



# Non-Contacting Position Sensors & Rotary Controls



**BOURNS®**

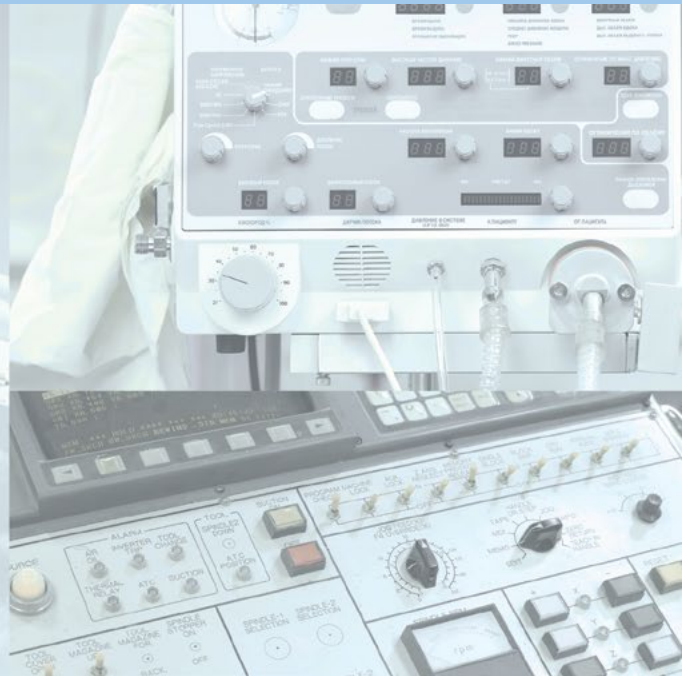
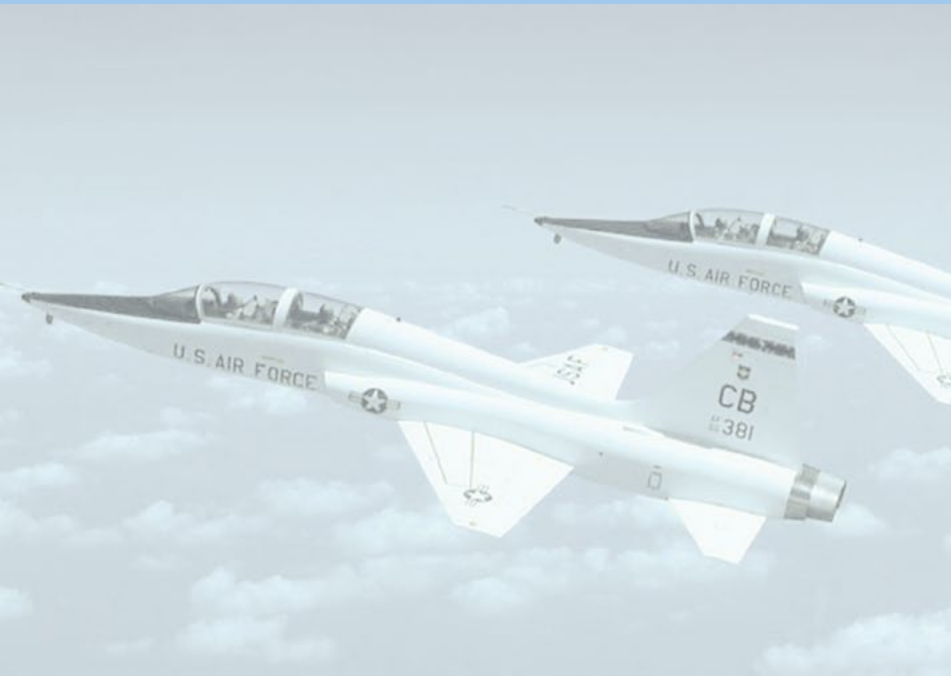
# Introduction



Bourns Sensors and Controls Product Line has continued to expand its product offering with a variety of models to support customers' specific applications. Recognized worldwide for supplying standard and custom solutions

and for superior technical and sales support, Bourns has now introduced a line of non-contacting rotary controls and position feedback sensors to support applications in the industrial market segment.





## Magnetic Technology

The Bourns® non-contacting magnetic rotary position sensors are based on a technology known as “Hall Effect.” This technology produces an analog or digital output similar to contacting potentiometers and encoders without the aid of a physical wiper contact. There are no internal contacting parts subject to mechanical failure, making this technology ideal for use in certain harsh environments where elevated levels of shock, vibration, temperature, moisture and particles may be present. Utilizing Hall Effect technology coupled with improvements in mechanical bearing surfaces and self-correcting, factory programmable

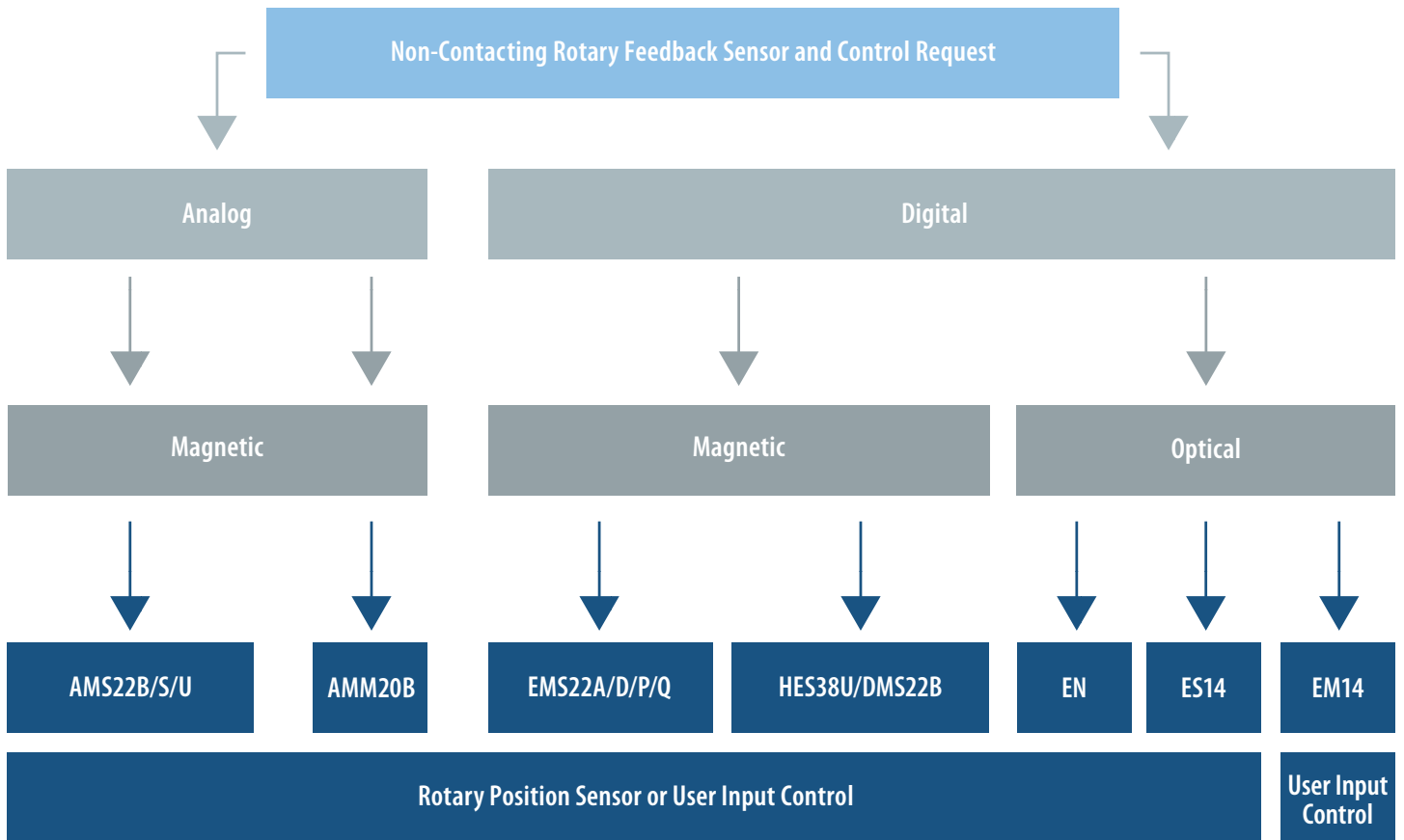
integrated circuits, Bourns Sensors and Controls Product Line offers a reliable and high-quality solution for rugged and harsh environment applications. An engineer or designer will have many options to configure a component for “best fit” in a given application. A selection of output types (analog or digital), mounting configurations (bushing or servo mount), single-turn or multiturn products, as well as custom enclosures and value added options ensures that Bourns can provide a tested and qualified solution for rotary control and position feedback sensor applications.

## Optical Technology

The Bourns® non-contacting optical encoders are also used as rotary controls and position feedback sensors. Optical encoders utilize an IRED (Infrared Light Emitting Diode), a receiver or ASIC (Application Specific Integrated Circuit), and a code disk with apertures to produce the digital signal. Similar to the magnetic Hall Effect technology, there are no internal

contacting parts subject to mechanical failure, resulting in a long deployment of cycle life and high reliability. A selection of bushing/shaft options, cable/connectors, detent and switch options along with value added options ensures that Bourns can provide the right solution for rotary control and position feedback sensor applications.

# Product Selection Criteria



When selecting a rotational control or position feedback sensor for a given application, the most important characteristics to consider are the technology type, output signal, and expected cycle life of the product. The flowchart above is provided to assist in selecting the product best suited for a given application.

Bourns' wide portfolio of products provides a variety of output types (analog, quadrature, direction/step, absolute, and pulse-width modulation), shaft/bushing and servo mounting options, switch and detent options, and resolution options ensures that Bourns can provide the optimum product configuration, quality and reliability best suited for the application. The following pages will provide a more in-depth overview of the products and capabilities.

# Analog Output



## Bourns® Model AMS22 Series Single-Turn Rotary Position Sensor

The Bourns® Model AMS22 Series of rotary position sensors are single-turn magnetic “Hall Effect” non-contacting technology devices. Offering superior side load performance, the Bourns® Model AMS22B and AMS22S have a sintered bronze sleeve bushing featuring up to 50 million shaft revolutions and a 250 gram side load capability, while

the Model AMS22U features a servo lid with ball bearings for up to 100 million shaft revolutions and a 250 gram side load capability. These models ship with standard solder lugs. Cable and connector options are also available as value-added options for ease of connection.



## Bourns® Model AMM20B Multiturn Rotary Position Sensor

The Bourns® Model AMM20B is a multiturn magnetic “Hall Effect” non-contacting technology device. Offering superior side load performance, the Bourns® Model AMM20B has a sintered bronze sleeve bushing featuring up to 50 million shaft revolutions and a 250 gram side load capability. The factory programmable chip allows

the Effective Electrical Angle (EEA) to be set at 10-turns, 5-turns or 3-turns with flexibility for custom programming on request. This product ships with standard PC pins. Cable and connector options are also available as value-added options for ease of connection.



## Common Performance Features

This family of rotary position sensors is available in a standard 5.0 VDC supply voltage. Environmental ratings include an operating temperature range of -40 °C to +125 °C and excellent performance in 98 % relative humidity. This product features 0.5 % independent linearity, with optional 0.3 % linearity available upon

request for long term, calibration-free performance. Other options include PWM or SPI output, and a single or dual output option for redundant system requirements. An extremely rugged design, the AMS22 series is sealed to IP 50 with an option up to IP 67.

# Digital Output



## Bourns Model HES38U-RS485 Hybrid Position Sensor

The Bourns Model HES38U-RS485 series is a hybrid position sensor based on a combination of magnetic “Hall Effect” non-contacting technology for the rotational position sensing combined with a long-lasting 10-turn electromechanical sensor for turns-counting. The output is RS-485 which is effective in applications or environments with significant electrical interference requiring a long transmission distance.

The RS-485 output has a resolution of 163,840 bits. This sensor is designed to meet the specifications of heavy-duty applications requiring long cycle life and high reliability and precision. The Bourns Model HES38U series features an industry standard servo mount package with a 38 mm housing, 6 mm diameter slotted shaft with an FMS of 12 mm and is RoHS compliant.



## Bourns Model DMS22B Series with SSI Output

The Bourns Model DMS22B series rotary position sensor is based on magnetic “Hall Effect” non-contacting technology. It has SSI output which provides effective synchronization in a closed-loop control system. The Bourns Model DMS22B is designed to meet the specifications of heavy-duty applications requiring long cycle life and high reliability.

This single-turn rotary sensor features a 7/8-inch flatted shaft supported by a factory programmable electrical angle from 10 to 360 degrees. It is available in a bushing mount configuration with a rotational life of up to 50 million shaft revolutions.



## Bourns® Model EM14 Rotary Control

The Bourns® Model EM14 rotary control utilizes optical non-contacting technology. This rotary control is available in a standard 5.0 VDC supply voltage. This product has the capability of rotation up to 120 RPM and a rotational life up to 2,000,000 shaft revolutions. Environmental ratings include

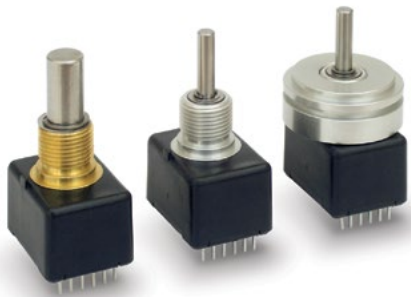
an operating temperature range of -40 °C to +75 °C and seal rating of IP 54. Model EM14 produces a 2-bit quadrature signal with resolutions of 8 to 64 PPR. Various shaft and bushing options, switch and detent options, along with cable/connector options are available.



## Bourns® Model EN Rotary Position Sensor

The Bourns® Model EN rotary position sensor utilizes optical non-contacting technology. This rotary position sensor is available in a standard 5.0 VDC supply voltage. Offered with dual ball bearing and bushing or servo-mount options, this product has the capability of rotation up to 3,000 RPM and an extended rotational life up to 200 million shaft revolutions. Environmental ratings

include an operating temperature range of -40 °C to +75 °C and a seal rating of IP 40 upgradable to IP 67 as a value-added option. Model EN produces a 2-bit quadrature signal with resolutions of 25 to 256 Pulses per Revolution (PPR). Various shaft and bushing options along with cable/connector options are available.



## Bourns® Model EMS22 Series Rotary Position Sensor

The Bourns® Model EMS22 Series of rotary position sensors are magnetic “Hall Effect” non-contacting technology devices. These rotary position sensors are available in 3.3 and 5.0 VDC supply voltage options. Utilizing dual ball bearings, this product has the capability of rotation up to 10,000 RPM and an extended rotational life up to 100 million shaft revolutions. Environmental ratings include an operating temperature range of -40 °C to +125 °C and excellent performance in 98 % relative humidity. Designed

and built for use in certain harsh environments, the Bourns® Model EMS22 family of products feature an IP 65 seal, upgradeable to IP 67. These products ship standard with PC pins. Cable and connector options are also available as value-added options for ease of connection. The Bourns® Model EMS22 is factory programmed to produce one of four distinct output waveforms.

### The Bourns® Model EMS22A produces an absolute output.

Absolute output refers to the absolute angular position. This type of output is especially useful for applications where the absolute position of a device is required. Also with 1024 distinct angular positions, Bourns® Model

EMS22A offers very high resolution indexing at every 0.35 ° of rotation. This type of output code is not affected by a power outage to the encoder since each angular position of the encoder has a unique code.

### The Bourns® Model EMS22D produces a direction/step output.

This output is very similar to the quadrature waveform but offers up to 512 PPR, as opposed to 256 PPR in quadrature. This output can be used in incremental counting

applications where a better resolution is desired. Indexing output is also available with a direction/step output waveform.

### The Bourns® Model EMS22P produces a Pulse-Width Modulation (PWM) output.

PWM is another form of absolute output that utilizes the square wave generated by the sensor to control the duty cycle of the output at different shaft positions. The Bourns® Model EMS22P encoder can generate pulses as low as 1 µs,

and as high as 1024 µs in a complete 1025 µs signal period. Some advantages of using this output waveform over other output types include immunity to noise and faster data acquisition.


### The Bourns® Model EMS22Q produces a quadrature output.


This output waveform is the most commonly selected output. Quadrature, also known as 2-bit quadrature or incremental is often used to determine magnitude (count) and direction (up/down) by an external interface circuit.


The Bourns® Model EMS22Q comes equipped with an indexed output that can be used for counting the shaft rotation.




# Digital Models


HES38U-RS485	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	50 million shaft revolutions	RS485	163,840	-40 ° to +85 °C	10 to 30 VDC	No	Magnetic	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>


EM14	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Non-detent: 2 million shaft revolutions  with detent: 200,000 shaft revolutions	Quadrature	8, 16, 32, 64	-40 °C to +70 °C	5.0 VDC	Yes	Optical	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• High rotational cycle life</li> <li>• Standard or 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>• Bracket option</li> </ul>


EN	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Standard: 10 million shaft revolutions  with ball bearings: 200 million shaft revolutions	Quadrature	25, 50, 64, 100, 125, 128, 200, 256	-40 °C to +75 °C	5.0 VDC	No	Optical	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Bushing or servo mount</li> <li>• Cable/connector options</li> <li>• High rotational life</li> <li>• High operating speed</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 million 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>



EMS22A	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Single ball bearings: 100 million shaft revolutions	Absolute	64, 128, 256, 512	-40 °C to +125 °C	3.3 VDC or 5.0 VDC	No	Magnetic	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Extremely long life</li> <li>• Bushing or servo mount</li> <li>• Sealed to IP 65 with option of IP 67</li> <li>• High operating speed</li> <li>• Recommended for HMI &amp; MMI applications</li> </ul>
	Dual ball bearings: 50 million shaft revolutions							

EMS22D	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Single ball bearings: 100 million shaft revolutions	Direction/Step	64, 128, 256, 512	-40 °C to +125 °C	3.3 VDC or 5.0 VDC	No	Magnetic	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Extremely long life</li> <li>• Bushing or servo mount</li> <li>• Sealed to IP 65 with option of IP 67</li> <li>• High operating speed</li> <li>• Recommended for HMI &amp; MMI applications</li> </ul>
	Dual ball bearings: 50 million shaft revolutions							

EMS22P	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Single ball bearings: 100 million shaft revolutions	Pulse-with Modulation	1024	-40 °C to +125 °C	3.3 VDC or 5.0 VDC	No	Magnetic	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Extremely long life</li> <li>• Bushing or servo mount</li> <li>• Sealed to IP 65 with option of IP 67</li> <li>• High operating speed</li> <li>• Recommended for HMI &amp; MMI applications</li> </ul>
	Dual ball bearings: 50 million shaft revolutions							

EMS22Q	Rotational Life	Type of Output	Resolution Options (PPR)	Operating Temp. Range	Supply Voltage	Detent Option	Technology	Features
	Single ball bearings: 100 million shaft revolutions	Quadrature	32, 64, 128, 256	-40 °C to +125 °C	3.3 VDC or 5.0 VDC	No	Magnetic	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Extremely long life</li> <li>• Bushing or servo mount</li> <li>• Index channel option</li> <li>• Sealed to IP 65 with option of IP 67</li> <li>• High operating speed</li> <li>• Recommended for HMI &amp; MMI applications</li> </ul>
	Dual ball bearings: 50 million shaft revolutions							

# Analog Models

AMS22S	Rotational Life	Type of Output	Independent Linearity	Operating Temp. Range	Supply Voltage	Programmable EEA	Output Resolution	Side Load Capability	Features
	50 million shaft revolutions	Analog	±0.5 % (±0.3 % available on request)	-40 °C to +125 °C	5 V ± 10 %	10° to 360° (10° increments)	12 bits @ 360°	250 grams	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Non-contacting magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Factory-programmable for zero position</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>
AMS22U	Rotational Life	Type of Output	Independent Linearity	Operating Temp. Range	Supply Voltage	Programmable EEA	Output Resolution	Side Load Capability	Features
	100 million shaft revolutions	Analog	±0.5 % (±0.3 % available on request)	-40 °C to +125 °C	5 V ± 10 %	10° to 360° (10° increments)	12 bits @ 360°	250 grams	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Non-contacting magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Factory-programmable for zero position</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>
AMS22B	Rotational Life	Type of Output	Independent Linearity	Operating Temp. Range	Supply Voltage	Programmable EEA	Output Resolution	Side Load Capability	Features
	50 million shaft revolutions	Analog	±0.5 % (±0.3 % available on request)	-40 °C to +125 °C	5 V ± 10 %	10° to 360° (10° increments)	12 bits @ 360°	250 grams	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Non-contacting magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Factory-programmable for zero position</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>
AMM20B	Rotational Life	Type of Output	Independent Linearity	Operating Temp. Range	Supply Voltage	Programmable EEA	Output Resolution	Side Load Capability	Features
	50 million shaft revolutions	Analog	±0.5 % (±0.3 % available on request)	-40 °C to +125 °C	5 V ± 10 %	1080°, 1800° or 3600° (other angles available on request)	12 bits @ 3600°	250 grams	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Non-contacting magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Factory-programmable for zero position</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>
DMS22B	Rotational Life	Type of Output	Independent Linearity	Operating Temp. Range	Supply Voltage	Programmable EEA	Output Resolution	Side Load Capability	Features
	50 million shaft revolutions	Digital SSI	±0.3 %	-40 °C to +125 °C	4.5 V minimum 5 V typical 5.5 V maximum	10° to 360° (10° increments)	12 bits @ 360°	250 grams	<ul style="list-style-type: none"> <li>• RoHS compliant*</li> <li>• Non-contacting magnetic technology</li> <li>• Highly resistant to vibration/shock</li> <li>• Highly resistant to fluid/dust ingress</li> <li>• Factory-programmable for zero position</li> <li>• Robust design for industrial applications</li> <li>• Highly repeatable</li> </ul>

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

# Typical Industrial Applications

## Maintenance

- Farm/forestry
- Recreational

## Clean Energy

- Solar tracking of solar cell panels
- Adjustment of windmill turbine houses
- Opening and closing of windmill hatches

## Machine Tools

- Loading/unloading of machined parts
- Positioning of machining tools
- Operating doors, hatches, and other safety features

## Material Handling

- Automatic/manual lift and transport aids
- Overhead crane systems
- Conveyor systems
- Feeding equipment
- Production line equipment

## Packaging and Handling

- Pick and place/palletizing
- Stretch-wrapping
- Filling

## Medical and Health\*\*

- Dental chairs
- Patient lifts
- Wheelchairs & mobility enhanced vehicles

## Factory Automation

- Robots and manipulators
- Automated gates/doors
- Printing/scanning

# Custom Solutions and Value-Added Options

A wide range of “value-added” enhancements are available to provide customers with cost-effective solutions. Capabilities to develop custom solutions and modifications include:

## Custom Electrical Features

- Electrical angles
- Linearity
- TR tolerance
- Digital resolution

## Custom Mechanical Features

- Housing
- Brackets/adapters
- Shafts and bushings
- Detents
- Torque

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

## Environment Protection (IP rated seal)

## Wire Leads & Connectors

*\*\* 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)*



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Bourns® products are available through an extensive network of manufacturer's representatives, agents and distributors. To obtain technical applications assistance, a quotation, or to place an order, contact a Bourns representative in your area.

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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