

Basics – Absolute Encoders

Principle of Operation

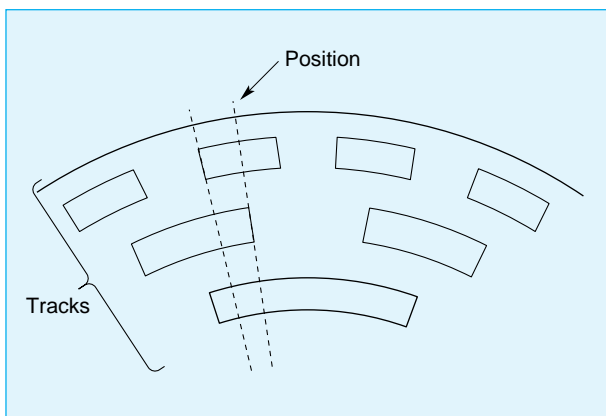
In principle, absolute encoders are similar to incremental encoders, in that a rotating disk interrupts a photodetector to produce an output signal.

However, absolute encoders are different in two very important ways:

1. Every position of an absolute encoder is unique. Unlike an incremental encoder, where position is determined by counting pulses from a zero mark or home base, the absolute encoder reads a system of coded tracks to establish position information. No two positions are alike.
2. Absolute encoders do not lose position when power is removed. Since each position is unique, true position verification is available as soon as power is up. It is not necessary to initialize the system by returning to home base.

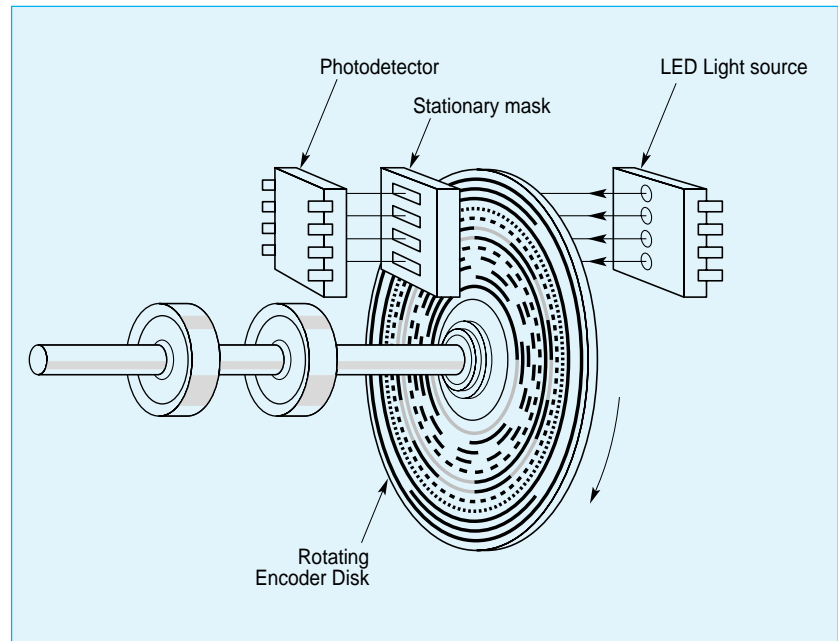
Absolute Encoder Disk

As opposed to the simple, single track system of an incremental encoder, an absolute encoder disk features several concentric tracks, each consisting of a pattern of transparent and opaque segments. These independent tracks provide a unique combination of absolute values for each position. The coded format is a variation of Binary code called Gray code. Gray code is used because only one "bit" changes between adjacent words on the disk. This limits any transition errors of the word track sensors to plus or minus one count. In all other codes, such as Binary or Binary Coded Decimal (BCD), several bits are required to change state between adjacent words.



Typical disk pattern showing radial scanning method used to read position.

Absolute Rotary Encoder



Absolute encoder disk incorporated in a multi-turn encoder.

Advantages of Absolute Encoders

Non-volatile Memory

An absolute encoder functions as a non-volatile position verification device. True position is not lost if the power fails or the system moves while power is off. A continuous reading of position is not required. This is particularly useful in applications, such as satellite tracking antennas, where occasional position verification is all that's necessary.

Programming Flexibility

By eliminating the need for system homing, absolute encoders can be controlled to provide positioning programs based on establishing reference from point-to-point, rather than from a home position.

In addition, a microprocessor interface module enables the system designer to program in several operating parameters, including resolution. (See Serial-to-Parallel Converter Module, pages 70-71.)

Safety

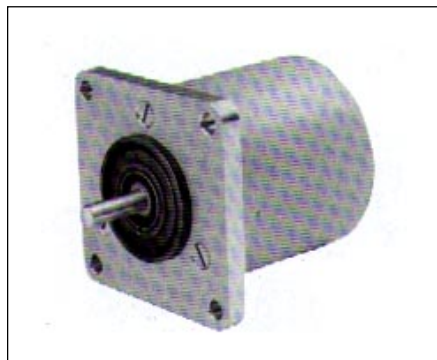
In some applications, a loss of position could result in damage to the machinery or injury to the operator. An absolute encoder provides position verification the moment power is up.

Better Immunity to Electrical Noise

Absolute encoders determine position by continually reading a coded signal. Stray pulses, resulting from electrical noise, will not accumulate and accurate position is available again on the next reading.

Long Distance Transmission

Our Synchronous Serial Interface (SSI) option is well suited to long cable runs. The encoder produces a parallel data output which is converted to serial and is ideal for transmitting information at high speeds over long distances . . . up to 4,000 feet.



Single Turn and Multi-Turn Absolute Encoders

As the name implies, single turn encoders are best suited for short travel, motion control applications where position verification is required within a single turn of the encoder shaft. A multi-turn encoder is recommended for applications involving lengthy or complex positioning requirements.

A multi-turn encoder consists of a series of disks connected to the basic high resolution disk through a system of gearing. The additional disks provide for turns counting so that position data is available over multiple revolutions. The Ledex multi-turn absolute encoder features 4,096 turns with a resolution of 4,096 positions/turn.

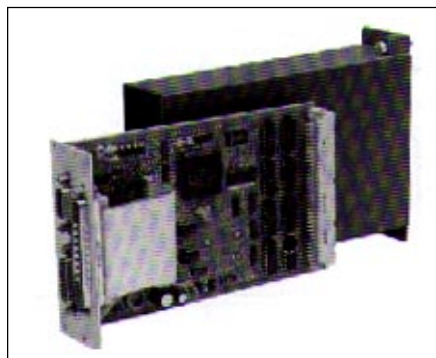
Single turn encoder



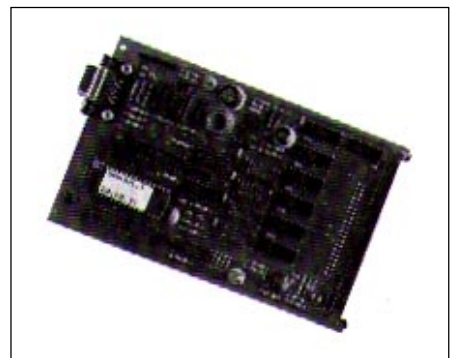
High precision multi-turn encoder

Programming with the Serial-to-Parallel Converter Module

The SPA 3 converter modules are available for use with multi-turn absolute encoders with serial data output to convert information from the encoder to a parallel format. The SPA 2 is used with absolute encoders that have a synchronous serial interface (SSI). In addition, several operating parameters can be programmed in by the user or programming can be done at the factory prior to shipment. See pages 70-71 for more information.



SPA 2



SPA 3