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# HEIDENHAIN



Product Information

## **ERA 4000 Series**

Incremental  
Modular Angle Encoders

May 2006

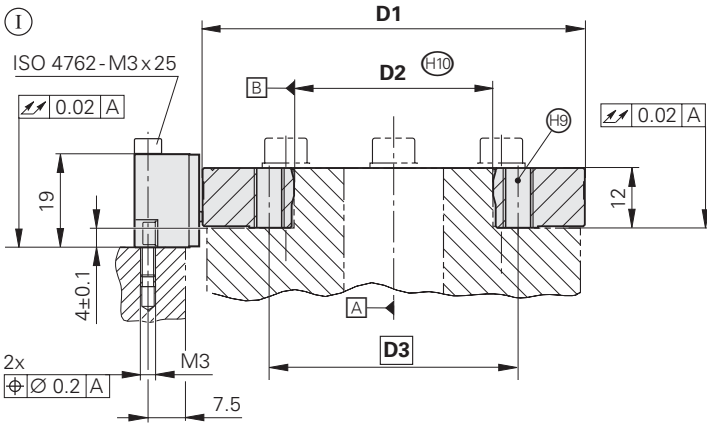
# ERA 4280 C, ERA 4480 C, ERA 4880 C

Steel circumferential-scale drum with centering collar

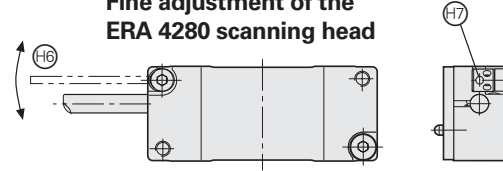
**ERA 4280 C** grating period 20  $\mu\text{m}$ —consisting of **ERA 4280 Scanning Head** and **ERA 4200 C Scale Drum**

**ERA 4480 C** grating period 40  $\mu\text{m}$ —consisting of **ERA 4480 Scanning Head** and **ERA 4400 C Scale Drum**

**ERA 4880 C** grating period 80  $\mu\text{m}$ —consisting of **ERA 4880 Scanning Head** and **ERA 4800 C Scale Drum**



**Fine adjustment of the ERA 4280 scanning head**



Dimensions in mm



Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm:  $\pm 0.2$  mm

Ⓚ, Ⓛ = Mounting options

Ⓐ = Bearing

Ⓜ = Mounting clearance (spacer foil)

Ⓝ = Marker for reference mark

Ⓟ = Positive direction of rotation

Ⓠ = Scale reference mark

Ⓡ = Ensure adjustability of mounting surface for scanning head

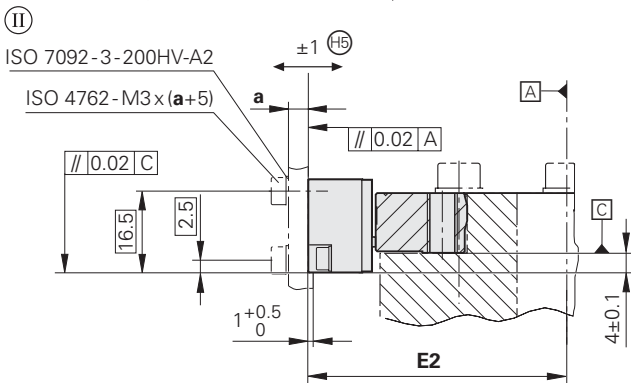
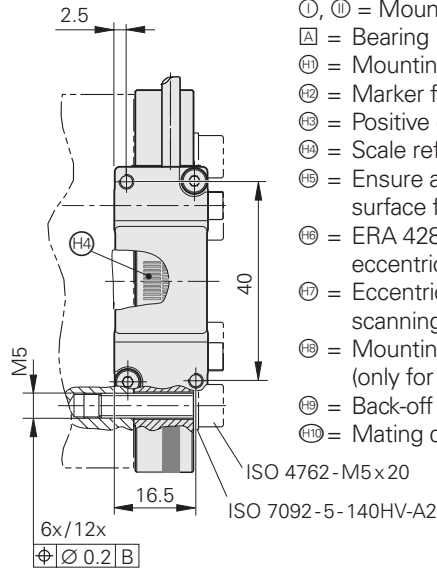
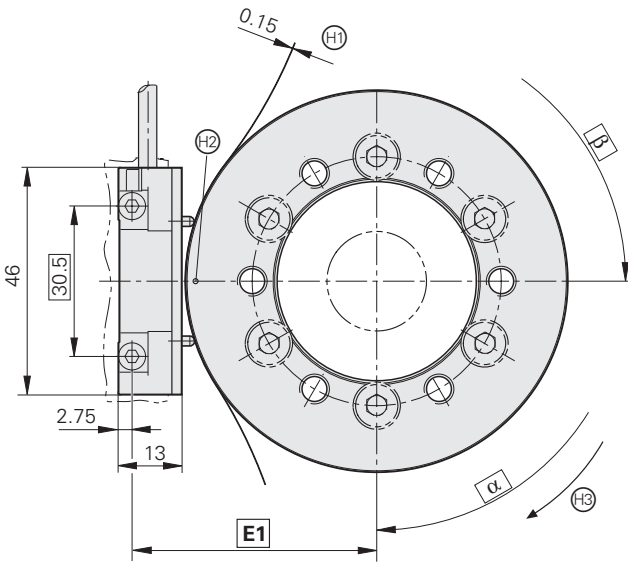
Ⓢ = ERA 4280 scanning head with eccentric nut for fine adjustment

Ⓣ = Eccentric nut (only on ERA 4280 scanning head)

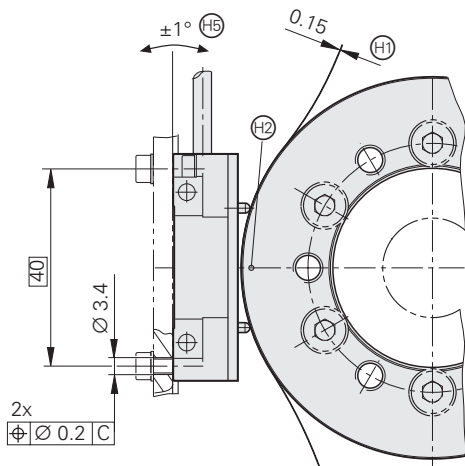
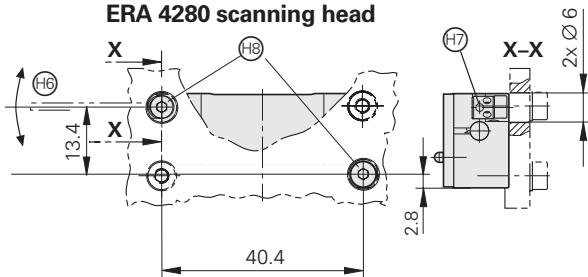
Ⓤ = Mounting holes for fine adjustment (only for ERA 4280 scanning head)

Ⓡ = Back-off thread M6

Ⓢ = Mating diameter of customer's shaft



**Fine adjustment of the ERA 4280 scanning head**



D1	D2	D3	E1	E2	$\alpha$	$\beta$
∅ 76.75	∅ 40+0.005	∅ 50	49.34	52.08	6 x 60° = 360°	6 x 60° = 360°
∅ 104.63	∅ 70+0.005	∅ 85	63.28	66.02		
∅ 127.64	∅ 80+0.005	∅ 95	74.78	77.52		
∅ 178.55	∅ 120+0.008	∅ 140	100.24	102.98		
∅ 208.89	∅ 150+0.008	∅ 165	115.41	118.15		
∅ 254.93	∅ 180+0.008	∅ 200	138.43	141.17	12 x 60° = 360°	12 x 60° = 360°
∅ 331.31	∅ 270+0.010	∅ 290	176.62	179.36		

**Scheduled availability: 3rd quarter of 2006**

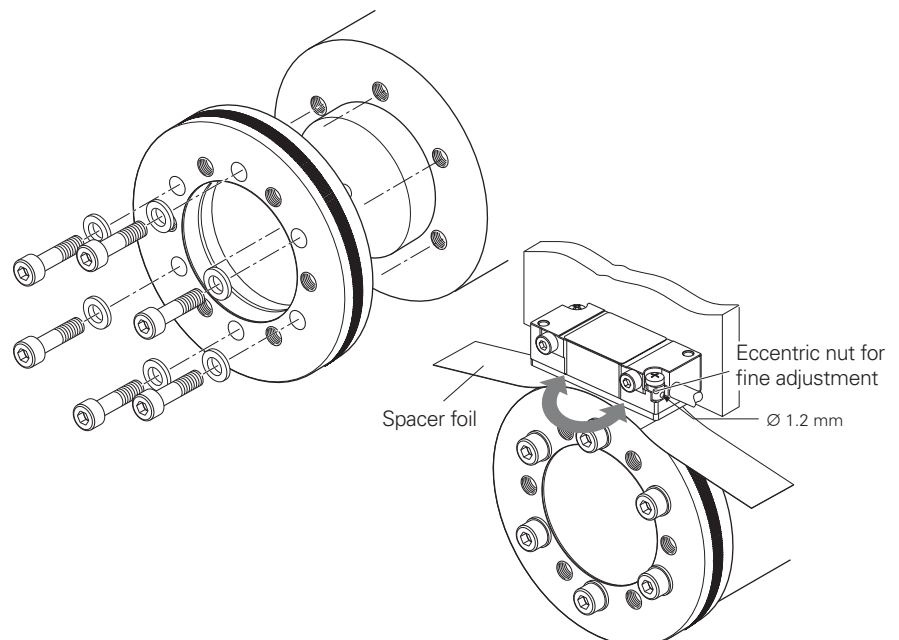
<b>Specifications</b>	<b>ERA 4280C</b> grating period 20 µm <b>ERA 4480C</b> grating period 40 µm <b>ERA 4880C</b> grating period 80 µm							
<b>Incremental signals</b>	~ 1 V <sub>PP</sub>							
Reference marks	Distance-coded							
Cutoff frequency -3dB	≥ 350 kHz							
<b>Power supply</b>	5 V ± 10%/max. 100 mA (without load)							
<b>Electrical connection</b>	Cable, 1 m, with M23 coupling (12-pin)							
<b>Cable length</b>	≤ 150 m (with HEIDENHAIN cable)							
<b>Drum inside diameter*</b>	40 mm	70 mm	80 mm	120 mm	150 mm	180 mm	270 mm	
<b>Drum outside diameter*</b>	76.75 mm	104.63 mm	127.64 mm	178.55 mm	208.89 mm	254.93 mm	331.31 mm	
<b>Line count</b>	<i>ERA 4280C</i> <i>ERA 4480C</i> <i>ERA 4880C</i>	12 000 6 000 3 000	16 384 8 192 4 096	20 000 10 000 5 000	28 000 14 000 7 000	32 768 16 384 8 192	40 000 20 000 10 000	52 000 26 000 13 000
<b>Grating accuracy</b>	± 5"	± 3.7"	± 3"	± 2.5"				
<b>System accuracy</b>	<i>ERA 4280C</i> <i>ERA 4480C</i> <i>ERA 4880C</i>	± 6.1" ± 7.2" ± 9.4"	± 4.5" ± 5.3" ± 6.9"	± 3.7" ± 4.3" ± 5.6"	± 3.0" ± 3.5" ± 4.4"	± 2.9" ± 3.3" ± 4.1"	± 2.9" ± 3.2" ± 3.8"	± 2.8" ± 3.0" ± 3.5"
<b>Mech. permissible speed</b>	10 000 rpm	8 500 rpm	6 250 rpm	4 500 rpm	4 250 rpm	3 250 rpm	2 500 rpm	
<b>Moment of inertia</b> of rotor	0.27 · 10 <sup>-3</sup> kgm <sup>2</sup>	0.81 · 10 <sup>-3</sup> kgm <sup>2</sup>	1.9 · 10 <sup>-3</sup> kgm <sup>2</sup>	7.1 · 10 <sup>-3</sup> kgm <sup>2</sup>	12 · 10 <sup>-3</sup> kgm <sup>2</sup>	28 · 10 <sup>-3</sup> kgm <sup>2</sup>	59 · 10 <sup>-3</sup> kgm <sup>2</sup>	
<b>Perm. axial movement</b>	≤ ± 0.5 mm (scale drum relative to scanning head)							
<b>Vibration</b> 55 to 2000 Hz <b>Shock</b> 6 ms	≤ 100 m/s <sup>2</sup> (IEC 60068-2-6) ≤ 500 m/s <sup>2</sup> (IEC 60068-2-27)							
<b>Operating temperature</b>	-10 °C to 80 °C							
<b>Protection</b> IEC 60529	IP 00							
<b>Weight</b>	Scale drum	0.28 kg	0.41 kg	0.68 kg	1.2 kg	1.5 kg	2.3 kg	2.6 kg
	Scanning head without cable	0.020 kg						

\* Please indicate when ordering

### Assembly

The **circumferential scale drum** is slid onto the drive shaft and fastened with screws. The scale drum is centered via the **centering collar** on its inner circumference. HEIDENHAIN recommends using a transition fit for mounting the scale drum. For mounting, the scale drum may be slowly warmed on a heating plate over a period of approx. 10 minutes to a maximum temperature of 100 °C.

To mount the **scanning head**, the spacer foil is placed on the surface of the scale drum. The scanning head is pressed against the foil, fastened, and the foil is removed. Encoders with 20 µm grating period also feature an eccentric nut for fine adjustment of the scanning field.

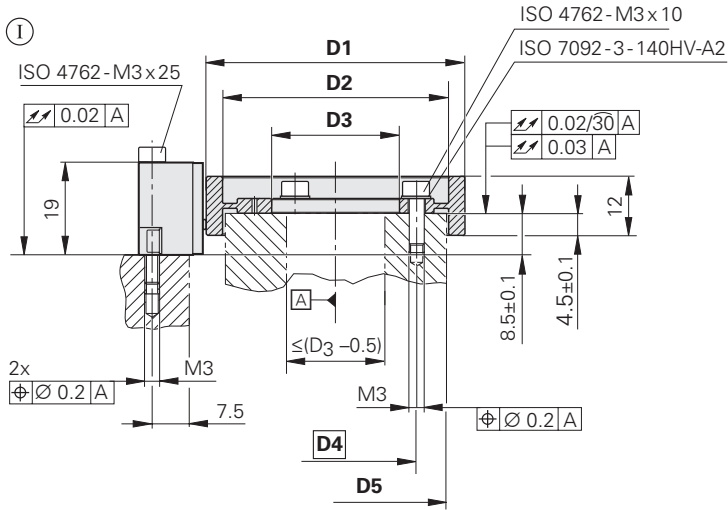


# ERA 4281 C, ERA 4481 C

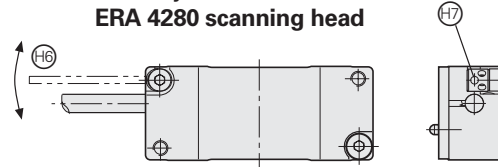
Steel circumferential-scale drum with low weight and low moment of inertia

ERA 4281 C grating period 20 μm—consisting of ERA 4280 Scanning Head and ERA 4201 C Scale Drum

ERA 4481 C grating period 40 μm—consisting of ERA 4480 Scanning Head and ERA 4401 C Scale Drum



## Fine adjustment of the ERA 4280 scanning head



Dimensions in mm



Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm: ±0.2 mm

Ⓚ, Ⓛ = Mounting options

ⓐ = Bearing

Ⓜ = Mounting clearance (spacer foil)

Ⓝ = Marker for reference mark

Ⓟ = Positive direction of rotation

Ⓡ = Scale reference mark

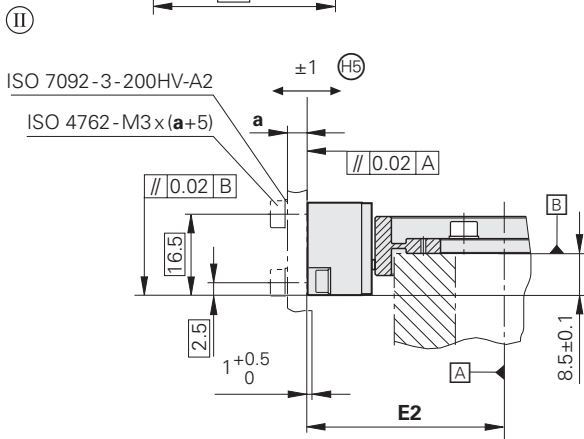
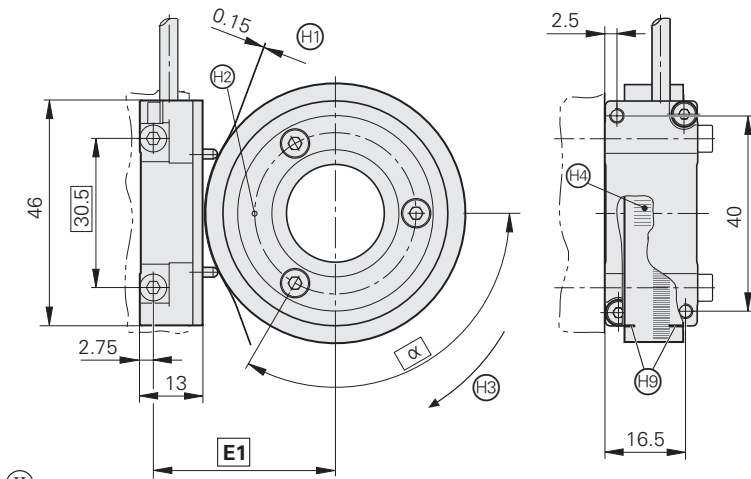
Ⓢ = Ensure adjustability of mounting surface for scanning head

Ⓣ = ERA 4280 scanning head with eccentric nut for fine adjustment

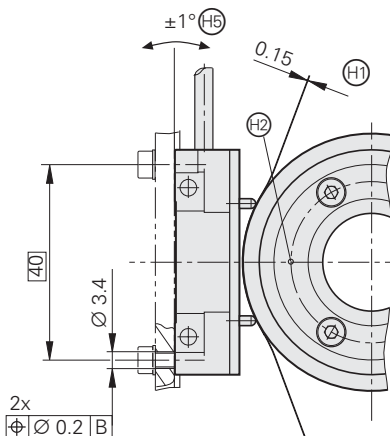
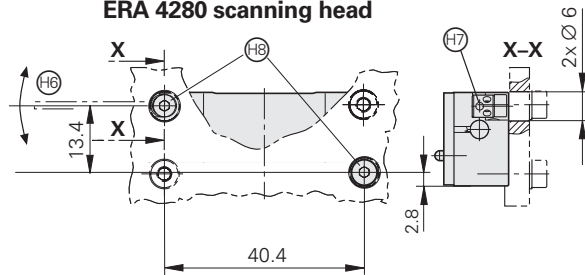
Ⓤ = Eccentric nut (only on ERA 4280 scanning head)

Ⓡ = Mounting holes for fine adjustment (only for ERA 4280 scanning head)

Ⓢ = Marks for drum centering (3 x 120°)



## Fine adjustment of the ERA 4280 scanning head



D1	D2	D3	D4	D5	E1	E2	α
∅ 52.65	∅ 46	∅ 26	∅ 33	∅ 44±1	37.29	40.03	3 x 120° = 360°
∅ 76.75	∅ 70	∅ 50	∅ 57	∅ 68±1	49.34	52.08	
∅ 104.63	∅ 98	∅ 78	∅ 85	∅ 96±1	63.28	66.02	6 x 60° = 360°
∅ 153.09	∅ 147	∅ 127	∅ 134	∅ 145±1	87.51	90.25	
∅ 208.89	∅ 203	∅ 183	∅ 190	∅ 201±1	115.41	118.15	8 x 45° = 360°
∅ 254.93	∅ 249	∅ 229	∅ 236	∅ 247±1	138.43	141.17	16 x 22.5° = 360°
∅ 305.84	∅ 300	∅ 280	∅ 287	∅ 298±1	163.88	166.62	

Scheduled availability: 4th quarter of 2006

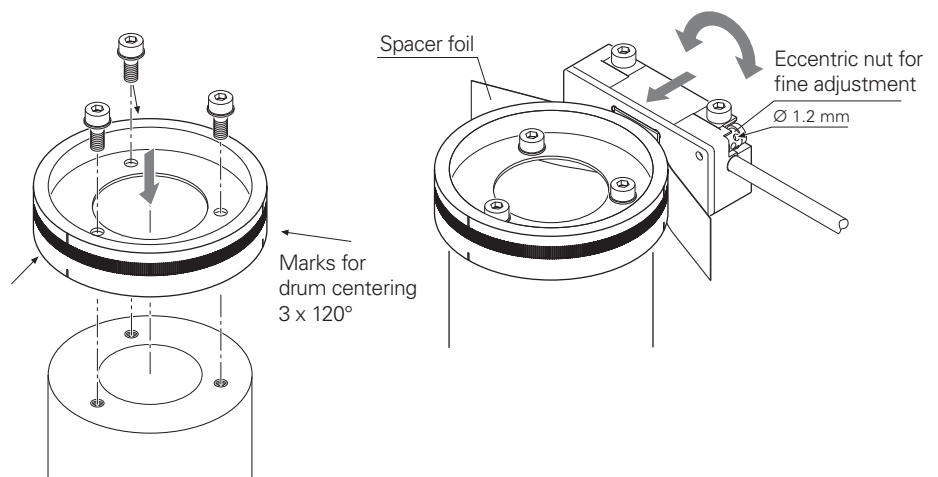
<b>Specifications</b>	<b>ERA 4281 C</b> grating period 20 µm <b>ERA 4481 C</b> grating period 40 µm							
<b>Incremental signals</b>	~ 1 V <sub>PP</sub>							
Reference marks	Distance-coded							
Cutoff frequency -3dB	≥ 350 kHz							
<b>Power supply</b>	5 V ± 10%/max. 100 mA (without load)							
<b>Electrical connection</b>	Cable 3 m with D-sub connector (15-pin)							
<b>Cable length</b>	≤ 150 m (with HEIDENHAIN cable)							
<b>Drum inside diameter*</b>	26 mm	50 mm	78 mm	127 mm	183 mm	229 mm	280 mm	
<b>Drum outside diameter*</b>	52.65 mm	76.75 mm	104.63 mm	153.09 mm	208.89 mm	254.93 mm	305.84 mm	
<b>Line count</b>	<i>ERA 4281 C</i> <i>ERA 4481 C</i>	8 192 4 096	12 000 6 000	16 384 8 192	24 000 12 000	32 768 16 384	40 000 20 000	48 000 24 000
<b>Grating accuracy</b>	± 7"	± 5"	± 3.7"	± 2.5"				
<b>System accuracy</b>	<i>ERA 4281 C</i> <i>ERA 4481 C</i>	± 8.6" ± 10.2"	± 6.1" ± 7.2"	± 4.5" ± 5.3"	± 3.1" ± 3.6"	± 2.9" ± 3.3"	± 2.9" ± 3.2"	± 2.8" ± 3.1"
<b>Mech. permissible speed</b>	6000 rpm		4000 rpm		2000 rpm			
<b>Moment of inertia</b> of rotor	$0.034 \cdot 10^{-3}$ kgm <sup>2</sup>	$0.12 \cdot 10^{-3}$ kgm <sup>2</sup>	$0.33 \cdot 10^{-3}$ kgm <sup>2</sup>	$1.1 \cdot 10^{-3}$ kgm <sup>2</sup>	$2.8 \cdot 10^{-3}$ kgm <sup>2</sup>	$5.2 \cdot 10^{-3}$ kgm <sup>2</sup>	$9.0 \cdot 10^{-3}$ kgm <sup>2</sup>	
<b>Perm. axial movement</b>	≤ ± 0.5 mm (scale drum relative to scanning head)							
<b>Vibration</b> 55 to 2000 Hz <b>Shock</b> 6 ms	≤ 100 m/s <sup>2</sup> (IEC 60 068-2-6) ≤ 500 m/s <sup>2</sup> (IEC 60 068-2-27)							
<b>Operating temperature</b>	-10 °C to 80 °C							
<b>Protection</b> IEC 60 529	IP 00							
<b>Weight</b>	Scale drum	0.065 kg	0.11 kg	0.15 kg	0.21 kg	0.28 kg	0.35 kg	0.41 kg
	Scanning head without cable	0.020 kg						

\* Please indicate when ordering

### Assembly

The **scale drum** is centered over three positions at 120° increments on its circumference and fastened with screws. The positions for centering are marked on the scale drum.

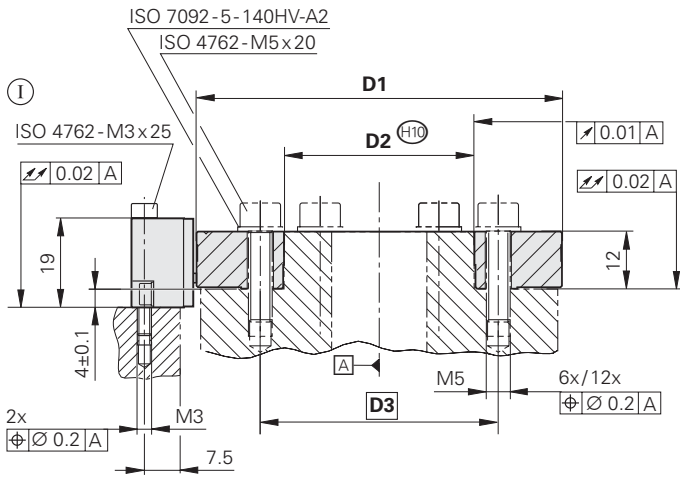
To mount the **scanning head**, the spacer foil is placed on the surface of the scale drum. The scanning head is pressed against the foil, fastened, and the foil is removed. Encoders with 20 µm grating period also feature an eccentric nut for fine adjustment of the scanning field.



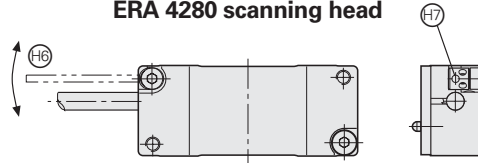
# ERA 4282 C

Steel circumferential-scale drum increased accuracy requirements

ERA 4282 C grating period 20 μm—consisting of ERA 4280 Scanning Head and ERA 4202 C Scale Drum



## Fine adjustment of the ERA 4280 scanning head



Dimensions in mm



Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm: ±0.2 mm

⊙, ⊕ = Mounting options

▭ = Bearing

⊕ = Mounting clearance (spacer foil)

⊕ = Marker for reference mark

⊕ = Positive direction of rotation

⊕ = Scale reference mark

⊕ = Ensure adjustability of mounting surface for scanning head

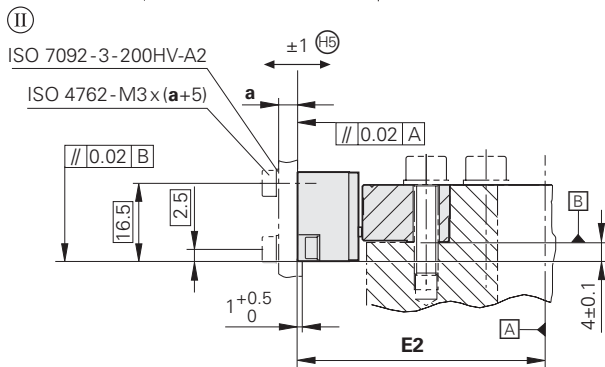
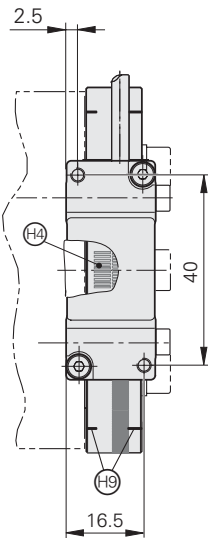
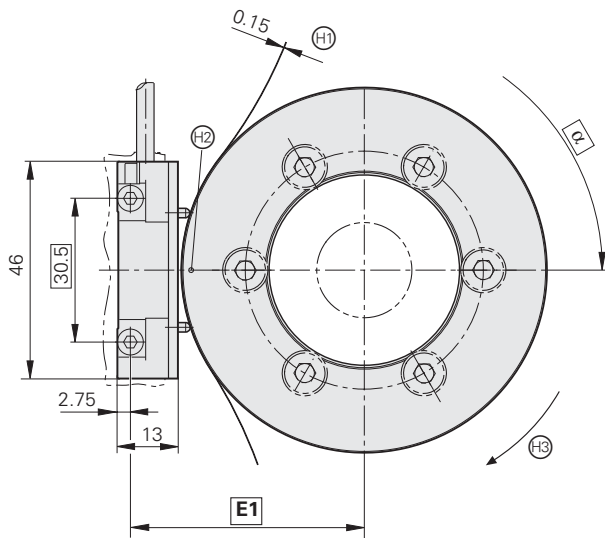
⊕ = ERA 4280 scanning head with eccentric nut for fine adjustment

⊕ = Eccentric nut (only on ERA 4280 scanning head)

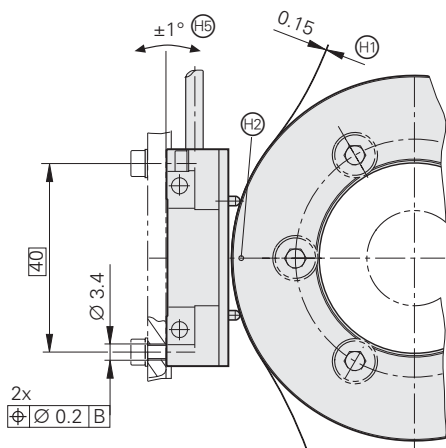
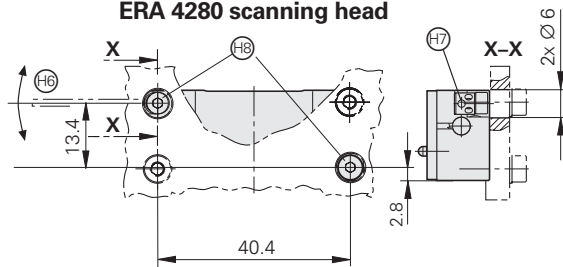
⊕ = Mounting holes for fine adjustment (only for ERA 4280 scanning head)

⊕ = Marks for drum centering (3x120°)

⊕ = Mating diameter of customer's shaft



## Fine adjustment of the ERA 4280 scanning head



D1	D2	D3	E1	E2	α
∅ 76.75	∅ 40+0.015	∅ 50	49.34	52.08	6 x 60° = 360°
∅ 104.63	∅ 70+0.015	∅ 85	63.28	66.02	
∅ 127.64	∅ 80+0.015	∅ 95	74.78	77.52	
∅ 178.55	∅ 120+0.015	∅ 140	100.24	102.98	
∅ 208.89	∅ 150+0.015	∅ 165	115.41	118.15	
∅ 254.93	∅ 180+0.015	∅ 200	138.43	141.17	
∅ 331.31	∅ 270+0.015	∅ 290	176.62	179.36	12 x 60° = 360°

Scheduled availability: 4th quarter of 2006

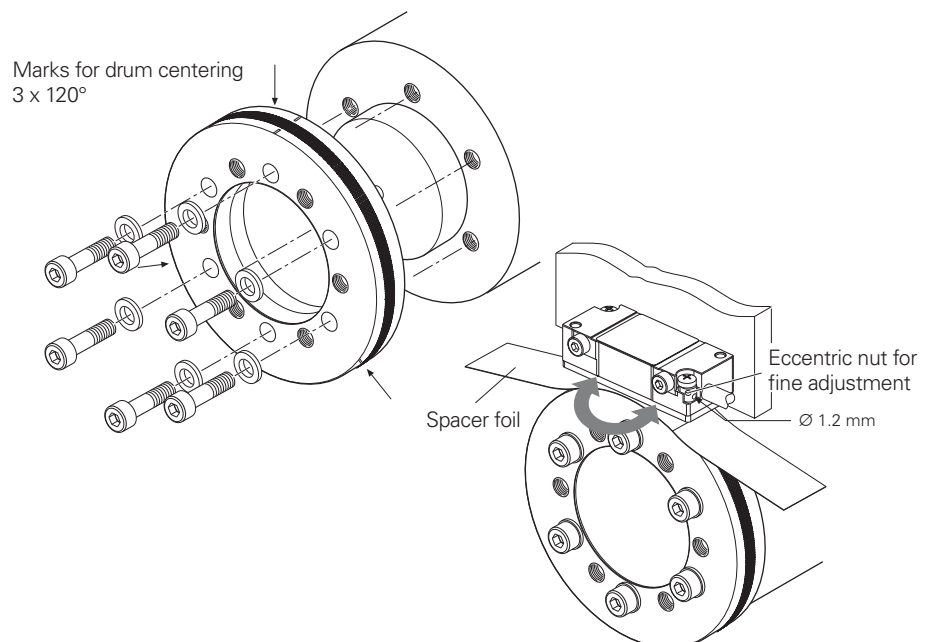
Specifications	ERA 4282C grating period 20 µm							
Incremental signals	~ 1 V <sub>PP</sub>							
Reference marks	Distance-coded							
Cutoff frequency -3dB	≥ 350 kHz							
Power supply	5 V ± 10%/max. 100 mA (without load)							
Electrical connection	Cable, 1 m, with M23 coupling (12-pin)							
Cable length	≤ 150 m (with HEIDENHAIN cable)							
Drum inside diameter*	40 mm	70 mm	80 mm	120 mm	150 mm	180 mm	270 mm	
Drum outside diameter*	76.75 mm	104.63 mm	127.64 mm	178.55 mm	208.89 mm	254.93 mm	331.31 mm	
Line count	12000	16384	20000	28000	32768	40000	52000	
Grating accuracy	± 4"	± 3"	± 2.5"	± 2"	± 1.9"	± 1.8"	± 1.7"	
System accuracy	± 5.1"	± 3.8"	± 3.2"	± 2.5"	± 2.3"	± 2.2"	± 2.0"	
Mech. permissible speed	10000 rpm	8500 rpm	6250 rpm	4500 rpm	4250 rpm	3250 rpm	2500 rpm	
Moment of inertia of rotor	$0.27 \cdot 10^{-3}$ kgm <sup>2</sup>	$0.81 \cdot 10^{-3}$ kgm <sup>2</sup>	$1.9 \cdot 10^{-3}$ kgm <sup>2</sup>	$7.1 \cdot 10^{-3}$ kgm <sup>2</sup>	$12 \cdot 10^{-3}$ kgm <sup>2</sup>	$28 \cdot 10^{-3}$ kgm <sup>2</sup>	$59 \cdot 10^{-3}$ kgm <sup>2</sup>	
Perm. axial movement	≤ ± 0.5 mm (scale drum relative to scanning head)							
Vibration 55 to 2000 Hz Shock 6 ms	≤ 100 m/s <sup>2</sup> (IEC 60068-2-6) ≤ 500 m/s <sup>2</sup> (IEC 60068-2-27)							
Operating temperature	-10 °C to 80 °C							
Protection IEC 60529	IP 00							
Weight	Scale drum	0.28 kg	0.41 kg	0.68 kg	1.2 kg	1.5 kg	2.3 kg	2.6 kg
	Scanning head without cable	0.020 kg						

\* Please indicate when ordering

### Assembly


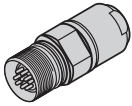
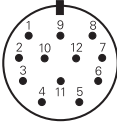
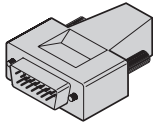

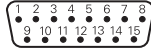



The **scale drum** is centered over three positions at 120° increments on its circumference and fastened with screws. The positions for centering are marked on the scale drum.

To mount the **scanning head**, the spacer foil is placed on the surface of the scale drum. The scanning head is pressed against the foil, fastened, and the foil is removed. Encoders with 20 µm grating period also feature an eccentric nut for fine adjustment of the scanning field.



# Electrical Connection

## Pin Layout




12-pin M23 coupling					15-pin D-sub connector									
														
	Power supply				Incremental signals						Other signals			
	12	2	10	11	5	6	8	1	3	4	/	7	9	
	4	12	2	10	1	9	3	11	14	7	5/6/8/15	13	/	
	Up	Sensor Up	0V	Sensor 0V	A+	A-	B+	B-	R+	R-	Vacant	Vacant	Vacant	
	Brown/ Green	Blue	White/ Green	White	Brown	Green	Gray	Pink	Red	Black	/	Violet	Yellow	




**Shield** on housing; **Up** = power supply voltage

**Sensor:** The sensor line is connected in the encoder connector with the corresponding power line

Color assignment applies only to connecting cable

## Encoder Cable

Connecting cable PUR Ø 8 mm [4(2 x 0.14 mm <sup>2</sup> ) + (4 x 0.5 mm <sup>2</sup> )]		
<p><b>Complete</b> with M23 connector (female) and M23 coupling (male) Id. Nr. 298401-xx</p> 	<p><b>With one</b> M23 connector (female) Id. Nr. 309777-xx</p> 	<p><b>Complete</b> with M23 connector (female) and D-sub connector (female) for HEIDENHAIN controls, IK 220 Id. Nr. 310199-xx</p> 

Connecting cable PUR Ø 8 mm [4(2 x 0.14 mm <sup>2</sup> ) + (4 x 0.5 mm <sup>2</sup> )]		
<p><b>Complete</b> with D-sub connectors (female/male) Id. Nr. 335074-xx</p> 	<p><b>With one</b> D-sub connector (female) Id. Nr. 332433-xx</p> 	<p><b>Complete</b> with D-sub connector (female) and connector (female) for HEIDENHAIN controls, IK 220 Id. Nr. 335077-xx</p> 

# HEIDENHAIN

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### For more information

- Brochure: *Angle Encoders without Integral Bearing*

