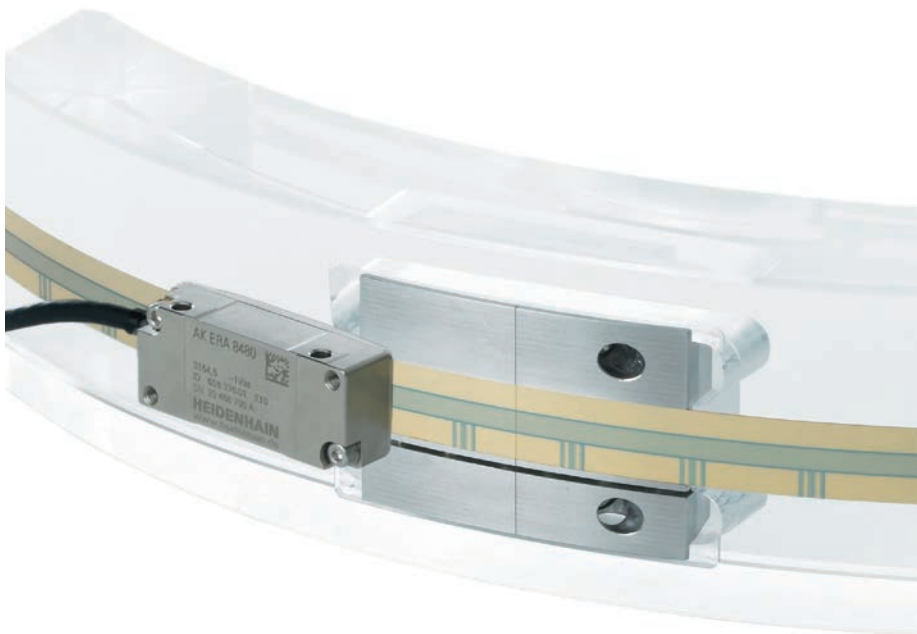




HEIDENHAIN



Product Information

ERA 7900 Series **ERA 8900 Series**

Scale-Tape Angle Encoders
with Very Large
Operating Tolerances

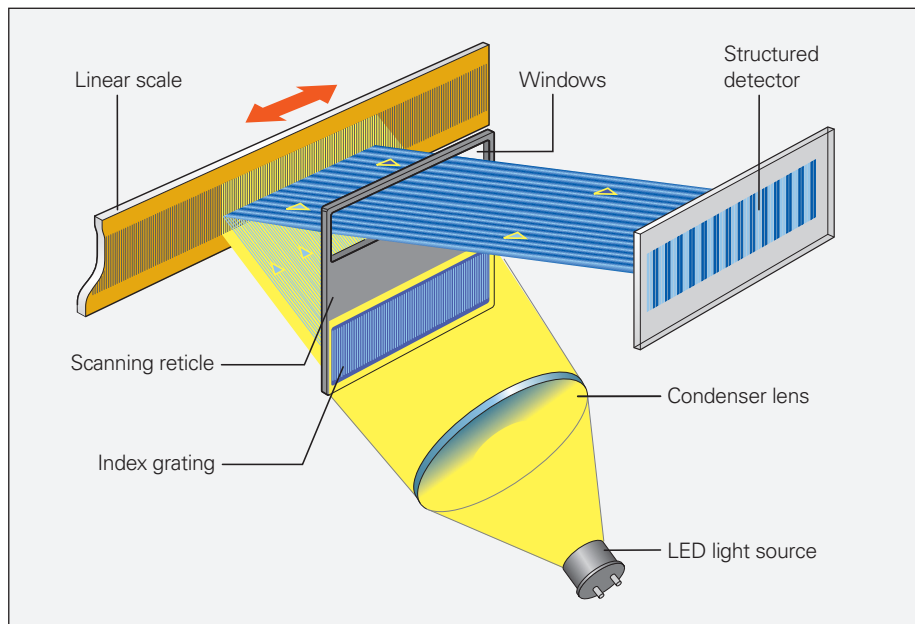
Reliability

Exposed angle encoders without integral bearing from HEIDENHAIN are optimized for use on fast, precise machines. In spite of the exposed mechanical design, they are highly tolerant to contamination, ensure high long-term stability, and are quickly and easily mounted.

Lower sensitivity to contamination

Both the high quality of the grating and the scanning method are responsible for the accuracy and reliability of the encoders. Encoders from HEIDENHAIN operate with **single-field scanning**. Only one scanning field is used to generate the scanning signals. Local contamination on the measuring standard (e.g. fingerprints or oil accumulation) influences the light intensity of the signal components, and therefore of the scanning signals, in equal measure. The output signals do change in their amplitude, but not in their offset and phase position. They remain highly interpolable, and the position error within one signal period remains small.

The **large scanning field** additionally reduces sensitivity to contamination. In many cases this can prevent encoder failure. Even if the contamination from printer's ink, PCB dust, water or oil is up to 3 mm in diameter, the encoders continue to provide high-quality signals. The position errors within one revolution remain far below the specified accuracy.



Photoelectric scanning in accordance with the imaging principle with a steel scale and single-field scanning

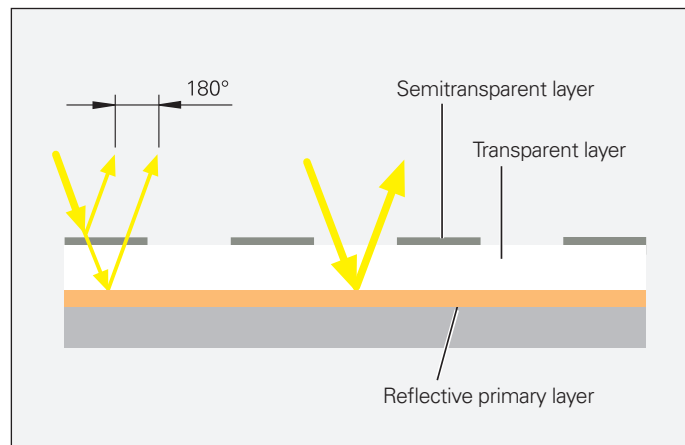
Durable measuring standards

By the nature of their exposed design, the measuring standards of angle encoders without integral bearing are less protected from their environment. HEIDENHAIN therefore always uses tough gratings manufactured in special processes.

In the DIADUR process, hard chrome structures are applied to a glass or steel carrier.

In the METALLUR process a reflective gold layer is covered with a thin layer of glass. On this layer are lines of chromium only several nanometers thick, which are semitransparent and act as absorbers. Measuring standards with METALLUR graduations have proven to be particularly robust and insensitive to contamination because the low height of the structure leaves practically no surface for dust, dirt or water particles to accumulate.

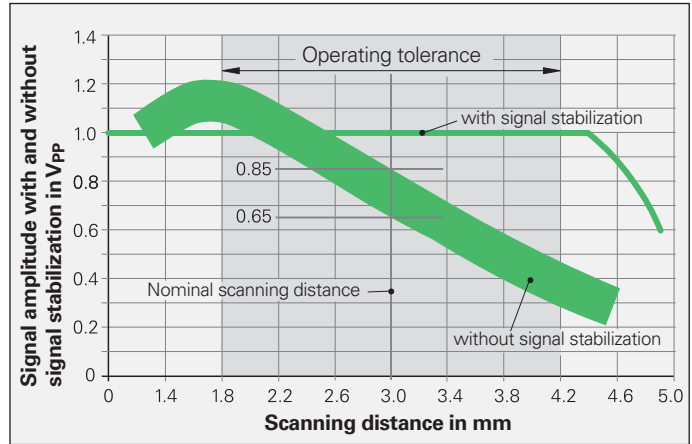
Due to the high surface hardness, even frequent cleaning will not harm the graduation.



Composition of a METALLUR graduation

Application-oriented operating tolerances

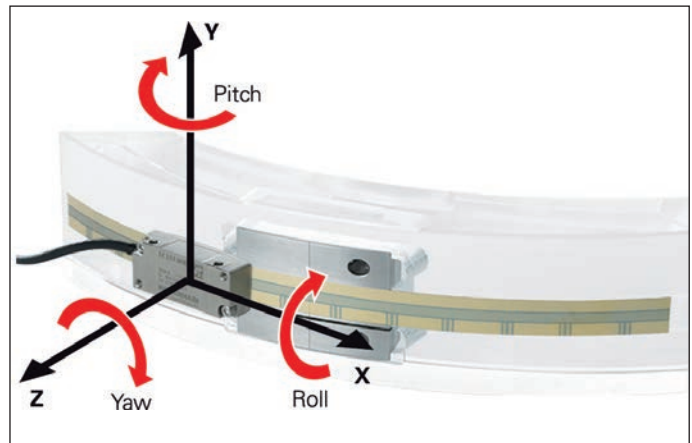
The operating tolerances of the ERA 7900 and ERA 8900 series have only a slight influence on the output signals. In particular, a variation in the scanning gap between the graduation carrier and scanning head causes only negligible change in the signal amplitude, and barely affect the position error within one signal period. This feature permits extraordinarily large mechanical operating tolerances.



Influence of the scanning gap on the signal amplitude for ERA 7900 and ERA 8900

Operating tolerance (in combination)

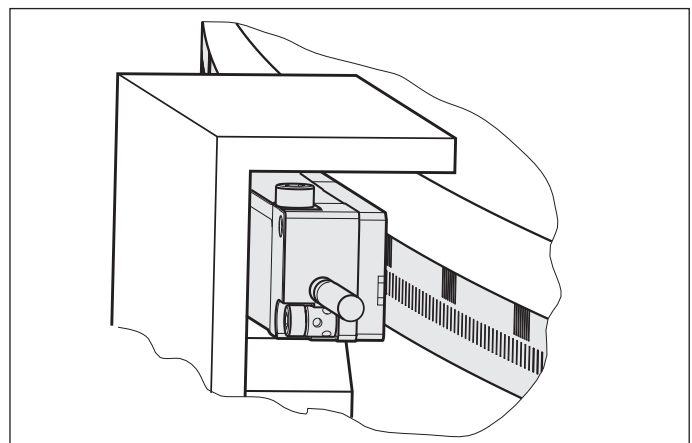
Axis	Incremental and Reference mark track	Incremental track
Y	± 0.5 mm	± 1 mm
Z	± 1.2 mm	+1.2 mm/-2.0 mm
Roll (X)	± 2.0 mrad	± 5.0 mrad
Pitch(Y)	± 0.5 mrad	± 5.0 mrad
Yaw (Z)	± 0.2 mrad	± 5.0 mrad



Operating tolerances for ERA 7900 and ERA 8900 after ideal mounting at diameters above approx. 3 m

Protection against ambient light influences

Due to the large scanning gap, intensive ambient light can have a negative effect on the signal quality of the measuring device. In these cases, a suitable cover has to be provided in order to avoid direct illumination of the scanning head.



Cover to prevent the penetration of ambient light into the scanning gap

Mechanical design types and mounting

ERA 7900 and ERA 8900 series

The ERA 7900 and ERA 8900 series of angle encoders consist of a scanning unit and a one-piece steel scale tape. The steel scale tape is available up to a length of approx. 180 m.

The tape is mounted on

- the inner ring (ERA 7900 series)
- the outer ring (ERA 8900 series)

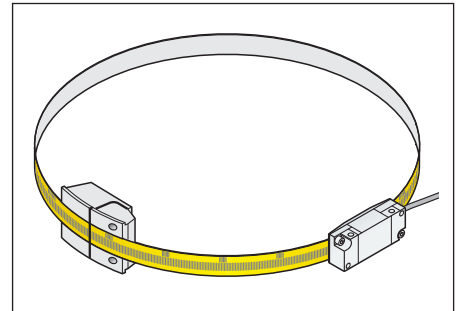
The ERA 7900C and ERA 8900C angle encoders are designed for **full-circle applications**. Thus, they are particularly suited to hollow shafts with large inside diameters and to applications requiring accurate measurement over a large circumference, such as large rotary tables or telescopes.

In applications where there is no full circle, or measurement is not required over 360°, **circle segments** are available for the ERA 8900 series.

Mounting the scale tape for full-circle applications

ERA 74x0C: An **internal slot** with a specified diameter is required for receiving the scale tape. The scale tape is inserted starting at the butt joint and is clicked into the slot. The length is cut so that the tape is held in place by its own force. To make sure that the scale does not move within the slot, and that the tape tension is equal over the entire circumference, the tape is additionally bonded to the slot floor.

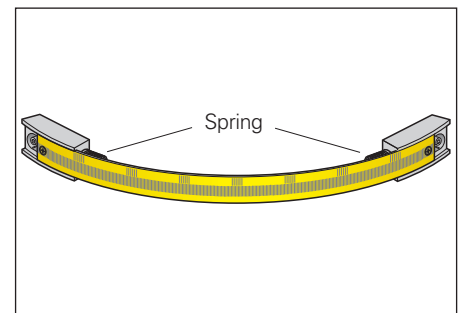
ERA 89x0C: The scale tape is supplied with the halves of the tensioning cleat already mounted on the tape ends. An **external slot** is necessary for mounting. A recess must also be provided for the tensioning cleat. After the scale tape has been inserted, it is fastened aligned along the slot edge and tensioned using the tensioning cleat.



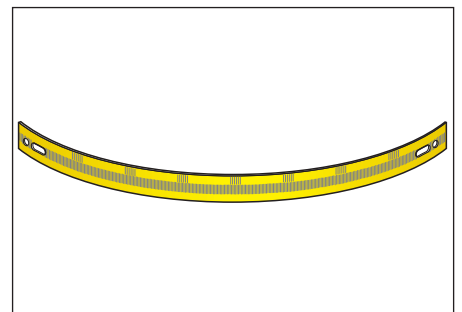
The scale tape ends are manufactured so exactly that only minor signal-form deviations can occur in the area of the butt joint. Depending on individual conditions (temperature, diameter, thermal expansion coefficient), various measures are required to make sure that the scale does not move within the slot.

Mounting the scale tape for circle segments

ERA 89x1C: The scale tape is supplied with premounted end pieces. An external slot with recesses for the bearing pieces is required for placing the scale tape. The end pieces are fitted with tension springs, which create an optimal bearing preload for increasing the accuracy of the scale tape, and evenly distribute the expansion over the entire length of the scale tape.

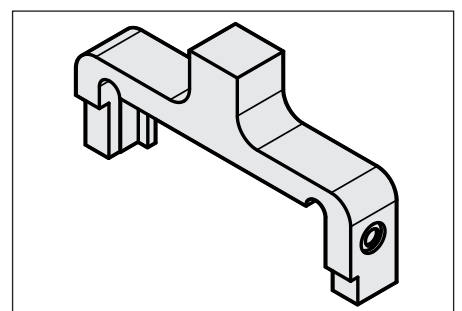


ERA 89x2C: An external slot or one-sided axial stop is recommended for placing the scale tape. The scale tape is supplied without tensioning elements. It must be preloaded with a spring balance, and secured using the two oblong holes.



Mounting the scanning head

The provided mounting aid facilitates the correct alignment of the scanning head relative to the tape during assembly.



ERA 7900 series

Incremental angle encoders for high accuracy and very large operating tolerances

- Steel scale tape for internal mounting
- Full-circle versions, also for very large diameters
- Consisting of a scanning head and scale tape

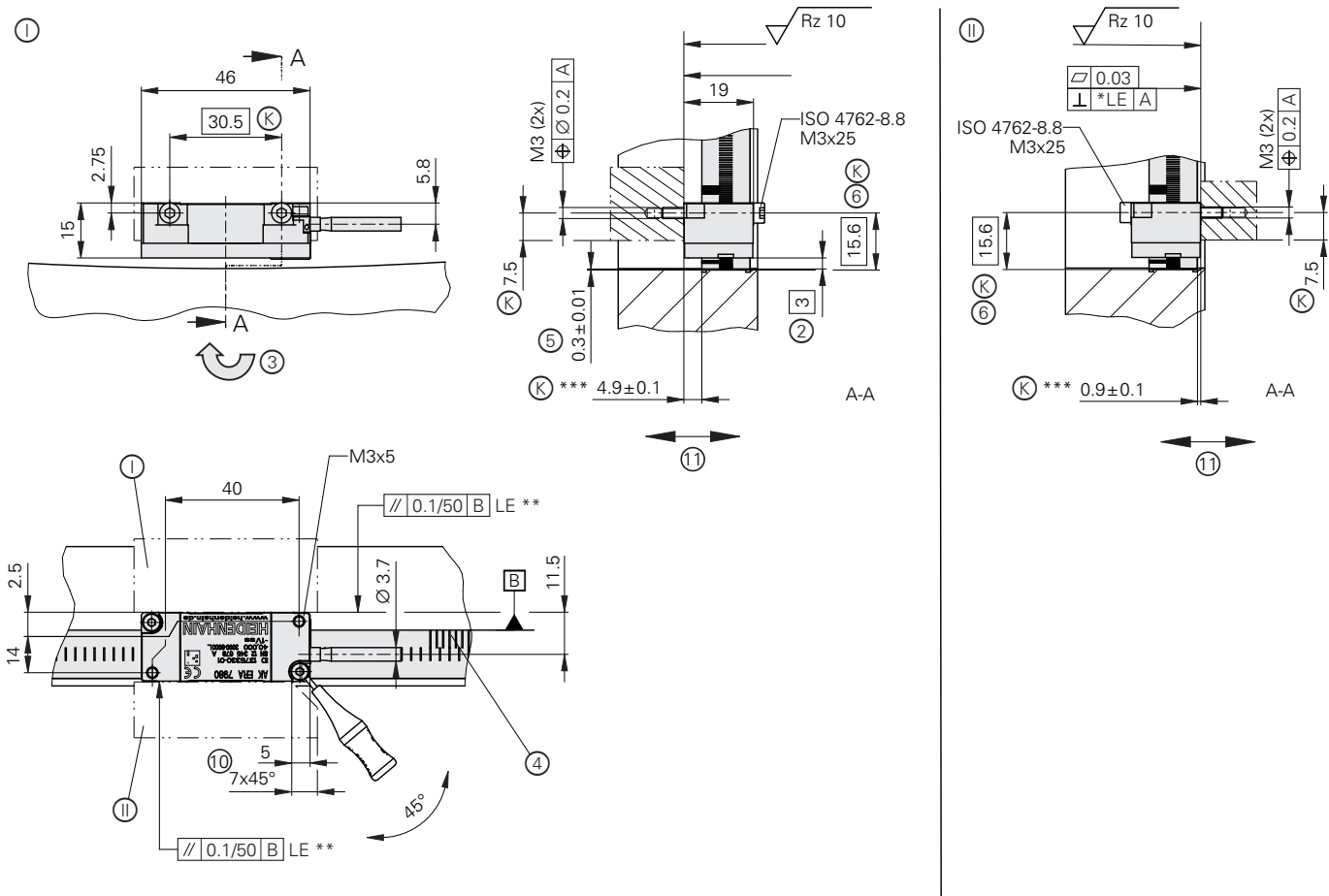


ERA 7980 full-circle version

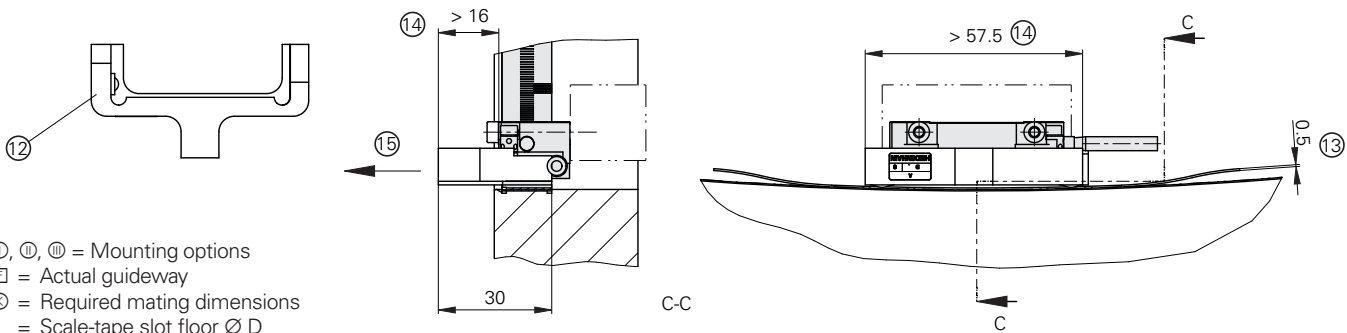
Scanning head	AK ERA 7980
Scanning gap	Nominal 3 mm Variation ± 1.2 mm
Interface	$\sim 1 V_{PP}$
Cutoff frequency -3 dB	≥ 350 kHz
Electrical connection	Cable 3 m, with M23 coupling (12-pin)
Cable length	≤ 150 m (with HEIDENHAIN cable)
Voltage supply	5 V DC ± 0.25 V
Current requirement	< 100 mA (without load)
Vibration 55 to 2000 Hz Shock 6 ms	≤ 200 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)
Operating temperature	-10 °C to 50 °C
Protection EN 60529	IP40
Weight	≈ 20 g (without cable)

Scale Tape	MSB ERA 7900C full-circle version
Measuring standard Grating period Coefficient of expansion	Steel scale-tape with METALLUR graduation 40 μ m $\alpha_{therm} \approx 10.5 \cdot 10^{-6} K^{-1}$
Signal periods	Upon request
Accuracy of the graduation	According to individual error budget calculation
Reference marks	Distance-coded
Scale-slot diameter Full circle	3000 mm to 8000 mm; upon request
Mech. permissible speed	Depending on diameter
Permissible expansion coefficient of shaft	$\alpha_{therm} \approx 9 \cdot 10^{-6} K^{-1}$ to $12 \cdot 10^{-6} K^{-1}$ Defines scale slot-floor diameter and tape tension
Protection EN 60529 for entire encoder	IP00
Weight	≈ 30 g/m

ERA 7900 series



Mounting option ① shown



①, ②, ③ = Mounting options

☐ = Actual guideway

⊙ = Required mating dimensions

1 = Scale-tape slot floor \varnothing D

2 = Mounting clearance

3 = Positive direction of rotation for output signals as per interface description

4 = Reference mark

5 = Scale-tape thickness

6 = Distance between scale-tape slot floor and thread for fastening screw

7 = Distance between scale-tape slot floor and scanning head's rear mounting surface

8 = Eccentric bushing (Moiré setting)

9 = Hole required for fine adjustment

10 = Chamfer for accessibility for Moiré setting (mounting option: ②)

11 = Permissible axial motion (scale tape relative to the scanning head) $\leq \pm 0.5$ mm

12 = Mounting aid for mounting at nominal scanning distance = 3 mm

13 = Mounting clearance (spacer shim)

14 = Installation room for mounting aid

15 = Direction for removing the mounting aid (with mounting option ①)

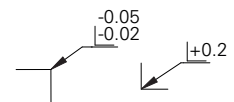
16 = Cover against extraneous light

17 = Notch for scale-tape disassembly (b = 3 mm)

* = Averaged relative to the total deviation of the scale-tape slot in direction Rx or Ry over 360°

** = The fine adjustment of the incremental signals and reference mark is performed with the aid of the H8 eccentric bushing

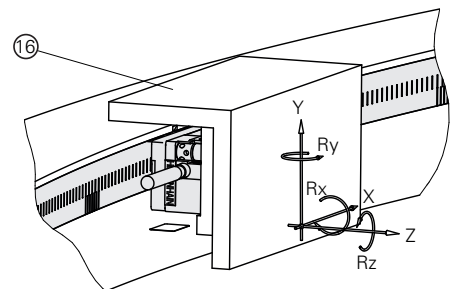
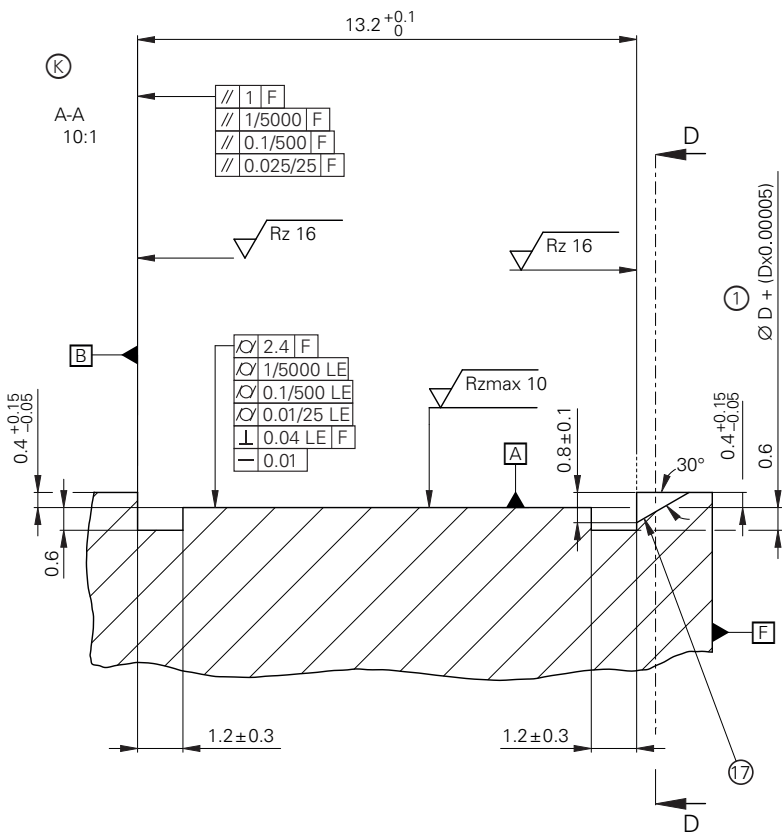
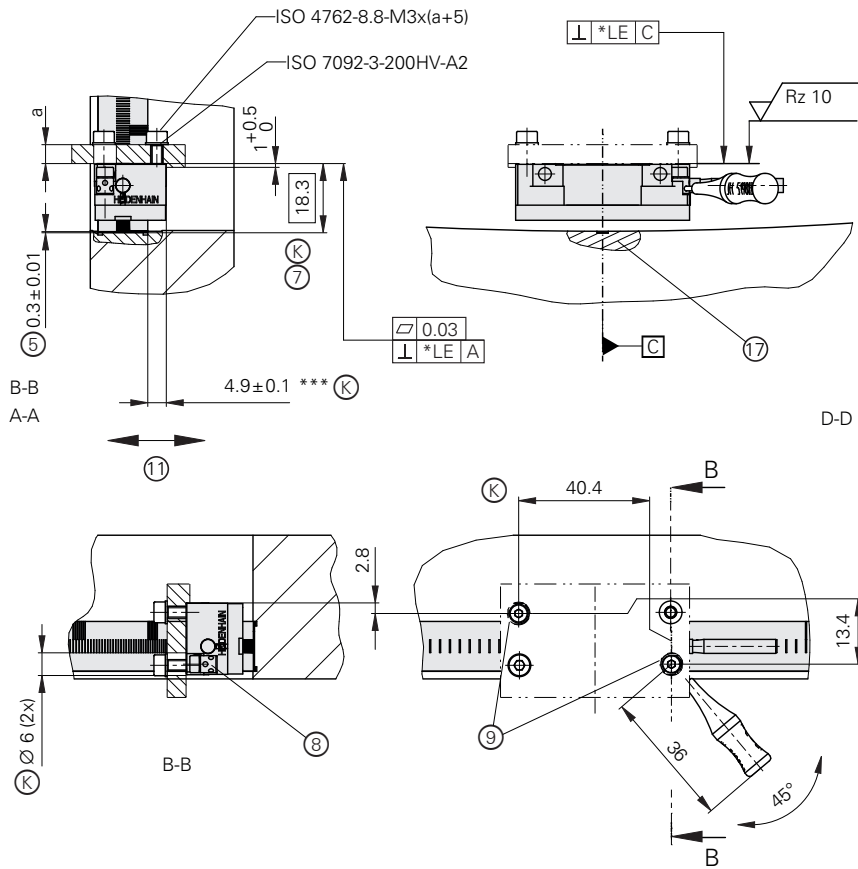
*** = The mounting of the scanning head in the Y direction must be performed in the range of the average deviation of the scale-tape slot in the Y direction over 360°



mm

 Tolerancing ISO 8015
 ISO 2768:1989-mH
 ≤ 6 mm: ± 0.2 mm

III



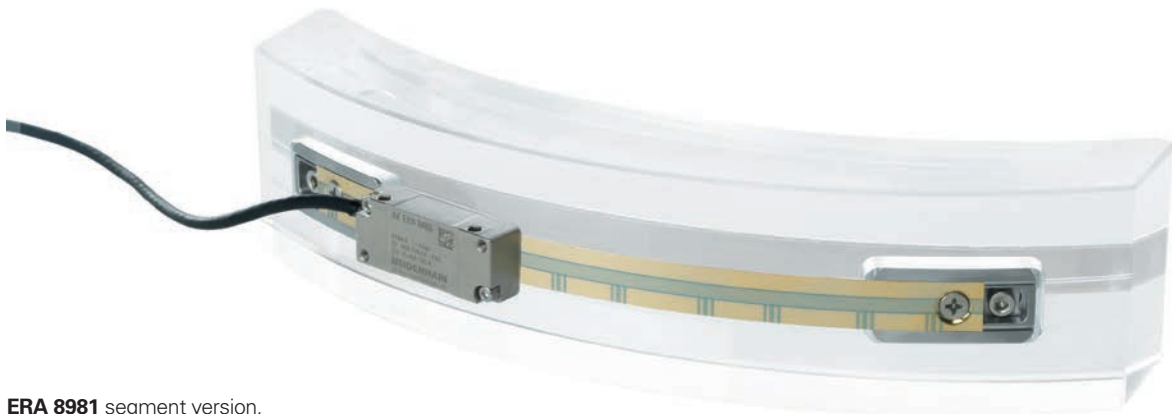
ERA 8900 series

Incremental angle encoders for high accuracy and very large operating tolerances

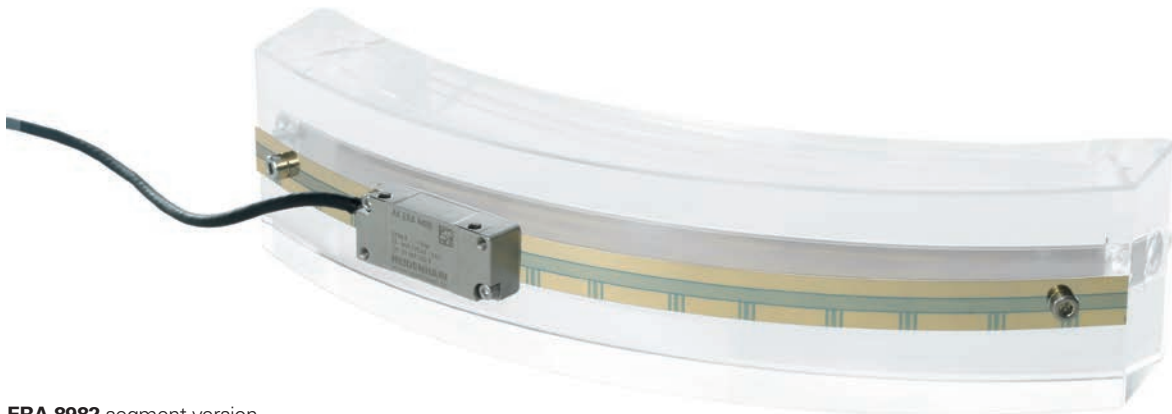
- Steel scale tape for external mounting
- Full-circle and segment versions, also for very large diameters
- Consisting of a scanning head and scale tape



ERA 8980 full-circle version



ERA 8981 segment version,
scale tape secured with tensioning elements

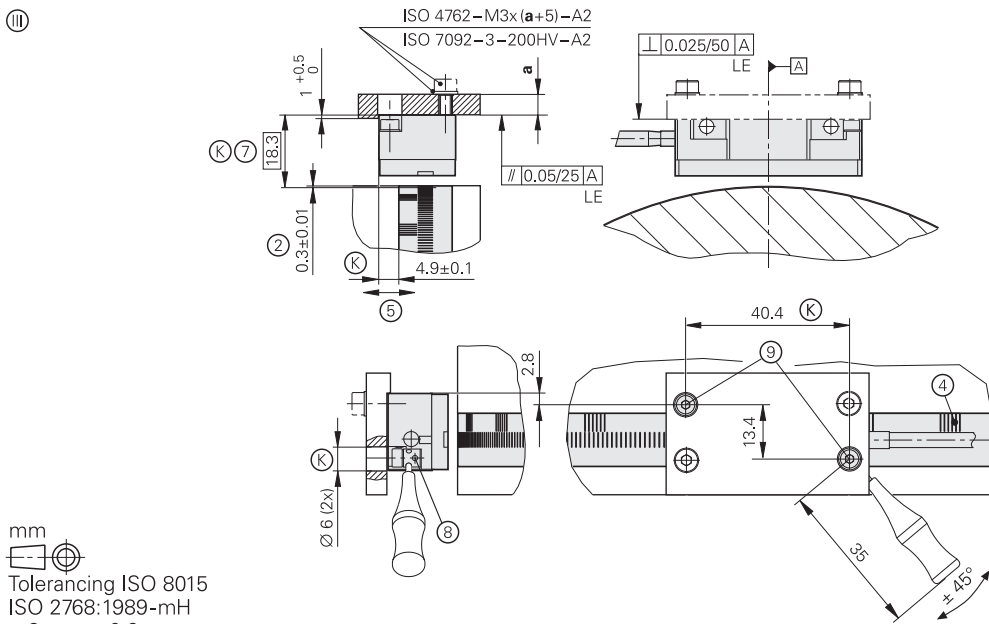
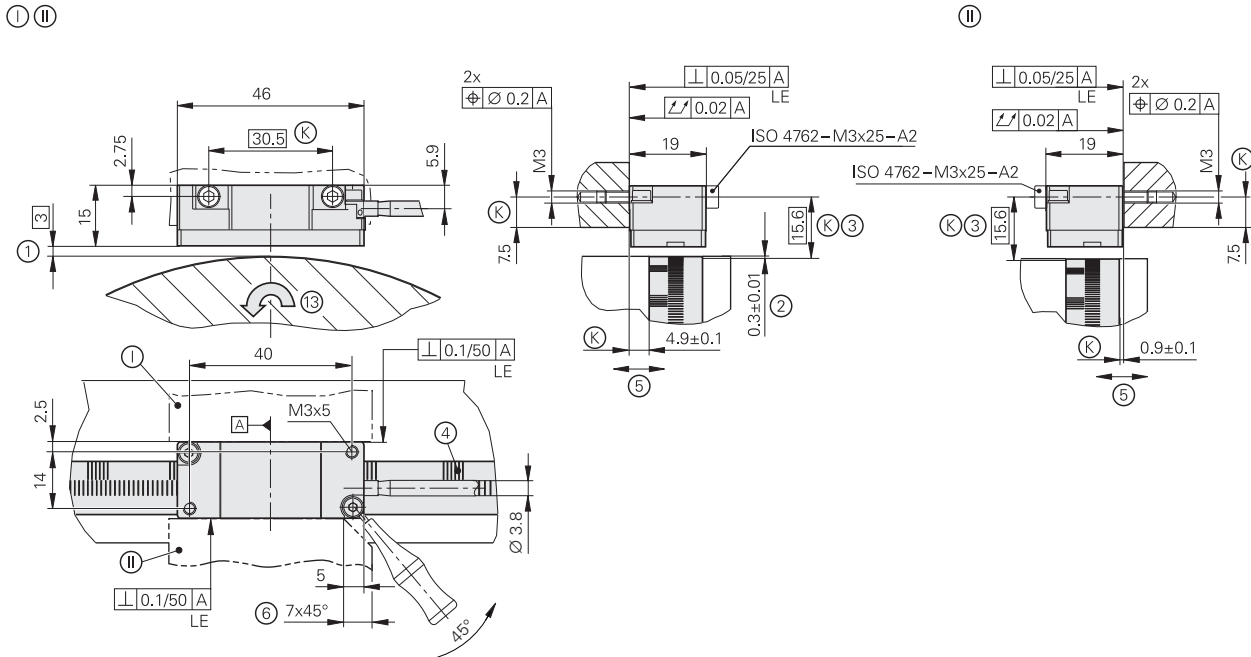


ERA 8982 segment version,
scale tape without tensioning elements

Scanning head	AK ERA 8980
Scanning gap	Nominal 3 mm Variation ± 1.2 mm
Interface	$\sim 1 V_{PP}$
Cutoff frequency -3 dB	≥ 350 kHz
Electrical connection	Cable 3 m, with M23 coupling (12-pin)
Cable length	≤ 150 m (with HEIDENHAIN cable)
Voltage supply	5 V DC ± 0.25 V
Current requirement	< 100 mA (without load)
Vibration 55 to 2000 Hz Shock 6 ms	≤ 200 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)
Operating temperature	-10 °C to 50 °C
Protection EN 60529	IP40
Weight	≈ 20 g (without cable)

Scale Tape	MSB ERA 8900C full-circle version MSB ERA 8901C segment version with tensioning elements MSB ERA 8902C segment version without tensioning elements
Measuring standard Grating period Coefficient of expansion	Steel scale-tape with METALLUR graduation 40 μ m $\alpha_{therm} \approx 10.5 \cdot 10^{-6} K^{-1}$
Signal periods	Upon request
Accuracy of the graduation	According to individual error budget calculation
Reference marks	Distance-coded
Scale-slot diameter	Full circle ≥ 3000 mm; upon request Segment ≥ 3000 mm; upon request
Mech. permissible speed	Depending on diameter
Permissible expansion coefficient of shaft	$\alpha_{therm} \approx 9 \cdot 10^{-6} K^{-1}$ to $12 \cdot 10^{-6} K^{-1}$ Defines scale slot-floor diameter and tape tension
Protection EN 60529 for entire encoder	IP00
Weight	≈ 30 g/m

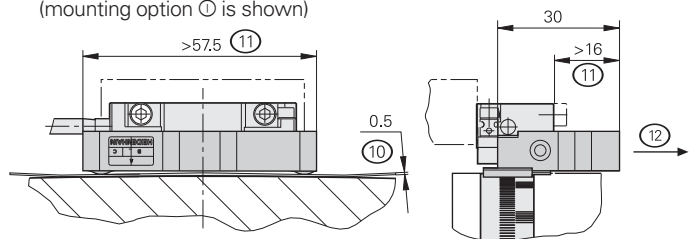
ERA 8900 series



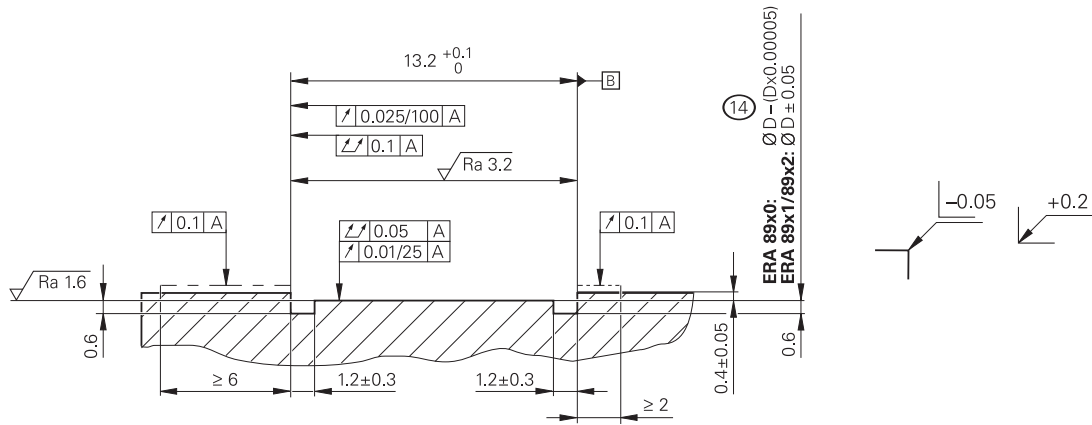
mm
 Tolerancing ISO 8015
 ISO 2768:1989-mH
 ≤ 6 mm: ± 0.2 mm

- ①, ②, ③ = Mounting options
 - ▢ = Bearing
 - ⊙ = Required mating dimensions
 - 1 = Mounting clearance
 - 2 = Scale-tape thickness
 - 3 = Distance between floor of scale-tape slot and threaded mounting hole
 - 4 = Reference mark
 - 5 = Permissible axial motion (scale tape relative to scanning head) ± 0.5 mm
 - 6 = Chamfer for accessibility with moiré setting (mounting option ②)
 - 7 = Distance between scale-tape slot floor and scanning head's rear mounting surface
 - 8 = Eccentric bushing (Moiré setting)
 - 9 = Holes required for fine adjustment
 - 10 = Mounting clearance (spacer shim)
 - 11 = Space for mounting aid
 - 12 = Direction for removing the mounting aid (with mounting option ①)
- With mounting option ③ the mounting aid can also be used from the opposite side
- 13 = Positive direction of rotation for output signals as per interface description
 - 14 = Scale tape slot floor $\varnothing D$
 - 15 = Floor of pocket is ferromagnetic for fixing the tensioning cleat
 - 16 = Chamfer length > 60 mm
 - 17 = Mounting screw (optional), depends on the required scale-tape tension

Mounting aid for installation with a scanning gap of 3 mm
 (mounting option ① is shown)

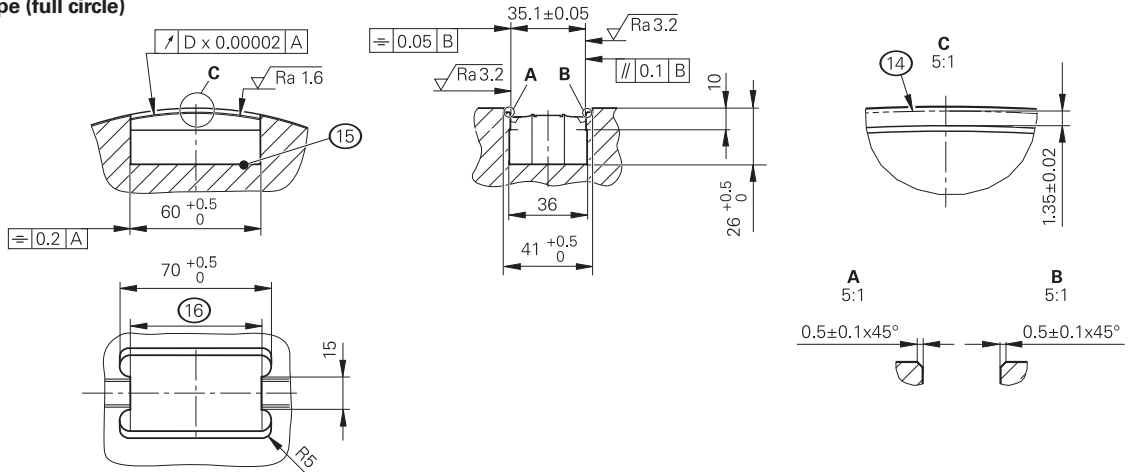


Ⓚ
M
5:1



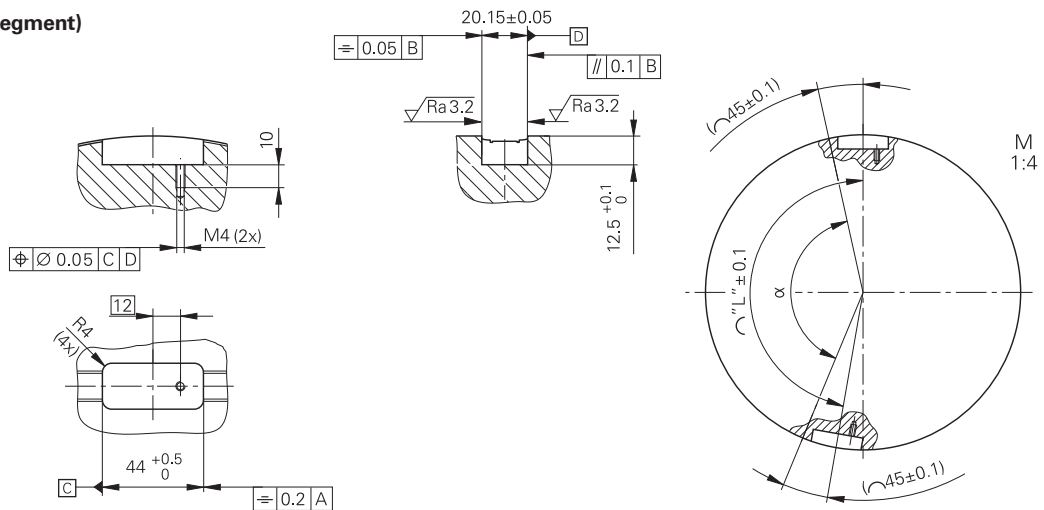
ERA 89x0 scale tape (full circle)

Ⓚ
M
1:2



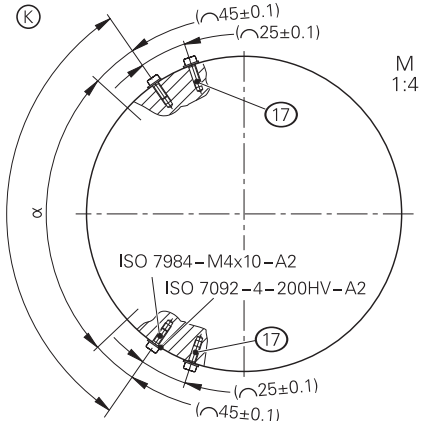
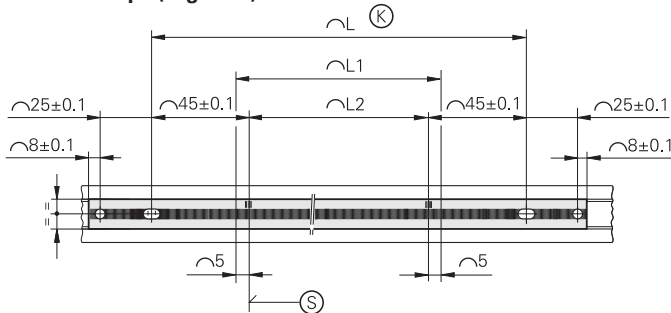
ERA 89x1 scale tape (segment)

Ⓚ
M
1:2




ERA 89x2 scale tape (segment)

M
1:2



- ⌒ = Length of the arc in the stress-free zone, pay attention to the scale-tape thickness
- ⌒L = Position of the two end-piece openings or threaded mounting holes
- ⌒L1 = Traverse path
- ⌒L2 = Measuring range in the arc
- S = Measurement start
- D = Slot-floor diameter
- α = Measuring range in degrees (segment angle)

Connecting cable

PUR connecting cable $[4(2 \times 0.14 \text{ mm}^2) + (4 \times 0.5 \text{ mm}^2)]$; $A_P = 0.5 \text{ mm}^2$		Ø 8 mm
Complete with connector (female) and D-sub connector (male) for signal alignment with PWM 21		1184705-xx

HEIDENHAIN

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This Product Information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information document edition valid when the order is placed.



More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Brochure: *Modular Angle Encoders with Scale Drum or Scale Tape* 1371806-xx