ACCU-CODER™

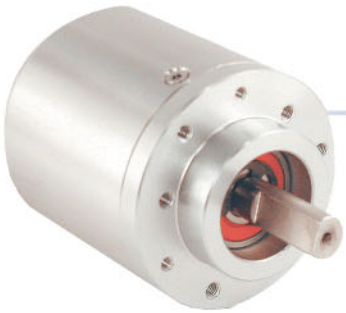
SPOTLIGHT ON ABSOLUTE SERIES ENCODERS

Model 960

The flagship of EPC's Absolute Accu-Coder™ line, the **Model 960** brings a new dimension of user friendliness to the world of absolute encoders. Boasting a thin profile, a variety of bore sizes, and EPC's innovative flexible mounting system, the **Model 960** Absolute Series Encoder is in a class by itself. Its unique design makes it an ideal choice for a wide variety of industrial applications, and it is so versatile that the possibilities are endless. Due to its completely digital signal, the Model 926 is particularly well suited for applications where the presence of electrical noise is especially high. The **Model 960** features resolutions up to 11-bit, the ability to produce both standard Gray and Excess Gray Code, a user programmable direction bit, integral, industrial grade bearings, and shaft speeds up to 6000 RPM.

Model 925

The **Model 925,** housed in an industry standard size 25 (2.5") case, is one of the most adaptable absolute encoders available. It offers a wide variety of both flange and servo mounting styles and its electronics have recently been completely updated to increase the number of available options. The **Model 925** can now output its completely digital signal in your choice of Binary, Gray Code, Excess Gray Code, or BCD. In addition, the direction of count is user programmable. Like all EPC Absolute Encoders, the **Model 925** is ideal for applications with an especially high presence of noise, or where absolute positioning information is needed even when power is lost and regained.



Model 958

The **Model 958,** offered in an European standard size 58 (58 mm) housing, shares all of the features of the **Model 925** and is an ideal alternative to the more costly European offerings. Both provide a fully digital output representing the absolute positioning information, and both are well suited for applications with a high degree of electrical noise, or where positioning information must be maintained even when power is lost. The **Model 925** and **Model 958** both have rugged, industrial grade housings and offer optional sealing up to IP66, making them an ideal choice for even your most environmentally demanding applications.

Encoder Products Company

Your Encoder Source for Over 30 Years

www.encoder.com

Absolute Output Codes

All EPC Accu-Coder^{tm} Absolute Encoders can provide their positioning information in a variety of output codes, including Natural Binary, Binary Coded Decimal (BCD), Gray Code, and Excess Gray Code. Natural Binary has been around since the earliest digital devices, and BCD nearly as long, so most people are quite familiar with them, but the other two may be less well known.

What is Gray Code?

Gray Code is a form of binary that uses a different method of incrementing from one number to the next. With Gray Code, only one bit changes state from one position to another. This feature allows a system designer to perform some error checking (i.e. if more than one bit changes, the data must be incorrect). The table below illustrates the difference between Natural Binary and Gray Code for a simple 4-bit system:

Gray Code		Natural Binary	
0000	0	0000	0
0001	1	0001	1
0011	2	0010	2
0010	3	0011	3

Why use Gray Code?

Gray Code is the most popular Absolute encoder output type because it can be used to prevent certain data errors that can occur with Natural Binary during state changes. For example, a highly capacitive circuit, sluggish system response, or small gain differences in individual channel photo-elements could easily cause a Natural Binary state change to be misread by the counter or PLC. This type of data distortion becomes more possible as more bits need to flip, such as from position 7 to position 8 in the example below. The use of Gray Code prevents these types of errors, making the data more reliable. (Note that even from 7 to 8, in Gray Code only one bit changes state.)

Gray Code					Natural Binary			
2^3	2^2	2^1	2^0	Position	2^3	2^2	2^1	2^0
0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	1
0	0	1	1	2	0	0	1	0
0	0	1	0	3	0	0	1	1
0	1	1	0	4	0	1	0	0
0	1	1	1	5	0	1	0	1
0	1	0	1	6	0	1	1	0
0	1	0	0	▶ 7 ◀	0	1	1	1
1	1	0	0	▶ 8 ◀	1	0	0	0
1	1	0	1	9	1	0	0	1
1	1	1	1	10	1	0	1	0
1	1	1	0	11	1	0	1	1
1	0	1	0	12	1	1	0	0
1	0	1	1	13	1	1	0	1
1	0	0	1	14	1	1	1	0
1	0	0	0	15	1	1	1	1

Gray Excess Code

Standard Gray codes work well if your desired resolution requirements (counts per turn of the encoder shaft) are equivalent to some value of 2^n, such as 16 (2^4), 256 (2^8), and 1024 (2^{10}). However, what happens if your resolution requirements are somewhere in between, such as 180, 360, and 1000?

Gray excess codes help provide resolutions like 180, 360, and 1000. The most popular is 360 counts per turn of the encoder shaft, or one count for each degree of shaft rotation.

Gray excess codes consist of a section from the middle of a Gray-code sequence. For example: A 4-bit Gray code encoder provides 16 (or 2^4) absolute position counts for one shaft revolution. In order to design an encoder to provide exactly 10 position counts in one revolution, the first and last 3 codes would be omitted to produce an excess-3 Gray code (see table below). The codes associated with excess Gray code positions 3-12 represent the 10 counts. Note that like all "Gray" codes, only 1 bit changes state from one position to another (even on the transition from position 12 to position 3).

A 360 count/revolution encoder is designed by starting with a resolution of 9-bits (512 counts/rev), and then removing the excess 76 bits from both the high and the low ends of the code sequence.

Gray Code					Excess Gray Code			
2^3	2^2	2^1	2^0	Position	2^3	2^2	2^1	2^0
0	0	0	0	0	~~0~~	~~0~~	~~0~~	~~0~~ ▶
0	0	0	1	1	~~0~~	~~0~~	~~0~~	~~1~~ ▶
0	0	1	1	2	~~0~~	~~0~~	~~1~~	~~1~~ ▶
0	0	1	0	3	0	0	1	0
0	1	1	0	4	0	1	1	0
0	1	1	1	5	0	1	1	1
0	1	0	1	6	0	1	0	1
0	1	0	0	7	0	1	0	0
1	1	0	0	8	1	1	0	0
1	1	0	1	9	1	1	0	1
1	1	1	1	10	1	1	1	1
1	1	1	0	11	1	1	1	0
1	0	1	0	12	1	0	1	0
1	0	1	1	13	~~1~~	~~0~~	~~1~~	~~1~~ ▶
1	0	0	1	14	~~1~~	~~0~~	~~0~~	~~1~~ ▶
1	0	0	0	15	~~1~~	~~0~~	~~0~~	~~0~~ ▶

Courtesy of Your Local Vendor