value for datum setting over switching input or with ENT key		
P80 <i>SEt</i> Reset/Preset	No zero reset/preset with CL/ENT		<i>SEt OFF</i>
	Zero reset with CL (Set Zero), no preset with ENT		<i>SEt ZERO</i>
	Zero reset with CL and preset with ENT to value in P79		<i>PRESEt</i>
P82 <i>MESS</i> Message	Behavior after switch-on	<i>ENT</i> ... <i>CL</i> message displayed	<i>MESS ON</i>
		<i>ENT</i> ... <i>CL</i> message not displayed	<i>MESS OFF</i>
P85 <i>REF</i> External REF	REF over D-sub connection EXT		<i>EXT ON</i>
	No REF over EXT connection		<i>EXT OFF</i>
P86 <i>MD</i> Mode	PRINT via MOD key	PRINT inhibited	<i>PR INt OFF</i>
		PRINT not inhibited	<i>PR INt ON</i>

*: Enter parameter separately for each encoder

¹⁾ **Example entry value for P41** Displayed length: $L_d = 620.000$ mm; Actual length (determined e.g. with a comparator system VM 101 from HEIDENHAIN): $L_a = 619.876$ mm; Length difference: $\Delta L = L_a - L_d = -124$ μm
Compensation factor: $k = \Delta L / L_d = -124$ $\mu\text{m} / 0.62$ m = **-200** [$\mu\text{m}/\text{m}$]

Parameter Settings for HEIDENHAIN Linear Encoders

Model	Signal period [µm]	Reference marks	P43	Display step (unit: P01)		The following settings apply for mm:		
				mm	inches	Sub-division 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 VM	4	one	single	0.0010	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
				0.00005	0.000002	80	5	5
LIF 101 LF 401	4	one	single	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
MT	10	one	single	0.001	0.00005	10	1	3
				0.0005	0.00002	20	5	4
LID	10	one dist.c.	single 2000	0.0002	0.00001	50	2	4
				0.0001	0.000005	100	1	4
LS 103 LS 405 ULS/10	10	one dist.c.	single 1000					
LS 106 LS 406 LS 706 ULS/20	20	one dist.c.	single 1000	0.01	0.0005	2	1	2
				0.005	0.0002	4	5	3
				0.002	0.0001	10	2	3
				0.001	0.00005	20	1	3
				0.0005	0.00002	40	5	4
LIDA 190 LB 101	40	one	single	0.002	0.0001	20	2	3
				0.001	0.00005	40	1	3
				0.0005	0.00002	80	5	4
LIDA 2xx LB 3xx	100	one	single	0.01	0.0005	10	1	2
				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 parameter for any encoder

Linear encoder with signal period $s = 10 \mu\text{m}$

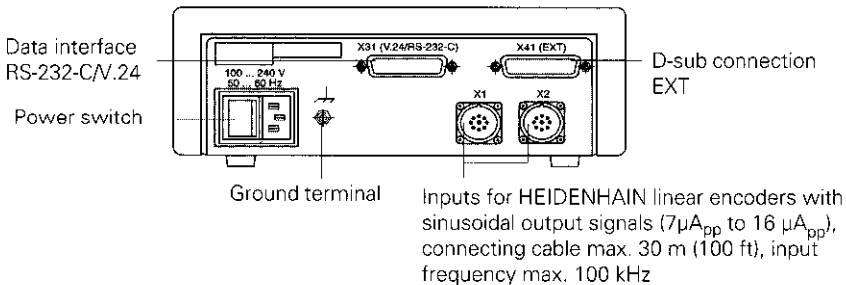
Desired display step $a = 0.0001 \text{ mm}$

Subdivision P32 = $0.001 \cdot s / a = 100$

Counting mode P33 = 1 (display counts 1, 2, 3, ...)

Places after decimal point of a : P38 = 4

Rear Panel

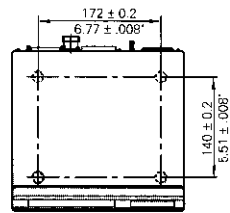


Interfaces X1, X2, X31 and X41 comply with the recommendations in VDE 0160, 5.88 for separation from line power.

Installation

You can mount the display unit to a flat surface with M4 bolts (see illustration at right).

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, class 2 overvoltage tolerance in accordance with VDE 0160, 5.88.

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 the power line: 0.75 mm^2



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 mm^2)

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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