Data sheet
L-9517-9728-02-B

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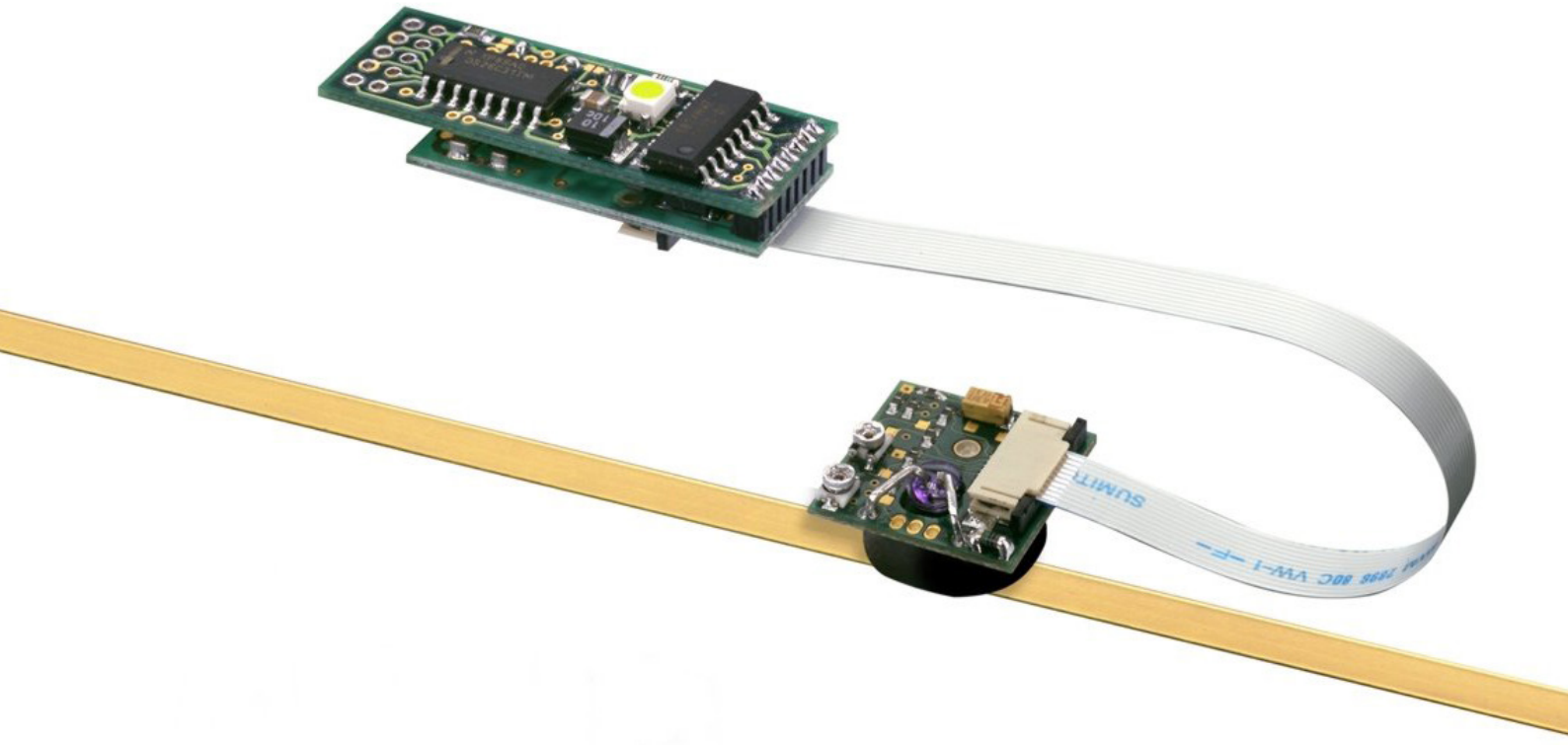
RGH34 encoder system



The Renishaw RGH34 series is a non-contact optical encoder system, providing highly-reliable positional feedback. This modular miniaturised encoder consists of an RGH34 readhead that reads a graduated scale; and an RGI34 interface that outputs a choice of industry standard 1 Vpp analogue or RS422 digital signals with a wide range of resolutions.

It offers the benefits of Renishaw's established encoder series, such as a set-up LED indicator for easy installation, and unique filtering optics for excellent dirt immunity. In addition to those popular features, the RGH34 adds higher speeds for improved productivity, increased setup tolerances, and reduced size enabling greater installation flexibility.

The RGH34 reads the 40 µm pitch RGS40-S gold tape-scale. RGS40-S is suitable for mounting to most common engineering materials including metals, granites, ceramics and composites. The scale can be mastered to the axis substrate by means of specially formulated pre-applied adhesive and epoxy fastened 'end clamps'. This method ensures the differential movement between the scale and the substrate is close to zero, even with significant temperature swings.

With a modular construction and industry proven reliability, RGH34 is designed for OEM applications where a conventional enclosed encoder cannot be fitted. It brings robust performance to size sensitive precision linear and rotary motion applications such as ultra-small linear actuators, microscopes and microstages.

RGH34 readhead and RGI34 interface:

- Compact component style readhead
- Non-contact open optical system
- Industry standard digital and analogue output options
- Resolutions from 10 µm to 50 nm
- Optional reference or limit sensor
- Integral set-up LED

RGS40-S scale:

- 'Cut-to-length' convenience
- Lengths from 100 mm to over 50 m
- Efficient, accurate installation
- Affixes to most common engineering materials
- Self-adhesive backing tape
- Applicator tool allows scale to be installed using the motion of the axis

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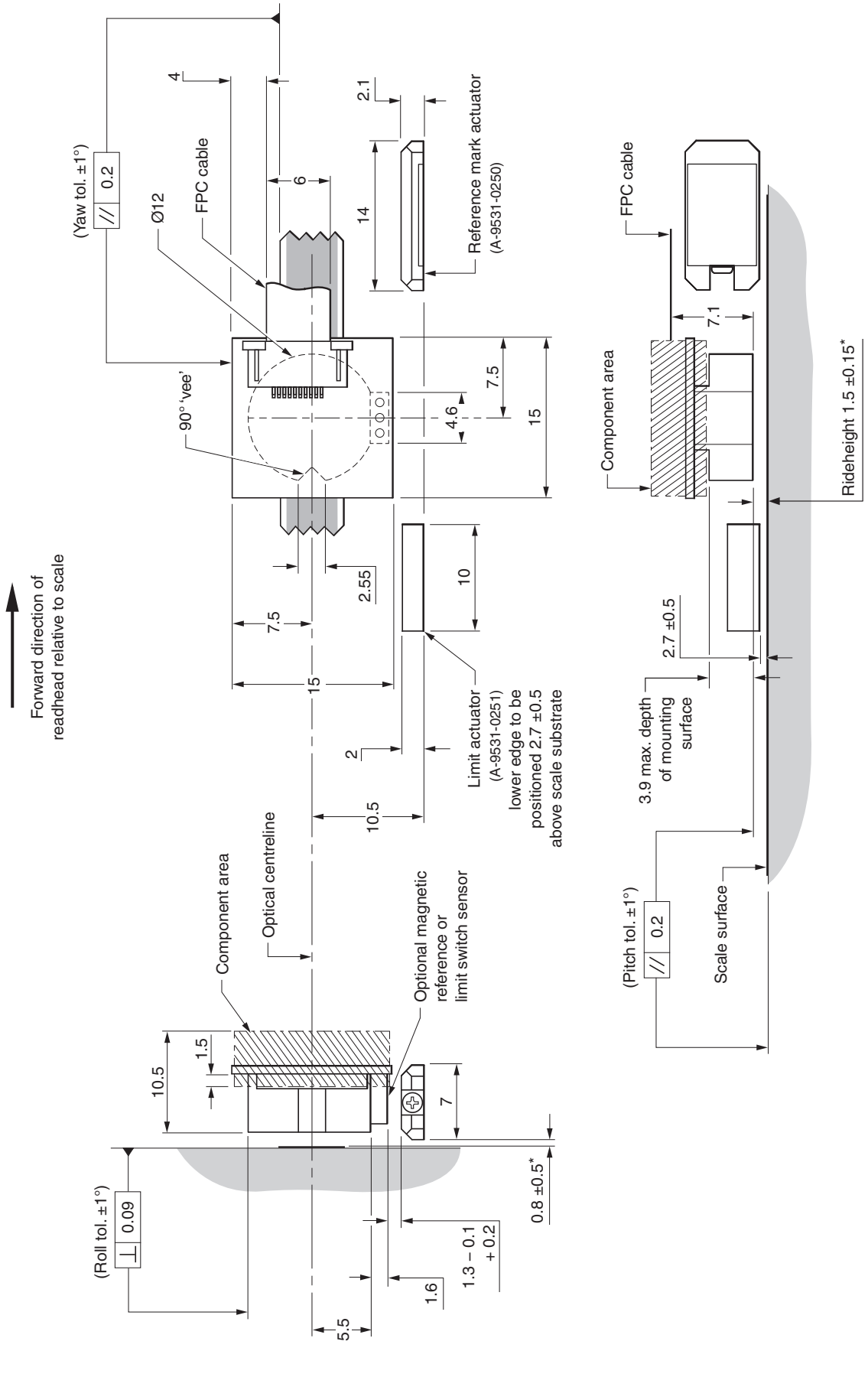
RGH34 readhead installation drawing

Dimensions and tolerances in mm

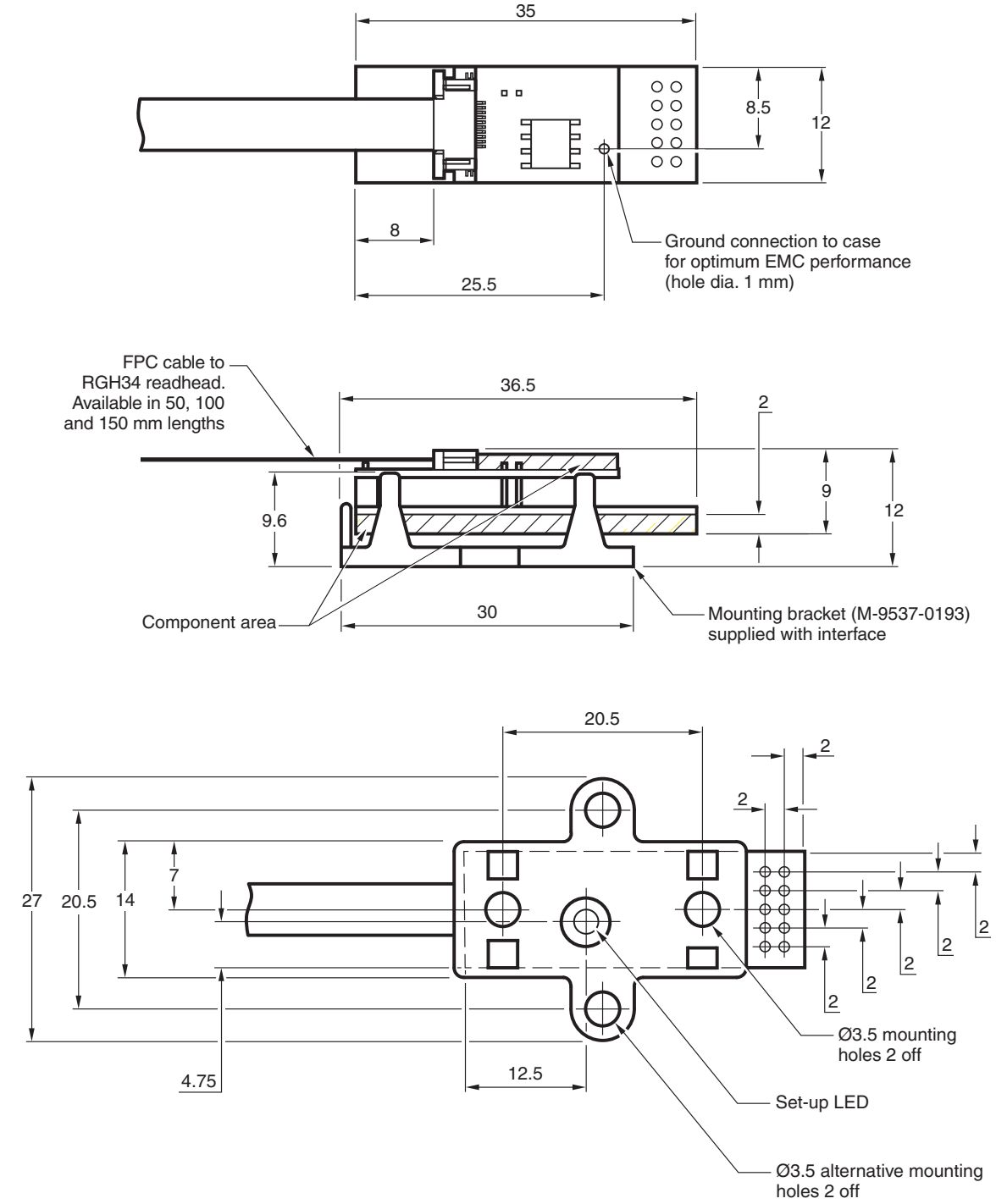


*Dimension measured from scale surface.

RGI34 interface drawing

Dimensions and tolerances in mm

Bracket omitted from this view



General specifications

Power supply	5 V ±5%	120 mA **NOTE:** Current consumption figures refer to unterminated RGI34 interfaces. For digital outputs a further 25 mA per channel pair (e.g. A+, A–) will be drawn when terminated with 120 Ω. For analogue outputs a further 20 mA will be drawn when terminated with 120 Ω. Power from a 5 V dc supply complying with the requirements for SELV of standard IEC BS EN 60950-1.
	Ripple	200 mVpp @ frequency up to 500 kHz maximium
Temperature	Storage Operating	–20 °C to +70 °C 0 °C to +55 °C
Humidity		95% relative humidity (non-condensing) to EN 60068-2-78
Acceleration	Operating	500 m/s², 3 axes
Shock	Non-operating	1000 m/s², 6 ms, ½ sine, 3 axes
Vibration	Operating	100 m/s² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Readhead Interface	2 g 3 g
Electrical integration		The RGH34 and RGI34 have been designed as system components and to be compliant with EMC regulations for products of their type. Care must be taken with shielding and grounding arrangements to ensure EMC performance once installed (refer to RGH34 RGS40 installation guide for full recommendations). It is the system integrator's responsibility to implement, test and prove EMC compatibility for the whole machine.
Readhead to interface connections		Very low profile zero insertion force micro-connector for 10 way Flexible Printed Circuit (FPC) cable. Cable flex life minimum 10×10^3 cycles at 5 mm bend radius.
FPC cables		FPC (flexible printed circuit) cables should be ordered separately from your local Renishaw representative. The part numbers for the standard lengths are listed below.

Part	Part number
50 mm FPC	A-9537-0182
100 mm FPC	A-9537-0183
150 mm FPC	A-9537-0184

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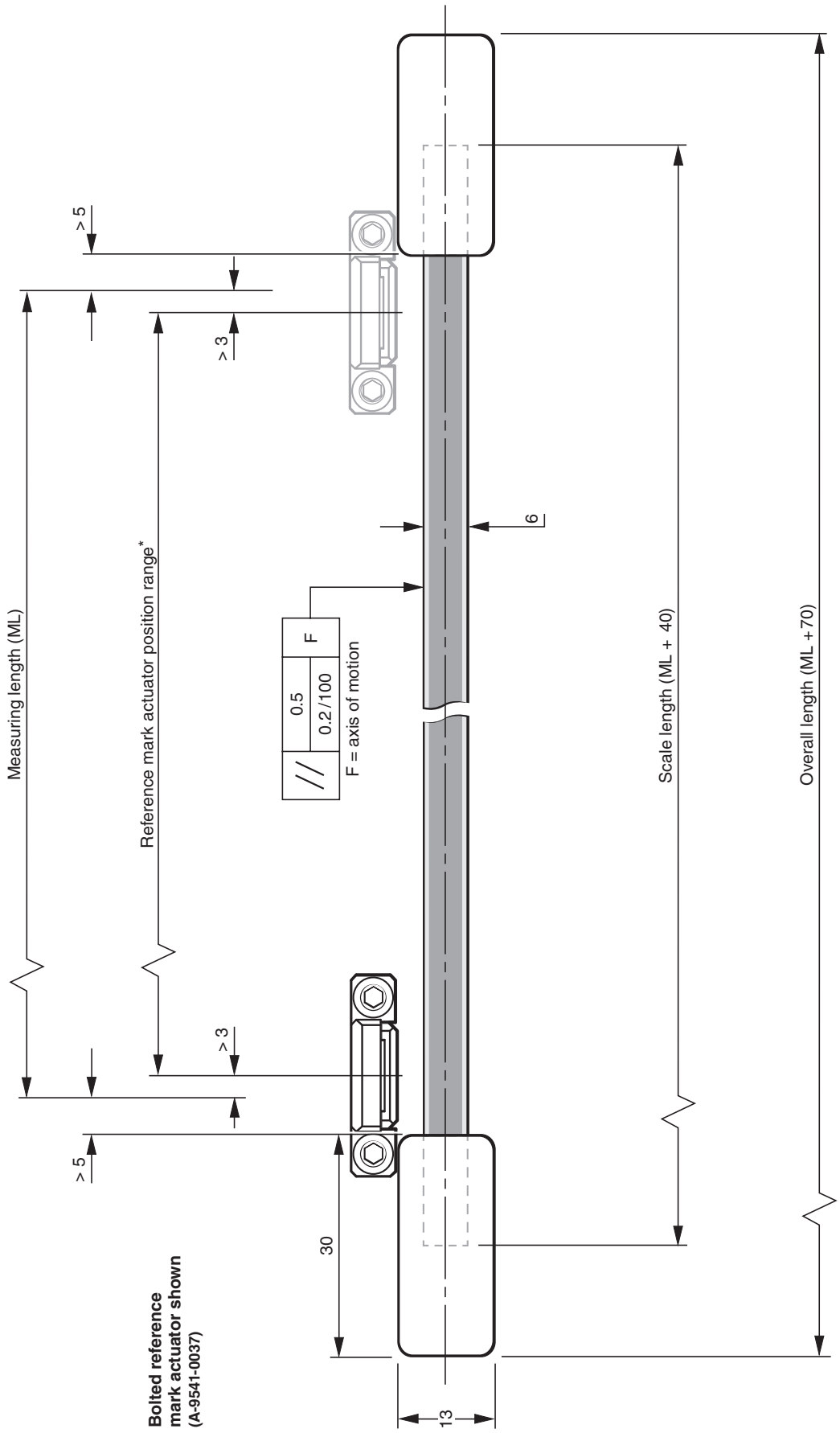
RGS40 scale installation drawing

Dimensions and tolerances in mm



NOTE: The surface roughness of the scale mounting surface must be ≤ 3.2 Ra.
The parallelism of the scale surface to the axis of motion (readhead rideheight variation) must be within 0.05 mm.

*For limit actuator position range refer to RGH34 RGS40 installation guide.

Scale specifications

Scale type		Reflective gold plated steel tape with protective lacquer coating. Adhesive backing tape allows direct mounting to the machine substrate.
Scale period		40 µm
Linearity		±3 µm/m
Scale length		Up to 50 m (>50 m by special order)
Form (H × W)		0.2 mm × 6 mm (includes adhesive)
Substrate materials		Metals, ceramics and composites with expansion coefficients between 0 and 22 µm/m/°C (steel, aluminium, Invar, granite, ceramic etc.)
Coefficient of thermal expansion		Matches that of substrate material when scale ends are fixed by epoxy mounted end clamps
End fixing		Epoxy mounted end clamps (A-9523-4015) using 2 part epoxy adhesive (A-9531-0342) Scale end movement typically < 1 µm up to +40 °C
Temperature	Operating	–10 °C to +120 °C
	Minimum installation	10 °C
	Storage	–20 °C to +70 °C
Humidity		95% relative humidity (non-condensing) to EN 60068-2-78

Speed performance

Digital interfaces

Non-clocked output interfaces.

Interface type	Maximum speed (m/s)	Lowest recommended counter input frequency (MHz)
T (10 µm)	8	$\left(\frac{\text{Encoder velocity (m/s)}}{\text{Resolution (µm)}}\right) \times 4$ safety factor
D (5 µm)	8	
G (2 µm)	7.5	
X (1 µm)	6	

Clocked output interfaces

The RGI34N, W, Y and H interfaces are available with a variety of different clocked outputs.
Customers must ensure they comply with the lowest recommended counter input frequency.

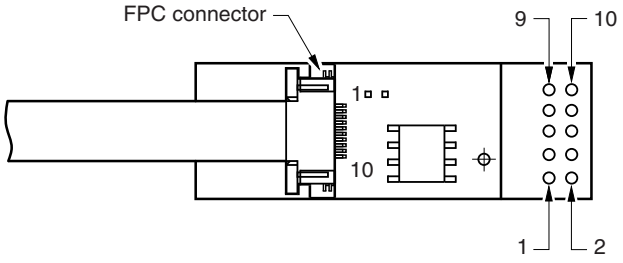
Clocked output code	Maximum speed (m/s)				Lowest recommended counter input frequency (MHz)
	Interface type				
	N (0.4 µm)	**W** (0.2 µm)	**Y** (0.1 µm)	**H** (50 nm)	
30	–	1.3	0.6	0.3	12
31	–	0.9	0.45	0.2	8
32	1.3	–	–	–	6
33	0.9	0.45	0.2	0.1	4

Analogue interfaces

RGI34B - 6 m/s (–3dB)
8 m/s (–6dB)

Output signals

Connections



RGI34 input

Signal	FPC connector pin
0 V	1, 2
A phase	3
B phase	4
C phase	5
V mid	6
Hall	7
5 V	8, 9, 10

Analogue 1 Vpp outputs - RGI34B

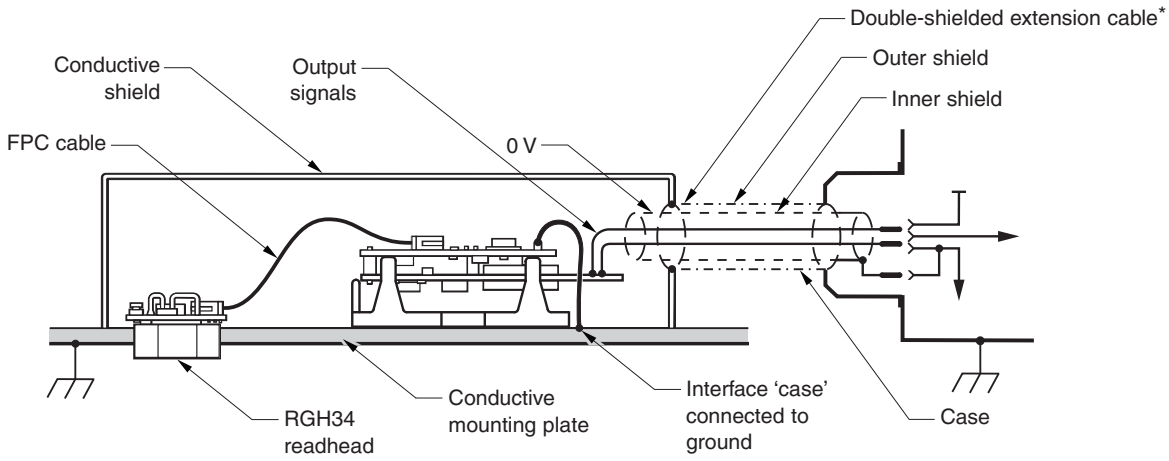
Analogue	Output signal	Through hole
Power	5 V	9
	0 V	10
Incremental signals	V_1+	8
	V_1-	7
	V_2+	6
	V_2-	5
Reference mark (if fitted)	V_0+	2
	V_0-	1

Digital RS422A outputs - RGI34T, D, G, X, N, W, Y and H

Digital	Output signal	Through hole
Power	5 V	9
	0 V	10
Incremental signals	A+	8
	A–	7
	B+	2
	B–	1
Reference mark (Z) or Limit switch (Q) (if fitted)	Z–/Q+	6
	Z+/Q–	5
External LED driver	Red	4
	Green	3

Electrical connections

Grounding and shielding



*Maximum extension cable length

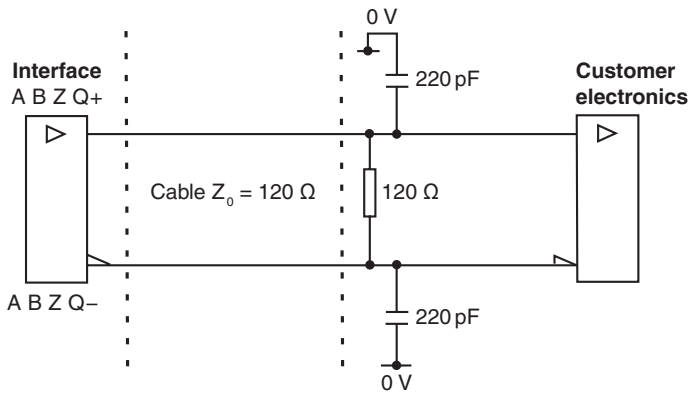
RGI34B - 100 m, RGI34T, D, G and X - 50 m, RGI34N, W, Y and H - 20 m

For optimum performance, ensure 100% screening

- Ground the readhead mounting bracket
- Ensure continuity of all shields
- Use double shielded extension cable
- Connect interface CASE to ground
- Use shielded connector shells on all cable connections
- Terminate the inner shield to 0 V power at the customer interface
- Maximise the distance between encoder and motor cables

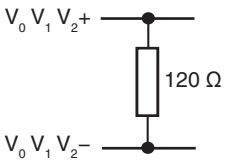
Recommended signal termination

Digital outputs - RGI34T, D, G, X, N, W, Y and H



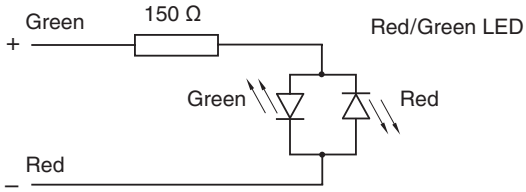
Standard RS422A line receiver circuitry
Capacitors recommended for improved noise immunity.

Analogue output - RGI34B



Remote LED driver outputs

The remote LED driver output allows remote monitoring of readhead installation.

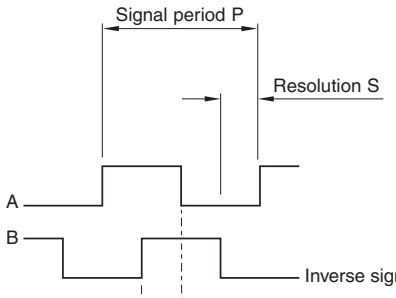


Output specifications

Digital output signals - type RGI34T, D, G, X, N, W, Y and H

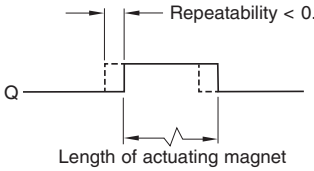
Form - Square wave differential line driver to EIA RS422A

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



Model	P (µm)	S (µm)
RGI34T	40	10
RGI34D	20	5
RGI34G	8	2
RGI34X	4	1
RGI34N	1.6	0.4
RGI34W	0.8	0.2
RGI34Y	0.4	0.1
RGI34H	0.2	0.05

Limit Asynchronous pulse



NOTE: RGH34 readheads and RGI34 interfaces are available with reference mark **or** limit switch detection. Select output at order.

Actuation device: A-9531-0251 or A-9541-0040

Inverse signal not shown for clarity.

Reference

Synchronised pulse Z, duration equal to the resolution. Repeatability of position (uni-directional) maintained within 20 °C from installation temperature and for speed <0.5 m/s.

Actuation device: A-9531-0250 or A-9541-0037

Inverse signal not shown for clarity

Alarm

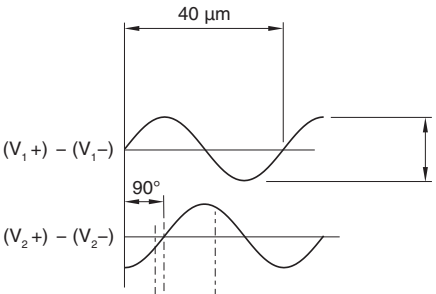
3-state alarm

Incremental channels forced open circuit for >20 ms when signal too low for reliable operation.

For RGI34N, W, Y and H only, incremental channels forced open circuit for >10 ms when signal too low or speed too high for reliable operation.

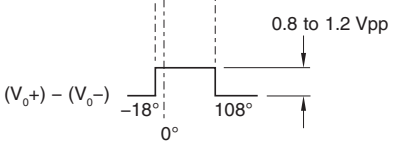
Analogue output signals type RGI34 (1 Vpp)

Incremental 2 channels V_1 and V_2 differential sinusoids in quadrature (90° phase shifted)



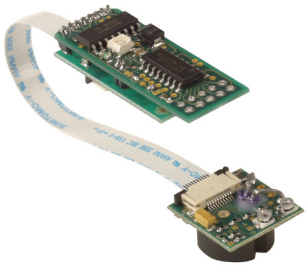
0.6 to 1.2 Vpp with green LED indication and 120 Ω termination.

Reference



Differential pulse V_0 –18° to 108°. Duration 126° (electrical).
Repeatability of position (uni-directional) maintained within ±20 °C from installation temperature

Actuation device: A-9531-0250 or A-9541-0037



RGH34 system = readhead & interface

+ scale

+ accessories

Readhead part numbers

RGH34U 00A 00A

Readhead series

Scale type
00A - RGS40-S tape scale compatible

Reference mark / limit switch
00A - reference mark sensor
00B - limit switch sensor
00C - no sensor

Interface part numbers

RGI34 B 00 A 00

Interface series

Output
B - analogue 1 Vpp
T - 10 µm digital
D - 5 µm digital
G - 2 µm digital
X - 1 µm digital
N - 0.4 µm digital
W - 0.2 µm digital
Y - 0.1 µm digital
H - 50 nm digital

Option
00 - FPC

Reference mark / limit switch
A - reference mark sensor (choose A also if no sensor was chosen when configuring the RGH34U readhead)
B - limit switch sensor (digital output only)

Clocked output
00 - not clocked (RGI34B, D, G, T and X only)
30 - 12 MHz clocked output (RGI34W, Y and H only)
31 - 8 MHz clocked output (RGI34W, Y and H only)
32 - 6 MHz clocked output (RGI34N only)
33 - 4 MHz clocked output (RGI34N, W, Y and H only)

NOTE: RGH34 readhead requires an RGI34 interface to function as a complete system
NOTE: Not all combinations are valid. Check valid combinations and all available options online at www.renishaw.com/epc

Scale part numbers

RGS40-S

40 µm pitch lacquered tape scale with self-adhesive backing tape.

Part number	Available lengths	Available in increments of	Ordering instructions
A-9537-3011	100 mm to 50,000 mm*	1 mm	Ordering a quantity of 2455 will result in a length of 2455 mm (multiple orders are required for multiple lengths)
A-9537-3010	1 m to 50 m*	1 m	Ordering a quantity of 15 will result in a length of 15 metres (multiple orders are required for multiple lengths)
A-9537-4xxx	10 cm to 999 cm	1 cm	xxx is the length in cm (ordering A-9537-4450 for example will result in a length of 450 cm)
A-9537-50xx	10 m to 50 m*	1 m	xx is the length in metres (ordering A-9537-5033 for example will result in a length of 33 metres)

* Lengths above 50 m are special order only. Please contact your local Renishaw representative.

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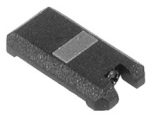
Accessory part numbers

Part number	Description	Image
A-9541-0037	RGM245S reference mark actuator magnet – screw mounted. A reference sensor within the readhead is used to determine an absolute datum within an incremental measuring system. The sensor does this by detecting the external RGM245S reference mark actuator magnet as the readhead passes it.	
A-9531-0250	RGM22S reference mark actuator magnet – epoxy mounted. A reference sensor within the readhead is used to determine an absolute datum within an incremental measuring system. The sensor does this by detecting the external RGM22S reference mark actuator magnet as the readhead passes it.	
A-9541-0040	RGP245S 90° limit switch actuator magnet – screw mounted. A limit sensor within the readhead detects end of travel by sensing the RGP245S limit switch actuator magnet.	
A-9531-0251	RGP22S limit switch actuator magnet 10 mm long – epoxy mounted. A limit sensor within the readhead detects end of travel by sensing the RGP22S limit switch actuator magnet.	
A-9523-4015	RGC-F end clamp kit – epoxy mounted. The RGC-F end clamps master the RGS scale to the substrate material to match its thermal expansion.	
A-9531-0342	RGG-2 2 part epoxy adhesive. The RGG-2 epoxy is recommended for the mounting of reference marks, limit switches and end clamps.	
A-9537-0197	RGH34 scale applicator guide block kit (for RGS40-S lacquered scale). The applicator block enables efficient and accurate scale application. Fixed to the customers readhead bracket it allows the correct placement of scale relative to where the readhead will be set.	
A-9537-0182	50 mm FPC flat flexible cable for connecting the RGH34 readhead to the RGI34 interface.	
A-9537-0183	100 mm FPC flat flexible cable for connecting the RGH34 readhead to the RGI34 interface	
A-9537-0184	150 mm FPC flat flexible cable for connecting the RGH34 readhead to the RGI34 interface	

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

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