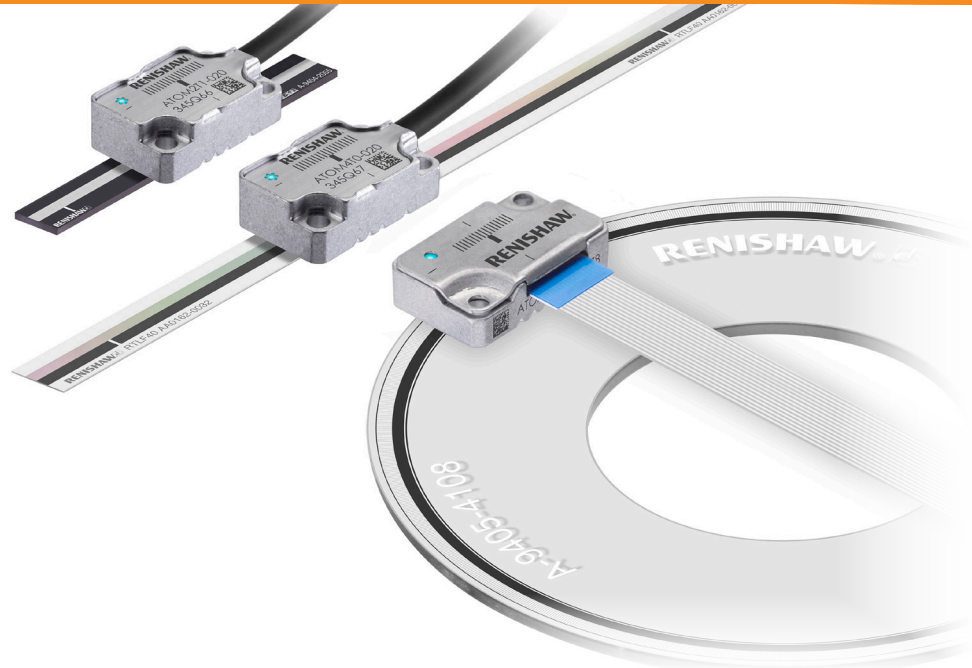


ATOM™ miniature encoder system



ATOM™ is the world's first miniature encoder with filtering optics, providing improvements in dirt immunity, signal stability and reliability for linear, partial arc and rotary applications.

ATOM features a number of other advances that help maintain signal stability, including integral Auto Gain Control and Auto Offset Control, along with a highly reliable IRED light source, making the product suitable for use in applications demanding quality and dependability.

The miniature readhead is available in 2 formats: hi-flex cable output or flexible-printed circuit (FPC) output. The FPC version helps reduce overall package size, with a reduced Z-height and easy cable routing.

ATOM is available with a range of high-accuracy optical linear, partial arc and rotary scales, including conventional glass spars, 'unbreakable' stainless steel tape scales and glass discs. Installation has been simplified by an intuitive set-up LED on the readhead that indicates signal level. Optical reference mark phasing and incremental signal optimisation can be achieved with the simple press of a button.

ATOM is suitable for use in a variety of applications that require compact size, including laser scanners, CMM arms, semiconductor manufacturing, compact linear motors/motion stages, small DDR torque motors, galvanometers and microscope stages.

ATOM – miniaturisation without compromise.

- **Miniature package: 8.35 mm × 12.7 mm × 20.5 mm (7.3 mm × 12.7 mm × 20.5 mm for FPC version)**
- **Highest signal stability and dirt immunity in its class 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**
- **Easy installation and diagnostics using the set-up LED on the readhead**
- **Fast, simple calibration at the push of a button**
- **Auto-phase optical reference mark**
- **Available in 20 µm and 40 µm scale pitch versions**
- **Analogue output direct from the readhead**
- **Multiple interpolation options, with resolutions to 1 nm**
- **Range of high accuracy rotary, partial arc and linear scales**

System features

High performance

- **Need higher speed?**

ATOM is the fastest encoder in its class, with maximum speeds up to 20 m/s and a range of high-speed interpolation options for digital versions.

- **Need higher accuracy?**

ATOM offers linear tape scales with specified overall accuracy to $\pm 5 \mu\text{m/m}$ at 20 °C, without the need for 2-point compensation that competitor encoders require.

- **Need improved positional stability and repeatability?**

ATOM has low noise (jitter), allowing users to increase servo-loop gain without instability, whilst reaping other dynamic performance benefits such as faster settling times and higher acceleration.

- **Need smoother velocity control?**

Reduce velocity ripple, improve scanning performance, reduce blur on vision systems and image capturing – all thanks to ATOM's superior optical scheme and integral AOC.

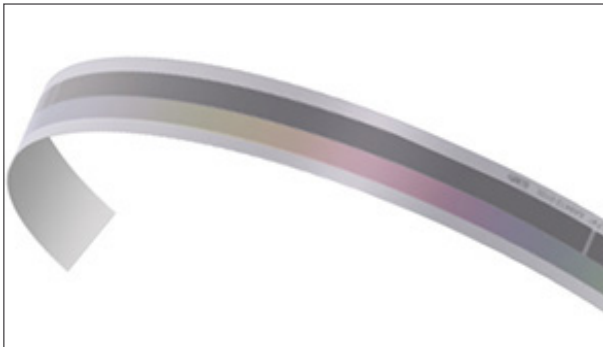
Lissajous stability

ATOM features a miniaturized version of Renishaw's unique filtering optics that are used in the TONiC™ 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.

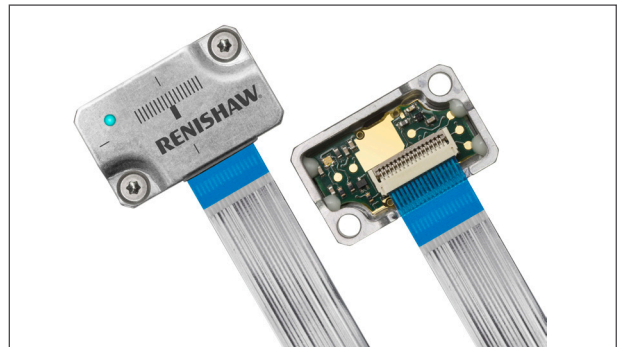
Product range

- **20 µm and 40 µm readheads with high-flex cable:**
For general purpose applications. Superior quality cable tested to 20 million flex cycles.
- **20 µm and 40 µm readheads with FPC cable:**
Side exit FPC cable allows the smallest overall package size.
- **Stainless steel tape scale (RKLF):**
Linear scale that can be wrapped around drums, arcs or shafts with radii down to 26 mm.
- **Stainless steel tape scale (RTLF):**
High-accuracy linear scale with graduations directly marked onto the steel tape surface. Available on reels for cut-to-suit flexibility.
- **Glass linear spars (RCLC):**
Conventional glass spars, available in lengths up to 130 mm.
- **Glass discs (RCDM):**
High-accuracy rotary scales with outer diameters down to 17 mm.

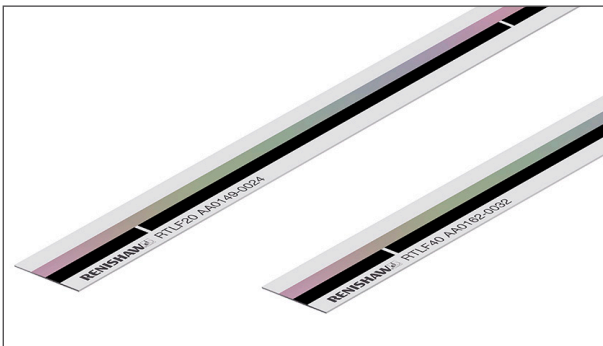
Stainless steel tape scale (RKLF)



20 µm and 40 µm readheads with FPC cable



Stainless steel tape scale (RTLF)



Glass discs (RCDM)



ATOM interface options

ATOM readheads are available in three versions all giving industry standard analogue output:

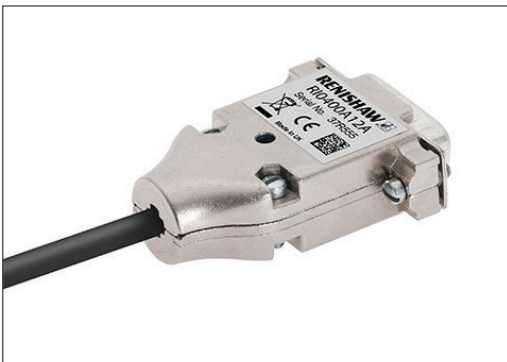
- High flex cable terminated with a 15-way D-type connector for high-volume users requiring analogue outputs.

NOTE: A CAL button is not included on this option. Refer to the installation guide for details on how to calibrate.

- High-flex cable terminated with a T-type interboard connector for use with ACi/Ri/Ti interfaces.
- FPC connector for use with ACi interface or direct connection to user electronics.



ACi interfaces are a range of high performance, miniature, open interpolator subsystems. They bring unparalleled price-performance benefits to today's motion systems that need fine resolution coupled to high speed performance in an ultra compact, open format, small footprint solution and have provision for calibrating the system. Digital interpolation down to 10 nm at up to 40 MHz clocked output is available. FPC or cable input versions available.



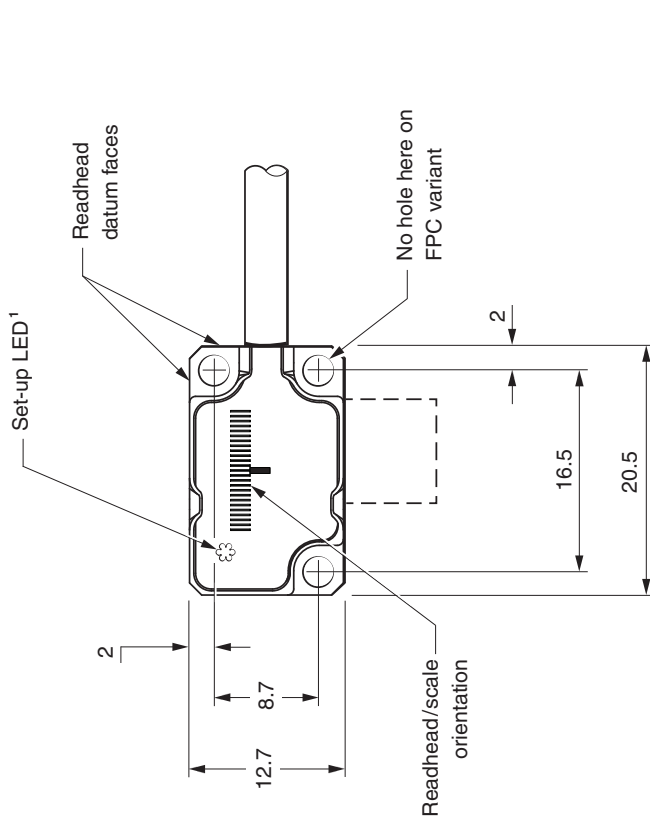
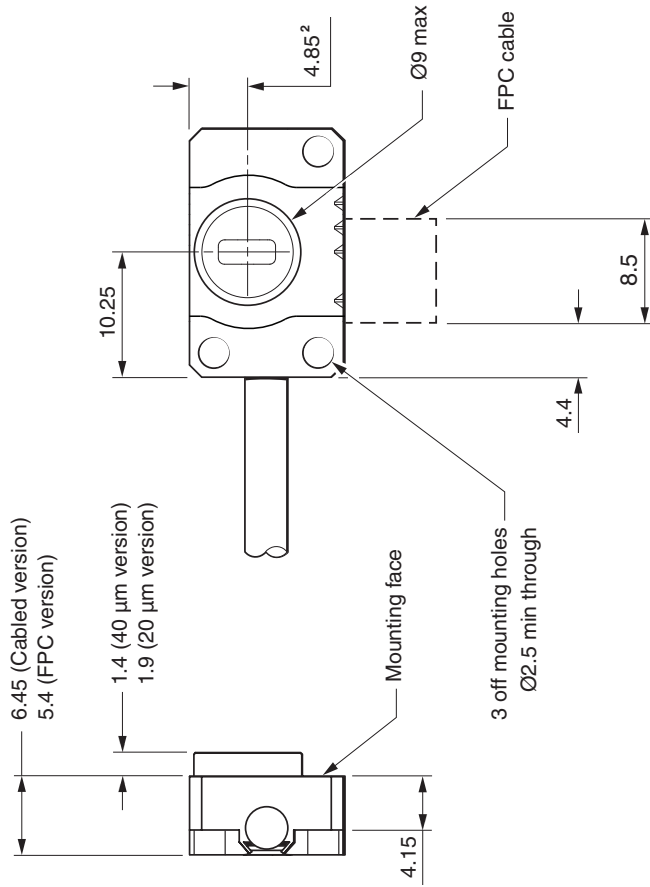
Ri interfaces are contained within an industry standard 15-way D-type connector shell, including CAL button. They offer digital interpolation down to 50 nm (clocked) and 0.5 μm (non-clocked). Analogue variants are also available.



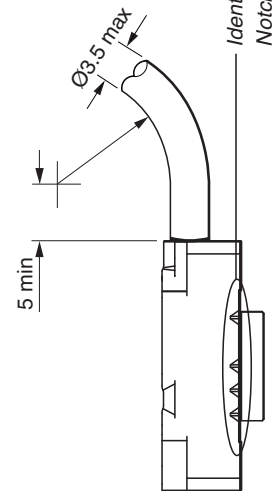
Ti interfaces are designed for applications that require higher speed, lower SDE, digital interpolation down to 1 nm resolution and include a CAL button. Clocked outputs have been optimised for speed and performance at all resolutions for industry-standard controllers. Analogue variants are also available.

ATOM readhead dimensions

Dimensions and tolerances in mm



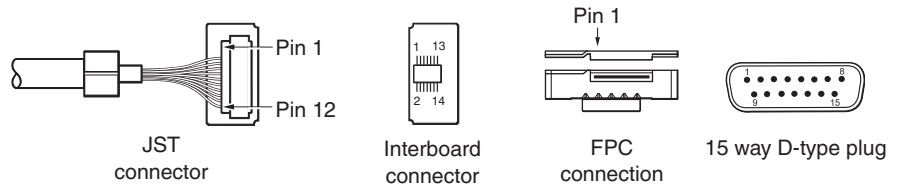
R > 20 Dynamic bend radius
R > 10 Static bend radius



¹ On FPC variants the set-up LED cut-out is circular.
² Not optical centreline.

Readhead output signals

Function	Signal	Colour	JST ² (on interboard)	Interboard connector (T)	FPC (F)	15-way D-type (D)		
			Pin	Pin	Pin	Pin		
Power ¹	5 V	Brown	11	4	9, 10	4, 5		
	0 V	White	5	13	3, 6, 11, 14	12, 13		
Incremental	Cosine	V ₁	+	Red	4	9	9	
			-	Blue	3	5	4	1
	Sine	V ₂	+	Yellow	7	12	2	10
			-	Green	6	14	1	2
Reference mark	V ₀	+	Violet	10	2	13	3	
		-	Grey	9	8	12	11	
Set-up	V _x	Clear	12	6	16	6		
Remote CAL	CAL	Orange	8	10	15	14		
Shield	-	Screen	Cable ferrule	Cable ferrule	Readhead body	Case		
Do not connect	-	-	1, 2	1, 3, 7, 11	7, 8	7, 8, 15		



Maximum speed

40 µm readhead - 20 m/s (-3dB)

20 µm readhead - 10 m/s (-3dB)

¹ All power connections can be used either to minimise voltage drop down the cable or incorporate voltage sensing.

² Only available on interboard connector.

RKLF technical specifications

Material	Hardened and tempered martensitic stainless steel fitted with a self-adhesive backing tape	
Form (H × W)	0.15 mm × 6 mm (including adhesive)	
Scale pitch	20 µm and 40 µm ¹	
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	+10 °C to +35 °C ³	
Coefficient of thermal expansion (at 20 °C)	Matches that of substrate material when scale ends fixed by epoxy mounted end clamp.	
Length	20 mm to 1 m in 10 mm increments 1 m to 10 m in 1 m increments ⁴ 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 not suitable for partial arc applications.

² Only 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™ linear encoder system* installation guide (Renishaw part no. M-9696-9723).

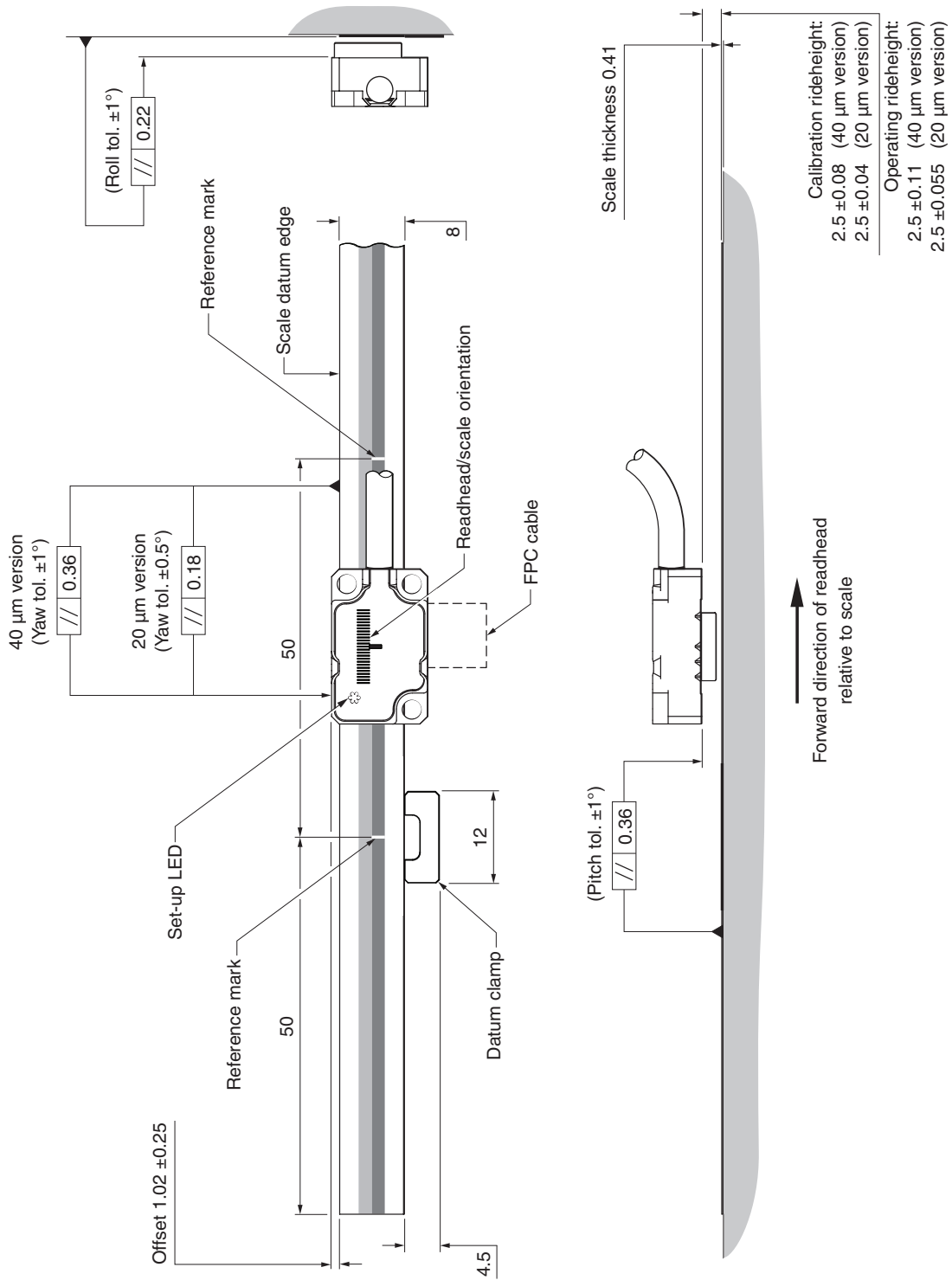
⁴ Maximum recommended axis length 1 m for 20 µm systems.

⁵ To limit 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



For detailed installation drawings refer to www.renishaw.com/atomdownloads.

RTLFL technical specifications

Material	Hardened and tempered martensitic stainless steel fitted with a self-adhesive backing tape
Form (H × W)	0.41 mm × 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)	RTLFL20-S / RTLFL40H-S ±5 µm/m RTLFL40-S ±15 µm/m
Coefficient of thermal expansion (at 20 °C)	10.1 ±0.2 µm/m/°C ²
Length	20 mm to 1 m in 10 mm increments 1 m to 10 m in 1 m increments ³ Scale length = measuring length + 6 mm (without optional end covers)
Mass	12.2 g/m

¹ Only selected reference mark is bi-directionally repeatable.

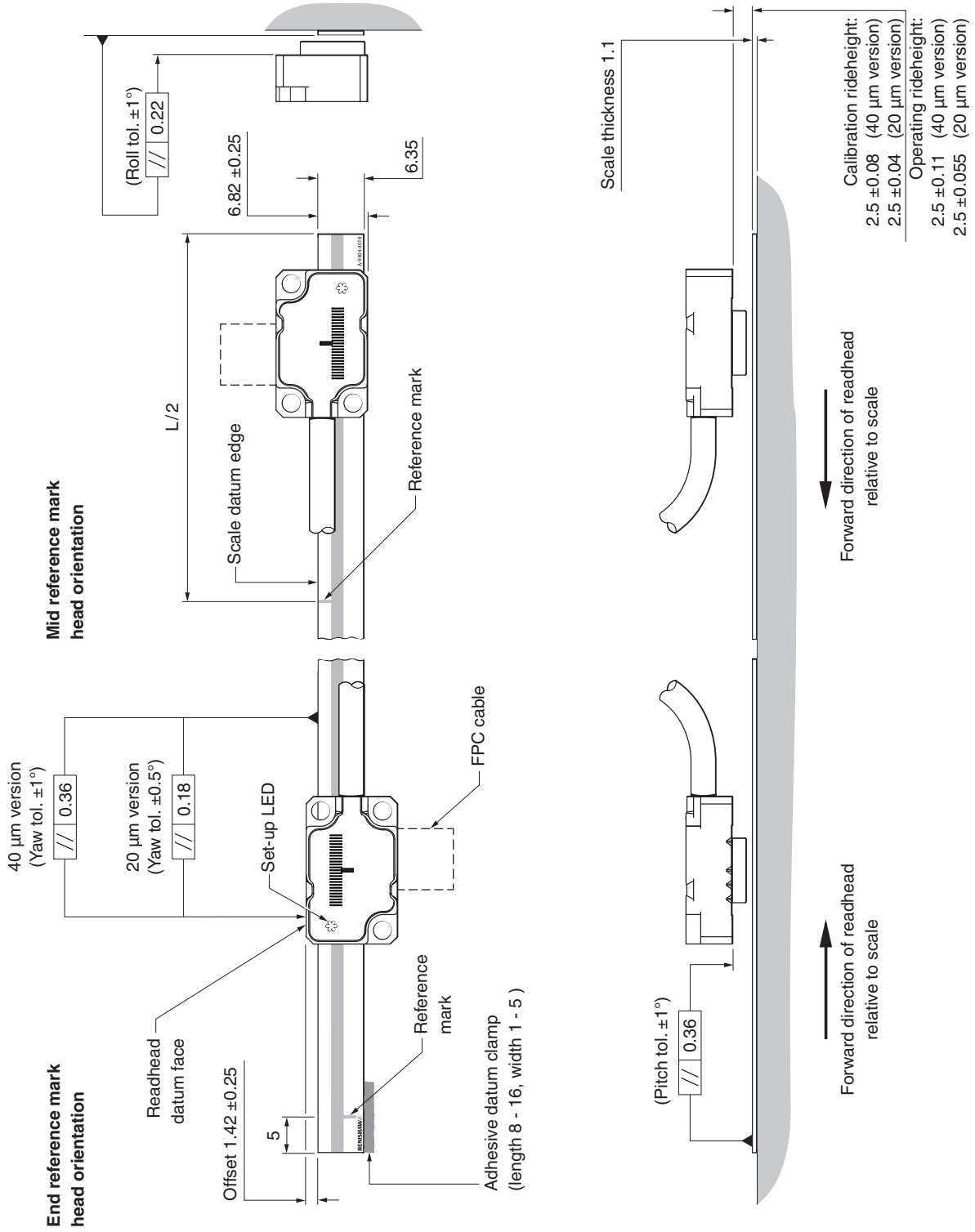
² Substrate coefficient of thermal expansion does not need to match that of the scale.

³ Maximum recommended axis length 1 m for 20 µm systems.

RCLC glass spar installation drawing



Dimensions and tolerances in mm



For detailed installation drawings refer to www.renishaw.com/atomdownloads.

RCLC technical specifications

Material	Soda-lime glass spar fitted with a self-adhesive backing tape
Form (H × W)	1.1 mm × 6.35 mm (including adhesive)
Scale 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

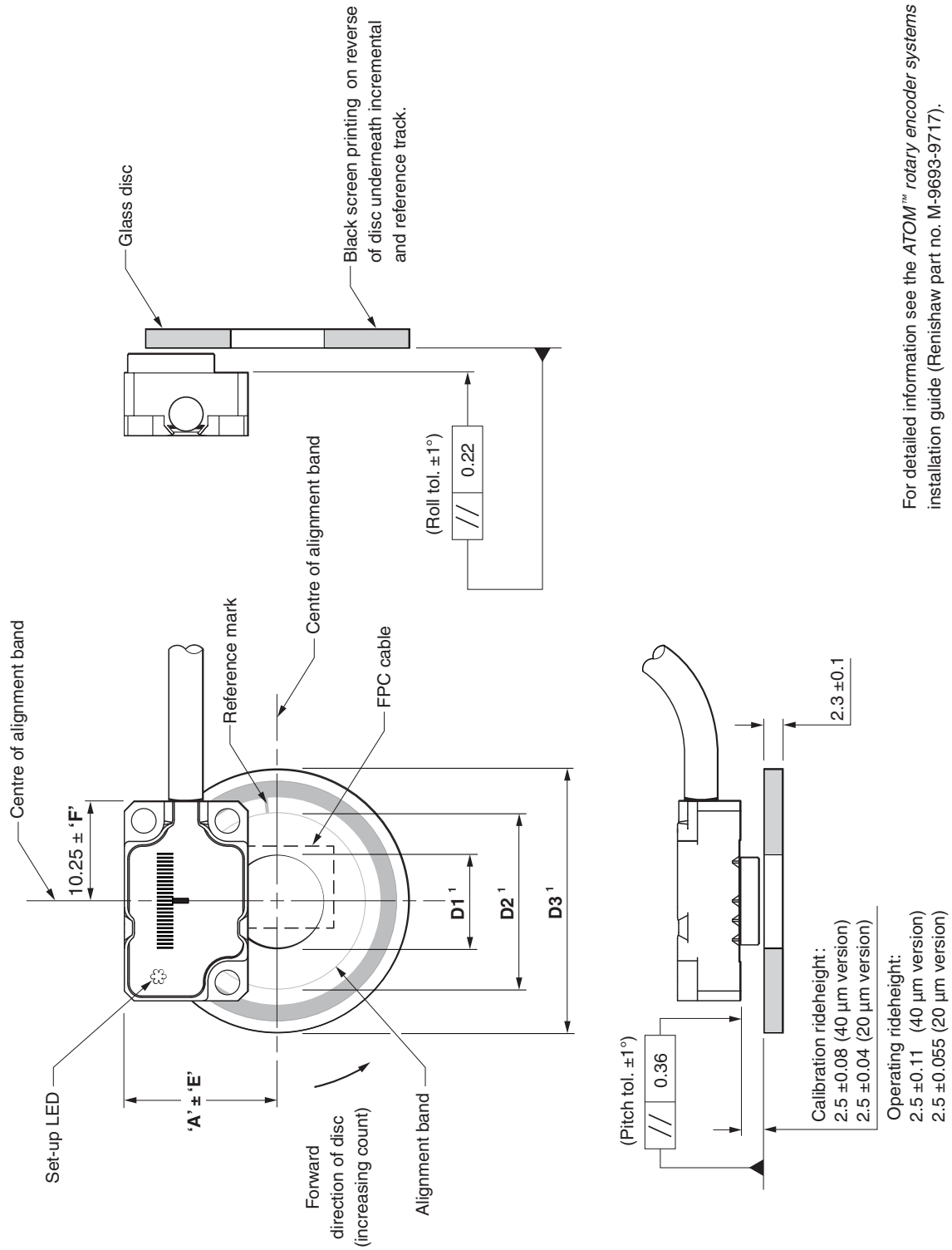
RCLC scale length

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

RCDM rotary disc installation drawing



Dimensions and tolerances in mm



¹ The dimensions D1, D2 and D3 are listed on the following page.

Dimensions

Disc size ¹ (mm)	Line count		D1 (mm)	D2 (mm)	D3 (mm)	Optical diameter (mm)	A (mm)	Radial tolerance E (mm)		Longitudinal tolerance F (mm)	
	20 µm version	40 µm version						20 µm version	40 µm version	20 µm version	40 µm version
17	-	1 024	3.275	8.1	16.9	13.04	10.63	-	0.1	-	0.1
20	-	1 250	3.275	11	19.9	15.92	12.07	-	0.1	-	0.1
25	-	1 650	6.46	16.1	24.9	21.01	14.62	-	0.125	-	0.075
27	-	1 800	9.625	18	26.9	22.92	15.57	-	0.125	-	0.075
30	4 096	2 048	12.8	21.15	29.9	26.08	17.15	0.1	0.125	0.075	0.125
36	5 000	2 500	12.8	26.9	35.9	31.83	20.03	0.125	0.175	0.075	0.2
50	7 200	3 600	25.5	40.9	49.9	45.84	27.03	0.125	0.2	0.075	0.2
56	8 192	4 096	25.5	47.25	55.9	52.15	30.19	0.125	0.2	0.1	0.2
68	10 000	5 000	25.5	58.55	67.9	63.66	35.94	0.15	0.2	0.125	0.3
108	16 384	8 192	50.9	99.2	107.9	104.3	56.26	0.2	0.2	0.225	0.3

¹ Special disc sizes available on request.

RCDM technical specifications

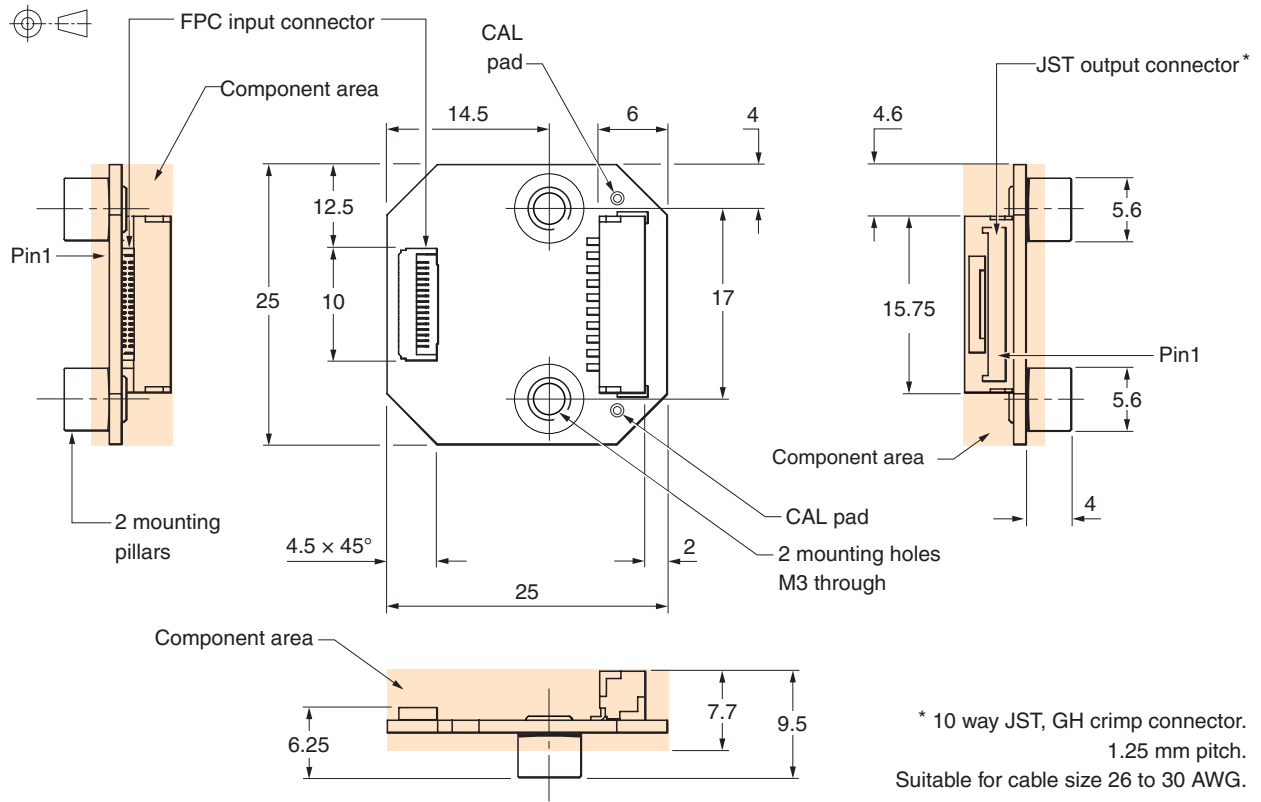
Material	Soda-lime glass	
Form	2.3 mm thick	
Reference mark	Single reference mark	
Coefficient of thermal expansion	~8 µm/m/°C	
Nominal outer diameter (mm)	40 µm	17, 20, 25, 27, 30, 36, 50, 56, 68, 108
	20 µm	30, 36, 50, 56, 68, 108

Graduation accuracy

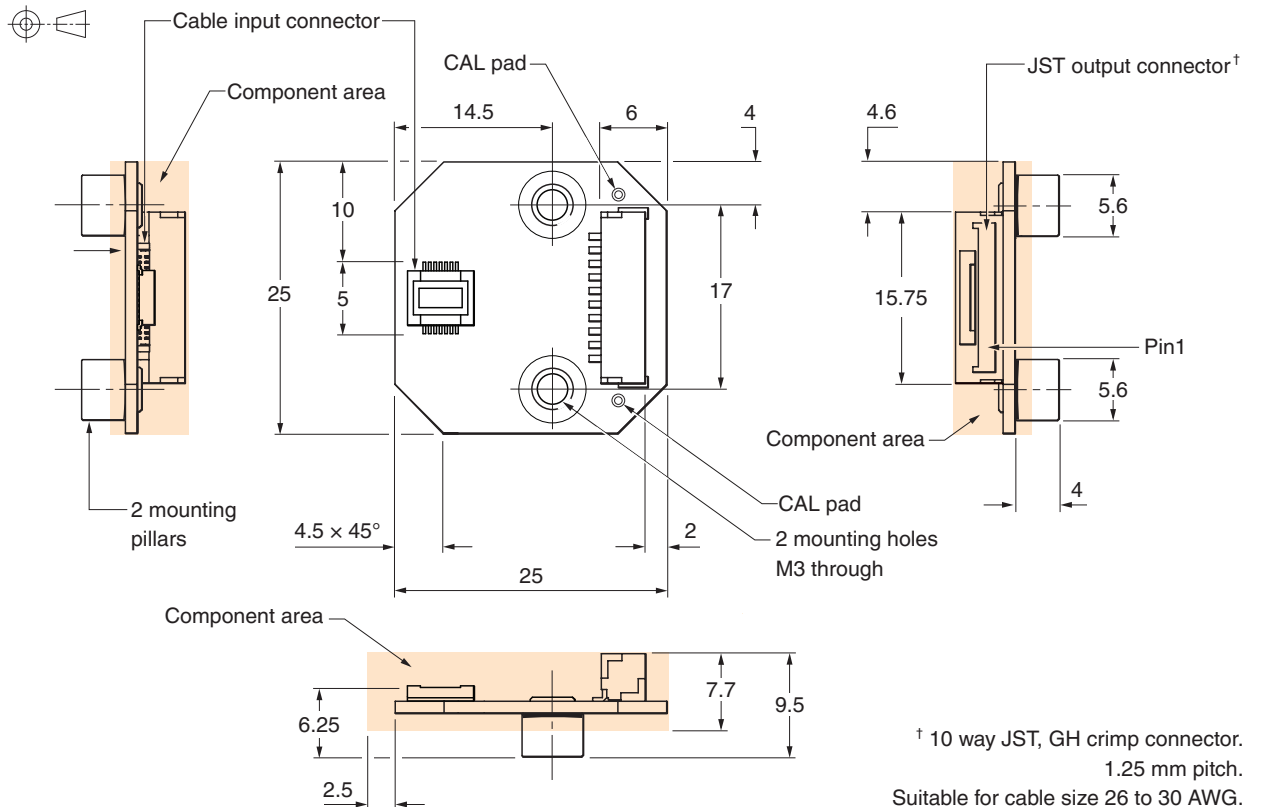
Disc size (mm)	17	20	25	27	30	36	50	56	68	108
Graduation accuracy (arc seconds)	15.81	12.95	9.82	9	7.91	6.49	4.5	3.95	3.24	2.78

ACi interface

FPC variant dimension drawing

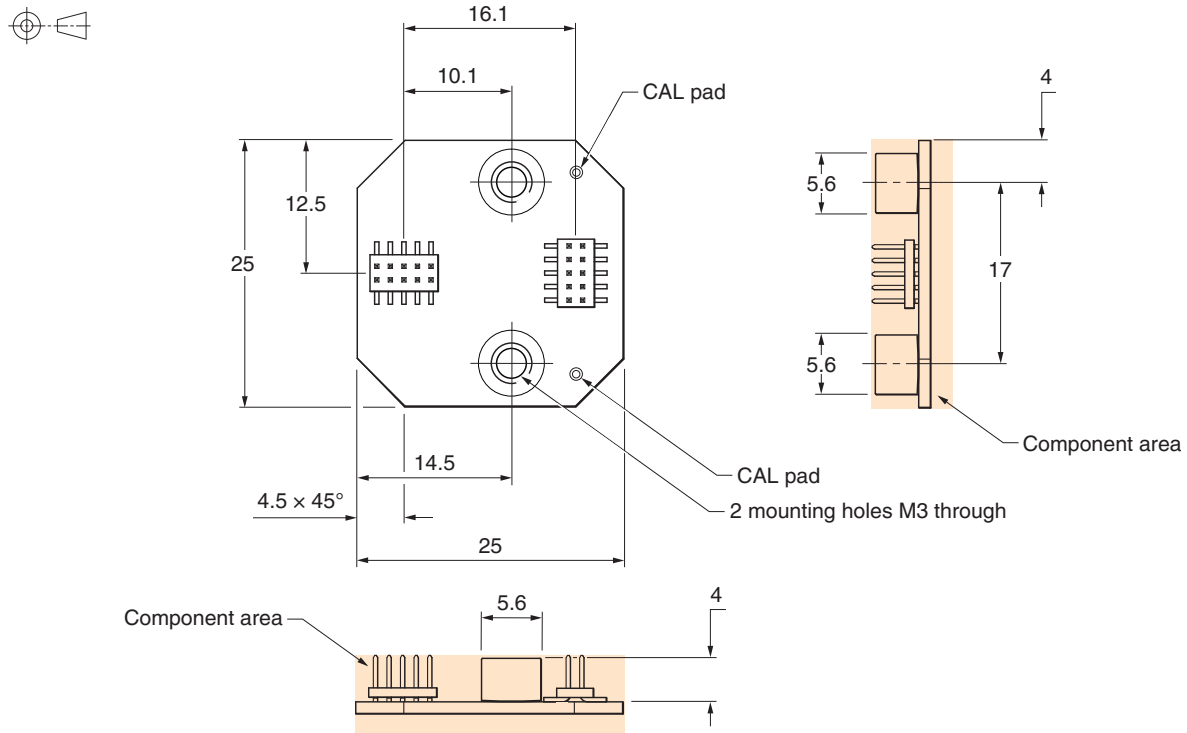


Cable variant dimension drawing



PCB mounting variant dimension drawing

Dimensions and tolerances in mm



ACi speed

20 µm system

Maximum speed (m/s)								Lowest recommended counter input frequency (MHz)
0020 (1 µm)	0040 (0.5 µm)	0080 (0.25 µm)	0100 (0.2 µm)	0200 (0.1 µm)	0400 (50 nm)	1000 (20 nm)	2000 (10 nm)	
6.5	6.5	6.5	5.8	3	-	-	-	40
6.5	6.5	4	3.2	1.6	-	-	-	20
-	-	-	-	-	0.35	0.13	0.06	12
6.5	4	2	1.6	0.8	-	-	-	10
-	-	-	-	-	0.18	0.06	0.03	6
4	2	1	0.8	0.4	-	-	-	5
-	-	-	-	-	0.12	0.04	0.02	4

40 µm system

Maximum speed (m/s)								Lowest recommended counter input frequency (MHz)
0020 (2 µm)	0040 (1 µm)	0080 (0.5 µm)	0100 (0.4 µm)	0200 (0.2 µm)	0400 (0.1 µm)	1000 (40 nm)	2000 (20 nm)	
13	13	13	11.6	6	-	-	-	40
13	13	8	6.4	3.2	-	-	-	20
-	-	-	-	-	0.7	0.26	0.12	12
13	8	4	3.2	1.6	-	-	-	10
-	-	-	-	-	0.36	0.12	0.06	6
8	4	2	1.6	0.8	-	-	-	5
-	-	-	-	-	0.24	0.08	0.04	4

Angular speed

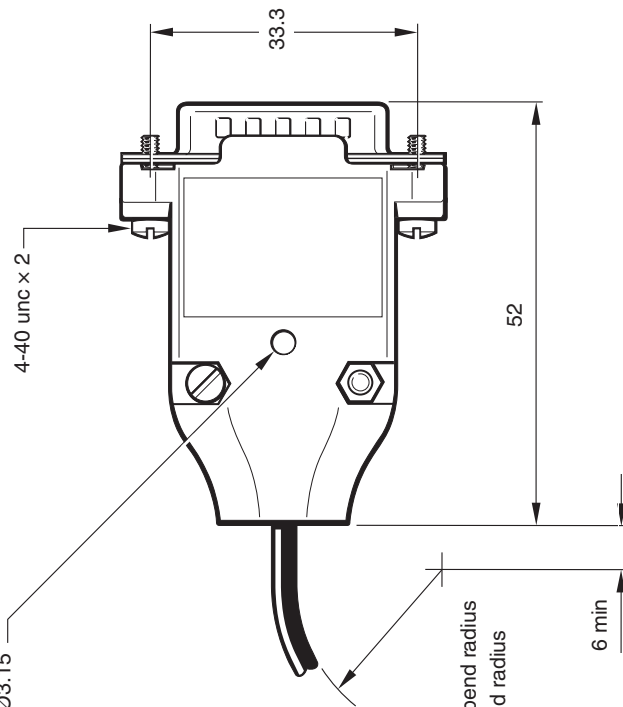
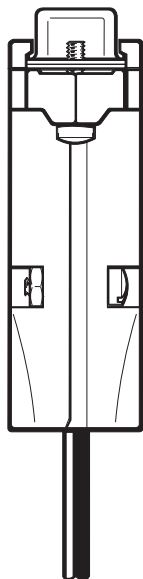
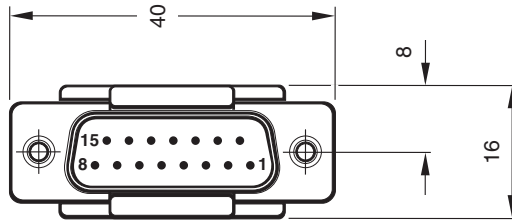
Angular speed depends on disc optical diameter – use the following equation to convert to rev/min:

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

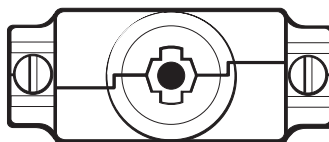
Ri interface

Dimension drawing

Dimensions and tolerances in mm



R > 20 Dynamic bend radius
R > 10 Static bend radius



CAL/AGC push button switch access hole Ø3.15

Ri speed

Clocked outputs

Ri0100, Ri0200 and Ri0400 interfaces have clocked outputs.

Customers must ensure they comply with the lowest recommended counter input frequency.

Maximum speed (m/s)						Lowest recommended counter input frequency (MHz)
20 µm system			40 µm system			
0100 (0.2 µm)	0200 (0.1 µm)	0400 (50 nm)	0100 (0.4 µm)	0200 (0.2 µm)	0400 (0.1 µm)	
-	0.8	0.4	-	1.6	0.8	12
-	0.5	0.25	-	1	0.5	10
0.8	0.4	0.2	1.6	0.8	0.4	6
0.5	0.25	0.12	1	0.5	0.24	4

Non-clocked outputs

Ri0004, Ri0008, Ri0020 and Ri0040 interfaces have non-clocked outputs.

20 µm system		40 µm system		Lowest recommended counter input frequency (MHz)
Interface type	Maximum speed (m/s)	Interface type	Maximum speed (m/s)	
0004 (5 µm)	10	0004 (10 µm)	20	$\left(\frac{\text{Encoder velocity (m/s)}}{\text{Resolution (µm)}} \right) \times 4 \text{ safety factor}$
0008 (2.5 µm)	10	0008 (5 µm)	20	
0020 (1 µm)	10	0020 (2 µm)	20	
0040 (0.5 µm)	10	0040 (1 µm)	20	

Analogue outputs

40 µm system - 20 m/s (-3dB)

20 µm system - 10 m/s (-3dB)

Angular speed

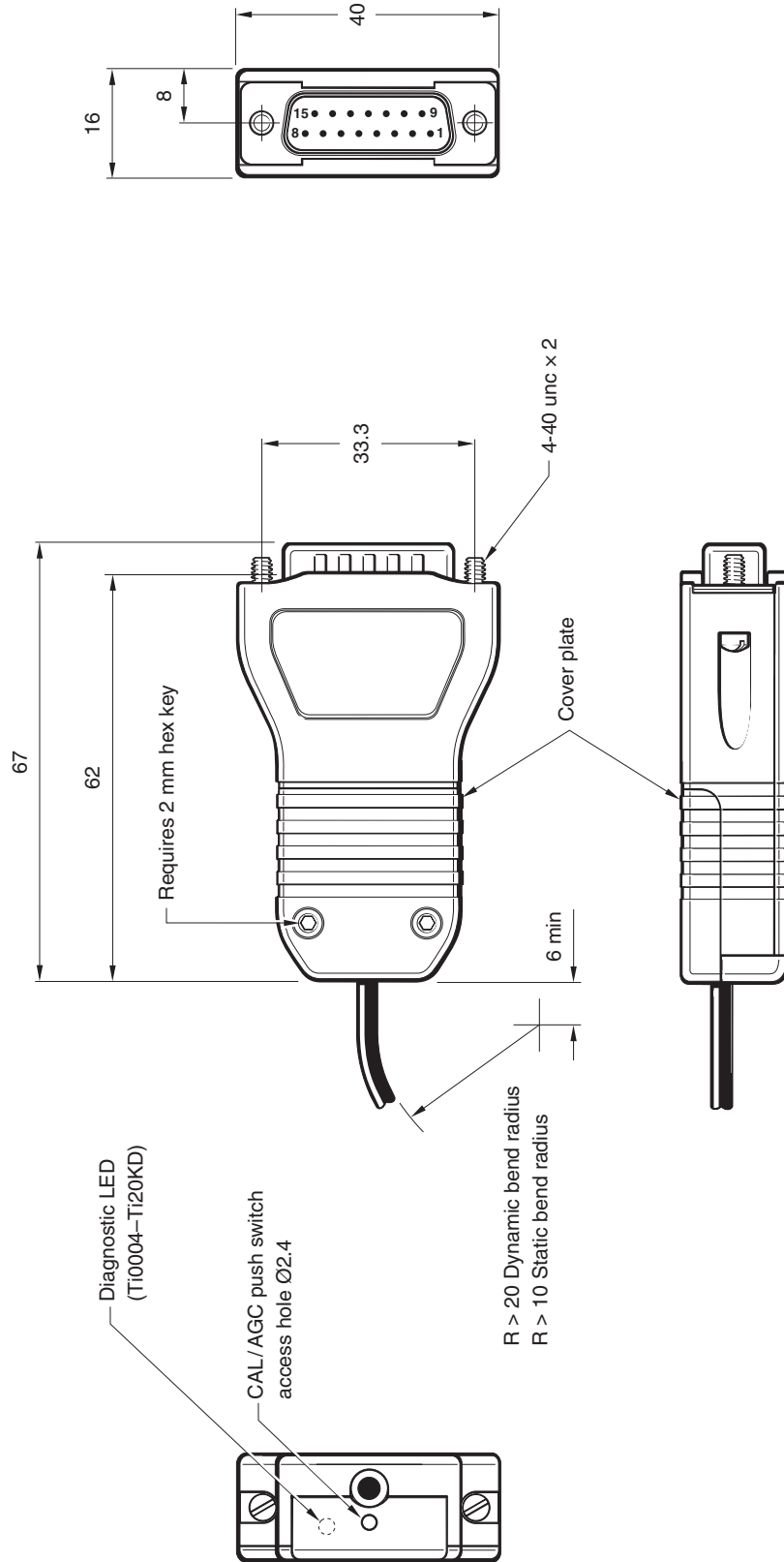
Angular speed depends on disc optical diameter – use the following equation to convert to rev/min:

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

Ti interface

Dimension drawing

Dimensions and tolerances in mm



Ti speed

20 µm system

Maximum speed (m/s)											Lowest recommended counter input frequency (MHz)
Ti0004 5 µm	Ti0020 1 µm	Ti0040 0.5 µm	Ti0100 0.2 µm	Ti0200 0.1 µm	Ti0400 50 nm	Ti1000 20 nm	Ti2000 10 nm	Ti4000 5 nm	Ti10KD 2 nm	Ti20KD 1 nm	
10	10	10	6.48	3.24	1.62	0.648	0.324	0.162	0.0654	0.032	50
10	10	10	5.4	2.7	1.35	0.54	0.27	0.135	0.054	0.027	40
10	10	8.1	3.24	1.62	0.81	0.324	0.162	0.081	0.032	0.016	25
10	10	6.75	2.7	1.35	0.675	0.27	0.135	0.068	0.027	0.013	20
10	9	4.5	1.8	0.9	0.45	0.18	0.09	0.045	0.018	0.009	12
10	8.1	4.05	1.62	0.81	0.405	0.162	0.081	0.041	0.016	0.0081	10
10	6.48	3.24	1.29	0.648	0.324	0.13	0.065	0.032	0.013	0.0065	8
10	4.5	2.25	0.9	0.45	0.225	0.09	0.045	0.023	0.009	0.0045	6
10	3.37	1.68	0.67	0.338	0.169	0.068	0.034	0.017	0.0068	0.0034	4
4.2	0.84	0.42	0.16	0.084	0.042	0.017	0.008	0.004	0.0017	0.0008	1

40 µm system

Maximum speed (m/s)											Lowest recommended counter input frequency (MHz)
Ti0004 10 µm	Ti0020 2 µm	Ti0040 1 µm	Ti0100 0.4 µm	Ti0200 0.2 µm	Ti0400 0.1 µm	Ti1000 40 nm	Ti2000 20 nm	Ti4000 10 nm	Ti10KD 4 nm	Ti20KD 2 nm	
20	20	20	12.96	6.48	3.25	1.296	0.648	0.324	0.013	0.064	50
20	20	20	10.8	5.4	2.7	1.08	0.54	0.27	0.108	0.054	40
20	20	16.2	6.48	3.24	1.62	0.648	0.324	0.162	0.064	0.032	25
20	20	13.5	5.4	2.7	1.34	0.54	0.27	0.136	0.054	0.026	20
20	18	9	3.6	1.8	0.9	0.36	0.18	0.09	0.036	0.018	12
20	16.2	8	3.24	1.62	0.8	0.324	0.162	0.082	0.032	0.0162	10
20	12.96	6.48	2.58	1.296	0.648	0.26	0.13	0.064	0.026	0.013	8
20	9	4.5	1.8	0.9	0.45	0.18	0.09	0.046	0.018	0.009	6
20	6.74	3.36	1.34	0.676	0.338	0.136	0.068	0.034	0.0136	0.0068	4
8.4	1.68	0.84	0.32	0.168	0.084	0.034	0.016	0.008	0.0034	0.0016	1

Analogue speed

40 µm system - 20 m/s (-3dB)

20 µm system - 10 m/s (-3dB)

Angular speed

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

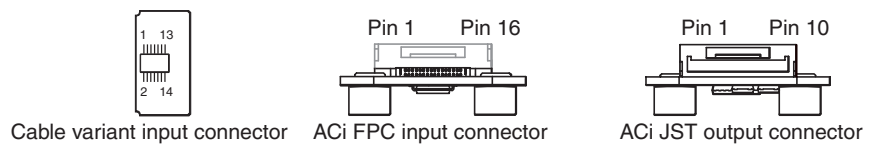
$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D} \quad \text{where } V = \text{maximum linear speed (m/s)} \text{ and } D = \text{optical diameter (mm)}$$

Interface signals

ACi FPC and cable variant interface (digital output only)

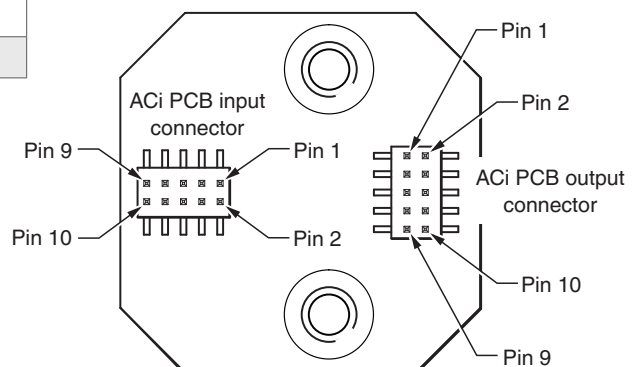
Function	Input				Output		
	Signal	Cable		FPC	JST		
		Colour	Pin	Pin	Signal	Pin	
Power ¹	5 V	Brown	4	7, 8	5 V	9	
	0 V	White	13	3, 6, 11, 14	0 V	10	
Incremental	V ₁	+	Red	9	A	+	1
		-	Blue	5		-	2
	V ₂	+	Yellow	12	B	+	3
		-	Green	14		-	4
Reference mark	V ₀	+	Violet	2	Z	+	5
		-	Grey	8		-	6
Set-up	V _x	Clear	6	1	X	7	
Remote CAL	CAL	Orange	10	2	CAL	8	
Shield	-	Screen	Cable ferrule	-	-	-	
Do not connect	-	-	1, 3, 7, 11	9, 10	-	-	

¹ All power connections can be used either to minimise voltage drop down the cable or incorporate voltage sensing.



ACi PCB mounting variant interface (digital output only)

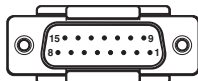
Function	Input		Output			
	Signal	Pin	Signal	Pin		
Power	5 V	9	5 V	6		
	0 V	2	0 V	5		
Incremental	V ₁	+	4	A	+	8
		-	6		-	10
	V ₂	+	3	B	+	7
		-	1		-	9
Reference mark	V ₀	+	8	Z	+	3
		-	10		-	1
Remote CAL	V _x	7	X	4		
Shield	CAL	5	CAL	2		



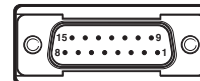
Interface signals

Ri and Ti interfaces

Function	Digital		Analogue			
	Signal	Pin	Signal	Pin		
Power ¹	5 V	7, 8	5 V	4, 5		
	0 V	2, 9	0 V	12, 13		
Incremental signals	A	+	14	V ₁	+	9
		-	6		-	1
	B	+	13	V ₂	+	10
		-	5		-	2
Reference mark	Z	+	12	V ₀	+	3
		-	4		-	11
Alarm ²	E	+	11	-	-	-
		-	3			
Set-up	X	1	V _x	6		
Remote CAL	-	-	CAL	14		
Shield	-	Case	-	Case		
Do not connect	-	10, 15	-	7, 8, 15		



Ri connector




Ti connector

¹ All power connections should be used either to minimise voltage drop down the cable or incorporate voltage sensing.

² The alarm signal can be output as a line driven signal or 3-state. Select the preferred option at time of ordering.

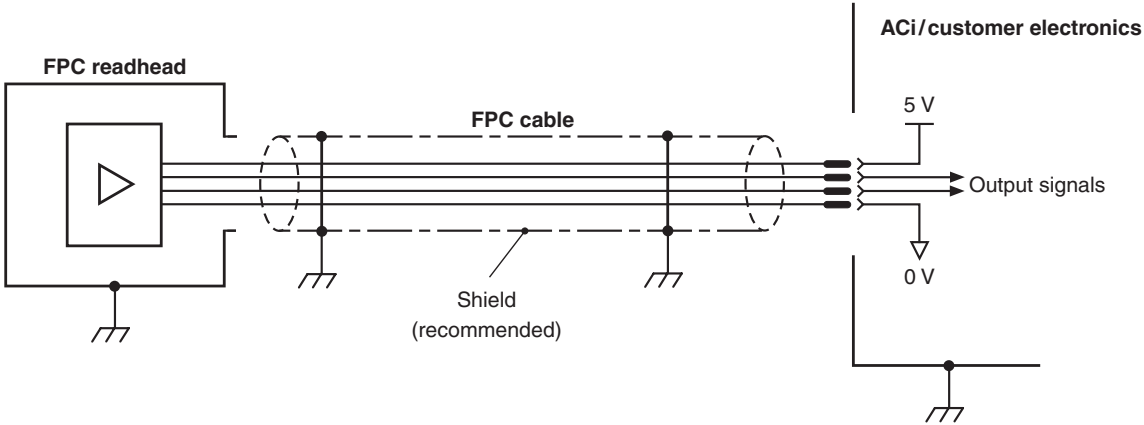
General specifications

Power supply ¹	5 V ±10%	<p>ATOM readhead typically < 50 mA</p> <p>ATOM with ACi typically < 100 mA</p> <p>ATOM with Ri typically < 100 mA</p> <p>ATOM with Ti typically < 200 mA</p> <p>For analogue outputs a further 10 mA in total will be drawn when terminated with 120R.</p> <p>For digital outputs a further 25 mA per channel pair (eg A+, A-) will be drawn when terminated with 120R.</p> <p>Power from a 5 Vdc supply complying with the requirements for SELV of standard IEC 60950-1.</p>
	Ripple	200 mVpp maximum@frequency up to 500 kHz
Temperature	Storage	-20 °C to +70 °C
	Operating	0 °C to +70 °C
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing	Cable variant	IP40
	FPC variant	IP20 (with lid fitted)
	Ri interface	IP20
	Ti interface	IP20
Acceleration (system)	Operating	400 m/s ² , 3 axes
Shock (system)	Operating	1000 m/s ² , 6 ms, ½ sine, 3 axes
Vibration	Operating	100 m/s ² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Cable readhead	4 g
	FPC readhead	2.3 g
	Cable	18 g/m
	Ti interface	100 g
	Ri interface	70 g
	ACi interface	4 g
Readhead cable		<p>10 core, high flex, EMI screened cable, outside diameter 3.5 mm maximum</p> <p>Flex life > 20 × 10⁶ cycles at 20 mm bend radius, maximum length 5 m.</p> <p>(Extension cable up to 25 m when using Renishaw approved extension cable)</p> <p>UL recognised component </p>
FPC cable		16 core, 0.5 mm pitch, maximum exposed conductor length 2.5 mm, maximum length 1 m
Connector options	Cable variants	Interboard connector compatible with the Ri, Ti and ACi (cable variant) interfaces
	FPC	15-way, D-type connector
Typical SDE (analogue)	20 µm version	< ±75 nm
	40 µm version	< ±120 nm

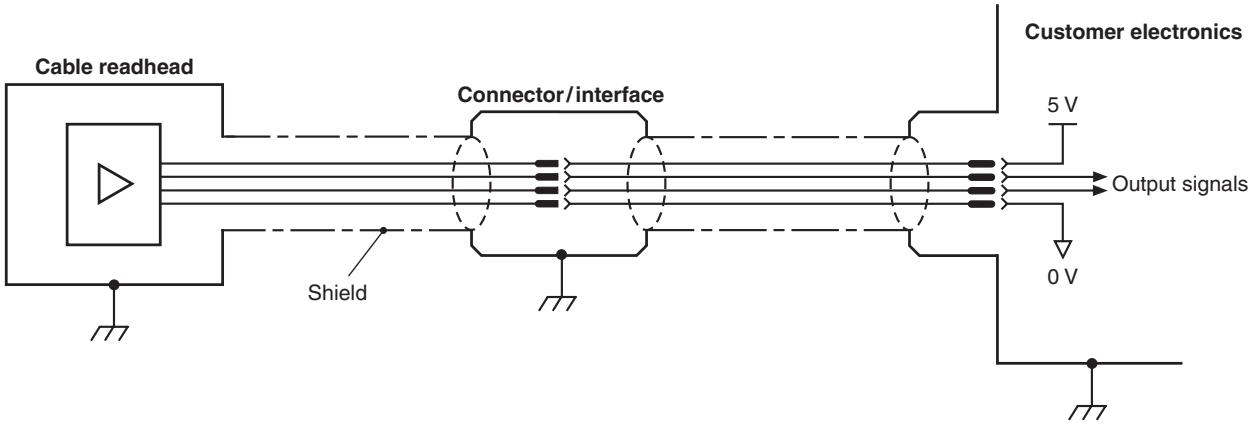
¹ Current consumption figures refer to unterminated systems.

Electrical connections

Grounding and shielding



For more information on FPC refer to the installation guide.

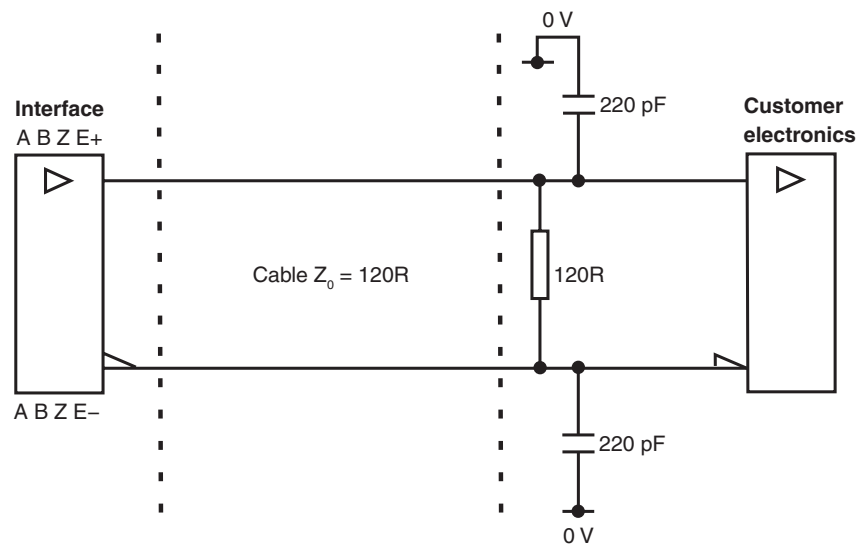


IMPORTANT: The shield should be connected to the machine earth (Field Ground).

NOTE: Maximum cable length between interface and customer electronics is 25 m for ACi and Ri and 50 m for Ti depending on clocked output.

Recommended signal termination

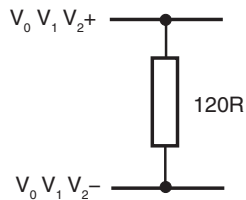
Digital outputs



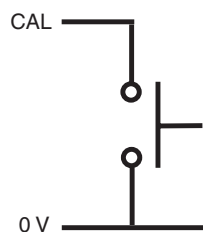
Standard RS422A line receiver circuitry.

Capacitors recommended for improved noise immunity.

Analogue outputs



Remote CAL operation



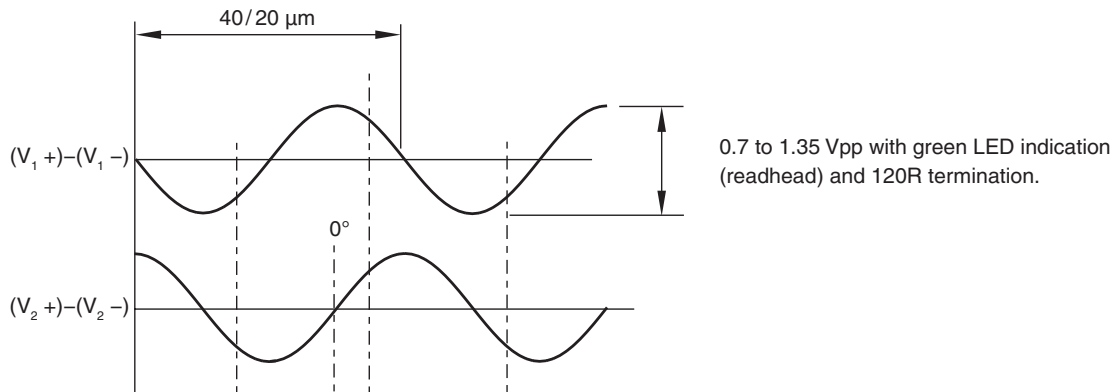
Remote operation of the CAL is possible via the CAL pin. For applications where no interface is used, remote CAL operation is essential.

Output specifications

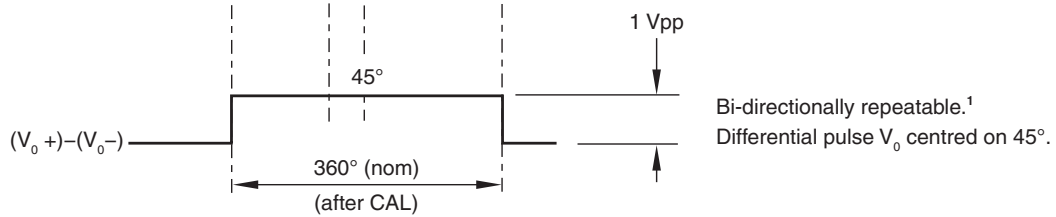
Analogue output signals

All ATOM readheads and Ri and Ti analogue interfaces

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



Reference

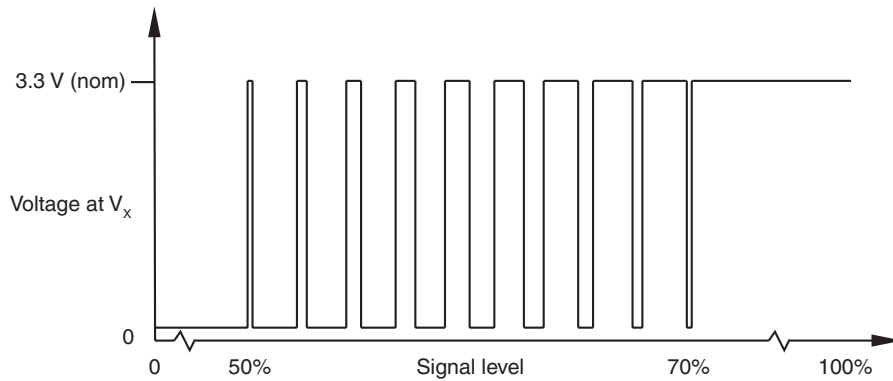


Differential signals V_{0+} and V_{0-} centred on ~ 1.65 V.

¹ Only calibrated reference mark is bi-directionally repeatable.

Set-up

During normal operation

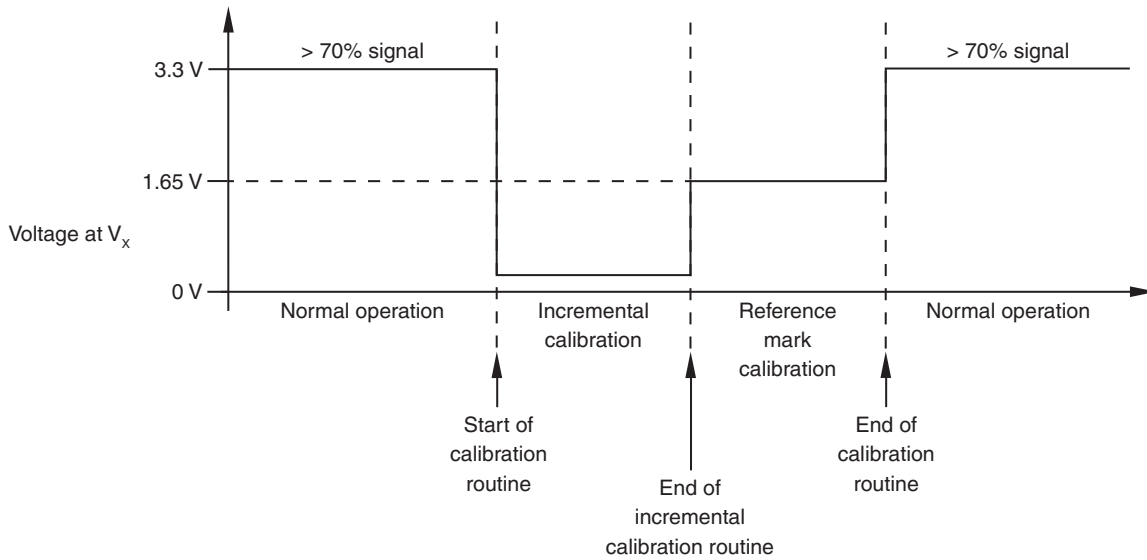


Between 50% and 70% signal level, V_x is a duty cycle.

Time spent at 3.3 V increases with incremental signal level.

At > 70% signal level V_x is nominal 3.3 V.

During CAL routine

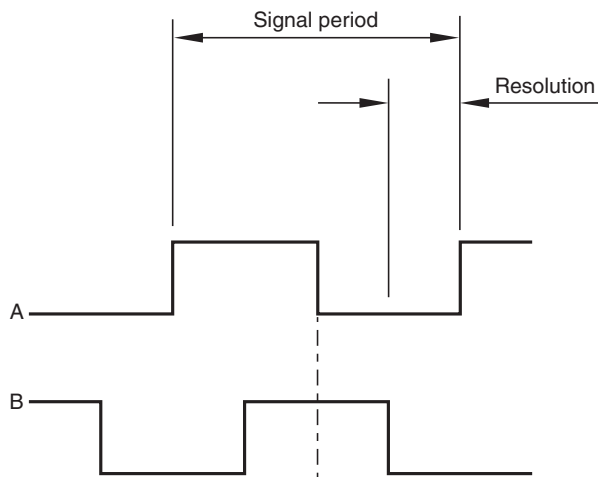


Digital output signals

Form - Square wave differential line driver to EIA RS422A

All ACi interfaces, Ri digital interfaces, and Ti digital interfaces

Incremental¹ 2 channels A and B in quadrature (90° phase shifted)



Reference¹



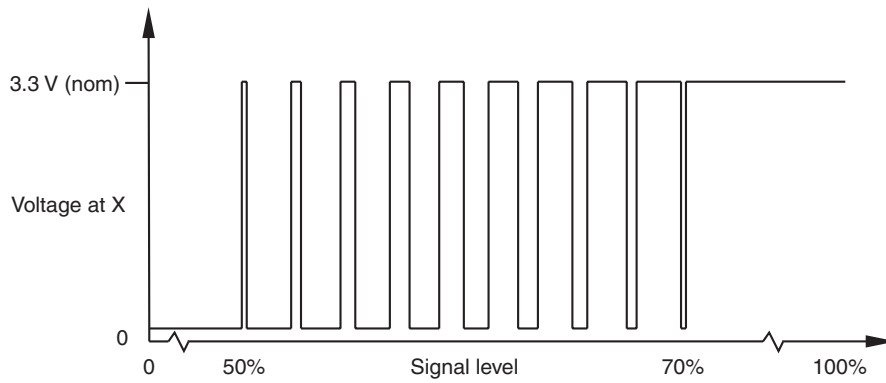
Synchronised pulse Z, duration as resolution.

Bi-directionally repeatable.²

¹ Inverse signals not shown for clarity.

² Only calibrated reference mark is bi-directionally repeatable.

Set-up (ACi interfaces and Ri digital interfaces)

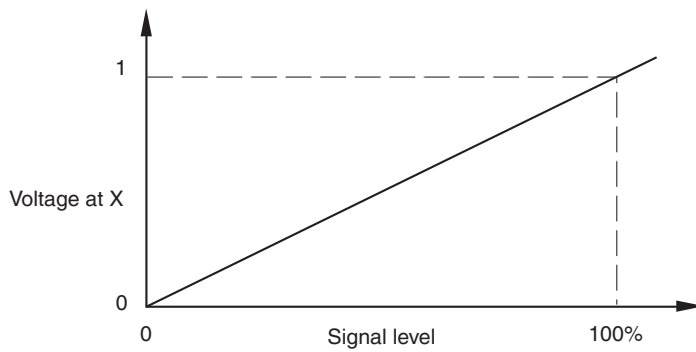


Between 50% and 70% signal level, X is a duty cycle.

Time spent at 3.3 V increases with incremental signal level.

At > 70% signal level X is nominal 3.3 V.

Set-up¹ (Ti digital interfaces only)

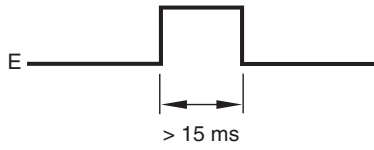


Set-up signal voltage proportional to incremental signal amplitude.

¹ Set-up signal as shown is not present during calibration routine.

Alarm¹

Differential line driven alarm output (Ri digital interfaces and Ti digital interfaces)



Interface model	Alarm asserted when
Ri0004	<ul style="list-style-type: none"> < 40% signal Overspeed
Ri0008	
Ri0020	
Ri0040	
Ri0100	<ul style="list-style-type: none"> < 20% signal > 130% signal
Ri0200	
Ri0400	

Interface model	Alarm asserted when
Ti	<ul style="list-style-type: none"> < 20% signal > 135% signal Overspeed

3-state alarm output (ACi interfaces, Ri digital interfaces, and Ti digital interfaces)

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

¹ Inverse signals not shown for clarity.

ATOM readhead

ATOM 4 F 0 - 000

Scale period

- 2 - 20 μm
- 4 - 40 μm

Head type

- F - FPC: for use with FPC variant ACi or customer PCB
- T - Cabled: interboard connector (for use with cable variant ACi, customer PCB, Ri or Ti interfaces)
- D - Cabled: D-type connector

Cable length

- 000 - FPC
- 020 - 200 mm
- 030 - 300 mm
- 050 - 500 mm
- 080 - 800 mm
- 100 - 1000 mm
- 150 - 1500 mm
- 200 - 2000 mm
- 300 - 3000 mm
- 500 - 5000 mm

Head gain setting

Head gain setting	RTL/ RKL ¹ (tape scale)	RCLC (glass spar)	40 μm rotary discs (mm)				20 μm rotary discs (mm)			
			< 20	20	25, 27, 30	> 30	30	36	50, 56, 68	108
0	✓									
1		✓				✓				✓
2					✓				✓	
3				✓				✓		
4			✓				✓			

¹ RKL¹ linear and RKL40 partial arc.

RTLF tape scale

Scale type	Scale pitch	Length	Increments	Part number (where xxxx is the length in cm) ¹	Head gain setting
RTLF20-S	20 µm	20 mm to 1 m	10 mm	A-9406-xxxx	0
		1 m to 10 m ²	1 m		
RTLF40H-S	40 µm (high accuracy)	20 mm to 1 m	10 mm	A-9408-xxxx	0
		1 m to 10 m ²	1 m		
RTLF40	40 µm	20 mm to 1 m	10 mm	A-9407-xxxx	0
		1 m to 10 m ²	1 m		

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

² Lengths greater than 10 m available on request.

RKLF mastered tape scales

Scale type	Scale pitch	Length	Increments	Part number (where xxxx is the length in cm) ³	Head gain setting
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		

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

⁴ Not recommended for partial arc applications.

RCLC glass spar

Length	20 µm	40 µm	Head gain setting
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

RCDM rotary discs (20 µm version)

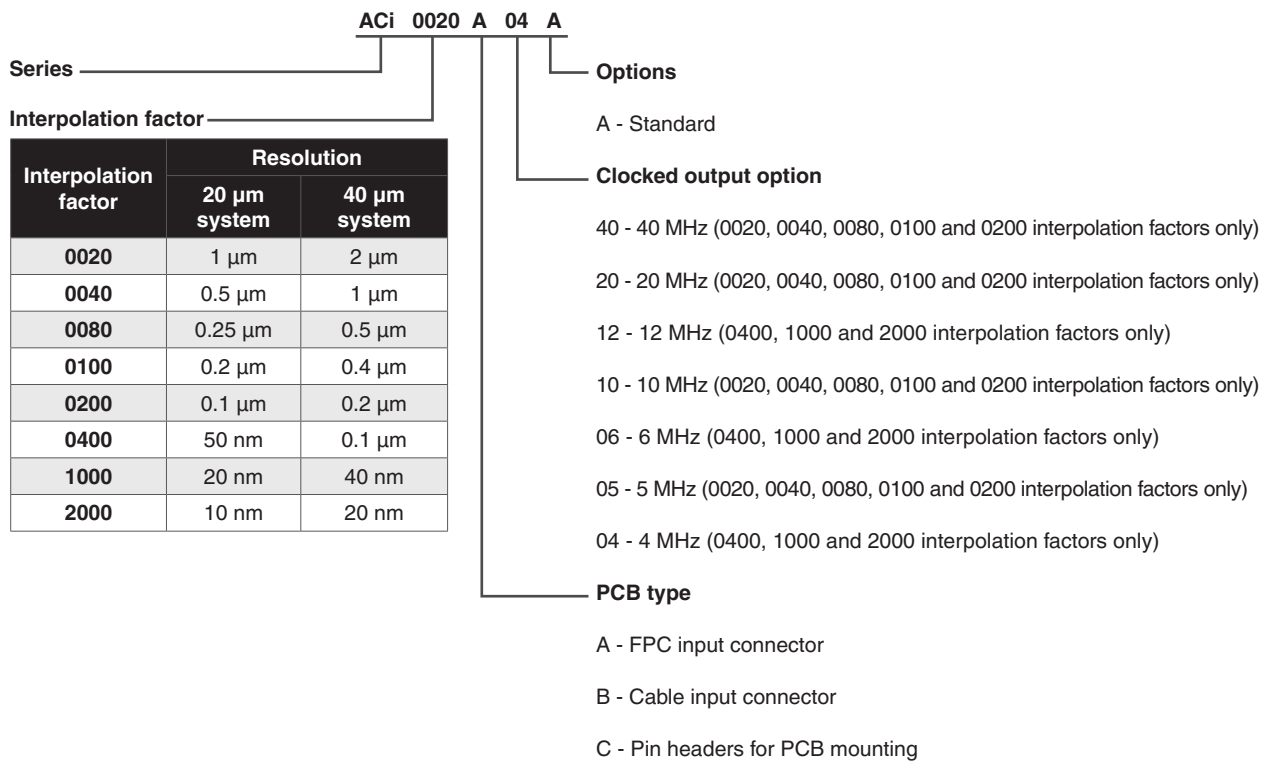
Diameter (mm)	Part number	Head gain setting
30	A-9405-2030	4
36	A-9405-2036	3
50	A-9405-2050	2
56	A-9405-2056	2
68	A-9405-2068	2
108	A-9405-2108	1

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

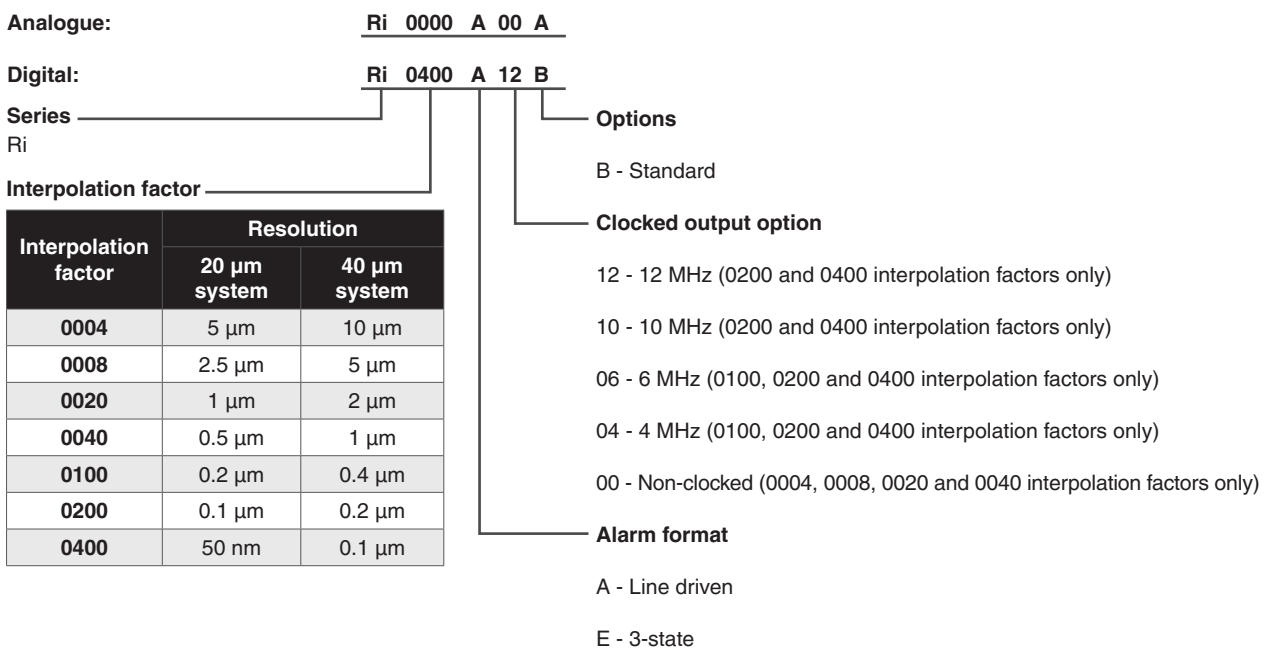
RCDM rotary discs (40 µm version)

Diameter (mm)	Part number	Head gain setting
17	A-9405-4017	4
20	A-9405-4020	3
25	A-9405-4025	2
27	A-9405-4027	2
30	A-9405-4030	2
36	A-9405-4036	1
50	A-9405-4050	1
56	A-9405-4056	1
68	A-9405-4068	1
108	A-9405-4108	1

ACi interface



Ri interface



Ti interface

Analogue: Ti 0000 A 00 A

Options _____

A - Vmid - 1.65 V

V - Vmid - 2.5 V

Digital: Ti 0200 A 20 E

Series _____

Ti

Interpolation factor _____

Options

E - Standard

Clocked output option

50, 40, 25, 20, 12, 10, 08, 06, 04, 01 (MHz)

Alarm format and conditions

A - Line driven; All alarms

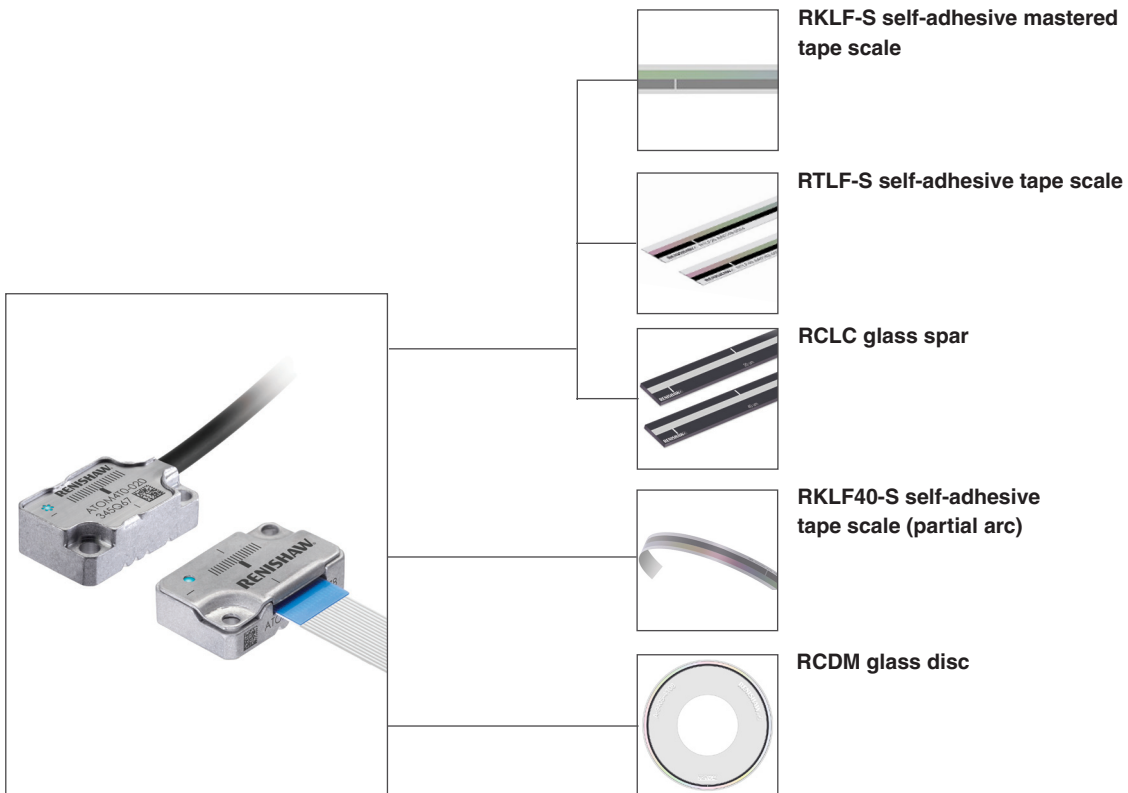
B - Line driven; low signal, high signal

E - 3-state; All alarms

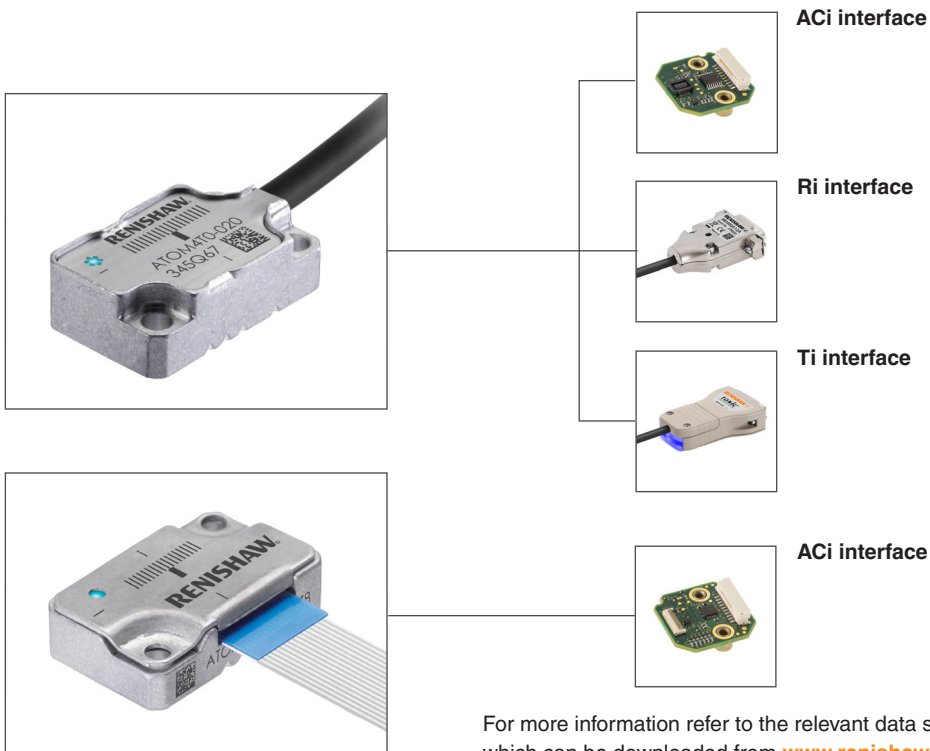
F - 3-state; low signal, high signal

Interpolation factor	Resolution	
	20 μm system	40 μm system
0004	5 μm	10 μm
0020	1 μm	2 μm
0040	0.5 μm	1 μm
0100	0.2 μm	0.4 μm
0200	0.1 μm	0.2 μm
0400	50 nm	0.1 μm
1000	20 nm	40 nm
2000	10 nm	20 nm
4000	5 nm	10 nm
10KD	2 nm	4 nm
20KD	1 nm	2 nm

ATOM compatible scales



ATOM compatible interfaces



For more information refer to the relevant data sheets and installation guides which can be downloaded from www.renishaw.com/atomdownloads.

www.renishaw.com/contact



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