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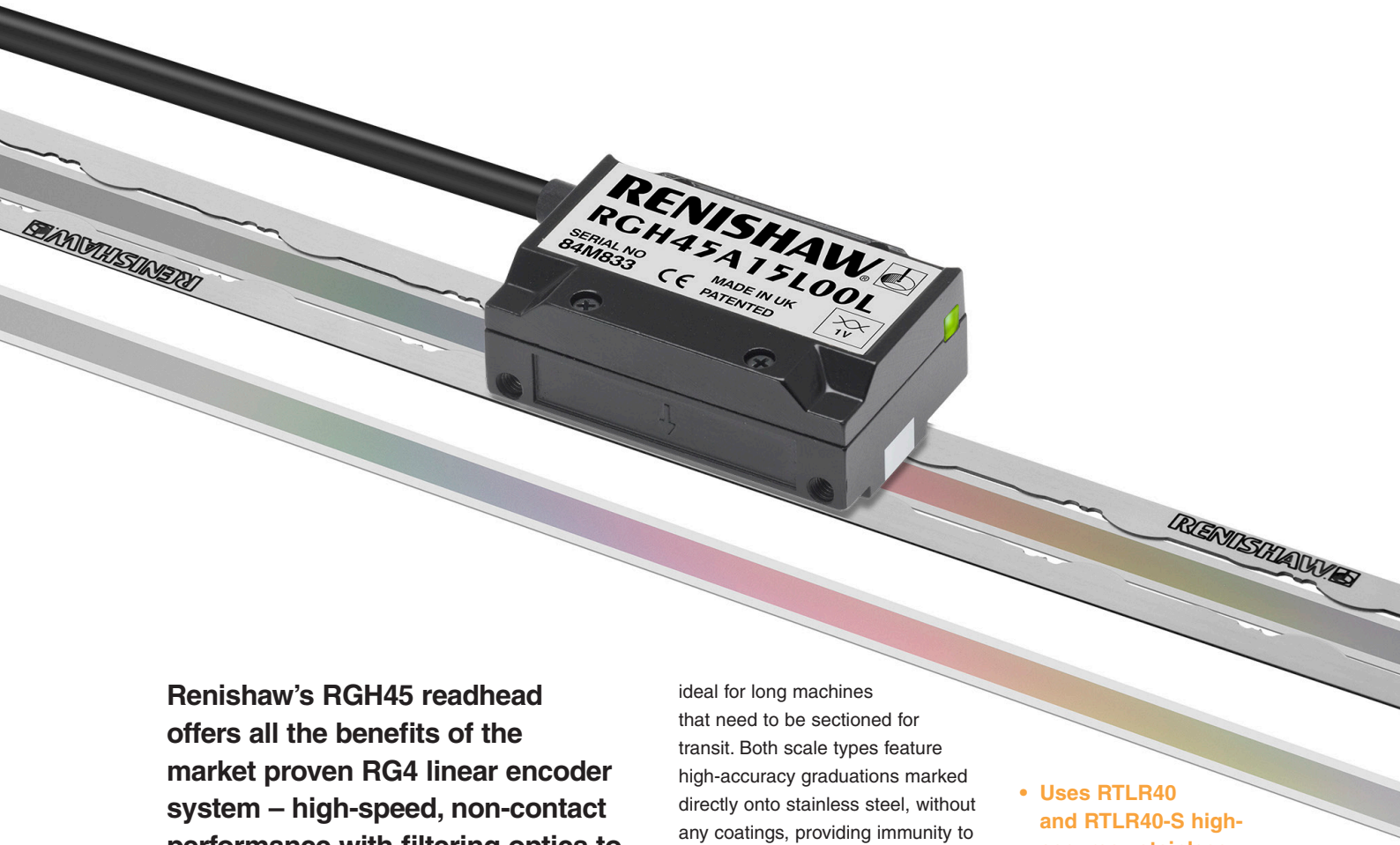
RGH45 encoder system



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

RGH45T - 10 µm resolution

RGH45D - 5 µm resolution

RGH45G - 2 µm resolution

RGH45X - 1 µm resolution

RGH45N - 0.4 µm resolution

RGH45W - 0.2 µm resolution

RGH45Y - 0.1 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 10 µm to 0.1 µm**
- **Integral reference and dual limit sensors**
- **Integral set-up LED**

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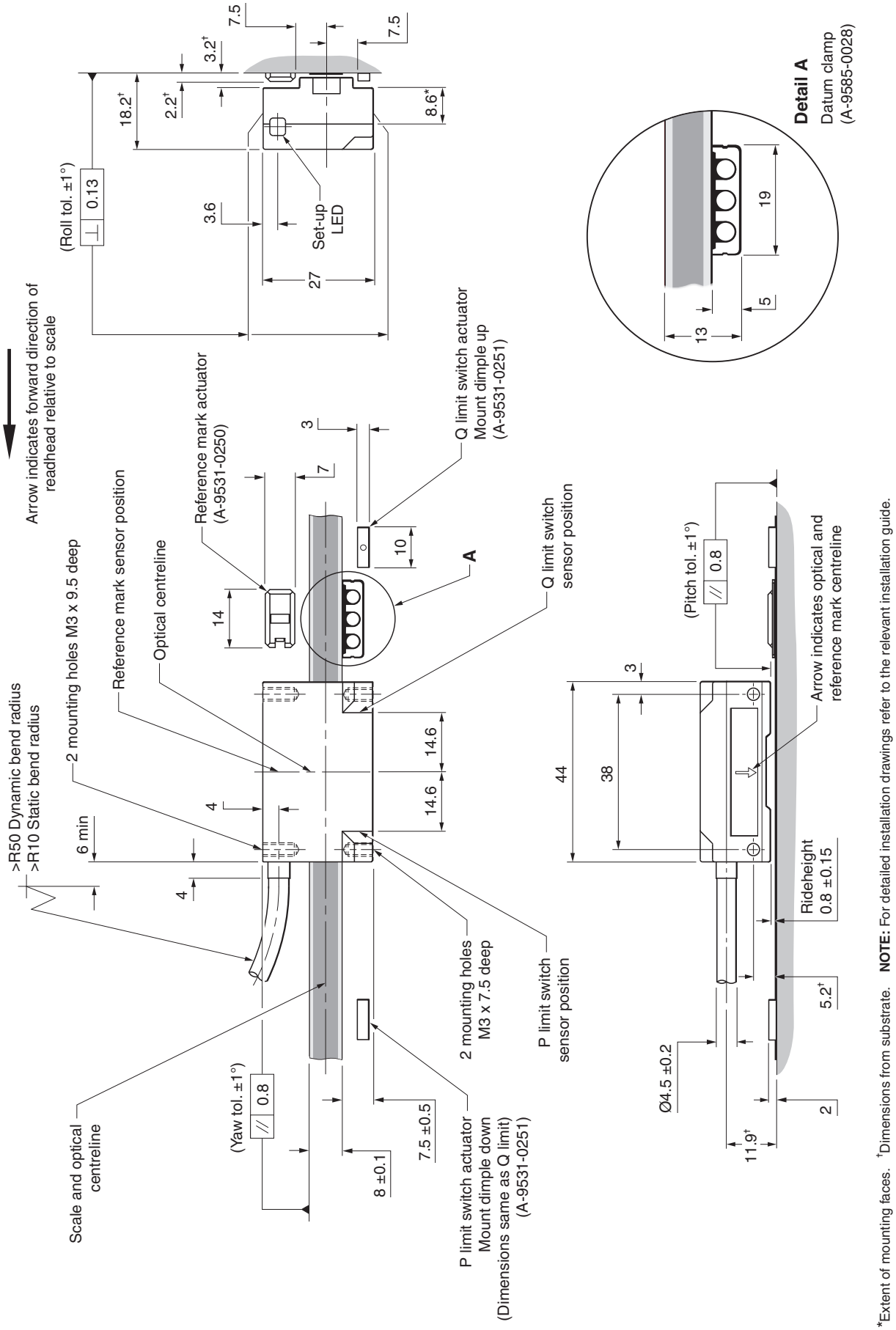
RGH45 installation drawing (on RTLR40-S scale)

Dimensions and tolerances in mm



*Extent of mounting faces. †Dimensions from substrate. **NOTE:** For detailed installation drawings refer to the relevant installation guide.

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General specifications

Power supply	5 V ±5%	RGH45A <160 mA RGH45T, D, G, X <125 mA RGH45N, W, Y <160 mA
	Ripple	<200 mVpp @ 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 EN (IEC) 60950.
Temperature	Storage	-20 °C to +70 °C
	Operating	0 °C to +55 °C
Humidity		Rated up to +40 °C, 95% relative humidity (non-condensing)
Sealing		IP50
Acceleration	Non-operating	500 m/s² BS EN 60068-2-7:1993
Shock	Operating	500 m/s², 11 ms, ½ sine BS EN 60068-2-27:2009
Vibration	Operating	100 m/s² max @ 55 Hz to 2000 Hz BS EN 60068-2-6:1996
Mass		Readhead 50 g Cable 38 g/m
EMC compliance		BS EN 61326-1: 2006
Environmental		Compliant with EU Directive 2011/65/EU (RoHS)
Cable		12 core, double shielded, outside diameter 4.5 ±0.2 mm Flex life >20 x 10^6 cycles at 50 mm bend radius

Connector options	**Code**	**Connector type**	**Readhead variant**
	D	15 pin D-type plug	RGH45T, D, G, X, N, W, Y
	L	15 pin D-type plug	RGH45A

Speed performance

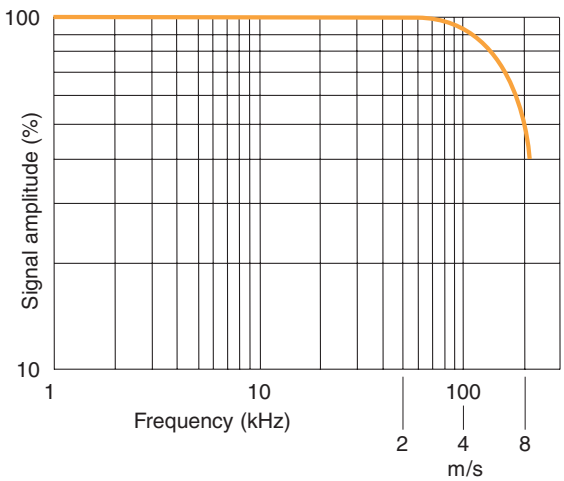
Clocked output readheads

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			$\left(\frac{\text{Encoder velocity (m/s)}}{\text{Resolution (µm)}}\right)$ x 4 safety factor
N, W, Y option	N	W	Y	
61 62 63	3.0 2.6 1.3	2.5 1.3 0.7	1.3 0.7 0.35	20 10 5

Analogue type RGH45A

Characteristic applies to RTLR40 tape scale

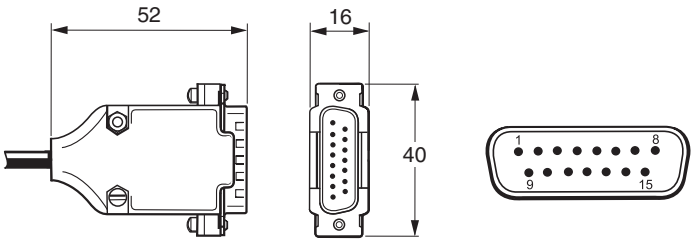


Output signals

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	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_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 **and** reverse
DIR	Do not connect	
For uni-directional operation		
BID	0 V	Forward **or** reverse
DIR	+5 V or not connected	Forward **only**
DIR	0 V	Reverse **only**

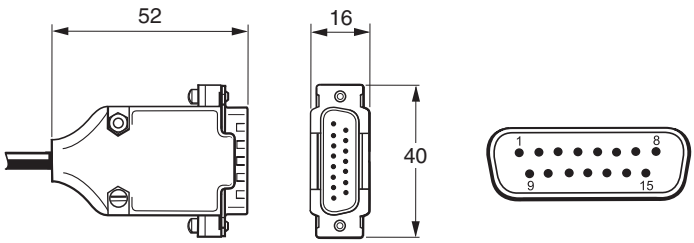
Output signals (continued)

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

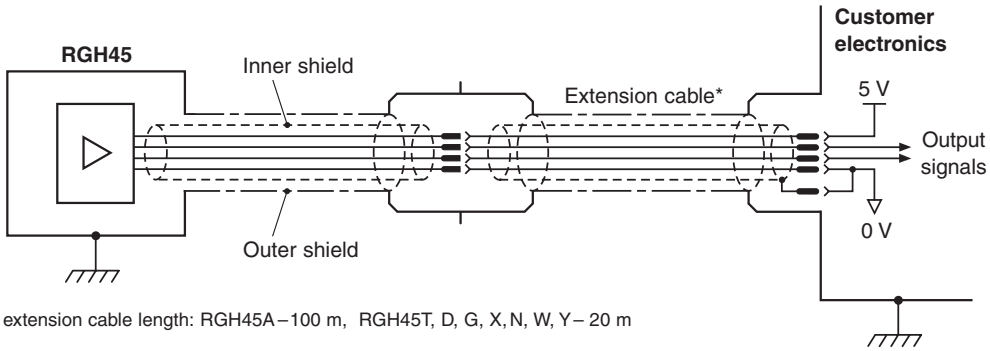
* **NOTE:** Alarm channel E- (option 05) or line driver 3-state (option 06)

15 pin D-type plug (termination code D)



Electrical connections

Grounding and shielding

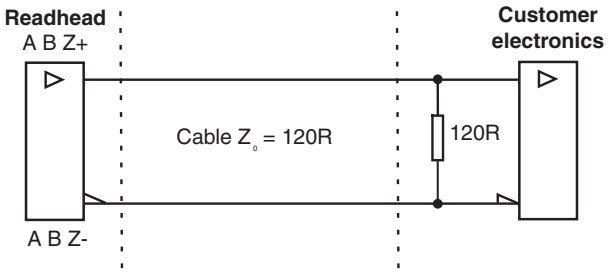


*Maximum extension cable length: RGH45A – 100 m, RGH45T, D, G, X, N, W, Y – 20 m

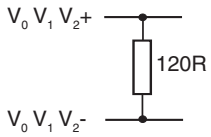
IMPORTANT: The outer shield should be connected to the machine earth (Field Ground). The inner shield should be connected to 0 V. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a short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

Recommended signal termination

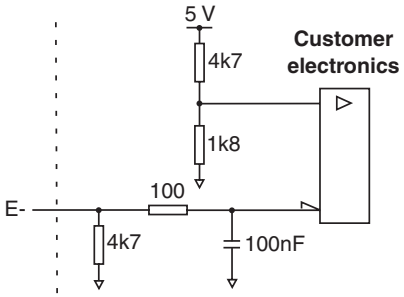
Digital outputs - RGH45T, D, G, X, N, W, Y



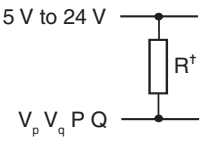
Analogue output - RGH45A



Single ended alarm signal termination
(Option 05)



Limit output



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

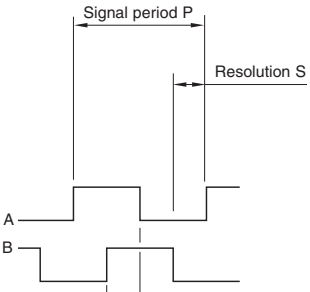
Alternatively, use a relay or opto-isolator.

Output specifications

Digital output signals - 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)



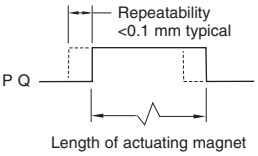
Model	P (µm)	S (µm)
RGH45T	40	10
RGH45D	20	5
RGH45G	8	2
RGH45X	4	1
RGH45N	1.6	0.4
RGH45W	0.8	0.2
RGH45Y	0.4	0.1

Reference†

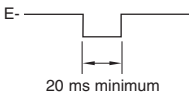
Synchronised pulse Z, duration as resolution S. Repeatability of position (uni-directional) maintained within ±20 °C from temperature at time of phasing and for speeds <0.5 m/s.

For RGH45N, W, Y only Z pulse re-synchronised at power-up with any one of the quadrature states (00, 01, 11, 10).

Limit open collector output, asynchronous pulse



Alarm single ended line driver output

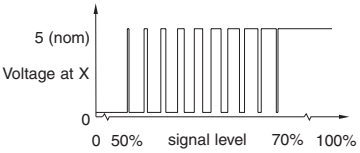


For RGH45T, D, G, X alarm asserted for signal amplitude <15%.
Either asynchronous pulse E- as shown (option 05) or line driver channels 3-state (option 06)

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

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

Set-up

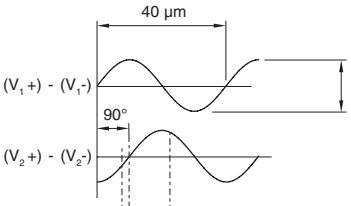


Between 50% and 70% signal level, X is a duty cycle.
Time spent at 5 V increases with signal level.
At >70% signal level X is nominal 5V.

†Inverse signals not shown for clarity

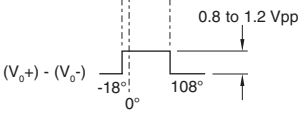
Analogue output signals - RGH45A

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



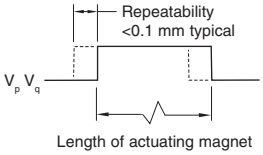
0.7 - 1.2 Vpp with green LED indication and 120R termination when signal is differentially received

Reference



Differential pulse V_0 - 18° to 108°. Duration 126° (electrical). Repeatability of position (uni-directional) maintained within ±10 °C from temperature at time of phasing and for speeds <0.5 m/s

Limit open collector output, asynchronous pulse



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Readhead part numbers

RGH45 A 15 L 00 L

Scale type
L = Renishaw RTLR 40 µm tape scale

Options
00 = Analogue 1 Vpp (RGH45A only)
05 = Digital, single ended alarm signal (RGH45T, D, G and X only)
06 = Digital, 3-state alarm signal (RGH45T D, G, and X only)
61 = 20 MHz receiver clock (RGH45N, W and Y only)
62 = 10 MHz receiver clock (RGH45N, W and Y only)
63 = 5 MHz receiver clock (RGH45N, W and Y only)

Termination
D = 15 pin D-type plug (RGH45T, D, G, X, N, W, and Y only)
L = 15 pin D-type plug (RGH45A only)

Cable length
05 = 0.5 m
10 = 1 m
15 = 1.5 m
30 = 3 m
50 = 5 m

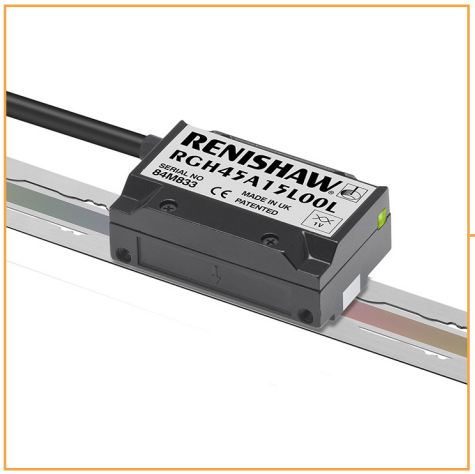
Output
Analogue
A = 1 Vpp
Digital
T = 10 µm
D = 5 µm
G = 2 µm
X = 1 µm
N = 0.4 µm
W = 0.2 µm
Y = 0.1 µm

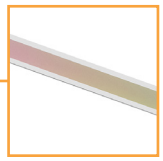
Readhead series

NOTE: Not all combinations are valid. Check valid options online at www.renishaw.com/epc

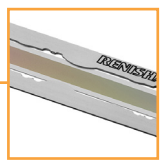
RGH45 compatible products

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

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

L-9517-9537-01