An Alternative to PLC Based ANALOG CONTROL

Applications controlled with a PLC that require accurate single- or multi-loop PID control and handling of discrete loops can add PID control modules supporting the PLC.

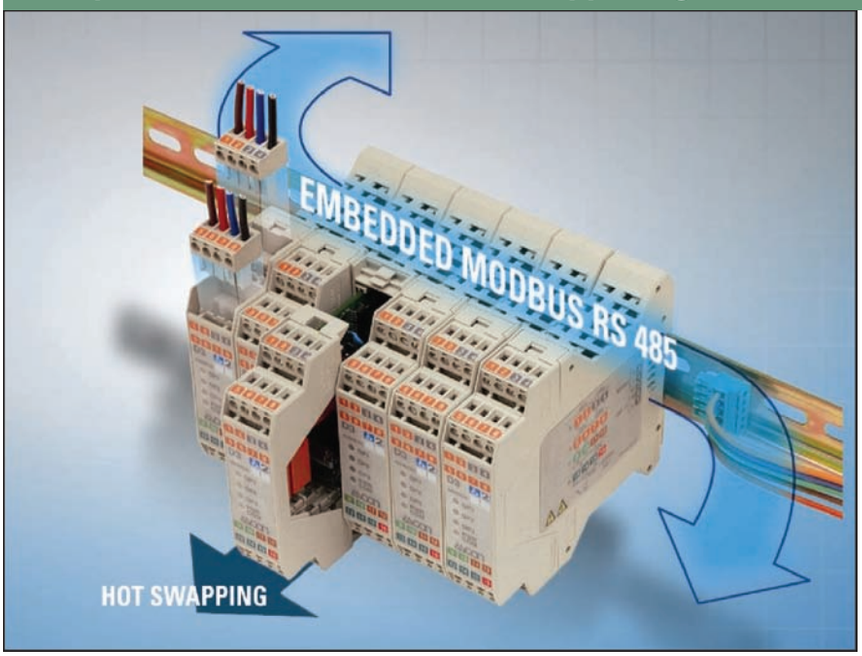
By Steve Rakers, Ascon Corp.

In recent years, it has become more common to integrate analog control loops and, more specifically, PID control, into a programmable logic controller (PLC) system. This practice is technically feasible but often not as functional or easy to support as off-the-shelf analog device technology in the long run. It often also is more costly than using off-the-shelf analog device technology.

The PLC normally is designed to work with digital I/O and sequence control. If a PID loop is added to the PLC application, the processing speeds of both the logic functions and the PID loop are decreased. To minimize speed lags, additional programming time, faster processors, extra system memory and more I/O cards are necessary. Further, if even a single loop must be added, multiple channel I/O cards must be purchased.

The increased cost of a more powerful PLC processor and analog input cards is in direct conflict with the desire for total-system-cost reductions and the larger desire for single-loop integrity. More processors are using — or trying to use — subpanel-mount devices that save panel space and reduce wiring time. More importantly, subpanel-mount devices help reduce total system cost by allowing processors to use less costly PLC equipment that requires fewer engineering manhours. Many products integrate to the PLC but not all satisfy the desire for single-loop integrity. Some devices merely try to replace the PLC analog loops with their own multiloop analog controller, which offers little real benefit to the user.

Successful systems, either OEM based or provided by system integrators, must consider:

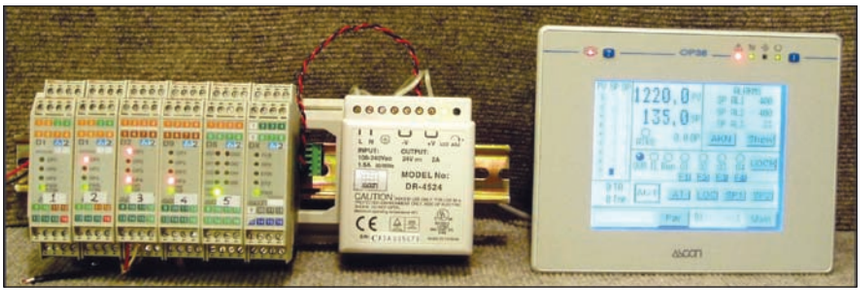


DIN-rail-mounting PID control modules allow component replacement without switching off the power supply, minimizing process downtime.

- The accuracy and repeatability of the analog inputs and loops.
- The individual component and total system costs.
- The desirability of each component.

Analog control can be quite difficult as it needs to be performed at higher speeds, especially with autotune, auto/manual transfer and routines such as alarm handling in the event of a sensor open circuit. Applications that require accurate single- or multi-loop PID control and handling of discrete loops — while enjoying the benefits of PLC control — have an alternative: using PID control modules supporting the PLC.

DIN-rail-mounted analog control and acquisition modules with configurable or universal PID modules are available that integrate with most PLC or PCs systems. Designed for heat-only or heat/cool control applications, each module shares an internal 24 VDC power and Modbus RTU communications bus, so external wiring and external backplanes are not necessary. Also, this approach provides single-loop integrity. System size can vary by the number of modules used and be centrally located or distributed in remote locations. Such modules offer the fast and dedicated sampling rates needed by analog inputs and PID loops, offer advanced autotune with overshoot control, provide I/O isolation,



PID control modules can be integrated with PLCs and PC control systems.

and are capable of hot swapping without affecting other loops. Modules are configured via PC software, allowing configurations to be saved, printed or e-mailed to other locations or personnel.

PID modules make it easier for machine builders or system integrators to build and program systems with analog and PID loops while offering ease of integration, robust single- or multi-loop PID control, and reduced engineering time and total system cost. A master control module is not required as the modules are independent and stand-alone. PID loops can be added without changing the PLC processor capability.

With each PID module, two methods of tuning — one-shot autotuning and natural frequency — are possible. The one-shot autotuning method works on a simple step-response basis. When activated, if a deviation exists between the setpoint and the process temperature that is larger than five percent of the scale range, the PID module modifies the output value. Then, in a short time, it calculates the new PID parameters, and the new PID parameters then are used. The main advantages of this method are fast calculation and quick implementation.

The natural frequency tuning method works best when the process temperature or other variable is very near setpoint. When activated, it initiates a temperature or other process variable oscillation around the setpoint value. The main advantage of this method of control is reduced disturbances to the process.

Utilizing a stand-alone PID control module allows process engineers to realize any combination of functions while purchasing only the needed loops. Modules can be hot swapped or added to the system without switching off the power or affecting other modules, thus reducing machine downtime. Also, modules can be used for simple stand-alone loop control or integrated in more complex applications. **PH**

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