HEIDENHAIN



General Catalog

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

09/2022

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 as well as automated machines and systems, especially in the semiconductor and electronics manufacturing industries.

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.

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 a high-speed machining center 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. HEIDENHAIN develops and builds most of the machines it needs for the production and measurement of linear and circular scales, including the necessary copying equipment.

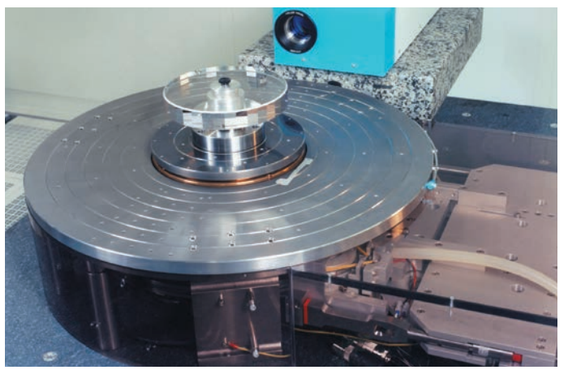


30 m long measuring machine for scale tapes



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 standards 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.



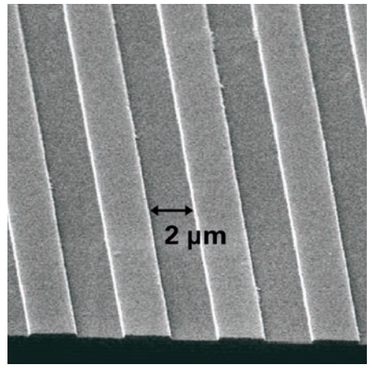
Angle comparator, measuring step approx. 0.001″



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 and can tolerate 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.

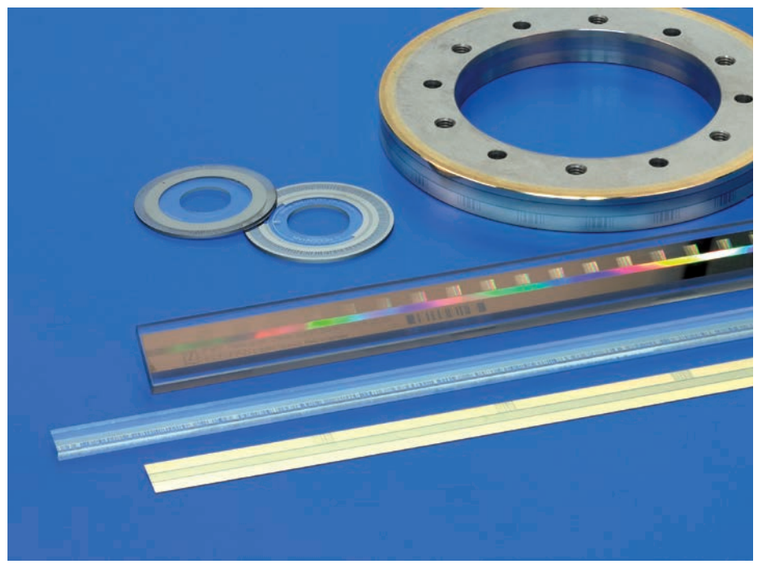
METALLUR
With its special optical composition of reflective gold layers, METALLUR graduations show a virtually planar structure. They are therefore particularly tolerant to contamination.

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 microns down to quarters of a micron.

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.**

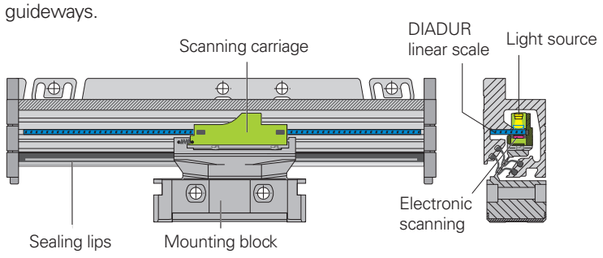
- Accuracy grades as fine as ±2 µm
- Measuring steps of down to 0.001 µm
- Measuring lengths of up to 30 m (72 m upon request)
- Fast and simple installation
- Large mounting tolerances
- High acceleration loading
- Protection against contamination



Sealed linear encoders are available with

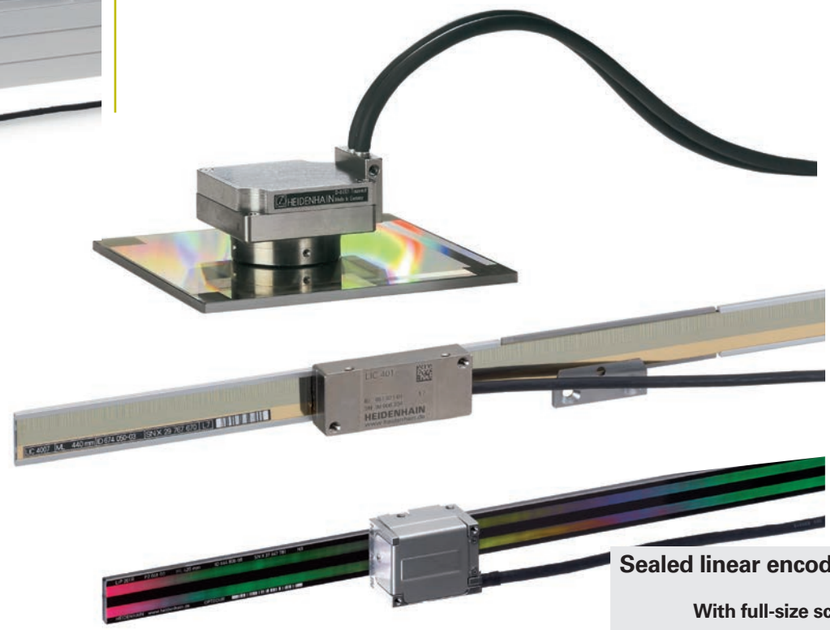
- **Full-size scale housing**
  - For high vibration loading
  - Up to 30 m measuring length (72 m upon request)
- **Slimline scale housing**
  - For limited installation space
  - Measuring lengths of up to 2040 mm (for measuring lengths starting from 1240 mm, mounting via mounting spar or tensioning 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 ±0.5 µm and better
- For measuring steps of down to 0.001 µm (1 nm)
- Measuring lengths of 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 ±0.1 µm
- For measuring steps of down to 0.005 µm (5 nm)
- Measuring lengths of 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 reference point 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**	
	Large measuring lengths	**LB 300**	
With slimline scale housing	Absolute position measurement	**LC 400**	**10**
	Incremental position measurement	**LS 400**	
	Very high repeatability	**LF 400**	
	Typically for manual machines	**LS 300**	
Exposed linear encoders	Very high accuracy	**LIP**	**12**
	Two-coordinate encoders	**LIF, PP**	**13**
	For high accuracy and large measuring lengths	**LIDA**	**14**
	Absolute position measurement	**LIC**	
Length gauges	For measuring stations and multipoint inspection apparatuses	**AT, CT, MT, ST**	**16**

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 requiring any previous traverse. 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 graduation—is delivered as a single piece, and after the housing sections have been mounted, is pulled through the sections, drawn to a defined tension and fixed at both ends to the machine base.

Absolute position measurement

LC 100 series
- Absolute position measurement
- Defined thermal behavior
- High vibration resistance
- Two mounting attitudes
- Single-field scanning

LC 200 series
- Absolute position measurement
- For large measuring lengths of up to 28 m[5)]
- Defined thermal behavior
- High vibration resistance
- Two mounting attitudes
- Single-field scanning

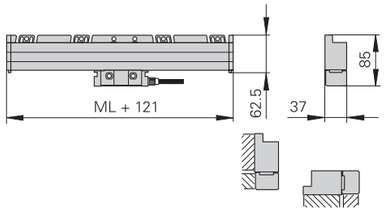
Incremental position measurement

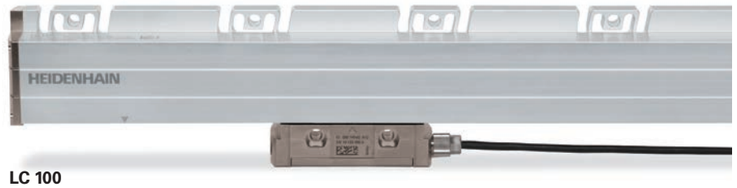
LS 100 series
- Incremental position measurement
- Defined thermal behavior
- High vibration resistance
- Two mounting attitudes
- Single-field scanning

LF 185
- Incremental position measurement
- Very high repeatability
- Thermal behavior similar to steel or cast iron
- High vibration rating
- Two mounting attitudes
- Single-field scanning

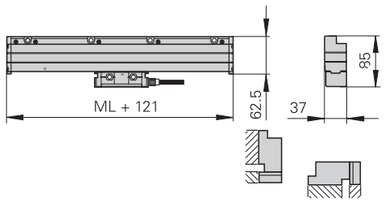
LB 382
- Incremental position measurement
- For large measuring lengths of up to 30 m[4)]
- Defined thermal behavior
- High vibration resistance
- Two mounting attitudes
- Single-field scanning

LS 600 series
- Incremental position measurement
- Typically for manual machines
- Simple mounting



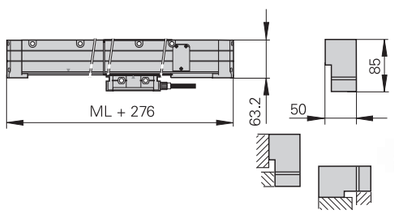


LC 100



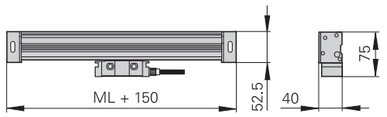


LF 185





LC 200





LS 600

	Absolute **LC 115[1)]/LC 185** **LC 195F/M/P/S[1)]** **LC 116/LC 196F/M**	**LC 211/LC 281** **LC 291F/M**	*Incremental* **LF 185**	**LS 187** **LS 177**	**LS 688C** **LS 628C**	**LB 382**
Measuring standard Grating period	DIADUR glass scale 20 µm	METALLUR steel scale tape 40 µm	SUPRADUR phase grating on steel 8 µm	DIADUR glass scale 20 µm	DIADUR glass scale 20 µm	METALLUR steel scale tape 40 µm
Interface	*LC 115/LC 116:* EnDat 2.2 *LC 185:* EnDat 2.2 with ~ 1 V_{PP} *LC 195:* Fanuc αi/Mitsubishi/ Panasonic/ DRIVE-CLiQ *LC 196:* Fanuc αi/Mitsubishi	*LC 211:* EnDat 2.2 *LC 281:* EnDat 2.2 with ~ 1 V_{PP} *LC 291:* Fanuc αi/Mitsubishi	~ 1 V_{PP}	*LS 187:* ~ 1 V_{PP} *LS 177:* ⊓⊔ TTL[2)]	*LS 688C:* ~ 1 V_{PP} *LS 628C:* ⊓⊔ TTL	~ 1 V_{PP}
Signal period	*LC 185:* 20 µm	*LC 281:* 40 µm	4 µm	*LS 187:* 20 µm	*LS 688C:* 20 µm	40 µm
Accuracy grade	±5 µm, ±3 µm[3)]	±5 µm	±3 µm, ±2 µm	±5 µm, ±3 µm	±5 µm	±5 µm
Measuring lengths ML	Up to 4240 mm	Up to 28040 mm[5)]	Up to 3040 mm	Up to 3040 mm		Up to 30040 mm[4)]
Reference mark	–		One or distance-coded; *LS 6xxC:* distance-coded			

1) Also available with functional safety
2) Integrated interpolation 5/10/20-fold
3) Up to an ML of 3040 mm
4) Up to an ML of 72040 mm upon request
5) Longer measuring lengths with the TNC 640 upon request

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

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.

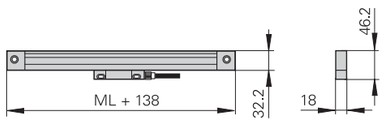
Absolute linear encoders of the **LC 400** series provide the **absolute position value** without requiring any previous traverse. Like the **LS 400** series incremental linear encoders, their high accuracy and defined thermal behavior make them especially well suited for use on **numerically controlled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

Absolute position measurement

LC 400 series
- Absolute position measurement
- Defined thermal behavior
- Single-field scanning

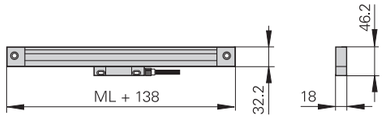




LC 400

Incremental position measurement

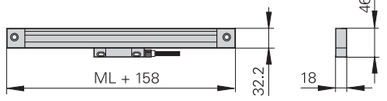
LS 400 series
- Incremental position measurement
- Defined thermal behavior
- Single-field scanning





LS 400

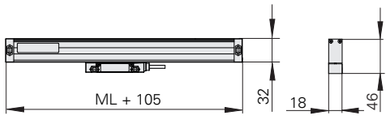
LF 485
- Incremental position measurement
- Very high repeatability
- Thermal behavior similar to steel or cast iron
- Single-field scanning





LF 485

LS 300 series
- Incremental position measurement
- Typically for manual machines

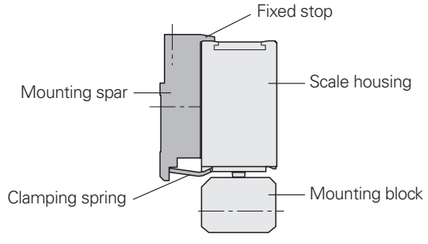




LS 300

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.





	Absolute **LC 415[1]/LC 485 LC 495 F/M/P/S[1] LC 416/LC 496 F/M**	***Incremental*** **LF 485**	**LS 487 LS 477**	**LS 383 C LS 373 C**
Measuring standard	DIADUR glass scale	SUPRADUR phase grating on steel	DIADUR glass scale	Glass scale
Grating period	20 µm	8 µm	20 µm	20 µm
Interface	*LC 415/LC 416:* EnDat 2.2 *LC 485:* EnDat 2.2 with ∿ 1 V_{PP} *LC 495:* Fanuc αi/ Mitsubishi/ Panasonic/ DRIVE-CLiQ *LC 496:* Fanuc αi/ Mitsubishi	∿ 1 V_{PP}	*LS 487:* ∿ 1 V_{PP} *LS 477:* ⊓⊔ TTL[2]	*LS 383 C:* ∿ 1 V_{PP} *LS 373 C:* ⊓⊔ TTL
Signal period	*LC 485:* 20 µm	4 µm	*LS 487:* 20 µm	20 µm
Accuracy grade	±5 µm, ±3 µm	±5 µm, ±3 µm		±5 µm
Measuring lengths ML	Up to 2040 mm[3]	Up to 1220 mm	Up to 2040 mm[3]	
Reference mark	–	One or distance-coded		One or distance-coded

[1] Also available with functional safety
[2] 5/10/20-fold integrated interpolation
[3] Over ML 1240 mm with mounting spar or clamping elements

DRIVE-CLiQ is a registered trademark of Siemens AG.

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. 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 481 V and LIP 481 V (for high vacuum, down to 10^{-7} bar) and LIP 481 U (for ultrahigh vacuum, down to 10^{-11} bar).

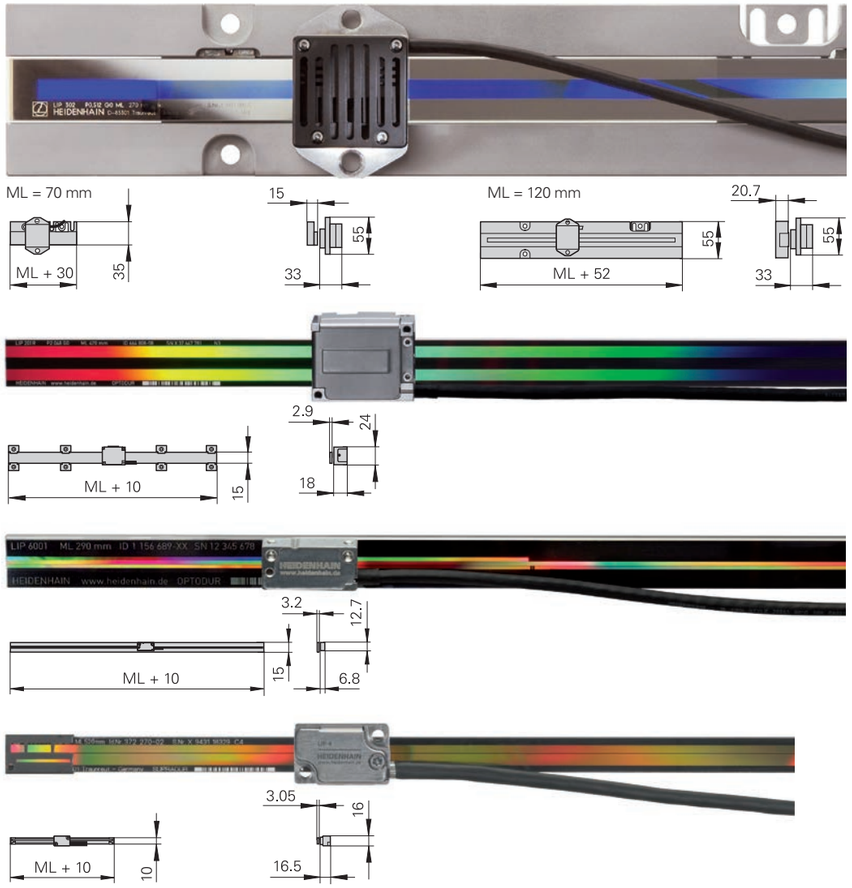
Incremental position measurement

LIP 300 series
- Highest resolutions, with measuring steps of down to < 1 nm
- Very high repeatability through an extremely fine signal period
- Defined thermal behavior thanks to a measuring standard on Zerodur glass ceramic scale

LIP 200 series
- Very high repeatability with compact dimensions
- Measuring lengths of up to 3040 mm
- Measuring steps of down to < 1 nm
- Defined thermal behavior thanks to a measuring standard on Zerodur glass ceramic scale

LIP 6000 series
- For highly dynamic applications
- For limited installation space
- Measuring steps of down to 1 nm
- Position detection through limit switches and homing track

LIF 400 series
- Fast, simple scale fastening with PRECIMET adhesive film
- Insensitive to contamination thanks to SUPRADUR graduation
- Position detection through limit switches and homing track



	Incremental **LIP 382**	**LIP 281** **LIP 211**		**LIP 6081** **LIP 6071**		**LIF 481** **LIF 471**	
Measuring standard Grating period	DIADUR phase grating on Zerodur glass ceramic 0.512 µm	OPTODUR phase grating on Zerodur glass ceramic 2.048 µm		OPTODUR phase grating on glass or Zerodur glass ceramic 8 µm		SUPRADUR phase grating on glass or Zerodur glass ceramic 8 µm	
Interface	∿ 1 V_{PP}	***LIP 281:*** ∿ 1 V_{PP} ***LIP 211:*** EnDat 2.2[1]		***LIP 6081:*** ∿ 1 V_{PP} ***LIP 6071:*** ⊓⊔ TTL		***LIF 481:*** ∿ 1 V_{PP} ***LIF 471:*** ⊓⊔ TTL	
Signal period	0.128 µm	***LIP 281:*** 0.512 µm		***LIP 6081:*** 4 µm		***LIF 481:*** 4 µm	
Accuracy grade	±0.5 µm	±1 µm	±3 µm	±1 µm (only for Zerodur)	±3 µm	±1 µm (only for Zerodur)	±3 µm
Baseline error	≤ ±0.075 µm/5 mm	≤ ±0.125 µm/5 mm		≤ ±0.175 µm/5 mm		≤ ±0.225 µm/5 mm	
Interpolation error[2]	±0.01 nm	±0.4 nm		±4 nm		±12 nm	
Measuring lengths ML	70 mm to 270 mm	20 mm to 1020 mm	370 mm to 3040 mm	20 mm to 1020 mm	20 mm to 3040 mm	70 mm to 1020 mm	70 mm to 1640 mm
Reference mark	None	One		One		One	

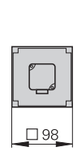
[1] Absolute position value after scanning the reference mark

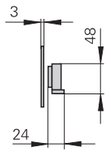
[2] Only with encoders with 1 V_{PP} or EnDat 2.2 interface

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





	Incremental **PP 281**
Measuring standard Grating period	DIADUR phase grating on glass 8 µm
Interface	∿ 1 V_{PP}
Signal period	4 µm
Accuracy grade	±2 µm
Interpolation error	±12 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** of up to 10 m/s and **large measuring lengths** of up to 30 m.

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

The LIC 4113V and LIC 4193V encoders are suitable for special **high-vacuum applications** (down to 10^{-7} bar).

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

There are **various possibilities for easy mounting** of the LIC and LIDA encoders:

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 pulled through aluminum extrusions and tensioned at its ends
- The aluminum extrusions can be screwed or bonded onto the mounting surface

LIC 41x7, LIC 31x7, LIC 21x7, LIDA 4x7, LIDA 2x7
- One-piece steel scale-tape pulled through aluminum extrusions and fastened at center
- The aluminum extrusions are bonded onto the mounting surface

LIC 41x9, LIC 31x9, LIC 21x9, LIDA 4x9, LIDA 2x9
- One-piece steel scale tape is bonded directly to the mounting surface
- Also available with functional safety (LIC 4119)

Absolute position measurement

LIC 4100 series
- Very high accuracy and long measuring lengths
- Various mounting options
- Grating on steel scale tape, glass, or glass ceramic
- Also available with functional safety

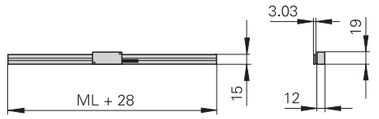
LIC 3100 series
- High accuracy and large measuring lengths
- Various mounting options
- Scale tape cut from roll

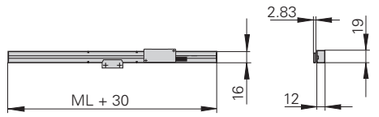
LIC 2100 series
- Large mounting tolerance
- For simple applications

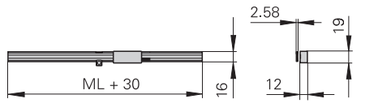
Incremental position measurement

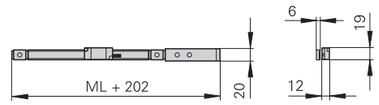
LIDA 400 series
- Large measuring lengths of up to 30 m
- Various mounting options
- Limit switches

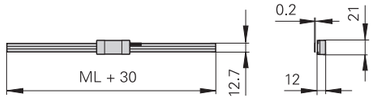
LIDA 200 series
- Scale tape cut from roll
- Large mounting tolerance
- For simple applications
- Simple installation through integrated function display













LIC 4113



LIC 3119



LIC 2117



LIDA 485



LIDA 279

	Absolute						***Incremental***					
	LIC 4113 LIC 4193	**LIC 4115 LIC 4195**	**LIC 4117 LIC 4197**	**LIC 4119[1] LIC 4199**	**LIC 3117 LIC 3197**	**LIC 3119 LIC 3199**	**LIC 2117 LIC 2197**	**LIC 2119 LIC 2199**	**LIDA 483 LIDA 473**	**LIDA 485 LIDA 475**	**LIDA 487 LIDA 477**	**LIDA 489 LIDA 479**	**LIDA 287 LIDA 277**	**LIDA 289 LIDA 279**
Measuring standard Grating period	METALLUR graduation on glass ceramic or glass 40 µm	METALLUR steel scale tape 40 µm			Steel scale tape with absolute track and incremental track 80 µm		Steel scale tape 220 µm		METALLUR graduation on glass ceramic or glass 20 µm	METALLUR steel scale tape 20 µm			Steel scale tape 200 µm	
Interface	*LIC 411x:* EnDat 2.2 *LIC 419x:* Fanuc αi/ Mitsubishi/ Panasonic/Yaskawa				*LIC 311x:* EnDat 2.2 *LIC 319x:* Fanuc αi/ Mitsubishi/ Panasonic/Yaskawa		*LIC 211x:* EnDat 2.2 *LIC 219x:* Fanuc αi/ Mitsubishi/ Panasonic/Yaskawa		*LIDA 48x:* ∿ 1 V_{PP} *LIDA 47x:* ⊓⊔ TTL[2]				*LIDA 28x:* ∿ 1 V_{PP} *LIDA 27x:* ⊓⊔ TTL[2]	
Signal period	–				–		–		*LIDA 48x:* 20 µm				*LIDA 28x:* 200 µm	
Accuracy grade	±3 µm; ±5 µm	±5 µm	±3 µm[3]; ±5 µm[3]; ±15 µm	±3 µm; ±15 µm	±15 µm[6]		±15 µm		±1 µm[4]; ±3 µm; ±5 µm	±5 µm	±3 µm[3]; ±5 µm[3]; ±15 µm	±3 µm; ±15 µm	±15 µm	
Baseline error	≤ ±0.275 µm/10 mm	≤ ±0.750 µm/50 mm			≤ ±0.750 µm/50 mm (typical)		–		≤ ±0.275 µm/10 mm	≤ ±0.750 µm/50 mm (typical)			–	
Interpolation error[5]	±20 nm	±20 nm			±100 nm		±1 µm		±45 nm	±45 nm			±2 µm	
Measuring lengths ML	240 mm to 3040 mm	140 mm to 28440 mm	240 mm to 6040 mm	70 mm to 1020 mm	Scale tape from the roll 3 m/5 m/10 m		Scale tape from the roll 3 m/5 m/10 m		240 mm to 3040 mm	140 mm to 30040 mm	240 mm to 6040 mm		Scale tape from the roll 3 m/5 m/10 m	
Reference mark	–				–		–		One or distance-coded	One			Selectable every 100 mm	

[1] Also available with functional safety
[2] Up to 100-fold integrated interpolation (LIDA 47x also 5-fold)
[3] Up to measuring length of 1020 mm or 1040 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
[6] ±5 µm after linear length-error compensation in the downstream electronics

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 of up to 100 mm. They feature plungers with integral bearings and therefore serve as compact measuring devices.

The **HEIDENHAIN-CERTO** CT length gauges 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 and quality control. They are also used 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.

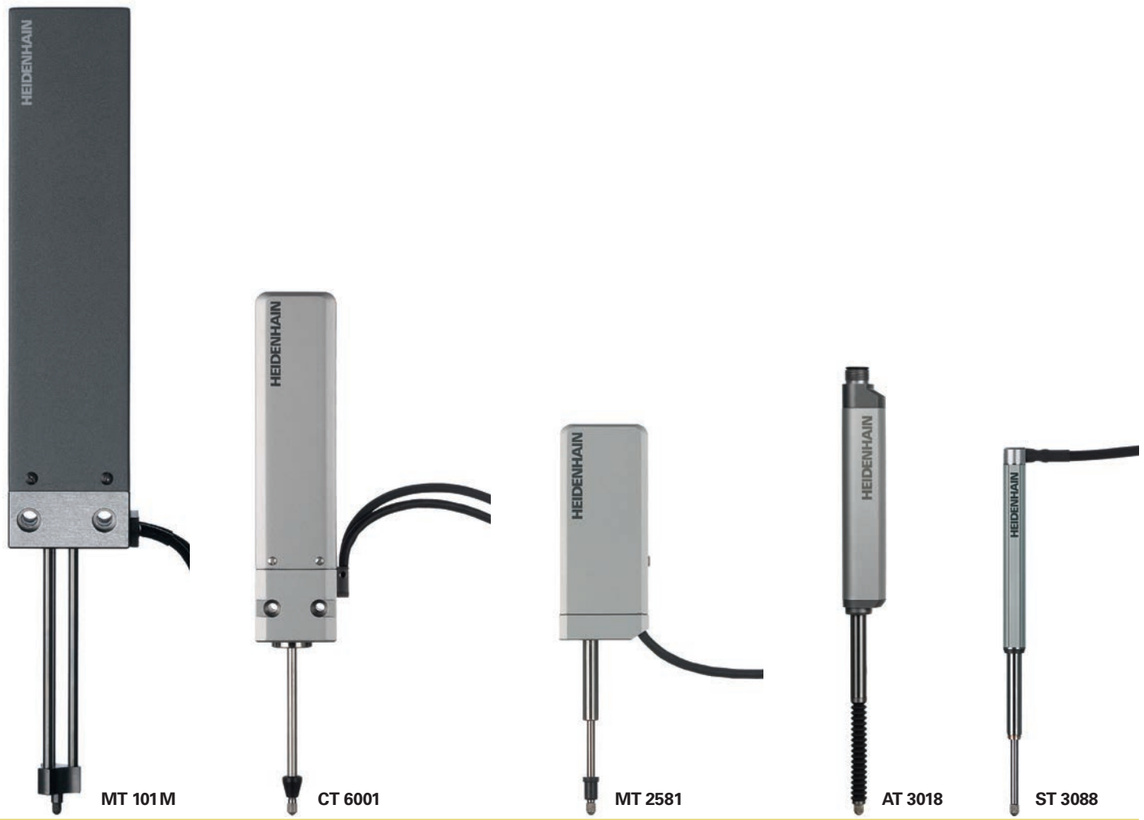
HEIDENHAIN-ACANTO
- Online diagnostics
- Protection up to IP67
- Absolute scanning

HEIDENHAIN-CERTO
- For highest 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
- Exceptionally compact dimensions
- Protection up to IP67
- Especially durable ball-bush guide
- Variant for harsh ambient conditions



MT 101 M · CT 6001 · MT 2581 · AT 3018 · ST 3088

	Absolute		*Incremental*											
	AT 1218 AT 1217	**AT 3018 AT 3017**	**CT 2501 CT 2502**	**CT 6001 CT 6002**	**MT 1281 MT 1287**	**MT 1271**	**MT 2581 MT 2587**	**MT 2571**	**MT 60 M MT 60 K**	**MT 101 M MT 101 K**	**ST 1288 ST 1287**	**ST 1278 ST 1277**	**ST 3088 ST 3087**	**ST 3078 ST 3077**
Measuring standard	DIADUR glass scale		DIADUR phase grating on Zerodur glass ceramic Coefficient of linear expansion: $\alpha_{therm} = (0\pm0.1) \cdot 10^{-6}\ K^{-1}$						DIADUR graduation on glass ceramic		DIADUR glass scale			
Grating period	188.4 µm		4 µm		4 µm				10 µm		20 µm			
Interface	EnDat 2.2		~ 11 μA_{PP}		~ 1 V_{PP}	⊓⊔ TTL[3]	~ 1 V_{PP}	⊓⊔ TTL[3]	~ 11 μA_{PP}		~ 1 V_{PP}	⊓⊔ TTL[3]	~ 1 V_{PP}	⊓⊔ TTL[3]
Signal period	–		2 µm			–	2 µm	–	10 µm		20 µm	–	20 µm	–
System accuracy	±1 µm	±2 µm	±0.1 µm[1] ±0.03 µm[2]	±0.1 µm[1] ±0.05 µm[2]	±0.2 µm				±0.5 µm	±1 µm	±1 µm			
Repeatability	0.4 µm	0.8 µm	0.02 µm	0.03 µm			0.09 µm		0.06 µm	0.04 µm	0.25 µm		0.7 µm	
Measuring range	12 mm	30 mm	25 mm	60 mm	12 mm		25 mm		60 mm	100 mm	12 mm		30 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				*MT xxM:* with motor *MT xxK:* by coupling		*ST xxx8:* by measured object *ST xxx7:* pneumatic			

[1] At 19 °C to 21 °C; permissible temperature fluctuation during measurement: ±0.1 K
[2] With linear length-error compensation in the evaluation electronics
[3] 5/10-fold integrated interpolation

Angle measurement

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

- Line counts: typically 9000 to 180000
- Accuracy: from ±5″ to ±0.4″
- Measuring steps: as fine as 0.000 01° 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, 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, elevators and handling devices, as well as various types of measuring, testing and inspection devices.

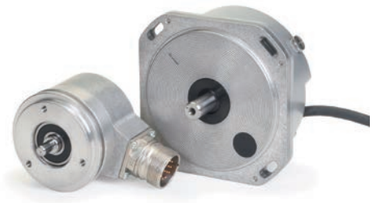
- Line counts: typically 16 to 5000
- Accuracy grades: to ±10″ (depending on the line count, corresponding to ±1/20 of the grating period)
- Measuring steps: as fine as 0.000 01°. Particularly for photoelectric rotary encoders, the high quality of the sinusoidal incremental signals permits high interpolation 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 mounting
- 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:
- Little space required
- Large hollow-shaft diameters
- High shaft speeds possible
- No additional starting torque







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 output, for example, over the purely serial, bidirectional **EnDat** interface. It enables automatic configuration of the higher-level electronics and provides 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 data interface.

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

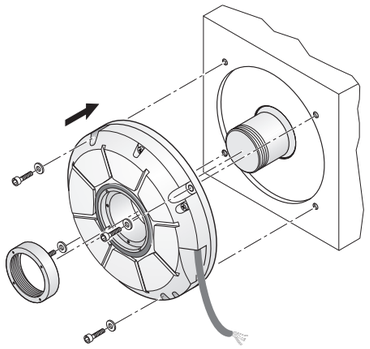
Incremental rotary encoders with commutation signals provide the angular shaft position value—without requiring previous traverse—with sufficient accuracy to correctly control the phases of the rotating field of a permanent-magnet three-phase motor.

		Series	Page
Sealed angle encoders			
With integral bearing and integrated stator coupling	Absolute (singleturn)/Incremental	**RCN, RON, RPN**	**20**
With integral bearing	Absolute (singleturn)/Incremental	**ROC, ROD, RON**	**22**
Angle encoder modules	With precision bearings	**MRP, SRP**	**24**
Modular angle encoders			
Without integral bearing, with optical scanning	Absolute (singleturn)/Incremental	**ECA, ERA, ERO, ERP**	**26**
Without integral bearing, with magnetic scanning	Absolute (singleturn)/Incremental	**ECM, ERM**	**32**
Rotary encoders			
With integral bearing, for mounting via stator coupling	Absolute (singleturn/multiturn) Incremental	**ECN, EQN ERN**	**34**
With integral bearing, for separate shaft coupling	Absolute (singleturn/multiturn) Incremental	**ROC, ROQ ROD**	**38**
Without integral bearing	Absolute (singleturn/multiturn) Incremental	**ECI, EQI, EBI ERO**	**40**

RCN, RON, RPN sealed 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 encoders for high-precision applications such as rotary tables and tilting axes. The measuring standard is usually a circular scale with DIADUR graduation. For the encoders 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.

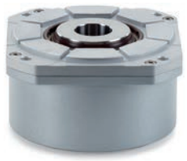


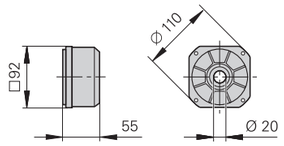
Features of the **RCN 2001, RCN 5001** and **RCN 8001** series of angle encoders:

- **High system accuracies** account for position error within one revolution and within one signal period, as well as errors arising from the coupling, while maintaining wide mounting tolerances
- **Optimized scanning technology,** so that even liquid contamination or condensation droplets barely affect the scanning signal quality and therefore the motor control
- **Simple acquisition of temperature values of direct drive motors** through evaluation of the winding temperatures in the direct drive motors
- **High permissible speeds** with purely serial interface: up to 3000 rpm
- Possibility of mechanical fault exclusion against loosening of the encoder-to-drive connection

RCN 2001, RCN 200 and RON 200 series

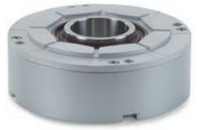
- Compact dimensions
- Sturdy design
- Typically used with rotary tables, tilting tables, for positioning and speed control





RCN 5001 series

- Large hollow shaft and small installation space
- Stator mounting dimensions compatible with RCN 2001 and RON 200

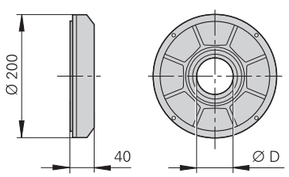


RCN 8001, RON 700 and RON/RPN 800 series

- Large hollow shaft diameters of up to 100 mm
- System accuracies: ±2″ and ±1″
- Typically used on rotary and angle measuring tables, indexing heads, measuring setups, image scanners, etc.



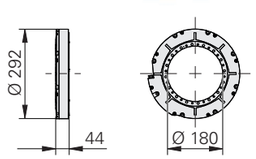
RCN 8001
D = 60 mm or 100 mm
RON 786/886, RPN 886
D = 60 mm



RCN 6000 series

- Very large hollow shaft
- System accuracy: ±2″
- Typically used with rotary tables, tilting tables and direct drive motors





	Absolute **RCN 2511**[1] **RCN 2311**[1] **RCN 210**	**RCN 2581** **RCN 2381** **RCN 280**	**RCN 2591 F** **RCN 2391 F** **RCN 290 F**	**RCN 2591 M** **RCN 2391 M** **RCN 290 M**	*Incremental* **RON 275**	**RON 285** **RON 287**
Interface	EnDat 2.2		Fanuc αi	Mitsubishi	⊓⊔ TTL	∿ 1 V_{PP}
Position values/revolution	*RCN 25x1:* 268 435 456 (28 bits); *RCN 23x1:* 67 108 864 (26 bits) *RCN 2x0:* 33 554 432 (25 bits)				–	
Signal periods/revolution	*RCN 2xx1:* 16 384; *RCN 2x0:* 2048				90 000/180 000[2]	18 000
System accuracy	*RCN 25x1:* ±2″; *RCN 23x1:* ±4″; *RCN 2x0:* ±6″				±5″	±5″; ±2.5″
Mech. permissible speed[3]	≤ 3000 rpm	*RCN 2x81:* ≤ 1500 rpm *RCN 280:* ≤ 3000 rpm	≤ 3000 rpm		≤ 3000 rpm	

	Absolute **RCN 5511**[1] **RCN 5311**[1]	**RCN 5581** **RCN 5381**	**RCN 5591 F** **RCN 5391 F**	**RCN 5591 M** **RCN 5391 M**
Interface	EnDat 2.2		Fanuc αi	Mitsubishi
Position values/revolution	*RCN 55x1:* 268 435 456 (28 bits); *RCN 53x1:* 67 108 864 (26 bits)			
Signal periods/revolution	16 384			
System accuracy	*RCN 55x1:* ±2″; *RCN 53x1:* ±4″			
Mech. permissible speed[3]	≤ 2000 rpm	≤ 1500 rpm (operating temperature ≤ 50 °C) ≤ 1200 rpm (operating temperature > 50 °C)	≤ 2000 rpm	

	Absolute **RCN 8511**[1] **RCN 8311**[1]	**RCN 8581** **RCN 8381**	**RCN 8591 F** **RCN 8391 F**	**RCN 8591 M** **RCN 8391 M**	*Incremental* **RON 786**	**RON 886**	**RPN 886**
Interface	EnDat 2.2		Fanuc αi	Mitsubishi	∿ 1 V_{PP}		
Position values/revolution	536 870 912 (29 bits)				–		
Signal periods/revolution	32 768				18 000, 36 000	36 000	180 000
System accuracy	*RCN 85x1:* ±1″; *RCN 83x1:* ±2″				±2″	±1″	
Mech. permissible speed[3]	≤ 1500 rpm[4]	≤ 750 rpm	≤ 1500 rpm[4]		≤ 1000 rpm		

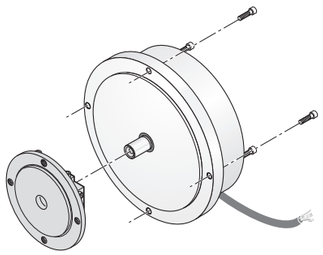
	Absolute **RCN 6310**[1]	**RCN 6390 F**	**RCN 6390 M**
Interface	EnDat 2.2	Fanuc Serial Interface αi interface	Mitsubishi high speed interface
Position values/revolution	268 435 456 (28 bits)		
System accuracy	±2.0″		
Mech. permissible speed	≤ 200 rpm[5]		

1) Also available with functional safety
2) Integrated 5/10-fold interpolation
3) See *Speeds* in the *Angle Encoders with Integral Bearing* brochure
4) For 60 mm hollow shaft diameter;
for 100 mm hollow shaft diameter: ≤ 1200 rpm
5) Higher speeds possible depending on the operating temperature

ROC, ROD sealed angle encoders
With integral bearing

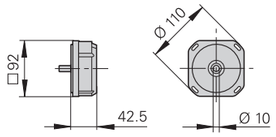
ROC and **ROD** angle encoders with solid shaft for separate shaft coupling are particularly suited to applications where higher shaft speeds and larger mounting tolerances are required. The precision shaft couplings allow up to ±1 mm of axial motion.

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 find the system accuracy.



For separate shaft coupling
ROC 2000 and ROD 200
- Compact dimensions
- Sturdy design
- Typically used with rotary tables, tilting tables, for positioning and synchronization monitoring

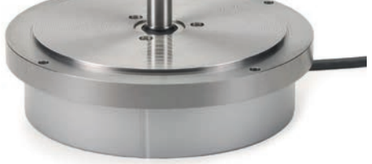


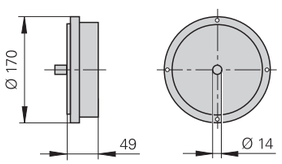


	Absolute ROC 2310	ROC 2380	ROC 2390F	ROC 2390M	*Incremental* ROD 270	ROD 280
Interface	EnDat 2.2[4]	EnDat 2.2[4] ∿ 1 V_{PP}	Fanuc αi	Mitsubishi	⊓⊔TTL	∿ 1 V_{PP}
Signal periods/revolution	16384				180000[3]	18000
System accuracy[1]	±5″					
Mech. permissible speed	≤ 3000 rpm				≤ 10000 rpm	

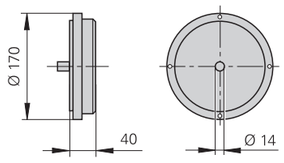
[1] Without shaft coupling
[2] 2-fold integrated interpolation
[3] 10-fold integrated interpolation
[4] DRIVE-CLiQ via EIB

For separate shaft coupling:
ROC 7000, ROD 780 and ROD 880
- High accuracy
  ROC 7000, ROD 780: ±2″
  ROD 880: ±1″
- Ideal for angle measurement on high-precision rotary tables, indexing heads, or measuring machines





ROD 780, ROD 880



ROC 7000

	Absolute ROC 7310	ROC 7380	ROC 7390F	ROC 7390M	*Incremental* ROD 780	ROD 880
Interface	EnDat 2.2[2]	EnDat 2.2[2] ∿ 1 V_{PP}	Fanuc αi	Mitsubishi	∿ 1 V_{PP}	
Signal periods/revolution	16384				18000, 36000	36000
System accuracy[1]	±2″				±2″	±1″
Mech. permissible speed	≤ 3000 rpm				≤ 1000 rpm	

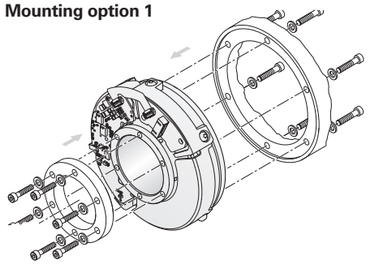
[1] Without shaft coupling
[2] DRIVE-CLiQ via EIB

DRIVE-CLiQ is a registered trademark of Siemens AG.

MRP, SRP angle encoder modules
Assemblies for high-precision rotary axes

MRP angle encoder module: combination of angle encoder and bearing
Angle encoder modules from HEIDENHAIN are optimally matched combinations of angle encoders and high-precision bearings. They boast high measuring and bearing accuracy, very high resolution, exceptional repeatability and low starting torque for smooth motion. Their design as specified and tested complete assemblies makes handling and installation easier.

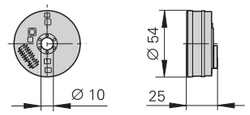
Mounting option 1



MRP 2000 series
Angle encoder modules with integrated encoder and bearing
- Particularly compact dimensions
- High measuring and bearing accuracy
- Hollow shaft diameter: 10 mm



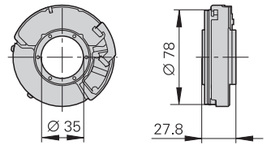
MRP 2010



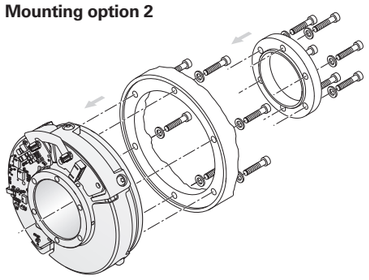
MRP 5000 series
Angle encoder modules with integrated encoder and bearing
- Compact dimensions
- High measuring and bearing accuracy
- Hollow shaft diameter: 35 mm



MRP 5010



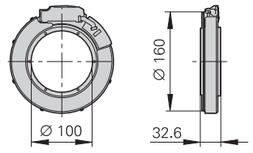
Mounting option 2



MRP 8000 / MRP 8100 series
Angle encoder modules with integrated encoder and bearing
- Compact dimensions
- High measuring and bearing accuracy
- *MRP 8000:* 100 mm hollow shaft Ø
  MRP 8100: 80 mm hollow shaft Ø
- *MRP 8100:* axial load of up to 1500 N

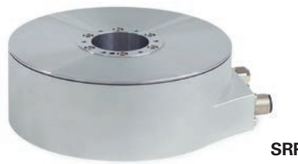


MRP 8010

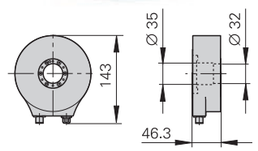


SRP angle encoder module: combination of angle encoder, bearing and motor
SRP angle encoder modules are additionally equipped with an integrated torque motor. They combine a motor, precision bearing and encoder with very high accuracy in one compact system. The torque motor with its very low cogging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

SRP 5000 series
Angle encoder modules with integrated encoder, bearing and torque motor
- Compact dimensions
- Torque motor with low cogging torque
- Peak torque: 2.70 Nm
- Rated torque: 0.385 Nm



SRP 5000



	Incremental **MRP 2080**	***Absolute*** **MRP 2010**
Interface	⁓ 1 V_{PP}	EnDat 2.2
Signal periods/revolution	2048	
System accuracy	±7″	
Maximum permissible axial load	50 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	≤ 0.60 µm	
Wobble of the axis	2.5″	

	Incremental **MRP 5080**	***Absolute*** **MRP 5010**
Interface	⁓ 1 V_{PP}	EnDat 2.2
Signal periods/revolution	30000	16384
System accuracy	±2.5″ or ±5″	
Maximum permissible axial load	200 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	≤ 0.20 µm	
Wobble of the axis	0.7″	

	Incremental **MRP 8080**	**MRP 8180**	***Absolute*** **MRP 8010**	**MRP 8110**
Interface	⁓ 1 V_{PP}		EnDat 2.2	
Signal periods/revolution	63000		32768	
System accuracy	±1″ or ±2″			
Maximum permissible axial load	300 N	1500 N	300 N	1500 N
Radial guideway accuracy	≤ 0.15 µm	≤ 0.25 µm	≤ 0.15 µm	≤ 0.25 µm
Wobble of the axis	0.5″	0.7″	0.5″	0.7″

	Incremental **SRP 5080**	***Absolute*** **SRP 5010**
Interface	⁓ 1 V_{PP}	EnDat 2.2
Signal periods/revolution	30000	16384
System accuracy	±2.5″ or ±5″	
Maximum permissible axial load	200 N (centered load, purely static, without additional vibrations or shock loading)	
Radial guideway accuracy	≤ 0.20 µm	
Wobble of the axis	0.7″	

ERP, ERO modular angle encoders

Without integral bearing, with optical scanning

The HEIDENHAIN **ERP** and **ERO** angle encoders without integral bearing operate without friction and use a circular glass scale with hub as the graduation carrier. They are characterized by their low weight and compact dimensions. They thus permit high accuracies and are designed for integration in machine elements or components.

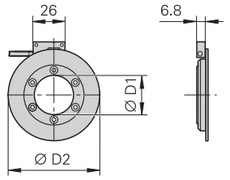
The attainable system accuracy depends on the eccentricity of the graduation to the drive shaft bearing, as well as the radial runout and wobble of the bearing.

The interferential scanning principle serves as the basis for the high accuracy of the **ERP** encoders. This makes them particularly attractive for high-precision angle measuring tables and precision devices in angular metrology. Additionally, the HSP 1.0 signal stabilization feature makes the encoders highly resistant to environmental factors.

Applications for the **ERO** are found in metrology, in compact rotary tables, and in precise, highly dynamic drives.

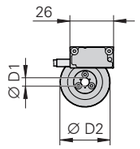
ERP 1000 series
- Very high resolution and accuracy
- Small mass, low mass moment of inertia
- Very flat design
- Circular scale available as full circle or segment

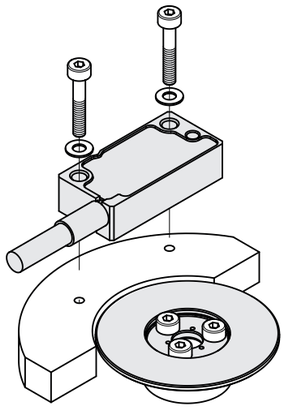




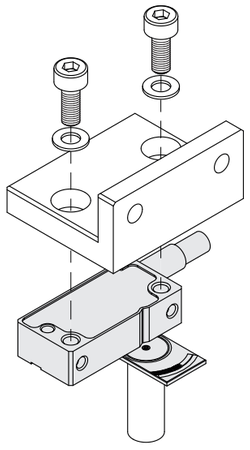
ERO 2000 series
- Very compact dimensions
- Small mass, low mass moment of inertia
- For highly dynamic applications







TKN ERO 2000 (full circle)



TKN ERO 2002 (segment)

	Incremental **ERP 1070** **ERP 1080** **ERP 1010**			
Interface	*ERP 1070:* ⊓⊔ TTL; *ERP 1080:* ∿ 1 V_{PP}; *ERP 1010:* EnDat 2.2			
Signal periods/revolution	23000	30000	50000	63000
Accuracy of graduation	±4″	±3″	±1.8″	±1.5″; ±0.9″
Inside diameter D1	13 mm	32 mm	62 mm	104 mm
Outside diameter D2	57 mm	75 mm	109 mm	151 mm
Mech. permissible speed	≤ 2600 rpm	≤ 2000 rpm	≤ 1200 rpm	≤ 950 rpm

	Incremental **ERO 2080**	
Interface	∿ 1 V_{PP}	
Signal periods/revolution	4096	2500
Accuracy of graduation	±8″	±10″
Inside diameter D1	5 mm	–
Outside diameter D2	30 mm	18.6 mm
Mech. permissible speed	≤ 14000 rpm	≤ 24000 rpm

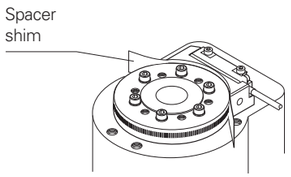
ECA, ERA modular angle encoders
Without integral bearing, with optical scanning

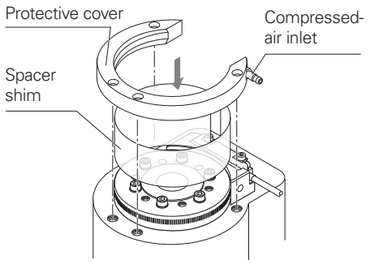
The **ECA** and **ERA** HEIDENHAIN angle encoders with solid graduation carrier function without integral bearings. They are intended for integration in machine elements or components.

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 **ECA** and **ERA** angle encoders feature a sturdy steel scale drum and are suited for high shaft speeds of up to 20 000 rpm. They are typically found on fast running spindles, rotary tables and tilting axes.

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

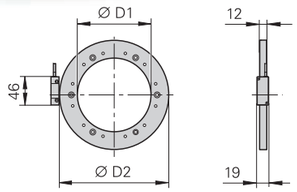




ERA 4000
With protective cover

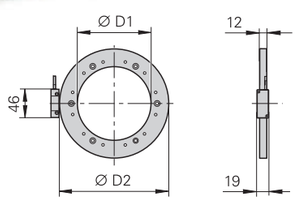
ECA 4400 series
- High accuracy
- Sturdy design with steel scale drum and METALLUR graduation
- Various drum versions
  ECA 4xx0: with centering collar
  ECA 4xx2: with 3-point centering





ERA 4000 series
- High shaft speeds of up to 20 000 rpm
- Sturdy design with steel scale drum and METALLUR graduation
- Axial motion of measured shaft permissible up to ± 0.5 mm
- The ERA 4480 C is available with larger diameters or as versions with protective cover
- Various drum versions
  ERA 4xx0: with centering collar
  ERA 4xx2: with 3-point centering





	Absolute **ECA 4410**[1] **ECA 4490 F** **ECA 4490 M** **ECA 4490 P** **ECA 4490 Y**								
Interface	*ECA 4410:* EnDat 2.2; *ECA 4490 F:* Fanuc αi; *ECA 4490 M:* Mitsubishi; *ECA 4490 P:* Panasonic; *ECA 4490 Y:* Yaskawa								
Signal periods/revolution	8195	10 010	11 616	14 003	16 379	19 998	25 993	37 994	44 000
Accuracy of graduation	±3″	±2.5″	±2.8″	±2″	±1.9″	±1.8″	±1.7″	±1.5″	±1.5″
Inside diameter D1	70 mm	80 mm	120 mm	120 mm	150/185 mm	180/210 mm	270 mm	425 mm	512 mm
Outside diameter D2	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
Mech. permissible speed	≤ 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 C**[1] Signal period: 20 µm **ERA 4480 C** Signal period: 40 µm **ERA 4880 C** Signal period: 80 µm								
Interface	~ 1 V_{PP}								
Signal periods/revolution *ERA 4280 C* *ERA 4480 C* *ERA 4880 C*	12 000 6000 3000	16 384 8192 4096	20 000 10 000 5000	28 000 14 000 7000	32 768 16 384 8192	40 000 20 000 10 000	52 000 26 000 13 000	– 38 000 –	– 44 000 –
Accuracy of graduation	±5″	±3.7″	±3″	±2.5″				±2″	
Inside diameter D1	40 mm	70 mm	80 mm	120 mm	150 mm	180 mm	270 mm	425 mm	512 mm
Outside diameter D2	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
Mech. permissible speed	≤ 20 000 rpm	≤ 15 000 rpm	≤ 12 250 rpm	≤ 8750 rpm	≤ 7500 rpm	≤ 6250 rpm	≤ 4750 rpm	≤ 3250 rpm	≤ 2750 rpm

[1] For other drum versions, please refer to the *Modular Angle Encoders with Magnetic Scanning* brochure

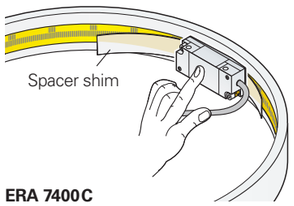
ERA modular angle encoders

Without integral bearing, with optical scanning

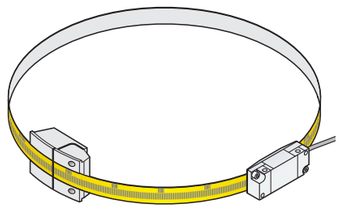
The HEIDENHAIN **ERA** angle encoders with steel scale tape as measuring standard function without integral bearings. They are intended for integration in machine elements or components. They are designed to meet the following requirements:

- Large hollow shaft diameters of up to 10 m
- No additional starting torque caused by rotary 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

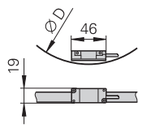
ERA 7000 and ERA 8000 series

- For very large diameters of up to 10 m
- METALLUR steel scale tape

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

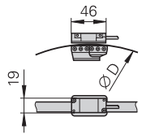


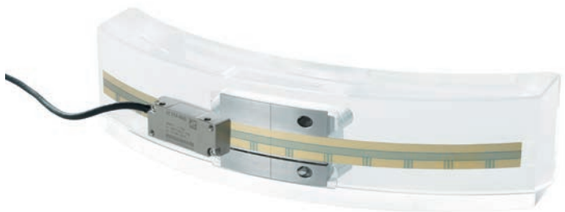


ERA 8000 series

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





	Incremental **ERA 7400C**		
Interface	∿ 1 V_{PP}; signal period 40 µm (on circumference)		
Signal periods/revolution	36000	45000	90000
Accuracy of graduation	±3.9″	±3.2″	±1.6″
Accuracy of the scale tape	±3 µm per meter of tape		
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/revolution	36000	45000	90000
Accuracy of graduation	±4.7″	±3.9″	±1.9″
Accuracy of the scale tape	±3 µm per meter of tape		
Diameter D1	458.04 mm	572.63 mm	1145.73 mm
Mech. permissible speed	≤ 50 rpm		≤ 45 rpm

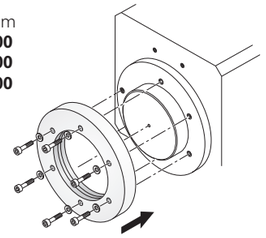
ECM, ERM modular angle encoders
Without integral bearing, with magnetic scanning

The **ECM** and **ERM** modular angle 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.

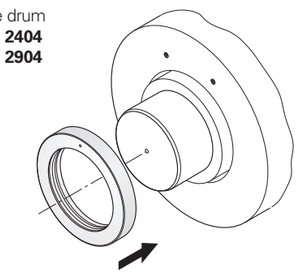
The attainable system accuracy depends on the eccentricity of the graduation to the drive shaft bearing, as well as the radial runout and wobble of the bearing.

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 and ECM 2400
- 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
ECM 2400

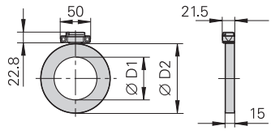


Scale drum
ERM 2404
ERM 2904



Absolute position measurement

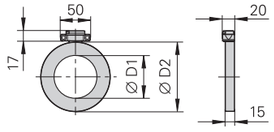
ECM 2400 series
- Drum fastening with axial screws
- Functional safety with ECM 2410



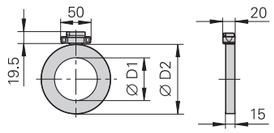


Incremental position measurement

ERM 2200 series
- High graduation accuracy
- Distance-coded reference marks
- Drum fastening with axial screws
- *ERM 2283:* low interpolation error, no reversal error

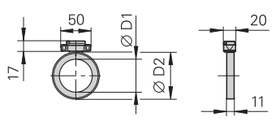


ERM 2400 series
- Distance-coded reference marks
- Drum fastening with axial screws
- Large selection of drum diameters





ERM 2484 and ERM 2984 series
- Especially compact dimensions for limited installation space
- High mechanically permissible shaft speeds and therefore particularly well suited for spindles
- Drum fastening via axial clamping





	Absolute **ECM 2410**[1] **ECM 2490F** **ECM 2490M**						
Interface	*ECM 2410:* EnDat 2.2; *ECM 2490F:* Fanuc αi; *ECM 2490M:* Mitsubishi						
Signal periods/revolution	900	1024	1200	1400	1696	2048	2600
Accuracy of graduation	±8″	±7″	±6″	±5.5″	±4.5″	±4″	±3.5″
Inside diameter D1	70 mm	80 mm	105 mm	130 mm	160 mm	180 mm	260 mm
Outside diameter D2	113.16 mm	128.75 mm	150.88 mm	176.03 mm	213.24 mm	257.5 mm	326.9 mm
Mech. permissible speed	≤ 14500 rpm	≤ 13000 rpm	≤ 10500 rpm	≤ 9000 rpm	≤ 7000 rpm	≤ 6000 rpm	≤ 4500 rpm

	Incremental **ERM 2410** (grating period ≈ 400 µm) **ERM 2420** **ERM 2480** **ERM 2280** (grating period ≈ 200 µm) **ERM 2283**								
Interface	*ERM 2410:* EnDat 2.2[2]; *ERM 2420:* ⊓⊔TTL; *ERM 2480/ERM2280/ERM 2283:* ∿ 1 V_{PP}								
Signal periods/revolution	600	720	900	1024	1200	1400	2048	2600	3600
ERM 2200	1200	1440	1800	2048	2400	2800	4096	5200	7200
Accuracy of graduation	±11″	±10″	±8″	±7″	±6″	±5.5″	±4″	±3.5″	±3″
ERM 2280	±10″	±8.5″	±7″	±6″	±5.5″	±5″	±3.5″	±3″	±2.5″
ERM 2283	±6.5″	±5.5″	±4.5″	±4″	±3.5″	±3″	±2″	±1.5″	–
Inside diameter D1	40 mm	55 mm	70 mm	80 mm	105 mm	130 mm	180 mm	260 mm	380 mm
Outside diameter D2	75.44 mm	90.53 mm	113.16 mm	128.75 mm	150.88 mm	176.03 mm	257.5 mm	326.9 mm	452.64 mm
Mech. permissible speed	≤ 19000 rpm	≤ 18500 rpm	≤ 14500 rpm	≤ 13000 rpm	≤ 10500 rpm	≤ 9000 rpm	≤ 6000 rpm	≤ 4500 rpm	≤ 3000 rpm

	Incremental **ERM 2484** (grating period ≈ 400 µm)				**ERM 2984** (grating period ≈ 1000 µm)			
Interface	∿ 1 V_{PP}							
Signal periods/revolution	512	600	900	1024	192	256	300	400
Accuracy of graduation	±17″	±14″	±10″	±9″	±68″	±51″	±44″	±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
Mech. permissible speed	≤ 42000 rpm	≤ 36000 rpm	≤ 22000 rpm	≤ 20000 rpm	≤ 47000 rpm	≤ 35000 rpm	≤ 29000 rpm	≤ 16000 rpm

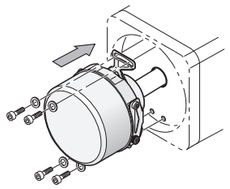
[1] Also available with functional safety
[2] Through integrated counting function after traverse of two reference marks

For other drum versions, please refer to our brochure *Modular Angle Encoders with Magnetic Scanning*

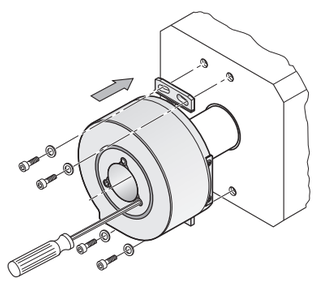
ECN, EQN, ERN rotary encoders

With integral bearing and mounted stator coupling
IP64 protection

HEIDENHAIN **ECN, EQN** and **ERN** rotary encoders with integral bearing and stator-mounted coupling 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.

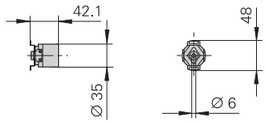


ECN/EQN/ERN 1000
ECN/EQN/ERN 400



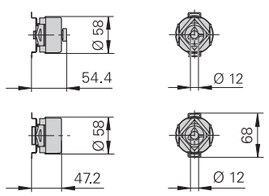
ECN/ERN 100

ECN/EQN/ERN 1000 series
- Miniaturized version
- Blind hollow shaft with 6 mm inside diameter
- Housing outside diameter: 35 mm
- Typical natural frequency f_N of the encoder coupling: 1500 Hz
  ERN 1023: 1000 Hz
- Mechanically permissible speed: ≤ 12000 rpm



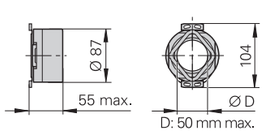


ECN/EQN/ERN 400 series
- Compact dimensions
- Blind hollow shaft or hollow through shaft with 8 mm, 10 mm, or 12 mm inside diameter
- Housing outside diameter: 58 mm
- Protection:
  IP67 at housing (IP66 with hollow through shaft)
  IP64 at shaft inlet (IP66 upon request)
- Typical natural frequency f_N of the encoder coupling: 1400 Hz (cable version)
- Mechanically permissible speed: ≤ 12000 rpm
- Fault exclusion of the mechanical coupling for functional safety available





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
- Typical natural frequency f_N of the encoder coupling: 1000 Hz
- Mechanically permissible speed:
  D ≤ 30 mm: ≤ 6000 rpm
  D > 30 mm: ≤ 4000 rpm



	Absolute ECN 1013	EQN 1025	ECN 1023 ECN 1023 S	EQN 1035 EQN 1035 S	*Incremental* ERN 1020	ERN 1030	ERN 1070	ERN 1080
Interface	EnDat 2.2[1] with ~ 1 V_{PP}		EnDat 2.2[1]; DRIVE-CLiQ		⊓⊔ TTL	⊓⊔ HTL	⊓⊔ TTL[2]	~ 1 V_{PP}
Position values/revolution	8192 (13 bits)		8388608 (23 bits)		–			
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–			
Line count	512		–		100 to 3600		1000/2500/3600	100 to 3600
Supply voltage	DC 3.6 V to 14 V		DC 3.6 V to 14 V; DC 10 V to 28.8 V		DC 5 V	DC 10 V to 30 V	DC 5 V	

	Absolute ECN 413	EQN 425	ECN 425[3] ECN 425 F ECN 424 S[3]	EQN 437[3] EQN 437 F EQN 436 S[3]	*Incremental* ERN 420 ERN 460	ERN 430	ERN 480
Interface	EnDat 2.2[1] with ~ 1 V_{PP}; SSI	EnDat 2.2[1] with ~ 1 V_{PP}; SSI	EnDat 2.2[1]; Fanuc αi; DRIVE-CLiQ		⊓⊔ TTL; ⊓⊔ TTL	⊓⊔ HTL	~ 1 V_{PP}
Position values/revolution	8192 (13 bits)	8192 (13 bits)	*ECN 425, EQN 437:* 33554432 (25 bits) *ECN 424 S, EQN 436 S:* 16777216 (24 bits)		–		
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–		
Line count	512 or 2048	512 or 2048	–		250 to 5000		1000 to 5000
Supply voltage	3.6 V to 14 V; 4.75 V to 30 V	3.6 V to 14 V; 4.75 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

	Absolute ECN 113	ECN 125	*Incremental* ERN 120	ERN 130	ERN 180
Interface	EnDat 2.2[1] with ~ 1 V_{PP}	EnDat 2.2[1]	⊓⊔ TTL	⊓⊔ HTL	~ 1 V_{PP}
Position values/revolution	8192 (13 bits)	33554432 (25 bits)	–		
Line count	2048	–	1000 to 5000		
Supply voltage	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

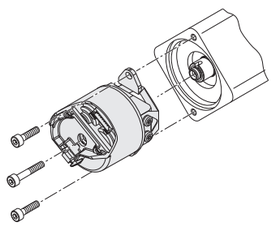
[1] Includes EnDat 2.1 command set; PROFIBUS DP via gateway
[2] 5/10-fold integrated interpolation
[3] Also available with functional safety

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

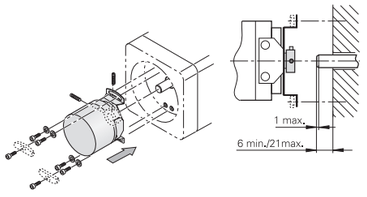
ECN, EQN, ERN rotary encoders

With integral bearing and mounted stator coupling
IP40 protection

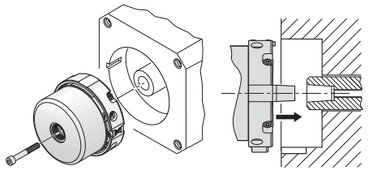
The **ECN, EQN** and **ERN** photoelectric rotary encoders from HEIDENHAIN with IP40 protection are specially designed for integration in motors. Bearings and mounted stator coupling are integrated. Absolute rotary encoders and versions with commutation tracks are available for synchronous motors. The 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

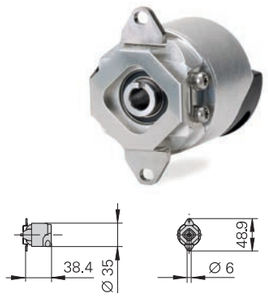


ERN 1123

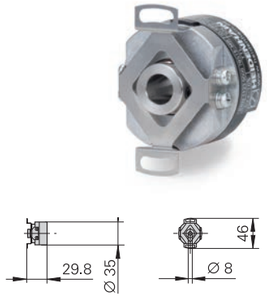


ECN/EQN/ERN 1300

ECN/EQN 1100 series
- Miniaturized version
- Blind hollow shaft, 6 mm inside diameter with positive-fit element
- Housing outside diameter: 35 mm
- Typical natural frequency f_N of the encoder coupling: 1000 Hz
- Mechanically permissible speed: 12000 rpm
- Fault exclusion of the mechanical coupling for functional safety available



ERN 1123
- Blind hollow shaft diameter: 8 mm
- Housing outside diameter: 35 mm
- Stator coupling with bolt-hole circle Ø 40 mm
- Typical natural frequency f_N of the encoder coupling: 1000 Hz
- Mechanically 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
- Typical natural frequency f_N of the encoder coupling: 1800 Hz
- Mechanically permissible speed:
  ERN/ECN: 15000 rpm
  EQN: 12000 rpm
- IP40 protection when mounted
- Fault exclusion of the mechanical coupling for functional safety available
- Version for hybrid motor cabe with just two wires for supply voltage and communication (E30-R2)



	Absolute **ECN 1113**	**EQN 1125**	**ECN 1123**[2] **ECN 1123 S**[2]	**EQN 1135**[2] **EQN 1135 S**[2]	***Incremental*** **ERN 1123**
Interface	EnDat 2.2[1] with ∿ 1 V_{PP}		EnDat 2.2[1]; DRIVE-CLiQ		⊓⊔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]
Supply voltage	DC 3.6 V to 14 V		***ECN 1123, EQN 1135:*** DC 3.6 V to 14 V; ***ECN 1123 S, EQN 1135 S:*** DC 10 V to 28.8 V		DC 5 V
Operating temperature	≤ 115 °C		***ECN 1123, EQN 1135:*** ≤ 115 °C; ***ECN 1123 S, EQN 1135 S:*** ≤ 95 °C		≤ 90 °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 **ECN 1313**	**EQN 1325**	**ECN 1325**[4]	**EQN 1337**[4]	**ECN 1324 S**[4]	**EQN 1336 S**[4]	***Incremental*** **ERN 1321**	**ERN 1326**	**ERN 1381**	**ERN 1387**
Interface	EnDat 2.2[1] with ∿ 1 V_{PP}		EnDat 2.2[1], EnDat 3		DRIVE-CLiQ		⊓⊔TTL		∿ 1 V_{PP}	
Position values/revolution	8192 (13 bits)		33554432 (25 bits)		16777216 (24 bits)		–			
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–	4096 (12 bits)	–			
Line count	512 or 2048		–				1024 2048 4096		512 2048 4096	2048
Commutation signals	–						–	Block commutation[2]	–	Z1 track[3]
Supply voltage	DC 3.6 V to 14 V (EnDat2.2); DC 4 V to 14 V (EnDat 3[5])				DC 10 V to 28.8 V		DC 5 V			
Operating temperature	≤ 115 °C				≤ 100 °C		≤ 120 °C; ***4096 lines:*** ≤ 100 °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
[5] With hybrid motor cable

DRIVE-CLiQ is a registered trademark of Siemens AG.

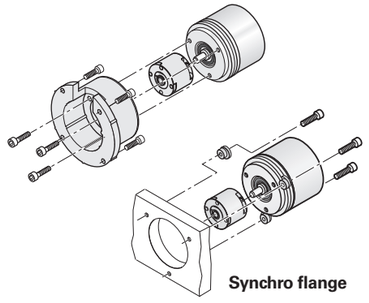
ROC, ROQ, ROD rotary encoders

With integral bearing, for separate shaft coupling

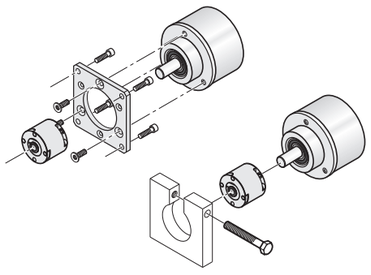
HR handwheel

The **ROC, ROQ** and **ROD** photoelectric rotary encoders 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.



Synchro flange



Clamping flange

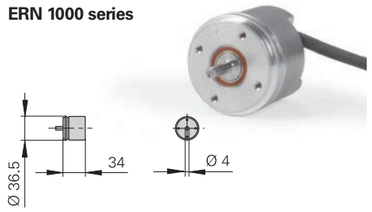
The **HR** electronic handwheel features an integral bearing and mechanical detent. It was conceived for use in portable or stationary housings, e.g. for positioning units or automation applications.

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

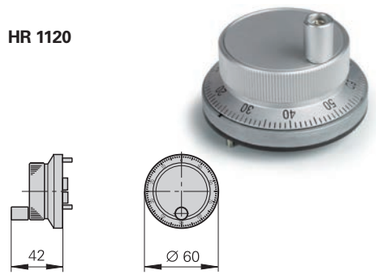
HR handwheel
- Compact dimensions
- Sturdy design
- Mechanical detent

ROC/ROQ/ROD 400 series
- Industrial standard regarding 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 available

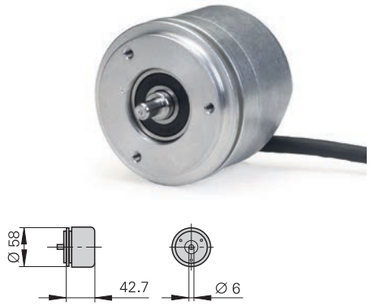
ERN 1000 series



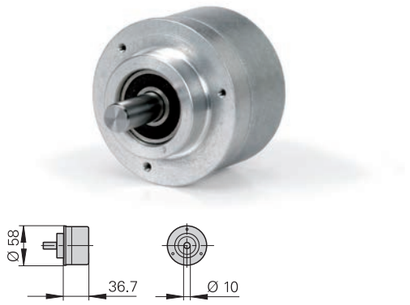
HR 1120



The 400 series with synchro flange



The 400 series with clamping flange



	Absolute				*Incremental*				
	ROC 1013	**ROQ 1025**	**ROC 1023** **ROC 1023 S**	**ROQ 1035** **ROQ 1035 S**	**ROD 1020**	**ROD 1030**	**ROD 1070**	**ROD 1080**	**HR 1120**
Interface	EnDat 2.2[1] with ~ 1 V_{PP}		EnDat 2.2[1]; DRIVE-CLiQ		⊓⊔ TTL	⊓⊔ HTL	⊓⊔ TTL[2]	~ 1 V_{PP}	⊓⊔ TTL
Position values/ revolution	8192 (13 bits)		8388608 (23 bits)		–				
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–				
Line count/ signal periods	512		–		100 to 3600		Up to 36000[2]	100 to 3600	100
Supply voltage	DC 3.6 V to 14 V		DC 3.6 V to 14 V; DC 10 V to 28.8 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] Signal periods above 3600 are generated through integrated 5/10-fold interpolation

DRIVE-CLiQ is a registered trademark of Siemens AG.

Synchro flange	*Absolute* **ROC 413**	**ROQ 425**	**ROC 424 S**[1]	**ROQ 436 S**[1]	**ROC 425**[1] **ROC 425 F**	**ROQ 437**[1] **ROQ 437 F**	*Incremental* **ROD 426**	**ROD 466**	**ROD 436**	**ROD 486**
Clamping flange							**ROD 420**	**–**	**ROD 430**	**ROD 480**
Interface	EnDat 2.2[2] with ~ 1 V_{PP}; SSI		DRIVE-CLiQ		EnDat 2.2[2]; Fanuc αi		⊓⊔ TTL	⊓⊔ TTL	⊓⊔ HTL	~ 1 V_{PP}
Position values/revolution	8192 (13 bits)		16777216 (24 bits)		33554432 (25 bits)		–			
Revolutions	–	4096 (12 bits)	–	4096 (12 bits)	–	4096 (12 bits)	–			
Line count/signal periods	512		2048				50 to 5000 *ROD 426/466:* up to 10000[3]			1000 to 5000
Supply voltage	DC 3.6 V to 14 V; DC 4.75 V to 30 V		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

[1] Also available with functional safety
[2] Includes EnDat 2.1 command set; PROFIBUS DP via gateway
[3] Signal periods over 5000 are generated through signal doubling in the encoder

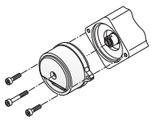
DRIVE-CLiQ is a registered trademark of Siemens AG.

ECI, EQI, EBI rotary encoders
Without integral bearing

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

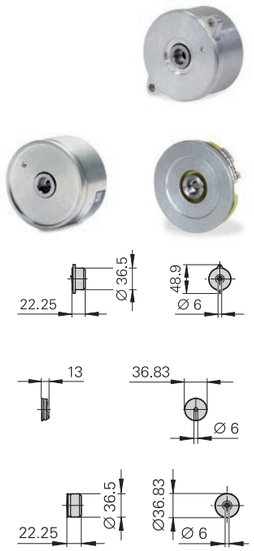
The **ECI, EQI** and **EBI 1100** inductive rotary encoders as well as the **ECI, EQI** and **EBI 1300** are mechanically compatible with the corresponding ExN photoelectric encoders: the shaft is fastened with a central screw. The stator of the encoder is fastened by several screws.

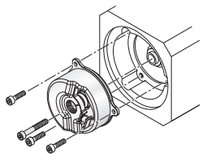
The correct installation of the rotary encoders without integral bearing can be inspected with the HEIDENHAIN PWM 21 or PWT 101 measuring and testing devices.



ECI/EQI/EBI 1100

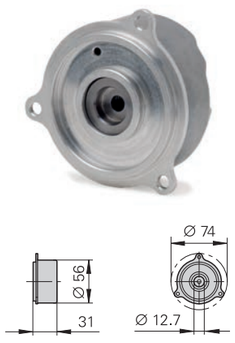
ECI/EQI/EBI 1100 series
- Miniature size
- Simple mounting without adjustment
- Blind hollow shaft diameter: 6 mm
- ***EBI 1135:*** multiturn function via battery-buffered revolution counter
- Version available featuring mounting-compatibility with ECN/EQN 1100
- Fault exclusion of the mechanical coupling for functional safety
- Synchro flange for variable mounting





ECI/EQI/EBI 1300

ECI/EQI/EBI 1300 series
- Simple mounting without adjustment
- Blind hollow shaft
- ***EBI 1335:*** multiturn function via battery-buffered revolution counter
- 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



	Absolute **ECI 1119**[1] **ECI 1319**[1) 3)] **ECI 1118**	**EQI 1131**[1)] **EQI 1331**[1) 3)]	**EBI 1135** **EBI 1335**
Interface	EnDat 2.2, EnDat 3		EnDat 2.2
Position values/revolution	524288 (19 bits) ***ECI 1118:*** 262144 (18 bits)		524288 (19 bits) ***EBI 1135:*** 262144 (18 bits)
Revolutions	–	4096 (12 bits)	65536 (16 bits)[2)]
Mech. permissible speed	≤ 15000 rpm	≤ 12000 rpm	≤ 12000 rpm
Shaft	Blind hollow shaft		

1) Also available with functional safety
2) Multiturn function via battery-buffered revolution counter
3) Also available with DRIVE-CLiQ interface

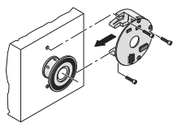
ERO, ECI, EBI rotary encoders
Without integral bearing

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 where there must be **no friction**.

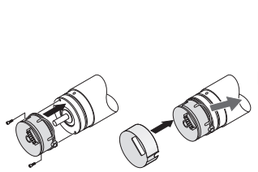
The **ECI/EBI 100** and **ECI/EBI 4000** inductive rotary encoders have a particularly small outside diameter with a large shaft opening. The encoders were conceived for simple axial mounting.

The correct installation of the rotary encoders without integral bearing can be inspected with the HEIDENHAIN PWM 21 or PWT 101 measuring and testing devices.

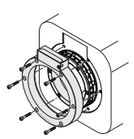
ERO 1200



ERO 1400

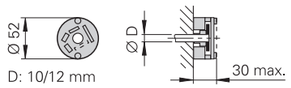


ECI/EBI 4000



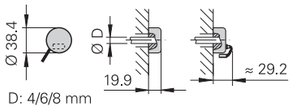
ERO 1200 series
- Compact dimensions
- For shaft diameters of up to 12 mm





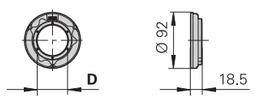
ERO 1400 series
- Miniaturized modular rotary encoders for measured shafts of up to 8 mm diameter
- Special integral mounting aid
- With cover cap



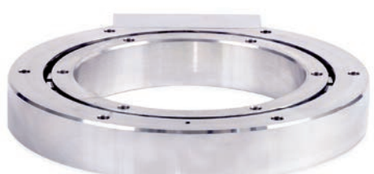


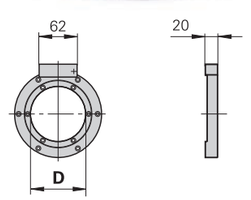
ECI/EBI 100 series
- Especially flat design
- Hollow through shaft Ø: 30, 38, 50 mm
- *EBI 135:* multiturn function via battery-buffered revolution counter





ECI/EBI 4000 series
- Flat design
- Hollow through shaft Ø: 90, 180 mm
- *EBI 4010:* multiturn function via battery-buffered revolution counter





	Incremental **ERO 1225**	**ERO 1285**
Interface	⊓⊔ TTL	∿ 1 V_{PP}
Line count	1024 2048	
Mech. permissible speed	≤ 25000 rpm	
Shaft diameter D	10 mm, 12 mm	

	Incremental **ERO 1420**	**ERO 1470**	**ERO 1480**
Interface	⊓⊔ TTL	⊓⊔ TTL[1)]	∿ 1 V_{PP}
Line count/Signal periods	512 1000 1024	Up to 37500[1)]	512 1000 1024
Mech. permissible speed	≤ 30000 rpm		
Shaft diameter D	4 mm, 6 mm, 8 mm		

[1)] Signal periods above 1500 are generated through integrated 5/10/20/25-fold interpolation

	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				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, 180 mm		

[1)] Also available with functional safety
[2)] Multiturn function via battery-buffered revolution counter

DRIVE-CLiQ is a registered trademark of Siemens AG.

Machine tool control

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 a simple three-axis CNC milling machine to a highly complex machine with up to 23 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
- High-speed machining operations
- Milling-turning operations

TNC controls are versatile and offer the right programming function for any task. Thanks to its **HEIDENHAIN Klartext** format, 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 shop-compatible functions support you optimally during:

- 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.

You can also reuse NC programs of older HEIDENHAIN lathe controls, such as the CNC PILOT 4290, on the CNC PILOT 640. With a convenient import filter you can simply load the programs into the new control, and then continue using them on the CNC PILOT 640.

Quickly and easily to the finished part
The operational design of the milling and lathe 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 **cycles** for real-world machining, 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 in accordance with the design engineer's specifications.

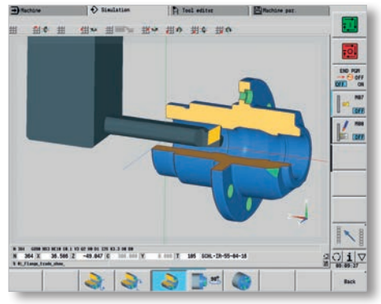
User-friendly and practical
Thanks to the robust design optimized for the application, HEIDENHAIN controls are ideally suited for a harsh work-day environment. The clear-cut screen displays informational notes, questions, prompts, program steps, graphics and soft-key rows. All texts are available in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

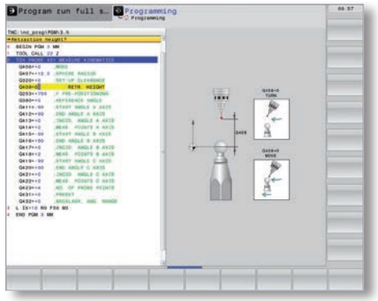


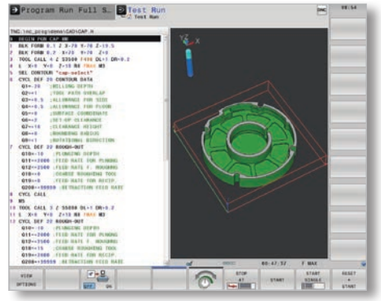
High quality and productivity
Thanks to intelligent motion control, HEIDENHAIN controls enable short machining times with perfect workpiece surfaces and very high workpiece accuracy. The bottom line is an increase in productivity: unit costs are reduced without affecting accuracy and surface quality.

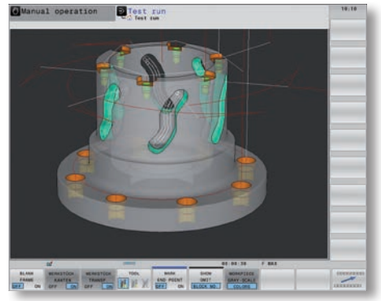
Automating manual operations
HEIDENHAIN controls let you also machine workpieces step-by-step without creating a complete machining program. In the process, you can switch between manual and automatic positioning.

Manufacturing complex components precisely
Regardless of whether the workpieces are simple or complex—HEIDENHAIN controls offer the appropriate functions. With them, neither are operations in a tilted plane a challenge, nor are multi-side or full-surface machining. 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 lathe controls


Klartext conversational input on a TNC


NC program simulation


High-resolution graphics of milling controls

HEIDENHAIN controls		Series	Page
Controls for milling machines	Contouring control for up to 24 control loops	**TNC7**	**46**
	Contouring control for up to 24 control loops	**TNC 640**	**48**
	Contouring control for up to 8 control loops	**TNC 620**	**50**
	Contouring control for up to 6 control loops	**TNC 320**	**50**
	Straight cut control for up to 5 control loops	**TNC 128**	**52**
Controls for lathes	Contouring control for up to 24 control loops	**CNC PILOT 640**	**54**
	Contouring control for up to 10 control loops	**MANUALplus 620**	**56**
Contouring controls	Digital control design		**58**
Accessories	Electronic handwheels	**HR**	**60**
	Programming stations	**TNC 640/TNC 620/TNC 320 DataPilot MP 620/CP 640**	**60**
	VT 121 camera system		**61**
Tool and workpiece setup and measurement	Workpiece touch probes	**TS**	**64**
	Tool touch probes	**TT**	**66**
	Transceivers	**SE**	**67**

TNC7 contouring control

For milling machines, milling-turning machines and machining centers

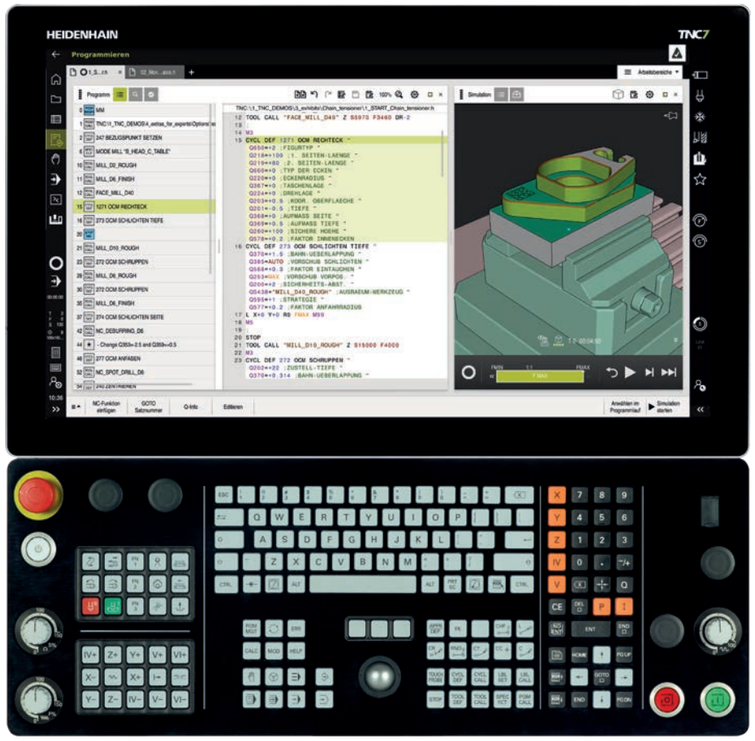
The **TNC7** supports you perfectly in your daily work and opens up completely new possibilities. Its optimized operating design ensures highly efficient and ergonomic operation at the machine tool. The control also provides optimal visualization of the workpiece and work envelope for easier programming, setup and machining.

The TNC7 is ideally suited for milling, turning, grinding and 5-axis machining on:

- Universal milling machines
- Boring mills
- High-speed machines
- Machining centers
- Large machines
- Milling-turning machines

Thanks to its optimized motion control, fast block processing and special control strategies, the TNC7 achieves impressive results. Consequently, the TNC7 stands for exceptional contour accuracy at very high machining speeds.

The TNC7 supports you from the initial idea to the finished workpiece. Its graphical programming allows you to draw contours directly on the touchscreen and automatically convert them into and save them in the Klartext conversational programming language. The TNC7 also provides graphically supported probing functions for aligning the workpiece and workholding equipment. During machining, the control's built-in process monitoring functionality helps you keep an eye on quality in three dimensions.





	TNC7
Axes	24 control loops (22 with functional safety), of which up to 4 can be configured as spindles
Interpolation	• Linear in up to 5 axes with Tool Center Point Management (**TCPM**) • Circular in up to 3 axes with tilted working plane • Helical • Cylinder surface[1)] • Rigid tapping[1)]
Program entry	HEIDENHAIN Klartext
Programming support	TNCguide provides user information directly on the control
CAD import[2)]	Loading of contours from 3D models
Program memory	SSDR hard drive with at least 21 GB
Position entry	Nominal positions in Cartesian or polar coordinates, absolute or incremental dimensions, in mm or inches; actual position capture
Input resolution and display step	Down to 0.1 µm or 0.0001°; optionally down to 0.01 µm or 0.00001°
Block processing time	0.5 ms (3D straight line without radius compensation at 100% PLC utilization)
Turning functions[2)]	• Turning tool data management • Tool-tip radius compensation • Constant cutting speed • Switching between milling and turning mode
High-speed cutting	Motion control with minimum jerk
Graphical programming	Intuitive graphical contour programming via symbolic gestures on the touchscreen
Coordinate transformations	• Shifting, rotating, mirroring, scaling (axis-specific) • Tilting the working plane, PLANE function[2)]
Machining cycles	For drilling, milling, turning[2)], interpolation turning[2)], grinding[2)], hobbing[2)] and cylinder surface machining[2)]; data-input with support from graphical images and forms
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and 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	RemoteAccess
Screen	15-inch or 24-inch screen for multitouch operation
Axis feedback control	• Feedforward control or operation with following error • Integrated digital motor control, including inverter
Adaptive Feed Control (AFC)[2)]	Adaptation of the contouring feed rate to the spindle power
Dynamic Collision Monitoring (DCM)[2)]	Dynamic monitoring of the work envelope for possible collisions with machine components[1)]
Accessories	• HR electronic handwheels • TS workpiece touch probe and TT tool touch probe

[1)] This function requires adaptation by the machine manufacturer
[2)] Software option
For further functions and function differences, see the product documentation

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, high-speed machining and 5-axis machining. The shop-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 closed-loop 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 3D contours.

You can program **turning contours** with the TNC 640 in the familiar HEIDENHAIN Klartext format. 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 codes, standardized table editors and smartSelect—the dialog-guided fast selection of functions—assist you while you work.





	TNC 640
Axes	24 control loops (22 with functional safety), of which up to 4 can be configured as spindles
Interpolation	• Linear in up to 5 axes with Tool Center Point Management (**TCPM**) • Circular in up to 3 axes with tilted working plane • Helical • Cylinder surface[1)] • Rigid tapping[1)]
Program entry	HEIDENHAIN Klartext conversational format, ISO (G codes)
Programming support	TNCguide presents user information directly on the control
CAD import[2)]	Loading of contours from 3D models
Program memory	HDR hard disk or SSDR solid state disk, at least 21 GB
Position entry	Nominal positions in Cartesian or polar coordinates, absolute or incremental dimensions, 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 (3D straight line without radius compensation at 100 % PLC utilization)
Turning functions[2)]	• Turning tool data management • Tool-tip radius compensation • Constant cutting speed • Toggling between milling and turning operations
High-speed cutting	Motion control with minimum jerk
FK free contour programming	HEIDENHAIN Klartext conversational format with graphical support
Coordinate transformation	• Shifting, rotating, mirroring, scaling (axis specific) • Tilting the working plane, PLANE function[2)]
Machining cycles	For drilling, milling, turning[2)], interpolation turning[2)], grinding[2)], hobbing[2)] and for cylinder surface machining[2)]; data input with graphical support
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and 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. 115 200 bauds)
Remote control and diagnosis	RemoteAccess
Screen	15-inch, 19-inch or 24-inch screen for multitouch operation
Axis feedback control	• Feedforward control or operation with following error • Integrated digital drive control including inverter
Adaptive feed control[2)]	AFC adjusts the contouring feed rate to the spindle power
Dynamic Collision Monitoring (DCM)[2)]	Dynamic monitoring of the working space for possible collisions with machine components[1)]
Accessories	• HR electronic handwheels • TS workpiece touch probe and TT tool touch probe

[1)] This function requires adaptation by the machine manufacturer
[2)] Software option
For further functions and differences in function, see the 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—shop-oriented programmability with the HEIDENHAIN Klartext format or offline programming—and their scope of features, they are especially suited for use on universal milling, drilling and boring machines for the following:

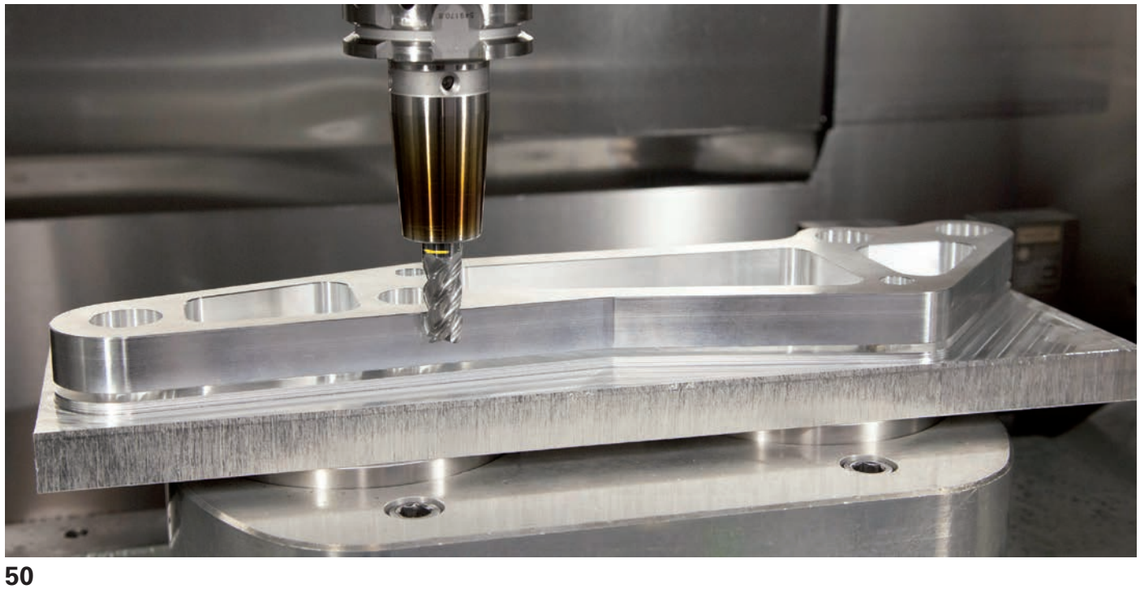
- Series and single-part production
- Tool making
- Machine building
- Research and development
- Prototypes and pilot plants
- Repair departments
- Training and education facilities

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 (which also provide nominal speed values), the **TNC 320** is well suited for retrofitting on machine tools.



TNC 620 touch screen version (only for TNC 620)



	TNC 620	TNC 320
Axes	8 control loops, of which up to 2 are configurable as spindles	6 control loops, of which up to 2 are configurable as spindles
Interpolation	• Linear in 4 (optionally 5) main axes • Circular in 2 (optionally 3) axes • Helical, superimposition of circular and straight paths • Cylinder surface[1)]	• Linear in 4 main axes • Circular in 2 axes • Helical, superimposition of circular and straight paths • Cylinder surface[1)]
Program entry	• HEIDENHAIN Klartext conversational format • ISO (G codes: input via soft keys or via external USB keyboard) • FK free programming of contours (software option on the TNC 620)	
Programming support	TNCguide presents user information directly on the TNC	
CAD import[1)]	Loading of contours from 3D models	
Program memory	7.7 GB CFR memory card	1.8 GB CFR memory card
Position entry	• 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	To 0.1 µm or 0.0001° (optionally to 0.01 µm or 0.00001°)	To 0.1 µm or 0.0001°
Block processing time	1.5 ms	6 ms
Coordinate transformation	• Shifting, rotating, mirroring, scaling (axis specific) • Tilting the working plane, PLANE function[1)]	
Machining cycles (some are software options on the TNC 620)	• Drilling, tapping, thread cutting, reaming and boring • Cycles for hole patterns, facing of flat surfaces • Clearance and finishing of pockets, slots and studs	
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and workpiece presetting (software option on the TNC 620)	
Graphics	For programming and program verification (software option on the TNC 620); graphic support with cycle programming	
Parallel operation	Programming during program run, program-run graphics (software option on the TNC 620)	
Data interface	Ethernet 1000BASE-T; USB 3.0; USB 2.0; RS-232-C/V.24 and RS-422/V.11 (max. 115200 bauds)	
Screen	15-inch screen (landscape) or 19-inch (portrait) for multitouch operation	15-inch screen with operating keys
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	• HR electronic handwheels • TS workpiece touch probe and TT tool touch probe	

[1)] Software option

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 the following possibilities:

- 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	5 control loops, of which up to 2 are configurable as spindles
Program entry	HEIDENHAIN Klartext conversational format
Program memory	1.8 GB CFR memory card
Position entry	• Positions in Cartesian or polar coordinates • Incremental or absolute dimensions • Display and entry in mm or inches
Input resolution and display step	To 0.1 µm or 0.0001°
Block processing time	6 ms
Coordinate transformation	Shifting, rotating, mirroring, scaling (axis specific)
Machining cycles	• 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 presetting
Graphics	For programming and program verification; graphic support for cycle programming
Parallel operation	Program run and programming, program-run graphics
Data interface	• Ethernet 1000BASE-T • USB 3.0; USB 2.0 • RS-232-C/V.24; max. 115 200 bauds
Screen	12.1-inch screen with operating keys
Axis feedback control	Feedforward control or operation with following error
Interfacing to the machine	Via integrated programmable logic controller (PLC); inputs/outputs expandable with PL 510
Accessories	• HR 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 designed for CNC lathes and is ideal for both horizontal and vertical lathes as well as for vertical boring and turning mills.

The CNC PILOT 640 supports lathes with main and counter spindle, one slide (X and Z axis), C axis or positionable spindle, driven tools, and 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 software 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 fixtures beforehand. TURN PLUS does everything else automatically.

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

The CNC PILOT 640 also supports multi-channel machining. Different machining steps can then be performed simultaneously using multiple slides.





	CNC PILOT 640
Axes	Up to 24 control loops (22 with functional safety)
Interpolation	• 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[1)] • B axis: 5-axis interpolation between X, Z, Y, B and C axes[1)]
Program entry	smart.Turn, DIN PLUS, Teach-In mode
Programming aids	TURNguide presents user information directly on the control
DXF import[1)]	Loading of DXF contours
Program memory	7.7 GB CFR memory card
Position entry	Nominal positions in Cartesian or polar coordinates, absolute or incremental dimensions, 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 axes: 1 µm B, C1/C2 axes: 0.001°
Block processing time	1.5 ms (3D straight line without radius compensation at 100 % PLC utilization)
Setup functions	• Setting the workpiece datum • Defining the tool change point • Defining the protection zone
Interactive contour programming (ICP)	Contour definition with graphic support
Machining cycles	Stock removal, recessing, recess turning, engraving, thread cutting, helical slot milling, boring, drilling, tapping, deburring, trochoidal milling, hobbing, eccentric and non-circular turning and simultaneous turning
Touch-probe cycles[1)]	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	RemoteAccess
Screen	15.6-inch or 24-inch screen for multitouch operation
Axis feedback control	• Feedforward control or operation with following error • Integrated digital drive control including inverter
Multi-channel capability	• Up to three channels for asynchronous multi-slide machining
Accessories	• HR electronic handwheels • TS workpiece touch probe and TT tool touch probe

[1)] Software option
For further functions and differences in function, see the product documentation

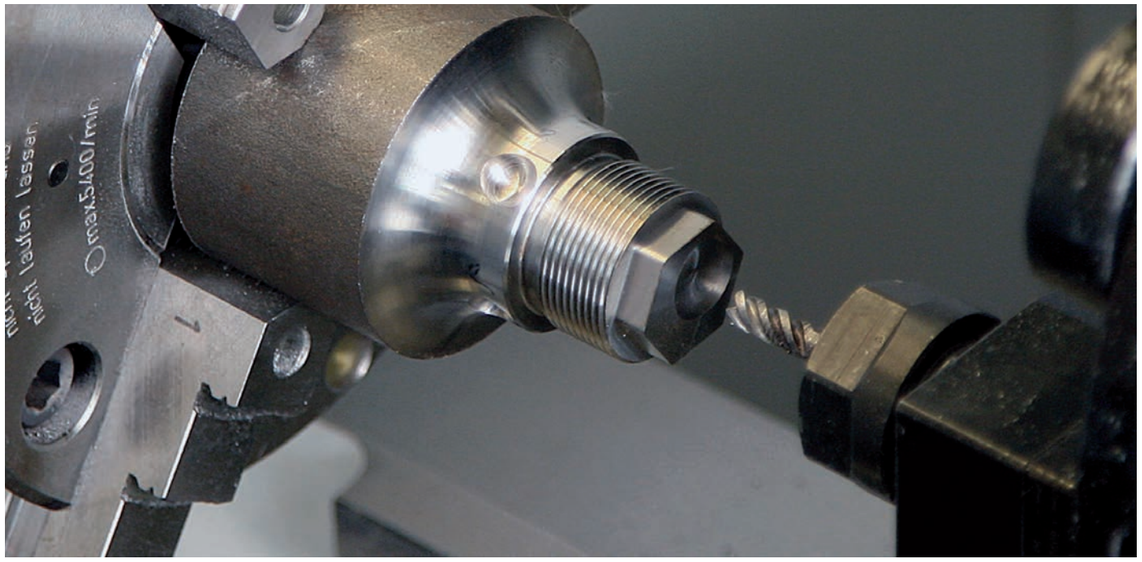
MANUALplus 620 contouring control
For CNC and cycle lathes

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

Regardless of whether you are manufacturing single parts or batches or whether your workpieces are simple or complex, the control 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	• 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[1)]
Program entry	Teach-In mode, smart.Turn[1)], DIN PLUS
Programming aids	TURNguide presents user information directly on the control
DXF import[1)]	Loading of DXF contours
Program memory	7.7 GB CFR memory card
Position entry	Nominal positions in Cartesian or polar coordinates, absolute or incremental dimensions, 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 axes: 1 µm B, C1/C2 axes: 0.001°
Block processing time	3 ms
Setup functions	• Setting the workpiece datum • Defining the tool change point • Defining the protection zone
Interactive contour programming (ICP)	Contour definition with graphic support
Machining cycles	Stock removal, recessing, recess turning, engraving, thread cutting, helical slot milling, boring, drilling, tapping, deburring, trochoidal milling, hobbing, eccentric and non-circular turning
Touch-probe cycles[1)]	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	RemoteAccess
Screen	15.6-inch screen for multitouch operation (with virtual operating panel)
Axis feedback control	• Feedforward control or operation with following error • Integrated digital drive control including inverter
Accessories	• HR electronic handwheels • TS workpiece touch probe and TT tool touch probe

[1)] Software option
For further functions and differences in function, see the product documentation

Contouring controls
Digital control design

Control packages from HEIDENHAIN are perfectly matched systems consisting of the following components:
- Software
- Control hardware and real-time hardware
- Drive electronics
- Motors
- Encoders

In this uniformly digital control solution, all components are connected over purely digital interfaces: the control components over **HSCI** (HEIDENHAIN Serial Controller Interface), which is 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.

The following HEIDENHAIN controls are available with HSCI and digital drive control:
- TNC7
- TNC 640
- TNC 620
- CNC PILOT 640
- MANUALplus 620

Motors for axis and spindle drives
HEIDENHAIN offers various motors for axis and spindle drives as accessories to its controls with integrated inverters:
- Feed motors with a stall torque of 1.5 Nm to 120 Nm and a power rating ranging from 0.5 kW to 14.4 kW.
- Spindle motors with a power rating ranging from 5.5 kW to 43.2 kW.

Inverter systems
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 30 kW. For the **modular inverters,** supply units from 30 kW to 135 kW as well as various power modules for axles 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.

Gen 3 drives
With the new Gen 3 components, HEIDENHAIN offers a complete system that is based on highly innovative and future-oriented technologies. You profit from state-of-the-art interface technology, improved performance data and increased controller performance. This makes the Gen 3 drive technology an important key component for machines that must fulfill stringent requirements regarding availability, surface quality and machining time.

Gen 3



TNC 640
With modular inverters, motors and position encoders



Accessories
Electronic handwheels and programming stations

With an 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 550 FS portable handwheels
The axis keys and certain functional keys are integrated in the housing. This way you can 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, the spindle speed, the operating mode and other functions, as well as override potentiometers for the 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. An adapter permits connection of up to three HR 150 electronic panel-mounted handwheels.



HR 130 for integration in the machine operating panel

With the TNC 640 and TNC 620/TNC 320 programming stations, you have the capability to program in Klartext conversational format just as you do at the machine, but away from the noise and distractions of the shop floor. With the DataPilot CP 640 and the DataPilot MP 620 you can also use smart.Turn, G codes and cycles to create programs for your HEIDENHAIN lathe controls.

Creating programs
The programming, testing and optimizing of HEIDENHAIN Klartext or G-code 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 with G codes as well as in Klartext conversational format, the programming stations can also be used in schools for TNC programming training.



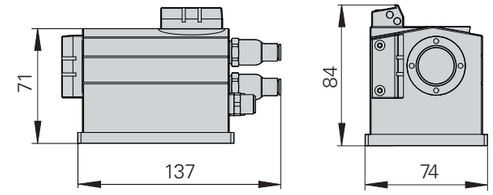
VT 121 camera system for tool inspection

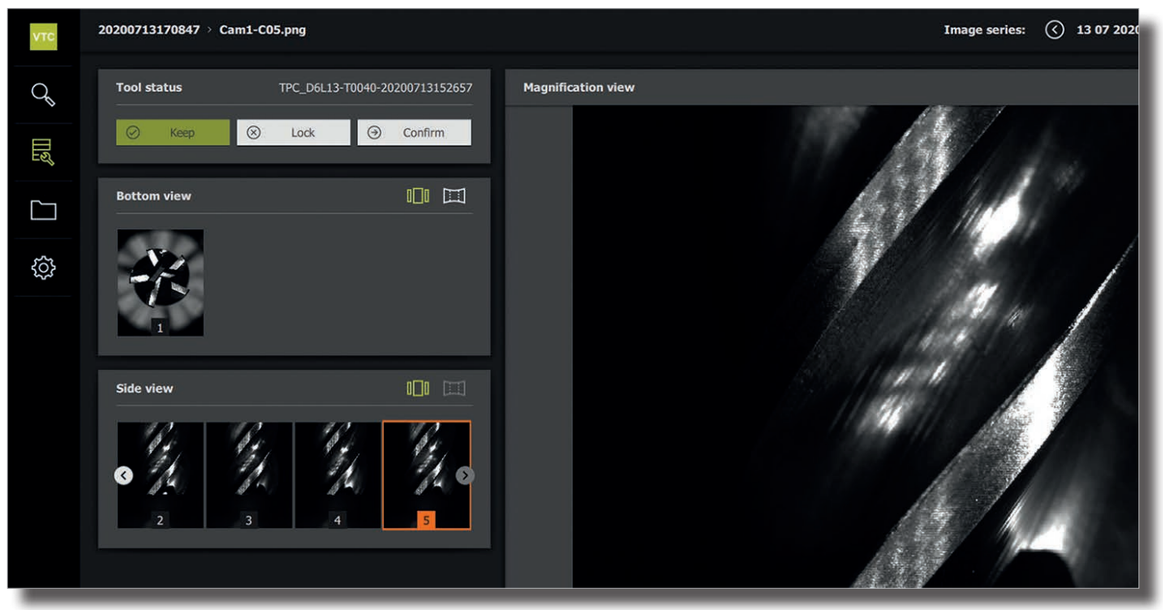
A system for always keeping an eye on the working space of the machine and the tool: the VT 121 camera systems from HEIDENHAIN monitor the cutting edges of tools during machining, thus providing for quick detection of worn tools. The camera system for tool inspection consists of the following two components:
- Camera with two objectives (VT 121)
- Software with touch operation (VTC)

Applications:
- Tool inspection before critical machining steps
- Documentation of tool condition and wear
- Optimization of cutting parameters
- Optimization of NC programs
- Breakage check
- Tool inspection after expiration of tool life

Your benefits:
- Automated imaging during machining
- Time savings, since the tool stays in the machine
- Compact system, even usable with very large tools
- Sturdy design
- Selective use of compressed air
- PC software for configuration and evaluation, even on the TNC







Digital Shop Floor: software solutions

The software solutions of the Digital Shop Floor from HEIDENHAIN are ideal for manufacturing companies that use CNC machine tools. They provide support along the process chain, ensuring improved process quality and enabling sustainable productivity gains.



Software solutions for your manufacturing operations

HEIDENHAIN StateMonitor

StateMonitor gives you insight into the production processes of your machine tools in real time. It collects and visualizes machine statuses, tool data, NC program durations and other machine-related data. This software solution allows you to document setup and production times, plan maintenance work and speed up your response time to malfunctions.
Interfaces:
- HEIDENHAIN DNC
- OPC UA
- umati
- MTConnect
- Modbus TCP
- FOCAS

HEIDENHAIN PlantMonitor

PlantMonitor provides a real-time overview of machine data from multiple StateMonitors, as well as an analysis of individually configurable machine combinations across multiple sites and production areas.



Software options for use with StateMonitor

HEIDENHAIN JobTerminal

JobTerminal manages job data, job times and job analyses.

HEIDENHAIN MaintenanceManager

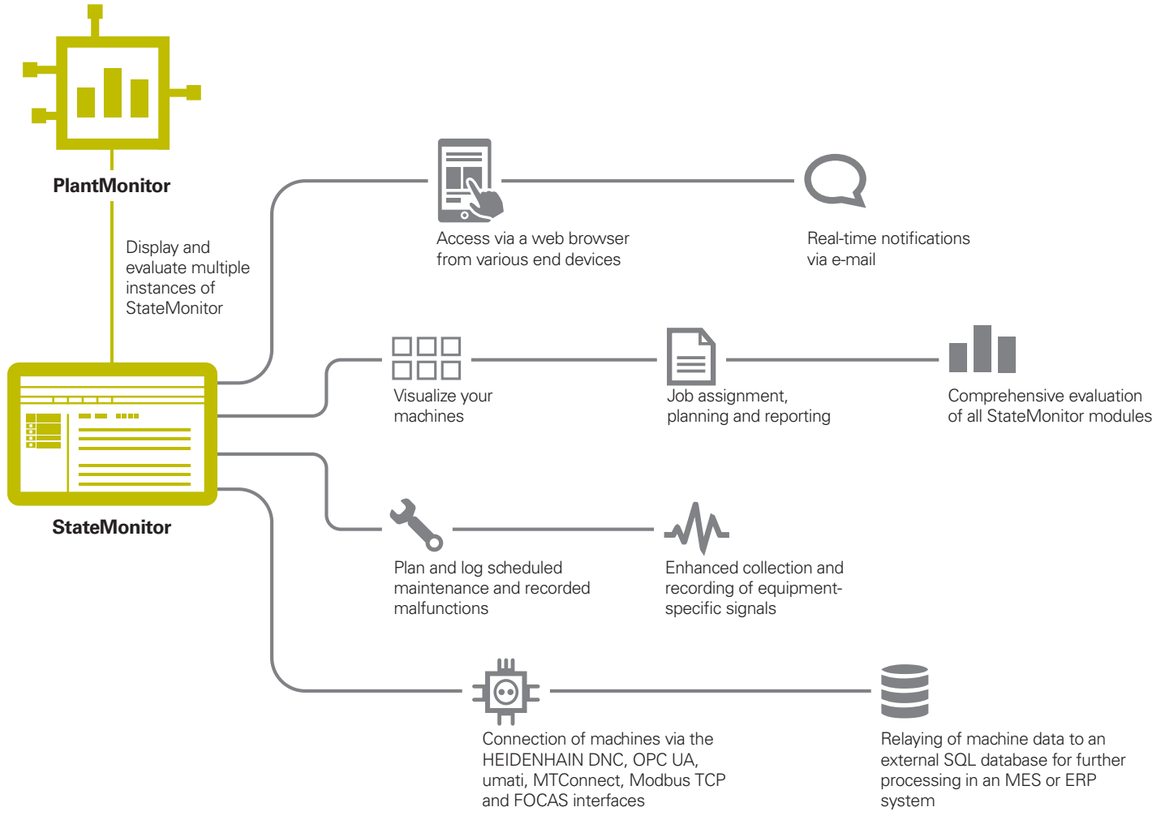
MaintenanceManager displays maintenance and malfunction messages. Maintenance work can be planned based on machining hours, machine messages and intervals of time.

HEIDENHAIN 5 Signals

5 Signals records additional machine data via PLC signals.

HEIDENHAIN 5 Machines

5 Machines allows you to connect an additional five machine tools.



Tool and workpiece setup and measurement
TS workpiece touch probes

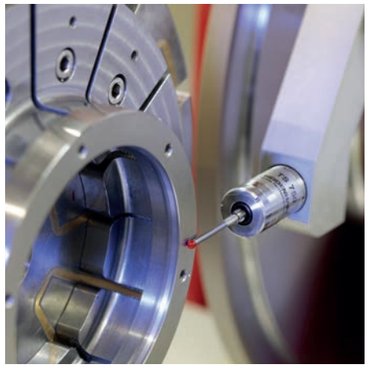
The **TS workpiece touch probes** from HEIDENHAIN help you perform setup, measuring and inspection functions directly on the machine tool.

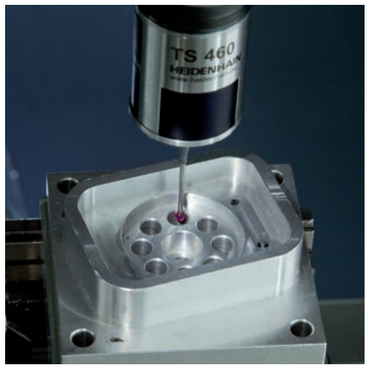
The stylus of a TS touch trigger probe is deflected upon contact with a workpiece surface. At that moment the TS generates a trigger signal that, depending on the model, is transmitted either by cable or over an infrared or radio beam to the control.

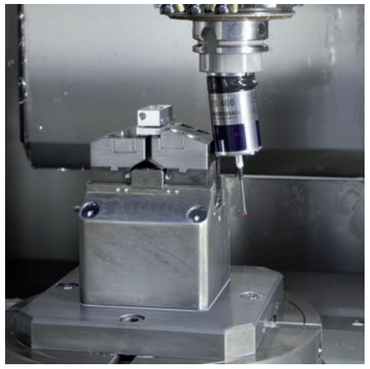
The control simultaneously saves the actual position values as measured by the machine axis encoders, and uses this information for further processing. The trigger signal is generated through a wear-free optical sensor that ensures high reliability.

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 speed
- 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 downstream 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 642:** touch probe for retrofitting
  Activation by switch in the taper shank
- **TS 760:** highly accurate touch probe
  High probing accuracy and repeatability, low probing force

Probe system with **cable-bound signal transmission** for machines with manual tool change, e.g. grinding, turning and milling machines:
- **TS 150:** cable-bound touch probe
  Radial or axial cable connection
- **TS 260:** cable-bound touch probe
  Radial or axial cable connection



TS 460



TS 642



TS 760



TS 260



TS 150/TS 750

	TS 460	TS 642	TS 760	TS 260	TS 150	TS 750
Machine type	**CNC machine tools for milling, drilling and boring,** as well as **lathes**			**CNC grinding machines or lathes**		
Signal transmission	Radio and infrared	Infrared	Radio and infrared	Cable		
Transceiver	***SE 540:*** infrared ***SE 640:*** infrared ***SE 660:*** radio/ infrared ***SE 661:*** radio/ infrared	***SE 540:*** infrared ***SE 640:*** infrared	***SE 540:*** infrared ***SE 640:*** infrared ***SE 660:*** radio/ infrared ***SE 661:*** radio/ infrared	–		
Supply voltage	Rechargeable or non-rechargeable batteries			10 V to 30 V DC	DC 10 V to 30 V[1)]	
Switching on/off	Radio or infrared transmission	Switch in the taper shank	Radio or infrared transmission	–		
Interface to control Signal level	EnDat via SE 661	HTL via SE transceiver	EnDat via SE 661	HTL		
Probe repeatability	2 σ ≤ 1 µm		2 σ ≤ 0.25 µm	2 σ ≤ 1 µm		2 σ ≤ 0.25 µm
Probing speed	≤ 3 m/min		≤ 0.1 m/min	≤ 3 m/min		≤ 0.1 m/min
Protection EN 60529	IP68					

[1)] Via UTI 150

TT tool touch probes

Tool measurement on the machine shortens non-productive times, increases machining accuracy and reduces the scrapping and reworking of machined parts. The tactile TT touch probes allow you to measure your tools efficiently and reliably.

Due to 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 3D touch trigger probes for tool measurement and inspection. The disk-shaped probe contact of the TT is deflected during the tactile probing of a tool. In that instant, the TT generates a trigger signal that is transmitted to the control, where it is then 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 transceiver unit
- The SE 660 is a shared transceiver 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 speed 1 m/min)	
Permissible deflection of probe contact	≈ 5 mm in all directions	
Supply voltage	DC 10 V to 30 V via NC	Rechargeable or nonrechargeable batteries
Interface to control Signal level	HTL	*SE 640:* infrared *SE 660:* radio/infrared *SE 661:* radio/infrared
Signal transmission	Via cable	Radio wave and infrared transmission with 360° range
Probe contact	∅ 40 mm or ∅ 25 mm	
Protection EN 60529	IP67	

SE transceiver units

The following transceiver units are available for **wireless signal transmission:**
- **SE 540:** for integration in spindle head; only infrared transmission
- **SE 640:** infrared transmission
- **SE 660:** shared SE for TS and TT; radio and infrared transmission
- **SE 661:** shared SE for TS and TT; radio and infrared transmission, EnDat interface for touch probes

With wireless signal transmission these touch probes are also suited for use on machines with automatic tool changer.

The SE 661 transceiver unit and the TS 460 and TT 460 touch probes are available with the EnDat interface. The EnDat interface from HEIDENHAIN is a digital, bidirectional interface that transmits the trigger status as well as diagnostic information and additional data from the touch probe. Thanks to the interface's serial transmission method, multiple items of data can be transmitted simultaneously.

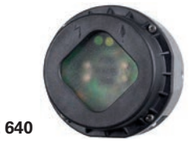


SE 660



SE 661


SE 540


SE 640

	SE 660	SE 661	SE 540	SE 640
TS 460	Radio/infrared		Infrared	
TS 642	Infrared	–	Infrared	
TS 740	–		Infrared	
TT 460	Radio/infrared		Infrared	

Signal transmission types and combinations of TS, TT and SE

Measured value acquisition and display

Digital readouts
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 and special machines—in fact all machines where axis slides are moved. This includes radial drilling machines and rapid radial drilling machines.

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 digital readouts speed 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 units
HEIDENHAIN provides the appropriate evaluation electronics units for each type of application. They offer numerous functions for measured data acquisition and statistical evaluation of measured values. For automation solutions the results of the measured-data evaluation can be processed further by integrated switching functions. The splash-proof front panel and the sturdy cast-metal housing make evaluation electronics units from HEIDENHAIN impervious to the harshest of everyday shop conditions.



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
- Intuitive operation using touchscreen or keyboard (depending on the product)
- All-in-one device with compact outside dimensions
- Sturdy aluminum housing
- Reference mark evaluation for distance-coded and single reference marks
- Problem-free installation, maintenance-free operation
- Fast payback with economical use

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

Signal converters
Signal converters from HEIDENHAIN enable the flexible adaptation of interfaces for encoder signals to the requirements of your application. Depending on the application, additional signals (such as from temperature sensors) are processed and transmitted to the downstream electronics.



Digital readouts for manually operated machine tools	**Series**	**Page**
For milling machines, lathes and positioning devices	**POSITIP 8000** **ND 7000** **ND 5000**	**70**
Evaluation units for metrology applications		
For measuring and testing tasks	**ND 287** **GAGE-CHEK 2000**	**72**
Inspection and testing devices	**PWM 21** **PWT 101**	**73**
Signal converters	**EIB 700** **IK 220**	**74**

Digital readouts for manually operated machine tools
Measuring and testing tasks

Digital readouts are used on manually operated machine tools, such as:
- Milling machine
- Drilling machines
- Lathes
- Radial drills
- Grinding machines

HEIDENHAIN offers the right digital readout for each of these types of machines. Thanks to their splash-water-resistant front panel and robust aluminum housing, the HEIDENHAIN digital readouts can handle harsh shop conditions.



POSITIP 8000



ND 7000



ND 5000

	POSITIP 8000	ND 7000	ND 5000
Application	Milling, drilling and boring machines and lathes		
Description	12.1-inch screen for multitouch operation, program memory, switching inputs and outputs (digital and analog)	7-inch screen for multitouch operation, switching inputs and outputs (digital and analog, depending on the version)	7-inch screen with operating keys
Axes	6, two of them as software option	3	3
Encoder inputs	∿ 1 V_{PP}, ∿ 11 μA_{PP}, or EnDat 2.2	∿ 1 V_{PP}, ∿ 11 μA_{PP}, or EnDat 2.2	TTL
Display step	10 µm, 5 µm, 1 µm, or finer		5 µm (with LS 328C/628C), 1 µm (with LS 378C)
Presets	100		10
Tool data	For 100 tools		For 16 tools
Programming	Yes	Software option	No
Functions	• Manual and MDI operation, graphical positioning aid, variable font size for display of position values • User administration and data management		
	• Touch probe connection • ACTIVE version: NC control of up to three axes (point to point), as software option • Support of machines with a central drive	Touch probe connection	–
For milling or boring operation	• Hole patterns (circular and linear patterns) • Roughing of rectangular pockets • Probing functions for reference-point acquisition • Switching functions		• Circle pattern, linear pattern • Diagonal and arc milling
	ACTIVE version: controlling the spindle speed	I/O version: controlling the spindle speed	–
For turning	• Radius/diameter display • Separate or sum display for Z and Z_0 • Freezing tool position for back-off/taper calculator • Switching functions		
	ACTIVE version: constant cutting speed	I/O version: constant cutting speed	–
Data interfaces	Ethernet, USB		USB

Evaluation units for metrology applications
Measuring and testing tasks

Evaluation units for measuring and testing tasks are ideal for
- Measurement equipment
- Adjustment and inspection equipment
- SPC inspection stations
- Multi-gauging fixtures
- Mobile data acquisition
- Positioning equipment

The evaluation units are independently operated devices with an integrated screen and a robust housing. They feature special functions for metrological collection and the statistical evaluation of measurements, such as sorting, minimum/maximum value recording and measurement series storage. These data make it possible to calculate mean values and standard deviations, as well as graphically display them in histograms or control charts.





	ND 287	GAGE-CHEK 2000
Application	• Measurement equipment • Testing devices • SPC inspection stations	• Positioning equipment • Measuring fixtures
Axes[1]	1 (optional 2)	3
Encoder inputs	∿ 1 V_{PP}, ∿ 11 μA_{PP}, or EnDat 2.2	∿ 1 V_{PP}, ∿ 11 μA_{PP}, EnDat 2.2, or ⊓⊔ TTL
Display	Screen	7-inch screen for multitouch operation
Function	• Sorting • Measurement series with minimum and maximum value recording • Functions for statistical process control (SPC) • Graphical display of measurement results • Storage of measured values *Optional:* Sum/difference display or thermal compensation	• Measurement series with minimum and maximum value recording • Touch probe connection for a HEIDENHAIN or Renishaw touch probe • Data transmission via Ethernet or RS-232 Manual Touch-probe triggered Continuous Switching-function triggered • User administration • Measurement with reference parts • Management of parts • Dial gage for a graph of the measured value • Diameter/radius display • Relative measurement • Probing functions • Remote access
Data interfaces	USB; RS-232-C; *optional:* Ethernet	Ethernet, USB, RS-232-C[2]

[1] Depending on version
[2] Possible with RS-232 adapter connection via USB port

Inspection and testing devices

Inspection and testing devices from HEIDENHAIN
HEIDENHAIN encoders provide all of the information needed for setup, 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 larger measuring tolerances, fewer available functions, and cannot be calibrated.

HEIDENHAIN encoders can usually be connected either directly or via signal converters to a number of different downstream electronics.

HEIDENHAIN therefore offers encoders and signal converters 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 21 and PWT 101).



PWM 21 inspection device with included ATS adjusting and testing software



PWT 101 testing device for mobile application

Encoder input	PWM 21	PWT 101
EnDat 2.1	✓	✓
EnDat 2.2	✓	✓
DRIVE-CLiQ	✓	✓
Fanuc Serial Interface	✓	✓
Mitsubishi high speed interface	✓	✓
Yaskawa Serial Interface	✓	✓
Panasonic Serial Interface	✓	✓
SSI	✓	–
1 V_{PP}/TTL/11 μA_{PP}	✓	✓
1 V_{PP} with Z1 track	✓	✓
HTL (via signal adapter)	✓	✓

DRIVE-CLiQ is a registered trademark of Siemens AG.

Signal converters

Signal converters from HEIDENHAIN adapt the encoder signals to the interface of the downstream 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 > Fanuc
EnDat > Yaskawa Serial Interface
EnDat > PROFIBUS DP
EnDat > PROFINET
E30-R2 > E30-R4 (SA 1210)

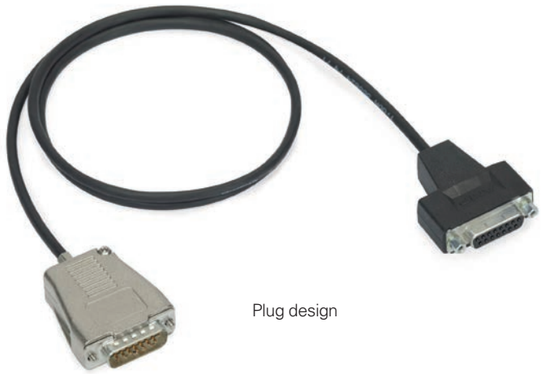


In addition to performing signal conversion, the signal converters also interpolate the sinusoidal encoder signals. This permits finer measuring steps, resulting in higher control quality and superior positioning behavior.

Various signal converters feature an integrated counter function. Starting from the last set reference point, an absolute position value is generated and output to the downstream electronics when the reference mark is crossed.

Signal converters such as the EIB 5000 sensor boxes can also directly collect temperature information from direct-drive motors. In combination with HEIDENHAIN encoders, the processed temperatures can be transferred to the higher-level control.

Signal converters from HEIDENHAIN are available in various designs:
- Box design
- Plug design
- Version for integration
- Top-hat rail design



Plug design

Adaptation of the interfaces
Signal converters from HEIDENHAIN for the adaptation of the encoder signals to the interface increase compatibility with the downstream electronics. Signals can be interpolated, and various versions (e.g., housing version, connector version, top hat rail version or integrated version) can be selected for greater flexibility in the application.

IBV 600, IBV 100, IBV 3000, EXE 100 series
- Incremental interface at the input (1 V_{PP} or 11 μA_{PP})
- Incremental interface at the output (TTL)

IBV 6000 series
- Incremental interface at the input (1 V_{PP})
- Multiple outputs (1 V_{PP} or TTL)

EIB 100, EIB 300 series
- Incremental interface at the input (1 V_{PP})
- Serial interface at the output (EnDat 2.2, Fanuc Serial Interface, Mitsubishi high speed serial interface)

EIB 2391 S, EIB 3392 S, EIB 3391Y series
- Serial interface at the input (EnDat 2.2)
- Serial interface at the output (DRIVE-CLiQ/Yaskawa)



Temperature measurement on direct-drive motors
Monitoring of all three windings for increased cost-effectiveness and protection of the direct-drive motor from overloading: optimized temperature measurement of up to three temperature sensors and compensation of the transmission timing behavior of the temperature measurement for ETEL direct-drive motors.

EIB 5000 series
- Fewer cables required
- Protection of the direct-drive motor from overloading
- Faster response behavior in the event of temperature exceedance
- Increased cost efficiency



Angular measurement with increased accuracy
Position calculation using two scanning heads from rotatory HEIDENHAIN encoders in real time without negative effects on the control loop. Deviations such as eccentric mounting of the graduation of a modular angle encoder or radial runout deviations of the shaft can be compensated for with the EIB 1500.

EIB 1500 Series
- Input: Incremental rotatory HEIDENHAIN encoder with two scanning heads and distance-coded reference marks (mounting of the scanning heads relative to each other: 180° ±5°)
- Output: EnDat 2.2, Fanuc Serial Interface or Mitsubishi high speed interface



Computer-aided measured-value acquisition
The signal converters enable the connection of encoders to computer-supported applications that, at the same time, require high resolution of the encoder signals and fast measurement: as an elevaluation unit for inspection stations and multi-gauging fixtures.

EIB 700 series
- Signal converters for high-resolution encoder signals and fast measurement
- Connection of multiple evaluation units via Ethernet transmission and, for example, WLAN transmission
- Encoder inputs: 1 V_{PP}, 11 μA_{PP}, EnDat 2.1 or SSI
- Connection of up to four HEIDENHAIN encoders

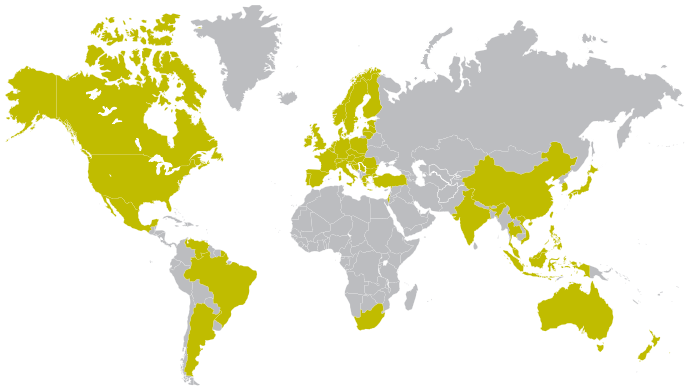
IK 220 series
- Signal converters for high-resolution encoder signals and fast measurement
- PCI counter card
- Encoder inputs: 1 V_{PP}, EnDat 2.1, EnDat 2.2 or 11 μA_{PP}
- Connection of up to two HEIDENHAIN encoders



Sales, consulting and services worldwide

HEIDENHAIN is represented across the globe by its own sales and servicing agencies, which offer the specialized brands of the corporate group in specific countries.

An additional distributor network supports our sales and services across selected regions.





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