Data sheet
RE36D01_01
Issue 1, 13th January 2009

RE36 series rotary encoders

The RE36 is a high-speed rotary magnetic encoder designed for use in harsh environments. The traditional design enables easy integration on existing machines.

A magnet is mounted to the shaft within the encoder's 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 to 13 bit (8,192 positions per revolution) with high operational speeds. Resolution options include binary and decimal. Output signals are provided in industry standard absolute, incremental or analogue formats.

The compact encoder body is 36 mm in diameter and provides dirt immunity up to IP68.

The RE36 can be used in a wide range of applications including marine, medical, print, converting, industrial automation, metal working and instrumentation.

5 V power supply version

RE36I - incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RE36S - synchro serial interface (SSI) and incremental, RS422

24 V power supply version

RE36P - absolute parallel interface with 512 positions per revolution

RE36I - incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RE36V - linear voltage output in a range of variants

RE36C - linear current output in a range of variants

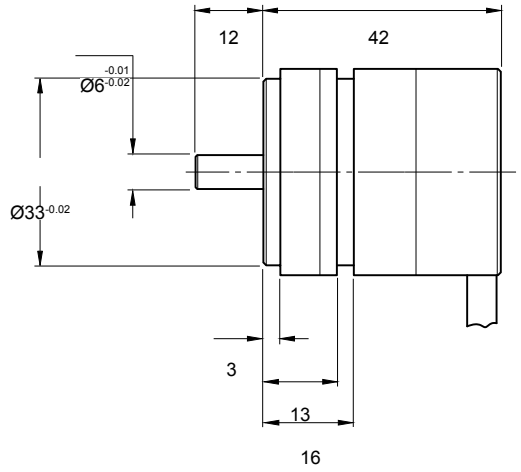
System features:

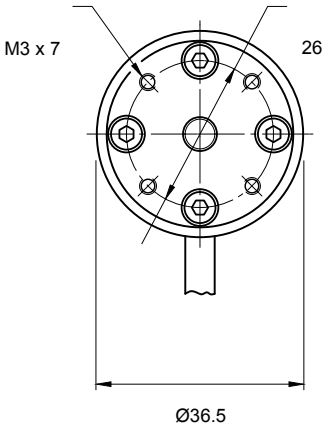
- **Excellent immunity to IP68**
- **High speed operation to 20,000 rpm**
- **36 mm diameter body**
- **Industry standard absolute, incremental and linear output formats**
- **Binary and decimal resolution options**
- **Accuracy to ±0.3°**
- **Simple integration**
- **Low inertia**

RE36 installation drawing

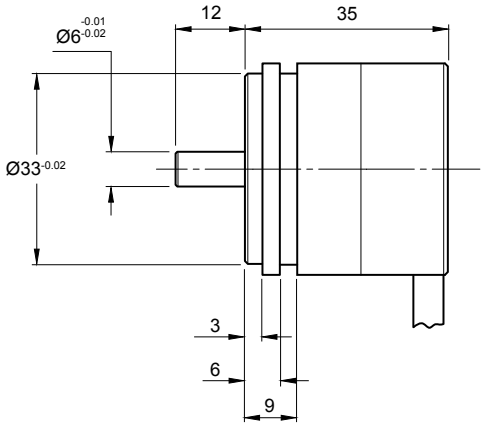
Dimensions and tolerances in mm

IP64/68





IP53



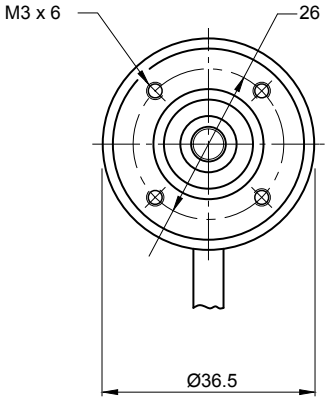


Table of expected bearing life ratings in hours

Speed (rpm)	Rad. load 15 N	Rad. load 20 N	Rad. load 25 N	Rad. load 30 N
500	296,282	227,542	178,523	142,631
1,000	148,142	113,767	89,267	71,317
2,000	74,071	56,883	44,633	35,658
5,000	29,628	22,753	17,853	14,263
10,000	14,814	11,377	8,927	7,131
15,000	9,876	7,584	5,951	4,754
20,000	7,407	5,688	4,463	3,566

Maximum recommended shaft loads:
radial 30N, axial 15N

Operating and electrical specifications

Humidity (for IP64 version)	Storage 95% maximum relative humidity (non-condensing) (IEC 61010-1) Operating 80% maximum relative humidity (non-condensing) (IEC 61010-1)
Acceleration	Operating 500 m/s² BS EN 60068-2-7:1993 (IEC 68-2-7:1983)
Shock (non-operating)	1000 m/s², 6 ms, 1/2 sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987)
Vibration (operating)	100 m/s² max at 55 to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995)
EMC compliance	BS EN 61326
Cable	Outside diameter 5 mm
Mass	Encoder unit 1 m cable (no connector) IP53 side cable 105 g. IP64/IP68 side cable 128 g
Environmental sealing **NOTE:**	IP53 IP64 (IP68 optional) BS EN 60529 IP68 version must be operated immersed in fluid to maintain bearing/seal life

Output specifications - 5 V supply

RE36I – Incremental outputs

Square wave differential line driver to RS422

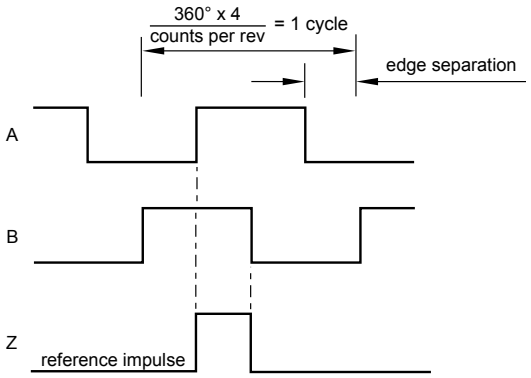
Power supply	V_{dd} = 5 V ± 5%
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Output signals	A, B, Z, A-, B-, Z- (RS422)
Max. cable length	50 m
Connector options	9 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +85 °C Storage -40 °C to +125 °C

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500	20,000	±0.5°	0.18°
512	20,000	±0.5°	0.45°
800, 1,000, 1,024	20,000	±0.3°	0.18°
1,600, 2,000, 2,048	10,000	±0.3°	0.18°
4,096	5,000	±0.3°	0.18°
8,192	2,500	±0.3°	0.18°

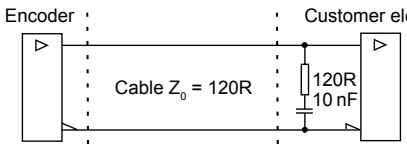
* Worst case within operational parameters including magnet position and temperature.

Timing diagram

(complementary signals not shown)



Recommended signal termination



B leads A for clockwise rotation of shaft

RE36S – Absolute binary synchro-serial interface (SSI)

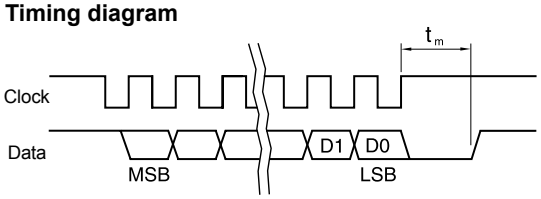
Serial encoded absolute position measurement

Output code	Natural binary
Power supply	V_{dd} = 5 V ± 5%
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Repeatability	≤ 0.07°
Data output	Serial data (RS422)
Data input	Clock (RS422)
Max. cable length	100 m (at 1 MHz)
Connector options	9 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +85 °C Storage -25 °C to +125 °C

Resolution options (positions per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500, 512	20,000	±0.5°	0.18°
800, 1,000, 1,024	20,000	±0.3°	0.18°
1,600, 2,000, 2,048	10,000	±0.3°	0.18°
4,096	5,000	±0.3°	0.18°
8,192	2,500	±0.3°	0.18°

* Worst case within operational parameters including magnet position and temperature.

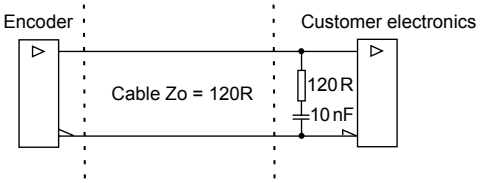
Timing diagram



Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Recommended signal termination

(For data output lines only)



Position increases for clockwise rotation of shaft

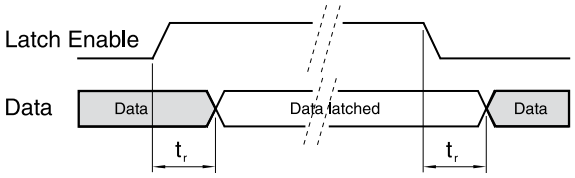
Output specifications - 24 V supply

RE36P – Absolute binary parallel interface

Parallel absolute position measurement

Output code	Natural binary
Power supply	8 V to 26 V = V_{supply}
Power consumption	(at 24 V) See table
Output voltage	$V_H \geq (V_{supply} - 1)$ at $-I_H \leq 10$ mA $V_L \leq 1$ V at $I_L \leq 10$ mA
Resolution	9 bit (512 positions per revolution)
Hysteresis	0.45°
Accuracy	±0.7°
Repeatability	≤ 0.07°
Data outputs	D0 (LSB) - D8 (MSB)
Data input	LE - latch enable input signal, active high Maximum sampling rate 500 kHz
Max. cable length	10 m
Connector options	15 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +85 °C 0 °C to +70 °C variant **PB** Storage -25 °C to +125 °C
Maximum speed	20,000 rpm

Timing diagram



t_r (reaction time) ≤ 1 µs

Output type and electrical variant

Variant	Type	Power consumption	Max. load
PA	Push-Pull	40 mA	30 mA
PB	Open Collector NPN	25 mA	20 mA

Position increases for clockwise rotation of shaft

RE36I – Incremental outputs

Square wave output

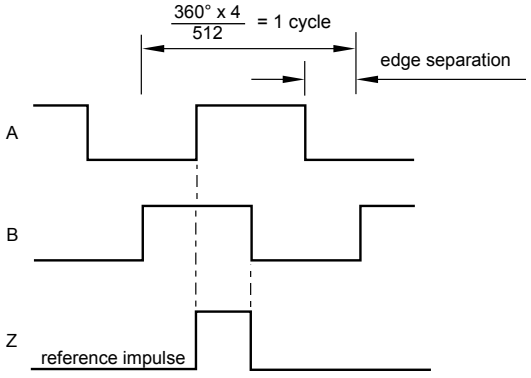
Power supply	8 V to 26 V = V_{supply}
Power consumption	(at 24 V) See table
Output signals	**Variant IA:** A, B, Z, A-, B-, Z- (RS422) **Variant IB:** A, B, Z
Resolution	**Variant IB:** 128 pulses per revolution (512 counts per revolution with 4x evaluation) **Variant IA:** 80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
Max. cable length	20 m
Connector options	9 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +70 °C 0 °C to +70 °C variant **IB** Storage -25 °C to +125 °C

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500	20,000	±0.5°	0.18°
512	20,000	±0.5°	0.45°
800, 1,000, 1,024	20,000	±0.3°	0.18°
1,600, 2,000, 2,048	10,000	±0.3°	0.18°
4,096	5,000	±0.3°	0.18°
8,192	2,500	±0.3°	0.18°

* Worst case within operational parameters including magnet position and temperature.

Timing diagram

(complementary signals not shown)



Output type and electrical variant

Variant	Type	Power consumption	Max. load
IA	Push-Pull	30 mA - 9-bit 50 mA - other resolutions	30 mA
IB	Open Collector NPN	25 mA	20 mA

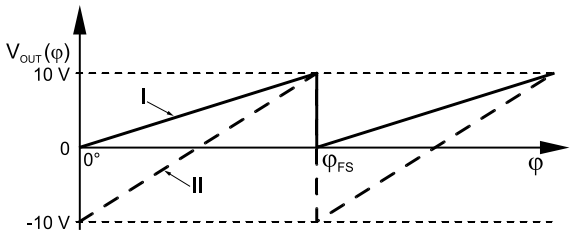
B leads A for clockwise rotation of shaft

Output specifications - 24 V supply

RE36V – Linear voltage output

Power supply	Type I: +20 V to +30 V DC Type II: ±12 V to ±16 V DC
Power consumption	40 mA typical
Output voltage	Type I: 0 V to 10 V DC Type II: -10 V to +10 V DC
Output loading	Max. 10 mA
Nonlinearity	1 %
Max. cable length	20 m
Connector options	9 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +70 °C Storage -25 °C to +125 °C
Maximum speed	20,000 rpm

Electrical output/shaft position



Output type and electrical variant

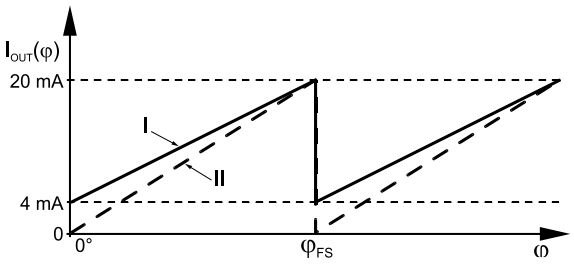
	Type I				Type II			
φ_{FS}	360°	180°	90°	45°	360°	180°	90°	45°
Clockwise	**VA**	**VB**	**VC**	**VD**	**VM**	**VN**	**VP**	**VQ**
Counterclockwise	**VE**	**VF**	**VG**	**VH**	**VR**	**VS**	**VT**	**VV**

Image shows clockwise rotation of shaft

RE36C - Linear current output

Power supply	V_{dd} = +20 V to +30 V DC
Power consumption	50 mA plus output current
Output current	Type I: 4 mA to 20 mA Type II: 0 mA to 20 mA
Output loading	$R_L = 0$ to $\frac{V_{dd}}{I_{OUTmax}}$
Nonlinearity	1 %
Max. cable length	20 m
Connector options	9 pin 'D' type plug (standard) Flying lead
Temperature	Operating -25 °C to +70 °C Storage -25 °C to +125 °C
Maximum speed	20,000 rpm

Electrical output/shaft position



Output type and electrical variant

	Type I				Type II			
φ_{FS}	360°	180°	90°	45°	360°	180°	90°	45°
Clockwise	**CA**	**CB**	**CC**	**CD**	**CM**	**CN**	**CP**	**CQ**
Counterclockwise	**CE**	**CF**	**CG**	**CH**	**CR**	**CS**	**CT**	**CV**

Image shows clockwise rotation of shaft

RE36 ordering code

Encoder part number
eg **RE36SC0612B10A2A00**

RE36 SC 06 12B 10 A 2 A 00

Output type
IA - Incremental, push-pull, 24 V
IB - Incremental, open collector, 24 V
IC - Incremental, RS422, 5 V
SC - Absolute binary synchro-serial (SSI), RS422, 5 V
SI - SSI and incremental, RS422, 5 V
PA - Absolute parallel, push-pull, 24 V
PB - Absolute parallel, open collector, 24 V
C_x - Linear current:

Linear current output 4 mA to 20 mA, supply +20 V to +30 V DC				
	360°	180°	90°	45°
Clockwise	**CA**	**CB**	**CC**	**CD**
Counter clockwise	**CE**	**CF**	**CG**	**CH**
Linear current output 0 mA to 20 mA, supply +20 V to +30 V DC				
	360°	180°	90°	45°
Clockwise	**CM**	**CN**	**CP**	**CQ**
Counter clockwise	**CR**	**CS**	**CT**	**CV**

V_x - Linear voltage:

Linear voltage output 0 V to 10 V, supply +20 V to +30 V DC				
	360°	180°	90°	45°
Clockwise	**VA**	**VB**	**VC**	**VD**
Counter clockwise	**VE**	**VF**	**VG**	**VH**
Linear voltage output ±10 V, supply ±12 V to ±16 V DC				
	360°	180°	90°	45°
Clockwise	**VM**	**VN**	**VP**	**VQ**
Counter clockwise	**VR**	**VS**	**VT**	**VV**

Shaft size
06 - 6 mm

Resolution
09B - 512 counts or positions per revolution

For output types **IA**, **IC**, **SC** and **SI**:

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	

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

Connector option
A - 'D' type connector - 9 way
B - 'D' type connector - 15 way (for output types **PA** and **PB** only)
F - Flying lead (no connector)

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

Environment
A - IP53, Aluminium body (standard)
B - IP64, Aluminium body
C - IP68, Aluminium body

Special requirements
00 - None
0M - Cable length in meters

NOTE: Not all combinations are valid.

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Document issues

Issue	Date	Page	Corrections made
1	13. 1. 2009	-	New layout

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