The QUANTiC™ encoder series provides robust incremental position measurement for linear, partial arc and rotary systems with excellent metrology and wide installation tolerances. This reduces or eliminates the need for mounting adjustment during the installation process.

QUANTiC encoders include Renishaw’s high-performance integrated interpolation technology, removing the need for additional adaptors or separate interfaces. This provides stable and reliable position signals for a wide range of demanding measurement and motion control applications.

The easy-to-use built-in installation and calibration functions can be enhanced with the optional Advanced Diagnostic Tool ADTi-100, providing comprehensive real-time encoder feedback during installation and diagnostics.

In addition to Renishaw’s proven unique filtering optics, QUANTiC encoders have a new detector design which gives superior signal purity and dirt immunity. They are combined in a compact readhead body, joining the VIONiC™ and TONiC™ family of encoders.

- Compact, all-in-one, optical encoder with analogue or digital output
- Wide tolerances
  - Rideheight from ±0.3 mm
  - Yaw ±0.9°
- Compatible with a wide range of linear, partial arc and rotary scales with IN-TRA™ auto-phase reference mark (datum)
- Maximum speed to 24 m/s
  (3.63 m/s at 0.1 µm resolution)
- Excellent dirt immunity
- Resolutions from 10 µm to 50 nm
- Integrated set-up LED for ease of installation
- Auto Gain Control (AGC), Auto Balance Control (ABC) and Auto Offset Control (AOC) ensure consistent signal strength for long-term reliability
- Integrated dual limits (linear only)
- Optional Advanced Diagnostic Tool ADTi-100 to optimise set-up and assist with system diagnostics
System features

In-built reliability and ease of installation

- **Robust position measurement over contamination**
  QUANTiC encoder readheads ensure excellent motion control performance in a wide range of applications by minimising positional error over scale contamination. A new detector design provides an additional layer of signal filtering which helps to eliminate non-harmonic signal frequencies, ensuring low subdivisional error (SDE) and minimal signal variation over dirt or contamination on the scale.

- **Easy installation and setup**
  The advanced optical design and signal processing of the QUANTiC encoder provides increased installation and operational tolerances whilst maintaining metrological performance. Low cost of ownership is achieved through reduced installation and setup times.

- **High speed performance**
  With best-in-class signal processing and optimum detector design, QUANTiC can achieve speeds up to 24 m/s to meet the most demanding motion control requirements. This enables end users to increase system throughput reducing cost per part to the end user.

Optional Advanced Diagnostic Tool ADTi-100*

The QUANTiC encoder system is compatible with the Advanced Diagnostic Tool ADTi-100 and ADT View software. They provide comprehensive real-time encoder data feedback to aid more challenging installations and diagnostics. The intuitive software interface can be used for:

- Remote calibration
- Signal optimisation over the entire axis length
- Readhead pitch indication
- Limit and reference mark indication
- Readout of encoder position (relative to scale)
- Monitoring velocity
- Exporting and saving data

* For more information refer to Advanced Diagnostic Tool ADTi-100 data sheet (Renishaw part no. L-9517-9699).
## Compatible scales

### Linear scales

<table>
<thead>
<tr>
<th></th>
<th>RTLC40-S</th>
<th>RTLC40 / FASTRACK™</th>
<th>RKLC40-S†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Form (H × W)</strong></td>
<td>0.4 mm × 8 mm including adhesive</td>
<td>RTLC40 scale: 0.2 mm × 8 mm</td>
<td>0.15 mm × 6 mm including adhesive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FASTRACK carrier: 0.4 mm × 18 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy (includes slope and linearity)</strong></td>
<td>RTLC40-S: ±15 µm/m</td>
<td>RTLC40: ±15 µm/m</td>
<td>RKLC40-S: ±15 µm/m</td>
</tr>
<tr>
<td></td>
<td>RTLC40H-S: ±5 µm/m</td>
<td>RTLC40H: ±5 µm/m</td>
<td>RKLC40H-S: ±5 µm/m</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>RTLC40-S: ±5 µm/m</td>
<td>RTLC40: ±5 µm/m</td>
<td>RKLC40-S: ±3 µm/m</td>
</tr>
<tr>
<td></td>
<td>RTLC40H-S: ±2.5 µm/m</td>
<td>RTLC40H: ±2.5 µm/m</td>
<td>RKLC40H-S: ±2.5 µm/m</td>
</tr>
<tr>
<td><strong>Maximum length</strong></td>
<td>10 m* (&gt; 10 m available on request)</td>
<td>10 m (&gt; 10 m available on request)</td>
<td>20 m (&gt; 20 m available on request)</td>
</tr>
<tr>
<td><strong>Coefficient of thermal expansion (at 20 °C)</strong></td>
<td>10.1 ±0.2 µm/m/°C</td>
<td>10.1 ±0.2 µm/m/°C</td>
<td>Matches that of substrate material when scale ends fixed by epoxy mounted end clamps</td>
</tr>
</tbody>
</table>

For RTLC40-S axis lengths > 2 m, FASTRACK carrier with RTLC40 is recommended

† Suitable for partial arc applications. For more information refer to RKL scale for partial arc applications data sheet (Renishaw part no. L-9517-9897)

### Rotary scales

<table>
<thead>
<tr>
<th></th>
<th>RESM40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stainless steel ring</td>
</tr>
<tr>
<td><strong>Graduation accuracy</strong></td>
<td>±0.38 arc second (550 mm diameter RESM40 ring)</td>
</tr>
<tr>
<td><strong>Ring diameters</strong></td>
<td>52 mm to 550 mm</td>
</tr>
<tr>
<td><strong>Coefficient of thermal expansion (at 20 °C)</strong></td>
<td>15.5 ±0.5 µm/m/°C</td>
</tr>
</tbody>
</table>

For more information about the scales refer to the relevant scale data sheet which can be downloaded from www.renishaw.com/quanticdownloads.
QUANTiC encoder system installation drawing (on RTLC40-S scale)

Dimensions and tolerances in mm

- Forward direction of readhead relative to scale
- Reference mark selector magnet
- Optical centreline marker
- Set-up LED
- P and Q limit switch sensor position

**NOTES:**
- Dimensions from substrate surface. For detailed installation drawings for other scale types, refer to the relevant QUANTiC encoder system installation guide or scale data sheet.
- External magnetic fields greater than 6 mT in the vicinity of the readhead may cause false activation of the limit and reference sensors.
- Bolted reference mark selector magnet and limit magnet available. See the relevant QUANTiC encoder system installation guide for further details.
- The recommended thread engagement is 5 mm (7.5 including counterbore) and the recommended tightening torque is between 0.25 and 0.4 Nm.

**Detail A:**
- Optical centreline (Incremental and reference mark)
- Set-up LED
- P and Q limit switch sensor position

**Reference Mark Selector Sensor Position:**
- IN-TRAC reference mark
- Reference mark selector sensor position

**Dimensions:**
- R > 30 Dynamic bend radius
- R > 10 Static bend radius
- Ø4.25 ±0.25
- 0.6
- 35
- 23
- 11.5
- 6 min.

**Mounting Holes:**
- Dimensions as P limit
- 2 mounting holes M2.5 through, counterbored
- Reference mark selector magnet
- Limit magnet

**NOTES:**
- The recommended thread engagement is 5 mm (7.5 including counterbore) and the recommended tightening torque is between 0.25 and 0.4 Nm.
- Dimensions from substrate surface. For detailed installation drawings for other scale types, refer to the relevant QUANTiC encoder system installation guide or scale data sheet.
- External magnetic fields greater than 6 mT in the vicinity of the readhead may cause false activation of the limit and reference sensors.

**External Magnetic Fields:**
- External magnetic fields greater than 6 mT in the vicinity of the readhead may cause false activation of the limit and reference sensors.

**Bolted Reference Mark Selector Magnet and Limit Magnet:**
- Bolted reference mark selector magnet and limit magnet available. See the relevant QUANTiC encoder system installation guide for further details.

**NOTES:**
- Dimensions from substrate surface. For detailed installation drawings for other scale types, refer to the relevant QUANTiC encoder system installation guide or scale data sheet.
- External magnetic fields greater than 6 mT in the vicinity of the readhead may cause false activation of the limit and reference sensors.
QUANTiC encoder system installation drawing (on RESM40 ring)

Dimensions and tolerances in mm

- R > 30 Dynamic bend radius
- R > 10 Static bend radius
- 2 mounting holes M2.5 through, counterbored Ø3 × 2.3 deep both sides.
- Calibration rideheight: 2.1 ±0.15
- Operating rideheight: 2.1 ±0.2
- Forward direction of ring (increasing count)
- Optical centreline (Incremental and reference mark)
- Set-up LED
- 'A' section ring – Offset 1.75 ±0.5
- 'B' section ring – Offset 3.25 ±0.5
- 6 min.
- 18
- 23
- 29
- R: 38.1 ±0.8
- Ø4.25 ±0.25
- 35
- 20
- 11.5
- 3
- 2
- 4.15
- 10
- 12.1
- 4.25
- 4.15
- 4.6
- 13.5
- 0.12
- 0.6
- 32.3
- 34.5
- 36.7
- 38.9
- 4.6
- 18
- 0.55
- * Extent of mounting face.

NOTES:
- QUANTiC encoder system on RESM40 ring shown. For detailed installation drawings for other scale types, refer to the relevant QUANTiC encoder system installation guide or scale data sheet.
- External magnetic fields greater than 6 mT in the vicinity of the readhead, may cause false activation of the limit and reference sensors.
- Calibration rideheight: 2.1 ±0.15
- Operating rideheight: 2.1 ±0.2
- Forward direction of ring (increasing count)

- Optical centreline (Incremental and reference mark)
- Set-up LED
- 'A' section ring – Offset 1.75 ±0.5
- 'B' section ring – Offset 3.25 ±0.5
- 6 min.
- 18
- 23
- 29
- R: 38.1 ±0.8
- Ø4.25 ±0.25
- 35
- 20
- 11.5
- 3
- 2
- 4.15
- 10
- 12.1
- 4.25
- 4.15
- 4.6
- 13.5
- 0.12
- 0.6
- 32.3
- 34.5
- 36.7
- 38.9
- 4.6
- 18
- 0.55
- * Extent of mounting face.

NOTES:
- QUANTiC encoder system on RESM40 ring shown. For detailed installation drawings for other scale types, refer to the relevant QUANTiC encoder system installation guide or scale data sheet.
- External magnetic fields greater than 6 mT in the vicinity of the readhead, may cause false activation of the limit and reference sensors.
### General specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Analogue output</th>
<th>Digital output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>5 V −5%/+10%</td>
<td>Typically 150 mA fully terminated (analogue output)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Typically 200 mA fully terminated (digital output)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power from a 5 Vdc supply complying with the requirements for SELV of standard IEC 60950-1</td>
</tr>
<tr>
<td>Ripple</td>
<td>200 mVpp maximum @ frequency up to 500 kHz</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature</strong> (system)</td>
<td>Storage −20 °C to +70 °C</td>
<td>Operating 0 °C to +70 °C</td>
</tr>
<tr>
<td><strong>Humidity</strong> (system)</td>
<td>95% relative humidity (non-condensing) to IEC 60068-2-78</td>
<td></td>
</tr>
<tr>
<td><strong>Sealing</strong></td>
<td>IP40</td>
<td></td>
</tr>
<tr>
<td><strong>Acceleration</strong></td>
<td>Operating 400 m/s², 3 axes</td>
<td></td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td>Operating 500 m/s², 11 ms, ½ sine, 3 axes</td>
<td></td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>Operating 100 m/s² max @ 55 Hz to 2000 Hz, 3 axes</td>
<td></td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>Readhead 9 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cable 26 g/m</td>
<td></td>
</tr>
<tr>
<td><strong>EMC compliance</strong></td>
<td>IEC 61326-1</td>
<td></td>
</tr>
<tr>
<td><strong>Readhead cable</strong></td>
<td>Single-shielded, outside diameter 4.25 ±0.25 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flex life &gt; 20 × 10⁶ cycles at 30 mm bend radius</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UL recognised component</td>
<td></td>
</tr>
<tr>
<td><strong>Connector options</strong></td>
<td>Code - connector type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A - 9-way D-type - Digital output only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L - 15-way D-type (standard pin-out) - Analogue output only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D - 15-way D-type (standard pin-out) - Digital output only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H - 15-way D-type (alternative pin-out)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X - 12-way circular connector - Digital output only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>J - 14-way JST connector</td>
<td></td>
</tr>
<tr>
<td><strong>Typical sub-divisional error (SDE)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear</td>
<td>&lt; ±120 nm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; ±80 nm</td>
<td></td>
</tr>
<tr>
<td>Rotary ≤ Ø135 mm</td>
<td>&lt; ±120 nm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; ±80 nm</td>
<td></td>
</tr>
<tr>
<td>Rotary &gt; Ø135 mm</td>
<td>&lt; ±150 nm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; ±150 nm</td>
<td></td>
</tr>
</tbody>
</table>

* Extension cables available. Contact your local Renishaw representative for further details.
### Speed

#### Digital readheads

<table>
<thead>
<tr>
<th>Clocked output option (MHz)</th>
<th>T (10 µm)</th>
<th>D (5 µm)</th>
<th>X (1 µm)</th>
<th>Z (0.5 µm)</th>
<th>W (0.2 µm)</th>
<th>Y (0.1 µm)</th>
<th>H (50 nm)</th>
<th>Minimum edge separation* (ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>18.13</td>
<td>7.25</td>
<td>3.626</td>
<td>1.813</td>
<td>25.1</td>
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<tr>
<td>40</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>14.50</td>
<td>5.80</td>
<td>2.900</td>
<td>1.450</td>
<td>31.6</td>
</tr>
<tr>
<td>25</td>
<td>24</td>
<td>24</td>
<td>18.13</td>
<td>9.06</td>
<td>3.63</td>
<td>1.813</td>
<td>0.906</td>
<td>51.0</td>
</tr>
<tr>
<td>20</td>
<td>24</td>
<td>24</td>
<td>16.11</td>
<td>8.06</td>
<td>3.22</td>
<td>1.611</td>
<td>0.806</td>
<td>57.5</td>
</tr>
<tr>
<td>12</td>
<td>24</td>
<td>24</td>
<td>10.36</td>
<td>5.18</td>
<td>2.07</td>
<td>1.036</td>
<td>0.518</td>
<td>90.0</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>24</td>
<td>8.53</td>
<td>4.27</td>
<td>1.71</td>
<td>0.853</td>
<td>0.427</td>
<td>109</td>
</tr>
<tr>
<td>08</td>
<td>24</td>
<td>24</td>
<td>6.91</td>
<td>3.45</td>
<td>1.38</td>
<td>0.691</td>
<td>0.345</td>
<td>135</td>
</tr>
<tr>
<td>06</td>
<td>24</td>
<td>24</td>
<td>5.37</td>
<td>2.69</td>
<td>1.07</td>
<td>0.537</td>
<td>0.269</td>
<td>174</td>
</tr>
<tr>
<td>04</td>
<td>24</td>
<td>24</td>
<td>3.63</td>
<td>1.81</td>
<td>0.73</td>
<td>0.363</td>
<td>0.181</td>
<td>259</td>
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<td>01</td>
<td>9.06</td>
<td>4.53</td>
<td>0.91</td>
<td>0.45</td>
<td>0.18</td>
<td>0.091</td>
<td>0.045</td>
<td>1038</td>
</tr>
</tbody>
</table>

#### Analogue readheads

Maximum speed: 20 m/s (−3dB)\(^\dagger\)

#### Angular speeds

Angular speed depends on ring diameter – use the following equation to convert to rev/min:

\[
\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D}
\]

Where \(V\) = maximum linear speed (m/s) and

\(D\) = external diameter of RESM40 ring (mm).

---

\(\dagger\) For a readhead with a 1 m cable.

\(^\dagger\) At speeds > 20 m/s, SDE may be affected.
## Output signals

### Digital outputs

<table>
<thead>
<tr>
<th>Function</th>
<th>Signal</th>
<th>Colour</th>
<th>9-way D-type (A)</th>
<th>15-way D-type (D)</th>
<th>15-way D-type alternative pin-out (H)</th>
<th>12-way circular connector† (X)</th>
<th>14-way JST‡ (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>Brown</td>
<td>5</td>
<td>7, 8</td>
<td>4, 12</td>
<td>G</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0 V</td>
<td>White</td>
<td>1</td>
<td>2, 9</td>
<td>2, 10</td>
<td>H</td>
<td>1</td>
</tr>
<tr>
<td>Incremental</td>
<td>A</td>
<td>Red</td>
<td>2</td>
<td>14</td>
<td>1</td>
<td>M</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>B</td>
<td>Blue</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>L</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>B</td>
<td>Yellow</td>
<td>4</td>
<td>13</td>
<td>3</td>
<td>J</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>B</td>
<td>Green</td>
<td>8</td>
<td>5</td>
<td>11</td>
<td>K</td>
<td>9</td>
</tr>
<tr>
<td>Reference mark</td>
<td>Z</td>
<td>Violet</td>
<td>3</td>
<td>12</td>
<td>14</td>
<td>D</td>
<td>8</td>
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<tr>
<td>Limits</td>
<td>P</td>
<td>Pink</td>
<td>-</td>
<td>11</td>
<td>8</td>
<td>A</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>Black</td>
<td>-</td>
<td>10</td>
<td>6</td>
<td>B</td>
<td>13</td>
</tr>
<tr>
<td>Alarm</td>
<td>E</td>
<td>Orange</td>
<td>-</td>
<td>3</td>
<td>13</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>Remote CAL*</td>
<td>CAL</td>
<td>Clear</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>C</td>
<td>4</td>
</tr>
<tr>
<td>Shield</td>
<td>-</td>
<td>Screen</td>
<td>Case</td>
<td>Case</td>
<td>Case</td>
<td>Case</td>
<td>Ferrule</td>
</tr>
</tbody>
</table>

† Remote CAL line must be connected for use with ADTi-100

‡ 12-way circular Binder mating socket - A-6195-0105.

‡ Pack of 5 14-way JST SH mating sockets: A-9417-0025 - Bottom mount; A-9417-0026 - Side mount.

## Analogue outputs

<table>
<thead>
<tr>
<th>Function</th>
<th>Signal</th>
<th>Colour</th>
<th>15-way D-type (L)</th>
<th>15-way D-type alternative pin-out (H)</th>
<th>14-way JST‡ (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>Brown</td>
<td>4, 5</td>
<td>4, 12</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0 V</td>
<td>White</td>
<td>12, 13</td>
<td>2, 10</td>
<td>1</td>
</tr>
<tr>
<td>Incremental</td>
<td>V₁</td>
<td>Red</td>
<td>9</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>V₁</td>
<td>Blue</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>V₂</td>
<td>Yellow</td>
<td>10</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>V₂</td>
<td>Green</td>
<td>2</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Reference mark</td>
<td>V₀</td>
<td>Violet</td>
<td>3</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limits</td>
<td>Vᵢ</td>
<td>Pink</td>
<td>7</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Vᵢ</td>
<td>Black</td>
<td>8</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Setup</td>
<td>Vᵢ</td>
<td>Clear</td>
<td>6</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Remote CAL*</td>
<td>Vᵢ</td>
<td>Orange</td>
<td>14</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td>Screen</td>
<td>Case</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

* Remote CAL line must be connected for use with ADTi-100

† 12-way circular Binder mating socket - A-6195-0105.

‡ Pack of 5 14-way JST SH mating sockets: A-9417-0025 - Bottom mount; A-9417-0026 - Side mount.
Electrical connections

Grounding and shielding

IMPORTANT: The shield should be connected to the machine earth (Field Ground).
For JST variants the ferrule should be connected to the machine earth.

Maximum cable length

<table>
<thead>
<tr>
<th></th>
<th>Analogue</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readhead cable</td>
<td>5 m</td>
<td>3 m</td>
</tr>
<tr>
<td>Maximum extension cable length</td>
<td>Dependent on cable type, readhead cable length and clocked output option. Contact your local Renishaw representative for more information.</td>
<td></td>
</tr>
<tr>
<td>Readhead to ADTi-100</td>
<td>5 m</td>
<td>3 m</td>
</tr>
</tbody>
</table>
Electrical connections (continued)

Recommended signal termination

Digital outputs

![Digital outputs diagram]

Standard RS422A line receiver circuitry.
Capacitors recommended for improved noise immunity.

Analogue outputs

![Analogue outputs diagram]

NOTE: 120R termination on the analogue output signals is essential for correct AGC operation.

Limit output

(Not available with ‘A’ cable termination)

![Limit output diagram]

* Select R so that maximum current does not exceed 20 mA.
Alternatively, use a suitable relay or opto-isolator.

Remote CAL operation

![Remote CAL operation diagram]

Remote operation of the CAL/AGC is possible via CAL signal.
Output specifications

Digital output signals

Form – Square wave differential line driver to EIA RS422A (except limits P and Q)

Incremental* 2 channels A and B in quadrature (90° phase shifted)

Resolution

<table>
<thead>
<tr>
<th>Resolution option code</th>
<th>P (µm)</th>
<th>S (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>X</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Z</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>W</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Y</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>H</td>
<td>0.2</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Reference*

Synchronised pulse Z, duration as resolution. Bi-directionally repeatable.†

Limits

Open collector output, asynchronous pulse
(Not available with ‘A’ cable termination)

Active high

Repeatability < 0.1 mm

– Length of limit actuator

Alarm

Line driven (Asynchronous pulse)
(Not available with ‘A’ cable termination)

Alarm asserted when:
– Signal amplitude < 20% or > 135%
– Readhead speed too high for reliable operation

or 3-state alarm
Differently transmitted signals forced open circuit for > 15 ms when alarm conditions valid.

NOTE: A wide reference mark option, outputting a reference pulse for the duration of the signal period is available. Contact your local Renishaw representative for more information.

* Inverse signals not shown for clarity
† Only calibrated reference mark is bi-directionally repeatable.
Output specifications (continued)

Analogue output signals

Incremental 2 channels $V_1$ and $V_2$ differential sinusoids in quadrature, centred on ~1.65 V (90° phase shifted)

![Graph showing incremental output signals](image)

0.7 to 1.35 Vpp with Green LED (AGC off) and Blue LED (AGC on) indication (readhead) and 120R termination.

Reference

![Graph showing reference signal](image)

Bi-directionally repeatable.*

Differential pulse $V_6$ centred on 45°.

Limits

Open collector output, asynchronous pulse

Active high

![Graph showing active high](image)

Repeatability < 0.1 mm

Set-up†

![Graph showing set-up](image)

Between 50% and 70% signal level, $V_x$ is a duty cycle.
Time spent at 3.3 V increases with incremental signal level.
At > 70% signal level $V_x$ is nominal 3.3 V.

* Only calibrated reference mark is bi-directionally repeatable.
† Set-up signal as shown is not present during calibration routine.
## Digital linear readhead part numbers

<table>
<thead>
<tr>
<th>Readhead series</th>
<th>Q4 - 40 μm QUANTiC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readhead type</td>
<td>B - Linear</td>
</tr>
<tr>
<td>Scale type compatibility</td>
<td>C - RTLC40 / RTLC40-S / RKLC40-S</td>
</tr>
<tr>
<td>Resolution</td>
<td>T - 10 μm, W - 0.2 μm, D - 5 μm, Y - 0.1 μm, X - 1 μm, H - 50 nm, Z - 0.5 μm</td>
</tr>
<tr>
<td>Cable length*</td>
<td>02 - 0.2 m (not available with 'J' cable termination), 05 - 0.5 m, 10 - 1 m, 15 - 1.5 m (not available with 'J' cable termination), 20 - 2 m (not available with 'J' cable termination), 20 - 2 m (not available with 'J' cable termination), 30 - 3 m</td>
</tr>
<tr>
<td>Cable termination</td>
<td>A - 9-way D-type plug ('E' and 'F' Reference mark options / Alarm format only), D - 15-way D-type plug (standard pin-out), H - 15-way D-type plug (alternative pin-out), X - 12-way circular connector, J - 14-way JST connector (0.5 m, 1 m and 3 m cables only)</td>
</tr>
<tr>
<td>Clocked output options†</td>
<td>50 - 50 MHz, 40 - 40 MHz, 25 - 25 MHz, 20 - 20 MHz, 12 - 12 MHz, 10 - 10 MHz, 08 - 8 MHz, 06 - 6 MHz, 04 - 4 MHz, 01 - 1 MHz</td>
</tr>
<tr>
<td>Reference mark options‡ / Alarm format</td>
<td>A - Customer selectable reference mark / Line driven alarm (not available with 'A' cable termination), B - All reference marks are output / Line driven alarm (not available with 'A' cable termination), E - Customer selectable reference mark / 3-state alarm, F - All reference marks are output / 3-state alarm</td>
</tr>
</tbody>
</table>

* Extension cables available. Contact your local Renishaw representative for further details.
† Additional clocked output options available. Contact your local Renishaw representative for further details.
‡ A or E - ‘Customer selectable reference mark’ - Reference pulse triggered only with selector magnet. Allows activation of specific reference mark when scale has multiple IN-TRAC reference marks.
B or F - ‘All reference marks are output’ - Reference pulse triggered without selector magnet. Recommended for scale with single IN-TRAC reference mark. Only calibrated reference mark is bi-directionally repeatable.

**NOTE:** Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)
## Digital rotary readhead part numbers

### Readhead series
- Q4 - 40 μm QUANTiC

### Readhead type
- B - Rotary > ∅135 mm (‘J’ scale type compatibility only)
- C - Rotary ≤ ∅135 mm (‘K’ and ‘L’ scale compatibility only)

### Scale type compatibility
- J - RESM40 > ∅135 mm (‘B’ readhead type only)
- K - RESM40 ∅60 mm to ∅135 mm (‘C’ readhead type only)
- L - RESM40 < ∅60 mm (‘C’ readhead type only)

### Resolution
- T - 10 μm
- D - 5 μm
- X - 1 μm
- Z - 0.5 μm
- W - 0.2 μm
- Y - 0.1 μm
- H - 50 nm

### Cable length*
- 02 - 0.2 m (not available with ‘J’ cable termination)
- 05 - 0.5 m
- 10 - 1 m
- 15 - 1.5 m (not available with ‘J’ cable termination)
- 20 - 2 m (not available with ‘J’ cable termination)
- 25 - 2.5 m
- 30 - 3 m

### Cable termination
- A - 9-way D-type plug (‘F’ Reference mark options / Alarm format only)
- D - 15-way D-type plug (standard pin-out)
- H - 15-way D-type plug (alternative pin-out)
- X - 12-way circular connector
- J - 14-way JST connector (0.5 m, 1 m and 3 m cables only)

### Clocked output options†
- 50 - 50 MHz
- 40 - 40 MHz
- 25 - 25 MHz
- 20 - 20 MHz
- 12 - 12 MHz
- 10 - 10 MHz
- 08 - 8 MHz
- 06 - 6 MHz
- 04 - 4 MHz
- 01 - 1 MHz

### Reference mark options / Alarm format
- B - All reference marks are output / Line driven alarm (not available with ‘A’ cable termination)
- F - All reference marks are output / 3-state alarm

---

* Extension cables available. Contact your local Renishaw representative for further details.
† Additional clocked output options available. Contact your local Renishaw representative for further details.

NOTE: Not all combinations are valid. Check valid options online at www.renishaw.com/epc
## Digital partial arc readhead part numbers

### Readhead series
- **Q4** - 40 μm QUANTiC

### Readhead type
- **B** - Partial arc radius > 67.5 mm ('R' scale type compatibility only)
- **C** - Partial arc radius ≤ 67.5 mm ('S' and 'T' scale compatibility only)

### Scale type compatibility
- **R** - RKLC40-S partial arc radius > 67.5 mm ('B' readhead type only)
- **S** - RKLC40-S partial arc radius 30 mm to 67.5 mm ('C' readhead type only)
- **T** - RKLC40-S partial arc radius 26 mm to 29 mm ('C' readhead type only)

### Resolution
- **T** - 10 μm
- **W** - 0.2 μm
- **D** - 5 μm
- **Y** - 0.1 μm
- **X** - 1 μm
- **H** - 50 nm
- **Z** - 0.5 μm

### Cable length*
- **02** - 0.2 m (not available with 'J' cable termination)
- **05** - 0.5 m
- **10** - 1 m
- **15** - 1.5 m (not available with 'J' cable termination)
- **20** - 2 m (not available with 'J' cable termination)
- **30** - 3 m

### Cable termination
- **A** - 9-way D-type plug ('F' Reference mark options / Alarm format only)
- **D** - 15-way D-type plug (standard pin-out)
- **H** - 15-way D-type plug (alternative pin-out)
- **X** - 12-way circular connector
- **J** - 14-way JST connector (0.5 m, 1 m and 3 m cables only)

### Clocked output options†
- **50** - 50 MHz
- **40** - 40 MHz
- **25** - 25 MHz
- **20** - 20 MHz
- **12** - 12 MHz
- **10** - 10 MHz
- **08** - 8 MHz
- **06** - 6 MHz
- **04** - 4 MHz
- **01** - 1 MHz

### Reference mark options‡ / Alarm format
- **B** - All reference marks are output / Line driven alarm (not available with 'A' cable termination)
- **F** - All reference marks are output / 3-state alarm

For more information on partial arc refer to *RKL scale for partial arc applications* data sheet (Renishaw part no. L-9517-9897).

---

* Extension cables available. Contact your local Renishaw representative for further details.
† Additional clocked output options available. Contact your local Renishaw representative for further details.
‡ Only calibrated reference mark is bi-directionally repeatable.

---

**NOTE:** Not all combinations are valid. Check valid options online at **www.renishaw.com/epc**
## Analogue linear readhead part numbers

<table>
<thead>
<tr>
<th>Readhead series</th>
<th>Q4 - 40 μm QUANTiC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readhead type</td>
<td>B - Linear</td>
</tr>
<tr>
<td>Scale type compatibility</td>
<td>C - RTLC40 / RTLC40-S / RKLC40-S</td>
</tr>
<tr>
<td>Output</td>
<td>A - 1 Vpp differential analogue signal</td>
</tr>
</tbody>
</table>

### Cable length

<table>
<thead>
<tr>
<th>Cable length</th>
<th>02 - 0.2 m (not available with 'J' cable termination)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05 - 0.5 m</td>
</tr>
<tr>
<td></td>
<td>10 - 1 m</td>
</tr>
<tr>
<td></td>
<td>15 - 1.5 m (not available with 'J' cable termination)</td>
</tr>
<tr>
<td></td>
<td>20 - 2 m (not available with 'J' cable termination)</td>
</tr>
<tr>
<td></td>
<td>30 - 3 m</td>
</tr>
<tr>
<td></td>
<td>50 - 5 m (not available with 'J' cable termination)</td>
</tr>
</tbody>
</table>

### Cable termination

<table>
<thead>
<tr>
<th>Cable termination</th>
<th>L - 15-way D-type plug (standard pin-out)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H - 15-way D-type plug (alternative pin-out)</td>
</tr>
<tr>
<td></td>
<td>J - 14-way JST connector (0.5 m, 1 m, 3 m and 5 m cables only)</td>
</tr>
</tbody>
</table>

### Clocked output option

| Clocked output option | 00 - No clock |

### Reference mark options

<table>
<thead>
<tr>
<th>Reference mark options</th>
<th>T - Customer selectable reference mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U - All reference marks are output</td>
</tr>
</tbody>
</table>

---

* Extension cables available. Contact your local Renishaw representative for further details.

† T - ‘Customer selectable reference mark’ - Reference pulse triggered only with selector magnet. Allows activation of specific reference mark when scale has multiple IN-TRAC reference marks.

† U - ‘All reference marks are output’ - Reference pulse triggered without selector magnet. Recommended for scale with single IN-TRAC reference mark. Only calibrated reference mark is bi-directionally repeatable.

**NOTE:** Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)
# Analogue rotary readhead part numbers

<table>
<thead>
<tr>
<th>Readhead series</th>
<th>Q4 - 40 μm QUANTiC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readhead type</td>
<td>B - Rotary &gt; Ø135 mm (‘J’ scale type compatibility only)</td>
</tr>
<tr>
<td></td>
<td>C - Rotary ≤ Ø135 mm (‘K’ and ‘L’ scale compatibility only)</td>
</tr>
<tr>
<td>Scale type compatibility</td>
<td>J - RESM40 &gt; Ø135 mm (‘B’ readhead type only)</td>
</tr>
<tr>
<td></td>
<td>K - RESM40 Ø60 mm to Ø135 mm (‘C’ readhead type only)</td>
</tr>
<tr>
<td></td>
<td>L - RESM40 &lt; Ø60 mm (‘C’ readhead type only)</td>
</tr>
<tr>
<td>Output</td>
<td>A - 1 Vpp differential analogue signal</td>
</tr>
<tr>
<td>Cable length*</td>
<td>02 - 0.2 m (not available with ‘J’ cable termination)</td>
</tr>
<tr>
<td></td>
<td>05 - 0.5 m</td>
</tr>
<tr>
<td></td>
<td>10 - 1 m</td>
</tr>
<tr>
<td></td>
<td>15 - 1.5 m (not available with ‘J’ cable termination)</td>
</tr>
<tr>
<td>20 - 2 m (not available with ‘J’ cable termination)</td>
<td></td>
</tr>
<tr>
<td>30 - 3 m</td>
<td></td>
</tr>
<tr>
<td>50 - 5 m (not available with ‘J’ cable termination)</td>
<td></td>
</tr>
<tr>
<td>Cable termination</td>
<td>L - 15-way D-type plug (standard pin-out)</td>
</tr>
<tr>
<td></td>
<td>H - 15-way D-type plug (alternative pin-out)</td>
</tr>
<tr>
<td></td>
<td>J - 14-way JST connector (0.5 m, 1 m, 3 m and 5 m cables only)</td>
</tr>
<tr>
<td>Clocked output option</td>
<td>00 - No clock</td>
</tr>
<tr>
<td>Reference mark options</td>
<td>U - All reference marks are output</td>
</tr>
</tbody>
</table>

* Extension cables available. Contact your local Renishaw representative for further details.

**NOTE:** Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)
### Analogue partial arc readhead part numbers

#### Readhead series
- **Q4** - 40 μm QUANTiC

#### Readhead type
- **B** - Partial arc radius > 67.5 mm (‘R’ scale type compatibility only)
- **C** - Partial arc radius ≤ 67.5 mm (‘S’ and ‘T’ scale compatibility only)

#### Scale type compatibility
- **R** - RKLC40-S partial arc radius > 67.5 mm (‘B’ readhead type only)
- **S** - RKLC40-S partial arc radius 30 mm to 67.5 mm (‘C’ readhead type only)
- **T** - RKLC40-S partial arc radius 26 mm to 29 mm (‘C’ readhead type only)

#### Output
- **A** - 1 Vpp differential analogue signal

#### Cable length
- 02 - 0.2 m (not available with ‘J’ cable termination)
- 05 - 0.5 m
- 10 - 1 m
- 15 - 1.5 m (not available with ‘J’ cable termination)
- 20 - 2 m (not available with ‘J’ cable termination)
- 30 - 3 m
- 50 - 5 m (not available with ‘J’ cable termination)

#### Cable termination
- **L** - 15-way D-type plug (standard pin-out)
- **H** - 15-way D-type plug (alternative pin-out)
- **J** - 14-way JST connector (0.5 m, 1 m, 3 m and 5 m cables only)

#### Clock output option
- **00** - No clock

#### Reference mark options
- **U** - All reference marks are output

For more information on partial arc refer to [RKL scale for partial arc applications data sheet](http://www.renishaw.com/epc) (Renishaw part no. L-9517-9897).

---

* Extension cables available. Contact your local Renishaw representative for further details.

† Only calibrated reference mark is bi-directionally repeatable.

**NOTE:** Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)
## Optional Advanced Diagnostic Tool ADTi-100

<table>
<thead>
<tr>
<th>Part description</th>
<th>Part number</th>
<th>Product image</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADTi-100</td>
<td>A-6195-0100</td>
<td><img src="image" alt="ADTi-100" /></td>
</tr>
<tr>
<td>ADT View software</td>
<td>Free to download from <a href="http://www.renishaw.com/adt">www.renishaw.com/adt</a></td>
<td><img src="image" alt="ADT View software" /></td>
</tr>
<tr>
<td>Termination tool (analogue readheads only)</td>
<td>A-6195-2132</td>
<td><img src="image" alt="Termination tool" /></td>
</tr>
</tbody>
</table>

### Adaptor cables

#### Digital readheads

<table>
<thead>
<tr>
<th>Cable termination</th>
<th>Pin-out</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9-way D-type</td>
<td>A-6195-0102</td>
</tr>
<tr>
<td>H</td>
<td>15-way D-type (alternative pin-out)</td>
<td>A-6195-0103</td>
</tr>
<tr>
<td>X</td>
<td>12-way circular</td>
<td>A-6195-0104</td>
</tr>
<tr>
<td>J</td>
<td>14-way JST</td>
<td>A-6195-2073</td>
</tr>
</tbody>
</table>

**NOTE:** Standard 15-way D-type readheads can be plugged directly into the ADT. No adaptor cable is required.

#### Analogue readheads

<table>
<thead>
<tr>
<th>Cable termination</th>
<th>Pin-out</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>15-way D-type (standard pin-out)</td>
<td>A-6637-1540</td>
</tr>
<tr>
<td>H</td>
<td>15-way D-type (alternative pin-out)</td>
<td>A-6195-0103</td>
</tr>
<tr>
<td>J</td>
<td>14-way JST</td>
<td>A-6195-2073</td>
</tr>
</tbody>
</table>

For more information on the ADT refer to the Advanced Diagnostic Tool ADTi-100 data sheet (Renishaw part no. L-9517-9699), Advanced Diagnostic Tool ADTi 100 and ADT View software user guide (Renishaw part no. M-6195-9413) and Advanced Diagnostic Tool ADTi 100 and ADT View software quick-start guide (Renishaw part no. M-6195-9321).
QUANTiC compatible products:

- RTLC40-S self-adhesive tape scale
- RTLC40 tape scale and FASTRACK carrier
- RKLC40-S self-adhesive mastered tape scale (linear)
- RKLC40-S self-adhesive tape scale (partial arc)
- RESM40 stainless steel ring
- Optional Advanced Diagnostic Tool ADTi-100 (A-6195-0100)

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