Machine-Builders' Needs Drive Selection of Motion Controllers for Fluid Power

By Peter Nachtwey, Delta Computer Systems, Inc.

The need for today's manufacturers to be more competitive is driving machine designers to implement sophisticated motion control to help improve quality and reduce waste from production processes. For example, molding machines use motion controllers to control both pressure and position of hydraulic presses simultaneously to maximize output while ensuring uniform material compaction. Sawmills provide another example, with articulating gang saws whose hydraulic positioning arms are driven by motion controllers to cut logs along the lines of their curves to maximize the yield of usable lumber from imperfect timbers.

New machines such as these are designed and constructed using modular design techniques that use "best-of-class" components and decrease the cost of machine maintenance and installation. One of the most critical "module" choices is the motion control technology.

Fluid power systems designers have three broad categories of motion controllers from which to choose:

1. Complete, stand-alone control systems that are designed for a particular application such as dedicated controllers for injection molding machines.
2. General-purpose programmable motion control computers, typically available as cards that plug into PCs.
3. Motion controllers with pre-programmed functions and flexible bus interfaces (See Figure 1 for example).

Each of these choices has distinct advantages and disadvantages. Complete stand-alone controllers can make it easy to implement basic motion functionality, but these systems may be difficult to modify and expand. Programmable general-purpose controllers have the advantage of a high degree of flexibility; virtually any type of control scheme can be implemented, but the downside is that the machine designer must do all the programming and design maintenance. Pre-programmed controllers can be a good compromise for hydraulic system designers because they offer a good mix of flexibility and ease-of-use. To ensure that the motion controller is up to the task of handling the application, designers should review each controller's technical specifications.

A motion controller that provides control signals to drive proportional valves offers smooth valve control that reduces the potential for fluid leaks and extends the life of the machine. If the application requires that the controller can transition from control based on position information to control based on pressure, the motion controller must be able to interface to position and pressure sensors. Motion controllers that provide direct transducer interfaces may offer the best cost/performance by eliminating the need for separate interfacing modules that can impose performance bottlenecks. And motion controllers that interface directly to the system's PLC or human-machine interface (HMI)

make the system simpler to design and contribute to higher system performance and lower system hardware costs.

A controller that interfaces to a standard fieldbus means that the designer is not locked in to a single vendor's control system offerings. Further, if relatively low quantities of machines (tens or less, compared to hundreds) are to be built, the economics favor an off-the-shelf controller rather than general-purpose computer components.

Finally, the motion controller must allow the designer to optimize the machine's performance by tuning the motion. In typical machine operation, a controlling PLC programs the motion controller by writing sequences of motion commands called "steps" into the controller. In the case of the RMC controller from Delta Computer Systems, for example, this is as simple as loading numbers into a spreadsheet table: No complicated software programming is required to generate complex motion profiles and PID loops. To tune the motion, Delta provides a software package called RMCWin that allows the designer to monitor how closely the actual motion profile matches the target and tweak parameters to optimize the performance of the system. Figure 2 shows a motion plot from RMCWin.

Fluid power applications place some special requirements on motion control systems. Designers should do their homework to make sure that the controller they choose is up to the task.

Figure 1. Motion controller with wide array of digital and analog interfaces

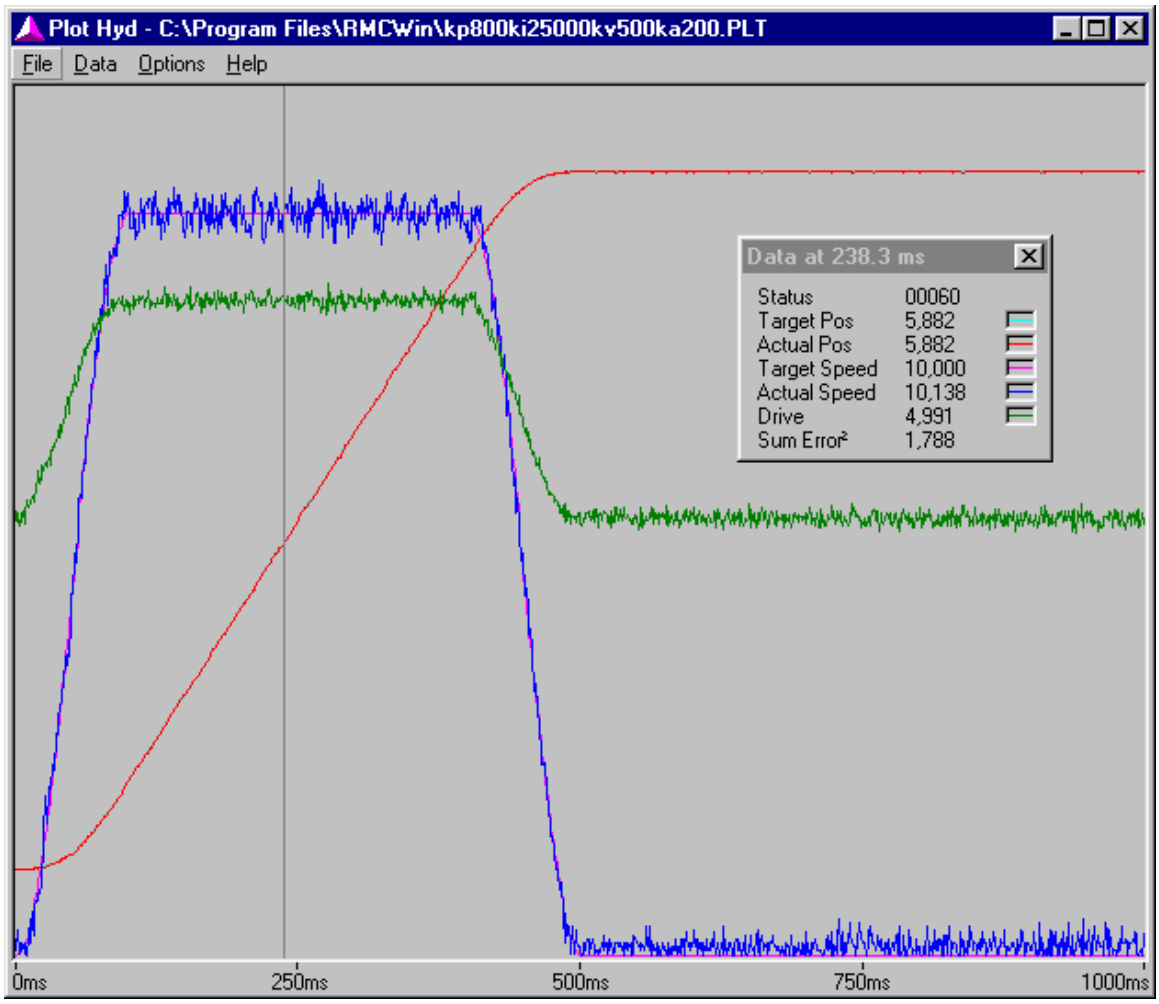

Figure 2. Plotting actual versus target motion profiles helps with system tuning