

AS

Absolute Magnetic Scales



The robust absolute magnetic scales consist of a stainless steel carrier and an elastomer-bonded ferrite. Two options are available, the AS10 and SAS10 magnetic scales. The AS10 scale is a 10 mm wide absolute scale with the exposed elasto-ferrite layer bonded to a flexible stainless steel carrier. The SAS10 is a solid scale available in predefined lengths. It can be fully enclosed making it suitable for harsh environments where oils or coolants are present.

RESISTANT TO
COOLANTS AND
OILS

UP TO 16.3 m
LENGTH

TRACK
SECTION
SYSTEM
(TRS)



Features and benefits

- ▶ Excellent resistance to dirt, dust and humidity
- ▶ Totally enclosed SAS10 scale protected from contaminants
- ▶ Optional protective cover foil for AS10 scale
- ▶ Easy installation with adhesive tape, end-clamps, or track system (TRS)



INDUSTRIAL AUTOMATION



LINEAR MOTOR



MEDICAL



ASSEMBLY LINES



MACHINE TOOL

General information

The AS10 and SAS10 absolute magnetic scales are compatible with the RLS LA11 and LA12 readheads. The LF11 readhead is compatible with the AS10 magnetic scale only.

SAS10 scales are available in predefined lengths up to 1.36 m (1.288 m measuring length). For longer scale options (>1.3m) please **contact RLS**. The AS10 scale is available in lengths up to 16.3 m.

The SAS10 scale comes in two versions, one fully welded and another with the elasto-ferrite layer exposed. The welded version is intended for harsh environments where contamination with industrial compounds is possible, while the exposed version is intended for applications where higher accuracy is required.

Absolute scale variants

AS10 and AS10 with cover foil



TRS option (AS10)



SAS10 with elasto-ferrite layer exposed (option A)



SAS10 fully welded (option C)



Selection guide

Scale	Accuracy at 0.2 mm ride height [$\mu\text{m}/\text{m}$]	Compatibility with readheads		
		LA11	LA12	LF11
AS10	$\pm 30^*$	✓	✓	✓
SAS10	$\pm 20^*$	✓	✓	-

*Check the accuracy as a function of ride height and lateral offset in AST01 at **RLS Media center**.

More about LF11, LA11 and LA12 readheads can be found at **RLS Media center**.

Storage and handling

Storage temperature



AS10: -40 °C to +60 °C
SAS10: -40 °C to +75 °C

Operating temperature



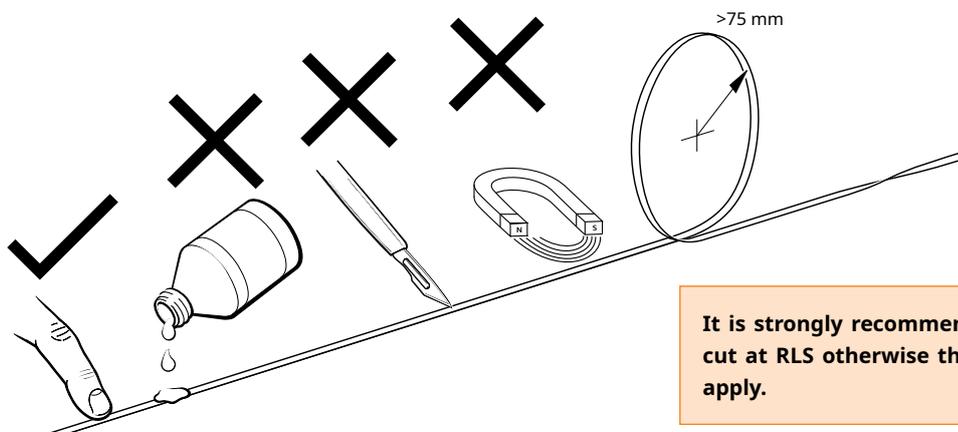
AS10: -40 °C to +100 °C
SAS10: -40 °C to +75 °C

Humidity



High resistance to humidity

The storage temperature of the AS10 scale is lower than the operating temperature. This limit has been established because the AS10 scale may be damaged within 2 months if exposed to higher temperatures. Once the scale is straightened and firmly attached, it can be exposed to the operating temperatures.



Minimum bending radius of the AS10 scale is 75 mm.

It is strongly recommended that the scale is factory cut at RLS otherwise the product warranty does not apply.

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

Chemical resistance

The use of alcohol for cleaning is considered safe for AS10 and SAS10 exposed version, but it is not allowed to immerse the scales in alcohol. Furthermore, the scale surface print may disappear if the scale is not carefully cleaned.

SAS10 welded cover foil completely encapsulates the scale and protects it from aggressive industrial chemicals

For more information on chemical resistance **contact RLS**.

Packaging

The type of packaging depends on the length of the AS magnetic scale and quality. Scales shorter than 1 m are packed individually in a plastic tube, while spiral packaging is used for longer lengths. This prevents demagnetization of the scale by maintaining the distance between the scale rolls.

When option B, H or N is selected, the protective cover foil is supplied with the scale. The cover foil is not mounted on the scale. SAS10 scales are packed individually in wooden boxes.

Individual packaging (up to and including 20 pieces)

Magnetic Scale Length	Type of packaging
≤ 330 mm	Plastic tube
> 330 mm	Rolled

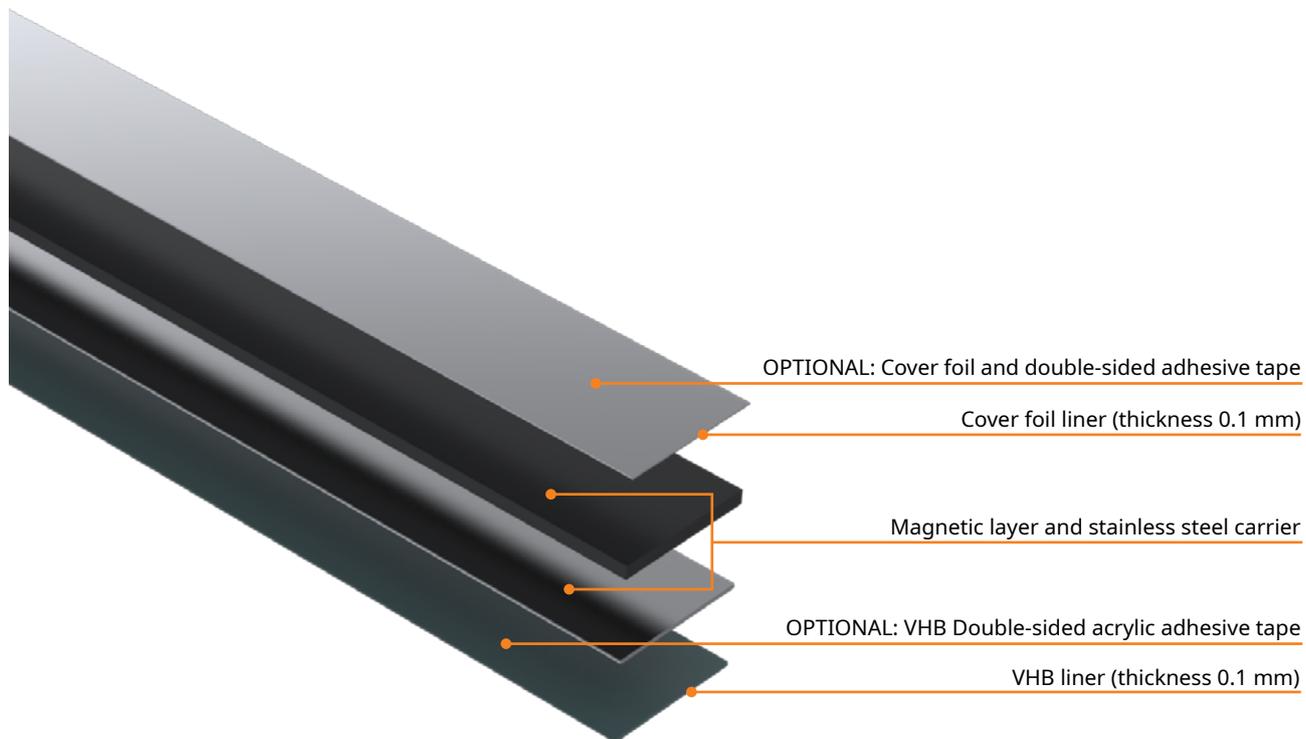
Bulk packaging (more than 20 pieces)

Magnetic Scale Length	Type of packaging
≤ 600 mm	Plastic tube
> 600 mm	Rolled

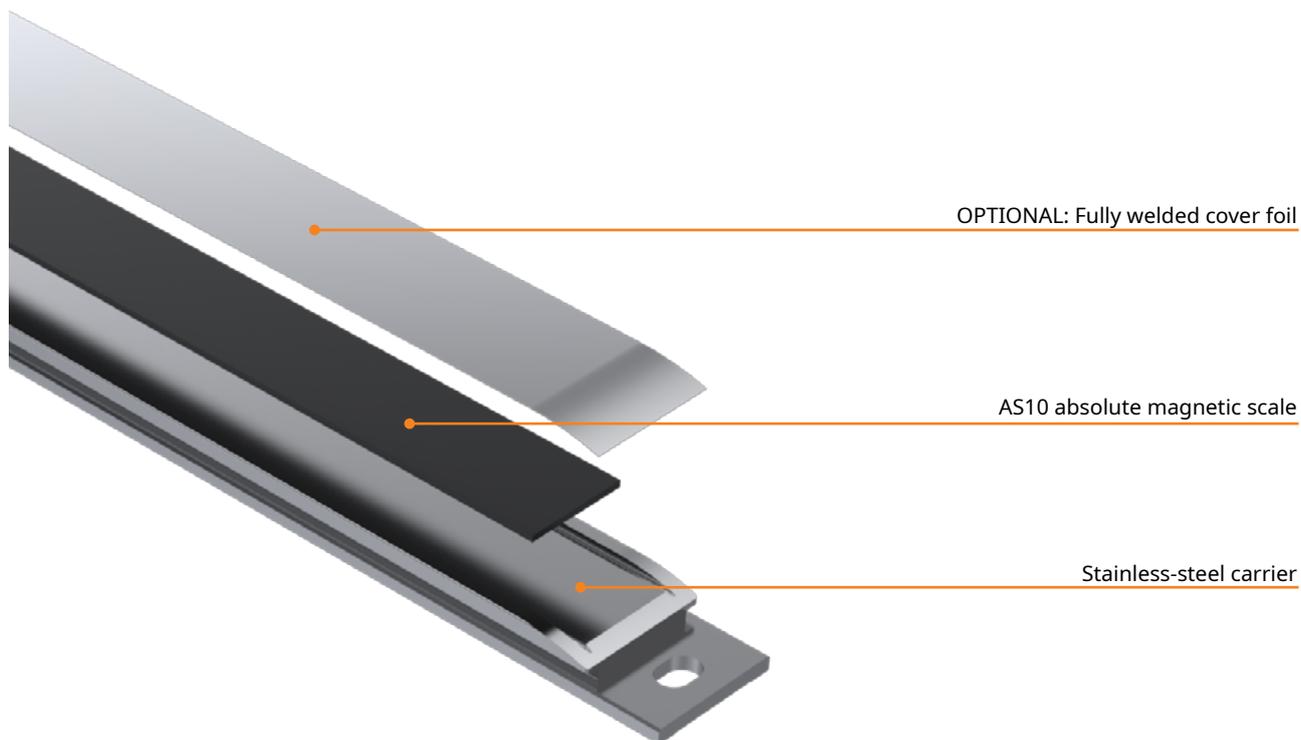
All AS magnetic scales have 12 months shelf life and should be installed within this period.

Magnetic scale design

Structure of AS10 absolute magnetic scale

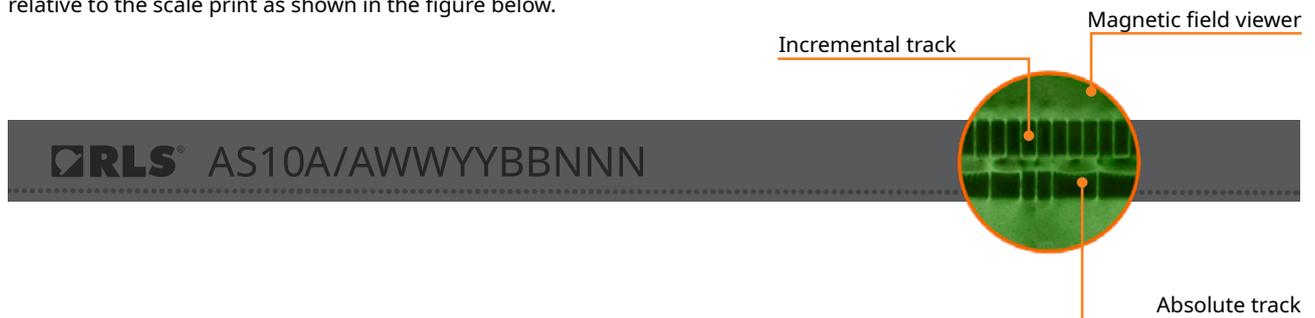


Structure of SAS10 absolute magnetic scale on a solid substrate



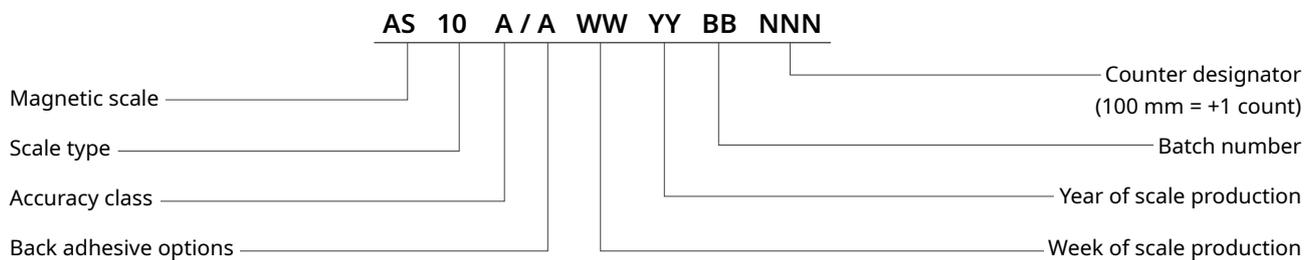
AS10 appearance and print

The orientation of the magnetised incremental track and absolute track is always the same, relative to the scale print as shown in the figure below.



AS10 scale surface print description

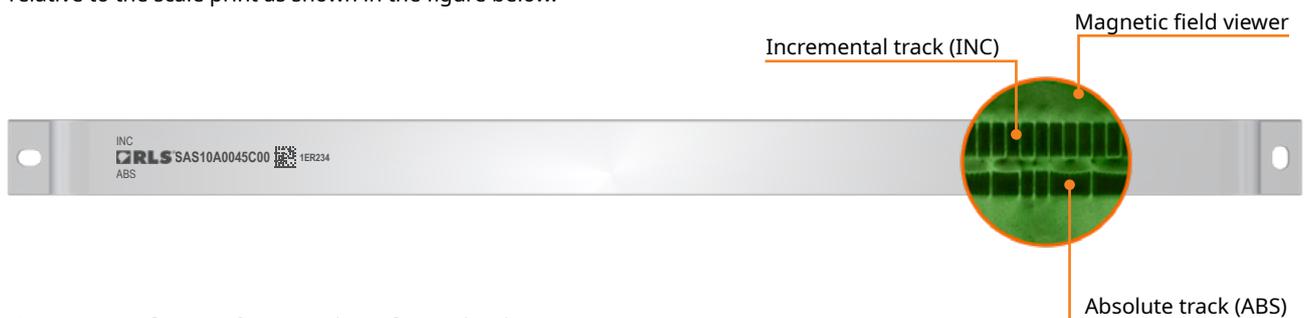
Scale surface print appears every 100 mm and contains the RLS logo and the designator described below.



The dotted line indicates the absolute side of the scale

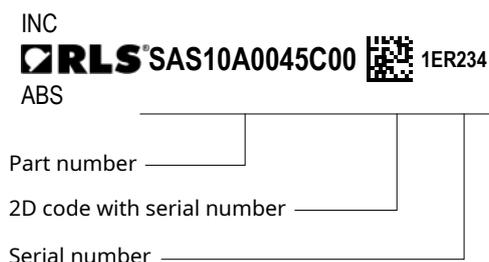
SAS10 appearance and print

The orientation of the magnetised incremental track and absolute track is always the same, relative to the scale print as shown in the figure below.



SAS10 scale surface print description

The print/engraving of the scale surface appears once per entire exposed/fully welded length of the scale. It includes the RLS logo, part number, serial number, marking of the incremental (INC) and absolute (ABS) track and QR code that contains serial number information.



Technical specifications

System data	AS10	SAS10
Incremental pole length	2 mm	2 mm
Maximum scale length	16.3 m	1.36 m (1.288 m measuring length)
Scale accuracy at 0.2 mm ride height*	±30 µm/m	±20 µm/m

*For more information about the accuracy please see the AST01 technical article at [RLS Media center](#).

Mechanical data

Material	Carrier	1.4310 stainless steel	1.4016 stainless steel
	Magnetic medium	NBR elasto-ferrite	NBR elasto-ferrite
Thickness	Carrier	0.3 ±0.05 mm	-
	Double-sided acrylic adhesive tape VHB 3M9469	0.13 mm	-
	VHB liner thickness	0.1 mm	-
	Cover foil	0.076 ±0.006 mm	-
	Double sided tape	0.05 mm	-
	Scale	1.43 ±0.1 mm (with back adhesive) 1.3 ±0.1 mm (without back adhesive)	6.08 ±0.03 mm
Mass		62 g/m	700 g/m
Width		10 ^{-0.05} _{+0.15} mm	18 ±0.05 mm
Cover foil width	CF10 (AS10)	9.5 ±0.1 mm (for regular scale)	
	CF08 (AS10)	7.6 ±0.35 mm (for track system)	
Length tolerance		±0.5 mm ± 40 [µm/m] * 10 ⁻³ * scale length [m]	
Expansion coefficient (carrier)		~17 × 10 ⁻⁶ [m/mK]	10.4 × 10 ⁻⁶ [m/mK]
Tolerance between the magnetized reference mark and the print		±2 mm	

Environmental data

Temperature	Operating	-40 °C to +100 °C	-40 °C to +75 °C
	Storage	-40 °C to +60 °C	-40 °C to +75 °C

Installation instructions

Installation of AS10 magnetic scale with adhesive tape

Installation surface preparation

AS magnetic scales are equipped with VHB backside adhesive tape. Most substrates are best prepared by cleaning with a 50:50 mixture of isopropyl alcohol and water before applying the magnetic scale. Exceptions to the general procedure that may require additional surface preparation include:

- Heavy oil/grease: To remove heavy oil or grease from a surface, a degreaser or solvent-based cleaning agent may be required, followed by cleaning with IPA/water.
- Abrasion: Sanding a surface and then cleaning with IPA/water can remove heavy dirt or oxidation and improve adhesion.
- Adhesion promoters: Priming a surface can significantly improve initial and ultimate adhesion to many materials such as plastics and paints.
- Porous surfaces: Most porous and fibrous materials such as wood, chipboard, concrete, etc. must be sealed to provide a unified surface.
- Unique materials: Special surface preparation may be required for glass and glass-like materials, copper and copper-containing metals, plastics or rubber containing migrating components (e.g. plasticisers).

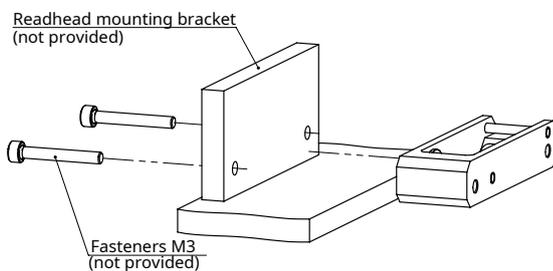
Further information can be found under "Surface Preparation for 3M™ VHB™ Tape Applications".

Scale application

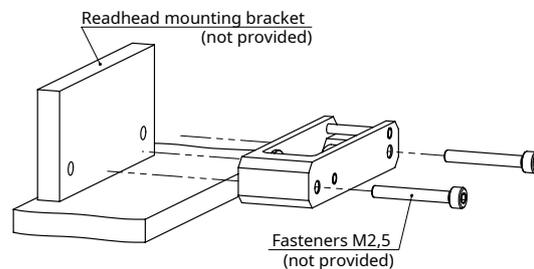
To simplify the scale installation use the scale applicator tool LMA10ASC00. Mount the applicator tool to the readhead mounting bracket. Use two fasteners as per readhead mounting configuration.

Fastener mounting variants

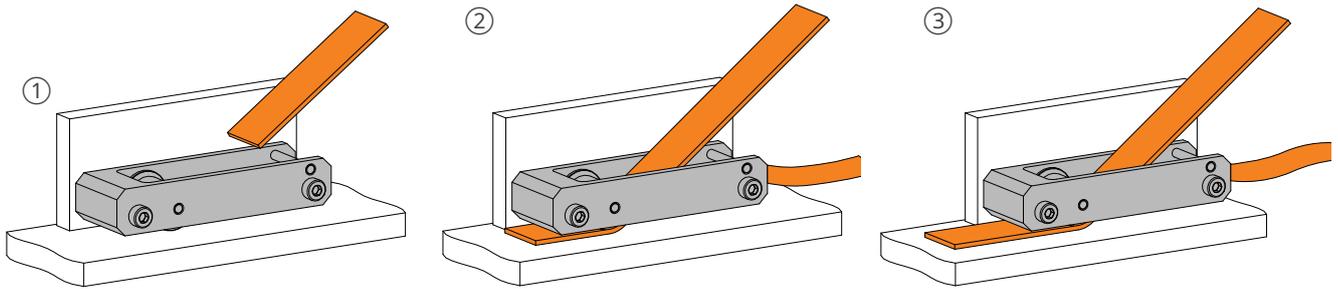
Variant A



Variant B



Good surface contact can be achieved by applying a pressure of about 100 kPa. At room temperature, approximately 50 % of the final bond strength is achieved after 20 minutes, 90 % after 24 hours and 100 % after 72 hours. Dynamic overlap shear (peak force to separate is measured after 72 hours dwell time): 830 kPa.



Load the scale into the applicator tool.

Separate the backing paper from the first 40 mm of scale and feed the scale into the applicator tool.

Apply the scale.

Push the scale carefully through to the end of scale mark, ensuring that it does not stick to the mounting surface until it is in position. Attach the end of the scale to the mounting surface with light finger pressure.

Ensure complete adhesion.

Apply firm finger pressure along the full length of the scale from the centre outwards to each end.

To prevent the scale sticking to the mounting surface during this operation it may be necessary to re-apply approximately 20 mm of backing paper to the end of the scale before inserting through applicator tool.

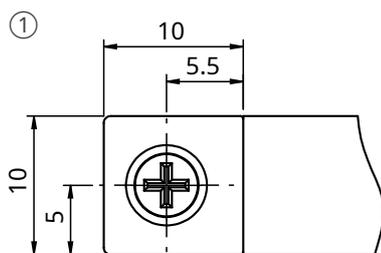
Traverse the axis through its full travel at a slow, steady speed. While moving the axis apply a light pressure (with a finger) to the scale behind the applicator tool to attach it to the mounting surface and gently pull the backing paper away from the applicator tool as it is separated.

Installation of AS10 magnetic scale with end clamps

End clamp kit has been designed to anchor the ends of the AS10 magnetic scale. Make sure the installation surface is clean and free of debris. Included in the kit are 2 end clamps and 2 fasteners M2.5 × 6 DIN 965.

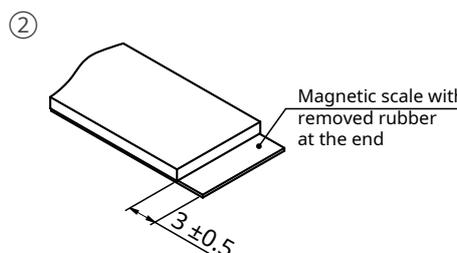
Installation process

All dimensions are in mm.



Prepare the mounting surface.

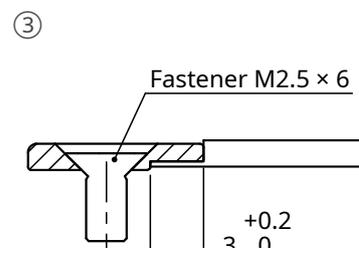
Drill the holes to the mounting surface as shown above.



Prepare the magnetic scale.

If the scale was not ordered pre-prepared for installation with end clamps, please make sure that:

- the hole to hole distance is correct (Scale length + 6 mm),
- the rubber surface at the ends of the scale was cut and removed as shown in the figure above.



Install the scale to the surface.

Make sure that the scale has been cut to the correct length and the mounting surface has been cleaned. Install the self-adhesive scale using the scale applicator tool.

Install the end clamp.

Use the supplied fasteners and attach the end clamps so that the magnetic scale is held under the clamp.

Magnetic scales can be mounted only with the end clamp option, without additional use of VHB adhesive tape. However, in this case the mounting surface should be prepared for mounting. To prevent the magnetic scale from moving in the lateral axis, mill a 10 mm wide and >0.3 mm deep groove in the mounting surface.

If you mount the scale with end clamps only, without combining it with VHB, the recommended maximum length of the scale is 100 mm. End clamps are used to better fix the ends of the scale. We highly recommend to use both end clamps together with the VHB adhesive option.

Installation of AS10 magnetic scale with TRS

TRS system is designed for applications that require an easily removable scale. The track system consists of aluminium guide rails, available in 1 m and 2 m sections, and a scale clamp element. It holds the magnetic scale securely while allowing it to expand and contract freely. The scale clamp provides a fixed point from which the magnetic scale can expand.

If damaged, the scale can be pulled out of the guide rails and replaced even if access is limited, reducing machine downtime. This feature also makes the system ideal for large machines that need to be disassembled for transport.

The design of the track section allows installation next to most standard guide rails or freely on any surface. This makes it suitable for many applications, such as automated assembly lines, packaging equipment, printing and other machines where the scale must be installed/removed for transport, or simply for all applications where the thermal expansion of the scale must be independent of the machine structure.

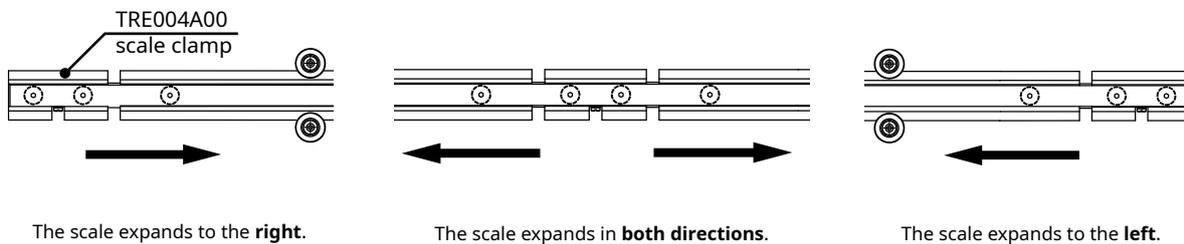
TRS technical specifications

Material	Aluminium, EN AW-6060
Mass	157 g/m
Thermal expansion	~25 $\mu\text{m}/\text{m}/^\circ\text{C}$
Dimensions - cross section	20 mm \times 4 mm
Available section lengths	1 m, 2 m

Installation tips

Thermal expansion control

The scale can be fixed either at the left/right end or at the center depending on the thermal expansion scheme.



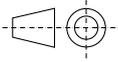
Alignment of different-level-substrate

The TRS system helps secure the level alignment of the scale across the whole axis.



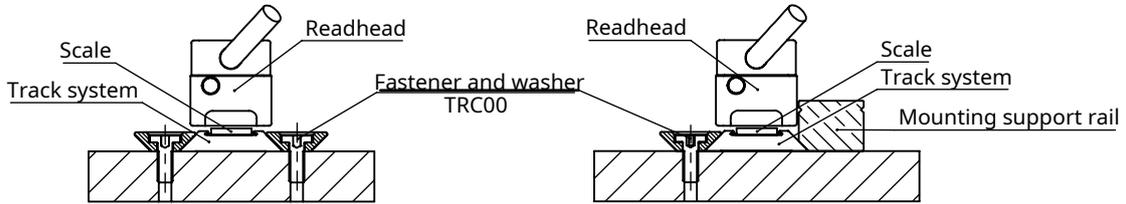
Installation methods

All dimensions are in mm.



Installation method 1

Installation method 2

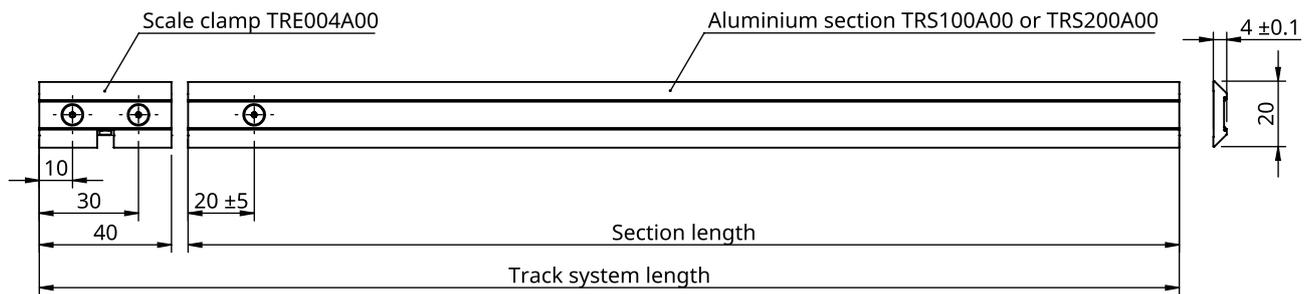


No mounting support rail available

Mounting support rail available for alignment of track section

Number of TRC00 (fasteners and washers) required

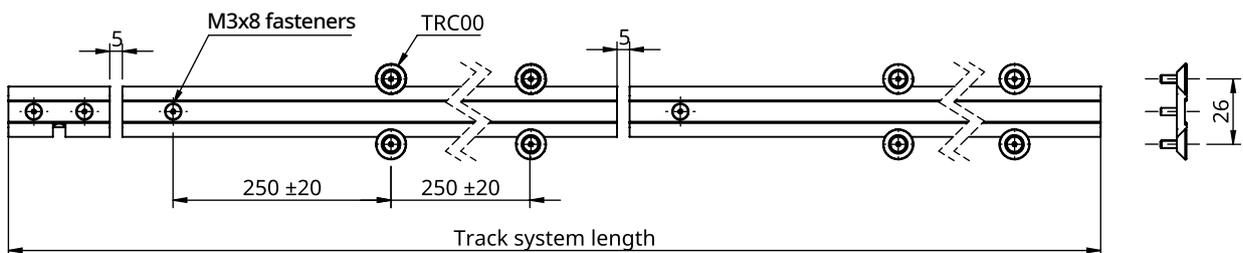
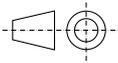
Track section	Installation method 1	Installation method 2
TRS100A00	8	4
TRS200A00	16	8



General tolerances: ISO 2768 m K

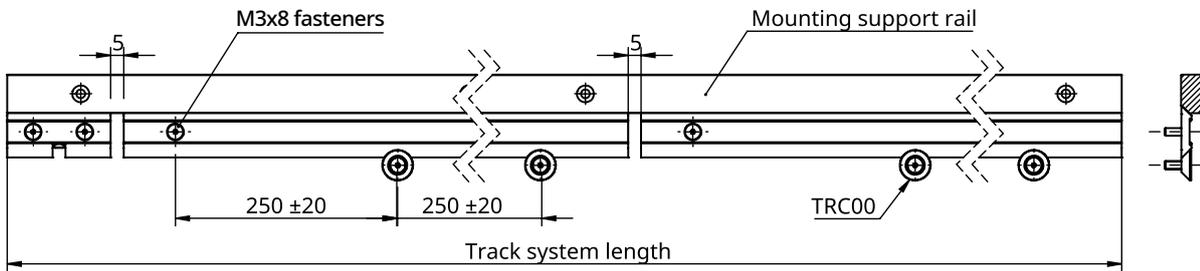
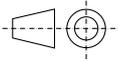
Installation method 1

All dimensions are in mm.



Installation method 2

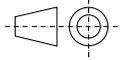
All dimensions are in mm.



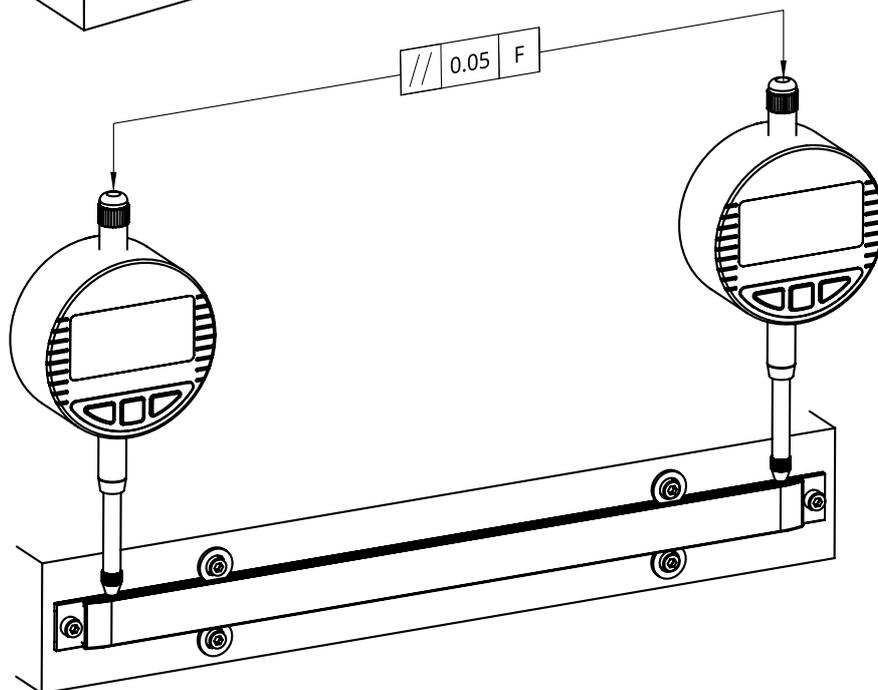
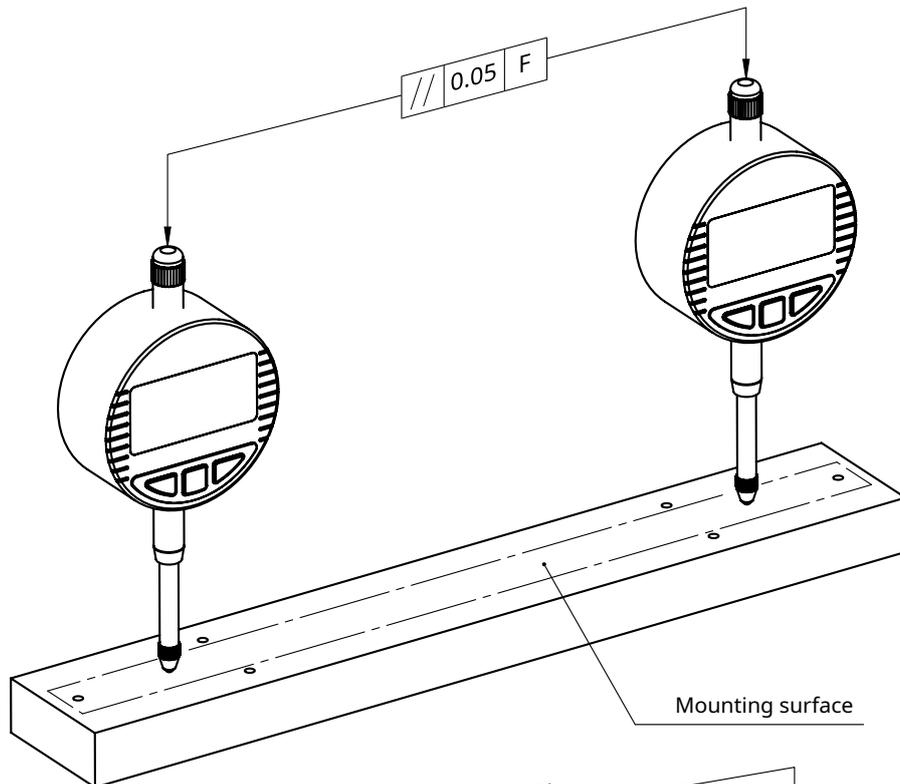
Recommended use of M3x 8 (CBSM3-8 Misumi). For more information see [Table of recommended fastener tightening torques](#) at [RLS Media center](#).

Installation of solid absolute scale (SAS10)

All dimensions are in mm.



Mounting on steel substrate with similar coefficient of thermal expansion (CTE) - recommended. Make sure that the mounting surface of the magnetic scale has been cleaned and degreased before you proceed.

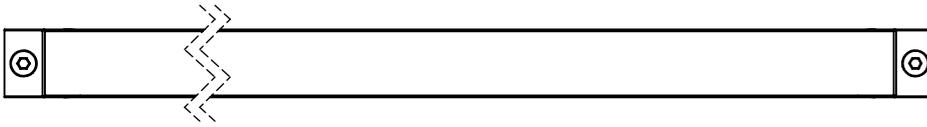


F: Machine guideway

To achieve specified performance, maintain the mounting surface and the readhead guideway inside 0.05 mm parallelism according to the machine guideway.

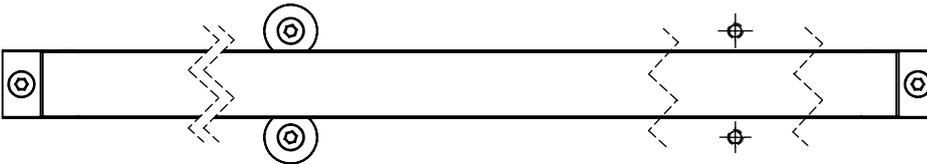
For scales up to 150 mm long:

Mount the left-most and right-most fasteners with a force of 1.2 Nm (no washers required).



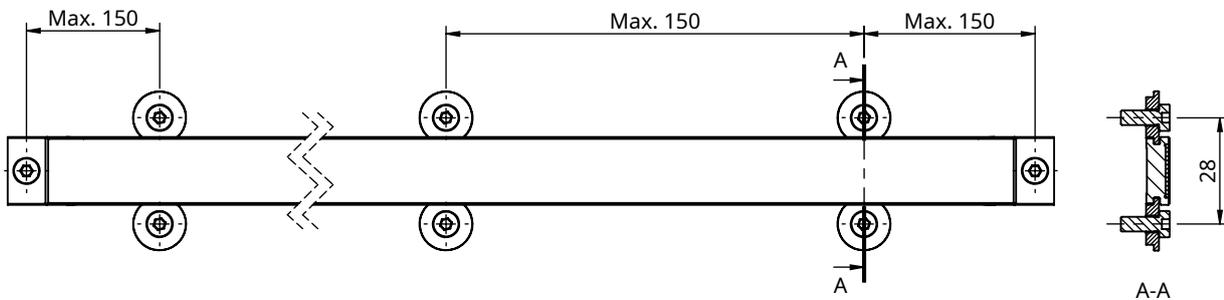
For scales longer than 150 mm:

Use washers every 150 mm along the scale to prevent bending. Mount the left-most and rightmost fasteners with force of 1.2 Nm. A required number of fasteners and washers is supplied with the scale.



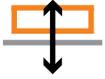
Example of SAS10 scale mounting (top view):

Dimensions and tolerances are in mm.



Installation tolerances

Ride height (RH)

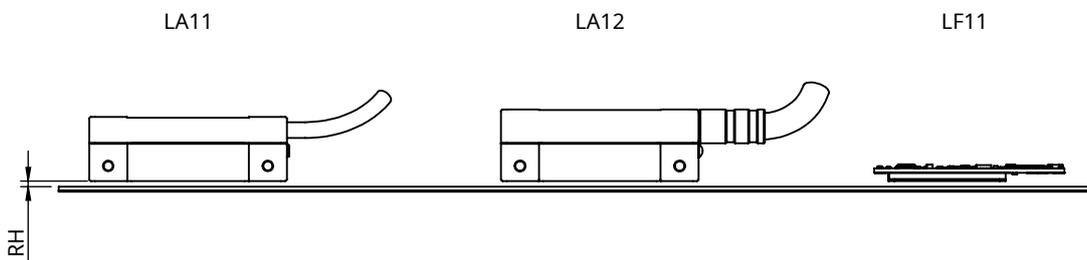


		LA11/LA12		LF11	
		AS10	SAS10	AS10	
No cover foil	No back-adhesion tape	0.1 to 0.6	0.1 to 0.5	0.1 to 0.7	
	With back-adhesion tape				
	Sides prepared for track system	0.1 to 0.5		0.1 to 0.6	
With cover foil	No back-adhesion tape	0.1 to 0.5		0.1 to 0.5	0.1 to 0.6
	With back-adhesion tape				
	Sides prepared for track system	0.1 to 0.4			0.1 to 0.5

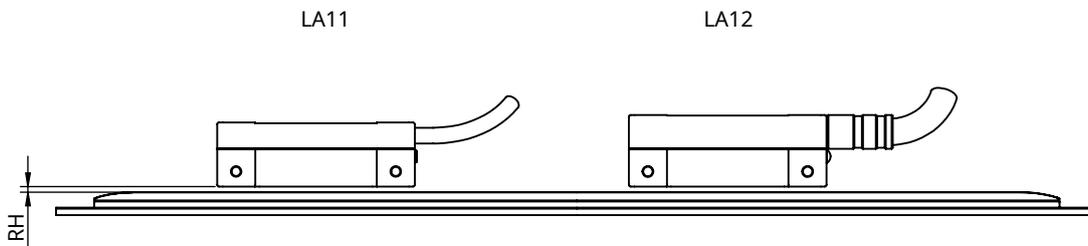
Values in mm.

The optimal installation is at 0.2 mm ride height. For easier and more reliable installation please use a 0.2 mm thick shim.

AS10 with LA11/LA12/LF11



SAS10 with LA11/LA12



Lateral offset (LO)



		LA11/LA12		LF11	
		AS10	SAS10	AS10	
No cover foil	No back-adhesion tape	3 ±0.3	±0.2	1 ±0.3	
	With back-adhesion tape				
	Sides prepared for track system	3 ±0.2		1 ±0.2	
With cover foil	No back-adhesion tape	3 ±0.3		±0.2	1 ±0.3
	With back-adhesion tape				
	Sides prepared for track system	3 ±0.2			1 ±0.2

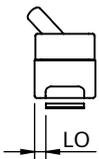
Values in mm.

AS10 with LA11/LA12/LF11

LA11

LA12

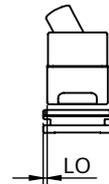
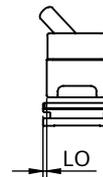
LF11



SAS10 with LA11/LA12

LA11

LA12

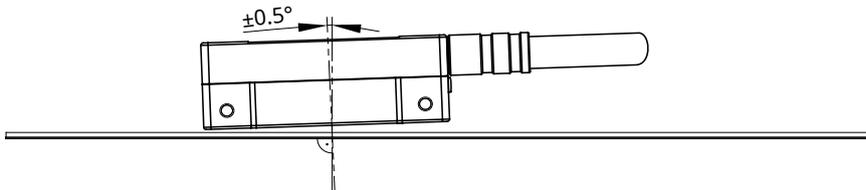


Roll, pitch and yaw

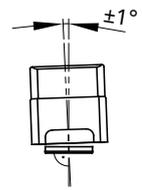


AS10 with LA11/LA12

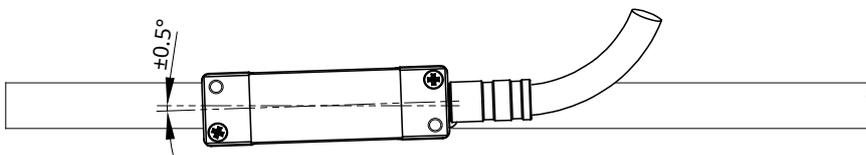
Pitch



Roll

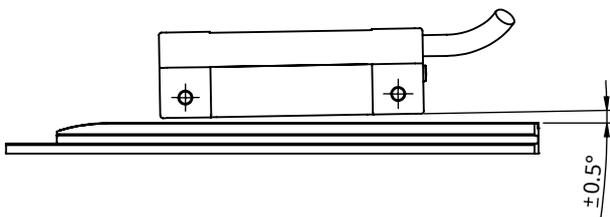


Yaw

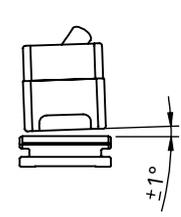


SAS10 with LA11/LA12

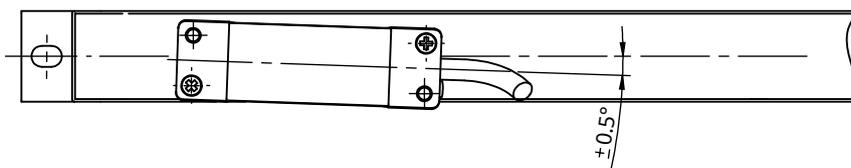
Pitch



Roll

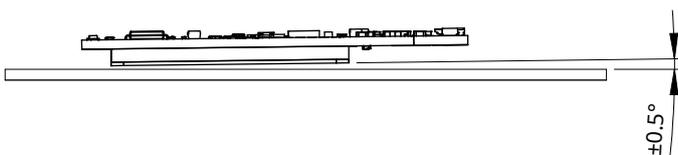


Yaw

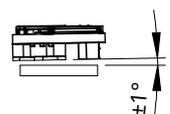


AS10 with LF11

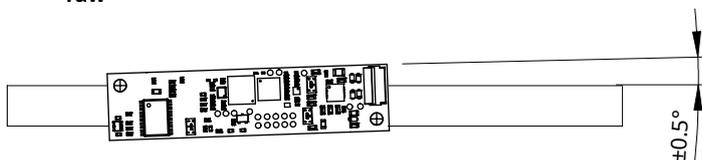
Pitch



Roll



Yaw



Maximum speed tables

LA11 (parallel incremental signals)

AS10, SAS10

Ordering code	Resolution (µm)	Interpolation factor	Maximum speed (m/s)								
			1.82	0.91	0.23	0.11	0.06	0.03	0.02	0.01	0.01
13B	~0.244	8,192	1.82	0.91	0.23	0.11	0.06	0.03	0.02	0.01	0.01
12B	~0.488	4,096	3.65	1.82	0.46	0.23	0.12	0.06	0.05	0.02	0.01
11B	~0.976	2,048	7	3.65	0.91	0.46	0.24	0.12	0.10	0.05	0.02
2D0	1	2,000	7	3.73	0.93	0.47	0.24	0.12	0.10	0.05	0.02
10B	~1.953	1,024	7	7	1.82	0.91	0.48	0.24	0.19	0.10	0.05
09B	~3.906	512	7	7	3.65	1.82	0.95	0.49	0.38	0.19	0.10
08B	~7.812	256	7	7	7	3.65	1.90	0.97	0.77	0.39	0.19
07B	15.625	128	7	7	7	7	3.81	1.94	1.53	0.77	0.39
06B	31.25	64	7	7	7	7	7	3.89	3.07	1.55	0.78
05B	62.5	32	7	7	7	7	7	7	6.14	3.10	1.56
04B	125	16	7	7	7	7	7	7	7	6.19	3.11
Minimum edge separation (µs)			0.07	0.12	0.50	1	2	4	5	10	20
Maximum count frequency (MHz)			15	8	2	1	0.50	0.25	0.20	0.10	0.05
Part numbering			K	A	B	C	D	E	F	G	H

LA12

AS10, SAS10

Ordering code	Resolution (µm)	Interpolation factor	Maximum speed (m/s)
13B	~0.244	8,192	2
12B	~0.488	4,096	4
11B	~0.976	2,048	7
8D0	0.250	8,000	2
2D0	1	2,000	7
1D0	2	1,000	7

LF11

AS10

Ordering code	Resolution (µm)	Interpolation factor	Maximum speed (m/s)
13B	~0.244	8,192	1.85
12B	~0.488	4,096	3.65
11B	~0.976	2,048	7

How to define scale length

AS10 installation with LA11 and LA12 readhead

1 and 2 are encoder position limits

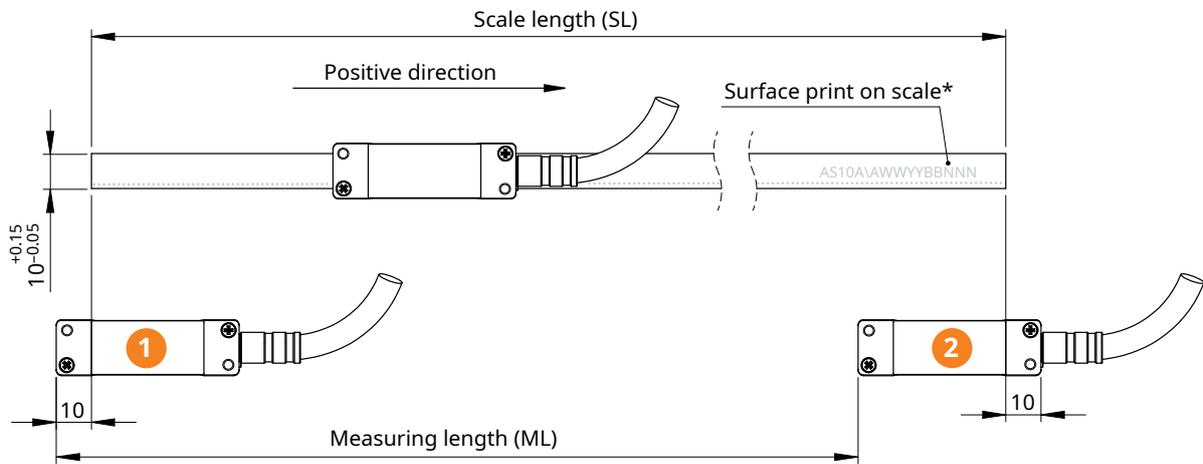
If special requirement AS10_03 (03 - absolute code begins with zero) is selected and the readhead is at location 1 as shown on the drawing above, the readhead reports the absolute position 5 ± 1 mm.

The absolute position reported by the encoder at location 2 can be calculated with the following equation:

$$\text{Absolute position value } 2 = x - 27 \text{ mm (within tolerance } \pm 1 \text{ mm)}$$

$$x = \text{Total length of the effective part of the magnetic scale (elasto-ferrite rubber)}$$

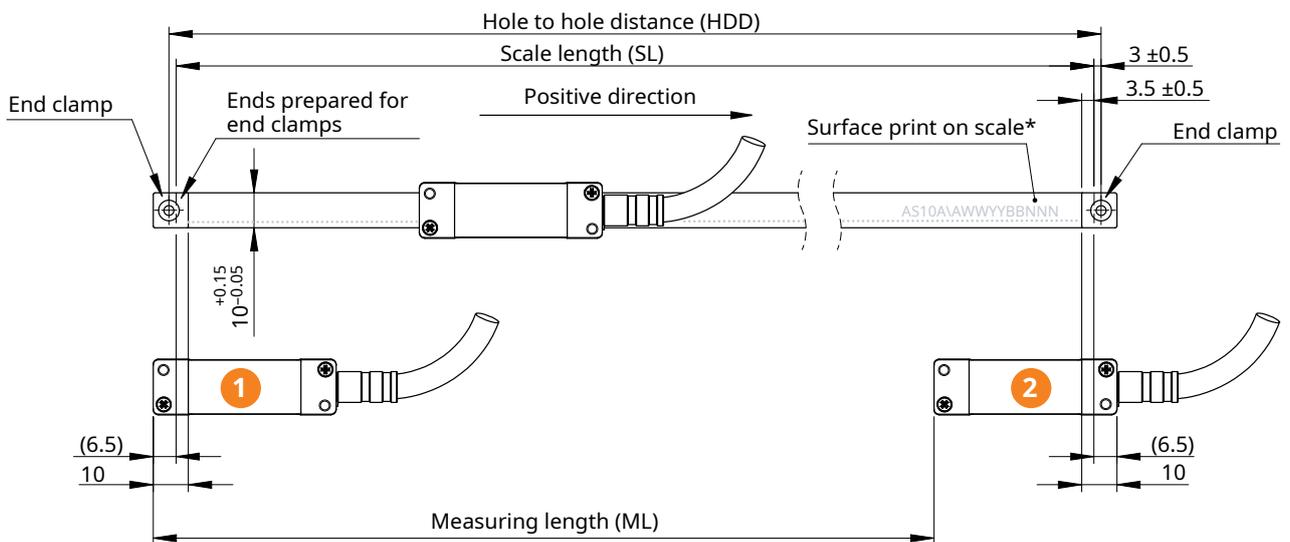
Installation of AS10 magnetic scale with adhesive tape



$$ML = SL - 32 \text{ mm}$$

* Scale surface print does not represent the actual ordering code. For orientation purpose only.

Installation of AS10 magnetic scale with end clamps

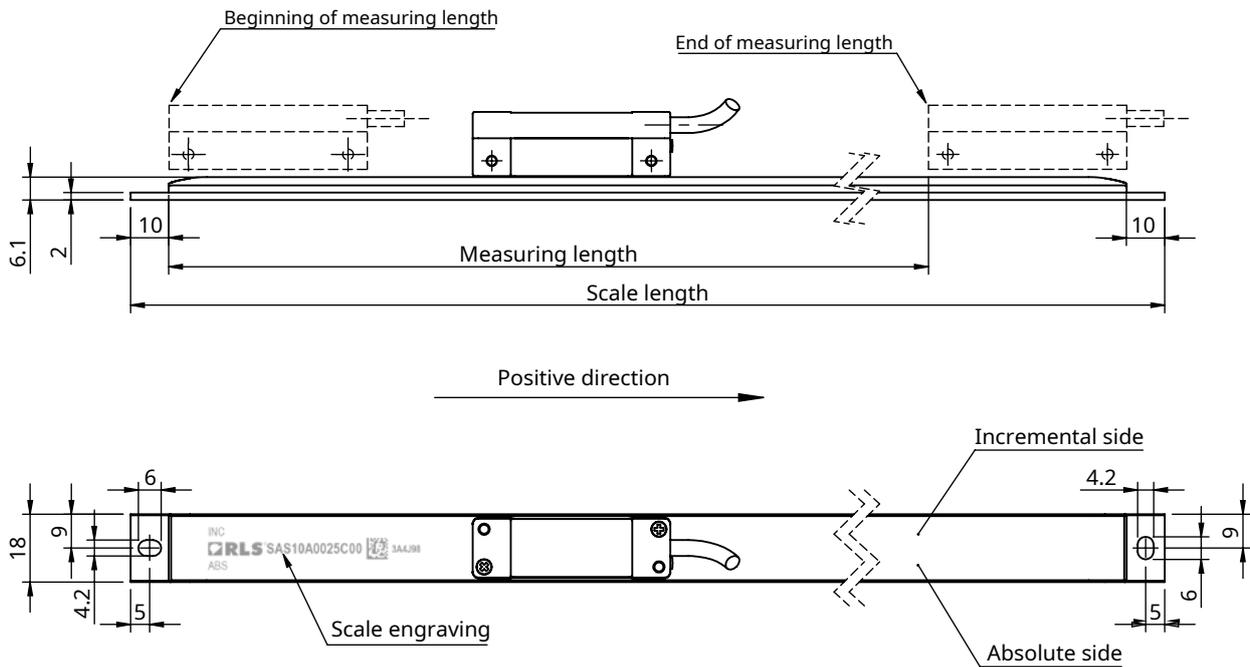


$$ML = SL - 39 \text{ mm}$$

$$HDD = SL + (6 \text{ mm } \pm 1 \text{ mm})$$

* Scale surface print does not represent the actual ordering code. For orientation purpose only.

SAS10 installation with LA11 and LA12 readhead



$$ML = SL - 72 \text{ mm}$$

SAS10 scales always start with the absolute position 0 regardless of scale length.

Scale length [mm]	Measuring length (LA11/LA12) [mm]
97	25
117	45
162	90
192	120
272	200
322	250
372	300
472	400
560	488
660	588
760	688
860	788
960	888
1060	988
1160	1088
1260	1188
1360	1288

AS10 installation with LF11 readhead

① and ② are encoder position limits

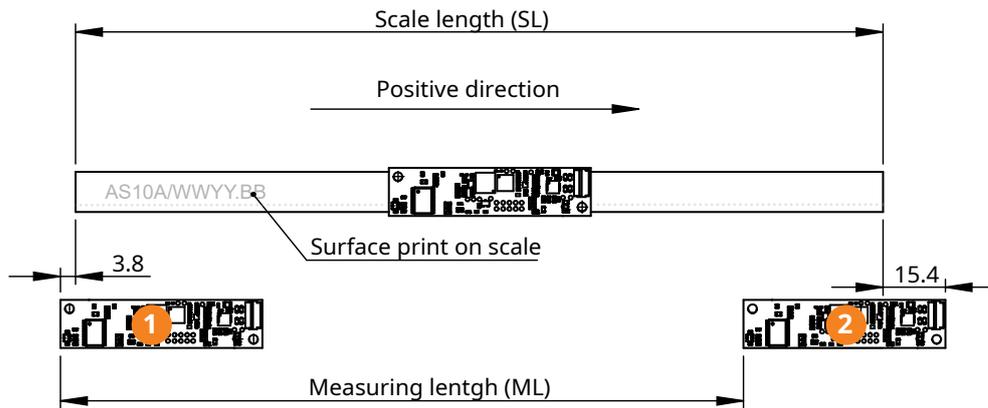
If special requirement 03 (absolute code begins with zero) is selected and the readhead is at location ① as shown on the drawing above, the readhead reports the absolute position 3 ± 1 mm.

The absolute position reported by the encoder at location ② can be calculated with the following equation:

$$\text{Absolute position value } ② = x - 30 \text{ mm (within tolerance } \pm 1 \text{ mm)}$$

$$x = \text{Total length of the effective part of the magnetic scale (elasto-ferrite rubber)}$$

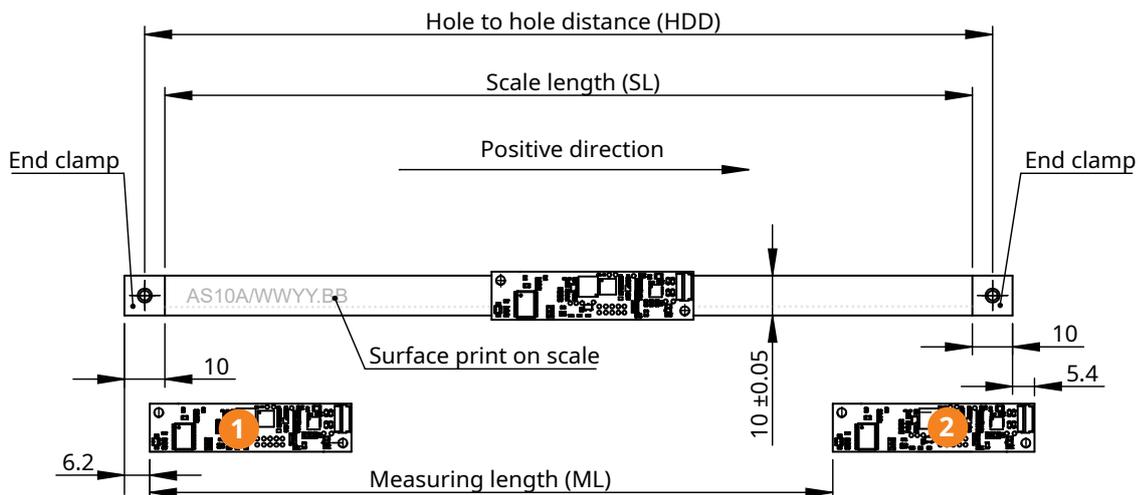
Installation of AS10 magnetic scale with adhesive tape



$$ML = SL - 31 \text{ mm}$$

* Scale surface print does not represent the actual ordering code.
For orientation purpose only.

Installation of AS10 magnetic scale with end clamps



$$ML = SL - 38 \text{ mm}$$

$$HDD = SL + (6 \text{ mm } \pm 1 \text{ mm})$$

* Scale surface print does not represent the actual ordering code.
For orientation purpose only.

Part numbering

AS10

AS 10 A 01000 A 00

Accuracy class

A - N/A

Scale length

xxxxx - Where xxxxx equals scale length in mm

Options

- A - VHB back adhesive tape (standard)
- B - VHB back adhesive tape; with cover foil *
- C - VHB back adhesive tape; ends prepared for end clamping
- G - No VHB back adhesive tape; sides prepared for insertion into track section
- H - No VHB back adhesive tape, sides prepared for insertion into track section; with cover foil *
- I - No back adhesive tape
- N - No back adhesive tape; with cover foil *
- P - No back adhesive tape; ends prepared for end clamping **

* Cover foil is not factory mounted on the scale and must be ordered separately.

** It can only be used when the magnetic scale is installed in the groove to prevent lateral sliding.

The groove dimension must correspond to the scale width.

Special requirements

- 00 - No special requirements (standard)
- 03 - Absolute code begins with 0. Available up to 16.3 m

The AS10 magnetic scale without the special option («00») is randomly cut from a reel with the corresponding absolute position of the 16.3 m long scale.

Cover foil part numbering

CF 10 1000

Cover foil width

- 08 - 08 mm width (for track system option **only**)
- 10 - 10 mm width

Cover foil length

xxxx - Where xxxx equals foil length in cm

Table of available combinations

Series	Accuracy class	Scale length	Options	Reference mark
AS10	A	xxxx	A / B / C / G / H / I / N / P	00 / 03

SAS10

SAS10 A 1100 A 00

Requirement

A - N/A

Measuring scale length (max. 1288 mm)

0025 - 25 mm	0250 - 250 mm	0688 - 688 mm	1188 - 1188 mm
0045 - 45 mm	0300 - 300 mm	0788 - 788 mm	1288 - 1288 mm
0090 - 90 mm	0400 - 400 mm	0888 - 888 mm	
0120 - 120 mm	0488 - 488 mm	0988 - 988 mm	
0200 - 200 mm	0588 - 588 mm	1088 - 1088 mm	

For longer scale options (>1.3m) please **contact RLS.**

Options

A - No cover foil
C - Welded cover foil

Special requirement

00 - N/A (no special requirement)

Table of available combinations

Series	N/A	Measuring scale length	Options	Special requirement
SAS10	A	xxxx	A / C	00

Accessories



Magnet viewer
MM0001



End clamp kit
LM10ECL00

(2 clamps + 2 fasteners)



Track section, 1.00 m
TRS100A00

(1x fastener M3x10 included)



Applicator tool for magnetic
scale and cover foil
LMA10ASC00



Fastener and washer for TRS
profile
TRC00



Track section, 2.00 m
TRS200A00

(1x fastener M3x10 included)



Scale clamp with fasteners,
0.04 m
TRE004A00

(2x fastener M3x10 and 1x fastener
M2x4 included)



Washer for SAS10
MN01509

(included when ordering the
SAS10 scale)

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Document issues

Date	Issue	Page	Description
11. 3. 2022	1	-	New document
		3	Magnetic field density limit amended
			Packaging information amended
8. 5. 2023	2	6	Length tolerance added
		19	SAS10 installation drawings amended
30. 1. 2023	3	5, 6, 18, 20	New print to scales added, Print tolerances added

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