Data sheet
L-9517-9113-05-C

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RGH25F encoder system

Renishaw's RGH25F offers all the benefits of the market leading RG2 non-contact linear encoder systems; patented filtering optical scheme, high contamination tolerance and high speed.

The RGH25F has been designed for use with Renishaw's RGS20-S gold-plated scale in precision applications requiring fine resolutions, high accuracy, compact size and low mass.

The readhead is enclosed in an RFI screened housing and uses proven solid state components to give outstanding reliability.

The REF interfaces can be mounted remotely to interpolate the signals produced by the readhead.

The interfaces incorporate automatic gain control and unique self-tuning adaptive electronics which, combined with the filtering optics, ensure excellent signal integrity, and give a low cyclic error.

Common applications include optical fibre alignment, semiconductor manufacturing, inspection, precision stages and other systems requiring high resolution where space is at a premium.

Readhead RGH25F - common readhead

Interfaces

Digital

REF0004 - 5 µm resolution

REF0020 - 1 µm resolution

REF0040 - 0.5 µm resolution

REF0100 - 0.2 µm resolution

REF0200 - 0.1 µm resolution

REF0400 - 50 nm resolution

REF1000 - 20 nm resolution

REF2000 - 10 nm resolution

REF4000 - 5 nm resolution

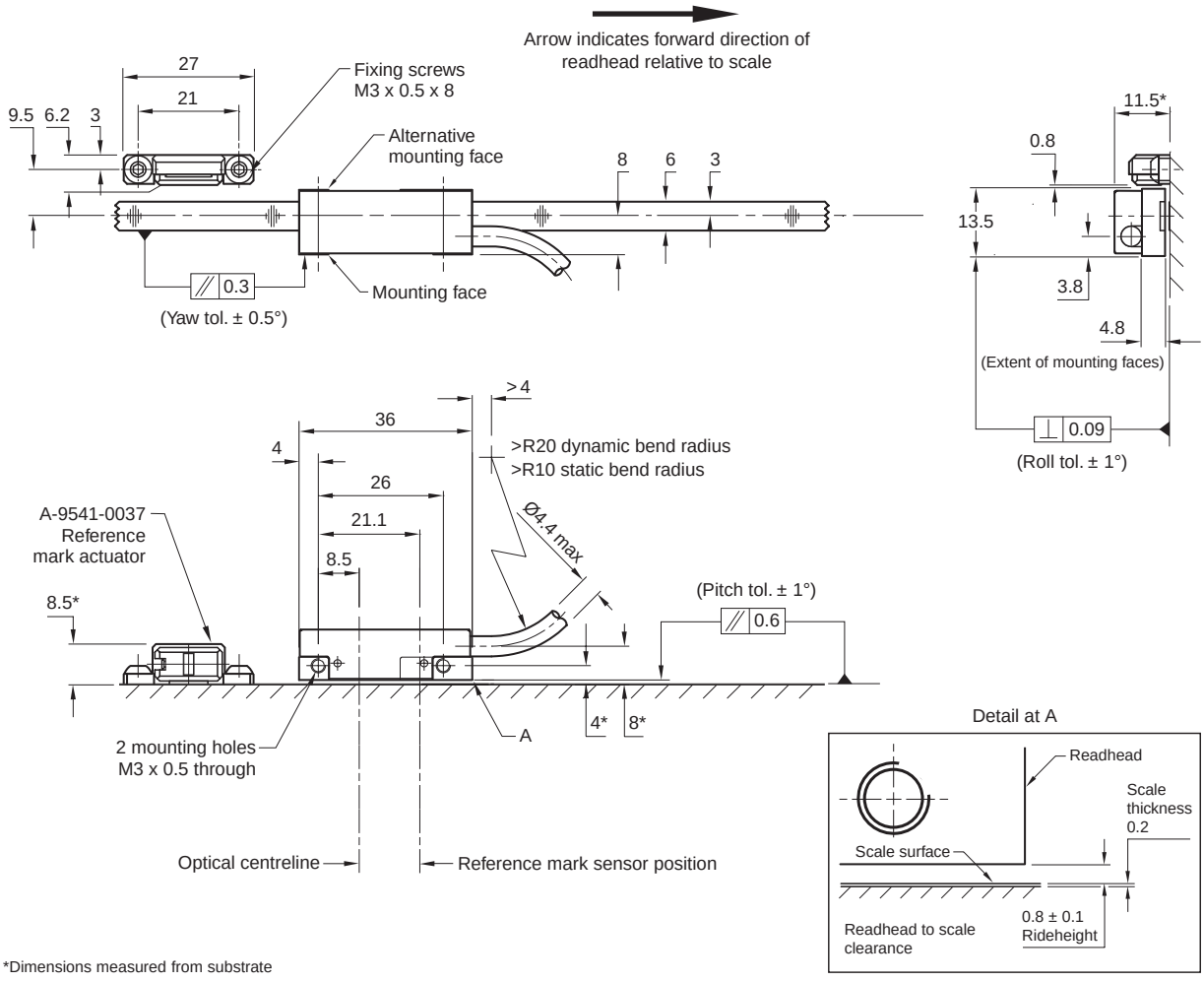
Analogue

REF0000 - 1 Vpp differential

- **Customer selectable AGC operational at all speeds**
- **Digital and analogue output options**
- **Resolutions from 5 µm to 5 nm**
- **Binary interpolation factors from x4 to x4096**
- **Low cyclic error (<50 nm)**
- **Self-tuning adaptive electronics give reliability and high accuracy**
- **Uses low profile RGS20-S self-adhesive scale**
- **Low mass**
- **Tri-coloured set-up LED indicating signal strength**

RGH25F installation drawing

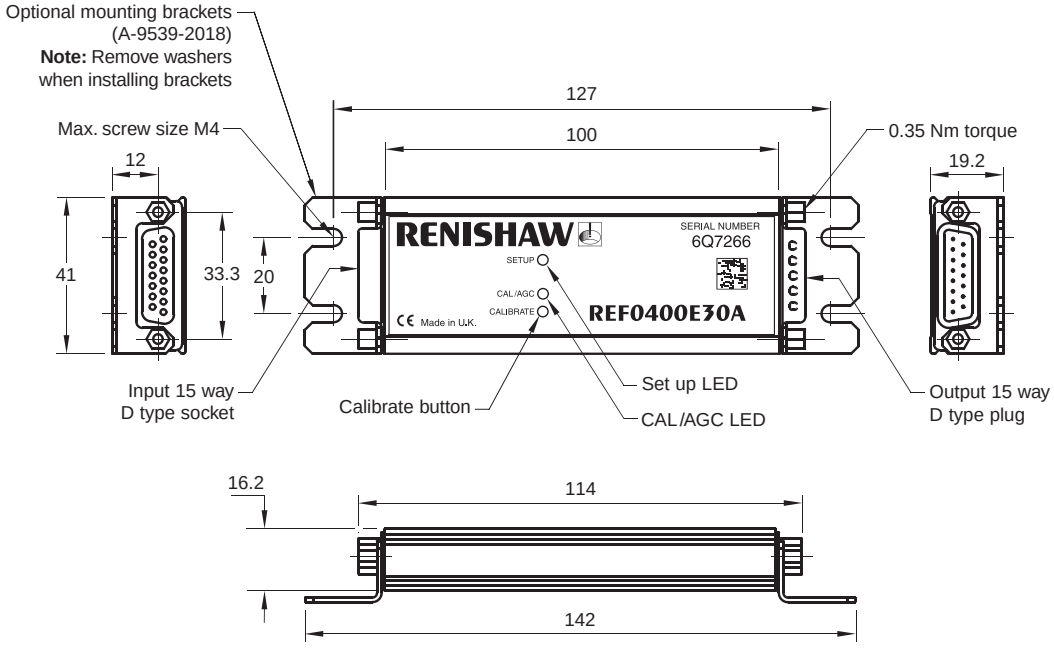
Dimensions and tolerances in mm



*Dimensions measured from substrate

REF installation drawing

Dimensions and tolerances in mm



Operating and electrical specifications

Power supply	5 V - 5% +10%	200 mA maximum (system) The interface will be fully active <300 ms after power is applied. Renishaw encoder systems must be powered from a 5 V dc supply complying with the requirements for SELV of standard EN (IEC) 60950. The interface and readhead are protected from reverse voltage and over voltage up to 12 V.
	Ripple	200 mVpp maximum @ frequency up to 500 kHz maximum
NOTE:		Current consumption figures refer to unterminated interfaces.
	(For digital interfaces)	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 will be drawn when terminated with 120 Ω.
Temperature (system)		Storage -20 °C +70 °C Operating 0 °C to +55 °C
Humidity (system)		Storage 95% maximum relative humidity (non-condensing) Operating 80% maximum relative humidity (non-condensing)
Sealing		Readhead IP40 Interface IP20
Acceleration (system)		Operating 500 m/s² BS EN 60068-2-7:1993 (IEC 68-2-7:1983)
Shock (system) non-operating		1000 m/s², 6 ms, ½ sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987)
Vibration (system) operating		100 m/s² max @ 55 to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995)
Mass		Readhead 9 g Readhead cable 34 g/m Interface 100 g
EMC compliance (system)		BS EN 61000 BS EN 55011
Readhead cable		Double-shielded, maximum outside diameter 4.4 mm Flex life >20 x10⁶ cycles at 20 mm bend radius
Maximum cable lengths		Readhead 5 m Interface to receiving electronics, analogue output - 100 m digital output, see table below

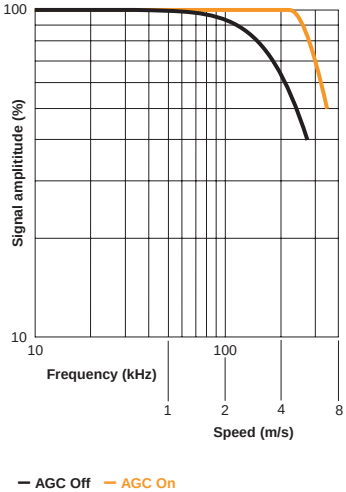
Recommended clock frequency (MHz)	Maximum cable length (m)
⩾ 25	20
⩽ 20	50

Speed

Digital systems, maximum speed (m/s)

Recommended minimum clock frequency (MHz)	Resolution (µm)									Internal clock frequency (MHz)
	5	1	0.5	0.2	0.1	50 nm	20 nm	10 nm	5 nm	
50	5.000	5.000	5.000	5.000	3.24	1.620	0.648	0.324	0.162	36
40	5.000	5.000	5.000	5.000	2.700	1.350	0.540	0.270	0.135	30
25	5.000	5.000	5.000	3.240	1.620	0.810	0.324	0.162	0.081	18
20	5.000	5.000	5.000	2.700	1.350	0.675	0.270	0.135	0.068	15
12	5.000	5.000	4.500	1.800	0.900	0.450	0.180	0.090	0.045	10
10	5.000	5.000	4.050	1.620	0.810	0.405	0.162	0.081	0.041	9
8	5.000	5.000	3.240	1.296	0.648	0.324	0.130	0.065	0.032	7.2
6	5.000	4.500	2.250	0.900	0.450	0.225	0.090	0.045	0.023	5
5	5.000	4.050	2.025	0.810	0.405	0.203	0.081	0.041	0.020	4.5
3	5.000	2.250	1.125	0.450	0.225	0.113	0.045	0.023	0.011	2.5
1	4.219	0.844	0.422	0.169	0.084	0.042	0.017	0.008	0.004	0.9
	4	20	40	100	200	400	1000	2000	4000	
Interpolation factor (period to resolution)										

Analogue system - RGH25F + REF0000



REF interface features

Self-tuning active correction

The REF interface actively corrects for input signal imperfections to optimise system accuracy.

Corrections are made for the following:

Automatic Offset Control (AOC) – adjusts offset independently for the sine and cosine signals

Automatic Gain Control (AGC) – ensures consistent 1 Vpp signal amplitude

Automatic Balance Control (ABC) – adjusts the gain to equalise the sine and cosine signals

These correction mechanisms operate over the full working speed range of the readhead.

The user can disable/enable the AGC by depressing the CALIBRATE button for greater than 3 seconds.

LED indicators

The REF interface **SETUP** LED provides visual feedback of signal strength, error condition and reference mark phasing, for setup and diagnostic use.

Flashing **Purple** indicates high signal alarm condition	>135%
Purple indicates high signal	>110% and <135%
Blue indicates optimum signal	>90% and <110%
Green indicates acceptable signal	>70% and <90%
Orange indicates low signal	>50% and <70%
Red indicates unacceptable signal	>20% and <50%
Flashing **Red** indicates unacceptable signal alarm condition	<20%

Flashing **Blue** indicates overspeed alarm condition

Red flash when traversing reference mark indicates good phasing*

Orange flash when traversing reference mark indicates poor phasing*

Blank flash when traversing reference mark indicates phasing unacceptable*

The **Yellow CAL/AGC** LED indicates when the REF is in a calibration routine and whether or not AGC is active

LED on indicates AGC active

LED off indicates AGC inactive

LED slow flashing indicates calibration routine

LED fast flashing indicates calibration failure

Alarm output

The REF interface asserts the alarm output (E) for the following conditions:-

Incremental signal level below 20%

Incremental signal level above 135%

Readhead speed in excess of specification

Signal offset compensation of sine and cosine excessive

Signal balance compensation excessive

***NOTE:** Reference mark flashes only occur up to 100 mm/s traverse speed.

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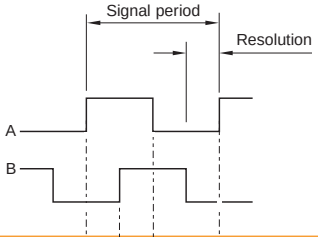
Output specifications

Digital output signals - type REF digital output interfaces
Form - Square wave differential line driver to EIA RS422A

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



†**Reference**

Synchronised pulse Z, duration as resolution

†**Wide reference** (option C)

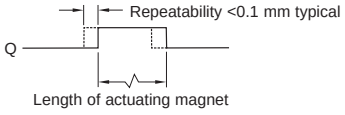
Synchronised pulse Z, duration as signal period

Repeatability of position (uni-directional) maintained within ±10 °C from installation temperature and for speed <250 mm/s

Actuation device A-9541-0037/A-9559-0650

NOTE: Wide reference mark option useful when using long cable lengths and/or high speed operation to overcome effects of skew

†**Limit**

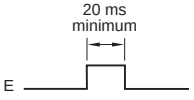


Asynchronous pulse Q

NOTE: RGH25F readheads and REF interfaces are available with reference mark **or** limit switch detection

Actuation device A-9541-0040/A-9531-0251

†**Alarm**

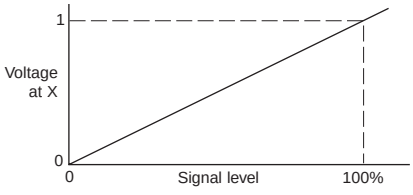


Asynchronous pulse E

Alarm asserted when:
- >20% signal amplitude >135%
- Readhead exceeds specified maximum speed
- Signal offset excessive

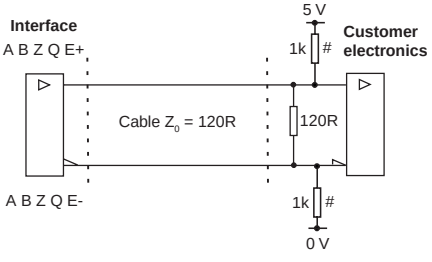
Note: 3-state alarm option also available

Set-up



Setup signal voltage proportional to signal amplitude

Recommended signal termination
Digital output

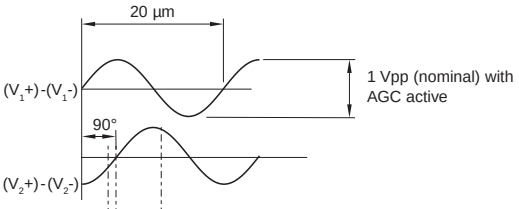


#Only required on alarm channel E for fail safe operation. Standard RS422A line receiver circuitry.

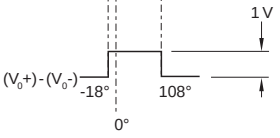
Contact Renishaw for further details on receiver circuitry.

Analogue output signals - type REF0000
Form - 1 Vpp differential

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



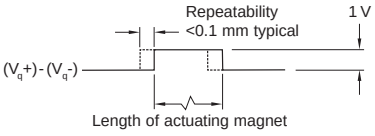
Reference



Differential pulse I_0 -18° to 108°.
Duration 126° (electrical)
Repeatability of position (uni-directional) maintained within ±10 °C from installation temperature and for speed <250 mm/s

Actuation device A-9541-0037/ A-9559-0650

Limit

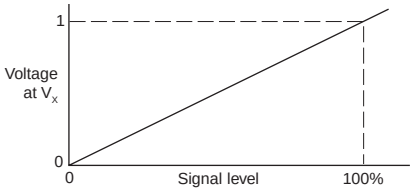


Asynchronous pulse V_q

NOTE: RGH25F readheads and REF interfaces are available with reference mark **or** limit switch detection

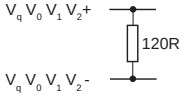
Actuation device A-9541-0040/A-9531-0251

Set-up



Setup signal voltage proportional to signal amplitude

Recommended signal termination
Analogue output



†Inverse signals not shown for clarity

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Readhead part numbers

RGH25F 15 J 00 A

Datum
A - Standard reference mark
B - Standard limit switch
C - Vacuum reference mark
D - Vacuum limit switch

Options
00 - Standard head
01 - Vacuum head and cable

Termination
J - 15 pin D type plug for REF interface
M - 15 pin D type plug for REF interface (vacuum only)

Cable length
15 - 1.5 m
30 - 3 m
50 - 5 m

Readhead series

Interface part numbers (analogue output) for use with RGH25F

REF 0000 A 00 A

Options
A - Reference mark
B - Limit switch

Interface part numbers (digital output) for use with RGH25F

REF 0100 E 25 A

Options
A - Reference mark
B - Limit switch
C - Wide reference mark

Clocked output
50 - 50 MHz customer clock
40 - 40 MHz customer clock
25 - 25 MHz customer clock
20 - 20 MHz customer clock
12 - 12 MHz customer clock
10 - 10 MHz customer clock
08 - 8 MHz customer clock
06 - 6 MHz customer clock
05 - 5 MHz customer clock
03 - 3 MHz customer clock
01 - 1 MHz customer clock

Alarms
Standard alarm E
A - All alarms
B - High and low signal alarms only
3 - state alarms
E- All alarms
F - High and low signal alarms only

Interpolation factor*
0004 - 5 µm
0020 - 1 µm
0040 - 0.5 µm
0100 - 0.2 µm
0200 - 0.1 µm
0400 - 50 nm
1000 - 20 nm
2000 - 10 nm
4000 - 5 nm

Interface series

*Binary interpolation factors from x4 to x4096 also available

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

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

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