

MS

Incremental Magnetic Scales

ACCURACY UP
TO $\pm 10 \mu\text{m/m}$

UP TO 150 m
LENGTH

DISTANCE
CODED
REFERENCE
MARK

The robust MS incremental magnetic scales consist of a stainless steel carrier and an elastomer-bonded ferrite. The elasto-ferrite layer is magnetised with 2 mm, 2.032 mm or 5 mm long alternating magnetic poles that form an incremental magnetic pattern.



Features and benefits

- ▶ Customer selectable position of reference mark
- ▶ Four accuracy grades available: $\pm 10 \mu\text{m/m}$, $\pm 20 \mu\text{m/m}$, $\pm 40 \mu\text{m/m}$, $\pm 100 \mu\text{m/m}$
- ▶ Partial arc application available
- ▶ Optional protective cover foil for heavy duty applications
- ▶ Excellent resistance to dirt, dust and humidity
- ▶ Easy installation with adhesive tape, end clamps or track section



SMT PICK AND PLACE



PRINTING TECHNOLOGY



LINEAR MOTOR



INDUSTRIAL AUTOMATION



ASSEMBLY LINES

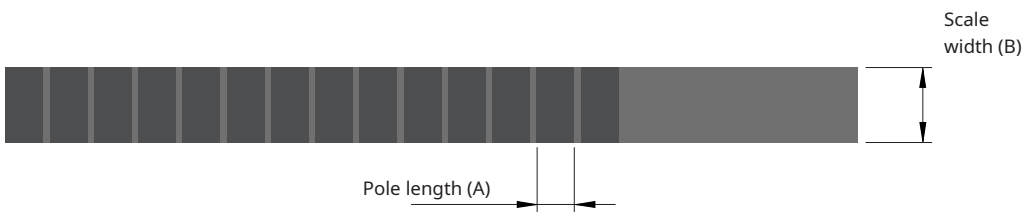
General information

The RLS incremental magnetic scales work in conjunction with RLS incremental magnetic readheads. They consist of a stainless steel carrier and an elastomer-bonded ferrite layer. The ferrite layer is magnetised with alternating magnetic poles, creating an incremental magnetic pattern. The readhead detects changes in the magnetic field pattern produced by the magnetised ferrite layer as it moves relative to the readhead. These changes in the magnetic pattern are converted into electrical signals, which are then processed to determine the position and movements of the object or system to which the scale is attached.

The RLS magnetic scales offer several advantages. Firstly, they are available in different levels of accuracy, ranging from $\pm 10 \mu\text{m/m}$ to $\pm 100 \mu\text{m/m}$, allowing engineers to choose the level of precision required for their specific tasks. Second, the scales can be used for partial arc applications, offering flexibility in design and use. Thirdly, they offer options for customised magnetisation, allowing engineers to adapt the scales to specific application requirements.

In addition, the RLS magnetic scales are highly durable and resistant to dirt, dust and moisture, so they perform reliably in challenging environments. The scales are easily installed with tape, end clamps or track sections, simplifying the integration process for engineers. Customer-selectable reference marks further enhance the ease of use and convenience of these scales.

Selection guide



Scale	A	B	Accuracy [$\mu\text{m/m}$]	Compatibility with readheads						
				LM10	LM13	LM15	RLB2	RLC2HD	RLC2IC	RLM2
MS05	2	5	$\pm 10 / \pm 20 / \pm 40$	x	x	x	No Ri	No Ri	Ri+DCRM	Ri+DCRM
MS07	2.032	5	± 40	x	x	x	x	x	x	Ri*
MS10	2	10	$\pm 10 / \pm 20 / \pm 40$	Ri+DCRM	Ri+DCRM	x	x	x	x	x
MS12	2.032	10	± 40	Ri*	Ri*	x	x	x	x	x
MS15	5	10	± 100	x	x	Ri+DCRM	x	x	x	x
*Compatible with DPI resolutions only.				All dimensions in mm.						

Ri+DCRM	Unique and distance-coded reference marks available
Ri	Unique reference marks available
No Ri	Incremental track only
x	Not compatible

For readhead specifications see data sheets available at [RLS Media center](#).

Storage and handling

Storage temperature



-40 °C to +60 °C

Operating temperature

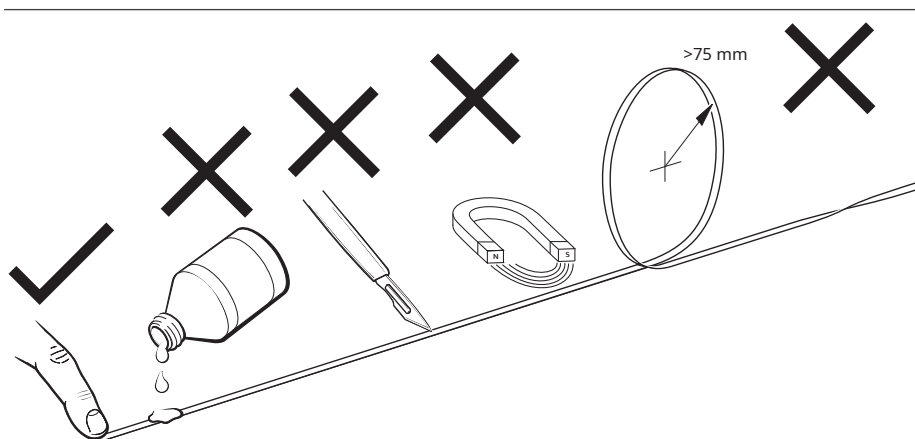


Flat surface
-40 °C to +100 °C
Curved surface
-40 °C to +80 °C

Humidity



85% non-condensing



It is strongly recommended that the scale is factory cut at RLS or 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, but the scale must not be immersed in alcohol. In addition, the imprint on the scale surface and the drawn reference mark may disappear if the scale is not cleaned carefully.

For more information on chemical resistance [contact RLS](#).

Packaging

To maintain accuracy, special packaging is used for magnetic scales of accuracy class D; 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.

Individual packaging (up to and including 20 pieces)

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

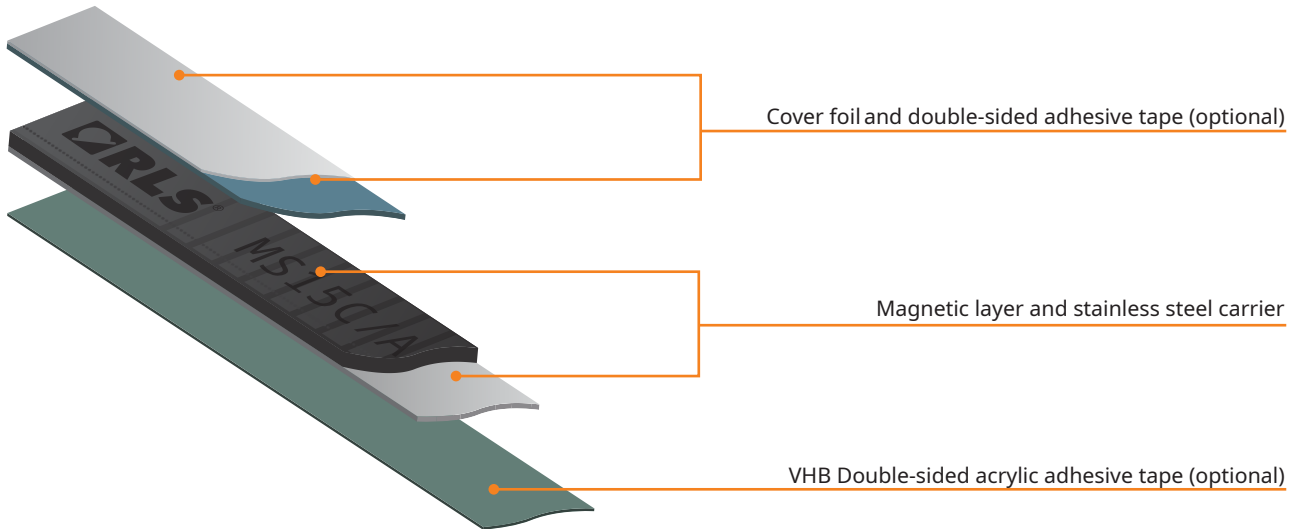
Bulk packaging (more than 20 pieces)

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

All MS magnetic scales have 12 months shelf life and should be installed within this period. The date of manufacture is printed on the product label on the packaging.

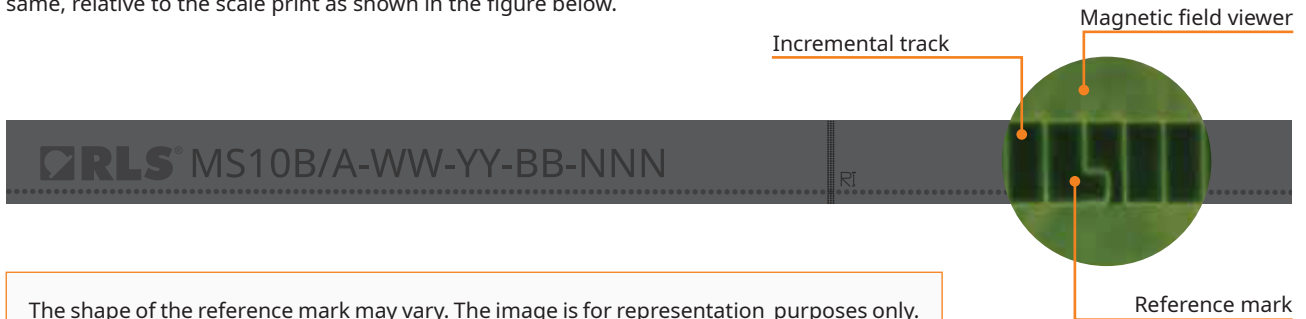
Magnetic scale design

Structure



Appearance and print

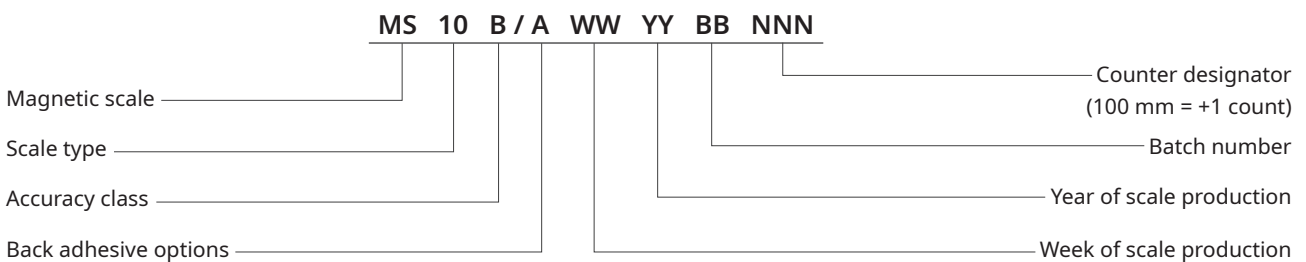
The orientation of the magnetised reference mark and the incremental track is always the same, relative to the scale print as shown in the figure below.



The dotted line indicates the reference side of the scale.
The vertical line marked RI indicates the reference mark.

Scale surface print description

Scale surface print appears every 100 mm and contains the RLS logo and a unique code.



Technical specifications

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



System data

Pole length	2 mm, 2.032 mm, 5 mm	
Reference mark	Unique, distance-coded, multiple reference marks	
Scale accuracy *	Class A	±20 µm/m
	Class B	±40 µm/m
	Class C	±100 µm/m
	Class D	±10 µm/m
Max speed	RLS Magnetic Scale Calculator	

* For more information about the accuracy please see the MST01 technical article at [RLS Media center](#).

Mechanical data

Material	Carrier	1.4310 stainless steel
	Magnetic scale	NBR elasto-ferrite
Thickness	Double-sided adhesive tape	0.13 mm (VHB 3M9469)
	Carrier	0.3 ±0.05 mm
	Scale / magnetic layer	1.43 ±0.1 mm (with adhesive tape) 1.3 ±0.1 mm (without adhesive tape)
	Double-sided adhesive tape	0.05 mm
	Cover foil	0.076 ±0.008 mm
Mass	MS05, MS07	31 g/m
	MS10, MS12, MS15	62 g/m
Width	MS05, MS07	5 mm
	MS10, MS12, MS15	10 mm
Cover foil width	CF05 (MS05, MS07)	4.8 ±0.35 mm
	CF08 (MS10, MS12, MS15)	7.6 ±0.35 mm
	CF10 (MS10, MS12, MS15)	9.5 ±0.1 mm
Maximum length	Class A, B, C	50 m (150 m with longer lead time**)
	Class D	20 m
Length tolerance	±0.5 mm ±accuracy class [µm/m] × 10 ⁻³ × scale length [m]	
Reference mark position tolerance (from edge of scale)	±0.5 mm ±accuracy class [µm/m] × 10 ⁻³ × reference mark position [m]	
Expansion coefficient (carrier)	~17 × 10 ⁻⁶ [m/mK]	
Minimum bending radius	75 mm	

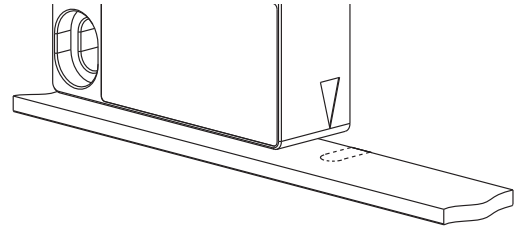
** Not applicable for MS05 and MS07.

Environmental data

Temperature	Operating	-40 °C to +100 °C (flat surface) -40 °C to +80 °C (curved surface)
	Storage	-40 °C to +60 °C

Reference mark options

The position of the magnetised reference mark is preset at the factory and cannot be changed.



Unique reference mark

The readhead must be ordered with reference mark option A (see corresponding readhead data sheet). The magnetic scale must be ordered with reference mark (see **Part numbering**). If required, the cover foil can be installed over the reference mark. Magnetised reference mark will have a visible marking.

Multiple reference marks

The readhead must be ordered with reference mark option A (see corresponding readhead data sheet). The magnetic scale must be ordered with reference mark option **P** (see **Part numbering**). Multiple reference marks are magnetised, factory predefined and spaced every 50, 100, or 200 mm on a 20 m long scale. For custom options please **contact RLS**.

Distance coded reference marks (DCRM)

The readhead must be ordered with reference mark option A (see corresponding readhead data sheet). The magnetic scale must be ordered with reference mark option **D** and a basic increment value (K). See **Part numbering**.

The distance coded reference mark option provides multiple magnetised reference marks that are individually spaced according to a specific mathematical algorithm. The absolute position is calculated after traversing 2 successive reference marks. Maximum length and minimum traverse depend on basic spacing between the reference marks (basic increment value K), as shown below.

The basic increment K (in mm) is chosen at the point of order and must be divisible by $2 \times P$ with no remainder.

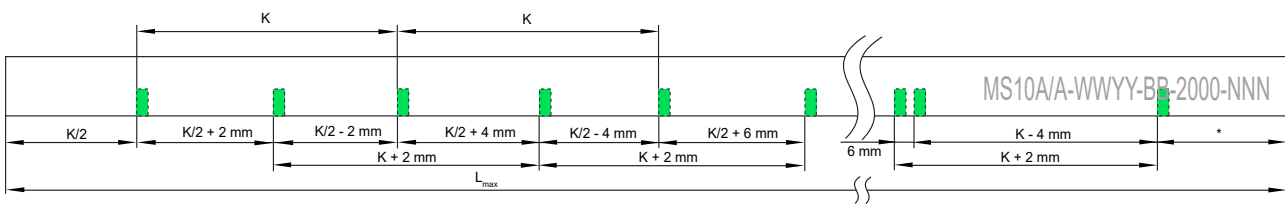
Maximum codable length:

$$L_{\max} = K \left(\frac{K}{2P} - 1 \right) - 2P$$

- L_{\max} - Maximum codable length (in mm)
- K - Basic increment (in mm)
- P - Pole length (in mm)

The minimum distance that needs to be traversed to determine the absolute position equals $K - 2P$.

The distribution of the reference marks is shown in the figure below.



* Depends on magnetic scale length.

K (mm)	Maximum codable length (mm)	
	P = 2 mm	P = 5 mm
20	76	
40	356	
60	836	
80	1,516	
100	2,396	890
200	9,796	3,790
300	22,196	8,690
400	39,596	15,590
500	61,996	24,490
600	89,396	35,390
700		48,290
800		63,190
900		80,090
1,000		98,990

There must be at least 3 reference marks on the scale.

Basic increment (K in mm) - Represents the distance in mm between odd reference marks; it determines the maximum codable length over which the absolute position can be defined. It also determines the minimum distance which needs to be traversed to capture 2 adjacent reference marks. The basic distance should be divisible by the length of 2 poles (in mm). K is customer selectable.

Maximum codable length (L_{max} in mm) - Is the maximum length of the magnetic scale over which the DCRM feature can be applied and still provide a unique absolute position. Lengths shorter than the maximum length may be used (see Table 1).

Pole length (P in mm) - Is the length of a magnetised pole (S or N). We currently offer magnetic scales with pole lengths of 2 mm (MS10) and 5 mm (MS15).

How the absolute position is evaluated

The absolute position of the first traversed reference mark is calculated by the following formula:

$$RI1 = \left[\frac{1}{P} \times \text{abs}(2 \times \Delta RI - K) - \text{sgn}(2 \times \Delta RI - K) - 1 \right] \times \frac{K}{2} + \left[\text{sgn}(2 \times \Delta RI - K) - \text{sgn}(D) \right] \times \frac{\text{abs}(\Delta RI)}{2}$$

The example of DCRM Calculation on [page 8](#)

Variables

- RI1** - Absolute position of first traversed reference mark (in mm)
- ΔRI** - Distance between two successively traversed reference marks (in mm)
- K** - Basic increment between two fixed reference marks (in mm)
- D** - Direction of movement (+1 or -1)

Operators

- abs** - Absolute value
- sgn** - Sign function (+1 or -1)

Timing of reference mark capturing

The minimum distance between 2 successive reference marks is equal to 3 × P. Subsequent electronics must be able to detect the position of 2 successive reference marks under the maximum speed condition. The minimum time for 2 successive reference marks to appear is given by the formula:

$$T_{Rimin} = \frac{3P}{V_{max}}$$

T_{Rimin} - Minimum time between 2 successive reference marks (in ms)
P - Pole length (in mm)
V_{max} - Maximum traverse speed (in m/s)

DCRM calculation example:

P = 2 mm

K = 60 mm

Readhead is crossing 6th and 7th reference mark:

		Reference marks positions in mm:
1 st	0	0
2 nd	$K/2 + 2$	32
3 rd	$1 \times K$	60
4 th	$1.5 \times K + 4$	94
5 th	$2 \times K$	120
6 th	$2.5 \times K + 6$	156
7 th	$3 \times K$	180

D = +1 ... positive direction of movement

$$\Delta RI = 180 - 156 = 24$$

$$\text{sgn}(2 \times dRI - K) = \text{sgn}(-12) = -1$$

$$RI1 = [1/2 \times \text{abs}(2 \times 24 - 60) - \text{sgn}(2 \times 24 - 60) - 1] \times 60/2 + [\text{sgn}(2 \times 24 - 60) - 1] \times \text{abs}(24)/2$$

$$RI1 = [1/2 \times \text{abs}(-12) - \text{sgn}(-12) - 1] \times 60/2 + [\text{sgn}(-12) - 1] \times \text{abs}(24)/2$$

$$RI1 = [1/2 \times 12 - (-1) - 1] \times 30 + [-1 - 1] \times 12$$

$$RI1 = [1/2 \times 12] \times 30 - 2 \times 12$$

$$RI1 = 6 \times 30 - 24 = 156$$

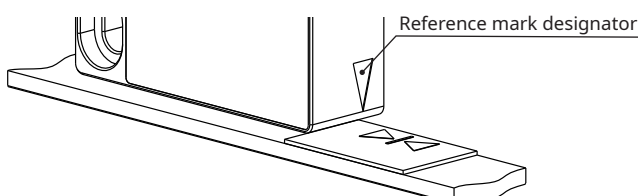
In this case RI1 is the 6th reference mark.

Periodic reference mark

The readhead must be ordered with reference mark option C (see corresponding readhead data sheet). The magnetic scale must be ordered without reference mark option (see **Part numbering**). The position information is output in incremental quadrature format with periodic reference pulses. The periodic reference pulses correspond to the magnetic pole length.

Stick-on reference mark

The readhead must be ordered with reference mark option A (see corresponding readhead data sheet). The magnetic scale must be ordered without reference mark option (see **Part numbering**). After the scale is installed, a reference mark sticker can be applied to the desired position on top of the scale using the reference mark applicator tool. Make sure that the reference mark sticker is aligned with the corresponding side of the readhead where the reference mark designator is located. It is recommended that the stick-on reference mark is applied for prototyping purposes only. As soon as the applications go to serial production, it is recommended to use a predefined magnetised reference mark. For the part number of the reference mark and applicator tool, see Accessories on **page 28**.



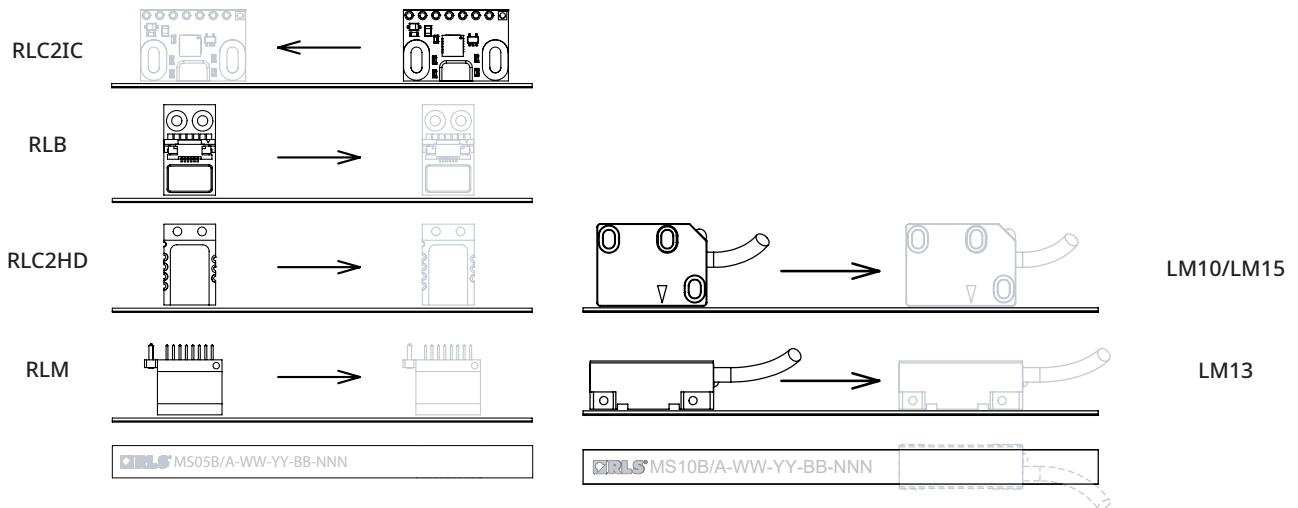
Stick-on reference mark is only available for MS10 scale.

Positive direction

Digital output signals – A leads B (magnetic scale is stationary)

Analogue output signals (1 V_{pp}) – V₁ leads V₂

The arrows represent the direction of positive counting (SSI and BiSS C).



Readhead orientation

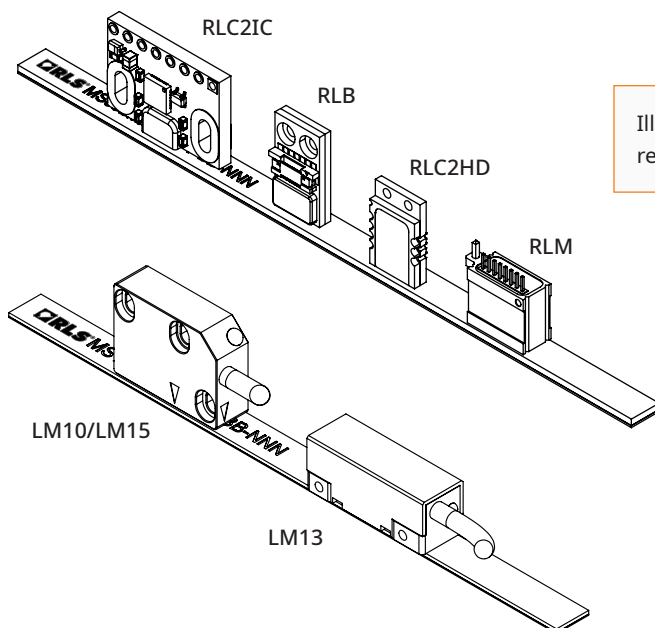


Illustration shows the orientation of the readhead in relation to the magnetic scale.

Installation instructions

Installation with adhesive tape

Applicable for MS05, MS07, MS10, MS12 and MS15

Installation surface preparation

Magnetic scales can be 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 online under "[Surface Preparation for 3M™ VHB™ Tape Applications](#)".

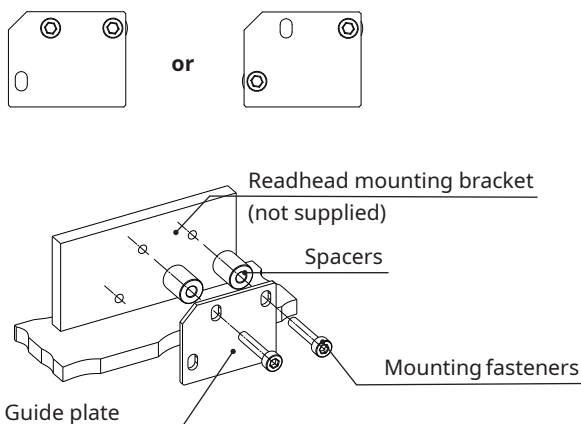
Scale application

To simplify the scale installation use the scale applicator tool LMA10ASC00 with LM10/LM15 readhead or LM13ASC00 applicator tool with LM13 readhead. Mount the applicator tool to the readhead mounting bracket. Use two fasteners as per readhead mounting configuration.

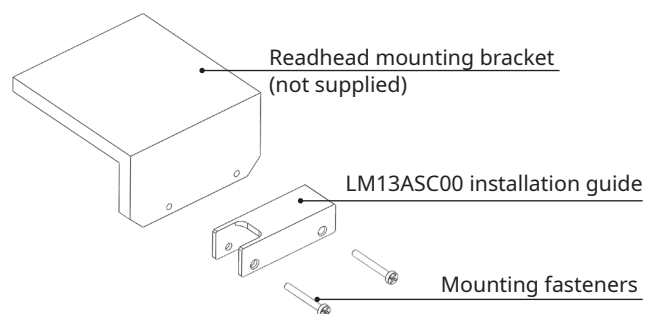
 **Explainer video: Installation process using applicator tool for LM10/LM15**

Fastener mounting variants

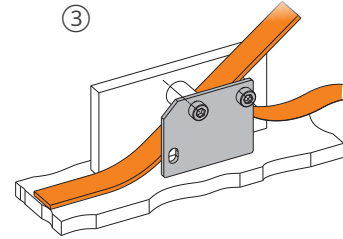
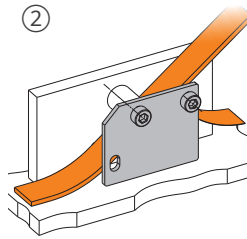
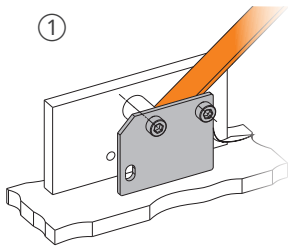
LM10 readhead with LM10ASC00 applicator tool



LM13 readhead with LM13ASC00 applicator tool



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.



1. 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.

2. 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.

3. 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 from 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 it 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.

4. Apply cover foil (if used).

Degrease the scale surface with alcohol and install as per scale installation instructions in step 3 onwards.

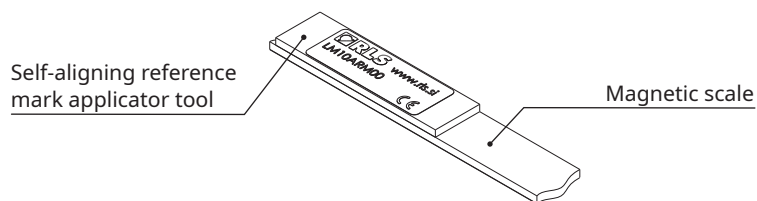
5. Remove the applicator tool.

When the scale has been applied unbolt the applicator tool from the readhead mounting bracket.

Steps 6-8 apply for MS10 system only.

6. Apply the stick-on reference mark (if used).

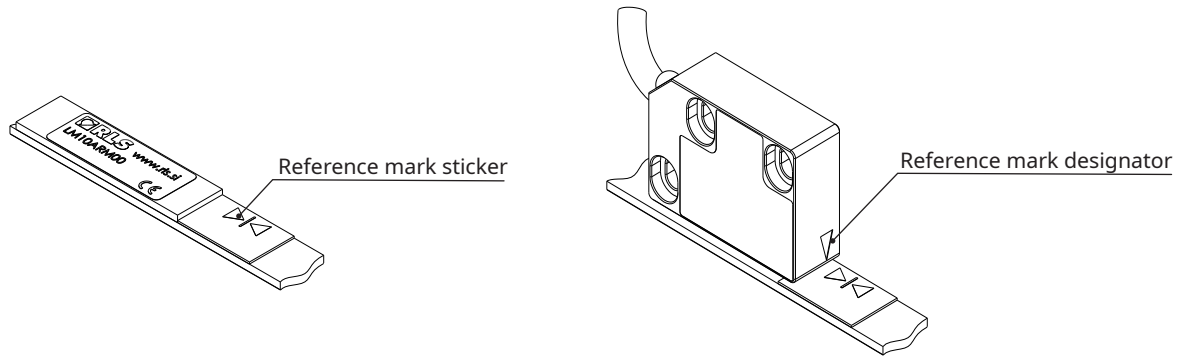
Place the LM10ARM00 reference mark applicator tool on scale in the correct orientation/required position along the length.



7. Stick the reference mark on the scale.

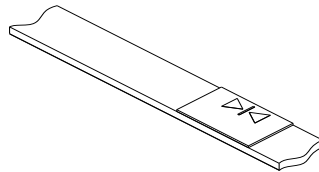
Remove the backing paper from the reference mark sticker and carefully attach it to the surface of the scale by placing it next to the applicator tool.

Correct orientation of the reference mark is crucial. The mark on the sticker should be on the same side as the reference mark designators.



8. Remove the stick-on reference mark applicator tool.

Remove the applicator tool leaving the reference mark sticker in the desired position.



Do not remove the scale for refitting or use elsewhere once it has been applied to the mounting surface. The scale can be applied only once.

Partial arc installation

Applicable for MS05, MS07, MS10, MS12 and MS15

The minimum bending radius of the magnetic scale is 75 mm. It is advised using the end-clamps on both ends to prevent the scale from peeling off the surface.

Please note that installing the scale around the circular part will reduce the system total accuracy.

Installation with end clamps

Applicable for MS10, MS12 and MS15

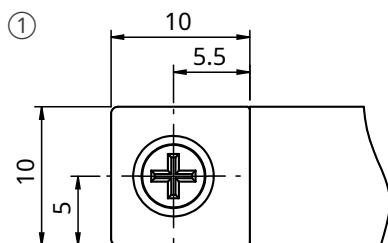
End clamp kit has been designed to anchor the ends of the MS magnetic scale. Make sure the installation surface is clean and free of debris. Included in the kit are 2 end clamps and 2 fasteners M2.5 × 6 DIN 965.

Magnetic scales can be mounted with end clamps only, without 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.

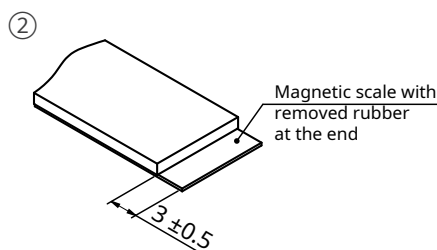
Installation Process

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



Prepare the mounting surface.

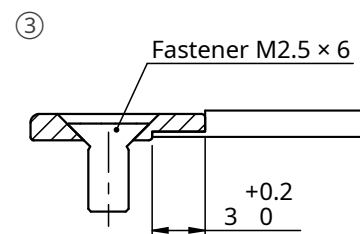
Drill the holes to the mounting surface as shown above. Refer to the table below for the minimum distance of the reference mark from the edge.



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.

Be aware of a possible collision between the end clamp and the readhead. Adjust the ride height (air gap) accordingly.

Magnetic scale	Minimum distance of the reference mark from the edge
MS10, MS15	13 mm
MS12	10 mm

Installation with TRS

Applicable for MS10 and MS15

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 MS 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.

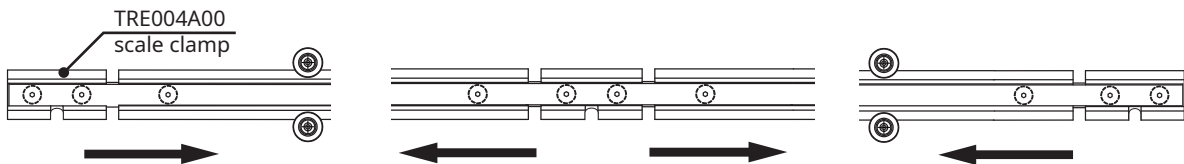
TRS technical specifications

Material	Aluminium, EN AW-6060
Mass	157 g/m
Thermal expansion	~25 µm/m/°C
Dimensions - cross section	20 mm × 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.



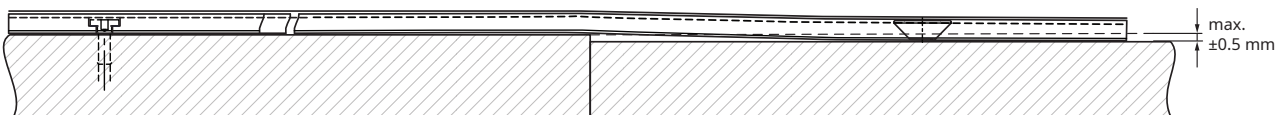
The scale expands to the **right**.

The scale expands in **both directions**.

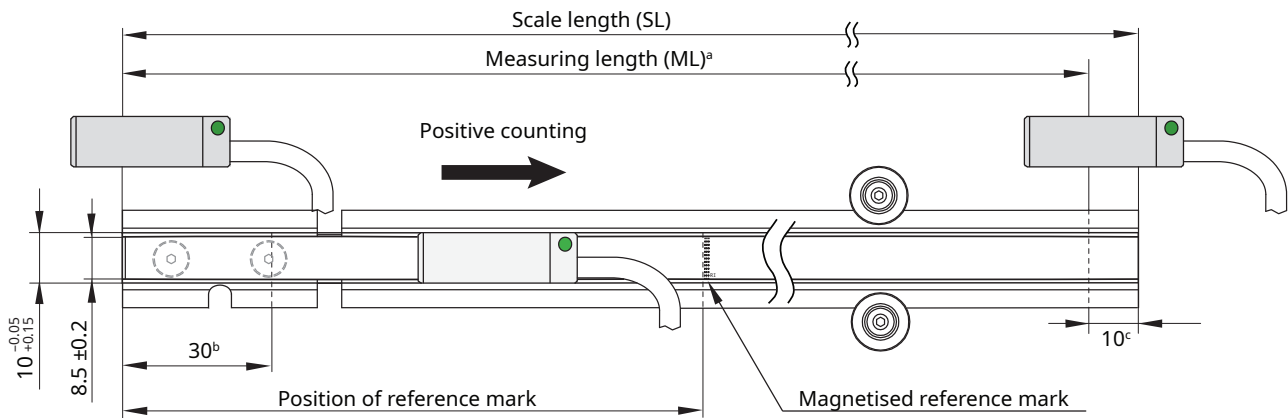
The scale expands to the **left**.

Alignment of different-level-substrate

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



Example: LM10 on MS10 scale with track system



ᵃ $ML = SL - 10 \text{ mm}$

ᵇ Minimum distance of reference mark from left edge

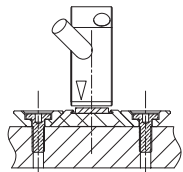
ᶜ Minimum distance of reference mark from right edge

Installation methods

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

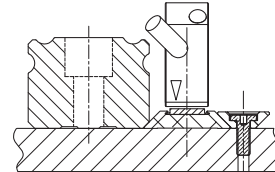


Installation method 1 (see page 15)



No reference surface available.

Installation method 2 (see page 16)

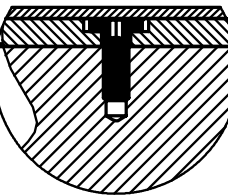
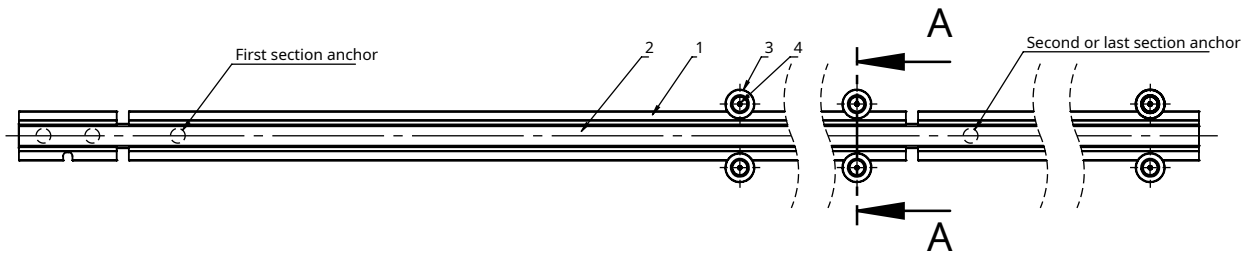
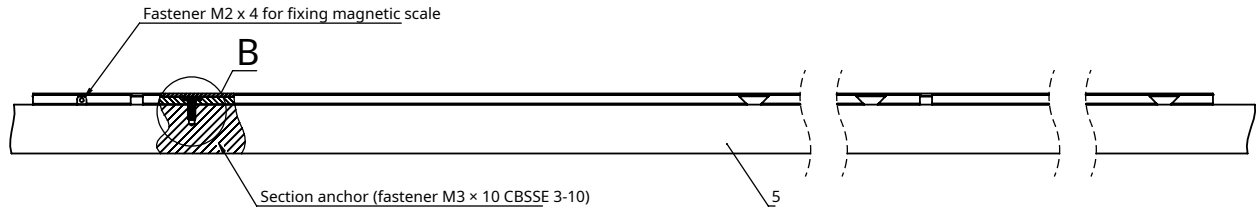
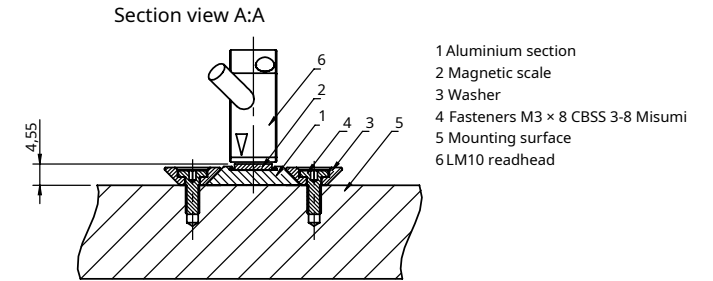
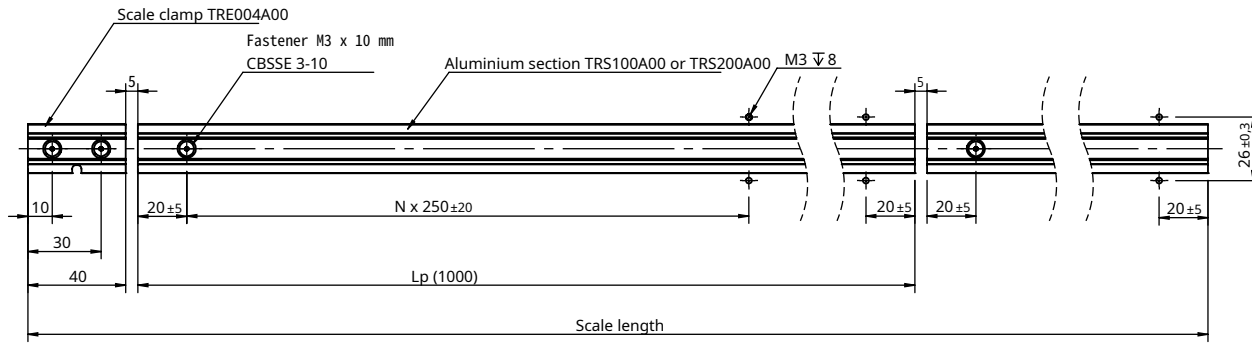


Reference surface available for alignment of track section.

Number of TRC00 (fasteners and washers) required

Track section	Number of TRC00 (fasteners and washers) required	
	Installation method 1	Installation method 2
TRS100A00	8	4
TRS200A00	16	8

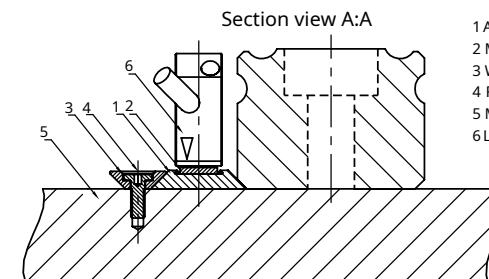
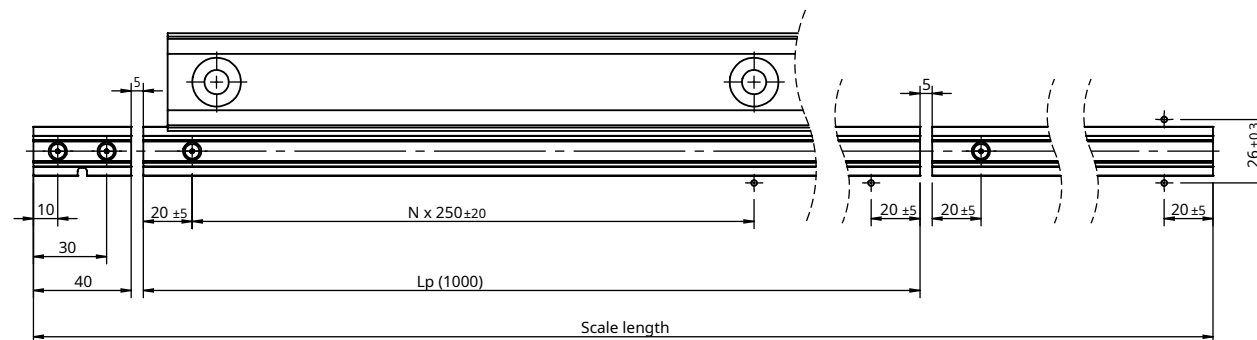
Installation method 1



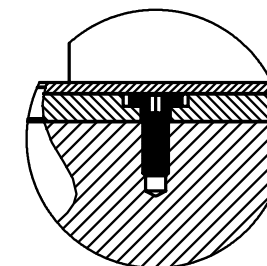
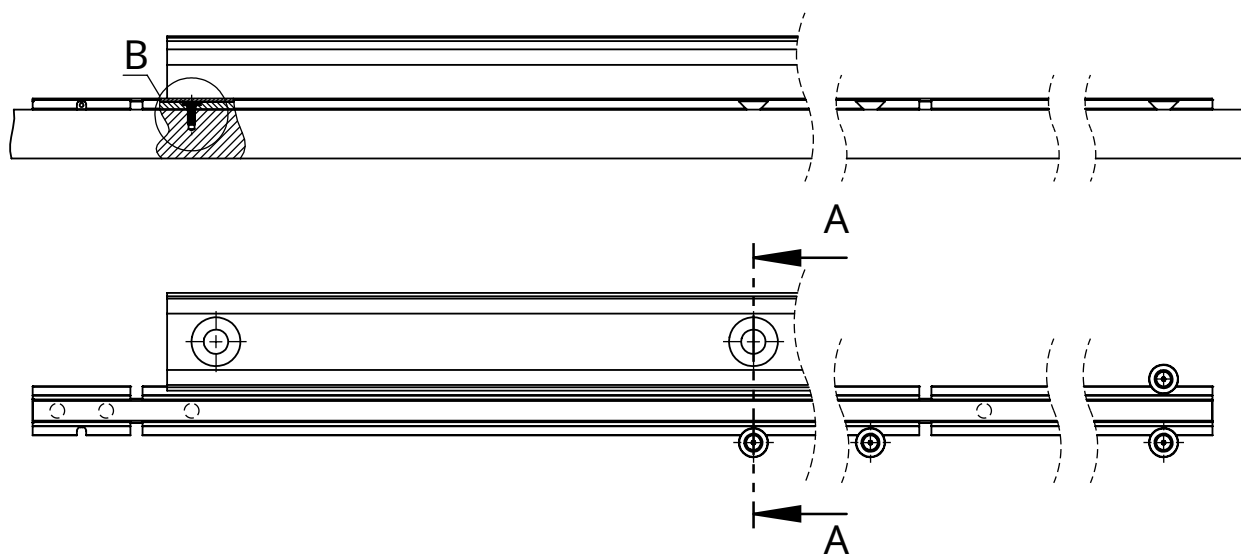
Detail B (2 : 3)

Installation method 2

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



- 1 Aluminium section
- 2 Magnetic scale
- 3 Washer
- 4 Fasteners M3 × 8 CBSS 3-8 Misumi
- 5 Mounting surface
- 6 LM10 readhead



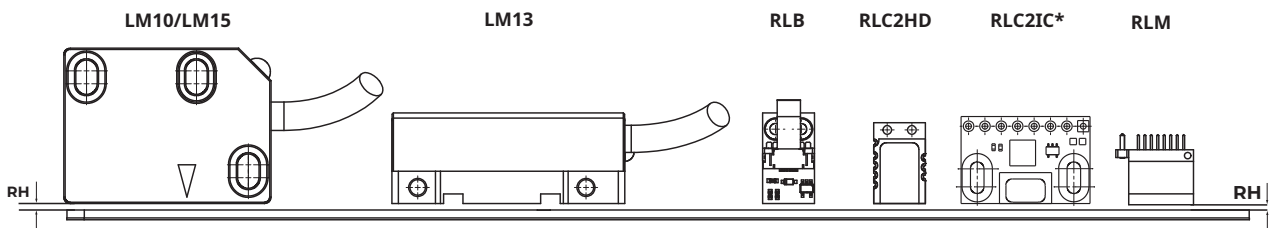
Detail B (2 : 3)

Installation tolerances

Ride height

Values in mm, marked RH

Readhead		LM10/LM13	LM15	RLB/RLC/RLM
No cover foil	No Ri	0.3 $\begin{smallmatrix} +1.2 \\ -0.2 \end{smallmatrix}$	0.5 $\begin{smallmatrix} +3.5 \\ -0.4 \end{smallmatrix}$	0.3 $\begin{smallmatrix} +0.5 \\ -0.2 \end{smallmatrix}$
	Magnetised Ri	0.3 $\begin{smallmatrix} +0.7 \\ -0.2 \end{smallmatrix}$	0.5 $\begin{smallmatrix} +2.5 \\ -0.4 \end{smallmatrix}$	
	Stick-on Ri	0.6 $\begin{smallmatrix} +0.4 \\ 0 \end{smallmatrix}$	-	-
With cover foil	No Ri	0.3 $\begin{smallmatrix} +1.1 \\ -0.2 \end{smallmatrix}$	0.5 $\begin{smallmatrix} +3.4 \\ -0.4 \end{smallmatrix}$	0.3 $\begin{smallmatrix} +0.4 \\ -0.2 \end{smallmatrix}$
	Magnetised Ri	0.3 $\begin{smallmatrix} +0.6 \\ -0.2 \end{smallmatrix}$	0.5 $\begin{smallmatrix} +2.4 \\ -0.4 \end{smallmatrix}$	

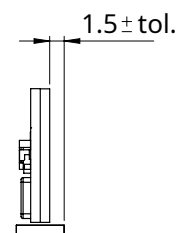
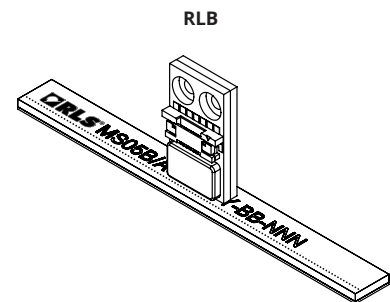
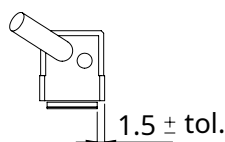
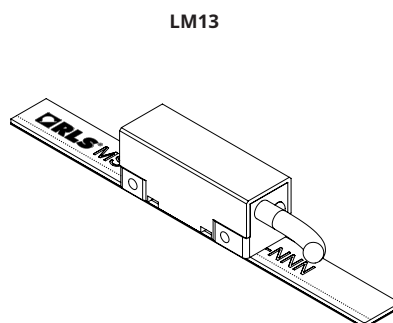
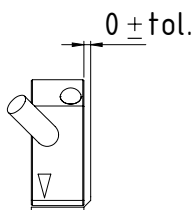
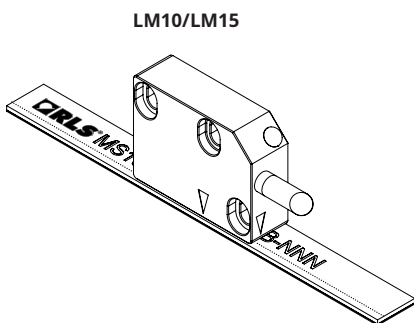
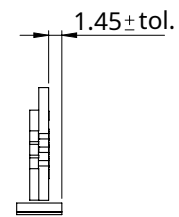
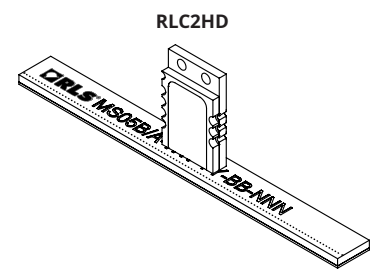
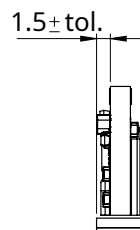
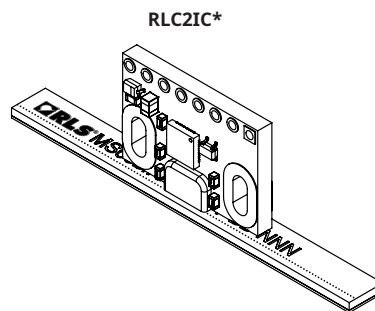
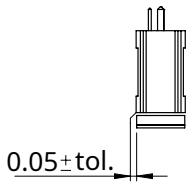
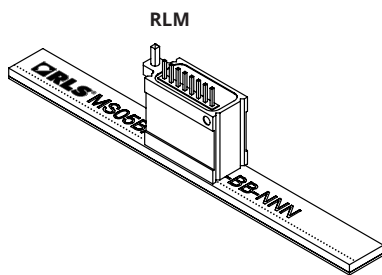


*Values apply for all RLC2IC encoder variants.

Lateral offset

Values in mm, marked as tolerance (tol.)

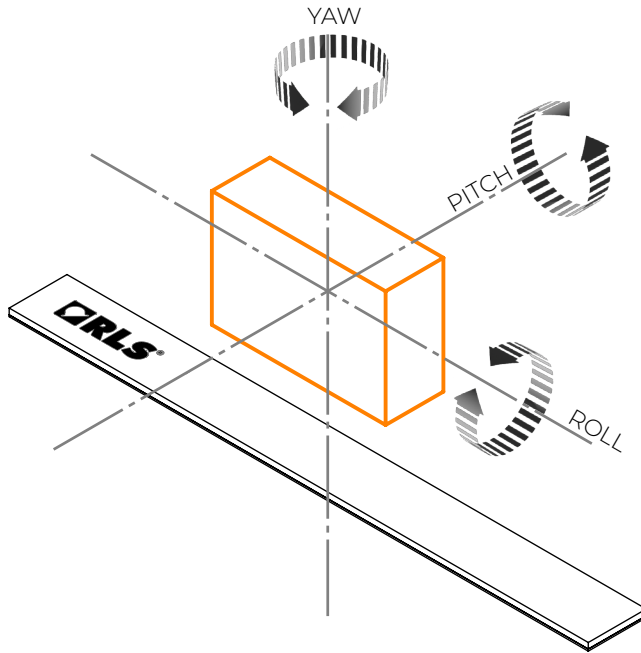
Readhead	LM10/LM13	LM15	RLB/RLC/RLM
No Ri	± 1	± 1	± 0.5
Magnetised Ri	± 0.7	± 0.7	-
Stick-on Ri	± 0.7	-	-



*Values apply for all RLC2IC encoder variants.

Roll, Pitch, Yaw

Illustration is intended for representation purpose only. The readhead is symbolic.



Roll

Values in °.	LM10/LM13/LM15	RLB, RLC2HD	RLM, RLC2IC*
	±3	±2	±1

Pitch

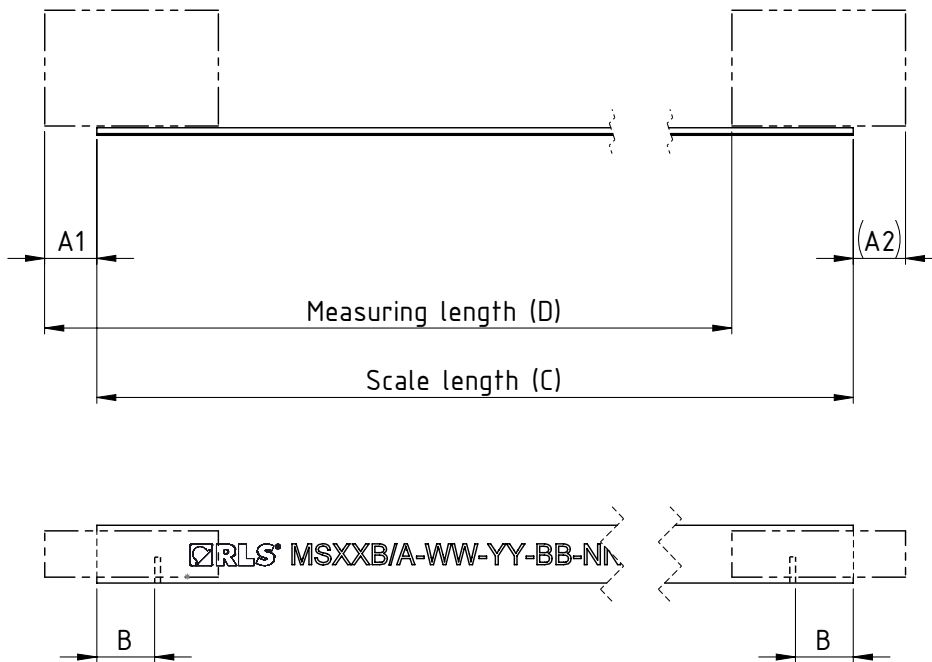
Values in °.	LM10/LM13/LM15	RLB, RLC2HD	RLM, RLC2IC*
	±3	±2	±1

Yaw

Values in °.	LM10/LM13/LM15	RLB, RLC2HD	RLM, RLC2IC*
	±3	±2	±1

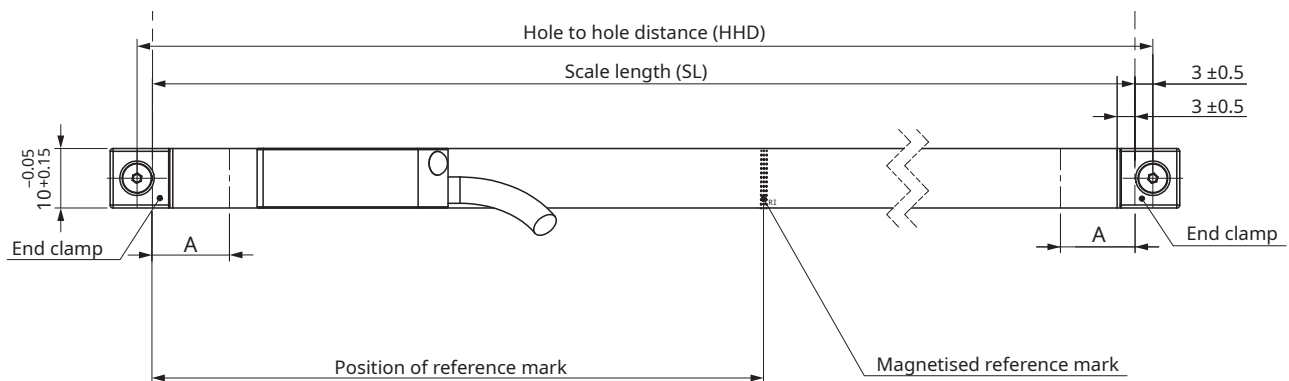
*Values apply for all RLC2IC encoder variants.

How to define scale length



Readhead	A1	A2	B	C
LM10	13 mm	7 mm	Min. 10 mm	D + 20 mm
LM13	11 mm	13 mm	Min. 10 mm	D + 20 mm
LM15	6.5 mm	0.5 mm	Min. 10 mm	D + 20 mm
RLB	-2 mm	-2 mm	-	D + 10 mm
RLC2HD	-2 mm	-2 mm	-	D + 10 mm
RLC2IC	4 mm	4 mm	Min. 8 mm	D + 16 mm
RLM	-1 mm	-1 mm	Min. 8 mm	D + 10 mm

Installation of MS magnetic scale with end clamps



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

$$\text{Measuring length with end clamps} = \text{SL} - 26 \text{ mm}$$

A - The minimum distance of the reference mark from the edge

Part numbering

MS 10 B 1000 B 0032

Scale type

- 05 - 2 mm pole length, 5 mm width
- 07 - 2.032 mm pole length, 5 mm width
- 10 - 2 mm pole length, 10 mm width
- 12 - 2.032 mm pole length, 10 mm width
- 15 - 5 mm pole length, 10 mm width

Accuracy class

- A - $\pm 20 \mu\text{m/m}$ C - $\pm 100 \mu\text{m/m}$
- B - $\pm 40 \mu\text{m/m}$ D - $\pm 10 \mu\text{m/m}$

Scale length

- xxxx - xxxx equals scale length in cm Mxxx - xxx equals scale length in mm
(for scale lengths below 1 m)

See [Page 25](#) for scale length definition.

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 (MS10 option only)
- 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 (MS10 option only)

Reference mark

- 0000 - No reference mark
- xxxx - Reference mark; xxxx equals position of reference mark in cm
(Reference mark position will be within ± 1 mm from requested position)
- Mxxx - Reference mark; xxx equals position of reference mark in mm
(Reference mark position will be within ± 1 mm from requested position)
- Dxxx - Distance coded reference mark; xxx equals basic increment K
- Pxxx - Multiple reference marks in mm; xxx equals distance between magnetised reference marks in mm,
factory predefined to 50 mm, 100 mm and 200 mm.
(each reference mark position will be within ± 1 mm from requested position)

Cover foil part numbering

CF 10 1000

Cover foil width

- 05 - 5 mm
- 08 - 8 mm (for track system option only)
- 10 - 10 mm

Cover foil length

- xxxx - xxxx equals foil length in cm

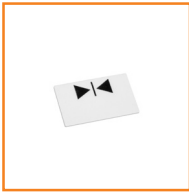
Not all part number combinations are valid. Please refer to the table of available combinations on the next page.

Table of available combinations

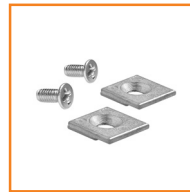
Series	Scale type	Accuracy class	Scale length	Options	Reference mark
MS	05	A / B / D	xxxx / Mxxx	A / B / I / N	0000 / xxxx / Mxxx / Dxxx
	07	B	xxxx / Mxxx		0000 / xxxx / Mxxx
	10	A / B / D	xxxx / Mxxx	A / B / C / G / H / I / N / P	0000 / xxxx / Mxxx / Dxxx
			2000		P050 / P100 / P200
	12	B	xxxx / Mxxx	A / B / G / H / I / N	0000 / xxxx / Mxxx
	15	C	xxxx / Mxxx		0000 / xxxx / Mxxx / Dxxx

More information about the max speed of readheads at [RLS Magnetic Scale Calculator](#)

Accessories



Stick-on reference mark
LM10SRM00



End clamp kit
LM10ECL00

(2 clamps + 2 fasteners)



Applicator tool for stick-on
reference mark
LM10ARM00



Magnet viewer
MM0001



Applicator tool for magnetic
scale and cover foil
LM10ASC00



Applicator tool for magnetic
scale and cover foil
LM13ASC00



Track section, 1.00 m
TRS100A00

(1x fastener M3x10 included)



Track section, 2.00 m
TRS200A00

(1x fastener M3x10 included)



Fastener and washer
TRC00



Scale clamp with fasteners,
0.04 m
TRE004A00

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



Scale clamp with fasteners,
0.04 m
TRE004A01

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

Head office

RLS Merilna tehnika d.o.o.

Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100

E mail@rls.si

www.rls.si

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Document issues

Issue	Date	Page	Description
4	13. 3. 2023	3, 5	Packaging and mechanical data amended
5	31. 3. 2023	3	Magnetic field density amended
6	21. 5. 2024	4, 5	New print to scales added, Print tolerances added
7	6. 9. 2024	2, 3, 5, 6	Document design amended
		5	Max speed calculator added
		8	DCRM calculation example added
		9	Positive direction and readhead orientation chapter added
		16, 17	Installation method drawings amended
		18, 19	Installation tolerances chapter amended
		20	Roll, Pitch, Yaw drawing added
		21	How to define scale length chapter amended
		23	Max speed tables removed, link to calculator added Part numbering, options amended
		24	TRE004A01 added

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