



Features

- 3.3 and 5 VDC voltage supply option
- Quadrature, absolute, PWM and direction/step output options
- Bushing or servo mount
- Non-contacting magnetic technology
- Small size
- CMOS and TTL compatible
- Resolution from 32-512 PPR and 1024 states
- Long life
- High operating speed
- Highly repeatable
- Sealed option

EMS22 - Non-Contacting Rotary Magnetic Encoder

Electrical Characteristics

Resolution	32 to 512 PPR and 1024 states
Insulation Resistance (500 VDC)	1,000 megohms
Electrical Travel	Continuous
Supply Voltage	5.0 VDC $\pm 10\%$, 3.3 VDC $\pm 10\%$
Supply Current	20 mA maximum
Output Voltage	
Low Output Level	Vss+0.4 V maximum
High Output Level	Vdd-0.5 V minimum
Output Current	
With 4.5 VDC Supply Voltage	4 mA maximum
With 3.0 VDC Supply Voltage	2 mA maximum
Rise/Fall Time (Incremental Output)	500 ns maximum
Shaft RPM (Ball Bearing)	10,000 rpm maximum
Linearity	0.35 %
Accuracy	
Nominal	$\pm 0.5^\circ$ or better
Worst Case	$\pm 1.4^\circ$
Output Transition Noise	0.12 $^\circ$ RMS max.

Environmental Characteristics

Operating Temperature Range	-40 $^\circ$ C to +125 $^\circ$ C (-40 $^\circ$ F to +257 $^\circ$ F)
Storage Temperature Range	-55 $^\circ$ C to +125 $^\circ$ C (-67 $^\circ$ F to +257 $^\circ$ F)
Humidity	MIL-STD-202, Method 103B, Condition B
Vibration	15 G
Shock	50 G
Rotational Life	
S Bushing (@1,000 rpm)	100,000,000 revolutions
T & W Bushings (@1,000 rpm with 250 g side load)	50,000,000 revolutions
IP Rating	IP 65

Mechanical Characteristics

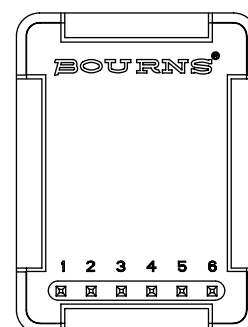
Mechanical Angle	360 $^\circ$ Continuous
Torque	
Starting	43 ± 21 g-cm (0.6 ± 0.3 oz-in.)
Running	29 ± 14 g-cm (0.4 ± 0.2 oz-in.)
Mounting Torque	203 N-cm (18 lb.-in.)
Shaft End Play	0.30 mm (0.012 ") T.I.R. maximum
Shaft Radial Play	0.12 mm (0.005 ") T.I.R. maximum
Weight	11 gms. (0.4 oz.)
Terminals	Axial, radial or ribbon cable
Soldering Condition	
Manual Soldering	96.5Sn/3.0Ag/0.5Cu solid wire or no-clean rosin cored wire 370 $^\circ$ C (700 $^\circ$ F) max. for 3 seconds
Wave Soldering	96.5Sn/3.0Ag/0.5Cu solder with no-clean flux 260 $^\circ$ C (500 $^\circ$ F) max. for 10 seconds
Wash processes	Not recommended
Marking	Manufacturer's trademark, name, part number, and date code.
Hardware	One lockwasher and one mounting nut supplied with each encoder, except on servo mount versions.

Pin Configuration

Output Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
A/B Quadrature	A	B	GND	Index	VCC*	CS**
Direction/Step	Pulse	Direction	GND	Index	VCC*	CS**
PWM	PWM Signal	GND	GND	GND	VCC*	CS**
Absolute	Digital Input	Clock	GND	Digital Output	VCC*	CS**

* Can be 5 or 3.3 VDC depending on the version.

** Active low chip select pin.



*RoHS Directive 2002/95/EC Jan 27 2003 including Annex.
Specifications are subject to change without notice.

Customers should verify actual device performance in their specific applications

Applications

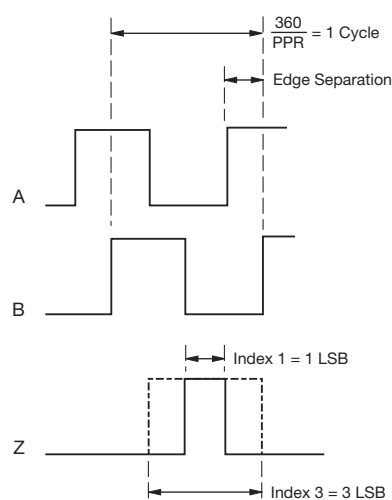
- Material handling equipment
 - Brushless DC motor commutation
 - Robotics
 - Automotive
 - Industrial automation
 - Petroleum refinery
- Medical
 - Office equipment
 - Audio and broadcast equipment

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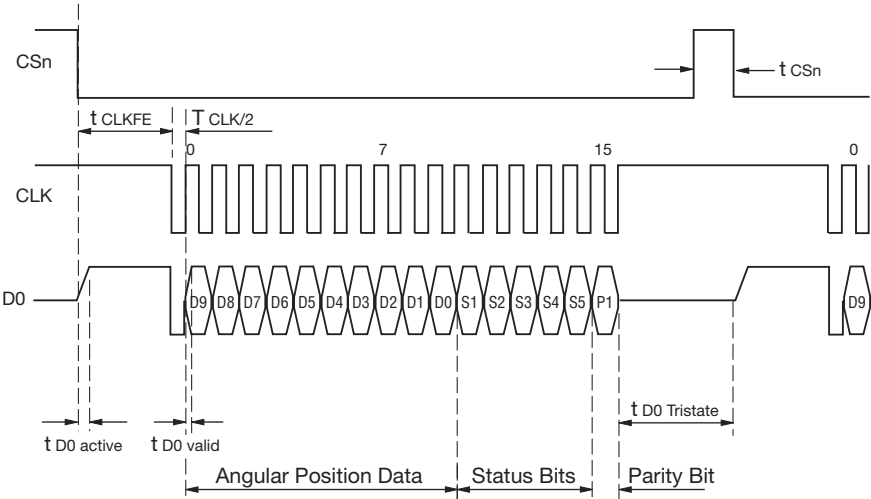
Output Type Waveforms and Variant Tables

Quadrature Output



PPR	3.3 Vcc	5.0 Vcc	Index 1	Index 3
256	X		X	
256	X			X
256		X	X	
256		X		X
128	X		X	
128	X			X
128		X	X	
128		X		X
64	X		X	
64	X			X
64		X	X	
64		X		X
32	X		X	
32	X			X
32		X	X	
32		X		X

Absolute Output



Data Content	Description
D9:D0	Absolute angular position data
S1	End of offset compensation algorithm
S2	Cordic overflow indicating an error in cordic part
S3	Linearity alarm
S4	Increase in magnitude
S5	Decrease in magnitude
P1	Even parity for detecting bits 1-15 transmission error

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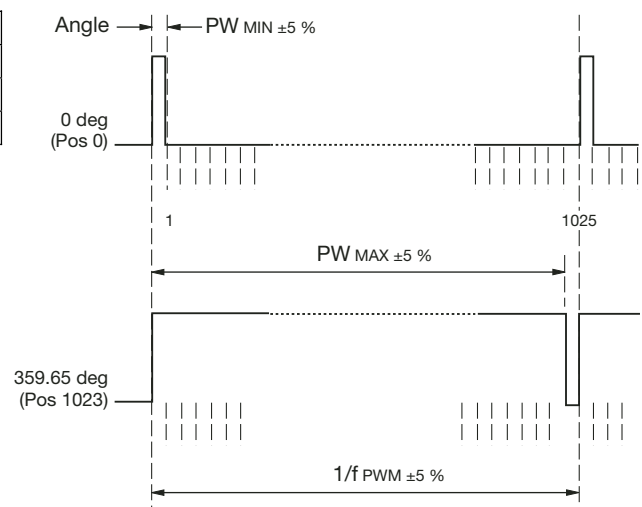
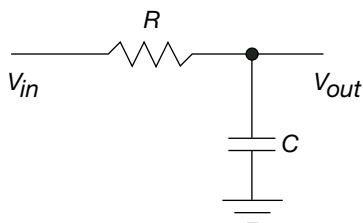
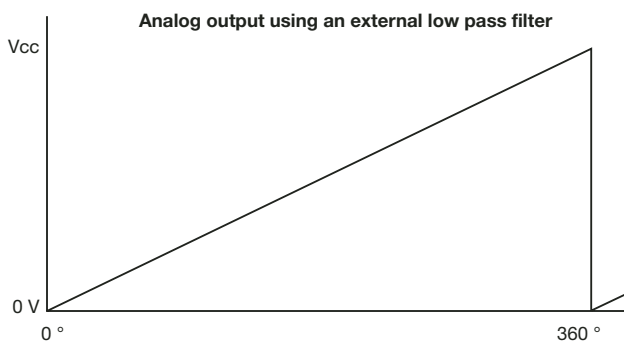
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Output Type Waveforms and Variant Tables (Continued)

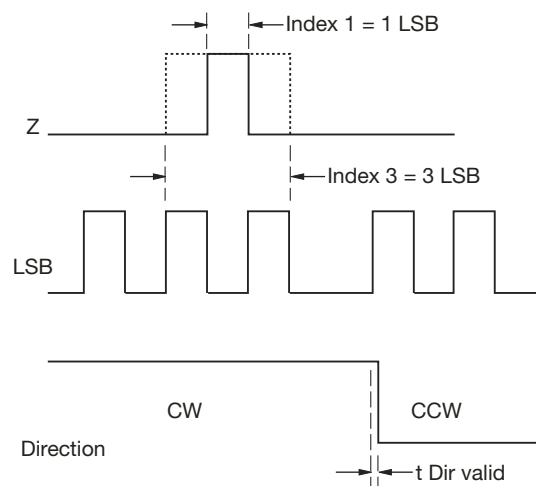
PWM Output

Parameter	Symbol	Type	Unit	Note
PWM frequency	fPWM	0.9756	KHz	Signal period: 1025 μ s
MIN pulse with	PWMIN	1	μ s	Position 0 Angle 0°
MAX pulse with	PWMAX	1024	μ s	Position 1023 Angle 359.65°



Direction/Step Output

PPR	3.3 Vcc	5.0 Vcc	Index 1	Index 3
512	X		X	
512	X			X
512		X	X	
512		X		X
256	X		X	
256	X			X
256		X	X	
256		X		X
128	X		X	
128	X			X
128		X	X	
128		X		X
64	X		X	
64	X			X
64		X	X	
64		X		X



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Consult factory for options not shown, including:

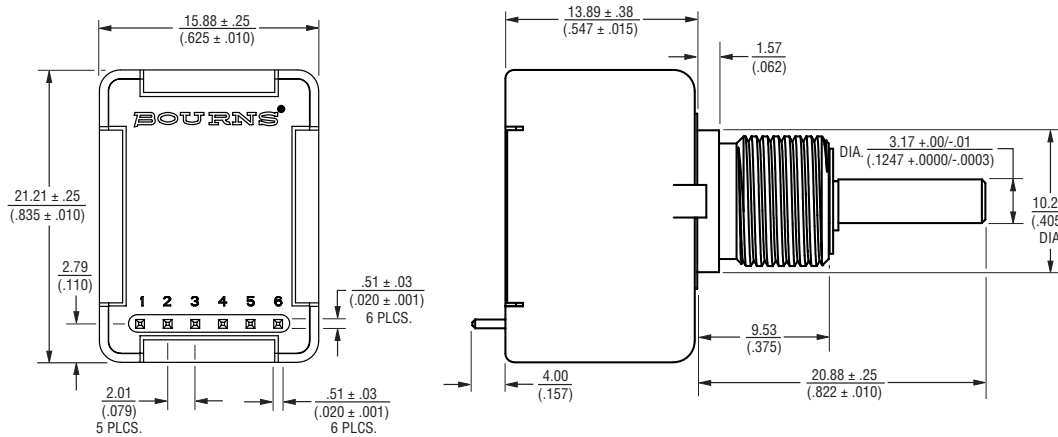
- Wire lead or cable options
- Special shaft/bushing sizes and features
- Connectors
- Special performance characteristics
- Non-standard resolutions
- PCB mounting bracket

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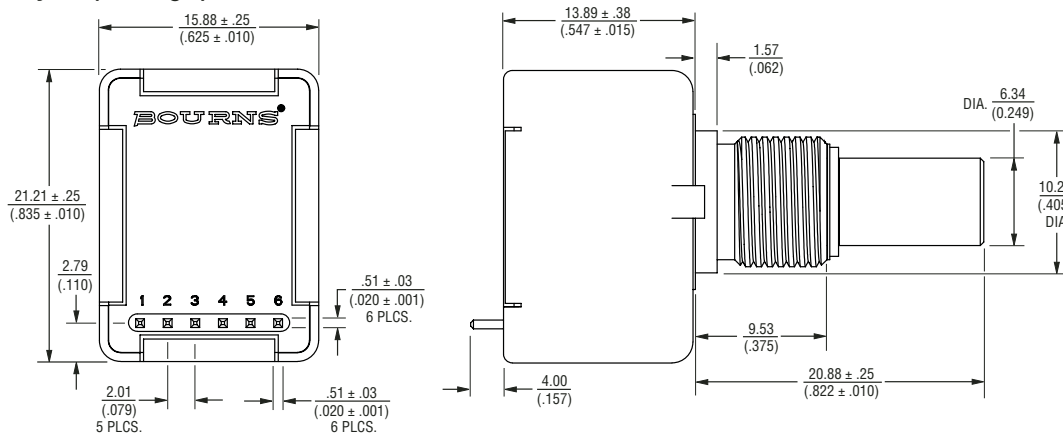
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Dimensional Drawings

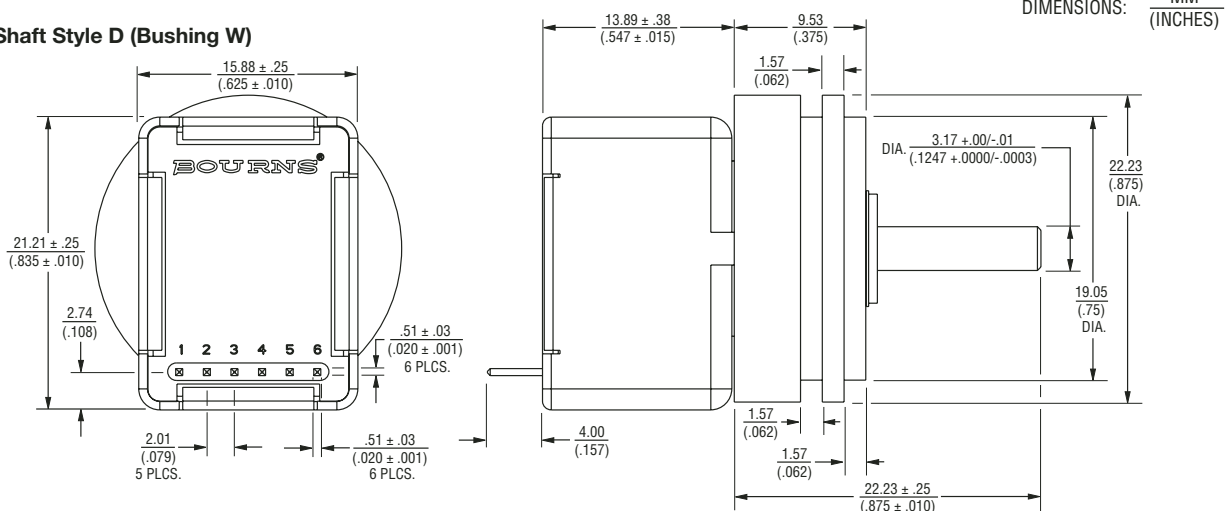
Shaft Style D (Bushing T)



Shaft Style B (Bushing S)



Shaft Style D (Bushing W)



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EMS22 - Non-Contacting Rotary Magnetic Encoder

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How To Order

BOURNS EMS22 22 MM NON-CONTACTING ROTARY MAGNETIC ENCODER

E	M	S	2	2	S	5	1	-	B	2	8	-	L	Q	3
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INDEX CHANNEL		
Code	Description	Available With Output Types (Code)
0	No Index	A, P
1	1 Pulse	Q, D
3	3 Pulses	Q, D

VOLTAGE SUPPLY	
Code	Description
3	3.3 VDC
5	5 VDC

SHAFT LENGTH DESIGNATOR*	
Code	Description
16	1/2 " Long
20	5/8 " Long
28	7/8 " Long
25	25 mm Long (Available with D Bushing Only)

RESOLUTION		
Code	PPR/States***	Avail. with Output Types
1	32	Q
2	64	Q, D
3	128	Q, D
4	256	Q, D
5	512	D
6	1024***	A, P

SHAFT STYLE		
Code	Description	Available With Bushings (Code)
B	1/4 " Dia., Plain End	S
C	1/4 " Dia., Flatted End	S
D	1/8 " Dia., Plain End	T, W
R	6 mm Dia., Slotted End	D
M	6 mm Dia., Flatted End	D

TERMINAL CONFIGURATION**	
Code	Description
L	Axial, Multi-Purpose Pin
M	Rear Ribbons Cable with Connector
W	Rear Ribbons Cable - No Connector

OUTPUT TYPE	
Code	Description
Q	Quadrature
A	CW Absolute
P	CW PWM
D	Direction/Step

BUSHING DESIGNATOR	
Code	Description
S	3/8 " D X 3/8 " L Threaded (Single Ball Bearing)
T	3/8 " D X 3/8 " L Threaded (Dual Ball Bearing)
W	Servo Mount 7/8 " D (Dual Ball Bearing)
D	9 mm D X 7.94 mm L Threaded (Single Ball Bearing)



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* Shaft length measured from mounting surface.

** Standard ribbon cable is 10 inches long. Consult factory for other lengths.

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