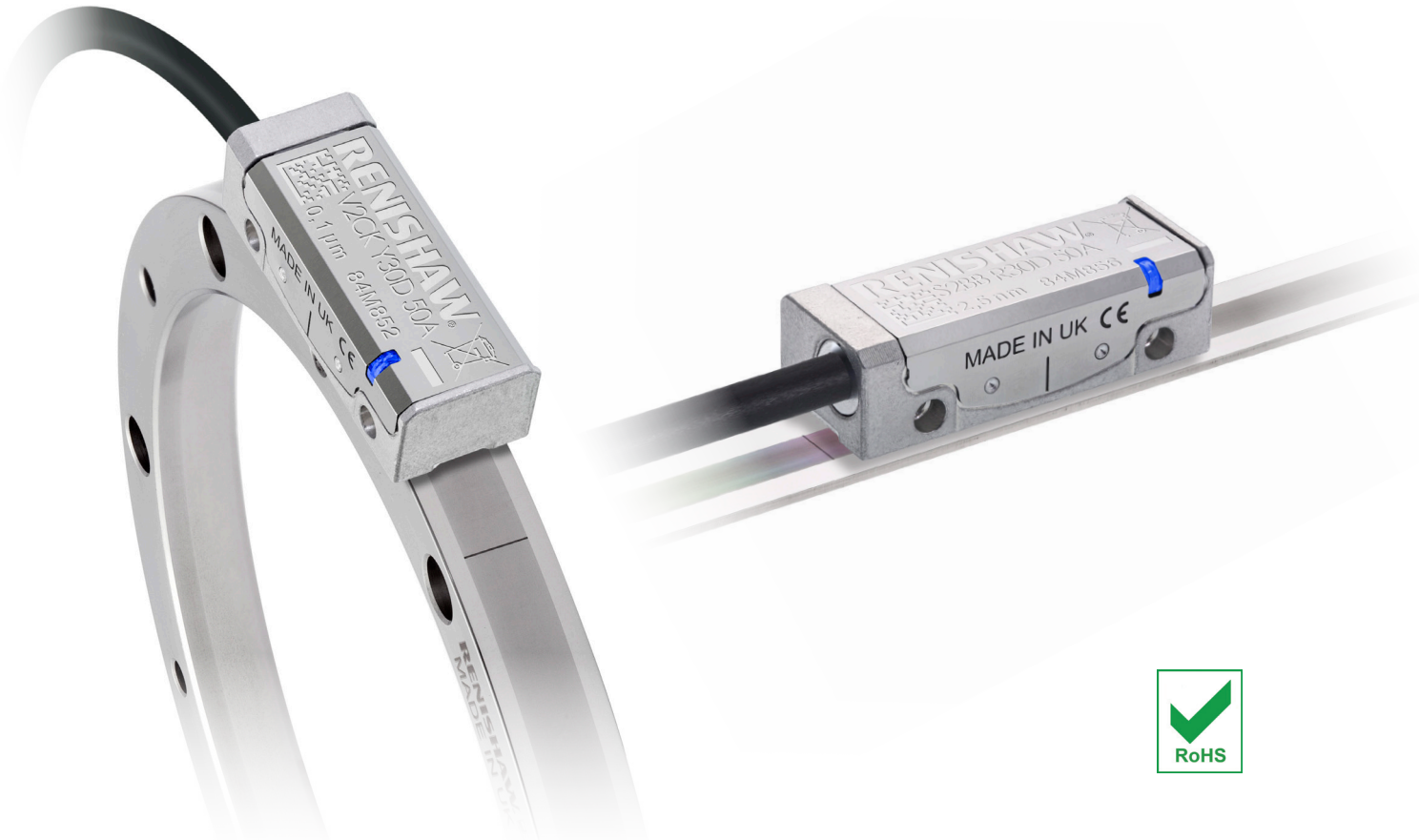


VIONiC™ series encoder system



The VIONiC encoder series integrates Renishaw's filtering optics design and interpolation technology. This creates a high performance, digital all-in-one, incremental optical encoder which has the benefit of eliminating the need for additional adaptors or separate interfaces. VIONiC is suitable for use across a wide range of demanding applications, including those which require dynamic motion control, superior accuracy and faster speeds.

Available in two variants, the VIONiC and VIONiCplus™ readheads offer a wide range of configurations to optimise the speed and performance of your motion control system. Both variants are quick and simple to install with wide set-up tolerances and automatic calibration.

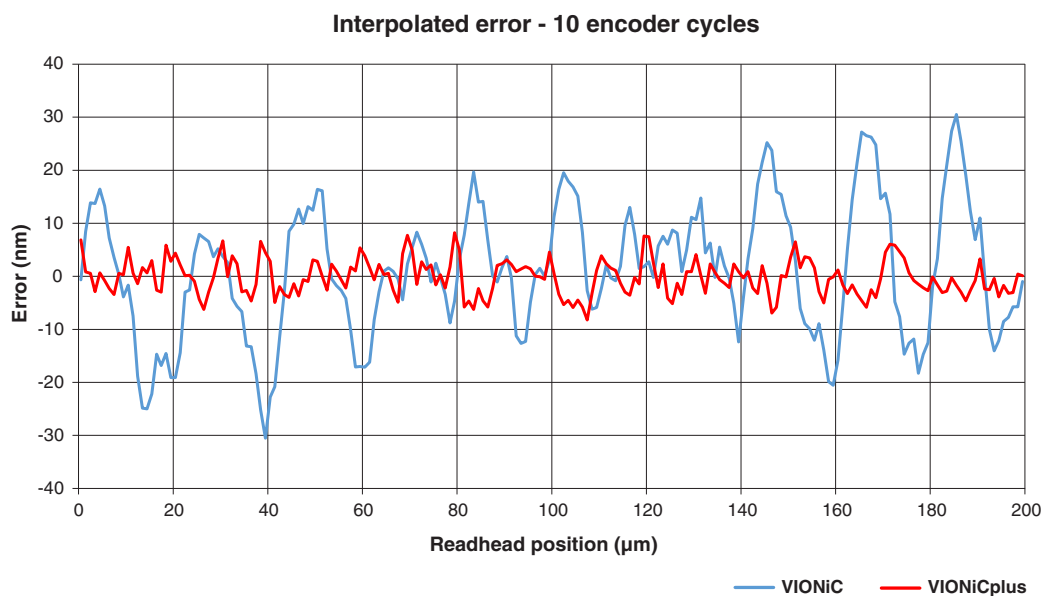
The standard version of VIONiC incorporates dynamic signal processing techniques giving improved signal stability with Sub-Divisional Error (SDE) of typically $<\pm 30$ nm and resolutions down to 20 nm.

For even greater performance the VIONiCplus system can achieve an SDE of $<\pm 10$ nm and resolutions down to 2.5 nm, helping to realise world leading motion control performance from a 20 µm pitch incremental system.

- Compact readhead (35 x 13.5 x 10 mm)
- Compatible with linear and rotary scales with *IN-TRAC*™ auto-phase optical reference mark (datum)
- Third-generation filtering optics optimised for even lower noise (jitter)
- Dynamic signal processing provides ultra-low Sub-Divisional Error of typically $<\pm 30$ nm (VIONiC) or as low as $<\pm 10$ nm (VIONiCplus)
- Auto Gain Control, Auto Balance Control and Auto Offset Control ensure consistent signal strength for long-term reliability
- Integral 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: VIONiC resolutions from 5 µm to 20 nm VIONiCplus resolutions from 0.1 µm to 2.5 nm
- Integral dual limits (linear only)
- Operating temperature to 70 °C
- Optional Advanced Diagnostic Tool (ADT) to optimise set-up and assist with system fault finding

System features

- ▶ **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 this maximum possible speed at fine resolutions.
- ▶ **Need higher accuracy?** VIONiC readheads are compatible with a range of linear and rotary scales, from $\pm 1 \mu\text{m/m}$ low expansion linear spar scales to ± 1 arc second total installed accuracy rings.
- ▶ **Need superior motion control?** VIONiCplus implements our latest interpolation algorithms and signal processing techniques to achieve a Sub-Divisional Error as low as $< \pm 10 \text{ nm}$. Low SDE directly equates to low velocity ripple which is important for constant velocity applications, such as scanning measurement systems. VIONiCplus' intelligent interpolation chip can achieve 8 000 x 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.



Typical SDE graph for VIONiC and VIONiCplus linear readheads

VIONiC readheads

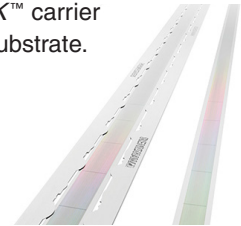


- ▶ **VIONiC readhead:** 20 μm high performance, digital all-in-one incremental open optical encoder. It offers resolutions down to 20 nm and has a wide range of configurations to optimise the speed for your motion control system. VIONiC's dynamic signal processing gives improved signal stability with Sub-Divisional Error of typically $< \pm 30 \text{ nm}$ to help realise superior motion control performance. For example VIONiC combined with stainless steel RTAL scale can be used across a range of linear motion control applications with ribbon scale convenience and unrivalled ruggedness.
- ▶ **VIONiCplus readhead:** In addition to all the benefits of the VIONiC readhead, the VIONiCplus readhead offers finer resolutions down to 2.5 nm and best in class Sub-Divisional Error as low as $< \pm 10 \text{ nm}$, suitable for the most demanding applications. VIONiCplus can be used with very high accuracy 'zero' thermal expansion RELM spar scale to provide the highest level of metrology performance.

Compatible scales

- ▶ **Stainless steel tape scale (RTLCL):** RTLCL for mounting in the revolutionary *FASTRACK™* carrier system and RTLCL-S tape scales with self-adhesive backing for mounting direct to the substrate.

- **Accuracy:** $\pm 5 \mu\text{m/m}$ (includes slope and linearity)
- **Linearity:** $\pm 2.5 \mu\text{m/m}$ achievable with two-point error correction
- **Maximum length:** 10 m
- **Coefficient of thermal expansion:** $10.1 \pm 0.2 \mu\text{m/m/}^\circ\text{C}$ @ 20 °C



- ▶ **Stainless steel spar scale (RSLM):** Shatter-proof stainless steel scale, offering higher accuracy and longer lengths than glass scales.

- **Accuracy:** $\pm 4 \mu\text{m}$ total accuracy over a complete 5 metre length
- **Maximum length:** 5 m
- **Coefficient of thermal expansion:** $10.1 \pm 0.2 \mu\text{m/m/}^\circ\text{C}$ @ 20 °C



- ▶ **ZeroMet spar scale (RELM):** Tough low expansion nickel alloy spar.

- **Accuracy:** $\pm 1 \mu\text{m}$ total accuracy up to 1 metre length
- **Maximum length:** 1.5 m
- **Coefficient of thermal expansion:** $0.75 \pm 0.35 \mu\text{m/m/}^\circ\text{C}$ @ 20 °C



- ▶ **Stainless steel ring (RESM):** Unique taper mount ring has large through hole for easy installation.

- **Graduation accuracy:** ± 0.38 arc second (550 mm diameter RESM ring)
- **Ring diameters:** 52 mm to 550 mm
- **Coefficient of thermal expansion:** $15.5 \pm 0.5 \mu\text{m/m/}^\circ\text{C}$ @ 20 °C



- ▶ **Stainless steel ring (REXM):** Ultra-high accuracy ring.

- **Total installed accuracy:** Using two VIONiC readheads and a DSi, eccentricity can be easily removed to achieve a total installed accuracy to ± 1 arc second
- **Ring diameters:** 52 mm to 417 mm
- **Coefficient of thermal expansion:** $15.5 \pm 0.5 \mu\text{m/m/}^\circ\text{C}$ @ 20 °C



VIONiC accessories

Easy fault finding and servicing

The optional Advanced Diagnostic Tool (ADT), part number A-6195-0100, is available for comprehensive real-time feedback from VIONiC encoders.

This can be used for challenging installations and fault finding.

It provides:

- ▶ Remote calibration functions
- ▶ Signal optimisation over axis length
- ▶ Readhead pitch indication
- ▶ Limit and reference mark indicators
- ▶ DRO and Lissajous outputs

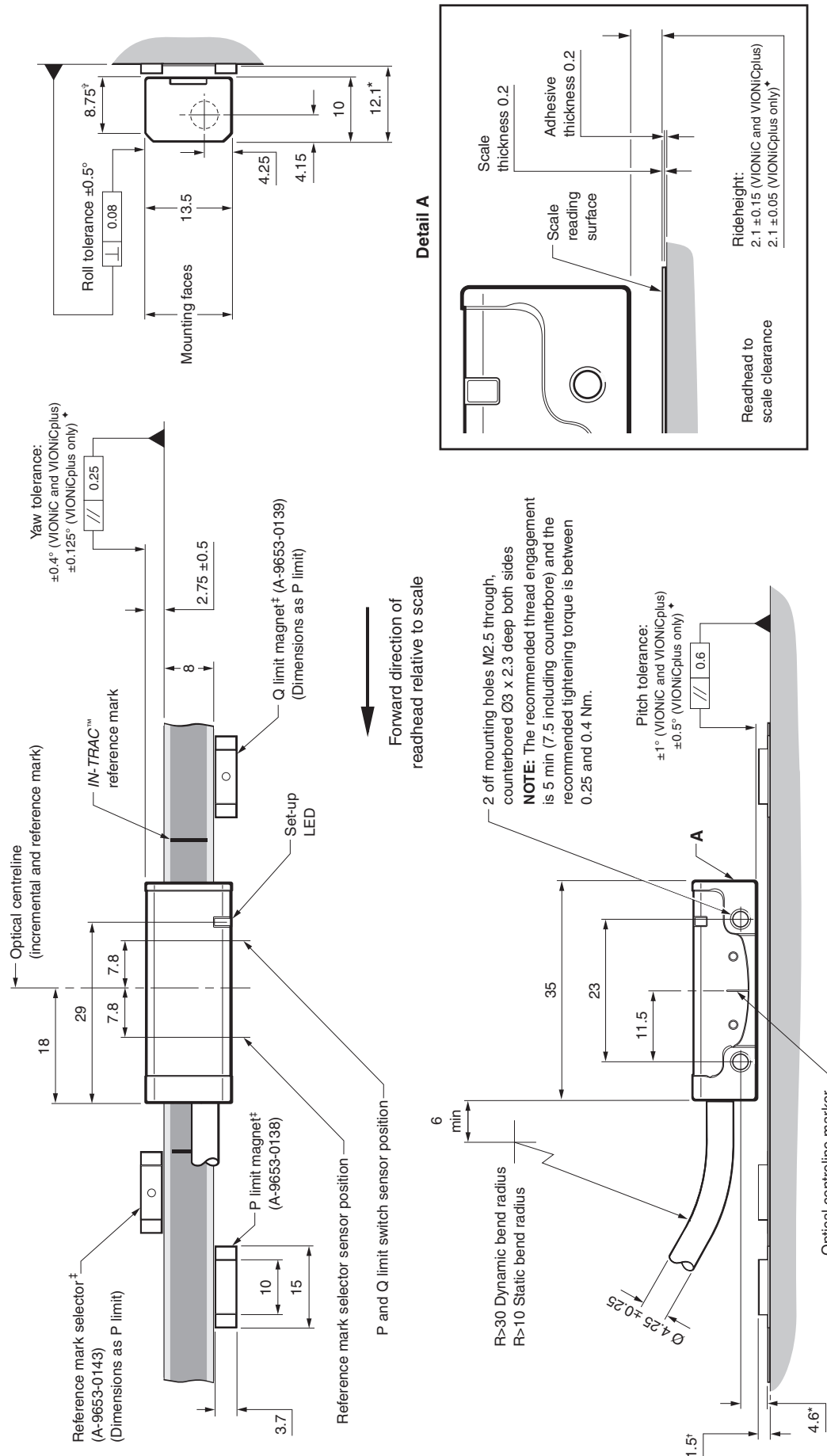
Free software download for the ADT is available directly from www.renishaw.com



Using the recommended USB cable (A-9572-0098), the ADT can be connected direct to a PC.

VIONiC installation drawing (on RTLC-S scale)

Dimensions and tolerances in mm



*Dimensions from scale surface. †Dimension from substrate surface. ‡Bolted reference mark selector magnet and limit magnet available. See RTLC-S installation guide for further details.

‡Extent of mounting faces. *Recommended alignment tolerance for optimum Sub-Divisional Error (SDE). For further details, refer to SDE table on page 6.

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

NOTE: External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit sensor.

General specifications

Power supply	5V -5%/+10%	Typically 200 mA fully terminated Power from a 5 V dc supply complying with the requirements for SELV of standard IEC BS EN 60950-1
	Ripple	200 mVpp maximum @ frequency up to 500 kHz
Temperature	Storage	-20 °C to +70 °C
	Operating	0 °C to +70 °C
Humidity		95% relative humidity (non-condensing) to EN 60068-2-78
Sealing		IP40
Acceleration	Operating	400 m/s ² , 3 axes
Shock	Operating	500 m/s ² , 11 ms, ½ sine, 3 axes
Vibration	Operating	100 m/s ² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Readhead	8.6 g
	Cable	26 g/m
EMC compliance		BS EN 61326-1: 2006
Readhead cable		Single-shielded, outside diameter 4.25 ±0.25 mm Flex life >20 x 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

Speed

Clocked output option (MHz)	VIONiC only				VIONiC and VIONiCplus					VIONiCplus only			Minimum edge separation* (ns)
	Maximum speed (m/s)				Maximum speed (m/s)					Maximum speed (m/s)			
	5 μm (D)	1 μm (X)	0.5 μm (Z)	0.2 μm (W)	0.1 μm (Y)	50 nm (H)	40 nm (M)	25 nm (P)	20 nm (I)	10 nm (O)	5 nm (Q)	2.5 nm (R)	
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 1m cable.

Angular speed depends on ring diameter - use the following equation to convert to rev/min.

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

System features

Reference mark

Form	<i>IN-TRAC</i> reference mark directly in incremental track. Refer to <i>RTLC-S</i> and <i>FASTRACK</i>, <i>RELM</i>, <i>RSLM</i>, <i>RESM</i> or <i>REXM</i> Data sheets for reference mark location. Bi-directionally repeatable across full speed and temperature range. Electronically phased, requires no physical adjustment.
Selection	All reference marks output (Alarm format and reference mark option: B or F) Single reference mark output by customer positioned selector magnet (Alarm format and reference mark option: A or E) Selector magnet options: self adhesive A-9653-0143 or bolted A-9653-0290
Repeatability	Unit of resolution repeatability over full operating temperature and speed.

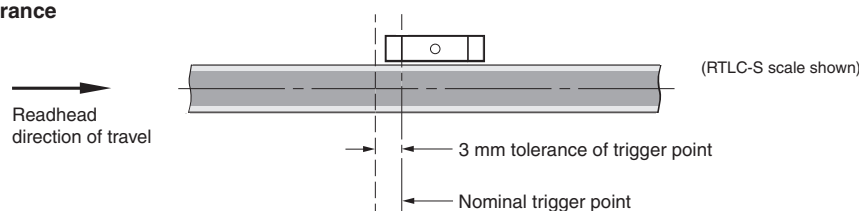
Dual limit switches (linear systems only)

Form Magnetic actuators for P and Q limit switches

	Self-adhesive	Bolted
10 mm P limit	A-9653-0138	A-9653-0292
10 mm Q limit	A-9653-0139	A-9653-0291
20 mm P limit	A-9653-0237	—
20 mm Q limit	A-9653-0238	—
50 mm P limit	A-9653-0235	—
50 mm Q limit	A-9653-0236	—

Trigger point Leading edge of magnet from direction of travel.

Trigger point tolerance



Mounting	Self-adhesive or bolted.
Position	Customer placed at desired locations.
Repeatability	<0.1 mm

Dynamic signal processing

Real time signal conditioning for optimized performance across a range of operating conditions.

- Automatic Gain Control (AGC)
- Automatic Offset Control (AOC)
- Automatic Balance Control (ABC)

Ultra low sub-divisional error of typically:

VIONiC	VIONiCplus rotary Ø >135 mm and linear	VIONiCplus rotary Ø <135 mm
<±30 nm	<±10 nm	<±20 nm

Calibration

- Simple auto-calibration.
- Optimization of incremental and reference mark signals.

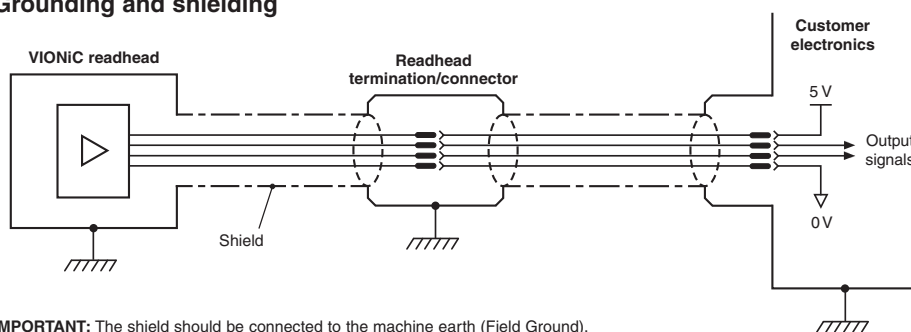
Output signals

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)
Power	5 V	Brown	5	7, 8	4, 12	G
	0 V	White	1	2, 9	2, 10	H
Incremental	A	+	2	14	1	M
		-	6	6	9	L
	B	+	4	13	3	J
		-	8	5	11	K
Reference mark	Z	+	3	12	14	D
		-	7	4	7	E
Limits	P	Pink	–	11	8	A
	Q	Black	–	10	6	B
Alarm	E	-	–	3	13	F
Remote CAL	CAL	Clear	9	1	5	C
Shield	–	Screen	Case	Case	Case	Case

Electrical connections

Grounding and shielding

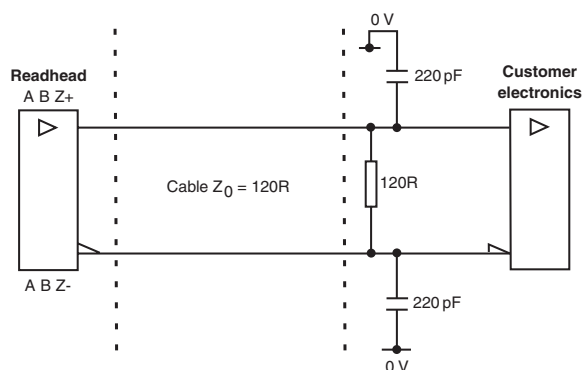


IMPORTANT: The shield should be connected to the machine earth (Field Ground).

Maximum readhead cable length: 3 m

Maximum extension cable length: Dependant on cable type, readhead cable length and clock speed.
Contact your local subsidiary for more information.

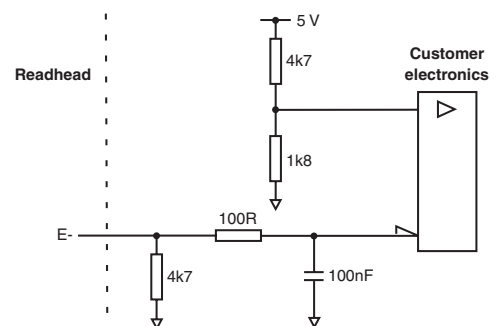
Recommended signal termination



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

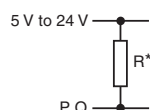
Single ended alarm signal termination

(D, H and X cable termination only)



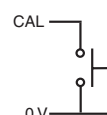
Limit output

(D, H and X cable termination only)



*Select R so that maximum current does not exceed 10 mA.
Alternatively, use a suitable relay or opto-isolator.

Remote CAL operation



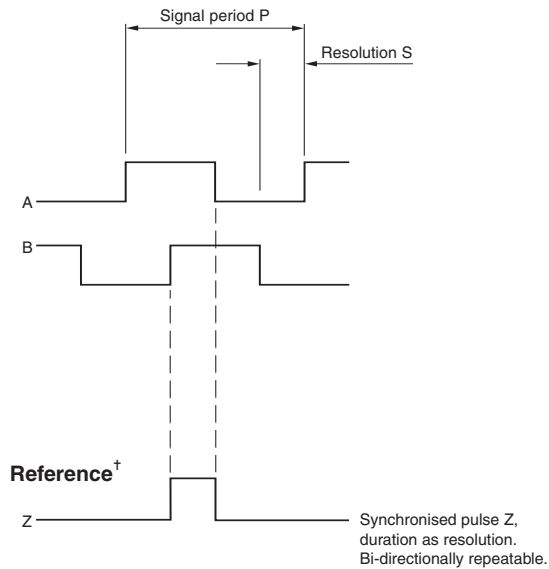
Remote operation of the CAL/AGC is possible via CAL signal.

Output specifications

Digital output signals

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

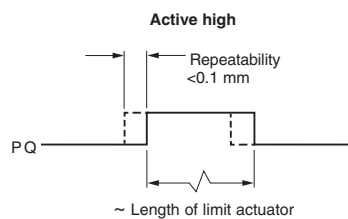
Incremental[†] 2 channels A and B in quadrature (90° phase shifted)



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

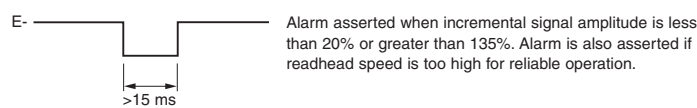
NOTE: Wide reference mark option duration as signal period available. Contact your local subsidiary for more information.

Limits Open collector output, asynchronous pulse



Alarm Asynchronous pulse

Line driven



or 3-state alarm

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

[†]Inverse signals not shown for clarity

Readhead part numbers

V2 B B X 30 D 50 B

Series

V2 - 20 µm VIONiC
S2 - 20 µm VIONiCplus

Readhead type

B - Standard (linear and rotary $\varnothing > 135$ mm)
C - Rotary $\varnothing < 135$ mm

Scale type compatibility

B - RSLM/RELM
C - RTLC
J - RESM/REXM $\varnothing > 135$ mm
K - RESM/REXM $\varnothing 60$ mm to $\varnothing 135$ mm
L - RESM/REXM $\varnothing < 60$ mm
M - RGSZ partial arc $\varnothing > 135$ mm
N - RGSZ partial arc $\varnothing \leq 135$ mm

Resolution

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

Cable length

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

Cable termination

A - 9 way D-type (3-state alarm only, no limits)
D - 15 way D-type (standard pin out)
H - 15 way D-type (alternative pin out)
X - 12 way circular connector

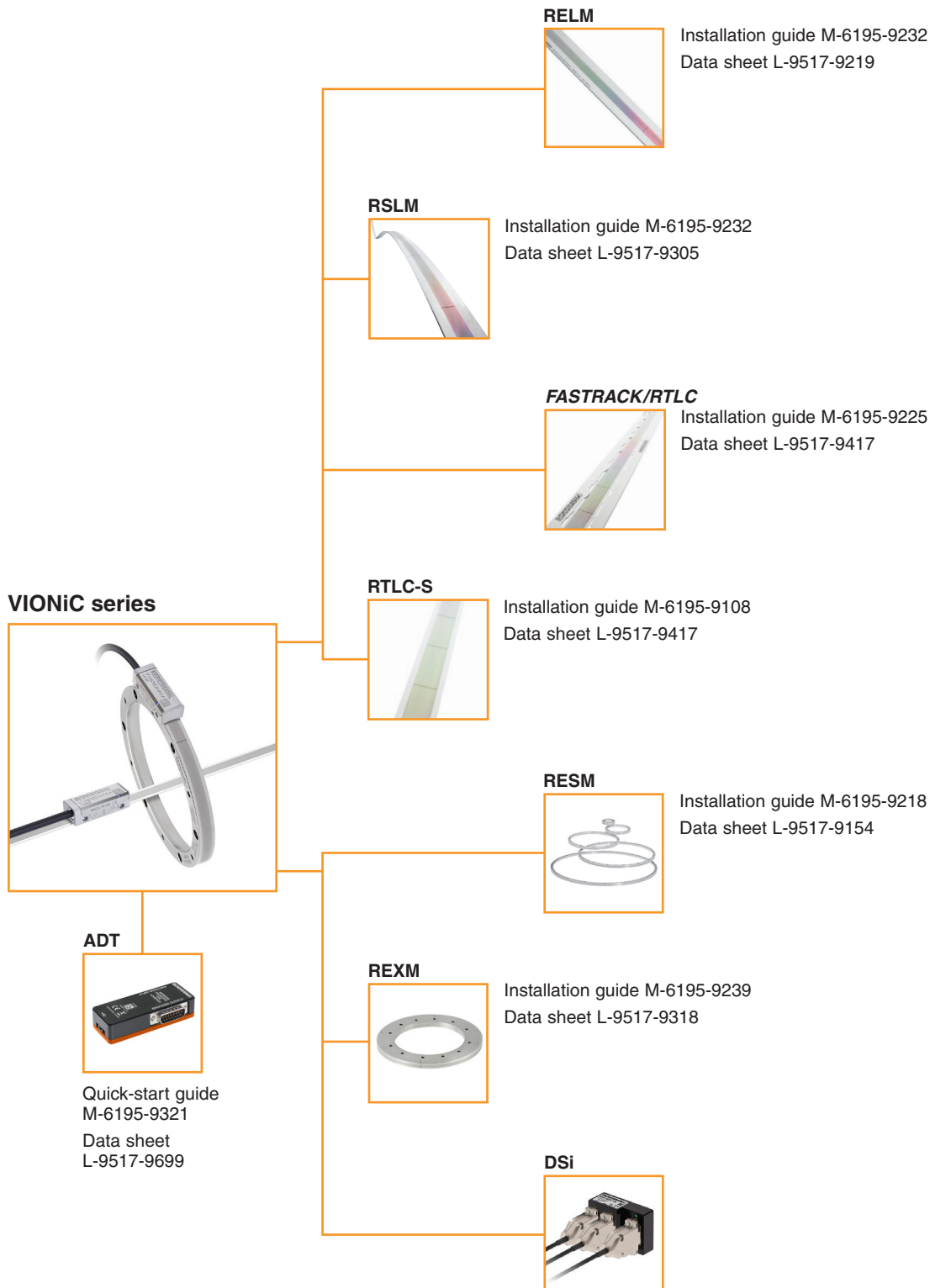
Clocked output option

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

Alarm format and reference mark options

A - Line driven alarm, customer selectable reference mark
B - Line driven alarm, all reference marks are output
E - 3-state alarm, customer selectable reference mark
F - 3-state alarm, all reference marks are output

VIONiC series compatible products:



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