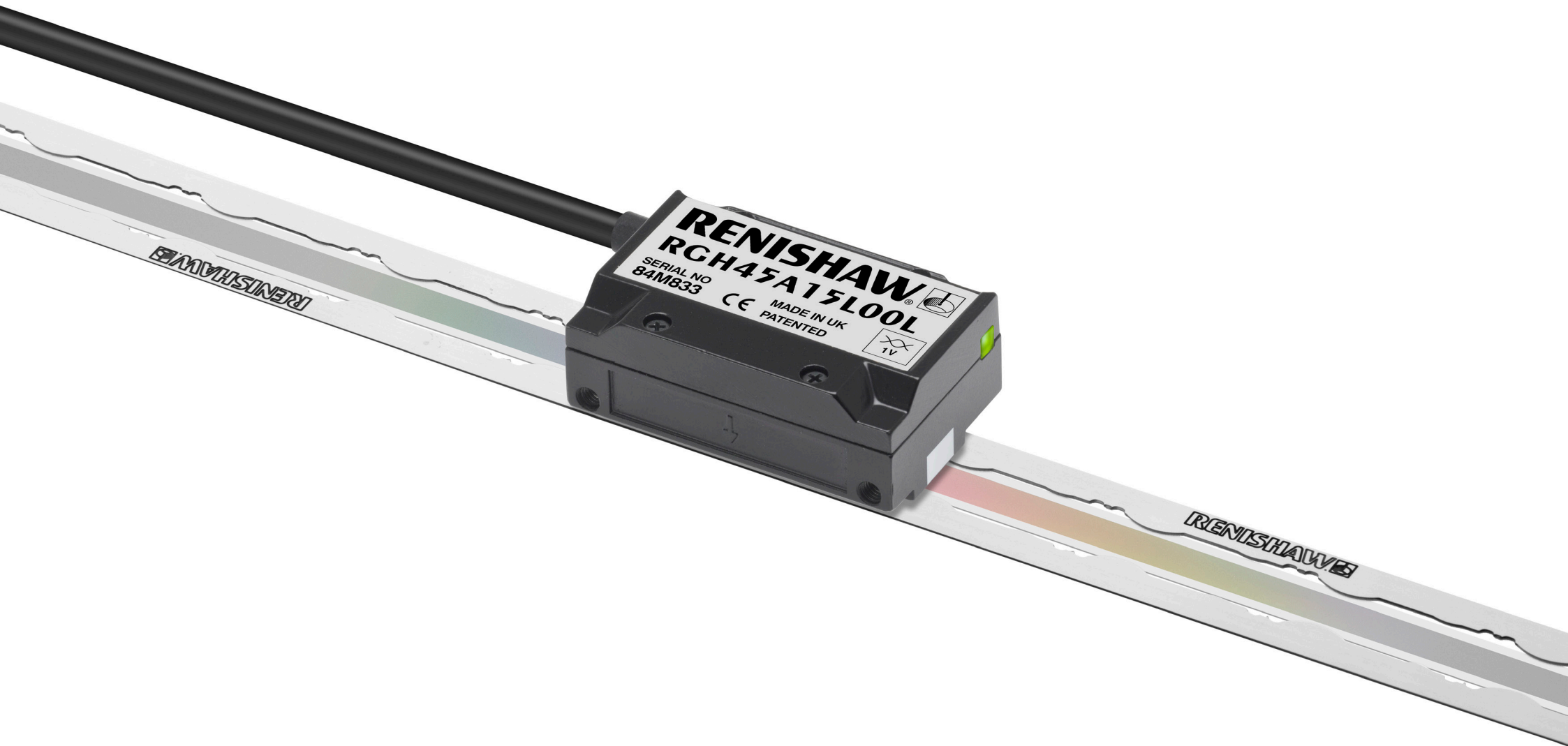


RGH45 RTL40/FASTRACK™ linear encoder system



Contents

Product compliance	1
Storage and handling	2
RGH45 readhead installation drawing	3
RTL40/<i>FASTRACK</i> installation drawing	4
RTL40/<i>FASTRACK</i> installation	5
Readhead mounting and alignment	7
Reference mark set-up	7
Output signals	8
Electrical connections	9
General specifications	10
Speed performance	10
Output specifications	11

Product compliance



Renishaw plc declares that RGH45 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)

Patents

Features of Renishaw's encoder systems and similar products are the subjects of the following patents and patent applications:

EP0748436	US5861953	EP826138	JP3676819	US6051971
CN1314511	EP1469969	JP5002559	US2005045586	US8141265
EP2294363	CN102057256	JP2011524534	KR20110033204	

Further information

Further information relating to the RGH45 encoder range can be found in the RGH45 Data sheet (L-9517-9537). 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, or 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.

Disclaimer

RENISHAW HAS MADE CONSIDERABLE EFFORTS TO ENSURE THE CONTENT OF THIS DOCUMENT IS CORRECT AT THE DATE OF PUBLICATION BUT MAKES NO WARRANTIES OR REPRESENTATIONS REGARDING THE CONTENT. RENISHAW EXCLUDES LIABILITY, HOWSOEVER ARISING, FOR ANY INACCURACIES IN THIS DOCUMENT.

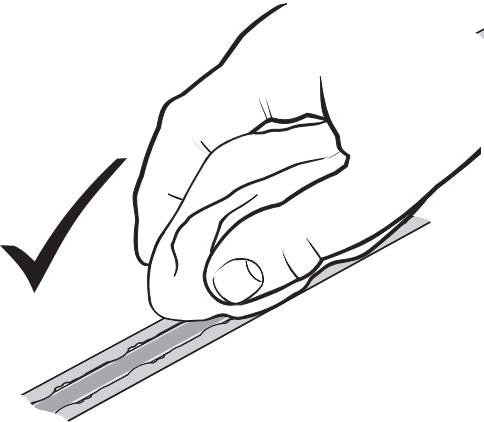
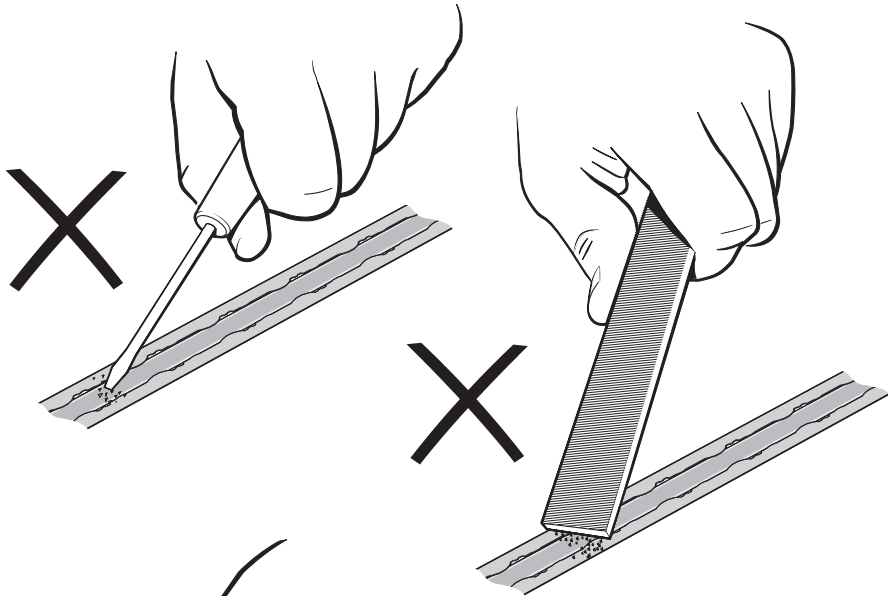
The packaging of our products contains the following materials and can be recycled.

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

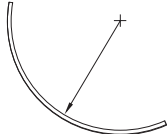


The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic 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.

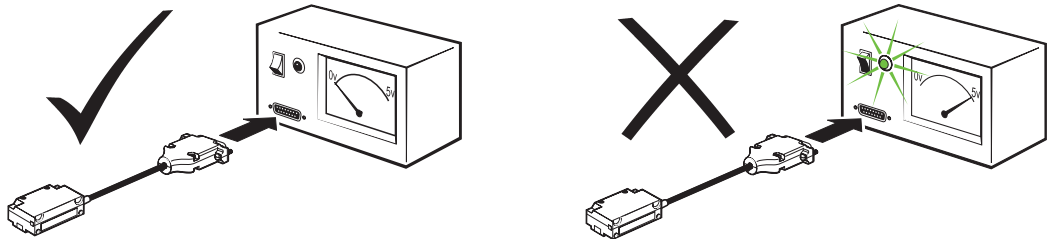
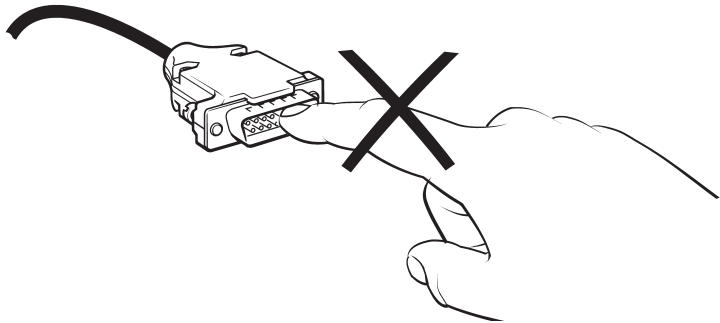
Storage and handling



Minimum bend radius
 RTLR40 – 50 mm
 FASTRACK – 200 mm

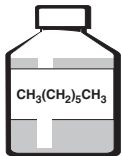


NOTE: Ensure self-adhesive tape is on the outside of bend radius.

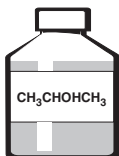


Scale and readhead

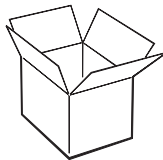
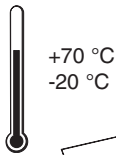
N-heptane



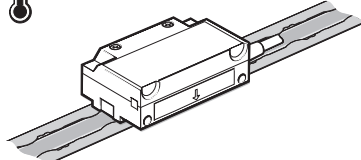
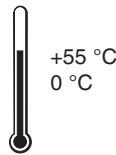
Propan-2-ol



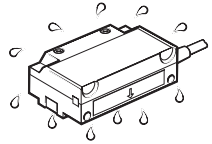
Storage



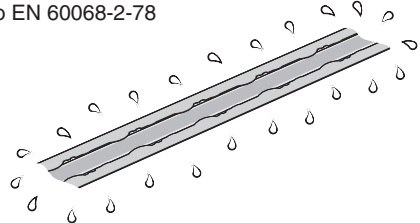
Operating



Humidity



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

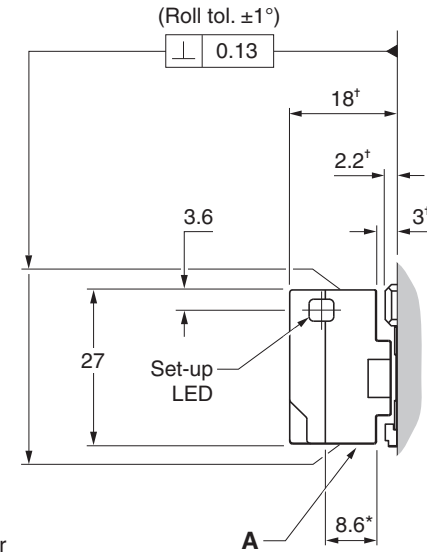
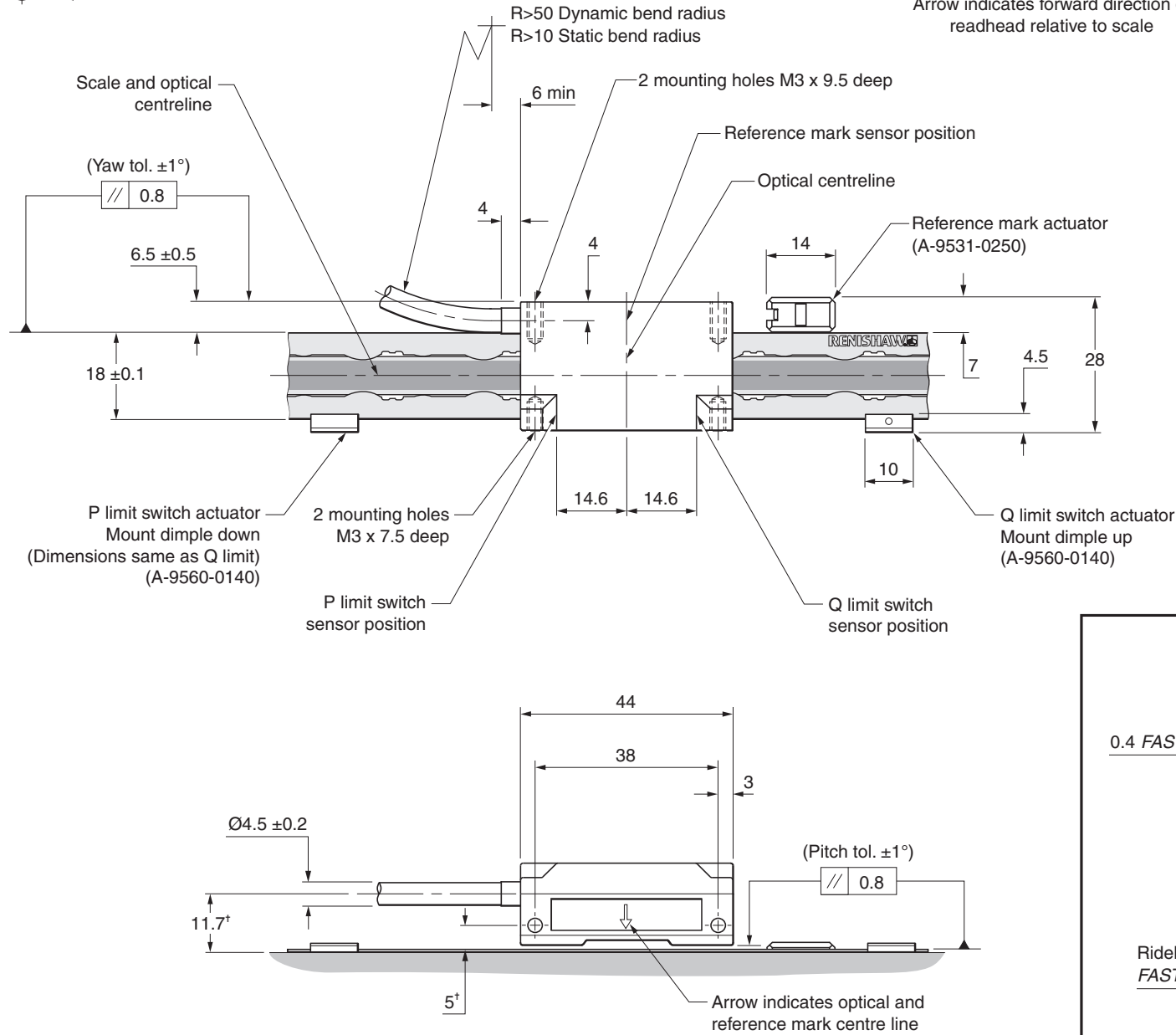


RGH45 readhead installation drawing

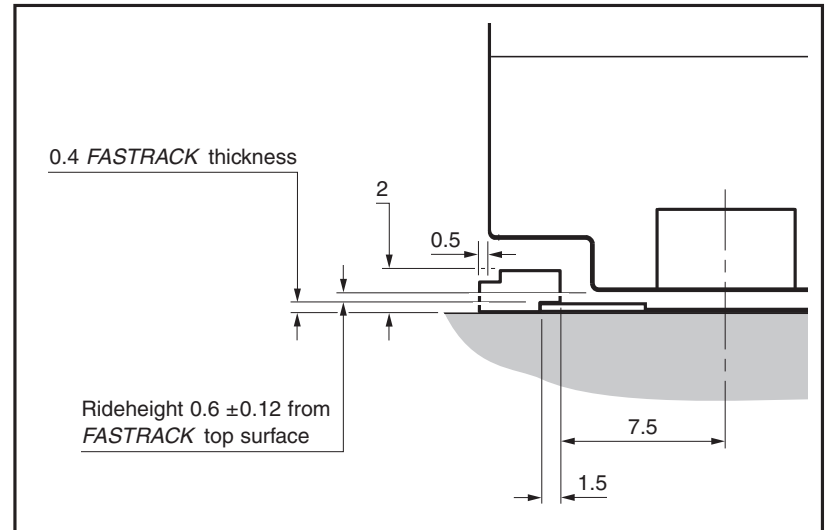
Dimensions and tolerances in mm



←
Arrow indicates forward direction of readhead relative to scale



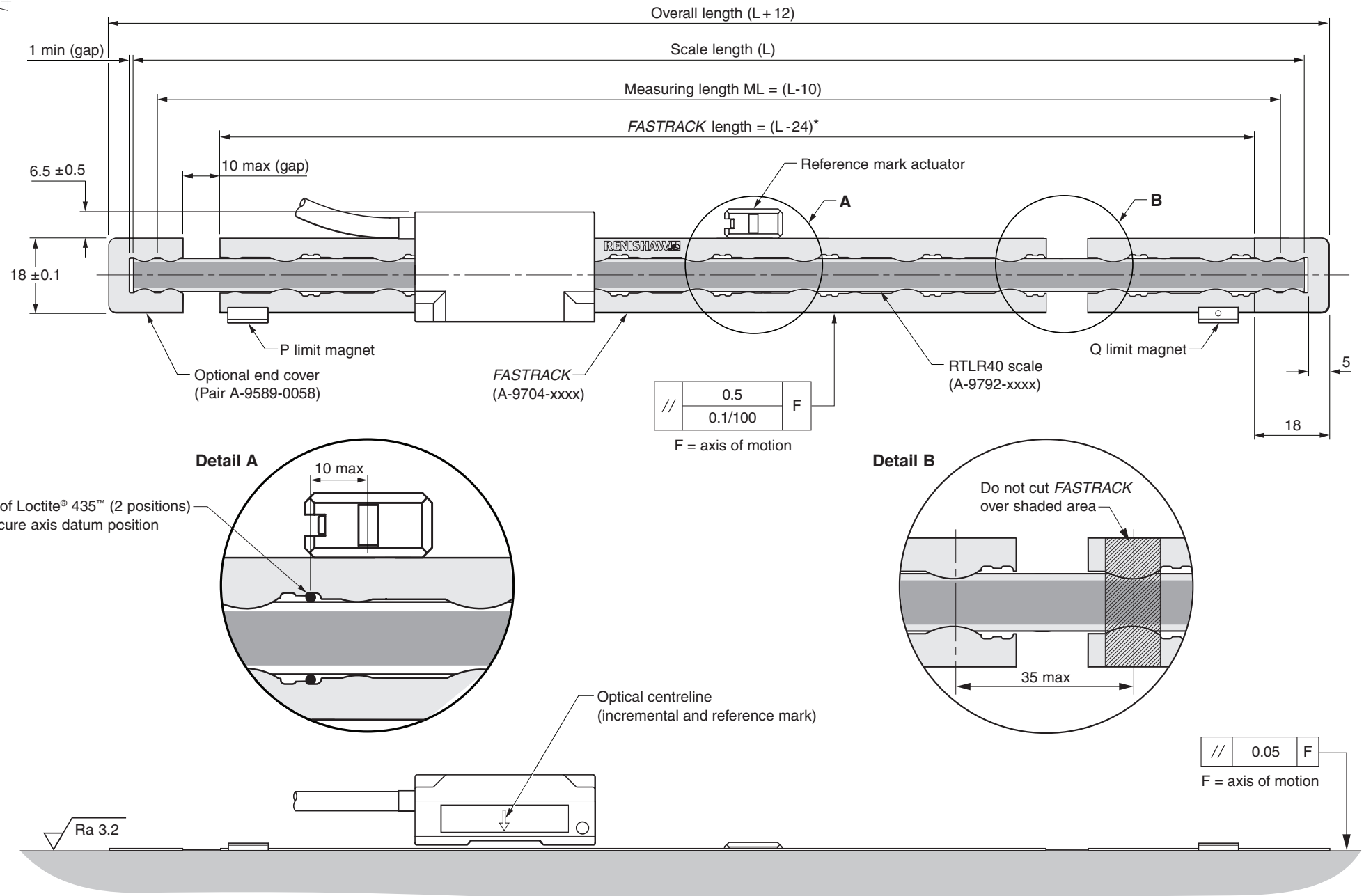
Detail A



*Extent of mounting faces. †Dimensions from substrate.

RTL40/FASTRACK installation drawing (adhesive datum clamp)

Dimensions and tolerances in mm



*Assumes 1 mm gap between scale and end covers and zero gap between FASTRACK and end covers. **NOTE:** Minimum recommended FASTRACK length = 100 mm

RTL40/FASTRACK installation

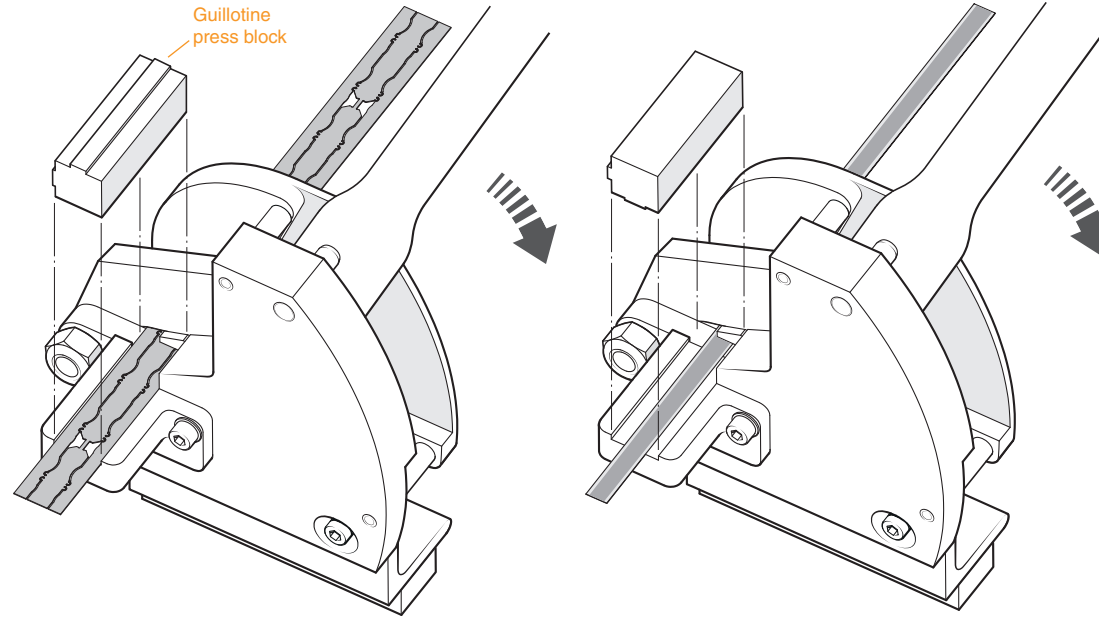
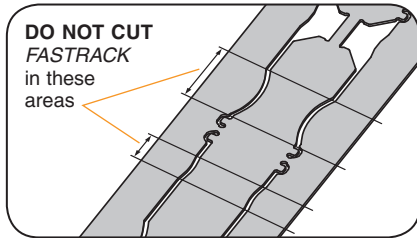
During handling or installation of *FASTRACK* suitable gloves should be worn to protect against injury from sharp edges.

- 1 If required cut *FASTRACK* and scale to length (separately) using guillotine (A-9589-0071) after referring to installation drawing.

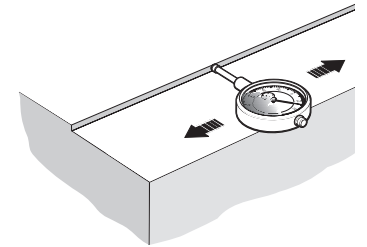
Guillotine should be held securely in place, using a suitable vice or clamping method.

Feed *FASTRACK* or scale through the guillotine as shown, and place guillotine press block down onto the *FASTRACK*/scale.

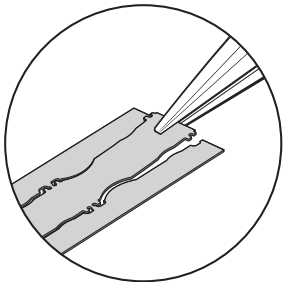
Ensure the block is in the correct orientation (as shown). Whilst holding the block in place, in a smooth motion, pull down the lever to cut through the *FASTRACK*/scale.



- 2 Thoroughly clean and degrease the substrate and allow to dry. For *FASTRACK* location a ledge, separate straight edge(s) or dowels can be used. Check alignment of ledge/separate straight edge(s) with respect to axis of motion (see installation drawing).



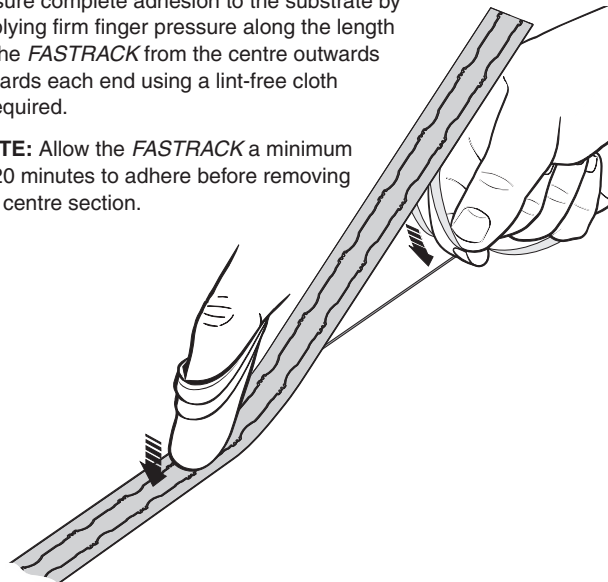
- 3 Before sticking *FASTRACK* to the substrate bend the centre section upwards slightly using a small pair of pliers.



- 4 Remove backing liner and stick to substrate, locating against ledge/separate straight edge(s) or dowels.

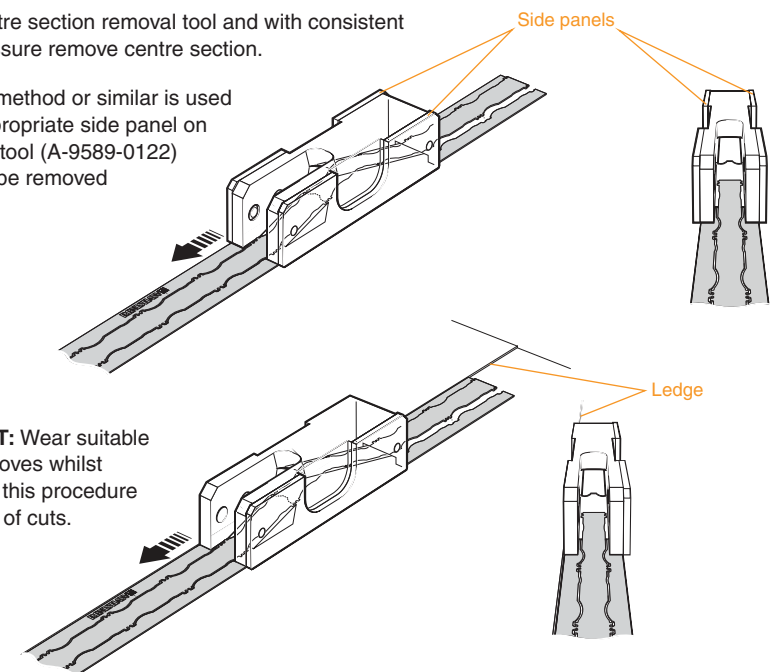
Ensure complete adhesion to the substrate by applying firm finger pressure along the length of the *FASTRACK* from the centre outwards towards each end using a lint-free cloth if required.

NOTE: Allow the *FASTRACK* a minimum of 20 minutes to adhere before removing the centre section.



- 5 Engage centre section removal tool and with consistent forward pressure remove centre section.

If the ledge method or similar is used then the appropriate side panel on the removal tool (A-9589-0122) will need to be removed as shown.



IMPORTANT: Wear suitable protective gloves whilst carrying out this procedure to avoid risk of cuts.

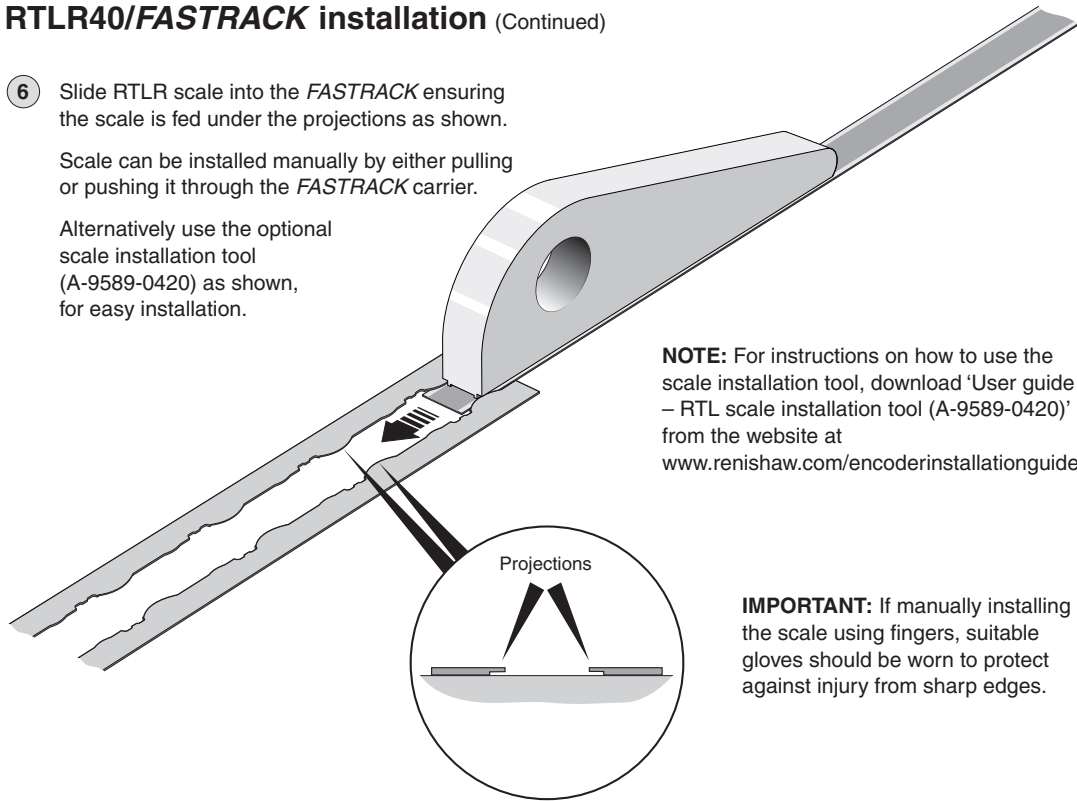


RTL40/FASTRACK installation (Continued)

- 6 Slide RTL scale into the *FASTRACK* ensuring the scale is fed under the projections as shown.

Scale can be installed manually by either pulling or pushing it through the *FASTRACK* carrier.

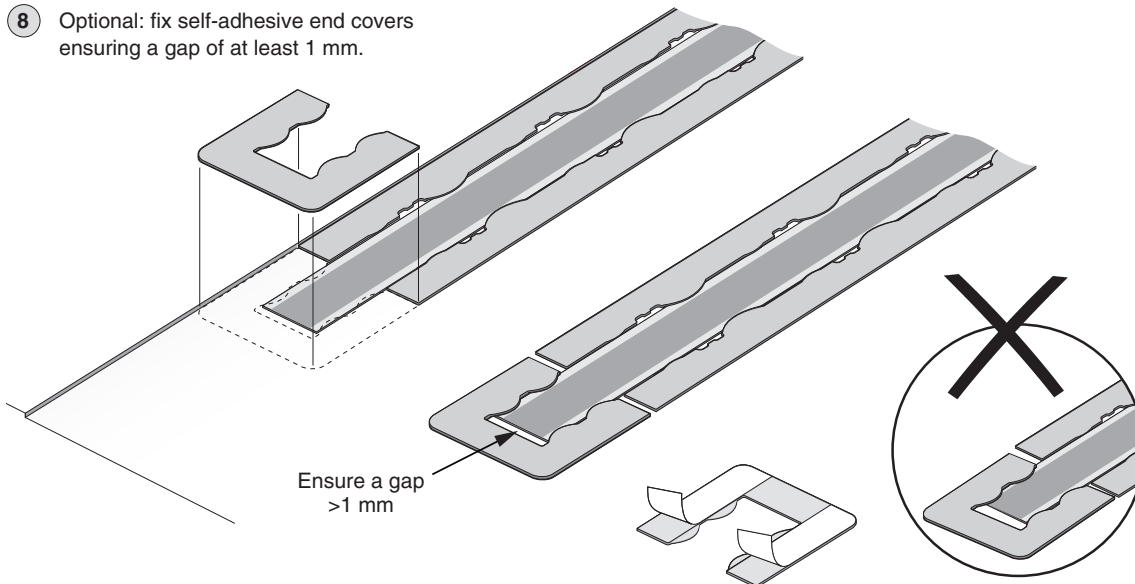
Alternatively use the optional scale installation tool (A-9589-0420) as shown, for easy installation.



NOTE: For instructions on how to use the scale installation tool, download 'User guide – RTL scale installation tool (A-9589-0420)' from the website at www.renishaw.com/encoderinstallationguides.

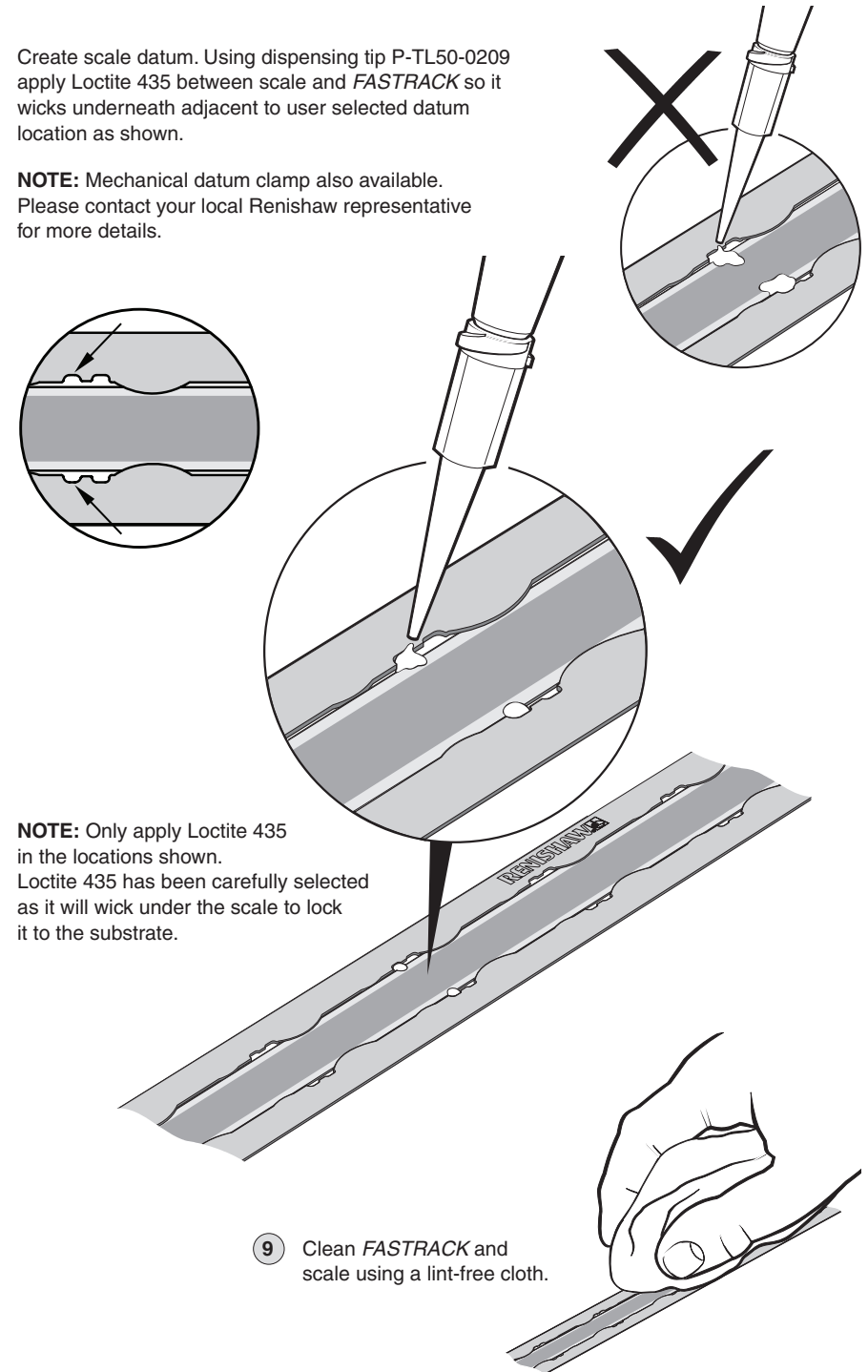
IMPORTANT: If manually installing the scale using fingers, suitable gloves should be worn to protect against injury from sharp edges.

- 8 Optional: fix self-adhesive end covers ensuring a gap of at least 1 mm.



- 7 Create scale datum. Using dispensing tip P-TL50-0209 apply Loctite 435 between scale and *FASTRACK* so it wicks underneath adjacent to user selected datum location as shown.

NOTE: Mechanical datum clamp also available. Please contact your local Renishaw representative for more details.



NOTE: Only apply Loctite 435 in the locations shown. Loctite 435 has been carefully selected as it will wick under the scale to lock it to the substrate.

- 9 Clean *FASTRACK* and scale using a lint-free cloth.

Readhead mounting and alignment

Mounting brackets

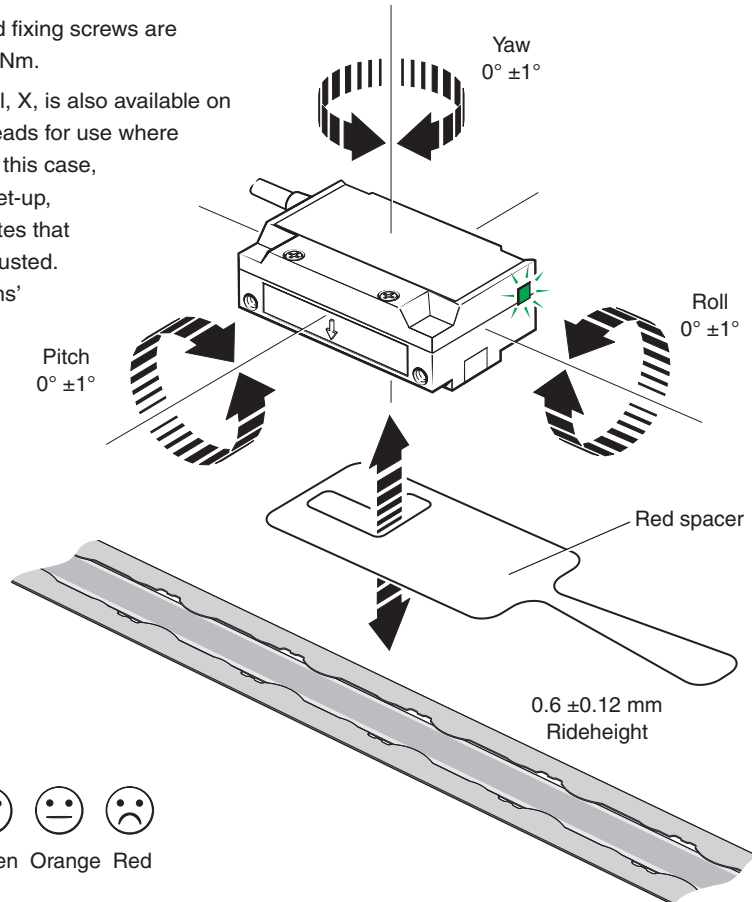
The bracket must have a flat mounting surface, ensure conformance to the installation tolerances, allow adjustment to the rideheight of the readhead, and be sufficiently stiff to prevent deflection of the readhead during operation. For easier installation, the bracket should be adjusted for roll and yaw with respect to the axis of readhead travel before the scale is applied using the appropriate applicator. This can be done with a clock gauge and a precision square.

Readhead set-up

Ensure that the scale, readhead window and mounting face are clean and free from obstructions. To set nominal rideheight, the red readhead spacer should be positioned with the aperture under the optical centre to allow normal LED function during set-up procedure. The scale, readhead optical window and mounting face should be clean and free from obstructions. When correctly installed, the set-up LED should be Green. The readhead should be moved slowly to ensure the set-up LED remains Green along the full axis of travel.

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

An external set-up signal, X, is also available on all digital RGH45 readheads for use where the LED is not visible. In this case, 5 V indicates optimum set-up, while a 0 V signal indicates that the set-up should be adjusted. See 'Output specifications' for further details.



Reference mark and limit installation

Limit magnets can be positioned at any user defined location along the *FASTRACK*, but the reference mark actuator should be positioned adjacent to the scale datum point.

Mix up a sachet of glue (A-9531-0342) and apply a small amount to the underside of the reference mark and limit switches. Align reference mark with the *FASTRACK* edge at scale datum position.



Ensure that the glue does not enter the reference mark adjuster screw.

Reference mark set-up

To ensure unidirectional 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.

The readhead should be set up correctly ensuring a Green LED indication over the full length of travel. The reference mark actuator should be installed as shown on the installation drawing.

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.

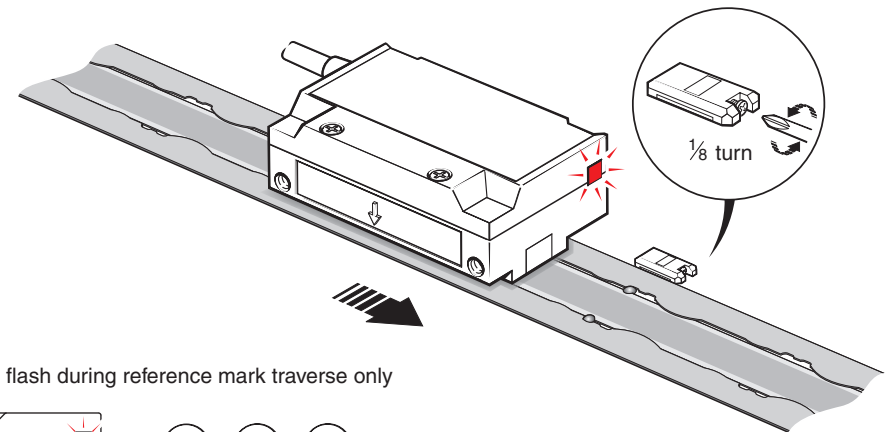
NOTE: Reference mark output is synchronised with the incremental channels, giving unit of resolution pulse width. For further details see 'General specifications'.

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.

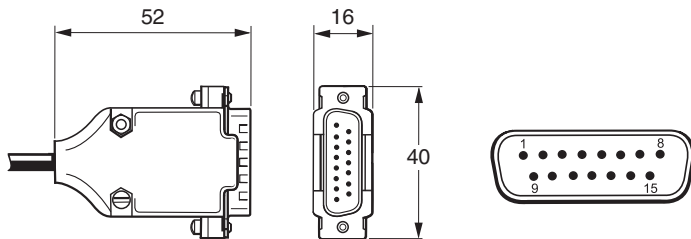


Output signals

RGH45A 1Vpp analogue

Function	Signal	Colour	15-pin D type (L)
Power	5 V	Brown	4
		Brown (link)	5
	0 V	White	12
		White (link)	13
Incremental signals	V ₁	+	Red 9
		-	Blue 1
	V ₂	+	Yellow 10
		-	Green 2
Reference mark	V ₀	+	Violet 3
		-	Grey 11
Reference mark uni-directional operation*	BID	Black	6
	DIR	Orange	14
Limit switch	V _p	Clear	7
	V _r	Pink	8
Shield	Inner	Green/Yellow	15
	Outer	–	Case

15 pin D-type plug (termination code L)



*Reference mark uni-directional operation

The RGH45 reference mark output is repeatable for one direction of travel only.

Certain controllers will flag an error when they see 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 the unphased direction (see section 'Reference mark set-up').

BID/DIR connections

BID/DIR connection	To:-	Reference mark output direction
For bi-directional operation (normal)		
BID	+5 V or not connected	Forward and reverse
DIR	Do not connect	
For uni-directional operation		
BID	0 V	Forward only
DIR	+5 V or not connected	
DIR	0 V	Reverse only

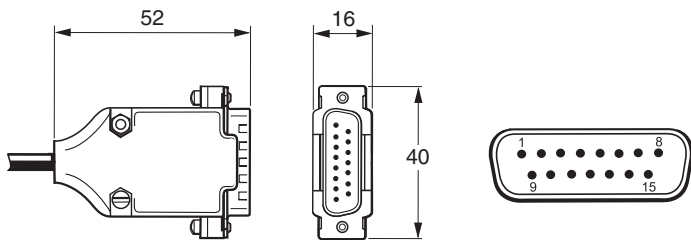
Output signals (continued)

RGH45T, D, G, X, N, W, Y RS422A digital

Function	Signal	Colour	15 pin D-type (D)	
Power	5 V	Brown	7	
		Brown (link)	8	
	0 V	White	2	
		White (link)	9	
Incremental signals	A	+	Green	14
		-	Yellow	6
	B	+	Blue	13
		-	Red	5
Reference mark	Z	+	Violet	12
		-	Grey	4
Limit switch	P	Black	11	
	Q	Pink	10	
Alarm*	E-	Orange	3	
External set-up	X	Clear	1	
Shield	Inner	Green/Yellow	15	
	Outer	-	Case	

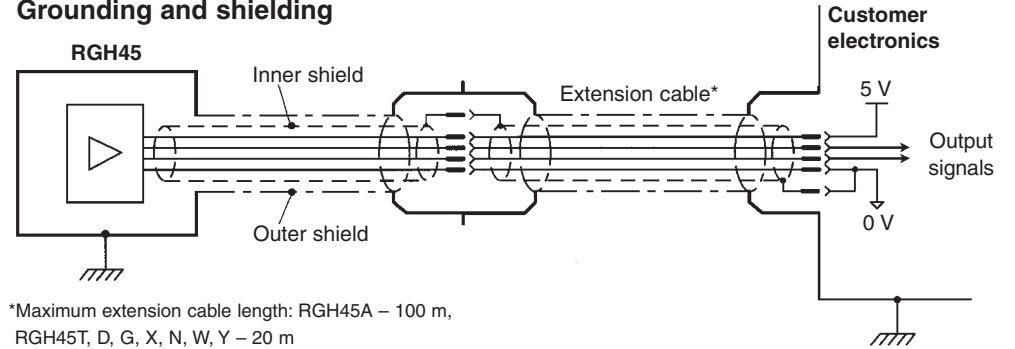
* NOTE: Alarm channel E- (option 05) line driver or 3-state (option 06)

15 pin D-type plug (termination code L)



Electrical connections

Grounding and shielding

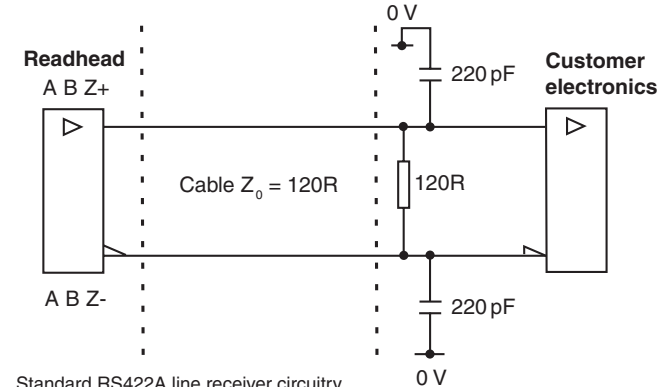


*Maximum extension cable length: RGH45A – 100 m, RGH45T, D, G, X, N, W, Y – 20 m

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.

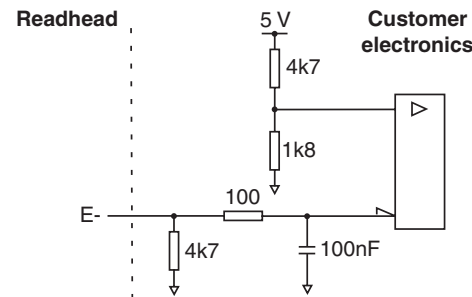
Recommended signal termination

Digital outputs - RGH45T, D, G, X, N, W, Y

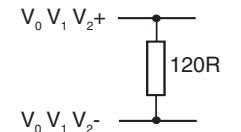


Standard RS422A line receiver circuitry
Capacitors recommended for improved noise immunity.

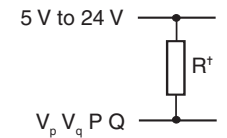
Single ended alarm signal termination (option 05)



Analogue output - RGH45A



Limit output



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

Alternatively, use a relay or opto-isolator.

General specifications

Readhead

Power supply	5 V ±5%	RGH45A <160 mA RGH45T, D, G, X <125 mA RGH45N, W, Y, H <160 mA
	Ripple	200 mVpp maximum@ frequency up to 500 kHz
		NOTE: Current consumption figures refer to unterminated readheads. For digital outputs, a further 25 mA per channel pair (eg A+, A-) will be drawn when terminated with 120 Ω. For analogue outputs, a further 20 mA in total 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.

Sealing		IP50
Acceleration	Non-operating	500 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 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 RGH45 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.

RTL40 scale technical specifications

Form	0.2 mm x 8 mm (H x W)
Datum fixing	Loctite 435
Material	Hardened and tempered martensitic stainless steel
Accuracy (at 20 °C)	±15 µm/m, calibration traceable to International Standards
Coefficient of thermal expansion	10.1 ±0.2 µm/m/°C @20 °C
Maximum length	20 m

FASTRACK technical specifications

Form	0.4 mm x 18 mm (H x W) (includes adhesive)
Material	Hardened and tempered martensitic stainless steel
Coefficient of thermal expansion	10.1 ±0.2 µm/m/°C @20 °C
Mounting	Self-adhesive backing tape
Minimum recommended length	100 mm
Maximum supplied length	25 m
Installation temperature	15 °C to 35 °C

Reference mark	Magnetic actuator Output synchronised with incremental channels Repeatability of position (uni-directional) maintained within these conditions: Temperature ±10 °C from installation temperature, speeds <0.5 m/s, magnetic field steady ±0.02 T or changing ±7.5 T/s
-----------------------	---

Limit switches	Magnetic actuator at user selected locations Repeatability 0.1 mm
-----------------------	--

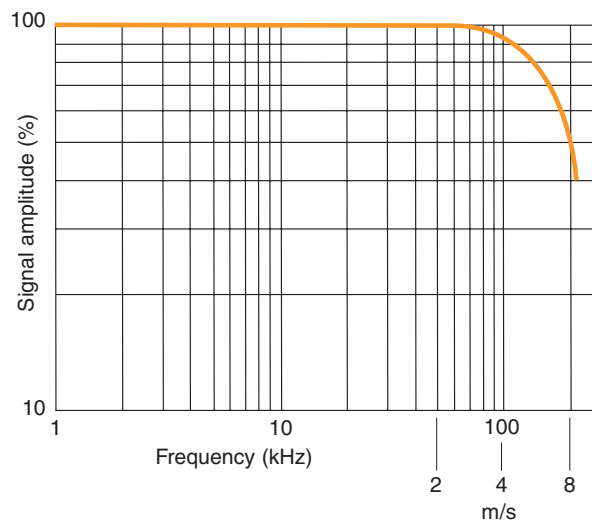
Speed performance

Clocked output readheads

The RGH45N, W, Y readheads are available with a variety of different clocked outputs. The clocked options have been designed to prevent fine edge separations being missed by receiving electronics utilising slower clock speeds. Depending on the clock frequency chosen, each option has a different maximum speed and associated minimum receiver clock frequency.

Digital readheads				
Head type	Maximum speed (m/s)			Minimum receiver clock frequency (MHz)
T D G X	10			$\left(\frac{\text{Encoder velocity (m/s)}}{\text{Resolution (}\mu\text{m)}} \right) \times 4$ safety factor
N, W, Y option	N	W	Y	
61	3.0	2.5	1.3	20
62	2.6	1.3	0.7	10
63	1.3	0.7	0.35	5

Analogue type RGH45A

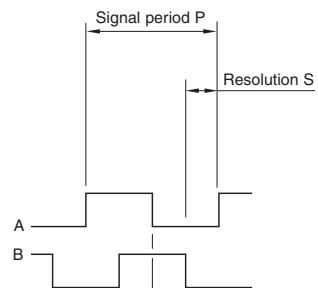


Output specifications

Digital output signals - RGH45T, D, G, X, N, W, Y

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)



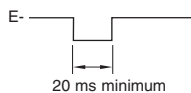
Model	P (µm)	S (µm)
RGH45T	40	10
RGH45D	20	5
RGH45G	8	2
RGH45X	4	1
RGH45N	1.6	0.4
RGH45W	0.8	0.2
RGH45Y	0.4	0.1

Reference[†]



Synchronised pulse Z, duration as resolution S. Repeatability of position (uni-directional) maintained within ±20 °C from temperature at time of phasing and for speeds <0.5 m/s. For RGH45N, W, Y only, Z pulse re-synchronised at power-up with any one of the quadrature states (00, 01, 11, 10).

Alarm single ended line driver output

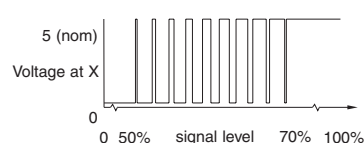


For RGH45T, G, X alarm asserted for signal amplitude <15%. Either asynchronous pulse E- as shown (option 05) or line driver channels 3-state (option 06)

For RGH45N, W, Y, H - alarm E- asserted when:
 - Signal amplitude >150%
 - Readhead exceeds specified maximum speed

Also, outputs are 3-stated at signal amplitude <15%

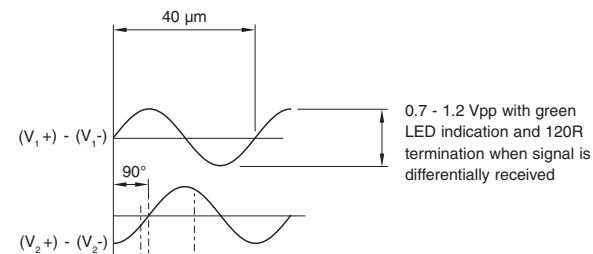
Set-up



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.

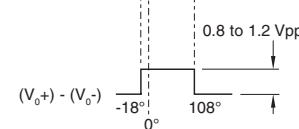
Analogue output signals - RGH45A

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



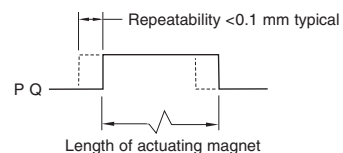
0.7 - 1.2 Vpp with green LED indication and 120R termination when signal is differentially received

Reference



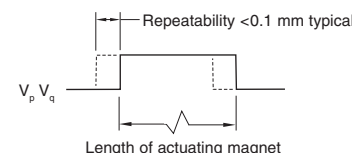
Differential pulse V_0 -18° to 108°. Duration 126° (electrical). Repeatability of position (uni-directional) maintained within ±20 °C from temperature at time of phasing and for speeds <0.5 m/s

Limit open collector output, asynchronous pulse



[†]Inverse signal not shown for clarity

Limit open collector output, asynchronous pulse



Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW 
apply innovation™

For worldwide contact details,
please visit our main website at
www.renishaw.com/contact

RENISHAW and the probe symbol used in the RENISHAW logo are registered trade marks of Renishaw plc in the United Kingdom and other countries.
apply innovation and names and designations of other Renishaw products and technologies are trade marks of Renishaw plc or its subsidiaries.
Loctite® is a registered trademark of the Henkel Corporation.

© 2012-2017 Renishaw plc All rights reserved Issued 0517



M - 9787 - 9017 - 01