

# National Instruments Announces Cyclone FPGA-Based Digital I/O Products Ideal for Industrial Measurement & Control Applications

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*National Instruments*

**Company:**  
National  
Instruments

**Industry:**  
Measurement &  
Automation

**End Products:**  
PCI/PXI Data  
Acquisition Boards

**Altera Product:**  
Cyclone FPGAs

With the advent of PC-based platforms for discrete, batch, and continuous automation applications, automation suppliers strive to provide customers with low-cost, PCI-based I/O modules (see Figure 1) with the safety and reliability features of a PLC. National Instruments (NI) recently released a new family of low-cost industrial digital I/O modules that delivers a high reliability industrial feature set using the Altera® Cyclone™ FPGA. These features, not all previously available for digital I/O modules on a single PCI module, include watchdog timers, change detection, input filters, and power-up states, all of which are programmable through software without jumpers. Many of the new products also feature isolated inputs and outputs for connecting to high-voltage, high-current, or high-noise signals.

Each of the modules feature an I/O connector, optocouplers for isolation, interface to PCI/PXI bus, and an Altera Cyclone FPGA to implement the industrial feature set (see Figure 2). Early in the development of the product incorporating these features on a PCI/PXI board seemed to be a daunting task, faced with tight deadlines, low target cost of the board, and a new development team.

“National Instruments has consistently set a price/performance standard for industrial measurement and control applications. We wanted to introduce powerful industrial features at the lowest cost in our new digital boards,” noted Keith Winkler, Engineering Section Manager for Data Acquisition and Control. “By using the Altera Cyclone FPGA and Quartus® II software tools, we were able to develop in a short time 12 new digital I/O products with superior industrial features and an aggressive price.”

The following advanced features were implemented on the Altera Cyclone FPGA.

## Input Filters

Input filters implemented on the Altera Cyclone FPGA help discard erroneous readings caused by a bouncing switch or chatter in relays. It does this by ignoring any pulses that are too small in width. You can programmatically select the minimum pulse width that is guaranteed to pass, thus eliminating chatter.

## Power-Up States

With programmable power-up states, you can configure the initial output states of the board in software to ensure glitch-free operations when connected to industrial actuators such as pumps, valves, motors, and relays. You can configure each individual digital line as high-impedance input, high output, or low output. The digital I/O module stores the settings in on-board, non-volatile memory, and the Altera Cyclone FPGA implements the power-up states automatically after power is applied to the device.

## Watchdog Timers

NI digital I/O watchdogs are an innovative technology that provide protection against a wide variety of fault conditions, including application failures or even a PCI bus failure. Watchdogs enable the digital outputs to go to a safe state when a fault condition is detected, allowing safe recovery. The Altera Cyclone FPGA monitors the software application and, if it fails to respond within the time limit, automatically sets the output lines to a user-defined safe state. The module remains in the watchdog state until the watchdog timer is disarmed by the application and new I/O values are written or until the computer is restarted.

**Figure 1. NI's New FPGA Based Digital I/O Modules with High Reliability Industrial Features**



## Change Detection

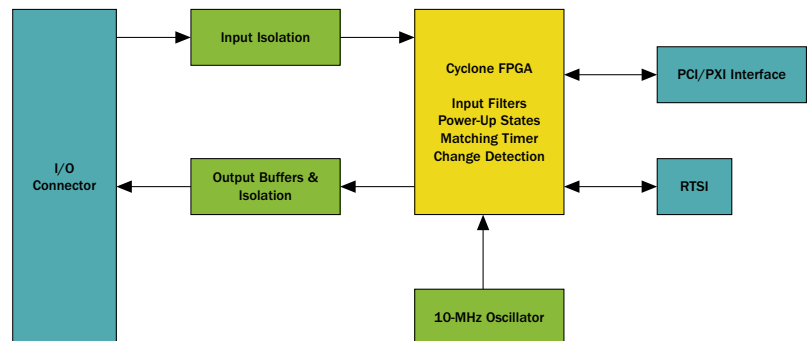
With change detection, you can automatically trigger your software application to perform a digital read operation upon a digital change of state. Change detection allows you to monitor for digital events with minimal processor usage.

The features implemented on the Altera Cyclone FPGA, coupled with integrated signal conditioning features like optical isolation and 24-V logic levels, have made these boards very attractive to industrial measurement and control engineers and machine builders. Not only do you get on-board intelligence for safety and reliability, but also integrated signal conditioning for direct connectivity to industrial sensors and actuators—all at a low price of \$5 per channel.

## About National Instruments

National Instruments ([www.ni.com](http://www.ni.com)) is a technology pioneer and leader in virtual instrumentation—a revolutionary concept that has changed the way engineers and scientists approach measurement and automation. Leveraging the PC and its related technologies, virtual instrumentation increases productivity and lowers costs through easy-to-integrate software, such as the NI LabVIEW graphical development environment, and modular hardware, such as PXI modules for data acquisition, instrument control, and machine vision. Headquartered in Austin, Texas, NI has more than 3,100 employees and direct operations in 40 countries. In 2003, the company sold products to more than 25,000 companies in 90 countries. For the past five years, Fortune magazine has named NI one of the 100 best companies to work for in America.

Figure 2. NI Industrial Digital I/O Module Architecture



## About the Author

Rahul Kulkarni is the product marketing manager for industrial data acquisition and control at National Instruments. He has contributed to many articles in professional publications including *Automation World*, *Control Engineering*, and *Product Design and Development*, and has authored several white papers. As a product marketing manager, he is responsible for worldwide marketing and product strategy for digital I/O and counter/timer product lines. Rahul holds a masters in mechanical engineering from Georgia Tech, Atlanta and a B.S. in mechanical engineering from VJTI, Mumbai.