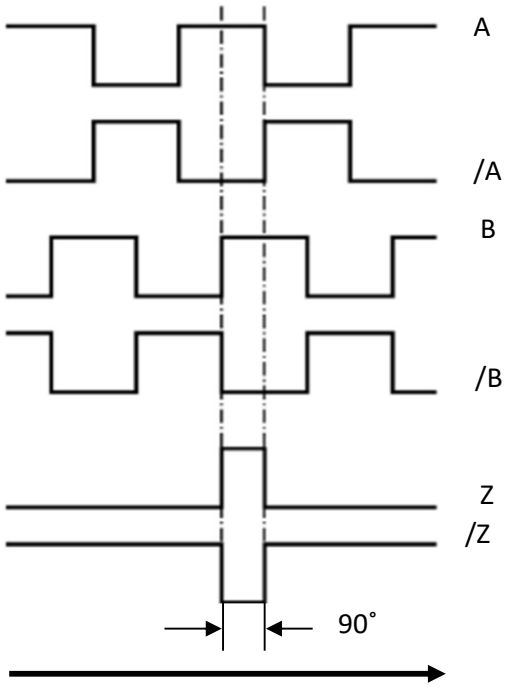
Incremental Vs Absolute Encoders

Rotary encoders are offered in Incremental and Absolute versions.

Incremental encoders output a signal based on a change in position, the finer the resolution the shorter the distance travelled between signals, these signals are typically a digital output on/off as the device moves. Also, Sine wave signals are available. By counting the number of pulses, it is possible to calculate the distance moved. By dividing this distance by time, it is possible to calculate the speed of movement.

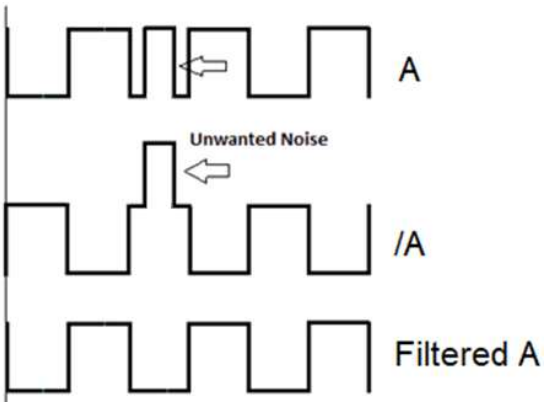


By measuring only one channel (A), It is not possible to check if the device is moving forward or backward.

By measuring two channels (A and B), it is possible to see direction and change in direction because the A channel rising edge (on) will lead the B channel leading edge. The use of A and B signals gives rise to increased resolution and reliability. Quadrature monitors the rising and falling edges of the A and B channels to give 4x the count per pulse. A 1024 pulse per rev (ppr) encoder can offer 4096 cpr (counts per rev).

The Z signal only occurs once every rotation, this acts as a reference marker for one complete rotation and can be used for relative positioning.

The inverse signals /A /B /Z (the NOT or Bar) of A,B, and Z are the exact opposite of their partner signal. This allows suitable electronics or controllers to monitor the encoder and detect noise or errors in the signal. If a voltage spike is detected on A for example, it will also appear on /A. Because A and /A should always be opposite, if both channels register a positive signal at the same time, there must be an error.



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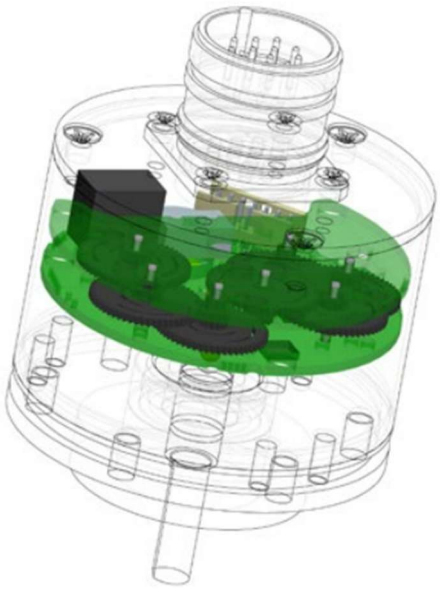
A limitation of incremental encoders is that they are not able to measure or record an absolute position. Therefore, if the power is lost for any reason, the encoder cannot identify it has moved position. It can only measure the incremental changes in position and therefore speed (position changed/time) while powered.

To determine the position, the system must first be homed or registered to find a reference position, this must be conducted each time the power is returned to the encoder. To overcome this, then an Absolute encoder is required.

Absolute rotary encoders are available in two main types, single-turn and multi-turn. Single turn provides the absolute position of rotation within one rotation. After one complete turn, the counting starts again. Single-turn encoders are therefore limited to recording the position of one turn, but lower cost than multi-turn encoders.

Multi-turn encoders, therefore, record the position over many turns. The number of turns will vary according to the model from a few turns to many thousands and permits the recording of the true position of the device regardless of travel. Commonly multiturn encoders will employ a gear train and multiple sensors to track the number of turns the encoder has made to track the changes, alternative methods may be Weigand effect (energy harvesting technology), or puffer batteries.



This ability to record position is key where it is inconvenient, costly (in time), or impossible to “home” the machines position and so the ability to detect a position even after power loss is the priority.

In the next papers, we will expand on the method of recording and communicating the data.

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