ROTARY ENCODERS JOIN THE INDUSTRIAL INTERNET OF THINGS

By: Jeff Smoot

CUI DEVICES

While it may be that Benjamin Franklin is widely attributed to making the phrase "time is money" popular, I do not believe that I am stretching the truth by stating that this phrase also rings painfully true for anyone associated with machine design, industrial automation, or robotics. Machine down time has caused more than its share of elevated blood pressure and it is certainly an understatement that it is a very costly and trying situation. The Industrial Internet of Things (IIoT) and the ability to harness sensor data, machine-to-machine (M2M) communication and automation technologies are revolutionizing the way machines capture and communicate data. This transition from analog to digital devices is creating highly intelligent machines that have the ability to tap into new and exciting diagnostic capabilities, providing engineers vital information and access to data not previously available. And with this new data, designers are making amazing advances in boosting a machine's ability to autonomously predict failures and reduce downtime.

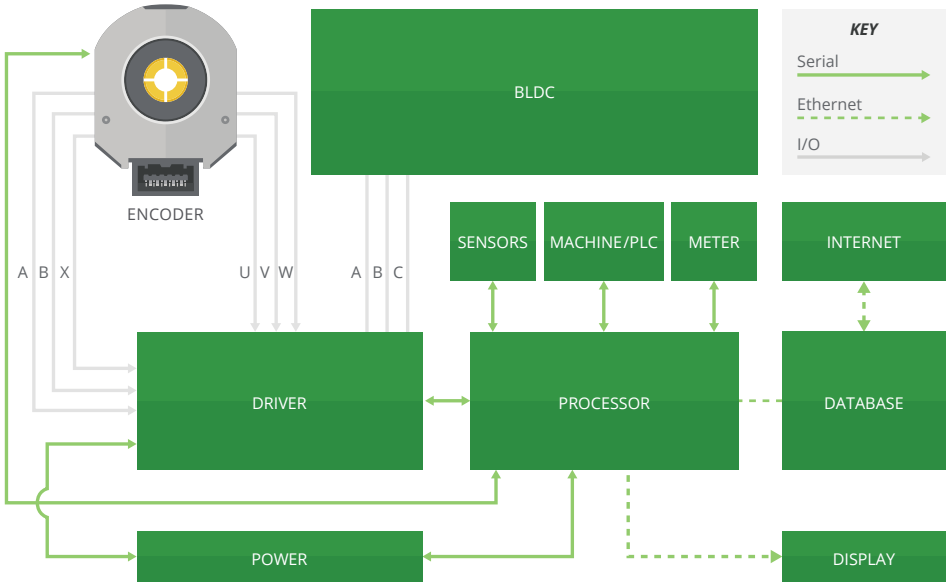


Figure 1: An illustration of a typical machine-to-machine communication system

Rotary encoders are vital components in the motion-control feedback loop of industrial, robotic, aerospace, energy and automation applications. In these installations, encoders are asked to provide long-term reliability, durability and high performance despite often working in severe conditions that include dust, dirt, grease, fluctuating temperatures and heavy vibration. With the recent explosion of robotics and automation industries, the need for faster, more precise, more efficient and more intelligent encoders have been increasing dramatically. Unfortunately, current encoders on the market fall short in being able to

provide any intelligence to the motion control designer. CUI Devices' line of digital ASIC-based AMT encoders bridges this gap, providing the designer with valuable diagnostic and programming tools that can speed time to market and reduce machine downtime in the field.

Figure 2: CUI Devices' AMT encoder family is the first on the market to employ a digital ASIC-based design

The incorporation of diagnostic capabilities into the rotary encoder provides the designer access to valuable system data that previously was not available in pure analog solutions. This data can be used to quickly allow the system to determine if the encoder is operating properly, has failed or become inoperable, or has become misaligned. The system can then use this data to inform operators of potential issues or to make informed decisions on its own before turning on the motor and causing potentially disastrous damage. Furthermore, engineers can use this feature for preventative measures - for example, executing an "encoder good" test sequence before running the application. These capabilities, not available in strictly analog encoders, allow designers to keep downtime to a minimum while anticipating issues that might occur with units in the field.

The diagnostic data can also be monitored over time via an industrial communication network, providing valuable performance trends that can be analyzed and used to predict failures within the motion control system before they happen. Due to the critical location of the encoder, mounted directly to the motor, diagnostic data is not solely limited to the individual encoder's performance, but can serve as a bellwether of other issues within the motion control system such as shaft misalignment, bearing wear, or thermal degradation. By careful examination of this data, preventative maintenance of the machine can be performed in a controlled manner and the issue remedied before a catastrophic failure occurs. This can limit crippling downtime, improve machine longevity, and boost overall system intelligence.

In addition to the predictive advantages, the on-board diagnostic data can also be used to speed up the troubleshooting process should an unfortunate field failure occur. Having access to this valuable encoder diagnostic capability gives the repair technician the ability to quickly zero in on the root cause of the failure by either eliminating the encoder as the problem or pointing to the encoder or motor as a likely cause. This can eliminate the time consuming and expensive trial and error process of having to remove and replace the encoder and motor from the system needlessly. Machine downtime in and of itself can be a very costly proposition due to the loss of productivity; the added cost of a field technician to repair the machine only adds to this expense. As such, the ability to tap into the encoder diagnostics to hasten the troubleshooting and repair process can result in a significant cost savings and minimize the effects of a field failure.

Diagnostic data from the encoder can also provide significant time savings during the product development process. As an engineer myself I would like to believe that all of my designs worked perfectly the first time. Unfortunately this is not typically the case. During the course of testing I will inevitably find issues with the design; often the cause of the issue is not readily apparent and the variables are seemingly infinite. This of course kicks off a troubleshooting process to determine why the device is not performing as expected. Diagnostic data thus can speed up this process and quickly point to the area of the design that may need improving, potentially eliminating days or weeks of investigation. These savings can result in shorter design cycles, more robust products, and faster time to market.

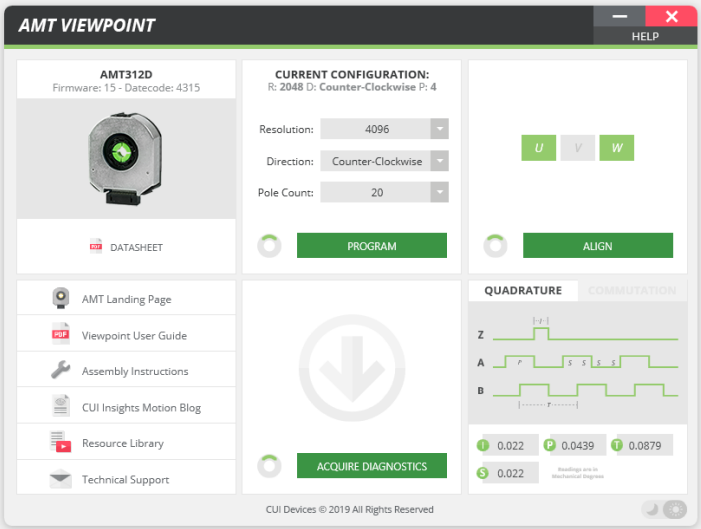
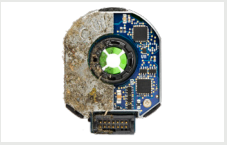


Figure 3: CUI Devices' AMT Viewpoint GUI offers users the ability to program multiple encoder parameters and access diagnostic data

CUI Devices' revolutionary AMT11 incremental series and AMT31 commutation series are the first rotary encoders to integrate these diagnostic capabilities. Through the use of the AMT Viewpoint™ software or simple serial commands, CUI Devices brings this valuable diagnostic data to the fingertips of the machine designer. These small units, with a 37 mm diameter and a 10 mm thick profile, operate from a single +5 V supply, provide a wide range of programmable resolution choices ranging from 48 to 4096 ppr and offer commutation signals for all BLDC pole-pair configurations. Both series also have single-ended or differential output options available in addition to axial and radial connection orientations depending on the application requirements. And for added durability, the rugged AMT encoders boast an operating temperate range of -40 to 125°C.

While downtime cannot be eliminated entirely, the progressive use of diagnostic data in today's machine designs is dramatically reducing the rate at which machine failures occur while improving the speed at which they are recovered from, making these occurrences far less painful. The encoder's move from an analog to a digital component in an M2M system brings with it new world of new possibilities. The insight gained from this vital diagnostic data is proving yet another adage true, that "knowledge is power".



View CUI Devices full line of AMT modular encoders

LEARN MORE ▶