

# 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  $< \pm 15$  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  $\mu$ m resolution)
- Digital signals direct from the readhead: Resolutions from 5  $\mu$ m 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

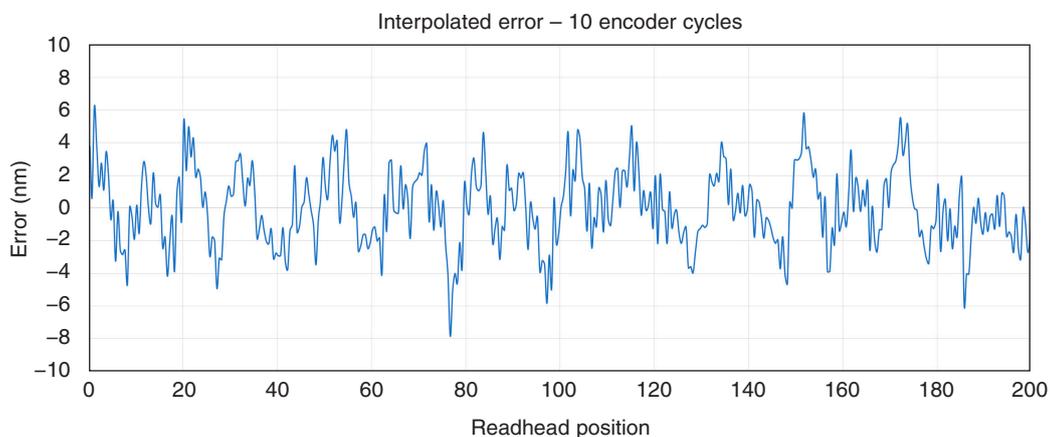
## System features

- ▶ **Need superior motion control?** VIONiC implements our latest interpolation algorithms and signal processing techniques to achieve a sub-divisional error (SDE) as low as  $< \pm 15$  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  $8000 \times$  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	$< \pm 15$ nm*
Rotary $> \varnothing 135$ mm	$< \pm 15$ nm*
Rotary $\leq \varnothing 135$ mm	$< \pm 20$ nm

\* $< \pm 10$  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  $\pm 1$   $\mu$ m/m low expansion linear spar scales to  $\pm 1$  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

	<b>RTL20-S</b>	<b>RTL20/FASTRACK™</b>	<b>RKLC20-S†</b>
	Self-adhesive mounted stainless steel tape scale 	Stainless steel tape scale and self-adhesive mounted carrier 	Self-adhesive mounted stainless steel tape scale 
<b>Form</b> (H × W)	0.4 mm × 8 mm including adhesive	RTL20 scale: 0.2 mm × 8 mm FASTRACK carrier: 0.4 mm × 18 mm including adhesive	0.15 mm × 6 mm including adhesive
<b>Accuracy</b> (includes slope and linearity)	±5 µm/m	±5 µm/m	±5 µm/m
<b>Linearity</b> (Figures achievable with two-point error correction)	±2.5 µm/m	±2.5 µm/m	±2.5 µm/m
<b>Maximum length</b>	10 m* (> 10 m available on request)	10 m (> 10 m available on request)	20 m (> 20 m available on request)
<b>Coefficient of thermal expansion</b> (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 RTL20-S axis lengths > 2 m, FASTRACK with RTL20 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).

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

### Rotary scales

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

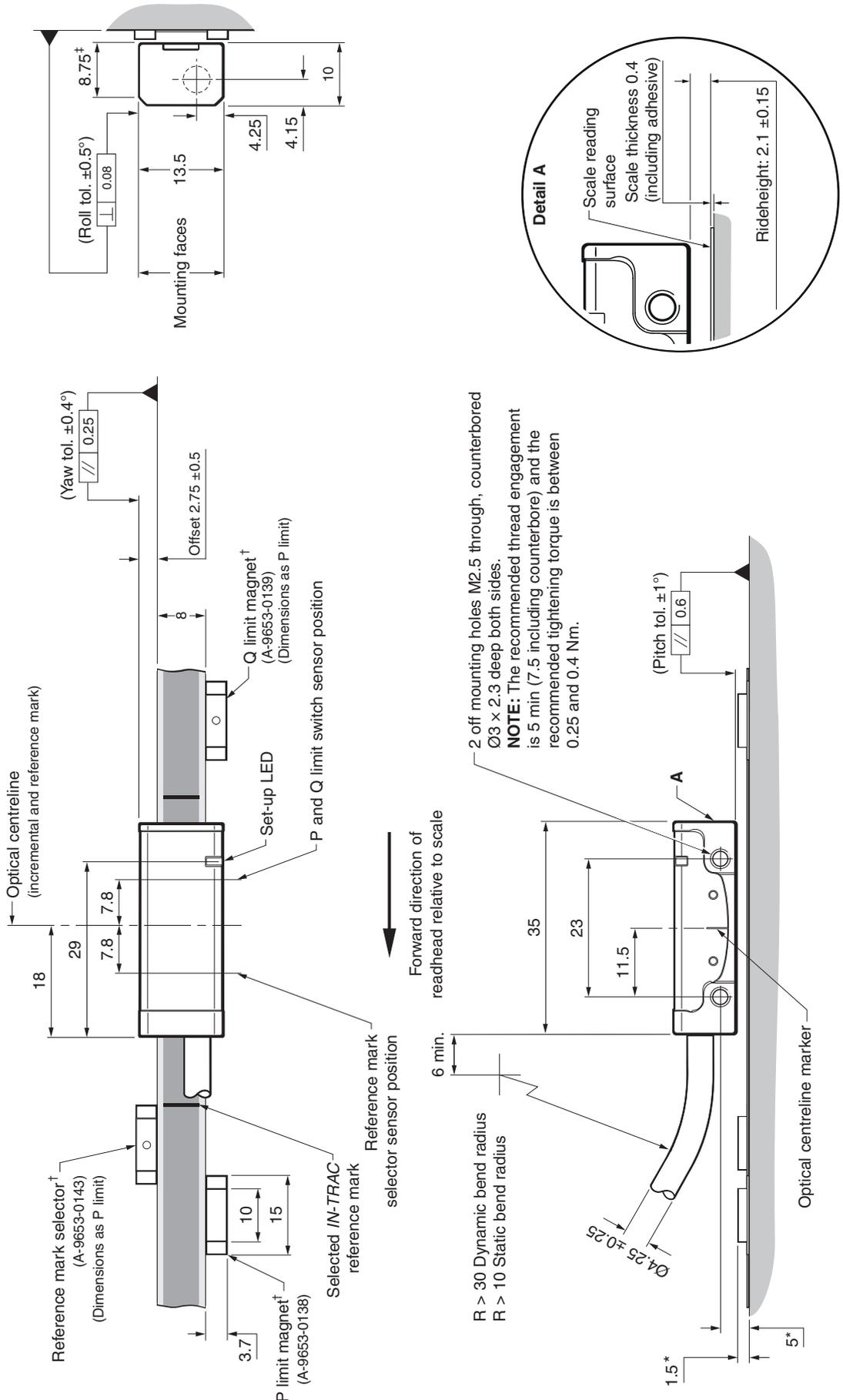
For more information about the scales refer to the relevant scale data sheet which can be downloaded from [www.renishaw.com/encoderdatasheets](http://www.renishaw.com/encoderdatasheets)

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

**VIONiC installation drawing (on RTALC20-S scale)**



Dimensions and tolerances in mm

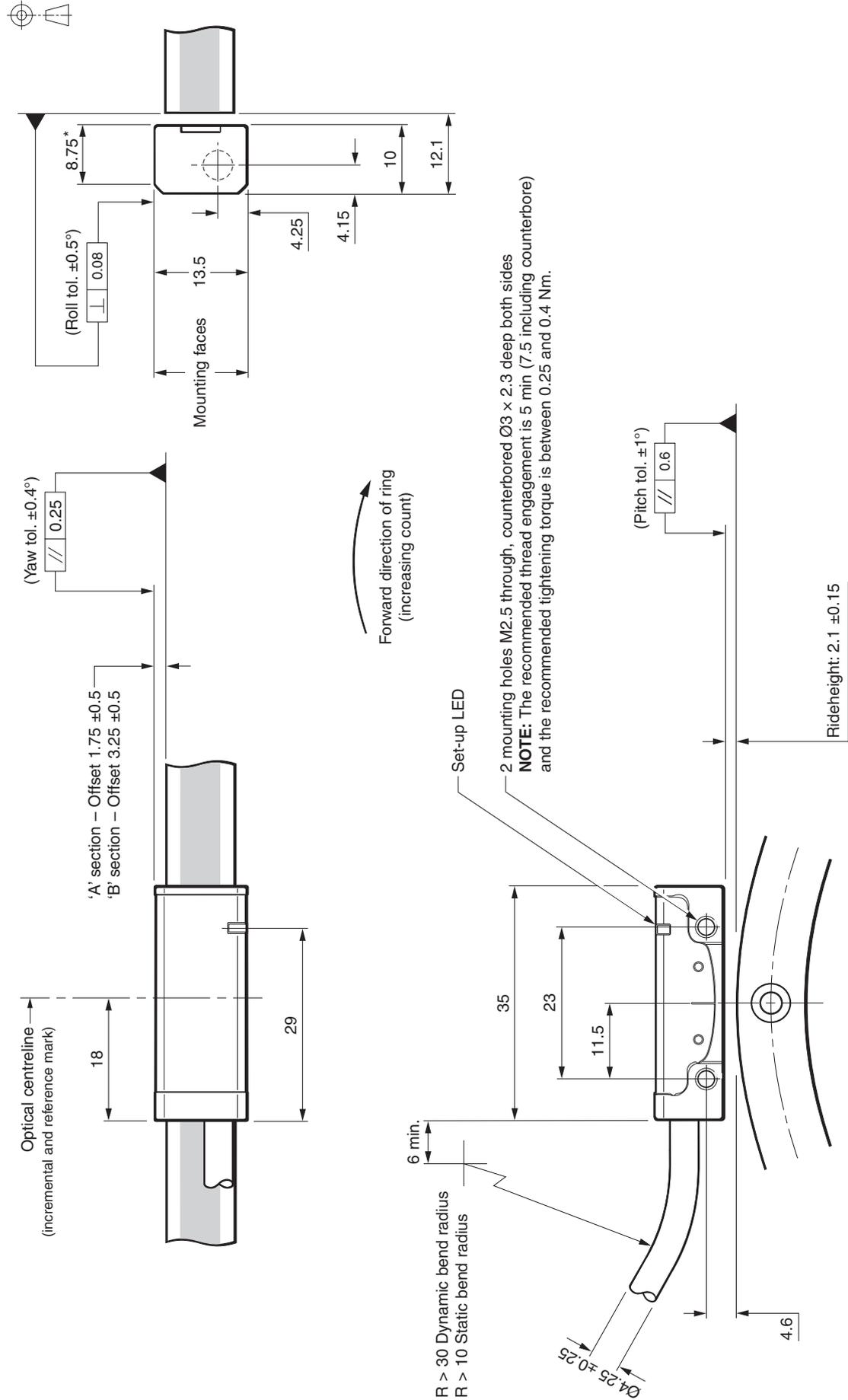


† Dimensions from substrate surface. ‡ Bolted reference mark selector magnet and limit magnet available. See relevant installation guide for further details. †† Extent of mounting faces.

NOTES: VIONiC on RTALC20-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.

**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

<b>Power supply</b>	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
<b>Temperature</b> (system)	Storage	-20 °C to +70 °C
	Operating	0 °C to +70 °C
<b>Humidity</b> (system)		95% relative humidity (non-condensing) to IEC 60068-2-78
<b>Sealing</b>		IP40
<b>Acceleration</b>	Operating	400 m/s <sup>2</sup> , 3 axes
<b>Shock</b>	Operating	500 m/s <sup>2</sup> , 11 ms, ½ sine, 3 axes
<b>Vibration</b>	Operating	100 m/s <sup>2</sup> max @ 55 Hz to 2000 Hz, 3 axes
<b>Mass</b>	Readhead	8.6 g
	Cable	26 g/m
<b>EMC compliance</b>		IEC 61326-1
<b>Readhead cable</b>		Single-shielded, outside diameter 4.25 ±0.25 mm
		Flex life > 20 × 10 <sup>8</sup> cycles at 30 mm bend radius
		UL recognised component 
<b>Connector options</b>	<b>Code – connector type</b>	
		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
<b>Typical sub-divisional error (SDE)</b>	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

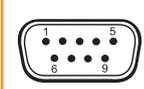
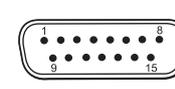
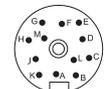
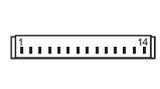
\*For a readhead with a 1 m cable.

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

$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D} \quad \text{Where } V = \text{maximum linear speed (m/s) and } D = \text{external diameter of RESM20 or REXM20 ring (mm).}$$

## Output signals

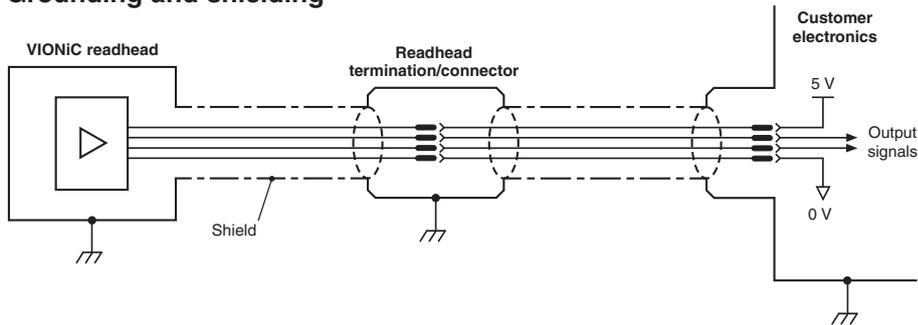
### Digital outputs

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 <sup>†</sup>	CAL	Clear	9	1	5	C	4	
Shield	-	Screen	Case	Case	Case	Case	Ferrule	

<sup>†</sup>Remote CAL line must be connected for use with the ADTi-100.

## Electrical connections

### Grounding and shielding



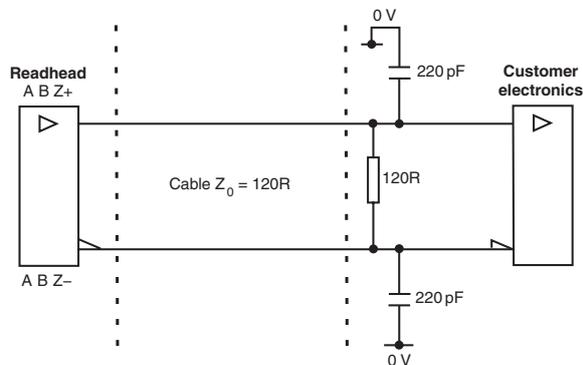
**IMPORTANT:** The shield should be connected to the machine earth (Field Ground).  
For JST variants the ferrule should be connected to machine earth.

**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.

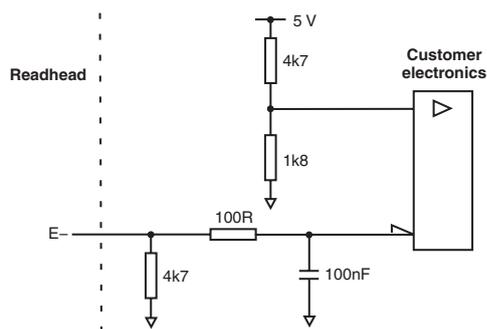
### Recommended signal termination



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

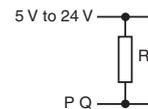
### Single ended alarm signal termination

(Alarm signal not available with 'A' cable termination)



### Limit output

(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

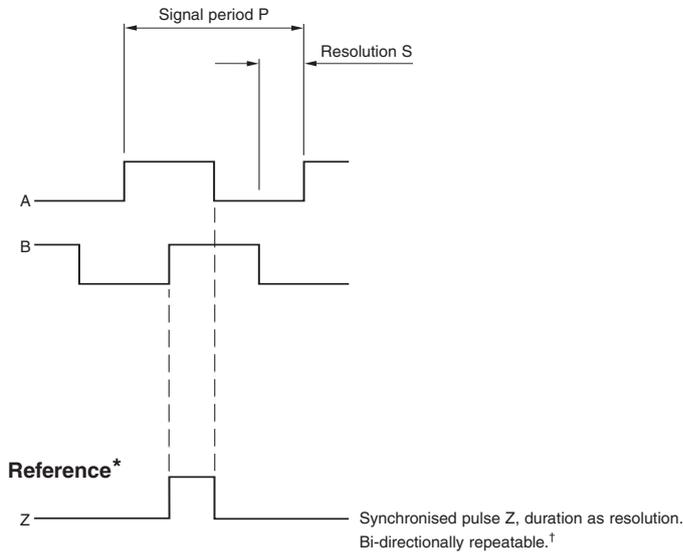


## Output specifications

### 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)

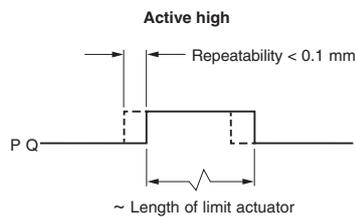


Resolution option code	P (µm)	S (µm)
D	20	5
X	4	1
Z	2	0.5
W	0.8	0.2
Y	0.4	0.1
H	0.2	0.05
M	0.16	0.04
P	0.1	0.025
I	0.08	0.02
O	0.04	0.01
Q	0.02	0.005
R	0.01	0.0025

**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

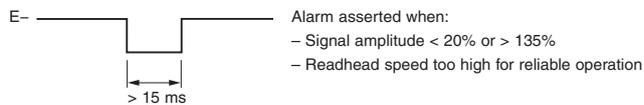
(Limit output not available with 'A' cable termination)



### Alarm

**Line driven** (Asynchronous pulse)

(Line driven alarm signal not available with 'A' cable termination)



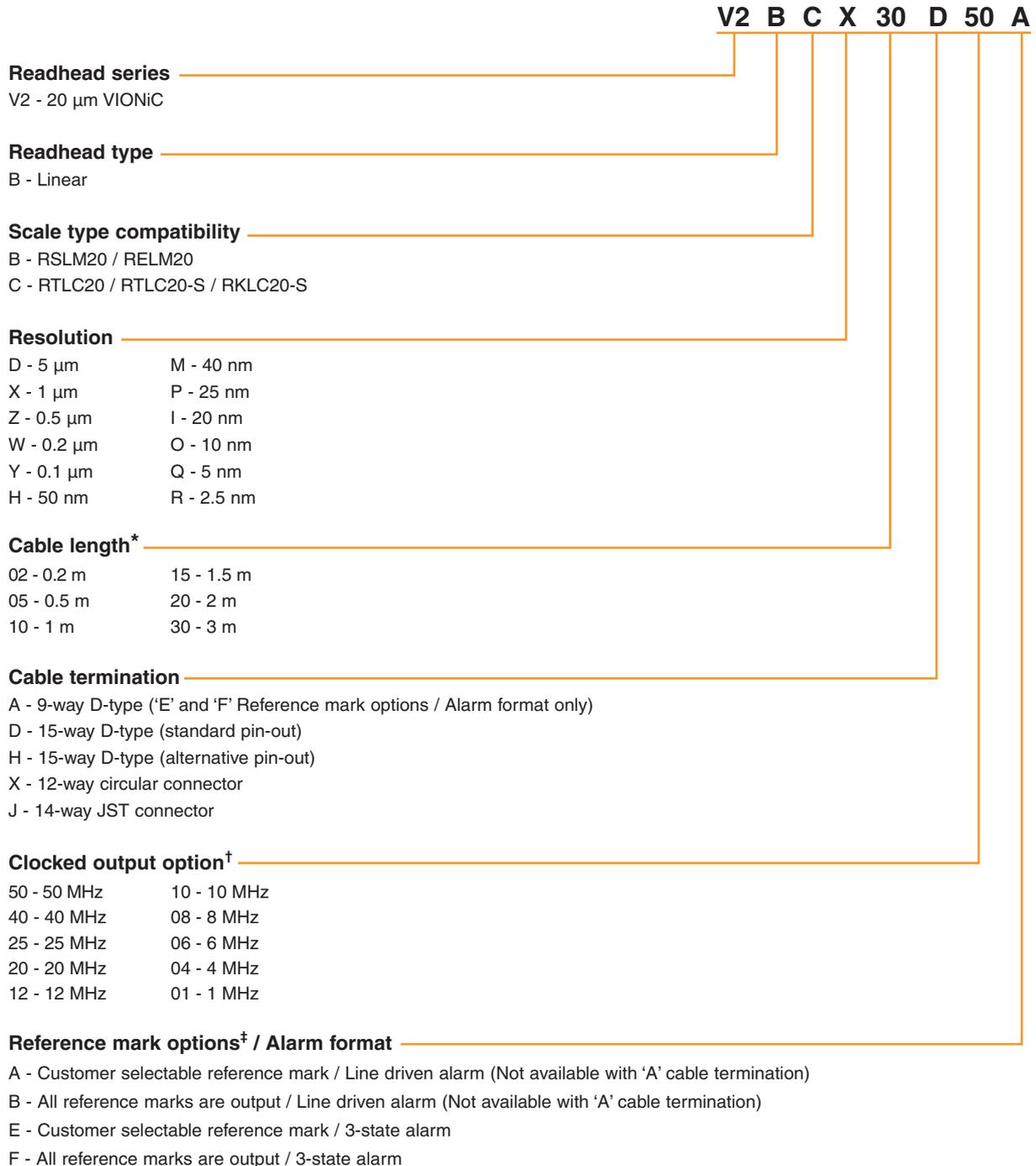
or 3-state alarm

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



\*Extension cables available. Contact your local Renishaw representative for further details.

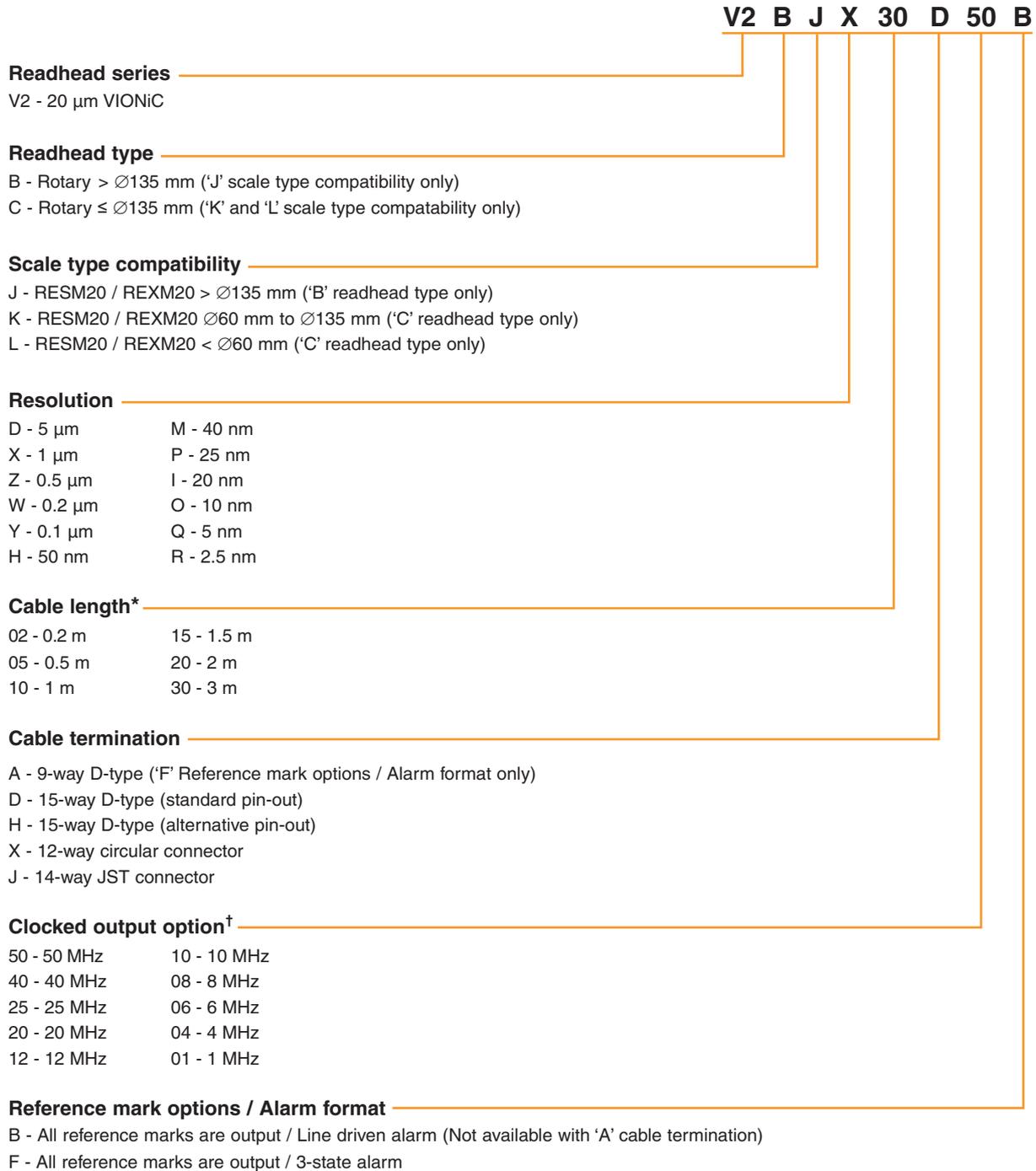
†Additional clocked output options available. Contact your local Renishaw representative for further details.

‡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.

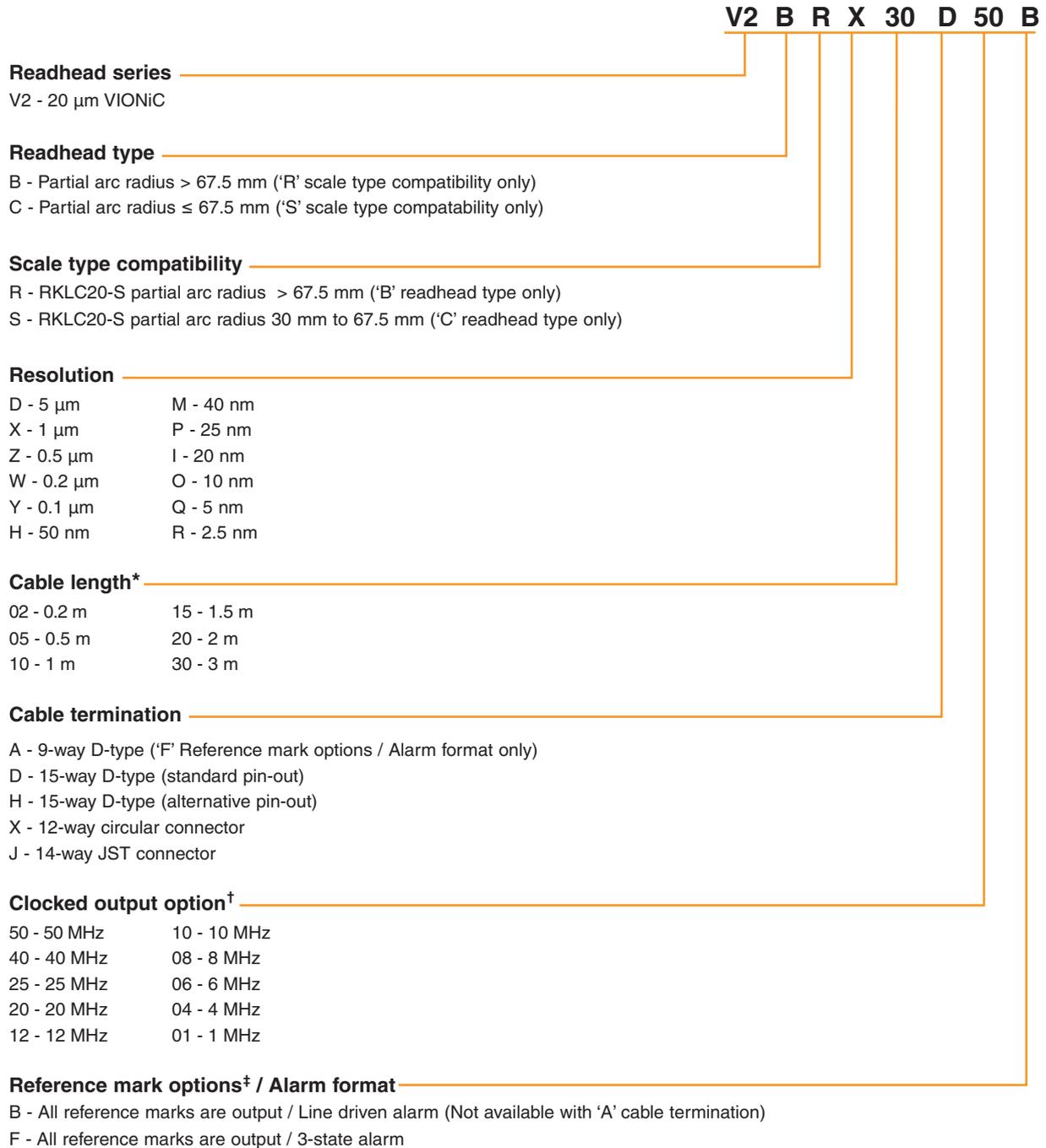
## Rotary readhead part numbers



\*Extension cables available. Contact your local Renishaw representative for further details.

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

## Partial arc readhead part numbers



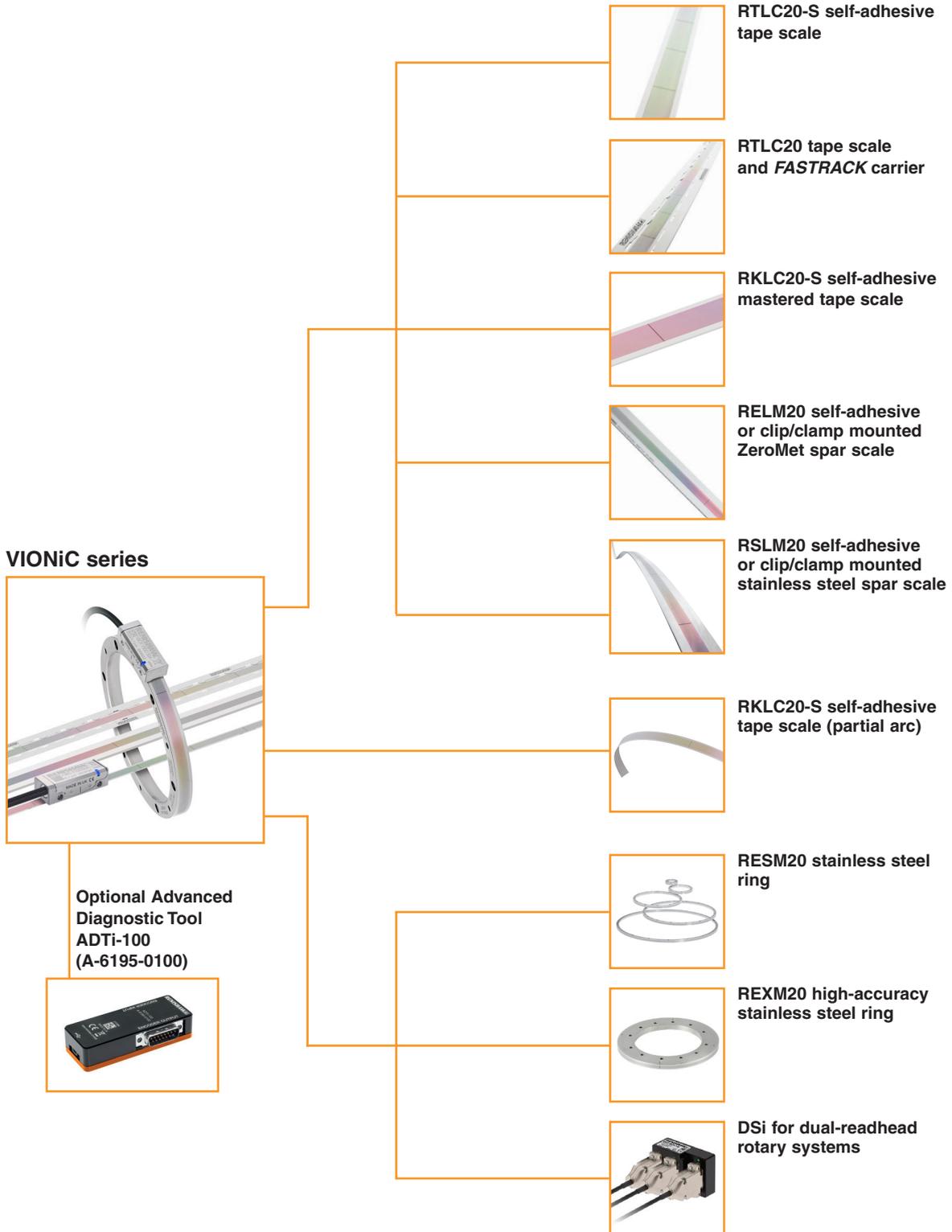
\*Extension cables available. Contact your local Renishaw representative for further details.

†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).

## VIONiC series compatible products



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](http://www.renishaw.com/opticalencoders)

For worldwide contact details, visit [www.renishaw.com/contact](http://www.renishaw.com/contact)

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L - 9517 - 9678 - 05

Part no.: L-9517-9678-05-A  
 Issued: 05.2020