Data sheet
L-9517-9678-05-C

RENISHAW
apply innovation™

VIONiC™ series encoder system

The VIONiC encoder series is Renishaw's highest performing incremental optical encoder. It provides digital position feedback with superior metrology, high speeds and high reliability.

VIONiC reads a wide range of linear, partial arc and rotary scales, with *IN-TRAC*™ auto-phase optical reference mark.

The VIONiC readhead integrates Renishaw's market proven filtering optics and advanced interpolation technology. This provides excellent dirt immunity, ultra-low sub-divisional error (SDE), and the benefit of eliminating the need for additional adaptors or separate interfaces.

Designed with intuitive auto calibration mode, VIONiC is easy to install. In addition, an optional Advanced Diagnostic Tool ADTi-100 provides comprehensive real-time encoder feedback during installation and diagnostics.

- Compact, all-in-one, digital output, optical encoder
- Dynamic signal processing provides ultra-low sub-divisional error of typically < ±15 nm
- Compatible with a wide range of linear, partial arc and rotary scales with *IN-TRAC* auto-phase optical reference mark (datum)
- Auto Gain Control (AGC), Auto Balance Control (ABC) and Auto Offset Control (AOC) ensure consistent signal strength for long-term reliability
- Integrated set-up LED for ease of installation
- Maximum speed to 12 m/s (3.63 m/s at 0.1 µm resolution)
- Digital signals direct from the readhead: Resolutions from 5 µm to 2.5 nm
- Integrated dual limits (linear only)
- Filtering optics optimised for excellent dirt immunity
- Optional Advanced Diagnostic Tool ADTi-100 to optimise set-up and assist with system diagnostics

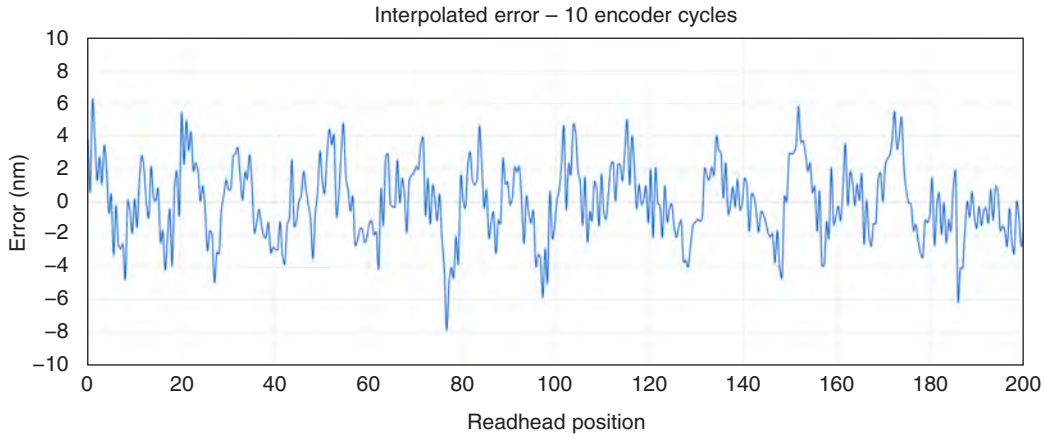
System features

- **Need superior motion control?** VIONiC implements our latest interpolation algorithms and signal processing techniques to achieve a sub-divisional error (SDE) as low as < ±15 nm. Low SDE directly equates to low velocity ripple which is important for constant velocity applications, such as scanning measurement systems. VIONiC's intelligent interpolation chip can achieve 8000 × interpolation which equates to 2.5 nm resolution directly out of the readhead. This system is used when precision and repeatability is of paramount importance.

System type	SDE
Linear	< ±15 nm*
Rotary > ∅135 mm	< ±15 nm*
Rotary ≤ ∅135 mm	< ±20 nm

*< ±10 nm SDE can be achieved with optimised set-up. Contact your local Renishaw representative for further details.

Typical SDE graph for VIONiC linear readheads



- **Need higher speed?** At its highest clock rate (50 MHz counter speed) the VIONiC readhead outputs quadrature edges with a minimum separation of 25.3 ns to allow the maximum possible speed at fine resolutions.
- **Need higher accuracy?** VIONiC readheads are compatible with a range of linear and rotary scales, from ±1 µm/m low expansion linear spar scales to ±1 arc second total installed accuracy rings.

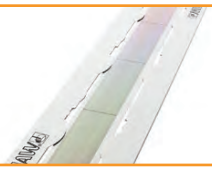
Optional Advanced Diagnostic Tool ADTi-100

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

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

Compatible scales

Linear scales

	RTLC20-S	RTLC20/*FASTRACK*™	RKLC20-S†
	Self-adhesive mounted stainless steel tape scale	Stainless steel tape scale and self-adhesive mounted carrier	Self-adhesive mounted stainless steel tape scale
			
Form (H × W)	0.4 mm × 8 mm including adhesive	RTLC20 scale: 0.2 mm × 8 mm *FASTRACK* carrier: 0.4 mm × 18 mm including adhesive	0.15 mm × 6 mm including adhesive
Accuracy (includes slope and linearity)	±5 µm/m	±5 µm/m	±5 µm/m
Linearity (Figures achievable with two-point error correction)	±2.5 µm/m	±2.5 µm/m	±2.5 µm/m
Maximum length	10 m* (> 10 m available on request)	10 m (> 10 m available on request)	20 m (> 20 m available on request)
Coefficient of thermal expansion (at 20 °C)	10.1 ±0.2 µm/m/°C	10.1 ±0.2 µm/m/°C	Matches that of substrate material when scale ends fixed by epoxy mounted end clamps

*For RTLC20-S axis lengths > 2 m, *FASTRACK* with RTLC20 is recommended.
†Suitable for partial arc applications. For more information refer to *RKL scale for partial arc applications* data sheet (Renishaw part no. L-9517-9897).

	RSLM20	RELM20
	Self-adhesive or clip/clamp mounted stainless steel spar scale	Self-adhesive or clip/clamp mounted low-expansion ZeroMet spar scale
		
Form (H × W)	1.5 mm × 14.9 mm	1.6 mm × 14.9 mm
Accuracy (includes slope and linearity)	±4 µm (Total accuracy over a complete 5 m length)	±1 µm (Total accuracy up to 1 m)
Maximum length	5 m	1.5 m
Coefficient of thermal expansion (at 20 °C)	10.1 ±0.2 µm/m/°C	0.75 ±0.35 µm/m/°C

For more information about the scales refer to the relevant scale data sheet which can be downloaded from
www.renishaw.com/encoderdatasheets

Rotary scales

	RESM20	REXM20
	Stainless steel ring	Ultra-high accuracy stainless steel ring
		
Accuracy	±1.9 arc second (Typical installed accuracy for 550 mm diameter RESM20 ring)*	±1 arc second† (Total installed accuracy for 417 mm diameter REXM20 ring)
Ring diameters	52 mm to 550 mm	52 mm to 417 mm
Coefficient of thermal expansion (at 20 °C)	15.5 ±0.5 µm/m/°C	15.5 ±0.5 µm/m/°C

* 'Typical' installations are a result of graduation and installation errors combining and, to some magnitude, cancelling.

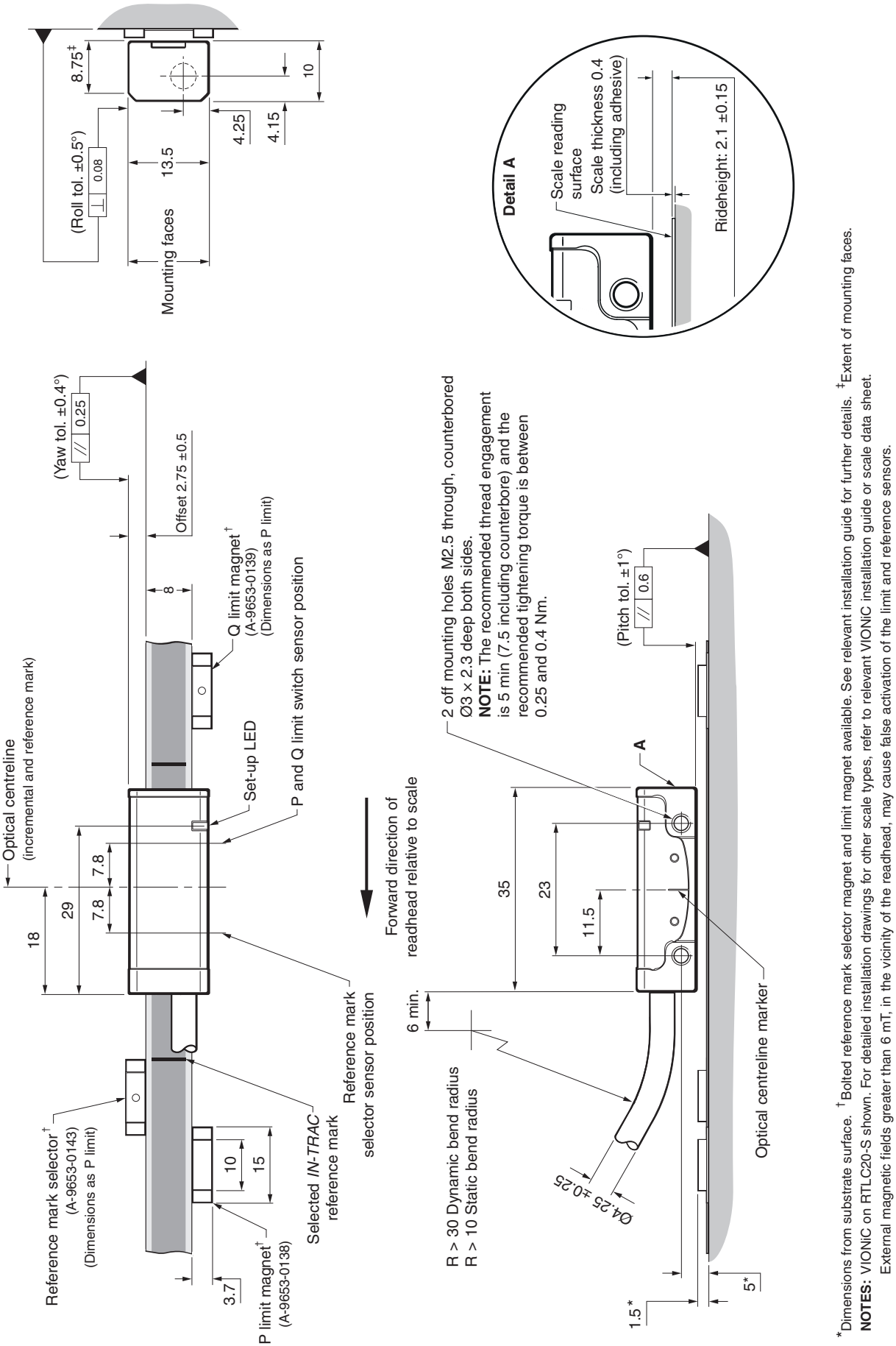
† When using two reading heads and an additional DSi interface..

For more information about the scales refer to the relevant scale data sheet which can be downloaded from www.renishaw.com/encoderdatasheets

RENISHAW
apply innovation™

VIONiC installation drawing (on RTLC20-S scale)

Dimensions and tolerances in mm



*Dimensions from substrate surface. †Bolted reference mark selector magnet and limit magnet available. See relevant installation guide for further details. ‡Extent of mounting faces.

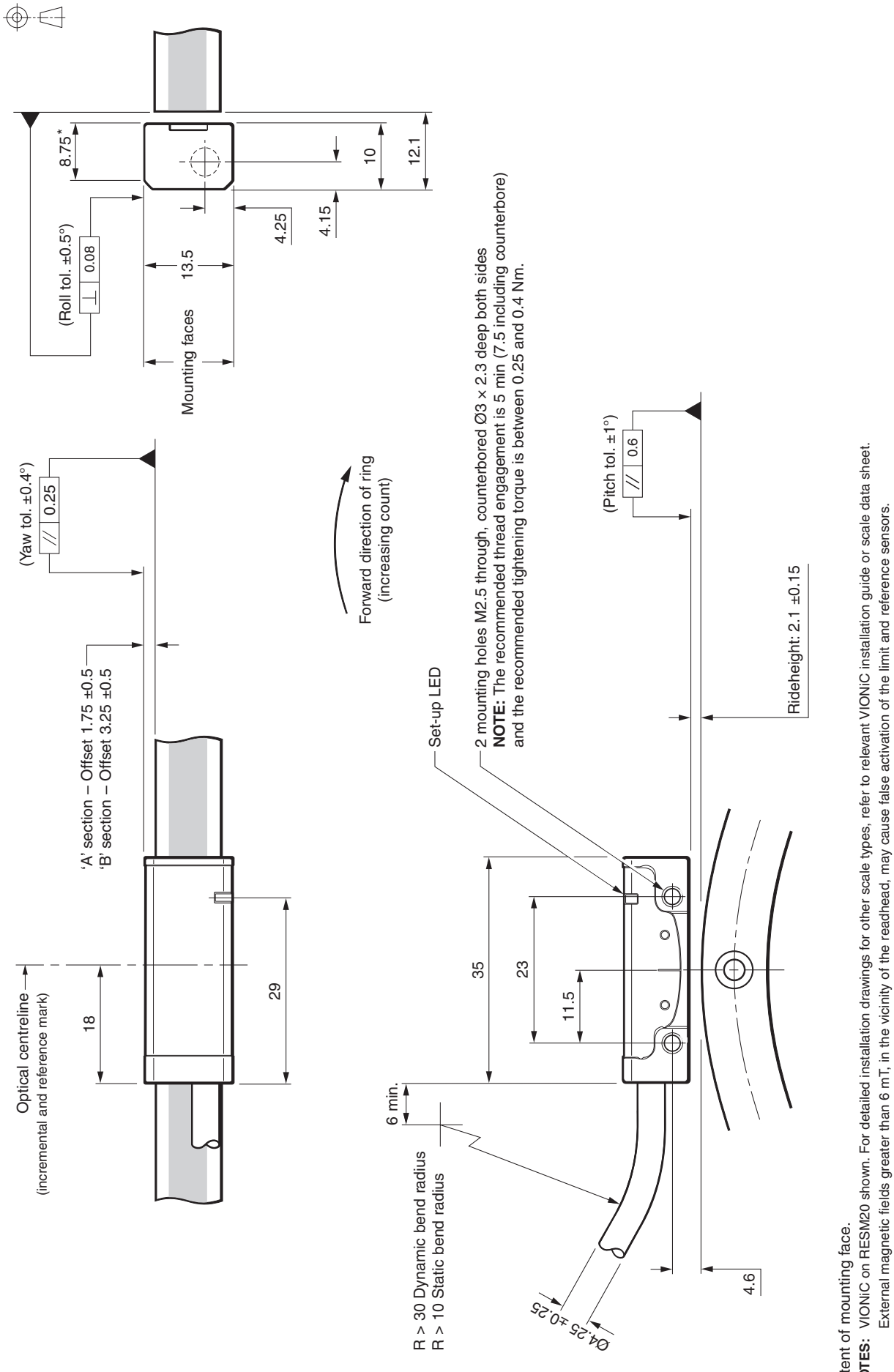
NOTES: VIONiC on RTLC20-S shown. For detailed installation drawings for other scale types, refer to relevant VIONiC installation guide or scale data sheet.

External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit and reference sensors.

RENISHAW
apply innovation™

VIONiC installation drawing (on RESM20 ring)

Dimensions and tolerances in mm



*Extent of mounting face.

NOTES: VIONiC on RESM20 shown. For detailed installation drawings for other scale types, refer to relevant VIONiC installation guide or scale data sheet.
External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit and reference sensors.

General specifications

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 (system)	Storage	–20 °C to +70 °C
	Operating	0 °C to +70 °C
Humidity (system)		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing		IP40
Acceleration	Operating	400 m/s², 3 axes
Shock	Operating	500 m/s², 11 ms, ½ sine, 3 axes
Vibration	Operating	100 m/s² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Readhead	8.6 g
	Cable	26 g/m
EMC compliance		IEC 61326-1
Readhead cable		Single-shielded, outside diameter 4.25 ±0.25 mm
		Flex life > 20 × 10^6 cycles at 30 mm bend radius
		UL recognised component
Connector options		**Code – connector type**
		A - 9-way D-type
		D - 15-way D-type (standard pin-out)
		H - 15-way D-type (alternative pin-out)
		X - 12-way circular connector
		J - 14-way JST connector
Typical sub-divisional error (SDE)	Linear	< ±15 nm
	Rotary > Ø135 mm	< ±15 nm
	Rotary ≤ Ø135 mm	< ±20 nm

Speed

Clocked output option (MHz)	Maximum speed (m/s)												Minimum edge separation* (ns)
	D (5 µm)	X (1 µm)	Z (0.5 µm)	W (0.2 µm)	Y (0.1 µm)	H (50 nm)	M (40 nm)	P (25 nm)	I (20 nm)	O (10 nm)	Q (5 nm)	R (2.5 nm)	
50	12	12	12	7.25	3.63	1.81	1.45	0.906	0.725	0.363	0.181	0.091	25.3
40	12	12	12	5.80	2.90	1.45	1.16	0.725	0.580	0.290	0.145	0.073	31.8
25	12	12	9.06	3.63	1.81	0.906	0.725	0.453	0.363	0.181	0.091	0.045	51.2
20	12	12	8.06	3.22	1.61	0.806	0.645	0.403	0.322	0.161	0.081	0.040	57.7
12	12	10.36	5.18	2.07	1.04	0.518	0.414	0.259	0.207	0.104	0.052	0.026	90.2
10	12	8.53	4.27	1.71	0.850	0.427	0.341	0.213	0.171	0.085	0.043	0.021	110
08	12	6.91	3.45	1.38	0.690	0.345	0.276	0.173	0.138	0.069	0.035	0.017	136
06	12	5.37	2.69	1.07	0.540	0.269	0.215	0.134	0.107	0.054	0.027	0.013	175
04	12	3.63	1.81	0.730	0.360	0.181	0.145	0.091	0.073	0.036	0.018	0.009	259
01	4.53	0.910	0.450	0.180	0.090	0.045	0.036	0.023	0.018	0.009	0.005	0.002	1038

*For a readhead with a 1 m cable.

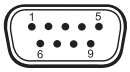
Angular speed depends on ring diameter – use the following equation to convert to rev/min:

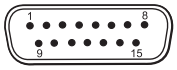
$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D}$$

Where V = maximum linear speed (m/s) and
D = external diameter of RESM20 or REXM20 ring (mm).

Output signals

Digital outputs



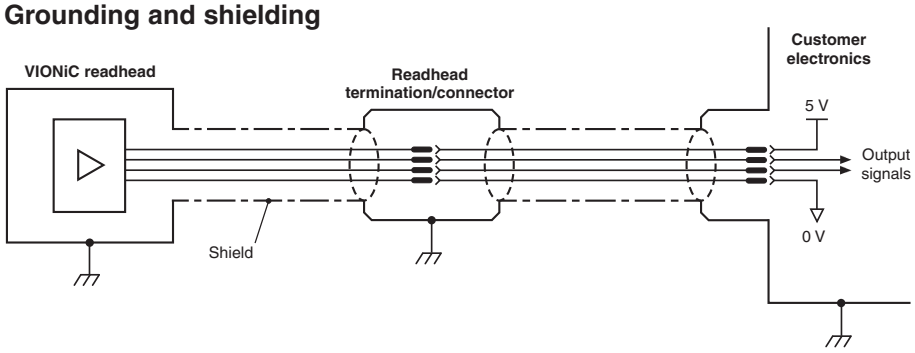


Function	Signal		Colour	9-way D-type (A)	15-way D-type (D)	15-way D-type alternative pin-out (H)	12-way circular connector (X)	14-way JST (J)
Power	5 V		Brown	5	7, 8	4, 12	G	10
	0 V		White	1	2, 9	2, 10	H	1
Incremental	A	+	Red	2	14	1	M	7
		–	Blue	6	6	9	L	2
	B	+	Yellow	4	13	3	J	11
		–	Green	8	5	11	K	9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

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

Electrical connections

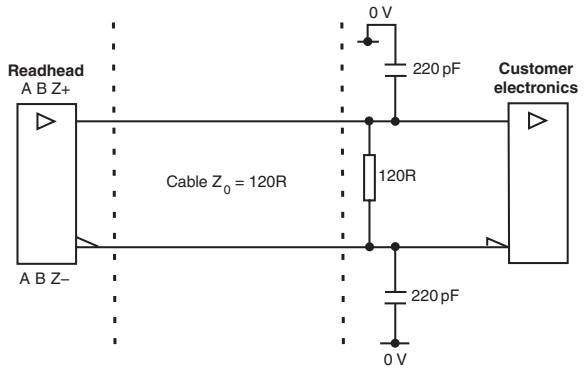
Grounding and shielding



IMPORTANT: The shield should be connected to the machine earth (Field Ground).
For JST variants the ferrule should be connected to machine earth.
Maximum readhead cable length: 3 m
Maximum extension cable length: Dependent on cable type, readhead cable length and clocked output option.
Contact your local Renishaw representative for more information.

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

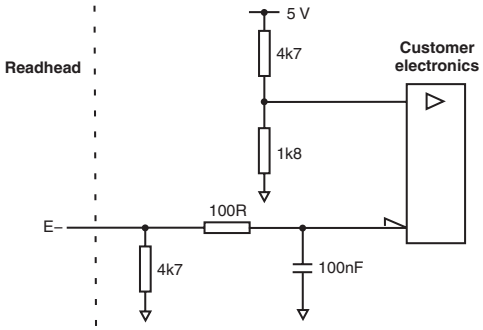
Recommended signal termination



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

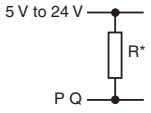
Single ended alarm signal termination

(Not available with 'A' cable termination)



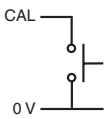
Limit output

(Not available with 'A' cable termination)



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

Remote CAL operation



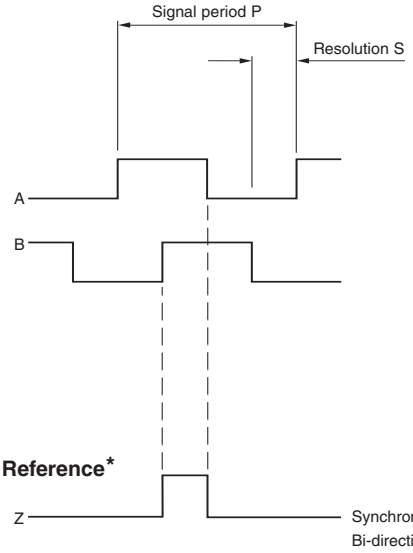
Remote operation of the CAL/AGC is possible via CAL signal.

Output specifications

Digital output signals

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

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

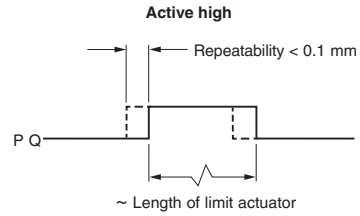


Synchronised pulse Z, duration as resolution.
Bi-directionally repeatable.†

Resolution option code	P (µm)	S (µm)
D	20	5
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
P	0.1	0.025
I	0.08	0.02
O	0.04	0.01
Q	0.02	0.005
R	0.01	0.0025

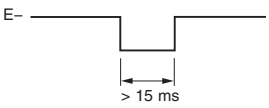
NOTE: A wide reference mark option, outputting a reference pulse for the duration of the signal period is available.
Contact your local Renishaw representative for more information.

Limits Open collector output, asynchronous pulse
(Not available with 'A' cable termination)



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.

*Inverse signals not shown for clarity.
†Only calibrated reference mark is bi-directionally repeatable.

Linear readhead part numbers

V2 B C X 30 D 50 A

Readhead series
V2 - 20 µm VIONiC

Readhead type
B - Linear

Scale type compatibility
B - RSLM20 / RELM20
C - RTLC20 / RTLC20-S / RKLC20-S

Resolution

D - 5 µm	M - 40 nm
X - 1 µm	P - 25 nm
Z - 0.5 µm	I - 20 nm
W - 0.2 µm	O - 10 nm
Y - 0.1 µm	Q - 5 nm
H - 50 nm	R - 2.5 nm

Cable length*

02 - 0.2 m	15 - 1.5 m
05 - 0.5 m	20 - 2 m
10 - 1 m	30 - 3 m

Cable termination
A - 9-way D-type ('E' and 'F' Reference mark options / Alarm format only)
D - 15-way D-type (standard pin-out)
H - 15-way D-type (alternative pin-out)
X - 12-way circular connector
J - 14-way JST connector

Clocked output option†

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

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

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

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

Rotary readhead part numbers

V2 B J X 30 D 50 B

Readhead series
V2 - 20 µm VIONiC

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

Scale type compatibility
J - RESM20 / REXM20 > ∅135 mm ('B' readhead type only)
K - RESM20 / REXM20 ∅60 mm to ∅135 mm ('C' readhead type only)
L - RESM20 / REXM20 < ∅60 mm ('C' readhead type only)

Resolution

D - 5 µm	M - 40 nm
X - 1 µm	P - 25 nm
Z - 0.5 µm	I - 20 nm
W - 0.2 µm	O - 10 nm
Y - 0.1 µm	Q - 5 nm
H - 50 nm	R - 2.5 nm

Cable length*

02 - 0.2 m	15 - 1.5 m
05 - 0.5 m	20 - 2 m
10 - 1 m	30 - 3 m

Cable termination
A - 9-way D-type ('F' Reference mark options / Alarm format only)
D - 15-way D-type (standard pin-out)
H - 15-way D-type (alternative pin-out)
X - 12-way circular connector
J - 14-way JST connector

Clocked output option†

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

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

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

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

Partial arc readhead part numbers

V2 B R X 30 D 50 B

Readhead series
V2 - 20 µm VIONiC

Readhead type
B - Partial arc radius > 67.5 mm ('R' scale type compatibility only)
C - Partial arc radius ≤ 67.5 mm ('S' scale type compatability only)

Scale type compatibility
R - RKLC20-S partial arc radius > 67.5 mm ('B' readhead type only)
S - RKLC20-S partial arc radius 30 mm to 67.5 mm ('C' readhead type only)

Resolution

D - 5 µm	M - 40 nm
X - 1 µm	P - 25 nm
Z - 0.5 µm	I - 20 nm
W - 0.2 µm	O - 10 nm
Y - 0.1 µm	Q - 5 nm
H - 50 nm	R - 2.5 nm

Cable length*

02 - 0.2 m	15 - 1.5 m
05 - 0.5 m	20 - 2 m
10 - 1 m	30 - 3 m

Cable termination
A - 9-way D-type ('F' Reference mark options / Alarm format only)
D - 15-way D-type (standard pin-out)
H - 15-way D-type (alternative pin-out)
X - 12-way circular connector
J - 14-way JST connector

Clocked output option†

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

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

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

For more information on partial arcs 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

Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
apply innovation™

VIONiC series compatible products

VIONiC series

Optional Advanced Diagnostic Tool ADTi-100 (A-6195-0100)

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

DSi for dual-readhead rotary systems

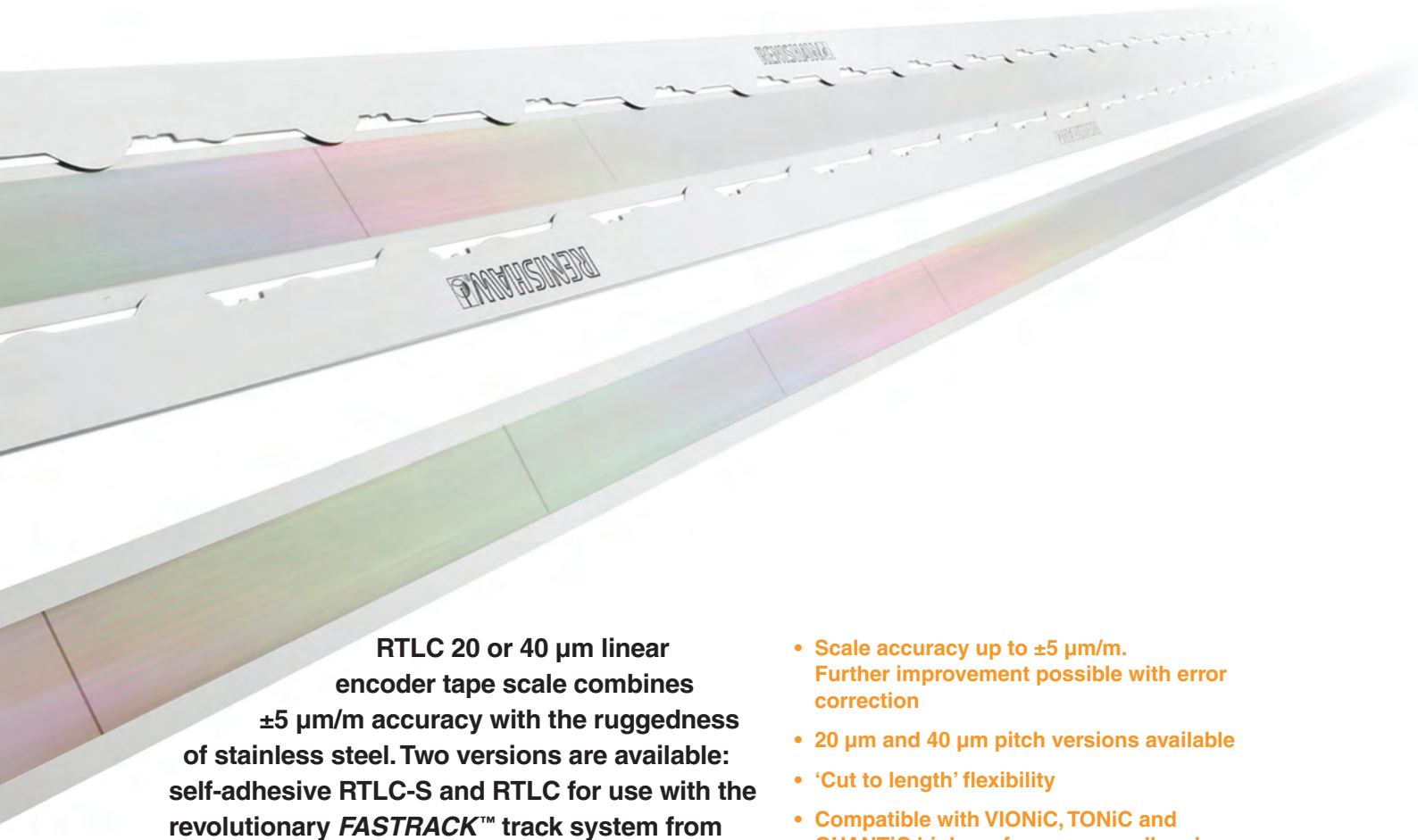
For more information about the ADT and the scale refer to the relevant data sheets and installation guides which can be downloaded from www.renishaw.com/opticalencoders

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

Part no.: L-9517-9678-05-C
Issued: 12.2022

RENISHAW
apply innovation™

RTLC incremental linear scale



RTLC 20 or 40 µm linear encoder tape scale combines ±5 µm/m accuracy with the ruggedness of stainless steel. Two versions are available: self-adhesive RTLC-S and RTLC for use with the revolutionary *FASTRACK*™ track system from Renishaw.

Designed for applications that demand high accuracy and an independent expansion coefficient with tape scale convenience, RTLC is read by Renishaw's compact and reliable VIONiC™, TONiC™ and QUANTiC™ readheads.

RTLC-S is laid onto the substrate using its self-adhesive backing tape. An application tool makes this a quick, simple and inexpensive process. A datum clamp is fitted at a single point to lock the scale to the substrate.

RTLC (without self-adhesive) is used with *FASTRACK*. In this case, the scale is held securely in place by two miniature, yet rugged, guide rails. Again, the scale is clamped in a single point to allow independent expansion with extremely low hysteresis, even over wide temperature ranges. If damaged, the scale can be pulled out of the guide rails and quickly replaced, even where access is limited, thus reducing machine downtime. This feature also makes the new linear encoder system ideal for large machines that need to be sectioned for transportation.

- **Scale accuracy up to ±5 µm/m. Further improvement possible with error correction**
- **20 µm and 40 µm pitch versions available**
- **'Cut to length' flexibility**
- **Compatible with VIONiC, TONiC and QUANTiC high-performance readheads**
- **RTLC scale expands at its own low thermal coefficient (10.1 ±0.2 µm/m/°C @ 20 °C)**
- **Use with *FASTRACK* for very low hysteresis**
- ***FASTRACK* guide rails are pre-aligned in reels for cut-to-suit flexibility**
- **Quick installation. *FASTRACK* adds fast scale replacement capability**
- **Scale can be locked to the substrate at a single datum point anywhere along the axis**
- **RTLC scale can bridge gaps in the *FASTRACK* up to 25 mm**
- **High solvent immunity**

General specifications

Coefficient of thermal expansion (at 20 °C)		10.1 ±0.2 µm/m/°C
Temperature (system)	Storage	–20 °C to +70 °C
	Operating	0 °C to +70 °C
Humidity (system)		95% relative humidity (non-condensing) to IEC 60068-2-78
Shock (system)	Operating	500 m/s², 11 ms, ½ sine, 3 axe
Vibration (system)	Operating	100 m/s² max @ 55 to 2000 Hz, 3 axes

RTLC-S scale specifications

Self-adhesive incremental scale

Form (H × W)		0.4 mm × 8 mm including adhesive
Pitch	RTLC20-S	20 µm
	RTLC40-S / RTLC40H-S	40 µm
Accuracy (at 20 °C)	RTLC20-S / RTLC40H-S	±5 µm/m
	RTLC40-S	±15 µm/m
Linearity	RTLC20-S / RTLC40H-S	±2.5 µm/m achievable with two point error correction
	RTLC40-S	±5 µm/m achievable with two point error correction
Maximum supplied length		10 m†
Material		Hardened and tempered stainless steel
Mass		12.9 g/m

RTLC scale and *FASTRACK* carrier specifications

Incremental scale for use with *FASTRACK* carrier self-adhesive mounting system

Form (H × W)		0.4 mm × 18 mm including adhesive
Pitch	RTLC20	20 µm
	RTLC40 / RTLC40H	40 µm
Accuracy (at 20 °C)	RTLC20 / RTLC40H	±5 µm/m
	RTLC40	±15 µm/m
Linearity	RTLC20 / RTLC40H	±2.5 µm/m achievable with two point error correction
	RTLC40	±5 µm/m achievable with two point error correction
Maximum supplied length	RTLC	10 m
	FASTRACK	25 m
Minimum recommended length of *FASTRACK*		100 mm
Material	RTLC	Hardened and tempered stainless steel
	FASTRACK	Hardened stainless steel
Mass	RTLC	12.2 g/m
	FASTRACK	24 g/m

† For lengths >2 m *FASTRACK* with RTLC is recommended.

Reference mark

Type	*IN-TRAC*™ reference mark, directly embedded into incremental track 50 mm (nominal) spacing. Bi-directional position repeatability
Selection	Single reference mark selection by magnetic actuator (A-9653-0143) customer positioned
Repeatability	Unit of resolution repeatability (bi-directional) across full system rated speed and temperature ranges

Limit switches

Type	Magnetic actuators; with dimple triggers Q limit, without dimple triggers P limit (see RTLC scale installation drawing)
Trigger point	The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge
Mounting	Customer placed at desired locations
Repeatability	< 0.1 mm

Compatible readheads

	VIONiC	TONiC	QUANTiC
			
Scale type	RTLC20	RTLC20	RTLC40
Pitch	20 µm	20 µm	40 µm
Outputs	Digital resolutions from 5 µm to 2.5 nm direct from the readhead	Analogue 1 Vpp. Digital resolutions from 5 µm to 1 nm from an interface.	Analogue 1 Vpp. Digital resolutions from 10 µm to 50 nm direct from the readhead.
SDE (typical)	< ±15 nm	±30 nm	< ±80 nm*
Jitter (RMS)	down to 1.6 nm	down to 0.5 nm	down to 2.73
Maximum speed	12 m/s	10 m/s	24 m/s*

*Digital variants.

Readhead features

- Filtering optics and Auto Gain Control for high reliability and solid Lissajous signals.
- Dynamic signal processing ensures ultra-low sub-divisional error (SDE).
  Result: smoother scanning performance.
- High signal-to-noise ratio provides ultra-low jitter for optimum positional stability.
- Auto-phasing of *IN-TRAC* reference mark.
- Clocked outputs ensure optimised speed performance for all resolutions, for a wide variety of industry-standard controllers.
- DOP Dual output interfaces available to provide simultaneous analogue and digital outputs (TONiC systems only).

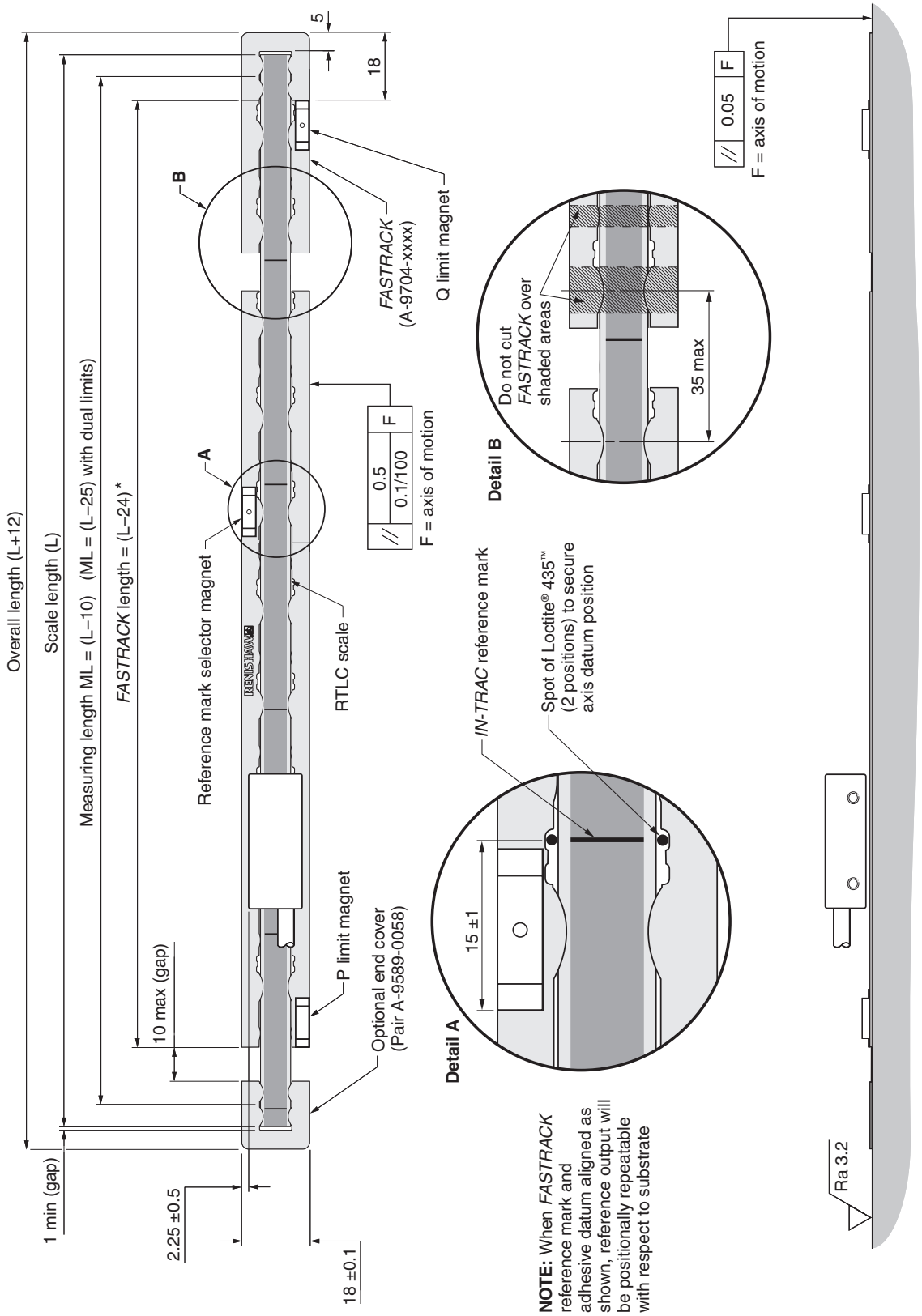
RENISHAW
apply innovation™

RTLC and *FASTRACK* carrier installation drawing

(adhesive datum clamp method†)

For further details, please refer to the relevant system installation guides.

Dimensions and tolerances in mm



*Assumes 1 mm gap between scale and end covers and zero gap between *FASTRACK* and end covers. †For alternative mechanical datum clamp method refer to the relevant system Installation guide.
NOTES: Minimum recommended *FASTRACK* length = 100 mm. The reference mark selector and limit actuator locations are correct for the readhead orientation shown.

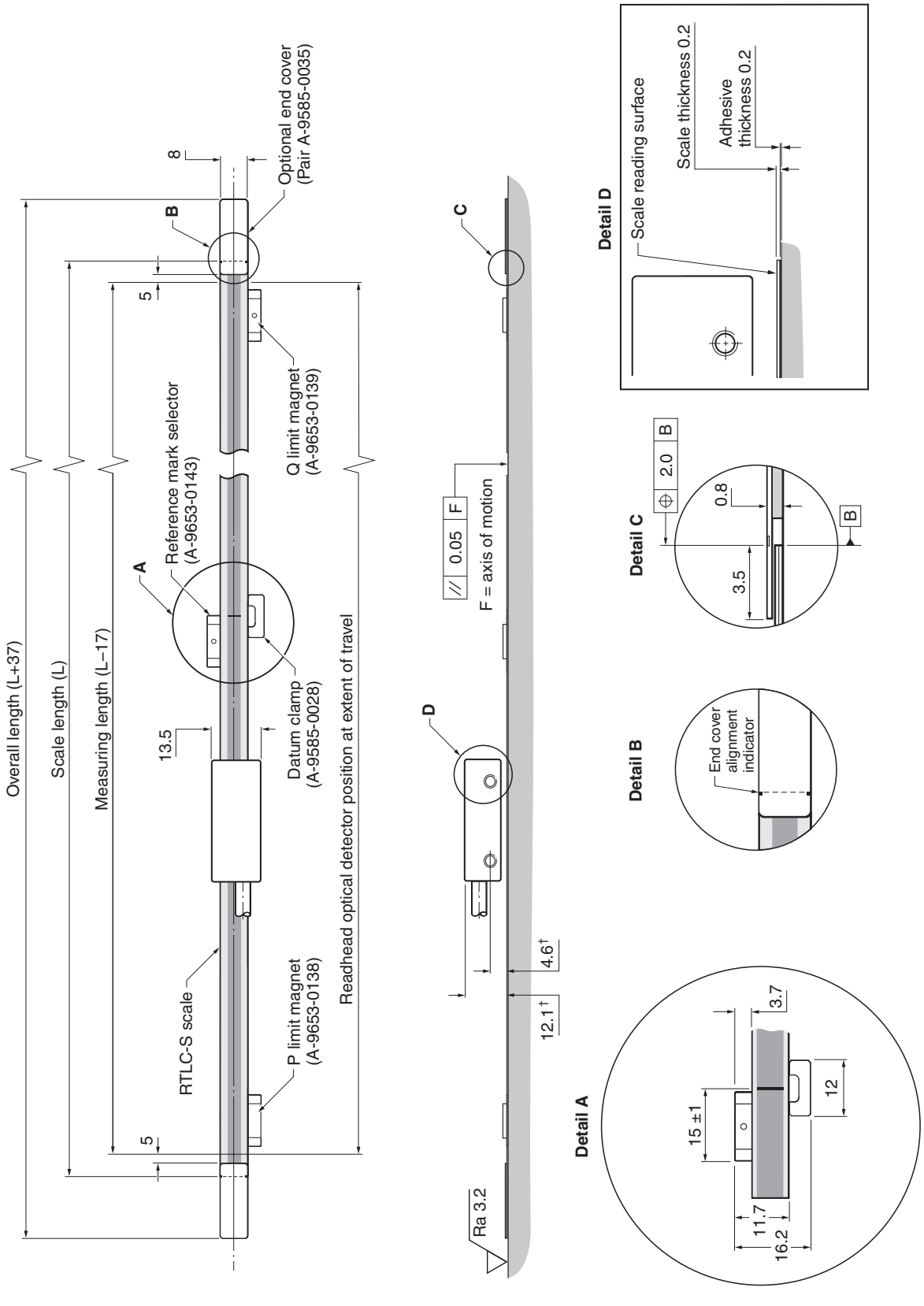
RENISHAW
apply innovation™

RTLC-S installation drawing

(Adhesive datum clamp method)

For further details, please refer to the relevant system installation guides.

Dimensions and tolerances in mm



†Dimensions from scale surface. **NOTE:** Bolted reference mark selector and limits also available. See the relevant system installation guide for details.

Scale part numbers

RTLC

Stainless steel tape scale for use with the *FASTRACK* carrier.

Available lengths	Available in increments of	Reference mark spacing	Distance from scale end to first reference mark	Part number (where xxxx is the length in cm)*		
				RTLC20 (Compatible with VIONiC and TONiC)	RTLC40 (Compatible with QUANTiC)	RTLC40H (Compatible with QUANTiC)
20 mm to 100 mm	10 mm	Middle of scale length	Middle of scale length	A-9705-xxxx	A-6566-xxxx	A-6668-xxxx
> 100 mm to 10 m	10 mm	50 mm	50 mm			

FASTRACK carrier

Stainless steel carrier for use with RTLC tape scale.

Available lengths	Available in increments of	Part number (where xxxx is the length in cm)*
100 mm to 25 m	25 mm†	A-9704-xxxx

† Part numbers for *FASTRACK* lengths ending in 25 mm are: A-9704-xxx3

Part numbers for *FASTRACK* lengths ending in 75 mm are: A-9704-xxx8

RTLC-S

Stainless steel tape scale with self-adhesive backing tape.

Available lengths	Available in increments of	Reference mark spacing	Distance from scale end to first reference mark	Part number (where xxxx is the length in cm)*		
				RTLC20-S (Compatible with VIONiC and TONiC)	RTLC40-S (Compatible with QUANTiC)	RTLC40H-S (Compatible with QUANTiC)
20 mm to 100 mm	10 mm	Middle of scale length	Middle of scale length	A-9715-xxxx	A-6567-xxxx	A-6670-xxxx
> 100 mm to 10 m	10 mm	50 mm	50 mm			

*Ordering A-9705-0070, for example, will result in a length of 70 cm of RTLC20.

Accessory part numbers

Reference mark and limit magnets†

Part description	Part number	Product image
Reference mark selector magnet – Adhesive mounted	A-9653-0143	
Bolted reference mark selector magnet (For use with RTLC-S only)	A-9653-0290	
Q limit switch actuator magnet – Adhesive mounted	A-9653-0139	
Bolted Q limit switch actuator magnet (For use with RTLC-S only)	A-9653-0291	
P limit switch actuator magnet – Adhesive mounted	A-9653-0138	
Bolted P limit switch actuator magnet (For use with RTLC-S only)	A-9653-0292	
Magnet applicator device (Aids positioning)	A-9653-0201	

†Longer limit magnets are available. Contact your local Renishaw representative for more information.

Datum clamps

Part description	Part number	Product image
Self-adhesive datum clamp (For use with RTLC-S only)	A-9585-0028	
Loctite 435 adhesive – 20 g bottle (For securing axis datum position of RTLC in *FASTRACK* carrier or RTLC-S)	P-AD03-0012	
Dispensing tip for Loctite 435 adhesive	P-TL50-0209	
Bolted datum clamp (For use with RTLC and *FASTRACK* only)	A-9589-0077	

Accessory part numbers (continued)

RTLC/RTLC-S scale and *FASTRACK* accessories

Part description	Part number	Product image
Guillotine (For cutting RTLC/RTLC-S scale and *FASTRACK* carrier)	A-9589-0071	
Shears (For cutting RTLC/RTLC-S scale and *FASTRACK* carrier)	A-9589-0133	
RTLC-S scale applicator	A-9589-0115	
FASTRACK centre section removal tool (Removes centre section of *FASTRACK* when carrier has been mounted)	A-9589-0066	
FASTRACK separator assembly (Removes centre section of *FASTRACK* when carrier has been mounted – includes removable side panels for use when *FASTRACK* is mounted against a ledge or dowels)	A-9589-0122	
RTLC scale pulling tool (Aids installation of RTLC scale through the *FASTRACK* carrier)	A-9589-0420	
End cover kit (RTLC-S only)	A-9585-0035	
End cover kit (*FASTRACK* only)	A-9589-0058	

Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
apply innovation™

Compatible products

RTLC20
RTLC20-S

VIONiC

TONiC

RTLC40
RTLC40-S
RTLC40H
RTLC40H-S

QUANTiC

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

L-9517-9417-06

Part no.: L-9517-9417-06-B
Issued: 12.2020

Data sheet
L-9517-9862-01-D

RENISHAW
apply innovation™

RKLC incremental linear scale

RKLC is a robust, 6 mm wide stainless steel encoder tape scale with a thickness of 0.15 mm. This allows the scale, when rigidly fixed to a machine axis, to become 'mastered' to the machine substrate, matching its thermal expansion coefficient and behaviour. Differential movement between the scale and the machine is thus minimised, improving the metrological performance that can be achieved with simple thermal system compensation.

Index positions are provided by *IN-TRAC*™ optical reference marks which are directly embedded into the incremental scale markings to enable auto-phasing. The combination of these compact reference marks with the narrow 6 mm wide scale facilitates encoder installation in space-constrained applications.

RKLC tape scale also combines ±5 µm/m accuracy with the mechanical and chemical ruggedness of stainless steel, easy coiling and cut-to-length convenience.

RKLC is installed onto the axis substrate by a self-adhesive backing tape and a simple application tool makes this a quick, straightforward and inexpensive process. The scale ends are rigidly fixed to the axis substrate by means of epoxy fastened end clamps, eliminating the need to drill holes.

- **Mastered scale matches the coefficient of thermal expansion of the substrate**
- **Narrow 6 mm wide scale suitable for confined spaces**
- **Suitable for partial arc applications**
- ***IN-TRAC* optical reference marks**
- **20 µm and 40 µm pitch versions available**
- **'Cut-to-length' convenience**
- **Up to 20 m lengths (> 20 m available on request)**
- **Compatible with VIONiC™, TONiC™ and QUANTiC™ high-performance readheads**
- **High solvent immunity**
- **Scale accuracy up to ±5 µm/m. Further improvement possible with error correction**

Compatible readheads

	VIONiC	TONiC	QUANTiC
			
Scale type	RKLC20-S	RKLC20-S	RKLC40-S / RKLC40H-S
Pitch	20 µm	20 µm	40 µm
Outputs	Digital resolutions from 5 µm to 2.5 nm direct from the readhead.	Analogue 1 Vpp. Digital resolutions from 5 µm to 1 nm from an interface.	Analogue 1 Vpp. Digital resolutions from 10 µm to 50 nm direct from the readhead.
SDE (typical)	< ±15 nm	±30 nm	< ±80 nm†
Jitter (RMS)	down to 1.6 nm	down to 0.5 nm	down to 2.73 nm
Maximum speed	12 m/s	10 m/s	24 m/s†
UHV variant	No	Yes*	No

* Scale mastering is not guaranteed after system bakeout.
† Digital variants.

Readhead features

- Filtering optics and Auto Gain Control for high reliability and solid Lissajous signals.
- Dynamic signal processing ensures ultra-low sub-divisional error (SDE).
  Result: smoother scanning performance.
- High signal-to-noise ratio provides ultra-low jitter for optimum positional stability.
- Auto-phasing of *IN-TRAC* reference mark.
- Clocked outputs ensure optimised speed performance for all resolutions, for a wide variety of industry-standard controllers.
- Diagnostic tool compatibility for detailed information on encoder performance.
- DOP Dual output interfaces available to provide simultaneous analogue and digital outputs (TONiC systems only).

RKLC scale specifications*

Form (H × W)		0.15 mm × 6 mm including adhesive
Pitch	RKLC20-S	20 µm
	RKLC40-S / RKLC40H-S	40 µm
Accuracy (at 20 °C)	RKLC20-S / RKLC40H-S	±5 µm/m
	RKLC40-S	±15 µm/m
Linearity (at 20 °C)	RKLC20-S / RKLC40H-S	±2.5 µm/m achievable with two point error correction
	RKLC40-S	±3 µm/m achievable with two point error correction
Supplied length		20 mm to 20 m (> 20 m available on request)
Material		Hardened and tempered stainless steel
Mass		4.6 g/m
Coefficient of thermal expansion (at 20 °C)		Matches that of substrate material when scale ends fixed by epoxy mounted end clamps
Temperature	Storage	–20 °C to +80 °C
	Operating†	0 °C to +70 °C
	Installation	+10 °C to +35 °C
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Shock	Operating	500 m/s², 11 ms, ½ sine, 3 axes
Vibration	Operating	300 m/s² max @ 55 to 2000 Hz, 3 axes
End fixing		Epoxy mounted end clamps (A-9523-4015) Approved epoxy adhesive (A-9531-0342) Scale end movement typically < 1 µm‡

Reference mark

Type	*IN-TRAC* reference mark✧, directly embedded into incremental track, 50 mm (nominal) spacing
Selection	Single reference mark selection by magnetic actuator (A-9653-0143) customer positioned
Repeatability	Unit of resolution repeatability (bi-directional) across full system rated speed and temperature ranges

Limit switches

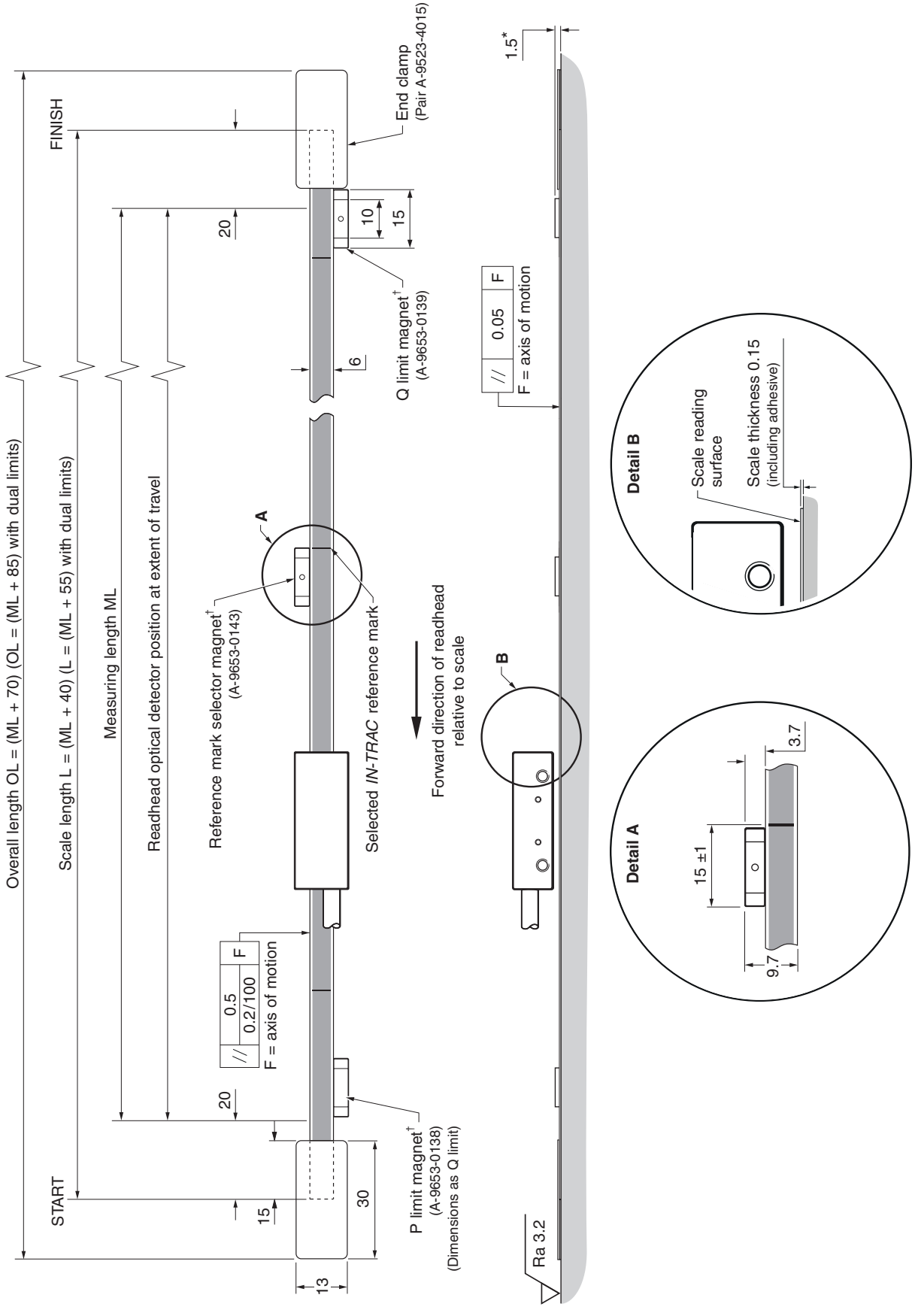
Type	Magnetic actuators; with dimple triggers Q limit, without dimple triggers P limit (see RKLC scale installation drawings)
Trigger point	The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge
Mounting	Customer placed at desired locations
Repeatability	< 0.1 mm

* For more information on partial arc applications refer to *RKL scale for partial arc applications* data sheet (Renishaw part no. L-9517-9897).
† To limit maximum tension in the scale ($CTE_{substrate} - CTE_{scale}$) × ($T_{use\ extreme} - T_{install}$) ≤ 550 µm/m where CTE_{scale} = ~ 10.1 µm/m/°C.
‡ Ensure that scale and end clamps have been installed following the installation process described in the relevant RKLC installation guide.
✧Scale available with no *IN-TRAC* reference mark; see scale part numbers for details.

RENISHAW
apply innovation™

RKLC scale installation drawing

Dimensions and tolerances in mm



* Dimensions from substrate surface. † Bolted reference mark selector magnet and limit magnet available. See relevant system installation guide for further details.
NOTE: The reference mark selector and limit actuator locations are correct for the readhead orientation shown.

Scale part numbers

RKLC-S

Stainless steel tape scale with self-adhesive backing tape.

Available lengths	Available in increments of	Reference mark spacing*	Distance from scale end to first reference mark	Part number (where xxxx is the length in cm)†		
				RKLC20-S (Compatible with VIONiC and TONiC)	RKLC40-S (Compatible with QUANTiC)	RKLC40H-S (Compatible with QUANTiC)
20 mm to 100 mm	10 mm	Middle of scale length	Middle of scale length	A-6663-xxxx	A-6665-xxxx	A-6685-xxxx
> 100 mm to 20 m‡	10 mm	50 mm	50 mm			

RKLR-S (no reference mark)

Stainless steel tape scale with self-adhesive backing tape.

Available lengths	Available in increments of	Part number (where xxxx is the length in cm)†	
		RKLR20-S (Compatible with VIONiC and TONiC)	RKLR40-S (Compatible with QUANTiC)
20 mm to 20 m‡	10 mm	A-6753-xxxx	A-6744-xxxx

* Only calibrated reference mark is bi-directionally repeatable.
† Ordering A-6663-0070 for example, will result in a 70 cm length of RKLC20-S.
‡ Lengths greater than 20 m available on request.

Accessory part numbers

Reference mark and limit magnets*

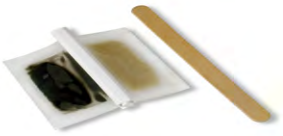
Part description	Part number	Product image
Reference mark selector magnet – Adhesive mounted	A-9653-0143	
Bolted reference mark selector magnet	A-9653-0290	
Q limit switch actuator magnet – Adhesive mounted	A-9653-0139	
Bolted Q limit switch actuator magnet	A-9653-0291	
P limit switch actuator magnet – Adhesive mounted	A-9653-0138	
Bolted P limit switch actuator magnet	A-9653-0292	
Magnet applicator device (Aids positioning)	A-9653-0201	

* Longer limit magnets are available. Contact your local Renishaw representative for more information.

RKLC scale accessories

Guillotine (For cutting RKLC scale)	A-9589-0071	
Shears (For cutting RKLC scale)	A-9589-0133	
RKLC-S side mount scale applicator (Compatible with all VIONiC, TONiC and QUANTiC side mount systems)	A-6547-1912	
RKLC-S top mount scale applicator (Required for TONiC top mounted systems only)	A-6547-1915	

End clamp accessories

Part description	Part number	Product image
RGC-F End clamp kit – epoxy mounted. The RGC-F end clamps master the RKLC scale to the substrate material to match its thermal expansion.	A-9523-4015	
End clamp kit, epoxy mounted, narrow The end clamps master the RKLC scale to the substrate material to match its thermal expansion.	A-9523-4027	
RGG-2 (2 part epoxy) The RGG-2 epoxy is recommended for the mounting of end clamps.	A-9531-0342	

Renishaw plc
New Mills, Wotton-under-Edge
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
apply innovation™

Compatible products

RKLC20-S

VIONiC

TONiC

RKLC40-S
RKLC40H-S

QUANTiC

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

L-9517-9862-01

Part no.: L-9517-9862-01-D
Issued: 12.2020

Data sheet
L-9517-9897-02-A

RENISHAW
apply innovation™

RKL scale for partial arc applications

Measuring a partial arc of rotation is made easy with Renishaw's flexible RKL encoder scales. The flexible nature of the small cross-sectional area of these scales allows them to be wrapped around a drum, shaft or arc with a minimum radius of 26 mm.

RKL scale is compatible with Renishaw's QUANTiC™, VIONiC™, TONiC™, ATOM DX™, ATOM™ and RESOLUTE™ readheads providing a partial arc solution for a wide range of applications.

RKL scale is installed onto the axis substrate by a self-adhesive backing tape making this a quick, straightforward and inexpensive process. The scale ends are rigidly fixed to the axis substrate by means of epoxy or epoxy fastened end clamps, eliminating the need to drill holes.

- **Small cross-sectional area making it ideal for partial arc rotation applications**
- **Suitable for external radii down to 26 mm**
- **Compatible with a wide range of Renishaw's incremental and absolute readheads**
- **20 µm, 30 µm and 40 µm pitch versions available**
- **'Cut-to-length' convenience**
- ***IN-TRAC*™ optical reference marks**
- **High solvent immunity**

www.renishaw.com/opticalencoders

#renishaw

RKL partial arc scale specifications

		Incremental			Absolute
		RKLC20-S	**RKLC40-S**	**RKLF40-S**	**RKLA30-S**
Compatible readheads		VIONiC and TONiC	QUANTiC	ATOM and ATOM DX [1]	RESOLUTE
Form (height × width)		0.15 mm × 6 mm (including adhesive)			
Pitch		20 µm	40 µm	40 µm	30 µm
Accuracy (at 20 °C) (based on neutral axis)		±5 µm/m	±15 µm/m	±15 µm/m	±5 µm/m (including slope and linearity)
Linearity (at 20 °C) (based on neutral axis)		±2.5 µm/m	±3 µm/m	±3 µm/m	-
Supplied length		20 mm to 20 m (> 20 m available on request)		20 mm to 10 m (> 10 m available on request)	20 mm to 21 m
Material		Hardened and tempered stainless steel			
Mass		4.6 g/m			
Coefficient of thermal expansion (at 20 °C)		10.1 ±0.2 µm/m/°C			
Temperature	Storage	–20 °C to +80 °C			
	Operating [2]	0 °C to +70 °C			
	Installation	+10 °C to +35 °C			
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78			
Shock	Operating	500 m/s², 11 ms, ½ sine, 3 axes			
Vibration	Operating	300 m/s² maximum @ 55 to 2000 Hz, 3 axes			
Recommended end fixing	R≥ 75 mm	Epoxy mounted end clamps (A-9523-4015)			
	R≥ 26 mm	Approved epoxy adhesive (A-9531-0342)			
Minimum arc radius [3]		30 mm	26 mm	26 mm	50 mm

Reference mark [4]

RKLC20-S and RKLC40-S [5]	*IN-TRAC* reference mark, directly embedded into incremental track. Bi-directional position repeatable to unit of resolution throughout specified speed. 50 mm spacing, first reference mark 50 mm from scale end. Reference mark at mid-point of scale length for lengths < 100 mm.
RKLF40-S	Customer de-selectable auto-phase optical reference mark. Bi-directional position repeatable to unit of resolution throughout specified speed. 50 mm spacing, first reference mark 50 mm from scale end. Reference mark at mid-point of scale length for lengths < 100 mm.
RKLA30-S	No reference mark

1 40 µm ATOM and ATOM DX readhead variants only.

2 To limit the maximum tension in the scale $(CTE_{substrate} - CTE_{scale}) \times (T_{use\ extreme} - T_{install}) \leq 550$ µm/m where CTE_{scale} = ~ 10.1 µm/m/°C.

3 For smaller radii contact your local Renishaw representative.

4 Only the calibrated reference mark is phased.

5 Where a specific reference mark location is required, contact your local Renishaw representative for advice on the best method to achieve this.

Compatible readheads

	Incremental		
	VIONiC	**TONiC**	**QUANTiC**
			
Readhead size (length × width × height in mm)	35 × 13.5 × 10	35 × 13.5 × 10	35 × 13.5 × 10
Interface	-	Ti, TD or DOP	-
Scale type	RKLC20-S	RKLC20-S	RKLC40-S
Output	Digital resolutions from 5 µm to 2.5 nm direct from the readhead	Analogue 1 Vpp. Digital resolutions from 5 µm to 1 nm from an interface.	Analogue 1 Vpp. Digital resolutions from 10 µm to 50 nm direct from the readhead.
Sub-divisional error (typical)	< ±15 nm	< ±30 nm	< ±150 nm (partial arc radius > 67.5 mm) < ±80 nm [1] (partial arc radius ≤ 67.5 mm)
Maximum speed	12 m/s	10 m/s	24 m/s [1]
Diagnostic tool	ADTi-100 and ADT View	TONiC diagnostic tool	ADTi-100 and ADT View

	Incremental		
	ATOM [2]	**ATOM DX [2]**	**RESOLUTE**
			
Readhead size (length × width × height in mm)	20.5 × 12.7 × 7.85 (FPC variant: 20.5 × 12.7 × 6.8)	20.5 × 12.7 × 10.85 (Top exit variant: 20.5 × 12.7 × 7.85)	36 × 16.5 × 17.2
Interface	Ri, Ti, ACi	-	DRIVE-CLiQ only
Scale type	RKLF40-S	RKLF40-S	RKLA30-S
Output	Analogue 1 Vpp. Digital resolutions from 10 µm to 2 nm from an interface.	Digital resolutions from 10 µm to 5 nm direct from the readhead.	BiSS, Siemens DRIVECLiQ, FANUC, Mitsubishi, Panasonic, Yaskawa
Sub-divisional error (typical)	< ±120 nm	< ±120 nm	±40 nm
Maximum speed	20 m/s	20 m/s	100 m/s
Diagnostic tool	ATOM diagnostic tool	ADTi-100 and ADT View	ADTa-100 and ADT View

NOTE: If installing RKL scale on a partial arc for a UHV or ETR application, contact your local Renishaw representative for more information.

1 Digital variants only.

2 40 µm ATOM and ATOM DX readhead variants only.

RKLC partial arc installation drawing

Dimensions and tolerances in mm

Z	=	Axis of rotation
R1	=	Substrate radius
R^N	=	Neutral axis radius (R1 + 100 µm)
ML	=	Measuring length
L	=	Scale length [2]
		with end clamps L = ML + 40 [3]
		without end clamps L = ML + 20
OL	=	Overall length
		with end clamps OL = ML + 70 [3]

NOTE: The drawing is applicable for all compatible readheads.

NOTE: The surface roughness of the substrate must be better than 3.2 µm. The parallelism of the scale surface to the axis guideway (readhead ride height variation) must be within 0.05 mm.

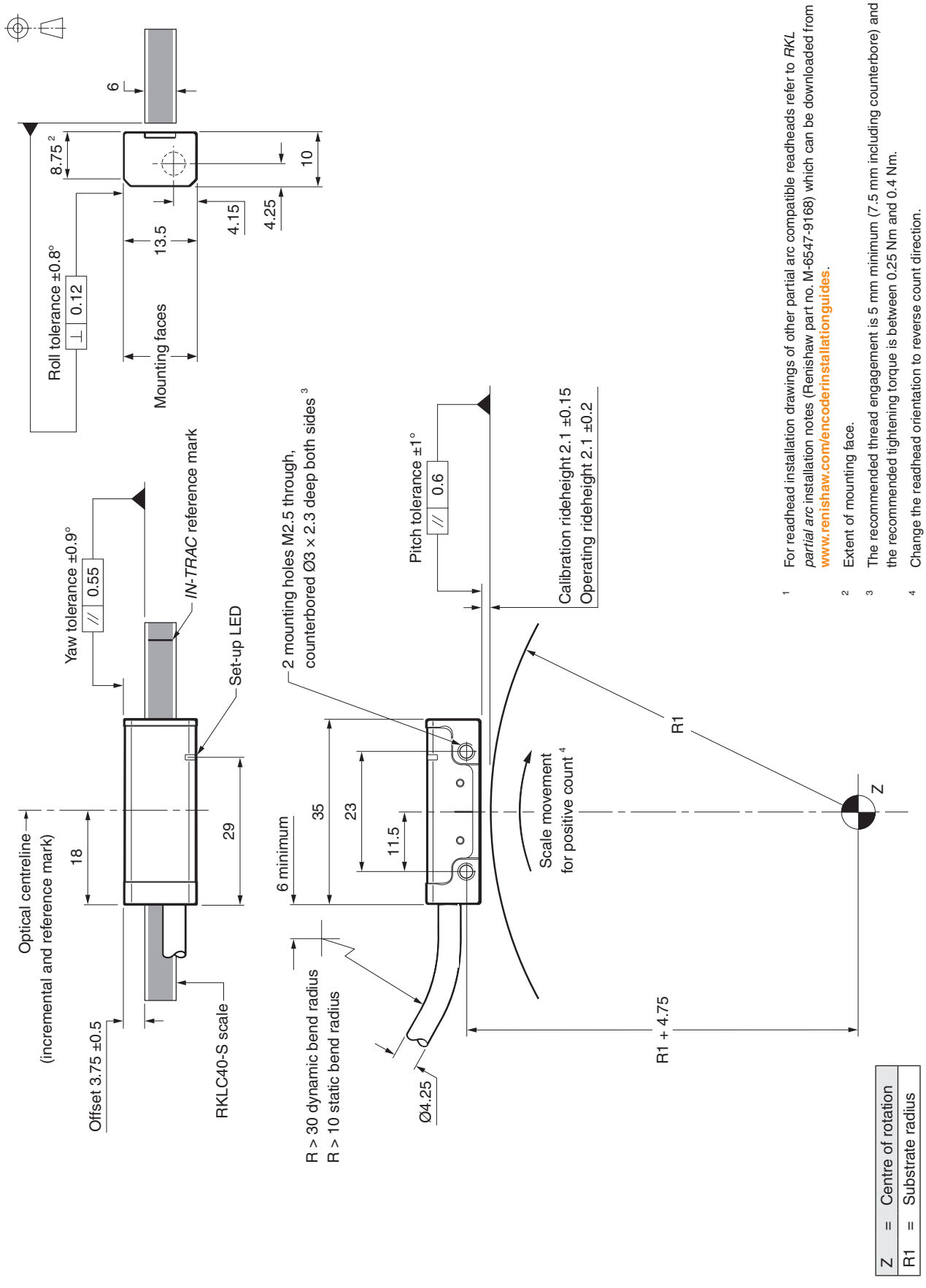
1 When not using end clamps, the scale ends must be secured using an alternative method. For further information refer to *RKL partial arc installation notes* (Renishaw part no. M-6547-9168) which can be downloaded from www.renishaw.com/encoderinstallationguides.

2 When calculating scale length, the first reference mark is 50 mm from scale end.

3 For RESOLUTE systems: To ensure readhead does not clash with the end clamps, L = ML + 66 and OL = ML + 96.

QUANTiC readhead installation drawing [1]

Dimensions and tolerances in mm



1 For readhead installation drawings of other partial arc compatible readheads refer to *RKL partial arc* installation notes (Renishaw part no. M-6547-9168) which can be downloaded from www.renishaw.com/encoderinstallationguides.

2 Extent of mounting face.

3 The recommended thread engagement is 5 mm minimum (7.5 mm including counterbore) and the recommended tightening torque is between 0.25 Nm and 0.4 Nm.

4 Change the readhead orientation to reverse count direction.

Scale part numbers

Scale type	Part number (where xxxx is the scale length in cm) [1]	Available lengths	Compatible readheads
RKLC40-S	A-6665-xxxx	20 mm to 20 m (> 20 m available on request)	QUANTiC
RKLC20-S	A-6663-xxxx	20 mm to 20 m (> 20 m available on request)	VIONiC and TONiC
RKLF40-S	A-6769-xxxx	20 mm to 20 m (> 20 m available on request)	ATOM and ATOM DX [2]
RKLA30-S	A-6667-xxxx	20 mm to 21 m	RESOLUTE

[1] For example, ordering A-6663-0110 will result in a 110 cm length of RKLC20-S.

[2] 40 µm ATOM and ATOM DX readhead variants only.

Accesssory part numbers

RKL scale accessories

Part description	Part number	Product image
Guillotine (for cutting RKL scale)	A-9589-0071	
Shears (for cutting RKL scale)	A-9589-0133	
RKLC-S side mount scale applicator (compatible with VIONiC, TONiC and QUANTiC side mount systems)	A-6547-1912	
RKLC-S top mount scale applicator (required for TONiC top mounted systems only)	A-6547-1915	
RKLF-S side mount applicator (compatible with ATOM and ATOM DX)	A-6547-1943	
RKLF-S top mount applicator (compatible with ATOM and ATOM DX)	A-6547-1939	
RKLF-S slim side mount applicator (compatible with ATOM and ATOM DX)	A-6547-1947	
RKLA-S scale applicator (compatible with RESOLUTE)	A-6547-1918	

End clamp accessories

Part description	Part number	Product image
RGC-F end clamp kit - epoxy mounted (the RGC-F end clamps fix the ends of the partial arc scale to the substrate material)	A-9523-4015	
RGG-2 two part epoxy (the RGG-2 epoxy is recommended for the mounting of end clamps and scale ends)	A-9531-0342	

Reference mark accessories

Part description	Part number	Product image
Reference mark de-selector stickers (pack of 20 de-selector stickers - RKLF ATOM /ATOM DX systems only)	A-9402-0049	

www.renishaw.com/contact

#renishaw

+44 (0) 1453 524524 **uk@renishaw.com**

Part no.: L-9517-9897-02-A
Issued: 08.2023

Data sheet
L-9517-9219-07-B

RENISHAW
apply innovation™

RELM20 high accuracy incremental linear scale

RELM20 ZeroMet™ scale is manufactured from near zero thermal expansion material, ensuring the high level of accuracy is maintained across the full temperature range.

It can be mounted direct to your machine, either mechanically or by the use of a self-adhesive backing tape. RELM20 scale also features the *IN-TRAC*™ optical reference mark allowing fast auto-phasing.

RELM20 is a 20 µm pitch scale and is compatible with Renishaw's VIONiC™ and TONiC™ range of encoders, offering levels of performance previously only available from delicate fine pitch systems.

- **High accuracy, certified to ±1 µm up to 1 m, calibrated against International Standards**
- **Robust ZeroMet offers 0.75 ±0.35 µm/m/°C@20 °C thermal expansion plus ease of handling and installation**
- **Scale mounting with self-adhesive or clips and clamps**
- ***IN-TRAC* bi-directional auto-phase optical reference mark**
- **Dual limits provide on-scale end of travel indication**

RELM20 scale specifications

Form (H × W)	1.6 mm × 14.9 mm
Scale lengths (L)	20 mm to 1.5 m (available in increments of 10 mm)
Pitch	20 µm
Accuracy	Certified to ±1 µm for lengths up to 1 m, ±1 µm/m for lengths >1 m to 1.5 m Calibrated traceable to International Standards
Material	ZeroMet. High stability, low-expansion nickel-iron alloy
Coefficient of thermal expansion (at 20 °C)	0.75 ±0.35 µm/m/°C
Mounting	Epoxy datum point and adhesive tape or datum clamp and mounting clips Adhesive backing tape is included with all scale (nominal thickness 0.2 mm)
Mass	184 g/m

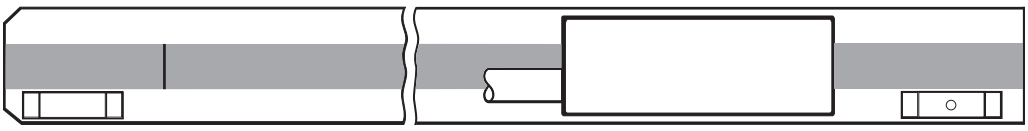
Reference mark

Type	*IN-TRAC* optical reference mark
Position	RELM20 – midpoint of scale length RELE20 – 20 mm from end of scale
Phasing	Auto-phased by readhead calibration routines
Repeatability	Repeatable to unit of resolution throughout specified temperature and speed range

NOTE: When using a VIONiC or TONiC system the readhead should be ordered so all reference marks are output; no actuator magnet is required.

Limit switches

Type	Magnetic actuators; with dimple triggers Q limit, without dimple triggers P limit (see image below)
Trigger point	The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge
Mounting	Customer placed at desired locations
Repeatability	<0.1 mm



P limit (10 mm, A-9653-0138)

Q limit (10 mm, A-9653-0139)

Limit magnets are available in 10 mm, 20 mm and 50 mm lengths and supplied on a back plate with self-adhesive tape.

NOTE: Use of limits will affect the available measuring length (see page 6).

Compatible readheads

	VIONiC	TONiC
		
Outputs	Digital resolutions from 5 µm to 2.5 nm direct from the readhead	Analogue 1 Vpp only. RS422 digital resolutions from 5 µm to 1 nm available when connected to a Ti, TD or DOP interface
SDE (typical)	<±15 nm	±30 nm
Jitter (RMS)	down to 1.6 nm	down to 0.5 nm
Maximum speed	12 m/s	10 m/s

Readhead features

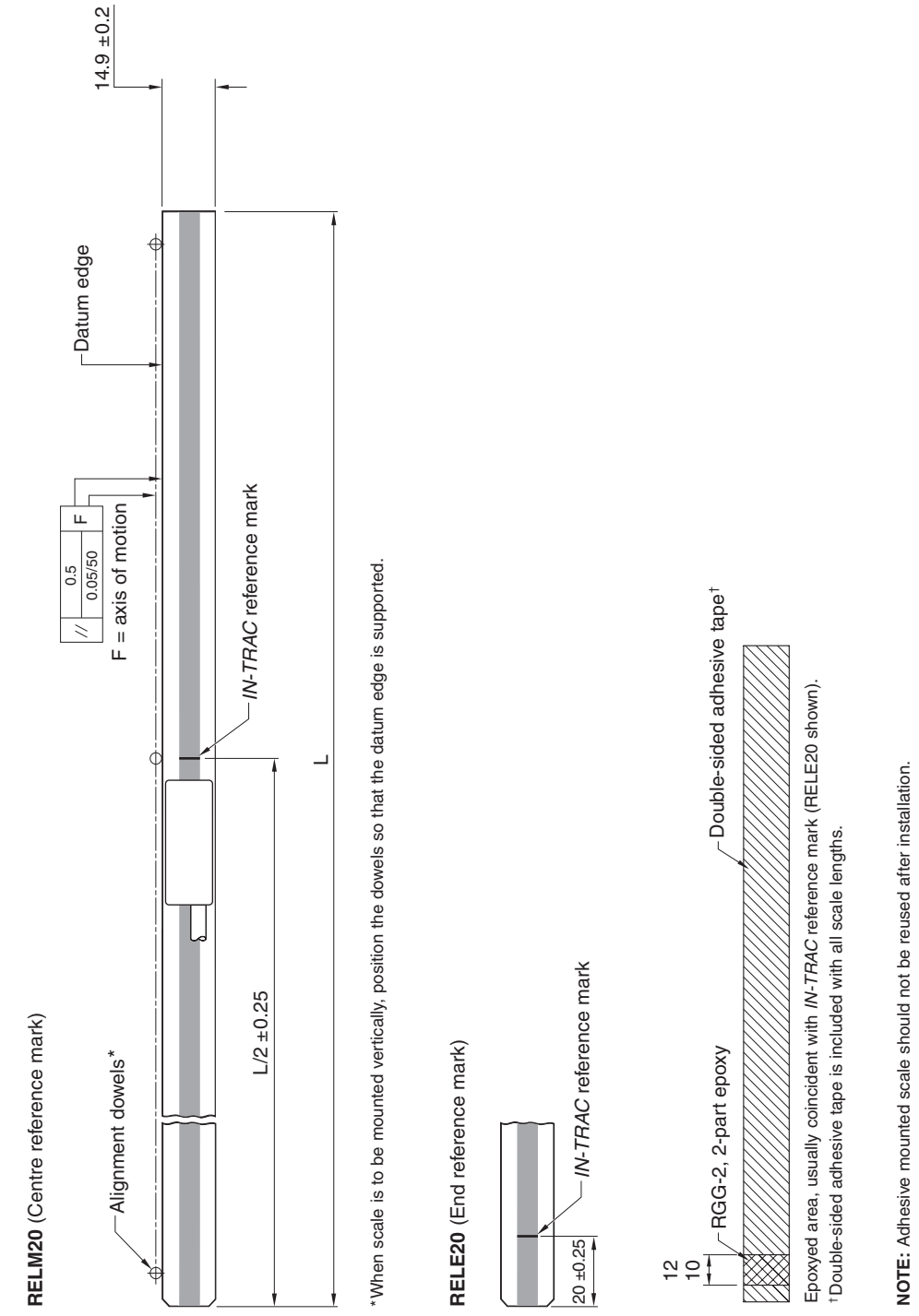
- Filtering optics and Auto Gain Control for high reliability and solid Lissajous signals.
- Dynamic signal processing ensures ultra-low Sub-Divisional Error (SDE).
  Result: smoother scanning performance.
- High signal-to-noise ratio provides ultra-low jitter for optimum positional stability.
- Auto-phasing of *IN-TRAC* reference mark.
- Clocked outputs ensure optimised speed performance for all resolutions, for a wide variety of industry-standard controllers.
- DOP Dual output interfaces available to provide simultaneous analogue and digital outputs (TONiC systems only).

RENISHAW
apply innovation™

RELM20 scale installation drawing (adhesive mounting method shown)

For further details please refer to relevant system installation guides

Dimensions and tolerances in mm



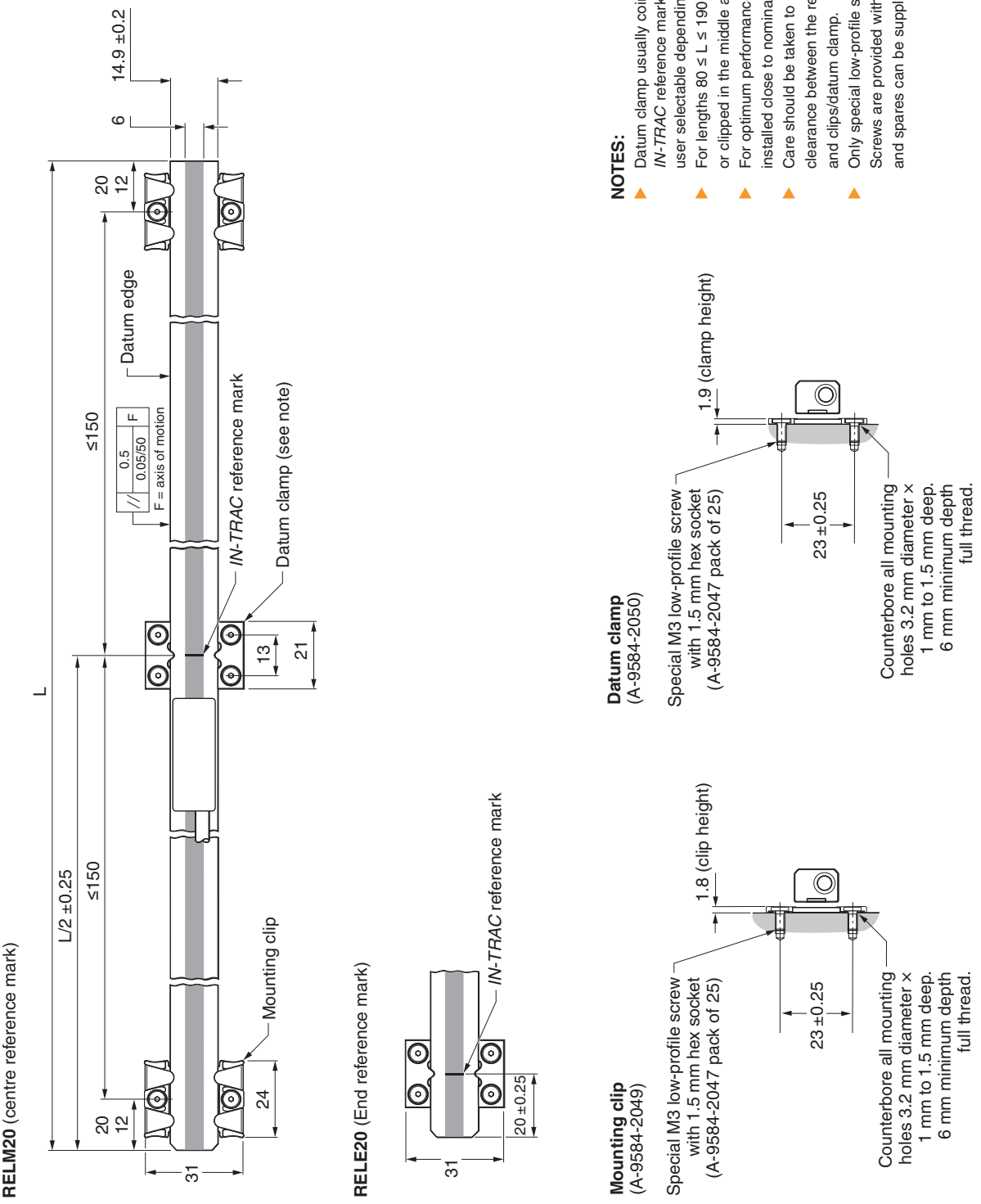
NOTE: Adhesive mounted scale should not be reused after installation.

RENISHAW
apply innovation™

RELM20 scale installation drawing (clip/clamp mounting method shown)

For further details please refer to relevant system installation guides

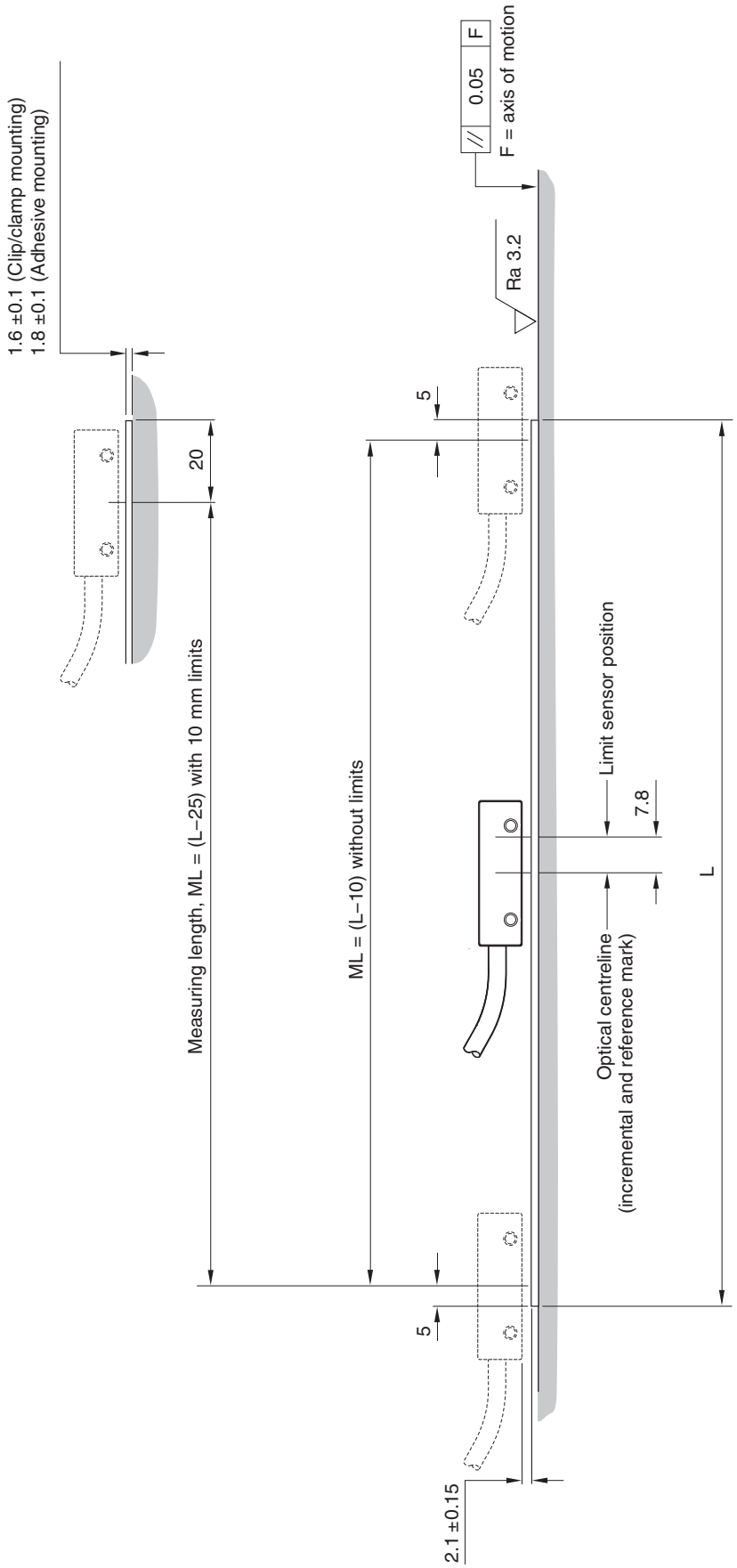
Dimensions and tolerances in mm



RELM20 scale measuring lengths

For further details please refer to relevant system installation guides

Dimensions and tolerances in mm



Scale part numbers

RELM20

20 µm pitch ZeroMet spar scale with single *IN-TRAC* reference mark at mid-point of scale length.

Part number	Available lengths	Available in increments of	Ordering instructions
A-9660-xxxx	20 mm to 1500 mm	10 mm	xxxx is the length in mm. Ordering A-9660-0450 for example will result in a length of 450 mm.

RELE20

20 µm pitch ZeroMet spar scale with single *IN-TRAC* reference mark 20 mm from scale end.

Part number	Available lengths	Available in increments of	Ordering instructions
A-9661-xxxx	30 mm to 1500 mm	10 mm	xxxx is the length in mm. Ordering A-9661-0450 for example will result in a length of 450 mm.

Accessory part numbers

Limit switch magnets*

Part description	Part number	Product image
10 mm Q limit switch actuator magnet Adhesive mounted	A-9653-0139	
10 mm P limit switch actuator magnet Adhesive mounted	A-9653-0138	
Magnet applicator device (Aids positioning)	A-9653-0201	

*Longer limit magnets are available. Contact your local subsidiary for more information.

Clip/clamp mounting accessories†

Part description	Part number	Product image
Mounting clips	A-9584-2049	
Datum clamp kit	A-9584-2050	
Replacement M3 screws (pack of 25)	A-9584-2047	
Spare clip setting shim	M-9584-0928	

† UHV and extra wide clip/clamp accessories are available. Contact your local subsidiary for more information.

Renishaw plc

New Mills, Wotton-under-Edge
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0) 1453 524524
F +44 (0) 1453 524901
E uk@renishaw.com

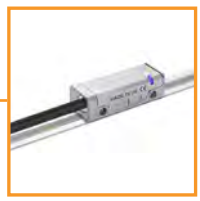
www.renishaw.com

RENISHAW
apply innovation™

Compatible products

RELM20
RELE20

TONiC



VIONiC

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

L-9517-9219-07

Part no.: L-9517-9219-07-B
Issued: 10.2019

Data sheet
L-9517-9305-08-B

RENISHAW
apply innovation™

RSLM20 high accuracy incremental linear stainless steel scale

- Total accuracy of ±4 µm over 5 m
- Available in defined lengths up to 5 m
- Coilable for simple storage and handling
- *IN-TRAC* auto-phase optical reference mark
- Robust special composition stainless steel with defined coefficient of thermal expansion 10.1 ±0.2 µm/m/°C @ 20 °C
- Dual limits provide on-scale end-of-travel indication

RSLM20 high accuracy stainless steel scale is compatible with Renishaw's VIONiC™ and TONiC™ range of high performance encoders, offering advanced features including dynamic signal processing and the *IN-TRAC*™ optical reference mark.

RSLM20 scale is available in lengths up to 5 m with an overall accuracy better than ±4 µm on 5 m lengths – an industry first! Combined with readheads featuring ultra-low Sub-Divisional Error (SDE), unique filtering optics, resolutions down to 1 nm and simple installation and setup, RSLM20 provides all the performance of a fine pitch system with the benefits of a 20 µm encoder.

RSLM20 offers the ease of use of a tape scale yet the performance of a glass spar; the scale can be coiled for simple storage and handling yet behaves as a spar once uncoiled. Available with a number of *IN-TRAC* reference mark options and a choice of mechanical or adhesive mounting, RSLM20 is perfect for long-travel applications where metrology cannot be compromised.

RSLM20 scale specifications

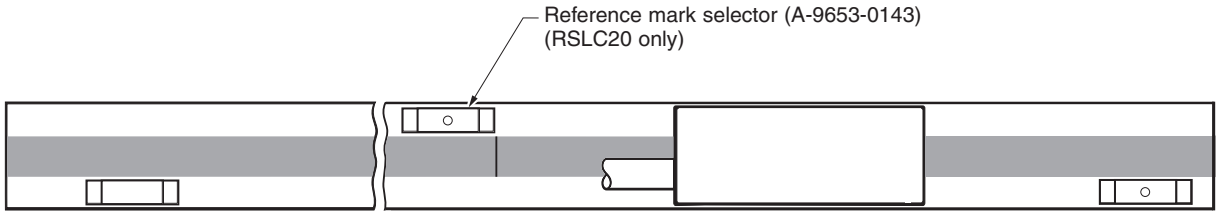
Form (H × W)	1.5 mm × 14.9 mm
Scale lengths	20 mm to 5 m (available in increments of 10 mm)
Pitch	20 µm
Accuracy (at 20 °C)	±1.5 µm up to 1 m ±2.25 µm from 1 m to 2 m ±3 µm from 2 m to 3 m ±4 µm from 3 m to 5 m (includes slope and linearity). Calibration traceable to International Standards.
Material	Hardened martensitic stainless steel
Coefficient thermal expansion (at 20 °C)	10.1 ±0.2 µm/m/°C
Mounting	Epoxy datum point and adhesive tape (nominal thickness 0.2 mm) or datum clamp and mounting clips
Mass	172 g/m
Storage	Lengths over 1.13 m are coiled (> 600 mm diameter)

Reference mark

Type	*IN-TRAC* auto-phase optical reference mark, no physical adjustments required	
Position	**RSLM20**	Midpoint of scale length
	RSLE20	(Option A) – 20 mm from end of scale (for use with 10 mm limits)
	RSLE20	(Option B) – 70 mm from end of scale (for use with 20 mm and 50 mm limits)
	RSLC20	Selectable reference marks every 200 mm
	RSLR20	No *IN-TRAC* reference mark, suitable for use with RGH20; external magnetic reference mark required. Please refer to the RGH20 Data sheet (L-9517-9125) for more information.
Phasing	Auto-phased by readhead calibration routine	
Repeatability	Repeatable to unit of resolution throughout specified temperature and speed range	

Limit switches

Type	Magnetic actuators; with dimple triggers Q limit, without dimple triggers P limit (see image below)
Trigger point	The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge
Mounting	Customer placed at desired locations
Repeatability	< 0.1 mm



P limit (10 mm, A-9653-0138)

Q limit (10 mm, A-9653-0139)

- Limit and reference mark selector magnets are available in 10 mm, 20 mm and 50 mm lengths and provided on a back plate with self-adhesive tape.
- For RSLM20 and RSLE20 scales VIONiC and TONiC readheads should be ordered with all reference marks output. (No reference mark selector required.)
- For RSLC20 scales VIONiC and TONiC readheads should be ordered with selected reference marks output. (Reference mark selector required at chosen reference mark location.)

Compatible readheads

	VIONiC	TONiC
		
Outputs	Digital resolutions from 5 µm to 2.5 nm direct from the readhead	Analogue 1 Vpp only. RS422 digital resolutions from 5 µm to 1 nm available when connected to a Ti, TD or DOP interface
SDE (typical)	< ±15 nm	±30 nm
Jitter (RMS)	down to 1.6 nm	down to 0.5 nm
Maximum speed	12 m/s	10 m/s

Readhead features

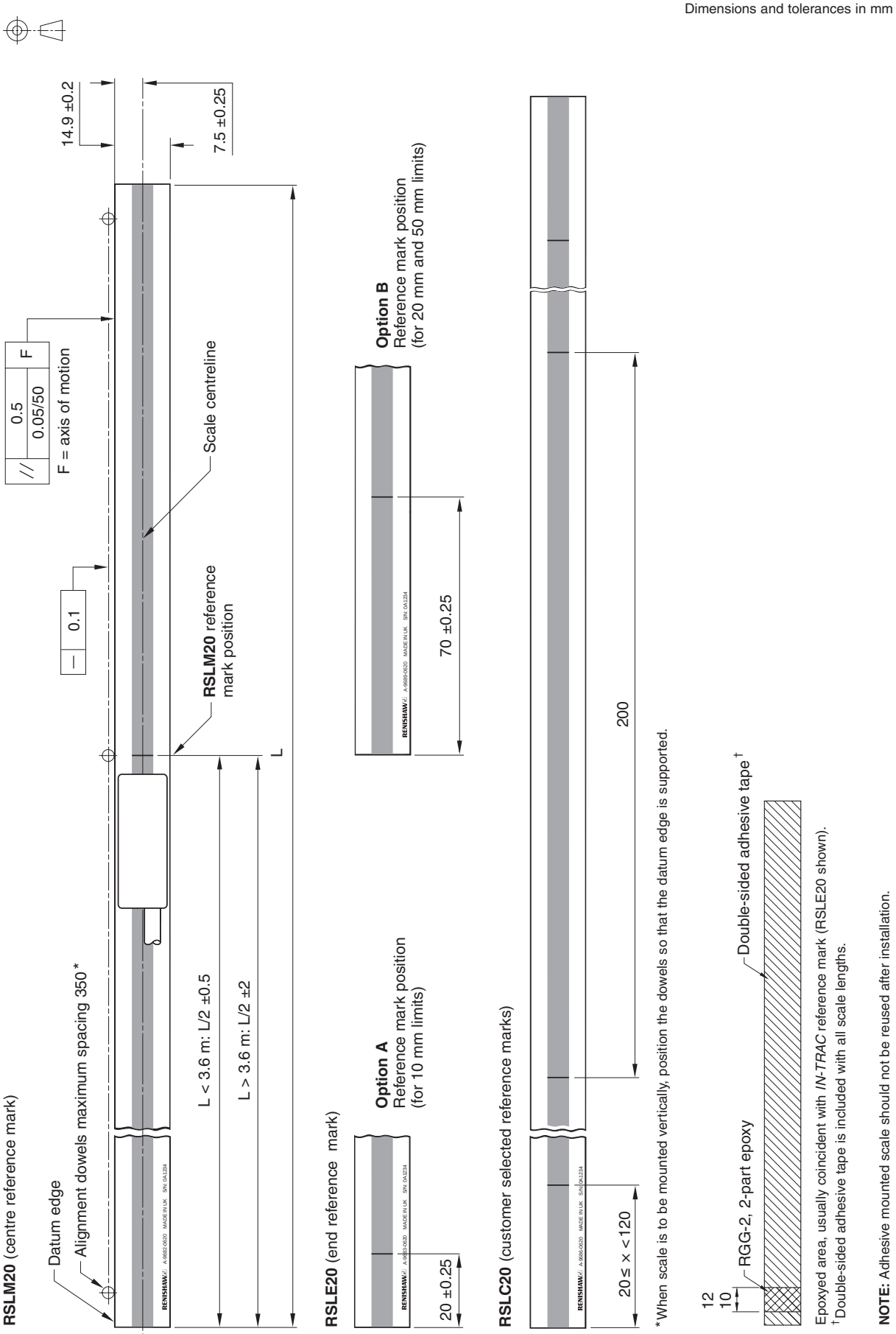
- Filtering optics and Auto Gain Control for high reliability and solid Lissajous signals.
- Dynamic signal processing ensures ultra-low Sub-Divisional Error (SDE).
  Result: smoother scanning performance.
- High signal-to-noise ratio provides ultra-low jitter for optimum positional stability.
- Auto-phasing of *IN-TRAC* reference mark.
- Clocked outputs ensure optimised speed performance for all resolutions, for a wide variety of industry-standard controllers.
- DOP Dual output interfaces available to provide simultaneous analogue and digital outputs (TONiC systems only).

RENISHAW apply innovation™

RSLM20 scale installation drawing (adhesive mounting method shown)

For further details please refer to relevant system installation guides

Dimensions and tolerances in mm

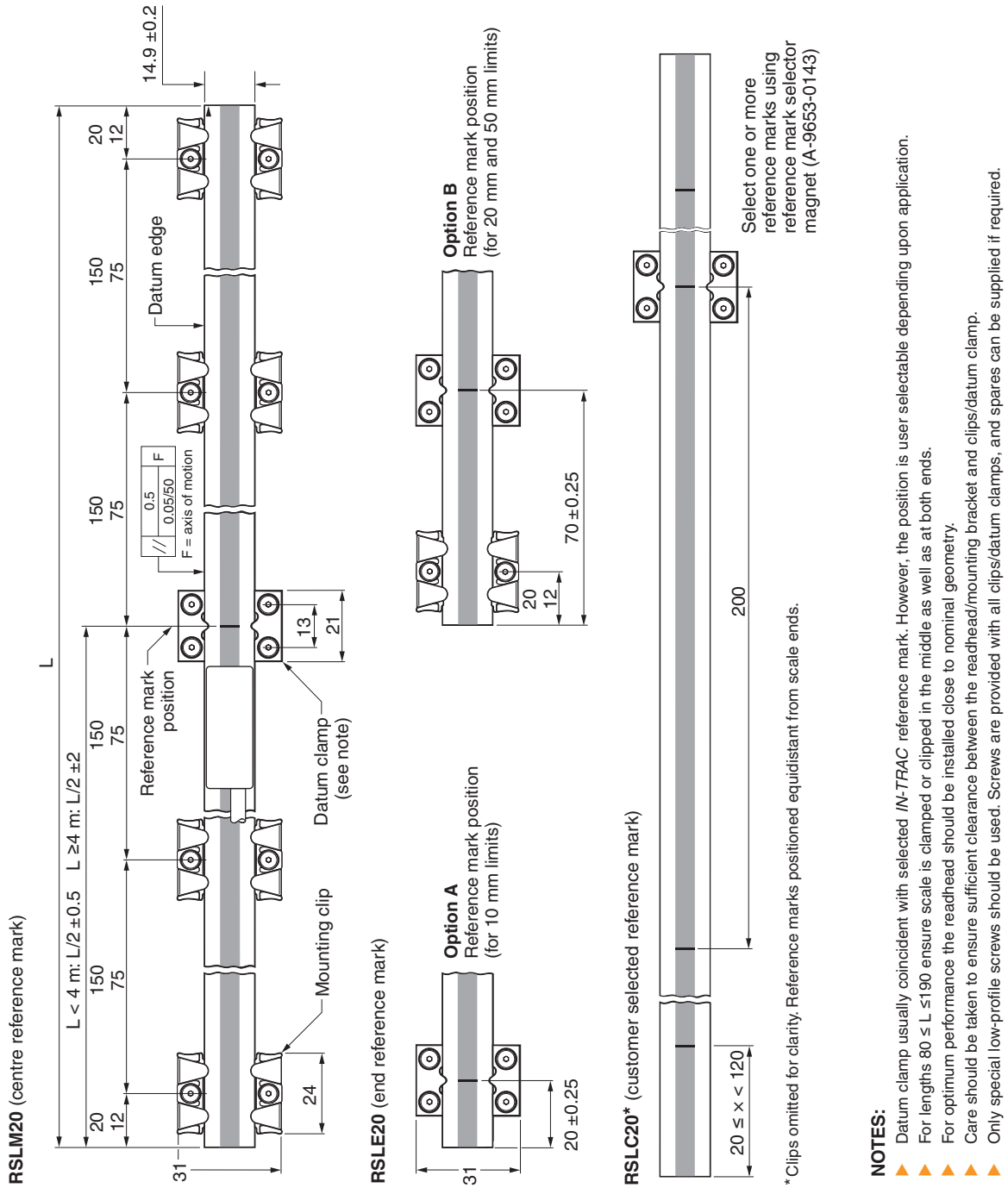


NOTE: Adhesive mounted scale should not be reused after installation.

RSLM20 scale installation drawing (clip/clamp mounting method shown)

For further details please refer to relevant system installation guides

Dimensions and tolerances in mm



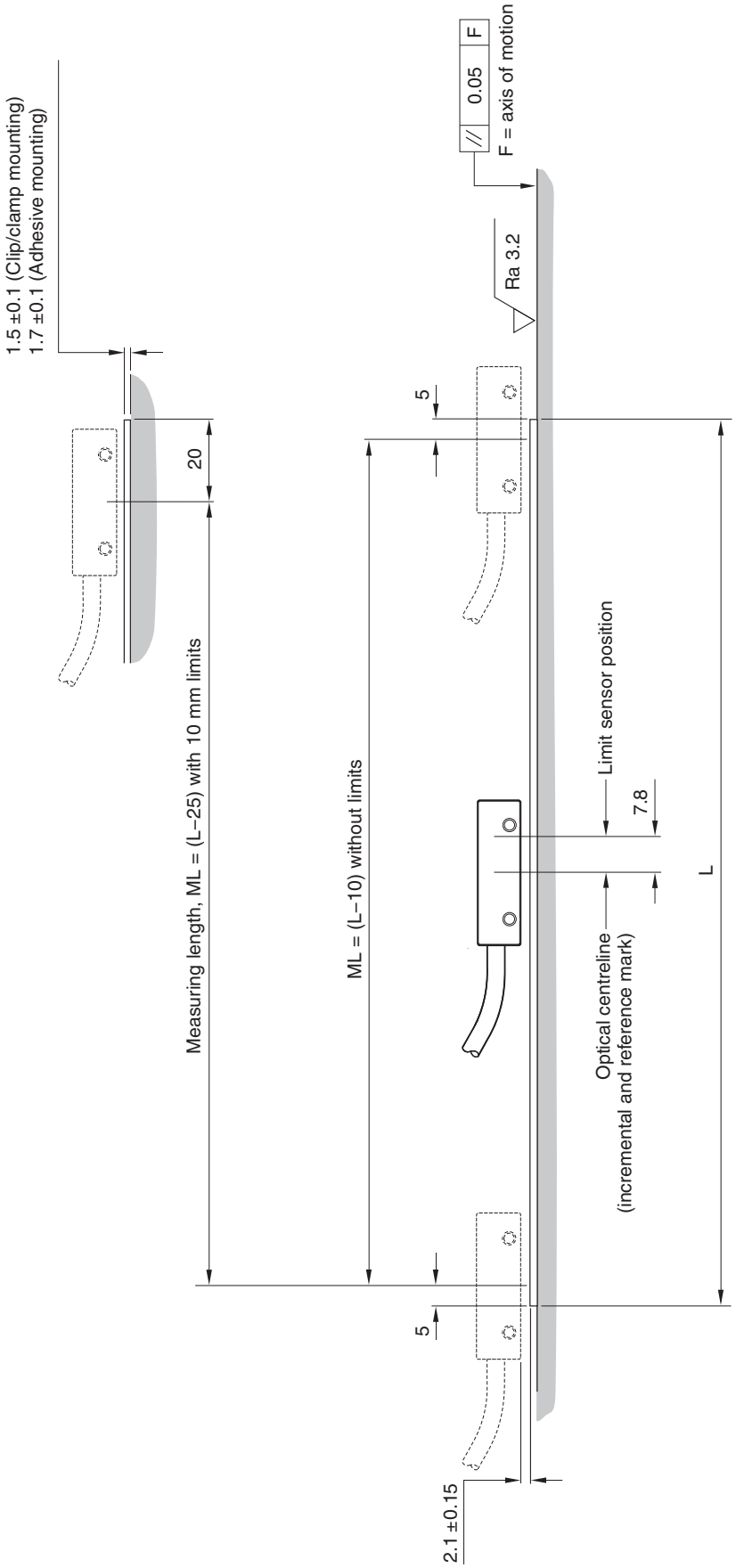
NOTES:

- Datum clamp usually coincident with selected *IN-TRAC* reference mark. However, the position is user selectable depending upon application.
- For lengths 80 ≤ L ≤190 ensure scale is clamped or clipped in the middle as well as at both ends.
- For optimum performance the readhead should be installed close to nominal geometry.
- Care should be taken to ensure sufficient clearance between the readhead/mounting bracket and clips/datum clamp.
- Only special low-profile screws should be used. Screws are provided with all clips/datum clamps, and spares can be supplied if required.

RSLM20 scale measuring length

For further details please refer to relevant system installation guides

Dimensions and tolerances in mm



Scale part numbers

20 µm pitch stainless steel spar scale

Series	Reference mark	Part number	Minimum length	Maximum length	Available in increments of	Ordering instructions
RSLM20	Single *IN-TRAC* reference mark at mid-point of scale length	A-9682-xxxx	20 mm	5 m	10 mm	Replace xxxx with one of the available standard lengths For example, 0480 will result in a length of 480 mm
RSLE20 (option A)	Single *IN-TRAC* reference mark 20 mm from scale end	A-9683-xxxx	50 mm	5 m		
RSLE20 (option B)	Single *IN-TRAC* reference mark 70 mm from scale end	A-9689-xxxx	130 mm	5 m		
RSLC20	Multiple *IN-TRAC* reference marks spaced every 200 mm Reference mark is customer selectable with selector magnet	A-9686-xxxx	280 mm	5 m		
RSLR20	No *IN-TRAC* reference mark	A-9684-xxxx	20 mm	5 m		

Accessory part numbers

Reference mark and limit magnets*

Part description	Part number	Product image
Reference mark selector magnet – Adhesive mounted **NOTE:** Only required for selecting *IN-TRAC* reference mark on RSLC20 scale	A-9653-0143	
Q limit switch actuator magnet Adhesive mounted	A-9653-0139	
P limit switch actuator magnet Adhesive mounted	A-9653-0138	
Magnet applicator device (Aids positioning)	A-9653-0201	

*Longer limit magnets are available. Contact your local subsidiary for more information.

Clip/clamp mounting accessories†

Part description	Part number	Product image
Mounting clips	A-9584-2049	
Datum clamp kit	A-9584-2050	
Replacement M3 screws (pack of 25)	A-9584-2047	
Spare clip setting shim	M-9584-0928	

† UHV and extra wide clip/clamp accessories are available. Contact your local subsidiary for more information.

Renishaw plc

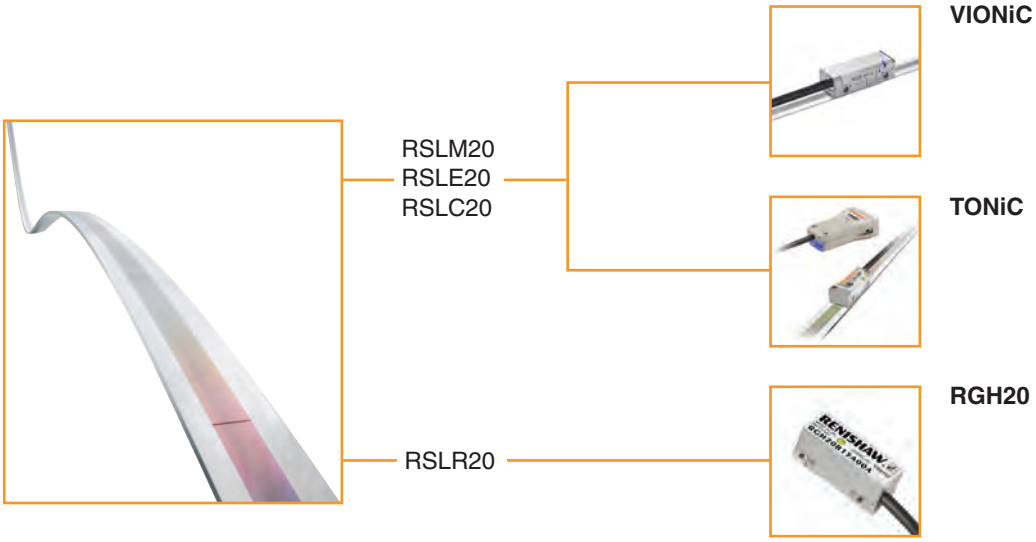
New Mills, Wotton-under-Edge
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0) 1453 524524
F +44 (0) 1453 524901
E uk@renishaw.com

www.renishaw.com

RENISHAW
apply innovation™

Compatible products



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

L-9517-9305-08

Part no.: L-9517-9305-08-B
Issued: 10.2019

Data sheet
L-9517-9154-09-A

RENISHAW
apply innovation™

RESM rotary scale

The RESM is a one-piece stainless steel ring with 20 µm or 40 µm scale marked directly onto the periphery, featuring the *IN-TRAC*™ auto-phase optical reference mark.

The RESM offers impressive accuracy with resolution to 0.00075 arc second, suiting the most demanding precision applications.

Read by Renishaw's VIONiC™, TONiC™ and QUANTiC™ encoder systems, it has high tolerance to dirt, scratches and greasy fingerprints that can cause other encoder systems to miscount.

The low profile RESM, with large internal diameter, is easy to design into most installations. Equally important, its low mass, low inertia design does not compromise system performance. Available in a wide range of sizes and line counts, providing compatibility with industry standard controllers.

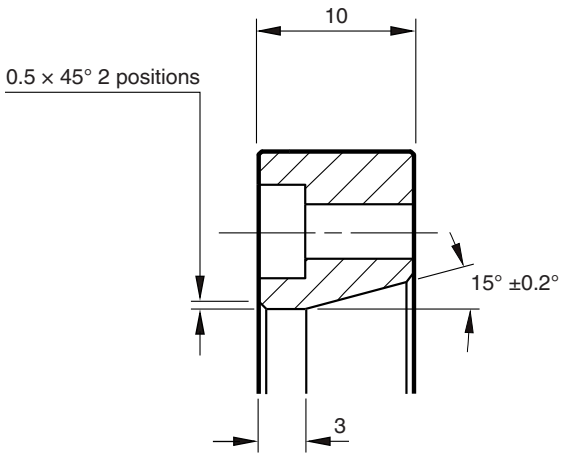
System features

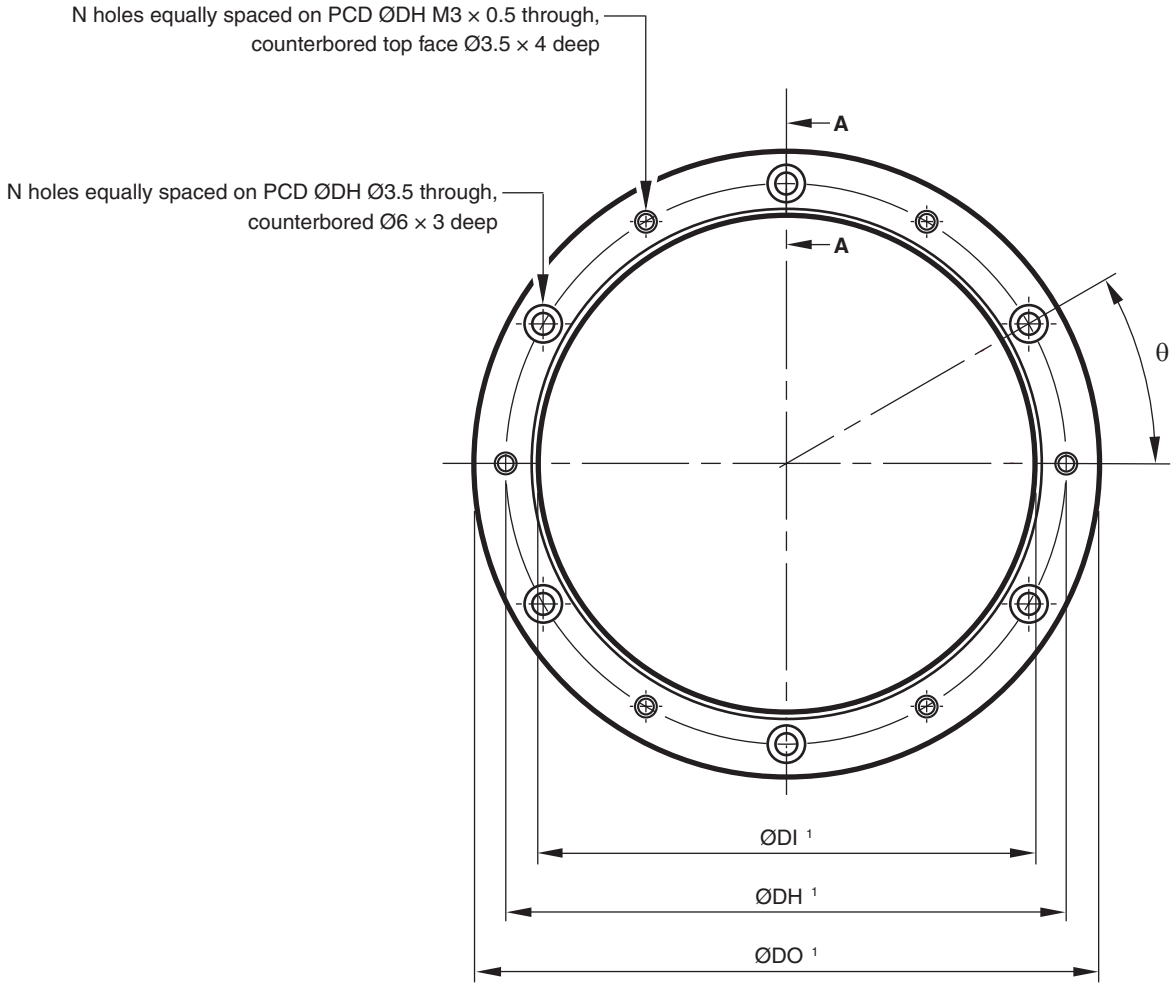
- **Compatible with the VIONiC, TONiC and QUANTiC encoder systems offering industry standard analogue or digital incremental outputs**
- ***IN-TRAC* bi-directional optical reference mark**
- **Typical installed accuracy to ±1.9 arc second (550 mm ring)**
- **Patented taper mount simplifies integration and minimises installation errors**
- **Large internal diameter for ease of integration**
- **Available in sizes from Ø52 mm to Ø550 mm with line counts from 4 096 to 86 400**
- **Custom sizes also available**
- **Low mass and low inertia**
- **Ultra-low inertia versions also available**
- **REST20 is a RESM20 with two reference marks, for use on dual readhead systems in partial arc applications**

RESM installation drawing (‘A’ section)

Dimensions and tolerances in mm

Section A-A





NOTE: θ is the angle between one tapped hole and the adjacent clearance hole. For example, the angle between two clearance holes is 2θ.

1 The dimensions DO, DI and DH for the RESM 'A' section rings are listed on the following page.

RESM specifications (‘A’ section)

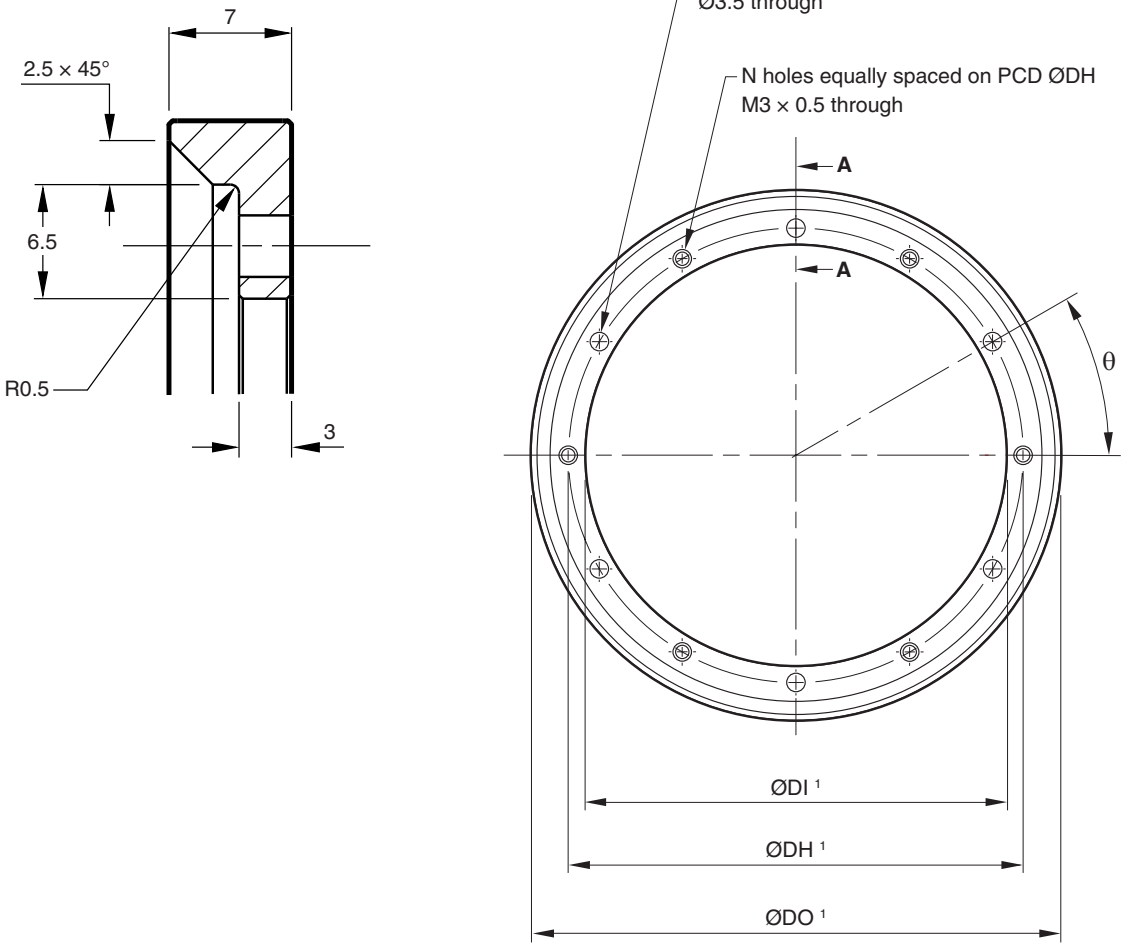
Nominal external diameter (mm)	Line count		DO (mm)	DI (mm)	Mounting holes		
	RESM20	RESM40			DH (mm)	N	θ
52	8 192	4 096	52.20 52.10	30.04 30.00	40	6	30°
57	9 000	4 500	57.35 57.25	37.04 37.00	47	6	30°
75	11 840	5 920	75.40 75.30	55.04 55.00	65	6	30°
94	14 800	7 400	94.30 94.26	74.59 74.55	84.5	6	30°
100	15 744	7 872	100.30 100.20	80.04 80.00	90	6	30°
103	16 200	8 100	103.20 103.00	80.04 80.00	90	6	30°
104	16 384	8 192	104.40 104.20	80.04 80.00	90	6	30°
115	18 000	9 000	114.70 114.50	95.04 95.00	105	6	30°
124	19 478	9 740	124.10 123.90	104.04 104.00	114	6	30°
150	23 600	11 800	150.40 150.20	130.04 130.00	140	9	20°
172	27 000	13 500	172.04 171.84	152.04 152.00	162	9	20°
183	28 800	14 400	183.45 183.25	163.04 163.00	173	9	20°
200	31 488	15 744	200.40 200.20	180.04 180.00	190	12	15°
206	32 400	16 200	206.50 206.10	186.05 186.00	196	12	15°
209	32 768	16 384	208.80 208.40	186.05 186.00	196	12	15°
229	36 000	18 000	229.40 229.00	209.05 209.00	219	12	15°
255	40 000	20 000	254.80 254.40	235.06 235.00	245	12	15°
300	47 200	23 600	300.40 300.20	280.06 280.00	290	16	11.25°
350	55 040	27 520	350.40 350.20	330.06 330.00	340	16	11.25°
413	64 800	32 400	412.70 412.30	392.08 392.00	402	18	10°
417	65 536	32 768	417.40 417.00	380.10 380.00	390	18	10°
489 [1]	76 800	38 400	489.12 488.72	451.10 450.90	462	20	18°
550	86 400	43 200	550.20 549.80	510.10 510.00	520	20	9°

[1] There are no tapped holes on the 489 mm ring.

RESM installation drawing (‘B’ section)

Dimensions and tolerances in mm

Section A-A



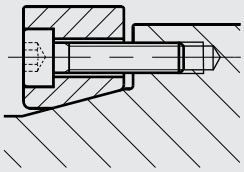
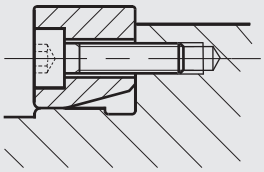
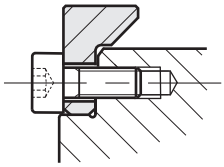
NOTE: θ is the angle between one tapped hole and the adjacent clearance hole. For example, the angle between two clearance holes is 2θ.

[1] The dimensions DO, DI and DH for the RESM 'B' section rings are listed on the following page.

RESM specifications ('B' section)

Nominal external diameter (mm)	Line count		DO (mm)	DI (mm)	Mounting holes		
	RESM20	RESM40			DH (mm)	N	θ
52	8 192	4 096	52.20 52.10	32.04 32.00	38	6	30°
57	9 000	4 500	57.35 57.25	37.04 37.00	43	6	30°
75	11 840	5 920	75.40 75.30	55.04 55.00	61	6	30°
100	15 744	7 872	100.30 100.20	80.04 80.00	86	6	30°
115	18 000	9 000	114.70 114.50	95.04 95.00	101	6	30°
150	23 600	11 800	150.40 150.20	130.04 130.00	136	9	20°
165	25 920	12 960	165.10 164.90	145.04 145.00	151	9	20°
200	31 488	15 744	200.40 200.20	180.04 180.00	186	12	15°

RESM mounting methods

	Taper mount	Interference fit
'A' section		
'B' section	Not applicable	
Notes	**Recommended for all installations** • Enables simplest adjustment. • Offers highest accuracy. • Enables eccentricity to be compensated. • Offers excellent mechanical stability against thermal cycling, shock and vibration. • Minimises cost of substrate preparation.	**Alternative installation** • Will not correct eccentricity of the supporting shaft.

For further information on installation and mounting options, refer to the relevant system installation guides, which are available from your local Renishaw representative, or can be downloaded from: **www.renishaw.com/encoderinstallationguides**.

Reference mark position

IN-TRAC reference mark is embedded in the scale, radially aligned with the centre of the mounting hole to the left of the 'Renishaw' logo, within ±0.5 mm. No external actuators or physical adjustment are required.

NOTE: For REST20 rings the second reference mark is located 180° from the first reference mark.

Compatible readheads

	VIONiC	TONiC	QUANTiC
			
Scale type	RESM20/REST20	RESM20/REST20	RESM40
Pitch	20 µm	20 µm	40 µm
Outputs	Digital resolutions from 5 µm to 2.5 nm direct from the readhead	Analogue 1 Vpp. Digital resolutions from 5 µm to 1 nm from an interface	Analogue 1 Vpp. Digital resolutions from 10 µm to 50 nm direct from the readhead
SDE (typical)	∅ > 135 mm < ±15 nm ∅ ≤ 135 mm < ±20 nm	±30 nm	∅ > 135 mm < ±150 nm ∅ ≤ 135 mm < ±80 nm [1]
Jitter (RMS)	down to 1.6 nm	down to 0.5 nm	down to 2.73 nm
Maximum speed	12 m/s	10 m/s	24 m/s [1]

[1] Digital variants

Readhead features

- Filtering optics and Auto Gain Control for high reliability and solid Lissajous signals.
- Dynamic signal processing ensures ultra-low Sub-Divisional Error (SDE). Result: smoother scanning performance.
- High signal-to-noise ratio provides ultra-low jitter for optimum positional stability.
- Auto-phasing of *IN-TRAC* reference mark.
- Clocked outputs ensure optimised speed performance for all resolutions, for a wide variety of industry-standard controllers.
- DOP Dual output interfaces available to provide simultaneous analogue and digital outputs (TONiC systems only).

Operating specifications

Material		303/304 stainless steel
Coefficient of thermal expansion (at 20 °C)		15.5 ±0.5 µm/m/°C
Temperature	Storage	–20 °C to +70 °C
	Operating	0 °C to +70 °C

Nominal external diameter (mm)		**52**	**57**	**75**	**94**	**100**	**103**	**104**
Nominal internal diameter (mm)		30 [1]	37	55	75	80	80	80
Line count	RESM20 (20 µm)	8 192	9 000	11 840	14 800	15 744	16 200	16 384
	RESM40 (40 µm)	4 096	4 500	5 920	7 400	7 872	8 100	8 192
Mass (kg)	'A' section	0.098	0.1	0.15	0.18	0.2	0.24	0.26
	'B' section	0.043	0.049	0.068	-	0.094	-	-
Moment of inertia (kg mm²)	'A' section	46	61	161	338	425	519	561
	'B' section	22	31	79	-	202	-	-

Nominal external diameter (mm)		**115**	**124**	**150**	**165**	**172**	**183**	**200**
Nominal internal diameter (mm)		95	104	130	145	152	163	180
Line count	RESM20 (20 µm)	18 000	19 478	23 600	25 920	27 000	28 800	31 488
	RESM40 (40 µm)	9 000	9 740	11 800	12 960	13 500	14 400	15 744
Mass (kg)	'A' section	0.23	0.26	0.32	-	0.36	0.40	0.43
	'B' section	0.1	-	0.15	0.16	-	-	0.2
Moment of inertia (kg mm²)	'A' section	644	849	1 581	-	2 400	3 006	3 928
	'B' section	296	-	740	970	-	-	1 822

Nominal external diameter (mm)		**206**	**209**	**229**	**255**	**300**	**350**	**413**
Nominal internal diameter (mm)		186	186	209	235	280	330	392
Line count	RESM20 (20 µm)	32 400	32 768	36 000	40 000	47 200	55 040	64 800
	RESM40 (40 µm)	16 200	16 384	18 000	20 000	23 600	27 520	32 400
Mass (kg)	'A' section	0.44	0.5	0.5	0.54	0.66	0.78	0.93
	'B' section	-	-	-	-	-	-	-
Moment of inertia (kg mm²)	'A' section	4 315	4 960	6 000	8 112	13 962	22 606	37 945
	'B' section	-	-	-	-	-	-	-

Nominal external diameter (mm)		**417**	**489**	**550**
Nominal internal diameter (mm)		380	451	510
Line count	RESM20 (20 µm)	65 536	76 800	86 400
	RESM40 (40 µm)	32 768	38 400	43 200
Mass (kg)	'A' section	1.76	2.13	2.53
	'B' section	-	-	-
Moment of inertia (kg mm²)	'A' section	70 386	118 244	178 598
	'B' section	-	-	-

[1] 32 mm for 'B' section ring.

Accuracy

Nominal external diameter	Typical installed accuracy [2]					
	'A' section [1]		'B' section		'A' section - dual head	
mm	arc second	µm	arc second	µm	arc second	µm
52	±12.7	±1.6	±21.1	±2.7	±3.4	±0.4
57	±11.8	±1.6	±19.5	±2.7	±3.2	±0.4
75	±9.5	±1.7	±14.9	±2.7	±2.6	±0.5
94	±7.9	±1.8	-	-	±2.25	±0.5
100	±7.5	±1.8	±11.3	±2.7	±2.2	±0.5
103	±7.4	±1.8	-	-	±2.1	±0.5
104	±7.3	±1.8	-	-	±2.1	±0.5
115	±6.8	±1.9	±9.9	±2.8	±2	±0.5
124	±6.3	±1.9	-	-	±1.8	±0.5
150	±5.5	±2.0	±7.7	±2.8	±1.6	±0.6
165	-	-	±7.0	±2.8	-	-
172	±5.0	±2.1	-	-	±1.45	±0.6
183	±4.7	±2.1	-	-	±1.35	±0.6
200	±4.3	±2.1	±5.8	±2.8	±1.3	±0.6
206	±4.2	±2.1	-	-	±1.3	±0.6
209	±4.2	±2.1	-	-	±1.3	±0.6
229	±3.9	±2.2	-	-	±1.2	±0.7
255	±3.6	±2.2	-	-	±1.1	±0.7
300	±3.1	±2.3	-	-	±1	±0.7
350	±2.8	±2.4	-	-	±0.9	±0.8
413	±2.4	±2.4	-	-	±0.8	±0.8
417	±2.4	±2.4	-	-	±0.8	±0.8
489	±2.1	±2.5	-	-	±0.7	±0.8
550	±1.9	±2.6	-	-	±0.6	±0.9

[1] Taper mounted installations recommend an installation of ±3 µm at the bolt hole locations; adjustments are not possible for bore mounted systems.

[2] 'Typical' installations are a result of graduation and installation errors combining and, to some magnitude, cancelling.

All rings supplied are tested to ensure a minimum installed accuracy grade. The manufactured installed accuracy limit is dependent on the ring type:

- A section rings : ±5 µm (±7.5 µm for Ø413 mm ring)
- B section rings : ±8 µm

NOTE: Bore mounted A section rings, have an assumed ±8 µm installed accuracy. Refer to your local Renishaw representative for more information.

$$\text{Minimum installed accuracy in arc seconds} = \frac{\text{Minimum installed accuracy (µm)}}{\text{Ring diameter (mm)}} \times 412.5$$

Refer to Appendix for system accuracy figures.

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, contact your local Renishaw representative.

VIONiC system: For 50 MHz clocked option

Nominal external diameter (mm)	Line count	Output resolution												
		5 µm	1 µm	0.5 µm	0.2 µm	0.1 µm	50 nm	40 nm	25 nm	20 nm	10 nm	5 nm	2.5 nm
52	8 192	4 407	4 407	4 407	2 663	1 332	666	533	333	266	133	66	33
57	9 000	4 021	4 021	4 021	2 429	1 215	607	486	304	243	122	61	30
75	11 840	3 056	3 056	3 056	1 846	923	462	369	231	185	92	46	23
94	14 800	2 438	2 438	2 438	1 473	738	368	295	184	147	74	37	18
100	15 744	2 292	2 292	2 292	1 385	693	346	277	173	138	69	35	17
103	16 200	2 225	2 225	2 225	1 344	672	336	269	168	134	67	34	17
104	16 384	2 204	2 204	2 204	1 331	666	333	266	166	133	67	33	17
115	18 000	1 993	1 993	1 993	1 204	602	301	241	150	120	60	30	15
124	19 478	1 848	1 848	1 848	1 117	559	279	223	140	112	56	28	14
150	23 600	1 528	1 528	1 528	923	462	231	185	115	92	46	23	12
165	25 920	1 389	1 389	1 389	839	420	210	168	105	84	42	21	11
172	27 000	1 332	1 332	1 332	805	403	201	161	101	81	40	20	10
183	28 800	1,252	1,252	1,252	757	379	189	151	95	76	38	19	9
200	31 488	1 146	1 146	1 146	692	346	173	138	87	69	35	17	8.7
206	32 400	1 113	1 113	1 113	672	336	168	134	84	67	34	17	8.4
209	32 768	1 097	1 097	1 097	663	331	166	133	83	66	33	17	8.3
229	36 000	1 001	1 001	1 001	605	302	151	121	76	60	30	15	7.6
255	40 000	899	899	899	543	272	136	109	68	54	27	14	6.8
300	47 200	764	764	764	462	231	115	92	58	46	23	12	5.8
350	55 040	655	655	655	396	198	99	79	49	40	20	10	5.0
413	64 800	555	555	555	335	168	84	67	42	34	17	8.4	4.2
417	65 536	550	550	550	332	166	83	66	41	33	17	8.3	4.2
489	76 800	469	469	469	283	142	71	57	35	28	14	7.1	3.6
550	86 400	417	417	417	252	126	63	50	31	25	13	6.3	3.2

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, contact your local Renishaw representative.

TONiC system: For 50 MHz clocked option

Nominal external diameter (mm)	Line count	Digital output resolution											Analogue output
		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	Ti0000
52	8 192	3 673	3 673	3 673	2 380	1 190	597	238	119	59	24	12	3 673
57	9 000	3 351	3 351	3 351	2 171	1 086	544	217	109	54	22	11	3 351
75	11 840	2 546	2 546	2 546	1 650	825	414	165	83	41	17	8.1	2 546
94	14 800	2 032	2 032	2 032	1 317	658	330	132	66	33	13	7	2 032
100	15 744	1 910	1 910	1 910	1 238	619	310	124	62	31	12	6.1	1 910
103	16 200	1 854	1 854	1 854	1 202	601	301	120	60	30	12	5.9	1 854
104	16 384	1 836	1 836	1 836	1 190	595	298	119	59	30	12	5.9	1 836
115	18 000	1 661	1 661	1 661	1 076	538	270	108	54	27	11	5.3	1 661
124	19 478	1 540	1 540	1 540	998	499	250	100	50	25	10	5	1 540
150	23 600	1 273	1 273	1 273	825	413	207	83	41	21	8.3	4.1	1 273
165	25 920	1 157	1 157	1 157	750	375	188	75	38	19	8	4	1 157
172	27 000	1 110	1 110	1 110	720	360	180	72	36	18	7	4	1 110
183	28 800	1 044	1 044	1 044	676	338	170	68	34	17	7	3	1 044
200	31 488	955	955	955	619	309	155	62	31	15	6.2	3.1	955
206	32 400	927	927	927	601	300	151	60	30	15	6.0	3.0	927
209	32 768	914	914	914	592	296	148	59	30	15	5.9	2.9	914
229	36 000	834	834	834	540	270	136	54	27	14	5.4	2.7	834
255	40 000	749	749	749	485	243	122	49	24	12	4.9	2.4	749
300	47 200	637	637	637	413	206	103	41	21	10	4.1	2.0	637
350	55 040	546	546	546	354	177	89	35	18	8.8	3.5	1.7	546
413	64 800	462	462	462	300	150	75	30	15	7.5	3.0	1.5	462
417	65 536	458	458	458	297	148	74	30	15	7.4	3.0	1.5	458
489	76 800	391	391	391	253	127	63	25	13	6.3	2.5	1.2	391
550	86 400	347	347	347	225	113	56	23	11	5.6	2.3	1.1	347

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, contact your local Renishaw representative.

QUANTiC system: For 50 MHz clocked option

Nominal external diameter (mm)	Line count	Digital output resolution							Analogue output
		10 µm	5 µm	1 µm	0.5 µm	0.2 µm	0.1 µm	50 nm	1 Vpp
52	4 096	8 815	8 815	8 815	6 659	2 663	1 332	666	7 346
57	4 500	8 042	8 042	8 042	6 075	2 429	1 215	607	6 701
75	5 920	6 112	6 112	6 112	4 617	1 846	923	462	5 093
94	7 400	4 876	4 876	4 876	3 684	1 473	737	368	4 064
100	7 872	4 584	4 584	4 584	3 463	1 385	693	346	3 820
103	8 100	4 450	4 450	4 450	3 362	1 344	672	336	3 708
104	8 192	4 407	4 407	4 407	3 329	1 331	666	333	3 673
115	9 000	3 986	3 986	3 986	3 011	1 204	602	301	3 321
124	9 740	3 697	3 697	3 697	2 792	1 117	558	279	3080
150	11 800	3 056	3 056	3 056	2 308	923	462	231	2 546
165	12 960	2 778	2 778	2 778	2 099	839	420	210	2 315
172	13 500	2 665	2 665	2 665	2 013	805	403	201	2 221
183	14 400	2 505	2 505	2 505	1 892	757	378	189	2 087
200	15 744	2 292	2 292	2 292	1 731	692	346	173	1 910
206	16 200	2 225	2 225	2 225	1 681	672	336	168	1 854
209	16 384	2 193	2 193	2 193	1 657	663	331	166	1 828
229	18 000	2 002	2 002	2 002	1 512	605	302	151	1 668
255	20 000	1 798	1 798	1 798	1 358	543	272	136	1 498
300	23 600	1 528	1 528	1 528	1 154	462	231	115	1 273
350	27 520	1 310	1 310	1 310	989	396	198	99	1 091
413	32 400	1 110	1 110	1 110	838	335	168	84	925
417	32 768	1 099	1 099	1 099	830	332	166	83	916
489	38 400	937	937	937	708	283	142	71	781
550	43 200	833	833	833	630	252	126	63	694

Resolution

VIONiC with RESM20

The RESM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	VIONiC digital resolution (interpolation factor)											
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	40 nm (×500)	25 nm (×800)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2.5 nm (×8 000)
Standard outside diameters	75 mm (11 840)	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.22"	≈ 0.14"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.014"
	94 mm (14 800)	≈ 21.9"	≈ 4.4"	≈ 2.2"	≈ 0.9"	≈ 0.44"	≈ 0.22"	≈ 0.18"	≈ 0.11"	≈ 0.09"	≈ 0.044"	≈ 0.022"	≈ 0.011"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.16"	≈ 0.010"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.010"
	124 mm (19 478)	≈ 16.6"	≈ 3.3"	≈ 1.7"	≈ 0.7"	≈ 0.33"	≈ 0.17"	≈ 0.13"	≈ 0.08"	≈ 0.07"	≈ 0.033"	≈ 0.017"	≈ 0.008"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.11"	≈ 0.07"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.007"
	172 mm (27 000)	≈ 12.0"	≈ 2.4"	≈ 1.2"	≈ 0.5"	≈ 0.24"	≈ 0.12"	≈ 0.10"	≈ 0.06"	≈ 0.05"	≈ 0.024"	≈ 0.012"	≈ 0.006"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.08"	≈ 0.05"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.005"
	255 mm [1] (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.06"	≈ 0.04"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.004"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.05"	≈ 0.03"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.003"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.05"	≈ 0.03"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.003"
	489 mm (76 800)	≈ 4.22"	≈ 0.84"	≈ 0.42"	≈ 0.17"	≈ 0.084"	≈ 0.042"	≈ 0.03"	≈ 0.02"	≈ 0.017"	≈ 0.0084"	≈ 0.0042"	≈ 0.002"
	550 mm (86 400)	≈ 3.75"	≈ 0.75"	≈ 0.38"	≈ 0.15"	≈ 0.075"	≈ 0.38"	≈ 0.03"	≈ 0.02"	≈ 0.015"	≈ 0.075"	≈ 0.038"	≈ 0.002"
2^n line count	52 mm (8 192)	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.32"	≈ 0.20"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.020"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.16"	≈ 0.010"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.010"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.8"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.005"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.002"
Subdivisions of degrees	57 mm (9 000)	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00008°	0.00005°	0.00004°	0.00002°	0.00001°	0.000005°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00004°	0.00003°	0.00002°	0.00001°	0.000005°	0.000003°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00002°	0.00001°	0.00001°	0.000005°	0.0000025°	0.000001°
Subdivisions of arc second	103 mm (16 200)	20"	4"	2"	0.8"	0.4"	0.2"	0.16"	0.10"	0.08"	0.040"	0.020"	0.010"
	165 mm (25 920)	12.50"	2.5"	1.25"	0.5"	0.25"	0.125"	0.1"	0.0625"	0.05"	0.025"	0.0125"	0.00625"
	183 mm (28 800)	11.25"	2.25"	1.125"	0.45"	0.225"	0.1125"	0.09"	0.05625"	0.045"	0.0225"	0.01125"	0.005625"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.08"	0.05"	0.04"	0.020"	0.010"	0.0050"
	413 mm (64 800)	5"	1"	0.5"	0.2"	0.1"	0.05"	0.04"	0.03"	0.02"	0.010"	0.0050"	0.003"

[1] Line count as a multiple of 1 000.

NOTES:

- The symbol " indicates units of arc seconds.
- Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} = \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Resolution

TONiC with RESM20

The RESM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	TONiC digital resolution (interpolation factor)										
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2 nm (×10 000)	1 nm (×20 000)
Standard outside diameters	**75 mm (11 840)**	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.011"	≈ 0.0055"
	94 mm (14 800)	≈ 21.9"	≈ 4.38"	≈ 2.19"	≈ 0.88"	≈ 0.44"	≈ 0.22"	≈ 0.09"	≈ 0.044"	≈ 0.022"	≈ 0.009"	≈ 0.0044"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.0082"	≈ 0.0041"
	124 mm (19 478)	≈ 16.6"	≈ 3.33"	≈ 1.66"	≈ 0.67"	≈ 0.33"	≈ 0.17"	≈ 0.07"	≈ 0.033"	≈ 0.017"	≈ 0.007"	≈ 0.0033"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.0055"	≈ 0.0027"
	172 mm (27 000)	≈ 12.0"	≈ 2.40"	≈ 1.2"	≈ 0.48"	≈ 0.24"	≈ 0.12"	≈ 0.05"	≈ 0.024"	≈ 0.012"	≈ 0.005"	≈ 0.0024"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.0041"	≈ 0.0020"
	255 mm [1] (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.0032"	≈ 0.0016"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.0027"	≈ 0.0014"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.0024"	≈ 0.0012"
	489 mm (76 800)	≈ 4.22"	≈ 0.84"	≈ 0.42"	≈ 0.17"	≈ 0.084"	≈ 0.042"	≈ 0.017"	≈ 0.0084"	≈ 0.0042"	≈ 0.0017"	≈ 0.00084"
	550 mm (86 400)	≈ 3.75"	≈ 0.75"	≈ 0.38"	≈ 0.15"	≈ 0.075"	≈ 0.38"	≈ 0.015"	≈ 0.075"	≈ 0.038"	≈ 0.0015"	≈ 0.00075"
2^n line count	**52 mm (8 192)**	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.016"	≈ 0.0079"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.0080"	≈ 0.0040"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.0040"	≈ 0.0020"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.0020"	≈ 0.00099"
Subdivisions of degrees	**57 mm (9 000)**	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00004°	0.00002°	0.00001°	0.000004°	0.000002°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00002°	0.00001°	0.000005°	0.000002°	0.000001°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00001°	0.000005°	0.0000025°	0.000001°	0.0000005°
Subdivisions of arc second	**103 mm (16 200)**	20"	4"	2"	0.8"	0.4"	0.2"	0.08"	0.040"	0.020"	0.0080"	0.0040"
	165 mm (25 920)	12.5"	2.5"	1.25"	0.5"	0.25"	0.125"	0.05"	0.025"	0.0125"	0.005"	0.0025"
	183 mm (28 800)	11.25"	2.25"	1.125"	0.45"	0.225"	0.1125"	0.05"	0.0225"	0.01125"	0.005"	0.00225"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.04"	0.020"	0.010"	0.0040"	0.0020"
	413 mm (64 800)	5"	1"	0.5"	0.2"	0.1"	0.05"	0.02"	0.010"	0.0050"	0.0020"	0.0010"

[1] Line count as a multiple of 1 000.

NOTES:

- The symbol " indicates units of arc seconds.
- Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} = \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Resolution

QUANTiC with RESM40

The RESM40 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	QUANTiC digital resolution (interpolation factor)						
		10 µm (×4)	5 µm (×8)	1 µm (×40)	0.5 µm (×80)	0.2 µm (×200)	0.1 µm (×400)	50 nm (×800)
Standard outside diameters	75 mm (5 920)	≈ 54.73"	≈ 27.36"	≈ 5.47"	≈ 2.74"	≈ 1.09"	≈ 0.55"	≈ 0.27"
	94 mm (7 400)	≈ 43.8"	≈ 21.9"	≈ 4.4"	≈ 2.2"	≈ 0.876"	≈ 0.438"	≈ 0.219"
	100 mm (7 872)	≈ 41.16"	≈ 20.58"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"
	124 mm (9 740)	≈ 33.3"	≈ 16.6"	≈ 3.3"	≈ 1.7"	≈ 0.665"	≈ 0.333"	≈ 0.166"
	150 mm (11 800)	≈ 27.46"	≈ 13.73"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"
	172 mm (13 500)	≈ 24.0"	≈ 12.0"	≈ 2.4"	≈ 1.2"	≈ 0.48"	≈ 0.24"	≈ 0.12"
	200 mm (15 744)	≈ 20.58"	≈ 10.29"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.10"
	255 mm* (20 000)	≈ 16.20"	≈ 8.10"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.08"
	300 mm (23 600)	≈ 13.73"	≈ 6.86"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.07"
	350 mm (27 520)	≈ 11.77"	≈ 5.89"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.06"
	489 mm (38 400)	≈ 8.44"	≈ 4.22"	≈ 0.84"	≈ 0.42"	≈ 0.17"	≈ 0.08"	≈ 0.04"
	550 mm (43 200)	≈ 7.50"	≈ 3.75"	≈ 0.75"	≈ 0.38"	≈ 0.15"	≈ 0.08"	≈ 0.04"
2^n line count	52 mm (4 096)	≈ 79.10"	≈ 39.55"	≈ 7.91"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.40"
	104 mm (8 192)	≈ 39.55"	≈ 19.78"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.40"	≈ 0.20"
	209 mm (16 384)	≈ 19.78"	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.40"	≈ 0.20"	≈ 0.10"
	417 mm (32 768)	≈ 9.89"	≈ 4.94"	≈ 0.99"	≈ 0.49"	≈ 0.20"	≈ 0.10"	≈ 0.05"
Subdivisions of degrees	57 mm (4 500)	0.02°	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°
	115 mm (9 000)	0.01°	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°
	229 mm (18 000)	0.005°	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°
Subdivisions of arc second	103 mm (8 100)	40"	20"	4"	2"	0.8"	0.4"	0.2"
	165 mm (12 960)	25"	12.5"	2.5"	1.25"	0.5"	0.25"	0.125"
	183 mm (14 400)	22.5"	11.25"	2.25"	1.125"	0.45"	0.225"	0.1125"
	206 mm (16 200)	20"	10"	2"	1"	0.4"	0.2"	0.1"
	413 mm (32 400)	10"	5"	1"	0.5"	0.2"	0.1"	0.05"

[1] Line count as a multiple of 1 000.

NOTES:

- The symbol " indicates units of arc seconds.
- Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} = \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Rotary scale part numbers

RESM 20U S A 300

Ring diameter

052 = 52 mm	115 = 115 mm	206 = 206 mm	417 = 417 mm
057 = 57 mm	124 = 124 mm	209 = 209 mm	489 = 489 mm
075 = 75 mm	150 = 150 mm	229 = 229 mm	550 = 550 mm
094 = 94 mm	165 = 165 mm	255 = 255 mm	
100 = 100 mm	172 = 172 mm	300 = 300 mm	
103 = 103 mm	183 = 183 mm	350 = 350 mm	
104 = 104 mm	200 = 200 mm	413 = 413 mm	

Form

A = Tapered internal diameter

B = Low inertia (only available in 52, 57, 75, 100, 115, 150, 165 and 200 mm diameters)

Material

S = Stainless steel

Pitch

20U = 20 µm

40U = 40 µm (RESM rotary scale series only)

Rotary scale series

RESM = Single reference mark for axes capable of full rotation

REST = Two reference marks for partial-rotation axws (20 µm pitch only)

Compatible products

RESM

RESM20

VIONiC

TONiC

RESM40

QUANTiC

Appendix

Graduation and system accuracy

Nominal external diameter	Graduation accuracy		System accuracy		
			VIONiC	TONiC	QUANTiC
mm	arc second	µm	arc second	arc second	arc second
52	±2.3	±0.3	±2.4	±2.5	±2.9
57	±2.2	±0.3	±2.3	±2.4	±2.8
75	±1.9	±0.4	±2.0	±2.1	±2.4
94	±1.7	±0.4	±1.8	±1.9	±2.1
100	±1.7	±0.4	±1.7	±1.8	±2.0
103	±1.6	±0.4	±1.7	±1.8	±2.0
104	±1.6	±0.4	±1.7	±1.8	±1.9
115	±1.6	±0.4	±1.6	±1.7	±1.8
124	±1.6	±0.4	±1.7	±1.7	±1.9
150	±1.4	±0.5	±1.4	±1.4	±1.6
165	±1.3	±0.5	±1.4	±1.4	±1.5
172	±1.3	±0.5	±1.3	±1.4	±1.5
183	±1.3	±0.5	±1.3	±1.3	±1.4
200	±1.2	±0.6	±1.2	±1.2	±1.3
206	±1.2	±0.6	±1.2	±1.2	±1.3
209	±1.2	±0.6	±1.2	±1.2	±1.3
229	±1.1	±0.6	±1.1	±1.2	±1.2
255	±1.0	±0.7	±1.1	±1.1	±1.2
300	±1.0	±0.7	±1.0	±1.0	±1.1
350	±0.9	±0.8	±0.9	±0.9	±1.0
413	±0.8	±0.8	±0.8	±0.9	±0.9
417	±0.8	±0.8	±0.8	±0.8	±0.9
489	±0.8	±0.9	±0.8	±0.8	±0.8
550	±0.7	±1.0	±0.7	±0.7	±0.8

Graduation accuracy is the maximum difference between the angle measured by a single readhead and the true rotation of the encoder as graduated. Application disturbances such as eccentricity are not included.

System accuracy is graduation accuracy plus SDE. For application advice, contact your local Renishaw representative.

RENISHAW
apply innovation™

www.renishaw.com/contact

#renishaw

+44 (0) 1453 524524 **uk@renishaw.com**

Part no.: L-9517-9154-09-A
Issued: 12.2022

RENISHAW
apply innovation™

REXM20 ultra-high accuracy angle encoder

With zero coupling losses and exceptional repeatability, the REXM20 ultra-high accuracy angle encoder achieves better than ±1 arc second total installed accuracy.

Like the RESM20 encoder, the REXM20 is a stainless steel ring with the scale graduations marked axially onto the periphery, but with a number of differences to improve upon RESM20's already impressive accuracy.

REXM20 has a thicker cross-section, to ensure that the only significant installation error is eccentricity. Eccentricity is easily removed using two readheads, either with Renishaw's DSi (Dual Signal interface), or by combining the signals inside the host controller. The only errors remaining are graduation errors and readhead SDE, both of which are so small they are often negligible.

As a non-contact encoder, REXM20 offers dynamic performance advantages, eliminating coupling losses, oscillation, shaft torsion and other hysteresis errors that plague enclosed encoders.

Combining two readheads is easy with the DSi, which also offers an angularly repeatable reference position (*propoZ*™) which is unaffected by bearing wander or power cycling.

REXM20 total installed accuracy grades:

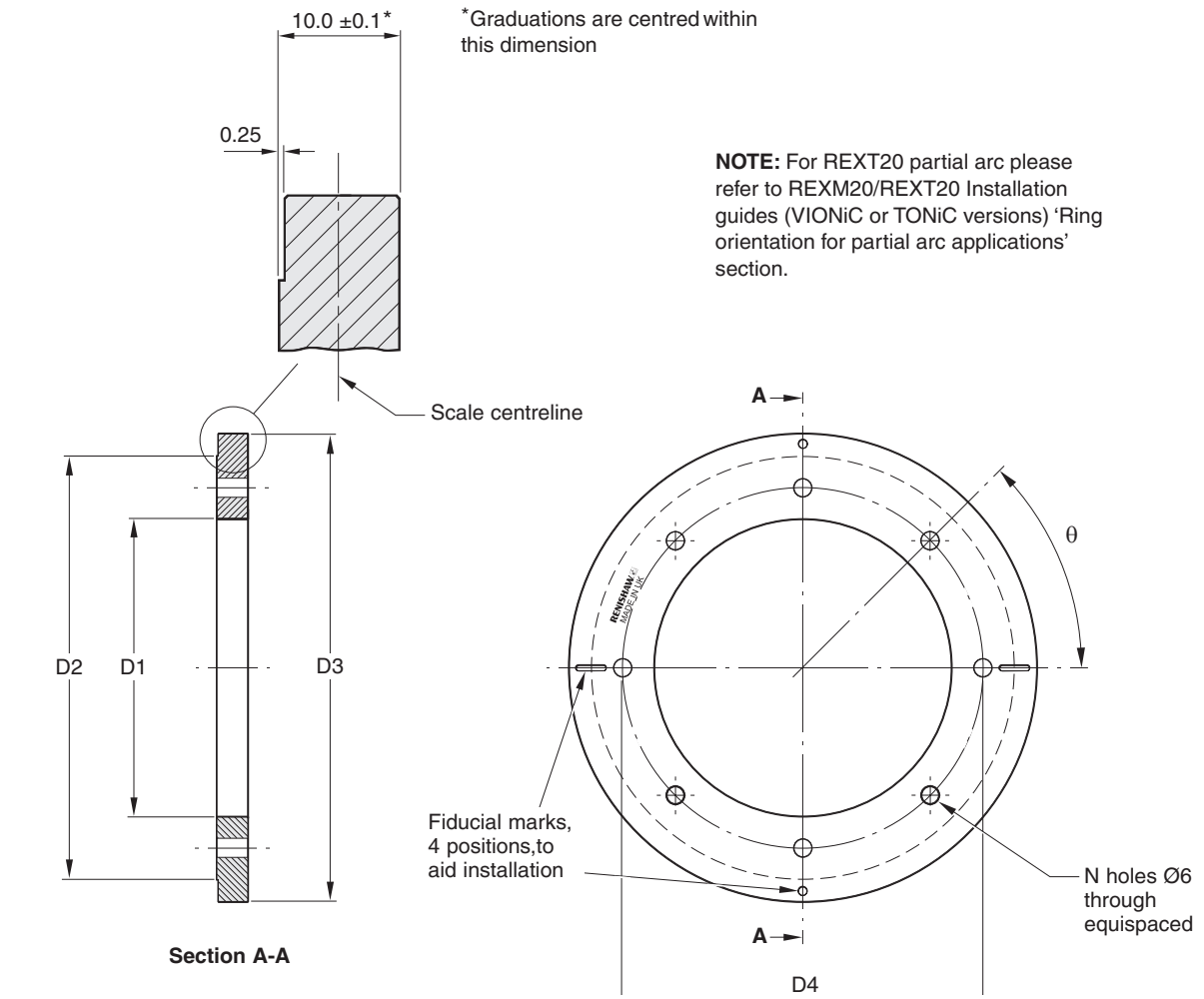
Ring diameter	Total installed accuracy
≥ 100 mm	±1 arc second
75 mm	±1.5 arc second
≤ 57 mm	±2 arc second

Designed for axes that are limited to partial rotation, REXT20 rings have two reference marks, oriented diametrically opposed, for use with partial arc versions of DSi. DSi processes these reference marks to give a single, angularly-repeatable *propoZ* reference output.

- **Use with two VIONiC™ or TONiC™ encoders, combined with DSi to give ultra-high accuracy**
- **Installed accuracy to ±1 arc second with dual readheads**
- **Wide range of standard sizes from 52 mm to 417 mm**
- **Large internal diameter for ease of integration**
- **Flange mounted with easy 4-point adjustment method**
- **Angularly repeatable *propoZ* reference position is unaffected by bearing wander or power cycling**

Installation drawing

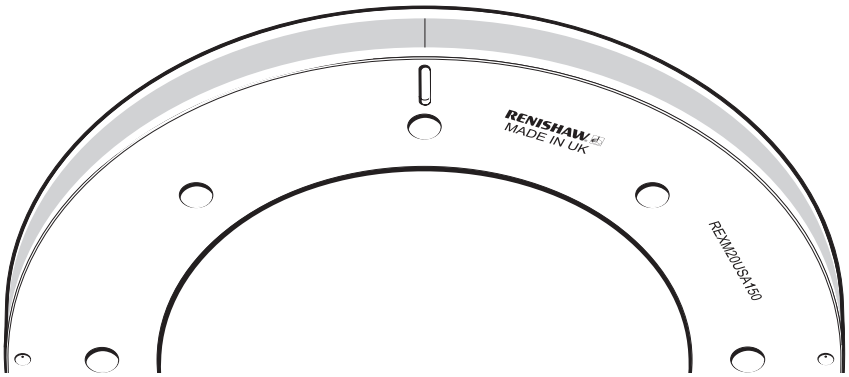
Dimensions and tolerances in mm



Nominal external diameter (mm)	Line count	Dimensions			Mounting holes		
		D1	D2	D3	N	D4	θ
52*	8 192	26	50	52.1 – 52.2	4	38	90°
57*	9 000	26	50	57.25 – 57.35	4	38	90°
75	11 840	40.5	64.5	75.3 – 75.4	8	52.5	45°
100	15 744	57.5	97.5	100.2 – 100.3	8	77.5	45°
103	16 200	57.5	97.5	103.0 – 103.2	8	77.5	45°
104	16 384	57.5	97.5	104.2 – 104.4	8	77.5	45°
115	18 000	68	108	114.5 – 114.7	8	88	45°
150	23 600	96	136	150.2 – 150.4	8	116	45°
183	28 800	122.5	162.5	183.2 – 183.4	12	142.5	30°
200	31 488	136	176	200.3 – 200.5	12	156	30°
206	32 400	140.5	180.5	206.1 – 206.5	12	160.5	30°
209	32 768	140.5	180.5	208.4 – 208.8	12	160.5	30°
229	36 000	160.5	200.5	229.0 – 229.4	12	180.5	30°
255	40 000	180.5	220.5	254.4 – 254.8	12	200.5	30°
300	47 200	216	256	300.4 – 300.6	12	236	30°
350	55 040	256	296	350.3 – 350.5	16	276	22.5°
417	65 536	305	345	417.0 – 417.4	16	325	22.5°

*52 mm and 57 mm rings have dimple fiducial features and no slots.

Reference mark position



REXM20

IN-TRAC™ reference mark is embedded in the scale, radially aligned to the line fiducial mark to the left of the 'Renishaw' logo. No external actuators or physical adjustment are required.

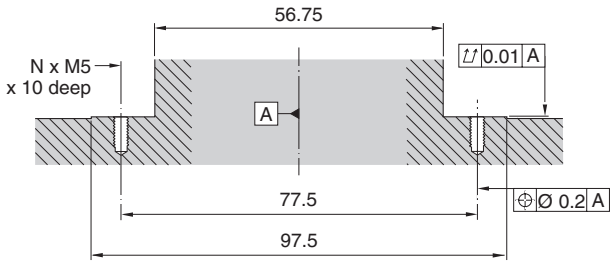
REXT20

The second reference mark is 180° from the first.

Mounting method (IMPORTANT: flange mount only. DO NOT interference fit)

Mounting surface preparation

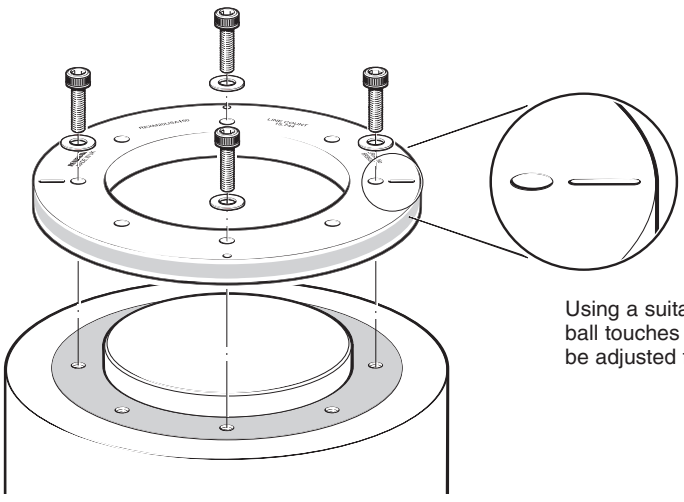
The mounting surface should have an axial run-out of 10 µm. This tolerance only needs to be held over the region where the flat surface of the ring mates to the mounting surface.



For other ring sizes refer to the VIONiC REXM20/REXT20 installation guide (M-6195-9239) or TONiC REXM20/REXT20 installation guide (M-9653-9248), which can be found on **www.renishaw.com/support**

Example of mounting surface for 100 mm REXM20

Installation technique (Please refer to the REXM20/REXT20 installation guide for full details)



REXM20 rings are made with 4 fiducial points engraved onto the top surface, which simplify alignment.

Using a suitable dial test indicator, positioned so that the stylus ball touches directly onto the scale surface, the ring only needs to be adjusted for run-out at the 4 fiducial points.

Operating specifications

Material	303/304 stainless steel		
Coefficient of thermal expansion (at 20 °C)	15.5 ±0.5 µm/m/°C		
Temperature	Storage	System	–20 °C to +70 °C
	Operating	VIONiC and TONiC	0 °C to + 70 °C

Ring mass and inertia

Ring diameter (mm)	52	57	75	100	103	104	115	150	183
Mass (kg)	0.13	0.17	0.26	0.43	0.47	0.48	0.54	0.85	1.18
Inertia (kg cm²)	0.55	0.82	2.3	7.2	8.1	8.5	12	34	71

Ring diameter (mm)	200	206	209	229	255	300	350	417
Mass (kg)	1.37	1.44	1.50	1.69	2.03	2.74	3.59	5.09
Inertia (kg cm²)	100	113	120	165	250	470	845	1700

Accuracy

The total installed accuracy of the REXM20 rings when used with two VIONiC or TONiC encoders, with the ring flange mounted onto a shaft surface prepared to the specifications detailed in the REXM20/REXT20 installation guide, centred so that the radial run-out at the fiducial points agrees to within 10 µm TIR, will be as follows:

Nominal external diameter (mm)	Total installed accuracy (arc second)
52	±2
57	±2
75	±1.5
100	±1
103	±1
104	±1
115	±1
150	±1
183	±1
200	±1
206	±1
209	±1
229	±1
255	±1
300	±1
350	±1
417	±1

NOTE: The figures in this table refer to 'total installed accuracy', not to be confused with 'system accuracy'. Total installed accuracy includes graduation errors, readhead sub-divisional errors, installation errors and errors caused by bearing wander.

RENISHAW apply innovation™

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, please contact your local representative.

VIONiC system: For 20 MHz clocked option

Nominal external diameter (mm)	Line count	Output resolution											
		5 µm	1 µm	0.5 µm	0.2 µm	0.1 µm	50 nm	40 nm	25 nm	20 nm	10 nm	5 nm	2.5 nm
52	8 192	4 395	4 395	2 950	1 180	590	295	236	148	118	59	30	15
57	9 000	4 000	4 000	2 686	1 074	537	269	215	134	107	54	27	13
75	11 840	3 041	3 041	2 041	817	408	204	163	102	82	41	20	10
100	15 744	2 287	2 287	1 535	614	307	154	123	77	61	31	15	7.7
103	16 200	2 222	2 222	1 492	597	298	149	119	75	60	30	15	7.5
104	16 384	2 197	2 197	1 475	590	295	148	118	74	59	30	15	7.4
115	18 000	2 000	2 000	1 343	537	269	134	107	67	54	27	13	6.7
150	23 600	1 525	1 525	1 024	410	205	102	82	51	41	20	10	5.1
183	28 800	1 250	1 250	839	336	168	84	67	42	34	17	8.4	4.2
200	31 488	1 143	1 143	768	307	154	77	61	38	31	15	7.7	3.8
206	32 400	1 111	1 111	746	298	149	75	60	37	30	15	7.5	3.7
209	32 768	1 099	1 099	738	295	148	74	59	37	30	15	7.4	3.7
229	36 000	1 000	1 000	671	269	134	67	54	34	27	13	6.7	3.4
255	40 000	900	900	604	242	121	60	48	30	24	12	6.0	3.0
300	47 200	763	763	512	205	102	51	41	26	20	10	5.1	2.6
350	55 040	654	654	439	176	88	44	35	22	18	8.8	4.4	2.2
417	65 536	549	549	369	148	74	37	30	18	15	7.4	3.7	1.8

RENISHAW
apply innovation™

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, please contact your local representative.

TONiC system: For 20 MHz clocked option

Nominal external diameter (mm)	Line count	Output resolution										Analogue*
		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	Ti0000
52	8 192	3 673	3 673	2 479	992	496	246	99	50	25	10	4.8	3 673
57	9 000	3 350	3 350	2 261	904	452	224	90	45	23	9.0	4.4	3 350
75	11 840	2 546	2 546	1 719	688	344	171	69	34	17	6.9	3.3	2 546
100	15 744	1 910	1 910	1 289	516	258	128	52	26	13	5.2	2.5	1 910
103	16 200	1 854	1 854	1 251	501	250	124	50	25	12	5.0	2.4	1 854
104	16 384	1 836	1 836	1 239	496	248	123	50	25	12	5.0	2.4	1 836
115	18 000	1 661	1 661	1 121	448	224	111	45	22	11	4.5	2.2	1 661
150	23 600	1 273	1 273	859	344	172	85	34	17	8.6	3.4	1.7	1 273
183	28 800	1 044	1044	705	282	141	70	28	14	7.0	2.8	1.4	1 044
200	31 488	955	955	645	258	129	64	26	13	6.4	2.6	1.2	955
206	32 400	927	927	626	250	125	62	25	12	6.2	2.5	1.2	927
209	32 768	914	914	617	247	123	61	25	12	6.2	2.5	1.2	914
229	36 000	834	834	563	225	113	56	22	11	5.6	2.3	1.1	834
255	40 000	749	749	506	202	101	50	20	10	5.0	2.0	1.0	749
300	47 200	637	637	430	172	86	43	17	8.6	4.3	1.7	0.8	637
350	55 040	546	546	369	147	74	37	15	7.4	3.7	1.5	0.7	546
417	65 536	458	458	309	124	62	31	12	6.2	3.1	1.2	0.6	458

*Currently Renishaw do not offer an analogue Dual Head summing box: customer would have to do their own summing.

Resolution – VIONiC

The REXM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	Digital resolution (interpolation factor)											
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	40 nm (×500)	25 nm (×800)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2.5 nm (×8 000)
Standard outside diameters	75 mm (11 840)	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.22"	≈ 0.14"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.014"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.16"	≈ 0.010"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.010"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.11"	≈ 0.07"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.007"
	183 mm (28 800)	≈ 11.3"	≈ 2.25"	≈ 1.13"	≈ 0.45"	≈ 0.23"	≈ 0.11"	≈ 0.090"	≈ 0.056"	≈ 0.045"	≈ 0.023"	≈ 0.011"	≈ 0.0056"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.08"	≈ 0.05"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.005"
	255 mm† (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.06"	≈ 0.04"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.004"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.05"	≈ 0.03"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.003"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.05"	≈ 0.03"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.003"
2^n line count	52 mm (8 192)	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.32"	≈ 0.20"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.020"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.16"	≈ 0.010"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.010"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.8"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.005"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.002"
Subdivisions of degrees	57 mm (9 000)	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00008°	0.00005°	0.00004°	0.00002°	0.00001°	0.000005°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00004°	0.00003°	0.00002°	0.00001°	0.000005°	0.000003°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00002°	0.00001°	0.00001°	0.000005°	0.0000025°	0.000001°
Subdivisions of arc second	103 mm (16 200)	20"	4"	2"	0.8"	0.4"	0.2"	0.16"	0.10"	0.08"	0.040"	0.020"	0.010"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.08"	0.05"	0.04"	0.020"	0.010"	0.0050"

†Line count as a multiple of 1000.

NOTE: The symbol " indicates units of arc seconds.

NOTE: Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} \quad \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Resolution – TONiC

The REXM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	Digital resolution (interpolation factor)										
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2 nm (×10 000)	1 nm (×20 000)
Standard outside diameters	75 mm (11 840)	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.011"	≈ 0.0055"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.0082"	≈ 0.0041"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.0055"	≈ 0.0027"
	183 mm (28 800)	≈ 11.2"	≈ 2.25"	≈ 1.13"	≈ 0.45"	≈ 0.23"	≈ 0.11"	≈ 0.045"	≈ 0.023"	≈ 0.011"	≈ 0.045"	≈ 0.023"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.0041"	≈ 0.0020"
	255 mm† (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.0032"	≈ 0.0016"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.0027"	≈ 0.0014"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.0024"	≈ 0.0012"
2^n line count	52 mm (8 192)	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.016"	≈ 0.0079"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.0080"	≈ 0.0040"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.0040"	≈ 0.0020"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.0020"	≈ 0.00099"
Subdivisions of degrees	57 mm (9 000)	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00004°	0.00002°	0.00001°	0.000004°	0.000002°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00002°	0.00001°	0.000005°	0.000002°	0.000001°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00001°	0.000005°	0.0000025°	0.000001°	0.0000005°
Subdivisions of arc second	103 mm (16 200)	20"	4"	2"	0.8"	0.4"	0.2"	0.08"	0.040"	0.020"	0.0080"	0.0040"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.04"	0.020"	0.010"	0.0040"	0.0020"

† Line count as a multiple of 1 000.

NOTE: The symbol " indicates units of arc seconds.

NOTE: Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} \quad \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Renishaw plc

New Mills, Wotton-under-Edge
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0) 1453 524524
F +44 (0) 1453 524901
E uk@renishaw.com

www.renishaw.com

RENISHAW
apply innovation™

REXM20 ultra high accuracy angle encoder part numbers

REXM 20U S A 183

High accuracy angle encoder series

REXM20 – Single reference mark for axes capable of full rotation

REXT20 – Two reference marks for partial-rotation axes

Pitch

20U – 20 µm

Material

S – Stainless steel

Form

A – Standard section

Diameter

052 – 52 mm
057 – 57 mm
075 – 75 mm
100 – 100 mm
103 – 103 mm
104 – 104 mm
115 – 115 mm
150 – 150 mm
183 – 183 mm
200 – 200 mm
209 – 209 mm
229 – 229 mm
255 – 255 mm
300 – 300 mm
350 – 350 mm
413 – 413 mm
417 – 417 mm

REXM20 compatible readheads

REXM20

VIONiC DSi

VIONiC

TONiC DSi

TONiC

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

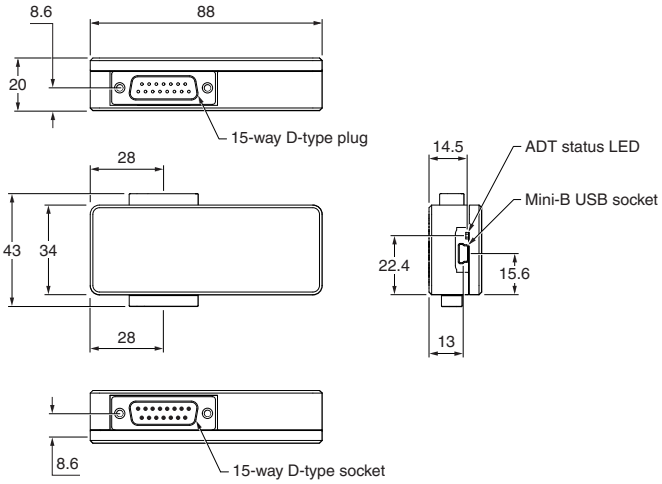
L-9517-9318-07

Part no.: L-9517-9318-07-A
Issued: 03.2019

Data sheet
L-9517-9699-03-B

RENISHAW
apply innovation™

Advanced Diagnostic Tool ADTi-100



The ADTi-100 (A-6195-0100) is used in conjunction with a PC* running the ADT View software†.

It provides comprehensive real-time feedback from QUANTiC™, VIONiC™ and ATOM DX™ encoders, aiding installation and diagnostics, as well as allowing system optimisation.

Function	Signal		Encoder input/output 15-way D-type
Power	5 V		7, 8
	0 V		2, 9
Incremental	A	+	14
		–	6
	B	+	13
		–	5
Reference mark	Z	+	12
		–	4
Limitsǂ	P		11
	Q		10
Alarm	E	–	3
Remote CAL‡	CAL		1
Shield	-		Case

‡ On input connector only.
ǂ Limits not available with ATOM DX.

General specifications

Power supply	5V –5%/+10%	Typically 200 mA fully terminated (ADTi-100 and readhead)
		Power from a 5 V dc supply complying with the requirements for SELV of standard IEC 60950-1 or via PC's USB port
	Ripple	200 mVpp maximum @ frequency up to 500 kHz
Temperature	Storage	–20 °C to +70 °C
	Operating	0 °C to +55 °C
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing		IP20
Shock	Operating	500 m/s², 11 ms, ½ sine, 3 axes
Vibration	Operating	40 m/s² max @ 55 Hz to 2000 Hz
Mass		110 g
EMC compliance		IEC 61326-1: 2013

* Supported Windows® operating systems (x86 or x64): 7 SP1, 10.
† Free ADT View software download is available directly from www.renishaw.com/adt.

Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
apply innovation™

ADT and accessory part numbers

Part description	Part number	Product image
ADTi-100	A-6195-0100	
USB cable (ADTi-100 to PC)	A-9572-0098	
ADT View software	Free to download from www.renishaw.com/adt	

Adaptor cables

Adaptor cables enable readheads with different terminations to be connected to the 15-way D-type input of the ADTi-100. Consists of two cables. One from readhead cable to ADTi-100. The other, if required, from the ADTi-100 to the controller cable.

Digital readheads

Readhead cable termination*	Pin-out	Part number
D	15-way D-type (standard pin-out)	None required. Readhead plugs directly into ADTi-100.
A	9-way D-type	A-6195-0102
K	10-way JST	A-6195-2074
H	15-way D-type (alternative pin-out)	A-6195-0103
X	12-way circular	A-6195-0104
J	14-way JST	A-6195-2073

Analogue readheads

NOTE: The ADT will require 120 Ω termination. This must be provided by, either the controller, or the termination tool. Refer to *Advanced Diagnostic Tools and ADT View software* User guide (Renishaw part no. M-6195-9413) for more information.

Readhead cable termination*	Pin-out	Part number
L	15-way D-type (standard pin-out)	A-6637-1540
H	15-way D-type (alternative pin-out)	A-6195-0103
J	14-way JST	A-6195-2073

Part description	Product image	Part number
Termination tool (For use with analogue variant of QUANTiC)		A-6195-2132

* Determined from readhead nomenclature. Refer to relevant readhead series data sheet for full readhead nomenclatures.

北京润诚时代科技有限公司
自动化事业部
地址：北京市朝阳区汤立路218号C 座968室
邮编：100012
电话：010-84450370
传真：010-84450371
网址：www.runcheng.net
邮箱：.runcheng_emd@sina.com