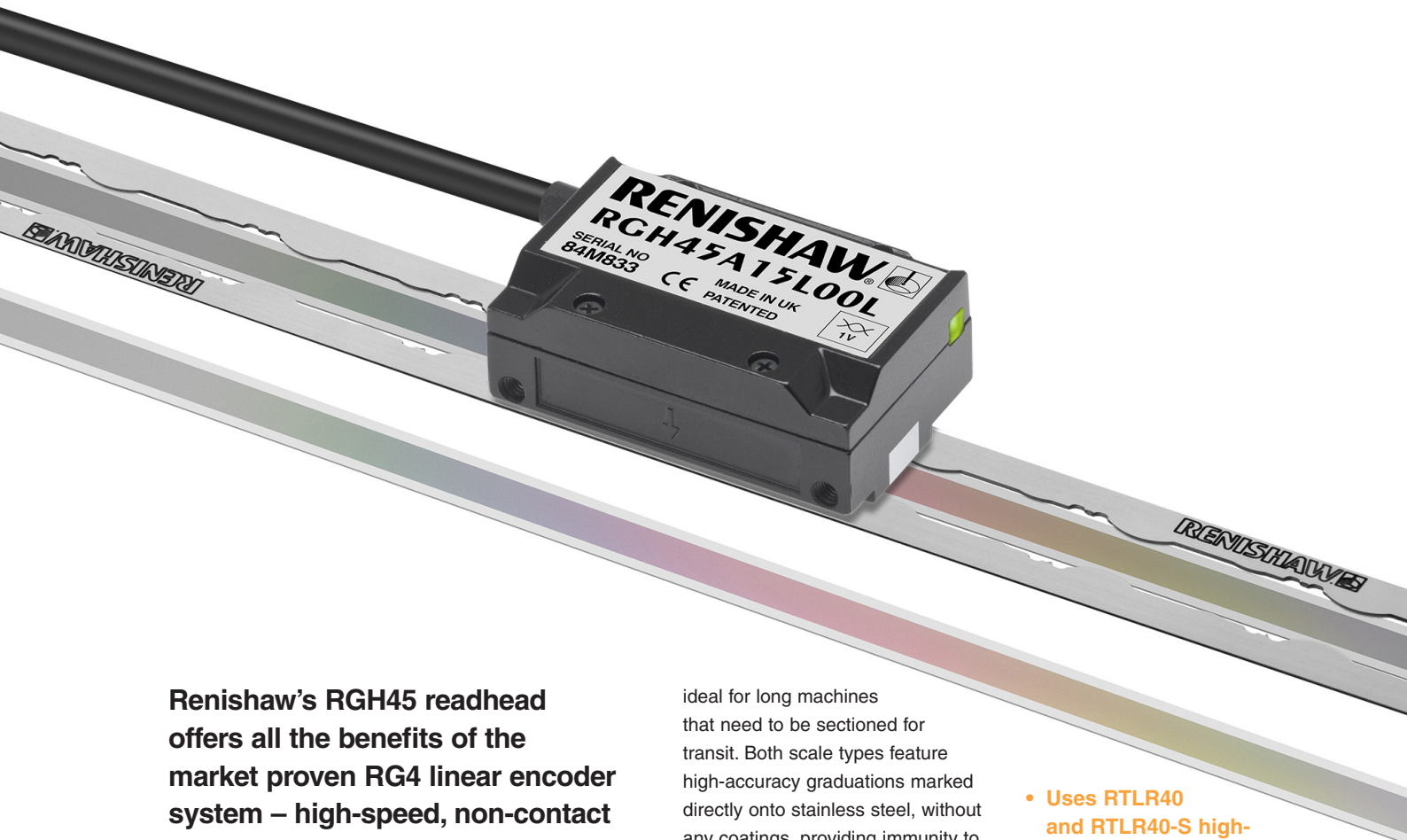


# RGH45 encoder system (limited)



**Renishaw's RGH45 readhead offers all the benefits of the market proven RG4 linear encoder system – high-speed, non-contact performance with filtering optics to guarantee reliable performance over dirt, contamination and scratches.**

The RGH45 readhead is designed for use with Renishaw's high-accuracy stainless steel RTLR40 tape scale. Enclosed within a rugged die-cast housing, the readhead uses proven solid state components to give outstanding reliability.

Dual limit switch sensing is also included as standard to provide dedicated signals for each end-of-axis indication, together with a repeatable reference mark (datum).

Installation is quick and easy to achieve thanks to generous readhead set-up tolerances and a rapid scale installation technique that uses the motion of the axis to lay the scale, which is then locked to the substrate via a single clamp fixed with Loctite®. Renishaw's unique set-up LED indicates when optimum conditions have been achieved, removing the need for complicated oscilloscopes or set-up equipment.

RGH45 is available with self-adhesive RTLR40-S tape scale or RTLR40 with Renishaw's unique *FASTRACK*™ track system that allows easy scale replacement –

ideal for long machines that need to be sectioned for transit. Both scale types feature high-accuracy graduations marked directly onto stainless steel, without any coatings, providing immunity to damage from harsh solvents.

These added benefits give RGH45 readheads greater flexibility, making them ideal for use in a variety of applications including linear motors, FPD manufacturing, electronics assembly and test, printing machines and a variety of high-speed motion control systems.

#### Digital range

RGH45D - 5 µm resolution

RGH45X - 1 µm resolution

RGH45N - 0.4 µm resolution

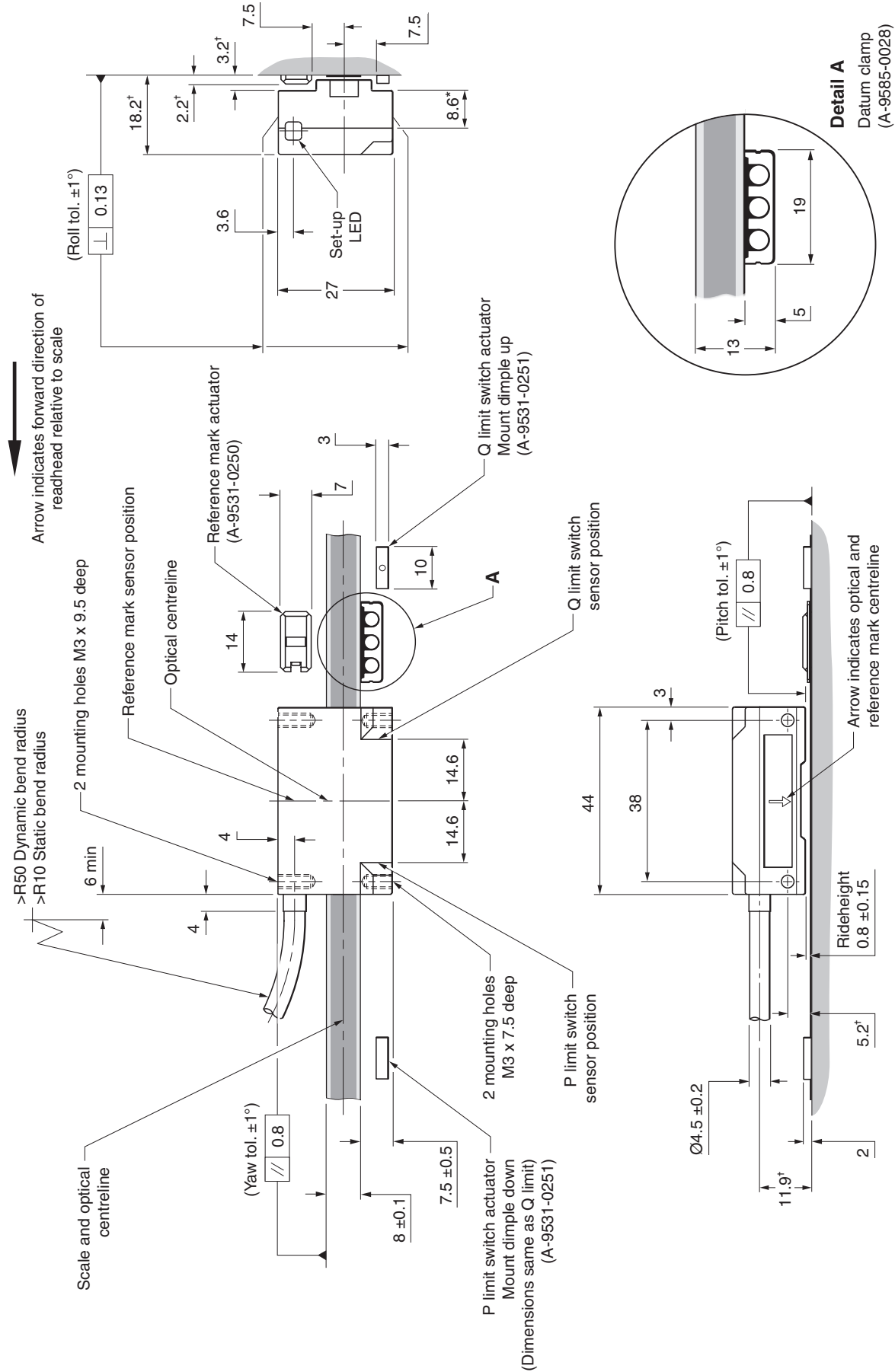
#### Analogue range

RGH45A - 1 Vpp differential

- Uses RTLR40 and RTLR40-S high-accuracy stainless steel tape scale
- Unique filtering optics and DC light servo
- Large installation tolerances
- Excellent dirt immunity
- High speed operation – up to 10 m/s
- Industry standard digital and analogue output options
- Resolutions from 5 µm to 0.4 µm
- Integral reference and dual limit sensors
- Integral set-up LED

**RGH45 installation drawing** (on RTLR40-S scale)

Dimensions and tolerances in mm



<sup>†</sup>Extent of mounting faces. **NOTE:** For detailed installation drawings refer to the relevant installation guide.

## General specifications

<b>Power supply</b>	5 V ±5%	RGH45A <160 mA RGH45D, X <125 mA RGH45N <160 mA	
	Ripple	<200 mVpp @ frequency up to 500 kHz. <b>NOTE:</b> 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 EN (IEC) 60950.	
<b>Temperature</b>	Storage	-20 °C to +70 °C	
	Operating	0 °C to +55 °C	
<b>Humidity</b>		Rated up to +40 °C, 95% relative humidity (non-condensing)	
<b>Sealing</b>		IP50	
<b>Acceleration</b>	Non-operating	500 m/s <sup>2</sup> BS EN 60068-2-7:1993	
<b>Shock</b>	Operating	500 m/s <sup>2</sup> , 11 ms, ½ sine BS EN 60068-2-27:2009	
<b>Vibration</b>	Operating	100 m/s <sup>2</sup> max @ 55 Hz to 2000 Hz BS EN 60068-2-6:1996	
<b>Mass</b>	Readhead	50 g	
	Cable	38 g/m	
<b>EMC compliance</b>		BS EN 61326-1: 2006	
<b>Environmental</b>		Compliant with EU Directive 2011/65/EU (RoHS)	
<b>Cable</b>		12 core, double shielded, outside diameter 4.5 ±0.2 mm Flex life >20 x 10 <sup>6</sup> cycles at 50 mm bend radius	
<b>Connector options</b>	<b>Code</b>	<b>Connector type</b>	<b>Readhead variant</b>
	D	15 pin D-type plug	RGH45D, X, N
	L	15 pin D-type plug	RGH45A

## Speed performance

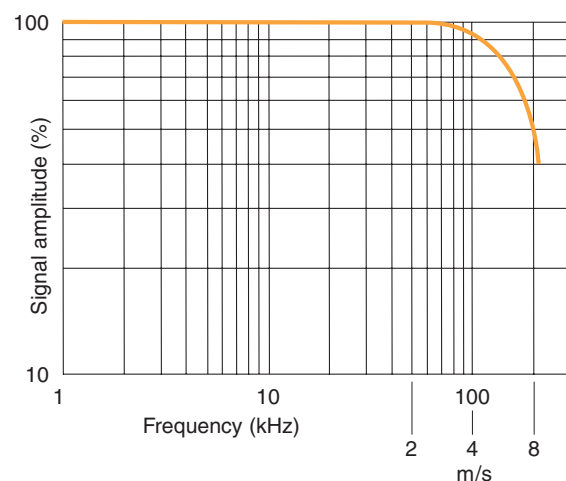
### Clocked output readheads

The RGH45N readhead is 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		
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

Characteristic applies to RTL40 tape scale

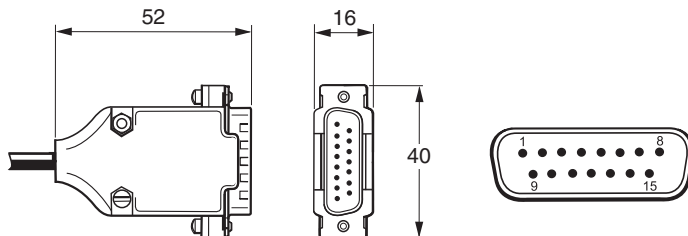


## Output signals

### 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
		-	Blue
	$V_2$	+	Yellow
		-	Green
Reference mark	$V_0$	+	Violet
		-	Grey
Reference mark uni-directional operation*	BID	Black	6
	DIR	Orange	14
Limit switch	$V_p$	Clear	7
	$V_q$	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 not repeatable in both directions. 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 installation guide for more information on reference mark set-up).

#### BID/DIR connections

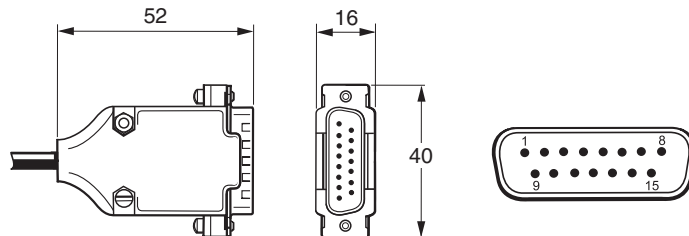
BID/DIR connection	To:-	Reference mark output direction
For bi-directional operation (normal)		
BID	+5 V or not connected	Forward <b>and</b> reverse
DIR	Do not connect	
For uni-directional operation		
BID	0 V	Forward <b>or</b> reverse
DIR	+5 V or not connected	Forward <b>only</b>
DIR	0 V	Reverse <b>only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

**Output signals** (continued)  
**RGH45D, X, N, 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

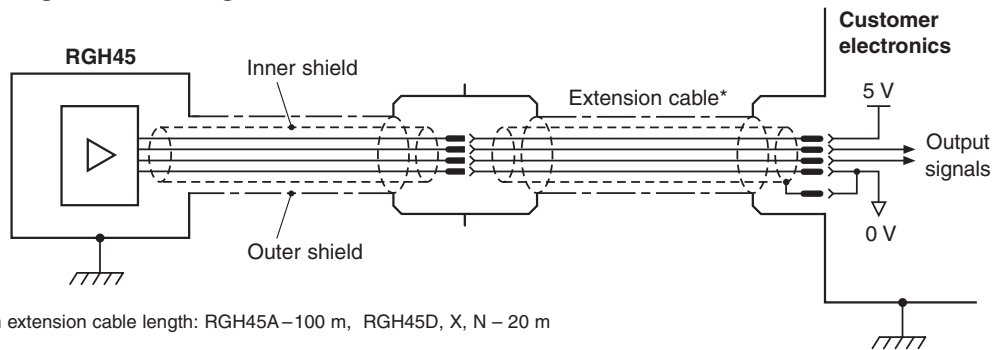
\* NOTE: Alarm channel E- (option 05) or line driver 3-state (option 06)

15 pin D-type plug (termination code D)



## Electrical connections

### Grounding and shielding

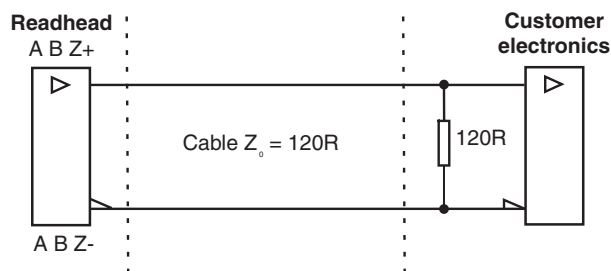


\*Maximum extension cable length: RGH45A – 100 m, RGH45D, X, N – 20 m

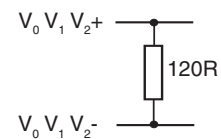
**IMPORTANT:** The outer shield should be connected to the machine earth (Field Ground). The inner shield should be connected to 0 V. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a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

## Recommended signal termination

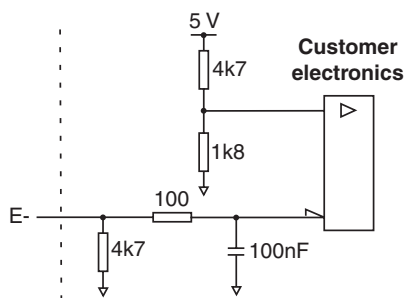
### Digital outputs - RGH45D, X, N



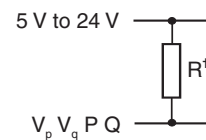
### Analogue output - RGH45A



### Single ended alarm signal termination (Option 05)



### Limit output



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

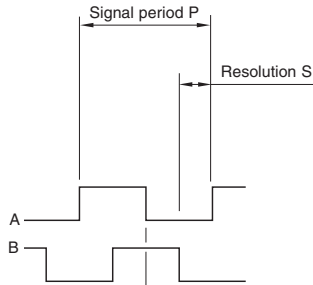
Alternatively, use a relay or opto-isolator.

## Output specifications

### Digital output signals - RGH45D, X, N

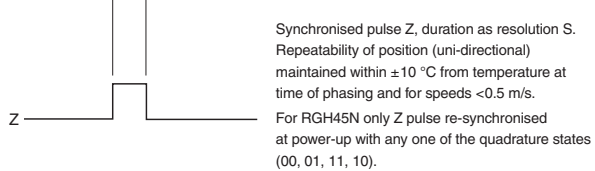
Form - square wave differential line driver to EIA RS422A  
(except limit switch P, Q, Alarm E- and external set-up signal X)

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



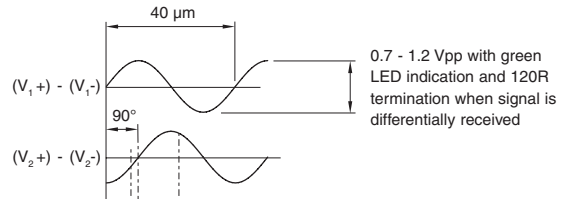
Model	P (µm)	S (µm)
RGH45D	20	5
RGH45X	4	1
RGH45N	1.6	0.4

### Reference†

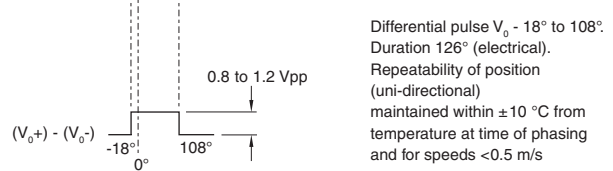


### Analogue output signals - RGH45A

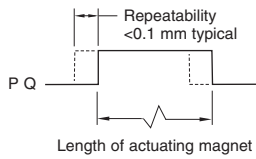
Incremental 2 channels  $V_1$  and  $V_2$  differential sinusoids in quadrature (90° phase shifted)



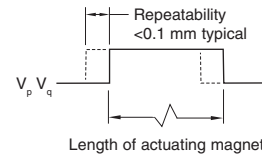
### Reference



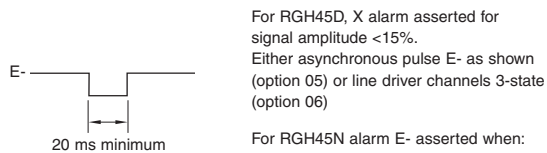
### Limit open collector output, asynchronous pulse



### Limit open collector output, asynchronous pulse



### Alarm single ended line driver output

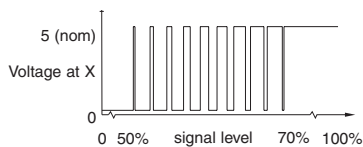


For RGH45D, X alarm asserted for signal amplitude <15%.  
Either asynchronous pulse E- as shown (option 05) or line driver channels 3-state (option 06)

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

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

### Set-up

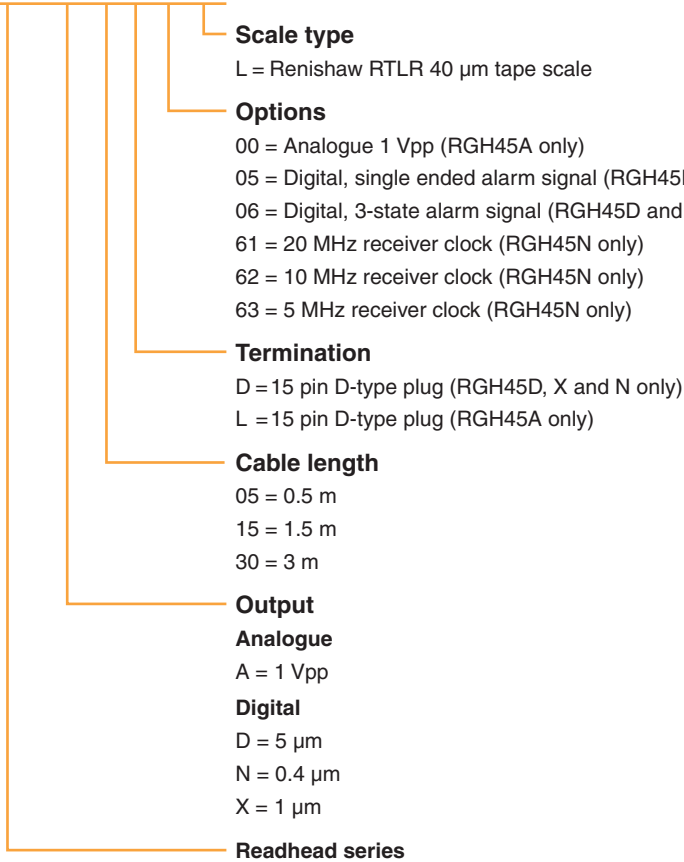


Between 50% and 70% signal level, X is a duty cycle. Time spent at 5 V increases with signal level. At >70% signal level X is nominal 5V.

†Inverse signals not shown for clarity

## Readhead part numbers

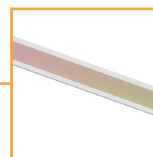
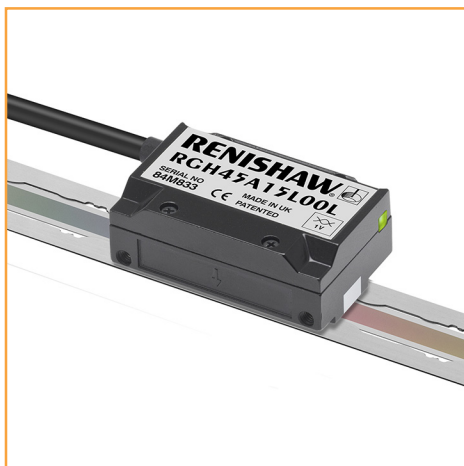
**RGH45 A 15 L 00 L**



**NOTE:** Not all combinations are valid. Check valid options online at [www.renishaw.com/epc](http://www.renishaw.com/epc)

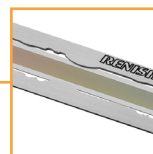
## RGH45 compatible products

### RGH45



#### RTLR40-S

Installation guide M-9787-9035  
Data sheet L-9517-9543



#### RTLR40 and *FASTRACK*

Installation guide M-9787-9017  
Data sheet L-9517-9543

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