



HEIDENHAIN



General Catalog

Linear Encoders
Length Gauges
Angle Encoders
Rotary Encoders
Contouring Controls
Touch Probes
Evaluation Electronics
Digital Readouts

DR. JOHANNES HEIDENHAIN GmbH develops and manufactures linear and angle encoders, rotary encoders, evaluation units, and numerical controls. HEIDENHAIN supplies its products to manufacturers of machine tools, and of automated machines and systems, in particular for semiconductor and electronics manufacturing.

HEIDENHAIN is represented in over 50 countries—mainly through its own subsidiaries. Sales engineers and service technicians support the user on-site with technical information and servicing.

This General Catalog offers you an overview of the HEIDENHAIN product program. More products and information is available in our specific product documentation (see page "For more information" on page 68) or in the Internet at www.heidenhain.de. Our sales personnel will be glad to help you personally. See page "Sales and service—worldwide" on page 70 for addresses and telephone numbers.

The image on the title page shows a milled part with curved surfaces that was milled with diagonal, alternating face-milling movements. The workpiece was machined with a TNC control from HEIDENHAIN on an HSC machining center. Despite the direction reversal during face milling, a very high surface quality was attained thanks to the highly dynamic motion control.



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Fundamentals and processes

The high quality of HEIDENHAIN products depends on special production facilities and measuring equipment. Masters and submasters for scale manufacturing are produced in a clean room with special measures for temperature stabilization and vibration insulation. The copying machines and the machines required for the manufacture and measurement of linear and circular graduations are largely developed and built by HEIDENHAIN.

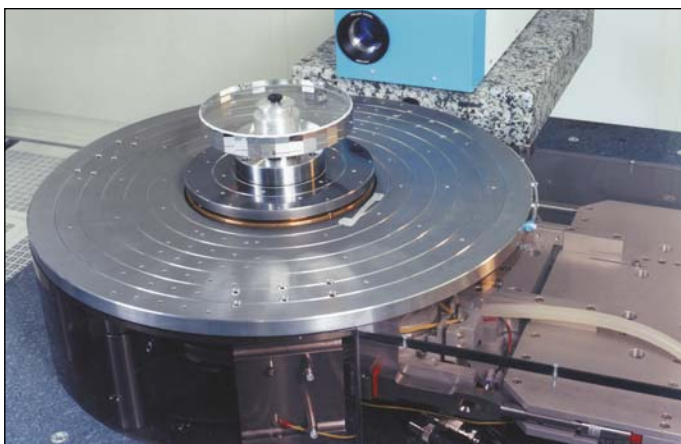


30 m long measuring machine for scale tapes



Vacuum machine for application of chromium layers

Competence in the area of linear and angular metrology is reflected by a large number of customized solutions for users. Among other implementations, they include the measuring and test equipment developed and built for standard laboratories and the angle encoders for telescopes and satellite receiving antennas. Of course, the products in the standard HEIDENHAIN product program profit from the knowledge gained.



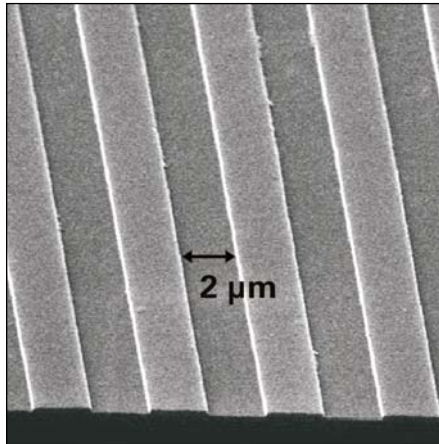
Angle comparator, measuring step approx. 0.001"



ALMA radio telescope in Chajnantor, Chile (photo courtesy of ESO)

Precision graduations—the foundation for high accuracy

The heart of a HEIDENHAIN encoder is its measuring standard, usually in the form of a grating with typical line widths of 0.25 μm to 10 μm . These precision graduations are manufactured in a process invented by HEIDENHAIN (e.g. DIADUR or METALLUR) and are a decisive factor in the function and accuracy of encoders. The graduations consist of lines and gaps at defined intervals with very little deviation, forming structures with very high edge definition. These graduations are resistant to mechanical and chemical influences as well as to vibration and shock. All measuring standards have a defined thermal behavior.



Phase grating with approx. 0.25 μm grating height

DIADUR

DIADUR precision graduations are composed of an extremely thin layer of chromium on a substrate—usually of glass or glass ceramic. The accuracy of the graduation structure lies within the micron and submicron range.

AURODUR

AURODUR graduations consist of highly reflective gold lines and matte etched gaps. AURODUR graduations are usually on steel carriers.

METALLUR

With its special optical composition of reflective gold layers, METALLUR graduations show a virtually planar structure. They are therefore particularly tolerant to contamination.

Phase gratings

Special manufacturing processes make it possible to produce three-dimensional graduation structures, possessing certain optical characteristics. The structure widths are in the range of a few micrometers down to quarters of a micrometer.

SUPRADUR

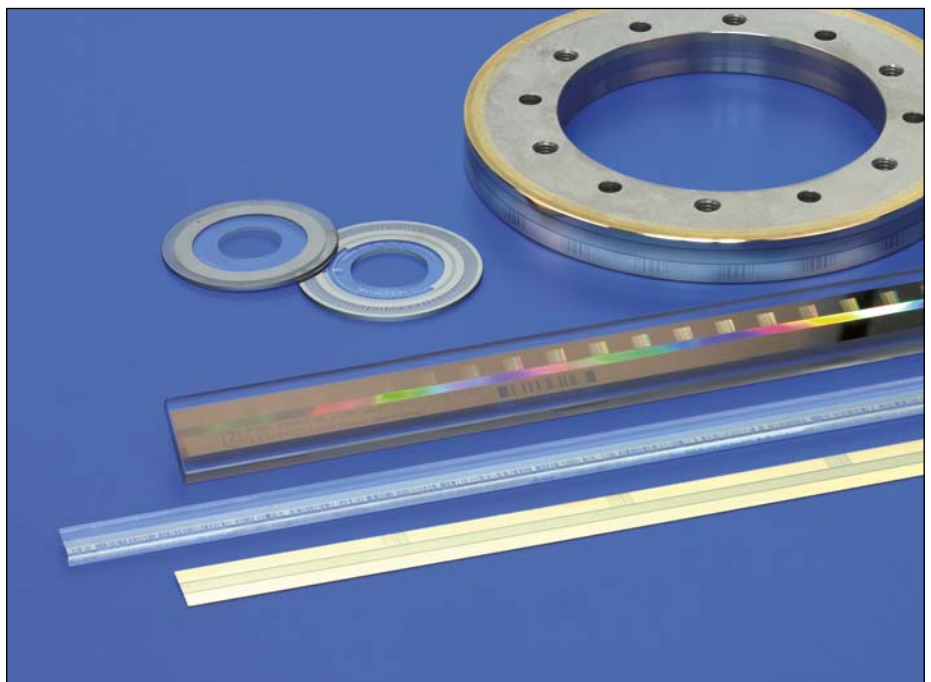
Graduations manufactured with the SUPRADUR process function optically like three-dimensional phase gratings, but they have a planar structure and are therefore particularly insensitive to contamination.

OPTODUR

The OPTODUR process produces graduation structures with particularly high reflectance. Its composition as an optically three dimensional, planar structure is similar to the SUPRADUR graduation.

MAGNODUR

Thin magnetically active layers in the micron range are structured for very fine, magnetized graduations.



DIADUR and METALLUR graduations on various carrier materials

Length measurement

Sealed linear encoders

Sealed linear encoders from HEIDENHAIN are protected from dust, chips and splash fluids and are ideal for operation on **machine tools**.

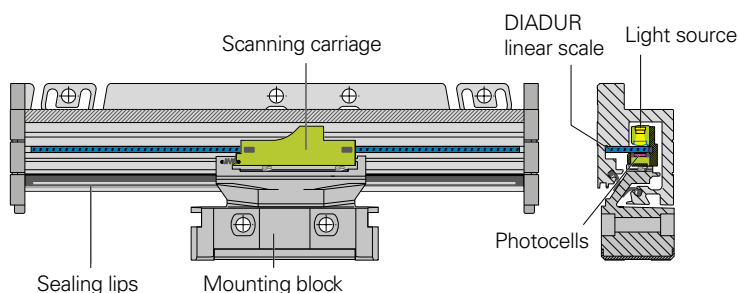
- Accuracy grades as fine as $\pm 2 \mu\text{m}$
- Measuring steps to $0.001 \mu\text{m}$
- Measuring lengths up to 30 m (72 m upon request)
- Fast and simple installation
- Large mounting tolerances
- High acceleration loading
- Protection against contamination



Sealed linear encoders are available with

- **Full-size scale housing**
 - For high vibration loading
 - Up to 30 m measuring length (72 upon request)
- **Slimline scale housing**
 - For limited installation space
 - Up to 1240 mm measuring length, up to 2040 mm with mounting spar or tensioning elements

The aluminum housing of a HEIDENHAIN sealed linear encoder protects the scale, scanning carriage, and its guideway from chips, dust, and fluids. Downward-oriented elastic lips seal the housing. The scanning carriage travels along the scale on a low-friction guide. It is connected to the external mounting block by a coupling that compensates unavoidable misalignment between the scale and the machine guideways.



Exposed linear encoders

Exposed linear encoders from HEIDENHAIN operate with no mechanical contact between the scanning head and the scale or scale tape. Typical areas of application for these encoders include **measuring machines, comparators** and other **precision devices**, as well as **production and measuring equipment**, for example in the semiconductor industry.

- Accuracy grades of $\pm 0.5 \mu\text{m}$ and better
- For measuring steps to $0.001 \mu\text{m}$ (1 nm)
- Measuring lengths up to 30 m
- No friction between scanning head and scale
- Small dimensions and low mass
- High traversing speeds



Length gauges

Length gauges from HEIDENHAIN feature integral guideways for the plunger. They are used to monitor measuring equipment, in industrial metrology, and as position encoders.

- Accuracy grades as fine as $\pm 0.1 \mu\text{m}$
- For measuring steps to $0.005 \mu\text{m}$ (5 nm)
- Measuring lengths up to 100 mm
- High measuring accuracy
- Available with automated plunger drive
- Simple mounting

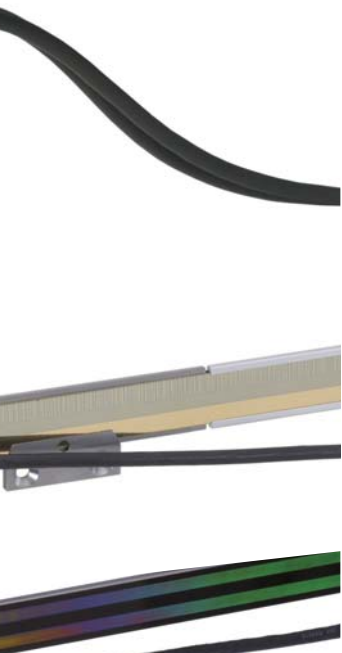


With **incremental linear encoders**, the current position is determined by starting at a datum and counting measuring steps, or by subdividing and counting signal periods. Incremental encoders from HEIDENHAIN feature reference marks, which must be scanned after switch-on to reestablish the reference point. This process is especially simple and fast with distance-coded reference marks.

Absolute linear encoders from HEIDENHAIN require no previous traverse to provide the current position value. The encoder transmits the absolute value through the **EnDat interface** or another serial interface.

The recommended **measuring steps** listed in the table refer primarily to position measurements. Smaller measuring steps, which are attained through higher interpolation factors of sinusoidal output signals, are useful in particular for applications in rotational speed control, e.g. on direct drives.

Under the designation **functional safety**, HEIDENHAIN offers encoders with purely serial data transmission as single-encoder systems for safety-related machines and systems. The two measured values are already formed independently of each other in the encoder, and are transmitted to the safe control via the EnDat interface.



Sealed linear encoders		Series	Page
With full-size scale housing	Absolute position measurement	LC 100	8
	Absolute position measurement and large measuring lengths	LC 200	
	Incremental position measurement	LS 100	
	Very high repeatability	LF 100	
	Typically for manual machines	LS 600	
With slimline scale housing	Large measuring lengths	LB 300	10
	Absolute position measurement	LC 400	
	Incremental position measurement	LS 400	
	Very high repeatability	LF 400	
Exposed linear encoders	Typically for manual machines	LS 300	12
	Very high accuracy	LIP, LIF	
	Two-coordinate encoders	PP	
	For high accuracy and large measuring lengths	LIDA	
Length gauges	Absolute position measurement	LIC	14
	For measuring stations and multipoint inspection apparatuses	AT, CT, MT, ST	

LC, LF, LS, LB sealed linear encoders

With full-size scale housing

Linear encoders with **full-size scale housing** are characterized particularly by high tolerance to vibration.

Absolute linear encoders of the **LC 100** and **LC 200** series provide the **absolute position value** without any previous traverse required. Depending on the version, incremental signals can be output additionally. The LC 100 can be mounted to the same mating dimensions as the incremental linear encoders of the **LS 100** series and feature the same mechanical design. Because of their high accuracy and defined thermal behavior, LC 100 and LS 100 series linear encoders are especially well suited for use on **numerically controlled machine tools**.

The incremental encoders of the **LF** type feature measuring standards with relatively fine grating periods. This makes them particularly attractive for applications requiring very **high repeatability**.

The **LS 600** series incremental linear encoders are used for simple positioning tasks, for example on **manual machine tools**.

The **LC 200** (absolute) and **LB** (incremental) linear encoders were conceived for very **long measuring lengths**. Their measuring standard—a steel tape with METALLUR or AURODUR graduation—is delivered as a single piece, and after the housing sections have been mounted, is pulled into the housing, drawn to a defined tension and fixed at both ends to the machine casting.

LC 100 series

- **Absolute position measurement**
- Defined thermal behavior
- High vibration rating
- Two mounting attitudes
- Single-field scanning

LC 200 series

- **Absolute position measurement for large measuring lengths** up to 28 m
- Defined thermal behavior
- High vibration rating
- Two mounting attitudes
- Single-field scanning

LS 100 series

- **Incremental position measurement**
- Defined thermal behavior
- High vibration rating
- Two mounting attitudes
- Single-field scanning

LF 185

- **Very high repeatability**
- Thermal behavior similar to steel or cast iron
- High vibration rating
- Two mounting attitudes
- Single-field scanning

LB 382

- **For large measuring lengths** up to 30 m⁴⁾
- Defined thermal behavior
- High vibration rating
- Two mounting attitudes
- Single-field scanning

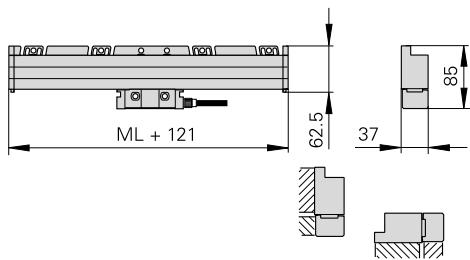
LS 600 series

- **Typically for manual machines**
- Simple installation

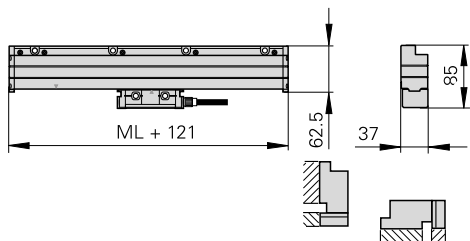
	Absolute LC 115 ¹⁾ /LC 185 LC 195 F/M/P/S ¹⁾	LC 211/LC 281 LC 291 F/M
Measuring standard	DIADUR glass scale	METALLUR steel scale tape
Grating period	20 µm	40 µm
Interface	LC 115: EnDat 2.2 LC 185: EnDat 2.2 with ~ 1 V _{PP} LC 195: Fanuc α /Mitsubishi/ Panasonic/DRIVE-CLiQ	LC 211: EnDat 2.2 LC 281: EnDat 2.2 with ~ 1 V _{PP} LC 291: Fanuc α /Mitsubishi
Signal period	LC 185: 20 µm	LC 281: 40 µm
Accuracy grade	±5 µm, ±3 µm ³⁾	±5 µm
Meas. lengths ML	Up to 4240 mm	Up to 28040 mm ⁵⁾
Reference mark	–	

¹⁾ Also available with **Functional Safety**

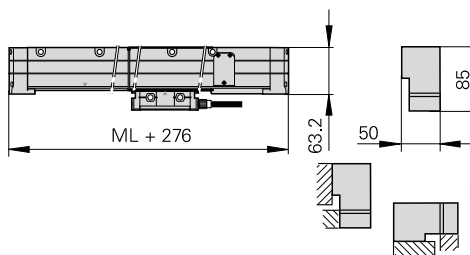
²⁾ 5/10/20-fold integrated interpolation



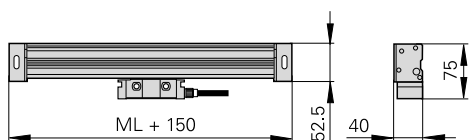
LC 100



LF 185



LC 200



LS 600

Incremental LF 185	LS 187 LS 177	LS 688C LS 628C	LB 382
SUPRADUR phase grating on steel 8 µm	DIADUR glass scale 20 µm	DIADUR glass scale 20 µm	AURODUR steel scale tape 40 µm
~ 1 V _{PP}	LS 187: ~ 1 V _{PP} LS 177: □ TTL ²⁾	LS 688C: ~ 1 V _{PP} LS 628C: □ TTL	~ 1 V _{PP}
4 µm	LS 187: 20 µm	LS 688C: 20 µm	40 µm
±3 µm, ±2 µm	±5 µm, ±3 µm	±10 µm	±5 µm
Up to 3040 mm	Up to 3040 mm		Up to 30 040 mm ⁴⁾
One or distance-coded; LS 6xxC: distance-coded			

³⁾ Up to ML 3040 mm

⁴⁾ Up to ML 72040 mm upon request

⁵⁾ Larger measuring lengths with TNC 640 upon request

LC, LF, LS sealed linear encoders

With slimline scale housing

Sealed linear encoders with **slimline scale housing** are primarily used where installation space is limited.

Absolute linear encoders of the **LC 400** series provide the **absolute position value** without any previous traverse required. Like the **LS 400** series incremental linear encoders, their high accuracy and defined thermal behavior make them especially well suited for use on **numerically controlled machine tools**.

The incremental encoders of the **LF** type feature measuring standards with relatively fine grating periods. This makes them particularly attractive for applications requiring very **high repeatability**.

The **LS 300** series incremental linear encoders are used for simple positioning tasks, for example on **manual machine tools**.

LC 400 series

- **Absolute position measurement**
- Defined thermal behavior
- Single-field scanning

LS 400 series

- **Incremental position measurement**
- Defined thermal behavior
- Single-field scanning

LF 485

- **Very high repeatability**
- Thermal behavior similar to steel or cast iron
- Single-field scanning

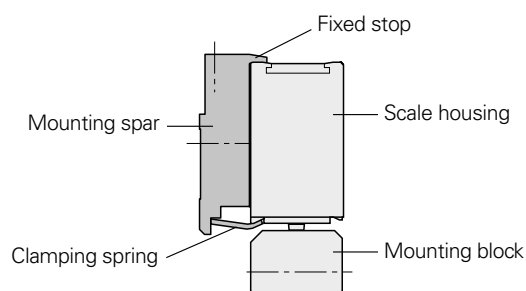
LS 300 series

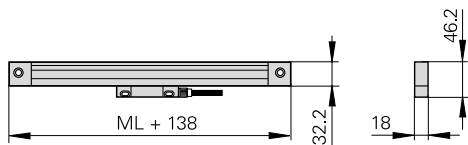
- **Typically for manual machines**

Simple installation with mounting spar

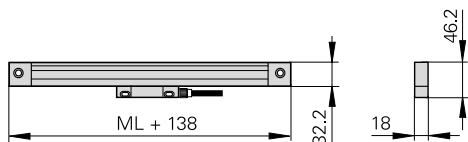
The use of a mounting spar is of great benefit when mounting slimline linear encoders. It can be fastened as part of the machine assembly process. The encoder is then simply clamped on during final mounting. Easy exchange also facilitates servicing.

Moreover, installation with a mounting spar significantly improves the encoder's acceleration behavior.

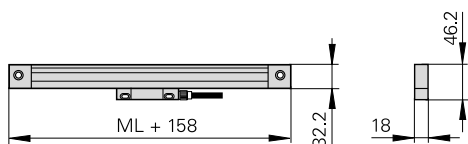




LC 400



LS 400



LF 485



LS 300

	Absolute LC 415 ¹⁾ /LC 485 LC 495 F/M/P/S ¹⁾	Incremental LF 485	LS 487 LS 477	LS 388 C LS 328 C
Measuring standard	DIADUR glass scale	SUPRADUR phase grating on steel	DIADUR glass scale	DIADUR glass scale
Grating period	20 µm	8 µm	20 µm	20 µm
Interface	LC 415: EnDat 2.2 LC 485: EnDat 2.2 with ~ 1 V _{PP} LC 495: Fancu αi/Mitsubishi/ Panasonic/DRIVE- CLiQ	~ 1 V _{PP}	LS 487: ~ 1 V _{PP} LS 477: □TTL ²⁾	LS 388 C: ~ 1 V _{PP} LS 328 C: □TTL
Signal period	LC 485: 20 µm	4 µm	LS 487: 20 µm	LS 388 C: 20 µm
Accuracy grade	±5 µm, ±3 µm	±5 µm, ±3 µm		±10 µm
Meas. lengths ML	Up to 2040 mm ³⁾	Up to 1220 mm	Up to 2040 mm ³⁾	Up to 1240 mm
Reference mark	-	One or distance-coded		Distance-coded

¹⁾ Also available with **Functional Safety**

²⁾ 5/10/20-fold integrated interpolation

³⁾ Over ML 1240 mm only with mounting spar or clamping elements

LIP, LIF exposed linear encoders

For very high accuracy

The exposed linear encoders of the **LIP** and **LIF** design are characterized by small measuring steps together with high accuracy and repeatability. The measuring standard is a phase grating applied to a substrate of glass or glass ceramic.

LIP and **LIF** encoders are typically used for:

- Measuring machines and comparators
- Measuring microscopes
- Ultra-precision machines such as diamond lathes for optical components, facing lathes for magnetic storage disks, and grinding machines for ferrite components
- Measuring and production equipment in the semiconductor industry
- Measuring and production equipment in the electronics industry

Special **vacuum applications in high vacuum** are served by LIF 481V and LIP 481V (for high vacuum, down to 10^{-7} bar) and LIP 481 U (for ultrahigh vacuum, down to 10^{-11} bar).

LIP 300 series

- **Very high resolution** with measuring steps to 1 nm
- Very high repeatability through an extremely fine signal period
- Defined thermal behavior thanks to a measuring standard on Zerodur glass ceramic

LIP 200 series

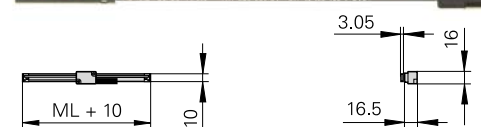
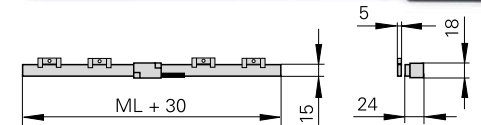
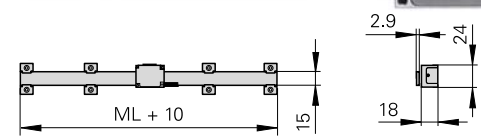
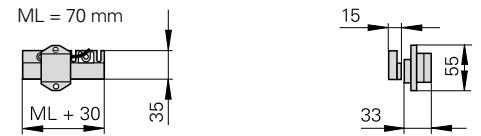
- Measuring lengths up to 3040 mm
- Measuring step down to 1 nm
- Very high repeatability with compact dimensions
- Defined thermal behavior thanks to a measuring standard on Zerodur glass ceramic

LIP 400 series

- Small dimensions
- Measuring steps as fine as $0.005 \mu\text{m}$
- Scale available with various thermal expansion coefficients

LIF 400 series

- **Fast, simple scale fastening** with PRECIMET adhesive film
- Relatively insensitive to contamination thanks to SUPRADUR graduation
- Position detection through limit switches and homing track



	Incremental LIP 382 LIP 372¹⁾	LIP 281 LIP 211	LIP 481 LIP 471
Measuring standard	DIADUR phase grating on Zerodur glass ceramic	OPTODUR phase grating on Zerodur glass ceramic	DIADUR phase grating on glass or Zerodur glass ceramic
Grating period	0.512 μm	2.048 μm	4 μm
Interface	<i>LIP 382:</i> $\sim 1 V_{PP}$ <i>LIP 372:</i> \square TTL	<i>LIP 281:</i> $\sim 1 V_{PP}$ <i>LIP 211:</i> EnDat 2.2 ²⁾	<i>LIP 481:</i> $\sim 1 V_{PP}$ <i>LIP 471:</i> \square TTL ³⁾
Signal period	<i>LIP 382:</i> 0.128 μm	<i>LIP 281:</i> 0.512 μm	<i>LIP 481:</i> 2 μm
Accuracy grade	$\pm 0.5 \mu\text{m}$	$\pm 1 \mu\text{m}$ $\pm 3 \mu\text{m}$	$\pm 1 \mu\text{m}$; $\pm 0.5 \mu\text{m}$
Baseline error	$\leq \pm 0.075 \mu\text{m}/5 \text{ mm}$	$\leq \pm 0.125 \mu\text{m}/5 \text{ mm}$	$\leq \pm 0.175 \mu\text{m}/5 \text{ mm}$
Interpolation error⁴⁾	$\pm 0.01 \text{ nm}$	$\pm 1 \text{ nm}$	$\pm 7 \text{ nm}$
Meas. lengths ML	70 mm to 270 mm	20 mm to 1020 mm 370 mm to 3040 mm	70 mm to 420 mm
Reference mark	None	One	One

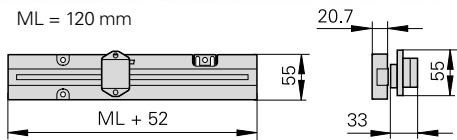
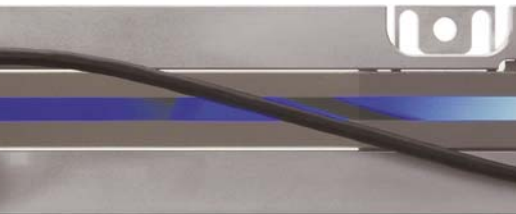
¹⁾ 32-fold integrated interpolation

²⁾ Absolute position value after scanning the reference mark

³⁾ 5/10-fold integrated interpolation

PP exposed linear encoders

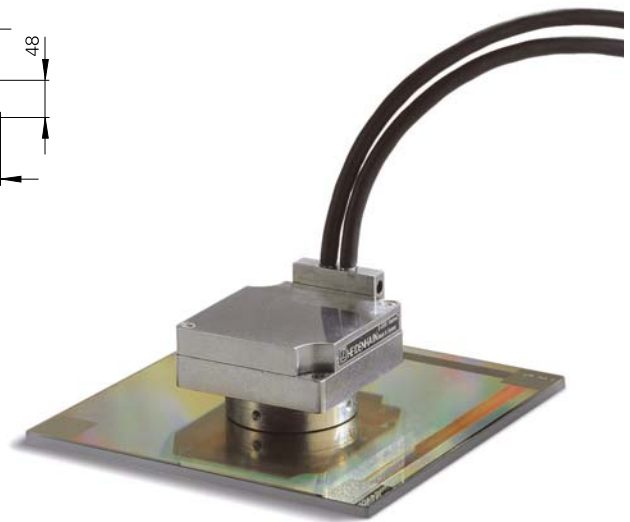
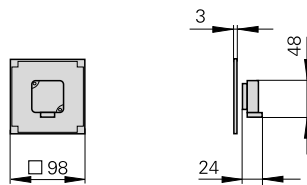
Two-coordinate encoders



The **PP** two-coordinate encoders feature as measuring standard a planar phase-grating structure on a glass substrate. This makes it possible to measure positions in a plane.

Applications include:

- Measuring and production equipment in the semiconductor industry
- Measuring and production equipment in the electronics industry
- Extremely fast X-Y tables
- Measuring machines and comparators
- Measuring microscopes



LIF 481 LIF 471	
	SUPRADUR phase grating on glass or Zerodur glass ceramic 8 μm
	LIF 481: $\sim 1 V_{PP}$ LIF 471: \square TTL ³⁾
	LIF 481: 4 μm
	$\pm 1 \mu\text{m}$ (only for Zerodur); $\pm 3 \mu\text{m}$
	$\leq \pm 0.225 \mu\text{m}/5 \text{ mm}$
	$\pm 12 \text{ nm}$
	70 mm to 1020 mm (up to 3040 mm upon request)
	One

⁴⁾ Only with encoders with 1 V_{PP} or EnDat 2.2 interface

	Incremental PP 281
Measuring standard Grating period	DIADUR phase grating on glass 8 μm
Interface	$\sim 1 V_{PP}$
Signal period	4 μm
Accuracy grade	$\pm 2 \mu\text{m}$
Interpolation error	$\pm 12 \text{ nm}$
Measuring range	68 mm x 68 mm, other measuring ranges upon request
Reference mark	One per coordinate

LIC, LIDA exposed linear encoders

For high accuracy and large measuring lengths

The **LIC** and **LIDA** exposed linear encoders are designed for **high traversing speeds** up to 10 m/s and **large measuring lengths** of up to 30 m.

The **LIC** makes **absolute position measurement** possible over measuring lengths up to 28 m. In their dimensions, they correspond to LIDA 400 and LIDA 200 incremental linear encoders.

On the **LIC** and **LIDA** linear encoders, steel scale tapes typically serve as substrate for METALLUR graduations. With the **LIC 41x3** and LIDA 4x3, graduation carriers of glass or glass ceramics permit **thermal adaptation** thanks to their different coefficients of linear expansion.

LIC and LIDA exposed linear encoders are typically used for:

- Coordinate measuring machines
- Inspection machines
- PCB assembly machines
- PCB drilling machines
- Precision handling devices
- Position and velocity measurement on linear motors

LIC and LIDA are particularly easy to mount with **various mounting possibilities**:

LIC 41x3, LIDA 4x3

- Scale of glass or glass ceramic is bonded directly onto the mounting surface

LIC 41x5, LIDA 4x5

- One-piece steel scale tape is drawn into an aluminum extrusion and tensioned at its ends
- The aluminum extrusions can be screwed or bonded onto the mounting surface

LIC 41x7, LIC 21x7, LIDA 4x7, LIDA 2x7

- One-piece steel scale-tape is drawn into aluminum extrusions and fixed at center
- The aluminum extrusions are bonded onto the mounting surface

LIC 41x9, LIC 21x9, LIDA 4x9, LIDA 2x9

- One-piece steel scale tape is bonded directly to the mounting surface

LIC 4100 series

- **Absolute position acquisition** up to 28 m
- Various mounting options

LIP 400 series

- Large **measuring lengths up to 30 m**
- Various mounting options
- Limit switches

LIC 2100 series

- **Absolute position measurement**
- Large mounting tolerances
- For simple applications

LIP 200 series

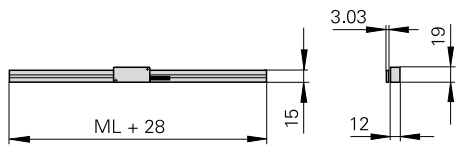
- **Scale tape cut from roll**
- Large mounting tolerances
- For simple applications
- Simple installation through integrated function display

	Absolute LIC 4113 LIC 4193F/M	LIC 4115 LIC 4195F/M	LIC 4117 LIC 4197F/M	LIC 4119 LIC 4199F/M	Incremental LIDA 483 LIDA 473
Measuring standard	METALLUR graduation on glass ceramic or glass	METALLUR steel scale tape			METALLUR graduation on glass ceramic or glass
Grating period	40 µm	40 µm			20 µm
Interface	LIC 411x: EnDat 2.2 LIC 419x: Fanuc α /Mitsubishi				LIDA 48x: \sim 1 V _{pp} ¹⁾ LIDA 47x: \square TTL ¹⁾
Signal period	–				LIDA 48x: 20 µm
Accuracy grade	±3 µm; ±5 µm	±5 µm	±3 µm ³⁾ ; ±5 µm ³⁾ ; ±15 µm	±3 µm; ±15 µm	±1 µm ⁴⁾ ; ±3 µm; ±5 µm
Baseline error	≤ ±0.275 µm/10 mm		≤ ±0.750 µm/50 mm		≤ ±0.275 µm/10 mm
Interpolation error ⁵⁾	±20 nm		±20 nm		±45 nm
Meas. lengths ML	240 mm to 3040 mm	140 mm to 28440 mm	240 mm to 6040 mm	70 mm to 1020 mm	240 mm to 3040 mm
Reference mark	–				One or distance-coded

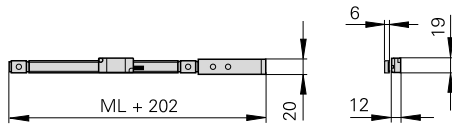
¹⁾ 5/10/50/100-fold integrated interpolation

²⁾ 10/50/100-fold integrated interpolation

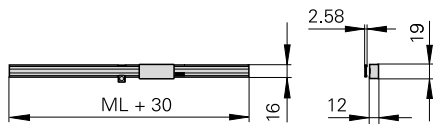
³⁾ Up to measuring length of 1020 mm or 1040 mm



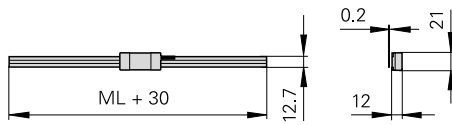
LIC 4113



LIDA 485



LIC 2117



LIDA 279

LIDA 485 LIDA 475	LIDA 487 LIDA 477	LIDA 489 LIDA 479	Incremental LIDA 287 LIDA 277	LIDA 289 LIDA 279	Absolute LIC 2117 LIC 2197F/M/P	LIC 2119 LIC 2199F/M/P
METALLUR steel scale tape			Steel scale tape		Steel scale tape	
20 µm			200 µm		220 µm	
			LIDA 28x: $\sim 1 V_{PP}$ LIDA 27x: $\square \square \square \square$ ²⁾		LIC 211x: EnDat 2.2 LIC 219x: Fanuc α /Mitsubishi/ Panasonic	
			LIDA 28x: 200 µm		-	
±5 µm	±3 µm ³⁾ ; ±5 µm ³⁾ ; ±15 µm	±3 µm; ±15 µm	±15 µm		±15 µm	
≤ ±0.750 µm/50 mm (typical)			-		-	
±45 nm			±2 µm		± 2 µm	
140 mm to 30040 mm	240 mm to 6040 mm		Scale tape from the roll 3 m/5 m/10 m		120 mm to 3020 mm (larger measuring lengths upon request)	
One			Selectable every 100 mm		-	

⁴⁾ Only for Robax glass ceramic up to ML 1640 mm

⁵⁾ Only with encoders with 1 V_{PP} or EnDat 2.2 interface

AT, CT, MT, ST length gauges

For measuring stations and multipoint inspection apparatuses

HEIDENHAIN length gauges are characterized by high accuracy together with large strokes up to 100 mm. They feature plungers with integral bearings and therefore serve as compact measuring devices.

The **HEIDENHAIN-CERTO** CT length gauge are used predominantly for production quality control of high-precision parts and for the monitoring and calibration of reference standards.

The **HEIDENHAIN-METRO** MT 1200 and MT 2500 length gauges are ideal for precision measuring stations and testing equipment. The ball-bush guided plunger tolerates high radial forces. The primary applications for the MT 60 and MT 101 are incoming inspection, production monitoring, quality control, but also as high-accuracy position encoders, for example on linear slides or X-Y tables.

Thanks to their very small dimensions, the **HEIDENHAIN-ACANTO** AT and **HEIDENHAIN-SPECTO** ST series length gauges are the product of choice for multipoint inspection apparatus and testing equipment.

Plunger actuation

The plungers of the length gauges with **motorized** plunger actuation are extended and retracted by an integral motor. They are operated through the associated switch box.

Length gauges with plunger actuation by **coupling** have no plunger drive. The freely movable plunger is connected by a separate coupling with the moving machine element.

The length gauges with plunger actuation **by the measured object** or **with cable-type lifter** feature a spring-loaded plunger that is extended in its resting position.

The MT 1281 and ST 1288 length gauges are available with various gauging forces. Particularly for fragile materials this makes it possible to measure without deformation.

On the length gauges with **pneumatic** plunger actuation, the plunger is retracted by the integral spring at its rest position. It is extended to the measuring position by application of compressed air.

HEIDENHAIN-ACANTO

- Online diagnostics
- Protection up to IP67
- Serial data transmission with CRC

HEIDENHAIN-CERTO

- For very high accuracy
- Low thermal expansion through thermally invariant materials
- High-precision ball bearing guide

HEIDENHAIN-METRO

- MT 1200 and MT 2500
- High repeatability
 - Various gauging force variants
 - Various possibilities for plunger actuation

HEIDENHAIN-METRO

- MT 60 and MT 101
- Large measuring ranges
 - Plunger actuation by motor or coupling
 - Ball-bush guided plunger

HEIDENHAIN-SPECTO

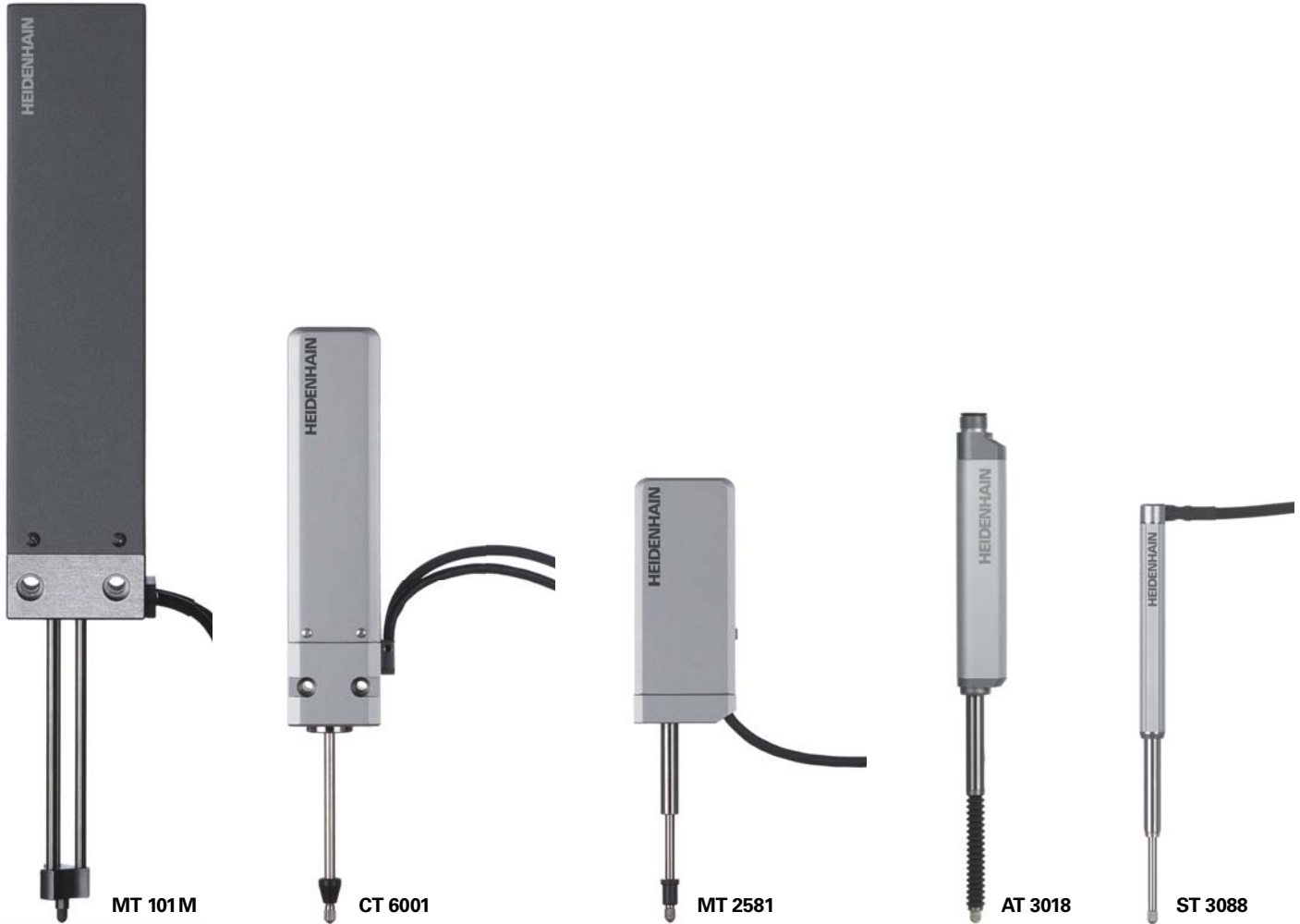
- Very compact dimensions
- Protection up to IP67
- Especially durable ball-bush guide
- Variant for harsh ambient conditions

	Absolute AT 1218 AT 1217		AT 3018 AT 3017	Incremental CT 2501 CT 2502		CT 6001 CT 6002	MT 1281 MT 1287	MT 1271
Measuring standard	DIADUR glass scale			DIADUR phase grating on Zerodur glass ceramic scale Coefficient of linear expansion: $\alpha_{\text{therm}} \approx (0 \pm 0.1) \times 10^{-6} \text{ K}^{-1}$				
Grating period	188.4 μm			4 μm			4 μm	
Interface	EnDat 2.2			$\sim 11 \mu\text{A}_{\text{PP}}$			$\sim 1 \text{V}_{\text{PP}}$	\square TTL ³⁾
Signal period	–			2 μm			–	
System accuracy	$\pm 1 \mu\text{m}$	$\pm 2 \mu\text{m}$		$\pm 0.1 \mu\text{m}^{1)}$ $\pm 0.03 \mu\text{m}^{2)}$	$\pm 0.1 \mu\text{m}^{1)}$ $\pm 0.05 \mu\text{m}^{2)}$		$\pm 0.2 \mu\text{m}$	
Probe repeatability typically	0.4 μm	0.8 μm		0.02 μm	0.03 μm			
Measuring range	12 mm	30 mm		25 mm	60 mm		12 mm	
Plunger actuation	AT xx18: By measured object AT xx17: Pneumatic			CT xx01: With motor CT xx02: By coupling			MT xxx1: Cable-type lifter or free MT xx87: pneumatic	

¹⁾ At 19 °C to 21 °C; permissible temperature fluctuation during measurement: $\pm 0.1 \text{ K}$

²⁾ With linear length-error compensation in the evaluation electronics

³⁾ 5/10-fold integrated interpolation



MT 2581 MT 2587		MT 2571	MT 60M MT 60K	MT 101 M MT 101 K	ST 1288 ST 1287	ST 1278 ST 1277	ST 3088 ST 3087	ST 3078 ST 3077	
			DIADUR graduation on glass ceramic scale		DIADUR glass scale				
			10 µm		20 µm				
~ 1 V _{PP}	□ TTL ³⁾		~ 11 µA _{PP}		~ 1 V _{PP}	□ TTL ³⁾	~ 1 V _{PP}	□ TTL ³⁾	
2 µm	-		10 µm		20 µm	-	20 µm	-	
			±0.5 µm	±1 µm	±1 µm				
0.09 µm			0.06 µm	0.04 µm	0.25 µm		0.7 µm		
25 mm			60 mm	100 mm	12 mm		30 mm		
				<i>MT xxM</i> : With motor <i>MT xxK</i> : By coupling		<i>ST xxx8</i> : By measured object <i>ST xxx7</i> : Pneumatically			

Angle encoders

HEIDENHAIN angle encoders are characterized by high accuracy values in the angular second range and better. These devices are used in applications such as rotary tables, swivel heads of machine tools, dividing apparatuses, high-precision angle measuring tables, precision devices in angular metrology, antennas and telescopes.

- Line counts typically 9000 to 180 000
- Accuracy from $\pm 5''$ to $\pm 0.4''$
- Measuring steps as fine as $0.000\ 01^\circ$ or $0.036''$ (incremental) or 29 bits, i.e. approx. 536 million positions per revolution (absolute)



Rotary encoders

Rotary encoders from HEIDENHAIN serve as measuring sensors for rotary motion, angular velocity and also, when used in conjunction with mechanical measuring standards such as lead screws, for linear motion. Application areas include electrical motors, machine tools, printing machines, woodworking machines, textile machines, robots and handling devices, as well as various types of measuring, testing, and inspection devices.

- Line counts of typically 16 to 5000
- Accuracy grades to $\pm 10''$ (depending on the line count, corresponding to $\pm 1/20$ of the grating period)
- Measuring steps to 0.001° .
Particularly for photoelectric rotary encoders, the high quality of the sinusoidal incremental signals permits high interpolation factors for digital speed control.



Mounting variants

In angle encoders and rotary encoders with integral bearing and **stator coupling**, the graduated disk of the encoder is connected directly to the shaft to be measured. The scanning unit is guided on the shaft via ball bearings, supported by the stator coupling. As a result, during angular acceleration of the shaft, the stator coupling must absorb only that torque resulting from friction in the bearing. These angle encoders therefore provide excellent dynamic performance. Thanks to the stator coupling, the system accuracy includes the error of the shaft coupling.

Other benefits of the stator coupling are:

- Simple installation
- Short overall length
- High natural frequency of the coupling
- Hollow through shaft is possible

Angle encoders and rotary encoders with integral bearings for a **separate shaft coupling** are designed with a solid shaft. The recommended coupling to the measured shaft compensates radial and axial tolerances. Angle encoders for separate shaft couplings permit higher shaft speeds.

Angle encoders and rotary encoders **without integral bearing** operate without friction. The two components—the scanning head and the scale disk, drum, or tape—are adjusted to each other during assembly. The benefits are:

- Requires little space
- Large hollow-shaft diameters
- High shaft speeds possible
- No additional starting torque



With **incremental angle encoders and rotary encoders**, the current position is determined by starting at a datum and counting measuring steps, or by subdividing and counting signal periods. Incremental encoders from HEIDENHAIN feature reference marks to reestablish the reference point.

Incremental rotary encoders with commutation signals provide the angular shaft position value—without requiring previous traverse—with sufficient accuracy to correctly control the phases of the rotating field of a permanent-magnet three-phase motor.

Absolute angle encoders and rotary encoders require no previous traverse to provide the current position value. **Singleturn encoders** provide the current angular position value within one revolution, while **multiturn encoders** can additionally distinguish between revolutions. The position values are transmitted over an **EnDat, SSI, PROFIBUS-DP, PROFINET or other serial data interface**. The EnDat-Interface, PROFIBUS-DP or PROFINET bidirectional interfaces enable automatic configuration of the higher-level electronics and provide monitoring and diagnostic functions.

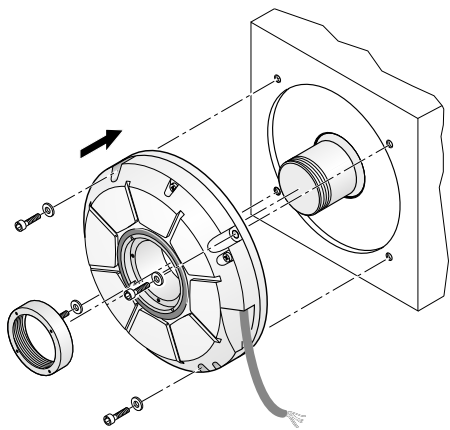
Under the designation **functional safety**, HEIDENHAIN offers encoders with purely serial data transmission as single-encoder systems for safety-related machines and systems. The two measured values are already formed independently of each other in the encoder, and are transmitted to the safe control via the EnDat interface.

Sealed angle encoders		Series	Page
With integral bearing and integrated stator coupling	Absolute (singleturn)/incremental	RCN/RON, RPN	20
With integral bearing, for separate shaft coupling	Incremental	ROC, ROD	22
Angle encoder modules		With precision bearings	MRP, SRP
Modular angle encoders			
Without integral bearing, with optical scanning	Absolute (singleturn)/incremental	ECA/ERP, ERO, ERA	26
Without integral bearing, with magnetic scanning	Incremental	ERM	32
Rotary encoders			
With integral bearing, for mounting by stator coupling	Absolute (Singleturn/Multiturn) Incremental	ECN/EQN ERN	34
With integral bearing, for separate shaft coupling	Absolute (Singleturn/Multiturn) Incremental	ROC/ROQ, RIC/RIQ ROD	38
Without integral bearing	Absolute (Singleturn/Multiturn) Incremental	ECI/EQI, EBI ERO	40

RCN, RON, RPN angle encoders

With integral bearing and integrated stator coupling

Because of their high static and dynamic accuracy, the **RCN, RON** and **RPN** angle encoders with integral bearings and integral stator couplings are the preferred units for high-precision applications such as rotary tables and tilting axes. The measuring standard is a circular scale with DIADUR graduation or—with the RPN—a phase grating. For the units with stator coupling, the specified accuracy includes the error caused by the coupling. For angle encoders with separate shaft coupling, the coupling error must be added to find the system accuracy.



Features of the **RCN 2000, RCN 5000** and **RCN 8000** series angle encoders:

- **Optimized scanning** with large scanning surface for absolute track (serial code structure) and incremental track (single-field scanning and optical filtering)
- **Large mounting tolerances** thanks to optimized stator coupling with improved torsional rigidity and revised shaft seal
- **Plug-in cable with quick disconnect**
- **Scanning and evaluation electronics** for a large power supply range and additional monitoring and diagnostic capabilities
- Possibility of a mechanical fault exclusion against loosening of the encoder-to-drive connection

RCN 2000 and RON 200 series

- **Compact design**
- Sturdy design
- Typically used with rotary tables, tilting tables, for positioning and speed control
- Stainless steel versions (e.g. for antennas) upon request



RCN 5000 series

- **Large hollow shaft and small installation space**
- Stator mounting dimensions compatible with RCN 2000 and RON 200



RCN 8000, RON 700 and RON/RPN 800 series

- **Large hollow shaft diameters** up to $\varnothing 100$ mm
- System accuracy $\pm 2''$ and $\pm 1''$
- Typically used on rotary and angle measuring tables, indexing fixtures, measuring setups, image scanners





RCN 8000
D = 60 mm or 100 mm
RON 786/886, RPN 886
D = 60 mm

RON 905

- **Very high-accuracy angle encoder**
- System accuracy $\pm 0.4''$
- Used with high-accuracy measuring devices and for the inspection of measuring equipment



	Absolute RCN 2380 RCN 2580	RCN 2310 ¹⁾ RCN 2510 ¹⁾	RCN 2390F RCN 2590F	RCN 2390M RCN 2590M	Incremental RON 225 RON 275	RON 285 RON 287
Interface	EnDat 2.2 ²⁾ with ~ 1 V _{PP}	EnDat 2.2 ²⁾	Fanuc α i	Mitsubishi	 TTL	 1 V _{PP}
Position values/revolution	RCN 23x0: 67 108 864 (26 bits); RCN 25x0: 268 435 456 (28 bits)				–	
Signal periods/rev	16384	–			18000 ³⁾ 90000/180000 ⁴⁾	18000
System accuracy	RCN 23x0: $\pm 5''$; RCN 25x0: $\pm 2.5''$				$\pm 5''$	$\pm 5''$; $\pm 2.5''$
Mech. permissible speed	≤ 1500 rpm				≤ 3000 rpm	

	Absolute RCN 5380 RCN 5580	RCN 5310 ¹⁾ RCN 5510 ¹⁾	RCN 5390F RCN 5590F	RCN 5390M RCN 5590M
Interface	EnDat 2.2 ²⁾ with ~ 1 V _{PP}	EnDat 2.2 ²⁾	Fanuc α i	Mitsubishi
Position values/revolution	RCN 53x0: 67 108 864 (26 bits); RCN 55x0: 268 435 456 (28 bits)			
Signal periods/rev	16384	–		
System accuracy	RCN 53x0: $\pm 5''$; RCN 55x0: $\pm 2.5''$			
Mech. permissible speed	≤ 1500 rpm			

	Absolute RCN 8380 RCN 8580	RCN 8310 ¹⁾ RCN 8510 ¹⁾	RCN 8390F RCN 8590F	RCN 8390M RCN 8590M	Incremental RON 786	RON 886	RPN 886
Interface	EnDat 2.2 ²⁾ with ~ 1 V _{PP}	EnDat 2.2 ²⁾	Fanuc α i	Mitsubishi	~ 1 V _{PP}		
Position values/revolution	536870912 (29 bits)				–		
Signal periods/rev	32 768	–	–		18000, 36000	36000	180000
System accuracy	RCN 83x0: $\pm 2''$; RCN 85x0: $\pm 1''$				$\pm 2''$	$\pm 1''$	
Mech. permissible speed	≤ 500 rpm				≤ 1000 rpm		

	Incremental RON 905
Interface	~ 11 μ A _{PP}
Signal periods/rev	36000
System accuracy	$\pm 0.4''$
Mech. permissible speed	≤ 100 rpm

¹⁾ Also available with **Functional Safety**

²⁾ DRIVE-CLiQ via EIB; PROFIBUS-DP via Gateway

³⁾ Integrated 2-fold interpolation

⁴⁾ 5/10-fold integrated interpolation

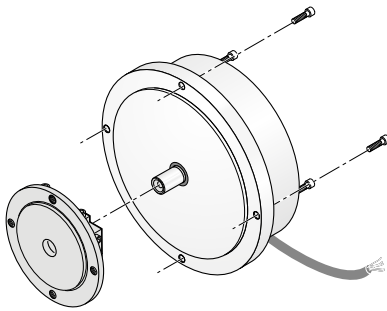
DRIVE-CLiQ is a registered trademark of SIEMENS AG.

ROC, ROD sealed angle encoders

With integral bearing, for separate shaft coupling

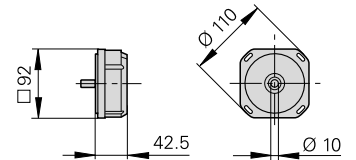
ROC and **ROD** angle encoders with solid shaft for separate shaft coupling are particularly suited to applications where higher shaft speeds and larger mounting tolerances are required. The precision shaft couplings allow axial motion up to ± 1 mm.

ROC and ROD angle encoders feature a DIADUR circular scale as measuring standard. For angle encoders with separate shaft coupling, the angular measuring error caused by the shaft coupling must be added to determine the system accuracy.



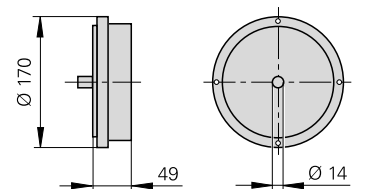
ROC 2000 and ROD 200 series

- **Compact design**
- Sturdy design
- Typically used with rotary tables, tilting tables, for positioning and synchronization monitoring

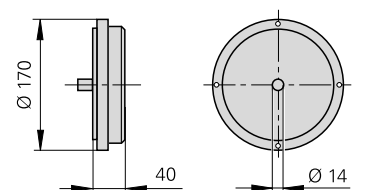


ROC 7000 and ROD 780, ROD 880 series



- **High accuracy**
ROC 7000, ROD 780: $\pm 2''$
ROD 880: $\pm 1''$
- Ideal for angle measurement on high-precision rotary tables, dividing apparatuses or measuring machines



ROD 780, ROD 880



ROC 7000

	Absolute				Incremental		
	ROC 2310	ROC 2380	ROC 2390F	ROC 2390M	ROD 220	ROD 270	ROD 280
Interface	EnDat 2.2 ⁴⁾	EnDat 2.2 ⁴⁾ ~ 1 V _{PP}	Fanuc α i	Mitsubishi	 TTL	 TTL	~ 1 V _{PP}
Signal periods/rev	16384				18000 ²⁾	180000 ³⁾	18000
System accuracy¹⁾	±5"						
Mech. permissible speed	≤ 3000 rpm				≤ 10000 rpm		

¹⁾ Without shaft coupling

²⁾ Integrated 2-fold interpolation

³⁾ 10-fold integrated interpolation

⁴⁾ DRIVE-CLiQ via EIB; PROFIBUS via Gateway

	Absolute				Incremental	
	ROC 7310	ROC 7380	ROC 7390F	ROC 7390M	ROD 780	ROD 880
Interface	EnDat 2.2 ²⁾	EnDat 2.2 ²⁾ ~ 1 V _{PP}	Fanuc α i	Mitsubishi	~ 1 V _{PP}	
Signal periods/rev	16384				18000, 36000	36000
System accuracy¹⁾	±2"				±2"	±1"
Mech. permissible speed	≤ 3000 rpm				≤ 1000 rpm	

¹⁾ Without shaft coupling

²⁾ DRIVE-CLiQ via EIB; PROFIBUS via Gateway

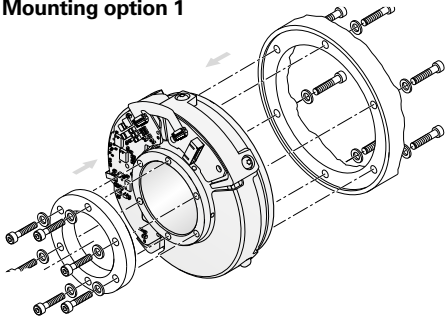
MRP, SRP angle encoders

Assemblies for high-precision rotary axes

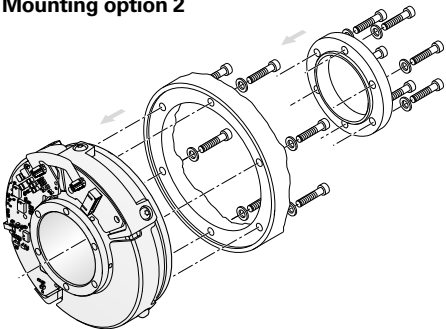
MRP angle encoder module—a combination of angle encoder and bearing

Angle encoder modules from HEIDENHAIN are combinations of angle encoders and high-precision bearings that are optimally adjusted to each other. They are characterized by their high degree of measuring and bearing accuracy, their very high resolution, and the highest degree of repeatability. The low starting torque permits smooth motions. Due to their design as completely specified and tested composite components, handling and installation is very simple.

Mounting option 1



Mounting option 2



SRP angle encoder module—a combination of angle encoder, bearing and motor

SRP angle encoder modules are additionally equipped with an integrated torque motor. They combine a motor, precision bearing and encoder with very high accuracy in one compact system. The torque motor with its very low detent torque enables extraordinarily smooth motion control. Neither disruptive detent torques nor radial forces impair the high guideway accuracy of the bearing.

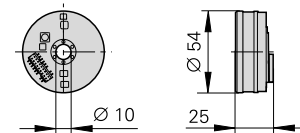
MRP 2000 series

Angle encoder modules with integrated encoder and bearing

- Very small dimensions
- High measuring and bearing accuracy
- Hollow shaft \varnothing 10 mm



MRP 2010



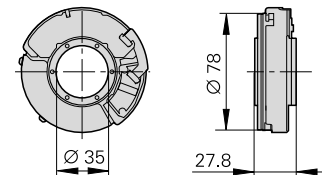
MRP 5000 series

Angle encoder modules with integrated encoder and bearing

- Compact dimensions
- High measuring and bearing accuracy
- Hollow shaft \varnothing 35 mm



MRP 5010



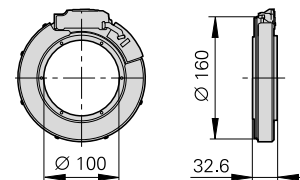
MRP 8000 series

Angle encoder modules with integrated encoder and bearing

- Compact dimensions
- High measuring and bearing accuracy
- Hollow shaft \varnothing 100 mm



MRP 8010



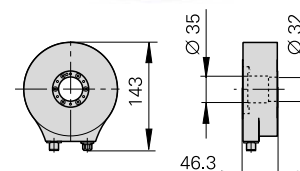
SRP 5000 series

Angle encoder modules with integrated encoder, bearing and torque motor

- Compact dimensions
- Torque motor with low detent torque
- Peak torque: 2.70 Nm
- Rated torque: 0.385 Nm



SRP 5000



	Incremental MRP 2080	Absolute MRP 2010
Interface	$\sim 1 V_{PP}$	EnDat 2.2
Signal periods/rev	2048	
System accuracy	$\pm 7''$	
Max. permiss. axial load	50 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	Measured at distance $h = 52$ mm from the ball race: $\leq 0.60 \mu\text{m}$	
Wobble of the axis	2.5''	

	Incremental MRP 5080	Absolute MRP 5010
Interface	$\sim 1 V_{PP}$	EnDat 2.2
Signal periods/rev	30000	16384
System accuracy	$\pm 2.5''$ or $\pm 5''$	
Max. permiss. axial load	200 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	Measured at distance $h = 55$ mm: $\leq 0.20 \mu\text{m}$ (without load)	
Wobble of the axis	0.7''	

	Incremental MRP 8080	Absolute MRP 8010
Interface	$\sim 1 V_{PP}$	EnDat 2.2
Signal periods/rev	63000	32768
System accuracy	$\pm 1''$ or $\pm 2''$	
Max. permiss. axial load	300 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	Measured at distance $h = 124$ mm: $\leq 0.15 \mu\text{m}$	
Wobble of the axis	0.5''	

	Incremental SRP 5080	Absolute SRP 5010
Interface	$\sim 1 V_{PP}$	EnDat 2.2
Signal periods/rev	30000	16384
System accuracy	$\pm 2.5''$ or $\pm 5''$	
Max. permiss. axial load	200 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	Measured at distance $h = 55$ mm: $\leq 0.20 \mu\text{m}$ (without load)	
Wobble of the axis	0.7''	

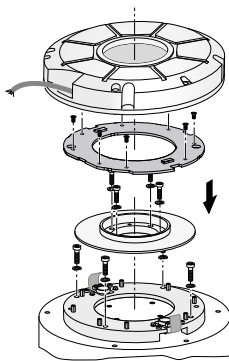
ERP modular angle encoders

Without integral bearing, with optical scanning

The HEIDENHAIN **ERP** angle encoders without integral bearing are intended for integration in machine elements or components. They operate without friction and permit high accuracy.

This makes them particularly attractive for high-precision angle measuring tables and precision devices in angular metrology. The **ERP 4080** and **ERP 8080** angle encoders are designed for applications in the clean room.

A circular scale with phase grating serves as the basis for the high accuracy of the ERP encoders. The attainable system accuracy depends on the eccentricity of the graduation to the drive shaft bearing, as well as the radial runout and wobble of the bearing.



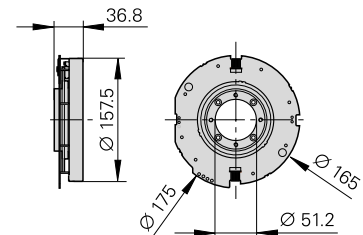
Mounting the ERP 880

ERP 880

- **Very high accuracy**
- Very fine grating period
- Low error within one signal period thanks to the interferential scanning principle

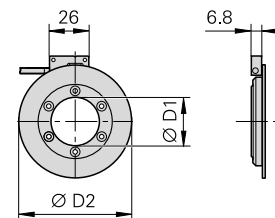


ERP 880 with housing



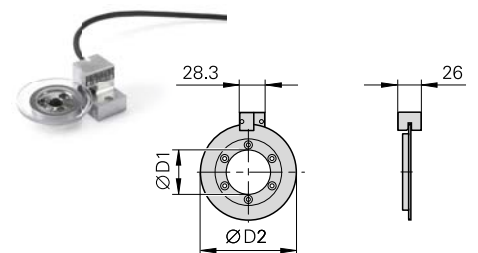
ERP 1000 series

- **Very high resolution and accuracy**
- Small mass, low mass moment of inertia
- Very flat design
- Circular scale available as full circle or segment



ERP 4080 and ERP 8080

- **Very high resolution**
- High accuracy
- Compact design
- Low error within one signal period thanks to the interferential scanning principle



	Incremental ERP 880
Interface	$\sim 1 V_{PP}$
Signal periods/rev	180000
Accuracy of graduation	$\pm 0.9''$
Mech. permissible speed	≤ 1000 rpm

	Incremental ERP 1070 ERP 1080			
Interface	<i>ERP 1070:</i> \square \square TTL; <i>ERP 1080:</i> $\sim 1 V_{PP}$			
Signal periods/rev	23000	30000	50000	63000
Accuracy of graduation	$\pm 3.5''$	$\pm 2.5''$	$\pm 1.5''$	$\pm 1.1''$
Inside diameter D1	13 mm	32 mm	62 mm	104 mm
Outside diameter D2	57 mm	75 mm	109 mm	151 mm
Mechanically permissible speed	≤ 2600 rpm	≤ 2000 rpm	≤ 1200 rpm	≤ 950 rpm

	Incremental ERP 4080	ERP 8080
Interface	$\sim 1 V_{PP}$	
Signal periods/rev	131072	360000
Accuracy of graduation	$\pm 2''$	$\pm 1''$
Diameter D1	8 mm	50 mm
Diameter D2	44 mm	108 mm
Mech. permissible speed	≤ 300 rpm	≤ 100 rpm

ERO, ECA, ERA modular angle encoders

Without integral bearing, with optical scanning

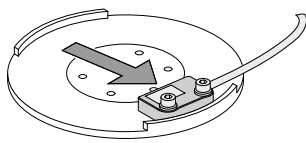
The **ERO, ECA** and **ERA** HEIDENHAIN angle encoders with solid graduation carrier function without integral bearings. They are intended for integration in machine elements or components.

The attainable system accuracy depends on the eccentricity of the graduation to the drive shaft bearing, as well as the radial runout and wobble of the bearing.

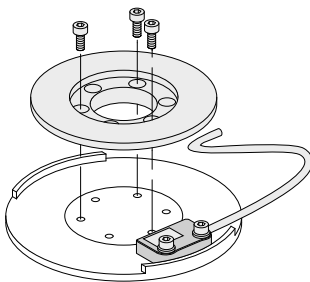
The **ERO** angle encoders use a circular glass scale with hub as the graduation carrier. The EROs are primarily characterized by their low weight and compact dimensions. Applications are to be found in metrology, in compact rotary tables and in precise, highly dynamic applications.

The angle encoders **ECA** and **ERA** feature a sturdy steel scale drum and are suited for high shaft speeds up to 10000 rpm. They are typically found on fast running spindles, on rotary tables and tilting axes.

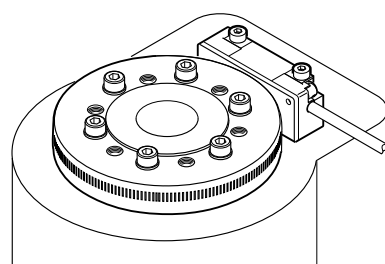
The angle encoders ECA 4000 V are suitable for vacuum applications in high vacuum (up to 10^{-7} bar).



ERO 6000



ERA 4000



ERO 6000 series

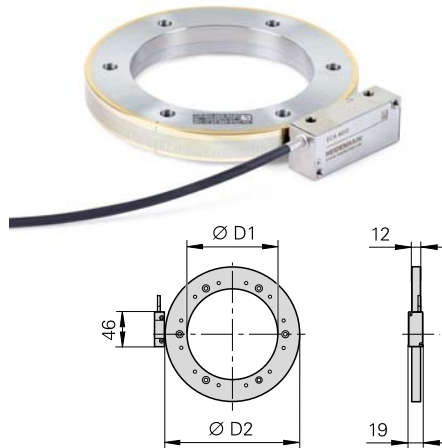
- Very flat design
- High system accuracy
- Simple installation

ERO 6100 series

- For dynamic applications with reduced accuracy requirements
- Application examples include printing machines and handling axes.
- Large inside diameter

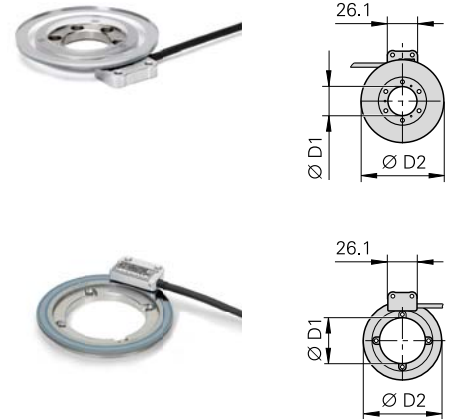
ECA 4400 series

- High accuracy
- Steel scale drum with three-point centering
- Sturdy design with steel scale drum and METALLUR graduation



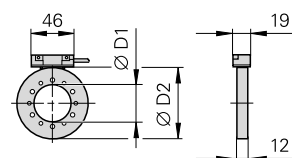
ERA 4000 series

- **High shaft speeds** up to 10000 rpm
- Sturdy design with steel scale drum and METALLUR graduation
- Axial motion of measured shaft permissible up to ± 0.5 mm
- The ERA 4480C is available for larger diameters or versions with protective cover
- Various **drum versions**
ERA 4x80C: With centering collar
ERA 4282C: 3-point centering



Interface
Signal periods/rev
Accuracy of graduation
Inside diameter D1
Outside diameter D2
Mech. permissible speed

Interface	
Signal periods/rev	ERA 4280C ERA 4480C ERA 4880C
Accuracy of graduation	
Inside diameter D1	
Outside diameter D2	
Mech. permissible speed	



	Incremental ERO 6070 ERO 6080		ERO 6180
Interface	ERO 6070: □□TTL; ERO 6080: ~ 1 V _{PP}		~ 1 V _{PP}
Signal periods/rev	9000	18000	4096
Accuracy of graduation	±3"	±2"	±10"
Inside diameter D1	25 mm	95 mm	41 mm
Outside diameter D2	71 mm	150 mm	70 mm
Mech. permissible speed	≤ 1600 rpm	≤ 800 rpm	≤ 3500 rpm

Absolute ECA 4412¹⁾ ECA 4492 F ECA 4492 M ECA 4492 P									
ECA 4412: EnDat 2.2; ECA 4492 F: Fanuc α i; ECA 4492 M: Mitsubishi; ECA 4492 P: Panasonic									
8195	10010	11 616	14003	16379	19998	25993	37994	44000	
±3"	±2.5"	±2.8"	±2"	±1.9"	±1.8"	±1.7"	±1.5"	±1.5"	
70 mm	80 mm	120 mm	120 mm	150/185 mm	180/210 mm	270 mm	425 mm	512 mm	
104.63 mm	127.64 mm	148.2 mm	178.55 mm	208.89 mm	254.93 mm	331.31 mm	484.07 mm	560.46 mm	
≤ 8500 rpm	≤ 6250 rpm	≤ 5250 rpm	≤ 4500 rpm	≤ 4250 rpm	≤ 3250 rpm	≤ 2500 rpm	≤ 1800 rpm	≤ 1500 rpm	

¹⁾ Also available with **Functional Safety**

Incremental ERA 4280 C¹⁾ Signal period 20 μm ERA 4480 C Signal period 40 μm ERA 4880 C Signal period 80 μm									
~ 1 V _{PP}									
12000 6000 3000	16384 8192 4096	20000 10000 5000	28000 14000 7000	32768 16384 8192	40000 20000 10000	52000 26000 13000	– 38000 –	– 44000 –	
±5"	±3.7"	±3"	±2.5"				±2"		
40 mm	70 mm	80 mm	120 mm	150 mm	180 mm	270 mm	425 mm	512 mm	
76.75 mm	104.63 mm	127.64 mm	178.55 mm	208.89 mm	254.93 mm	331.31 mm	484.07 mm	560.46 mm	
≤ 10000 rpm	≤ 8500 rpm	≤ 6250 rpm	≤ 4500 rpm	≤ 4250 rpm	≤ 3250 rpm	≤ 2500 rpm	≤ 1800 rpm	≤ 1500 rpm	

¹⁾ For other drum versions, please refer to our brochure *Angle Encoders without Integral Bearings*

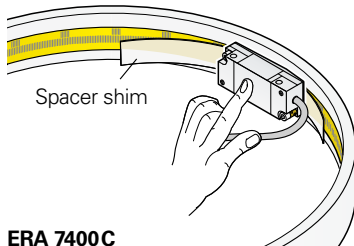
ERA modular angle encoders

Without integral bearing, with optical scanning

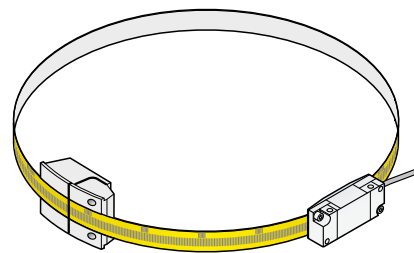
The HEIDENHAIN **ERA** angle encoders with steel scale tape as measuring standard function without integral bearings. They are intended for integration in machine elements or components. They are designed to meet the following requirements:

- Large hollow shaft diameters up to 10 m
- No additional starting torque from shaft seals

The attainable system accuracy depends on the machining accuracy of the scale-tape carrier diameter, on its radial runout and wobble.



ERA 7400C



ERA 8400C

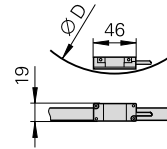
ERA 7000 and ERA 8000 series

- **For very large diameters** up to 10 m
- METALLUR steel scale tape
- High accuracy even at the junction of the scale-tape ends

ERA 7000 series

Scale tape is placed in a slot on the inside circumference of the machine element

- **ERA 7400C:** Full-circle version
- **ERA 7401C:** Segment version

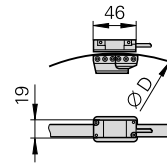


ERA 7481C

ERA 8000 series

Scale tape is fastened on the circumference of the machine element

- **ERA 8400C:** Full-circle version
- **ERA 8401C:** Segment version, scale tape secured with tensioning elements
- **ERA 8402C:** Segment version, scale tape secured without tensioning elements



ERA 8480C

	Incremental ERA 7400C		
Interface	~ 1 V _{PP} ; signal period 40 μm (on circumference)		
Signal periods/rev	36000	45000	90000
Accuracy of graduation	±3.9"	±3.2"	±1.6"
Accuracy of the scale tape	±3 μm per meter tape length		
Diameter D1	458.62 mm	573.20 mm	1146.10 mm
Mech. permissible speed	≤ 250 rpm		≤ 220 rpm

	Incremental ERA 8400C		
Interface	~ 1 V _{PP} ; signal period 40 μm (on circumference)		
Signal periods/rev	36000	45000	90000
Accuracy of graduation	±4.7"	±3.9"	±1.9"
Accuracy of the scale tape	±3 μm per meter tape length		
Diameter D1	458.04 mm	572.63 mm	1145.73 mm
Mech. permissible speed	≤ 50 rpm		≤ 45 rpm

ERM modular angle encoders

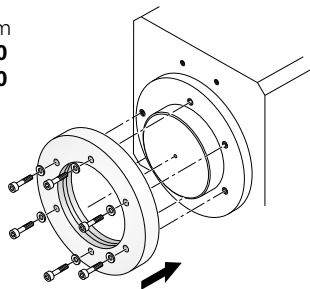
Without integral bearing, with magnetic scanning

The **ERM** modular encoders from HEIDENHAIN with magnetic scanning consist of a magnetized scale drum and a scanning unit. Their MAGNODUR measuring standard and the magnetoresistive scanning principle make them particularly tolerant to contamination.

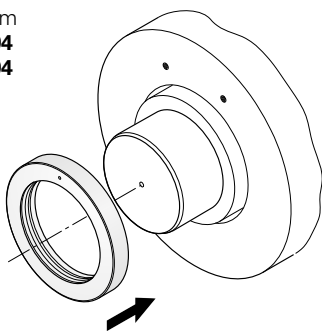
Typical fields of application include machines and equipment with **large hollow shaft diameters** in environments with large amounts of airborne particles and liquids, for example:

- Rotary and tilting axes for ERM 2280
- C axes on lathes for ERM 2410, ERM 2420 and ERM 2480
- Main spindles on milling machines for ERM 2484, ERM 2485 and ERM 2984

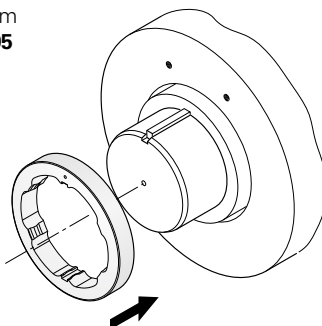
Scale drum
ERM 2200
ERM 2400



Scale drum
ERM 2404
ERM 2904

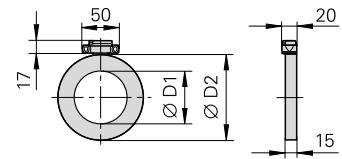


Scale drum
ERM 2405



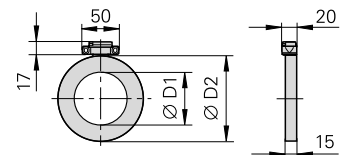
ERM 2280 series

- High graduation accuracy
- Signal period 200 μm at circumference
- Distance-coded reference marks
- Drum fastening with axial screws



ERM 2420 and ERM 2480 series

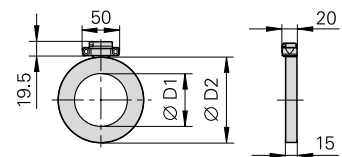
- For large shaft diameters up to 410 mm
- Drum fastening with axial screws
- Distance-coded reference marks are possible



ERM 2480

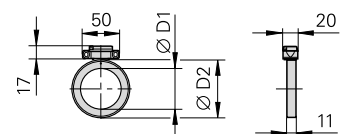
ERM 2410

- Consists of ERM 2410 scanning head and the ERM 2400C scale drum
- Incremental measuring method with distance-coded reference marks
- Integrated counting function for **absolute position-value output**
- Absolute position value after traverse of two reference marks



ERM 2484 and ERM 2485 series

- Especially compact dimensions for limited installation space
- High mechanically permissible shaft speeds and therefore particularly well suited for spindles
- **ERM 2484**: Drum fastening by axial clamping
- **ERM 2485**: Drum fastening by axial clamping and feather key as anti-rotation element



ERM 2484



ERM 2984 series

Except for its line count, the ERM 2984 modular encoder shares the same mechanical and electrical features as the ERM 2484.

Incremental ERM 2280						
Interface	~ 1 V _{PP}					
Signal period	≈ 200 μm (at circumference)					
Line count/accuracy of graduation	1800/±7"	2048/±6"	2800/±5"	4096/±3.5"	5200/±3"	7200/±2.5"
Inside diameter D1	70 mm	80 mm	130 mm	180 mm	260 mm	380 mm
Outside diameter D2	113.16 mm	128.75 mm	176.03 mm	257.50 mm	326.90 mm	452.64 mm
Speed¹⁾	≤ 14500 rpm	≤ 13000 rpm	≤ 9000 rpm	≤ 6000 rpm	≤ 4500 rpm	≤ 3000 rpm
Operating temperature	-10 °C to 60 °C					

Incremental ERM 2420 ERM 2480 ERM 2410									
Interface	<i>ERM 2420:</i> □□TTL; <i>ERM 2480:</i> ~ 1 V _{PP} ; <i>ERM 2410:</i> EnDat 2.2 ²⁾								
Signal period	≈ 400 μm (at circumference); <i>ERM 2410:</i> –								
Line count/accuracy of graduation	600/±11"	900/±8"	1024/±7"	1200/±6"	1400/±5,5"	2048/±4"	2048/±5"	2600/±4"	3600/±3,5"
Inside diameter D1	40 mm	70 mm	80 mm	120 mm	130 mm	180 mm	220 mm	295 mm	410 mm
Outside diameter D2	75.44 mm	113.16 mm	128.75 mm	150.88 mm	176.03 mm	257.50 mm	257.50 mm	326.90 mm	452.64 mm
Speed¹⁾	≤ 19000 rpm	≤ 14500 rpm	≤ 13000 rpm	≤ 10500 rpm	≤ 9000 rpm	≤ 6000 rpm	≤ 6000 rpm	≤ 4500 rpm	≤ 3000 rpm
Operating temperature	-10 °C to 100 °C								

Incremental ERM 2484 ERM 2485³⁾				ERM 2984⁴⁾					
Interface	~ 1 V _{PP}								
Signal period	≈ 400 μm (at circumference)				≈ 1 mm (at circumference)				
Line count/accuracy of graduation	512/±17"	600/±14"	900/±10"	1024/±9"	192/±68"	256/±51"	300/±44"	400/±33"	
Inside diameter D1	40 mm	55 mm	80 mm	100 mm	40 mm	55 mm	60 mm	100 mm	
Outside diameter D2	64.37 mm	75.44 mm	113.16 mm	128.75 mm	58.06 mm	77.41 mm	90.72 mm	120.96 mm	
Speed¹⁾	<i>ERM 2484:</i> ≤ 42000 rpm	≤ 36000 rpm	≤ 22000 rpm	≤ 20000 rpm	≤ 47000 rpm	≤ 35000 rpm	≤ 29000 rpm	≤ 16000 rpm	
	<i>ERM 2485:</i> ≤ 33000 rpm	≤ 27000 rpm	–	–	–	–	–	–	
Operating temperature	-10 °C to 100 °C								

¹⁾ Mech. permissible speed

²⁾ Through integrated counting function after traverse of two reference marks

³⁾ Only with outside diameters D2 64.37 mm and 75.44 mm

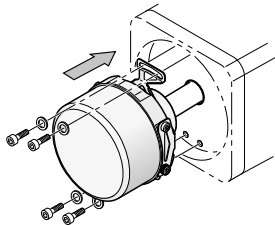
⁴⁾ Additional drum diameters upon request

ECN, EQN, ERN rotary encoders

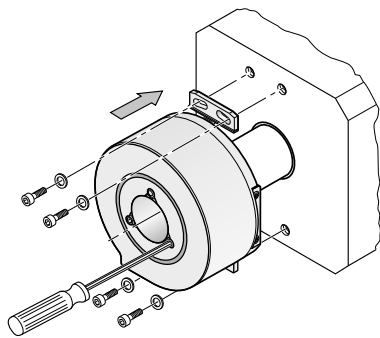
With integral bearing and mounted stator coupling
Degree of protection IP64

HEIDENHAIN **ECN, EQN** and **ERN** rotary encoders with integral bearings and stator-mounted couplings operate by photoelectric scanning. They are characterized by their simple mounting and short overall length. Possible applications range from simple measuring tasks to position and speed control on servo drives. The hollow shaft of these encoders is slid directly onto and fastened to the shaft to be measured. During angular acceleration of the shaft, the stator coupling must absorb only that torque resulting from friction in the bearing. Rotary encoders with stator coupling therefore provide excellent dynamic performance and a high natural frequency.

Some rotary encoders are suitable in a special version for potentially explosive atmospheres in accordance with Directive 2014/34/EU, (**ATEX**). They comply with Equipment Group II, meet the requirements of Category 2 and can be used for Zones 1 and 21 as well as 2 and 22.



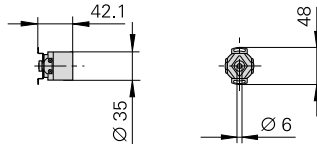
ECN/EQN/ERN 1000
ECN/EQN/ERN 400



ECN/ERN 100

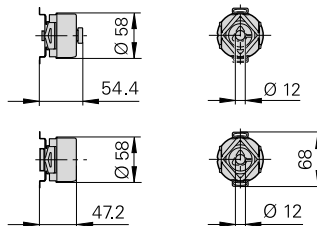
ECN, EQN, ERN 1000 series

- **Miniaturized version**
- Blind hollow shaft with 6 mm inside diameter
- Housing outside diameter: 35 mm
- Natural frequency of the encoder stator coupling: ≥ 1500 Hz
- Mechanically permissible speed: $\leq 12\,000$ rpm



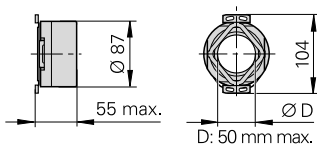
ECN, EQN, ERN 400 series

- **Compact design**
- Blind hollow shaft or hollow through shaft with 8 mm or 12 mm inside diameter
- Housing outside diameter: 58 mm
- Protection: IP67 at housing (IP66 with hollow through shaft) IP64 at shaft inlet (IP66 upon request)
- Natural frequency of the encoder stator coupling: ≥ 1400 Hz (cable version)
- Mechanically permissible speed: $\leq 12\,000$ rpm
- Fault exclusion of the mechanical coupling for functional safety



ECN/ERN 100 series

- **For large shaft diameters**
- Hollow through shaft with inside diameters D : 20, 25, 38, 50 mm
- Housing outside diameter: 87 mm
- Natural frequency of the encoder stator coupling: ≥ 1000 Hz
- Mechanically permissible speed: $D \leq 30$ mm: ≤ 6000 rpm $D > 30$ mm: ≤ 4000 rpm



Interface

Position values/revolution

Revolutions

Line count

Voltage supply

Interface

Position values/revolution

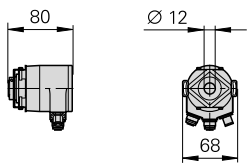
Revolutions

Line count

DC voltage supply

Absolute ECN 1013	EQN 1025	ECN 1023	EQN 1035	Incremental ERN 1020	ERN 1030	ERN 1070	ERN 1080
EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$; SSI		EnDat 2.2 ¹⁾		\square TTL	\square HTL	\square TTL ²⁾	$\sim 1 V_{PP}$
8192 (13 bits)		8388608 (23 bits)		–			
–	4096 (12 bits)	–	4096 (12 bits)	–			
512		–		100 to 3600		1000/2500/3600	100 to 3600
DC 3.6 V to 14 V; DC 4.75 V to 30 V				DC 5 V	DC 10 V to 30 V	DC 5 V	

Absolute ECN 413³⁾		EQN 425³⁾		ECN 425⁴⁾ ECN 425 F ECN 425 M ECN 424 S⁴⁾	EQN 437⁴⁾ EQN 437 F EQN 435 M EQN 436 S⁴⁾	Incremental ERN 420³⁾ ERN 460	ERN 430³⁾	ERN 480³⁾
EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$; SSI	PROFIBUS-DP; PROFINET	EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$; SSI	PROFIBUS-DP; PROFINET	EnDat 2.2 ¹⁾ ; Fanuc α ; Mitsubishi; Siemens DRIVE-CLiQ		\square TTL; \square TTL	\square HTL	$\sim 1 V_{PP}$
8192 (13 bits)		8192 (13 bits)		ECN 425, EQN 437: 33554432 (25 bits) ECN 424, EQN 436: 16777216 (24 bits)		–		
–	–	4096 (12 bits)		–	4096 (12 bits)	–		
512 or 2048	–	512 or 2048	–	–		250 to 5000		1000 to 5000
3.6 V to 14 V; 4.75 V to 30 V	9 V to 36 V; 10 V to 30 V	3.6 V to 14 V; 4.75 V to 30 V	9 V to 36 V; 10 V to 30 V	3.6 V to 14 V; 10 V to 28.8 V		5 V; 10 V to 30 V	10 V to 30 V	5 V



PROFIBUS-DP/PROFINET



	Absolute ECN 113	ECN 125	Incremental ERN 120	ERN 130	ERN 180
Interface	EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$	EnDat 2.2 ¹⁾	\square TTL	\square HTL	$\sim 1 V_{PP}$
Position values/revolution	8192 (13 bits)	33554432 (25 bits)	–		
Line count	2048	–	1000 to 5000		
Voltage supply	DC 3.6 V to 14 V	DC 3.6 V to 14 V	DC 5 V	DC 10 V to 30 V	DC 5 V

¹⁾ Includes EnDat 2.1 command set; PROFIBUS-DP via gateway

²⁾ 5/10-fold integrated interpolation

³⁾ ATEX version available (ECN 413/EQN 425 with 5 V power supply and EnDat 2.2)

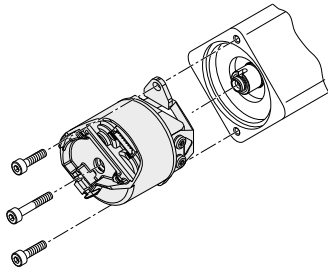
⁴⁾ Also available with **Functional Safety**

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

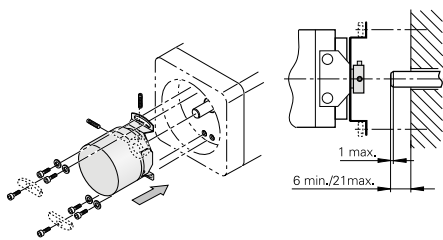
ECN, EQN, ERN rotary encoders

With integral bearing and mounted stator coupling
IP40 protection

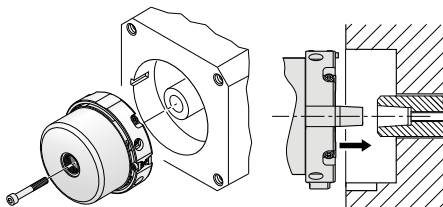
The **ECN, EQN** and **ERN** photoelectric rotary encoders from HEIDENHAIN with IP40 degree of protection are specially designed for integration in motors. Bearings and mounted stator coupling are integrated. Absolute rotary encoders and versions with commutation tracks are available for synchronous motors. The taper shaft or the blind hollow shaft is fastened directly to the shaft to be measured. This ensures an extremely stiff coupling that permits exceptionally high dynamic performance of the drive. The stator coupling is designed to be fastened on a plane surface or a location hole and permits fast, simple mounting.



ECN/EQN 1100



ERN 1123



ECN/EQN/ERN 1300

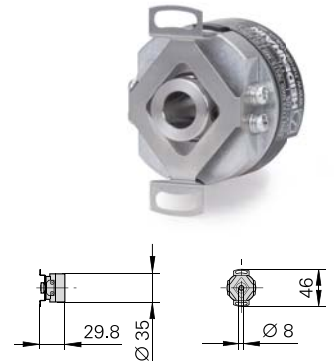
ECN/EQN 1100 series

- **Miniaturized version**
- Blind hollow shaft \varnothing 6 mm with positive fit element
- Housing outside diameter 35 mm
- Natural frequency of the encoder stator coupling: \geq 1000 Hz
- Mech. permissible speed 12000 rpm
- Fault exclusion of the mechanical coupling for functional safety



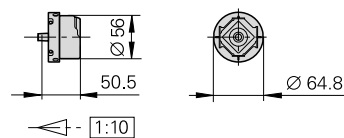
ERN 1123

- Blind hollow shaft \varnothing 8 mm
- Housing outside diameter 35 mm
- Stator coupling with bolt-hole circle \varnothing 40 mm
- Natural frequency of the stator coupling: \geq 1000 Hz
- Mech. permissible speed 6000 rpm
- IP00 protection



ECN, EQN, ERN 1300 series

- **Compact dimensions**
- 1:10 taper shaft with 9.25 mm functional diameter for extremely stiff connection
- Housing outside diameter 56 mm. The stator coupling is suited for location holes with 65 mm inside diameter
- Natural frequency of the encoder stator coupling: \geq 1800 Hz
- Mech. permissible speed
ERN/ECN: 15000 rpm
EQN: 12000 rpm
- IP40 protection when mounted
- Fault exclusion of the mechanical coupling for functional safety



Interface
Position values/revolution
Revolutions
Line count
Commutation signals
Voltage supply
Operating temperature

	Absolute				Incremental
	ECN 1113	EQN 1125	ECN 1123²⁾	EQN 1135²⁾	ERN 1123
Interface	EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$		EnDat 2.2 ¹⁾		\square TTL
Position values/revolution	8192 (13 bits)		8388608 (23 bits)		–
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–
Line count	512		–		500 to 8192
Commutation signals	–				Block commutation ³⁾
Voltage supply	DC 3.6 V to 14 V				DC 5 V
Operating temperature	$\leq 115\text{ }^{\circ}\text{C}$				$\leq 90\text{ }^{\circ}\text{C}$

¹⁾ Includes EnDat 2.1 command set; PROFIBUS-DP via gateway

²⁾ Also available with **Functional Safety**

³⁾ Three block commutation tracks with 90°, 120° or 180° mech. phase shift

Absolute						Incremental				
ECN 1313	EQN 1325	ECN 1325⁴⁾	EQN 1337⁴⁾	ECN 1324S⁴⁾	EQN 1336S⁴⁾	ERN 1321	ERN 1326	ERN 1381	ERN 1387	
EnDat 2.2 ¹⁾ with $\sim 1 V_{PP}$		EnDat 2.2 ¹⁾		Siemens DRIVE-CLiQ		\square TTL		$\sim 1 V_{PP}$		
8192 (13 bits)		33554432 (25 bits)		16777216 (24 bits)		–				
–	4096 (12 bits)	–	4096 (12 bits)	–	4096 (12 bits)	–				
512 or 2048		–				1024	2048	4096	512 2048 4096	2048
–						–	Block commutation ²⁾	–	Z1 track ³⁾	
DC 3.6 V to 14 V				DC 10 V to 28.8 V		DC 5 V				
$\leq 115\text{ }^{\circ}\text{C}$				$\leq 100\text{ }^{\circ}\text{C}$		$\leq 120\text{ }^{\circ}\text{C}$; 4096 lines : $\leq 100\text{ }^{\circ}\text{C}$				

¹⁾ Includes EnDat 2.1 command set; PROFIBUS-DP via gateway

²⁾ Three block commutation tracks with 90° or 120° mech. phase shift

³⁾ One sine and one cosine signal with one period per revolution of the encoder shaft

⁴⁾ Also available with **Functional Safety**

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

ROC, ROQ, ROD, RIC, RIQ rotary encoders

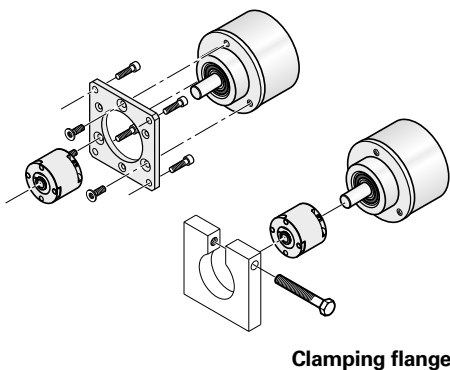
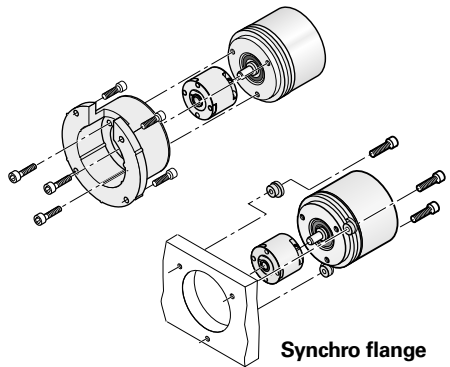
With integral bearing, for separate shaft coupling

HR handwheel

The photoelectric encoders **ROC, ROQ** and **ROD**, as well as the inductive **RIC** and **RIQ** from HEIDENHAIN have integrated bearings and are sealed. The degree of protection is IP64 to IP66, depending on the version. They are robust and compact.

These encoders are coupled by the rotor to the measured shaft through a separate coupling that compensates axial motion and misalignment between the encoder shaft and measured shaft.

Some rotary encoders are suitable in a special version for potentially explosive atmospheres in accordance with Directive 2014/34/EU, **(ATEX)**. They comply with Equipment Group II, meet the requirements of Category 2 and can be used for Zones 1 and 21 as well as 2 and 22.

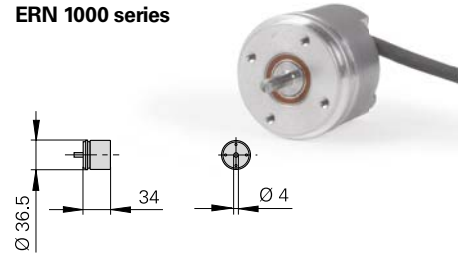


The **HR** electronic handwheel features an integral bearing and mechanical detent. It was conceived for use in portable or stationary housings, e.g. for positioning units or automation applications.

ROC, ROQ, ROD 1000 series

- **Miniaturized dimensions** for installation in small devices or in limited installation space
- Mounting by synchro flange
- Shaft diameter 4 mm

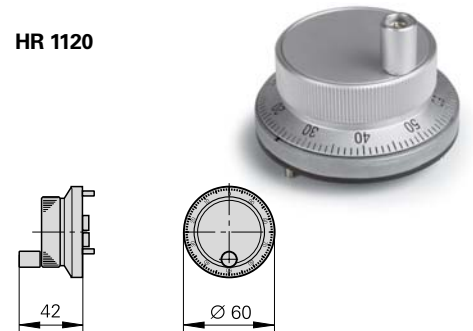
ERN 1000 series



HR handwheel

- Compact dimensions
- Sturdy design
- Mechanical detent

HR 1120



ROC/ROQ/ROD 400 series

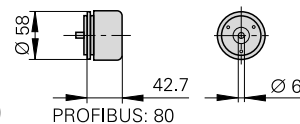
- **Industrial standard** for dimensions and output signals
- IP67 protection at housing, IP64 at shaft inlet (IP66 upon request)
- Mounting via synchro flange or clamping flange
- Shaft diameter 6 mm with synchro flange 10 mm with clamping flange
- Preferred types with fast delivery (see *Rotary Encoders* brochure or ask HEIDENHAIN)
- Fault exclusion of the mechanical coupling for functional safety

Series 400 with synchro flange



RIC/RIQ 400 series

- Inductive scanning principle
- For reduced accuracy requirements up to $\pm 480''$
- Mechanical design same as ROC/ROQ 400



Synchro flange	Absolute RIC 418	RIQ 430	ROC 413 ¹⁾	ROQ 425 ¹⁾	ROC 413
Clamping flange					
Interface	EnDat 2.1 with $\sim 1 V_{PP}$		EnDat 2.2 ⁴⁾ with $\sim 1 V_{PP}$; SSI		PROFIBUS-DP; PROFINET
Position values/revolution	262 144 (18 bits)		8192 (13 bits)		
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–
Line count/signal periods	16		512		
Voltage supply	DC 5 V		DC 3.6 V to 14 V; DC 4.75 V to 30 V		DC 9 V to 36 V DC 10 V to 30 V

¹⁾ ATEX version available (*ROC/ROQ* with 5 V voltage supply and EnDat 2.2)

²⁾ Also available with **Functional Safety**

³⁾ Signal periods over 5000 are generated through signal doubling in the encoder

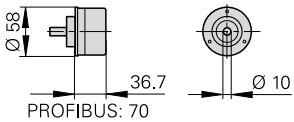
	Absolute				Incremental				
	ROC 1013	ROQ 1025	ROC 1023	ROQ 1035	ROD 1020	ROD 1030	ROD 1070	ROD 1080	HR 1120
Interface	EnDat 2.2 ¹⁾ with ~ 1 V _{PP} ; SSI		EnDat 2.2 ¹⁾						
Position values/ revolution	8192 (13 bits)		8388608 (23 bits)		-				
Revolutions	-	4096 (12 bits)	-	4096 (12 bits)	-				
Line count/ signal periods	512		-		100 to 3600		1000/2500/ 3600	100 to 3600	100
Voltage supply	DC 3.6 V to 14 V; DC 4.75 V to 30 V		DC 3.6 V to 14 V		DC 5 V	DC 10 V to 30 V	DC 5 V		

¹⁾ Includes EnDat 2.1 command set; PROFIBUS-DP via gateway

²⁾ 5/10-fold integrated interpolation

**Series 400
with clamping flange**

PROFIBUS-DP/PROFINET



ROQ 425	ROC 424S²⁾	ROQ 436S²⁾	ROC 425²⁾ ROC 425F ROC 425M	ROQ 437²⁾ ROQ 437F ROQ 435M	Incremental ROD 426¹⁾	ROD 466¹⁾	ROD 436¹⁾	ROD 486¹⁾
					ROD 420¹⁾	-	ROD 430¹⁾	ROD 480¹⁾
Siemens DRIVE-CLiQ			EnDat 2.2 ⁴⁾ ; Fanuc α i; Mitsubishi					
16777216 (24 bits)			33554432 (25 bits)		-			
4096 (12 bits)	-	4096 (12 bits)	-	4096 (12 bits)	-			
					50 to 5000 ROD 426/466: Up to 10000³⁾			1000 to 5000
DC 10 V to 28.8 V			DC 3.6 V to 14 V		DC 5 V	DC 10 V to 30 V		DC 5 V

⁴⁾ Includes EnDat 2.1 command set; PROFIBUS-DP via gateway

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

ECI, EQI, EBI, ERO rotary encoders

Without integral bearing

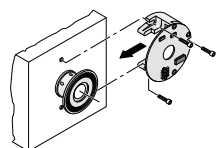
The photoelectric **ERO** modular rotary encoders from HEIDENHAIN consist of a graduated disk with hub and a scanning unit. They are particularly well suited for **limited installation space** or for applications for which there must be **no friction**

Compared with optical rotary encoders without integral bearings, inductive rotary encoders are particularly robust and have large mounting tolerances.

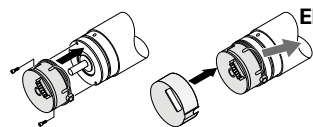
The inductive rotary encoders **ECI/EQI 1100** and **ECI/EQI 1300** are mechanically compatible with the corresponding ExN photoelectric encoders: the shaft is fastened with a central screw. The stator of the encoder fastened in a location hole by several screws.

The **ECI/EBI 100** and **ECI/EBI 4000** inductive rotary encoders have a particularly small outside diameter with a large shaft opening. The encoders were conceived for simple axial mounting.

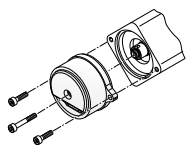
The correct installation of the rotary encoders without integral bearing can be inspected with the HEIDENHAIN PWM 20 or PWT 100 measuring and testing devices.



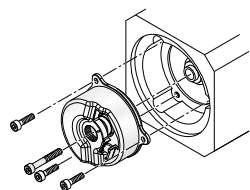
ERO 1200



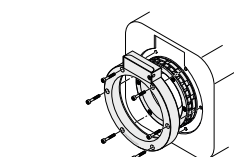
ERO 1400



ECI/EQI 1100



ECI/EQI 1300



ECI/EBI 4000

ERO 1200 series

- **Compact design**
- For shaft diameters up to 12 mm



ERO 1400 series

- **Miniaturized modular rotary encoder** for measured shafts up to \varnothing 8 mm
- Special integral mounting aid
- With cover cap



ECI/EQI/EBI 1100 series

- **Miniature size**
- Simple mounting without adjustment
- Blind hollow shaft \varnothing 6 mm
- **EBI 1135**: Multiturn function via battery-buffered revolution counter
- Version available featuring mounting-compatibility with ECN/EQN 1100
- Fault exclusion of the mechanical coupling for functional safety



ECI/EQI 1300 series

- **Simple mounting** without adjustment
- Blind hollow shaft
- Version featuring mounting-compatibility with ECN/EQN 1300 with tapered shaft or blind hollow shaft available upon request
- Fault exclusion of the mechanical coupling for functional safety



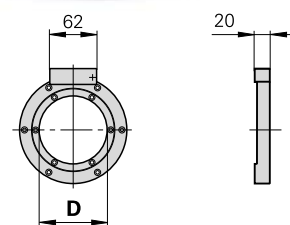
ECI/EBI 100 series

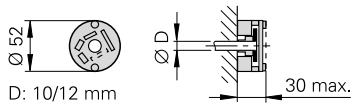
- Especially **flat design**
- Hollow through shaft \varnothing 30, 38, 50 mm
- **EBI 135**: Multiturn function via battery-buffered revolution counter



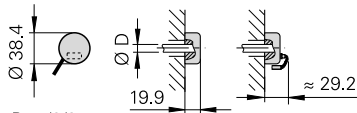
ECI/EBI 4000 series

- Flat design
- Hollow through shaft \varnothing 90 mm
- **EBI 4010**: Multiturn function via battery-buffered revolution counter

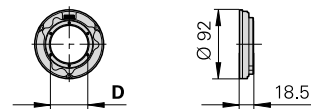
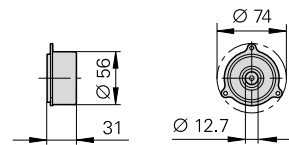
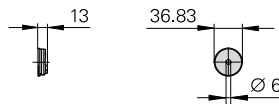
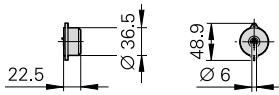




D: 10/12 mm



D: 4/6/8 mm



	Incremental ERO 1225	ERO 1285
Interface	□TTL	~ 1 V _{PP}
Line count	1024 2048	
Mech. permissible speed	≤ 25000 rpm	
Shaft diameter D	Ø 10, 12 mm	

	Incremental ERO 1420	ERO 1470	ERO 1480
Interface	□TTL	□TTL ¹⁾	~ 1 V _{PP}
Line count	512 1000 1024	1000 1500	512 1000 1024
Mech. permissible speed	≤ 30000 rpm		
Shaft diameter D	Ø 4, 6, 8 mm		

¹⁾ Integrated 5/10/20/24-fold interpolation

	Absolute ECI 1119 ¹⁾ ECI 1319 ¹⁾	EQI 1131 ¹⁾ EQI 1331 ¹⁾	ECI 1118 EBI 1135
Interface	EnDat 2.2		EnDat 2.2
Position values/revolution	524288 (19 bits)		262144 (18 bits)
Revolutions	–	4096 (12 bits)	<i>ECI 1118:</i> – <i>EBI 1135:</i> 65536 (16 bits) ²⁾
Mech. permissible speed	≤ 15000 rpm	≤ 12000 rpm	<i>ECI 1118:</i> ≤ 15000 rpm <i>EBI 1135:</i> ≤ 12000 rpm
Shaft	Blind hollow shaft		

¹⁾ Also available with **Functional Safety**

²⁾ Multiturn function via battery-buffered revolution counter

	Absolute ECI 119	EBI 135	ECI 4010 ¹⁾	EBI 4010 ¹⁾	ECI 4090 S ¹⁾
Interface	EnDat 2.1 with ~ 1 V _{PP}	EnDat 2.2			Siemens DRIVE-CLiQ
Position values/revolution	524288 (19 bits)		1048576 (20 bits)		
Revolutions	–	65536 (16 bits) ²⁾	–	65536 (16 bits) ²⁾	–
Line count	32	–			
Mech. permissible speed	≤ 6000 rpm				
Shaft	Hollow through shaft Ø 30, 38, 50 mm			Hollow through shaft Ø 90 mm	

¹⁾ Also available with **Functional Safety**

²⁾ Multiturn function via battery-buffered revolution counter

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

Controls for milling machines

With its TNC controls, HEIDENHAIN offers a complete product line for all common types of machines in the area of milling: from simple three-axis CNC milling machines to highly complex machines with up to 20 axes—a TNC control is always the right choice. Thanks to their flexible operational design and practical functions, the TNCs are particularly suitable for the following applications:

- Simple milling, drilling and boring operations
- Machining in a tilted working plane
- Complex 5-axis operations
- HSC operations
- Milling-turning operations

TNC controls are versatile and offer the right programming function for any task. Thanks to its **HEIDENHAIN Klartext** conversational programming, the user need not learn G codes or special programming languages. The control “speaks” with him with easily understandable questions and prompts. Ease of use is also promoted by clear, **unambiguous key symbols** and names. Each key has only one function. Even if you are used to **G-code programming**, however, the TNC is still the right control—you can enter G-code address letters simply over soft keys.

TNC part programs have long lives because they are **upwardly compatible**. Programs from older TNCs can usually also run on the new models. When moving up to a more advanced TNC, the user merely builds on what he already knows.

Controls for lathes

Lathe controls from HEIDENHAIN have been proving themselves for years both on standard and complex lathes as well as on turning centers.

Many workshop-compatible functions support you optimally at:

- Conventional lathe operations
- Operations with driven tools
- Machining with the C and Y axes
- Full-surface machining with dual spindles
- Machining with the B axis

HEIDENHAIN lathe controls are extremely flexible: Whether you need only single cycles, short program sequences or complete NC programs—you only need to select the appropriate operating mode.

Program creation with **smart.Turn** is particularly easy and convenient. The straightforward fillable-form input provides graphical support, meaningful dialogs, and a logical check of entries.

Quickly and easily to the finished part

The operational design of the milling and rotary controls is tailored to the needs of the user and therefore offers you the greatest possible flexibility in program creation. When **programming at the machine**, all required inputs are guided by practice-oriented prompts and questions while highly expressive help images support you. Standard operations and even complex applications are on call as a large variety of real-world machining **cycles**, coordinate transformations or for setup.

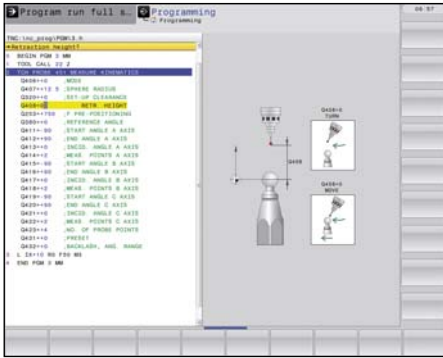
The HEIDENHAIN controls can be **programmed remotely** just as well—for example on a CAD/CAM system or at a HEIDENHAIN programming station.

You can also open **DXF files** that were created on a separate CAD system directly on the control and extract contours and machining positions from them. This not only saves time otherwise spent on programming and testing, but you can also be sure that the adopted data is exactly according to the design engineer’s specifications.

User-friendly and practical

Thanks to the robust design optimized for the application, HEIDENHAIN controls are ideally suited for a harsh work-day environment. The clear-cut screen displays notes, questions, prompts, program steps, graphics and soft key rows. All texts are available in numerous languages. **Graphic illustrations** simplify programming and provide valuable aid for verifying the program during simulation.





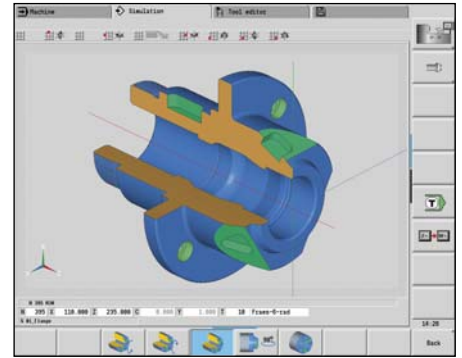
Klartext conversational input on a TNC

High quality and productivity

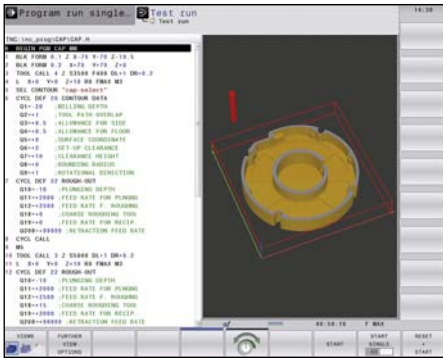
Thanks to intelligent motion control, HEIDENHAIN controls enable short machining times with perfect workpiece surfaces and very high workpiece accuracy. The bottom line is an increase in productivity: unit costs are reduced without affecting accuracy and surface quality.

Automating manual operations

You can start working with the HEIDENHAIN controls even before writing a complete part program. Simply machine a part step by step—switching as you want between manual operation and automatic positioning.



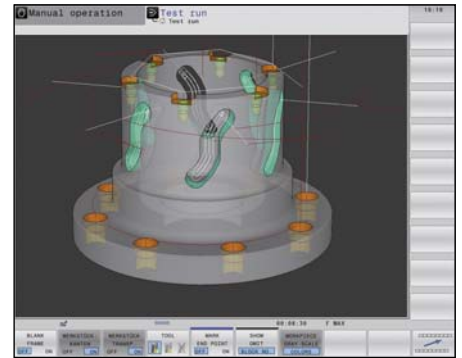
High-resolution graphics of lathe controls



NC program simulation

Manufacturing complex components precisely

Regardless of whether the workpieces are simple or complex—HEIDENHAIN controls offer the appropriate functions. With them, even operations in a tilted plane, multi-side or full-surface machining are not a challenge. Simultaneous machining with up to five axes is an especially strong point of HEIDENHAIN controls. With special control strategies, functions for process monitoring and compensation of production-induced disturbances, you can also manufacture components with complex geometries exactly, with process reliability, and efficiently.



High-resolution graphics of milling controls

HEIDENHAIN controls		Series	Page
Controls for milling machines	Contouring control for up to 20 control loops	TNC 640	44
	Contouring control for up to 6 control loops	TNC 620	46
	Contouring control for up to 5 control loops	TNC 320	46
	Straight cut control for up to 5 control loops	TNC 128	48
Controls for lathes	Contouring control for up to 20 control loops	CNC PILOT 640	50
	Contouring control for up to 10 control loops	MANUALplus 620	52
Accessories	Electronic handwheels	HR	55
	Programming stations	TNC 640/TNC 620/TNC 320 DataPilot MP 620/CP 640	55
Tool and workpiece setup and measurement	Workpiece touch probes	TS	56
	Tool touch probes	TT, TL	58

TNC 640 contouring control

For milling machines, milling-turning machines and machining centers

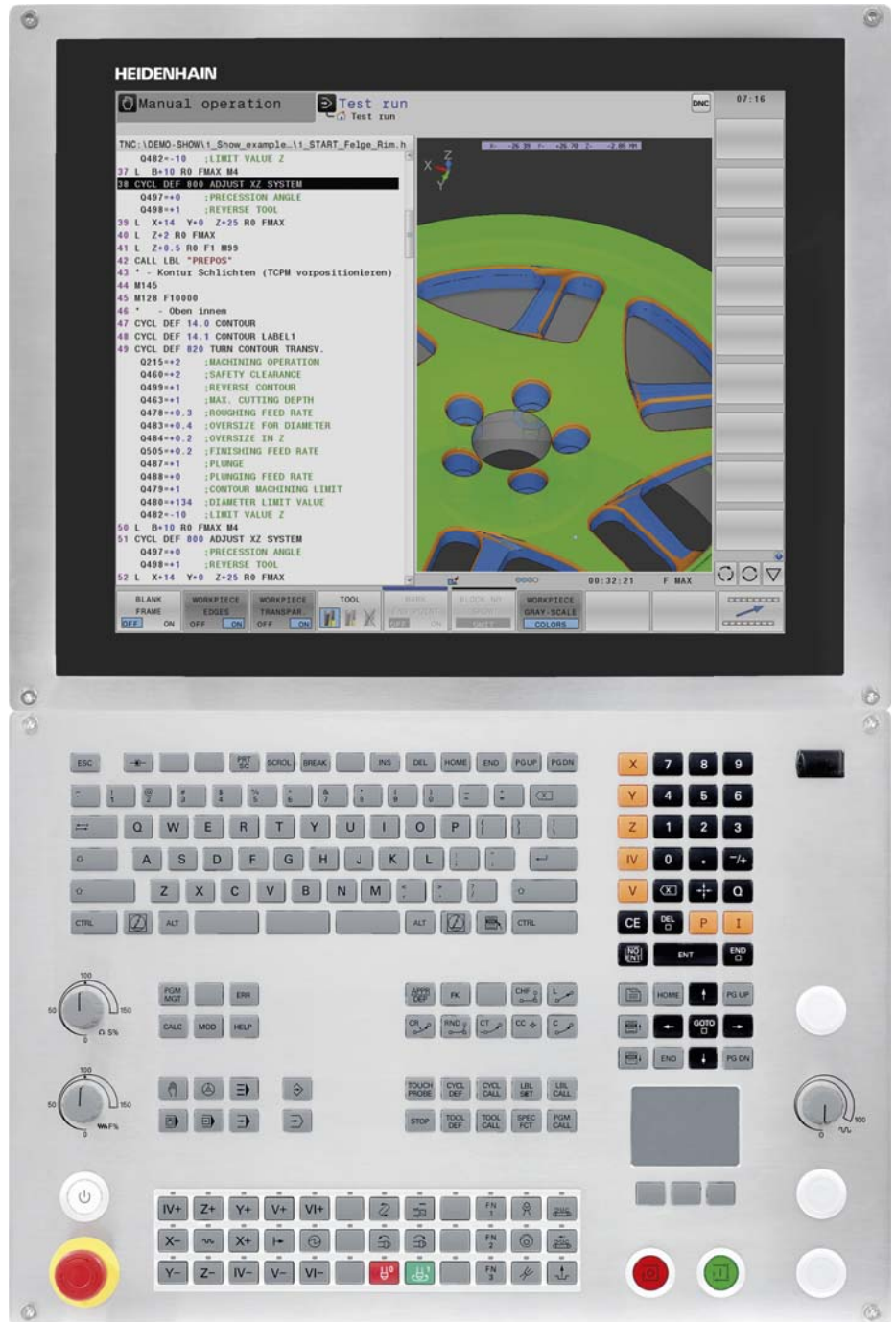
Besides milling, the **TNC 640** from HEIDENHAIN is also capable of combined milling and turning operations. It is particularly well suited for milling-turning, HSC and 5-axis machining on machines with up to 18 axes. The workshop oriented and versatile control features numerous functions. It is especially attractive for the following areas of application:

- Universal milling machines
- Combined milling-turning machines
- High speed milling
- Five-axis machining with swivel head and rotary table
- Five-axis machining on very large machines
- Boring mills
- Machining centers and automated machining

The TNC 640 features **optimized motion control, short block processing times** and special control strategies. Together with its **uniform digital design** and its integrated digital drive control including inverters, it enables you to reach very high machining speeds and the best possible contour accuracy—particularly when machining 3-D contours.

You can program **turning contours** with the TNC 640 in the familiar HEIDENHAIN Klartext language. Beyond this, you have typical contour elements for turning (recesses, undercuts, thread undercuts) as well as cycles for complex turning operations.

The **optimized user interface** of the TNC 640 gives you a fast overview: various color coding, standardized table editors and smartSelect—the dialog-guided fast selection of functions—aid you at your work.



	TNC 640
Axes	20 control loops, of which up to 4 are configurable as spindles
Interpolation	<ul style="list-style-type: none"> • Linear in max. 5 axes with Tool Center Point Management (TCPM) • Circular in max. 3 axes with tilted working plane • Helical • Cylinder surface¹⁾ • Rigid tapping¹⁾
Program entry	HEIDENHAIN Klartext, DIN/ISO
Programming support	TNCguide presents user information directly on the control
DXF converter option	Download contours and machining positions from DXF files
Program memory	Hard disk with at least 21 GB
Position entry	Nominal positions in Cartesian or polar coordinates, dimensions absolute or incremental, in mm or inches; actual position capture
Input resolution and display step	To 0.1 µm or 0.0001°; optionally to 0.01 µm or 0.00001°
Block processing time	0.5 ms (3-D straight line without radius compensation at 100 % PLC utilization)
Turning functions option	<ul style="list-style-type: none"> • Turning tool data management • Tool-tip radius compensation • Constant surface speed • Toggling between milling and turning operations
High speed cutting	Motion control with minimum jerk
FK free contour programming	HEIDENHAIN conversational with graphical support
Coordinate transformation	<ul style="list-style-type: none"> • Shifting, rotating, mirroring, scaling (axis specific) • Tilting the working plane, PLANE function (option)
Fixed cycles	For drilling, milling and turning (option), interpolation turning (option), hobbing (option) and for cylinder surface machining (option), data input with graphical support
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and workpiece presetting
Graphics	For programming and program verification
Parallel operation	Program run and programming with graphics
Data interface	Ethernet 1000BASE-T; USB 3.0; USB 2.0; RS-232-C/V.24 (max. 115200 bauds)
Remote control and diagnosis	TeleService
LCD screen	15-inch or 19-inch color flat-panel display (TFT)
Axis feedback control	<ul style="list-style-type: none"> • Feedforward control or operation with following error • Integrated digital drive control including inverter
Adaptive feed rate control option	AFC adjusts the contouring feed rate to the spindle power
DCM collision monitoring option	Dynamic monitoring of the working space for possible collisions with machine components ¹⁾
Accessories	<ul style="list-style-type: none"> • Electronic Handwheel • TS workpiece touch probe and TT or TL tool touch probe

¹⁾ This function requires adaptation by the machine tool builder
For further functions and differences in function, see product documentation

TNC 620, TNC 320 contouring controls

For milling machines

The HEIDENHAIN **TNC 620** and **TNC 320** controls are compact but versatile contouring controls. Thanks to their flexible operation—workshop-oriented programmability with HEIDENHAIN conversational programming or offline programming—and their scope of features, they are especially suited for use on universal milling, drilling and boring machines for the following:

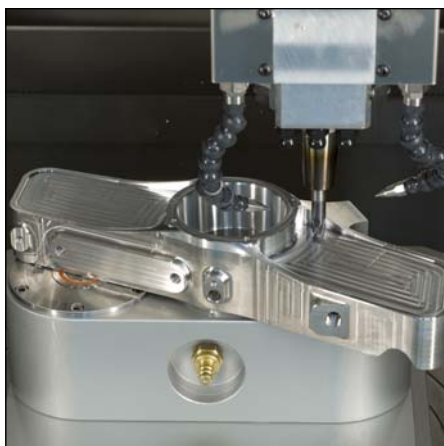
- Series and single-part production
- Tool making
- Machine building
- Research and development
- Prototypes and pilot plants
- Repair departments
- Training and education facilities

Thanks to its **digital design**, the **TNC 620** has control over the machine's entire drive system. Not only does the field-proven digital drive technology from HEIDENHAIN make high contour fidelity and rapid machining at high speeds possible, but also all control components of the TNC 620 are connected via digital interfaces. The TNC 620 is available in a touch-screen version as well as in a screen and keyboard version.

Because of its analog outputs that also provide nominal speed values, the **TNC 320** is particularly well suited for retrofitting on machine tools.



TNC 620 touch screen version (only for TNC 620)



	TNC 620	TNC 320
Axes	6 control loops, of which up to 2 are configurable as spindles	6 control loops, of which up to 2 are configurable as spindles
Interpolation	<ul style="list-style-type: none"> • Linear: in 4 (optionally 5) main axes • Circular: in 2 (optionally 3) axes • Helical, superimposition of circular and straight paths • Cylinder surface (option) 	<ul style="list-style-type: none"> • Linear in 4 main axes • Circular in 2 axes • Helical, superimposition of circular and straight paths • Cylinder surface (option)
Program entry	<ul style="list-style-type: none"> • HEIDENHAIN Klartext conversational • DIN/ISO (input via soft keys or via external USB keyboard) • FK free programming of contours (option with TNC 620) 	
Programming support	TNCguide presents user information directly on the TNC	
DXF converter option	Download contours and machining positions from DXF files	–
Program memory	1.8 GB	
Position entry	<ul style="list-style-type: none"> • Positions in Cartesian or polar coordinates • Incremental or absolute dimensions • Display and entry in mm or inches • Actual position capture 	
Input resolution and display step	Down to 0.1 µm or 0.0001°; optionally to 0.01 µm or 0.00001°	Down to 0.1 µm or 0.0001°
Block processing time	1.5 ms	6 ms
Coordinate transformation	<ul style="list-style-type: none"> • Shifting, rotating, mirroring, scaling (axis specific) • Tilting the working plane, PLANE function (option) 	
Fixed cycles (some optional with the TNC 620)	<ul style="list-style-type: none"> • Drilling, tapping, thread cutting, reaming and boring • Cycles for hole patterns, facing of flat surfaces • Pocket clearance and finishing, slots and studs 	
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and workpiece presetting (optional for TNC 620)	
Graphics	For programming and program verification (option with TNC 620); graphic support with cycle programming	
Parallel operation	Programming during program run, program-run graphics (option with TNC 620)	
Data interface	<ul style="list-style-type: none"> • Ethernet 1000BASE-T • USB 3.0; USB 2.0 • RS-232-C/V.24 and RS-422/V.11 (max. 115200 bauds) 	
LCD screen	15-inch or 19-inch vertical color flat-panel display (TFT)	15-inch color flat-panel display (TFT)
Axis feedback control	Feedforward control or operation with following error	
	Integrated digital drive control for synchronous and asynchronous motors	–
Interfacing to the machine	Via integrated programmable logic controller (PLC)	
	Inputs/outputs with PL 6000	Inputs/outputs expandable with PL 510
Accessories	<ul style="list-style-type: none"> • HR panel-mounted electronic handwheels • TS workpiece touch probe and TT or TL tool touch probe 	

TNC 128 straight cut control

For milling machines

The **TNC 128** from HEIDENHAIN is a compact but versatile straight-cut control for three servo axes and servo spindle. A further servo axis is an option. Thanks to its simple operation and scope of features, it is especially well suited for use on universal milling, drilling and boring machines for:

- Series and single-part production
- Machine building
- Prototypes and pilot plants
- Repair departments
- Training and education facilities

Because of its analog output that also provides nominal speed values, the TNC 128 is well suited for retrofitting on machine tools.



	TNC 128
Axes	6 control loops, of which up to 2 are configurable as spindles
Program entry	HEIDENHAIN conversational
Program memory	1.8 GB
Position entry	<ul style="list-style-type: none"> • Positions in Cartesian or polar coordinates • Incremental or absolute dimensions • Display and entry in mm or inches
Input resolution and display step	Down to 0.1 µm or 0.0001°
Block processing time	6 ms
Coordinate transformation	Shifting, rotating, mirroring, scaling (axis specific)
Fixed cycles	<ul style="list-style-type: none"> • Drilling, tapping, reaming and boring • Cycles for hole patterns, facing of flat surfaces • Pocket, stud and slot milling
Touch probe cycles	Touch probe calibration and datum setting
Graphics	For programming and program verification; graphic support for cycle programming
Parallel operation	Program run and programming, program-run graphics
Data interface	<ul style="list-style-type: none"> • Ethernet 1000BASE-T • USB 3.0; USB 2.0 • RS-232-C/V.24; max. 115200 bauds
LCD screen	12.1-inch color flat-panel display (TFT)
Axis feedback control	Feedforward control or operation with following error
Interfacing to the machine	Via integrated programmable logic controller (PLC); inputs/outputs expandable by PL 510
Accessories	<ul style="list-style-type: none"> • HR panel-mounted electronic handwheels • TS or KT workpiece touch probe and TT tool touch probe

CNC Pilot 640 contouring control

For lathes and turning-milling machines

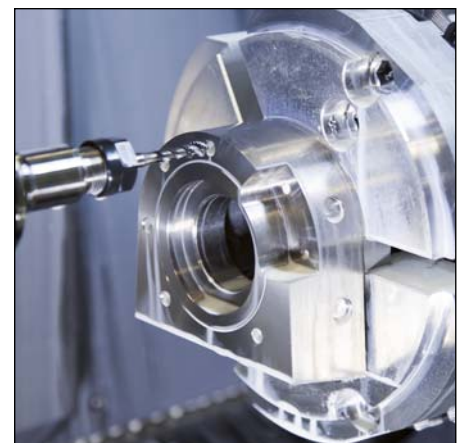
The **CNC PILOT 640** offers you the right support thanks to its flexible design and versatile programming capabilities. Regardless of whether you are manufacturing single parts or batches, simple or complex workpieces. The CNC PILOT 640 is characterized by its simple operation and programming. It is quickly learned and requires minimum training time.

The CNC PILOT 640 was conceived for CNC lathes. It is suitable for horizontal and vertical lathes.

The CNC PILOT 640 supports lathes with main and counter spindle, one slide (X and Z axis), C axis or positionable spindle and driven tools as well as machines with Y and B axes.

Regardless of whether you are turning simple parts or complex workpieces, the CNC PILOT 640 provides you with the benefits of graphical contour input and convenient programming with smart.Turn. With the TURN PLUS option, you can even create an NC program at the touch of a button. You only need to describe the contour, the material and the clamping material beforehand. TURN PLUS does everything else automatically.

Programming with variables, controlling special machine components, or using externally created programs, etc., simply switch to DIN PLUS. With DIN PLUS you'll find the fitting solution for your special tasks.



	CNC PILOT 640
Axes	Up to 20 control loops
Interpolation	<ul style="list-style-type: none"> • Straight line: In 2 principal axes, optional in 3 principal axes • Circle: In 2 axes, optional additional linear interpolation in the third axis • C1/C2 axis: interpolation of X and Z linear axes with the C1/C2 axis (option) • B axis: 5-axis interpolation between X, Z, Y, B, and C axes (option)
Program entry	smart.Turn, DIN PLUS, Teach-In mode (option)
Programming aids	TNCguide presents user information directly on the control
DXF import option	Loading DXF contours
Program memory	CFR memory card, 1.8 GB
Position entry	Nominal positions in Cartesian or polar coordinates, dimensions absolute or incremental, in mm or inches; actual position capture
Input resolution and display step	X axis: 0.5 µm, diameter: 1 µm U, V, W, Y, Z axis: 1 µm B, C1/C2 axis: 0.001°
Block processing time	1.5 ms (3-D straight line without radius compensation at 100 % PLC utilization)
Setup functions	<ul style="list-style-type: none"> • Setting the workpiece zero point • Define the tool change position • Definition of protection zone
Interactive Contour Programming ICP	Contour definition with graphic support
Fixed cycles	Stock removal, recessing, recess turning, engraving, thread cutting, helical slot milling, boring, drilling, tapping, eccentric and non-circular turning
Touch probe cycles option	For tool and workpiece measurement as well as presetting
Graphics	For programming and program verification
Parallel operation	Program run and programming with graphics
Data interface	Ethernet 1000BASE-T; USB 3.0; USB 2.0; RS-232-C/V.24 (max. 115200 bauds)
Remote control and diagnosis	TeleService
LCD screen	15-inch or 19-inch color flat-panel display (TFT)
Axis feedback control	<ul style="list-style-type: none"> • Feedforward control or operation with following error • Integrated digital drive control including inverter
Accessories	<ul style="list-style-type: none"> • Electronic Handwheel • TS workpiece touch probe and TT tool touch probe

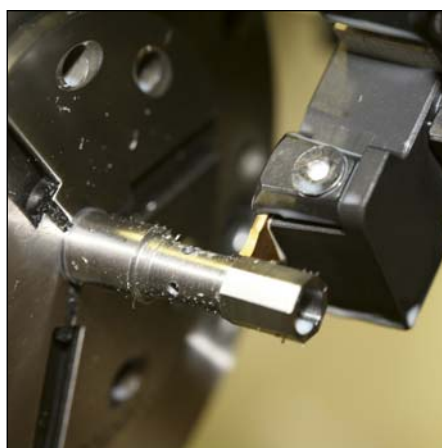
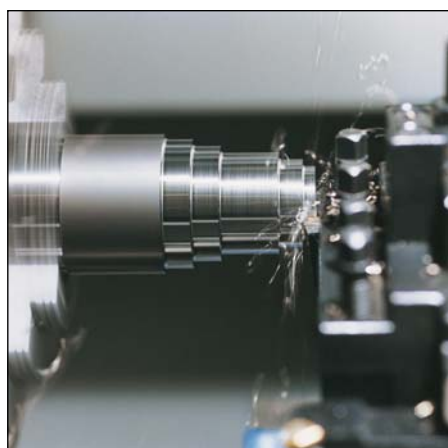
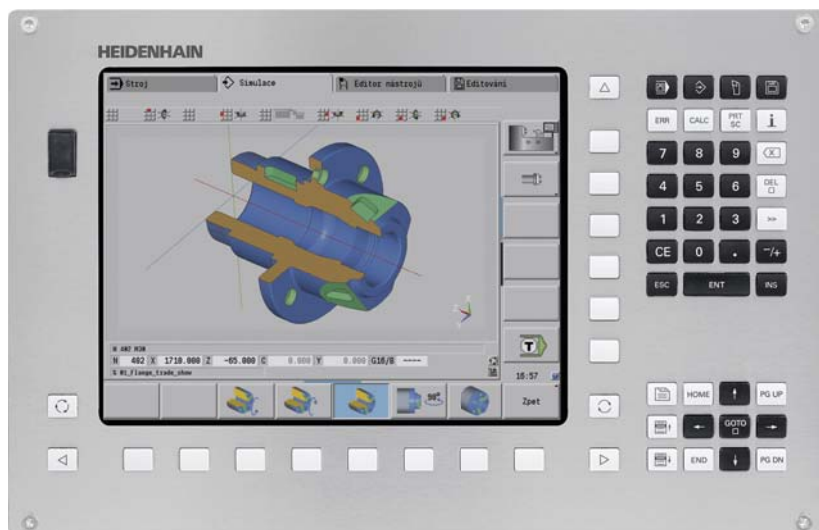
For further functions and differences in function, see product documentation

MANUALplus 620 contouring control for CNC and cycle lathes

The **MANUALplus 620** is a compact and versatile contouring control that is particularly well suited for cycle-controlled lathes. The MANUALplus 620 offers the ideal combination between the ease of use of conventional lathes and the advantages of CNC-controlled machines.

Regardless of whether you are manufacturing single parts or batches, simple or complex workpieces, the control always adapts to the needs of your company. The MANUALplus 620 is characterized by its simple operation and programming. It is quickly learned and requires minimum training time.

The MANUALplus 620 supports lathes with main and counter spindle, one slide (X and Z axis), C axis or positionable spindle and driven tools as well as machines with Y and B axes.



	MANUALplus 620
Axes	10 control loops
Interpolation	<ul style="list-style-type: none"> • Straight line: In 2 principal axes, optional in 3 principal axes • Circle: In 2 axes, optional additional linear interpolation in the third axis • C1/C2 axis: interpolation of X and Z linear axes with the C1/C2 axis (option)
Program entry	Teach-In mode, smart.Turn (option), DIN PLUS
Programming aids	TNCguide presents user information directly on the control
DXF import option	Loading DXF contours
Program memory	CFR memory card, 1.8 GB
Position entry	Nominal positions in Cartesian or polar coordinates, dimensions absolute or incremental, in mm or inches; actual position capture
Input resolution and display step	X axis: 0.5 µm, diameter: 1 µm U, V, W, Y, Z axis: 1 µm B, C1/C2 axis: 0.001°
Block processing time	3 ms
Setup functions	<ul style="list-style-type: none"> • Setting the workpiece zero point • Define the tool change position • Definition of protection zone
Interactive Contour Programming ICP	Contour definition with graphic support
Fixed cycles	Stock removal, recessing, recess turning, engraving, thread cutting, helical slot milling, boring, drilling, tapping, eccentric and non-circular turning
Touch probe cycles option	For tool and workpiece measurement as well as presetting
Graphics	For programming and program verification
Parallel operation	Program run and programming with graphics
Data interface	Ethernet 1000BASE-T; USB 3.0; USB 2.0; RS-232-C/V.24 (max. 115200 bauds)
Remote control and diagnosis	TeleService
LCD screen	12.1-inch color flat-panel display (TFT)
Axis feedback control	<ul style="list-style-type: none"> • Feedforward control or operation with following error • Integrated digital drive control including inverter
Accessories	<ul style="list-style-type: none"> • Electronic Handwheel • TS workpiece touch probe and TT tool touch probe

For further functions and differences in function, see product documentation

Contouring controls

Digital control design

In the uniformly digital control solution from HEIDENHAIN, all components are connected over purely digital interfaces: the control components over **HSCI** (HEIDENHAIN Serial Controller Interface), the HEIDENHAIN real-time protocol for Fast Ethernet and the encoders over **EnDat 2.2**, the bidirectional interface from HEIDENHAIN. This achieves a high degree of availability for the entire system. It can be diagnosed and is immune to noise—from the main computer to the encoder. The outstanding characteristics of the uniform digital solution from HEIDENHAIN guarantee very high accuracy and surface definition together with high traversing speeds.

Digital drive control

High surface definition, high contouring accuracy of the finished workpiece, and short machining times—these requirements can be met only with digital control techniques. Here HEIDENHAIN offers NC products with integrated **digital drive control**.

Either compact or modular inverters are available, depending on the type of machine. The **compact inverters** include power electronics for up to five axes plus spindle with a rated output of the total system up to 22 kW. For the **modular inverters**, supply units from 22 kW to 125 kW as well as various power modules for axes and spindles are available. Modular inverters are suited for machines with up to 24 axes, of which up to four can be configured as spindles.

Feed motors with a stall torque of 1.5 Nm to 120 Nm and **spindle motors** with a power rating of 5.5 kW to 40 kW are available for connection to HEIDENHAIN inverters.

The following HEIDENHAIN controls are available with HSCI and digital drive control:

- TNC 640
- TNC 620
- iTNC 530
- MANUALplus 620
- CNC PILOT 640



TNC 640
With modular inverters,
motors and position
encoders

Accessories

Electronic handwheels

With the electronic handwheel from HEIDENHAIN, you can use the feed drive to make very precise movements in the axis slides in proportion to the rotation of the handwheel. As an option, the handwheels are available with mechanical detent.

HR 510, HR 520 and HR 550FS portable handwheels

The axis keys and certain functional keys are integrated in the housing. It allows you to switch axes or set up the machine at any time—and regardless of where you happen to be standing. The **HR 520** also features a display for the position value, the feed rate and spindle speed, the operating mode and other functions, as well as an override potentiometer for feed rate and spindle speed. You can enjoy unlimited freedom of movement with the **HR 550 FS** with radio transmission. Its features correspond to those of the HR 520.



HR 550 FS

HR 510

HR 130 and HR 150 panel-mounted handwheels

Panel-mounted handwheels from HEIDENHAIN can be integrated in the machine operating panel or be installed at another location on the machine. Up to three HR 150 electronic handwheels can be connected through an adapter.



HR 130 for integration in the machine operating panel

Programming stations

With the TNC 640 and TNC 620/TNC 320 programming stations, you have the capability to program in conversational language just as you do at the machine, but away from the noise and distractions of the shop floor.

Creating programs

The programming, testing and optimizing of HEIDENHAIN conversational or ISO programs with the programming station substantially reduces machine idle times. You do not need to change your way of thinking. At the programming station you program on the same keyboard as at the machine.

Training with the programming station

Because the programming stations are based on the respective control software, they are ideally suited for apprentice and advanced training.

TNC training in schools

Since they can be programmed in ISO as well as in conversational format, the programming stations can also be used in schools for TNC programming training.



Tool and workpiece setup and measurement

TS workpiece touch probes

The **TS workpiece touch probes** from HEIDENHAIN help you perform setup, measuring and inspection functions directly on the machine tool.

The stylus of a TS touch trigger probe is deflected upon contact with a workpiece surface. At that moment the TS generates a trigger signal that, depending on the model, is transmitted either by cable or over an infrared or radio beam to the control.

The control simultaneously saves the actual position values as measured by the machine axis encoders, and uses this information for further processing. The trigger signal is generated through a wear-free optical sensor that ensures high reliability.

HEIDENHAIN offers probe styli with various ball-tip diameters and stylus lengths. On the **TS 260**, asymmetric probing elements can also be attached through an adapter and exactly aligned with the aid of the screw connection.

Benefits of HEIDENHAIN touch probes

- High probing repeatability
- High probing velocity
- No wear thanks to contact-free optical switch and high-accuracy pressure sensor.
- High repeatability over a long period
- Noise-free signal transmission by cable, radio or infrared beam
- Optical status indicator
- Integrated flusher/blower on infrared touch probes
- Effective energy saving mode
- With **TS 460**: Collision protection adapter (optional) prevents damage and reduces heating of the TS through the spindle
- With **TS 260**: Direct connection with any subsequent electronics; no interface required



Touch probe with **radio and infrared transmission** for machines with automatic tool change:

- **TS 460** – standard touch probe
Compact dimensions, energy-saving mode, optional collision protection and thermal decoupling

Touch probes with **infrared signal transmission** for machines with automatic tool change:

- **TS 444** – battery-free touch probe
Voltage supply through integrated air turbine generator over central compressed air supply
- **TS 642** – touch probe for retrofitting
Activation by switch in the taper shank
- **TS 740** – high-accuracy touch probe
High probe accuracy and repeatability, low probing forces

Probe system with **cable-connected signal transmission** for machines with manual tool change, e.g. grinding, turning and milling machines:

- **TS 260** – cable-connected touch probe
Radial cable connection
- **TS 248** – cable-connected touch probe
Radial cable connection, with reduced deflection forces

The following transmitter/receiver units are available for wireless signal transmission:

- **SE 540**: For integration in spindle head; only infrared transmission
- **SE 660**: As common SE for TS and TT; radio and infrared transmission
- **SE 642**: Common SE for TS and TT; only infrared transmission

Machine type

Signal transmission

Transmitter/receiver unit

Voltage supply

Switching on/off

Interface to control signal levels

Probe repeatability

Probe velocity

Protection EN 60529



SE 660



SE 540



SE 642



TS 460



TS 444



TS 642



TS 740



TS 260

TS 460	TS 444	TS 642	TS 740	TS 260 TS 248
CNC machine tools for milling, drilling and boring as well as CNC grinding machines or lathes				
Radio and infrared	Infrared			Via cable
SE 540: Infrared SE 642: Infrared SE 660: Radio/Infrared	SE 540: Infrared SE 642: Infrared			–
Batteries, rechargeable or nonrechargeable	Air turbine generator	Batteries, rechargeable or nonrechargeable		DC 15V to 30V
Radio or infrared transmission	By infrared signal	Switch in taper shank	By infrared signal	–
HTL via SE transmitter/receiver unit				HTL
$2\sigma \leq 1\ \mu\text{m}$			$2\sigma \leq 0.25\ \mu\text{m}$	$2\sigma \leq 1\ \mu\text{m}$
$\leq 3\ \text{m/min}$			$\leq 0.25\ \text{m/min}$	$\leq 3\ \text{m/min}$
IP68				

TT and TL tool touch probes

Tool measurement on the machine shortens non-productive times, increases machining accuracy and reduces scrapping and reworking of machined parts. With the tactile TT touch probes and the contact-free TL laser systems, HEIDENHAIN offers two different possibilities for tool measurement.

With their rugged design and high degree of protection, these tool touch probes can be installed directly within the machine tool's work envelope.

Tool measurement is possible at any time: before machining, between two machining steps, or after machining is done.

Touch probes

The TT 160 and TT 460 are 3-D touch trigger probes for tool measurement and inspection. The disk-shaped probe contact of the TT is deflected during physical probing of a tool. At that moment the TT generates a trigger signal that is transmitted to the control, where it is processed further. The trigger signal is generated through a wear-free optical sensor that ensures high reliability.

TT 160

- Signal transmission to the NC over **connecting cable**

TT 460

- Signal transmission over **radio and infrared beam** to transmitter/receiver unit
- The SE 660 is a common transmitter/receiver unit for tool and workpiece touch probes with radio and infrared transmission



TT 160



TT 460

	TT 160	TT 460
Probing method	Physical probing in three dimensions: ±X, ±Y, ±Z	
Probe repeatability	2 σ ≤ 1 μm (probing velocity 1 m/min)	
Permissible deflection of probe contact	≈ 5 mm in all directions	
Voltage supply	DC 10V to 30V via NC	Batteries, rechargeable or nonrechargeable
Interface to control Signal level	HTL	SE 642: Infrared SE 660: Radio/Infrared
Signal transmission	Via cable	Radio wave and infrared transmission with 360° range
Probe contact	Ø 40 mm or Ø 25 mm	
Protection EN 60529	IP67	

TL laser systems

The TL Micro and TL Nano laser systems can measure tools at the rated speed without making contact. With the aid of the included measuring cycles you can measure tool lengths and diameters, inspect the form of the individual teeth and check for tool wear or breakage. The control automatically saves the results of measurement in the tool table.



	TL Nano	TL Micro 150	TL Micro 200	TL Micro 350
Probing method	Contact-free with laser beam in two dimensions; 2 dimensional $\pm X$, (or $\pm Y$), $+Z$			
Tool diameter Central measurement	0.03 to 37 mm:	0.03 to 30 mm:	0.03 to 80 mm:	0.03 to 180 mm:
Reproducibility	$\pm 0.2 \mu\text{m}$		$\pm 1 \mu\text{m}$	
Spindle speed	For individual tooth measurement, optimized to standard spindles or HSC spindles ($> 30000 \text{ rpm}$)			
Laser	Visible red-light laser with beam focused at center of system, protection class 2 (IEC 825)			
Voltage supply	DC 24 V via NC			
Interface to control Signal level	HTL			
Protection EN 60529	IP68 (when connected, with sealing air)			
Tool cleaning	Integral blowing unit			

Measured value acquisition and display

Evaluation electronics units

Evaluation electronics for metrology applications from HEIDENHAIN serve to visualize and process the values measured with linear encoders, length gauges, rotary encoders or angle encoders. They combine measured value acquisition with intelligent, application-specific further processing. They are used in many metrological applications, ranging from simple measuring stations to complex inspection systems with multiple measuring points.

The evaluation electronics include units with integrated display—which can be used independently—and units that require a PC for operation. They feature interfaces for various encoder signals.



Evaluation electronics for 2-D and 3-D measuring tasks

Position display units

HEIDENHAIN digital readouts for manually operated machine tools have universal application: In addition to standard tasks on milling, drilling and boring machines and lathes, they also offer ideal solutions for many applications on machine tools, measuring and testing equipment, and special machines—in fact all machines where axis slides are moved manually.

Digital readouts for manual machine tools increase your productivity. They save time and increase the dimensional accuracy of the finished workpiece while offering very user-friendly operation.

Practice-oriented functions and cycles are available for various applications. The distance-to-go display feature with graphic positioning aid allows you to approach the next nominal position quickly and reliably simply by traversing to a display value of zero. And POSITIP speeds up small-batch production—repetitive machining sequences can be saved as a program.

Precise manufacturing made easy: Together with linear encoders from HEIDENHAIN, the digital readouts measure the axis movements directly. The backlash caused by mechanical transfer elements such as lead screws, racks and gears therefore has no influence.



Evaluation electronics for measuring and testing tasks



Interface electronics

HEIDENHAIN interface electronics adapt the encoder signals to the interface of the subsequent electronics. They are used when the subsequent electronics cannot directly process the output signals from HEIDENHAIN encoders, or if additional interpolation of the signals is necessary.



User-friendly environment

Digital readouts and evaluation electronics with integrated display are specially designed for user friendliness. Typical characteristics:

- Optimally readable, graphic flat panel display
- Simple, logically arranged keypad and user interface
- Ergonomically designed push-button keys
- Sturdy die-cast housing
- Conversational user guidance with help and graphic functions
- User-friendly functions for easier operation of manual machines and equipment
- Reference mark evaluation for distance-coded and single reference marks
- Problem-free installation, maintenance-free operation
- Fast payback with economical use

Evaluation electronics and digital readouts from HEIDENHAIN feature a data interface for further processing in the higher-level electronics or simply to print out the measured values.

Evaluation electronics for metrology applications	Series	Page
For 2-D and 3-D measuring tasks	ND 100 QUADRA-CHEK ND 1000 QUADRA-CHEK QUADRA-CHEK 3000 IK 5000 QUADRA-CHEK	58
For measuring and testing tasks	ND 287 ND 1100 QUADRA-CHEK ND 2100 G GAGE-CHEK MSE 1000 EIB 700 IK 220	60
Digital readouts for manually operated machine tools		
For milling machines, lathes and positioning devices	POSITIP 880 ND 780 ND 500	62
Interface electronics, inspection and test equipment		63

Evaluation electronics for metrology applications

2-D and 3-D measuring tasks

The evaluation electronics for 2-D and 3-D measuring tasks feature special functions for measured-value acquisition and evaluation. They serve primarily as

- Profile projectors
- Measuring microscopes
- Video measuring machines
- Coordinate measuring machines (manual or with CNC)
- 2-D measuring machines

QUADRA-CHEK evaluation electronics for profile projectors, measuring microscopes, 2-D and video measuring machines as well as CMMs measure points on **2-D contours**, depending on the version either automatically or manually by crosshairs, by optical edge detection or by video camera with real-time display of the live image and integrated image processing. For **3-D contours** such as planes, cylinders, cones, and spheres you can measure points using a triggering touch probe. In the optional **CNC version**, they also operate as full-fledged controls for axis positioning and can automatically execute measuring programs.

The **ND** and the **QUADRA-CHEK 3000** are independently operating devices. They feature an integrated screen and sturdy housing.

The **IK 5000 QUADRA-CHEK** universal PC package solution consists of a PC card and the associated software. Together with a PC, they make for a powerful measuring station.



ND 100



ND 1200

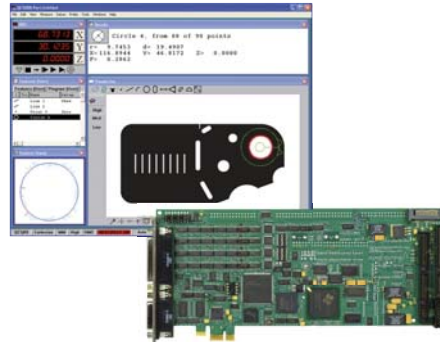
	ND 100 QUADRA-CHEK	ND 1200 QUADRA-CHEK
Application	<ul style="list-style-type: none"> • Profile projectors • Measuring microscopes 	<ul style="list-style-type: none"> • Profile projectors • Measuring microscopes • 2-D measuring machines
Axes	2 or 3 ¹⁾	XY, XYQ, XYZ or XYZQ ¹⁾
Encoder inputs	□TTL	~ 1 V _{PP} or □TTL (other interfaces upon request)
Display	5.7-inch monochrome flat-panel display	
Function	<ul style="list-style-type: none"> • Measurement of 2-D features • Measuring point acquisition via crosshairs • Entry of tolerances • Graphic display of measurement results 	<ul style="list-style-type: none"> • Measure Magic function • Creation of measuring programs
<i>Optional or depending on the version</i>	–	Automatic edge finding through optical edge detector
Data interfaces	USB	USB; RS-232-C

¹⁾ Depending on version

²⁾ Depending on software option



QUADRA-CHEK 3000



IK 5000

QUADRA-CHEK 3000	ND 1400 QUADRA-CHEK	IK 5000 QUADRA-CHEK
<ul style="list-style-type: none"> • Profile projectors • Measuring microscopes • 2-D measuring machines • Video measuring machines 	<ul style="list-style-type: none"> • Manual coordinate measuring machines 	<ul style="list-style-type: none"> • Profile projectors • Measuring microscopes • Video measuring machines • Coordinate measuring machines • Multi-sensor measuring machines
XYZQ ²⁾	XYZQ	XYQ, XYZ or XYZQ ¹⁾
12.1-inch color wide-screen (multi-touch)	8.4-inch color flat-panel display (touchscreen)	By PC screen
<ul style="list-style-type: none"> • Measurement of 2-D features • Measuring point acquisition via crosshairs • Entry of tolerances • Graphic display of measurement results • User management • Creation of measuring programs (teach-in) • Creation and output of measuring logs 	<ul style="list-style-type: none"> • Measurement of 2-D and 3-D features • Points measured via touch probe, crosshairs or rigid probing element • Entry of tolerances • Graphic display of measurement results • Five coordinate systems can be stored • Touch-probe management 	<ul style="list-style-type: none"> • Measurement of 2-D features • Measuring point acquisition via crosshairs • Entry of tolerances • Graphic display of measurement results • Creation of measuring programs (teach-in) • Report generator • Import and export functions for CAD and measured data • Nominal-to-actual comparison for 2-D free-form contours from a CAD model
<p>AEI1 software option</p> <ul style="list-style-type: none"> • Additional encoder input <p>VED software option</p> <ul style="list-style-type: none"> • Video edge detection and live image display • Image archiving • Light control 	-	<ul style="list-style-type: none"> • Measurement of 3-D features • Automatic edge finding through optical edge detector • Video edge detection and live image display • Image archiving • Point measurement by touch probe (also TP 200) • CNC axis control and autofocus • Zoom and light control
Ethernet, USB	USB; RS-232-C	PCIe (PC interface)

Evaluation electronics for metrology applications

Measuring and testing tasks

Evaluation electronics for measuring and testing tasks are ideal for

- Measurement equipment
- Adjustment and inspection equipment
- SPC inspection stations
- Multipoint inspection apparatuses
- Mobile data acquisition
- Positioning equipment

The **ND** evaluation units are independently operating devices with integrated screen and sturdy housing. They feature special functions for measuring and statistical evaluation of measured values such as sorting and tolerance check mode, minimum/maximum value storage, and measurement series storage. These data make it possible to calculate mean values and standard deviations and graphically display them in histograms or control charts. With the ND 2100G, even complex properties like flatness and volume can be ascertained: its inputs can be assigned and combined as desired with mathematical, trigonometric or statistical formulas.

The **MSE 1000** is a modular electronics unit for multipoint measuring apparatuses for shop-floor metrology. With its modular design and various interfaces, it can be adapted flexibly to a wide variety of applications. Measured values are evaluated and displayed through a higher-level computer system.

The **EIB 700** is ideal for applications requiring high resolution, fast measured-value acquisition, mobile data acquisition or data storage.

The data is transferred over the standard Ethernet interface for evaluation and display in a higher-level computer system.

The **IK 220** is an expansion board for PCs for recording the measured values of two incremental or absolute HEIDENHAIN encoders.



ND 2100G

	ND 287	ND 1100 QUADRA-CHEK
Application	<ul style="list-style-type: none"> • Measurement equipment • Testing devices • SPC inspection stations 	<ul style="list-style-type: none"> • Positioning equipment • Measuring fixtures
Axes ¹⁾	1 (optional 2)	2, 3 or 4
Encoder inputs	$\sim 1 V_{PP}$, $\sim 11 \mu A_{PP}$ or EnDat 2.2	$\sim 1 V_{PP}$ or \square TTL (other interfaces upon request)
Display	Color flat-panel display	5.7-inch monochrome flat-panel display
Function	<ul style="list-style-type: none"> • Sorting and tolerance checking • Measurement series with min./max. value storage • Functions for statistical process control (SPC) • Graphic display of measurement results • Storage of measured values <p><i>Optional:</i> Sum/difference display or thermal compensation</p>	<ul style="list-style-type: none"> • Measurement series with min./max. value storage • Touch probe connection for a HEIDENHAIN or Renishaw touch probe
Data interfaces	USB; RS-232-C; <i>optional:</i> Ethernet	USB; RS-232-C

¹⁾ Depending on version



MSE 1000



EIB 700



IK 220

ND 2100G GAGE-CHEK	MSE 1000	EIB 700	IK 220
<ul style="list-style-type: none"> • Multipoint inspection apparatuses • SPC inspection stations 	<ul style="list-style-type: none"> • Multipoint inspection apparatuses • PLC testing stations 	<ul style="list-style-type: none"> • Testing stations • Multipoint inspection apparatuses • Mobile data acquisition 	<ul style="list-style-type: none"> • Measuring and testing stations
4 or 8	Up to 250	4	2
$\sim 1 V_{PP}$, \square TTL, EnDat 2.2, LVDT or HBT (other interfaces upon request)		$\sim 1 V_{PP}$, EnDat 2.1 or EnDat 2.2 $(\sim 11 \mu A_{PP}$ upon request)	$\sim 1 V_{PP}$, $\sim 11 \mu A_{PP}$, EnDat 2.1 or SSI
5.7-inch color flat-panel display	By PC screen		
<ul style="list-style-type: none"> • Sorting and tolerance checking • Measurement series with min./max. value storage • Functions for statistical process control (SPC) • Graphic display of measurement results • Storage of measured values • Programming of up to 100 parts • Entry of any formulas, combinations and variables • Output of measurement results 	<ul style="list-style-type: none"> • Modular design • Configurable as desired • Various interfaces • Fast communication with higher-level computer system • Universal outputs 	<ul style="list-style-type: none"> • Precise position measurement up to 50 kHz updating rate • Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for approx. 250 000 measured values per channel • Connection over standard Ethernet interface to higher-level computer systems 	<ul style="list-style-type: none"> • Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for 8192 measured values per channel
Ethernet		PCI (PC interface)	

Digital readouts for manually operated machine tools

Applications for digital readouts are on manually operated machine tools, e.g.

- Milling machines
- Drilling and boring machines
- Lathes
- Radial drilling machines
- Grinding machines
- Electrical discharge machines

The splash-proof front panel and the sturdy cast-metal housing make digital readouts from HEIDENHAIN impervious to the hardest of everyday workshop conditions.



ND 780



ND 500

	POSITIP 880	ND 780	ND 500
Application	Milling, drilling, boring machines and lathes		
Description	Color flat-panel display, program memory, splash-proof full-travel keyboard	Monochrome flat-panel display, splash-proof full-travel keyboard	Monochrome flat-panel display, membrane keyboard
Axes	Up to 6 axes	Up to 3 axes	2 or 3 axes
Encoder inputs	~ 1 V _{PP} or EnDat 2.1	~ 1 V _{PP}	□□TTL
Display step	10 μm, 5 μm, 1 μm or finer		5 μm (with LS 328C/LS 628C)
Datums	<i>Milling: 99; turning: 1</i>	10	
Tool data	For 99 tools	For 16 tools	
Programming	Max. 999 program blocks per program	–	
Functions	Contour monitoring with magnify function	Contour monitoring	
For milling, drilling and boring machines	<ul style="list-style-type: none"> • Calculation of positions for hole patterns (bolt circles, linear hole patterns) • Cutting data calculator 		
	Probing functions for reference-point acquisition with the KT edge finder: "Edge", "Centerline" and "Circle center"		–
	Positioning aids for milling and roughing of rectangular pockets	–	
For turning	<ul style="list-style-type: none"> • Radius/Diameter display • Separate or sum display for Z and Z₀ • Taper calculator • Freezing tool position for back-off 		
	<ul style="list-style-type: none"> • Oversize allowances • Cycle for area clearance 	–	
Interfaces	Edge finder, switching functions (optional)		–
	RS-232-C/V.24, Centronics	RS-232-C/V.24	USB

Interface electronics, inspection and test equipment

Interface electronics

Interface electronics from HEIDENHAIN adapt the encoder signals to the interface of the subsequent electronics, for example:

Incremental signals

~ 1 V_{PP} > □TTL

~ 11 μA_{PP} > □TTL

Incremental signals > position values

~ 1 V_{PP} > EnDat

~ 1 V_{PP} > Fanuc Serial Interface

~ 1 V_{PP} > Mitsubishi high speed Interface

Position values

EnDat > DRIVE-CLiQ

EnDat > Yaskawa Serial Interface

EnDat > PROFIBUS-DP

EnDat > PROFINET

In addition to being converted, the sinusoidal encoder signals are also interpolated in the interface electronics. This permits finer measuring steps and, as a result, higher control quality and better positioning behavior.

Some interface electronics have an integrated counting function. Starting from the last reference point set, an absolute position value is formed when the reference mark is traversed, and is transferred to the subsequent electronics.

HEIDENHAIN interface electronics are available in various mechanical designs:

- Box design
- Plug design
- Version for integration
- Top-hat rail design



Plug design

Inspection and testing devices from HEIDENHAIN

HEIDENHAIN encoders are provided with all information necessary for commissioning, monitoring and diagnostics. HEIDENHAIN offers the appropriate PWM inspection devices and PWT testing devices for encoder adjustment and analysis. The PWM inspection devices can be used universally. They have low measuring tolerances and can be calibrated.

Testing devices have fewer available functions, larger measuring tolerances and cannot be calibrated.

HEIDENHAIN encoders can usually be connected directly or via interface electronics to a number of different subsequent electronics.

HEIDENHAIN therefore offers encoders and interface electronics with various interfaces. The testing and inspection devices from HEIDENHAIN also support various interfaces, which makes their application more flexible (see overview for the PWM 20 and PWT 100).

Encoder input	PWM 20	PWT 100
EnDat 2.1	✓	✓
EnDat 2.2	✓	✓
DRIVE-CLiQ	✓	–
Fanuc Serial Interface	✓	✓
Mitsubishi high speed interface	✓	✓
Yaskawa Serial Interface	✓	✓
Panasonic Serial Interface	✓	✓
SSI	✓	–
1V _{PP} /TTL/11 μA _{PP}	✓	✓
HTL (via signal adapter)	✓	–



PWM 20 inspection device with included ATS adjusting and testing software



PWT test device for mobile application

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

For more information

Brochures, data sheets and CD-ROMs

The products shown in this General Catalog are described in more detail in separate documentation, including complete specifications, signal descriptions and dimension drawings in English and German (other languages available upon request).

HEIDENHAIN on the Internet

At our home page on the Internet at www.heidenhain.de you will find these brochures in various languages, but also a great deal of further up-to-date information on the company and its products.

Our web site also includes:

- Technical articles
- Press releases
- Addresses
- TNC training programs

Length measurement



Brochure
Linear Encoders
For Numerically Controlled Machine Tools

Contents:
Absolute linear encoders
LC
Incremental linear encoders
LB, LF, LS



Brochure
Length Gauges

Contents:
HEIDENHAIN-ACANTO
HEIDENHAIN-SPECTO
HEIDENHAIN-METRO
HEIDENHAIN-CERTO



Brochure
Exposed Linear Encoders

Contents:
Absolute linear encoders
LIC
Incremental linear encoders
LIP, PP, LIF, LIDA

Angle measurement



Brochure
Rotary Encoders

Contents:
Absolute rotary encoders
ECN, EQN, ROC, ROQ
Incremental rotary encoders
ERN, ROD



Brochure
Angle Encoders with Integral Bearing

Contents:
Absolute angle encoders
RCN, ECN
Incremental angle encoders
RON, RPN, ROD



Brochure
Encoders for Servo Drives

Contents:
Rotary encoders
Angle encoders
Linear encoders



Brochure
Angle Encoders without Integral Bearing

Contents:
Incremental angle encoders
ERP, ERO, ERA



Brochure
Modular Angle Encoders
With Magnetic Scanning

Contents:
Incremental encoders
ERM

Machine tool control



Brochures
TNC 128 Straight Cut Control
TNC 320 Contouring Control
iTNC 530 Contouring Control
TNC 620 Contouring Control
TNC 640 Contouring Control

Contents:
 Information for the user



OEM brochures
TNC 128 Straight Cut Control
TNC 320 Contouring Control
iTNC 530 Contouring Control
TNC 620 Contouring Control
TNC 640 Contouring Control

Contents:
 Information for the machine tool builder



Brochures
MANUALplus 620 Contouring Control
CNC Pilot 640 Contouring Control

Contents:
 Information for the user



OEM brochures
MANUALplus 620 Contouring Control
CNC Pilot 640 Contouring Control

Contents:
 Information for the machine tool builder

Setup and measurement



Brochure
Touch Probes

Contents:
 Tool touch probes
TT, TL
 Workpiece touch probes
TS



Brochure
Evaluation Electronics
For Metrology Applications

Contents:
ND 100, ND 287, ND 1100, ND 1200, ND 1300, ND 1400, QUADRA-CHEK 3000, ND 2100G, MSE 1000, EIB 700, IK 220, IK 5000



Brochure
Measuring Devices for Machine Tool Inspection and Acceptance Testing

Contents:
 Incremental linear encoders
KGM, VM



Brochure
Digital Readouts/Linear Encoders
For Manually Operated Machine Tools

Contents:
 Digital readouts
ND 280, ND 500, ND 700, POSITIP, ND 1200R
 Linear encoders
LS 300, LS 600



Product overview
Interface Electronics



Product Information
QUADRA-CHEK 3000

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