



HEIDENHAIN



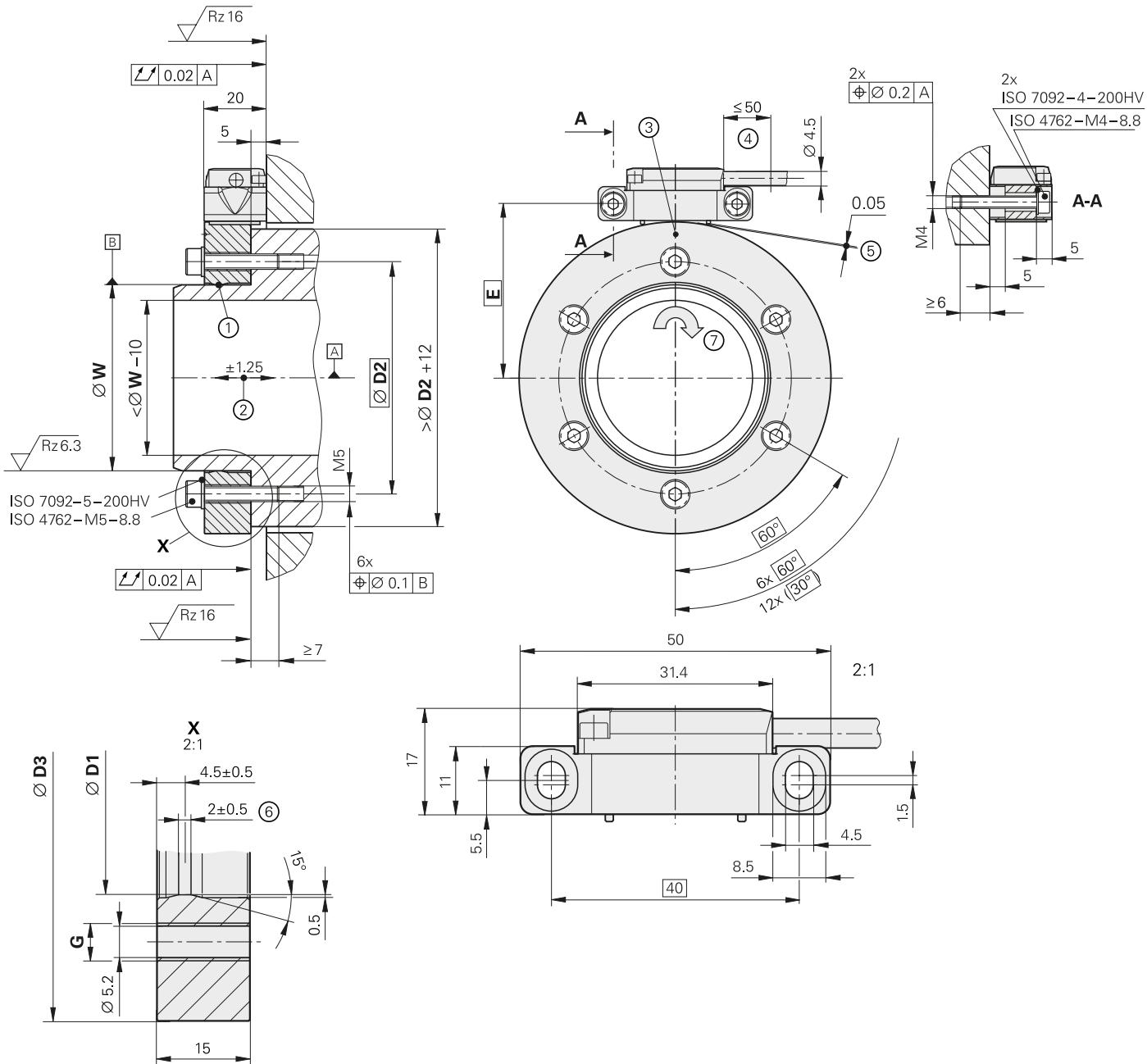
Product Information

AK ERM 2xx0 TTR ERM 2x00

Modular Angle Encoders
with Magnetic Scanning
and Mechanical Fault
Exclusion

ERM 2200 series

- Consisting of AK ERM 2280 and TTR ERM 2200 or TTR ERM 2200C
- Modular encoders with magnetic scanning principle
- Signal period approx. 200 µm (at circumference)
- For rotary and tilting axes
- Suitable for fault exclusion for loosening of the mechanical connection



mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ± 0.2 mm

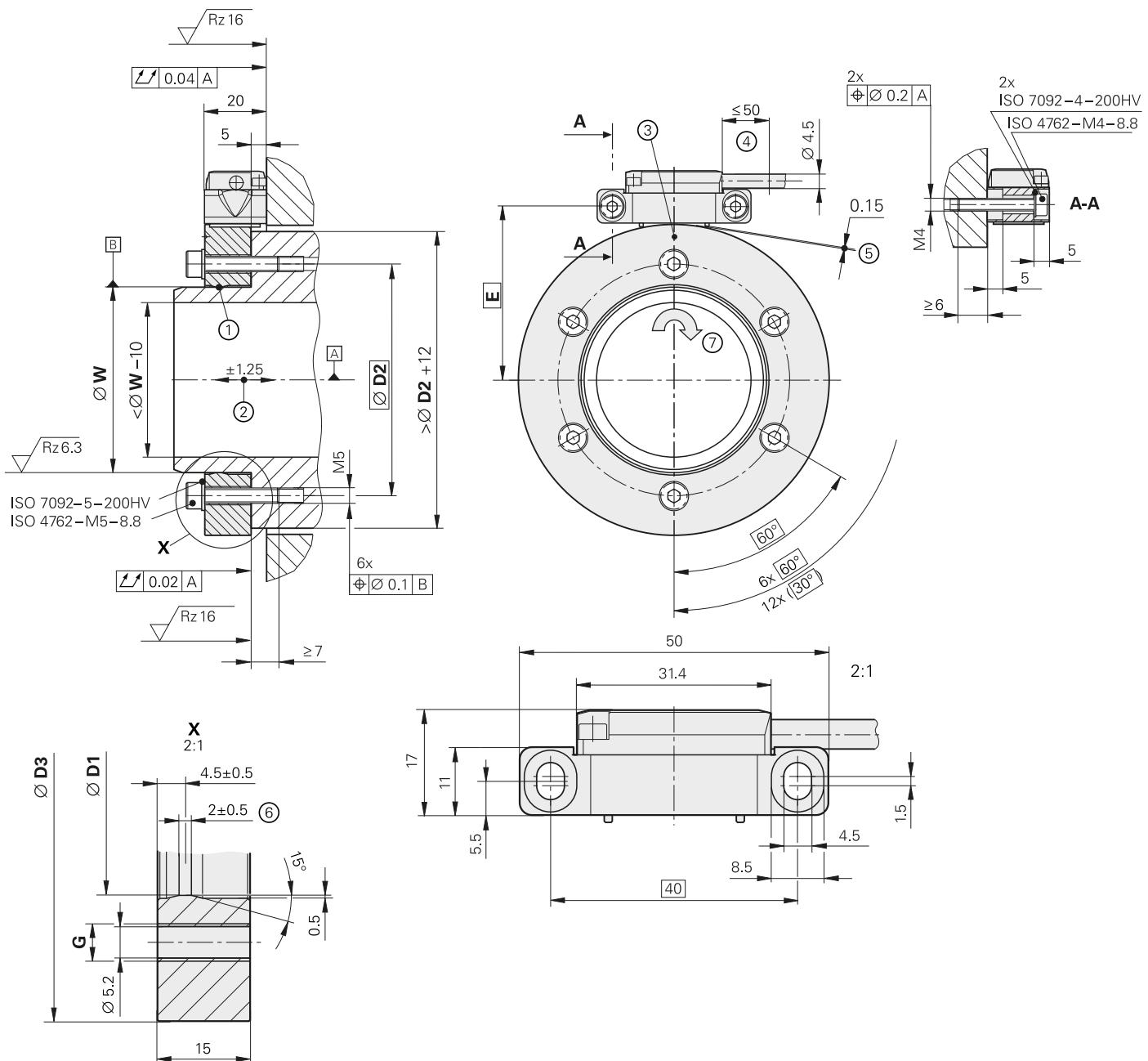
A = Bearing of mating shaft
① = Shaft fit; ensure full-surface contact
② = Axial tolerance of mating shaft
③ = Reference mark position
④ = Cable support
⑤ = Mounting distance of 0.05 mm set with spacer foil
⑥ = Centering collar
⑦ = Direction of shaft rotation for output signals as per the interface description

D1	W	D2	D3	E	G	1)	2)
Ø 70 0/-0.008	Ø 70 +0.019/+0.011	Ø 85	Ø 113.16	62.3	6x M6	1800	9000 rad/s ²
Ø 80 0/-0.008	Ø 80 +0.022/+0.014	Ø 95	Ø 128.75	70.1	6x M6	2048	6000 rad/s ²
Ø 130 0/-0.012	Ø 130 +0.041/+0.029	Ø 145	Ø 176.03	93.7	6x M6	2800	3300 rad/s ²
Ø 180 0/-0.012	Ø 180 +0.055/+0.043	Ø 195	Ø 257.50	134.5	6x M6	4096	820 rad/s ²
Ø 260 0/-0.016	Ø 260 +0.082/+0.066	Ø 275	Ø 326.90	169.2	6x M6	5200	560 rad/s ²
Ø 380 0/-0.018	Ø 380 +0.119/+0.110	Ø 395	Ø 452.64	232.0	12x M6	7200	570 rad/s ²

1) = Line count
2) = Max. angular acceleration

ERM 2400 series

- Consisting of AK ERM 2420 or AK ERM 2480 and TTR ERM 2400 or TTR ERM 2400C
- Modular encoders with magnetic scanning principle
- Signal period approx. 400 µm (at circumference)
- For C axis on lathes
- Suitable for fault exclusion for loosening of the mechanical connection



mm
 Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ± 0.2 mm

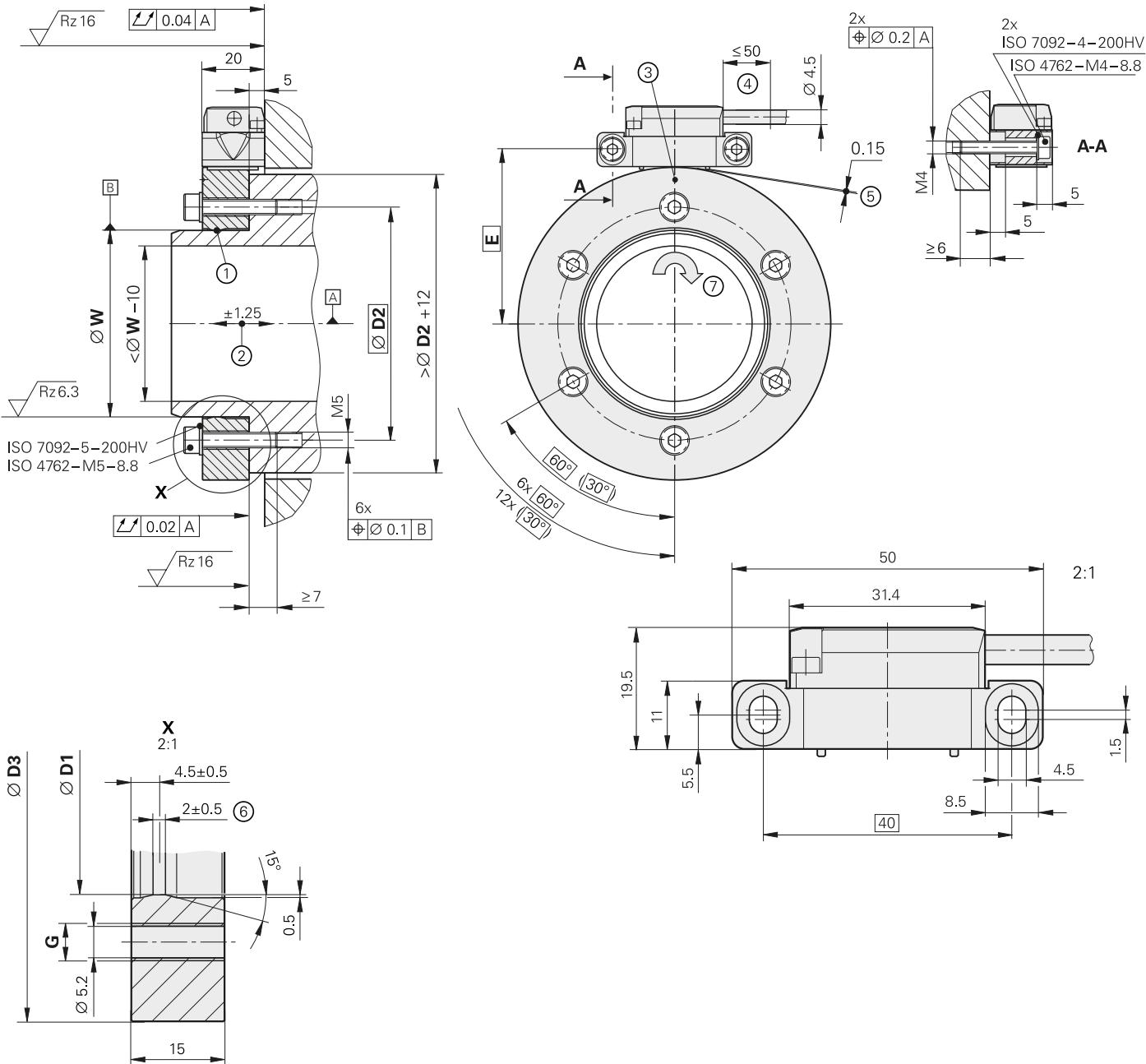
■ = Bearing of mating shaft
① = Shaft fit; ensure full-surface contact
② = Axial tolerance of mating shaft
③ = Reference mark position
④ = Cable support
⑤ = Mounting distance of 0.15 mm set with spacer foil
⑥ = Centering collar
⑦ = Direction of shaft rotation for output signals as per the interface description

D1	W	D2	D3	E	G	1)	2)
$\varnothing 40$ 0/-0.007	$\varnothing 40$ +0.010/+0.003	$\varnothing 50$	$\varnothing 75.44$	43.4	6x M6	600	27000 rad/s^2
$\varnothing 70$ 0/-0.008	$\varnothing 70$ +0.019/+0.011	$\varnothing 85$	$\varnothing 113.16$	62.3	6x M6	900	9000 rad/s^2
$\varnothing 80$ 0/-0.008	$\varnothing 80$ +0.022/+0.014	$\varnothing 95$	$\varnothing 128.75$	70.1	6x M6	1024	6000 rad/s^2
$\varnothing 120$ 0/-0.010	$\varnothing 120$ +0.036/+0.026	$\varnothing 135$	$\varnothing 150.88$	81.2	6x M6	1200	7000 rad/s^2
$\varnothing 130$ 0/-0.012	$\varnothing 130$ +0.041/+0.029	$\varnothing 145$	$\varnothing 176.03$	93.7	6x M6	1400	3300 rad/s^2
$\varnothing 180$ 0/-0.012	$\varnothing 180$ +0.055/+0.043	$\varnothing 195$	$\varnothing 257.50$	134.5	6x M6	2048	820 rad/s^2
$\varnothing 220$ 0/-0.014	$\varnothing 220$ +0.069/+0.055	$\varnothing 235$	$\varnothing 257.50$	134.5	6x M6	2048	1800 rad/s^2
$\varnothing 295$ 0/-0.016	$\varnothing 295$ +0.093/+0.077	$\varnothing 310$	$\varnothing 326.90$	169.2	6x M6	2600	1300 rad/s^2
$\varnothing 410$ 0/-0.020	$\varnothing 410$ +0.130/+0.110	$\varnothing 425$	$\varnothing 452.64$	232.0	12x M6	3600	960 rad/s^2

1) = Line count
2) = Max. angular acceleration

ERM 2410 series

- Consisting of AK ERM 2410 scanning head and TTR ERM 2400 scale drum
- Modular encoders with magnetic scanning principle
- Signal period approx. 400 µm (at circumference)
- For C axis on lathes
- Suitable for fault exclusion for loosening of the mechanical connection



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ISO 2768 - m H
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A = Bearing of mating shaft
① = Shaft fit; ensure full-surface contact
② = Axial tolerance of mating shaft
③ = Reference mark position
④ = Cable support
⑤ = Mounting distance of 0.15 mm set with spacer foil
⑥ = Centering collar
⑦ = Direction of shaft rotation for output signals as per the interface description

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$\varnothing 295$ 0/-0.016	$\varnothing 295$ +0.093/+0.077	$\varnothing 310$	$\varnothing 326.90$	169.2	6x M6	2600	1300 rad/s^2
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1) = Line count
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Fault exclusion against loosening of the mechanical connection

Mounting with mechanical fault exclusion is to be seen as an option. This documentation describes the prerequisites or limitations for assembly with a mechanical fault exclusion as far as they differ from the information in the brochure *Modular Angle Encoders with Magnetic Scanning*. If no mechanical fault exclusion is required for the safety strategy, the drum can be fixed as before (according to the brochure *Modular Angle Encoders with Magnetic Scanning*).

A mechanical fault exclusion exists for the following products:

- AK ERM 2280 (ID 1144028-xx) together with the scale drum TTR ERM 2200 (ID 733349-xx) or TTR ERM 2200C (ID 671712-xx)
- AK ERM 2420 (ID 1144042-xx), AK ERM 2480 (ID 1144048-xx), AK ERM 2410 (ID 1144041-xx) together with the scale drum TTR ERM 2400 (ID 1144140-xx) or TTR ERM 2400C (ID 1144150-xx)

In addition to the data interface, the mechanical connection of the encoder to the motor is relevant to safety. The standard for electrical drives, EN 61800-5-2, defines the loosening of the mechanical connection between the encoder and drive as a fault that requires consideration. Since it cannot be guaranteed that the control will detect such errors, in many cases a fault exclusion for the loosening of the mechanical connection is required.

The machine manufacturer is responsible for the dimensioning of mechanical connections in a drive system. The OEM should ideally consider the application conditions for the mechanical design. Providing objective evidence of a safe connection is time-consuming, however. For this reason, HEIDENHAIN has developed a mechanical fault exclusion for the ERM 2xx0 series.

The qualification of the mechanical fault exclusion was performed for a broad application range of the encoders. This means that fault exclusion is ensured under the operating conditions listed below. The great range of temperatures in combination with the multitude of material characteristics, as well as the maximum permissible shaft speeds and accelerations require an interference fit of the drum. Because of the dimensioning of the interference fit and taking into account all safety factors, HEIDENHAIN recommends heating the scale drum.

The scanning head and scale drum are mounted by screws, with special attention paid to the following:

Mechanical connection	Fastening	Safe position for the mechanical coupling ¹⁾	Restricted characteristic values ²⁾
Scale drum	Interference fit according to dimension drawing. Screw connection: ³⁾ M5 ISO 4762 8.8	±0.025°	<ul style="list-style-type: none">• Maximum acceleration of the scanning head including vibration 55 to 2000 Hz (as per EN 60068-2-6) and shock 6 ms (as per EN 60068-2-27) $\leq 400 \text{ m/s}^2$ <p>See Dimensions:</p> <ul style="list-style-type: none">• Maximum angular acceleration of the scale drum• Inside diameter and mounting tolerance of the measured shaft• Surface roughness of the mating surfaces• Screw depth
Scanning head	Screw connection: ³⁾ M4 ISO 4762 8.8		<p>See Mounting:</p> <ul style="list-style-type: none">• Usable materials

¹⁾ Fault exclusions are given only for the explicitly named mounting option

²⁾ Unlike ERM 2xx0, without mechanical fault exclusion

³⁾ Friction coefficient class B as per VDI 2230

Material

The data given in the table for the material of the mating shaft and stator are to be complied with.

Mounting temperature

All information on screw connections is given with respect to a mounting temperature of 15 °C to 35 °C.

Assembling the scale drum

An oversize of the shaft is required for fault exclusion. The scale drum should preferably be shrunk thermally onto the mating shaft and additionally be fastened with screws. For this purpose, the scale drum must be heated slowly before mounting. Use a heat chamber or a heat plate (but no induction heating sources). The diagram shows the recommended minimum temperatures for the different drum diameters. The maximum temperature should not exceed 140 °C.

During shrink-fitting, make sure that the hole patterns of the scale drum and mating shaft are properly aligned. Appropriate positioning aids (setscrews) can facilitate mounting. When the scale drum has cooled down, all mounting screws have to be tightened again with the correct torque. The mounting screws used for the assembly of the scanning head and scale drum must be used only to secure the scanning head and the scale drum. Do not additionally fasten any other components with these screws.

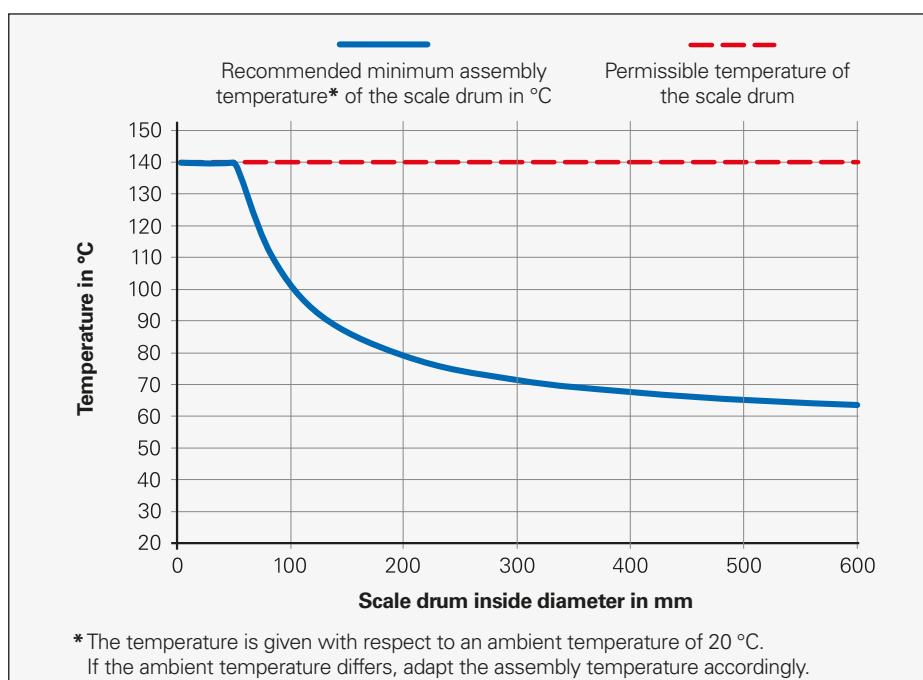
Removing the scale drum

The scale drum is disassembled using the corresponding back-off threads in the drum. To do so, fasten greased screws and tighten them consecutively until the scale drum comes off the shaft. It is also helpful here to use setscrews inserted into the mating shaft, on which the screws in the back-off threads apply pressure.

Mounting the scanning head

Care must be taken to ensure that the correct scale drum and scanning head are used (correct size and number of signal periods). In order to mount the scanning head, the provided spacer foil is applied to the surface of the circumferential scale drum. The scanning head is pressed against the foil, fastened, and the foil is removed.

	Mating shaft (drum connection)	Mating stator (scanning head connection)
Material	Steel	Steel/cast iron
Tensile strength R_m	$\geq 600 \text{ N/mm}^2$	$\geq 250 \text{ N/mm}^2$
Shear strength τ_m	$\geq 390 \text{ N/mm}^2$	$\geq 290 \text{ N/mm}^2$
Elastic modulus E	$200\,000 \text{ N/mm}^2$ to $215\,000 \text{ N/mm}^2$	$110\,000 \text{ N/mm}^2$ to $215\,000 \text{ N/mm}^2$
Coefficient of thermal expansion α_{therm}	$(10 \text{ to } 13) \cdot 10^{-6} \text{ K}^{-1}$	



HEIDENHAIN

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This Product Information 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 made.

Related documents: Comply with the information in the following documents to ensure the correct and intended operation of the encoder:

- Catalog Modular Angle Encoders with Magnetic Scanning
 - Mounting Instructions AK ERM 2280 1156253
 - AK ERM 2420/2480 1156255
 - AK ERM 2410 1156254
 - TTR ERM 2200 1165087
 - TTR ERM 2400 1165088

For catalogs, brochures and Product Information Sheets, visit www.heidenhain.de.