NUMERIK JENA

we set the standards

Mounting Instructions

RIK

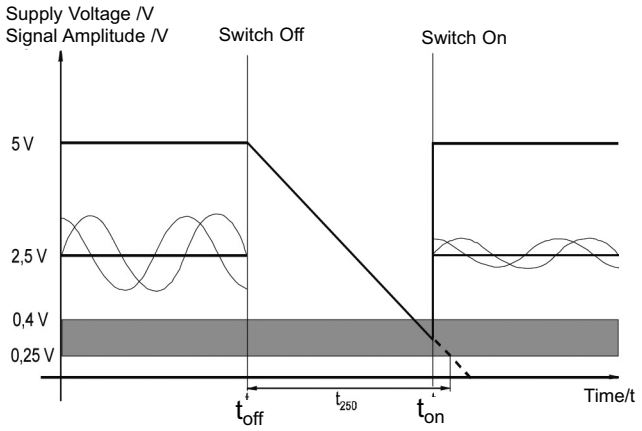
Rotary Encoder System

Compact Model Range

Contents

0 "Power Off/Power On" behavior

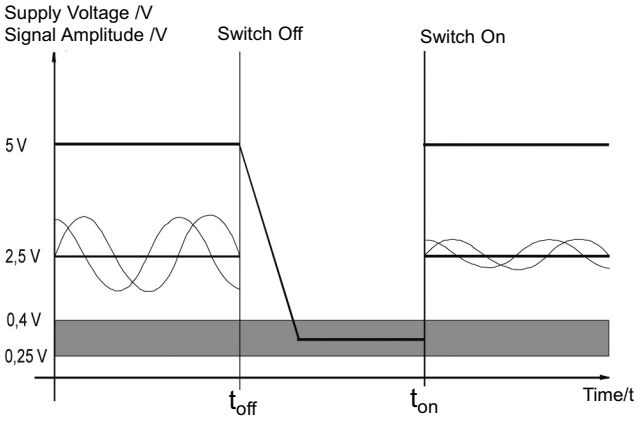
Starting (switch on) from a power voltage between 250 mV and 400 mV determines incorrect signals.



Case 1

Problem: Time between t_{off} and t_{on} is to short.

Solution: Time between switch off and switch on has to be longer than t_{250}. This time depends on the subsequent electronics. Fitting a time relay into the power switch!
Also it's possible to realise a longer duration between switch off and switch on. The power voltage drops down below 250 mV.



Case 2

Problem: The power voltage never drops down below 250 mV.

Solution: Add a resistor (in the range of 2 kΩ, it depends on the concrete situation) between 5 V and 0 V of the power lines.

Starting (switch on) from a power voltage > 400 mV or < 250 mV is not critical.

1 Safety

General information

- Make sure to familiarize yourself thoroughly with the contents of these installation instructions before installing and commissioning the encoder.
- On request, our service department or authorized dealers will provide you with supplementary information.
- The manufacturer assumes no liability for damage or malfunction due to faulty initial servicing. Unauthorized handling voids all warranty claims.
- Proper function of the encoder is guaranteed if the mounting and working conditions are observed according this instruction manual.
- The manufacturer assumes no liability for damage or malfunction due to faulty mounting conditions or faulty commissioning.
- In order to achieve the given accuracies, the tolerances given in both the dimension drawings and in the specifications must be maintained.
- If the internal tolerances of the machine exceed the tolerances specified in this instruction manual, they can result in improper function during operation. In such cases the manufacturer assumes no liability.
- Please refer to the relevant operating instructions for the functions of the RIK Encoder in conjunction with
  – auxiliary electronic units
  – counters
  – displays
  – controls
  – measuring instruments
  – fundamental mechanical instruments such as processing machines
- Observe notes and warnings.

Possible damage to the device!

Disconnect voltage supply!

Inflammable!

Legal directives

- The RIK Encoder as described in this documentation conforms to EC regulations and is marked with the CE label.
- The RIK Encoder conforms to relevant regulations for technical equipment (Legislation on Product Safety), revision 2001.05.11 and the appropriate rules for the prevention of accidents.
- The manufacturer of the complete system, including the basic mechanical unit, the encoder and the subsequent electronics, is responsible for compliance with the directives of the Legislation on Product Safety.
- The manufacturer of the complete system is also responsble for compliance with electromagnetic compatibility (EMC) regulations.
- The encoder meets the IEC 1010-1 safety requirements for electrical measuring systems, control devices, control apparatus and laboratory instruments.
- Proof of the electromagnetic compatibility (EMC) for industrial regions was provided by type tests according to EG Guideline 89/336/EEG
  Testing according to EN 61000-6-2 (03/2006)
  DIN EN 61000-4-2 (12/2001)
  Immunity against electrostatic discharges:
  air discharge 8 kV
  contact discharge 4 kV
  DIN EN 61000-4-4 (07/2005)
  Immunity against rapid transients
- In order to maintain this status, only operate the instrument as intended by the manufacturer, and adhere to the notes and warnings given in these installation instructions.

1 Safety

Transport and storage

RIK Encoder

- The encoder may only be transported in its original packaging.
- The same is recommended for storage.

Grating disks

- Handle the grating disk carefully. Its surface is very sensitive to scratching.
- Small surface errors evident at the time of shipping are due to the production process and do not affect the encoder's functionality.

Use

Disconnect voltage supply before connecting or disconnecting plugs.

RIK Encoder

- Use the RIK Encoder only with the supply voltage described in the installation instructions.
- Comply with applicable pin assignment if auxiliary electronic units are connected (counter, displays, controls).
- Integrate the RIK Encoder in instruments, machines or devices in such a way that it is protected against contamination.

Grating disks

- Protect the grating disk against physical damage (scratches).
- Handle the aluminum disk carefully and protect it against bending and scratching.
  Unevenness of the disk influences the correct operation of the RIK Encoder.
- Protect the scanning head against shock, impact and humidity: it contains electronic units.

Maintenance and cleaning

- Modifications and repairs of this encoder may only be carried out by the manufacturer or appropriately authorized persons. The manufacturer is not liable for damages caused by unauthorized handling of the RIK Encoder. All warranty claims are forfeited by unauthorized handling.
- The RIK Encoder requires no maintenance of any kind.
- Exposed measuring systems are sensitive to contamination.
- They must therefore be protected against dirt by way of a suitable construction by the user.
- The graduation of the grating disk (disk surface) and the side of the EPIFLEX measuring module (scanning window) facing the grating disk are in special need of protection.
- They are particularly sensitive to rough and irregular contamination and deposits (e.g. oil, grease, water).
- Depending on the position in which the system has been installed and the ambient condition, it may be necessary to clean the disk surface or scanning window of the scanning head from time to time.
- If the monitoring signal output by the RIK Encoder is used, a request for cleaning is displayed.

When cleaning the components, ensure that the scanning window and the grating disk are not scratched by any deposited particles.

- Dirt should be removed using a soft brush or oil-free compressed air.
- For subsequent cleaning, cotton or a soft cloth is ideal.
- For tenacious stains use acetone or alcohol.
- Ensure that no solvents flow beneath the grating disk.

Acetone and alcohol are inflammable!

2 Installation conditions

Delivery specification

Standard

- Scanning head according to the specification ordered
- Grating disk according to the specification ordered
- Installation instructions
- Packaging

Optional

- Extension cable

Notice

Use of NUMERIK extension cable is recommended for optimum adaptation to the encoder and maximum resistance against electromagnetic interference.
Please consult the encoder manufacturer before using a self-made cable.
You must absolutely avoid using the encoder cable for transmission of other signals (non-encoder signals).

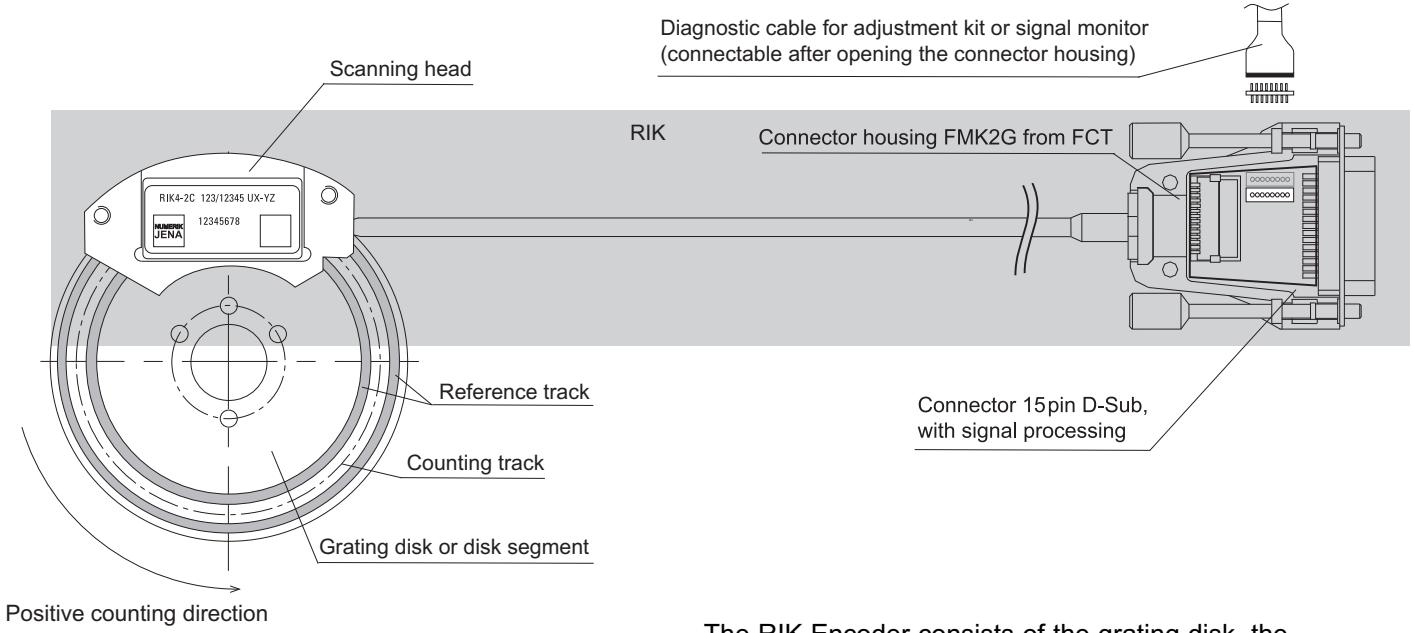
The RIK Encoder is a minimum configuration of an angle or rotary encoder for use in situations where installation space is limited:

- automation technology
- drive systems (especialy torque motors)
- rotary axis
- instruments and machines used in the microelectronic industry
- robotics and handling technology
- fine mechanics
- metrology
- medical technology

Particularly advantageous is the aluminum disk's low moment of inertia.

2 Installation conditions

Setup of RIK Encoder



The RIK Encoder consists of the grating disk, the scanning head with integrated EPIFLEX measuring module and the connecting cable with 15-pin D-sub connector.

The grating disk is scanned opto-electronically by the EPIFLEX measuring module in reflected light.

2 Installation conditions

Installation position/Counting direction

- The RIK Encoder can be installed in any position.
- Adopt suitable design measures to prevent dirt and particles from settling on the RIK Encoder during use.
- The counting direction of the system is positive (increasing measuring values) if the grating disk opposite the EPIFLEX measuring module moves in the direction shown in the installation drawings.

Cable, EMC

- Mount the scanning head on the rigid part of the machine, and the grating disk on the mobile part, if possible.
- The cables of the encoder and the connecting cable must be laid away from sources of interference (mains cables, fuses, motors, solenoid valves, power supplies); normally, a distance of 100 mm will be sufficient.
- When installing the encoder in the machine, lay the cable so that it cannot be damaged by the moving carriage.
- Be aware of the cable's permissible bending radius "r". occasional flexing (rigid placement): 8 mm constant flexing (in drag chains): 40 mm

Observe the following to ensure maximum protection against electrical and magnetic interference:

- Connect the housing/cover with the instrument's/machine's protective ground ensuring galvanic conductivity; if this is not possible (e.g. carrier component made of non-conductive material), provide a cable eyelet between the connector board and the screw head with a potential equalization line to the instrument's/machine's protective ground.
- If additional electronic units are used, mount their housing to ensure good galvanic conductivity; if this is not possible, (e.g. on painted surfaces) connect the housing by an additional potential equalization line (Cu line with cross section 6 mm^2) with the machine's protective ground.
- Please contact our service department or that of the appropriate manufacturer if you experience any problems when working with specific display or control units.

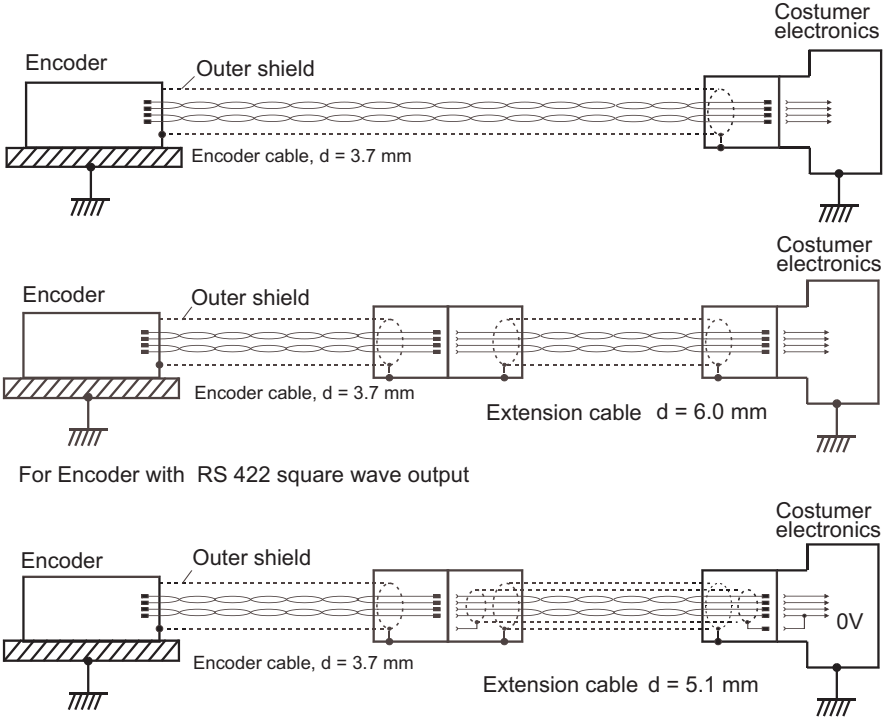
The RIK Encoder conforms to the EG guidline 89/336/EEG. Testing is according to EN 61000-6-2 (03/2006) - Immunity for Industrial Environments.

(See chapter 1 "Notes on safety" as well)

2 Installation conditions

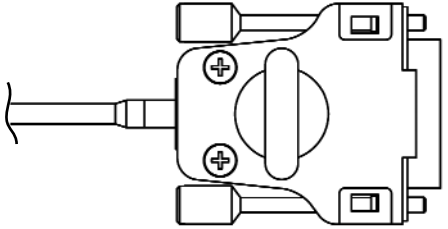
Electromagnetic compatibility, shielding concept

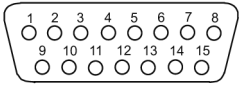
In order to avoid electromagnetic interference, you must follow this shielding concept!



For Encoder with 1 V_{PP} voltage output
Extension cable including encoder cable max. 15 m

Connectors, pin assignment





Standard pin assignment: 15pin D-sub plug

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1 V_{PP}	-	-	-	U_{0-}	U_{2-}	U_{1-}	-	5 V	0 V	-	-	U_{0+}	U_{2+}	U_{1+}	-	Shield
RS 422	-	-	NAS	R-	B-	A-	-	5 V	0 V	-	AS	R+	B+	A+	-	Shield
Colour	-	-	VT	PK	RD	BN	-	BU	WH	-	-	GY	BK	GN	-	-

1 V_{PP}: voltage interface

RS 422: square wave interface

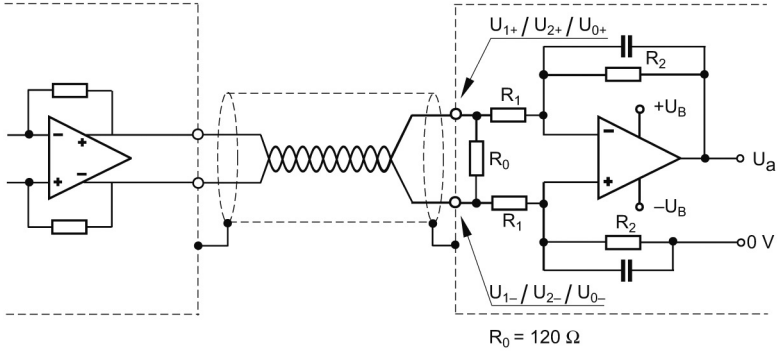
AS: monitoring signal

NAS: negated monitoring signal

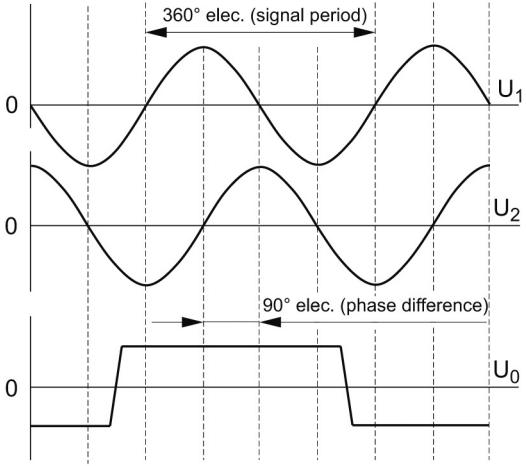
2 Installation conditions

Recommended connection circuits – voltage output

Circuit



Signal curve



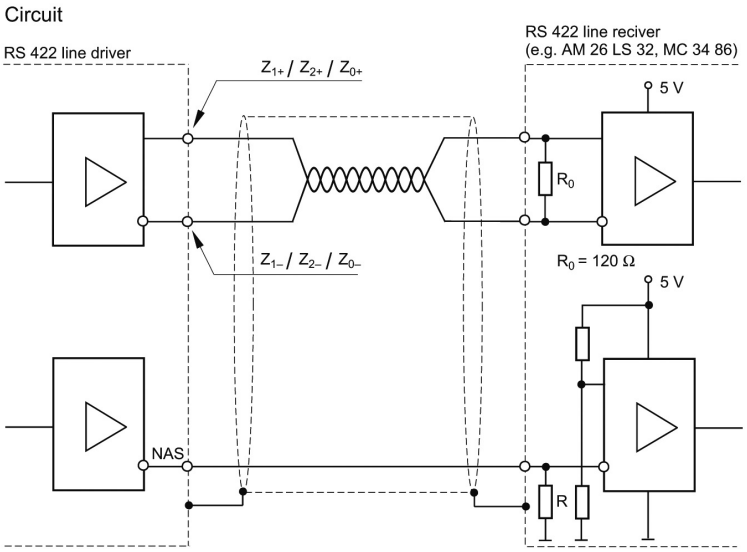
Difference signals measured on R_0:

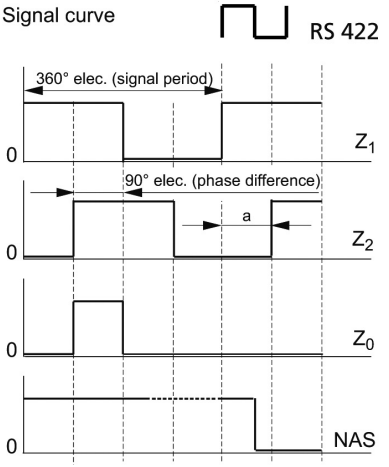
$U_1 = U_{1+} – U_{1–}$ = 0.6 ... 1.2 V_{PP} (rated voltage:: 1 V_{PP})

$U_2 = U_{2+} – U_{2–}$ = 0.6 ... 1.2 V_{PP} (rated voltage: 1 V_{PP})

$U_0 = U_{0+} – U_{0–}$ = 0.5 ... 1.2 V (rated voltage:: 0.8 V)

Recommended connection circuits – RS 422 square wave output





For avoiding electro-magnetic interference the cable adaptation with a terminate resistor of 120 Ω is necessary. In case of connection more than one parallel signal inputs to the encoder output (for example drives with parallel connection to position controller, speed controller, excelleration controller) pay attention on a resulting terminate resistor R_{0res} ~120 Ω.

NAS high:
measuring system functioning;
input signals within tolerance range
NAS low:
measuring system in disorder
a:
minimum edge distance as a function of interpolation factor and speed
(see Mechanical Data)

2 Installation conditions

Grating disks, scanning head

- The mounting surfaces must be prepared according to the installation drawings for the chosen type of disk and scanning head.
- Clean the mounting surfaces. Alien elements can lead to unevenness and deviations of disk and scanning head with the result of failure.
- In case of horizontal installation, the grating disk is preferably to be mounted with the grating face down to avoid contamination deposits.
- The disk must be centered on the axis. The centering accuracy necessary depends on diameter of the disk and the required angular error.
- There are two possibilities for achieving a minimal axial run-out of the aluminum grating disk:

– Clamping the grating disk between the contact surface and clamping disk

– Full-surface gluing of the grating disk on the contact surface using technical adhesive (Epoxy)

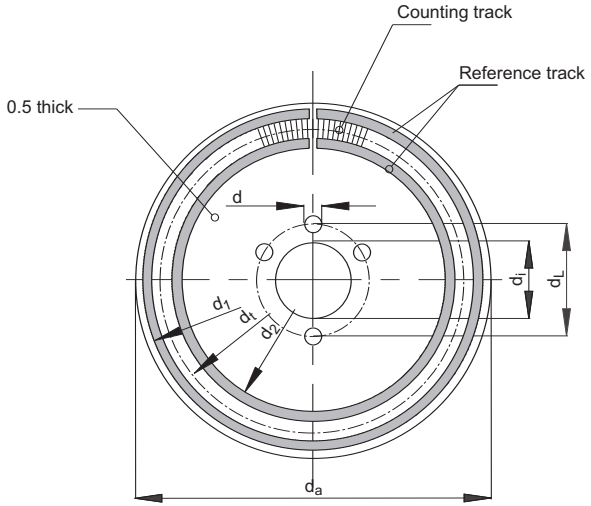
- Surfaces to be glued must be cleaned with solvent (e.g. acetone, alcohol).

Acetone and alcohol are inflammable.

- If an optical centering is necessary, the grating must be accessible.

3 Installation drawings

Grating disk



d_i	Grating disk – inside diameter
d_a	Grating disk – outside diameter
d_t	Counting track – center diameter
d_1	Reference 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

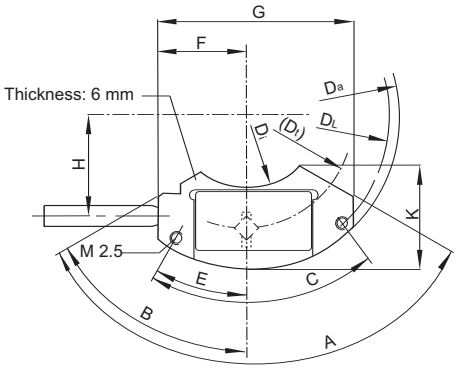
3 Installation drawings

Grating disks available – data

Type	d_i	d_a	d_t	d_1	d_2	d_L	d	Z
RS 19/6/3600	6 + 0.1	26 $^{-0.2}_{-0.5}$	19	24	14	-	-	3600
RS 29/16/900	16 + 0.1	36 $^{-0.2}_{-0.5}$	29	34	24	-	-	900
RS 29/16/1000	16 + 0.1	36 $^{-0.2}_{-0.5}$	29	34	24	-	-	1000
RS 39/10/1800	10 M5	46 $^{-0.2}_{-0.5}$	39	44	34	14,5	2,3	1800
RS 39/10/2048	10 M5	46 $^{-0.2}_{-0.5}$	39	44	34	14,5	2,3	2048
RS 39/10/3600	10 M5	46 $^{-0.2}_{-0.5}$	39	44	34	14,5	2,3	3600
RS 39/25/1800	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	44	34	-	-	1800
RS 39/25/2048	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	44	34	-	-	2048
RS 39/25/3600	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	44	34	-	-	3600
RS 64/48.5/2048	48.5 + 0.1	71 $^{-0.2}_{-0.5}$	64	69	59	-	-	2048
RS 64/48.5/9000	48.5 + 0.1	71 $^{-0.2}_{-0.5}$	64	69	59	-	-	9000
RS 64/48.5/10000	48.5 + 0.1	71 $^{-0.2}_{-0.5}$	64	69	59	-	-	10000
RS 92/70/3600	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	97	87	-	-	3600
RS 92/70/9000	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	97	87	-	-	9000
RS 92/70/18000	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	97	87	-	-	18000
RS 142/120/5400	120 + 0.2	150 $^{-0.2}_{-0.5}$	142	147	137	-	-	5400
RS 142/120/18000	120 + 0.2	150 $^{-0.2}_{-0.5}$	142	147	137	-	-	18000
RS 192/160/24000	160 + 0.2	200 $^{-0.2}_{-0.5}$	192	197	187	-	-	24000

3 Installation drawings

Scanning head – data



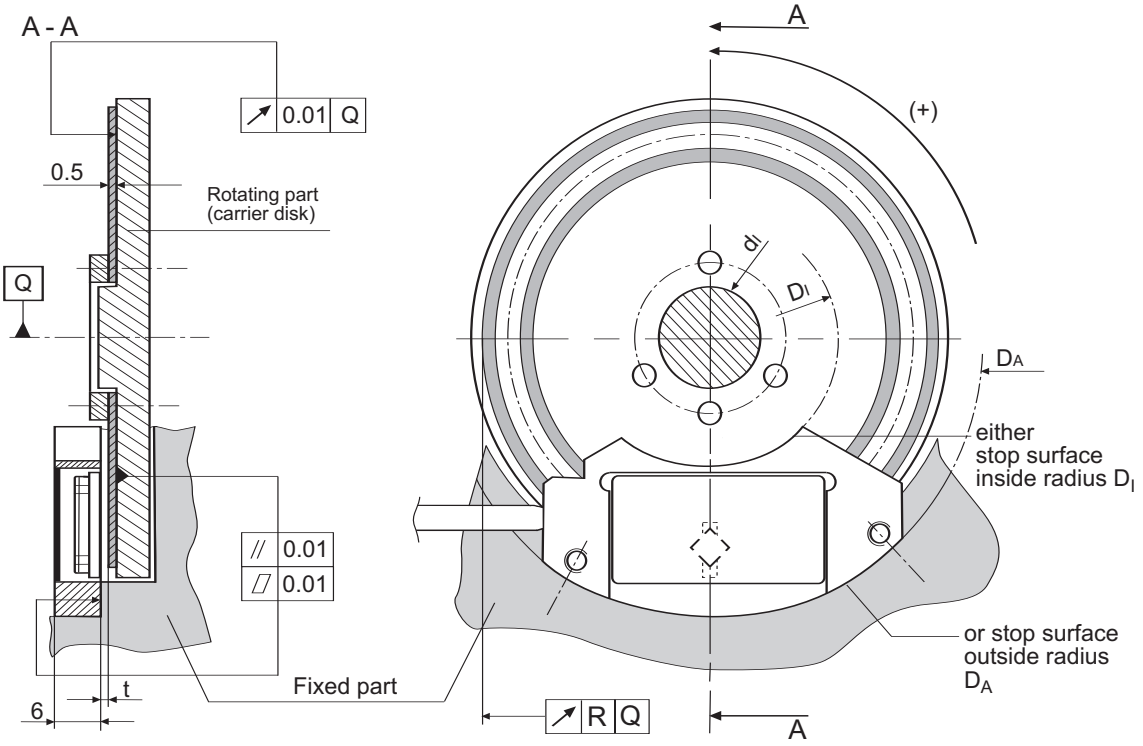
D_a Scanning head – outside diameter
D_i Scanning head – center diameter
D_t Scanning head – inside diameter
D_L Scanning head – diameter for borings of the mounting

Type	D_a	D_t	D_i	D_L	A	B	C	E	F	G	H	K
19	38 $_{h6}$	19	4 mm*	34 ± 0.1	-	-	44°	22°	12	24	8	15.0
29	45 $_{h6}$	29	16 ^{H6}	41 ± 0.1	120°	60°	82°	34°	16	34	13	18.8
39	55 $_{h6}$	39	26 ^{H6}	51 ± 0.1	120°	60°	70°	30°	16	35	18	18.6
64	82 $_{h6}$	64	50.8 ^{H6}	77 ± 0.1	90°	45°	44°	22°	18	36	30	19.2
92	110 $_{h6}$	92	78 ^{H6}	106 ± 0.1	90°	45°	34°	17°	18	36	44	18.5
142	160 $_{h6}$	142	126 ^{H6}	156 ± 0.1	90°	45°	22°	11°	18	36	69	18.7
192	210 $_{h6}$	192	180 ^{H6}	206 ± 0.1	-	-	10°	5°	13	26	94	15.8

*distance to the center, do not use as datum dimension

3 Installation drawings

Measuring system



D_A	Stop surface - outside diameter (for scanning head)	R*	Grating disk - radial eccentricity of the graduation
D_I	Stop surface - inside diameter (for scanning head)	R**	Radial eccentricity of the disk bearing
d_I	Diameter of the axis	t	Working distance

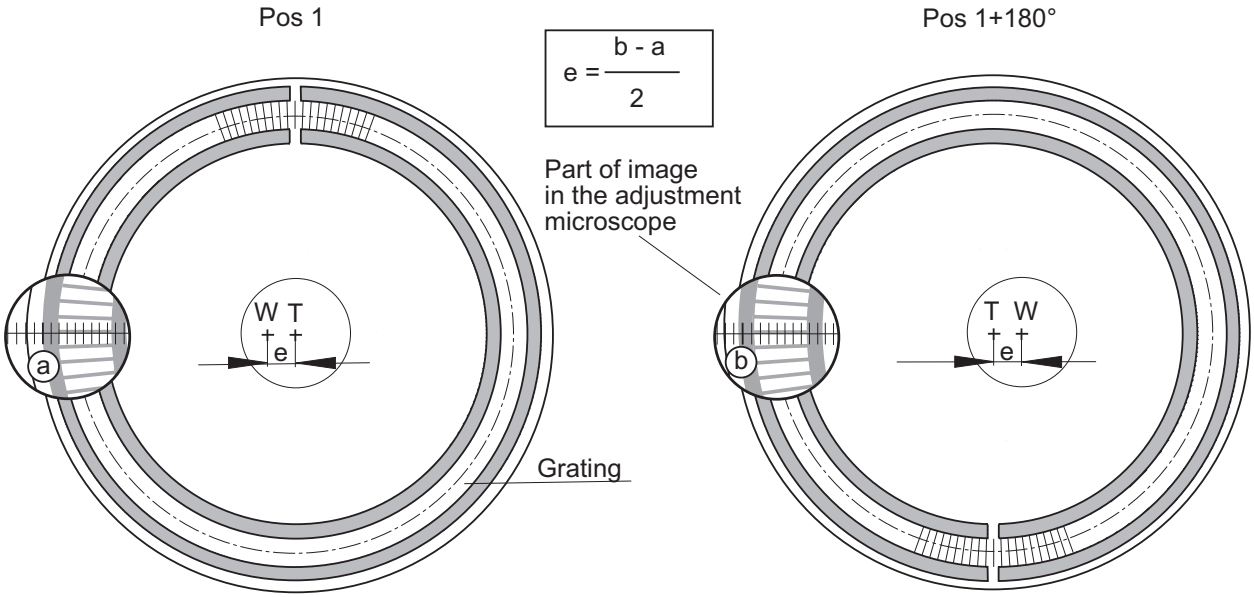
3 Installation drawings

Encoder dimensions and tolerance limits to be observed by the user to ensure proper functioning, without taking the angular error into account

Type	D_A	D_I	d_i	R*	R**	t
RS 19/6/3600	38 H6	-	-	0.01	-	0.5 ± 0.02
RS 29/16/900	45 H6	16 h6	-	0.015	-	0.6 ± 0.05
RS 29/16/1000	45 H6	16 h6	-	0.015	-	0.7 ± 0.05
RS 39/10/1800	55 H6	26 h6	10 fg4	-	0.01	0.5 ± 0.05
RS 39/10/2048	55 H6	26 h6	10 fg4	-	0.01	0.7 ± 0.05
RS 39/10/3600	55 H6	26 h6	10 fg4	-	0.01	0.4 ± 0.05
RS 39/25/1800	55 H6	26 h6	-	0.015	-	0.5 ± 0.05
RS 39/25/2048	55 H6	26 h6	-	0.015	-	0.7 ± 0.05
RS 39/25/3600	55 H6	26 h6	-	0.015	-	0.4 ± 0.05
RS 64/48.5/2048	82 H6	50.8 h6	-	0.015	-	0.8 ± 0.05
RS 64/48.5/9000	82 H6	50.8 h6	-	0,015	-	0.9 ± 0.05
RS 64/48.5/10000	82 H6	50.8 h6	-	0.015	-	0.7 ± 0.05
RS 92/70/3600	110 H6	78 h6	-	0.015	-	0.5 ± 0.05
RS 92/70/9000	110 H6	78 h6	-	0.015	-	0.4 ± 0.05
RS 92/70/18000	110 H6	78 h6	-	0.015	-	0.4 ± 0.05
RS 142/120/5400	160 H6	126 h6	-	0.015	-	0.8 ± 0.05
RS 142/120/18000	160 H6	126 h6	-	0.015	-	1.2 ± 0.05
RS 192/160/24000	210 H6	180 h6	-	0.015	-	1.1 ± 0.05

*) alternatively D_A or D_I

Centering of grating disks



W	Center of axis
T	Center of grating
e	Centering error
a,b	Minimum/maximum deviation

Centering of grating disks

Grating disk with center bore (RS 39/10)

- Carefully place the grating disk on the prepared center diameter (Ø 10 fg4) and clamp it (e.g. with clamping disk).
  By maintaining the required dimensions and tolerances the function is guaranteed without any additional centering being necessary.

Grating disks without center bore

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]

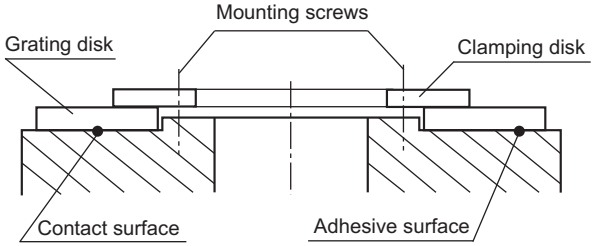
D graduation diameter of the grating disk [mm]

The grating disk is pre-centered mechanically, e.g. on the outside diameter.

An adjustment microscope with marks in the intermediate image plane is necessary for the optical fine adjustment of the disk:

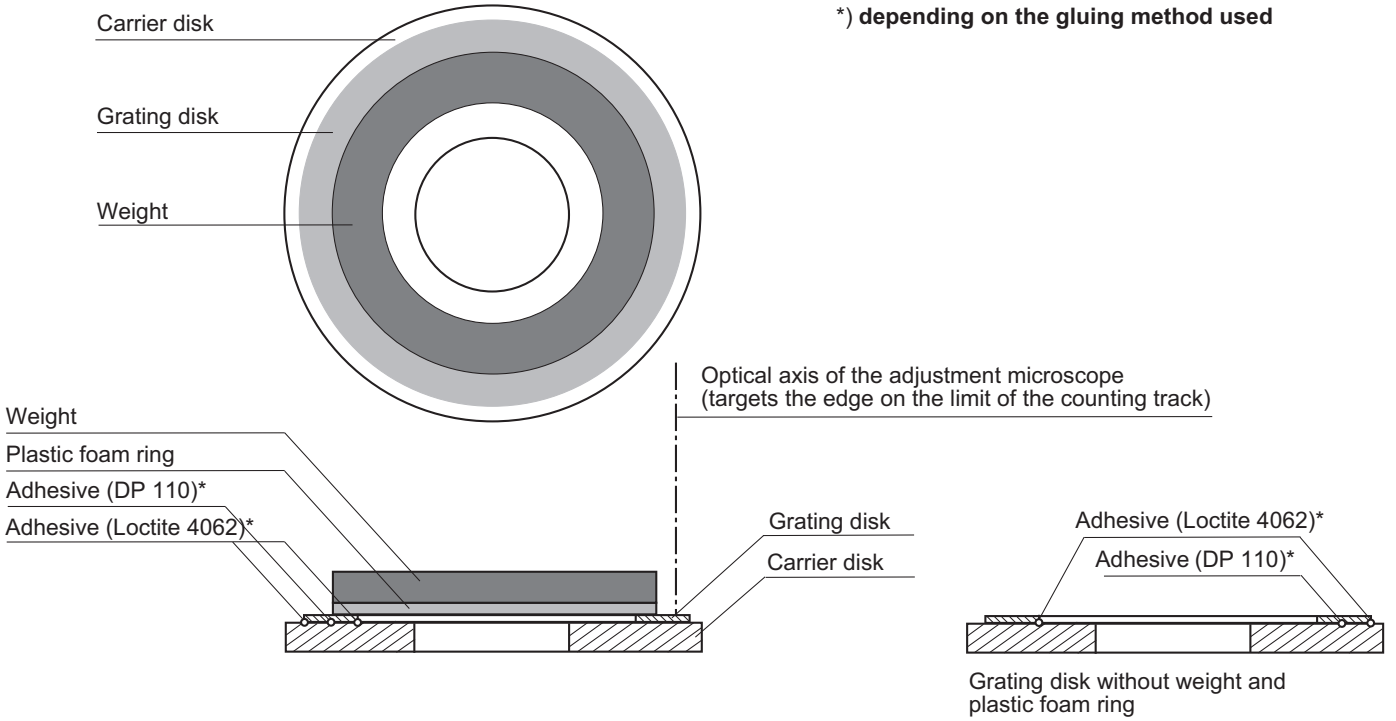
- Focus on the grating edge of the disk.
- Rotate the shaft with the grating disk and find the positions with the minimum (a) and maximum (b) deviation.
- Rotate the shaft to the position with the minimum deviation.
- Shift the disk by a distance of half difference between the minimum and maximum deviation; this aligns the center of the grating with the rotational axis of the shaft.
- Check the radial run-out and repeat the procedure if necessary.
- Secure the grating disk on the shaft.

Proposed mounting of grating disk



- Grating disk clamped by clamping disk **or**
- Grating disk glued by using technical adhesive (Epoxy)

Gluing of grating disks



Gluing of grating disks

Depending on the adhesive used, two methods of gluing aluminum grating disks to the carrier disks are recommended.
In each case the entire surface of the grating disk must be glued to the carrier disk (without a groove). See installation drawings for the required tolerances for the carrier disk.

Handle the grating disk carefully.
Its surface is very sensitive to scratching.

Using Acrylate adhesive Loctite 4062

- Loctite 4062 is very fluid; adhesive may drip down into movable parts.
- To avoid this, the carrier disk must have a larger diameter than the grating disk. This ensures that no adhesive can flow over the edge of the carrier disk.
- Remove the surplus adhesive immediately; hardened adhesive can be removed by using acetone or alcohol;
  glued parts can be separated in an acetone bath.

Note the usage requirements of the manufacturer for Loctite 4062.

- Use acetone or alcohol to clean the surfaces to be glued.
- Place the grating disk on the carrier disk.
- Roughly center the outside or inside diameters of the grating disk and carrier disk to each other.
- Press the grating disk to the carrier disk with a uniform pressure; a foam ring as an elastic intermediate layer and a ring-shaped weight made of steel (0.6 kg to 1.0 kg) can be used. This spreads the pressure equally. The outside edge of the counting track on the grating disk must not be hidden.
  The total thickness of the foam ring and the weight plate must be less than the free distance between the front lens of the adjustment microscope and the grating disk.
- Center the grating disk optically with the adjustment microscope.
- Put Loctite 4062 **on the outside diameter** of the grating disk until the whole perimeter is moistened. The adhesive creeps into the capillaries between the grating disk and carrier disk, and hardens immediately.

Gluing of grating disks

- Remove the surplus adhesive by using acetone or alcohol.
- Remove the weight ring and the foam ring.
- Put Loctite 4062 on the inside diameter of the grating disk until the whole perimeter is moistened. The adhesive creeps into the capillaries between the grating disk and carrier disk, and hardens immediately.
- Remove the surplus adhesive by using acetone or alcohol.

Using Duo-Component Epoxy Adhesive DP 110

- Use acetone or alcohol to clean the surfaces to be glued.
  Apply DP 110 adhesive (3M Scotch-Weld) very thinly on the carrier disk. Spread it very thinly and evenly by using a blade so that a thin, constant and continuous film of epoxy results.

An outer peripheral zone of 1 mm on the carrier disk must be kept free of adhesive for absorption of the fixing adhesive ("second adhesive").

- Apply the grating disk with uniform pressure and roughly center the disk.
- Use acetone to remove the surplus adhesive .
- Press the grating disk to the carrier disk with a uniform pressure; a foam ring as an elastic intermediate layer and a ring-shaped weight made of steel (0.6 kg to 1.0 kg) can be used. This spreads the pressure equally. The outside edge of the counting track on the grating disk must not be hidden.
  The total thickness of the foam ring and the weight plate must be less than the free distance between the front lens of the adjustment microscope and the grating disk.
- Center the grating disk optically with the adjustment microscope.
- Secure the adjusted grating disk with some spots of "second adhesive" or UV hardening epoxy.
- Epoxy must harden according to the manufacturer’s use instructions.
  If "second adhesive" is used, the weight ring can be removed during the hardening process of the epoxy.

5 Technical specifications

Resolution and accuracy – definition

A distinction must be made between the resolution and the accuracy of an encoder.
The two parameters do not directly depend on each other, and may differ from each other.

Resolution
Resolution “A“ is defined as the smallest angular value that is still detected by the evaluating electronics (display, control) when the grating disk is turned relative to the scanning head.

The resolution can be calculated using the following formula:

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

$$A = \frac{360°}{Z \cdot i \cdot N} \qquad \text{[degrees]}$$

Z the number of lines on the grating disk

i interpolation factor of the evaluating electronics (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 scanning head (mounting tolerances)
- 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:

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

$\Delta\varphi$ angular error [seconds of arc]

e eccentricity of the graduation relative to the rotational axis including the radial eccentricity of the axis bearing [µm]

D graduation diameter of the grating disk [mm]

5 Technical specifications

Mechanical data

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

Maximum speed

The maximum speed for system versions with interpolation is limited by the system resolution and the input frequency of the evaluation electronics. It can be calculated with the following formula:

$$n_{max} = \frac{f\,[MHz] \cdot 60 \cdot 1.000.000}{I \cdot SC \cdot 4 \cdot Z} \quad [rpm]$$

f signal input frequency of the evalution electronics at 4 time evaluation

I Interpolation factor

Z Number of lines

SC Safety coefficient = 1.5

This correlation is stated with the position "X" in the ordering key. If the speed and input frequency are specified the according identifier can be completed by NUMERIK JENA.

For system versions without interpolation the speed is limited by the maximum scanning frequency (500 kHz) of the sensor.

5 Technical specifications

Mechanical data

Weight of scanning head without cable	5.5 g
Number of revolutions - without interpolation, e.g. for 1800 numbers of lines - with interpolation 50x e.g. for 1800 numbers of lines	16,600 rpm 2,400 rpm
Number of lines of the grating disks	900 ... 24,000
Number of counting pulses per revolution (including signal interpolation and quad-edged evaluation)	bis 9,600,000
Diameter of grating disks (Diameter of graduation)	19.0 mm 29.0 mm 39.0 mm 64.0 mm 92.0 mm 142.0 mm 192.0 mm

Ambient conditions

Operating temperature range	0°C ... +55°C
Storage temperature range	-20°C ... +70°C
Vibration (50 Hz ... 2,000 Hz)	≤ 200 ms^{-2}
Shock (11 ms)	≤ 400 ms^{-2}
Humidity	93% RH (no condensation)

5 Technical specifications

Electrical data

Scanning frequency	max. 500 kHz
Output interfaces - voltage output - square wave output	 1 V_{PP} RS 422 with interpolation up to 100x
Connector	15pin D-sub plug
Supply voltage	5 V ± 10%
Power consumption - voltage output - square wave output	 65 ± 5 mA* 195 ± 5 mA*
Cable diameter	3.7 mm
Permissible bending radius of cables - occasional flexing - constant flexing	 8 mm 40 mm

Cable lengths (cable fixed to the scanning head) - standard lengths	0.3 m; 0.5 m; 1.0 m 1.5 m; 2.0 m; 3.0 m
- Extension cable with 15pin D-sub female possible	max. 100 m (on request)

* with 120 Ω load resistance

6 Ordering key

Grating disks available

Grating Disk Type	Center diameter of graduation d_i	Inside diameter of disk d_a	Outside diameter of disk d_t	Number of lines Z
RS 19/6/3600	6 + 0.1	26 $^{-0.2}_{-0.5}$	19	3600
RS 29/16/900	16 + 0.1	36 $^{-0.2}_{-0.5}$	29	900
RS 29/16/1000	16 + 0.1	36 $^{-0.2}_{-0.5}$	29	1000
RS 39/10/1800	10 M5	46 $^{-0.2}_{-0.5}$	39	1800
RS 39/10/2048	10 M5	46 $^{-0.2}_{-0.5}$	39	2048
RS 39/10/3600	10 M5	46 $^{-0.2}_{-0.5}$	39	3600
RS 39/25/1800	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	1800
RS 39/25/2048	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	2048
RS 39/25/3600	25 + 0.1	46 $^{-0.2}_{-0.5}$	39	3600
RS 64/48.5/2048	48,5 + 0.1	71 $^{-0.2}_{-0.5}$	64	2048 .
RS 64/48.5/9000	48,5 + 0.1	71 $^{-0.2}_{-0.5}$	64	9000
RS 64/48.5/10000	48,5 + 0.1	71 $^{-0.2}_{-0.5}$	64	10000
RS 92/70/3600	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	3600
RS 92/70/9000	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	9000
RS 92/70/18000	70 + 0.1	100 $^{-0.2}_{-0.5}$	92	18000
RS 142/120/5400	120 + 0.2	150 $^{-0.2}_{-0.5}$	142	5400
RS 142/120/18000	120 + 0.2	150 $^{-0.2}_{-0.5}$	142	18000
RS 192/160/24000	160 + 0.2	200 $^{-0.2}_{-0.5}$	192	24000

6 Ordering key

Designation example scanning head:

RIK	4	-	2	C	39/3600	L	4	-	T	Z

Type of sensor

4	one-field - 13 x 8 - SV3

Housing – version of attachment

2	thread M 2.5

Type of housing

C	aluminium

Grating disks see page 33

Output signals see page 33

Speed factor

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

Type of connector

Z	15-pin; D-sub; signal processing in the connector (RS 422, 1 V_{PP})

Cables 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

6 Ordering key

Designation example scanning head:

RIK	4	-	2	C	39/3600	L	4	-	T	Z

Grating disks

Optical diameter of graduation	Number of lines
19	3600
29	900
29	1000
39	1800
39	2048
39	3600
64	2048
64	9000
64	10000
92	3600
92	9000
92	18000
142	5400
142	18000
192	24000

Interface – output signals

C	sinusoidal 1 V_{PP}
K	RS 422 square wave without interpolation
L	RS 422 square wave with interpolation 5x
M	RS 422 square wave with interpolation 10x
I[2]	RS 422 square wave with interpolation 25x
N[2]	RS 422 square wave with interpolation 50x
P[2]	RS 422 square wave with interpolation 100x

1 Supplied for a surcharge

2 Electronic adjustment recommended; requires adjustment kit or signal monitor

* The RIK is also available as vacuum version for pressure ranges up to 10^{-9} mbar. The according datasheet can be downloaded at www.numerikjena.de.

7 Troubleshooting

Error	Possible causes	Solution
No measuring signal	No power at the scanning head	Check the status of the evaluation electronics Check the connection assignment between the encoder and the evaluation electronics
Error message from the evaluation electronics	Following error due to temporary failure of the measuring signal	Check the assignment of the scale tape to the scanning head; Mechanical readjustment; Electronic readjustment with the adjustment kit* or signal monitor*
Rough, loud motor running (for linear motors)	Irregular edge separations of the counting signals due to interpolation errors	Check the assignment of the scale tape to the scanning head; Mechanical readjustment; Electronic readjustment with the adjustment kit* or signal monitor*
Counting error (compared to a standard)	Mounting error	Check the assignment of the scale tape to the scanning head; Mechanical readjustment; Electronic readjustment with the adjustment kit* or signal monitor*
No reference signal Reference mark can only be detected from one direction Reference mark appears twice Not all reference marks are detected	Mounting error	Check the assignment of the scale tape to the scanning head; Mechanical readjustment; Electronic readjustment with the adjustment kit* or signal monitor*

7 Troubleshooting

Error	Possible causes	Solution
Failure signal reports (for RS 422)	Mounting error; results in level of the analog signal from the sensor being too low	Check the assignment of the scale tape to the scanning head; Mechanical readjustment; Electronic readjustment with the adjustment kit* or signal monitor*
	Contamination on the scale tape; results in level of the analog signal from the sensor being too low	Clean the scale tape
	Encoder function operating error	Contact your supplier

*) The adjustment kit and signal monitor are tools which allow to adjust encoders from NUMERIK Jena electronically after mounting.

You can find further information on the Internet at www.numerikjena.de.

The functions of all scanning heads and accuracy of all scale tapes are tested before the encoders are shipped. However, if problems should occur, proceed according to the following table. If this does not work, please contact NUMERIK Jena: Telephone: +49 3641 47 28 -888.

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