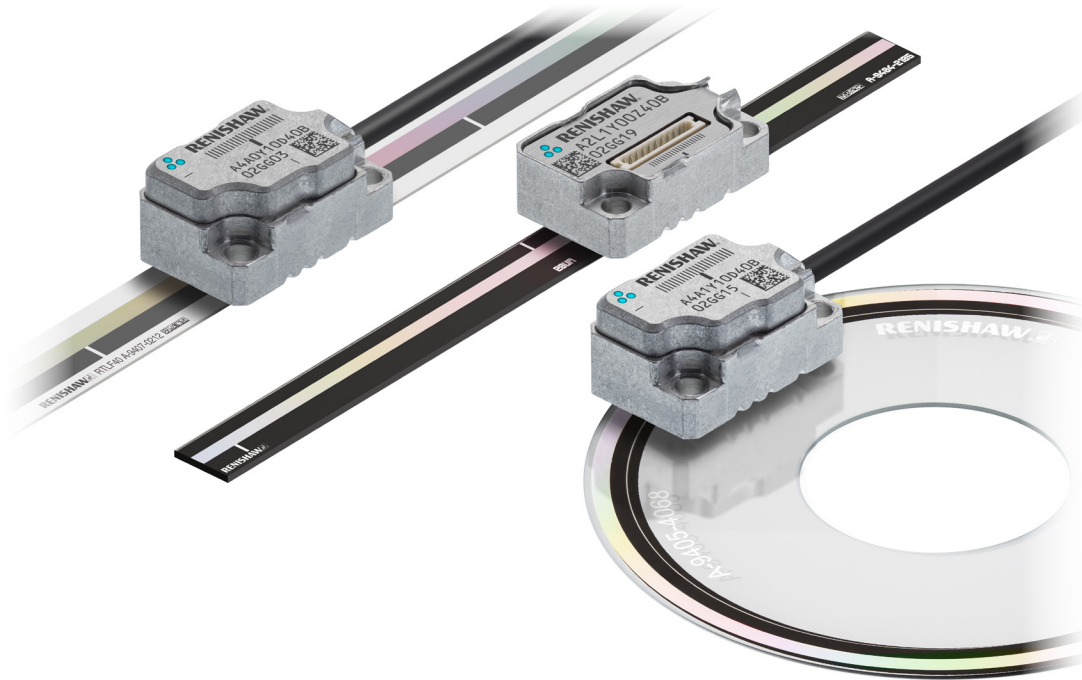


ATOM DX™ miniature encoder system



The ATOM DX™ encoder series is Renishaw's smallest incremental optical encoder with digital output direct from the readhead, providing positional feedback, onboard interpolation, and filtering optics all in a miniature package.

ATOM DX incorporates the market proven filtering optical system of the ATOM™ encoder series, and integrates Renishaw's high-performance interpolation technology, reducing system size and removing the need for additional adaptors and interfaces. This makes ATOM DX suitable for the most space constrained applications where performance cannot be compromised.

Constructed with Renishaw's integrated set-up LED for an intuitive and simple installation process based on the well-established auto-calibration routine, ATOM DX is ready to install straight from the box. It is compatible with the optional ADTi-100 Advanced Diagnostic Tool and ADT View software to give in-depth advanced diagnostic information to aid optimisation of encoder installation and in-field fault finding to satisfy the most demanding motion control applications.

ATOM DX can be used with the ATOM series of linear, partial arc and rotary scales to meet most application requirements.

- Miniature, all-in-one, digital output optical encoder with resolutions down to 2.5 nm
- Class leading signal stability and dirt immunity due to filtering optics
- Long-term stability provided by integral Auto Gain Control (AGC) and Auto Offset Control (AOC)
- Low sub-divisional error (SDE) and jitter
- Integrated set-up LED for ease of installation
- Maximum speed up to 20 m/s (3.63 m/s @ 0.1 µm resolution)
- Available in 20 µm and 40 µm scale pitch versions
- Range of high accuracy linear, partial arc and rotary scales with auto-phase bi-directional optical reference mark
- Optional Advanced Diagnostic Tool ADTi-100 to optimize set-up and assist with system diagnostics
- Available in two variants; cabled and top exit, for the most demanding space constrained installations

System features

High performance

- **Performance in speed**

ATOM DX encoders offer maximum speeds up to 20 m/s and a range of high-speed interpolation options.

- **Performance in scale**

ATOM DX offers linear tape scales with specified overall accuracy to $\pm 5 \mu\text{m/m}$ @20 °C, reducing the need for 2-point compensation.

- **Performance in velocity control**

ATOM DX incorporates Renishaw's latest interpolation technology with updated signal processing algorithms to reduce sub-divisional error (SDE). This helps to reduce velocity ripple and improve closed loop feedback in motion control systems.

- **Performance in a miniature head**

ATOM DX fits in to the smallest applications with heights as low as 7.85 mm. The top exit variant offers all the benefits and features of the cabled ATOM DX encoder, but in an even smaller package. The top exit variant is a component encoder with the cable assembly integrated separately to the readhead, making the ATOM DX top exit suitable for the smallest spaces.

- **Performance over contamination**

ATOM DX features the proven filtering optics of the ATOM encoder range. This optical scheme is tuned to a specific spatial frequency, so it rejects other harmonics, including those caused by dirt or other contaminants. The result is a Lissajous with high purity, that retains its fidelity even when the scale is exposed to contamination: ideal for applications where reliability is critical.

Optional Advanced Diagnostic Tool ADTi-100



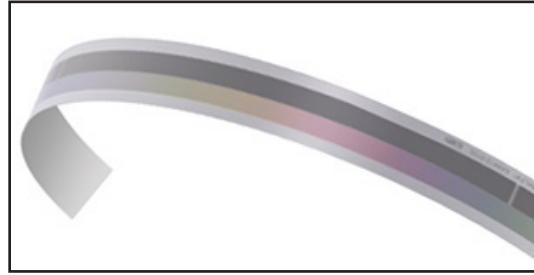
The ATOM DX encoder system is compatible with the Advanced Diagnostic Tool ADTi-100 and ADT View software, which provides comprehensive real-time encoder data feedback to aid more challenging installations and diagnostics. The intuitive software interface can be used for:

- Remote calibration
- Signal optimization over the entire axis length
- Reference mark indication
- Digital readout of encoder position (relative to scale)
- Monitoring velocity
- Exporting and saving data

Compatible scales

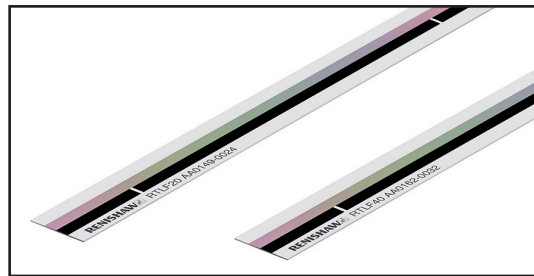
- **Stainless-steel tape scale (RKLF):**

Self-adhesive mounted stainless steel tape scales that can be wrapped around drums, arcs or shafts with radii down to 26 mm.



- **Stainless-steel tape scale (RTLFL):**

High-accuracy scales with graduations directly marked onto the steel tape surface. Available on reels for cut-to-length convenience.



- **Glass linear spars (RCLC):**

Conventional glass spars, available in lengths up to 130 mm.



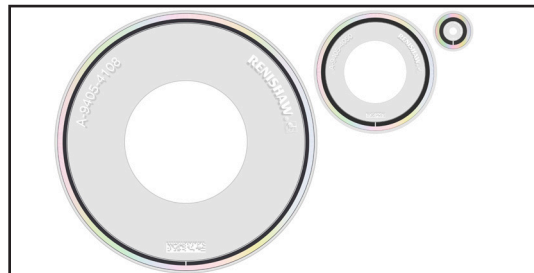
- **Stainless-steel discs (CENTRUM™ CSF40):**

Self-centring rotary scales that are quick and easy to install.



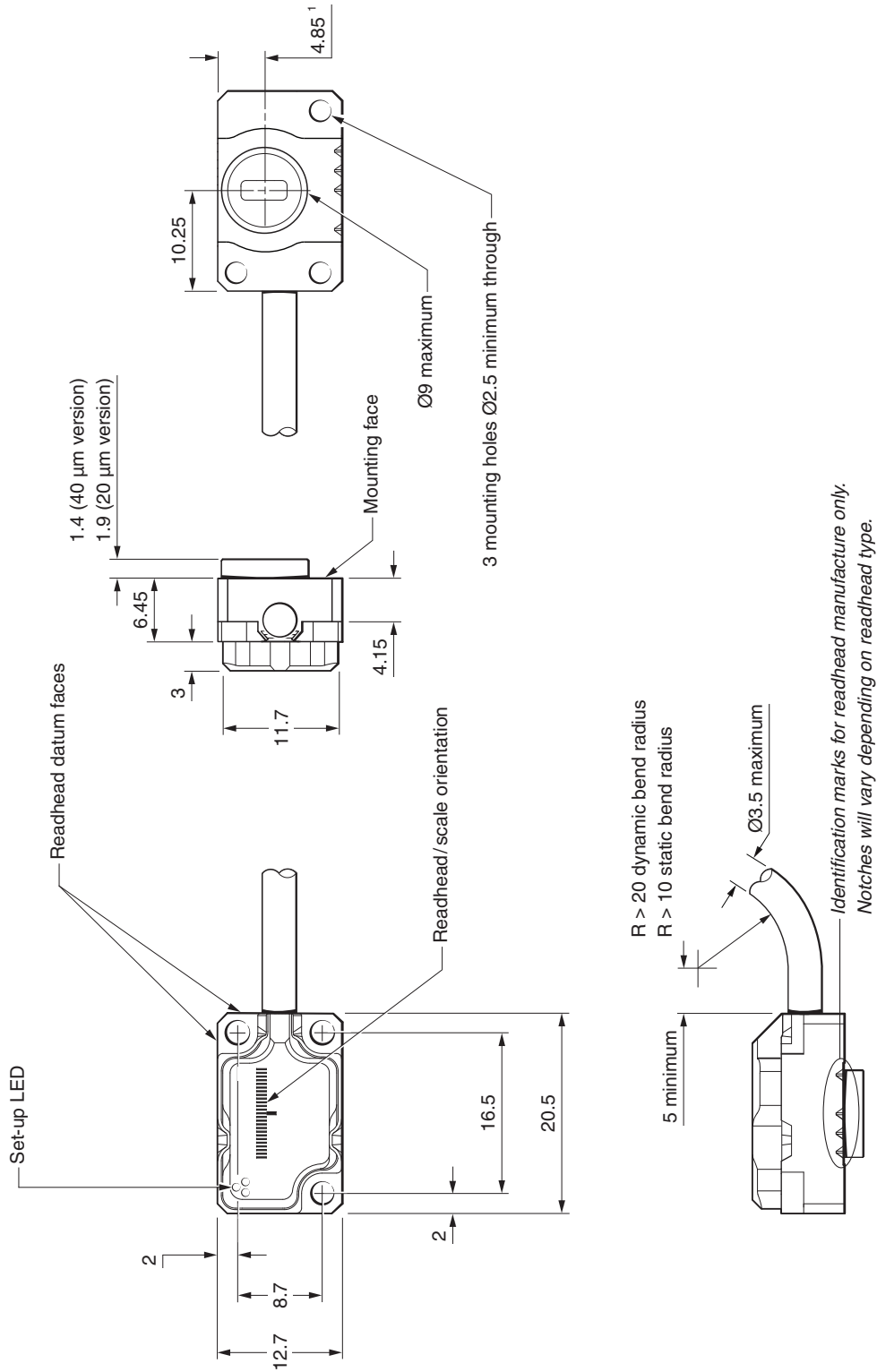
- **Glass discs (RCDM):**

High-accuracy rotary scales with outer diameters down to 17 mm.



ATOM DX cabled readhead dimensions

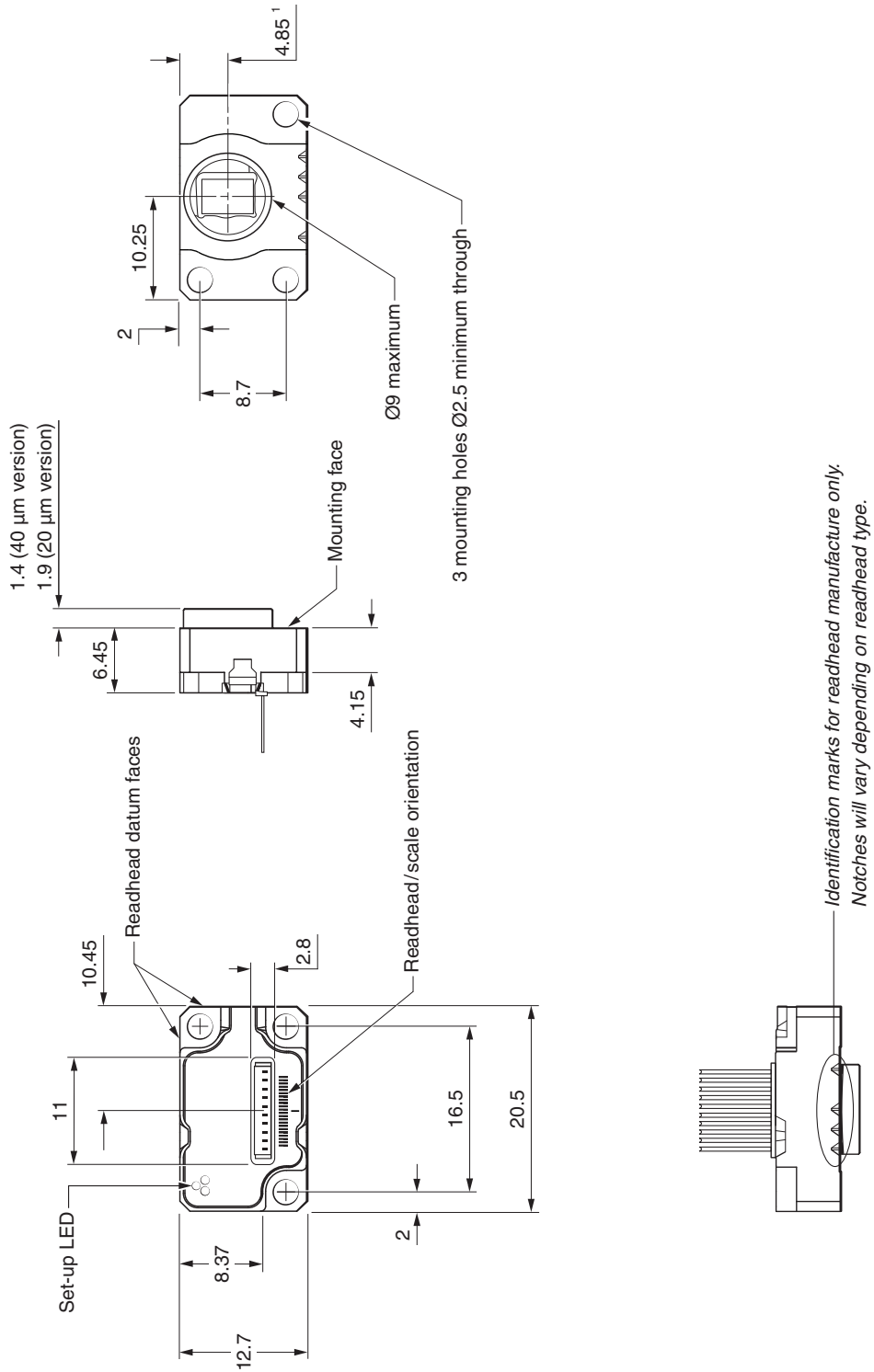
Dimensions and tolerances in mm



¹ Not the optical centreline.


ATOM DX top exit readhead dimensions

Dimensions and tolerances in mm



¹ Not the optical centreline.

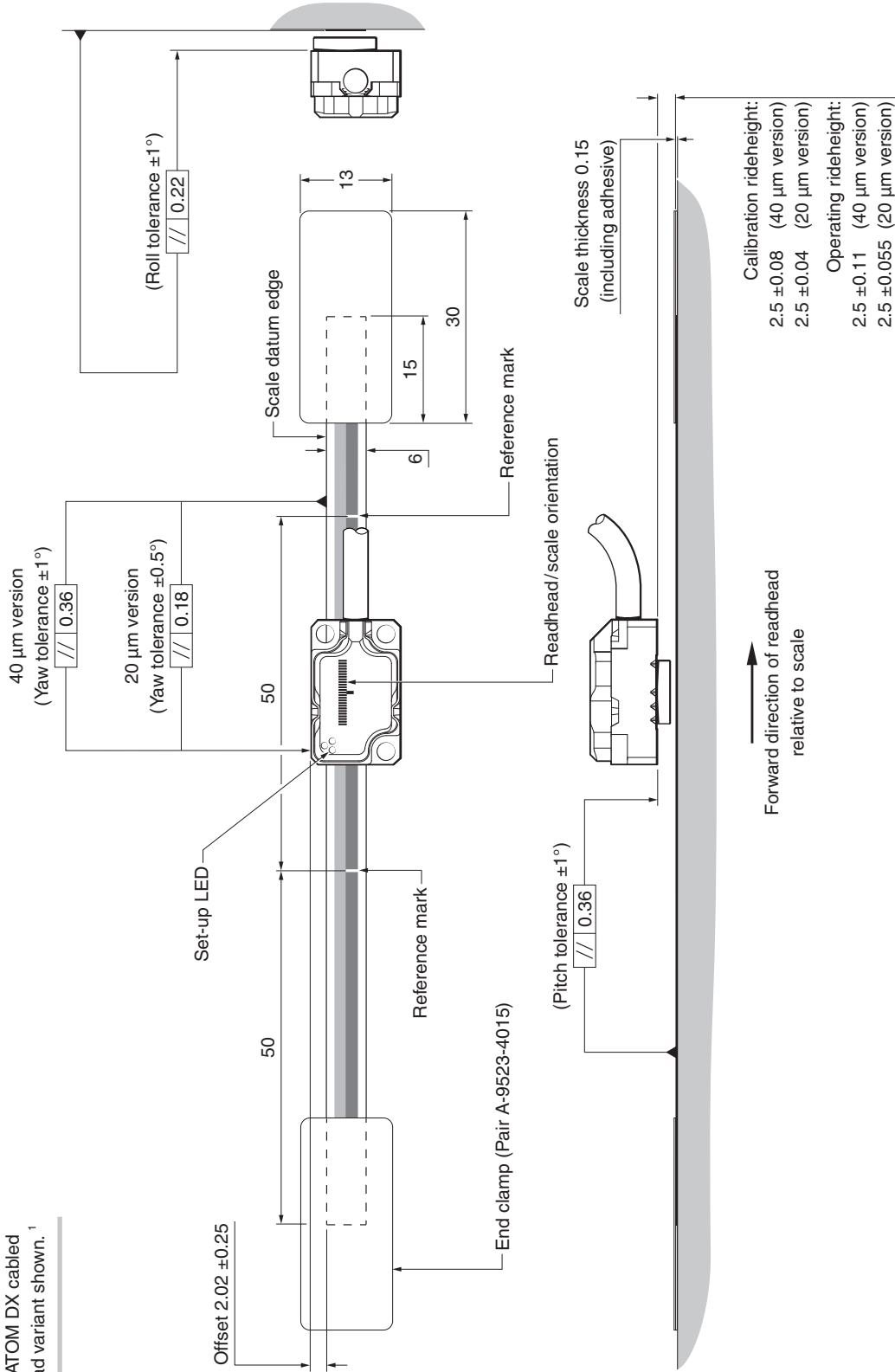
General specifications

| | | |
|---|--------------------------|---|
| Power supply | 5 V $-5 / +10\%$ | Typically < 200 mA fully terminated Power 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 |
| Temperature | Storage | $-20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$ |
| | Operating | $0\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$ |
| Humidity | | 95% relative humidity (non-condensing) to IEC 60068-2-78 |
| Sealing | | IP40 |
| Acceleration (system) ¹ | Operating | 400 m/s ² , 3 axes |
| Shock (system) | Operating | 500 m/s ² , 11 ms, ½ sine, 3 axes |
| Vibration | Operating | 100 m/s ² max @ 55 Hz to 2000 Hz, 3 axes |
| Mass | Cabled readhead | 3.2 g |
| | Top exit readhead | 2.9 g |
| | Cable | 18 g/m |
| EMC compliance | | IEC 61326-1 (cabled readhead variant only) |
| Cable | Cabled readhead | 10 core, high flex, EMI screened cable, outside diameter 3.5 mm maximum Flex life > 20×10^6 cycles at 20 mm bend radius, maximum length 3 m (Extension cable up to 25 m when using Renishaw approved extension cable) UL recognised component  |
| | Top exit readhead | Cables available in lengths from 0.5 m to 3 m with 15-way D-type or 10-way JST (SH) connector options |
| Connector options | Cabled readhead | 9-way D-type 15-way D-type (standard and alternative pin-out) 10-way JST (SH) |
| | Top exit readhead | 10-way JST (SUR) |
| Typical sub-divisional error (SDE) | 20 μm version | < $\pm 75\text{ nm}$ |
| | 40 μm version | < $\pm 120\text{ nm}$ |

¹ Bolted CENTRUM CSF40 acceleration: 100 m/s² radial, 50 m/s² axial

RKLF tape scale installation drawing

Dimensions and tolerances in mm



NOTE: ATOM DX cabled readhead variant shown.¹

For further information on the use of RKLF scale for partial arc applications, refer to the *RKL partial arc scale* data sheet (Renishaw part no. L-9517-9897).

¹ For readhead dimensions see pages 4 and 5.

RKLF tape scale technical specifications

| | | |
|--|--------------------------------|---|
| Material | | Hardened and tempered martensitic stainless steel fitted with a self-adhesive backing tape |
| Form (height x width) | | 0.15 mm x 6 mm (including adhesive) |
| Scale pitch ¹ | | 20 µm and 40 µm |
| Reference mark | | Auto-phase optical reference mark repeatable to unit of resolution throughout specified speed and temperature range Customer de-selectable reference marks at 50 mm spacing ² Reference mark in the centre of scale for lengths < 100 mm |
| Accuracy (at 20 °C) | RKLF20-S/RKLF40H-S RKLF40-S | ±5 µm/m ±15 µm/m |
| Linearity (at 20 °C) | RKLF20-S/RKLF40H-S RKLF40-S | ±2.5 µm/m achievable with two-point error correction ±3 µm/m achievable with two-point error correction |
| Installation temperature ³ | | +10 °C to +35 °C |
| Coefficient of thermal expansion (at 20 °C) | | Matches that of substrate material when scale ends fixed by epoxy mounted end clamp |
| Length ⁴ | | 20 mm to 1 m in 10 mm increments 1 m to 10 m in 1 m increments Overall length = measuring length + 70 mm Scale length = measuring length + 40 mm |
| Mass | | 4.6 g/m |
| End fixing | | Epoxy mounted end clamps (A-9523-4015) Approved epoxy adhesive (A-9531-0342) Scale end movement typically < 1 µm ⁵ |

¹ 20 µm RKLF scale is not suitable for partial arc applications.

² Only the selected reference mark is bi-directionally repeatable.

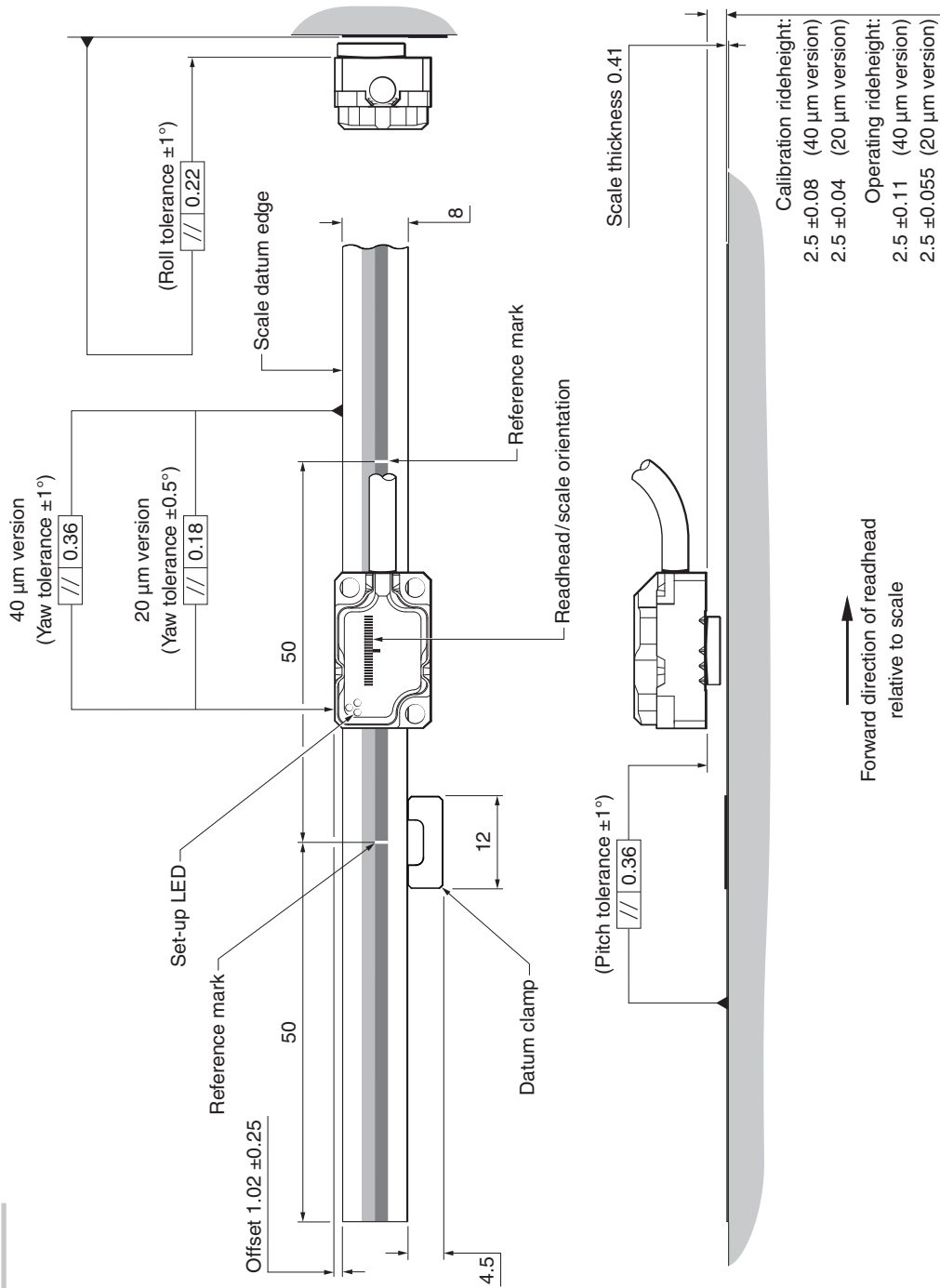
³ Ensure that the scale and end clamps are installed following the installation process described in the *ATOM DX™ linear encoder systems* installation guide (Renishaw part no. M-9414-9446).

⁴ The maximum recommended axis length is 1 m for 20 µm RKLF systems.

⁵ To limit the maximum tension in the scale $(CTE_{\text{substrate}} - CTE_{\text{scale}}) \times (T_{\text{use extreme}} - T_{\text{install}}) \leq 550 \mu\text{m/m}$ where $CTE_{\text{scale}} = \sim 10.1 \mu\text{m/m}^\circ\text{C}$.

RTLFL tape scale installation drawing

Dimensions and tolerances in mm



NOTE: ATOM DX cabled readhead variant shown.¹

¹ For readhead dimensions see pages 4 and 5.

RTLIF tape scale technical specifications

| | |
|---|--|
| Material | Hardened and tempered martensitic stainless steel fitted with a self-adhesive backing tape |
| Form (height x width) | 0.41 mm x 8 mm (including adhesive) |
| Scale pitch | 20 µm and 40 µm |
| Datum fixing | Adhesive datum clamp A-9585-0028 secured with Loctite® 435 |
| Reference mark | Auto-phase optical reference mark repeatable to unit of resolution throughout specified speed and temperature range Customer deselectable reference marks at 50 mm spacing ¹ Reference mark in the centre of scale for lengths < 100 mm |
| Accuracy (at 20 °C) | RTLIF20-S/RTLIF40H-S ±5 µm/m RTLIF40-S ±15 µm/m |
| Coefficient of thermal expansion (at 20 °C) ² | 10.1 ±0.2 µm/m/°C |
| Length ³ | 20 mm to 1 m in 10 mm increments 1 m to 10 m in 1 m increments Scale length = measuring length + 6 mm (without optional end covers) |
| Mass | 12.2 g/m |

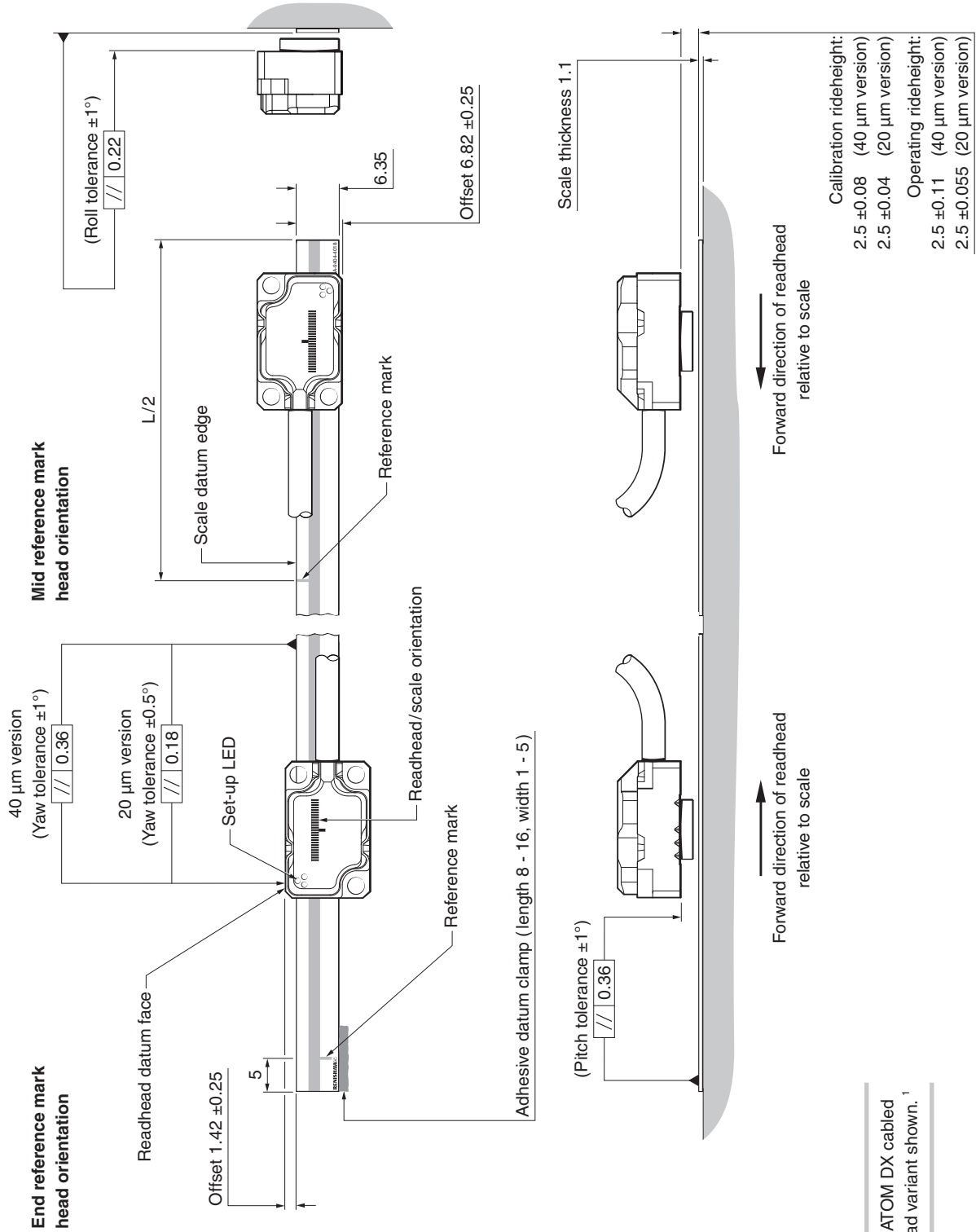
¹ Only the selected reference mark is bi-directionally repeatable.

² The substrate coefficient of thermal expansion does not need to match that of the scale.

³ The maximum recommended axis length is 1 m for 20 µm RTLIF systems.

RCLC glass spar installation drawing

Dimensions and tolerances in mm



NOTE: ATOM DX cabled readhead variant shown.¹

¹ For readhead dimensions see pages 4 and 5.

RCLC glass spar technical specifications

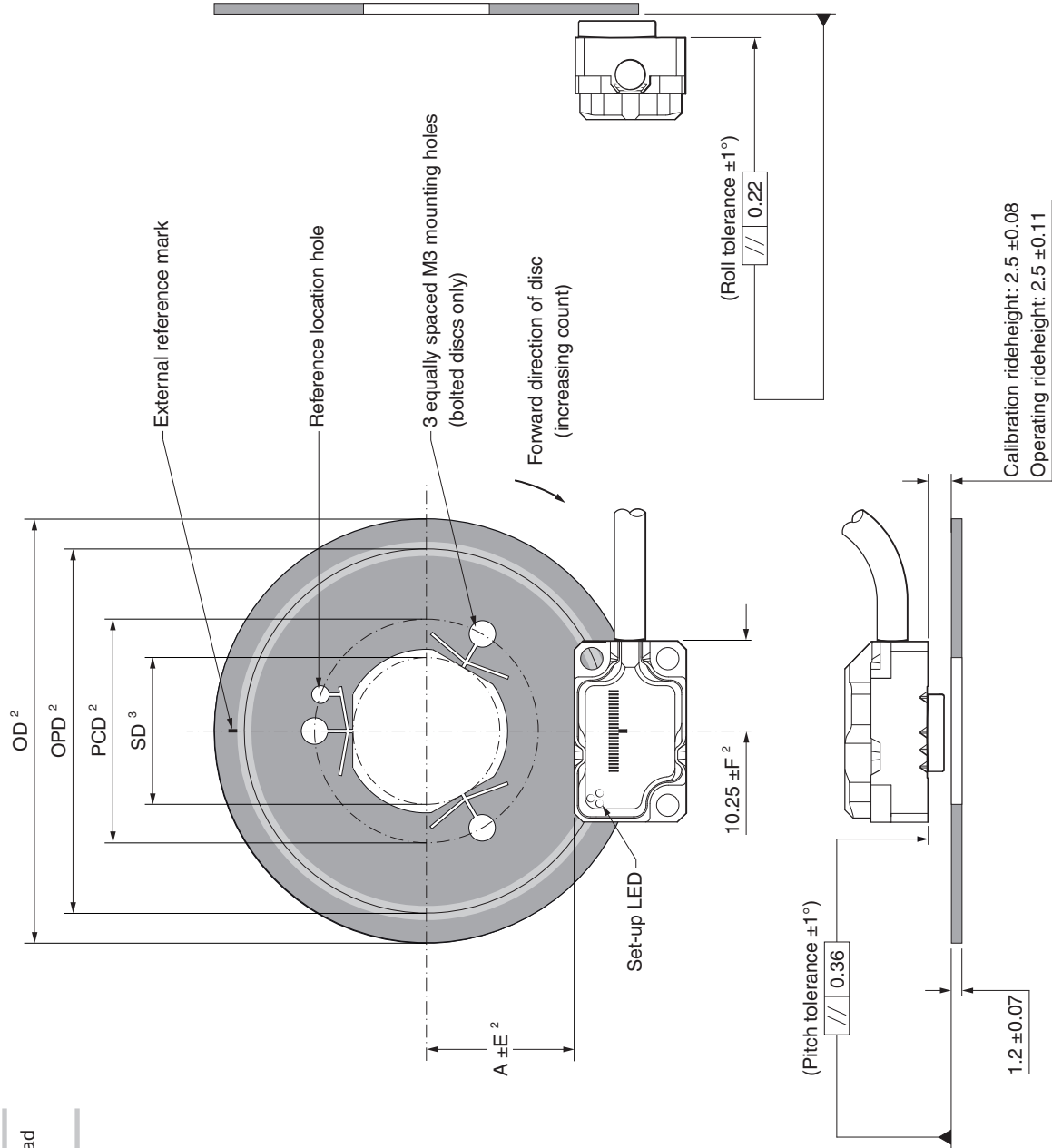
| | |
|---|---|
| Material | Soda-lime glass fitted with a self-adhesive backing tape |
| Form (height x width) | 1.1 mm x 6.35 mm (including adhesive) |
| Pitch | 20 µm and 40 µm |
| Datum fixing | Fillet of adhesive (A-9531-0342) on one side of the scale |
| Reference mark | Auto-phase optical reference mark repeatable to unit of resolution throughout specified speed and temperature range Either mid or one end of travel; determined by orientation of the readhead |
| Accuracy (at 20 °C) | ±3 µm |
| Coefficient of thermal expansion | ~8 µm/m/°C |
| Mass | 13.9 g/m |

RCLC glass spar lengths

| Overall length L (mm) | Measuring length ML (mm) |
|-----------------------|--------------------------|
| 10 | 7 |
| 18 | 15 |
| 30 | 27 |
| 55 | 52 |
| 80 | 77 |
| 100 | 97 |
| 105 | 102 |
| 130 | 127 |

CENTRUM CSF40 rotary disc with external reference mark installation drawing

Dimensions and tolerances in mm



NOTE: ATOM DX cabled readhead on bolted CSF40 shown.¹

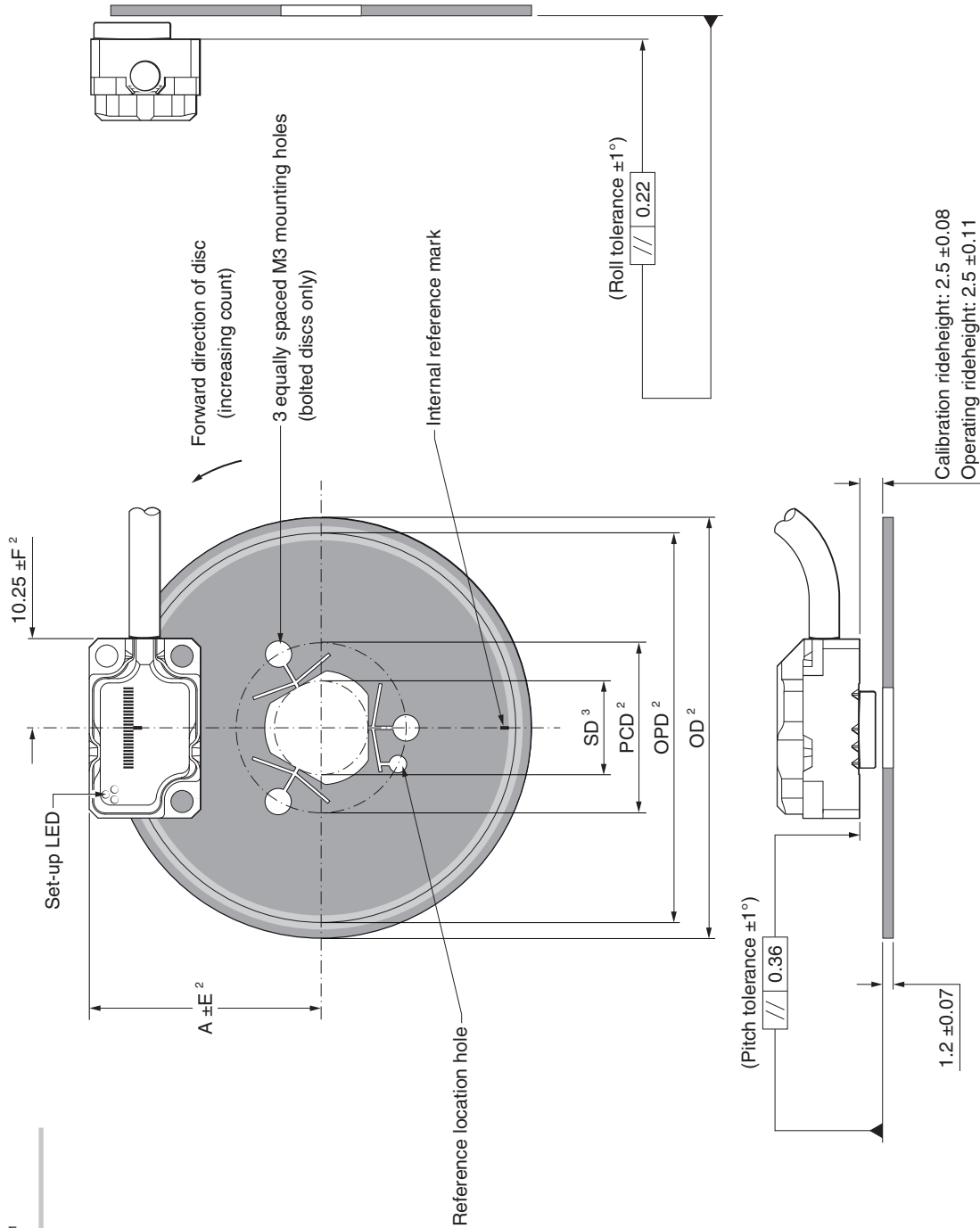
¹ For readhead dimensions see pages 4 and 5.

² The tolerances are defined on page 15 and the dimensions on page 16.

³ The inner diameter of the disc is designed to fit a shaft diameter equal to SD with a tolerance of h6. The dimension of SD is defined on page 16.

CENTRUM CSF40 rotary disc with internal reference mark installation drawing

Dimensions and tolerances in mm



NOTE: ATOM DX cabled readhead on bolted CSF40 shown.¹

¹ For readhead dimensions see pages 4 and 5.
² The tolerances are defined on page 15 and the dimensions on page 16.
³ The inner diameter of the disc is designed to fit a shaft diameter equal to SD with a tolerance of h6. The dimension of SD is defined on page 16

CENTRUM CSF40 rotary disc tolerances

Radial and longitudinal tolerances

| Optical diameter (mm) | Radial tolerance (mm) |
|-----------------------|-----------------------|
| OPD | E |
| < 20 | 0.100 |
| < 30 | 0.125 |
| < 40 | 0.175 |
| ≥ 40 | 0.200 |

| Optical diameter (mm) | Longitudinal tolerance (mm) |
|-----------------------|-----------------------------|
| OPD | F |
| < 30 | 0.100 |
| < 45 | 0.150 |
| < 60 | 0.200 |
| ≥ 60 | 0.300 |

CENTRUM CSF40 rotary disc dimensions

CSF40 discs can be customised to fit most applications. The limits and dependencies specified below can be used to create a dimensionally representative approximation of a custom CSF40 disc.

The absolute limits are the physical limitations that dictate the maximum and minimum possible size for a CSF40 disc. The dependencies limit the parameter values in relation to each other.

NOTE: This information does not provide a total and comprehensive guide on how to design a disc. Contact your local Renishaw representative for additional support.

Absolute limits

| Mounting | Reference mark | Line count | | OPD ¹ (mm) | | SD ¹ (mm) | | OD ¹ (mm) | |
|----------|----------------|------------|---------|-----------------------|---------|----------------------|---------|----------------------|---------|
| | | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum |
| Bolted | External | 2 482 | 8 890 | 31.6 | 113.2 | 7.0 | 88.6 | 38.4 | 120 |
| | Internal | 3 204 | 9 142 | 40.8 | 116.4 | 7.0 | 82.6 | 44.4 | 120 |
| Clamped | External | 1 900 | 8 890 | 24.2 | 113.2 | 7.0 | 95.0 | 31.0 | 120 |
| | Internal | 2 624 | 9 142 | 33.4 | 116.4 | 7.0 | 90.0 | 37.0 | 120 |

Dependencies

IMPORTANT: The line count (LC) must always be a whole number.

General

- All dimensions in mm.
- The outer diameter (OD) – the shaft diameter (SD) must be ≤ 40 mm.
- The shaft diameter (SD) must be $\leq 19/24 \times OD$.
- The optical diameter (OPD) = $\frac{LC \times 0.04}{\pi}$

Mounting specific

| Mounting | Reference mark | SD ¹ | OD ¹ | PCD ¹ | Readhead (A) |
|----------|----------------|-------------------|------------------|---------------------------------------|----------------|
| Bolted | External | $\leq OPD - 24.6$ | $\geq OPD + 6.8$ | $\leq OPD - 15.9$ and $\geq SD + 8.7$ | $OPD/2 - 4.11$ |
| | Internal | $\leq OPD - 33.8$ | $\geq OPD + 3.6$ | $\leq OPD - 25.1$ and $\geq SD + 8.7$ | $OPD/2 + 4.11$ |
| Clamped | External | $\leq OPD - 17.2$ | $\geq OPD + 6.8$ | N/A | $OPD/2 - 4.11$ |
| | Internal | $\leq OPD - 26.4$ | $\geq OPD + 3.6$ | N/A | $OPD/2 + 4.11$ |

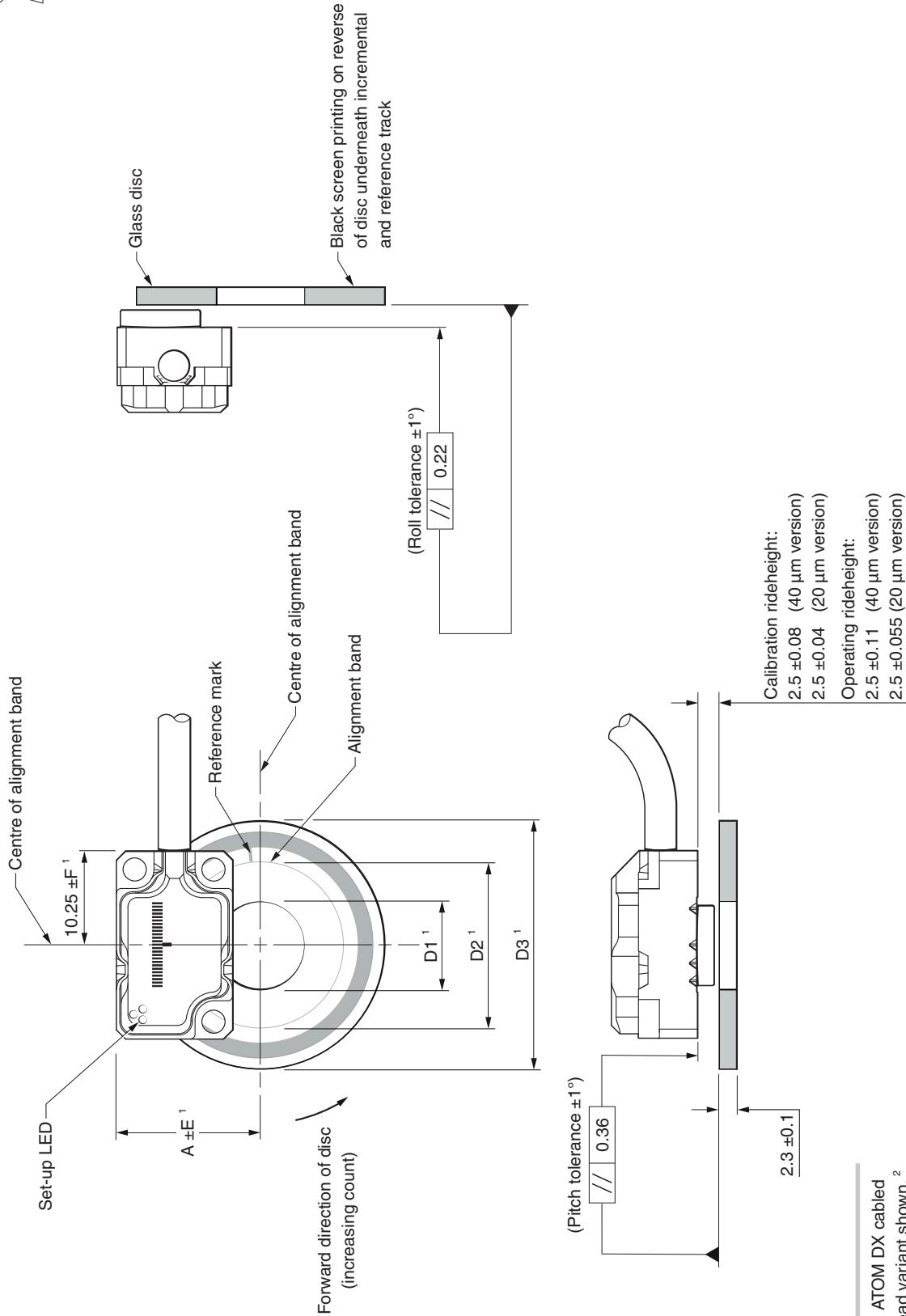
¹ OD = outer diameter; SD = shaft diameter; OPD = optical diameter; PCD = bolt hole diameter.

CENTRUM CSF40 rotary disc technical specifications

| | |
|--|--|
| Material | 304 grade stainless-steel |
| Form | 1.2 mm thick |
| Pitch | 40 μm |
| Reference mark | Single reference mark, external or internal |
| Installed accuracy (scale to shaft) | $\leq \pm 10 \mu\text{m}$ |
| Eccentricity (scale to shaft) | Typically $\leq \pm 5 \mu\text{m}$ |
| Graduation accuracy | Typically $\leq \pm 0.5 \mu\text{m}$ |
| Coefficient of thermal expansion (at 20 °C) | $15.5 \pm 0.5 \mu\text{m}/\text{m}/^\circ\text{C}$ |
| Density | $8000 \text{ kg}/\text{m}^3$ |

RCDM rotary disc installation drawing

Dimensions and tolerances in mm



For detailed information see the ATOM DX™ rotary encoder systems installation guide (Renishaw part no. M-9414-9447).

¹ The dimensions and tolerances are defined on page 19.
² For readhead dimensions see pages 4 and 5.

RCDM rotary disc dimensions and tolerances

20 µm discs

| Optical diameter (mm) | Line count | Nominal outer diameter (mm) ¹ | D1 (mm) | D2 (mm) | D3 (mm) | A (mm) | Radial tolerance E (mm) | Longitudinal tolerance F (mm) |
|-----------------------|------------|--|---------|---------|---------|--------|-------------------------|-------------------------------|
| 26.08 | 4 096 | 30 | 12.8 | 21.15 | 29.9 | 17.15 | 0.1 | 0.075 |
| 31.83 | 5 000 | 36 | 12.8 | 26.9 | 35.9 | 20.03 | 0.125 | 0.075 |
| 45.84 | 7 200 | 50 | 25.5 | 40.9 | 49.9 | 27.03 | 0.125 | 0.075 |
| 52.15 | 8 192 | 56 | 25.5 | 47.25 | 55.9 | 30.19 | 0.125 | 0.1 |
| 63.66 | 10 000 | 68 | 25.5 | 58.55 | 67.9 | 35.94 | 0.15 | 0.125 |
| 104.3 | 16 384 | 108 | 50.9 | 99.2 | 107.9 | 56.26 | 0.2 | 0.225 |

40 µm discs

| Optical diameter (mm) | Line count | Nominal outer diameter (mm) ¹ | D1 (mm) | D2 (mm) | D3 (mm) | A (mm) | Radial tolerance E (mm) | Longitudinal tolerance F (mm) |
|-----------------------|------------|--|---------|---------|---------|--------|-------------------------|-------------------------------|
| 13.04 | 1 024 | 17 | 3.275 | 8.1 | 16.9 | 10.63 | 0.1 | 0.1 |
| 15.92 | 1 250 | 20 | 3.275 | 11 | 19.9 | 12.07 | 0.1 | 0.1 |
| 21.01 | 1 650 | 25 | 6.46 | 16.1 | 24.9 | 14.62 | 0.125 | 0.1 |
| 22.92 | 1 800 | 27 | 9.625 | 18 | 26.9 | 15.57 | 0.125 | 0.1 |
| 26.08 | 2 048 | 30 | 12.8 | 21.15 | 29.9 | 17.15 | 0.125 | 0.1 |
| 31.83 | 2 500 | 36 | 12.8 | 26.9 | 35.9 | 20.03 | 0.175 | 0.15 |
| 45.84 | 3 600 | 50 | 25.5 | 40.9 | 49.9 | 27.03 | 0.2 | 0.2 |
| 52.15 | 4 096 | 56 | 25.5 | 47.25 | 55.9 | 30.19 | 0.2 | 0.2 |
| 63.66 | 5 000 | 68 | 25.5 | 58.55 | 67.9 | 35.94 | 0.2 | 0.3 |
| 104.3 | 8 192 | 108 | 50.9 | 99.2 | 107.9 | 56.26 | 0.2 | 0.3 |

¹ Special disc sizes are available on request

RCDM rotary disc technical specifications

| | |
|---|-----------------------|
| Material | Soda-lime glass |
| Form | 2.3 mm thick |
| Pitch | 20 µm and 40 µm |
| Reference mark | Single reference mark |
| Coefficient of thermal expansion | ~8 µm/m/°C |

RCDM rotary disc graduation accuracy

| Optical diameter (mm) | Nominal outer diameter (mm) | Graduation accuracy (arc seconds) |
|------------------------------|------------------------------------|--|
| 13.04 | 17 | 15.81 |
| 15.92 | 20 | 12.95 |
| 21.01 | 25 | 9.82 |
| 22.92 | 27 | 9 |
| 26.08 | 30 | 7.91 |
| 31.83 | 36 | 6.49 |
| 45.84 | 50 | 4.5 |
| 52.15 | 56 | 3.95 |
| 63.66 | 68 | 3.24 |
| 104.3 | 108 | 2.78 |

Speed

20 µm encoder

| Clocked output option (MHz) | Maximum speed (m/s) | | | | | | Minimum edge separation ¹ (ns) |
|--------------------------------|---------------------|-------------|---------------|---------------|---------------|--------------|--|
| | Readhead type | | | | | | |
| | D (5 µm) | X (1 µm) | Z (0.5 µm) | W (0.2 µm) | Y (0.1 µm) | H (50 nm) | |
| 50 | 10 | 10 | 10 | 7.25 | 3.63 | 1.813 | 25.1 |
| 40 | 10 | 10 | 10 | 5.80 | 2.90 | 1.450 | 31.6 |
| 25 | 10 | 10 | 9.06 | 3.63 | 1.81 | 0.906 | 51.0 |
| 20 | 10 | 10 | 8.06 | 3.22 | 1.61 | 0.806 | 57.5 |
| 12 | 10 | 10 | 5.18 | 2.07 | 1.04 | 0.518 | 90.0 |
| 10 | 10 | 8.53 | 4.27 | 1.71 | 0.85 | 0.427 | 109 |
| 08 | 10 | 6.91 | 3.45 | 1.38 | 0.69 | 0.345 | 135 |
| 06 | 10 | 5.37 | 2.69 | 1.07 | 0.54 | 0.269 | 174 |
| 04 | 10 | 3.63 | 1.81 | 0.73 | 0.36 | 0.181 | 259 |
| 01 | 4.53 | 0.91 | 0.45 | 0.18 | 0.09 | 0.045 | 1038 |

| Clocked output option (MHz) | Maximum speed (m/s) | | | | | Minimum edge separation ¹ (ns) |
|--------------------------------|---------------------|--------------|--------------|-------------|---------------|--|
| | Readhead type | | | | | |
| | M (40 nm) | I (20 nm) | O (10 nm) | Q (5 nm) | R (2.5 nm) | |
| 50 | 1.450 | 0.725 | 0.363 | 0.181 | 0.091 | 25.1 |
| 40 | 1.160 | 0.580 | 0.290 | 0.145 | 0.073 | 31.6 |
| 25 | 0.725 | 0.363 | 0.181 | 0.091 | 0.045 | 51.0 |
| 20 | 0.645 | 0.322 | 0.161 | 0.081 | 0.040 | 57.5 |
| 12 | 0.414 | 0.207 | 0.104 | 0.052 | 0.026 | 90.0 |
| 10 | 0.341 | 0.171 | 0.085 | 0.043 | 0.021 | 109 |
| 08 | 0.276 | 0.138 | 0.069 | 0.035 | 0.017 | 135 |
| 06 | 0.215 | 0.107 | 0.054 | 0.027 | 0.013 | 174 |
| 04 | 0.145 | 0.073 | 0.036 | 0.018 | 0.009 | 259 |
| 01 | 0.036 | 0.018 | 0.009 | 0.005 | 0.002 | 1038 |

Angular speed depends on disc optical diameter. Use the following equation to convert to rev/min.

$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D} \quad \text{Where } V = \text{maximum linear speed (m/s)} \text{ and } D = \text{optical diameter of chosen disc in mm}$$

¹ For a readhead with a 1 m cable

40 µm encoder

| Clocked output option (MHz) | Maximum speed (m/s) | | | | | | Minimum edge separation ¹ (ns) |
|--------------------------------|---------------------|-------------|-------------|-------------|---------------|---------------|--|
| | Readhead type | | | | | | |
| | T (10 µm) | D (5 µm) | G (2 µm) | X (1 µm) | Z (0.5 µm) | W (0.2 µm) | |
| 50 | 20 | 20 | 20 | 20 | 18.13 | 7.25 | 25.1 |
| 40 | 20 | 20 | 20 | 20 | 14.50 | 5.80 | 31.6 |
| 25 | 20 | 20 | 20 | 18.13 | 9.06 | 3.63 | 51.0 |
| 20 | 20 | 20 | 20 | 16.11 | 8.06 | 3.22 | 57.5 |
| 12 | 20 | 20 | 20 | 10.36 | 5.18 | 2.07 | 90.0 |
| 10 | 20 | 20 | 17.06 | 8.53 | 4.27 | 1.71 | 109 |
| 08 | 20 | 20 | 13.81 | 6.91 | 3.45 | 1.38 | 135 |
| 06 | 20 | 20 | 10.74 | 5.37 | 2.69 | 1.07 | 174 |
| 04 | 20 | 18.13 | 7.25 | 3.63 | 1.81 | 0.73 | 259 |
| 01 | 9.06 | 4.53 | 1.81 | 0.91 | 0.45 | 0.18 | 1038 |

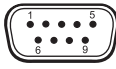
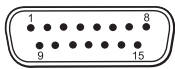
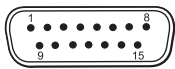


| Clocked output option (MHz) | Maximum speed (m/s) | | | | | | Minimum edge separation ¹ (ns) |
|--------------------------------|---------------------|--------------|--------------|--------------|--------------|-------------|--|
| | Readhead type | | | | | | |
| | Y (0.1 µm) | H (50 nm) | M (40 nm) | I (20 nm) | O (10 nm) | Q (5 nm) | |
| 50 | 3.63 | 1.813 | 1.450 | 0.725 | 0.363 | 0.181 | 25.1 |
| 40 | 2.90 | 1.450 | 1.160 | 0.580 | 0.290 | 0.145 | 31.6 |
| 25 | 1.81 | 0.906 | 0.725 | 0.363 | 0.181 | 0.091 | 51.0 |
| 20 | 1.61 | 0.806 | 0.645 | 0.322 | 0.161 | 0.081 | 57.5 |
| 12 | 1.04 | 0.518 | 0.414 | 0.207 | 0.104 | 0.052 | 90.0 |
| 10 | 0.85 | 0.427 | 0.341 | 0.171 | 0.085 | 0.043 | 109 |
| 08 | 0.69 | 0.345 | 0.276 | 0.138 | 0.069 | 0.035 | 135 |
| 06 | 0.54 | 0.269 | 0.215 | 0.107 | 0.054 | 0.027 | 174 |
| 04 | 0.36 | 0.181 | 0.145 | 0.073 | 0.036 | 0.018 | 259 |
| 01 | 0.09 | 0.045 | 0.036 | 0.018 | 0.009 | 0.005 | 1038 |

Angular speed depends on disc optical diameter. Use the following equation to convert to rev/min.

$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D} \quad \text{Where } V = \text{maximum linear speed (m/s) and } D = \text{optical diameter of chosen disc in mm}$$

¹ For a readhead with a 1 m cable

Output signals

| | | | Cabled | | | | Top Exit | |
|-------------------------|--------|--------|---|--|--|---|---|--|
| | | |  |  |  |  |  | |
| Function | Signal | Colour | 9-way D-type (A) | 15-way D-type (D) | 15-way D-type alternative pin-out (H) | 10-way JST ¹ (K) | 10-way JST ² (Z) | |
| Power | 5 V | Brown | 5 | 7, 8 | 4, 12 | 10 | 10 | |
| | 0 V | White | 1 | 2, 9 | 2, 10 | 2 | 9 | |
| Incremental | A | + | 2 | 14 | 1 | 9 | 5 | |
| | | - | 6 | 6 | 9 | 7 | 6 | |
| | B | + | 4 | 13 | 3 | 4 | 8 | |
| | | - | 8 | 5 | 11 | 1 | 7 | |
| Reference mark | Z | + | 3 | 12 | 14 | 8 | 4 | |
| | | - | 7 | 4 | 7 | 5 | 3 | |
| Alarm | E | - | - | 3 | 13 | 6 | 2 | |
| Remote CAL ³ | CAL | Clear | 9 | 1 | 5 | 3 | 1 | |
| Shield | - | Screen | Case | Case | Case | Ferrule | - | |

NOTE: Top exit cables are terminated with the 'K' pin-out or the 'D' pin-out dependent upon which top-exit readhead cable is used. See available top exit readhead cables on page 31.

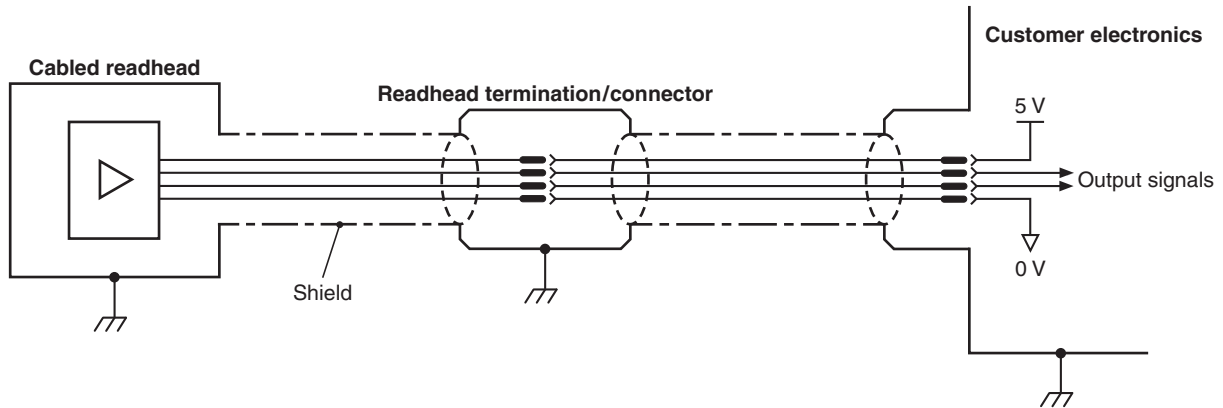
¹ PCB mount mating connectors: Top entry (BM10B-SRSS-TB); Side entry (SM10B-SRSS-TB).

² Connector on top exit readhead only: Mating connector (10SUR - 32S).

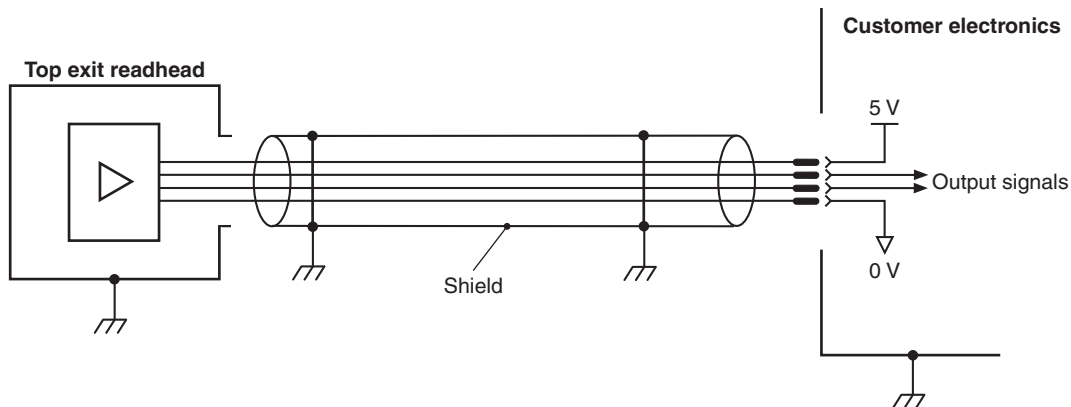
³ Remote CAL line must be connected for use with the ADTi-100.

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.



For more information on top exit readheads refer to the relevant ATOM DX installation guide.

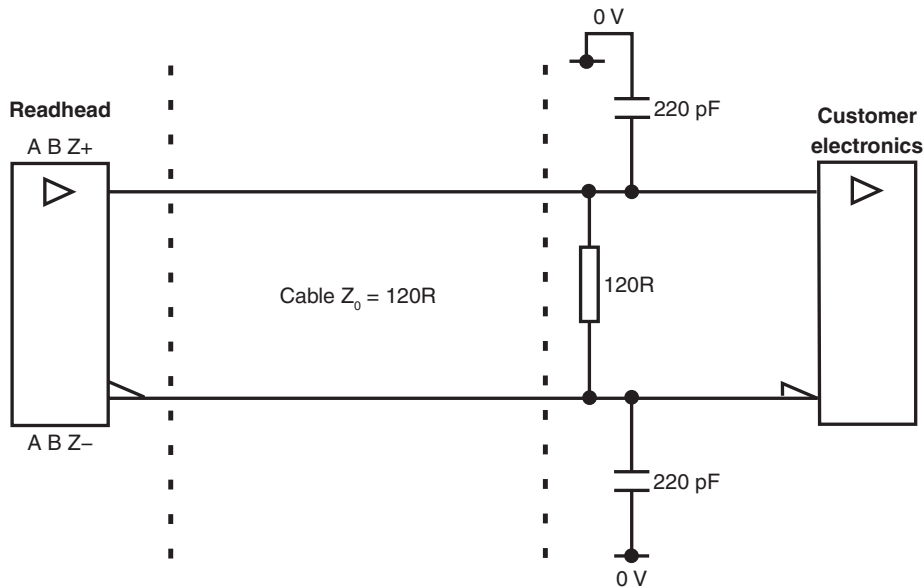
Maximum readhead cable length: 3 m

Maximum extension cable length: Dependent on cable type, readhead cable length and clock speed.
Contact your local Renishaw representative for more information.

NOTE: The maximum cable length between the readhead and the ADTi-100 is 3 m.

Recommended signal termination

Digital outputs

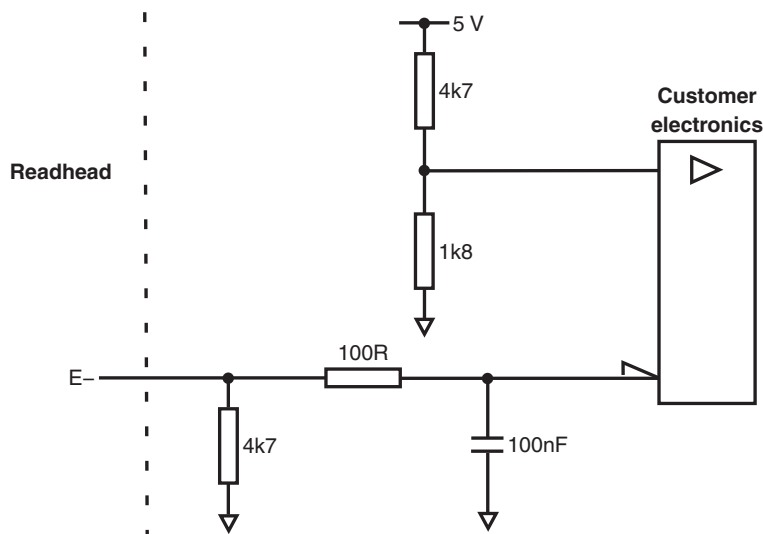


Standard RS422A line receiver circuitry.

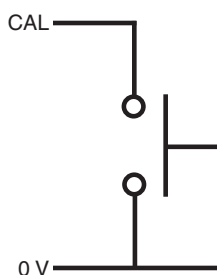
The capacitors are recommended for improved noise immunity.

Single ended alarm signal termination

(Not available with 'A' cable termination)



Remote CAL operation



Remote system calibration (CAL) is possible via the CAL pin.

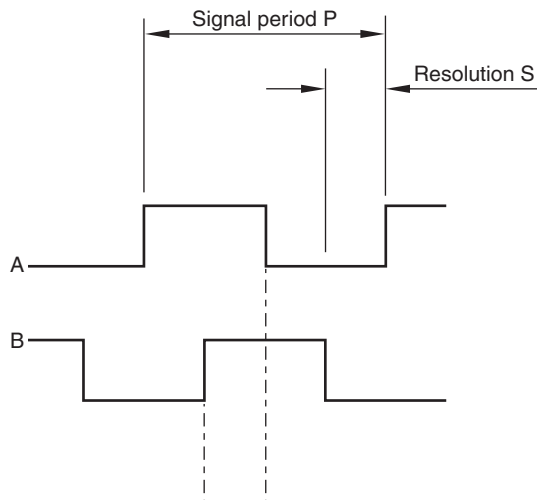
Output specifications

Digital output signals

Form – Square wave differential line driver to EIA RS422A

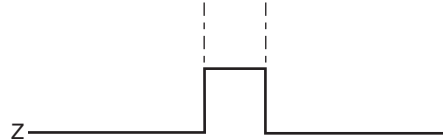
Incremental¹

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



| Resolution option code | P (μm) | S (μm) |
|------------------------|--------|--------|
| T ² | 40 | 10 |
| D | 20 | 5 |
| G ² | 8 | 2 |
| X | 4 | 1 |
| Z | 2 | 0.5 |
| W | 0.8 | 0.2 |
| Y | 0.4 | 0.1 |
| H | 0.2 | 0.05 |
| M | 0.16 | 0.04 |
| I | 0.08 | 0.02 |
| O | 0.04 | 0.01 |
| Q | 0.02 | 0.005 |
| R ³ | 0.01 | 0.0025 |

Reference¹



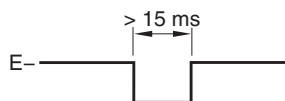
Synchronised pulse Z, duration as resolution.

Bi-directionally repeatable.⁴

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

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

¹ For clarity, the inverse signals are not shown.

² 40 μm ATOM DX only

³ 20 μm ATOM DX only

⁴ Only the calibrated reference mark is bi-directionally repeatable.

ATOM DX 20 µm part numbers

| | | | A | 2 | A | 0 | X | 10 | D | 50 | B | | | | | | | | | | | | | | | | | | | |
|--|--|------------|---|---|---|---|---|----|---|----|---|--|----------------|--------------------------------------|--|---|------------------|-------------|------------|-------------|-------------|-------------------------|--------------------------|--|-----------------------|----------------------------|--|---|----------------------------|--|
| Series | | | A2 - 20 µm ATOM DX | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Variant | | | A - Cabled L - Top exit ('00' cable length and 'Z' cable termination only) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scale type compatibility | | | <table border="1"> <thead> <tr> <th rowspan="3">Linear</th> <th colspan="2">Rotary</th> </tr> <tr> <th colspan="2">RCDM20 glass disc</th> </tr> <tr> <th colspan="2">Optical diameter</th> </tr> </thead> <tbody> <tr> <td>0 - RTLF20</td> <td colspan="2">1 - ≥ 77 mm</td> </tr> <tr> <td>0 - RKLF20¹</td> <td colspan="2">2 - ≥ 42.4 mm to < 77 mm</td> </tr> <tr> <td>1 - RCLC20 glass spar</td> <td colspan="2">3 - ≥ 31.4 mm to < 42.4 mm</td> </tr> <tr> <td>-</td> <td colspan="2">4 - ≥ 26.1 mm to < 31.4 mm</td> </tr> </tbody> </table> | | | | | | | | | Linear | Rotary | | RCDM20 glass disc | | Optical diameter | | 0 - RTLF20 | 1 - ≥ 77 mm | | 0 - RKLF20 ¹ | 2 - ≥ 42.4 mm to < 77 mm | | 1 - RCLC20 glass spar | 3 - ≥ 31.4 mm to < 42.4 mm | | - | 4 - ≥ 26.1 mm to < 31.4 mm | |
| Linear | Rotary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RCDM20 glass disc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Optical diameter | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 - RTLF20 | 1 - ≥ 77 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 - RKLF20 ¹ | 2 - ≥ 42.4 mm to < 77 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 - RCLC20 glass spar | 3 - ≥ 31.4 mm to < 42.4 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | 4 - ≥ 26.1 mm to < 31.4 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Resolution | | | <table> <tbody> <tr> <td>D - 5 µm</td> <td>Y - 0.1 µm</td> <td>O - 10 nm</td> </tr> <tr> <td>X - 1 µm</td> <td>H - 50 nm</td> <td>Q - 5 nm</td> </tr> <tr> <td>Z - 0.5 µm</td> <td>M - 40 nm</td> <td>R - 2.5 nm</td> </tr> <tr> <td>W - 0.2 µm</td> <td>I - 20 nm</td> <td></td> </tr> </tbody> </table> | | | | | | | | | D - 5 µm | Y - 0.1 µm | O - 10 nm | X - 1 µm | H - 50 nm | Q - 5 nm | Z - 0.5 µm | M - 40 nm | R - 2.5 nm | W - 0.2 µm | I - 20 nm | | | | | | | | |
| D - 5 µm | Y - 0.1 µm | O - 10 nm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X - 1 µm | H - 50 nm | Q - 5 nm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Z - 0.5 µm | M - 40 nm | R - 2.5 nm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W - 0.2 µm | I - 20 nm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cable length | | | <table> <tbody> <tr> <td>00 - no cable ('L' variant and 'Z' cable termination only)</td> <td>15 - 1.5 m</td> </tr> <tr> <td>02 - 0.2 m</td> <td>20 - 2.0 m</td> </tr> <tr> <td>05 - 0.5 m</td> <td>30 - 3.0 m</td> </tr> <tr> <td>10 - 1.0 m</td> <td></td> </tr> </tbody> </table> | | | | | | | | | 00 - no cable ('L' variant and 'Z' cable termination only) | 15 - 1.5 m | 02 - 0.2 m | 20 - 2.0 m | 05 - 0.5 m | 30 - 3.0 m | 10 - 1.0 m | | | | | | | | | | | | |
| 00 - no cable ('L' variant and 'Z' cable termination only) | 15 - 1.5 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 02 - 0.2 m | 20 - 2.0 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 05 - 0.5 m | 30 - 3.0 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 - 1.0 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cable termination | | | <table> <tbody> <tr> <td>A - 9-way D-type</td> <td>K - 10-way JST</td> </tr> <tr> <td>D - 15-way D-type (standard pin-out)</td> <td>Z - 10-way JST readhead connector ('L' variant and '00' cable length only)</td> </tr> <tr> <td>H - 15-way D-type (alternative pin-out)</td> <td></td> </tr> </tbody> </table> | | | | | | | | | A - 9-way D-type | K - 10-way JST | D - 15-way D-type (standard pin-out) | Z - 10-way JST readhead connector ('L' variant and '00' cable length only) | H - 15-way D-type (alternative pin-out) | | | | | | | | | | | | | | |
| A - 9-way D-type | K - 10-way JST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D - 15-way D-type (standard pin-out) | Z - 10-way JST readhead connector ('L' variant and '00' cable length only) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H - 15-way D-type (alternative pin-out) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clocked output option² | | | <table> <tbody> <tr> <td>50 - 50 MHz</td> <td>12 - 12 MHz</td> <td>04 - 4 MHz</td> </tr> <tr> <td>40 - 40 MHz</td> <td>10 - 10 MHz</td> <td>01 - 1 MHz</td> </tr> <tr> <td>25 - 25 MHz</td> <td>08 - 8 MHz</td> <td></td> </tr> <tr> <td>20 - 20 MHz</td> <td>06 - 6 MHz</td> <td></td> </tr> </tbody> </table> | | | | | | | | | 50 - 50 MHz | 12 - 12 MHz | 04 - 4 MHz | 40 - 40 MHz | 10 - 10 MHz | 01 - 1 MHz | 25 - 25 MHz | 08 - 8 MHz | | 20 - 20 MHz | 06 - 6 MHz | | | | | | | | |
| 50 - 50 MHz | 12 - 12 MHz | 04 - 4 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 - 40 MHz | 10 - 10 MHz | 01 - 1 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 - 25 MHz | 08 - 8 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 - 20 MHz | 06 - 6 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alarm format | | | <table> <tbody> <tr> <td>B - Line driven alarm³</td> <td></td> </tr> <tr> <td>F - 3-state alarm</td> <td></td> </tr> </tbody> </table> | | | | | | | | | B - Line driven alarm ³ | | F - 3-state alarm | | | | | | | | | | | | | | | | |
| B - Line driven alarm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F - 3-state alarm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

¹ RKLF20 is not suitable for partial arc applications.

² Additional clocked output options available. Contact your local Renishaw representative for further details.

³ No alarm output on readheads with 'A' cable termination

ATOM DX 40 µm part numbers

A4 A 0 X 10 D 50 B

Series

A4 - 40 µm ATOM DX

Variant

A - Cabled

L - Top exit ('00' cable length and 'Z' cable termination only)

Scale type compatibility

| Linear | Rotary | |
|-----------------------|----------------------------|----------------------------|
| | RCDM40 glass disc | CENTRUM CSF40 metal disc |
| | Optical diameter | Optical diameter |
| 0 - RTLF40 | 1 - ≥ 30.6 mm | C - ≥ 47.0 mm |
| 0 - RKLF40 | 2 - ≥ 19.7 mm to < 30.6 mm | D - ≥ 23.0 mm to < 47.0 mm |
| 1 - RCLC40 glass spar | 3 - ≥ 15.2 mm to < 19.7 mm | E - ≥ 16.0 mm to < 23.0 mm |
| - | 4 - ≥ 13.0 mm to < 15.2 mm | - |

Resolution

| | | |
|-----------|------------|-----------|
| T - 10 µm | Z - 0.5 µm | M - 40 nm |
| D - 5 µm | W - 0.2 µm | I - 20 nm |
| G - 2 µm | Y - 0.1 µm | O - 10 nm |
| X - 1 µm | H - 50 nm | Q - 5 nm |

Cable length

| | |
|--|------------|
| 00 - no cable ('L' variant and 'Z' cable termination only) | 15 - 1.5 m |
| 02 - 0.2 m | 20 - 2.0 m |
| 05 - 0.5 m | 30 - 3.0 m |
| 10 - 1.0 m | |

Cable termination

| | |
|---|--|
| A - 9-way D-type | K - 10-way JST |
| D - 15-way D-type (standard pin-out) | Z - 10-way JST readhead connector ('L' variant and '00' cable length only) |
| H - 15-way D-type (alternative pin-out) | |

Clocked output option ¹

| | | |
|-------------|-------------|------------|
| 50 - 50 MHz | 12 - 12 MHz | 04 - 4 MHz |
| 40 - 40 MHz | 10 - 10 MHz | 01 - 1 MHz |
| 25 - 25 MHz | 08 - 8 MHz | |
| 20 - 20 MHz | 06 - 6 MHz | |

Alarm format

B - Line driven alarm ²
F - 3-state alarm

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

¹ Additional clocked output options available. Contact your local Renishaw representative for further details.

² No alarm output on readheads with 'A' cable termination

Linear scale part numbers

RTLTF tape scale

| Scale type | Scale pitch | Length | Increments | Part number (where xxxx is the length in cm) ¹ | ATOM DX readhead scale type compatibility |
|------------|--------------------------|--------------------------|------------|--|---|
| RTLTF20-S | 20 µm | 20 mm to 1 m | 10 mm | A-9406-xxxx | 0 |
| | | 1 m to 10 m ² | 1 m | | |
| RTLTF40H-S | 40 µm (high accuracy) | 20 mm to 1 m | 10 mm | A-9408-xxxx | 0 |
| | | 1 m to 10 m ² | 1 m | | |
| RTLTF40-S | 40 µm | 20 mm to 1 m | 10 mm | A-9407-xxxx | 0 |
| | | 1 m to 10 m ² | 1 m | | |

RKLF mastered tape scale

| Scale type | Scale pitch | Length | Increments | Part number (where xxxx is the length in cm) ³ | ATOM DX readhead scale type compatibility |
|------------|---------------------------------------|--------------|------------|--|---|
| RKLF20-S | 20 µm ⁴ | 20 mm to 1 m | 10 mm | A-6767-xxxx | 0 |
| | | 1 m to 10 m | 1 m | | |
| RKLF40H-S | 40 µm (high accuracy) ⁴ | 20 mm to 1 m | 10 mm | A-6771-xxxx | 0 |
| | | 1 m to 10 m | 1 m | | |
| RKLF40 | 40 µm | 20 mm to 1 m | 10 mm | A-6769-xxxx | 0 |
| | | 1 m to 10 m | 1 m | | |

RCLC glass spar

| Length (mm) | 20 µm | 40 µm | ATOM DX readhead scale type compatibility |
|-------------|-------------|-------------|--|
| 10 | A-9404-2010 | A-9404-4010 | 1 |
| 18 | A-9404-2018 | A-9404-4018 | 1 |
| 30 | A-9404-2030 | A-9404-4030 | 1 |
| 55 | A-9404-2055 | A-9404-4055 | 1 |
| 80 | A-9404-2080 | A-9404-4080 | 1 |
| 100 | A-9404-2100 | A-9404-4100 | 1 |
| 105 | A-9404-2105 | A-9404-4105 | 1 |
| 130 | A-9404-2130 | A-9404-4130 | 1 |

¹ Ordering A-9408-0070 for example will result in a 70 cm length of RTLTF40H-S scale.

² Lengths greater than 10 m are available on request.

³ Ordering A-6767-0070 for example will result in a 70 cm length of RKLF20-S scale.

⁴ Not recommended for partial arc applications.

Rotary disc part numbers

RCDM rotary discs (20 µm version)

| Optical diameter (mm) | Nominal outer diameter (mm) | Part number | ATOM DX readhead scale type compatibility |
|-----------------------|-----------------------------|-------------|---|
| 26.08 | 30 | A-9405-2030 | 4 |
| 31.83 | 36 | A-9405-2036 | 3 |
| 45.84 | 50 | A-9405-2050 | 2 |
| 52.15 | 56 | A-9405-2056 | 2 |
| 63.66 | 68 | A-9405-2068 | 2 |
| 104.3 | 108 | A-9405-2108 | 1 |

RCDM rotary discs (40 µm version)

| Optical diameter (mm) | Nominal outer diameter (mm) | Part number | ATOM DX readhead scale type compatibility |
|-----------------------|-----------------------------|-------------|---|
| 13.04 | 17 | A-9405-4017 | 4 |
| 15.92 | 20 | A-9405-4020 | 3 |
| 21.01 | 25 | A-9405-4025 | 2 |
| 22.92 | 27 | A-9405-4027 | 2 |
| 26.08 | 30 | A-9405-4030 | 2 |
| 31.83 | 36 | A-9405-4036 | 1 |
| 45.84 | 50 | A-9405-4050 | 1 |
| 52.15 | 56 | A-9405-4056 | 1 |
| 63.66 | 68 | A-9405-4068 | 1 |
| 104.3 | 108 | A-9405-4108 | 1 |

CENTRUM CSF40 rotary discs

CENTRUM CSF40 discs can be customised to fit most applications.

The following part numbers are the existing CENTRUM discs available from Renishaw.

All dimensions and tolerances are in mm.

| | Part numbers | | |
|---------------------------|--------------|-------------|-------------|
| | A-9400-1035 | A-9400-1030 | A-9400-1025 |
| Mounting method | Bolted | Bolted | Bolted |
| Reference mark | External | External | External |
| Line count | 3 860 | 6 360 | 8 880 |
| Optical diameter (OPD) | 49.15 | 80.98 | 113.06 |
| Shaft diameter (SD) | 24.5 | 56.5 | 88.5 |
| Outer diameter (OD) | 56 | 88 | 120 |
| Bolt holes diameter (PCD) | 34.5 | 66.0 | 98.5 |
| Readhead installation (A) | 20.46 ±0.2 | 36.83 ±0.2 | 52.42 ±0.2 |

NOTE: Other disc diameters are available; contact your local Renishaw representative for more information.

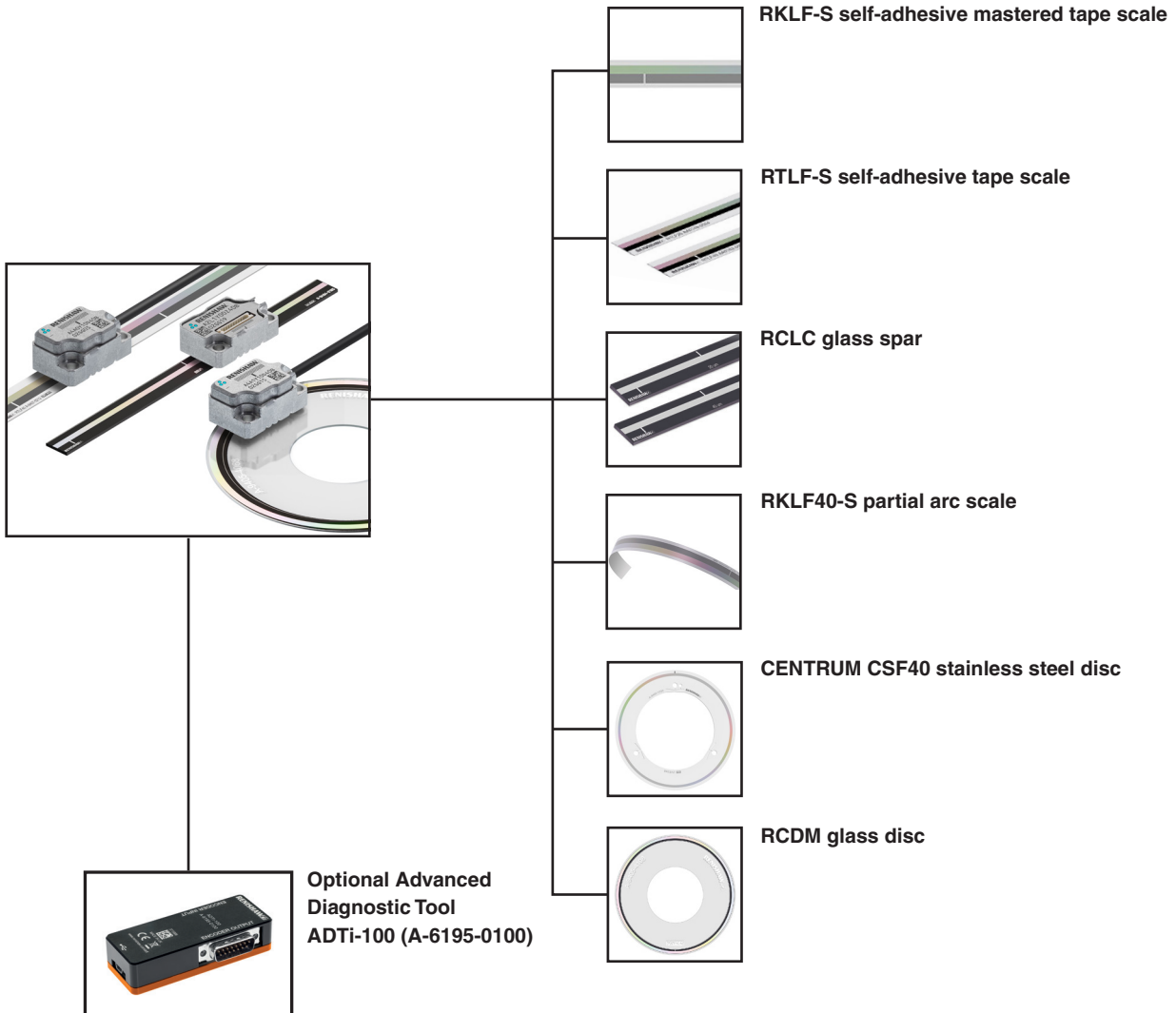
Top exit readhead cable part numbers

| Cable length (m) | Cable termination | Part number |
|------------------|--------------------------------------|-------------|
| 0.5 | 15-way D-type connector ¹ | A-9414-1223 |
| 1.0 | | A-9414-1225 |
| 1.5 | | A-9414-1226 |
| 3.0 | | A-9414-1228 |
| 0.5 | 10-way JST connector ² | A-9414-1233 |
| 1.0 | | A-9414-1235 |
| 1.5 | | A-9414-1236 |
| 3.0 | | A-9414-1238 |

¹ Provided with 'D' pin-out

² Provided with 'K' pin-out


ATOM DX compatible products:



www.renishaw.com/contact

 #renishaw

 +44 (0) 1453 524524

 uk@renishaw.com

© 2017–2023 Renishaw plc. All rights reserved. This document may not be copied or reproduced in whole or in part, or transferred to any other media or language by any means, without the prior written permission of Renishaw.

RENISHAW® and the probe symbol are registered trade marks of Renishaw plc. Renishaw product names, designations and the mark 'apply innovation' are trade marks of Renishaw plc or its subsidiaries. Other brand, product or company names are trade marks of their respective owners.

WHILE CONSIDERABLE EFFORT WAS MADE TO VERIFY THE ACCURACY OF THIS DOCUMENT AT PUBLICATION, ALL WARRANTIES, CONDITIONS, REPRESENTATIONS AND LIABILITY, HOWSOEVER ARISING, ARE EXCLUDED TO THE EXTENT PERMITTED BY LAW. RENISHAW RESERVES THE RIGHT TO MAKE CHANGES TO THIS DOCUMENT AND TO THE EQUIPMENT, AND/OR SOFTWARE AND THE SPECIFICATION DESCRIBED HEREIN WITHOUT OBLIGATION TO PROVIDE NOTICE OF SUCH CHANGES.

Renishaw plc. Registered in England and Wales. Company no: 1106260. Registered office: New Mills, Wotton-under-Edge, Glos, GL12 8JR, UK.

Part no.: L-9517-9736-04-D

Issued: 07.2023