Data sheet
RE22D01_03
Issue 3, 18th May 2018

RE22 rotary magnetic shaft encoder

The RE22 is a compact, high-speed rotary magnetic encoder designed for use in harsh environments. The traditional design allows for easy integration to existing machines.

A magnet is mounted to the shaft within the encoder body. Rotation of this magnet is sensed by a custom encoder chip within the body, and processed to give the required output format.

The encoder chip processes the signals received to provide resolutions of up to 13 bit (8,192 positions per revolution) with high operational speeds. Output signals are provided in industry standard absolute, incremental, analogue or linear formats.

The compact encoder body is just 22 mm in diameter and provides dirt immunity up to IP68.

The RE22 can be used in a wide range of applications including marine, medical, print, converting, industrial automation, metal working and instrumentation.

Product range

RE22AC
Analogue with a single sine/cosine cycle per revolution

RE22BC
Complementary analogue outputs with a single sine/cosine cycle per revolution

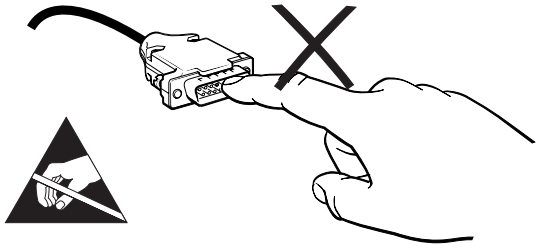
RE22IC
Incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RE22SC
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution

RE22Vx
Linear voltage output in a range of variants

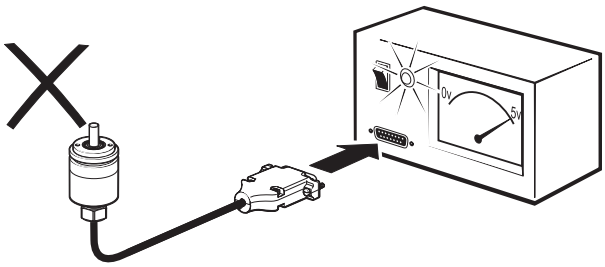
- **Excellent immunity to IP68**
- **High speed operation to 20,000 rpm**
- **Compact - 22 mm diameter body**
- **Absolute - to 13 bit (8,192 ppr)**
- **Industry standard absolute, incremental, analogue and linear output formats**
- **Accuracy to ±0.3°**
- **Simple integration**

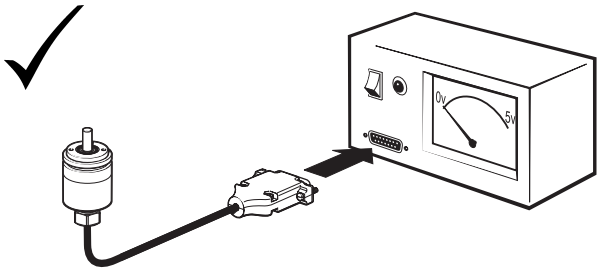
Storage and handling



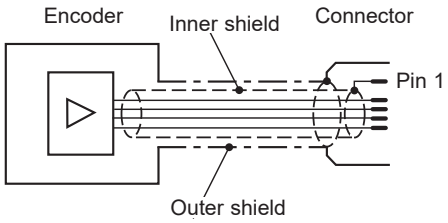
IMPORTANT: Power to RE22 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

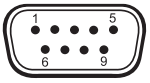
The RE22 series encoders have been designed to the relevant EMC standards, but must be correctly integrated to achieve EMC compliance. In particular, attention to shielding arrangements is critical.





Connections





D' type connector - 9 way

	RE22AC		RE22BC		RE22IC		RE22SC		RE22V	
Pin nr.	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**
1	Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram			
2	V_A	Green	V_{A+}	Green	Z	White	Clock	White	NC	–
3	V_B	Brown	V_{B+}	Brown	B	Green	Clock–	Brown	V_{out}	Green
4	NC	–	NC	–	A	Grey	NC	–	NC	–
5	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red
6	NC	–	V_{A-}	Yellow	Z–	Brown	Data	Green	NC	–
7	NC	–	V_{B-}	White	B–	Yellow	Data–	Yellow	NC	–
8	NC	–	NC	–	A–	Pink	NC	–	NC	–
9	GND	Blue	GND	Blue	GND	Blue	GND	Blue	GND	Blue

Operating and electrical specifications

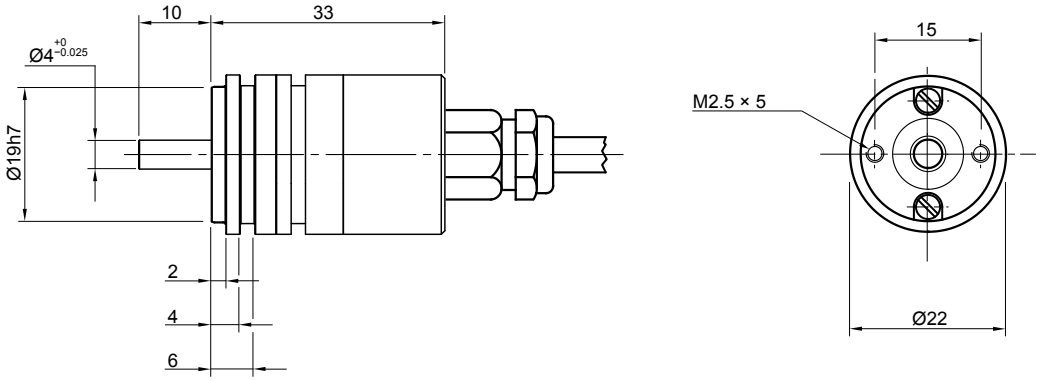
EMC compliance	EN 61326
Cable	Outside diameter 5 mm
Connector options	'D' type connector - 9 way Flying lead
Mass	Encoder unit 1 m cable (no connector) IP53 axial cable 68 g, side cable 60 g. IP64/IP68 axial cable 73 g.
Environmental sealing **NOTE:**	IP53 (IP64/IP68 optional) EN 60529:1992 IP68 version must be operated immersed in fluid

Installation drawing

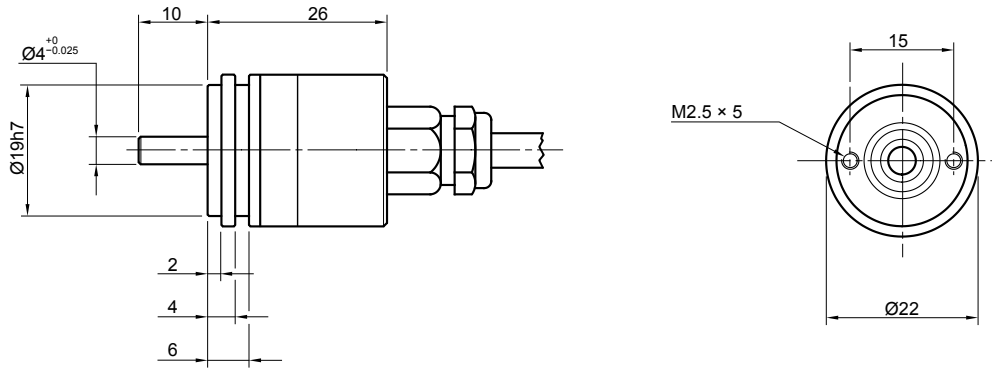
Dimensions and tolerances in mm

IP64 / IP68

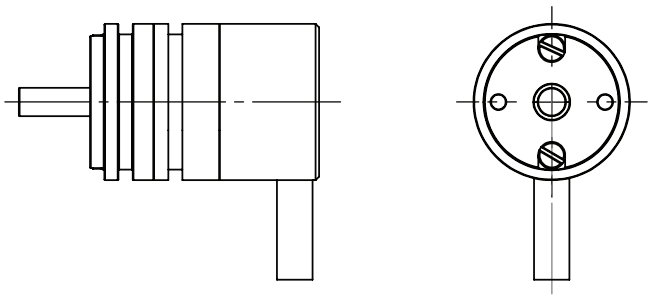
(axial cable exit)



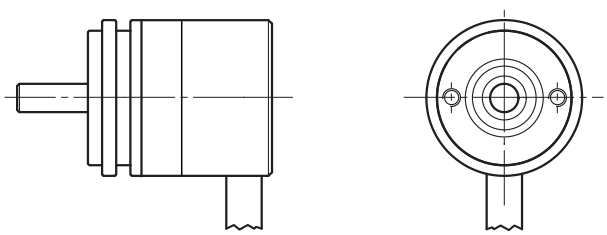
IP53 (axial cable exit)



IP64/68 (radial cable exit)



IP53 (radial cable exit)



Special option 06

Flat, D-shaped shaft

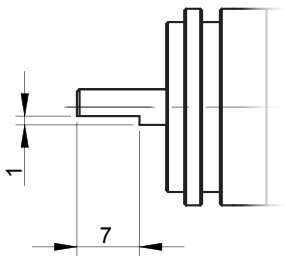


Table of expected bearing life ratings in hours

Speed (rpm)	Rad. load 5 N	Rad. load 10 N	Rad. load 15 N	Rad. load 20 N
500	205,401	98,455	54,569	33,333
1,000	102,700	49,227	27,285	16,667
2,000	51,350	24,613	13,642	8,333
5,000	20,540	9,845	5,457	3,333
10,000	10,270	4,923	2,728	1,667
15,000	6,847	3,282	1,819	1,111
20,000	5,135	2,461	1,364	833

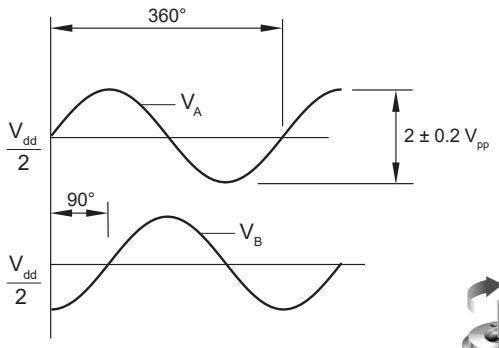
Maximum recommended shaft loads: radial 20N, axial 10N

RE22AC – Analogue sinusoidal outputs

2 channels V_A V_B sinusoids (90° phase shifted, single ended)

Power supply	V_{dd} = 5 V ± 5 %
Power consumption	20 mA
Outputs	Signal amplitude 2 ± 0.2 V_{pp} Signal offset $\frac{V_{dd}}{2}$ ± 5 mV
Maximum output frequency	333 Hz
Maximum cable length	3 m
Operating temperature	−40 °C to +125 °C
Maximum speed	20,000 rpm
Internal serial impedance	720 Ω

Timing diagram



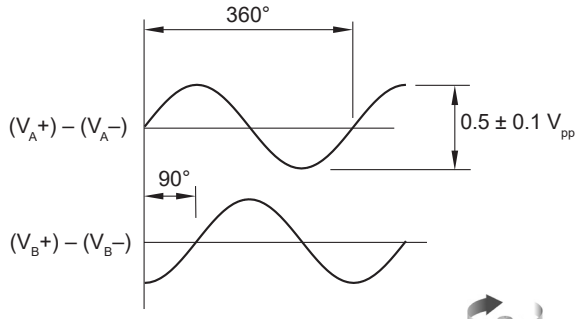
V_A leads V_B by 90° for clockwise rotation of shaft

RE22BC – Analogue complementary sinusoidal outputs

2 channels V_A and V_B differential sinusoids in quadrature (90° phase shifted)

Power supply	V_{dd} = 5 V ± 5 %
Power consumption	20 mA
Outputs	Signal amplitude 0.5 ± 0.1 V_{pp} Signal offset $\frac{V_{dd}}{2}$ ± 5 mV
Maximum output frequency	333 Hz
Maximum cable length	20 m
Operating temperature	−40 °C to +125 °C
Maximum speed	20,000 rpm
Internal serial impedance	100 Ω

Timing diagram



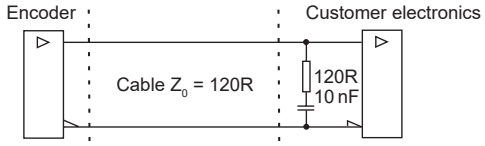
V_A leads V_B by 90° for clockwise rotation of shaft

RE22IC – Incremental outputs

Square wave differential line driver to RS422

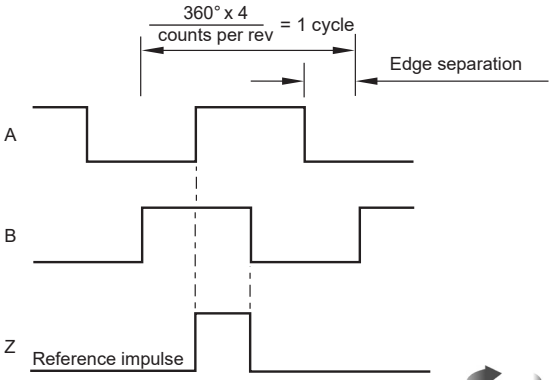
Power supply	V_{dd} = 5 V ± 5 %
Power consumption	35 mA
Accuracy	±0.5° Typ
Hysteresis	0.18°
Operating speed	30,000 rpm
Output signals	A, B, Z, A–, B–, Z– (RS422)
Maximum cable length	50 m
Operating temperature	−40 °C to +125 °C

Recommended signal termination



Timing diagram

Complementary signals not shown



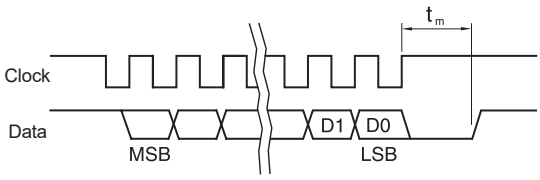
B leads A for clockwise rotation of shaft

RE22SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

Output code	Natural binary
Power supply	V_{dd} = 5 V ± 5 %
Power consumption	35 mA
Accuracy	±0.5° Typ
Hysteresis	0.18°
Operating speed	30,000 rpm
Repeatability	≤ 0.07°
Data output	Serial data (RS422)
Data input	Clock (RS422)
Maximum cable length	100 m (at 1 MHz)
Operating temperature	−40 °C to +125 °C

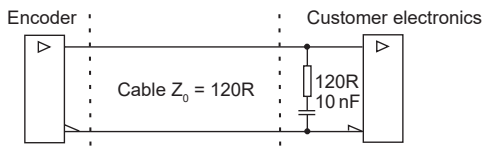
Timing diagram



Clock ≤ 900 kHz 16 µs ≤ t_m ≤ 22 µs (for 9 bit resolution)
Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs (for all other resolutions)

Recommended signal termination

For data output lines only



Position increases for clockwise rotation of shaft

RE22Vx – Linear voltage output

Power supply	V_{dd} = 5 V ± 5 %
Power consumption	26 mA typical
Output voltage	0 V to V_{dd}
Output loading	Max. 10 mA
Nonlinearity	1 %
Maximum cable length	20 m
Operating temperature	−40 °C to +125 °C
Maximum speed	20,000 rpm

φ_{period}	N_{period}	N_{step}	φ_{step}
360°	1	1,024	0.35°
180°	2	1,024	0.18°
90°	4	1,024	0.09°
45°	8	512	0.09°

Timing diagram

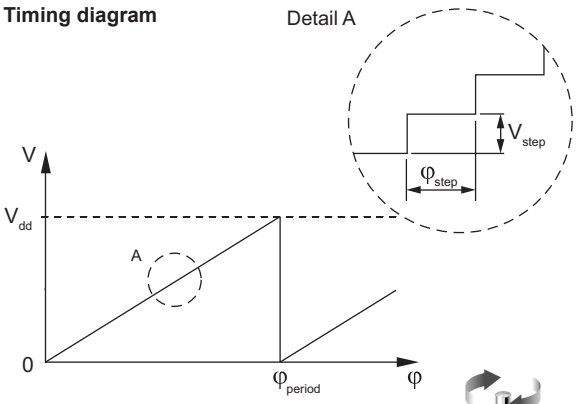


Image shows clockwise rotation of shaft

Output type and electrical variant

φ_{period} / Rotation	**360°**	**180°**	**90°**	**45°**
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

$$\varphi_{step} = \frac{\varphi_{period}}{N_{step}} \qquad V_{step} = \frac{V_{dd}}{N_{step}}$$

φ_{period} = Angle covered in one period (one sawtooth)
V_{period} = Output voltage range for one period
φ_{step} = Step angle (angular movement needed to register a change in the position)
V_{step} = Output voltage range for one step
N_{period} = Number of periods in one revolution
N_{step} = Number of steps in one period

The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and V_{dd} (5 V). The number of periods within one revolution (N_{period}) can be 1, 2, 4 or 8, representing one full swing over an angle (φ_{period}) of 360°, 180°, 90° or 45° respectively. The signal is made up of steps which represent the angular movement needed to register a change in the position (φ_{step}) and the resulting change in the output voltage (V_{step}). The number of steps in one period (N_{step}) is given in the table below.

For clockwise rotation of the magnetic actuator, the output voltage increases. For counterclockwise rotation, the output voltage decreases.

Part numbering

Encoder part number
eg **RE22SC0409B10A3A00**

RE22 SC 04 09B 10 A 3 A 00

Output type
AC - Analogue sinusoidal 2 V_{pp}
BC - Analogue complementary sinusoidal
IC - Incremental, RS422
SC - Absolute binary synchro-serial (SSI), RS422
Vx - Linear voltage:

Linear voltage output 0 - 5 V, supply 5 V DC				
	360°	180°	90°	45°
CW	**VA**	**VB**	**VC**	**VD**
CCW	**VE**	**VF**	**VG**	**VH**

Shaft size
04 - 4 mm

Resolution
For output types **AC** and **BC**:
01S - One sine/cosine wave per revolution

For output type **Vx**:
10B - 1,024 positions per revolution

For output types **IC** and **SC** (counts or positions per revolution):

Decimal			Binary	
D32 - 320	**D80** - 800	**2D0** - 2000	**09B** - 512	**12B** - 4096
D40 - 400	**1D0** - 1000		**10B** - 1024	**13B** - 8192
D50 - 500	**1D6** - 1600		**11B** - 2048	

Special requirements
00 - None
06 - With flat, D-shaped shaft
0M - Cable length in meters

Environment
A - IP53, Aluminium body (standard)
B - IP64, Aluminium body (for Body style 3 only)
C - IP68, Aluminium body (for Body style 3 only)

Body style and cable exit
2 - Cylindrical body, radial cable exit
3 - Cylindrical body, axial cable exit

Connector option
A - 'D' type connector - 9 way
F - Flying lead (no connector)

Cable length
10 - 1.0 meter (10 meters if **0M** is chosen)

NOTE: Not all combinations are valid.

Head office

RLS merilna tehnika d.o.o.
Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
F +386 1 5272129
E mail@rls.si
www.rls.si

Document issues

Issue	Date	Page	Corrections made
1	13. 1. 2011	-	New document
2	9. 7. 2015	2	Storage and handling info added; connections diagram and table added
		3	Installation drawing tolerances updated, flat D-shaped shaft drawing added
		4−6	Temperature range amended
		6	Parallel output removed
		7	Parallel output removed, resolution options updated and special option 06 added
3	18. 5. 2018	5	Resolutions amended