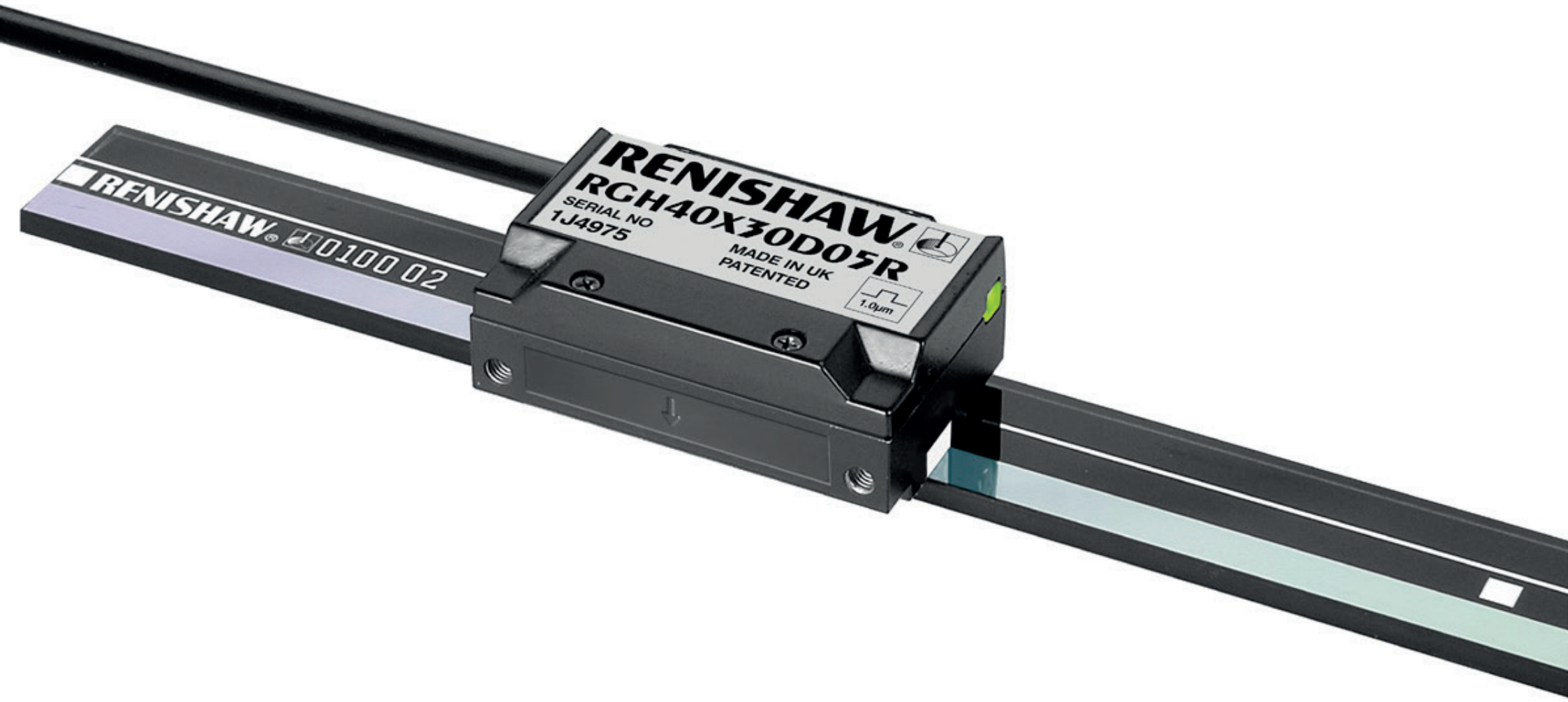
Installation guide
M-9550-9023-01-A

RENISHAW
apply innovation™

RGH40 RGS40-G linear encoder system



Contents

Product compliance

CE

Renishaw plc declares that RGH40 complies with the applicable standards and regulations.
A copy of the EC Declaration of Conformity is available on request.

FCC compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc or authorised representative could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTE: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to ensure compliance.

RoHS compliance

Compliant with EC directive 2011/65/EU (RoHS)

Further information

Further information relating to the RGH40 encoder range can be found in the RGH40 System Data sheet. (L-9517-9752) This can be downloaded from our website www.renishaw.com/encoder and is also available from your local representative. This document may not be copied or reproduced in whole or in part, transferred to any other media or language, by any means without the written prior permission of Renishaw. The publication of material within this document does not imply freedom from the patent rights of Renishaw plc.

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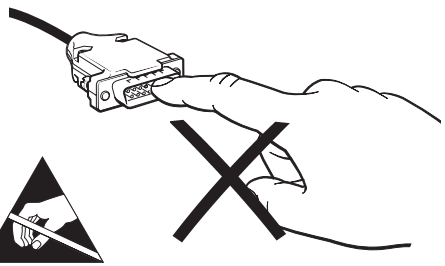
The packaging of our products contains the following materials and can be recycled.

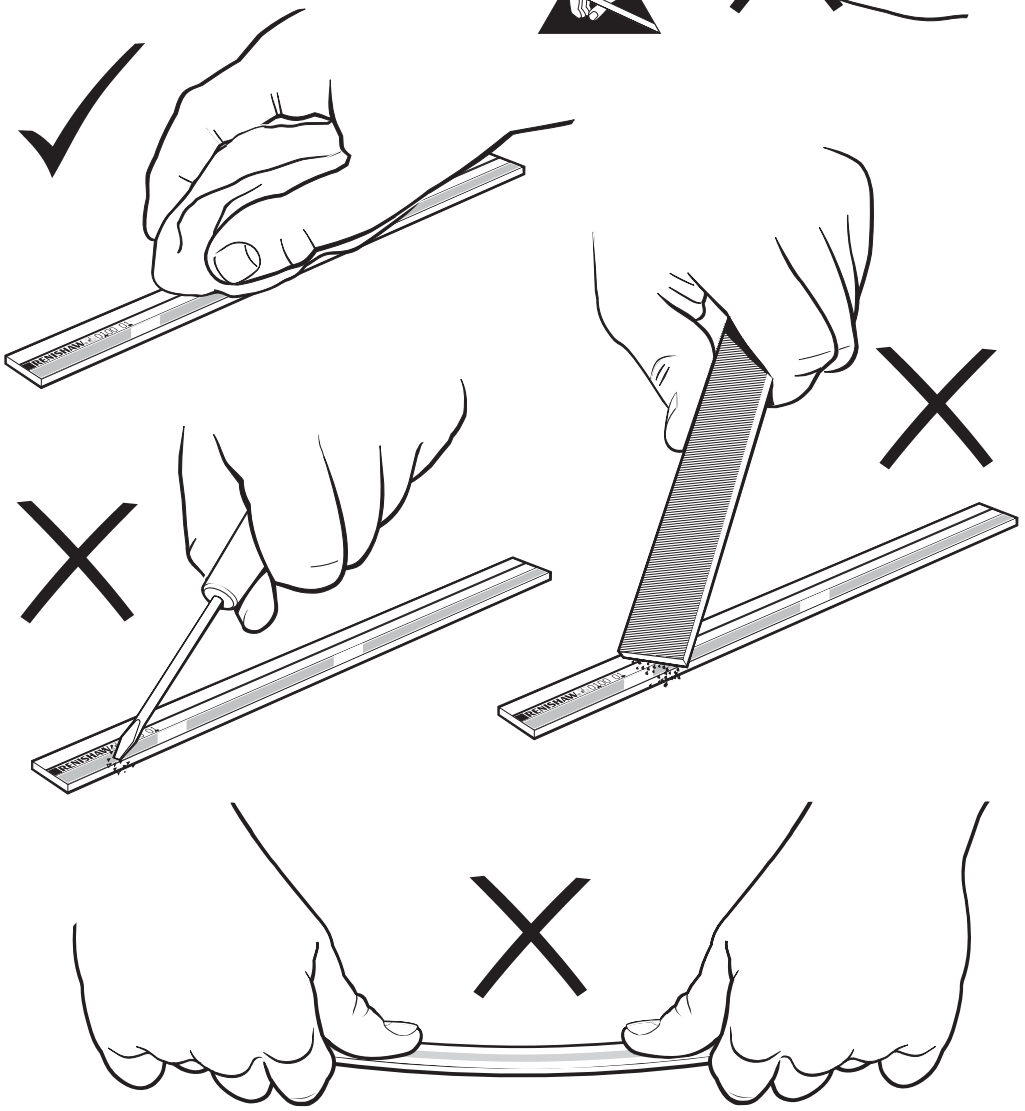
Packaging Component	Material	ISO 11469	Recycling Guidance
Outer box	Cardboard	Not applicable	Recyclable
	Polypropylene	PP	Recyclable
Inserts	Low Density Polyethylene Foam	LDPE	Recyclable
	Cardboard	Not applicable	Recyclable
Bags	High Density Polyethylene Bag	HDPE	Recyclable
	Metalised Polyethylene	PE	Recyclable

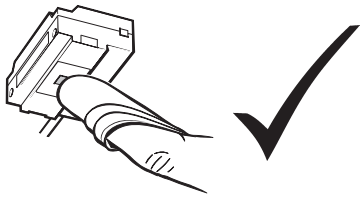
The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or Renishaw distributor.

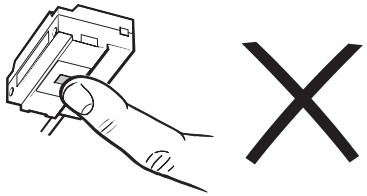
Storage and handling

RGS40-G is a non-contact optical encoder scale that provides good immunity against contaminants such as dust, fingerprints and light oils. However, in harsh environments such as machine tool applications, protection should be provided to prevent ingress of coolant or oil.

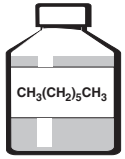




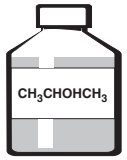




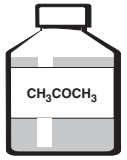
N-heptane

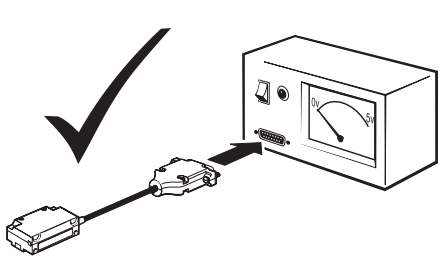


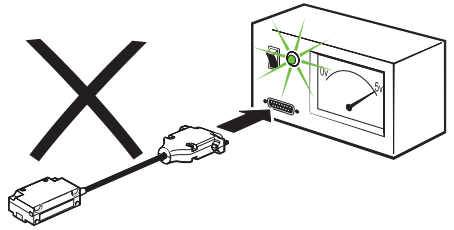
Propan-2-ol



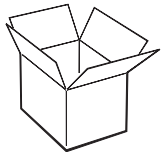
Acetone





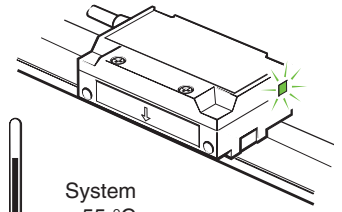


Storage



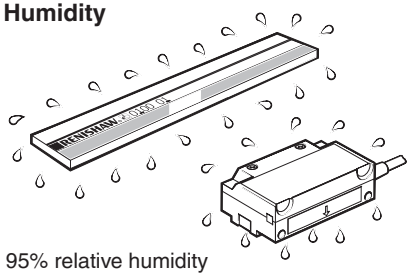
System
+70 °C
-20 °C

Operating



System
+55 °C
0 °C

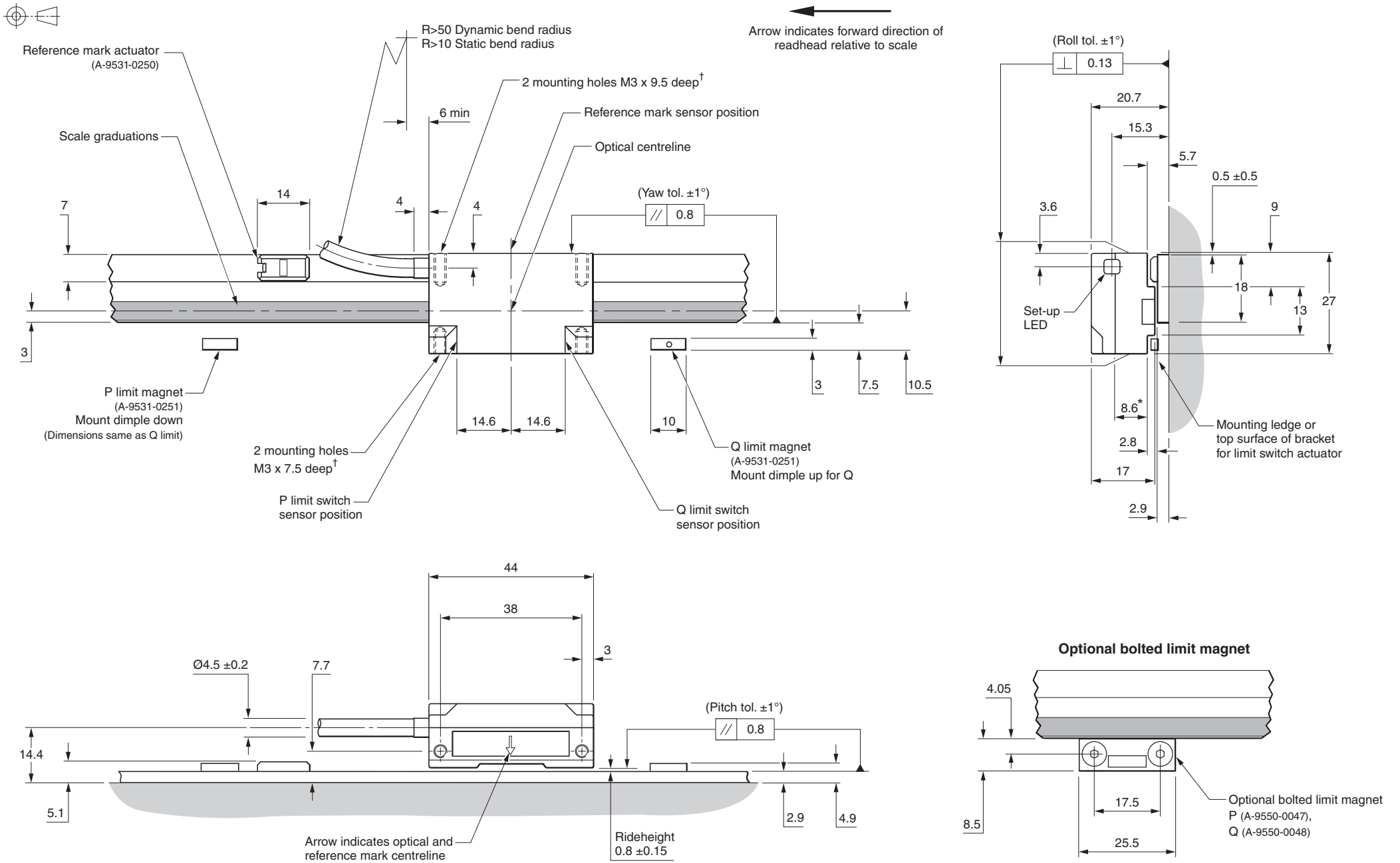
Humidity



95% relative humidity
(non-condensing)
to EN 60068-2-78

RGH40 installation drawing

Dimensions and tolerances in mm



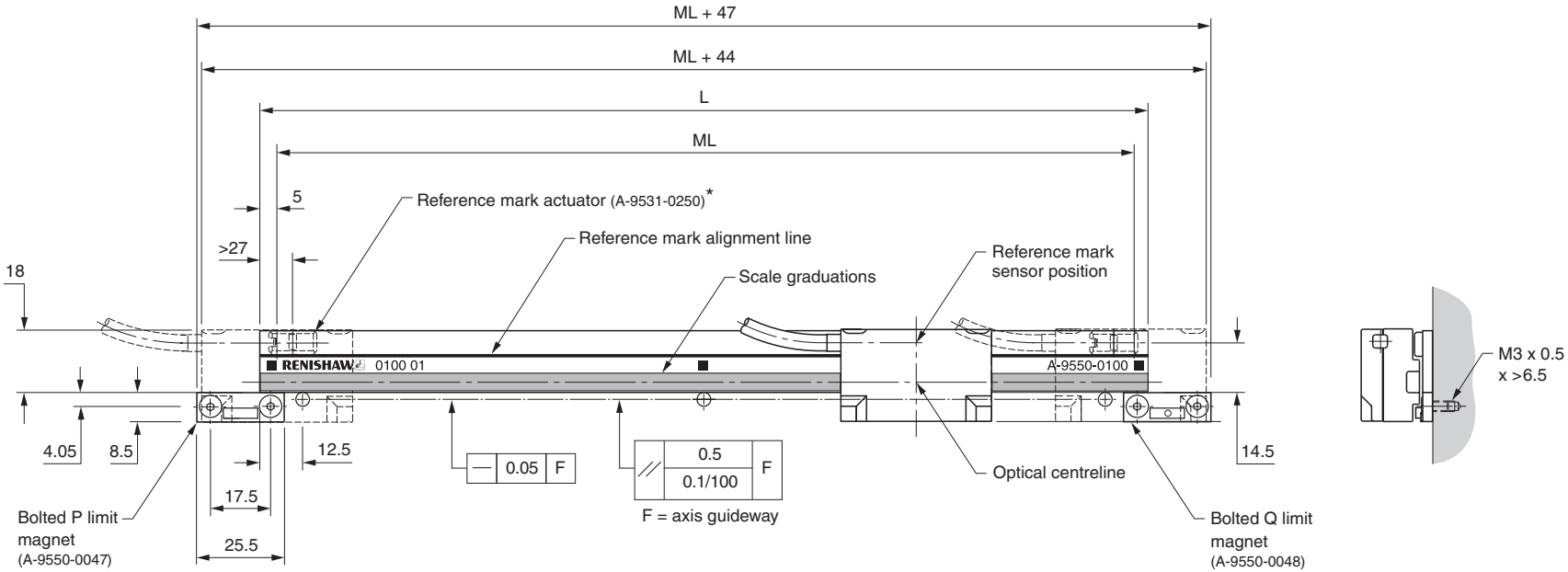
Optional bolted limit magnet

*Extent of mounting faces.

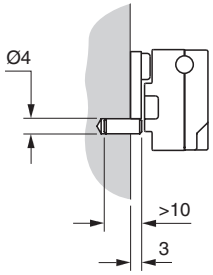
†The recommended thread engagement is 5 mm. The recommended tightening torque is between 0.5 and 0.7 Nm.

RGS40-G glass scale installation drawing (adhesive mounting)

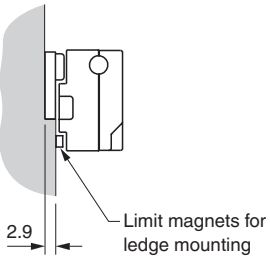
Dimensions and tolerances in mm

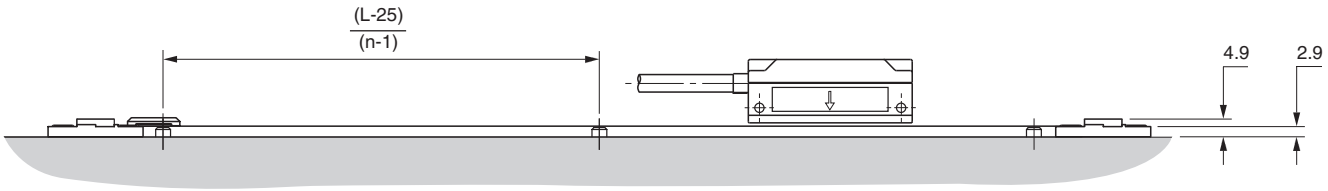


Support dowel alignment method

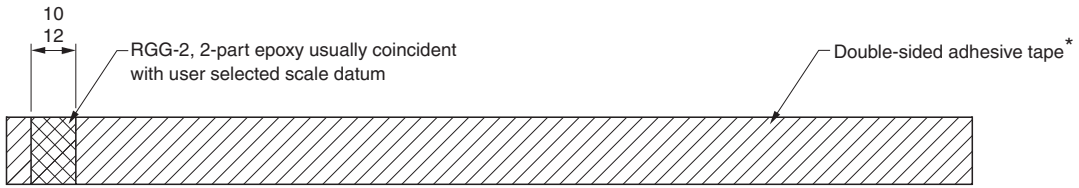


Ledge alignment method





Adhesive datum clamp

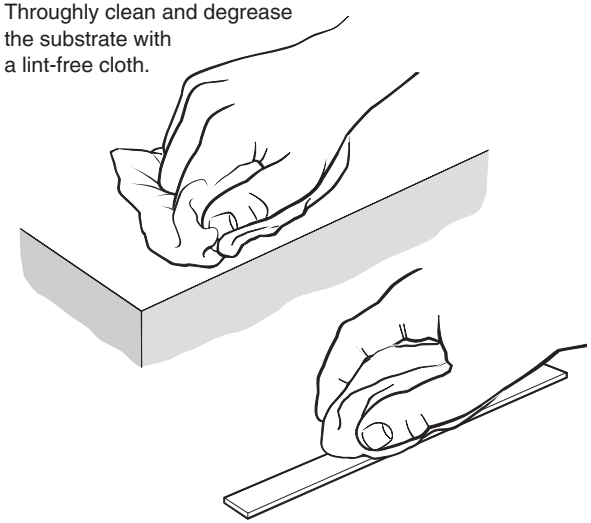


Scale length L (mm)	130	180	230	280	310	400	510	760	1010
Measuring length ML (mm)	120	170	220	270	300	390	500	750	1000
Recommended number of support dowels, n	3	3	3	3	3	3	3	4	5

*Double-sided adhesive tape is included with all scale lengths

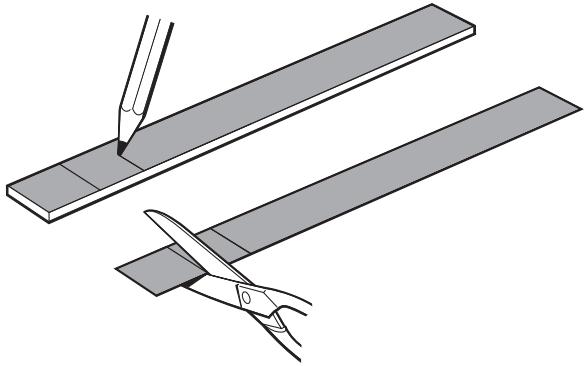
Adhesive mounting installation

1 Throughly clean and degrease the substrate with a lint-free cloth.

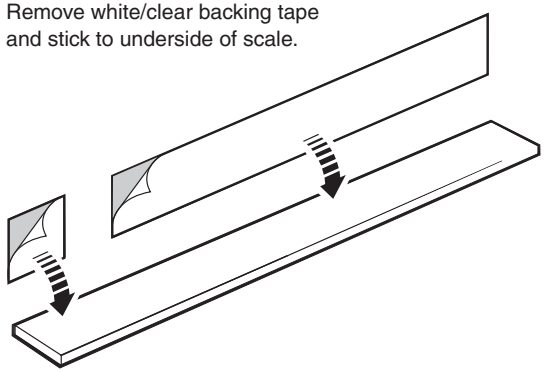


Clean underside of glass scale using approved solvents (see 'Storage and handling').

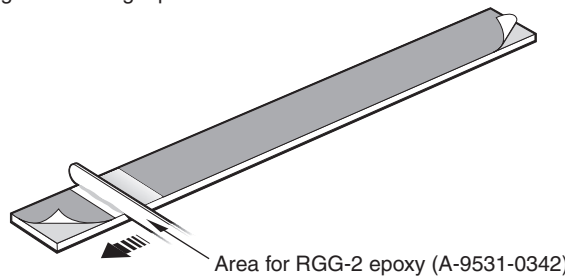
2 Mark area for epoxy on adhesive tape.



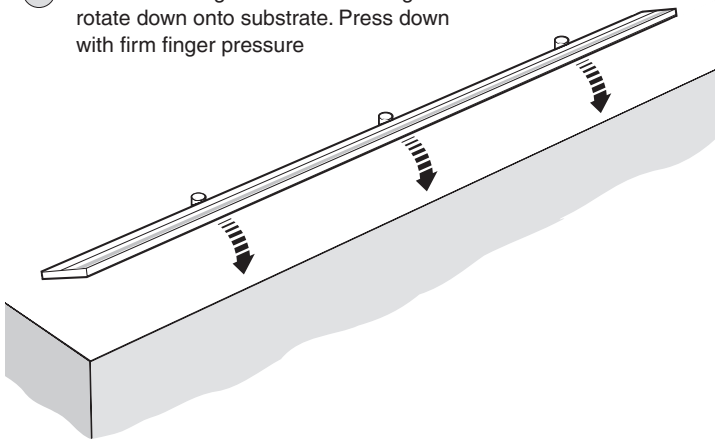
3 Remove white/clear backing tape and stick to underside of scale.



4 Throughly mix and apply epoxy then remove green backing tape and stick to substrate.



5 Locate scale against dowels or ledge and rotate down onto substrate. Press down with firm finger pressure



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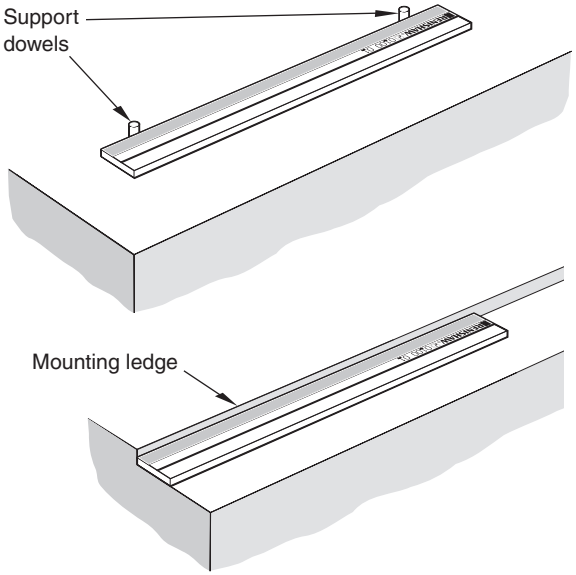

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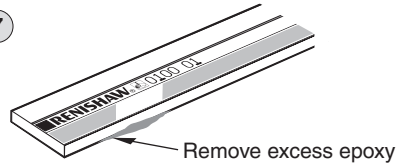

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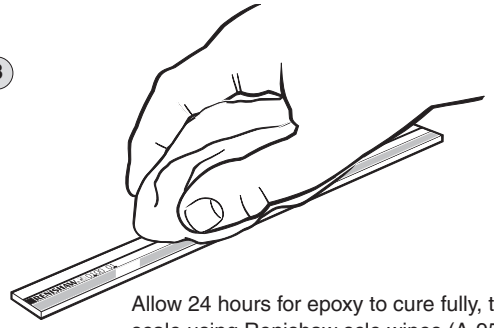
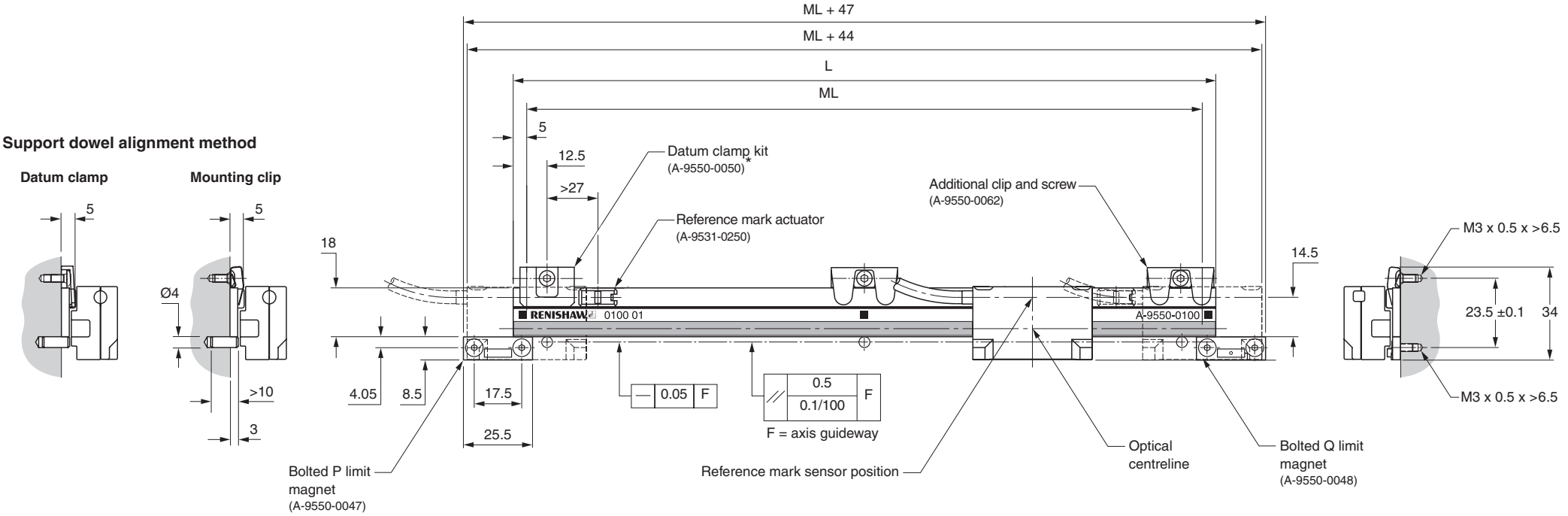


Allow 24 hours for epoxy to cure fully, then clean scale using Renishaw scle wipes (A-9523-4040) or a clean, dry, lint-free cloth.

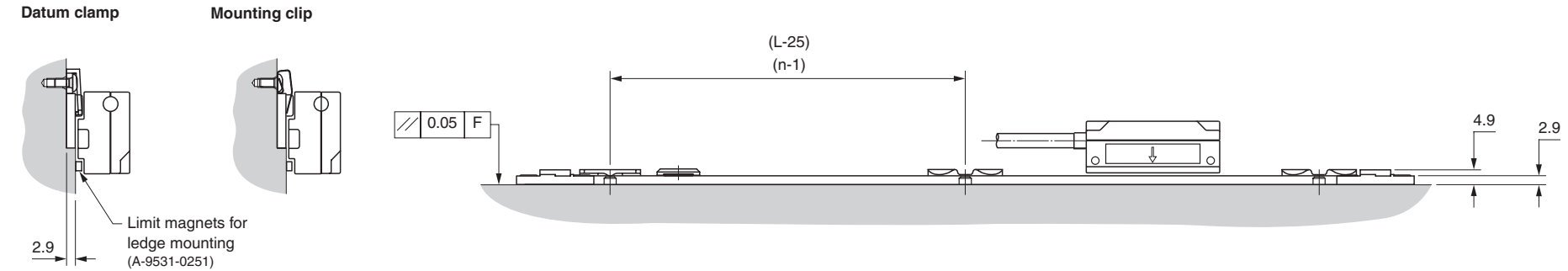
RGS40-G glass scale installation drawing (clip/clamp mounting)

Dimensions and tolerances in mm

Support dowel alignment method



Alternative ledge alignment method

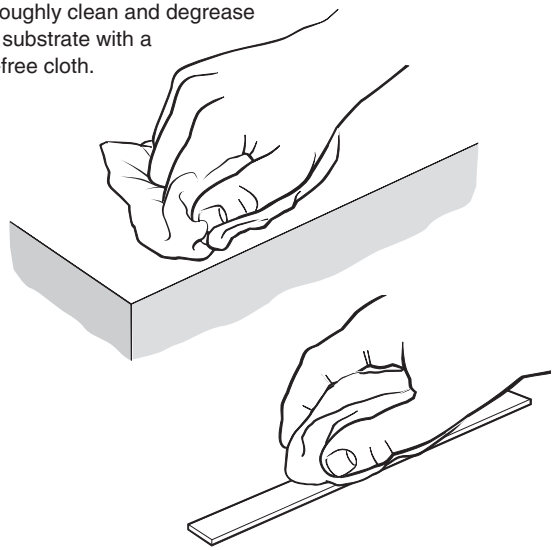


Scale length L (mm)	130	180	230	280	310	400	510	760	1010
Measuring length ML (mm)	120	170	220	270	300	390	500	750	1000
Recommended number of support dowels, n	3	3	3	3	3	3	3	4	5

***Datum clamp kit includes:**
1 x datum clamp
1 x datum clip shim
2 x mounting clip (Additional mounting clips available to order A-9550-0062)
3 x screw
2 x single IPA cleaning wipes

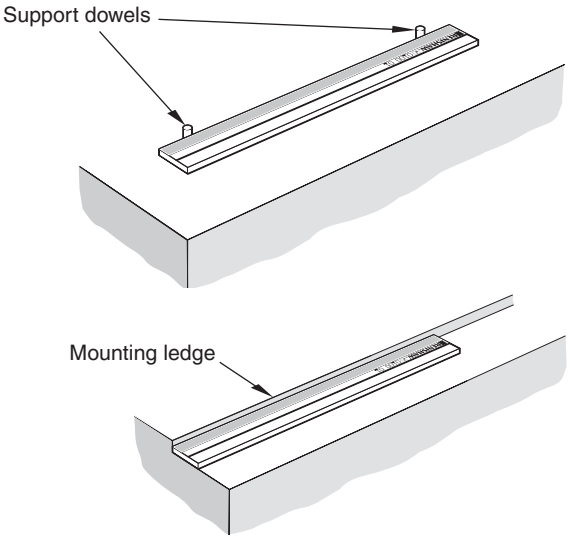
Clip/clamp mounting installation

1 Throughly clean and degrease the substrate with a lint-free cloth.



Clean underside of glass scale using approved solvents (see 'Storage and handling').

2



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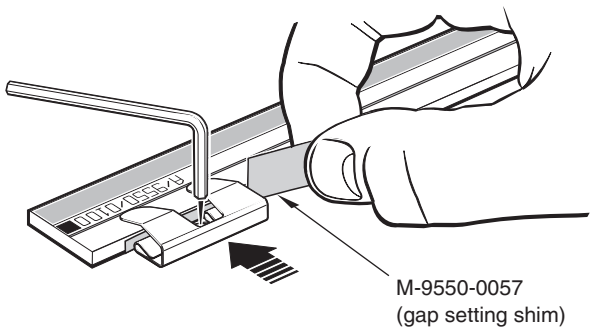
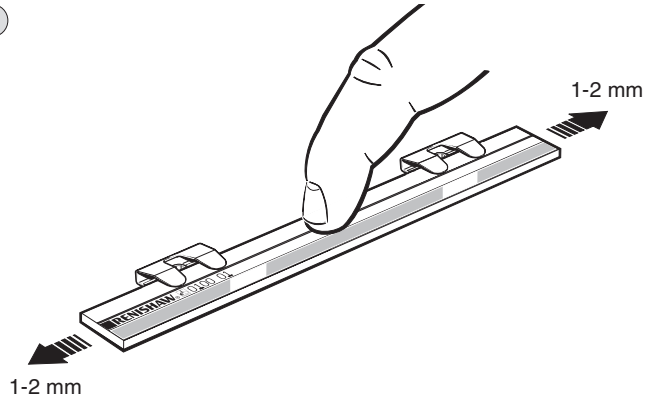


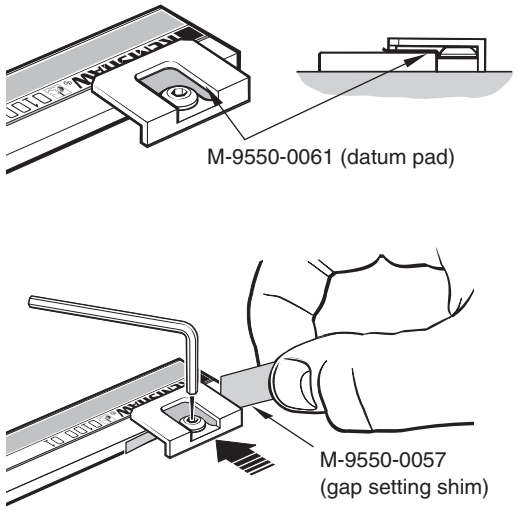
Repeat as necessary.

4



Ensure scale can move so free to expand/contract.

5



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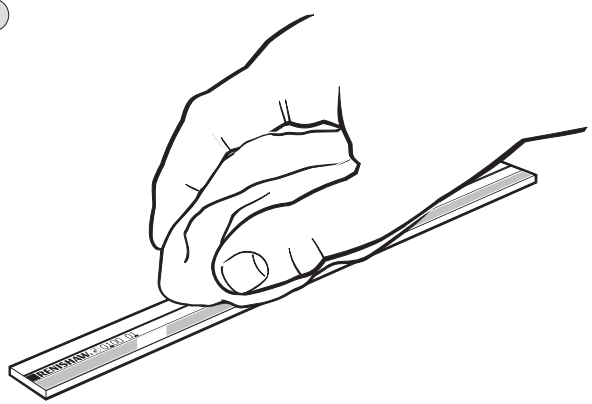


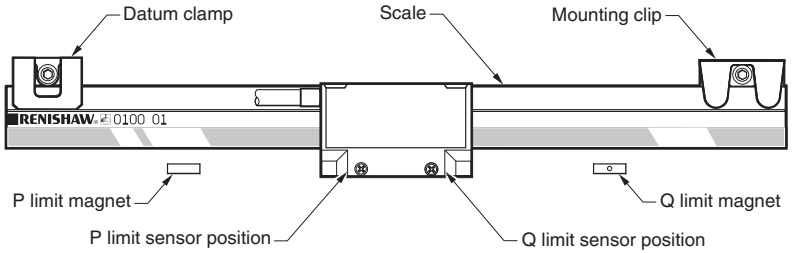
Clean scale using Renishaw scle wipes (A-9523-4040) or a clean, dry, lint-free cloth.

Reference mark actuator installation

Refer to RGH40 readhead installation drawing and RGS40-G scale installation drawings for actuator positioning. Reference mark actuator (A-9531-0250) should be mounted using RGG-2 epoxy (A-9531-0342). Ensure epoxy is thoroughly mixed prior to use. Allow 24 hours at 20 °C for full cure.

Limit switch installation

Screw mounted or adhesive mounted limit switch actuators are available. Refer to RGH40 readhead installation drawing and RGS40-G scale installation drawings for actuator positioning.



Adhesive P and Q limit magnets (A9531-0251) should be mounted using RGG-2 epoxy (A-9531-0342). Ensure epoxy is thoroughly mixed prior to use. Allow 24 hours at 20 °C for full cure.

Optional bolted limit magnets available, see RGH40 installation drawing for details.

Readhead mounting and alignment

Mounting brackets

The bracket must have a flat mounting surface, enable conformance to the installation tolerances, allow adjustment to the rideheight of the readhead, and be sufficiently stiff to prevent deflection or vibration of the readhead during operation.

For easier installation, adjust the roll and yaw of the bracket with respect to the axis of readhead travel before the RGH40 is attached. This can be done with a clock gauge and a precision square.

Readhead set-up

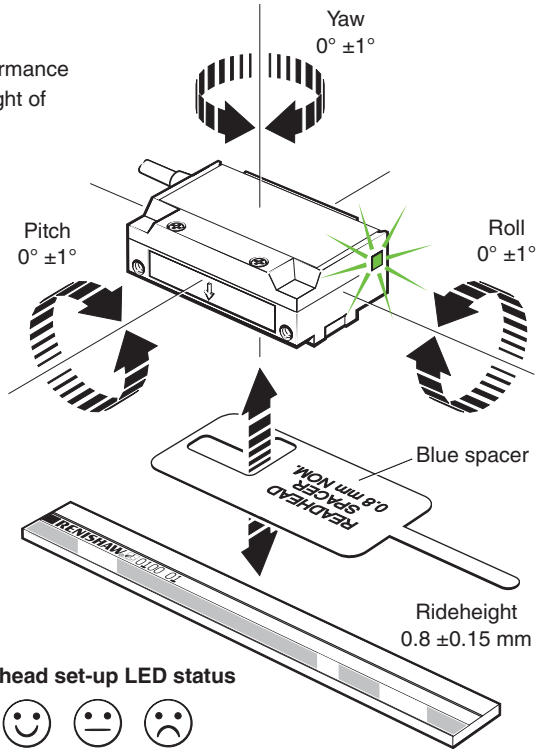
To set nominal rideheight, position readhead spacer with 'L' shaped aperature under the optical centre of the readhead to allow normal LED function during set-up procedure. Ensure that the scale, readhead optical window and mounting face are clean and free from obstructions.

NOTE: Ensure readhead fixing screws are tightened to 0.5 Nm – 0.7 Nm.

For reliable operation, the set-up LED should be GREEN when readhead is moved along the full axis of travel.

An external set-up signal, X, is also available on RGH40 readheads for use where the LED is not visible.

See 'Output specifications' for details.



Readhead set-up LED status

Green Orange Red

Reference mark set-up

To ensure uni-directional repeatability, the reference mark requires phasing with the scale in the direction of normal datuming operation.

A reference pulse is output in both directions, but repeatability is guaranteed only in the phased direction.

Ensure readhead is set-up correctly with a Green LED indication over the full length of travel and that the reference mark actuator is fitted correctly.

NOTE: It is recommended that a datum procedure is performed as part of any power-up sequence to ensure the correct datum position is recorded.

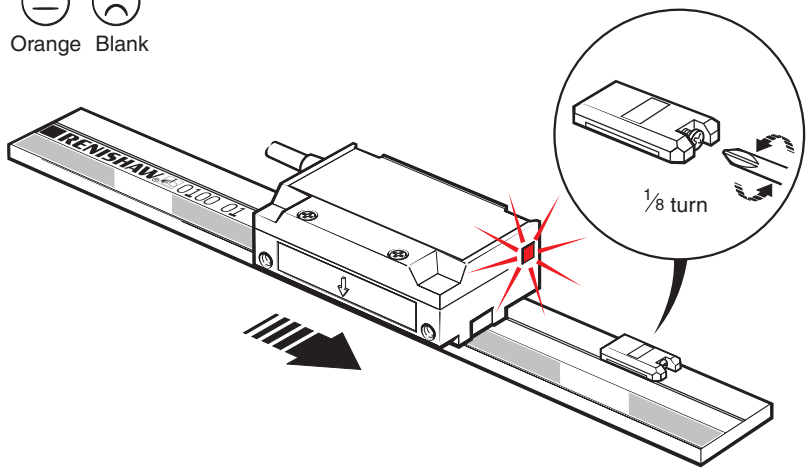
NOTE: Reference mark output is synchronised with the incremental channels, giving unit of resolution pulse width. For further details see 'Output specifications'.

Phasing procedure

The readhead must be moved over the reference mark in the direction to be used for the datuming operation. The reference mark is phased correctly when the set-up LED flashes Red for 0.25 seconds. If it flashes Orange or goes blank, the reference mark adjuster screw should be turned anti-clockwise by $\frac{1}{8}$ turn and the procedure repeated until a Red flash is obtained.

Readhead set-up LED flash during reference mark traverse only

Red Orange Blank



Limit switch

Limit switch detection is entirely independent of other readhead functions - the signal is only output when the readhead is positioned over the limit switch actuator.

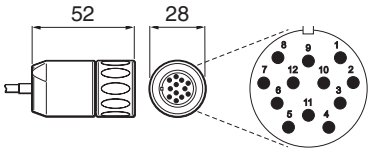
Output signals

RGH40A 1Vpp analogue

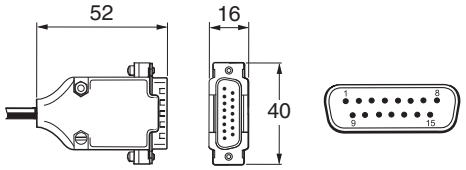
Function	Signal		Colour	15 way D-type plug (L)	12 way circular (V)	12 way circular coupling (W)	16 way in-line connector (X)
Power	5 V		Brown	4	2	2	A
			Brown (link)	5	12	12	M
	0 V		White	12	10	10	B
			White (link)	13	11	11	N
Incremental signals	V_1	+	Red	9	5	5	F
		-	Blue	1	6	6	R
	V_2	+	Yellow	10	8	8	D
		-	Green	2	1	1	G
Reference mark	V_0	+	Violet	3	3	3	K
		-	Grey	11	4	4	O
Limit switch	V_q		Pink	8	N/C	N/C	H
	V_p		Clear	7	N/C	N/C	E
BID DIR connections*	BID		Black	6	9†	9††	I
	DIR		Orange	14	7†	7††	P
Shield	Inner		Green / Yellow	15	11 (link)	11 (link)	L
	Outer		–	Case	Case	Case	Case

†Only connected with option 17 ††Only connected with option 18

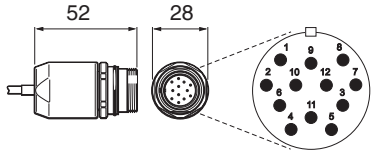
12 pin circular plug (termination code V)



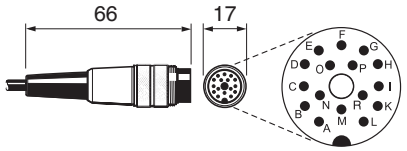
15 pin D-type plug (termination code L)



12 pin circular coupling (termination code W)



In-line connector plug (termination code X)



*Reference mark uni-directional operation

The RGH40 reference mark output is repeatable for one direction of travel only.

Certain controllers will flag an error when they detect different reference mark positions in the forward and reverse directions.

BID/DIR pins allow the readhead to be configured to ignore the reference pulse output in one direction (see section 'Reference mark set-up').

BID/DIR connections

BID / DIR connection For bi-directional operation (normal)	To:-	Reference mark output direction
BID	+5 V or not connected	Forward **and** reverse
DIR	Do not connect	

BID / DIR connection For uni-directional operation	To:-	Reference mark output direction
BID	0 V	
DIR	+5 V or not connected	Forward **only**
DIR	0 V	Reverse **only**

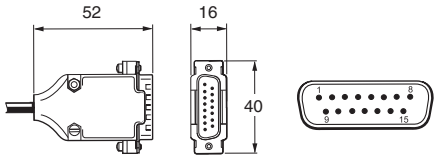
Output signals (continued)

RGH40T, D, G, X, N, W, Y, H RS422A digital

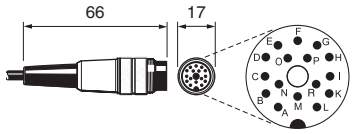
Function	Signal		Colour	15 way D-type plug (D)	16 way in-line connector (X)
Power	5 V		Brown	7	A
			Brown (link)	8	M
	0 V		White	2	B
			White (link)	9	N
Incremental signals	A	+	Green	14	G
		-	Yellow	6	D
	B	+	Blue	13	R
		-	Red	5	F
Reference mark	Z	+	Violet	12	K
		-	Grey	4	O
Limit switch	Q		Pink	10	H
	P		Black	11	I
Alarm*	E-		Orange	3	P
External set-up	X		Clear	1	E
Shield	Inner		Green / Yellow	15	L
	Outer		–	Case	Case

*Alarm channel E- (Option 05) or line driver 3-state (Option 06)

15 pin D-type plug (termination code D)



In-line connector plug (termination code X)



Speed

Digital readheads

Non-clocked output readheads

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

Clocked output readheads

The RGH40N, W, Y and H readheads are available with a variety of different clocked outputs. Customers must ensure they comply with the lowest recommended counter input frequency.

Options	Maximum speed (m/s) Head type				Lowest recommended counter input frequency (MHz)
	N (0.4 µm)	**W** (0.2 µm)	**Y** (0.1 µm)	**H** (50 nm)	
61	3	2.5	1.3	0.6	20
62	2.6	1.3	0.7	0.3	10
63	1.3	0.7	0.35	0.15	5

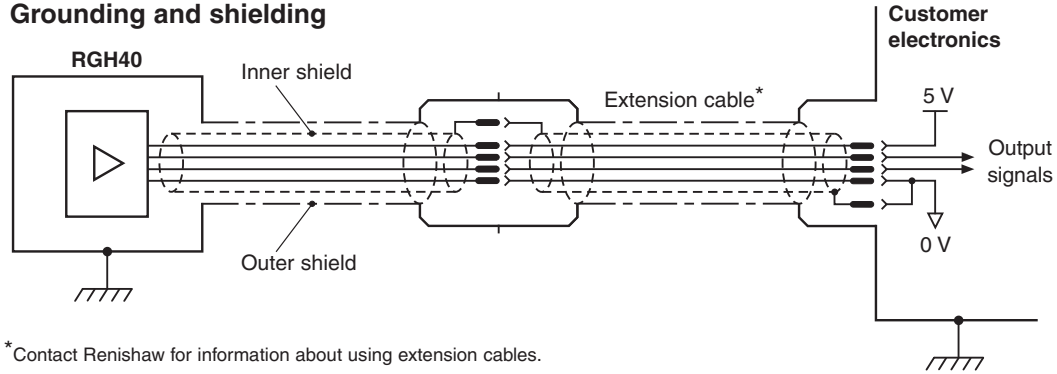
NOTE: Maximum speeds of clocked output variants assume 3 m maximum cable length and minimum 5 V supply at readhead connector.

Analogue readhead

RGH40A - 8 m/s (-3dB)

Electrical connections

Grounding and shielding

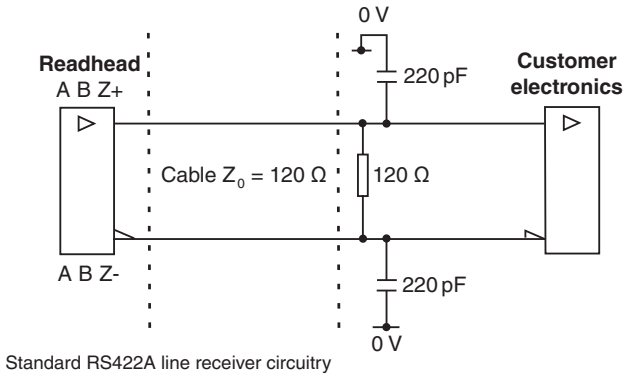


*Contact Renishaw for information about using extension cables.

IMPORTANT: The outer shield should be connected to the machine earth (Field Ground). The inner shield should be connected to 0 V at receiving electronics only. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a short between 0 V and earth, which could cause electrical noise issues.

Recommended signal termination

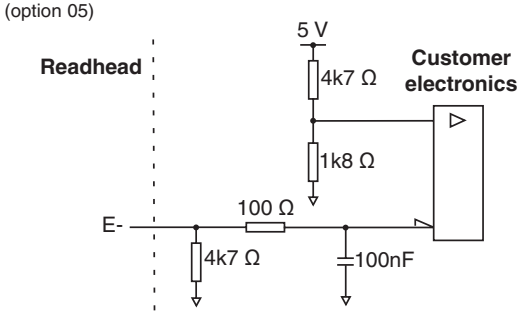
Digital outputs – RGH40T, D, G, X, N, W, Y, H



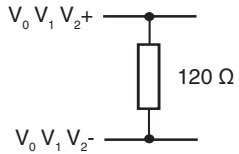
Standard RS422A line receiver circuitry
Capacitors recommended for improved noise immunity.

Single ended alarm signal termination

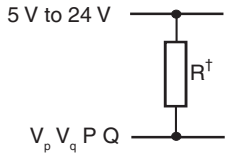
(option 05)



Analogue output – RGH40A



Limit output



†Select R so that the maximum current does not exceed 20 mA.

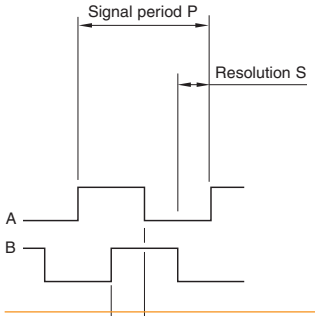
Alternatively, use a suitable relay or opto-isolator.

Output specifications

Digital output signals – RGH40T, D, G, X, N, W, Y, H

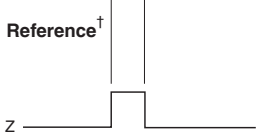
Form – Square wave differential line driver to EIA RS422A (except limit switch P, Q, Alarm E- and external set-up signal, X)

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



Model	P (µm)	S (µm)
RGH40T	40	10
RGH40D	20	5
RGH40G	8	2
RGH40X	4	1
RGH40N	1.6	0.4
RGH40W	0.8	0.2
RGH40Y	0.4	0.1
RGH40H	0.2	0.05

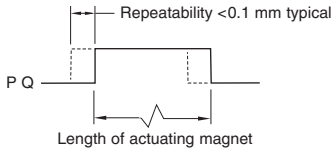
Reference†



Synchronised pulse Z, duration as resolution S. Repeatability of position (uni-directional) maintained within ±10 °C from temperature at time of phasing and for speeds <250 mm/s.

For RGH40N, W, Y, H only, Z pulse re-synchronised at power-up with any one of the quadrature states (00, 01, 11, 10).

Limit open collector output, asynchronous pulse



†Inverse signal not shown for clarity

Alarm

RGH40T, D, G and X

Alarm output asserted when <15% signal

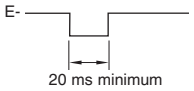
Option	Alarm type
05	single ended line driven output
06	3-state output

RGH40N, W, Y and H
Options 61, 62 and 63

Single ended line driven output alarm asserted when >150% signal or overspeed

3-state output alarm asserted when <15% signal

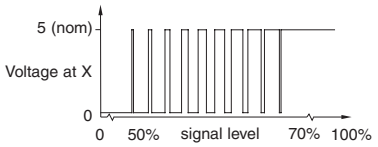
Line driven alarm output



3-state alarm output

Differentially transmitted signals forced open circuit for >20 ms when alarm conditions valid.

Set-up



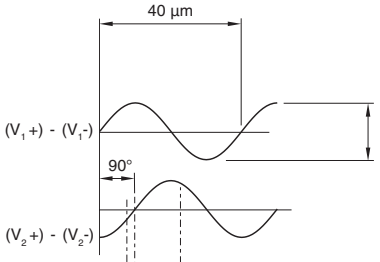
Between 50% and 70% signal level X is a duty cycle.

Time spent at 5 V increases with signal level.

At >70% signal level X is nominal 5V.

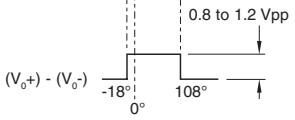
Analogue output signals – RGH40A

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



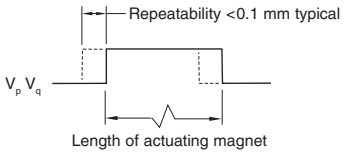
0.7 - 1.2 Vpp with green LED indication and 120 Ω termination when signal is differentially received

Reference



Differential pulse V_0 -18° to 108°. Duration 126° (electrical). Repeatability of position (uni-directional) maintained within ±10 °C from temperature at time of phasing and for speeds <250 mm/s

Limit open collector output, asynchronous pulse



General specifications

Power supply	5 V ± 5%	RGH40A, T, D, G and X <120 mA RGH40N, W, Y and H <150 mA **NOTE:** Current consumption figures refer to unterminated readheads. For digital outputs a further 35 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 maximum.
Temperature	Storage	-20 °C to +70 °C
	Operating	0 °C to +55 °C
Humidity		95% relative humidity (non-condensing) to EN 60068-2-78
Sealing		IP50
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	50 g
	Cable	38 g/m
Cable		12 core, double shielded, outside diameter 4.5 ±0.2 mm. Flex life >20 x 10^6 cycles at 50 mm bend radius.

The RGH40 series readheads have been designed to the relevant EMC standards, but must be correctly integrated to achieve EMC compliance. In particular, attention to shielding and earthing arrangements is essential.

Scale specifications

Material	Chrome on glass
Form (H x W)	2.9 mm x 18 mm
Scale period	40 µm
Coefficient of thermal expansion	~8.5 µm/m/°C
Mounting	Epoxy datum point and adhesive backing tape, or mechanical datum clamp and mounting clips

Scale length (mm)	130	180	230	280	310	400	510	760	1010
Accuracy (±µm)	0.7	0.9	1.1	1.3	1.4	1.8	2.2	3.2	4.2

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