# Isolation is good when it's digital: Protect your people and devices

The programmable logic controller (PLC)[1] is considered the main control center for manufacturing machines, even in Industry 4.0 and other "smart factory" initiatives. It is the central processor for all real-time decisions for the manufacturing process.

Sensors provide input to the PLC about their status so that it can automatically make decisions about the manufacturing process. The PLC is also the interface to a particular machine in real time to allow the human aspect of machine operation to be more automated and secure.

## INDUSTRY 4.0 AND THE FUTURE OF PLCS

Although Industry 4.0 is starting to attract a lot of attention in the market, there are many concerns and risks associated with adopting this "smart factory" initiative based on new and emerging technologies.

While Industry 4.0 and the internet of things are commonly used terms, there are still many people that do not understand the distinction between the two. A survey about the industrial internet of things (IIoT) and Industry 4.0 familiarity, conducted by Control Engineering, showed that 67 percent of respondents have little to no familiarity with Industry 4.0 principles, and 41 percent have little or no familiarity with the internet of things.[2] Today, only one-third of all plant floor equipment has a network interface.

The "smart factory"[3] has sensors that report to both the cloud and the PLC simultaneously. In this way, locally collected data not sent to the cloud can be tracked and analyzed for preventative maintenance of individual machines in the production facility. The PLC sends aggregated data, which includes sensor performance and other details relating to the manufacturing process itself, to the control centers and the cloud. The PLC data, in conjunction with data from the sensor and other devices, can be pulled together to show the "big picture" that results from the collection of the "big data." Analysis tools can then help plant managers and others leverage resources better: batch scheduling of jobs, logistics, supplier timing and other functions that are critical for creating more efficient manufacturing processes. The bottom line is that the PLC is an integral part of IIoT, Industry 4.0 and the "smart factory."

Most PLCs work at 24 V,[4] which is considered the global voltage standard and digital language for industrial applications. In those environments, power fluctuations are frequent and can cause unexpected malfunctions and damage to electronics.

Securing the machines and their electronic components with galvanic isolators is critical to protect essential equipment and ensure continuous operation.

## ADVANTAGES OF DIGITAL ISOLATORS

Until recently, most PLC circuit boards featured optoisolators or optocouplers.[5] They are inexpensive, easy to install and widely available in the market.

Optocouplers, however, have several fundamental limitations, including poor noise immunity, long delays and low energy efficiency, because they need high current to ensure functionality. Additionally, an optocoupler's reliability suffers from age, temperature and bias voltage.

CMOS-based digital isolation is immune to the output variations that plague LED-based optocouplers. Digital isolators provide more than 10 times the reliability rate of optocouplers, enabling system builders to offer more extended functionality to their PLCs and longer product warranties.

Their small size, in addition to different packaging configurations, makes digital isolators an ideal solution in which board real estate is a premium, opening up new possibilities for their placement and distribution and reducing the cost of the circuit board.

Another huge advantage is having more than a single channel on a chip. It is possible to build CMOS digital isolators with up to six independent channels supporting different data directions. Ultimately, digital isolators offer the benefit of unmatched lifespan and protection, with little or no degradation over decades.

The market has been shifting from opto to digital isolators for several years. According to IHS[6], the global digital isolator market is predicted to be valued at $303.5M by 2021, with a compound annual growth rate over 14% during this time period.

## SILICON LABS' ADVANTAGE

Silicon Labs' basic isolators are available in one- to six-channel bi- and unidirectional configurations, fitting smaller board designs and reducing board production costs. What's more, Silicon Labs has a family of isolators specifically for PLC applications that provide additional integration. The Si838x family features advanced 24V inputs in either sourcing or sinking configurations. This family integrates 8 channels into one package in order to optimize space and costs.

## ISOLATOR DEVELOPMENT KIT

The Silicon Labs' family of CMOS digital isolators gives designers the ability to create lower cost, smaller, higher performance, lower power and more reliable isolated circuits than competing optocoupler solutions.

The Si80xx, Si86xx, Si87xx and Si88xx families of one- to six-channel bi- and unidirectional digital isolators support isolation voltage ratings up to 5 kV.[7] The Si838x family integrates 8-channels and supports 2.5 kV isolation voltage.

The Si838x PLC Input Isolator Evaluation Kit allows designers to evaluate Silicon Labs' Si838x family of PLC input isolators. The Si838xISO-EVB is populated with a Si8384P and three different input networks, each representing a recommendation to achieve the respective IEC 61131-2 digital input standard at 24 V. Other evaluation kits, including the Si86xxT Multi-Channel Isolator Evaluation Kit, allows designers to quickly evaluate the Si8642ET digital isolator's capabilities and functionality.

OEMs continue to shift from traditional optocouplers to digital isolators. It is time to hedge your investment and make a move to the new technology. In most cases, your product or component will still be expected to work after many years in an industrial settings. Reliability is a critical feature that needs to be addressed from the initial design.

As evidenced throughout this article, the advantages of Silicon Labs' digital isolators go beyond providing a suitable alternative to opto technology. They can save you money, and board real estate, plus provide several channels per chip, and unmatched technical support.

If you need more information, want to talk to a sales representative or wish to discuss your design needs, contact Silicon Labs.

**Footnotes**

[1] "Programmable logic controller - Wikipedia." https://en.wikipedia.org/wiki/Programmable_logic_controller.

[2] Six IIoT, Industry 4.0 key findings https://www.controleng.com/articles/six-iiot-industry-4-0-key-findings/

[3] "What is the Smart Factory and its Impact on Manufacturing?." 13 Jun. 2018, https://ottomotors.com/blog/what-is-the-smart-factory-manufacturing. Accessed 25 Nov. 2018.

[4] "How PLCs Work - Machine Information Systems." http://www.machine-information-systems.com/How_PLCs_Work.html

[5] "Opto-isolator - Wikipedia." https://en.wikipedia.org/wiki/Opto-isolator

[6] "Optoelectronic Components – 2016" from IHS Technology https://technology.ihs.com/api/binary/582900

[7] Digital Isolators https://www.silabs.com/products/isolation/digital-isolators