

Absolute Encoders



Basics

Use absolute encoders when position data must be retained after loss of power. Examples include robotics, lead/ball screws, overhead cranes, and rack and pinion applications.

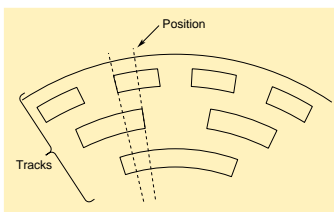
Basic Operation of Optical Rotary Absolute Encoders

As with incremental encoders, absolute optical rotary encoders use a rotating disk to interrupt the light path to a photodetector, which produces an output signal. However, absolute encoders read uniquely coded tracks to generate position information. No two adjacent positions are alike. Therefore, absolute encoders do not lose position data when power is lost. True position is available as soon as power is restored.

Conventional Optical Absolute Encoder Disks

A conventional absolute encoder disk features a series of concentric tracks, each consisting of a pattern of transparent and opaque segments. These independent tracks provide a unique combination of absolute values for each resolvable position. One track is needed for each "bit" of position information that is output as either a serial or parallel data "word."

The preferred code format is Gray Code, in which only one



Typical disk pattern showing radial scanning method used to read position

bit of information changes between adjacent positions on the disk. This limits the position error from the track sensors to plus or minus one count. Other available codes, such as Natural Binary or Binary Coded Decimal (BCD), may have several bits change between adjacent positions.

CoreTech® Technology

Stegmann's CoreTech® concept uses a minimum number of very sophisticated components to achieve maximum variety: A proprietary hybrid OPTO-ASIC, designed by Stegmann, and a small, unique disk with a barcode track.

Unique Code Disk Design

The very small CoreTech® code disk condenses absolute position information into one non-repeating circular barcode pattern. A second track with 1024 analog

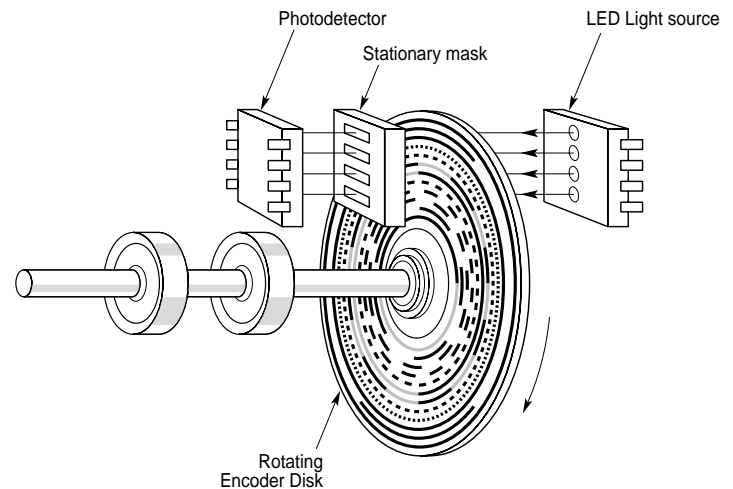
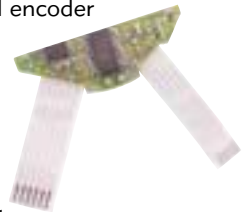


sin/cosine signals is used to enhance resolution and accuracy. Any absolute number of positions from 2 to 32,768 can be configured via internal software based on the single unique code disk design.

A Photodetector Array

The CoreTech® pickup system is also very different from conventional encoder systems.

The sensitive area of the OPTO-ASIC consists of a sophisticated sensor array, where individual sensors are selectively accessible. The sensor array reads complete serial data strings from the barcode track. At the same time a separate section of the array reads the very precise sine/cosine information, which is transformed into a high-resolution ARCTAN value within the hardwired ASIC. After synchronization of the two signals, the desired resolution



Absolute rotary encoder with conventional code disk.

Get Instant Detailed Information!

For detailed, up-to-date specifications, CAD drawings, application examples and reference information, go to:

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For documentation on specific products, use our fax back system in the web site or call our 24-hour fax back system

916-431-6545

and follow the recorded instructions. See the selection guides in this brochure for specific document numbers.

and accuracy for the position data is obtained. Absolutely no angular movement is required to read the position information. Due to the high integration level of the custom ASIC, the complete operation is processed in real-time. Customer-specific resolutions are factory-selected for the CoreTech® module via firmware.

Magnetic Absolute Encoders

Many applications require resistance to extremely high shock and vibration, wide temperature variations, or high humidity with condensation. Stegmann magnetic absolute encoders meet these unique challenges.

Magnetic field strength of a proprietary 32-pole magnetic ring is measured using two strategically spaced magneto-resistors that pick up variation of the magnetic field intensity along the circumference of the ring. The resulting 32 sine/cosine signals per turn (5-bit) are then enhanced by 8-bit

interpolation. A single north-south pole magnet, read by a Hall effect sensor, is used to assign absolute values to individual sine/cosine cycles. Thus, the 32-pole magnetic ring is calibrated for a 13-bit single-turn absolute position feedback. Additional software is used to compensate for temperature variation and resulting differential thermal expansion to insure data integrity.

Advantages of Absolute Encoders

- **Non-Volatile Memory.** Absolute encoders are non-volatile position verification devices. True position is not lost if the power fails. Continuous reading of position is not required.
- **Safety.** In some applications, a loss of position could result in damage to the machinery or injury to the operator. An absolute encoder provides position verification the moment power is applied without requiring movement to a reference position.

- **Noise Immunity.** Absolute encoders determine position by continually reading a coded signal. Stray pulses will not accumulate and accurate position is available again on the next reading.

Electronic Zero Position

With all Stegmann absolute encoders, the zero position is electronically assigned by the user to the current mechanical position by activation of a pushbutton or set line. No mechanical detachment or rotation of the encoder is necessary.

Parallel or Serial Transmission

With parallel transmission, each position bit is transmitted over a separate data line, and all bits are read simultaneously into the control. Parallel transmission is generally used for shorter cable runs, or when real-time transmission of all data bits is required.

Stegmann developed SSI (Synchronous Serial Interface)

to offer a cost-effective solution for long cable runs. The encoder produces a parallel data output, which is internally converted to serial data and transmitted using only 6 wires, regardless of encoder resolution. This is ideal for transmission at high speed over long distances — up to 3000 feet.

Single and Multi-Turn Absolute Encoders

Use single turn encoders when the full range of positions in the application occurs within one full revolution (360°) of the encoder shaft. Multi-turn encoders are recommended for applications involving multiple revolutions of the encoder shaft.

In Stegmann multi-turn encoders, a high precision, miniaturized gear train, with a magnet on each gear stage, is used to mechanically store position information over as many as 8,192 turns. The position of each gear stage is determined with a pair of Hall sensors. This eliminates the need for costly and often unreliable counters and battery back up systems. Also, position changes that occur while the power is off are automatically tracked.

Serial to Parallel Conversion Module

The SPA-3 converter module can be used with our SSI absolute encoders to convert the transmitted data from serial to parallel format. These devices can be used if the control does not directly accept the SSI format.

Fieldbus Systems

Stegmann absolute encoders are also supplied with popular fieldbus interfaces including DeviceNet, Profibus, Interbus, and CAN Open. ■

