

Application Note

CE Series Mechanical Encoders

Audio Applications

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Encoders in Audio Applications

Introduction

Rotary Encoders are used in all types of audio equipment. These devices are used to control system functions such as frequency, tone, balance, sound and mix levels. Equipment such as audio mixing boards, instrument amplifiers, sound processing equipment and guitar effects pedals all use rotary encoders as well as panel potentiometers for various adjustment controls.

Background

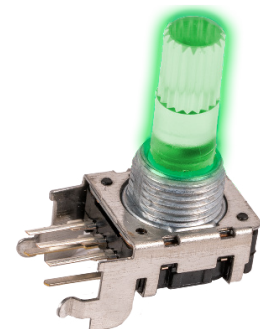
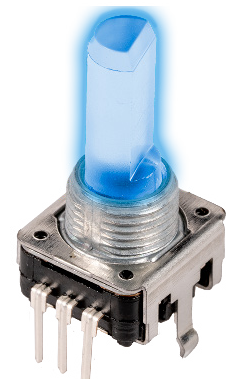
Rotary encoders are electro-mechanical devices that convert angular position or rotation of a shaft to digital output signals. The output signal is fed to a microprocessor that will execute stored instructions based on the direction of rotation and the angle of rotation. Mechanical encoders are commonly 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 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.

Evolution of Digital Audio Equipment

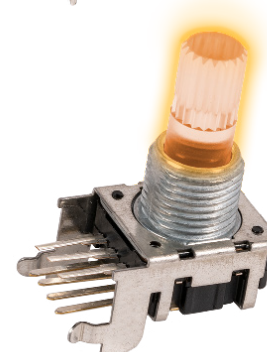
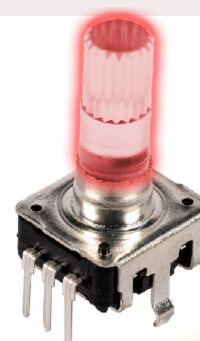
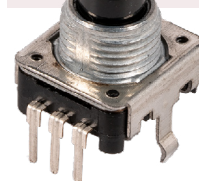
As sound and audio equipment continues to evolve, there is a trend for equipment to shrink in size and to transition next generation platforms from analog to digital. Concurrently, there is a trend to pack more controls into existing or smaller sized units and to utilize a single control for multiple functions. To address these trends, rotary encoders are being utilized to save printed circuit board space while maintaining performance and extending the individual control functionality by utilizing a menu control to assign and change functions of the individual control.

Both professional and consumer grade audio mixers have transitioned from analog to digital platforms as signal processing technology has become very inexpensive. Mixers use encoders to control frequency, tone, balance, effect send and attenuation. The versatility of a single encoder to function as assigned by a master menu select control opens a door of possibilities with mixer designs.



All associated digital platform signal processors that support the recording process also use rotary encoders for effect controls, wet/dry mix, input/output level controls and other functions. Guitar effects “stomp boxes” are currently booming in popularity. What were once large multi-function effects floor units have been pushed aside by guitarists who prefer individual effects units to customize their sound. Many of these effects with digital designs use rotary encoders to control input level, output level, sound mix, and effect intensity. Also increasing in popularity are LED backlit control shafts that allow the guitarist to see control settings in dark club or concert settings.

Another trend over the last few years is the evolution of digital guitar amplifiers. These amplifiers are packed with features that require the flexibility to assign functions to the controls. Rotary encoders are used in these designs as they can be assigned various functions by a master menu select control. Rotary encoders with an integrated push switch have the additional flexibility to toggle functions or to activate/deactivate the control.



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 $+70^{\circ}\text{C}$ 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.

About CTS Corporation

Founded in 1896, CTS Corporation (NYSE: CTS) is a leading designer and manufacturer of products that Sense, Connect, and Move. The company manufactures sensors, actuators, and electronic components in North America, Europe, and Asia. CTS provides solutions to OEMs in the aerospace, communications, defense, industrial, information technology, medical, and transportation markets. CTS focuses on providing advanced technology, exceptional customer service and superior value to industry partners throughout the globe.

CTS aims to be at the forefront of technology, delivering innovative sensing, connectivity and motion solutions for the creation and advancement of products and services around the world.

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