

# Rotary Encoders



**BOURNS®**

# Introduction

Bourns® Sensors Controls Product Line has continued to expand its encoder product offering with a wide variety of models to support our customers' specific applications.

Recognized worldwide for supplying standard and custom solutions as well as providing excellent technical support, Sensors and Controls is committed to providing our customers with reliable rotary encoder solutions.

## General Design Consideration

Encoders are the digital version of potentiometers and panel controls. Rather than providing a resistive variable output with rotation of the shaft, encoders simulate an on/off switching digital output. Applied as human-to-machine interface (HMI) devices, encoders are typically used to sense human adjustment of the device in a clockwise or counter-

clockwise direction triggering some action by the digital circuit. Applied as machine-to-machine interface (MMI) devices, encoders are typically coupled to a motor or other mechanical device to sense speed and direction of rotation.

## Important Characteristics

In selecting an encoder for your application, the most important characteristics to consider are the type of technology, type of output signal, speed of rotation, expected cycle life and switching capability of the product and whether an incremental or absolute encoder is needed.

There are two basic technology classifications of encoders: contacting (mechanical) and non-contacting (optical and magnetic). Your application will dictate the type of technology that will be best suited for your design.

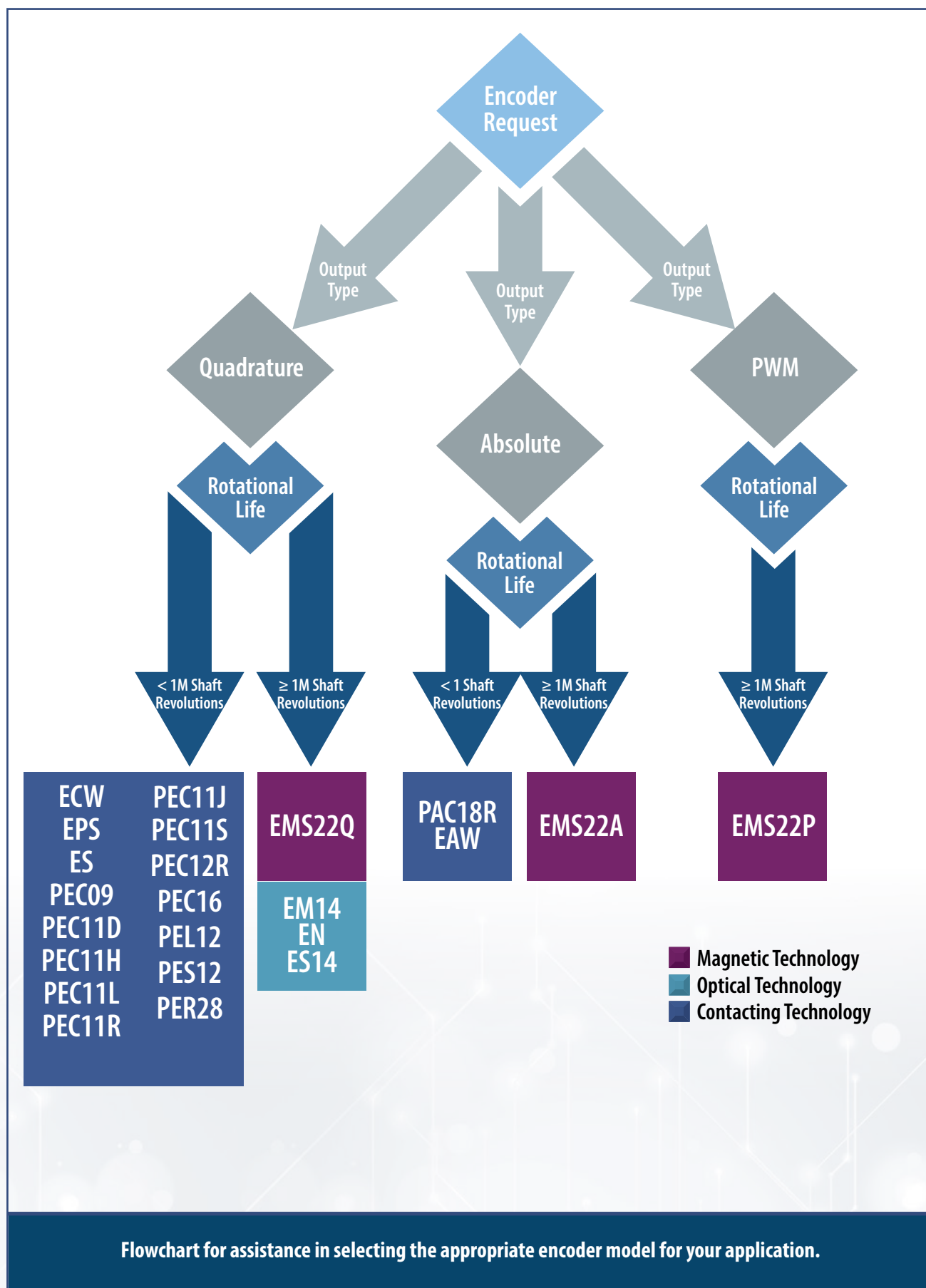
## Custom Solutions

A wide range of "value-added" enhancements are available to provide our customers with cost-effective solutions. Bourns' capability to develop custom encoder solutions and modifications includes the following:

- Cable harness/lead wires
- Detents
- Custom output
- Seal
- Torque
- Special packaging
- Terminal configurations
- Hardware
- Marking
- Mechanical stops
- Mounting brackets
- Special test requirements
- Customized shaft options

For additional information on value-added enhancements, please contact your local Bourns Sales Representative.


# Encoder Selection Guide Flowchart




# Bourns® Encoders


EAW	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	25,000 Cycles Min.	Absolute	128 Position	-40 °C to +85 °C	10 mA @ 10 VDC	No	Contacting	<ul style="list-style-type: none"> <li>Absolute encoder / absolute code output</li> <li>Digital output</li> <li>Sturdy construction</li> <li>Bushing mount</li> <li>Available with PC board mounting bracket</li> <li>RoHS compliant version available*</li> </ul>
ECW	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	6, 9, 12, 24, 36	-40 °C to +85 °C	10 mA @ 10 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Exceptionally long operating life</li> <li>Sturdy construction</li> <li>Bushing mount</li> <li>Available with PC board mounting bracket</li> <li>RoHS compliant version available*</li> <li>Recommended for HMI applications</li> </ul>
EPS	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	6, 9, 12, 24, 36	+1 °C to +85 °C	10 milliamp @ 10 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Incremental encoder</li> <li>Momentary push switch option</li> <li>Sturdy construction</li> <li>Snap-in mount</li> <li>Long operating life</li> </ul>
ES	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	6, 9, 12, 24	-40 °C to +85 °C	10 mA @ 10 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Snap-in shaft flexibility - top or bottom</li> <li>Snap-in PC board mount</li> <li>Long operating life</li> <li>Up to 24 full quadrature outputs per revolution</li> <li>RoHS compliant version available*</li> <li>Recommended for HMI applications</li> </ul>
PAC18R	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Absolute	8, 12 & 16 Positions	-35°C to +70°C	1 mA @ 10 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Low Profile Absolute Encoder</li> <li>High-class rotational feel</li> <li>Haptic Detent Feedback</li> <li>Sealed Shaft</li> <li>Insulated Plastic Shaft and Bushing</li> <li>RoHS compliant*</li> </ul>
PEC09	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Quadrature	19	-10 °C to +65 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Compact design</li> <li>Long life and high reliability</li> <li>Shaftless</li> <li>Detent option</li> <li>RoHS compliant*</li> <li>Recommended for HMI applications</li> </ul>
PEC11D	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 shaft revolutions	Quadrature	12, 18, 24	-30 °C to +70 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>High reliability</li> <li>RoHS compliant*</li> <li>Momentary push switch option</li> <li>Compact, rugged design</li> <li>Metal bushing/shaft</li> <li>Recommended for HMI applications</li> </ul>
PEC11H	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	8, 15, 16, 20 and 24	-20 °C to +70 °C	10 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>Push switch option</li> <li>High detent torque</li> <li>High rotational life and switch life</li> <li>Metal bushing/shaft</li> <li>RoHS compliant*</li> </ul>


\*RoHS Directive 2015/863, Mar 31, 2015 and Annex.


PEC11J	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	9, 15	-10 °C to +70 °C	10 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Push switch option standard</li> <li>• Compact, rugged design</li> <li>• High reliability</li> <li>• Metal bushing/shaft</li> <li>• Surface mount</li> <li>• Long rotational life</li> <li>• RoHS compliant*</li> </ul>
PEC11L	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	100,000 Cycles Min.	Quadrature	9, 15, 20	-30 °C to +70 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• High reliability</li> <li>• RoHS compliant*</li> <li>• Momentary push switch option</li> <li>• Compact, rugged design</li> <li>• Metal bushing/shaft</li> <li>• Recommended for HMI applications</li> </ul>
PEC11R	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Quadrature	12, 18, 19, 24	-30 °C to +70 °C	10 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Push switch option</li> <li>• Compact, rugged design</li> <li>• High reliability</li> <li>• Metal bushing/shaft</li> </ul>
PEC11S	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Quadrature	15	-10 °C to +65 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Long life and high reliability</li> <li>• Shaftless</li> <li>• Detent option</li> <li>• RoHS compliant*</li> <li>• Recommended for HMI applications</li> </ul>
PEC12R	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	15,000 Cycles Min.	Quadrature	12, 24	-30 °C to +70 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• RoHS compliant*</li> <li>• Long life and high reliability</li> <li>• Momentary push switch option</li> <li>• Rear and side mount versions</li> <li>• Recommended for HMI applications</li> </ul>
PEC16	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	50,000 Cycles Min.	Quadrature	12, 24	-30 °C to +70 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• RoHS compliant*</li> <li>• Long life and high reliability</li> <li>• Momentary push switch option</li> <li>• Rear and side mount versions</li> <li>• Recommended for HMI applications</li> </ul>
PEL12	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Quadrature	24	-10 °C to +65 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Long life and high reliability</li> <li>• Shaftless</li> <li>• Detent option</li> <li>• RoHS compliant*</li> <li>• Recommended for HMI applications</li> </ul>
PES12	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	30,000 Cycles Min.	Quadrature	24	-10 °C to +65 °C	1 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Long life and high reliability</li> <li>• Shaftless</li> <li>• Detent option</li> <li>• RoHS compliant*</li> <li>• Recommended for HMI applications</li> </ul>




PER28	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	50,000 Cycles Min.	Quadrature	10	-10 °C to +60 °C	10 mA @ 5 VDC	Yes	Contacting	<ul style="list-style-type: none"> <li>• Low Profile Incremental Encoder</li> <li>• High-class rotational feel</li> <li>• Haptic Detent Feedback</li> <li>• RoHS compliant*</li> </ul>

EM14	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	Non-detent: 1,000,000 cycles With detents: 100,000 cycles	Quadrature	8, 16, 32, 64	-40 °C to +70 °C	TTL, CMOS, HCMOS	Yes	Optical	<ul style="list-style-type: none"> <li>• Compact package size</li> <li>• Bracket option</li> <li>• High rotational cycle life</li> <li>• RoHS compliant*</li> <li>• Standard and high force push switch option</li> <li>• Splash proof shaft seal</li> <li>• Recommended for HMI applications</li> <li>• Cable &amp; connector option</li> <li>• Sealed to IP 54</li> </ul>

EN	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	5,000,000 cycles / With ball bearing: 100,000,000 cycles	Quadrature	25, 50, 64, 100, 125, 128, 200, 256	-40 °C to +85 °C	TTL, CMOS, HCMOS	No	Optical	<ul style="list-style-type: none"> <li>• Bushing or servo mount</li> <li>• Index channel available</li> <li>• High rotational cycle life</li> <li>• High operating speed</li> <li>• RoHS compliant version available*</li> <li>• Recommended for HMI and MMI applications</li> </ul>

EMS22	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	50,000,000 cycles	Quadrature, Absolute and PWM	32, 64, 128, 256, 512/1024	-40 °C to +125 °C	TTL, CMOS	No	Magnetic	<ul style="list-style-type: none"> <li>• Extremely long life</li> <li>• RoHS compliant*</li> <li>• High operating speed</li> <li>• Bushing or servo mount</li> <li>• 3.3 and 5 VDC voltage supply options</li> <li>• 1 or 3 index channels (quadrature output only)</li> <li>• Sealed to IP 65 with option of IP 67</li> <li>• Recommended for HMI &amp; MMI applications</li> </ul>

ES14	Rotational Life	Types of Output	Resolution Options (PPR)	Operating Temp. Range	Contact Rating	Detent Option	Technology	Features
	50,000,000 Cycles Min.	Quadrature	8, 16, 32, 64	-40 °C to +70 °C	HCMOS, CMOS and TTL	No	Contacting	<ul style="list-style-type: none"> <li>• HCMOS, CMOS and TTL compatible</li> <li>• Compact package size</li> <li>• High rotational cycle life</li> <li>• Ball bearing shaft support</li> <li>• RoHS compliant*</li> <li>• Recommended for HMI and MMI applications</li> </ul>

# Bourns® Encoder Applications

## Professional and Consumer Audio Applications

- Studio recording equipment
- Digital mixing consoles
- Digital broadcast equipment
- Professional sound systems
- Digital amplifiers
- Digital car audio

## Industrial/Factory Automation Applications

- Robotics
- Material handling
- Forklift trucks
- Machine tools
- Automated gates/doors
- Fluid measurement

## Medical Product Applications\*\*

- Blood / chemical analyzers
- Centrifuge equipment
- Blood monitors
- Computer Assisted Tomography (CAT) equipment
- Electrosurgical equipment
- Dialysis equipment
- Incubators
- Lasers
- Magnetic Resonance Imaging (MRI) equipment
- Medical meters
- EKG, EEG, heart monitors
- Temperature and respiratory monitors
- Insulin and infusion pumps
- Radiographic equipment
- Strip charts

## Test and Measurement Product Applications

- Oscilloscopes
- Logical and spectrum analyzers
- Signal level testers
- Weather instruments
- Digital monitors
- Board in-circuit testers
- Calibration equipment
- Counters
- Timers
- Cycle testers
- Distortion testers
- Electrostatic testers
- Environmental chambers and testers

## Portable Electronics Product Applications

- Data communication testers
- Appliances
- Intercom systems
- Irrigation controllers
- Measuring equipment
- Power generators, radio systems
- Portable monitoring equipment
- Portable test equipment
- Portable weather stations and systems
- Scanners
- Copiers
- Multimeters

### Note:

*\*\* Bourns® products have not been designed for and are not intended for use in "lifesaving," "life-critical" or "life-sustaining" applications nor any other applications where failure or malfunction of the Bourns® product may result in personal injury or death. See Legal Disclaimer at: [www.bourns/docs/legal/disclaimer.pdf](http://www.bourns/docs/legal/disclaimer.pdf)*



# Worldwide Sales Offices

Country	Phone	Email
Americas:	+1-951-781-5500	americus@bourns.com
Brazil:	+55 11 5505 0601	americus@bourns.com
China:	+86 21 64821250	asiacus@bourns.com
Europe, Middle East, Africa:	+36 88 885 877	eurocus@bourns.com
Japan:	+81 49 269 3204	asiacus@bourns.com
Korea:	+82 70 4036 7730	asiacus@bourns.com
Singapore:	+65 6348 7227	asiacus@bourns.com
Taiwan:	+886 2 25624117	asiacus@bourns.com
Other Asia-Pacific Countries:	+886 2 25624117	asiacus@bourns.com
<b>Technical Assistance</b>		
Region	Phone	Email
Asia-Pacific:	+886 2 25624117	techweb@bourns.com
Europe, Middle East, Africa:	+36 88 885 877	eurotech@bourns.com
Americas:	+1-951-781-5500	techweb@bourns.com

**BOURNS®**  
**www.bourns.com**

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Specifications subject to change without notice. Actual performance in specific customer applications may differ due to the influence of other variables. Customers should verify actual device performance in their specific applications.

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