

RESOLUTE™ ETR (Extended Temperature Range) absolute encoder



RESOLUTE ETR is a revolutionary new true absolute, fine pitch optical angle encoder system, with excellent dirt immunity, wide set-up tolerances, fine resolution and now with guaranteed operation down to $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$).

RESOLUTE 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 uses a unique single optical absolute track (a world first) of $30\text{ }\mu\text{m}$ pitch, 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.

Reliability is assured by **RESOLUTE**'s excellent dirt immunity and built-in separate position-checking algorithm, which actively checks every reading.

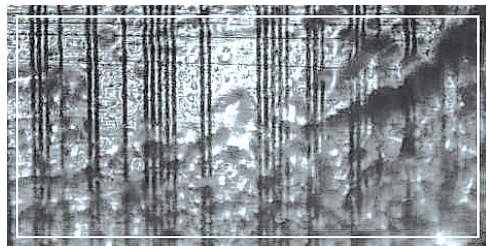
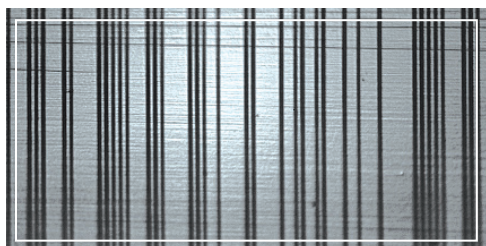
- True absolute non-contact optical encoder system: no batteries required
- Operates down to $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$) and up to $+80\text{ }^{\circ}\text{C}$ ($+176\text{ }^{\circ}\text{F}$)
- Wide set-up tolerances for quick and easy installation
- High immunity to dirt, light oils and scratches
- Resolutions of 18, 26 or 32 bit
- 50 m/s maximum speed for all resolutions (to 18 000 rev/min)
- $30\text{ }\mu\text{m}$ scale pitch ensures exceptional motion control performance
- $\pm 40\text{ nm}$ 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
- Solid stainless steel ring scales
- IP64 sealed readhead for high reliability in harsh environments
- Integral set-up LED enables easy installation and provides diagnostics at a glance
- Readhead and rings are bolt-hole compatible with **SIGNUM™** encoders
- Integral over-temperature alarm
- **BiSS®** pure serial communications for high RFI immunity

System features



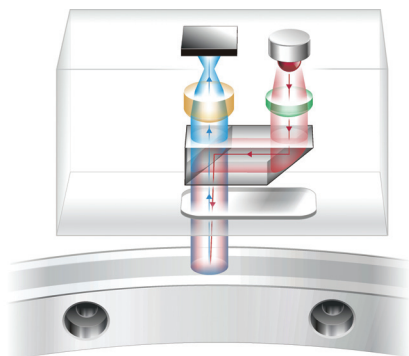
Unique single track absolute optical scale

- ▶ Absolute position is determined immediately upon switch-on
- ▶ No battery back-up
- ▶ No yaw de-phasing, unlike dual-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 stainless steel for outstanding metrology and reliability



High dirt immunity

- ▶ Advanced optics and embedded surplus code means RESOLUTE 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 DSP to determine absolute position
- ▶ Built-in position-check algorithm constantly monitors calculations for ultimate safety and reliability
- ▶ Advanced optics and determination algorithms are designed to provide low noise (jitter <math>< 10 \text{ nm RMS}</math>) and low sub-divisional error (SDE $\pm 40 \text{ nm}</math>)$

Range of rotary (angle) scales

- ▶ RESA ring with unique taper mount has large through hole for easy installation
- ▶ REXA ultra-high accuracy ring with ± 1 arc second total installed accuracy with dual readheads



Absolute angle encoder specifications

Resolution

RESOLUTE ETR is available with a variety of resolutions, to meet the needs of a wide range of applications. There are no limitations due to ring size, eg, 32 bit resolution is available on all ring sizes.

BiSS RESOLUTE ETR resolution options:

18 bit (262 144 counts per revolution, \approx 4.94 arc second)

26 bit (67 108 864 counts per revolution, \approx 0.019 arc second)

32 bit (4 294 967 296 counts per revolution, \approx 0.00030 arc second)


Note that 32 bit resolution is below the noise floor of the RESOLUTE encoder.

Speed and accuracy

| RESA diameter (mm) | Maximum reading speed (rev/min) | System accuracy (arc second) |
|--------------------|---------------------------------|------------------------------|
| 52 | 18 000 | \pm 5.49 |
| 57 | 18 000 | \pm 4.89 |
| 75 | 12 500 | \pm 3.82 |
| 100 | 9 500 | \pm 2.86 |
| 103 | 9 250 | \pm 2.72 |
| 104 | 9 000 | \pm 2.69 |
| 115 | 8 250 | \pm 2.44 |
| 150 | 6 000 | \pm 1.91 |
| 200 | 4 750 | \pm 1.43 |
| 206 | 4 600 | \pm 1.42 |
| 209 | 4 500 | \pm 1.4 |
| 229 | 4 150 | \pm 1.27 |
| 255 | 3 700 | \pm 1.11 |
| 300 | 3 150 | \pm 0.95 |
| 350 | 2 700 | \pm 0.82 |
| 413 | 2 300 | \pm 0.69 |
| 417 | 2 250 | \pm 0.68 |
| 489 | 1 950 | \pm 0.59 |
| 550 | 1 700 | \pm 0.52 |

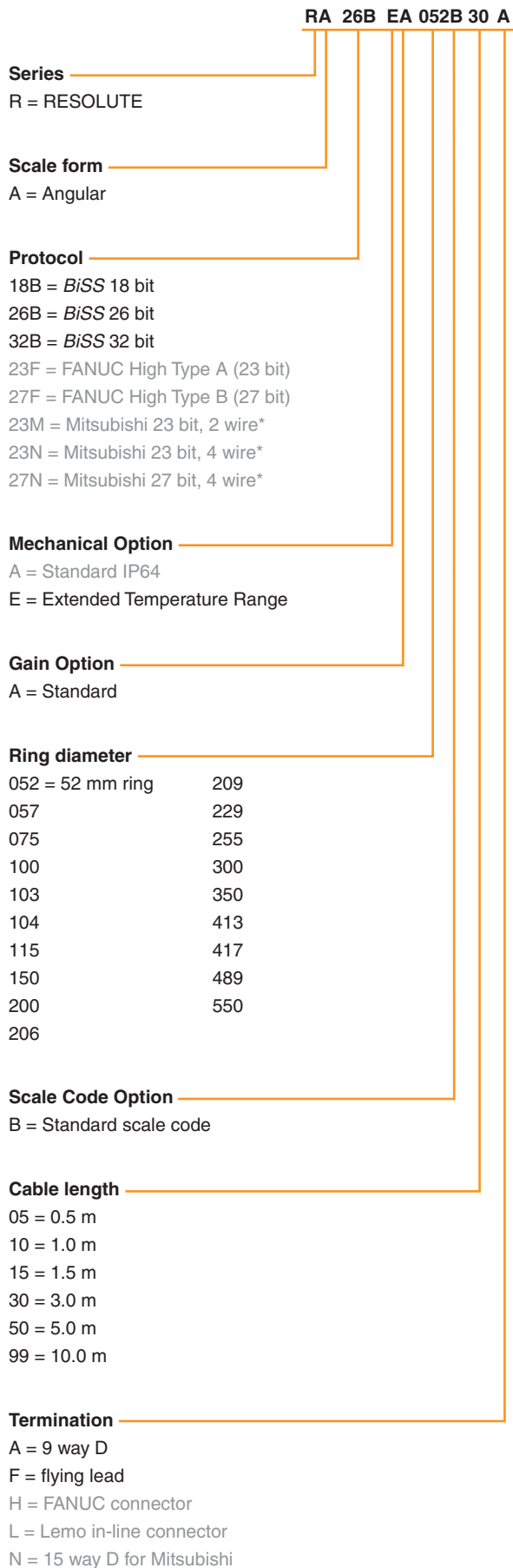
System accuracy is graduation accuracy plus SDE. Effects such as eccentricity influence installed accuracy; for application advice, please contact your local representative.

General specifications

| | | |
|---|---------------|---|
| Power supply | 5 V \pm 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 V dc supply complying with the requirements for SELV of standard EN (IEC) 60950. |
| | Ripple | 200 mVpp maximum @ frequency up to 500 kHz maximum |
| Temperature | | -40 °C to +80 °C |
| Humidity | Storage | 0 °C to 60 °C 95% maximum relative humidity decreasing linearly to 40% at 80 °C |
| | Operating | 0 °C to 60 °C 95% maximum relative humidity decreasing linearly to 40% at 80 °C |
| Sealing | | IP64 |
| Acceleration (Readhead) | Operating | 500 m/s ² BS EN 60068-2-7:1993 (IEC 68-2-7:1983) |
| Maximum acceleration of scale with respect to readhead | | BiSS - 2000 m/s ² NOTE: This is the worst case figure that is correct for the slowest communications clock rates. For faster clock rates, the maximum acceleration of scale with respect to the readhead can be higher. For more details, please contact your local representative. |
| Vibration | Operating | 300 m/s ² max @ 55 Hz to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995) 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 |
| EMC compliance | | BS EN 61326-1: 2006 |
| Cable | | Double-shielded, outside diameter 4.7 \pm 0.2 mm maximum Flex life >20 x 10 ⁶ cycles at 20 mm bend radius (tested at 20 °C) NOTE: Cable must be held static for operation below 0 °C UL recognised component  |

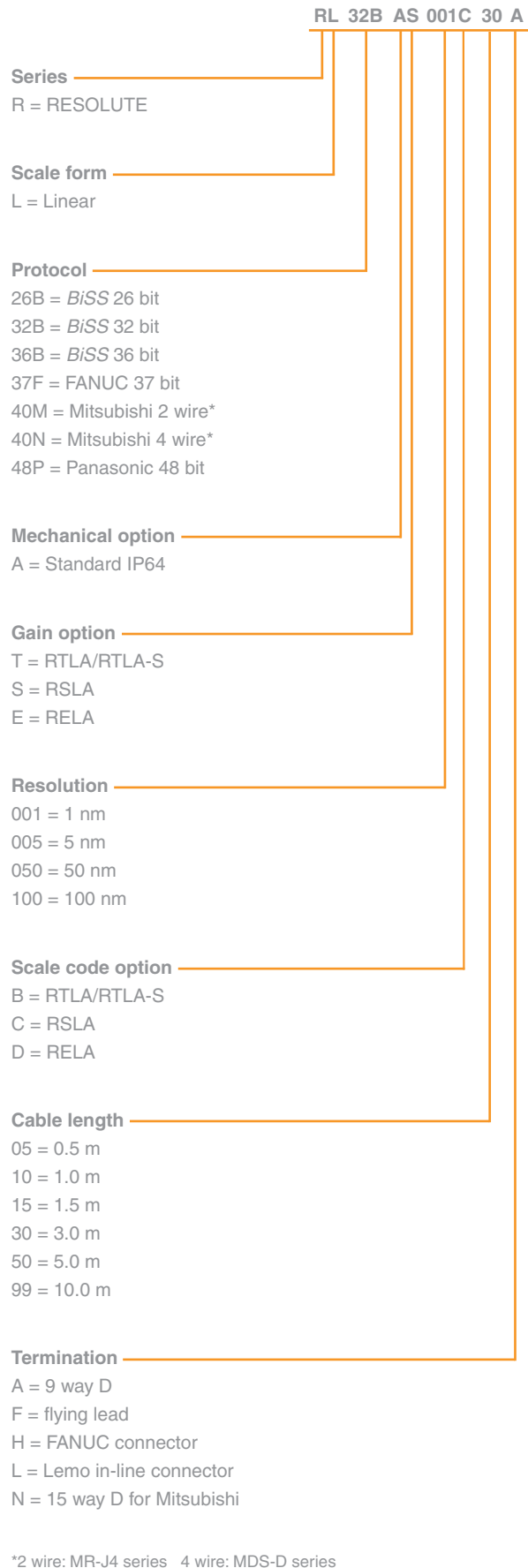
NOTE: For RESA the hub should be made of a material with a CTE of between 15 and 19 μ m/m/°C. If using REXA please contact your local Renishaw representative. Further environmental testing has been carried out. Please contact Renishaw if you have specific requirements.

RESOLUTE angle nomenclature



Greyed-out options not available with this variant

RESOLUTE linear nomenclature



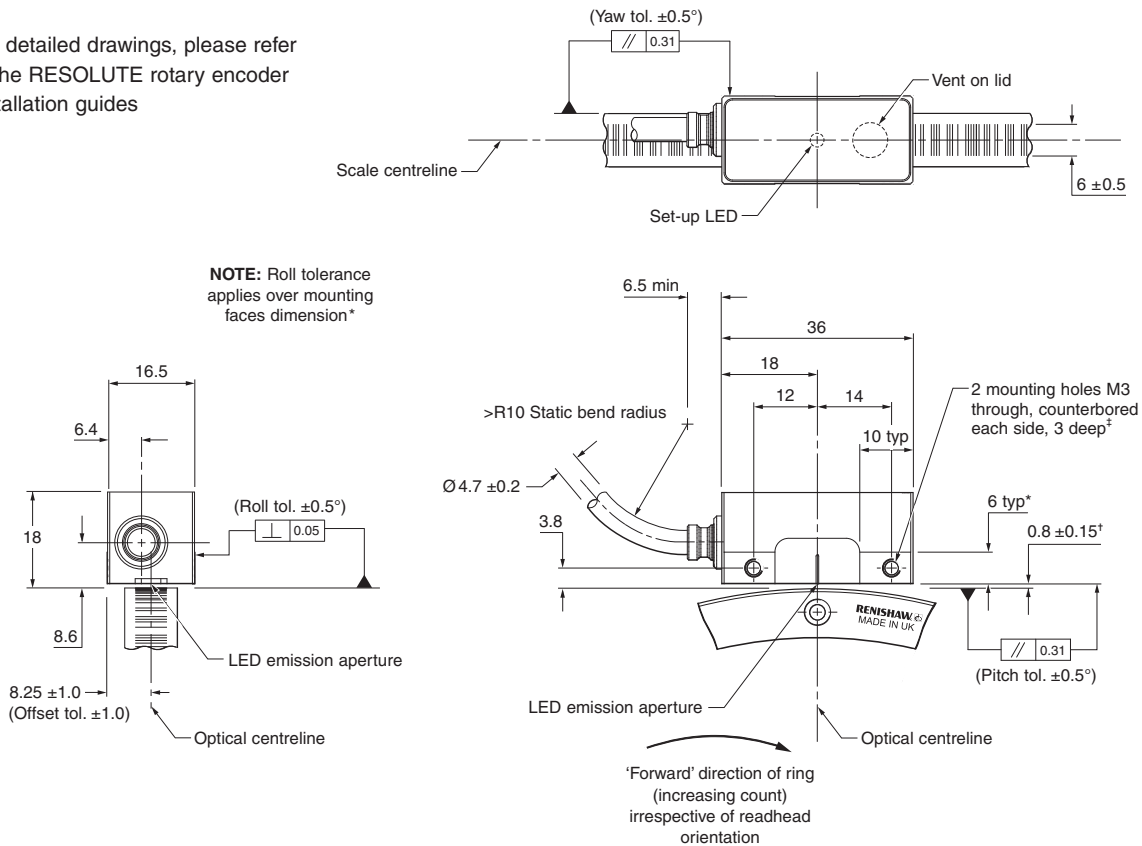
Contact your local Renishaw representative if you have specific requirements

RESOLUTE installation drawing (on RESA scale)

Dimensions and tolerances in mm



For detailed drawings, please refer to the RESOLUTE rotary encoder installation guides



*0.1 mm on 52 mm rings.

†Recommended thread engagement 5 mm (8 mm including counterbore). Recommended tightening torque 0.5 to 1.0 Nm.

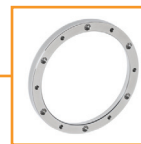
For more information on installation and mounting options please refer to the RESOLUTE RESA or RESOLUTE REXA Installation guides. These can be downloaded from our website www.renishaw.com/encoder or contact your local representative.

RESOLUTE ETR compatible products:

Linear scales are not available with RESOLUTE Extended Temperature Range



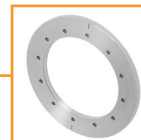
RESA



Installation guide M-9553-9140

Data sheet L-9517-9399

REXA



Installation guide M-9553-9411

Data sheet L-9517-9405

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