## Specification

<table>
<thead>
<tr>
<th>Measuring standard</th>
<th>Renishaw stainless steel scale with single track absolute encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of thermal expansion (at 20 °C)</td>
<td>10.1 ±0.2 μm/m/°C</td>
</tr>
<tr>
<td>Thermal datum</td>
<td>At centre position (encoder position of 0.5 × measuring length)</td>
</tr>
<tr>
<td>Measuring lengths available (mm)</td>
<td>70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 920, 1020, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040 (mounting spar available – recommended for &gt; 620 mm length)</td>
</tr>
</tbody>
</table>
| Accuracy grades | High grade: ±3 μm  
Standard grade: ±5 μm |
| Resolution* | 0.5 nm, 1 nm, 1.25 nm, 10 nm, 12.5 nm, 25 nm, 50 nm |
| Sub-Divisional Error (typical) | ±40 nm |
| Jitter (RMS) | 10 nm |
| Absolute position serial interface | BISS C, FANUC (α/β), Mitsubishi, Panasonic, Siemens DRIVE-CLiQ (with external interface) |
| Encoder electrical connection | Cable connector M12 custom |
| Controller electrical connection | 8-way M12, FANUC 20-way, 10-way Mitsubishi, 17-way M23, 9-way D-Type, 14-way LEMO, flying lead |
| Cable length | Up to 100 m (with extension cable) |
| Power supply | 5 V ±10%  1.25 W maximum (250 mA @ 5 V) |
| Set-up LED | Signal strength indicator LED |
| Maximum speed | 4 m/s |
| Acceleration (readhead relative to scale) | < 200 m/s² in measuring direction |
| Moving force (maximum force required to move the readhead through the seals) | < 4 N |
| Vibration (55 Hz to 2000 Hz) | Readhead: < 300 m/s² to IEC 60068-2-6  
Housing without mounting spar: < 200 m/s² to IEC 60068-2-6  
Housing with mounting spar: < 300 m/s² to IEC 60068-2-6 |
| Shock 11 ms half-sine | < 300 m/s² IEC 60068-2-27 |
| Operating temperature | 0 °C to 50 °C |
| Environment protection | IP53 when installed correctly, IP64 with air purge |
| Air purge requirements | Air supply pressure = 1 bar at encoder  
At correct supply pressure the supplied air connection fitting restricts the air flow rate to 2 l/min |
| Weight | 0.11 kg + 0.45 kg/m |

* See page 2.
## Resolution per accuracy grade and serial interface – standard options

<table>
<thead>
<tr>
<th>Accuracy grade</th>
<th>Serial interface</th>
<th>Resolution nm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td>3 µm</td>
<td>BiSS C, Mitsubishi, Panasonic, Siemens DRIVE-CLiQ</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>FANUC</td>
<td></td>
</tr>
<tr>
<td>5 µm</td>
<td>BiSS C, Mitsubishi, Panasonic, Siemens DRIVE-CLiQ</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>FANUC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
System installation drawings – standard end caps

(ML 320 mm shown)

Dimensions and tolerances in mm

KEY

C = Compressed air inlet fitting
D = Required mounting dimensions
L = LED set-up illumination
ML = Measuring length
P = Gauging points for alignment
S = Start of measuring length
X = Machine guideway/axis datum

*The parallelism between the machine guideway and the mounting surface from P1 to P2 should be under 0.1 mm. Dowel pins should ideally be located on P1 and P2. Other positions are permissible (not on endcaps).

ML 70 120 170 220 270 320 370 420 470 520 570 620 670 720 770 820 920 1020 1140 1240 1340 1440 1540 1640 1740 1840 2040
System installation drawings – short end caps

(ML 320 mm shown)

Dimensions and tolerances in mm

**KEY**
- C = Compressed air inlet fitting
- D = Required mounting dimensions
- L = LED set-up illumination
- ML = Measuring length
- P = Gauging points for alignment
- S = Start of measuring length
- X = Machine guideway/axis datum

**ML**
- 70
- 120
- 170
- 220
- 270
- 320
- 370
- 420
- 470
- 520
- 570
- 620
- 670
- 720
- 770
- 820
- 920
- 1020
- 1140
- 1240
- 1340
- 1440
- 1540
- 1640
- 1740
- 1840
- 2040

- 4.5 ±0.2
- 18.2 ±0.05
Mounting orientations – standard end caps

Dimensions and tolerances in mm

KEY
D = Required mounting dimensions
X = Machine guideway/axis datum

NOTES
✧ Side elevations show alternative mounting orientations.
✧ Alignment pin and machine edge mounting options to mate directly to the top face of the extrusion.

Mounting orientation – short end caps

KEY
D = Required mounting dimensions
X = Machine guideway/axis datum

NOTES
✧ Side elevation shows alternative mounting orientation.
✧ Extrusion mounting can be machine edge or dowel pins.
Mounting spar installation drawing

(ML 620 mm shown)

Dimensions and tolerances in mm

<table>
<thead>
<tr>
<th>ML</th>
<th>70</th>
<th>120</th>
<th>170</th>
<th>220</th>
<th>270</th>
<th>320</th>
<th>370</th>
<th>420</th>
<th>470</th>
<th>520</th>
<th>570</th>
<th>620</th>
<th>670</th>
<th>720</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>37.5</td>
<td>55</td>
<td>75</td>
<td>100</td>
<td>115</td>
<td>140</td>
<td>175</td>
<td>200</td>
<td>225</td>
<td>250</td>
<td>275</td>
<td>300</td>
<td>325</td>
<td>350</td>
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<tr>
<td>n</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ML</th>
<th>770</th>
<th>820</th>
<th>920</th>
<th>1020</th>
<th>1140</th>
<th>1240</th>
<th>1340</th>
<th>1440</th>
<th>1540</th>
<th>1640</th>
<th>1740</th>
<th>1840</th>
<th>1940</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>375</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>550</td>
<td>640</td>
<td>655</td>
<td>710</td>
<td>760</td>
<td>810</td>
<td>855</td>
<td>910</td>
<td>1010</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

KEY

D = Required mounting dimensions
ML = Measuring length
P = Gauging points for alignment
X = Machine guideway/axis datum

View showing system mounted in reverse

Section B–B through the spar

Showing clamp installed
Dimensions and tolerances in mm

- R0.6 max.: 2.5 ±0.5
- R1 max.: 2.5
- Alignment pin: 2.5 ±0.5

Spar mounting options
## Nomenclature

### Product
- **F** - FORTiS

### Series
- **S** - Standard (37 mm)
- **N** - Narrow (18 mm)

### Encoder type
- **1** - Absolute

### Scale type
- **0** - 30 μm B code RTLA

### End caps
- **0** - Standard
- **1** - Small end caps (N type only)

### Lip seal configuration
- **A** - DuraSeal™ × 1
- **B** - DuraSeal × 2 (S type only)

### Measuring length *
- **FORTiS-S 014** = 140 mm to 304 = 3040 mm
- **FORTiS-N 007** = 70 mm to 204 = 2040 mm

### System accuracy
- **S** - Standard accuracy
- **H** - High accuracy

### Thermal datum position
- **C** - Centrally located ¹

### Serial interface
- **36B** - BiSS 36 bit
- **37F** - 37 bit FANUC α and αi
- **40N** - 40 bit Mitsubishi 4 wire
- **48P** - 48 bit Panasonic
- **28D** - Siemens DRIVE-CLiQ 28 bit (50 nm only)
- **30D** - Siemens Drive-CLiQ 30 bit (10 nm only)
- **34D** - Siemens Drive-CLiQ 34 bit (1 nm only)

### Functional Safety
- **X** - Standard
- **S** - Functional Safety (BiSS Safety and Siemens DRIVE-CLiQ only)

### Resolution
- **001** - 1 nm (all protocols except FANUC)
- **010** - 10 nm (all protocols except FANUC)
- **050** - 50 nm (all protocols except FANUC)
- **T12** - 1 / 0.5 nm (FANUC only)
- **108** - 10 / 1.25 nm (FANUC only)
- **502** - 50 / 25 nm (FANUC only)
- **504** - 50 / 12.5 nm (FANUC only)

### Additional field
- **X** - Standard, no option
- **D** - Standard encoder with one additional readhead

* For all permissible measuring length options refer to specification table.
¹ For other datum requirements contact your local Renishaw representative.

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