

RESOLUTE™ ETR (Extended Temperature Range) absolute encoder



RESOLUTE™ ETR is a true-absolute fine-pitch optical rotary (angle) encoder system, with guaranteed operation down to $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$).

The RESOLUTE encoder system combines 18, 26 or 32 bit resolution with exceptionally high speeds of up to 18 000 rev/min (50 metres/second) and high accuracy stainless steel ring scales.

RESOLUTE encoder systems use a single optical absolute track with a nominal pitch of $30\text{ }\mu\text{m}$, combined with sophisticated optics to ensure wide set-up tolerances and impressive low-noise performance. The detection method also intrinsically provides very low sub-divisional error of $\pm 40\text{ nm}$ and ultra-low noise (jitter) less than 10 nm RMS , resulting in better velocity control performance and rock solid positional stability.

Operation down to $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$) in non-condensing environments is guaranteed, making this product suitable for use in applications such as telescopes, scientific research, military and aerospace. The encoder is also tough enough to survive the physical punishment of harsh environments, with high vibration resistance and solid stainless steel ring scales.

The RESOLUTE encoder system ensures reliability with excellent dirt immunity and a built-in separate position-checking algorithm, which actively checks every reading.

- True-absolute non-contact optical encoder system: no batteries required
- Operates down to $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$) and up to $+80\text{ }^{\circ}\text{C}$ ($+176\text{ }^{\circ}\text{F}$)
- Wide set-up tolerances for quick and easy installation
- High immunity to dirt, scratches and light oils
- Resolutions to 32 bit rotary
- 50 m/s maximum speed for all resolutions (to 18 000 rev/min)
- $\pm 40\text{ nm}$ sub-divisional error for smooth velocity control
- Less than 10 nm RMS jitter for improved positional stability
- Built-in separate position-checking algorithm provides inherent safety
- High shock and vibration resistance
- IP64 sealed readhead for high reliability in harsh environments
- Integral set-up LED enables easy installation and provides diagnostics at a glance
- Integral over-temperature alarm
- BiSS® serial communications for high RFI immunity

Compatible with:

- RESA30 angle encoders
- Ultra-high accuracy REXA30 angle encoders
- Optional Advanced Diagnostic Tool ADTa-100

System features



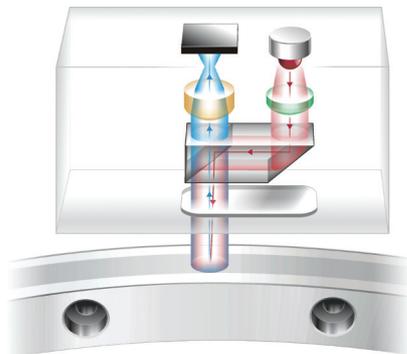
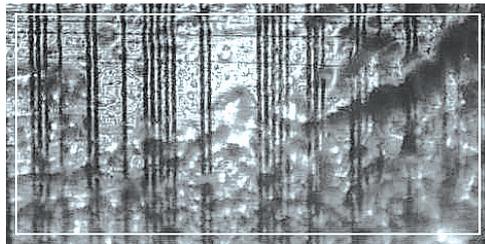
Unique single-track absolute optical scale

- ▶ Absolute position is determined immediately upon switch-on
- ▶ No battery back-up
- ▶ No yaw de-phasing unlike multiple-track systems
- ▶ Fine pitch (30 µm nominal period) optical scale for superior motion control compared to inductive, magnetic or other non-contact optical absolute encoders
- ▶ High-accuracy graduations marked directly onto tough engineering materials for outstanding metrology and reliability



High dirt immunity

- ▶ Advanced optics and embedded surplus code means the RESOLUTE encoder system even reads dirty scale
- ▶ Absolute position can be determined in all three cases shown here; clean scale (left), grease contamination (below-left), particle contamination (below)



Unique detection method

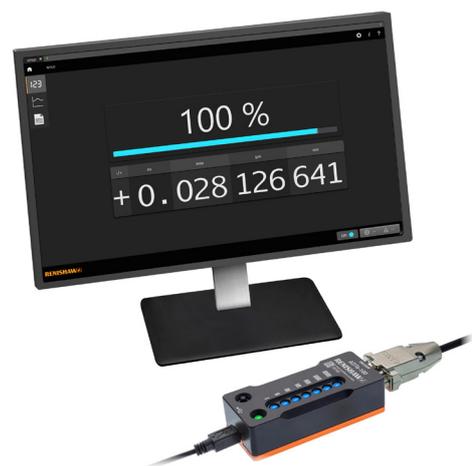
- ▶ Readhead acts like an ultra-fast miniature digital camera, taking photos of a coded scale
- ▶ Photos are analysed by a high-speed digital signal processor (DSP) to determine absolute position
- ▶ Built-in position-check algorithm constantly monitors calculations for ultimate safety and reliability
- ▶ Advanced optics and position determination algorithms are designed to provide low noise (jitter < 10 nm RMS) and low sub-divisional error (SDE ±40 nm)

Optional Advanced Diagnostic Tool

The RESOLUTE encoder system is compatible with the Advanced Diagnostic Tool ADTa-100* and ADT View software, which acquire detailed real-time data from the readhead to allow easy set-up, optimisation and in-field fault finding.

The intuitive software interface provides:

- ▶ Digital readout of encoder position and signal strength
- ▶ Graph of signal strength over the entire axis travel
- ▶ Ability to set a new zero position for the encoder system
- ▶ System configuration information



* ADTa-100 compatible readheads are marked with the symbol **ADT**

Angle absolute encoder version

Resolution

RESOLUTE encoders are available with a variety of resolutions, to meet the needs of a wide range of applications.

The choice of resolutions depends on the serial protocol being used, but there are no limitations due to ring size; for example BiSS 26 bit resolution is available on all ring sizes.

RESOLUTE ETR encoders with BiSS C serial comms are available with the following resolution options:

Resolution	Counts per revolution	Arc second
18 bit	262 144	≈ 4.94
26 bit	67 108 864	≈ 0.019
32 bit	4 294 967 296	≈ 0.00030

NOTE: 32 bit resolution is below the noise floor of the RESOLUTE encoder.

Speed and accuracy

RESA30 diameter (mm)	Maximum reading speed (rev/min)	Typical installed accuracy (arc second)*
52	18 000	±12.7
57	18 000	±11.8
75	12 500	±9.5
100	9 500	±7.5
103	9 250	±7.4
104	9 000	±7.3
115	8 250	±6.8
150	6 000	±5.5
200	4 750	±4.3
206	4 600	±4.2
209	4 500	±4.2
229	4 150	±3.9
255	3 700	±3.6
300	3 150	±3.1
350	2 700	±2.8
413	2 300	±2.4
417	2 250	±2.4
489	1 950	±2.1
550	1 700	±1.9

For REXA30 speed and accuracy figures, refer to the *REXA30 ultra-high accuracy absolute angle encoder* data sheet (Renishaw part no. L-9517-9405).

* 'Typical' installations are a result of graduation and installation errors combining and, to some magnitude, cancelling.

Rotary scale specifications

For more detailed scale information, refer to the relevant scale data sheet.

Material	303/304 stainless steel
Coefficient of thermal expansion (at 20 °C)	15 ±0.5 µm/m/°C

General specifications

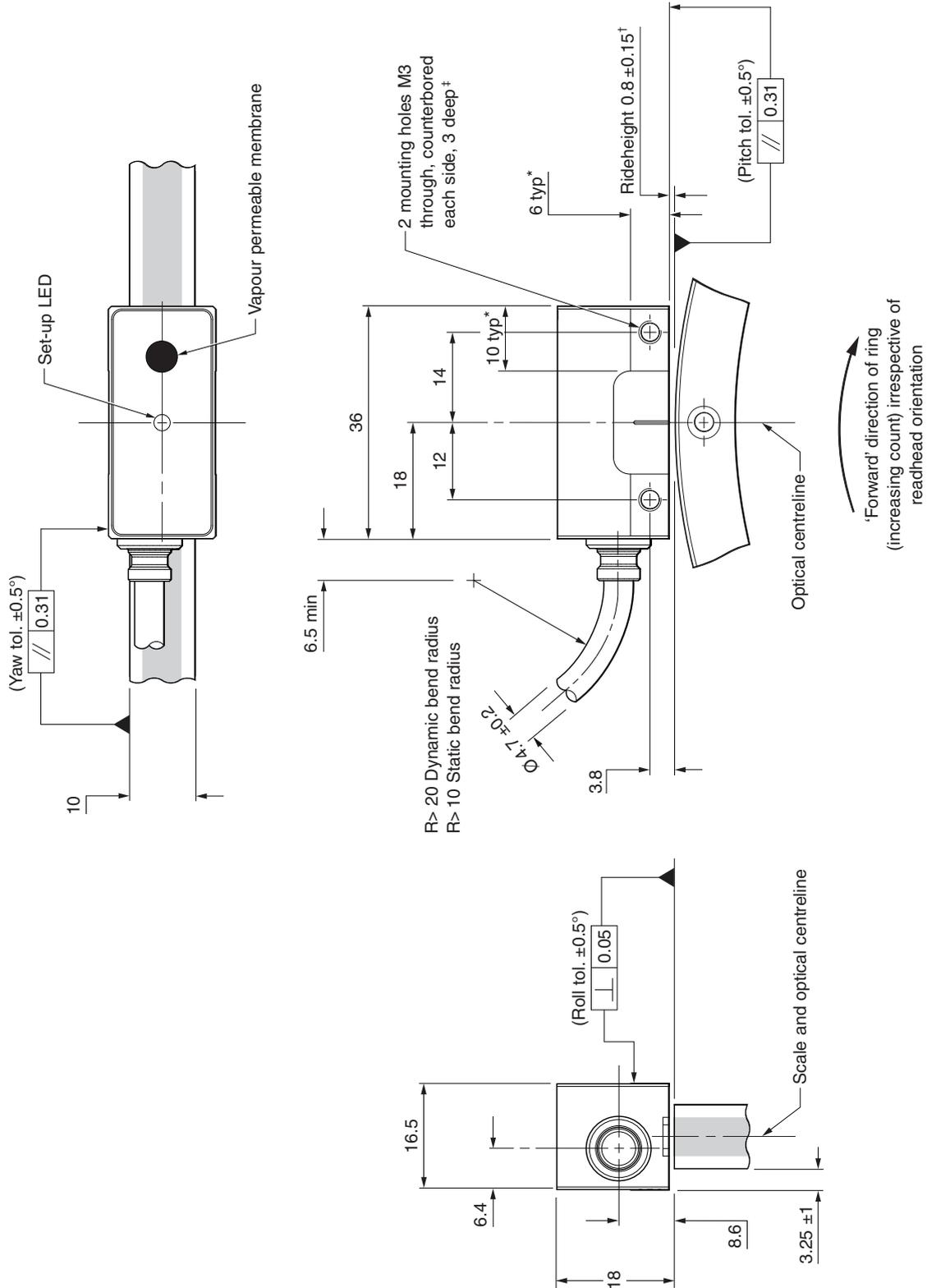
Power supply	5 V ±10%	1.25 W maximum (250 mA @ 5 V)
		NOTE: Current consumption figures refer to terminated RESOLUTE systems. Renishaw encoder systems must be powered from a 5 Vdc supply complying with the requirements for SELV of standard IEC 60950-1.
	Ripple	200 mVpp maximum @ frequency up to 500 kHz maximum
Temperature	Storage	-40 °C to +80 °C
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing		IP64
Acceleration (readhead)	Operating	
	(-40 °C to 0 °C)	300 m/s ² , 3 axes
	(0 °C to 80 °C)	500 m/s ² , 3 axes
Shock (readhead)	Non-operating	1000 m/s ² , 6 ms, ½ sine, 3 axes
Maximum acceleration of scale with respect to readhead		2000 m/s ² NOTE: This is the worst-case figure that is correct for the slowest communications request rates. For faster request rates, the maximum acceleration of scale with respect to the readhead can be higher. For more details, contact your local Renishaw representative.
Vibration	Operating	300 m/s ² max @ 55 Hz to 2000 Hz, 3 axes Random vibration 0.175 g ² /Hz ASD 20-1000 Hz, -6dB roll off 1-2 kHz
Mass	Readhead	18 g
	Cable	32 g/m
Cable		7 core, tinned and annealed copper, 28 AWG
		Single-shielded, outside diameter 4.7 ±0.2 mm
		Flex life > 40 × 10 ⁶ cycles at 20 mm bend radius
		NOTE: Cable must be held static for operation below 0 °C UL recognised component 
Communication format		RS485/RS422 differential line-driven signal

NOTE: If using RESA30, the hub should be made of a material with a CTE of between 14 and 18 µm/m/°C. If using REXA30, contact your local Renishaw representative. Further environmental testing has been carried out. Contact Renishaw if you have specific requirements.

RESOLUTE readhead installation drawing (on RESA30 ring)



Dimensions and tolerances in mm



* Extent of mounting faces

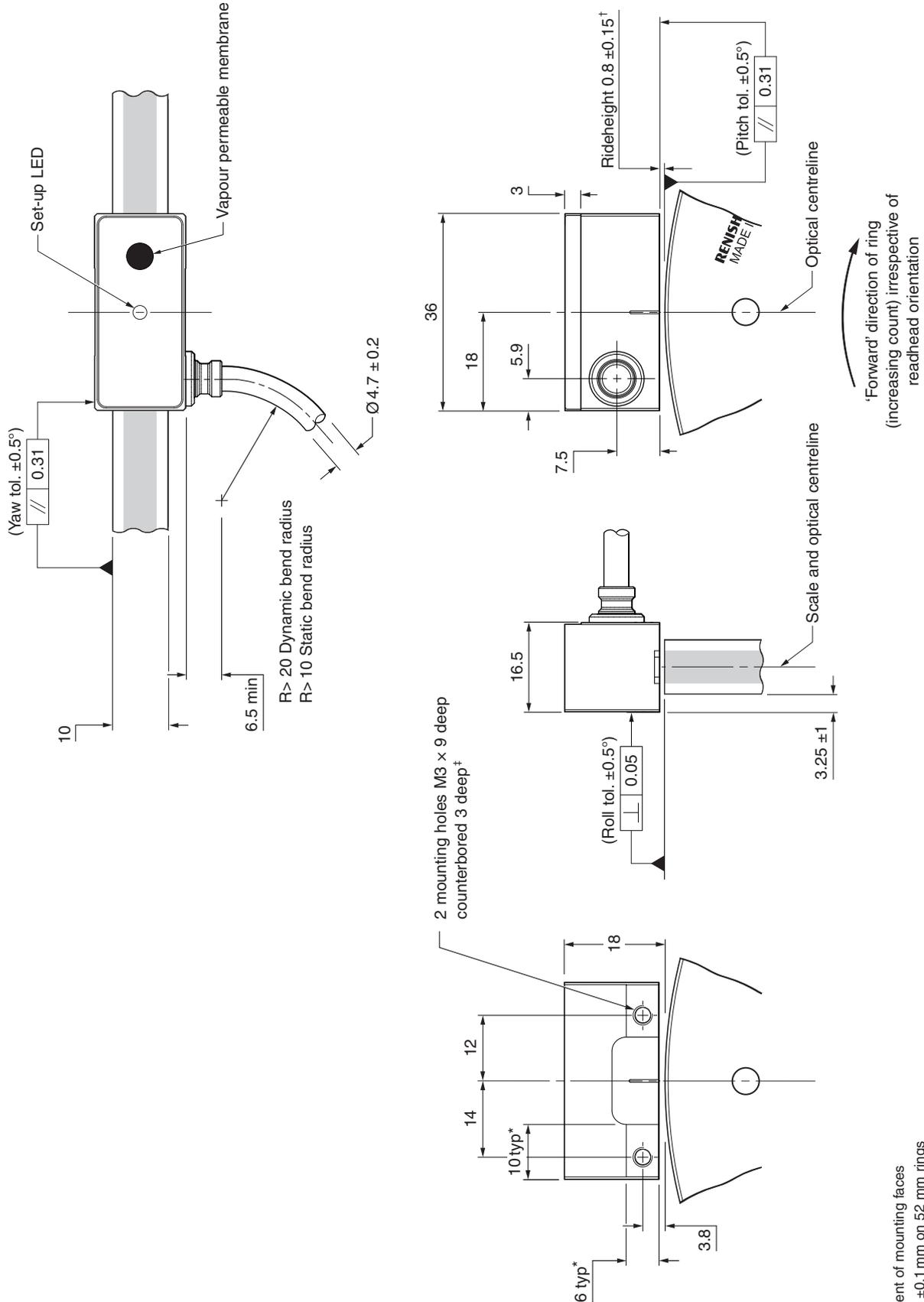
† 0.8 ± 0.1 mm on 52 mm rings

‡ Recommended thread engagement 5 mm (8 mm including counterbore). Recommended tightening torque 0.5 to 0.7 Nm

RESOLUTE readhead side exit cable installation drawing (on REXA30 ring)



Dimensions and tolerances in mm



* Extent of mounting faces

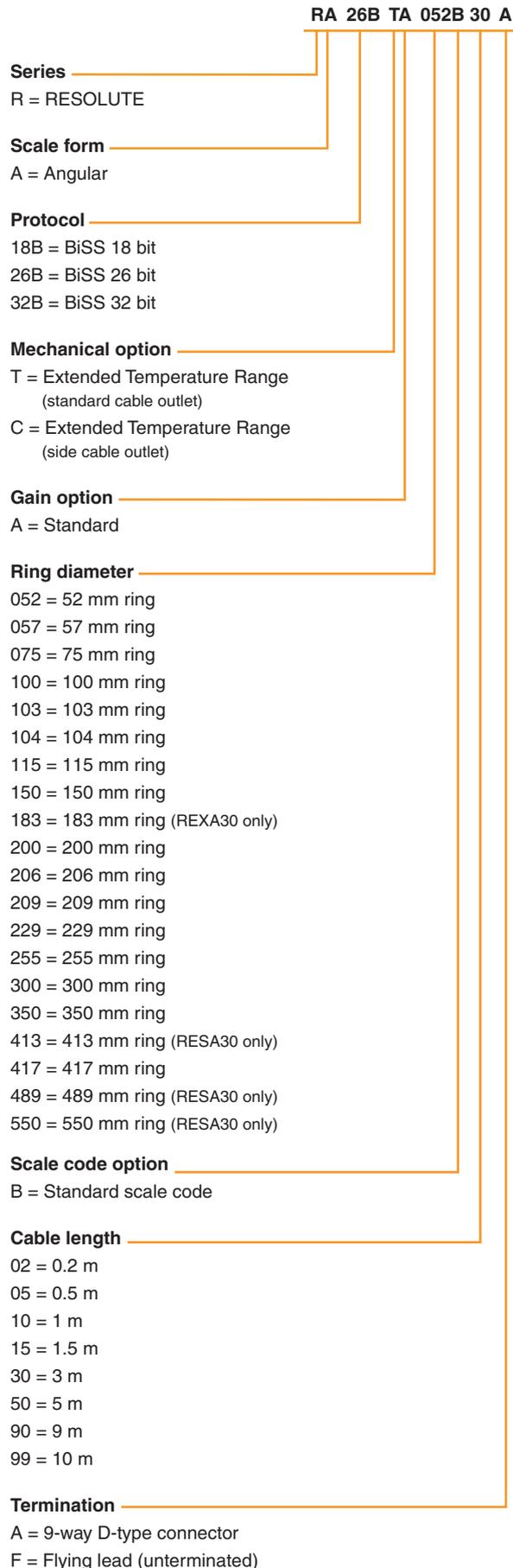
† 0.8 ± 0.1 mm on 52 mm rings

‡ Recommended thread engagement 5 mm (8 mm including counterbore). Recommended tightening torque 0.5 to 0.7 Nm

Data sheet

RESOLUTE ETR (Extended Temperature Range) absolute encoder

RESOLUTE angle readhead nomenclature

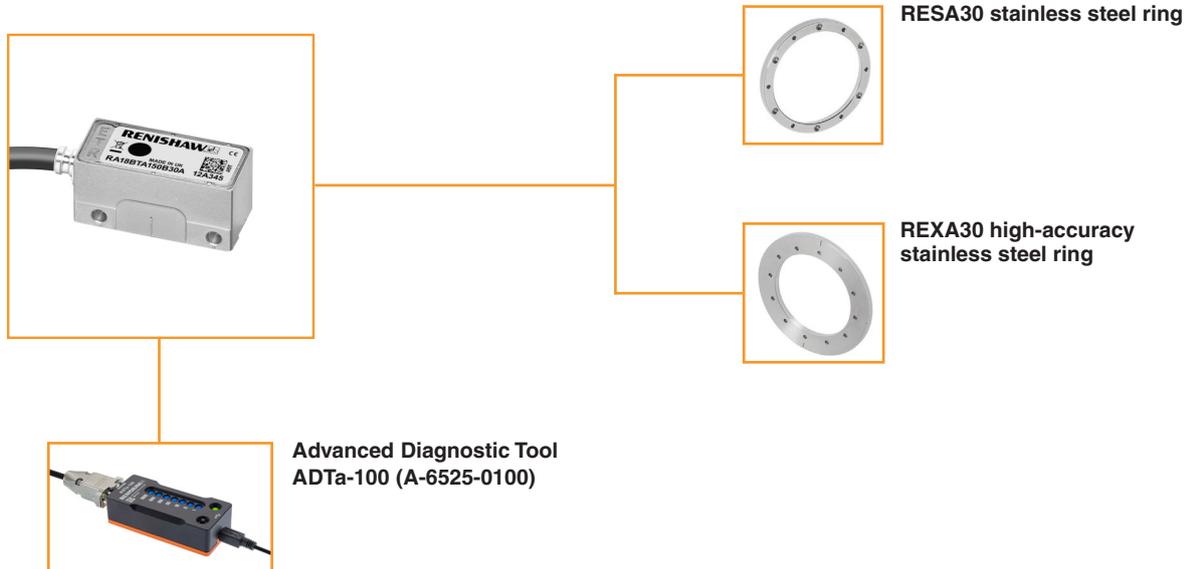


NOTES:

- ▶ Not all combinations are valid. Check valid options online at www.renishaw.com/epc
- ▶ Contact your local Renishaw representative if you have specific ETR requirements.

RESOLUTE ETR series compatible products

Linear scales are not available with RESOLUTE Extended Temperature Range



Lid orientation in photos is for illustration purposes only.

For more information about the ADTa-100 and the scale, refer to the relevant data sheets and installation guides which can be downloaded from www.renishaw.com/opticalencoders.

For worldwide contact details, visit www.renishaw.com/contact

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