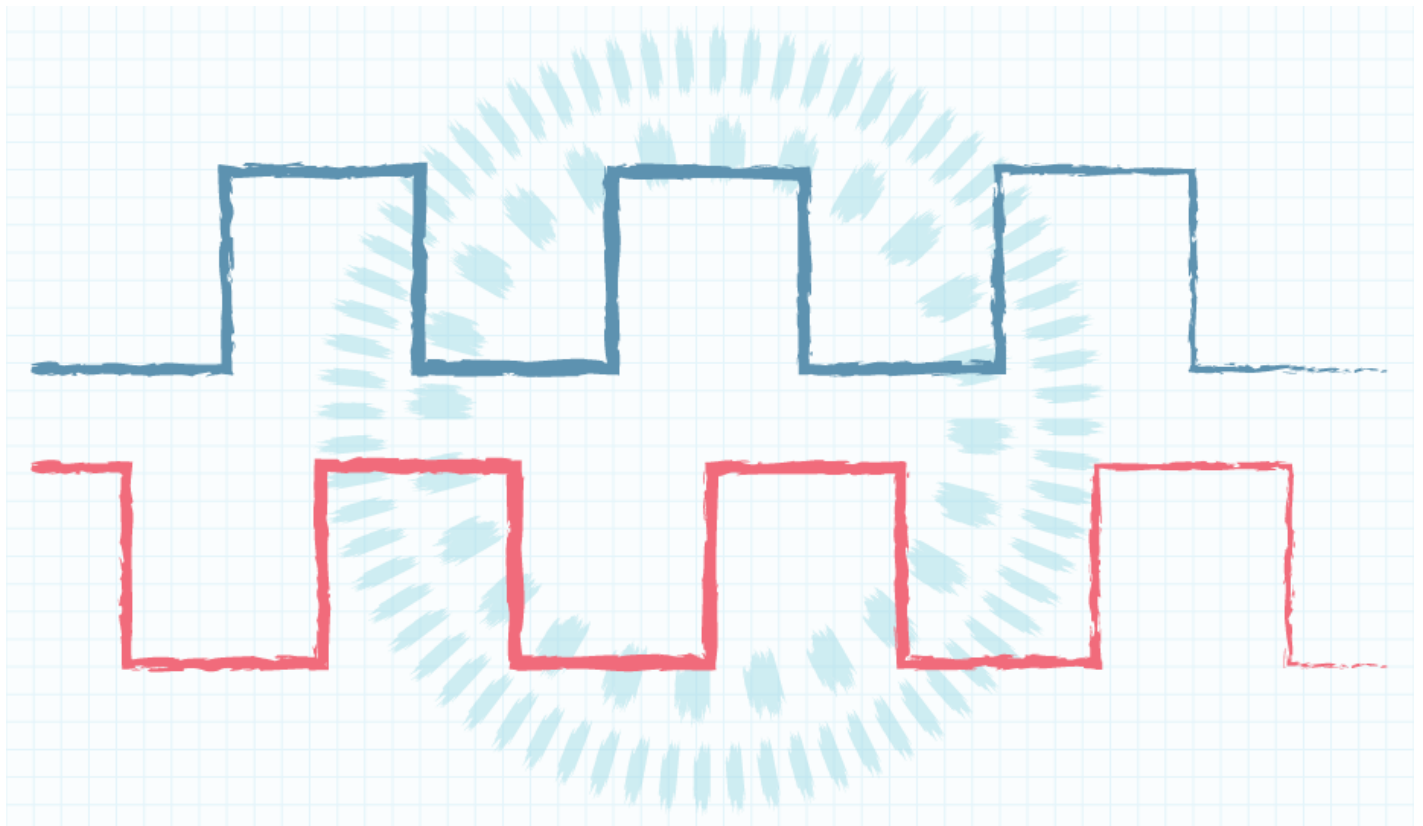


# *What's the Difference Between an Incremental Encoder's PPR, CPR, and LPR?*

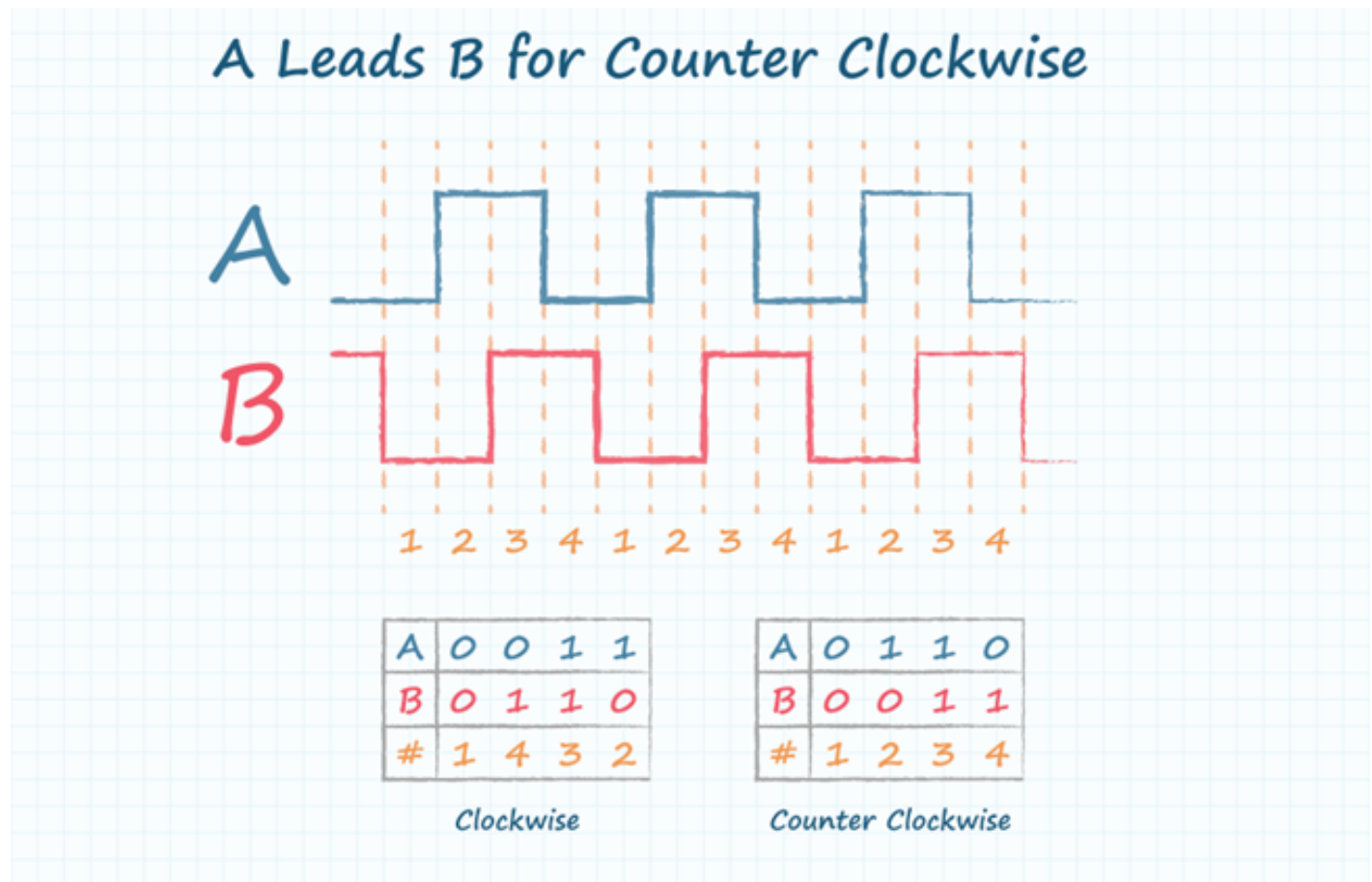
By Ryan Smoot



## *In This Post...*

1. [Pulses Per Revolution \(PPR\)](#)
2. [Counts Per Revolution \(CPR\)](#)
3. [Lines Per Revolution \(LPR\)](#)
4. [Additional Resources](#)

As an incremental encoder rotates it produces two square wave outputs A and B; together these signals create an incremental encoder's quadrature output. For most encoders these square waves A and B are 90 degrees out of phase. By observing the changing states of the A and B outputs the encoder's direction can be determined.

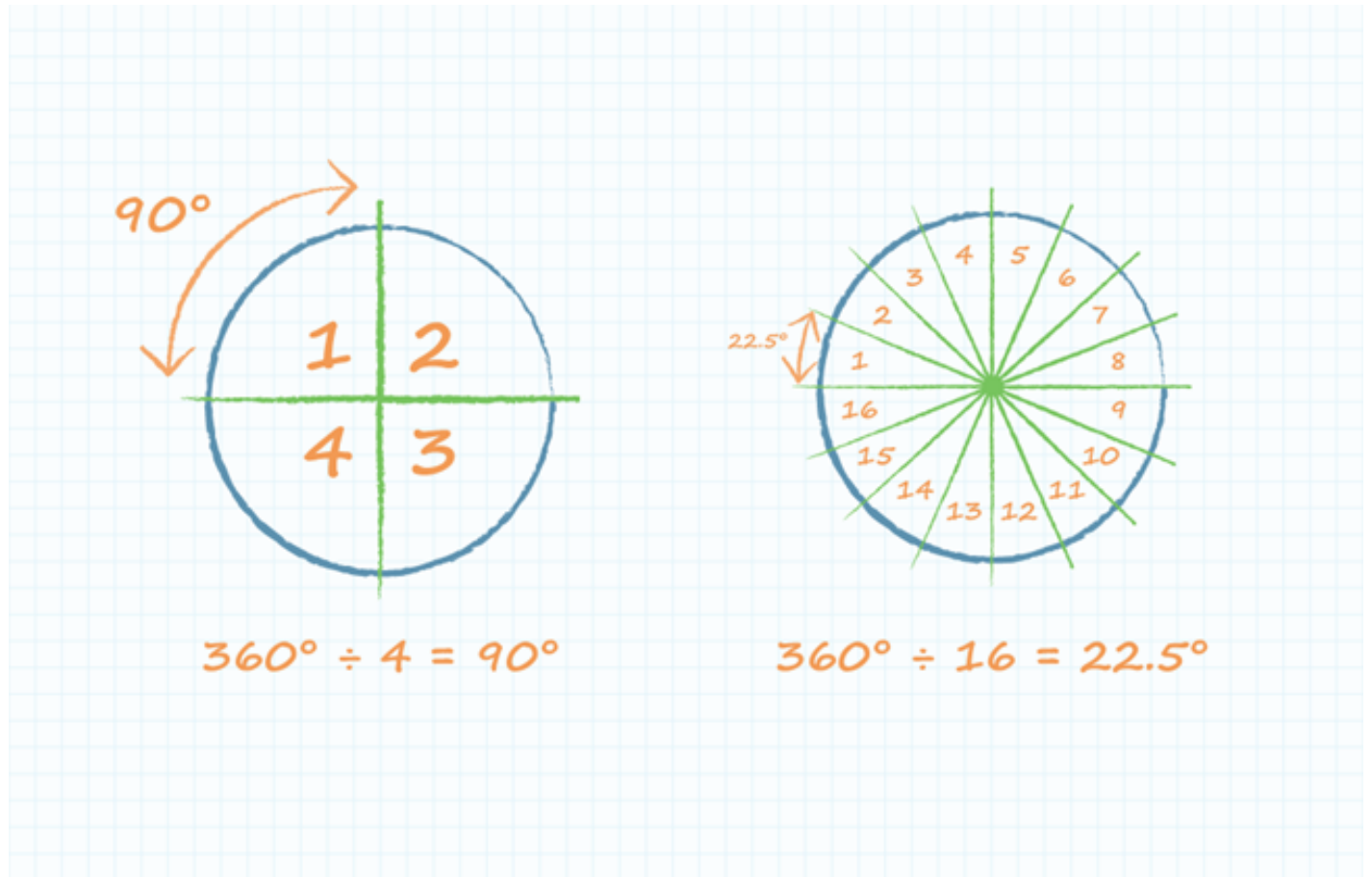


*Typical encoder square wave outputs A and B*

However, to determine the distance an encoder has traveled, or at what speed it is rotating, more information is required. To calculate this information it is important to know the encoder's resolution. Resolution can be thought of as the encoder's granularity, or put simply, how many pieces of the pie the encoder is divided into for one revolution.

## ***Pulses Per Revolution (PPR)***

CUI Devices uses the term PPR, or Pulses per Revolution, to represent encoder resolution. PPR describes the number of high pulses an encoder will have on either of its square wave outputs A or B over a single revolution. While CUI Devices does not use PPR to represent Periods per Revolution, it would still technically be accurate as the duty cycle of our standard offering of incremental encoders is 50%. Once resolution is known it can be used to calculate how many mechanical degrees each pulse and period is equal to.

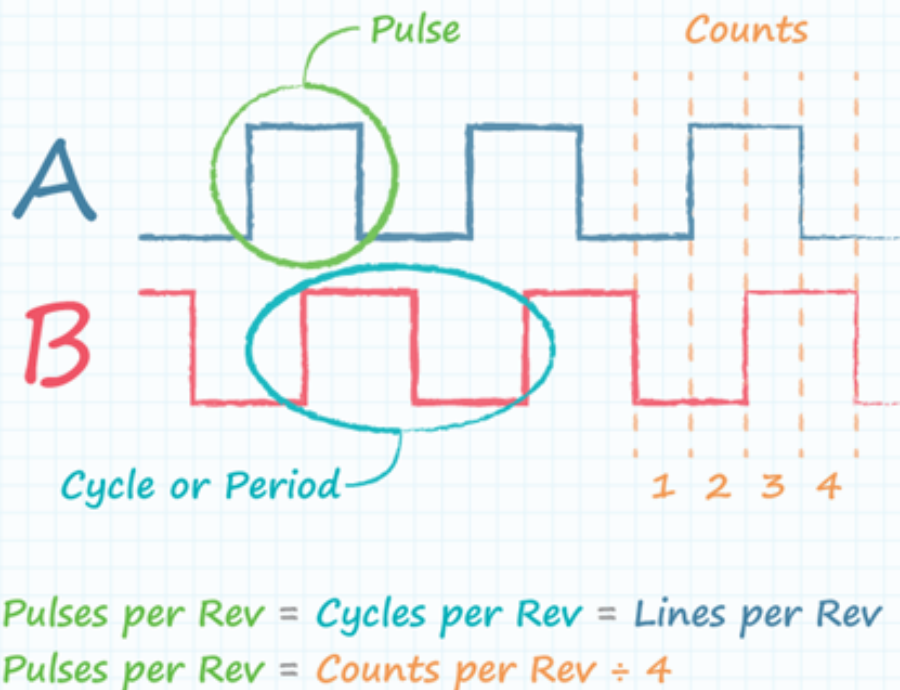


*Once an encoder's PPR is known, mechanical degrees for each pulse can be determined*

With that being said, the term PPR is not ubiquitous throughout the motion control industry. Although CUI Devices uses PPR for all of our encoder products, many companies will often use the terms PPR, CPR, LPR or resolution interchangeably with conflicting definitions.

## ***Counts Per Revolution (CPR)***

CPR most commonly stands for Counts per Revolution, and refers to the number of quadrature decoded states that exist between the two outputs A and B. With both outputs A and B switching between high and low, there exists 2 bits of information represented as 4 distinct states. The term quadrature decoding describes the method of using both outputs A and B together to count each state change. This results in 4 times the amount of counts that exist for each pulse or period. Therefore, the CPR of an encoder is the encoder's PPR multiplied by 4. It should also be noted that some encoder manufacturers use the CPR acronym to mean Cycles per Revolution. Cycles per Revolution refers to the full electrical cycles or periods on any one of the encoder outputs and is equivalent to Pulses per Revolution. With both Counts per Revolution and Cycles per Revolution using the same CPR acronym, but differing by a factor of 4, this can understandably cause some confusion and one must be careful to understand how the resolution is being defined.



*How to compare typical datasheet waveform drawings and figures*

## Lines Per Revolution (LPR)

LPR, or Lines per Revolution, is another term that is equivalent to PPR. The line refers to the bars etched or printed onto an optical encoder's disk. Each line on an optical encoder disk would represent a low pulse on the output as they have a one-to-one relationship.

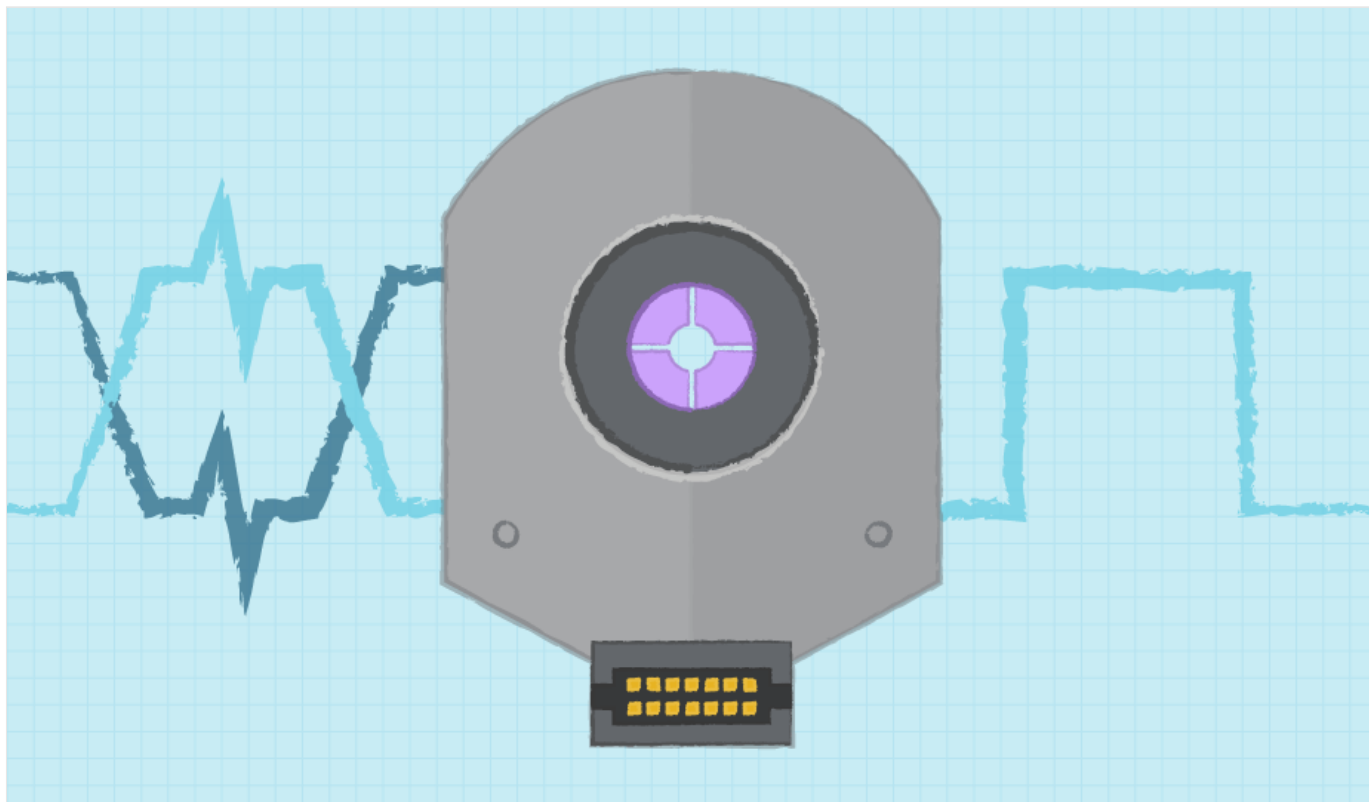
Because resolution is defined differently across the industry, it is important to get the numbers into the same format when comparing products from different encoder manufacturers. This is best done by viewing waveforms or timing diagrams on the datasheet and if possible calculating the pulse width in degrees or arcminutes.

## ***Additional Resources***



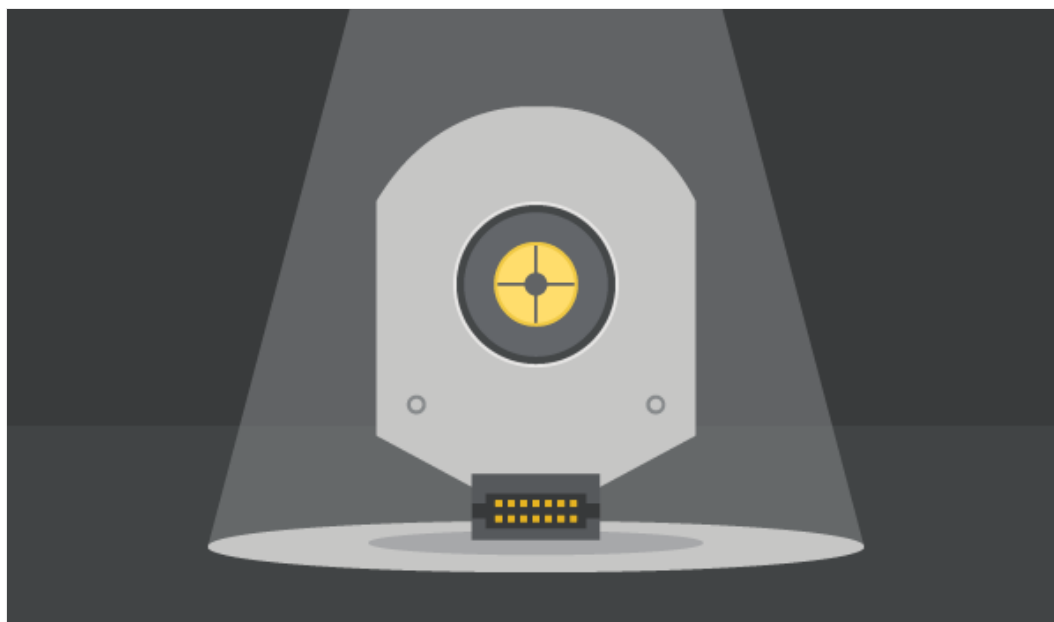
### **Incremental Rotary Encoders**

#### **Featured Products**



### ***A Comparison of Common Encoder Output Signals***

*CUI Insights™ Blog*



### ***Capacitive Incremental Encoder Basics***

*Product Spotlight*



### **Rotary Encoder Improvements Save Power in Mobile Robotics**

*CUI Insights™ Blog*



#### **Tags:**

[Motion](#)

[Rotary Encoders](#)

[Incremental Encoders](#)

---

*Have comments regarding this post or topics that you would like to see us cover in the future?*

*Send us an email at [cuiinsights@cuidevices.com](mailto:cuiinsights@cuidevices.com)*

[Share](#)

[Share](#)

[Share](#)



TM

***Ryan Smoot******Technical Support Engineer***

With an extensive knowledge of CUI Devices' products, Ryan Smoot provides customers with a wide range of technical and application support capabilities in the field. His management of CUI Devices' robust CAD model library further offers engineers with an invaluable resource for streamlining their



product designs. When he's not assisting customers, Ryan enjoys running, the outdoors, and spending time with his wife and two kids.