

## Retrofitting Control Systems to Increase Machine Performance

### **Quicker return on investment makes retrofits and upgrades attractive**

In tough economic times, tight capital budgets often force companies to delay purchasing new equipment, despite their increasing need to reduce manufacturing costs. However, machines are key assets that must be maintained and supported for optimal productivity and quality.

Retrofitting the control system on an existing machine can provide a significant increase in performance. At the same time, it retains the investment in mechanical and power components that may still have many years of useful life. And for an OEM machine builder, upgrading the control system on an existing design can bring much of the benefit of developing a new machine at a fraction of the cost.

Benefits of upgrading to a high-performance electronic motion controller include:

1. Higher throughput by reducing the time it takes for an axis to move and stabilize at the new position and by supporting synchronization and gearing of multiple axes to increase the performance of complex motion systems.
2. Better quality through more precise positioning and advanced capabilities such as pressure control.
3. Reduced changeover time through the use of “recipes”—complete motion sequences that are downloaded to reconfigure a machine.
4. Reduced maintenance costs due to the lower shock and vibration provided by smoother motion.

### **Selecting a motion controller for retrofit applications**

When retrofitting equipment, the systems integrator is faced with the challenge of designing around equipment that is either mandated by the end user (a certain brand of PLC, for example) or would be cost-prohibitive to replace. The goal of the integrator is to select a motion controller that can be adapted to the application, replacing only those components required to achieve the performance or productivity improvement goals.

Specific factors that must be considered include:

**Communications support.** An ideal motion controller for retrofit applications must be capable of supporting a wide range of communications interfaces and protocols for connection to the host system. The new controller may need to plug into legacy systems with a popular industrial bus that has been around for a long time, such as Modbus Plus. Alternately, if the bus is to be upgraded as well, the controller would need to interface to modern buses such as PROFIBUS or Allen-Bradley EtherNet I/P.

**Transducer connectivity options.** For efficient retrofit implementation, a motion controller must support direct connection to position feedback devices. In addition, since the ability to control pressure as well as position is key to improving productivity and quality, the motion controller also needs to provide interfaces to pressure transducers.

**Complementary operation.** Motion controllers that have the capability of running time-critical sequences within the controller at motion loop times allow fast motion control even with a slow PLC.

**Advanced programming options.** Machine productivity gains may require complex motion sequences to be performed, so the controller software should be easy to program. The controller's functional repertoire should support powerful operations such as simultaneous operation of multiple PID loops, full parameter sets including feed-forwards, and high-level instructions such as third-order equation interpolation. A motion controller that can be programmed with high-level commands allows a motion project to be completed in significantly less time than with low-level machine commands, thus speeding time to market.

**Software support for tuning and diagnostics.** Since tuning for optimal performance is key to obtaining the benefits of a control system upgrade, the motion controller should be supported by a suite of tuning tools to allow the graphical plot comparisons of actual and target performance.

**Applications expertise and commitment to customer support.** When selecting a motion controller for a system upgrade, it is important to look beyond the product specs to also select a motion system supplier with expertise in the application of the technology. Mating new technology with existing systems can be a bit like completing a puzzle, and the motion controller manufacturer can help the process along by providing user-friendly features such as detailed on-line help, training classes, and 24/7 telephone support.

***Examples of retrofits using Delta Computer Systems' RMC100 motion controller:***

**Bushing Press Upgrade**

A control system upgrade by system integrator Horizon Technology of Wyandotte, Michigan resulted in

manufacturing cost savings of hundreds of thousands of dollars for the company's customer, a manufacturer of assemblies for the automotive industry.

The application involves pressing bushings into power steering housings. Before the upgrade, the hydraulic press actuator was controlled by simple two-position "bang-bang" valves using a limit switch to stop at the motion at the desired bushing position. However, the tolerance variations of the power steering housing made it impossible to be sure the bushing would always be fully seated without overstressing the housing. Dealing with the overstressed housings was very expensive, particularly if the damage did not show up until the unit was installed into a vehicle.

The system was upgraded to closed-loop servo control with pressure as well as position feedback. The new system is ten times more accurate ( $\pm 0.003$  vs.  $\pm 0.025$  inch). The pressure limit mode of the Delta RMC100 is used to stop the motion when the pressure reaches the limit that indicates the bushing is fully seated. In addition to virtually eliminating defects, the RMC upgrade increased production by about 10%, mainly by eliminating a significant amount of setup time. The RMC also provided better information to the controlling PLC, so that quality criteria can be verified and documented.

**Veneer Lathe Upgrade**

System integrator Altec Integrated Solutions of Vancouver, B.C. implemented a complex motion control system that includes multiple, non-linear slave axes, giving their customer the flexibility to adjust parameters on the fly, speeding up production and reducing changeover time. Delta's programming toolset, including the powerful Curve Tool, made the difference.

As Altec owner, Bill Long, put it: “The Curve Tool significantly cut our development and debugging time compared to other motion controller programming techniques that involve assembling, managing, and calculating extensive sequences of motion programming. And we were able to integrate this functionality with our PLC-based controls to give the end user a simple front-end interface to a complex process.”

This forest products application involved retrofitting the control system on a veneer lathe. The application has 31 axes of motion, including linear and rotary axes. The old control system used a Modicon PLC and a proprietary motion controller.

High-performance veneer lathes are made up of complex mechanical systems. To control them, the systems integrator used the motion controller not only for typical functions of electronic gearing and synchronizing axes, but also for advanced functions such as performing a spline move relative to another axis and superimposed moves relative to a spline move already in progress. Capabilities such as these are built into the off-the-shelf RMC100 motion controller, but would be very expensive to custom program.

With the RMC’s ability to communicate quickly and efficiently over PROFIBUS DP to the Mitsubishi PLC, Altec was able to use “best of class” components to implement the user interface and integrate into the plant system. Through Delta’s RMCWin Tuning and Diagnostics package, both the integrator and customer gained the ability to plot and analyze motion data on site and to adjust, maintain, and tune the system more effectively to maximize performance and minimize maintenance.

#### More Information Available

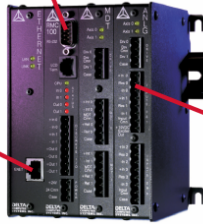
More information is available on these retrofitting applications. For interested publications, Delta engineers are available to write contributed articles with an application or design focus, or to discuss the pros and cons of retrofitting control systems for OEMs, system integrators and end users.



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**PLC** and **Mechanical** system engineers alike can take advantage of Delta's expertise in precision motion and pressure/force control via Delta's extensive software tools, on-line Help and 24/7 telephone support.

**PLC / HMI / Plant MIS** system integration eased by communication choices and programming options to maximize performance with any host system.



**Mechanical** motion system integration helped by the capability of connecting to virtually any servo motion loop, electric, hydraulic or pneumatic.

**Delta Computer Systems RMC100 motion controllers provide unmatched flexibility.**