Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Integrated Measuring System

for Ball and Roller Rail Systems

R310EN 2350 (2007.07)

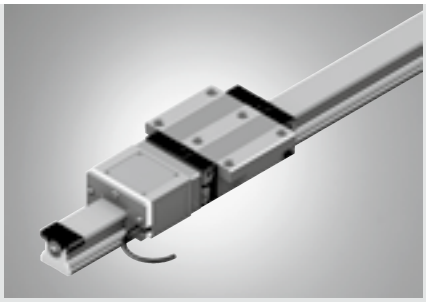
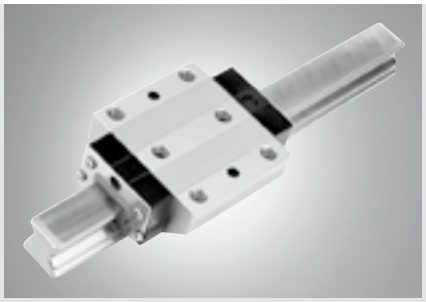
The Drive & Control Company

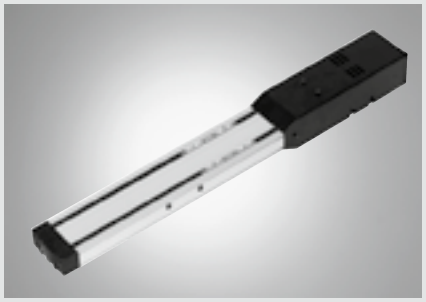
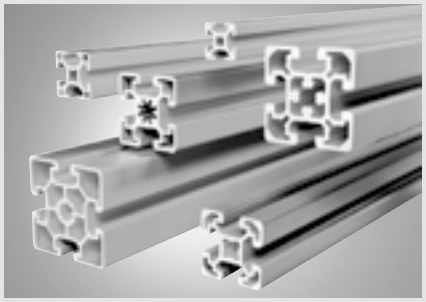
Linear Motion and Assembly Technologies

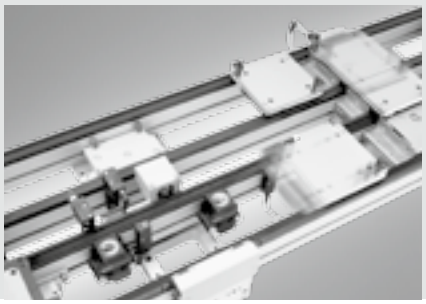
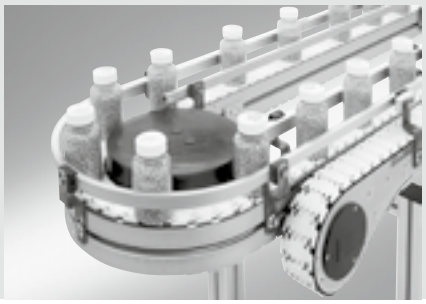
Ball Rail Systems
Roller Rail Systems
Linear Bushings and Shafts

Ball Screw Drives
Linear Motion Systems

Basic Mechanical Elements
Manual Production Systems
Transfer Systems

www.boschrexroth.com/brl

Integrated Measuring System for Ball and Roller Rail Systems

Product Overview

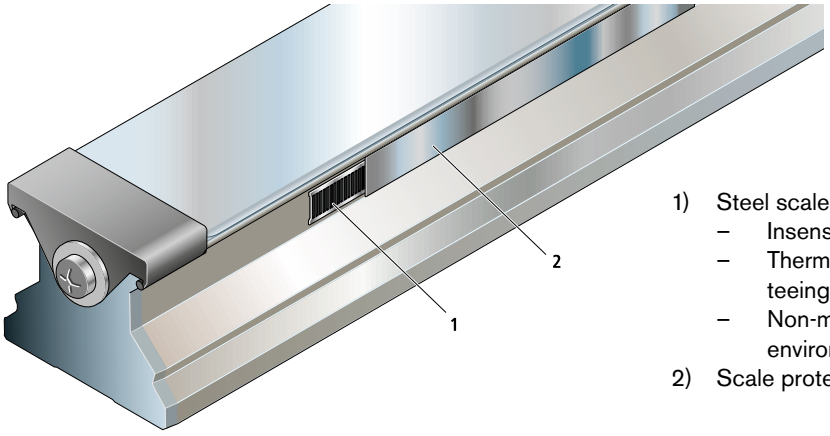
Rexroth Ball Rail and Roller Rail Systems can be supplied with an integrated, inductive linear measuring system. This development combines the guiding and measuring functions in one unit and opens up new opportunities in machine design.
In a word: Mechatronics in practice

Highlights:
Integrated Measuring System
- The guide system and the measuring system form one unit, building on standard guide elements.
- No additional space is required, except possibly in the longitudinal direction to accommodate the scanner
- No external mounting surfaces required for measuring systems
- No measuring inaccuracies due to deviations in parallelism between the measuring system and the guideway
- Easy retrofitting and replacement

Inductive Measuring System
- Contact-free scanning ensures zero maintenance
- Resistant to water, oil, dust, shavings, etc.
- Insensitive to magnetic fields
- Virtually indestructible
- One-piece guide rails:
  Standard length up to 4000 mm,
  On request up to 4500 mm
- Several scanners can be mounted on one rail

Incremental Measuring Principle
- Precise position detection through a high-precision scale paired with distance coded reference marks or with a single reference mark.
- High resolution, up to 0.25 µm

Guide rail with integrated scale
- Same mounting pattern as standard guide rails
- Choice of single reference mark or distance coded reference marks over the entire rail length, covered by a laser-welded stainless steel strip

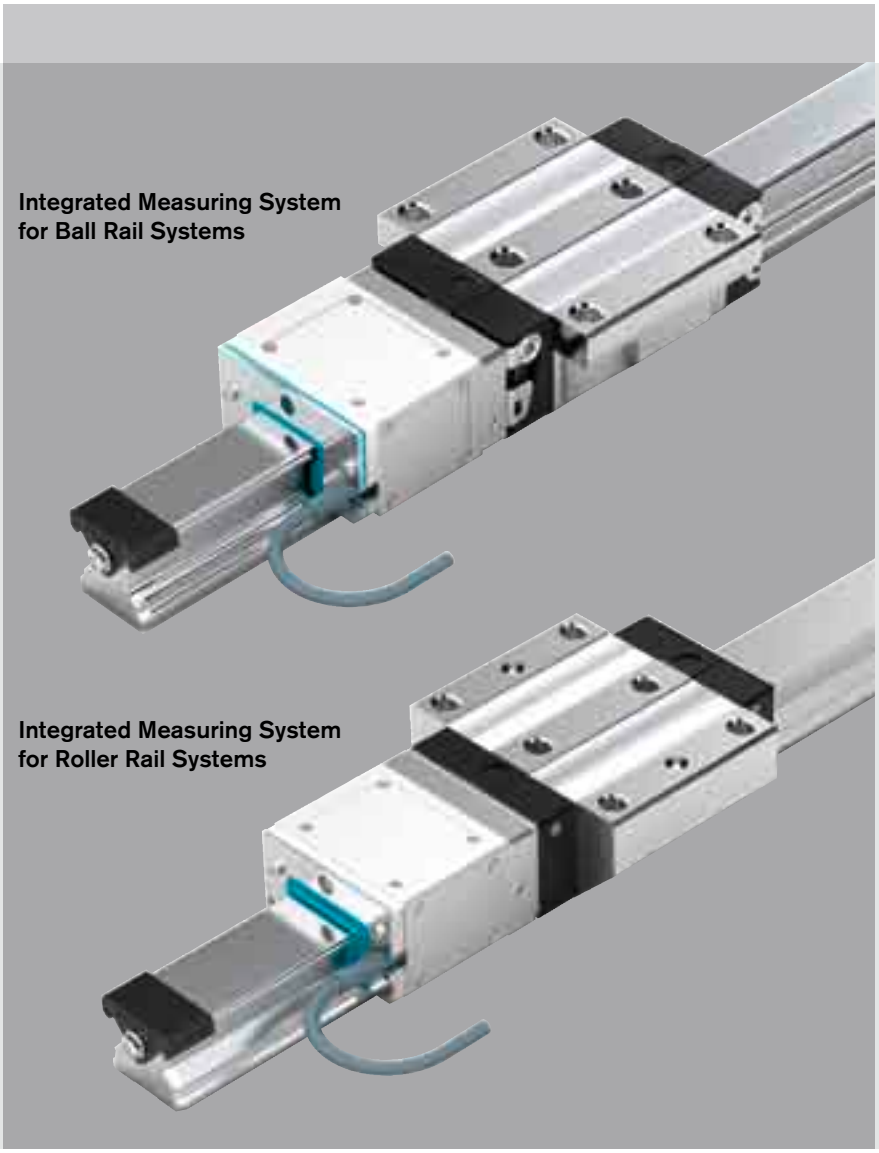


1) Steel scale integrated in the guide rail:
   - Insensitive to vibration
   - Thermal expansion matches that of the rail, guaranteeing consistently accurate measuring data
   - Non-magnetic, suitable for metalcutting machine environments
2) Scale protected by a laser-welded stainless steel strip

Integrated Measuring System for Ball and Roller Rail Systems

- Same mounting hole pattern as standard runner blocks
- Installation requirements: Scanner fastening screws must be accessible and there must sufficient clearance at the end of the rail for pulling the scanner off.
- Adapter plate allows scanner to be replaced during servicing (by Rexroth service engineers) without removing the runner block.

For more information on Ball and Roller Rail Systems, please refer to the respective main catalog.



Product Overview

Standard range

Ball runner blocks		Size				
		20	25	30	35	45
FNS R1651	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	P	P	P	P	P
	Preload	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C
FLS R1653	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	P	P	P	P	P
	Preload	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C
SNH R1621	Signal type	–	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	–	P	P	P	P
	Preload	–	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C
SNS R1622	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	P	P	P	P	P
	Preload	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C
SLS R1623	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	P	P	P	P	P
	Preload	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C
SLH R1624	Signal type	–	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	–	P	P	P	P
	Preload	–	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C	0.02 / 0.08 C

Other accuracy and preload classes on request

Roller runner blocks		Size			
		35	45	55	65
FNS R1851	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	SP	SP	SP	SP
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C
FLS R1853	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	SP	SP	SP	SP
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C
SNH R1821	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	–
	Accuracy class	SP	SP	SP	–
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	–
SNS R1822	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	–
	Accuracy class	SP	SP	SP	–
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	–
SLS R1823	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	–
	Accuracy class	SP	SP	SP	–
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	–
SLH R1824	Signal type	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL	1 V_{pp} / TTL
	Accuracy class	SP	SP	SP	SP
	Preload	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C	0.08 / 0.13 C

Accuracy class P on request

Codes for design styles of all the available runner blocks

FNS = Flanged, normal, standard height
FLS = Flanged, long, standard height
SNH = Slimline, normal, high
SNS = Slimline, normal, standard height
SLS = Slimline, long, standard height
SLH = Slimline, long, high

Definition Design style		Code (example) F	N	S
Width	**F**langed	**F**		
	Slimline			
Length	**N**ormal		**N**	
	Long			
Height	**S**tandard height			**S**
	High			

Guide rails

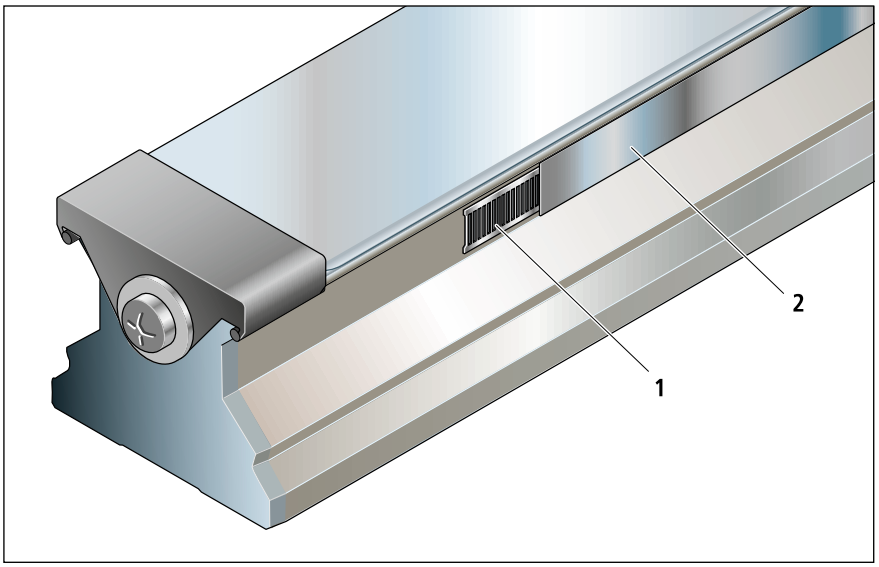
For mounting from above, with cover strip and protective caps
For mounting from above, with plastic mounting hole plugs

Technical Data

Scale

The scale (1), a high precision graduated steel strip, is welded into a groove on the guide rail and protected by a rust-proof-laser-welded stainless-steel band (2).
The scale used by Rexroth is produced on a specially designed machine and has the following features:

- Pitch of 1000 µm,
- Same thermal expansion coefficient as the guide rail
  $\alpha_{Therm} \approx 11 \cdot 10^{-6}\ K^{-1}$
- Max. measuring length:
  $M_L = L-(2x30\ mm)$
  For manufacturing reasons, the measuring length is shorter than the rail length by 30 mm at each end of the rail.

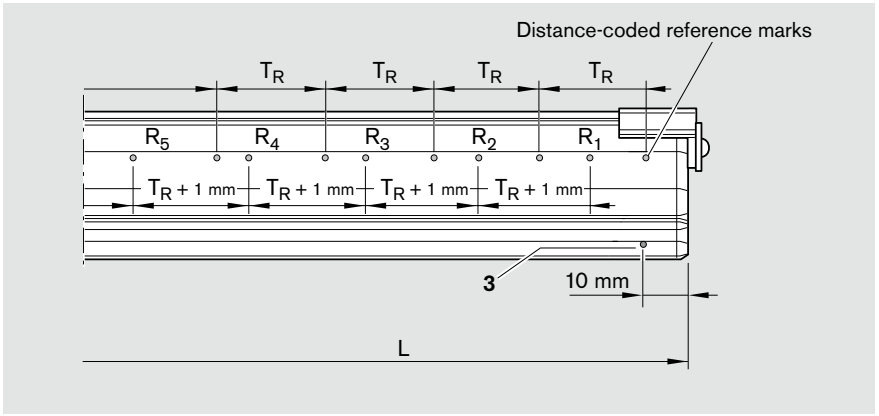


Reference marks

When scanned, the scale itself delivers only ascending or descending numerical values (incremental signals): incremental measuring principle.

Distance-coded reference marks

In order to be able to approach a specific position, an absolute reference point is necessary.
This reference point is achieved by **distance-coded reference marks** that are machined into the guide rail on the side opposite the scale, to deliver a reference mark signal. The reference marks are also protected by a tightly welded stainless-steel band. The side with reference marks is identified by a hole drilled into the reference edge of the guide rail (3).
The advantage of distance coded reference marks is that an absolute positioning signal is available as soon as the sensor on the runner block has passed two reference marks.

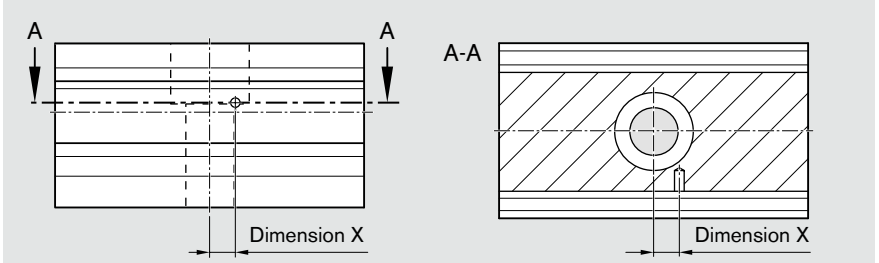


R_1 to R_n = reference marks

Distance coding of reference marks (mm)	
L_{max}	T_R
800	40
2400	70
4000	90

Single, absolute reference mark

The location of the reference mark may be defined as desired by the customer, but must remain within the measuring range. If the reference mark coincides with a rail mounting hole, it must be shifted up to 8 mm. (Dimension X, see diagram.)



Product Overview

Technical Data

Resolution with TTL signal	0.25;	1;	5;	10 µm
Repeatability	2;	2;	5;	10 µm
Interpolation accuracy (at 5 V and 20°C)	± 3;	3;	3;	3 µm

Max. travel speed

5 m/s at resolution 5 µm, 10 µm; 1 V_{pp}
0.5 m/s at resolution 0.25 µm
1 m/s at resolution 1 µm

Vibration (55 – 2000 Hz)

≤ 100 m/s²

Shock (11 ms)

≤ 500 m/s²

Max. rail length (one-piece)

4000 mm (standard)
4500 mm (special order)

Enclosure protection class (EN 60529)

IP 67

Operating temperature

0 to 50°C

Storage temperature

–10 to 70°C

Power supply

5 $V^{+5\%}_{-3\%}$

Current consumption

	(mA)
1 V_{pp}:	200
TTL 5 µm; 10 µm:	400
TTL 0.25 µm; 1 µm:	420

Voltage drop
per meter of cable length

	Standard cable (mV/m)	Extension cable (mV/m)
1 V_{pp}:	54	17
TTL 5 µm; 10 µm:	120	38
TTL 0.25 µm; 1 µm:	130	42

Maximum length of extension cable

25 m

Accuracy of the measuring system

The accuracy of the measuring system is made up of the following components:
– Scale pitch accuracy + guideway accuracy (pitch accuracy)
– Deviation of the interpolation (± 3 µm)

The sums of the deviations are summarized in the term system accuracy.

Definition of pitch accuracy:
The pitch accuracy is the maximum deviation from the mean of any position over a measuring distance of 1m, expressed in ± a (µm).

Four different pitch accuracies are available: (ref. temp. 20°C):

± 3 µm
± 5 µm
± 10 µm
± 30 µm

A detailed **accuracy report** can be provided on request.
A sample report is shown on page 12.

When ordering:

The pitch accuracy is selected by stating the appropriate code in the guide rail part number.

System accuracy

Scale pitch and guideway (µm)	**Interpolation** (µm)	**System accuracy** (µm)
± 3	± 3	± 6
± 5	± 3	± 8
± 10	± 3	± 13
± 30	± 3	± 33

Product Overview

Electrical data

Output signals

– Analog sinusoidal voltage signals (1 V_{pp}) or,
– Digital square-wave output signals (RS 422)
Both signal outputs are equipped with evaluation electronics in real-time mode so that highly dynamic drives can be served.

Analog output signals

Sinusoidal signals 1 V_{pp}

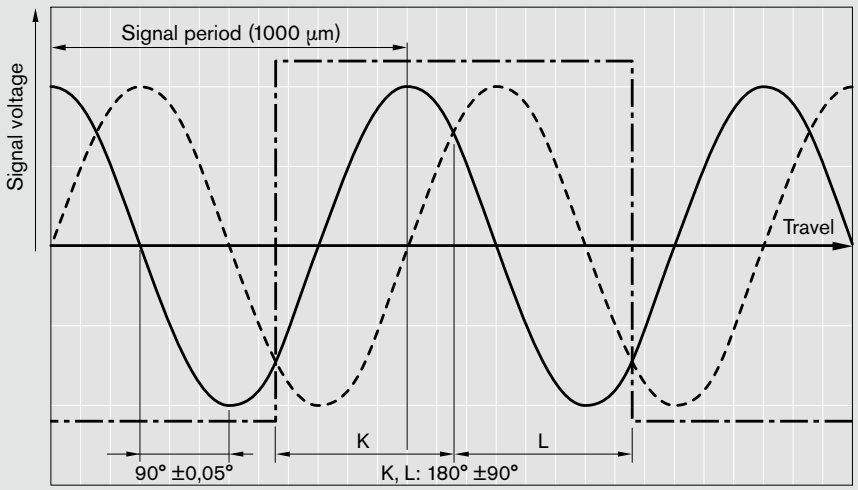
Incremental signals
The sinusoidal incremental signals A and B are phase-shifted 90° relative to each other and have a typical signal amplitude of 1 V_{pp}.

Signal amplitude:
A, B = 1 V_{pp} (±0.1 V)

The illustrated output signal sequence (B phase-lagged to A) relates to motion of the scanner in the positive counting direction (see graph).

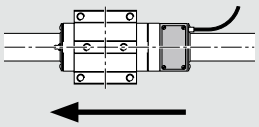
Reference mark signal
The differential reference mark signal RI has an amplitude of approx. –1 V when inactive (low).
In the active state (high), the amplitude is +1 V.

The stated amplitudes apply for operation with a terminating resistor Z_0 = 120 Ω. (See interface circuitry)

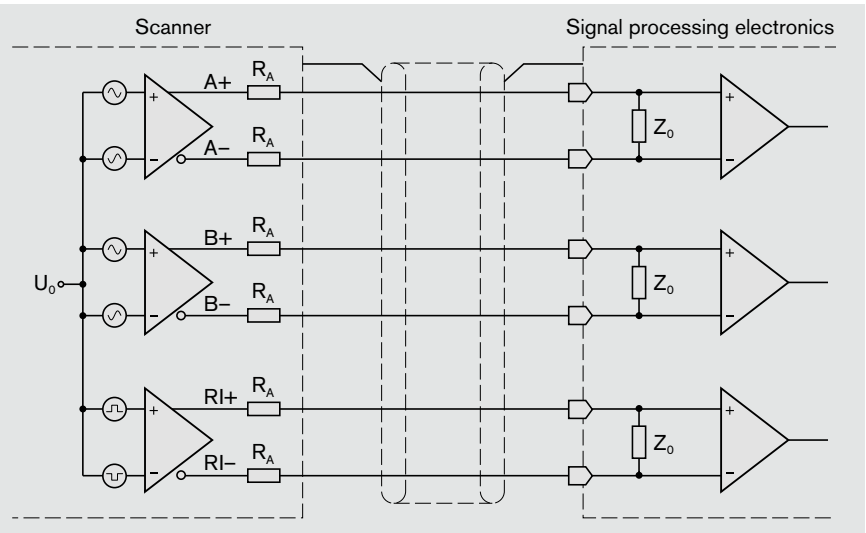


The graph shows signals A, B and full differential RI for sensor motion in the positive counting direction.

Motion direction for positive counting of sensor signals



Interface circuitry
R_A = 47 Ω
Z_0 = 120 Ω
U_0 = 2.5 V

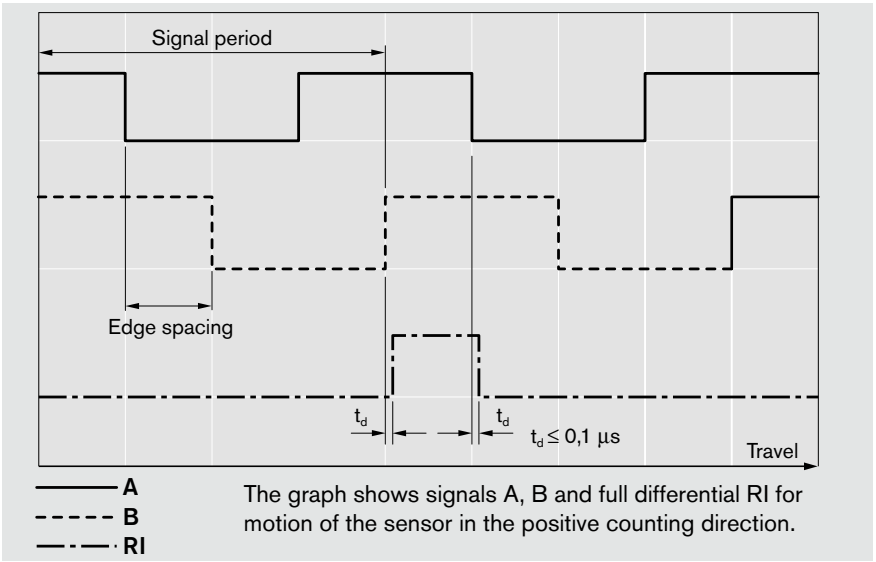


Digital output signals

Square-wave TTL output signals through an integrated interpolation unit

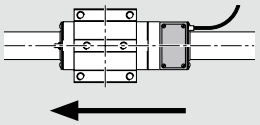
Incremental signals
The digital incremental signals A and B comply with the EIA/TIA-422-A standard. They are 90° phase shifted and have the following signal levels:
$U_{high} > 2.5$ V
$U_{low} < 0.5$ V
The switching response times are ≤ 100 ns at a capacitative load of ≤ 1000 pF.

Reference mark signal
The differential reference mark signal RI has the same electrical characteristics as the incremental signals. The delay for evaluation of the incremental signals A, B and the reference mark signal is td ≤ 0.1 µs.
The stated amplitudes apply for operation with a terminating resistor $Z_0 = 120\ \Omega$. (See interface circuitry)



The graph shows signals A, B and full differential RI for motion of the sensor in the positive counting direction.

Motion direction for positive counting of sensor signals

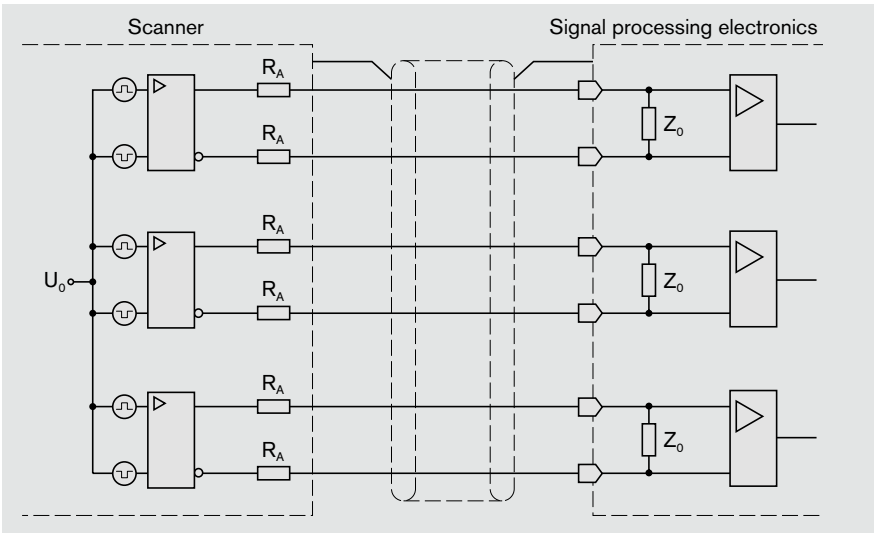


Resolution and Interpolation
Measuring systems with digital output signals are available with resolution rates of 0.25 µm, 1 µm, 5 µm, 10 µm.
Example: An interpolation factor of 25 yields a signal period of 40 µm. The signal period is divided by 4, reflecting the 4-edge evaluation of the incremental signals A and B. This results in a resolution of 10 µm.

Resolution (edge spacing) (µm)	Signal period (µm)	Max. scanner travel speed (m/s)	Interpolation factor (1 mm grid scale)
10.00	40	5.0	25
5.00	20	5.0	50
1.00[1)]	4	1.0	256
0.25[2)]	1	0.5	1024

1) $\frac{1000\mu m}{4 \times 256} = \mathbf{0.976\ \mu m}$ 2) $\frac{1000\mu m}{4 \times 1024} = \mathbf{0.244\ \mu m}$

Interface circuitry
R_A = 47 Ω
Z_0 = 120 Ω
U_0 = 2.5 V



Test Report Part 1 and Part 2 (accuracy reports)

Rexroth
Bosch Group

Hersteller-Prüfzertifikat / Manufacturer's Inspection Certificat (DIN 55350-18.4.2.2)

Materialnummer / Material no.:	R1685 732 11
Bezeichnung / Part name	Führungsschiene GR.30 STANDARD Integriertes Messsystem
Seriennummer / Serial no.:	8003451
Schienenlänge / Rail length (mm)	3196
FA-Nr. / Production no.:	01779756
Kundenauftragsnr.: / Customer order no.:	
Positionsnr.: / Position no.:	
Kunde: / Customer:	
Kundennr.: / Customer no.:	

Daten zum Messsystem / Measuring system

Messlänge: / Measuring length:	3136
Messposition: / Measuring position:	0
Genauigkeitsklasse: / Accuracy class:	+/-3 [µm]
Ref.-Marke / Ref. mark (Pos. mm)	Rückseitig 220,0 mm
Bezugstemperatur: / Nominal termperature:	20°C +/- 0,5°C
Kalibrierung normal: / Calibration standard:	HP Interferometer 3617A00271
Datum: / Date:	05.10.2005
Prüfer: / Inspector:	Muster Katalog Integriertes Messsystem
Unterschrift: / Signature:	

Bei Rückfragen / For Information
Bosch Rexroth AG / Abt. SPR
Ernst-Sachs-Straße 100
D-97424 Schweinfurt
Tel.: / Phone: +49 (0) 9721 / 937-0

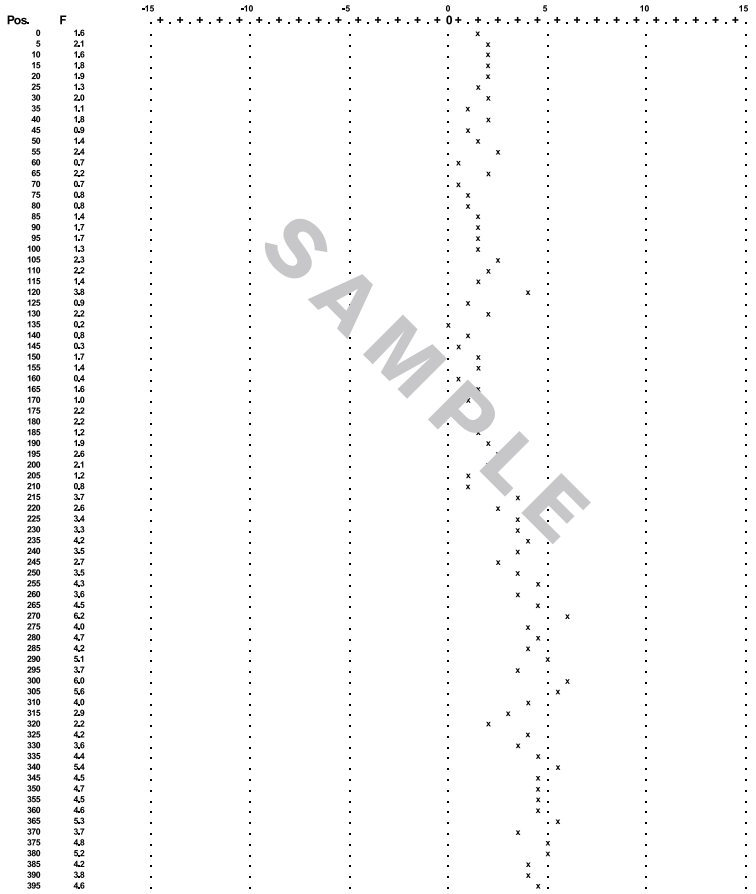
F-Q-xx-01-253-0400/PRÜFPROIML

Prüfbericht / Inspection Report

Rexroth
Bosch Group

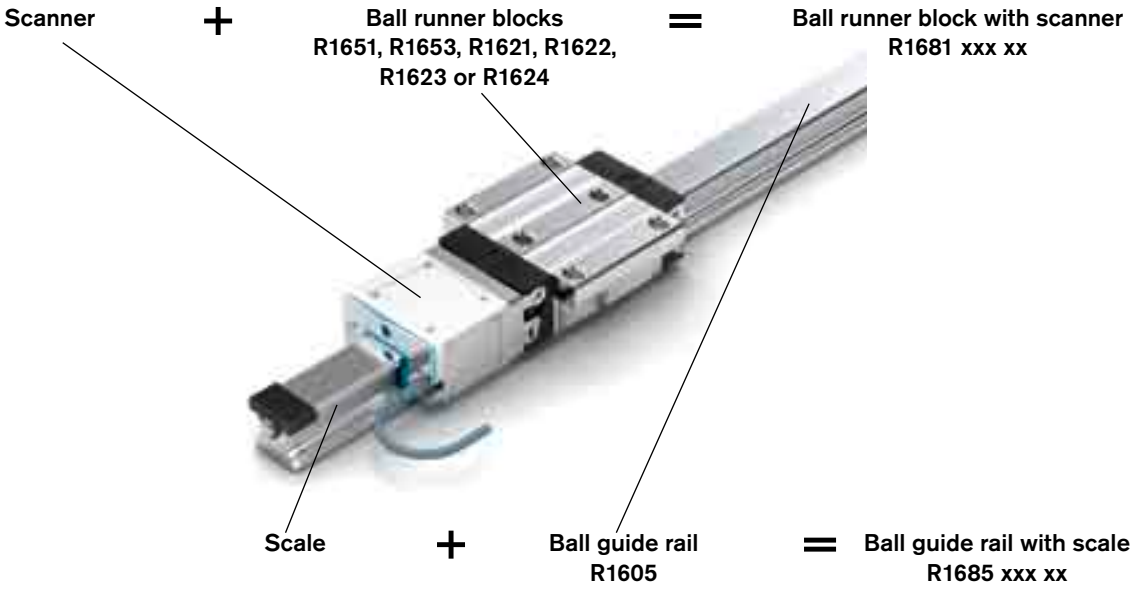
Kundenauftragsnr. / Customer order no.:
Positionsnr. / Position no.: Muster Katalog Integriertes Messsystem
Seriennummer / Serial no.: 8003451 Datum / Date: 05.10.2005

Messprotokoll / Calibration Chart



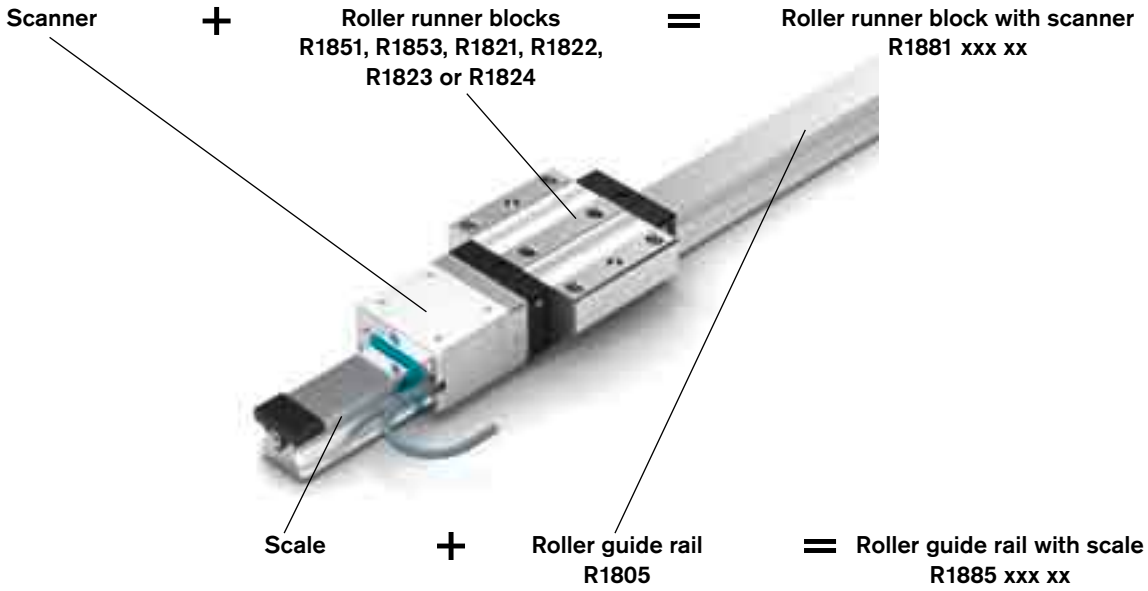
Ordering System

Ball Rail Systems



When Ball Rail Systems are ordered with integrated measuring system, the part number (PN) changes.
A ball runner block with PN R1651, R1653, R1621, R1622, R1623 or R1624 is then given the PN R1681 to indicate that the scanner has been mounted. A similar procedure is followed when ordering the ball guide rail. The PN changes from R1605 to R1685 to indicate that the scale has been incorporated.

Roller Rail Systems



When Roller Rail Systems are ordered with integrated measuring system, the part number (PN) changes.
A roller runner block with PN R1851, R1853, R1821, R1822, R1823 or R1824 is then given the PN R1881 to indicate that the scanner has been mounted. A similar procedure is followed when ordering the roller guide rail. The PN changes from R1805 to R1885 to indicate that the scale has been incorporated.

Integrated Measuring System for Ball Rail Systems

Steel Ball Runner Blocks

Preload class C1 (2% C), C2 (8% C)
Accuracy class P

FNS R1651

FLS R1653

SNH R1621

SNS R1622

SLS R1623

SLH R1624

Part number

☞ **Note**:
Please refer to the sections "Ordering System" and "Order Examples."

R 16 x x x x 2 x x

Ball runner block version
FNS ..... = 51
FLS ..... = 53
SNH * ..... = 21
SNS ..... = 22
SLS ..... = 23
SLH * ..... = 24

* not in size 20

20 = ... Without ball chain
22 = ... With ball chain

2 = ... Accuracy class P

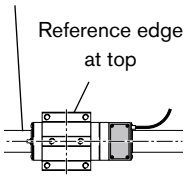
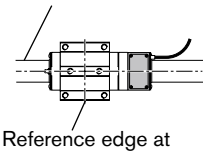
1 = ... Preload C1 (2% C)
2 = ... Preload C2 (8% C)

Size
8 = ... 20
2 = ... 25
7 = ... 30
3 = ... 35
4 = ... 45

Codes for runner block design styles

FNS = Flanged, normal, standard height
FLS = Flanged, long, standard height
SNH = Slimline, normal, high
SNS = Slimline, normal, standard height
SLS = Slimline, long, standard height
SLH = Slimline, long, high

Scanner Options

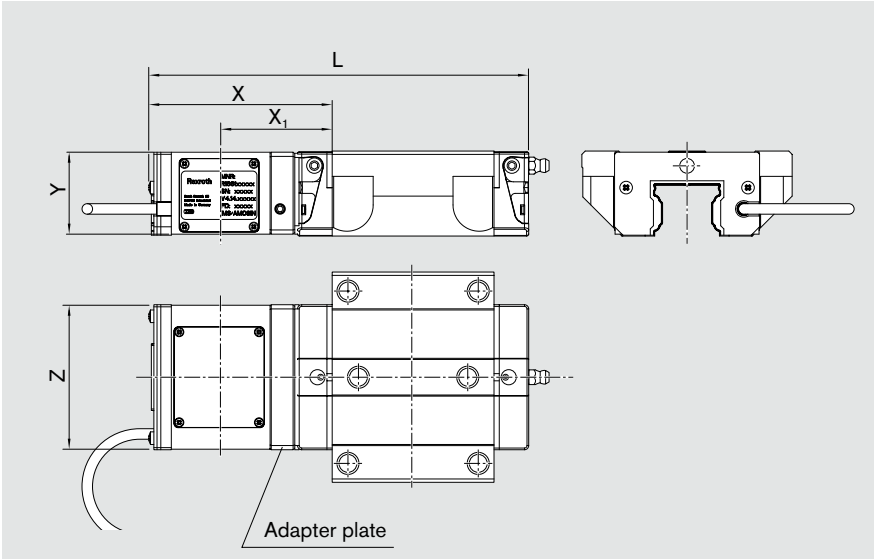
Mounting side		Signal type and resolution					Cable length [1]	Connector [2]		Protection class	
Reference edge Ball runner block		1 V_{pp}	TTL (µm)				max. 3000 mm	12-pin Connei		IP 67	IP 67 plus 3)
Scale 	Scale 		0.25	1	5	10	Preferred length 1000 mm	Connector male contacts	Coupling male contacts		
01	02	01	02	03	04	05	. . .	01	02	01	02

1) For cable length 3 m: voltage drop of 0.3 V
2) For precise details of connectors, see the section on Electrical Accessories.
3) IP 67 and resistant to metalworking fluids (tested with Curtis S90)

Recommendation for cable lengths:
For cable lengths > 1 m use extension cable R1688 090 20 (see Accessories catalog).

Dimensions of ball runner blocks with integrated measuring system

To allow replacement, the scanner is mounted to the runner block via an adapter plate.



Size	Dimensions (mm)					
	L[5]	L[6]	X	X_1[4]	Y	Z
20	147.4	164.1	84.9	50.0	24.9	43.0
25	157.3	179.7	85.1	51.0	29.4	47.0
30	168.8	190.8	85.1	52.0	34.0	58.5
35	182.6	210.4	87.3	53.8	39.0	68.5
45	209.8	246.3	91.5	56.9	48.5	83.0

4) X_1: Position of the reference sensor in the scanner
5) For ball runner blocks FNS, SNH, SNS
6) For ball runner blocks FLS, SLS, SLH

Ball Guide Rails with Measuring System

Steel Ball Guide Rails

for mounting from above
Accuracy class P

With cover strip and protective end caps R1605 . 6 2 . 1

With plastic mounting hole plugs R1605 . 0 2 . 1

Part number

☞ **Note**:
Please refer to the sections "Ordering System" and "Order Examples."

R1605 x x x x 1

1 = Code for no. of sections (one-piece)

For mounting from above

Size
20 ..... = 8
25 ..... = 2
30 ..... = 7
35 ..... = 3
45 ..... = 4

62 3 = Guide rail with cover strip Sizes 20 – 30 Accuracy class P

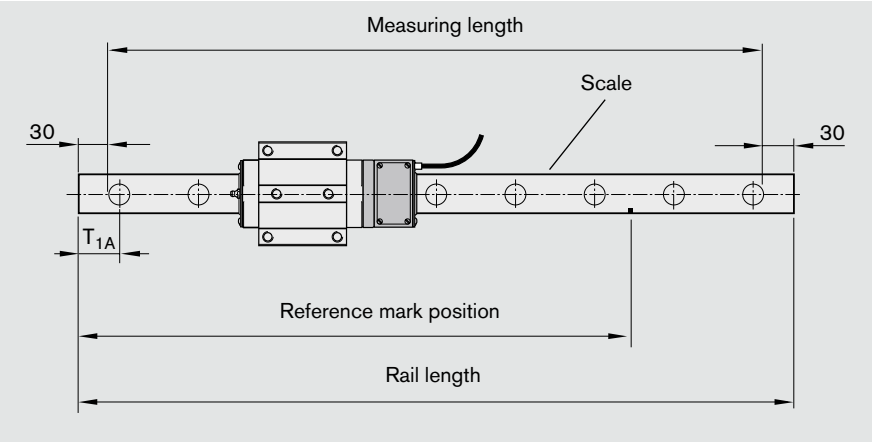
62 6 = Guide rail with cover strip Sizes 35 – 45 Accuracy class P

02 3 = Guide rail with mounting hole plugs, all sizes

Scale Options

Reference mark (n)			Scale pitch accuracy				Rail length	Reference mark position	T_{1A}
Without	Single	Distance coded	± 3	± 5	± 10	± 30	(max. 4000 mm)	For single reference mark only	(For asymmetrical rail ends)
00	01	02	01	02	03	04	. . .	. . .	. . .

Additional ordering data for single reference mark



Integrated Measuring System for Roller Rail Systems

Steel Roller Runner Blocks

Preload C2 (8% C), C3 (13% C)
Accuracy class SP

FNS R1851

FLS R1853

SNH R1821

SNS R1822 [1)]

SLS R1823 [1)]

SLH R1824

1) In preparation

Part number

R 18 x x x x 1 1 0

Roller runner block version
FNS ..... = 51
FLS ..... = 53
SNH ..... = 21
SNS ..... = 22
SLS ..... = 23
SLH ..... = 24

1 = ... Accuracy class SP

Preload
2 = ... C2 (8% C)
3 = ... C3 (13% C)

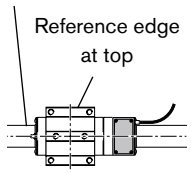
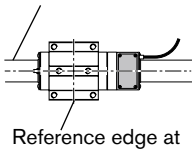
Size
3 = ... 35
4 = ... 45
5 = ... 55
6 = ... 65

☞ **Note:**
Please refer to the sections "Ordering System" and "Order Examples."

Codes for runner block design styles

FNS = Flanged, normal, standard height
FLS = Flanged, long, standard height
SNH = Slimline, normal, high
SNS = Slimline, normal, standard height
SLS = Slimline, long, standard height
SLH = Slimline, long, high

Scanner Options

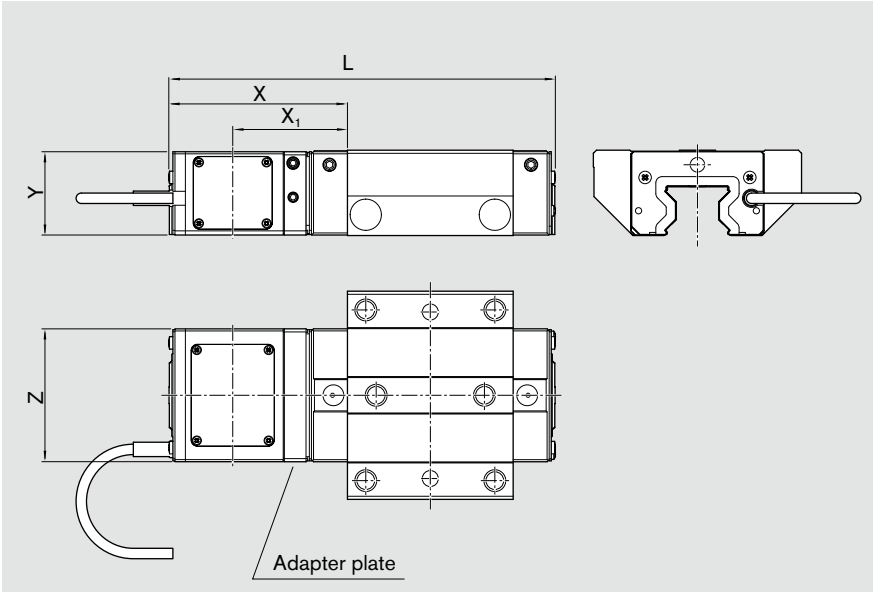
Mounting side		Signal type and resolution					Cable length [1]	Connector [2]		Protection class	
Reference edge Roller runner block		1 V_{pp}	TTL (µm)				max. 3000 mm	12-pin Connei		IP 67	IP 67 plus [3]
Scale  	Scale  		0.25	1	5	10	Preferred length 1000 mm	Connector male contacts	Coupling male contacts		
01	02	01	02	03	04	05	. . .	01	02	01	02

1) For cable length 3 m: voltage drop of 0.3 V
2) For precise details of connectors, see the section on Electrical Accessories.
3) IP 67 and resistant to metalworking fluids (tested with Curtis S90)

Recommendation for cable lengths:
For cable lengths > 1 m, use extension cable R1688 090 20 (see Accessories catalog).

Dimensions of roller runner blocks with integrated measuring system

To allow replacement, the scanner is mounted to the runner block via an adapter plate.



Size	Dimensions (mm)					
	L [5]	L [6]	X	X_1 [4]	Y	Z
35	186.0	210.0	85.9	55.1	40.0	63.8
45	216.2	248.7	90.8	58.2	50.0	78.0
55	250.3	289.3	100.5	64.3	56.4	91.4
65	288.6	336.6	107.9	72.0	75.0	119.0

4) X_1: Position of the reference sensor in the scanner
5) For roller runner blocks FNS, SNH, SNS
6) For roller runner blocks FLS, SLH, SLS

Roller Guide Rails with Measuring System

Steel Roller Guide Rails

for mounting from above
Accuracy class P

With cover strip and protective end caps R1805 . 6 2 3 1

With plastic mounting hole plugs R1805 . 5 2 3 1

Part number

☞ **Note**:
Please refer to the sections "Ordering System" and "Order Examples."

R1805 x x x x 1

For mounting from above

Size
35 ..... = 3
45 ..... = 4
55 ..... = 5
65 ..... = 6

1 = Code for no. of sections (one-piece)

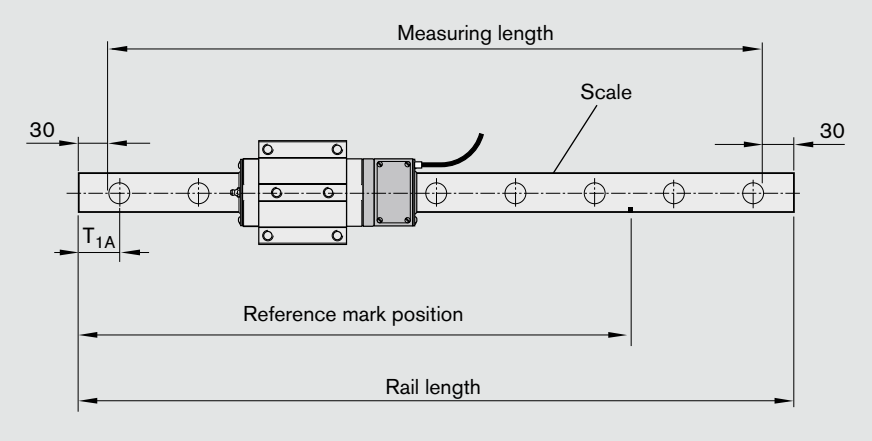
52 3 = Guide rail with mounting hole plugs Accuracy class P

62 3 = Guide rail with cover strip Accuracy class P

Scale Options

Reference mark (n)			Scale pitch accuracy				Rail length	Reference mark position	T_{1A}
Without	Single	Distance coded	± 3	± 5	± 10	± 30	(max. 4000 mm)	For single reference mark only	(For asymmetrical rail ends)
01	02	03	01	02	03	04	. . .	. . .	. . .

Additional ordering data for single reference mark

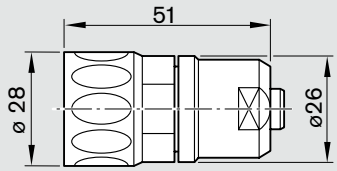


Electrical Accessories

Connector
Standard

CONNEI

Connector
Option 01

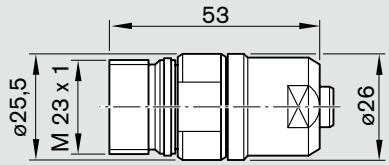


Pin assignment
(view from contact side)

12-pin

Contact type

Coupling
Option 02

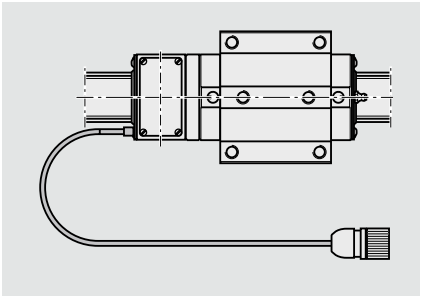


12-pin

Contact type

12-pin. Connei (IP66) Pin no.	Color	Signal assignment
1	white	B–
2	red-white	5V sensor
3	pink	RI+
4	gray	RI–
5	green	A+
6	yellow	A–
7	–	–
8	brown	B+
9	–	–
10	blue	0V
11	blue-white	0V sensor
12	red	+5V
–	Shield	Housing
–	black	–
–	purple	–

Cables
Wire Assignment



Color assignment for standard cable (on scanner)
PUR cable, black

Cable structure
Cores: 5 x (2 x 0.05 mm^2) + (2 x 0.14 mm^2)
Shield: braided, galvanized, high-conductivity Cu wire – coverage approximately 85 %
Sheath: PUR
Color: black
Outside diameter (d): 5.0 ± 0.15 mm

Mechanical properties (standard cable)
Bending radius for one-time bending (stationary): 5 x d (cable outside diameter)
Bending radius for repeated bending (flexing installation): 10 x d
Processing and operating temperature: –30°C to max. +90°C
Shipping and storage temperature: –40°C to max. +90°C

Further accessories (on request)
- Digital display unit
- Precision sinusoidal amplifier
- TTL/HTL adapter
- Extension cable

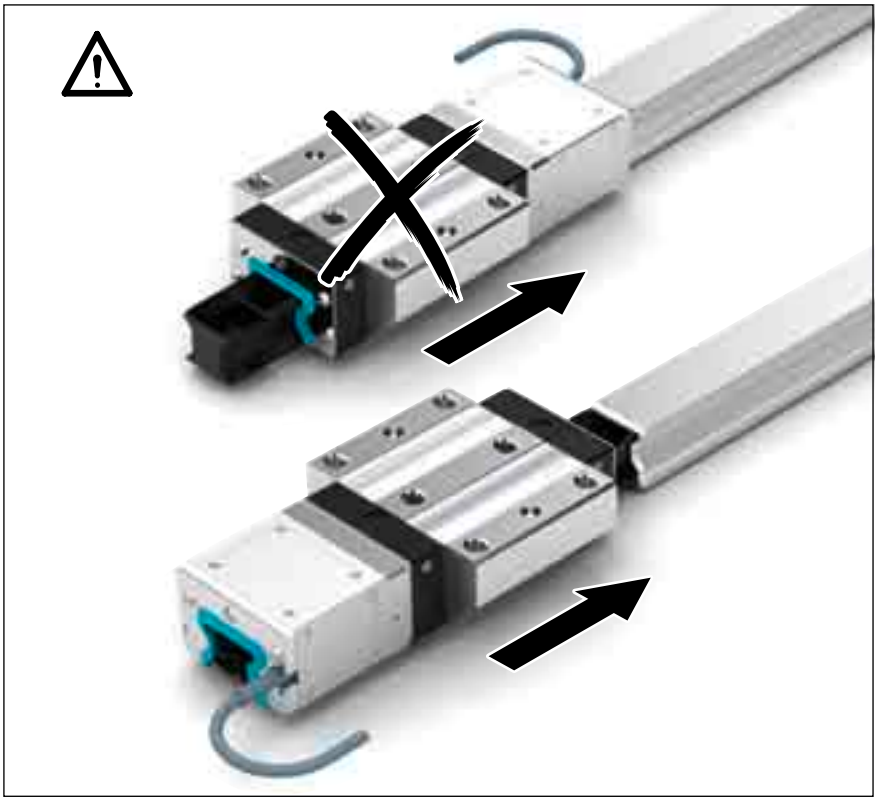
Mounting Instructions for Ball and Roller Runner Blocks

⚠ **Always handle the measuring system with great care!**

Mounting

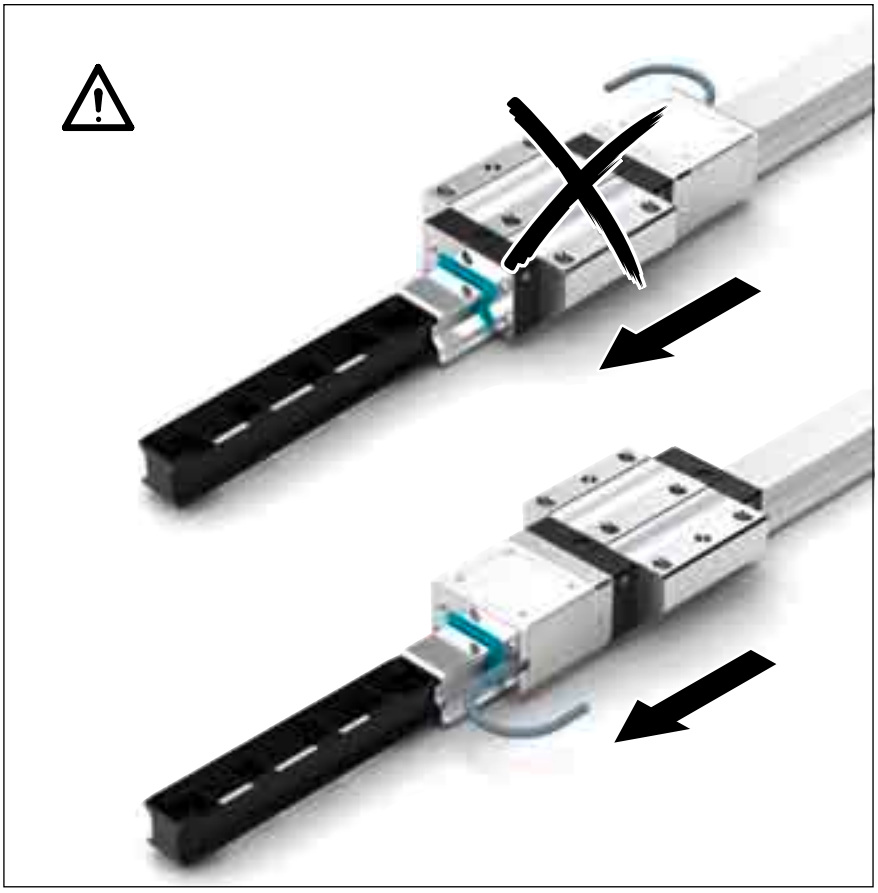
⚠ **Do not remove the mounting arbor, otherwise the rolling elements may be lost! Position the runner block on its mounting arbor against the end of the guide rail and carefully push the runner block off the mounting arbor and onto the guide rail.**

⚠ **Do not discard the mounting arbor. It will be needed again when removing the runner block.**



Removal

⚠ **Position the mounting arbor against the end of the guide rail. Always slide the runner block directly onto the mounting arbor, otherwise the rolling elements may be lost! The removed runner block must remain on the mounting arbor!**



Mounting Instructions

Mounting the guide rails

⚠ **Always handle the measuring system with great care!**

To ensure that the repeatable accuracy of the measuring system is achieved upon assembly, the guide rails must be screwed down in sequence from the ends toward the center. Partial sections should be screwed down in the same way.

Screw installation sequence (example)

Note:
For guide rails with distance coded reference marks, the side with the reference marks is indicated by a hole in the reference edge of the guide rail (see page 7). The scale is located on the opposite side.

For more detailed information on mounting Ball Rail and Roller Rail Systems, as well as cover strips, see the following mounting instructions:

Maintenance Instructions

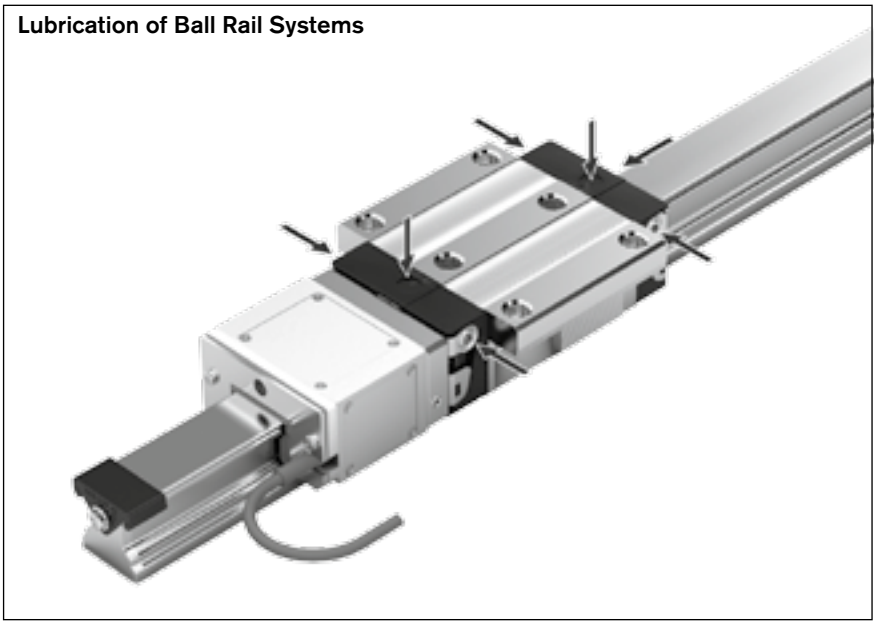
Lubrication

Ball Rail and Roller Rail Systems with Measuring System cannot be lubricated through the scanner.

The runner blocks can be easily lubricated using the free lube ports, as indicated by the arrows.

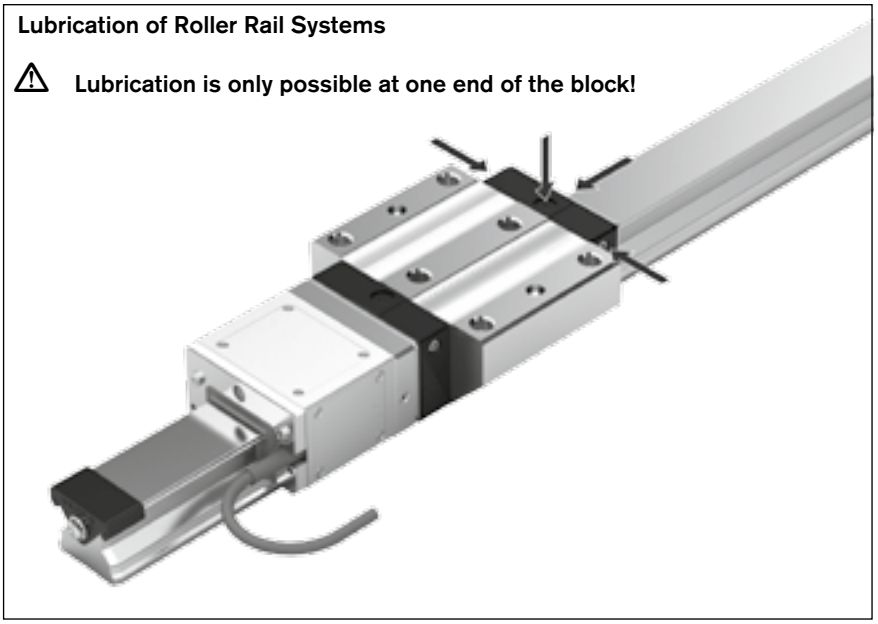
For more information on maintenance and lubrication, see the respective sections in the Ball Rail Systems catalog or the Roller Rail Systems catalog.

Lubrication of Ball Rail Systems



Lubrication of Roller Rail Systems

⚠ **Lubrication is only possible at one end of the block!**



Safety notes

See “Instructions for Integrated Measuring System for Ball Rail and Roller Rail Systems” (R310EN 2386/2004-04).

Order Examples

Integrated Measuring System for Ball Rail Systems

Ball runner block

Order Examples		Description
Integrated measuring system runner block R1681		Ball runner block with integrated measuring system
Runner block	= R1651 722 20	Ball runner block FNS size 30, accuracy class P, preload C2, (8%) without ball chain
Mounting side	= 01	Reference edge of runner block at top
Signal type	= 03	TTL with 1 µm resolution
Cable length	= 1000	Cable length 1000 mm
Connector	= 01	12-pin Connei connector with male contacts
Protection class	= 01	Enclosure protection class IP 67

Ball guide rail

Ordering data		Description
Integrated measuring system guide rail R1685		Ball guide rail with integrated measuring system
Guide rail	= R1605 762 31	Ball guide rail with cover strip and protective end caps, size 30, accuracy class P
Reference mark	= 01	Single reference mark
Accuracy	= 03	Scale pitch accuracy ± 10 µm
Rail length	= 3836	Rail length 3836 mm
Reference mark position	= 1700	Reference mark position: 1700 mm from end face of rail
T_{1A}	= –	T_{1A}: symmetrical spacing

Integrated Measuring System for Roller Rail Systems

Roller runner block

Order Examples		Description
Integrated measuring system runner block R1881		Roller runner block with integrated measuring system
Runner block	= R1851 431 10	Roller runner block FNS size 45, accuracy class SP, preload C3 (13%)
Mounting side	= 01	Reference edge of runner block at top
Signal type	= 03	TTL with 1 µm resolution
Cable length	= 1000	Cable length 1000 mm
Connector	= 01	12-pin Connei connector with male contacts
Protection class	= 01	Enclosure protection class IP 67

Roller guide rail

Ordering data		Description
Integrated measuring system guide rail R1885		Roller guide rail with integrated measuring system
Guide rail	= R1805 462 61	Roller guide rail with cover strip and protective end caps, size 45, accuracy class P
Reference mark	= 01	Single reference mark
Accuracy	= 03	Scale pitch accuracy ± 10 µm
Rail length	= 3836	Rail length 3836 mm
Reference mark position	= 1700	Reference mark position: 1700 mm from end face of rail
T_{1A}	= –	T_{1A}: symmetrical spacing

Inquiry/Order Form

Bosch Rexroth AG **Telephone** **+49 9721 937-0**

D-97419 Schweinfurt **Telefax (direct)** **+49 9721 937-250**

Germany

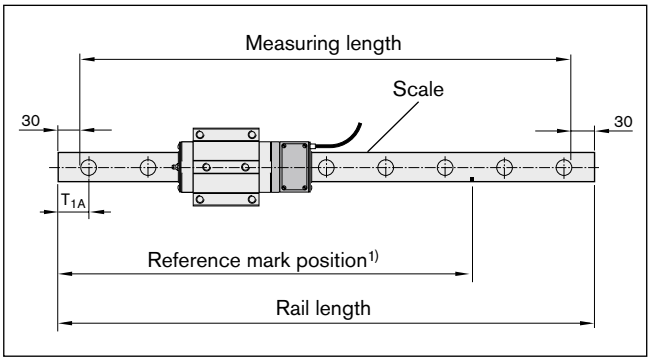
To be completed by customer: Inquiry ❑ / Order ❑

Runner block with integrated measuring system

Integrated measuring system runner block	
Runner block	
Mounting side	
Signal type	
Cable length	
Connector	
Protection class	

Guide rail with integrated scale

Integrated measuring system guide rail	
Guide rail	
Reference marks	
Accuracy (scale pitch)	
Rail length	
Reference mark position	
T_{1A}	



1) For specification of reference marks, please refer to “Technical Data,” section “Single absolute reference mark.”

Quantity Order of: _____ pcs, _____ per month, _____ per year, per order, or _____
Comments:

From

Company: _____ Name: _____
Address: _____ Department: _____
_____ Telephone: _____
_____ Telefax: _____

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Bosch Group

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