Renishaw’s TONiC encoder series is designed for highly-dynamic precision motion systems, bringing higher accuracy, speed and greater reliability to a wide variety of demanding industry sectors.

The readhead is compatible with a wide range of linear, partial arc and rotary scales with bi-directional optical IN-TRAC™ reference marks.

For ultimate reliability and high dirt immunity, TONiC encoder system readheads incorporate Renishaw’s market proven filtering optics, tuned for even lower noise (jitter), further enhanced by dynamic signal processing including Auto Gain Control (AGC) and Auto Offset Control (AOC). The result is ultra-low sub-divisional error (SDE) giving smoother velocity control for improved scanning performance and increased positional stability.

TONiC encoder system readheads also feature a detachable analogue or digital interface in the form of a robust, convenient connector that can be located up to 10 m from the readhead. The interface offers digital interpolation to 1 nm resolution, with clocked outputs for optimised speed performance at all resolutions for industry-standard controllers.

- Compact readhead (35 mm × 13.5 mm × 10 mm)
- Compatible with a wide range of linear, partial arc and rotary scales with customer-selectable IN-TRAC auto-phase optical reference mark (datum)
- Optimised filtering optics for even lower noise (jitter)
- Dynamic signal processing provides ultra-low SDE of typically ±30 nm
- Auto Gain Control (AGC) ensures consistent signal strength for long-term reliability
- Integrated set-up LED for ease of installation
- Maximum speed to 10 m/s (3.24 m/s at 0.1 µm resolution)
- Detachable analogue or digital connector with integral interpolation to 1 nm resolution (0.00075 arc seconds)
- Integral dual limits (linear only)
- Operating temperature to 70 °C
- Dual resolution version available
## Compatible scales

### Linear scales

<table>
<thead>
<tr>
<th></th>
<th>RTLC20-S</th>
<th>RTLC20/FASTRACK™</th>
<th>RKLC20-S†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-adhesive mounted stainless steel tape scale</strong></td>
<td>Stainless steel tape scale and self-adhesive mounted carrier</td>
<td>Self-adhesive mounted stainless steel tape scale</td>
<td></td>
</tr>
<tr>
<td><strong>Form (H × W)</strong></td>
<td>0.4 mm x 8 mm including adhesive</td>
<td>RTLC20 scale: 0.2 mm x 8 mm FASTRACK carrier: 0.4 mm x 18 mm including adhesive</td>
<td>0.15 mm x 6 mm including adhesive</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±5 µm/m</td>
<td>±5 µm/m</td>
<td>±5 µm/m</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>±2.5 µm/m</td>
<td>±2.5 µm/m</td>
<td>±2.5 µm/m</td>
</tr>
<tr>
<td><strong>Maximum length</strong></td>
<td>(&gt; 10 m available on request)</td>
<td>( &gt; 10 m available on request)</td>
<td>(&gt; 20 m on available 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 RTLC20-S axis lengths > 2 m, FASTRACK with RTLC20 is recommended.
† Suitable for partial arc applications. For more information refer to RK scale for partial arc applications data sheet (Renishaw part no. L-9517-9897).

### Rotary scales

<table>
<thead>
<tr>
<th></th>
<th>RESM20</th>
<th>REXM20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stainless steel ring</strong></td>
<td></td>
<td>Ultra-high accuracy stainless steel ring</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.38 arc second (Graduation accuracy for 550 mm diameter RESM20 ring)</td>
<td>±1 arc second‡ (Total installed accuracy for 417 mm diameter REXM20 ring)</td>
</tr>
<tr>
<td><strong>Ring diameters</strong></td>
<td>52 mm to 550 mm</td>
<td>52 mm to 417 mm</td>
</tr>
<tr>
<td><strong>Coefficient of thermal expansion (at 20 °C)</strong></td>
<td>15.5 ±0.5 µm/m/°C</td>
<td>15.5 ±0.5 µm/m/°C</td>
</tr>
</tbody>
</table>

‡ When using two readheads and an additional DSI interface.

For more information about the scales refer to the relevant scale data sheet which can be downloaded from www.renishaw.com/tonicdownloads
Dimensions and tolerances in mm

**NOTES:**

- RTLC20-S only shown. For detailed installation drawings, refer to relevant TONiC installation guide or 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.
- Connects to Ti interface

**Extents of mounting faces:**
- † Bolted reference mark selector magnet and limit magnet available. See relevant TONiC installation guide for details.
- † Bolts are countersunk. Reference mark selector magnets are afield. See relevant TONiC installation guide for details.
- Scale thickness 0.4 (including adhesive)
- Scale reading surface

**Recommended tightening torque:**
- Between 0.25 and 0.4 Nm

**Recommended thread engagement:**
- 5 min (7.5 including counterbore)

**Recommended mounting faces:**
- Alternative mounting face

**Recommended installation drawing:**
- on RTLC20-S scale

**Dimensions:***

- Optical centreline (incremental and reference mark)
- 18
- 31
- 16
- 7.8
- 7.8
- 22
- 29
- 6 min
- 2 mounting holes M2.5 through, counterbored Ø3 × 2.75 deep from alternative mounting face
- 2 mounting holes M2.5 through, counterbored Ø3 × 2.3 deep both sides

**Tolerances:**

- Pitch tol. ±1°
- Roll tol. ±0.5°
- Yaw tol. ±0.4°
- 2 mounting holes M2.5 through, counterbored Ø3 × 2.75 deep from alternative mounting face
- 2 mounting holes M2.5 through, counterbored Ø3 × 2.3 deep both sides
- Ø4.25 ±0.25
- 10

**Additional Notes:**

- The recommended tightening torque is between 0.25 and 0.4 Nm.
- The recommended thread engagement is 5 min (7.5 including counterbore).

**Additional References:**

- A-9653-0143
- A-9653-0139
- A-9653-0138
- A-9653-0139

**Recommended Installation Drawing:**

- TONiC readhead installation drawing

**Data sheet**

**TONiC encoder system**

**RENNSAY**

**apply innovation**
**TONIC encoder system**

**Dimensions and tolerances in mm**

- **R > 20 Dynamic bend radius**
- **R > 10 Static bend radius**
- **R ≈ 20**
- **R ≈ 10**
- **R > 1 Dynamic bend radius**
- **R > 0.5 Static bend radius**
- **R ≈ 0.5**
- **R > 0.1 Dynamic bend radius**
- **R > 0.05 Static bend radius**
- **R ≈ 0.05**
- **R > 0.02 Dynamic bend radius**
- **R > 0.01 Static bend radius**
- **R ≈ 0.01**
- **R > 0.005 Dynamic bend radius**
- **R > 0.002 Static bend radius**
- **R ≈ 0.002**
- **R > 0.001 Dynamic bend radius**
- **R > 0.0005 Static bend radius**
- **R ≈ 0.0005**
- **R > 0.0002 Dynamic bend radius**
- **R > 0.0001 Static bend radius**
- **R ≈ 0.0001**
- **R > 0.00005 Dynamic bend radius**
- **R > 0.00002 Static bend radius**
- **R ≈ 0.00002**
- **R > 0.00001 Dynamic bend radius**
- **R > 0.000005 Static bend radius**
- **R ≈ 0.000005**
- **R > 0.000002 Dynamic bend radius**
- **R > 0.000001 Static bend radius**
- **R ≈ 0.000001**
- **R > 0.0000005 Dynamic bend radius**
- **R > 0.0000002 Static bend radius**
- **R ≈ 0.0000002**
- **R > 0.0000001 Dynamic bend radius**
- **R > 0.00000005 Static bend radius**
- **R ≈ 0.00000005**
- **R > 0.00000002 Dynamic bend radius**
- **R > 0.00000001 Static bend radius**
- **R ≈ 0.00000001**
- **R > 0.000000005 Dynamic bend radius**
- **R > 0.000000002 Static bend radius**
- **R ≈ 0.000000002**
- **R > 0.000000001 Dynamic bend radius**
- **R > 0.0000000005 Static bend radius**
- **R ≈ 0.0000000005**
- **R > 0.0000000002 Dynamic bend radius**
- **R > 0.0000000001 Static bend radius**
- **R ≈ 0.0000000001**
- **R > 0.00000000005 Dynamic bend radius**
- **R > 0.00000000002 Static bend radius**
- **R ≈ 0.00000000002**
- **R > 0.00000000001 Dynamic bend radius**
- **R > 0.000000000005 Static bend radius**
- **R ≈ 0.000000000005**
- **R > 0.000000000002 Dynamic bend radius**
- **R > 0.000000000001 Static bend radius**
- **R ≈ 0.000000000001**

**NOTE:**
- Extent of mounting faces.
- External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit sensor.
**Ti/TD interface dimension drawing**

Dimensions and tolerances in mm

**TD dual resolution interface**

Allows output to be switched between two resolutions. See TD interface part number section for details of available resolutions.

**NOTES:**
- It is recommended that movement should be halted before switching resolutions.
- No limit outputs.
## General specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>5V ±10%</td>
</tr>
<tr>
<td></td>
<td>Readhead only &lt; 100 mA</td>
</tr>
<tr>
<td></td>
<td>T1xxx/T2xxx with Ti0000 &lt; 100 mA</td>
</tr>
<tr>
<td></td>
<td>T1xxx/T2xxx with Ti0004 - Ti20KD or TD4000 - TD0040 &lt; 200 mA</td>
</tr>
<tr>
<td><strong>Ripple</strong></td>
<td>200 mVpp maximum @ frequency up to 500 kHz</td>
</tr>
<tr>
<td><strong>Temperature (system)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage: −20 °C to +70 °C</td>
</tr>
<tr>
<td></td>
<td>Operating: 0 °C to +70 °C</td>
</tr>
<tr>
<td><strong>Humidity (system)</strong></td>
<td>95% relative humidity (non-condensing) to IEC 60068-2-78</td>
</tr>
<tr>
<td><strong>Sealing (readhead)</strong></td>
<td>IP40</td>
</tr>
<tr>
<td></td>
<td>(interface) IP20</td>
</tr>
<tr>
<td><strong>Acceleration (readhead)</strong></td>
<td>500 m/s², 3 axes</td>
</tr>
<tr>
<td><strong>Shock (system)</strong></td>
<td>Operating: 500 m/s², 11 ms, ½ sine, 3 axes</td>
</tr>
<tr>
<td><strong>Vibration (system)</strong></td>
<td>Operating: 100 m/s² max @ 55 Hz to 2000 Hz, 3 axes</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>Readhead: 10 g</td>
</tr>
<tr>
<td></td>
<td>Interface: 100 g</td>
</tr>
<tr>
<td></td>
<td>Cable: 26 g/m</td>
</tr>
<tr>
<td><strong>EMC compliance (system)</strong></td>
<td>IEC 61326-1</td>
</tr>
<tr>
<td><strong>Readhead cable</strong></td>
<td>Double-shielded, outside diameter 4.25 ±0.25 mm</td>
</tr>
<tr>
<td></td>
<td>Flex life &gt; 20 × 10⁶ cycles at 20 mm bend radius</td>
</tr>
<tr>
<td></td>
<td>UL recognised component</td>
</tr>
<tr>
<td><strong>Typical sub-divisional error (SDE)</strong></td>
<td>±30 nm</td>
</tr>
</tbody>
</table>
NOTE: TD interface maximum speeds are resolution dependent as defined above.

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 RESM20 or REXM20 ring (mm).

### Output signals

#### Digital outputs

<table>
<thead>
<tr>
<th>Function</th>
<th>Signal</th>
<th>Pin</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>7, 8</td>
<td>7, 8</td>
</tr>
<tr>
<td></td>
<td>0 V</td>
<td>2, 9</td>
<td>2, 9</td>
</tr>
<tr>
<td>Incremental</td>
<td>A</td>
<td>+</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Incremental</td>
<td>B</td>
<td>+</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Reference mark</td>
<td>Z</td>
<td>+</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Limits</td>
<td>P(^1)</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Q(^2)</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Set-up</td>
<td>X</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Alarm(^3)</td>
<td>E</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Resolution switching(^4)</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Shield</td>
<td>Inner</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Outer</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

#### Analogue outputs

<table>
<thead>
<tr>
<th>Readhead T1xxx/2xxx</th>
<th>Interface T0000</th>
<th>Function</th>
<th>Signal</th>
<th>Colour</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>Brown</td>
<td>4, 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental Cosine</td>
<td>V_1</td>
<td>Red</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Blue</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental Sine</td>
<td>V_2</td>
<td>Yellow</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Green</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference mark</td>
<td>V_6</td>
<td>Violet</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Grey</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limits</td>
<td>V_p</td>
<td>Pink</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V_n</td>
<td>Black</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set-up</td>
<td>V_s</td>
<td>Clear</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote CAL</td>
<td>CAL</td>
<td>Orange</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shield</td>
<td>Inner</td>
<td>Green/Yellow(^*)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer</td>
<td>Outer screen</td>
<td>Case</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Becomes alarm (E+) for Ti options E, F, G, H.

\(^2\) The alarm signal can be output as a line driven signal or 3-state. Please select the preferred option at time of ordering.

\(^3\) On TD interfaces pin 10 should be connected to 0 V to switch to lower resolution.

\(^4\) Inner shield is connected to 0 V inside the Ti/TD interface.
**Electrical connections**

**Grounding and shielding**

**IMPORTANT:** The outer shield should be connected to the machine earth (Field Ground). The inner shield should be connected to 0 V at receiving electronics only. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a short between 0 V and earth, which could cause electrical noise issues.

**Maximum cable length**

<table>
<thead>
<tr>
<th>Receiver clock frequency (MHz)</th>
<th>Maximum cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 to 50</td>
<td>25</td>
</tr>
<tr>
<td>&lt; 40</td>
<td>50</td>
</tr>
<tr>
<td>analogue</td>
<td>50</td>
</tr>
</tbody>
</table>

**Recommended signal termination**

**Digital outputs**

Standard RS422 line receiver circuitry. Capacitors recommended for improved noise immunity.

**Single ended alarm signal termination**

(Ti options A, B, C, D)

**Limit outputs** (Ti interface only)

5 to 24 V

\[ V_P, V_Q \]

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

**Analogue outputs**

\[ V_0, V_1, V_2 \]
Output specifications

Digital output signals

Interface models Ti0004 - Ti20KD and TD4000 - TD0040

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)

<table>
<thead>
<tr>
<th>Model</th>
<th>P (µm)</th>
<th>S (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ti0004</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Ti0020</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ti0040</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Ti0100</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Ti0200</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Ti0400</td>
<td>0.2</td>
<td>0.05</td>
</tr>
<tr>
<td>Ti1000</td>
<td>0.08</td>
<td>0.02</td>
</tr>
<tr>
<td>Ti2000</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Ti4000</td>
<td>0.02</td>
<td>0.005</td>
</tr>
<tr>
<td>Ti10KD</td>
<td>0.008</td>
<td>0.002</td>
</tr>
<tr>
<td>Ti20KD</td>
<td>0.004</td>
<td>0.001</td>
</tr>
</tbody>
</table>

NOTES:
- Select ‘standard’ or ‘wide’ reference at time of ordering, to match the requirements of the controller being used.
- Wide reference mark not available on Ti0004.

### Reference

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

### Wide reference

- Synchronised pulse Z, duration as signal period. Bi-directionally repeatable.

### Limits

Open collector output, asynchronous pulse

Digital Ti interfaces only

- Active high
- Active low

NOTES:
- No limits on TD interfaces.
- P limit becomes E+ for Ti options E, F, G and H.

### Alarm

Line driven (Asynchronous pulse)

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

Inverse signal E+ only available for Ti options E, F, G and H.

or 3-state alarm

Differentially transmitted signals forced open circuit for > 15 ms when alarm conditions valid.

### Set-up

Set-up signal voltage proportional to incremental signal amplitude.

* Inverse signals not shown for clarity.
† Only calibrated reference mark is bi-directionally repeatable.
‡ Set-up signal as shown is not present during calibration routine.
Output specifications (continued)

Analogue output signals
Interface model Ti0000 and direct output from all readheads

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

\[
(V_1^+ - V_1^-) \\
(V_2^+ - V_2^-)
\]

0.7 to 1.35 Vpp with green LED indication (readhead) and 120R termination.

NOTE: Ti0000A00V centred on 2.5 V.

Reference

\[
(V_0^+ - V_0^-)
\]

0.8 to 1.2 Vpp

Bi-directionally repeatable.*

Differential pulse \( V_0 \) centred on 45°.

Limits Open collector output, asynchronous pulse

<table>
<thead>
<tr>
<th>Ti0000 interface only</th>
<th>Direct output from readhead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active high</td>
<td>Active low</td>
</tr>
<tr>
<td>Repeatability &lt; 0.1 mm</td>
<td>Repeatability &lt; 0.1 mm</td>
</tr>
<tr>
<td>( V_1^+ - V_1^- )</td>
<td>( V_2^+ - V_2^- )</td>
</tr>
<tr>
<td>~ Length of limit actuator</td>
<td>~ Length of limit actuator</td>
</tr>
</tbody>
</table>

NOTE: Ti0000 interface contains a transistor to invert the readhead’s ‘active low’ signal to give an ‘active high’ output.

Remote CAL operation (analogue versions only)

All Ti and TD interfaces include a push-button switch to enable CAL/AGC features.

Remote operation of the CAL/AGC is possible via pin 14 of analogue Ti0000 interfaces.

For applications where no interface is used, remote operation of CAL/AGC is essential.

Set-up†

Between 50% and 70% signal level, \( V_1 \) is a duty cycle.

Time spent at 3.3 V increases with incremental signal level.

At > 70% signal level \( V_1 \) is nominal 3.3 V.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series</strong></td>
<td>T - TONiC</td>
</tr>
<tr>
<td><strong>Scale form</strong></td>
<td>1 - Linear</td>
</tr>
<tr>
<td><strong>Readhead type</strong></td>
<td>0 - Standard</td>
</tr>
<tr>
<td><strong>Scale type compatibility</strong></td>
<td>1 - RSLM20 / RELM20</td>
</tr>
<tr>
<td></td>
<td>3 - RTLC20 / RTLC20-S / RKLC20-S</td>
</tr>
<tr>
<td><strong>Reference mark</strong></td>
<td>0 - Customer selectable reference mark</td>
</tr>
<tr>
<td></td>
<td>1 - All reference marks are output*</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>02 - 0.2 m</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</td>
</tr>
<tr>
<td></td>
<td>20 - 2 m</td>
</tr>
<tr>
<td></td>
<td>30 - 3 m</td>
</tr>
<tr>
<td></td>
<td>50 - 5 m</td>
</tr>
<tr>
<td></td>
<td>60 - 6 m</td>
</tr>
<tr>
<td></td>
<td>99 - 10 m</td>
</tr>
<tr>
<td><strong>Cable termination</strong></td>
<td>A - Standard mini connector to mate with Ti/TD interface</td>
</tr>
</tbody>
</table>

* 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)
### Rotary readhead part numbers

#### Series
- **T** - TONiC

#### Scale form
- **2** - Rotary

#### Readhead type
- **0** - Standard

#### Scale type compatibility
- **0** - RESM20 / REXM20 > Ø135 mm
- **1** - RESM20 / REXM20 Ø60 mm to Ø135 mm
- **2** - RESM20 / REXM20 < Ø60 mm

#### Reference mark
- **1** - All reference marks are output

#### Cable length
- **02** - 0.2 m
- **05** - 0.5 m
- **10** - 1 m
- **15** - 1.5 m
- **20** - 2 m
- **30** - 3 m
- **50** - 5 m
- **60** - 6 m
- **99** - 10 m

#### Cable termination
- **A** - Standard mini connector to mate with Ti/TD interface

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

**Series**
- T - TONiC

**Scale form**
- 2 - Rotary

**Readhead type**
- 0 - Standard

**Scale type compatibility**
- 6 - RKLC20-S partial arc radius > 67.5 mm
- 7 - RKLC20-S partial arc radius 30 mm to 67.5 mm

**Reference mark**
- 1 - All reference marks are output*

**Cable length**
- 02 - 0.2 m
- 05 - 0.5 m
- 10 - 1 m
- 15 - 1.5 m
- 20 - 2 m
- 30 - 3 m
- 50 - 5 m
- 60 - 6 m
- 99 - 10 m

**Cable termination**
- A - Standard mini connector to mate with Ti/TD interface

* Only calibrated reference mark is bi-directionally repeatable.

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

**NOTE:** Not all combinations are valid. Check valid options online at www.renishaw.com/epc
Ti interface part numbers

Compatible with all TONiC readheads

Analogue:

Options

A - Dual active high limits
V - 2V5 Vmid dual active high limits

Digital:

Series

Ti - TONiC interface

Interpolation factor/resolution*

<table>
<thead>
<tr>
<th>Ti 0000 A 00 A</th>
</tr>
</thead>
</table>

Alarm format and conditions†

<table>
<thead>
<tr>
<th>Ti 0200 A 20 A</th>
</tr>
</thead>
</table>

Clocked output option‡

<table>
<thead>
<tr>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - P/Q limits – ‘active high’, standard reference mark</td>
</tr>
<tr>
<td>B - P/Q limits – ‘active low’, standard reference mark</td>
</tr>
<tr>
<td>C - P/Q limits – ‘active high’, wide reference mark</td>
</tr>
<tr>
<td>D - P/Q limits – ‘active low’, wide reference mark</td>
</tr>
<tr>
<td>E - Q limit only – ‘active high’, differential alarm, standard reference mark</td>
</tr>
<tr>
<td>F - Q limit only – ‘active low’, differential alarm, standard reference mark</td>
</tr>
<tr>
<td>G - Q limit only – ‘active high’, differential alarm, wide reference mark</td>
</tr>
<tr>
<td>H - Q limit only – ‘active low’, differential alarm, wide reference mark</td>
</tr>
</tbody>
</table>

NOTE: Not all combinations are valid. Check valid options online at www.renishaw.com/epc
## TD interface part numbers

Compatible with all TONiC readheads

### Dual resolution:

<table>
<thead>
<tr>
<th>Series</th>
<th>Interpolation factor/resolution*</th>
<th>Alarm format and conditions†</th>
<th>Clocked output option†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD - TONiC dual resolution</td>
<td>Pin 10 open 4000 - 5 nm Pin 10 = 0 V</td>
<td>A - Line driven, differential output; All alarms</td>
<td>50 - 50 MHz</td>
</tr>
<tr>
<td></td>
<td>2000 - 10 nm 10 nm</td>
<td>B - Line driven, differential output; Low signal and high signal alarms only</td>
<td>40 - 40 MHz</td>
</tr>
<tr>
<td></td>
<td>1000 - 20 nm 20 nm</td>
<td>E - 3-state; All alarms</td>
<td>25 - 25 MHz</td>
</tr>
<tr>
<td></td>
<td>0400 - 50 nm 0.1 µm</td>
<td>F - 3-state; Low signal and high signal alarms only</td>
<td>20 - 20 MHz</td>
</tr>
<tr>
<td></td>
<td>0200 - 0.1 µm 0.2 µm</td>
<td></td>
<td>12 - 12 MHz</td>
</tr>
<tr>
<td></td>
<td>0040 - 0.5 µm 1 µm</td>
<td></td>
<td>04 - 4 MHz</td>
</tr>
</tbody>
</table>

### Options

A - Standard reference mark
B - Wide reference mark

* Additional interpolation factors available. Contact your local Renishaw representative for further details.
† When using with a DSI, the interface should be configured with line driven alarm outputs and a clocked output option of 01, 04, 06, 08, 10, 12 or 20.

NOTE: Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)
TONiC compatible products

- RTLC20-S self-adhesive tape scale
- RTLC20 tape scale and FASTRACK carrier
- RKLC20-S self-adhesive mastered tape scale
- RELM20 self-adhesive or clip/clamp mounted ZeroMet spar scale
- RSLM20 self-adhesive or clip/clamp mounted stainless steel spar scale
- RKLC20-S self-adhesive tape scale (partial arc)
- RESM20 stainless steel ring
- REXM20 high-accuracy stainless steel ring
- TONiC DOP Dual output interface
- DSi for dual-readhead rotary systems

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