



HEIDENHAIN



Product Information

ECA 4000V

Absolute Modular Angle
Encoder for Application in
High Vacuum

ECA 4412V, ECA 4492V

Absolute angle encoder with high accuracy for use in high vacuum

- Steel scale drum with three-point centering
- Consists of scanning head and scale drum



ECA 4000

Scanning head

Interface

Ordering designation

Clock frequency/Processing time t_{cal}

Electrical connection

Cable length¹⁾

Power supply

Power consumption (max.)

Current consumption (typical)

Vibration 55 Hz to 2000 Hz

Shock 6 ms

Operating temperature

Baking temperature

Vacuum class

Protection EN 60529

Mass

Scale drum

Measuring standard

Coefficient of expansion

Drum inside diameter*

Drum outside diameter*

Mechanically permissible speed

Electrically permissible speed

Moment of inertia of rotor

Permissible axial movement

Positions per revolution

Measuring step

Signal periods

Accuracy of graduation

Position error per signal period

RMS (1σ)

Protection EN 60529

Mass

Scale drum

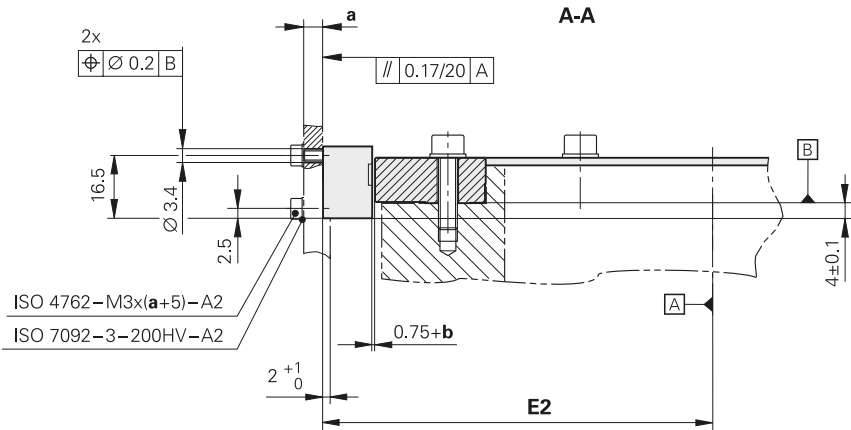
* Please select when ordering
Product Information ECA 4000V

AK ECA 4410 V		AK ECA 4490F V		AK ECA 4490M V		AK ECA 4490P V	
EnDat 2.2		Fanuc Serial Interface; α i Interface		Mitsubishi high speed interface		Panasonic Serial Interface	
EnDat22		Fanuc05		Mit03-4		Pana01	
≤ 16 MHz/ ≤ 5 μ s		-					
Cable, 1 m or 3 m, with 15-pin D-sub connector (female)							
≤ 100 m		≤ 50 m		≤ 30 m		≤ 50 m	
DC 3.6 V to 14 V							
At 3.6 V: 700 mW; at 14 V: 800 mW		At 3.6 V: 850 mW; at 14 V: 950 mW					
At 5 V: 90 mA (without load)		At 5 V: 100 mA (without load)					
≤ 500 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)							
-10 °C to 50 °C							
100 °C							
High vacuum up to 10^{-7} mbar							
IP40							
Scanning head: 18 g (without cable); cable: 21 g/m; connector (D-sub): 64 g							

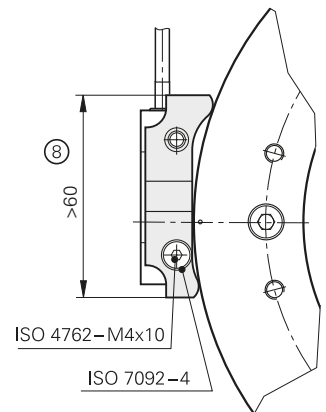
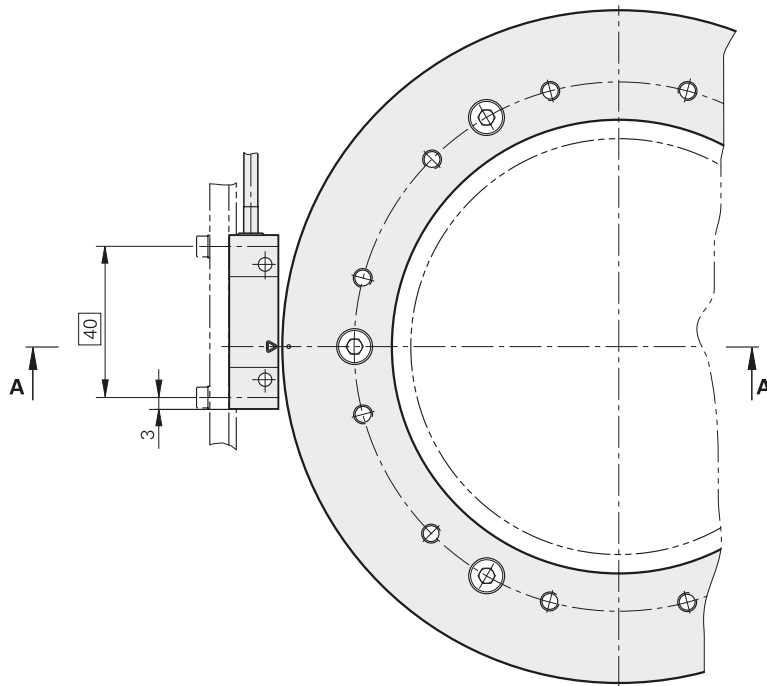
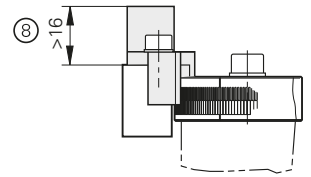
TTR ECA 4402									
Steel drum $\alpha_{\text{therm}} \approx 10.4 \cdot 10^{-6} \text{ K}^{-1}$									
70 mm	80 mm	120/150 mm	130 mm	150/185 mm	180/210 mm	270 mm	425 mm	512 mm	
104.63 mm	127.64 mm	178.55 mm	148.20 mm	208.89 mm	254.93 mm	331.31 mm	484.07 mm	560.46 mm	
≤ 8500 rpm	≤ 6250 rpm	≤ 4500 rpm	≤ 5250 rpm	≤ 4250 rpm	≤ 3250 rpm	≤ 2500 rpm	≤ 1800 rpm	≤ 1500 rpm	
≤ 7000 rpm	≤ 5750 rpm	≤ 3000 rpm	≤ 4400 rpm	≤ 2550 rpm	≤ 2100 rpm	≤ 900 rpm	≤ 600 rpm	≤ 550 rpm	
$0.83 \cdot 10^{-3}$ kgm ²	$2.0 \cdot 10^{-3}$ kgm ²	$7.1/4.5 \cdot 10^{-3}$ kgm ²	$1.7 \cdot 10^{-3}$ kgm ²	$12/6.5 \cdot 10^{-3}$ kgm ²	$28/20 \cdot 10^{-3}$ kgm ²	$59 \cdot 10^{-3}$ kgm ²	$199 \cdot 10^{-3}$ kgm ²	$263 \cdot 10^{-3}$ kgm ²	
$\leq \pm 0.4$ mm (scale drum relative to the scanning head)									
134217728 (27 bits)					268435456 (28 bits)		536870912 (29 bits)		
0.0097"					0.0048"		0.0024"		
8195	10010	14003	11616	16379	19998	25993	37994	44000	
± 3 "	± 2.5 "	± 2 "	± 2.3 "	± 1.9 "	± 1.8 "	± 1.7 "	± 1.5 "	± 1.5 "	
± 0.20 " 0.040"	± 0.16 " 0.032"	± 0.12 " 0.023"	± 0.14 " 0.028"	± 0.10 " 0.020"	± 0.08 " 0.016"	± 0.06 " 0.012"	± 0.04 " 0.009"	± 0.04 " 0.007"	
Complete encoder in mounted condition: IP00									
≈ 0.42 kg	≈ 0.69 kg	$\approx 1.2/0.66$ kg	≈ 0.35 kg	$\approx 1.5/0.66$ kg	$\approx 2.3/1.5$ kg	≈ 2.6 kg	≈ 3.8 kg	≈ 3.7 kg	

¹⁾ With HEIDENHAIN cable

II



Accessory: Mounting aid



D1	⊙	D2	D3	E1	E2	α	M	G	b [mm]	c [mm]
$\varnothing 70 +0.05/+0.07$	$\varnothing \leq 70$	$\varnothing 85$	$\varnothing 104.63$	56.57	66.07	$6 \times 60^\circ = 360^\circ$	6x M5	/	± 0.07	0.3
$\varnothing 80 +0.05/+0.07$	$\varnothing \leq 80$	$\varnothing 95$	$\varnothing 127.64$	68.07	77.57	$6 \times 60^\circ = 360^\circ$	6x M5	/	± 0.07	0.3
$\varnothing 120 +0.05/+0.07$	$\varnothing \leq 120$	$\varnothing 140$	$\varnothing 178.55$	93.52	103.02	$6 \times 60^\circ = 360^\circ$	6x M5	/	± 0.10	0.3
$\varnothing 130 +0.05/+0.07$	$\varnothing \leq 130$	$\varnothing 139$	$\varnothing 148.20$	78.35	87.85	$12 \times 30^\circ = 360^\circ$	12x M3	/	± 0.07	0.3
$\varnothing 150 +0.05/+0.07$	$\varnothing \leq 150$	$\varnothing 163$	$\varnothing 178.55$	93.52	103.02	$12 \times 30^\circ = 360^\circ$	12x M3	/	± 0.10	0.3
$\varnothing 150 +0.05/+0.07$	$\varnothing \leq 150$	$\varnothing 165$	$\varnothing 208.89$	108.69	118.19	$6 \times 60^\circ = 360^\circ$	6x M5	/	± 0.12	0.5
$\varnothing 180 +0.05/+0.07$	$\varnothing \leq 180$	$\varnothing 200$	$\varnothing 254.93$	131.71	141.21	$6 \times 60^\circ = 360^\circ$	6x M5	/	± 0.12	0.5
$\varnothing 185 +0.05/+0.07$	$\varnothing \leq 185$	$\varnothing 197$	$\varnothing 208.89$	108.69	118.19	$12 \times 30^\circ = 360^\circ$	12x M3	/	± 0.12	0.5
$\varnothing 210 +0.05/+0.07$	$\varnothing \leq 210$	$\varnothing 230$	$\varnothing 254.93$	131.71	141.21	$12 \times 30^\circ = 360^\circ$	12x M3	/	± 0.12	0.5
$\varnothing 270 +0.05/+0.07$	$\varnothing \leq 270$	$\varnothing 290$	$\varnothing 331.31$	169.90	179.40	$12 \times 30^\circ = 360^\circ$	12x M5	/	± 0.15	1.0
$\varnothing 425 +0.05/+0.07$	$\varnothing \leq 425$	$\varnothing 445$	$\varnothing 484.07$	246.29	255.79	$12 \times 30^\circ = 360^\circ$	12x M6	12x M6	± 0.15	1.0
$\varnothing 512 +0.05/+0.07$	$\varnothing \leq 512$	$\varnothing 528$	$\varnothing 560.46$	284.48	293.98	$18 \times 20^\circ = 360^\circ$	18x M6	12x M8	± 0.15	1.0

For CAD data go to cad.heidenhain.de

Encoders for application in a vacuum

The vacuum-compatible encoders are distinguished by the following features:

- Air vents
- Production in a clean room
- Specialized cleaning and packaging
- Cable with PTFE insulation and tin-plated copper braiding

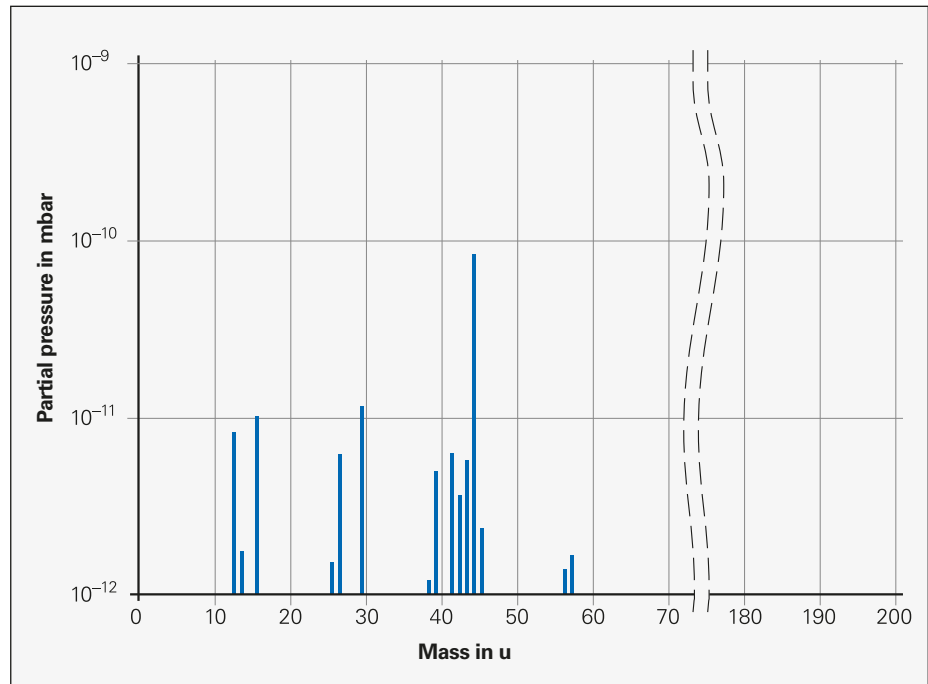
Residual gas analysis

The influence of encoders on the quality of the vacuum can be determined through residual gas analyses. In such an analysis, a sample in a vacuum chamber is pumped out at least to 10^{-6} mbar (turbomolecular pump, pumping speed 15 l/s to 200 l/s) whereby the residual gases are measured with a mass spectrometer (Pfeiffer QMA 200) and an absolute pressure sensor (VACOM ATMION). If the typical residual gases of the empty chamber are then subtracted, the outgassing behavior of the examined sample can be deduced.

The amount of remaining residual gases depends not only on the cleanliness of the sample and the materials tested, but also on the pump type used and its suction power. The higher the pumping speed used for the measurement is, and the longer the gas is pumped out, the lower the quantity of residual gases is.

To attain the lowest possible outgassing values, HEIDENHAIN recommends baking at 100 °C for 48 hours under high vacuum conditions.



The figure shows the spectrum of the residual gas analysis of an AK ECA 4410 V scanning head with 1 m cable and D-sub connector. The scanning head was baked in a high vacuum at 100 °C for 48 hours. The outgases from the scale drum were hardly measurable or depictable.





Residual gas analysis of an AK ECA 4410V scanning head with 1 m cable (with pumping speed of 107 l/s, pressure $6 \cdot 10^{-8}$ mbar)

Electrical connection



EnDat pin layout

15-pin D-sub connector								
	Power supply				Serial data transfer			
	5	12	7	14	4	11	1	9
	U_P	Sensor U _P	0V	Sensor 0V	DATA	DATA	CLOCK	CLOCK
	Brown	Turquoise	White	Beige	Gray	Pink	Violet	Black



Fanuc pin layout

15-pin D-sub connector								
	Power supply				Serial data transfer			
	5	12	7	14	4	11	1	9
	U_P	Sensor U _P	0V	Sensor 0V	Serial Data	Serial Data	Request	Request
	Brown	Turquoise	White	Beige	Gray	Pink	Violet	Black

Mitsubishi pin layout

15-pin D-sub connector								
	Power supply				Serial data transfer			
	5	12	7	14	4	11	1	9
	U_P	Sensor U _P	0V	Sensor 0V	Serial Data	Serial Data	Request Frame	Request Frame
	Brown	Turquoise	White	Beige	Gray	Pink	Violet	Black

Panasonic pin layout

15-pin D-sub connector								
	Power supply				Serial data transfer			
	4	12	2	10	5	13	8	15
	U_P	Sensor U _P	0V	Sensor 0V	Vacant¹⁾	Vacant¹⁾	Request Data	Request Data
	Brown	Turquoise	White	Beige	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Power supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

Vacant pins or wires must not be used.


¹⁾ Required for adjustment/inspection by PWM 21


HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

 +49 8669 31-0

 +49 8669 32-5061

E-mail: info@heidenhain.de

www.heidenhain.de

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.



For more information:

Comply with the requirements described in the following documents to ensure the correct operation of the encoder:

- Brochure: *Modular Angle Encoders with Optical Scanning* 1222041-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx

For brochures and product information sheets, visit www.heidenhain.de.