



RIK

**Rotary Encoder System
Compact Model Range**

Incremental Exposed Linear RIK encoder

Features

- Compact design, consisting of scanning head, round cable and 15-pin D-sub connector
- Minimum dimensions
- Low mass moment of inertia of the grating disk
- High measuring speed
- Signal processing in the D-sub connector
- Optionally: signal interpolation up to 100x in the connector

Fields of application

Fields of application where rotational movements, angles or revolutions must be measured in confined installation conditions:

- Automation technology
- Drive systems
- Instruments and machines used in the electronic industry
- Robot and handling technology
- High-precision engineering
- Metrology
- Rotary axes
- Medical technology

Technical Specification

Mechanical data		Elektrical data	
Weight of scanning head without cable	5.5 g	Scanning frequency	max. 500 kHz
Number of revolutions <ul style="list-style-type: none"> • without interpolation, e.g. for 1800 numbers of lines • with interpolation 50x e.g. for 1800 numbers of lines • see table page 6 too 	16 600 rpm 2 400 rpm	Output interfaces <ul style="list-style-type: none"> • voltage output • square wave output 	1 V _{PP} RS 422 with interpolation up to 100x
Number of lines of the grating disks	1 000 ... 18 000	Connector	15-pin, D-sub plug
Number of counting pulses per revolution (including signal interpolation and quad-edged evaluation)	up to 7 200 000	Supply voltage	+5 V ± 10%
Diameter of grating disks (Diameter of graduation)	30.0 mm 40.4 mm 64.4 mm 92.2 mm 142.4 mm	Power consumption <ul style="list-style-type: none"> • voltage output • square wave output 	< 60 mA < 180 mA
Ambient conditions		Cable diameter	3.7 mm
Operating temperature range	0°C ... +55°C	Cable lengths (cable fixed to the scanning head)	
Storage temperature range	-20°C ... +70°C	<ul style="list-style-type: none"> • standard lengths • extension cable with 15pin D-sub female possible 	0.3 m; 0.5 m; 1.0 m 1.5 m; 2.0 m; 3.0 m max. 100 m
Vibration (50 Hz ... 2000 Hz)	≤ 200 ms ⁻²	Permissible bending radius of cables	
Shock (11 ms)	≤ 400 ms ⁻²	<ul style="list-style-type: none"> • occasional flexing • constant flexing 	8 mm 40 mm
Humidity	93% (no condensation)		

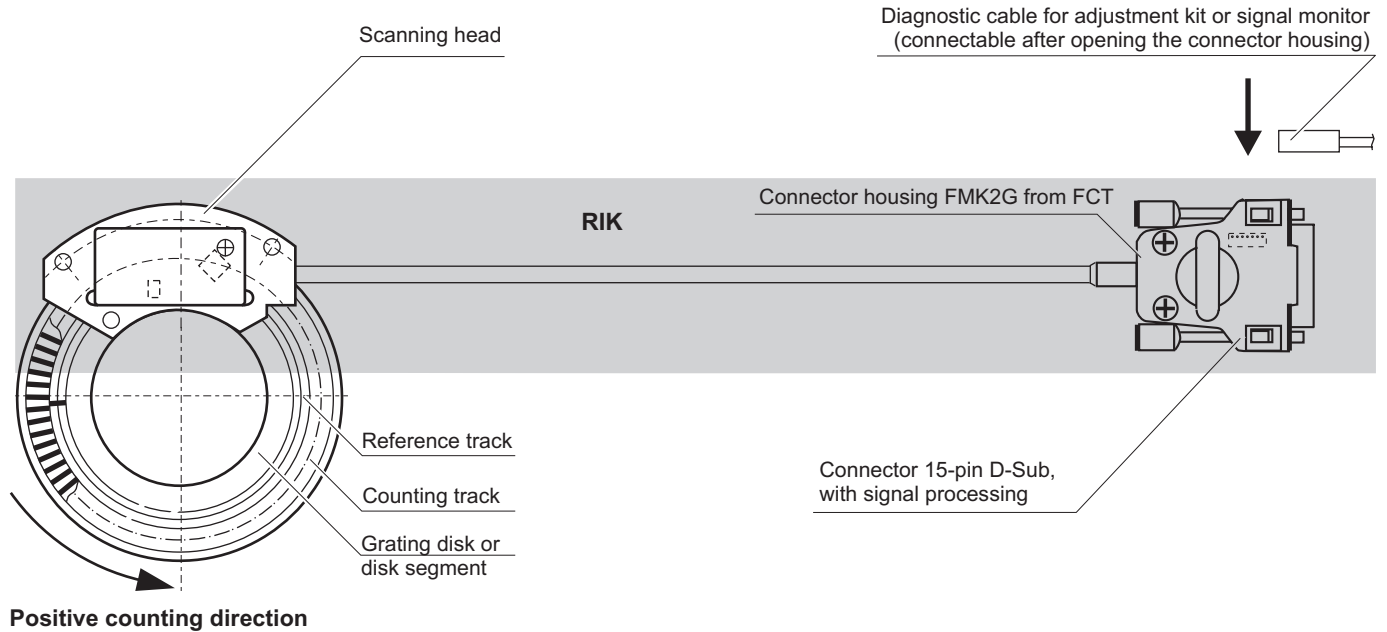
Installation Dimensions

RIK encoder

Designation example:

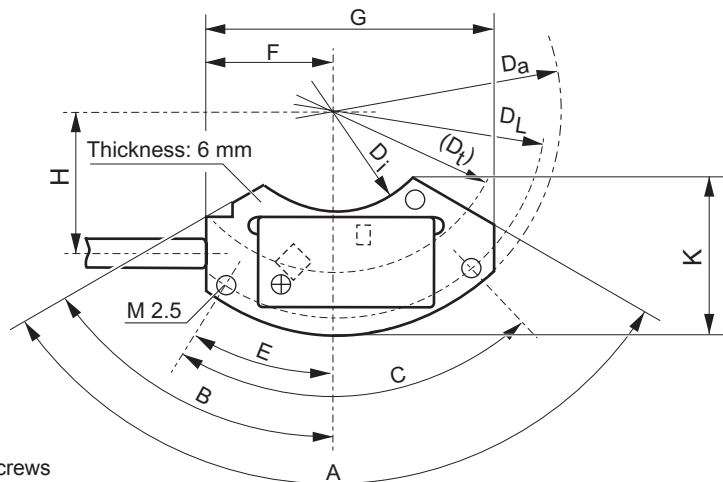
RIK scanning head **RIK 1 – 2 C 40/3600 L 4 T Z** (see page 7)
 (EPIFLEX measuring module fixed in the scanning head, round cable with 15-pin D-sub plug)

Grating disk **RS 40.4/10/3600** (see page 4)



Scanning head

Standard C according to ordering key

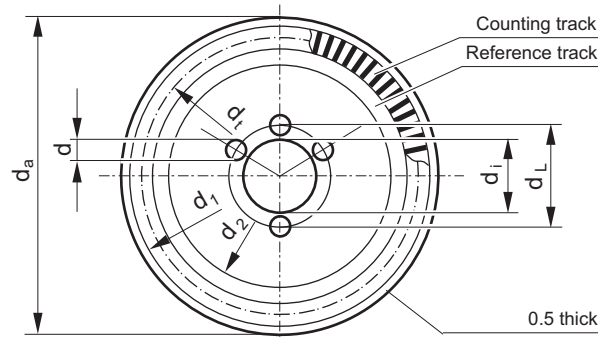


- D_a Scanning head – outside diameter
- D_i Scanning head – inside diameter
- D_t Scanning head – center diameter
- D_L Scanning head – diameter for borings of the mounting screws

Type	D_a	D_t	D_i	D_L	A	B	C	E	F	G	H	K
30	45 _{h6}	30.0	16 ^{H6}	41 ± 0.1	120°	60°	82°	34°	16	34	13	18.8
40	55 _{h6}	40.4	26 ^{H6}	51 ± 0.1	120°	60°	70°	30°	16	35	18	18.6
64	82 _{h6}	64.4	50,8 ^{H6}	77 ± 0.1	90°	45°	44°	22°	18	36	30	19.2
92	110 _{h6}	92.4	78 ^{H6}	106 ± 0.1	90°	45°	34°	17°	18	36	44	18.5
142	160 _{h6}	142.4	126 ^{H6}	156 ± 0.1	90°	45°	22°	11°	18	36	69	18.7

Installation Dimensions

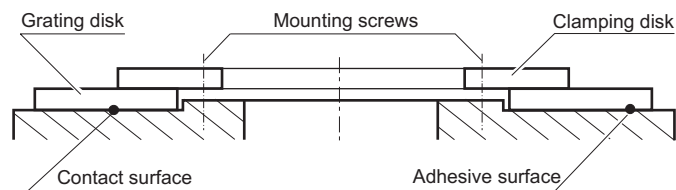
Grating disks available — Ordering key



Type – Ordering key	d_i	d_a	d_t	d_1	d_2	d_L	d	Z
RS 30/16/1000	16 + 0.1	36 ^{-0.2} _{-0.5}	30.0	33.6	21.6	–	–	1000
RS 40.4/10/1800	10 ^{M5}	46 ^{-0.2} _{-0.5}	40.4	44	32	14.5	2.3	1800
RS 40.4/10/2048	10 ^{M5}	46 ^{-0.2} _{-0.5}	40.4	44	32	14.5	2.3	2048
RS 40.4/10/3600	10 ^{M5}	46 ^{-0.2} _{-0.5}	40.4	44	32	14.5	2.3	3600
RS 40.4/25/1800	25 + 0.1	46 ^{-0.2} _{-0.5}	40.4	44	32	–	–	1800
RS 40.4/25/2048	25 + 0.1	46 ^{-0.2} _{-0.5}	40.4	44	32	–	–	2048
RS 40.4/25/3600	25 + 0.1	46 ^{-0.2} _{-0.5}	40.4	44	32	–	–	3600
RS 64.4/48.5/2048	48.5 + 0.1	71 ^{-0.2} _{-0.5}	64.4	68	56	–	–	2048
RS 64.4/48.5/9000	48.5 + 0.1	71 ^{-0.2} _{-0.5}	64.4	68	56	–	–	9000
RS 64.4/48.5/10000	48.5 + 0.1	71 ^{-0.2} _{-0.5}	64.4	68	56	–	–	10000
RS 92.4/70/3600	70 + 0.1	100 ^{-0.2} _{-0.5}	92.4	96	84	–	–	3600
RS 92.4/70/9000	70 + 0.1	100 ^{-0.2} _{-0.5}	92.4	96	84	–	–	9000
RS 92.4/70/18000	70 + 0.1	100 ^{-0.2} _{-0.5}	92.4	96	84	–	–	18000
RS 142.4/120/5400	120 + 0.2	150 ^{-0.2} _{-0.5}	142.4	146	134	–	–	5400
RS 142.4/120/18000	120 + 0.2	150 ^{-0.2} _{-0.5}	142.4	146	134	–	–	18000

- d_i Grating disk – inside diameter
- d_a Grating disk – outside diameter
- d_t Counting track – center diameter
- d_1 Counting track – outside diameter
- d_2 Reference track – inside diameter
- d_L Grating disk – diameter for borings of the mounting screws
- d Diameter of the borings
- Z Number of lines of the grating disk

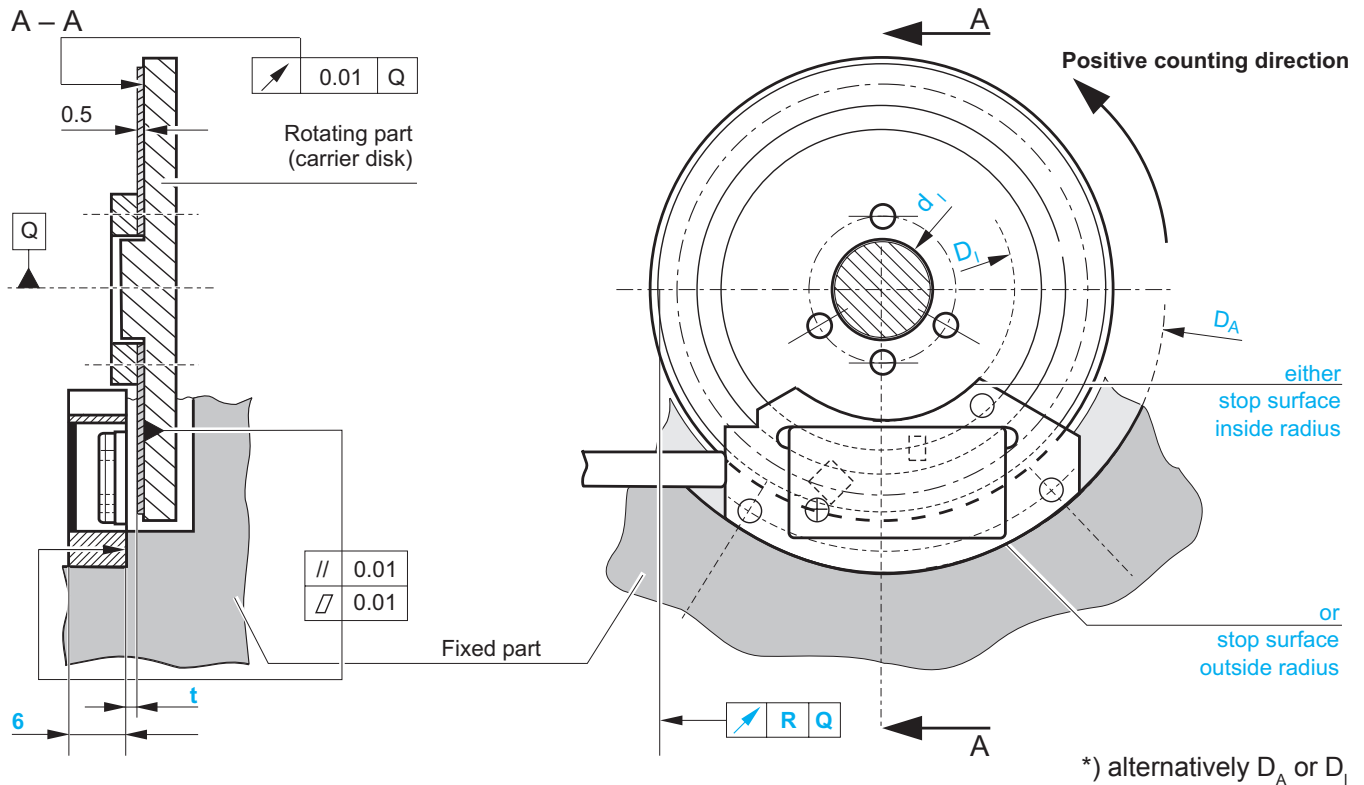
Proposed mounting of grating disk



Clamping (only for RS 40.4/10 ... and RS 92.4 ...) or full-surface bonding (without clamping disk)

Installation Dimensions

Dimensions and tolerance limits to be observed by the user to ensure proper functioning, without angular error being taken into account



Type	D_A^*	D_I^*	d_i	R	R **	t
RS 30/16/1000	45 ^{H6}	16 _{h6}	–	0.015	–	0.8 ± 0.05
RS 40.4/10/1800	55 ^{H6}	26 _{h6}	10 _{fg4}	–	0.01	0.5 ± 0.05
RS 40.4/10/2048	55 ^{H6}	26 _{h6}	10 _{fg4}	–	0.01	0.7 ± 0.05
RS 40.4/10/3600	55 ^{H6}	26 _{h6}	10 _{fg4}	–	0.01	0.4 ± 0.05
RS 40.4/25/1800	55 ^{H6}	26 _{h6}	–	0.015	–	0.5 ± 0.05
RS 40.4/25/2048	55 ^{H6}	26 _{h6}	–	0.015	–	0.7 ± 0.05
RS 40.4/25/3600	55 ^{H6}	26 _{h6}	–	0.015	–	0.4 ± 0.05
RS 64.4/48.5/2048	82 ^{H6}	50.8 _{h6}	–	0.015	–	0.8 ± 0.05
RS 64.4/48.5/9000	82 ^{H6}	50.8 _{h6}	–	0.015	–	0.8 ± 0.05
RS 64.4/48.5/10000	82 ^{H6}	50.8 _{h6}	–	0.015	–	0.6 ± 0.05
RS 92.4/70/3600	110 ^{H6}	78 _{h6}	–	0.015	–	0.5 ± 0.05
RS 92.4/70/9000	110 ^{H6}	78 _{h6}	–	0.015	–	0.4 ± 0.05
RS 92.4/70/18000	110 ^{H6}	78 _{h6}	–	0.015	–	0.35 ± 0.05
RS 142.4/120/5400	160 ^{H6}	126 _{h6}	–	0.015	–	1.2 ± 0.05
RS 142.4/120/18000	160 ^{H6}	126 _{h6}	–	0.015	–	1.2 ± 0.05

D_A Stop surface – outside diameter (for scanning head)

D_I Stop surface – inside diameter (for scanning head)

d_i Diameter of the axis

R Grating disk – radial eccentricity of the graduation

R** Radial eccentricity of the disk bearing

t Working distance

Accuracy

Resolution

Resolution A is defined as the smallest angular value which is still detected by the evaluating electronics (display, control) when the grating disk is turned relative to the EPIFLEX measuring module.

The resolution can be calculated using the following formula:

$$A = Z \cdot i \cdot N \quad [\text{increments/revolution}]$$

$$A = \frac{360^\circ}{Z \cdot i \cdot N} \quad [\text{degrees}]$$

- Z the number of lines on the grating disk
 i interpolation factor of the connector board (5x, 10x, 25x, 50x or 100x)
 N factor for evaluation mode in the counter
 N = 1 for single-edged evaluation
 N = 2 for double-edged evaluation
 N = 4 for quad-edged evaluation

Accuracy

Accuracy (extremes of direction deviations) is affected by

- graduation errors of the grating disk
- eccentricity of the graduation relative to the axis bearing
- radial eccentricity of the axis bearing
- deviations in the positions of the grating disk and the EPIFLEX measuring module (installation tolerance)
- interpolation error in signal processing

The accuracy is largely determined by the eccentricity of the graduation relative to the axis bearing and the radial eccentricity of the axis bearing.

The error resulting from these factors is calculated using the following formula:

$$\Delta\varphi = \pm 412 \frac{e}{D}$$

- $\Delta\varphi$ angular error [seconds of arc]
 e eccentricity of the graduation relative to the axis of rotation including the radial eccentricity of the axis bearing [μm]
 D graduation diameter of the grating disk [mm]

Signal adjustment

The EPIFLEX measuring module can be adjusted to the particular mounting conditions with an electronic fine adjustment. This provides optimal output signals and a reduced interpolation error.

Using the RIK encoder system with 25x interpolation or higher, the electronic signal adjustment is recommended.

The signal adjustment can be done with the following devices:

- Adjustment Kit in connection with an oscilloscope and a PC **or**
- Signal monitor

Counting frequencies

Interpolation	none	5x	10x	25x	50x	100x
max. speed (rpm)	$\frac{30\,000\,000}{Z}$	$\frac{30\,000\,000}{Z}$	$\frac{24\,000\,000}{Z}$	$\frac{9\,600\,000}{Z}$	$\frac{4\,800\,000}{Z}$	$\frac{2\,400\,000}{Z}$
min. edge separation of output signals at max. speed	333 ns	42 ns	42 ns	42 ns	42 ns	42 ns
min. counting frequency (clock frequency) of counter at max. speed	3 MHz	24 MHz	24 MHz	24 MHz	24 MHz	24 MHz

Safety factor: 1.5

Z = Number of lines of the grating disk

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(Designation example)

RIK	1	-	2	C	40/3600	L	4	-	T	Z
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Type of sensor

1	one-field – 20 x 8 – SV1
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Housing – version of attachment

2	thread M 2.5
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Type of housing

C	aluminum chromated
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Disks

Optical diameter of graduation	Number of lines
30.0 ³	1000 ⁴
40.4 ³	1800 ⁴
40.4 ³	2048 ⁴
40.4 ³	3600 ⁴
64.4 ³	2048 ⁴
64.4 ³	9000 ⁴
64.4 ³	10000 ⁴
92.4 ³	3600 ⁴
92.4 ³	9000 ⁴
92.4 ³	18000 ⁴
142.4 ³	5400 ⁴
142.4 ³	18000 ⁴

Connector type

Z ²	15-pin; D-sub; signal processing in the connector (RS 422, 1 V _{SS})
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Cable

	Cable Ø 3.7 mm
R	0.3 m
S	0.5 m
T	1.0 m
P	1.5 m
V	2.0 m
W	3.0 m
U ¹	others on request

Encoder version

-	standard
3 ¹	non-magnetic scanning head

Speed factor

X	Customer-specific value, depending on the max. speed and max. input frequency of the evaluation electronics; consult NUMERIK JENA
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Interface – output signals

C ²	sinusoidal 1 V _{PP}
L ²	RS 422 square wave with interpolation 5x
M ²	RS 422 square wave with interpolation 10x
I ^{4,2}	RS 422 square wave with interpolation 25x
N ^{4,2}	RS 422 square wave with interpolation 50x
P ^{4,2}	RS 422 square wave with interpolation 100x

1 Supplied for a surcharge

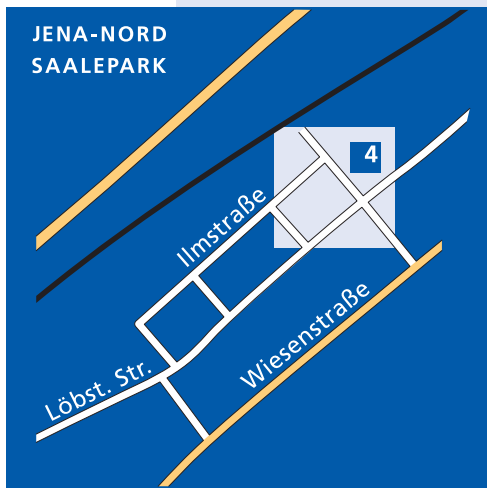
2 Max. 3 m cable attached to the scanning head; greater lengths with extension cable (with 15-pin female D-sub) possible

3 For ordering, please round the diameter of the disks to a whole number

4 Electronic adjustment recommended; requires adjustment kit

Standard pin assignment: 15-pin D-sub plug

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1 V _{SS}	-	-	-	U ₀₋	U ₂₋	U ₁₋	5 V	5 V	0 V	-	-	U ₀₊	U ₂₊	U ₁₊	-	Shield
RS 422	-	-	NAS	Z ₀₋	Z ₂₋	Z ₁₋	5 V	5 V	0 V	-	AS	Z ₀₊	Z ₂₊	Z ₁₊	-	Shield
Colour	-	-	violet	pink	red	brown	blue	blue	white	-	-	grey	black	green	-	-



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