Technical Article

How to Read Motor Velocity Using the Quadrature Emulation Interface

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What is quadrature encoder emulation? As the name suggests, it emulates the output of a quadrature encoder. Motor-position sensors (such as a resolver) that support the quadrature emulation interface may work in an application using encoders, assuming that the system accuracy is within the specifications. Industrial applications such as factory automation and motor control use the encoder interface to read motor-shaft position and velocity.

Figure 1 shows how quadrature encoder signals emulate motor commutation signals with the addition of an index pulse. For example, in the case of the PGA411-Q1, the quadrature encoder output and index pulse outputs (the A, B and Z signals) are permanently available at their OUTA, OUTB and OUTZ pins. Depending on the resolution, the quadrature encoder will provide 256 pulses on OUTA and OUTB when the device is operating in 10-bit mode, or 1,024 pulses on OUTA and OUTB when operating in 12-bit mode. The index pulse on OUTZ generates once per revolution whenever the angle output is at 0 degrees. You must count the pulses to determine the current angle.

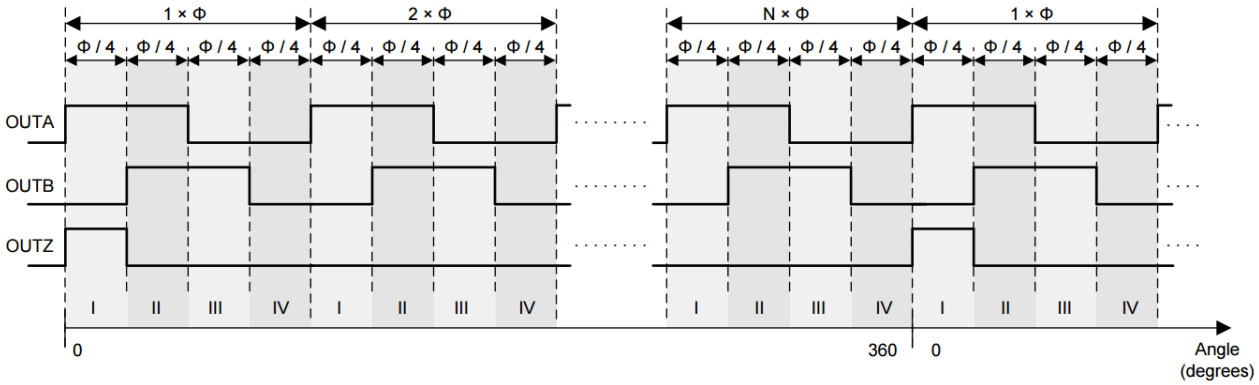

Figure 1. The Quadrature Emulation Interface

You can set up an interrupt to read the OUTZ pulse output (see Figure 2 for connections to the timer circuitry, Figure 3 for system block diagram) to read lower velocities down to even 1rpm. The timer of the controller should have the resolution to support the timing between the two OUTZ pulses. For example, between two OUTZ pulses, if the timer counts to 1 minute, then that means 1rpm.

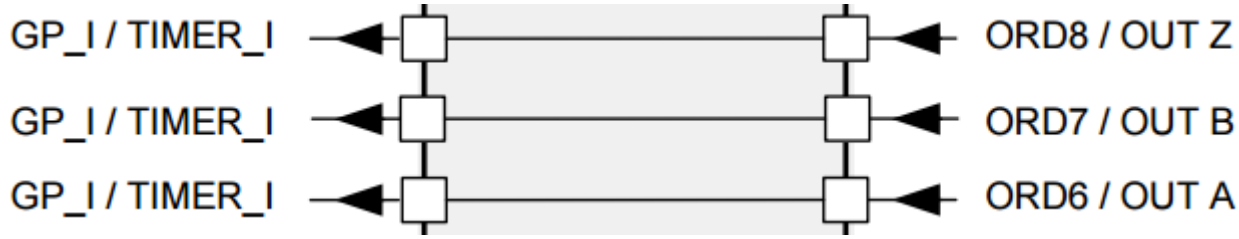

Figure 2. Timer Circuitry Connection

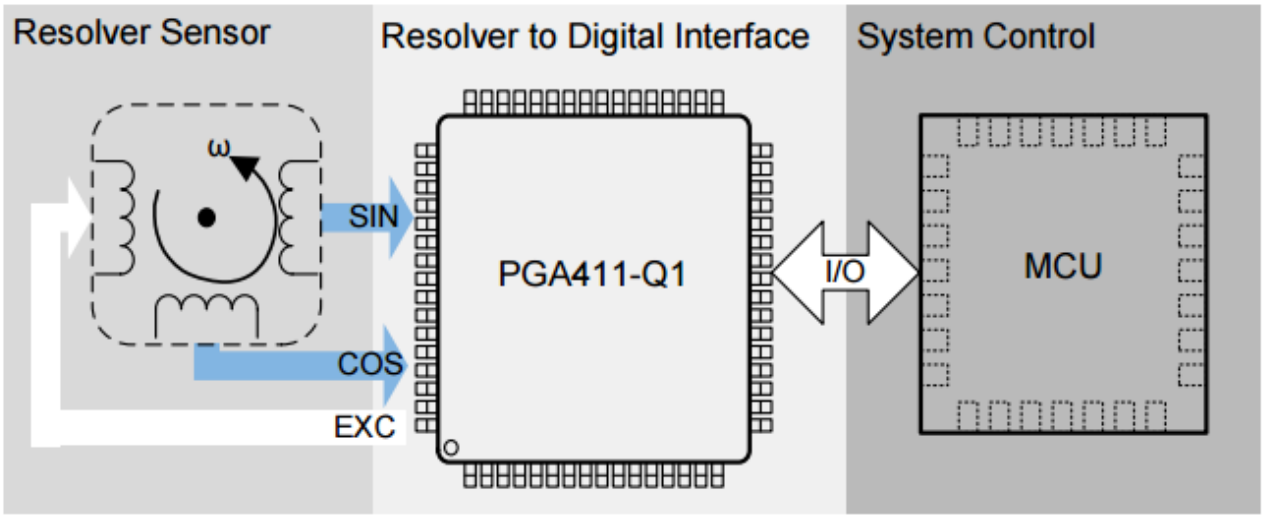

Figure 3. System Block Diagram

For industrial applications like servo drive control, you must measure lower rpms accurately. The quadrature emulation interface is one way to do this. Visit the TI E2E™ Community Automotive forum to ask any questions you may have about this interface.

Additional Resources

- Read more about electric vehicle design in part one and part two of this EDN article series.
- Jump-start a resolver-based rotary-position sensing design with the Resolver-to-Digital Converter Reference Design for Safety Application.

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