

# 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



-20 °C to +85 °C

### Operating temperature

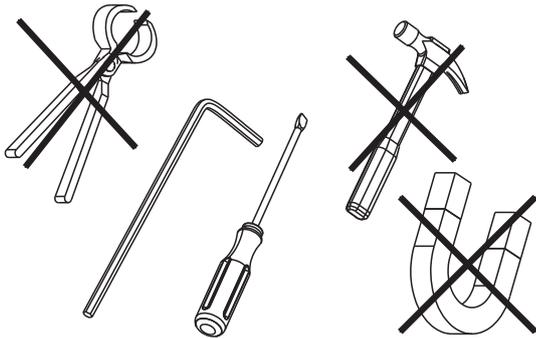


-20 °C to +85 °C

### 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.

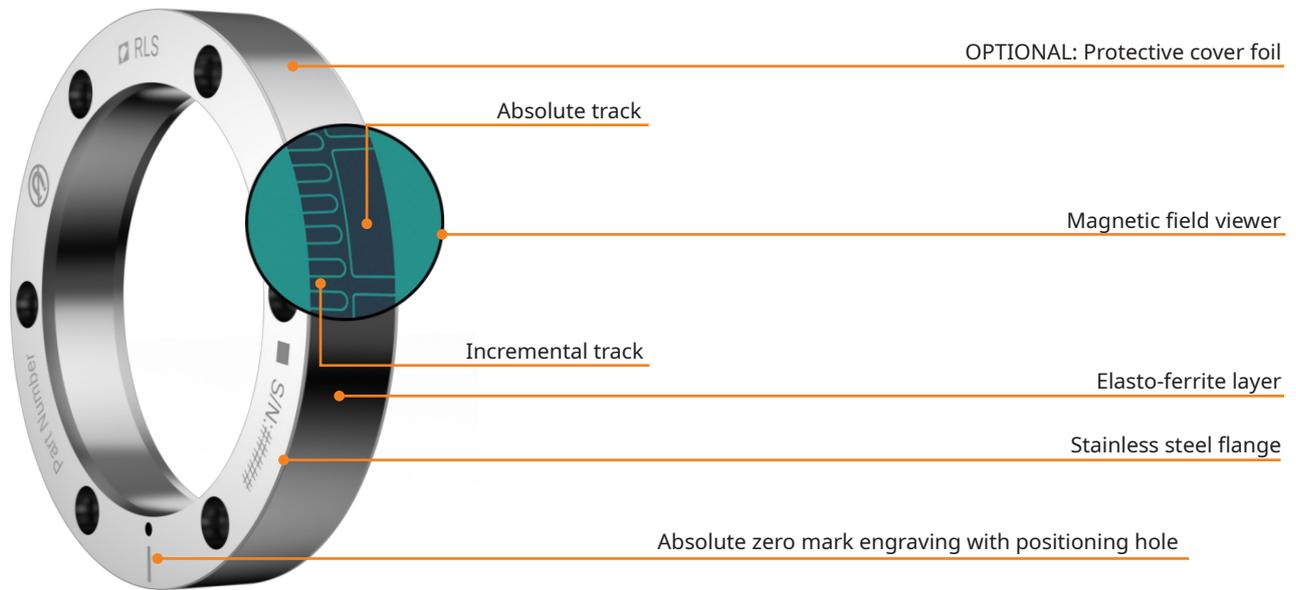
## Packaging

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

# Magnetic ring design

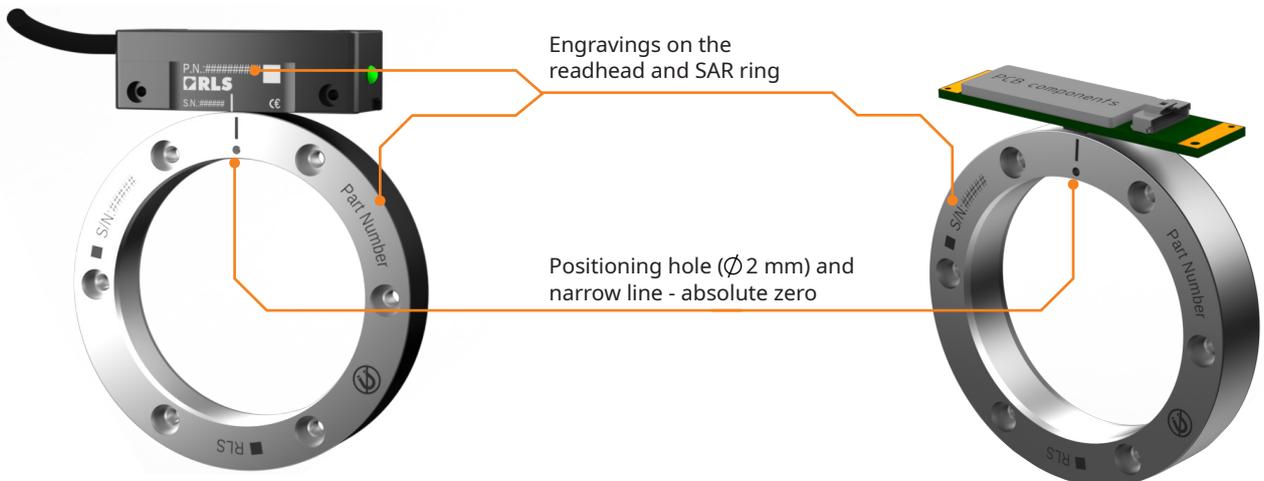
## Structure, appearance and markings

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  $\pm 1^\circ$ . The engraving also serves for the orientation purpose between the ring and readhead. The positioning hole ( $\varnothing 2$  mm) can be used for repeatable installation of the ring.



# Technical specifications

## Mechanical data

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

## Environmental data

<b>Storage and operating temperature</b>	-20 °C to +85 °C
<b>Sealing type</b>	Exposed type: dirt, dust, humidity (non-condensing)
	Cover foil type: dirt, dust, humidity (non-condensing)
	Sealed version: IP67 (oils, coolant, grease)
<b>Maximum non-operational external magnetic field</b>	25 mT

## System specifications

Ring PN	Maximum resolution CPR	Maximum resolution in arcsec	System accuracy *
<b>SAR057</b>	1,474,560	~0.88	±70 mdeg / ±252 arcsec
<b>SAR081</b>	2,097,152 / 21 bits	~0.62	±40 mdeg / ±144 arcsec
<b>SAR114</b>	2,949,120	~0.44	±30 mdeg / ±108 arcsec
<b>SAR162</b>	4,194,304 / 22 bits	~0.31	±25 mdeg / ±90 arcsec
<b>SAR229</b>	5,898,240	~0.22	±20 mdeg / ±72 arcsec
<b>SAR325</b>	8,388,608 / 23 bits	~0.15	±15 mdeg / ±54 arcsec
<b>SAR478</b>	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.

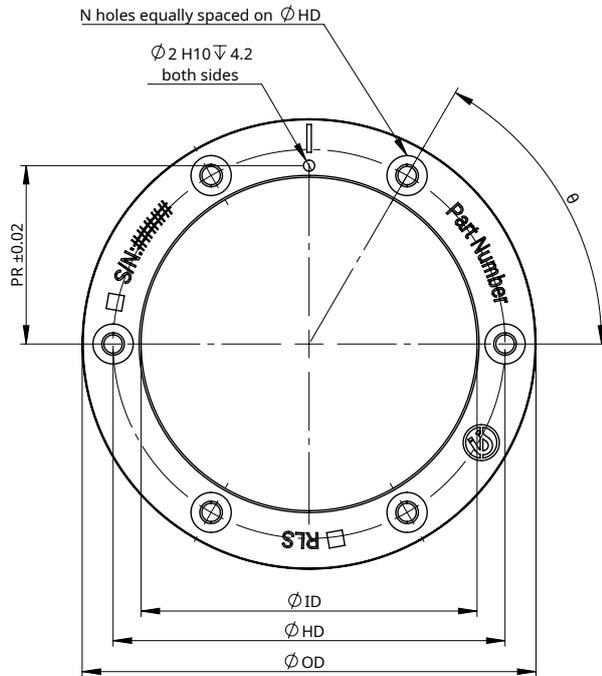
Ring PN	Mass [kg]	Moment of inertia [kg × m <sup>2</sup> ]
<b>SAR057</b>	0.09	$0.06 \times 10^{-3}$
<b>SAR081</b>	0.22	$0.28 \times 10^{-3}$
<b>SAR114</b>	0.31	$0.85 \times 10^{-3}$
<b>SAR162</b>	0.47	$2.7 \times 10^{-3}$
<b>SAR229</b>	1.38	$15 \times 10^{-3}$
<b>SAR325</b>	4.06	$78 \times 10^{-3}$
<b>SAR478</b>	3.35	$171 \times 10^{-3}$

# Dimensions and installation drawings

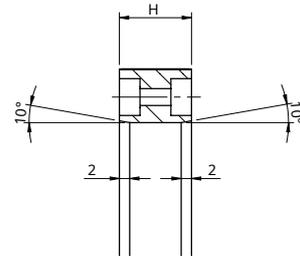
Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.



## Ring



## Ring cross-section



3D models available on [RLS website](#).

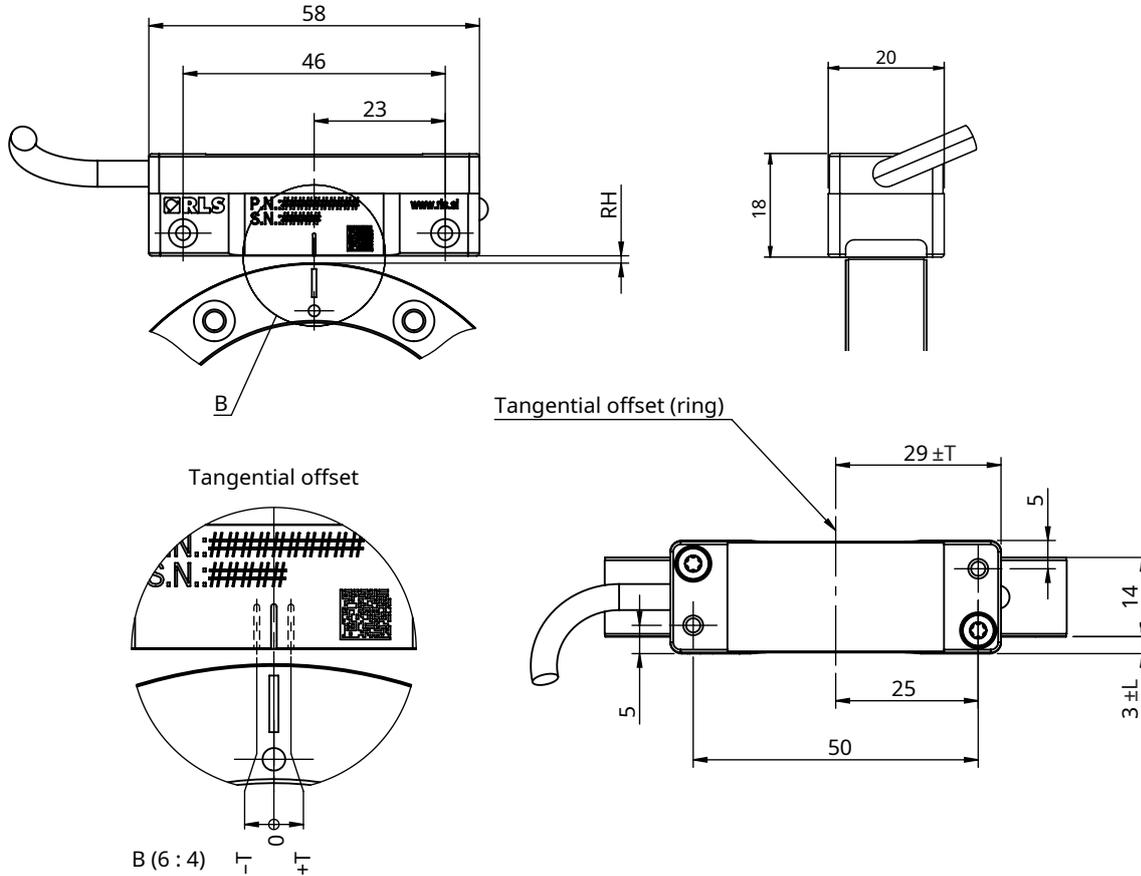
Ring	OD	OD (with cover foil)	ID	Height (H)	HD	Hole [deg]	N of holes	Hole Type	PR [mm]
SAR057	56.70 ±0.01	56.90 ±0.10	45 H6	14	-	-	-	-	25
SAR081	80.90 ±0.01	81.10 ±0.10	60 H6	14	70	60	6	M4 through counterbore both sides $\text{Ø } 7.2 \sqrt{4}$	32.1
SAR114	114.00 ±0.01	114.20 ±0.10	95 H6	14	104	60	6	M5 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 $\text{Ø } 10.5 \sqrt{6.5}$	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	$\text{Ø } 5.5$ through counterbore top side $\text{Ø } 10 \sqrt{5.4}$	220

### General tolerances for linear dimensions according to ISO 2768 m

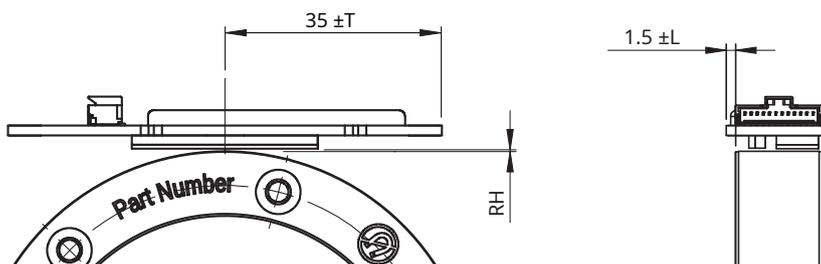
Tolerance class	up to 6	6-30	30-120
m (medium)	±0.1	±0.2	±0.3

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



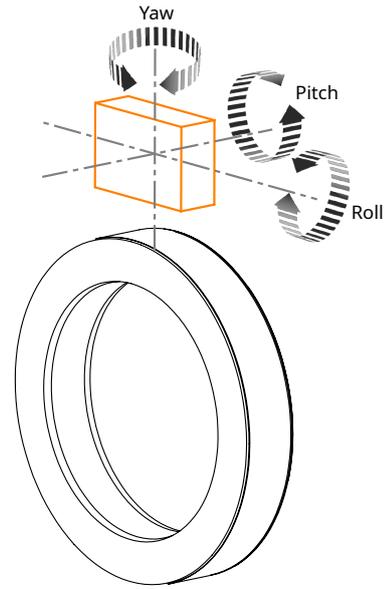
Ring	Ride height (RH) / radial offset	Ride height (RH) / radial offset (with cover foil)	Recommended ride height / radial offset	Lateral offset (L) / axial offset	Tangential (T) / centerline offset	
SAR057	0.1 to 0.6 mm	0.1 to 0.5 mm	0.2 mm	1 mm	0.8 mm	
SAR081	0.1 to 0.7 mm	0.1 to 0.6 mm	0.3 mm		1 mm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

## Installation tolerances (readhead to ring)

Non-parallel mounting (roll)  $\pm 1^\circ$

Non-parallel mounting (yaw)  $\pm 1^\circ$

Non-parallel mounting (pitch)  $\pm 1^\circ$



## 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

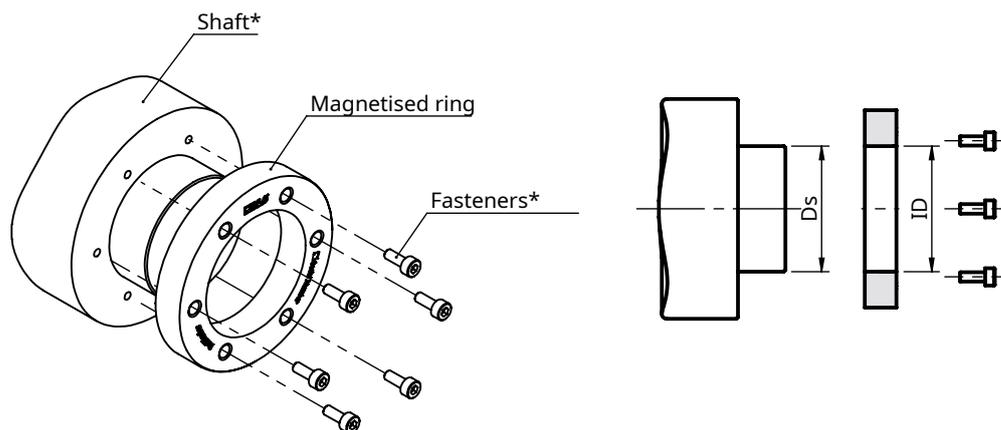
Design the mounting shaft according to the dimensions given in the table below.

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	-0.009	45n6	0.033
				0	-0.025		0.017
SAR081	80.90 ±0.01	81.10 ±0.10	60H6	+0.019	-0.01	60n6	0.039
				0	-0.029		0.02
SAR114	114.00 ±0.01	114.20 ±0.10	95H6	+0.019	-0.012	95n6	0.045
				0	-0.034		0.023
SAR162	162.40 ±0.01	162.60 ±0.10	143H6	+0.025	-0.014	143n6	0.052
				0	-0.039		0.027
SAR229	228.81 ±0.20	228.96 ±0.25	180H6	+0.025	-0.014	180n6	0.052
				0	-0.039		0.027
SAR325	325.50 ±0.20	325.65 ±0.25	220H6	+0.029	-0.015	220n6	0.06
				0	-0.044		0.031
SAR478	478.18 ±0.20	/	425H7	+0.063	-0.02	425n6	0.08
				0	-0.06		0.04

## 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.

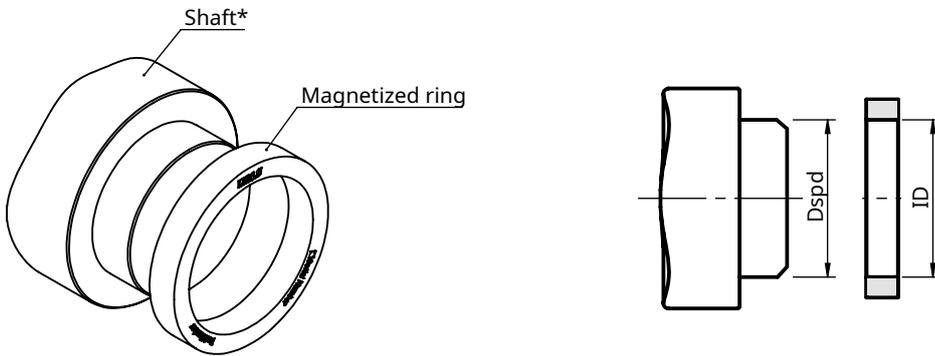
For recommended tightening torque see [Table of recommended fasteners tightening torques](#).



\* Not provided.

## Installation by press-fitting

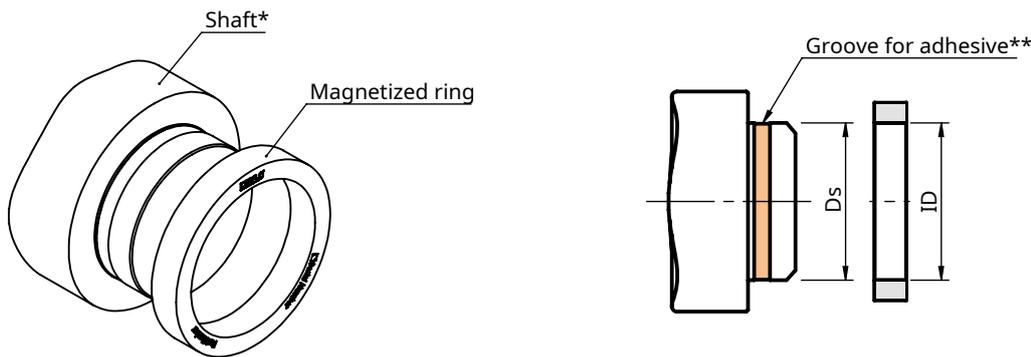
Ensure that the installation surface is clean and free from contamination. Slip the ring onto the mating shaft applying equal or uniform force along the whole ring circumference. For recommended shaft diameter ( $D_{spd}$ ) see table above.



\* Not provided.

## Installation by gluing

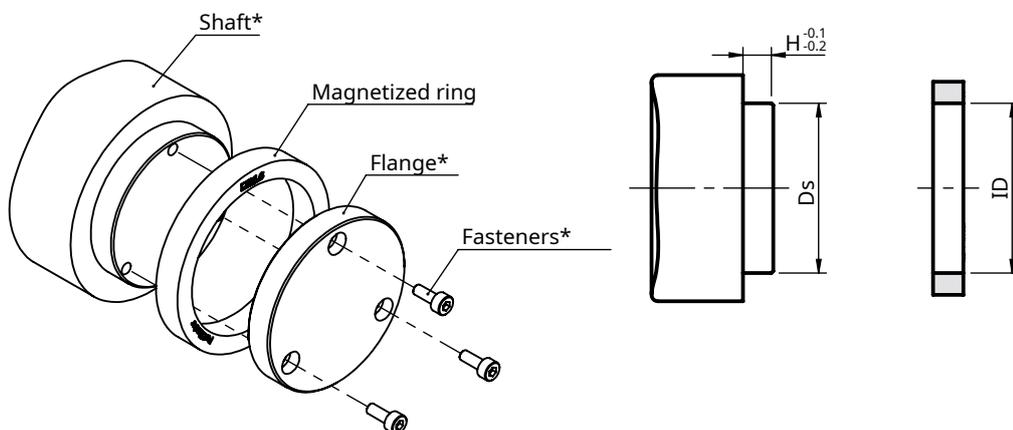
Ensure that the installation surface is clean and free from contamination. For more information see the adhesive manufacturer's data sheet.



\* Not provided.

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

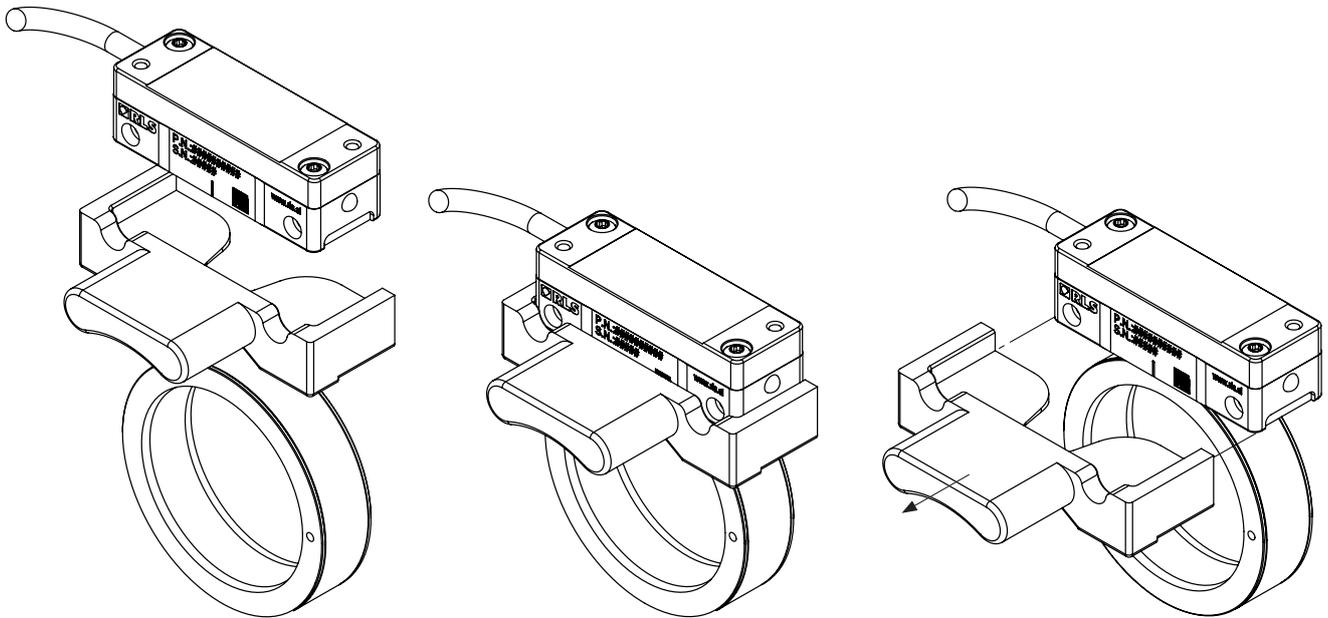
## Installation with flange



\* 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.



# Part numbering

SAR 057 C 045 A F 14 E A P 00

## Outer diameter

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

## Readhead type

C - Radial absolute IP-67 readhead  
D - Radial absolute PCB-A module readhead

## Inner diameter

045 - 45 mm      180 - 180 mm  
060 - 60 mm      220 - 220 mm  
095 - 95 mm      425 - 425 mm  
143 - 143 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 / D	045	A	F	14	E / W	A	P	00
	081		060							
	114		095							
	162		143							
	229		180			12	E / C			
	325		220							
	478		425							

## Installation tool

	IT	R	AH	0114	V0	00
<b>Accessory</b>						
IT - Installation tool						
<b>Type of the magnetic ring/scale</b>						
R - SAR ring						
<b>Type of the readhead</b>						
AH - Housed readhead						
<b>Outer diameter</b>						
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						
<b>N/A</b>						
V0 - N/A						
<b>Special requirements</b>						
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

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Magnet viewer  
**MM0001**



Installation tool for Artos™ rings  
**IT**

## Head office

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### Document issues

Issue	Date	Page	Description
1	19. 3. 2024	-	New document

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