

Encoder Products Division TECHNICAL NOTE – TN 047_02

Product: VIONiC™ QUANTiC™ readhead
Title: Cable configuration and maximum length

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Subsidiaries
Customers

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Interconnect cable to customer electronics typically comprises readhead cable plus extension cable.
Readhead cable length + Extension cable(s) length = Total cable length

The maximum total cable length is determined by a combination of the following factors:

- Readhead cable length – datasheet selectable option
- Extension cable resistivity – customer design choice
- Readhead clock speed – datasheet selectable option

Cable resistivity

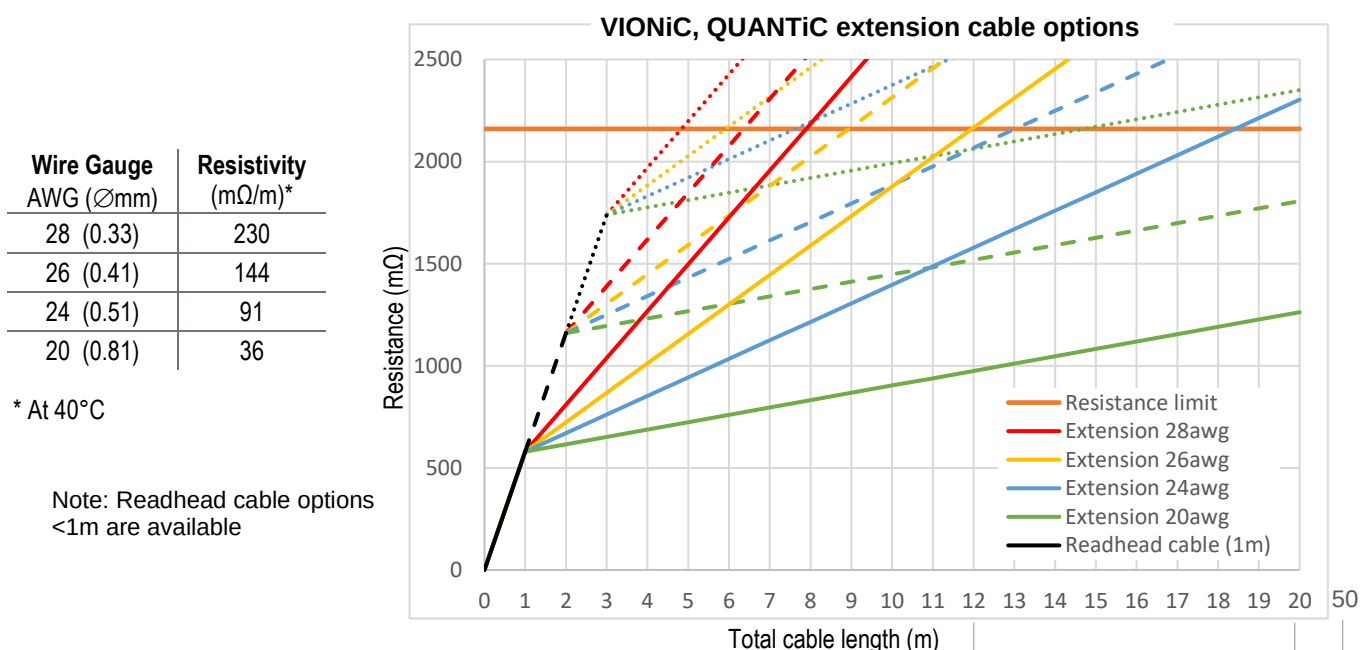
Total cable resistance between 5v PSU (customer controller) and readhead $\leq 2160\text{m}\Omega$

Total cable resistance: *Readhead cable resistance + Extension cable resistance $\leq 2160\text{m}\Omega$*

Readhead cable specification: 32AWG ($\varnothing 0.2\text{mm}$), resistivity $580\text{m}\Omega/\text{m}$ (at 40°C)

Maximum readhead cable length: $2160 / 580 = 3.72\text{m}$ (3m fitted length).

Total cable lengths are detailed in the plot below, with extension cable maximum length determined from a combination of readhead cable length options plus extension cable wire gauge resistivity values as shown.



Readhead clock speed

Clock speed restriction
to maximum total cable length

50MHz

12 - 40MHz

<12MHz

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Extension cable

Extension cable from Renishaw is available in the following options, up to 100m:

Part number (/m)	Specification	Description	Resistivity	Termination code#
A-9531-0238	14 core 20AWG†, O/D 7.2mm, double shield*	Low resistance, lo-flex	36 mΩ/m	A, D, H
A-9531-0237	12 core 28AWG, O/D 4.7mm, double shield*	Hi-flex, high resistance	230 mΩ/m	A, D, H, X

† 5V/0V only

* Connect inner shield to 0v

VIONiC, QUANTiC connector compatibility

Alternative extension cable specification: 12core 24awg, single shield (braid), good dynamic bend performance

Note: Renishaw extension cable assemblies are only compatible with termination option 'D'

Formula to determine extension cable maximum length or suitable wire gauge:

$$Le \leq \frac{2160 - (580 * Lr)}{Re}$$

Where:

Le = Extension cable length (m)

Lr = Readhead cable length (m)

Re = Extension cable resistivity (mΩ/m)

Combination extension cable

Where an application requires extension cable, to include both hi-flex plus long length, a combination of the listed cable types may be necessary.

Extension cable design rules to maximise total cable length:

- Minimise readhead cable length option ($L_r < 1\text{m}$)
- Hi-flex extension cable (L_f), length only as necessary
- Low resistance extension cable (L_e), wire gauge to suit

Example using above listed cable types
($L_r = 1\text{m}$, $L_f = 5\text{m}$)

$$Le \leq \frac{2160 - (580 * L_r) - (230 * L_f)}{36}$$

$$Le \leq \frac{2160 - (580 * 1) - (230 * 5)}{36}$$

$$Le \leq 12\text{m}$$

Maximum total cable length ($1 + 5 + 12$) $\leq 18\text{m}$

Refer to **Extension Cable Calculator Tool** for any cable combination

VIONiC, QUANTiC extension cable combination examples

Plot of hi-flex plus low resistance extension cable combination, with typical example shown

- readhead cable 1m
- hi-flex cable 3 or 5m
- lo-res cable 20 / 24awg

Note: Readhead clock speed restrictions also apply

