

## RESD angle encoder with distance-coded reference marks



The RESD is a one-piece stainless steel ring with 20 µm scale marked directly onto the periphery, featuring distance-coded *IN-TRAC*™ auto-phase optical reference marks.

Distance-coded reference marks are spaced at defined unique intervals, allowing a controller to calculate absolute position with only a small movement of the axis.

The RESD offers impressive accuracy with resolution to 0.002 arc second, suiting the most demanding precision applications.

Read by Renishaw's **TONIC**™ encoder system, it has high tolerance to dirt, scratches and greasy fingerprints that can cause other encoder systems to miscount.

The low profile RESD, with large internal diameter, is easy to design into most installations. Equally important, its low mass, low inertia design does not compromise system performance. RESD is available in a range of sizes and line counts, providing compatibility with industry standard controllers.

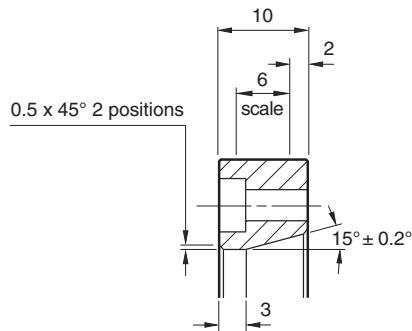
### System features

- Compatible with the **TONIC T20x1** encoder system offering industry standard analogue or digital incremental outputs
- Distance code *IN-TRAC* bi-directional optical reference marks allow absolute position to be calculated after a small movement
- High speed operation, up to 3 673 rev/min (10 m/s)
- Graduation accuracy to ±0.99 arc second (209 mm ring)
- New high-resolution, 2 nm and 1 nm digital versions
- Angular resolution to 0.002 arc second
- System repeatability to 0.003 arc second
- Patented taper mount simplifies integration and minimises installation errors
- Large internal diameter enables easy design-in
- Available in sizes from Ø52 mm to Ø209 mm with line counts from 8 192 to 32 768
- Custom sizes and very large diameters also available
- Low mass and low inertia
- Integral set-up LED on readhead for quick set-up and instant 'health check' at any time
- True absolute encoders also available from Renishaw. Please contact your local representative for details.

## Installation drawing ('A' section)

Dimensions and tolerances in mm

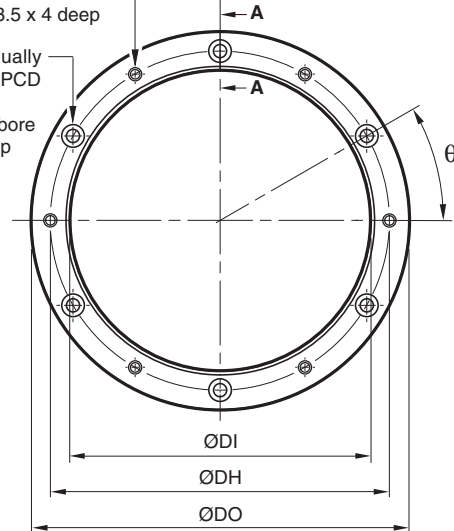
### Section A-A



**NOTE:**  $\theta$  is the angle between one tapped hole and the adjacent clearance hole. For example, the angle between two clearance holes is  $2\theta$ .

N holes equally spaced on PCD  $\varnothing$ DH M3 x 0.5 through, counterbored top face  $\varnothing$ 3.5 x 4 deep

N holes equally spaced on PCD  $\varnothing$ DH  $\varnothing$ 3.5 through, c/bore  $\varnothing$ 6 x 3 deep



## Master reference mark position



The master *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.

**IMPORTANT:** Before selecting ring size, check reference mark 'Box size' compatibility with controller supplier

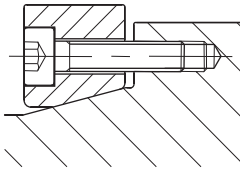
Nominal external diameter (mm)	Line count	DO (mm)	DI (mm)	Mounting holes			Reference marks	Max wake angle
				DH (mm)	N	$\theta$		
52	8 192	52.20 52.10	30.04 30.00	40	6	30°	16	45°
57	9 000	57.35 57.25	37.04 37.00	47	6	30°	18	40°
101	16 000	101.90 101.80	80.04 80.00	90	6	30°	32	22.5°
104	16 384	104.40 104.20	80.04 80.00	90	6	30°	32	22.5°
115	18 000	114.70 114.50	95.04 95.00	105	6	30°	36	20°
153	24 000	152.90 152.70	130.04 130.00	140	9	20°	48	15°
209	32 768	208.80 208.40	186.05 186.00	196	12	15°	64	11.25°

Custom sizes also available.

Contact your local Renishaw representative for more details.

## Taper mount

### 'A' section



#### Recommended for all installations

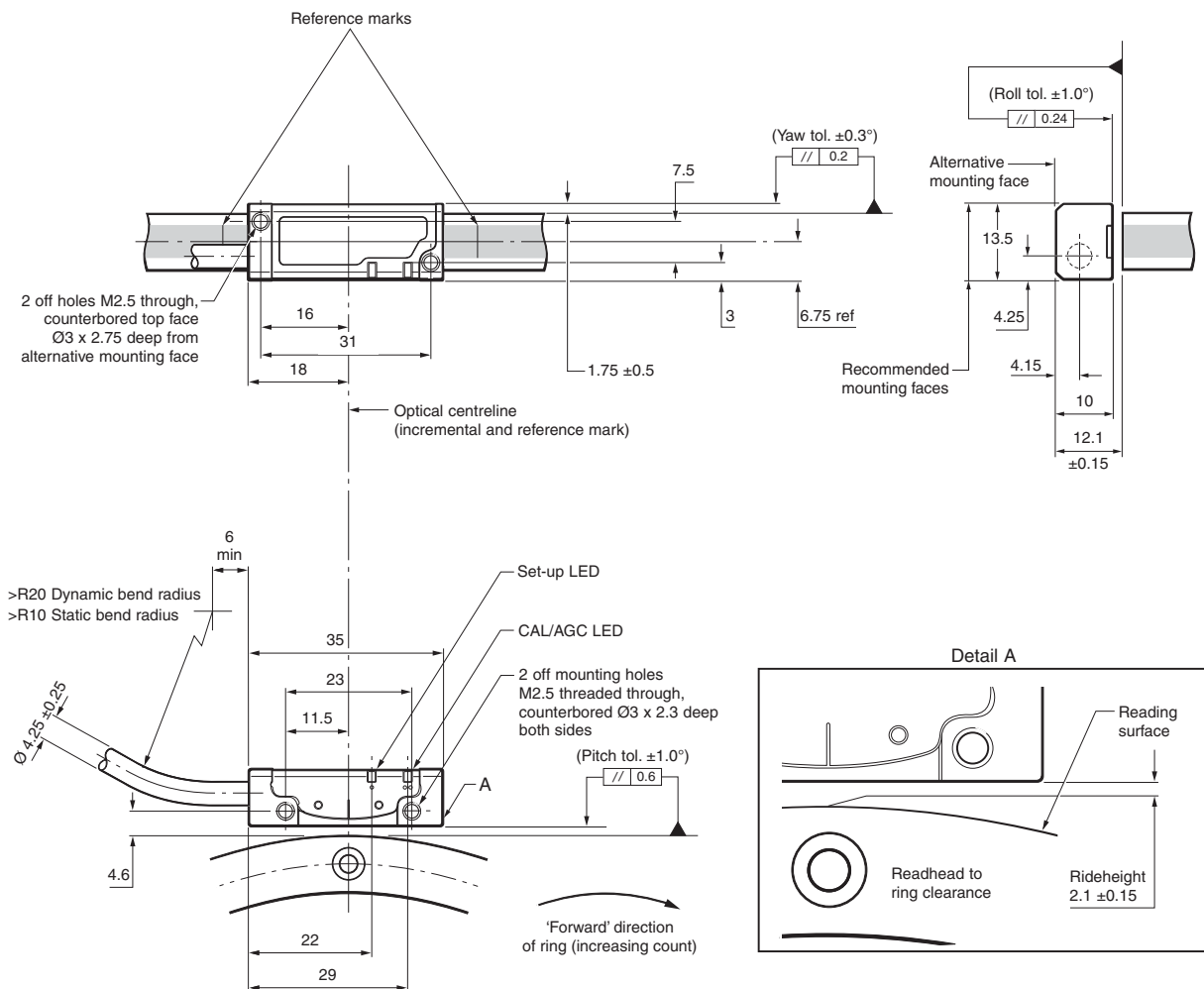
- Offers highest accuracy.
- Enables simplest adjustment.
- Enables eccentricity to be compensated.
- Offers excellent mechanical stability against thermal cycling, shock and vibration.
- Minimises cost of substrate preparation.

**NOTE:** Interference fit is not recommended for RESD rings.

For further information on installation and mounting, please refer to the **TONiC** T20x1 RESD Installation guide (M-9676-9000) which can be downloaded from: [www.renishawsupport.com](http://www.renishawsupport.com)

## TONiC T20x1 readhead installation drawing ('A' section RESD)

Dimensions and tolerances in mm



## Maximum speed (rev/min)

For details of maximum speeds for other clocked options, please contact your local representative.

### TONIC system: For 50 MHz clocked option.

Nominal external diameter (mm)	Line count	Output resolution											
		Ti0004 5 µm	Ti0020 1 µm	Ti0040 0.5 µm	Ti0100 0.2 µm	Ti0200 0.1 µm	Ti0400 50 nm	Ti1000 20 nm	Ti2000 10 nm	Ti4000 5 nm	Ti10KD 2 nm	Ti20KD 1 nm	Ti0000 1 Vpp
52	8 192	3 673	3 673	3 673	2 380	1 190	597	238	119	59	24	12	3 673
57	9 000	3 351	3 351	3 351	2 171	1 086	544	217	109	54	22	11	3 351
101	16 000	1 891	1 891	1 891	1 225	613	307	123	62	30	12.2	6.1	1 891
104	16 384	1 836	1 836	1 836	1 190	595	297	119	59	30	11.9	5.9	1 836
115	18 000	1 661	1 661	1 661	1 076	538	270	108	54	27	10.8	5.4	1 661
153	24 000	1 248	1 248	1 248	809	405	203	81	41	20	8.0	4.1	1 248
209	32 768	914	914	914	592	296	148	59	30	15	5.9	3.0	914

## Operating specifications

<b>Material</b>	303/304 stainless steel
<b>Coefficient of expansion</b>	17 ± 0.3 µm/m/°C (ppm/°C)
<b>Temperature</b>	Storage -20 °C to +70 °C      Operating 0 °C to + 70 °C

Nominal external diameter (mm)		52	57	101	104	115	153	209
Nominal internal diameter (mm)		30	37	80	80	95	130	186
Line count		8 192	9 000	16 000	16 384	18 000	24 000	32 768
Mass (kg)	'A' section	0.1	0.1	0.2	0.25	0.25	0.3	0.5
Moment of inertia (kgmm <sup>2</sup> )	'A' section	47	63	420	550	640	1 600	4 900

## Accuracy

Nominal external diameter (mm)	Graduation accuracy (arc second)	System accuracy (arc second)
52	±3.97	±4.28
57	±3.62	±3.91
101	±2.06	±2.23
104	±1.98	±2.14
115	±1.79	±1.94
153	±1.38	±1.49
209	±0.99	±1.08

**Graduation accuracy** is the maximum difference between the angle measured by a single readhead and the true rotation of the encoder as graduated. Application disturbances such as eccentricity are not included.

**System accuracy** is graduation accuracy plus SDE.

Effects such as eccentricity influence installed accuracy; for application advice, please contact your local representative.

## Resolution

**NOTE:** 1 arc second resolution =  $1.296 \times 10^6$  counts per revolution  $\approx 2.778 \times 10^{-4}$  degree resolution.

	Nominal external diameter (line count)	TONiC digital resolution (interpolation factor)					
		5 $\mu\text{m}$ (x4)	1 $\mu\text{m}$ (x20)	0.5 $\mu\text{m}$ (x40)	0.2 $\mu\text{m}$ (x100)	0.1 $\mu\text{m}$ (x200)	50 nm (x400)
Standard outside diameters	52 mm (8 192)	$\approx 39.6''$	$\approx 7.9''$	$\approx 39.6''$	$\approx 1.58''$	$\approx 0.79''$	$\approx 0.4''$
	57 mm (9 000)	$\approx 36''$	$\approx 7.2''$	$\approx 3.6''$	$\approx 1.44''$	$\approx 0.72''$	$\approx 0.36''$
	101 mm (16 000)	$\approx 20.3''$	$\approx 4.1''$	$\approx 2.0''$	$\approx 0.81''$	$\approx 0.4''$	$\approx 0.2''$
	104 mm (16 384)	$\approx 19.8''$	$\approx 3.95''$	$\approx 1.97''$	$\approx 0.79''$	$\approx 0.39''$	$\approx 0.2''$
	115 mm (18 000)	$\approx 18''$	$\approx 3.6''$	$\approx 1.8''$	$\approx 0.72''$	$\approx 0.36''$	$\approx 0.18''$
	153 mm (24 000)	$\approx 13.5''$	$\approx 2.7''$	$\approx 1.35''$	$\approx 0.54''$	$\approx 0.27''$	$\approx 0.13''$
	209 mm (32 768)	$\approx 9.89''$	$\approx 1.98''$	$\approx 0.99''$	$\approx 0.4''$	$\approx 0.2''$	$\approx 0.1''$

	Nominal external diameter (line count)	TONiC digital resolution (interpolation factor)				
		20 nm (x1 000)	10 nm (x2 000)	5 nm (x4 000)	2 nm (x10 000)	1 nm (x20 000)
Standard outside diameters	52 mm (8 192)	$\approx 0.16''$	$\approx 0.08''$	$\approx 0.04''$	$\approx 0.016''$	$\approx 0.008''$
	57 mm (9 000)	$\approx 0.14''$	$\approx 0.072''$	$\approx 0.036''$	$\approx 0.014''$	$\approx 0.007''$
	101 mm (16 000)	$\approx 0.08''$	$\approx 0.04''$	$\approx 0.02''$	$\approx 0.008''$	$\approx 0.004''$
	104 mm (16 384)	$\approx 0.079''$	$\approx 0.039''$	$\approx 0.019''$	$\approx 0.0079''$	$\approx 0.0039''$
	115 mm (18 000)	$\approx 0.07''$	$\approx 0.035''$	$\approx 0.017''$	$\approx 0.007''$	$\approx 0.0035''$
	153 mm (24 000)	$\approx 0.054''$	$\approx 0.027''$	$\approx 0.013''$	$\approx 0.005''$	$\approx 0.0025''$
	209 mm (32 768)	$\approx 0.04''$	$\approx 0.02''$	$\approx 0.01''$	$\approx 0.004''$	$\approx 0.002''$

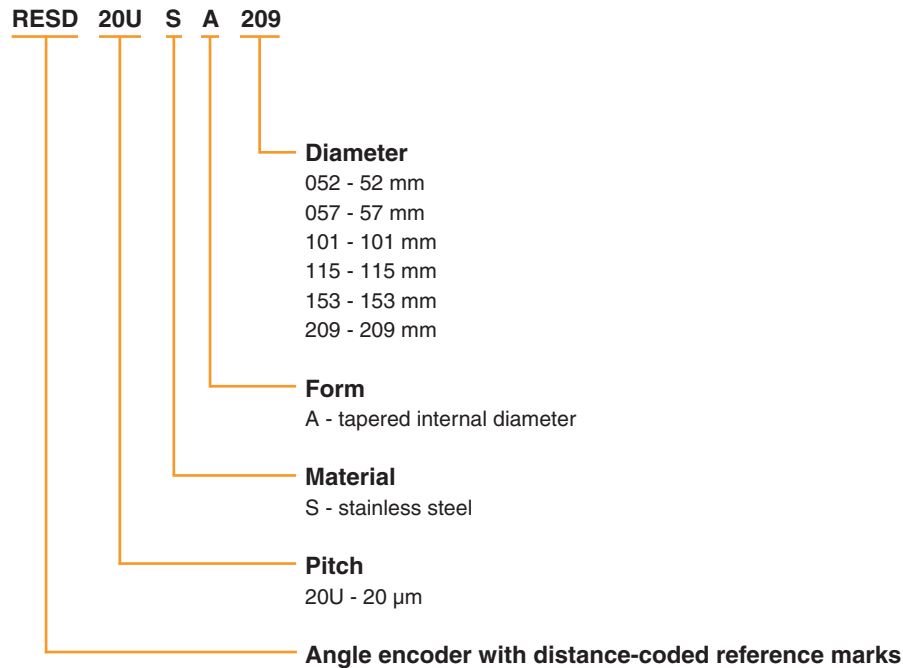
**NOTE:** The symbol " indicates units of arc seconds.

**NOTE:** Numbers preceded with a  $\approx$  symbol show rounded resolution values.

To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} = \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

## Angle encoder part numbers



## RESD compatible readhead

### RESD



**TONIC™ T20x1 RESD**  
Installation guide M-9676-9000

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