

RESOLUTE™ absolute optical encoder with BiSS® serial communications



RESOLUTE™ is a true-absolute fine-pitch optical encoder system with excellent metrology performance.

Patented RESOLUTE encoder technology combines 1 nm resolution with exceptionally high speed, up to 100 m/s (36 000 rev/min), reading from a range of high-accuracy linear tape and spar scales or angle encoder rings.

RESOLUTE encoder systems use a single optical absolute track with a nominal pitch of 30 µm, combined with sophisticated optics. This ensures wide set-up tolerances, very low sub-divisional error of ±40 nm and ultra-low noise (jitter) of less than 10 nm RMS, resulting in better velocity control performance and rock solid positional stability.

The RESOLUTE system ensures reliability with excellent dirt immunity, built-in separate position-checking algorithm and IP64 sealed readhead with wipe-clean recovery.

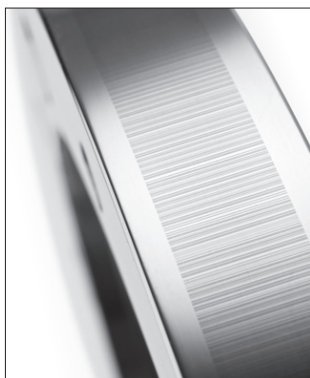
RESOLUTE encoders are available with a variety of serial protocols. Contact your local Renishaw representative for details.

- True-absolute non-contact optical encoder system: no batteries required
- Wide set-up tolerances for quick and easy installation
- High immunity to dirt, scratches and light oils
- Resolutions to 1 nm linear or 32 bit rotary
- 100 m/s maximum speed for all resolutions (to 36 000 rev/min)
- ±40 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
- IP64 sealed readhead for high reliability in harsh environments
- Integral set-up LED enables easy installation and provides diagnostics at a glance
- Operates up to 80 °C
- Integral over-temperature alarm

Compatible with:

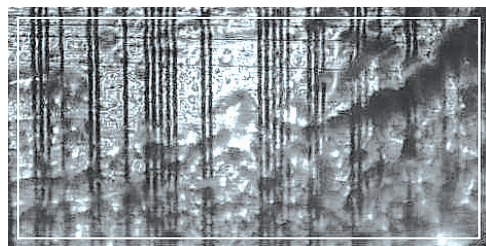
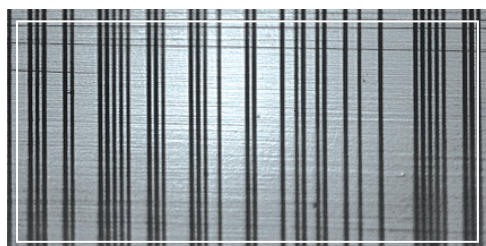
- RELA30 low-expansion, high-stability spar scales
- RSLA30 stainless steel spars
- RTLA30 with *FASTRACK*™ carrier
- RTLA30-S self-adhesive tape scale
- RESA30 angle encoders
- Ultra-high accuracy REXA30 angle encoders
- Optional Advanced Diagnostic Tool ADTa-100

System features



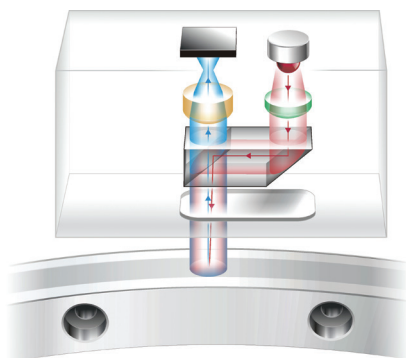
Unique single-track absolute optical scale

- ▶ 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

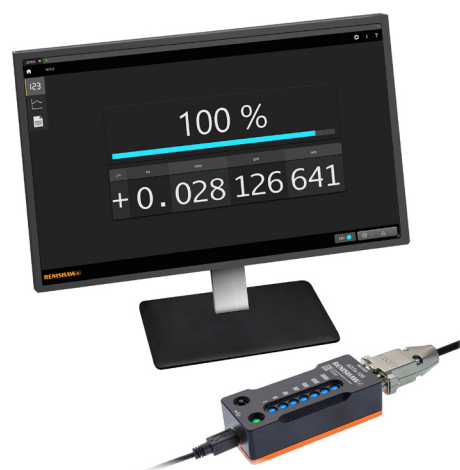
- ▶ Readhead acts like an ultra-fast miniature digital camera, taking photos of a coded scale
- ▶ Photos are analysed by a high-speed digital signal processor (DSP) to determine absolute position
- ▶ Built-in position-check algorithm constantly monitors calculations for ultimate safety and reliability
- ▶ 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**

Linear absolute encoder version

Resolutions and scale lengths

The maximum scale length is determined by the readhead resolution and the number of position bits in the serial word. For RESOLUTE readheads with fine resolution and short word length, the maximum scale length will be limited accordingly. Conversely, coarser resolutions or longer word lengths enable the use of longer scale lengths.

RESOLUTE encoders are available with a variety of serial protocols. The table shows a RESOLUTE system using BiSS C (uni-directional) protocol with three options for the position word length; 36 bit, 32 bit and 26 bit.

The 36 bit and 32 bit position words facilitate longer lengths that can be a significant benefit, especially at fine resolutions.

Resolution	1 nm	5 nm	50 nm
Maximum scale length (L) with 36 bit position word	21 m	21 m	21 m
Maximum scale length (L) with 32 bit position word	4.295 m	21 m	21 m
Maximum scale length (L) with 26 bit position word	67 mm	336 mm	3.355 m
Maximum reading speed	100 m/s	100 m/s	100 m/s

Contact your local Renishaw representative for details of other serial protocols.

Linear scale specifications

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

Description	RELA30	High-performance low-expansion spar scale for very high-accuracy applications. Lengths up to 1.5 m
	RSLA30	High-performance stainless steel spar scale for very high-accuracy applications with longer axis lengths. Lengths up to 5 m
	RTLA30/ <i>FASTRACK</i>	Track-mounted hardened stainless steel tape scale for high-performance motion control systems requiring easier and faster scale installation and field replacement. RTLA30 lengths up to 21 m <i>FASTRACK</i> lengths up to 25 m
	RTLA30-S	Self-adhesive hardened stainless steel tape scale for high-performance motion control systems requiring simple installation. Lengths up to 21 m
Accuracy (at 20 °C)	RELA30	±1 µm up to 1 m ±1 µm/m for lengths from 1 m to 1.5 m
	RSLA30	±1.5 µm up to 1 m ±2.25 µm for lengths from 1 m to 2 m ±3 µm for lengths from 2 m to 3 m ±4 µm for lengths from 3 m to 5 m
	RTLA30/ <i>FASTRACK</i>	±5 µm/m
	RTLA30-S	±5 µm/m
Coefficient of thermal expansion (at 20 °C)	RELA30	0.75 ±0.35 µm/m/°C
	RSLA30	10.1 ±0.2 µm/m/°C
	RTLA30/ <i>FASTRACK</i>	10.1 ±0.2 µm/m/°C
	RTLA30-S	10.1 ±0.2 µm/m/°C

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 encoders with BiSS 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.

For resolution options on other protocols, contact your local Renishaw representative.

Speed and accuracy

RESA30 diameter (mm)	Maximum reading speed (rev/min)	System accuracy (arc second)
52	36 000	±5.49
57	33 000	±4.89
75	25 000	±3.82
100	19 000	±2.86
103	18 500	±2.72
104	18 000	±2.69
115	16 500	±2.44
150	12 000	±1.91
200	9 500	±1.43
206	9 200	±1.42
209	9 000	±1.4
229	8 300	±1.27
255	7 400	±1.11
300	6 300	±0.95
350	5 400	±0.82
413	4 600	±0.69
417	4 500	±0.68
489	3 900	±0.59
550	3 400	±0.52

System accuracy is graduation accuracy plus SDE. Effects such as eccentricity influence installed accuracy; for application advice, contact your local Renishaw representative.

CAUTION: Very high speed motion axes require additional design consideration. For applications that will exceed 50% of the rated maximum reading speed of the ring, contact your local Renishaw representative.


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

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 (angle and linear)

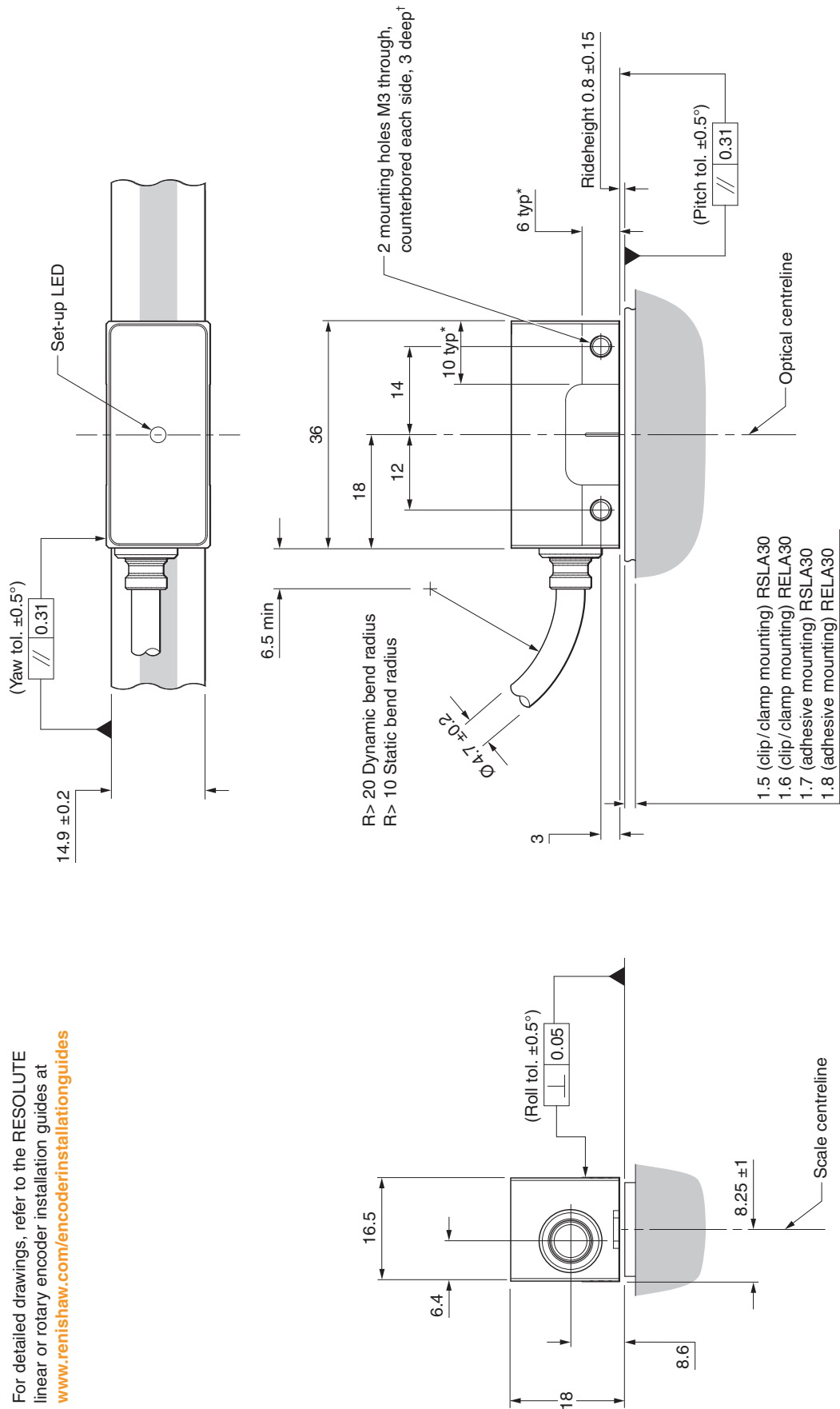
Power supply	5 V ±10%	1.25 W maximum (250 mA @ 5 V)
		NOTE: Current consumption figures refer to terminated RESOLUTE systems. Renishaw encoder systems must be powered from a 5 Vdc supply complying with the requirements for SELV of standard IEC 60950-1.
	Ripple	200 mVpp maximum @ frequency up to 500 kHz maximum
Temperature	Storage	-20 °C to +80 °C
	Operating	0 °C to +80 °C
		For extended temperature range, see the <i>RESOLUTE ETR (Extended Temperature Range) absolute encoder</i> data sheet (Renishaw part no. L-9517-9420)
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing		IP64
Acceleration (readhead)	Operating	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
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
		UL recognised component 
Communication format		RS485/RS422 differential line-driven signal

NOTE: For Vacuum and Extended Temperature Range (ETR) specifications refer to the relevant data sheets.

RESOLUTE readhead installation drawing (on RSLA30/RELA30 scale)



Dimensions and tolerances in mm



For detailed drawings, refer to the RESOLUTE linear or rotary encoder installation guides at www.renishaw.com/encoderinstallationguides

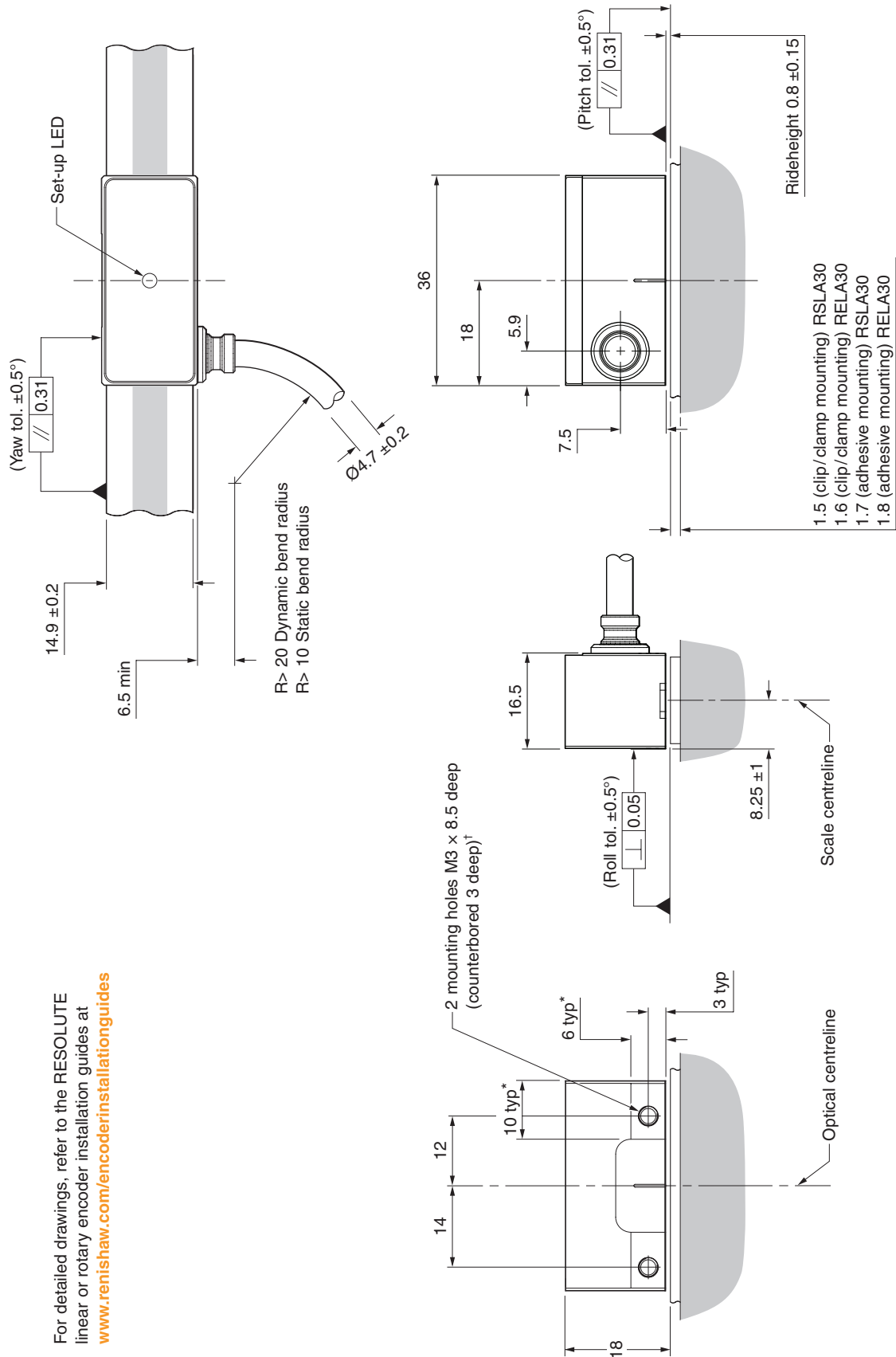
* Extent of mounting faces.

† Thread depth from mounting face. Recommended thread engagement 5 mm (8 including counterbore). Recommended tightening torque 0.5 to 0.7 Nm.

RESOLUTE readhead side exit cable installation drawing (on RSLA30/RELA30 scale)



Dimensions and tolerances in mm

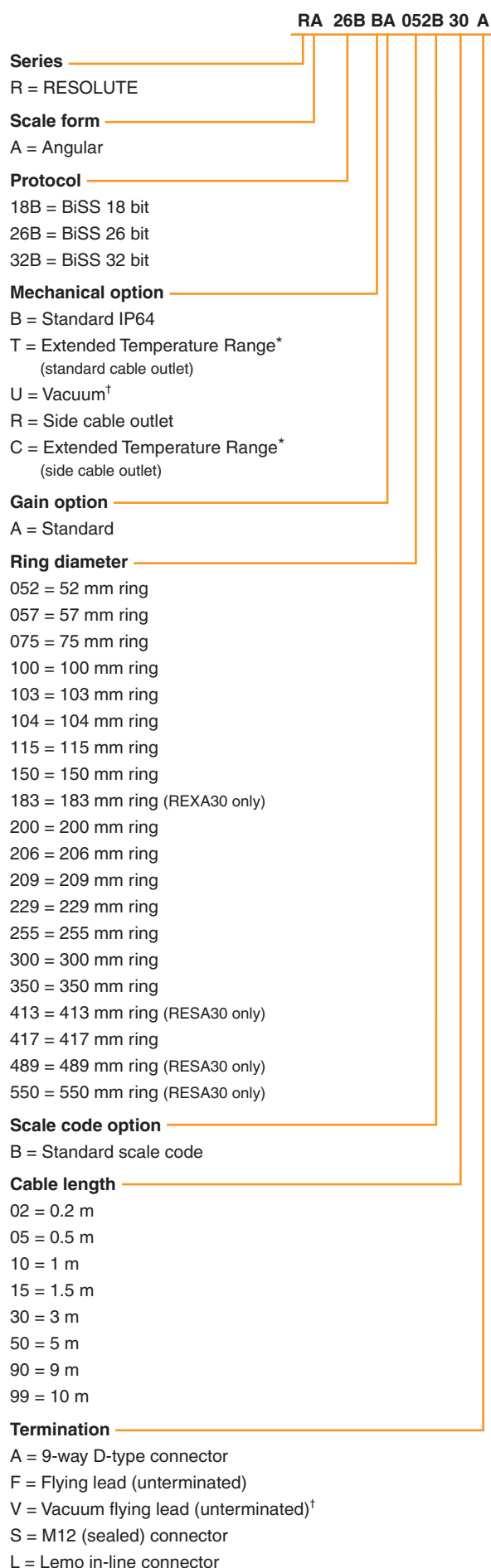


For detailed drawings, refer to the RESOLUTE linear or rotary encoder installation guides at www.renishaw.com/encoderinstallationguides

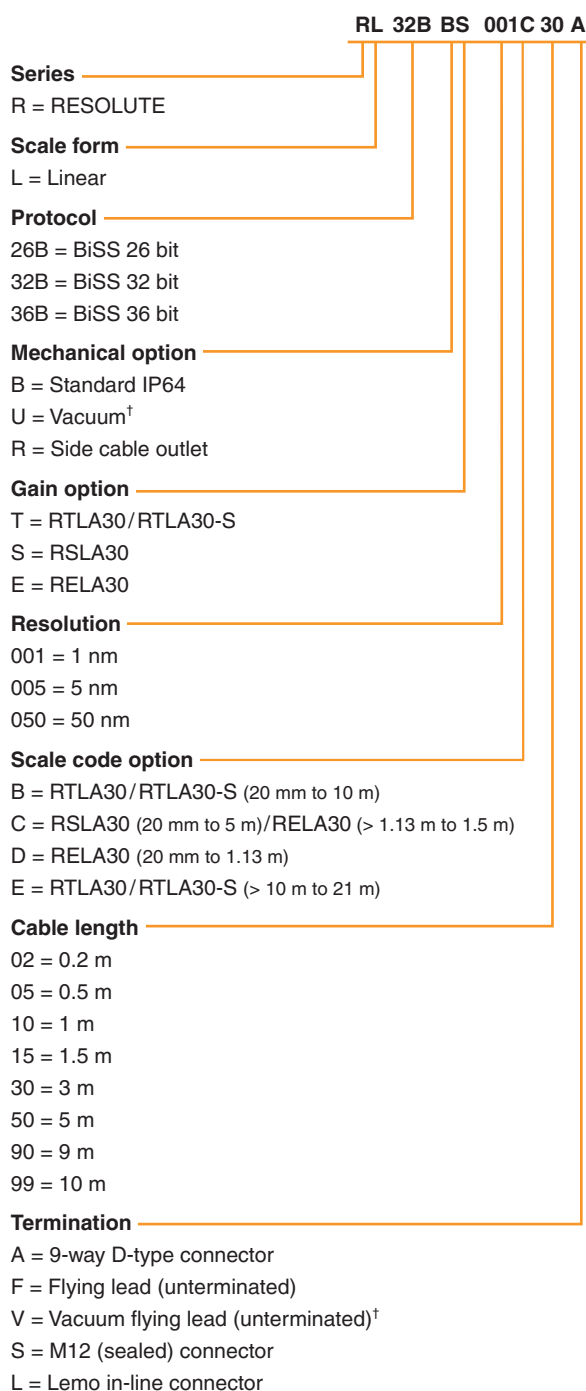
* Extent of mounting faces.

† Thread depth from mounting face. Recommended thread engagement 5 mm (8 including counterbore). Recommended tightening torque 0.5 to 0.7 Nm.

RESOLUTE angle readhead nomenclature



RESOLUTE linear readhead nomenclature

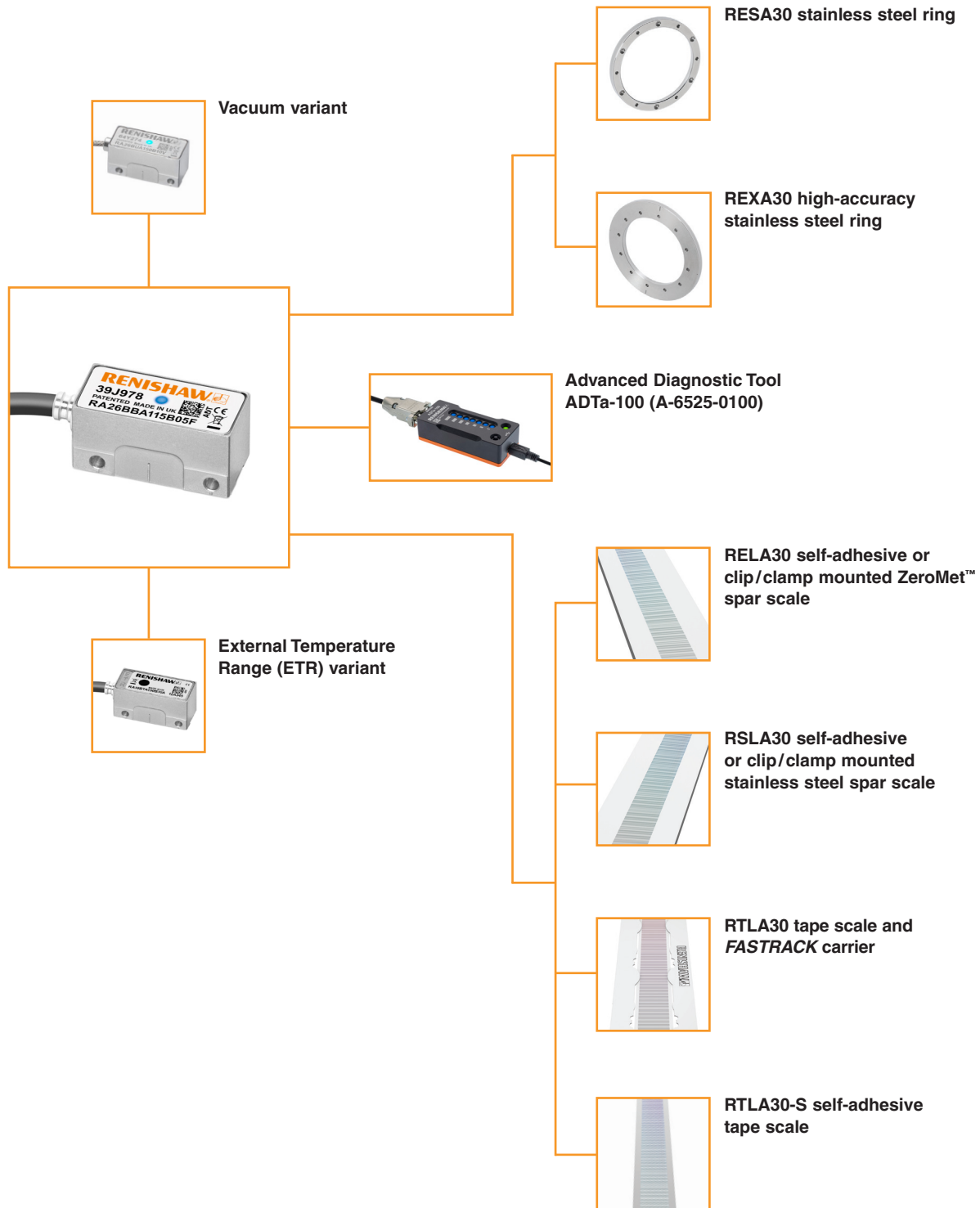


* For additional information on the Extended Temperature Range variant, refer to the *RESOLUTE™ ETR (Extended Temperature Range) absolute encoder* data sheet (Renishaw part no. L-9517-9420).

† For additional information on the Vacuum variant, refer to the *RESOLUTE™ UHV absolute optical encoder* data sheet (Renishaw part no. L-9517-9530).

NOTE: Not all combinations are valid. Check valid options online at www.renishaw.com/epc

RESOLUTE series compatible products:



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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