

# **SIGNUM™** RESM angle encoder



## Patents

Features of Renishaw's RESM angle encoder systems and similar products are the subjects of the following patents and patent applications:

|                 |                 |              |                |                 |
|-----------------|-----------------|--------------|----------------|-----------------|
| EP 0207121      | US 4959542      | EP 0514081   | JP 3,202,316   | US 5,241,173    |
| EP 0543513      | JP 248,895/1993 | US 5,302,820 | EP 0748436     | US 5,861,953    |
| EP 1094302      | US 6,481,115 B1 | GB 2397040   | CN CN1585685A  | JP 2005-508,760 |
| US 2005-0079499 | CN CN1668894A   | EP 1552251   | JP 2005-533248 | US 2005-0235502 |

Further patent applications pending.

## Further information

For further information relating to the installation of RESM angle encoder system, see also the RESM Data sheet (L-9517-9154) and the **SIGNUM**™ system Data sheet and Installation guide (L-9517-9155 and M-9572-0057).

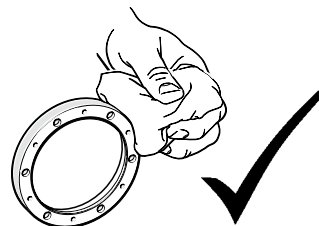
These can be downloaded from our website [www.renishaw.com](http://www.renishaw.com) and are also available from your local representative.

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## Storage and handling

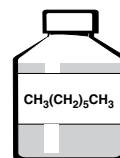


The RESM is a non-contact optical encoder that provides good immunity against contaminants such as dust, fingerprints and light oils.

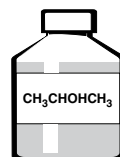
However, in harsh environments such as machine tool applications, protection should be provided to prevent ingress of coolant or oil.

### Ring and readhead

N-heptane

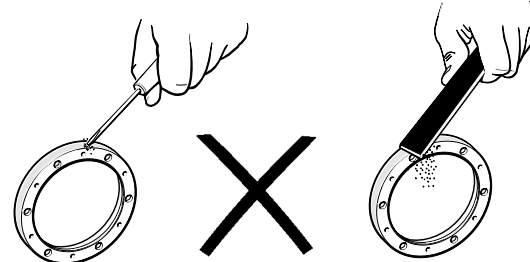
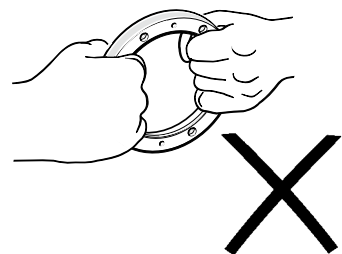
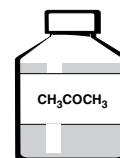


Propan-2-ol

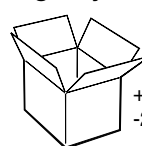


### Ring only (avoid contact with readhead)

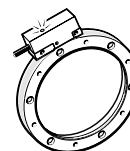
Acetone



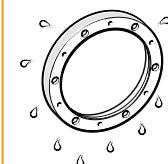
### Ring only



+70 °C  
-20 °C



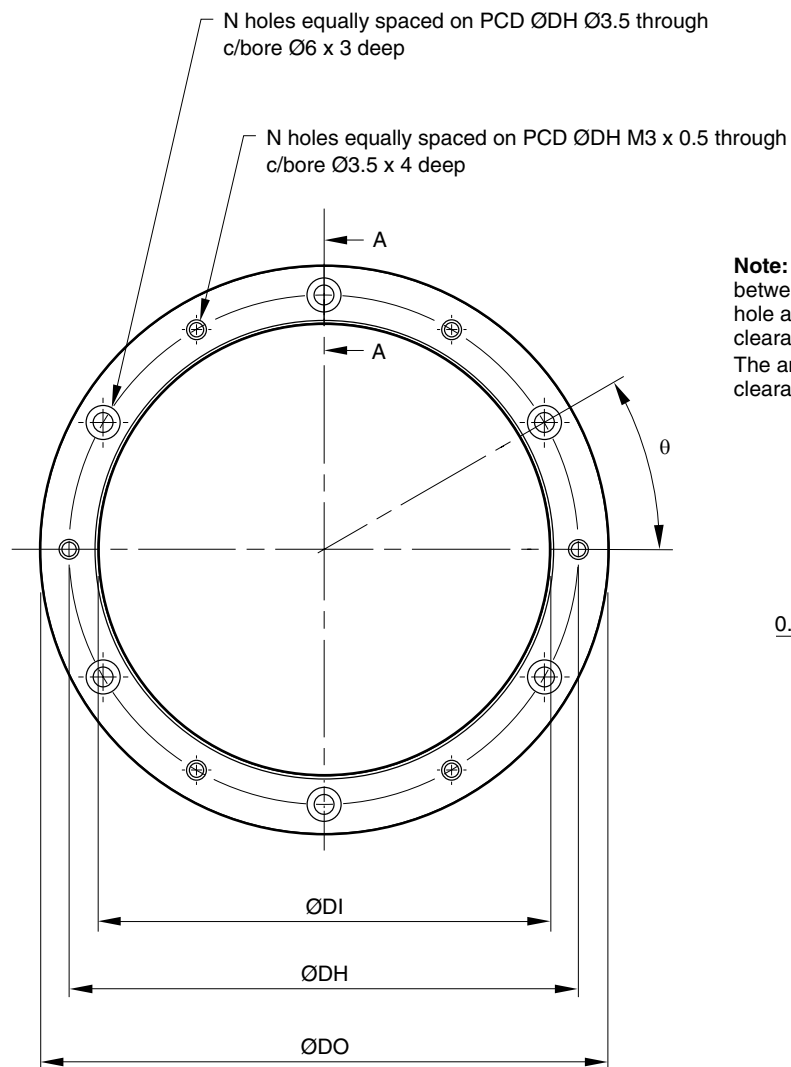
+85 °C  
0 °C



Storage <95% RH  
Operating <80% RH

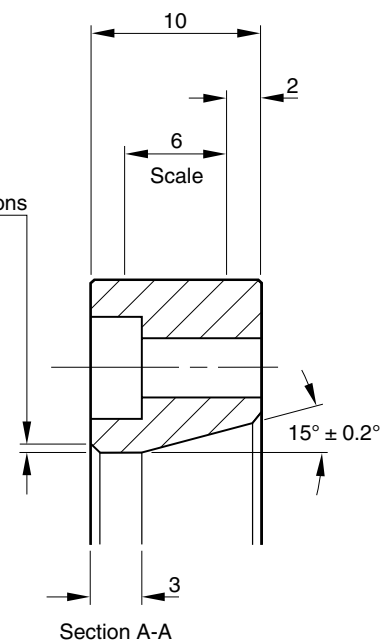
## Installation drawing ('A' section)

General outline and dimensions Dimensions and tolerances in mm



**Note:** θ is the angle between one tapped hole and the adjacent clearance hole.  
The angle between two clearance holes is 2θ.

0.5 x 45° 2 positions

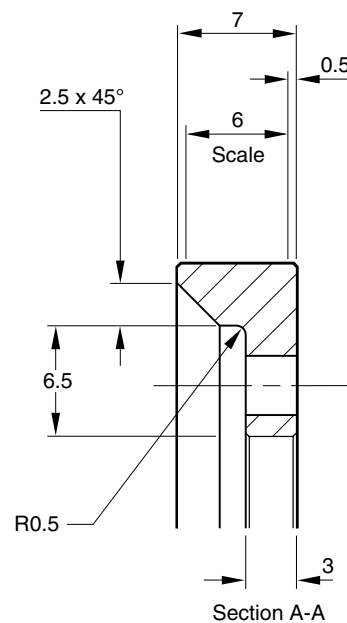
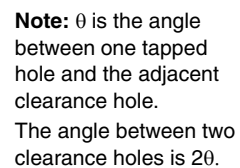


| Nominal external diameter (mm) | DO (mm)          | DI (mm)          | DH (mm) | N  | θ      |
|--------------------------------|------------------|------------------|---------|----|--------|
| 52                             | 52.20<br>52.10   | 30.04<br>30.00   | 40      | 6  | 30°    |
| 57                             | 57.35<br>57.25   | 37.04<br>37.00   | 47      | 6  | 30°    |
| 75                             | 75.40<br>75.30   | 55.04<br>55.00   | 65      | 6  | 30°    |
| 100                            | 100.30<br>100.20 | 80.04<br>80.00   | 90      | 6  | 30°    |
| 103                            | 103.20<br>103.00 | 80.04<br>80.00   | 90      | 6  | 30°    |
| 104                            | 104.40<br>104.20 | 80.04<br>80.00   | 90      | 6  | 30°    |
| 115                            | 114.70<br>114.50 | 95.04<br>95.00   | 105     | 6  | 30°    |
| 150                            | 150.40<br>150.20 | 130.04<br>130.00 | 140     | 9  | 20°    |
| 200                            | 200.40<br>200.20 | 180.04<br>180.00 | 190     | 12 | 15°    |
| 206                            | 206.50<br>206.10 | 186.05<br>186.00 | 196     | 12 | 15°    |
| 209                            | 208.80<br>208.40 | 186.05<br>186.00 | 196     | 12 | 15°    |
| 229                            | 229.40<br>229.00 | 209.05<br>209.00 | 219     | 12 | 15°    |
| 255                            | 254.80<br>254.40 | 235.06<br>235.00 | 245     | 12 | 15°    |
| 300                            | 300.40<br>300.20 | 280.06<br>280.00 | 290     | 16 | 11.25° |
| 350                            | 350.40<br>350.20 | 330.06<br>330.00 | 340     | 16 | 11.25° |
| 413                            | 412.70<br>412.30 | 392.08<br>392.00 | 402     | 18 | 10°    |
| 417                            | 417.40<br>417.00 | 380.10<br>380.00 | 390     | 18 | 10°    |
| 489                            | 489.12<br>488.72 | 451.10<br>450.90 | 462     | 20 | *18°   |
| 550                            | 550.20<br>549.80 | 510.10<br>510.00 | 520     | 20 | 9°     |

\*Note: There are no tapped holes on the 489 mm ring.

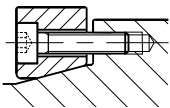
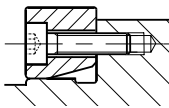
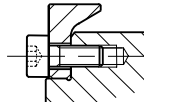
**General outline and dimensions** Dimensions and tolerances in mm

**General outline and dimensions** Dimensions and tolerances in mm



| Nominal external diameter (mm) | DO (mm)          | DI (mm)          | DH (mm) | N  | $\theta$ |
|--------------------------------|------------------|------------------|---------|----|----------|
| 75                             | 75.40<br>75.30   | 55.04<br>55.00   | 61      | 6  | 30°      |
| 100                            | 100.30<br>100.20 | 80.04<br>80.00   | 86      | 6  | 30°      |
| 150                            | 150.40<br>150.20 | 130.04<br>130.00 | 136     | 9  | 20°      |
| 200                            | 200.40<br>200.20 | 180.04<br>180.00 | 186     | 12 | 15°      |

## Select a mounting option

|             | Taper mount                                                                                                                                                                                                                                                                        | Interference fit                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 'A' section |                                                                                                                                                                                                   |          |
| 'B' section | Not applicable                                                                                                                                                                                                                                                                     |          |
| Notes       | <b>Recommended for all installations</b><br>Enables simplest adjustment.<br>Offers highest accuracy.<br>Enables eccentricity to be compensated.<br>Offers excellent mechanical stability against thermal cycling, shock and vibration.<br>Minimises cost of substrate preparation. | <b>Alternative installation</b><br>Will not correct eccentricity of the supporting shaft. |

## Taper mount method Step 1

Mounting shaft specifications

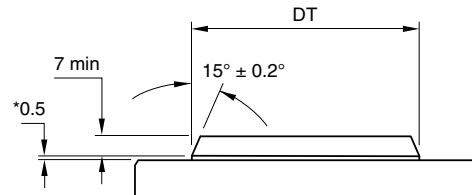
Recommended taper roundness

| Diameter (mm) | Roundness value (mm TIR) |
|---------------|--------------------------|
| ≤ 115         | 0.025                    |
| 150 to 255    | 0.050                    |
| ≥ 300         | 0.075                    |

Recommended taper roundness when using 2 heads and DSi

| Diameter (mm) | Roundness value (mm TIR) |
|---------------|--------------------------|
| ≤ 115         | 0.0125                   |
| 150 to 255    | 0.025                    |
| ≥ 300         | 0.0375                   |

Recommended surface finish  
Ra value is 1.2 µm or better



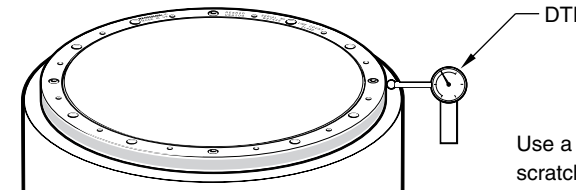
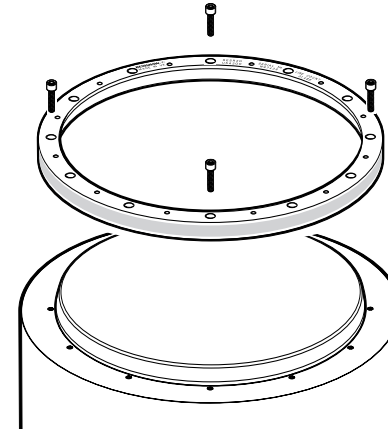
\*For 417 mm, 489 mm and 550 mm rings only, 1.0

Recommended taper diameter (DT)

| DO (mm) | DT (mm)        | DO (mm) | DT (mm)          | DO (mm) | DT (mm)          |
|---------|----------------|---------|------------------|---------|------------------|
| 52      | 33.85<br>33.65 | 150     | 133.85<br>133.65 | 350     | 333.85<br>333.65 |
| 57      | 40.85<br>40.65 | 200     | 183.85<br>183.65 | 413     | 395.85<br>395.65 |
| 75      | 58.85<br>58.65 | 206     | 189.85<br>189.65 | 417     | 383.85<br>383.65 |
| 100     | 83.85<br>83.65 | 209     | 189.85<br>189.65 | 489     | 454.85<br>454.65 |
| 103     | 83.85<br>83.65 | 229     | 212.85<br>212.65 | 550     | 513.85<br>513.65 |
| 104     | 83.85<br>83.65 | 255     | 238.85<br>238.65 |         |                  |
| 115     | 98.85<br>98.65 | 300     | 283.85<br>283.65 |         |                  |

DO = Nominal external diameter

## Taper mount method Step 2



► Clean shaft taper and internal taper of RESM as recommended in the storage and handling section.

► Use 4 equally spaced M3 screws (on RESM sizes 52 mm to 150 mm use 3 screws).

**Note:** Do not lubricate screws.

► Insert the screws so that the RESM is loosely connected to the shaft, then roughly align the ring by eye and touch.

► Lightly tighten the screws. Use a Dial Test Indicator (DTI) to check the radial displacement at the screw locations.

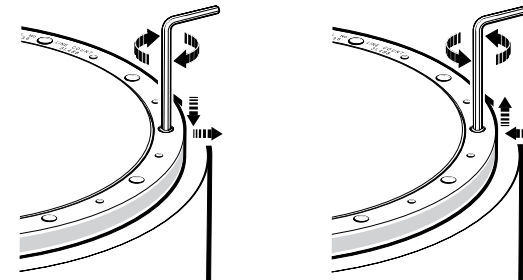
**Note:** Disregard the radial displacement between the screw locations.

Use a DTI with low exertion force to reduce scratching on the scale surface. It may also be beneficial to use a DTI with a ruby ball to further reduce scratching.

► Adjust the screws so the radial displacement is the same at each screw location.

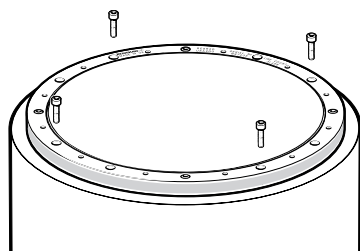
► When adjusting, identify the screw location with the lowest radial displacement and tighten that screw, aiming for the average of the highest and lowest indicator readings.

► Repeat this process until the DTI readings are within ±15 µm at the screw locations.



**Note:** At this stage, the screws should only be lightly tightened (approximately 0.5 Nm) to allow further final adjustment.

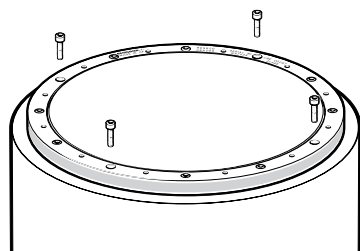
### Taper mount method **Step 3**



- ▶ Insert the next 4 screws (on RESM sizes 52 mm to 150 mm insert the next 3 screws).
- ▶ Adjust all the screws inserted thus far, so that the radial displacement at each screw location is within  $\pm 15 \mu\text{m}$ .
- ▶ Again, at this stage, the screws should only be lightly tightened.

**Note:** You may notice that the torque required to achieve the radial displacement tolerance will be slightly higher during step 3 than during step 2. This is normal.

### Taper mount method **Step 4**



- ▶ Insert the remaining screws.
- ▶ Adjust all of the screws inserted thus far, so that the radial displacement at each screw location is within  $\pm 15 \mu\text{m}$ .

### Taper mount method **Step 5**

- ▶ Rotate the RESM ring, measuring the radial displacement at all of the screw locations.
- ▶ Tighten the screw with the lowest radial displacement so that it matches the average radial displacement.
- ▶ Again, rotate the RESM ring and re-check the radial displacement at all of the screw locations, tightening the screw with the lowest radial displacement so that it matches the average.
- ▶ Repeat this process until the radial displacement at all of the screw locations is within  $\pm 3 \mu\text{m}$ .

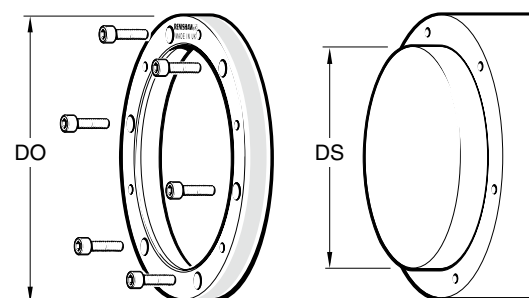
### Taper mount method **Step 6**

| Diameter (mm) | Torque (Nm) |
|---------------|-------------|
|               | min         |
| $\leq 115$    | 1.5         |
| 150 to 255    | 1.25        |
| $\geq 300$    | 1.0         |

- ▶ Finally, ensure that all the screws are tightened to the torque recommendations (see table).
- ▶ When torquing-up the screws, follow the method used in Step 5.
- ▶ Continue the torquing process until all of the screws are set to the minimum recommended torque.
- ▶ If some of the screws seem loose, continue the torquing process, but aim to adjust the screw with the lowest radial deflection to a point which is just above the average radial deflection.
- ▶ Ensure that the radial deflection at the screw locations is within  $\pm 3 \mu\text{m}$ .
- ▶ Further fine tuning can improve the installed accuracy.
- ▶ Excessive tightening of screws can have a small effect on accuracy. Please contact your local representative for more details.

### Interference fit method

Mounting shaft specifications.



| DO (mm) | DS (mm)            | DO (mm) | DS (mm)            |
|---------|--------------------|---------|--------------------|
| 52      | 30.028<br>30.015   | 200     | 180.052<br>180.027 |
| 57      | 37.028<br>37.015   | 206     | 186.060<br>186.031 |
| 75      | 55.039<br>55.020   | 209     | 186.060<br>186.031 |
| 100     | 80.045<br>80.023   | 229     | 209.060<br>209.031 |
| 103     | 80.045<br>80.023   | 255     | 235.060<br>235.031 |
| 104     | 80.045<br>80.023   | 300     | 280.066<br>280.034 |
| 115     | 95.045<br>95.023   | 350     | 330.073<br>330.037 |
| 150     | 130.052<br>130.027 | 413     | 392.073<br>392.037 |

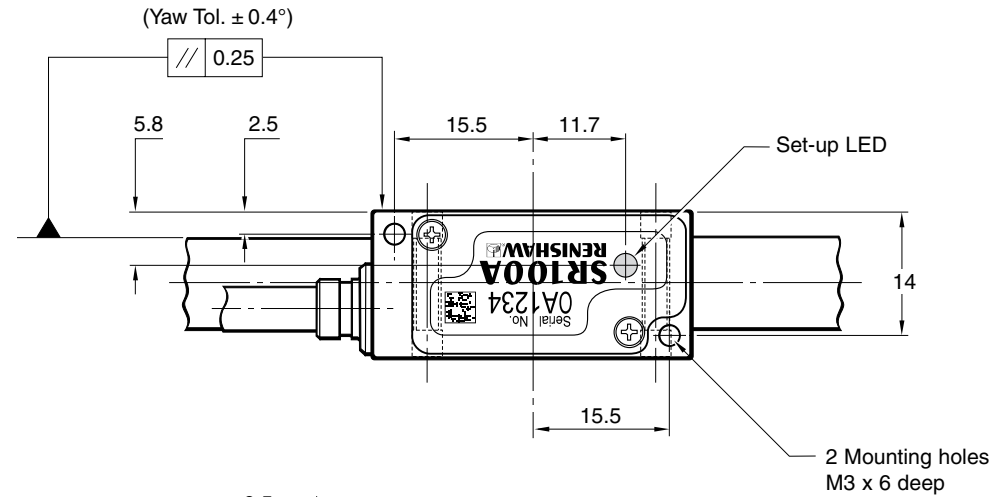
DO = Nominal external diameter

DS = Recommended shaft diameter to enable transition fit

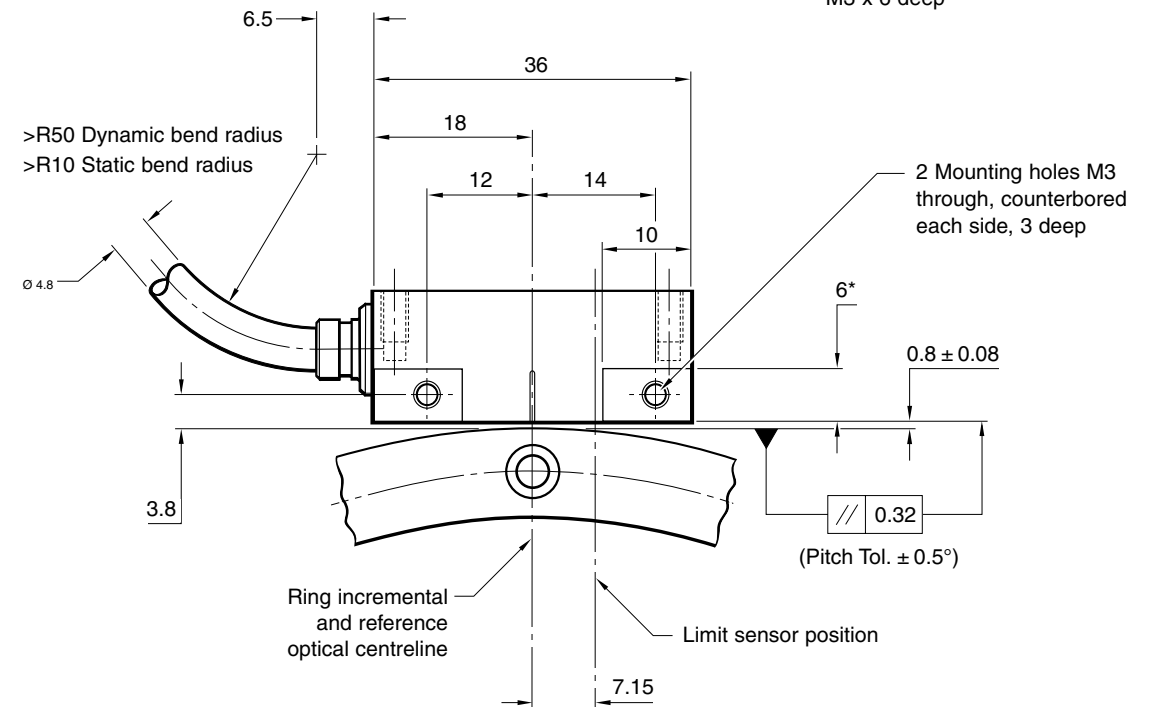
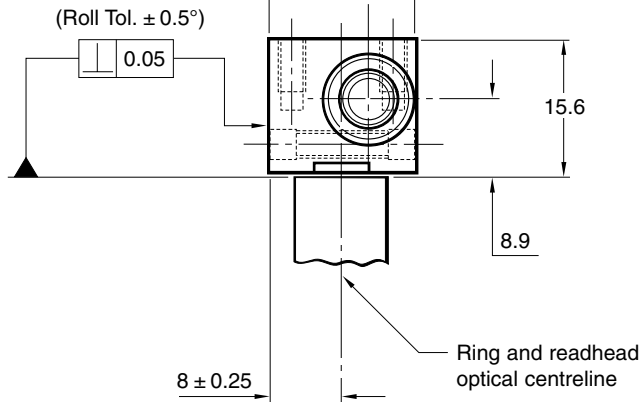
**NOTE:** 417 mm, 489 mm and 550 mm rings should be taper mounted only

# **siGNUM™ readhead mounted on 'A' section RESM**

Dimensions and tolerances in mm.



**NOTE:** Roll tolerance applies over mounting faces dimension\*



For **siGNUM™** readhead installation details refer to **siGNUM™** SR, Si encoder system installation guide (M-9572-0057).

## Reference mark position



**IN-TRAC™** reference mark is integrated in the scale, radially aligned with the centre of the mounting hole to the left of the 'Renishaw' logo within  $\pm 0.5$  mm. No external actuators or physical adjustment are required.

For details on phasing the reference mark see the **SIGNUM™** SR, Si encoder system installation guide (M-9572-0057).

## On-scale limits

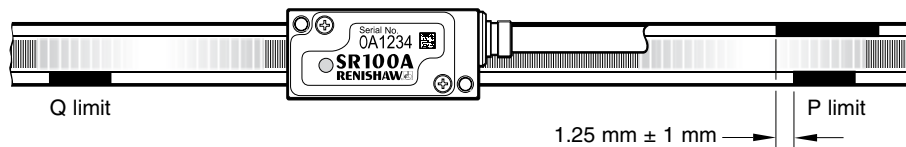
For partial rotation systems such as tilting rotary tables, dual on-scale limits can be used on 'A' section rings having an external diameter of 100 mm or more.

Self-adhesive limit markers are available in 10 mm, 20 mm and 50 mm lengths as pre-aligned pairs on backing paper.

## Limit alignment

The limits are aligned on the ring as shown below. (For standard orientation readheads only).

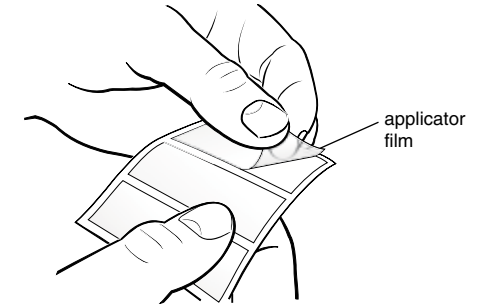
- The P limit is located at the cable exit side of the readhead and consists of 2 markers, 1 either side of the incremental track. The markers are pre-aligned with the correct offsets on the backing paper.
- The Q limit is located at the opposite end to the cable exit and consists of 1 marker. The marker should be affixed to the bottom edge relative to the cable exit as shown in the drawing below.



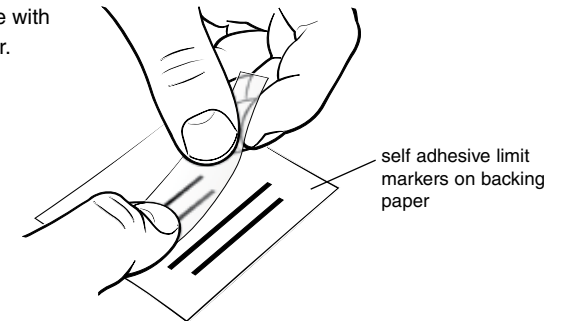
## Installing the limits

Limit switches are available in a pack of 3 off 10 mm long actuators (A-9570-0140) or a pack containing 1 off 10 mm, 1 off 20 mm and 1 off 50 mm long actuators (A-9570-0139).

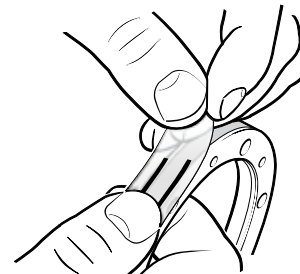
- Ensure the ring is free from dirt and grease.
- Select the length of limit marker required.
- Place the transparent applicator film over the required limit marker and rub firmly until the limit marker adheres to the applicator film. For the P limit, select the pair of markers required together.



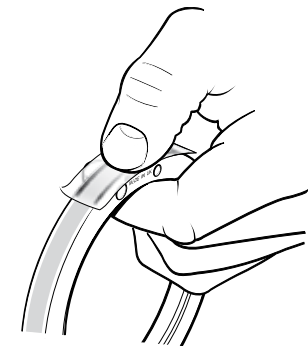
- Remove the applicator film, complete with limit markers, from the backing paper.



- Align the markers on the ring next to the scale track, as shown in the diagram, and rub firmly on the applicator film until the markers adhere to the ring.



- Remove applicator film.



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