SAR
Solid Absolute Magnetic Rings

COMPACT AND ROBUST DESIGN

VARIOUS SIZES

HIGH SPEED AND TEMPERATURE

Absolute radial magnetic rings are compatible with the Artos™ readhead and are suitable for most demanding applications. The robust design protects the magnetic ring against the ingress of liquids and high temperatures, so that it remains undamaged even in extremely contaminated and hot environments.

Features and benefits

- Compatible with Artos™ readhead
- Excellent resistance to common machine tool contaminants
- Various sizes of diameters available
- Easy mounting
- High operating speed
- Operation at high temperatures

MACHINE TOOL | ASSEMBLY LINES | GIMBALS | INDUSTRIAL AUTOMATION | HARSH ENVIRONMENT

General information

The magnetic ring is available in two versions: exposed and protected with a cover foil. The version with the visible elasto-ferrite layer, called the exposed ring, is intended for applications where aggressive liquids are not expected to damage the sensitive part of the ring. The exposed ring can withstand dust, moisture and dirt. However if a thin layer of stainless steel is applied over the elasto-ferrite layer, the ring becomes more robust and suitable for harsh environments. The cover foil can be applied in two different ways. In one variant, the cover foil is wrapped around the circumference of the ring, with the elasto-ferrite layer of the ring is visible from the sides. This type of protection is suitable for high rotational speeds and protects the sensitive elasto-ferrite layer from rotational forces. In the second variant, the cover foil is applied and welded around the entire circumference. This type of protection gives the ring IP67 protection and can withstand significantly higher rotational speeds. The fully protected version is intended for demanding applications, e.g. in the machine tool industry, where various aggressive liquids are present - oils, coolants, greases, solid non-ferrous particles (swarf) and high-speed applications.

The magnetic rings are available in different sizes, from 57 mm up to 478 mm outer diameter. In addition, the readhead supports partial-arc applications from the smallest diameter of 200 mm upwards. For partial-arc applications, the flexible magnetic scale DS19 is used, which can be attached to shafts with larger diameters. The use of the DS19 magnetic scale does not support a full 360° rotation of the shaft, but is intended for applications with large shaft where full rotation is not required.

Solid absolute ring variants

Exposed SAR radial ring

Available on rings:
SAR057
SAR081
SAR114
SAR162
SAR229
SAR325
SAR478

SAR ring with cover foil

Available on rings:
SAR229
SAR325

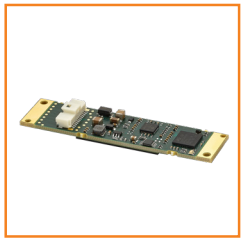
SAR ring with welded cover foil (IP67)

Available on rings:
SAR057
SAR081
SAR114
SAR162

Selection guide

Artos readhead

Artos PCB-A readhead



For readhead specifications see Artos™ data sheets available at **RLS media center.**

Storage and handling

Storage temperature

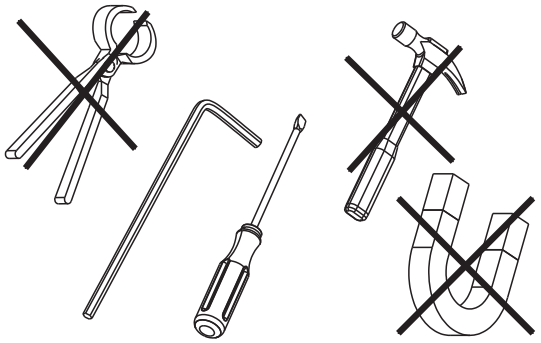
–40 °C to +85 °C

Operating temperature

–40 °C to +85 °C

IP rating

Up to IP67



The magnetic ring should not be exposed to magnetic field densities higher than 25 mT on its surface, as this can damage the ring.

HANDLE WITH CARE

The use of industrial tools during installation or exposure to strong magnets such as a magnetic base is not recommended as it carries the risk of damaging parts of the system which as a result might not perform in accordance with specifications.

Use of tools such as drift, punch or similar are expressly forbidden and should not be used during installation to adjust run-out.

Improper assembly of the readhead and ring may impair function of the magnetic encoder system and lead to increased wear or damage to the system.

- All permissible distance and angle tolerances must be strictly complied with.
- The readhead may not come into contact with the ring over the entire revolution. The contact between the readhead and ring must also be avoided, to prevent ring from being damaged.
- Induction heating of the ring is expressly forbidden due to the possible damage of the magnetization pattern.
- The product should remain in the original packaging until ready for installation.

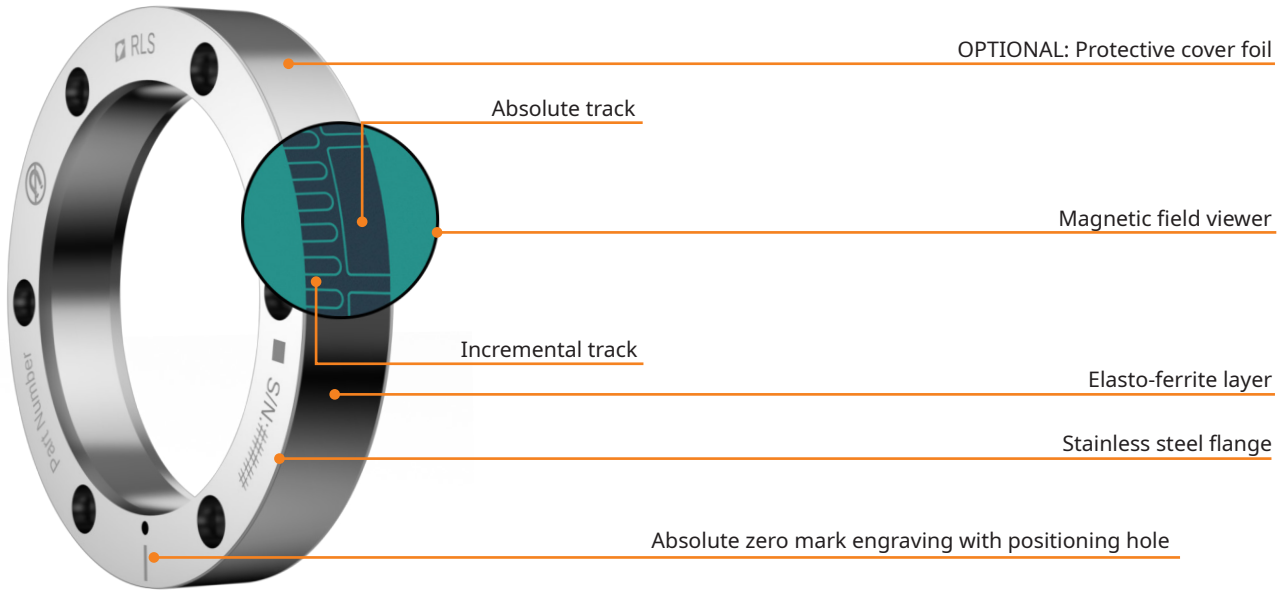
Packaging

All SAR absolute radial rings are supplied individually packaged in an antistatic box.

Magnetic ring design

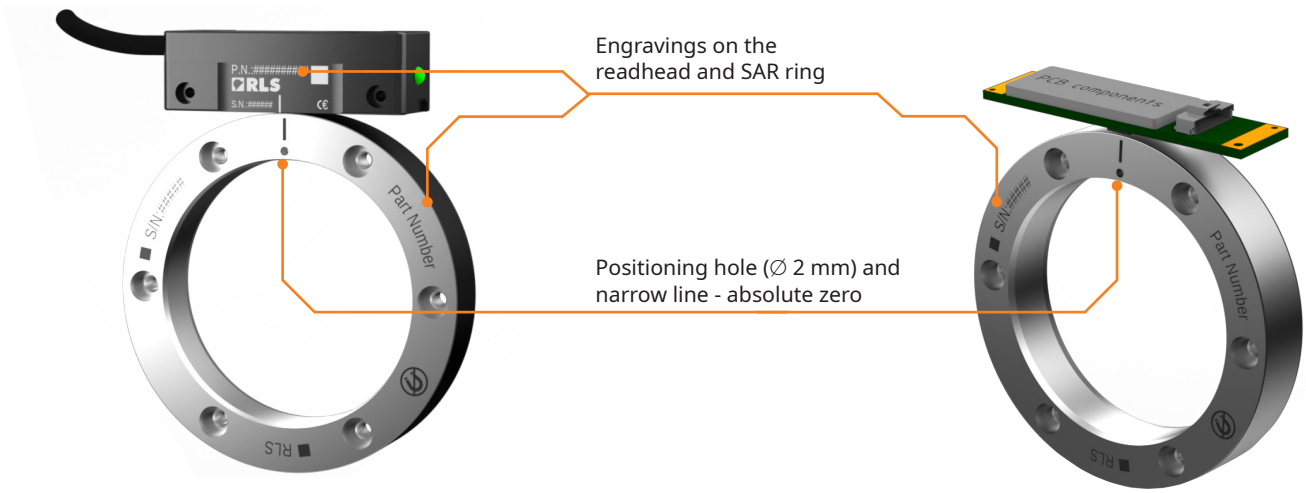
Structure, appearance and markings

The incremental track of the ring is always on the engraving side, as shown in the figure below.



Surface markings, features and orientation of the ring and readhead

All magnetic ring markings include serial number, QR code, RLS logo, part number, absolute zero mark and no-magnet sign. The absolute zero mark engraving can deviate from the actual absolute position zero for ±3°. The engraving also serves for the orientation purpose between the ring and readhead. The positioning hole (∅ 2 mm) can be used for repeatable installation of the ring.



Technical specifications

Mechanical data

Ring types	Exposed / with cover foil / completely sealed IP67 (welded)
Material of magnetic layer	NBR + ferrite
Ring dimensions	From outer diameter 57 mm to 478 mm
Hub thermal expansion coefficient (CTE)	$11.2 \times 10^{-6}\,K^{-1}$

Environmental data

Storage and operating temperature	–40 °C to +85 °C
Sealing type	Exposed type: dirt, dust, humidity (non-condensing)
	Cover foil type: dirt, dust, humidity (non-condensing)
	Sealed version: IP67 (oils, coolant, grease)
Maximum non-operational external magnetic field	25 mT

System specifications

Ring PN	Maximum resolution CPR	Maximum resolution in arcsec	System accuracy *
SAR057	1,474560	~0.88	±70 mdeg / ±252 arcsec
SAR081	2,097,152 / 21 bits	~0.62	±40 mdeg / ±144 arcsec
SAR114	2,949,120	~0.44	±30 mdeg / ±108 arcsec
SAR162	4,194,304 / 22 bits	~0.31	±25 mdeg / ±90 arcsec
SAR229	5,898,240	~0.22	±20 mdeg / ±72 arcsec
SAR325	8,388,608 / 23 bits	~0.15	±15 mdeg / ±54 arcsec
SAR478	8,388,608 / 23 bits	~0.15	±15 mdeg / ±54 arcsec

* Installation errors such as eccentricity (run-out) are not included in the system accuracy.

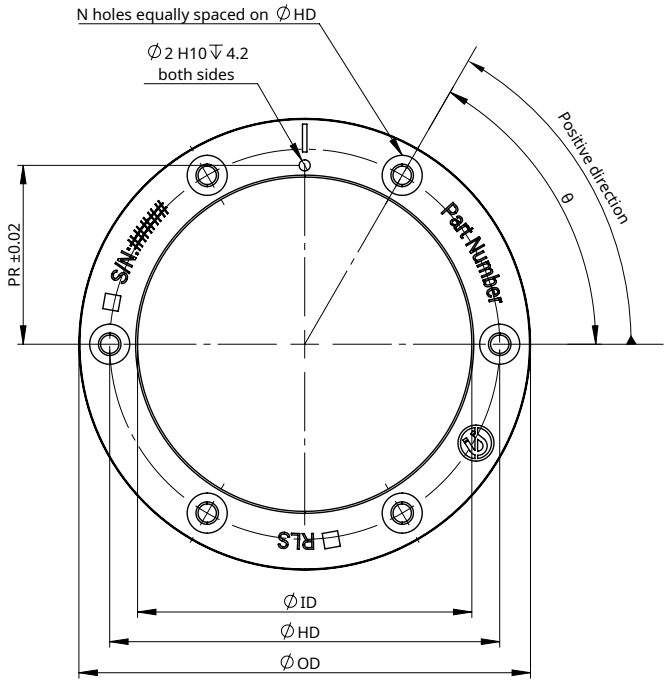
The installation induced eccentricity can be compensated with the self-calibration method. More details can be found in the **DBD01**, **DRD01** datasheets and **APP07** application note for Artos BiSS C bidirectional access.

Ring PN	Mass [kg]	Moment of inertia [kg × m²]
SAR057	0.09	0.06×10^{-3}
SAR081	0.22	0.28×10^{-3}
SAR114	0.31	0.85×10^{-3}
SAR162	0.47	2.7×10^{-3}
SAR229	1.38	15×10^{-3}
SAR325	4.06	78×10^{-3}
SAR478	3.35	171×10^{-3}

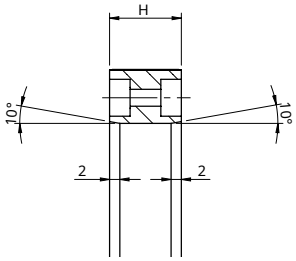
Dimensions and installation drawings

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.

Ring



Ring cross-section



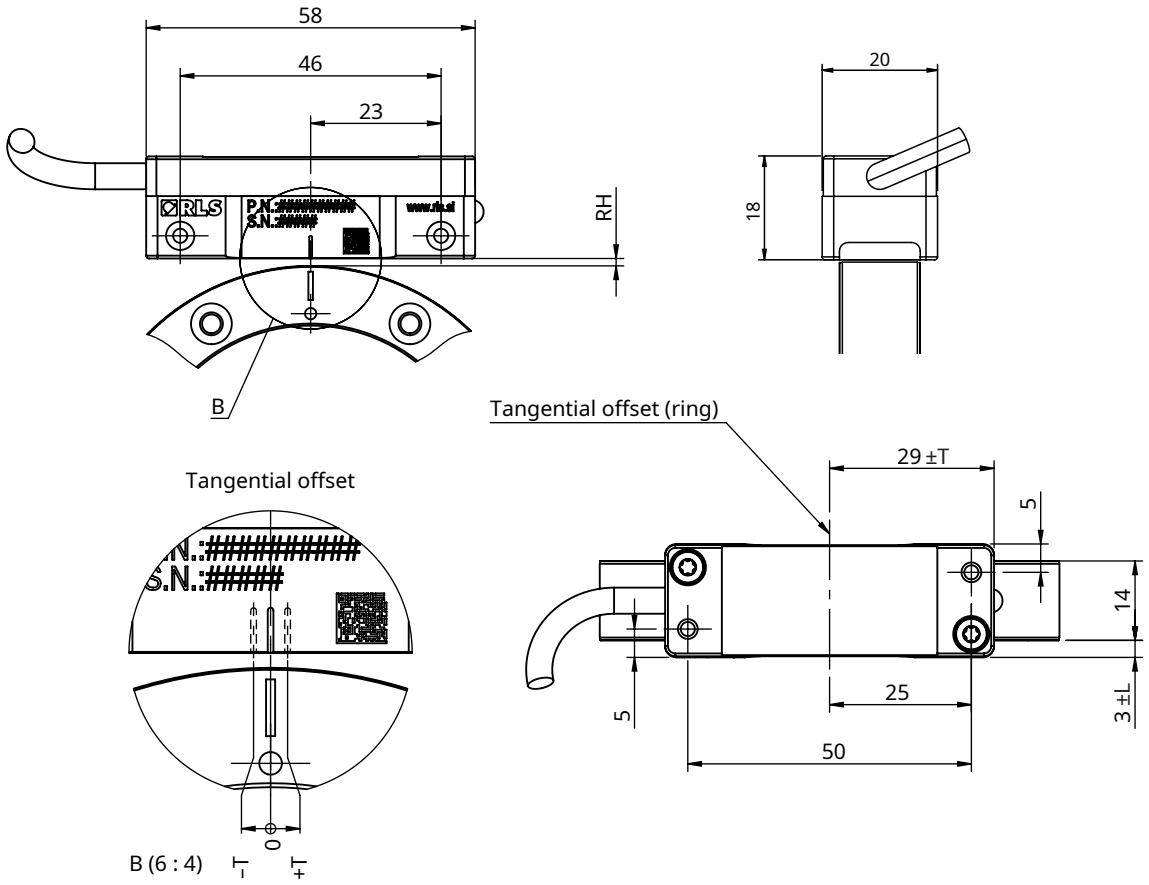
3D models available on **RLS website.**

Ring	OD	OD (with cover foil)	ID	Height (H)	HD	Hole [deg]	N of holes	Hole Type	PR [mm]
SAR057	56.70 ±0.01	56.90 ±0.10	45 H6	14	-	-	-	-	25
SAR081	80.90 ±0.01	81.10 ±0.10	60 H6	14	70	60	6	M4 through counterbore both sides ∅ 7.2 ↧4	32.1
SAR114	114.00 ±0.01	114.20 ±0.10	95 H6	14	104	60	6	M5 through	50
SAR162	162.40 ±0.01	162.60 ±0.10	143 H6	14	152	60	6		74
SAR229	228.81 ±0.20	228.96 ±0.25	180 H6	12	195	60	6	M6 through counterbore top side ∅ 10.5 ↧6.5	92.5
SAR325	325.50 ±0.20	325.65 ±0.25	220 H6	12	235	30	12		112.5
SAR478	478.18 ±0.20	/	425 H7	12	440	30	12	∅ 5.5 through counterbore top side ∅ 10 ↧5.4	220

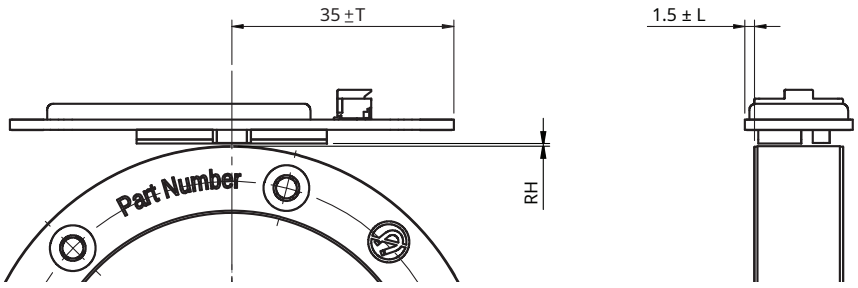
General tolerances for linear dimensions according to ISO 2768 m			
Tolerance class	up to 6	6-30	30-120
m (medium)	±0.1	±0.2	±0.3

The orientation of the readhead and ring is essential. The engraved side of the ring and readhead must match for the orientation to be correct.

Installation with housed readhead



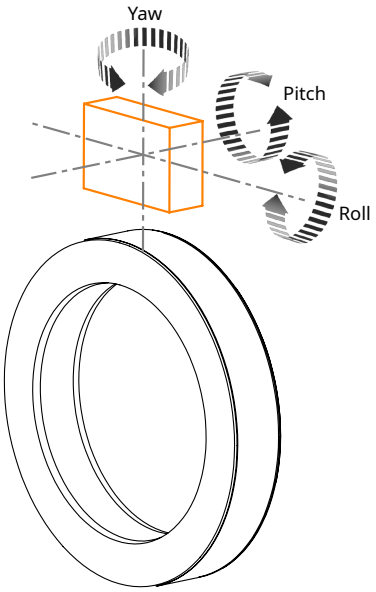
Installation with PCB-A readhead



Ring	Ride height (RH) / radial offset	Ride height (RH) / radial offset (with cover foil)	Recommended ride height / radial offset	Lateral offset (L) / axial offset	Tangential (T) / centerline offset
SAR057	0.1 to 0.6 mm	0.1 to 0.5 mm	0.2 mm	1 mm	0.8 mm
SAR081	0.1 to 0.7 mm	0.1 to 0.6 mm	0.3 mm		1 mm
SAR114					
SAR162	0.1 to 0.9 mm	0.1 to 0.8 mm			
SAR229					
SAR325					
SAR478					

Installation tolerances (readhead to ring)

Non-parallel mounting (roll)	± 1°
Non-parallel mounting (yaw)	± 1°
Non-parallel mounting (pitch)	± 1°



Maximum speed table

Maximum speed values are limited by the mechanical characteristics of the ring and ABZ output (if enabled) on the PCB-A Artos™ module. Refer to **Maximum speed calculator.**

Ring	Option E (no cover foil)	Option C (with cover foil)	Option W (with welded cover foil)
SAR057	7,000	-	30,000
SAR081	5,000	-	25,000
SAR114	3,500	-	17,000
SAR162	2,500	-	13,000
SAR229	2,000	10,000	-
SAR325	1,000	5,000	-
SAR478	600	-	-

Speed is in rpm.

Installation instructions

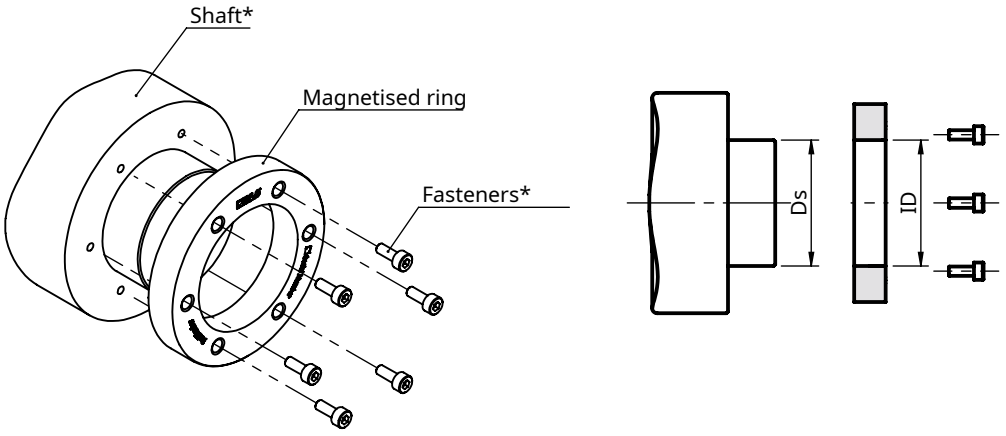
Design the mounting shaft according to the dimensions given in the table below.

Ring	OD	OD (with cover foil)	ID		Shaft diameter (clearance fit installation, fasteners, gluing) - D_s		Shaft outer diameter (press-fit) - D_{spd}	
SAR057	56.70 ±0.01	56.90 ±0.10	45H6	+0.016	45g6	–0.009	45s6	+0.059
				0		–0.025		+0.043
SAR081	80.90 ±0.01	81.10 ±0.10	60H6	+0.019	60g6	–0.01	60s6	+0.072
				0		–0.029		+0.053
SAR114	114.00 ±0.01	114.20 ±0.10	95H6	+0.019	95g6	–0.012	95s6	+0.093
				0		–0.034		+0.071
SAR162	162.40 ±0.01	162.60 ±0.10	143H6	+0.025	143g6	–0.014	143s6	+0.125
				0		–0.039		+0.100
SAR229	228.81 ±0.20	228.96 ±0.25	180H6	+0.025	180g6	–0.014	180s6	+0.133
				0		–0.039		+0.108
SAR325	325.50 ±0.20	325.65 ±0.25	220H6	+0.029	220g6	–0.015	220s6	+0.159
				0		–0.044		+0.130
SAR478	478.18 ±0.20	/	425H7	+0.063	425g6	–0.02	425s6	+0.272
				0		–0.06		+0.232

Installation with fasteners

Installation with fasteners is possible with the rings SAR081, SAR114, SAR162, SAR229, SAR325 and SAR478. Ensure that the installation surface is clean and free from contamination. Rings must be attached with fasteners in accordance with the installation drawings.

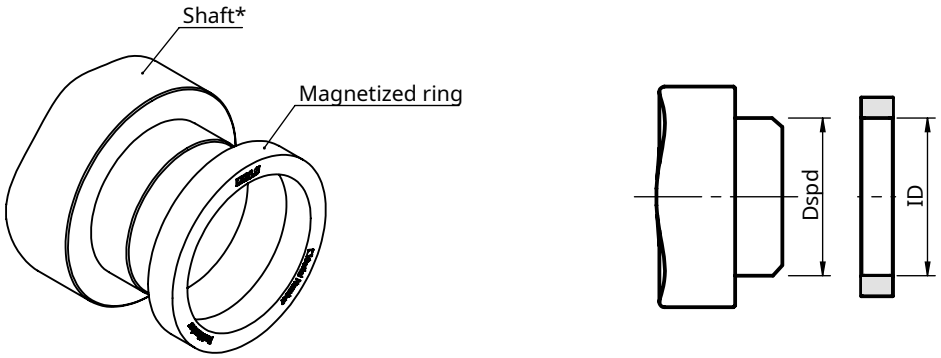
For recommended tightening torque see **Table of recommended fasteners tightening torques**.



* Not provided.

Installation by press-fitting

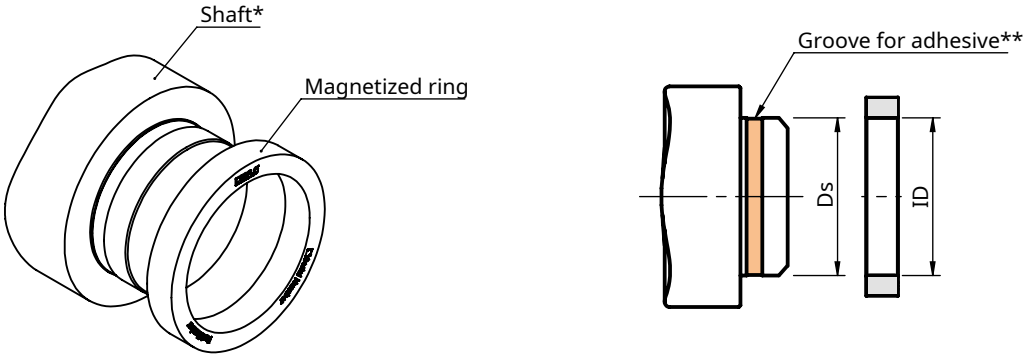
Ensure that the installation surface is clean and free from contamination. Slip the ring onto the mating shaft applying equal or uniform force along the whole ring circumference. For recommended shaft diameter (D_{spd}) see table above.



* Not provided.

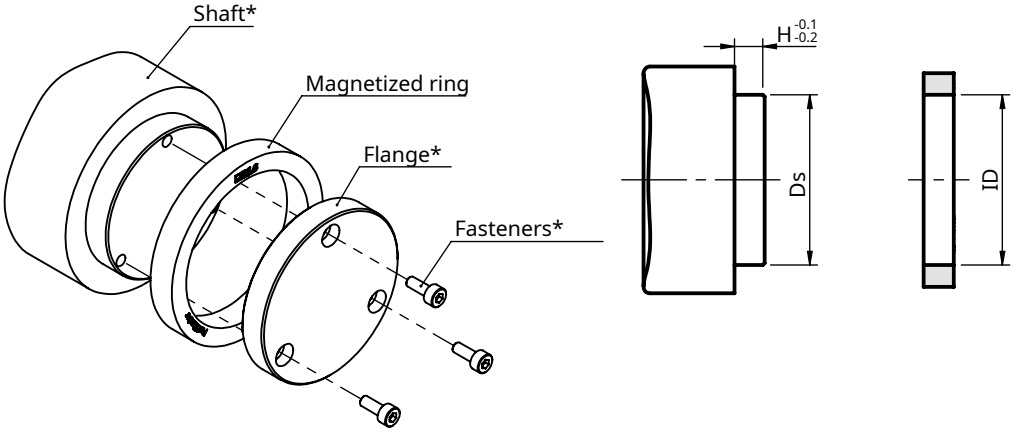
Installation by gluing

Ensure that the installation surface is clean and free from contamination. For more information see the adhesive manufacturer's data sheet.



* Not provided.
** For the depth of the groove, please check the specifications of the adhesive (adhesive not provided).

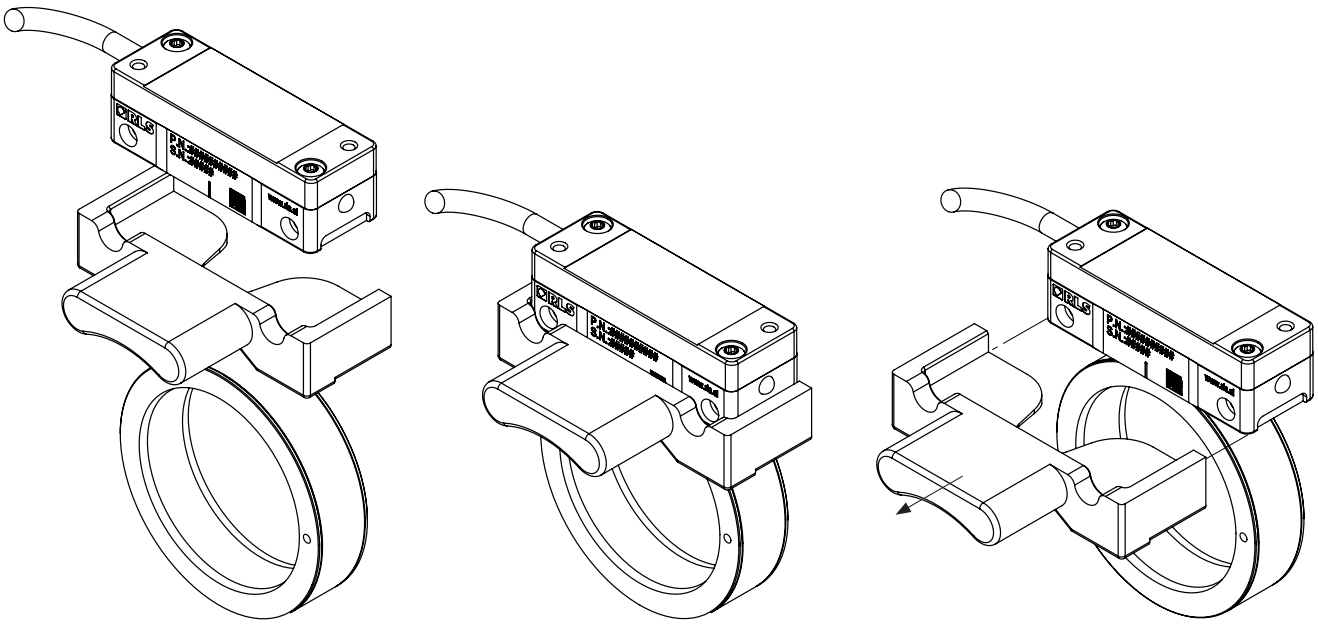
Installation with flange



* Not provided.

Readhead installation with a dedicated installation tool

A special installation tool can be supplied for easier, more reliable and time-saving installation of the readhead in relation to the ring. The installation tool limits the readhead in 6 directions (ride height/radial offset, centerline/tangential, yaw, axial/lateral, pitch and roll offset) and thus ensures precise alignment of the readhead, guaranteeing optimal performance. A dedicated mounting tool is required for each SAR ring to adjust the diameter of the ring. Please check the part number diagram to select the correct installation tool for the selected ring.



Operation in ultra high vacuum applications

Artos encoders were tested for outgassing under ultra-high vacuum conditions (UHV, below 1×10^{-6} Pa) for 24 hours at a maximum operating temperature of 85° C. No prior preparation of the encoders was applied. No critical outgassing was detected during the test. The maximum observed relative mass loss (RML) was 0.02 %. The ultra-high vacuum test had no effect on the performance of the Artos encoders.

Part numbering

SAR 057 C 045 A F 14 E A P 00

Outer diameter

057 - 57 mm
081 - 81 mm
114 - 114 mm
162 - 162 mm
229 - 229 mm
325 - 325 mm
478 - 478 mm

Readhead type

C - Artos DHR/DBR readhead

Inner diameter

045 - 45 mm
060 - 60 mm
095 - 95 mm
143 - 143 mm
180 - 180 mm
220 - 220 mm
425 - 425 mm

N/A

A - N/A

N/A

F - N/A

Cross section

14 - 14 mm thickness
12 - 12 mm thickness

IP rating class

E - Exposed (Without cover foil)
C - Cover foil (SAR229 and SAR325)
W - Completely sealed IP67

Material

A - Martensitic stainless steel hub with bonded rubber tape

Packaging type

P - Individual packaging

Special requirements

00 - No special requirements

Not all part number combinations are valid. Please refer to the table of available combinations.

Table of available combinations

Series	Outer diameter	Readhead type	Inner diameter	N/A	N/A	Height	Degree of protection	Material	Packaging type	Special requirements
SAR	057	C	045	A	F	14	E / W	A	P	00
	081		060							
	114		095							
	162		143							
	229		180			12	E / C			
	325		220							
	478		425				E			

Installation tool

IT R AH 0114 V0 00

Accessory
IT - Installation tool

Type of the magnetic ring/scale
R - SAR ring

Type of the readhead
AH - Housed readhead

Outer diameter
0057 - For ring OD 57 mm
0081 - For ring OD 81 mm
0114 - For ring OD 114 mm
0162 - For ring OD 162 mm
0229 - For ring OD 229 mm
0325 - For ring OD 325 mm
0478 - For ring OD 478 mm

N/A
V0 - N/A

Special requirements
00 - No special requirements

Table of available combinations

Accessory	Type of the magnetic ring/scale	Type of the readhead	Outer diameter	N/A	Special requirements
IT	P	AH	0057	V0	00
			0081		
			0114		
			0162		
			0229		
			0325		
			0478		

Accessories

Magnet viewer
MM0001

Installation tool for Artos™ rings
IT

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Visit our **website** to contact your nearest sales representative.

Document issues

Issue	Date	Page	Description
1	19. 3. 2024	-	New document
2	21. 6. 2024	12	Part numbering amended
3	23. 8. 2024	6	Positive direction added
		7	Installation with PCB drawing amended
4	11. 11. 2024	3, 5	Temperature data amended
5	20. 11. 2025	4	Deviation from absolute zero amended
		9	Installation instructions amended
		11	Ultra-high vacuum chapter added

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