Programmable Logic Controllers and Watlow®: More L for Your PLCs

By: Eric Ludwig, principal engineer, and Trevor Smith, staff engineer. - December 14, 2022

Programmable logic controllers (PLCs) are still the most widely used units for control and automation technology. Their versatility makes them suited for a wide variety of tasks. Dedicated proportional integral derivative (PID) controls, however, contain specialized algorithms, usually for the control of heat and temperature.

So when will a general-purpose PLC system meet all of your requirements, and when do you need a dedicated PID controller? Can you use PLC hardware and a PID algorithm (or vice versa)? When is it worthwhile to integrate both? If you are scratching your head trying to imagine the Venn diagram of dedicated PID controller versus PLC, a look at the core differences might help you design the optimal system.

PLC vs.Dedicated PID Controller: Reading the Alphabet Soup

The sheer volume of sensors and controllers is enough to give almost anyone analysis paralysis. At their simplest, here are the differences between PLC and PID:

	PLC	Dedicated PID Controller for Thermal Applications
Power to Heaters	Needs external power switch to power the heater. PLC hardware often drives external devices to carry "heavier" loads	Can directly power heater in many applications
Use	Used with a wide variety of sensors, often for counting or to make binary determinations	Uses specialized algorithms to monitor or control a process with one or more control loops

Tolerances	General purpose device; temperature control with tight tolerances not built-in	Specifically designed for temperature control with tight tolerances
Firmware	PLC manufacturers use their own operating systems; programmers have to work with the relevant OS	Watlow® devices also run on a root OS, but configuration is done out of the box. Each device has control loops built in, offering functional blocks to virtually connect sensors and outputs with the software
Setup	Programmed via code with their own syntax and formatting; often requires developers to create ladder logic diagrams	Can perform complex functions simply by combining functional blocks in different ways
Cost of Components	Roughly $1,000 per control loop, depending on the input and outputs selected	Roughly $200 for Watlow hardware, per control loop, depending on package
Operating Cost	Pay for software licensing, maintenance fees	Download Watlow's proprietary software for free

There are also similarities between PLCs and dedicated PID controllers like many of Watlow's devices. For example, there is significant overlap when it comes to hardware: The device must read a thermocouple, then drive a mechanical relay or provide a transistor-transistor logic (TTL) output to drive a solid state relay.

PID vs. PLC: When to Use Each

Some of the core benefits of going the dedicated PID controller route for thermal applications include quicker uptime to performance (https://www.watlow.com/blog/posts/start-up-guide-temperature-control-panels) and significant operating cost savings. So should you use a Watlow® controller for your entire system?

Not necessarily. A PLC can encompass control of an entire system, and sometimes that flexibility is needed. A dedicated PID controller, on the other hand, is made specifically for controlling the thermal components of the system. Because it has that narrow function, the dedicated PID controller can be

optimized both for precise control and for extending the life of the system. Furthermore, Watlow's controllers (such as the F4T® Temperature and Process Controller (https://www.watlow.com/products/controllers/temperature-and-process-controllers/f4t-integrated-controller)) use advanced algorithms (https://www.watlow.com/blog/posts/use-smart-power-control-to-improve-temperature-control) to control thermal systems with accuracy that goes above and beyond the industry standard. Such algorithms become useful when an existing process benefits from further refined thermal control.

So, if the thermal portion of a process is mission critical, having a dedicated controller makes sense. There is the added benefit of simplicity as well: Separating the thermal system PID from the PLC means that your PLC code will be simpler to implement and test, and there will not be unexpected interactions between the PID and the rest of your controls. This translates to a more reliable and robust system design.

Can You Get the Job Done with PLCs Only?

The nature of the differences between PLCs versus dedicated PID controllers make it so the two work in harmony more than they compete with each other. However, there are times when it is not worth it to use two separate packages. For example, a tolerance of +/-20°F does not necessarily warrant a specialized PID algorithm.

Once such a wide range becomes unacceptable (https://www.watlow.com/blog/posts/new-alternatives-in-power-conversion-for-electric-heaters), specialized thermal controllers like Watlow devices offer value that outweighs the cost by far. This is especially common in the energy department, where temperature tolerances are low.

For example, precise temperature control is vital when producing semiconductor wafers. The abatement process–vaporizing gasses that are required during production but are unsafe for the finished product–requires a specific temperature. Previously, the best practice was to simply achieve a temperature greater than 130°F. Today, we know that a temperature in the tight range of 145°F-150°F is highly preferable.

What About PID Software + PLC Hardware?

Programming advanced algorithms into PLC hardware also remains an option. There are some things to keep in mind, though:

1. PLCs differ in the ways in which they are programmed/coded. The engineer must be comfortable programming open-source algorithms in the given PLC for the application.
2. Open-source PID algorithms do not exceed industry standards, and may fall flat as tolerances get tight.

3. Powering PID software with PLC hardware can get expensive because the hardware was not built for such an application.
4. Cost can be an issue as well. Three PLC inputs can cost roughly $1,500-$2,500 with one input card. Sometimes it takes a combination of PLC and PID technologies to control costs.

Yes, the temptation is there to use a PLC for everything, especially if this is equipment with which you are already familiar. While there is nothing inherently wrong with the approach, it is often faster, simpler and more efficient to let a dedicated PID controller handle the thermal aspects.

Getting Started With Watlow's Thermal Controllers

Again, dedicated PID controllers do not make PLCs obsolete. On the contrary, Watlow's thermal controllers are designed for easy integration into processes in which PLCs are helpful, or even required. Our devices are for situations in which specialized temperature control can have a positive effect on the final product.

Our team of thermal controller specialists thinks in terms of PLCs plus Watlow controllers more than PLCs versus Watlow controllers. We work with your PLCs, rather than supplant them, to address thermal requirements the PLCs cannot. When your processes demand tight temperature tolerances, you can call us to handle your PID labor.

When thermal precision becomes a pressing requirement, our thermal control experts are ready to help. Contact us (https://www.watlow.com/contact-us) to learn how Watlow might add value by integrating into your existing system.

(abcimg://tech-tips-logo)