

Motion Control

Choosing the right platform for your machine control

By Jayson Wilkinson

The world today is full of choices, ranging from which long-distance provider you should use to which diet to follow. To add to the multitude of decisions you face, you now have a choice of machine control platforms for your machine control applications. Unlike some decisions in life, your choice of machine control platform is a fairly easy one if you know the base requirements of your machine and fully understand your options.

The fundamental part of a machine control application is the machine controller. Most machines require a machine controller or machine control system capable of controlling motion, digital I/O, and analog I/O. When choosing a platform for your machine controller, you have the following options:

1 A traditional PC platform running a general-purpose operating system with plug-in data acquisition, vision, and motion boards;

2 An industrial computer platform running a real-time operating system with plug-in data acquisition, vision, and motion boards;

3 A rugged, embedded controller platform running a real-time operating system with I/O, motion, and vision capabilities.

Aside from cost, which is nearly always a factor, the three most important factors to consider when choosing your machine control platform are performance, reliability and flexibility. You should evaluate how well each platform meets your needs in each of these areas.

A traditional PC with a general-purpose operating system such as Windows provides optimal performance and is a good choice if cost is the most important factor in your application. Using a standard PC, you can take advantage of the latest processors and memory at a lower cost than using an industrial PC, but you sacrifice industrial quality. Another disadvan-



Using PXI with LabVIEW Real-Time as an industrial control platform is said to provide high performance with the flexibility to add in the modules needed for motion and I/O control.

tage is the small number of PCI slots available in the newest standard desktop PCs, which limits the amount of I/O boards you can incorporate into your system without going to an external bus.

In addition, when using a standard operating system, such as Windows XP, your applications have less determinism due to the non-real-time nature of Windows. Using a real-time operating system instead of a standard one could solve that problem. Another option for improving reliability and determinism when using a standard PC is to use a hybrid machine controller plug-in board. These boards include an on-board

processor, digital I/O, analog I/O, and motion control, and are becoming increasingly popular among machine builders. National Instruments (NI) offers several plug-in hybrid machine controllers.

Using an industrial computer platform with a real-time operating system, such as a PXI system running LabVIEW Real-Time from NI, gives you several advantages over the standard PC for machine control. Systems based on PXI are more rugged, providing 0° to 50°C operating temperature range, as much as 30 g functional shock, and as much as 500 Hz operating vibration with 0.31 g. They also provide many more PXI/CompactPCI slots to support the I/O your machine requires. Using these slots, you can add motion control, analog I/O, digital I/O or plug-in vision boards. A PXI machine control system running LabVIEW Real-Time is suitable for applications that



Embedded platforms such as the National Instruments' Compact FieldPoint are said to provide highly reliable, rugged, and distributed systems for machine control applications.

require precision motion control or general PID control at rates of up to 39 kHz.

When creating a machine control application using LabVIEW Real-Time, you simply write your code on a standard PC and target it to the PXI controller. Your LabVIEW code then runs independently of your host computer, ensuring both reliability and determinism.

An embedded control platform is ideal for applications that require reliability, smaller form factor and distributed I/O. System platforms such as the NI Compact FieldPoint, which can withstand 50 g shock, 5 g vibration and temperature ranges from -20° to 60°C, are specifically designed for use in industrial applications. Using Compact FieldPoint, users can implement analog and digital I/O, and create simple motor control applications.

Another embedded control platform, the new NI Compact Vision System, integrates with Compact FieldPoint and provides rugged machine vision capability. The Compact Vision System incorporates digital I/O, a high-performance processor, non-volatile storage, and three IEEE 1394 FireWire ports for connectivity to more than 80 cameras.

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HMI and motion control: the Human Factor

By Oliver Obermeier

From conveyors and robots to fully-automated stamping plants – motion control systems are key to industrial automation solutions. However, while these technologies reduce the need for muscle on the production line, the human factor is still an important element in the production process. It's just that now, instead of large teams of workers directly handling products and tools, we are more likely to encounter individual operators at control consoles, often located right next to the production equipment in a harsh environment.

A major driver is the ongoing trend, enabled by the rapid development of field buses and industrial Ethernet, to spread more and more I/O intelligence across the factory floor.

Rugged and reliable control panels and workstations are key components of the human-machine interface (HMI). These provide the operator with real-time system status information so that he can take appropriate corrective actions. Experienced plant

engineers and systems integrators know that getting the HMI "right" can spell the difference between a successful motion control system implementation and one that fails. A good HMI will provide the operator with the "right" information, presented in a clear format. It will provide the "right" controls, laid out in a manner that makes them easily accessible and minimizes the chances of inadvertently pushing the wrong button at the wrong time.

A good HMI will be convenient to work with. Displays will be easy to see; controls easy to reach. Devices should be easy to reposition. And finally, a good HMI will be robust and reliable. On the factory floor, where dust, heat, vibration and humidity are often the order of the day, displays and controls must be housed in enclosures that provide "industrial strength" protection for the sensitive electronic equipment they house. Failure is no option! Reliability is crucial, particularly when downtime (in the automotive industry) can cost \$30,000 per minute!

Rittal, a major producer of enclosures for

industrial equipment, has offerings designed to meet the requirements of a wide range of motion control systems. The products are modular and scalable (for investment protection), and work equally well in centralized or decentralized automation environments.

For large-scale systems, there are enclosures and command panels (VIP series pictured) with scalable space and depth to house (and protect) industrial PCs, PLCs, bus modules, disk drives and other motion control devices. Where smaller panels are needed, there is the OptiPanel series such as Proctor & Gamble implemented in Belleville, ON. The series provides a more compact console well suited for LCD panels and/or touch screens. All Rittal HMI panels can be configured to include virtually any display and any arrangement of I/O devices that the application requires – including keyboards, switches, LED displays, keys, signal lamps – even the necessary "panic" (emergency stop) button.

Rittal enclosures typically offer IP65 protection and can be fitted with a variety of cooling systems to ensure that the equipment inside will continue to operate reliably in the harshest factory environment. Thanks to a highly modular architecture, these features can be delivered at reasonable cost, according to Tim Rourke, business development manager for Rittal Canada. "We supply made-to-measure solutions, but can generally put them together from our range of standard components," said Rourke. "And naturally that is reflected in the price."

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Circle DPN 354

► The Rittal VIP 6000 command centre at Thyssen-Krupp Tailored Blanks in Duisburg, Germany. Here, enclosures are part of a highly automated plant making components for the Volkswagen Golf. Industrial workstations based on Rittal's VIP panels serve as operating consoles for laser welding robots and as control consoles in the stamping plant.

