

Application Note

# CE Series Mechanical Encoders

## Instrumentation Applications

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Author:  
Chuck Manzano  
Senior Product Manager  
Chuck.Manzano@ctscorp.com  
CTS Corporation

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## Encoders in Instrumentation

### Introduction

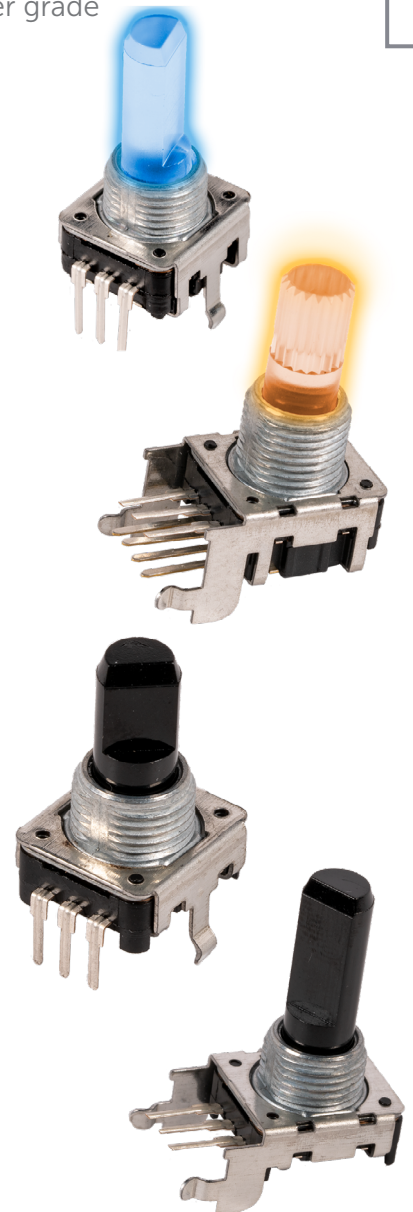
Rotary encoders are commonly used in all types of digital measuring instruments, collectively known as instrumentation, that are used for indicating, measuring and recording physical quantities, or simply to control a function. Instrumentation can be found in many applications from medical equipment to laboratory equipment to communications equipment to electronic measurement equipment to consumer appliances. Rotary encoders are used in digital instrumentation to adjust screen display brightness, volume controls, set voltage levels, set sensitivity levels, and many other functions. Although equipment has evolved from panel controls to digital touch screens over the years, many end users continue to prefer a human-to-machine interface on many specialized measuring instruments, and in consumer grade applications.

### Background

Instrumentation engineering is the engineering specialization focused on the principle of operation and measuring instruments that are used in various pieces of equipment with a variety of applications. Instrumentation engineering is loosely defined because the required tasks are very domain dependent. An expert in biomedical instrumentation has very different scope over an expert in rocket instrumentation, or even kitchen appliance controls. However, the common concerns for engineers are the selection of appropriate controls for the instrument panel that will be used to adjust and/or calibrate the piece of equipment or appliance.

Rotary encoders are electro-mechanical devices that convert angular position or rotation of a shaft to digital output signals. The output signal is fed to a microprocessor that will execute stored instructions based on the direction of rotation and the angle of rotation. Mechanical encoders are commonly constructed with phenolic or ceramic element with resistive ink pattern printed on the surface, or a lead frame that is insert molded to create an element that will produce the output signal. A wiper rides across the element to create the incremental quadrature output signal. Wipers are commonly fabricated from stamped phosphor bronze or nickel-silver, or can even be fabricated from multiple formed wire strands (multi-finger wiper) welded to a tie bar forming a rake design.

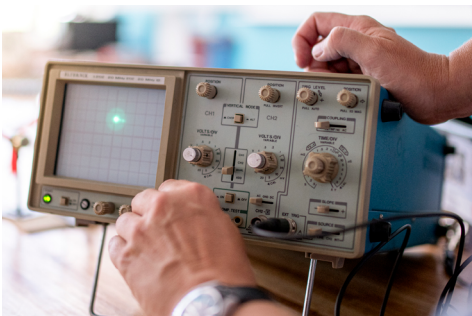
Rotary encoders are typically powered with a 5 volt DC power source. Two output terminals provide the incremental quadrature output signal when the shaft is rotated. When the user turns the shaft, the output signal fed to the preprogrammed microprocessor that in turn makes adjustments to the frequency, volume, balance, or other function adjustment. Mechanical encoders with contacting technology typically require debouncing with a filter circuit or the addition of a debounce IC so that the output signal is clear of any inherent noise that could cause output errors.





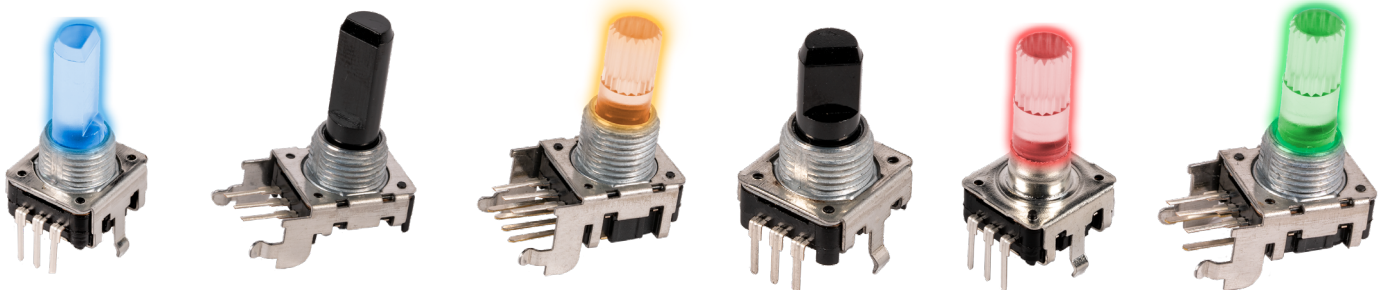
## Applications

Rotary encoders are selected for instrument panels in a variety of electronic equipment depending on the end application. **Medical and laboratory equipment** such as ultrasound scanner and electron microscopes may need rotary encoders for adjustment of display brightness, contrast, opacity or image sharpness. Portable vitals monitor equipment and portable electrocardiogram equipment may use rotary encoders for brightness control on the display, and to set frequency and capture rate. **Digital communications equipment** use rotary encoders to adjust bandwidth, frequency, squelch, and microphone gain. **Electronic digital test equipment** such as oscilloscopes use rotary encoders to adjust input voltage, signal position, time/division rate, and other functions. **Digital power supplies** use rotary encoders to adjust voltage output and current output. **Car audio** systems use encoder for adjustment of volume, tone, balance and other menu functions.



## CE Series 11CE and 12CE Mechanical Encoders

CTS CE Series family of mechanical encoders offers horizontal and vertical mount styles, sleeve bushing or threaded bushing, 12 PPR and 24 PPR resolution, detent options and momentary push switch option. Rotational life is rated at 30,000 cycles along with momentary switch life of 20,000 actuations for extended deployment. An operating temperature range of -10°C to +70°C provides all excellent performance in all temperatures. Shaft length and trim options are available. In addition, Series 12CE offers backlit illuminated shafts for those applications requiring an illuminated shaft. LEDs are available in single, dual and three-color options in a variety of colors and color combinations.



Custom configurations are also available on request.  
Contact an authorized CTS Sales Representative for additional details.  
Contact us with any questions at <https://www.ctscorp.com/contact>.

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### Technical Inquiries

[sensorscontrols@ctscorp.com](mailto:sensorscontrols@ctscorp.com)

## Contact

Chuck Manzano  
Chuck.Manzano@ctscorp.com  
CTS Corporation  
4925 Indiana Avenue  
Lisle, IL 60532

Jacqueline Morris  
Marketing & Communications Manager  
Jacqueline.Morris@ctscorp.com  
T: 630.577.8865  
CTS Corporation  
4925 Indiana Avenue  
Lisle, IL 60532

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