ENCODER PRODUCTS COMPANY

WHITE PAPER

Accuracy of Encoders

Contents

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Accuracy of Encoders

Executive Summary

In motion control applications, it is imperative to get accurate, reliable motion feedback from the encoders providing position, velocity, or acceleration.

Definition

For our purposes, "accuracy" is defined as how close an actual pulse is to the theoretical perfect position. To function well, many applications require encoders with a high degree of accuracy. With poor accuracy, measurements can be erratic, motion control is more difficult, and position control is sloppy.

Figure 1 at right shows expected positions of an accurate 12 CPR encoder. Much like the face of a clock, each position is equally spaced throughout the full revolution. The more equally spaced, the more accurate.

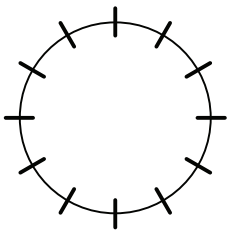


Figure 1

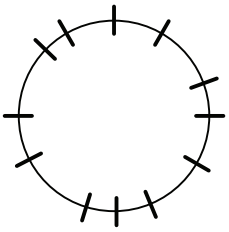


Figure 2

In Figure 2 at right, the positions are not equally spaced on this less-accurate encoder. An application using this encoder will have difficulty accurately measuring position, velocity, or acceleration.

Determining Accuracy

A number of factors determine the accuracy of an encoder. Accuracy of the disc master, quality of the bearings, stability of the rotating assembly, concentricity of the disc pattern to the true center, and design of the optics are among the most important factors.

The concentricity of the disc and its pattern relative to true center of the encoder shaft is one of the biggest contributing factors in determining overall accuracy. Additionally, mounting the encoder concentric relative to the motor or drive shaft affects accuracy, making the flex mount or coupling design and installation an important consideration.

Meaning of Accuracy Specification

Accuracy is typically defined as degrees or arc-minutes from a true mechanical position, or from one cycle to another cycle; hence, the lower the number the better. For example, an encoder may have an accuracy specification of 0.01° or 0.6 arc-minutes; less accurate encoders will have their accuracy stated as 0.04° or 2.5 arc-minutes.

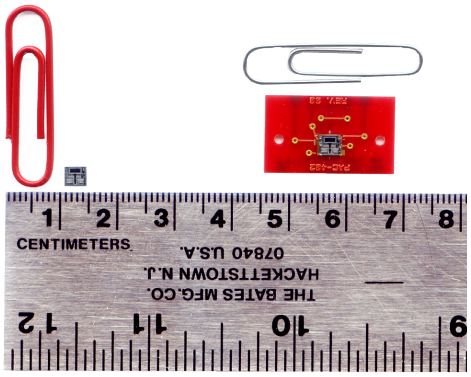
Defining Resolution

Resolution is defined as the total number of increments produced during one encoder revolution. For incremental encoders, resolution is defined as Cycles Per Revolution (CPR).

Accuracy of Encoders

High resolution, however, does not guarantee high accuracy. For instance, a low-resolution 256 CPR encoder can be very accurate, while a high-resolution 10,000 CPR encoder may be inaccurate if the manufacturer did not adhere to the necessary steps required to produce highly-accurate encoders.

As a rule, there is some improvement in accuracy from a very low resolution encoder (for example, an encoder with 50 CPR) to a higher resolution encoder, such as 1000 or 2000 CPR. This is usually due to the finer switching points associated with the higher CPR, and to the averaging effect, where more lines are in the active sensor area at one time.



ASIC chip

Accuracy of EPC Accu-Coder™ and Accu-CoderPro™ Encoders

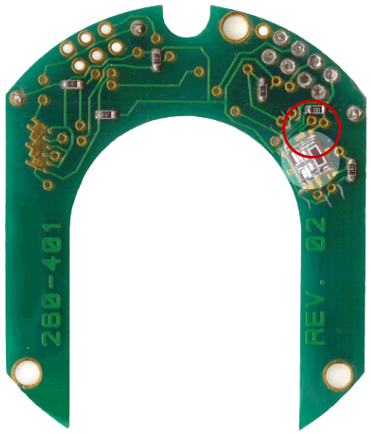
Using a custom built accuracy testing machine, sample Accu-Coder™ encoders are compared to an extremely accurate 7,200,000 CPR reference. As the sample encoder rotates, each position compares to the theoretical perfect position reference.

Accu-Coder™ and Accu-CoderPro™ encoders incorporate proprietary Opto-ASIC technology – a single chip that combines all of the components of a typical sensor board, including the photosensor, into a single circuit. While this in itself may sound unimportant, the resulting benefits over traditional sensor boards are numerous.

This proprietary Opto-ASIC technology provides a clean, reliable signal without missed or extra counts, and greater immunity to electrical noise than traditional analog sensors.

In addition, the potential for quadrature drift from exposure to time and temperature is virtually eliminated.

The single-chip design also provides superior resistance to particulate contamination-related signal distortion. If dust does get into the optics, it's not likely to cause a problem.



ASIC chip on sensor board

Conclusion

To determine the right encoder for your application, with the configuration that will work best, give us a call. When you **contact EPC**, you talk to real engineers and encoder experts who can answer your toughest encoder questions. You'll get the answers that make sense for your application.