Product Family: Loop Controller

Number: AN-LC-006

Subject: Single loop process controller versus mulitiple loop PLC control.

Date Issued: 8/11/03

Revision: Original

A customer writes in and asks the following question:

> **"I think it would be helpful for you to provide a discussion of the pros and cons of using separate temperature controller modules vs. using a thermocouple module and the PID built into a system."**

To answer this question we must define what a control loop and PID loop are?

A control loop is a measure of control utilizing the feedback error signal as the controlling medium within a process. The error signal is created between a process variable and the desired set point. Based on this algorithm, the controller will physically change the mechanism that drives the process variable up or down depending on the process needs.

An a brief overview of PID in some commonly used terms can be the cruise control of your car. It is the method of controlling a process around a specific point with the least amount of fluctuation as possible.

An example of what is not PID is your household heating and cooling thermostat system. This is an example of full ON/OFF control (aka. Hysteresis control.) This is less precise than PID control.

Fore more information visit our newly revised Technical support application notes page and example program page. More specifically go to the following application PID tutorial. http://support.automationdirect.com/tutorials/pid_trainer.pps.

PID single loop process controller

Process and temperature controllers are powerful process control tools but offer very simple operation. Our offerings range from a simple On/Off controller, known as a limit controller, to full-blown, isolated, 4-20 mA autotune PID* control units.

Automationdirect carries three models of process controllers.

PM24 Series Limit Controller

- LCD display
- LED status indicators
- Programming keys for easy setup and monitoring
- Temperature (T/C & RTD) inputs
- Other process inputs
- On/off control

TC33 Series Temperature Controllers

- LCD display
- LED status indicators
- Programming keys for easy setup and monitoring
- Temperature (T/C & RTD) inputs
- Other process inputs
- On/off control
- 4-20 mA control
- DC pulse control

PC35 Series Process Controllers

- LCD display
- LED status indicators
- Programming keys for easy setup and monitoring
- Temperature (T/C & RTD) inputs
- Other process inputs
- Digital input
- On/off control
- 4-20 mA control
- DC pulse control

Application specifics

1.) Stand alone low cost process control.
    a. Compare the price of these controllers to Omega, Honeywell, Watlow, or Eurotherm. You might be surprised.
    b. http://support.automationdirect.com/docs/ratioapplication.pdf
    c. http://support.automationdirect.com/docs/tc33_blower.pdf
    d. The current models cannot be networked serially.
2.) Can be used for code requirements similar to NFPA 85 (boiler and combustion systems hazard code) and NFPA 86 (combustion system design).
    a. The code stipulates that to be compliant, each fired zone must have an independent over-temperature control (NFPA 86:4-11.1 & .4).
    b. Please review your local code requirements.

3.) Alarm annunciation and display usage via retransmission functions to a larger system.
   a. This adds a new element to basic display units.
   b. http://support.automationdirect.com/docs/basic_retrans.pdf
4.) Retrofit of older hard to find controllers.
   a. The PC35 and TC33 (certain models) have a pulse width modulated output specifically designed to control a solid-state relay. This is one of the oldest and most trusted methods in controlling heater elements and ovens in the world.

PID multiple loop PLC control

The versatility of a PLC is vast. The comparison of both process mediums will be limited to just the PID section of the DL260 and DL06 cpu's on our most popular PLC lines.

DL260 CPU DL205 Series PLC

The D2-260 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic, manual, and cascade control. There are also a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The loop operation parameters (Process Variable, Setpoint, Setpoint Limits, etc.) are stored in V-memory, which allows easy access from operator interfaces or Human Machine Interfaces (HMIs). Setup is accomplished with easy-to-use setup menus and monitoring views in the ***Direct***SOFT32 PLC programming software. The auto tuning feature is easy to use and can reduce setup and maintenance time. Basically, the CPU uses the auto tuning feature to automatically determine near optimum loop settings.

- The D2-260 offers over 230+ RLL instructions that give it the most power of all the DL205 CPUs. Key features include
- Powerful and easy-to-use ASCII instructions
- 16 PID loops with auto-tune
- Total memory of 30.4 K, and support for a maximum of 16,384 I/O points
- Four base sizes with built-in power supply support 12/24 VDC, 110/220 VAC and 125 VDC (6 and 9 slot only) power sources.
- Local expansion I/O bases in all sizes, along with expansion modules
- Over 35 powerful I/O and communication modules
- AC/DC discrete input/output, up to 32 points
- 10 Amp. relay out
- 12-bit and 16-bit analog inputs and outputs
- Temperature inputs
- Data communications, including serial and Ethernet modules
- Counter input/pulse output
- Remote I/O master and slave

DL06 PLC

The DL06 is our first micro PLC to combine its fixed I/O of 20 inputs and 16 outputs with four option card slots for expansion (discrete, analog, communication modules), all in the same package. With the DL06, you can use the same PLC panel layout for all applications from 36 to 100 I/O.

- 14.8 K of total memory
- 229 instructions, including 8 PID loops
- Two communication ports, including RS232/422/485 capability
- Supports networking for MODBUS RTU master/slave, ASCII in/out, and a DeviceNET slave option card
- Integrated high-speed inputs and pulse output
- Built-in real-time clock/calendar
- Optional LCD display for operator interface or maintenance troubleshooting

Application specifics

1.) Grouped medium cost process control.
    a. Versatility of standalone or multiple loop applications.
2.) Integrated control functionality.
    a. Inside and outside control loop data sharing for advanced process control.
3.) Data acquisition and trend analysis.
4.) Using Dsdata to share data to any DDE/OPC compliant software package.
5.) The PLC can communicate directly to a HMI package like Lookout Direct

Technical Assistance: If you have questions regarding this Application Note, please contact us at 770-844-4200 for further assistance.