TECH NOTE

Nominal PID Constants for the Newport 350B Temperature Controller

OVERVIEW

When setting PID constants for a temperature controller, various combinations of values can be used to optimize performance for a given application. The major factors considered during PID control loop optimization are the overshoot and undershoot, time to setpoint, stability, and temperature range. For every application a different subset of these factors will be most important. Discussions of how to achieve high stability and how to adjust or eliminate overshoot and undershoot already exist in ILX Lightwave Application Notes #38 Achieving Millikelvin Temperature Stability and #20 PID Control Loops in Thermoelectric Temperature Controllers. In this technical note a discussion of a flexible set of PID constants that offers a quick time to stability over a wide temperature range is found for the Newport 350B Thermoelectric Temperature Controller.

TEST SET UP

The Newport 350B was tested with various mounts in a variety of operating conditions. The mounts tested were the LDM-4405 Low-Cost TO-can mount, LDM- 4407 TO-can mount, LDM-4409 C-mount fixture, LDM-4412 TO-can mount with collimating lens, and LDM-4984T 14-pin butterfly laser diode mount with integrated thermoelectric module. A set of PID constants was found that worked well regardless of the specific laser diode mount being temperature controlled. The temperature was controlled to different setpoints between 15°C and 35°C. The temperature control behavior was adjusted and monitored during all testing using the Newport 500B/300B remote control application.

TEST PROCEDURE

In order to find PID constants that would work in many different conditions, a baseline of useable PID terms were found using a LDM-4984T by varying the P, I, and D terms and observing the resulting behavior. These same PID terms were then tested with the other four mounts. Of the terms tried, one set of P, I, and D terms stood out as exceptionally useful for quickly reaching any temperature in the range regardless of the mount being used or the operating and environmental conditions.

RESULTS

Value	P	I	D	I Limit
Setting	40.0	30.0	25.0	1.0 Amp

Table 1: Most application-flexible PID constants found for Newport 350B Temperature Controller

The values found to offer the best performance are shown in Table 1 above. When operated using the settings shown the Newport 350B would stabilize to ±0.1°C of the setpoint within 2 minutes for any temperature change ≤ ±2.5°C from the starting temperature. Temperature changes >2.5°C would stabilize to ±0.5°C of the setpoint within 5 minutes. The Newport 350B demonstrated this performance over the entire temperature range from 15°C and 35°C with all mounts tested and under all operating conditions.

CONCLUSION

The values found for the PID settings and current limit are especially useful because of the wide range of conditions in which they function. The strength of these settings is they offer a baseline to use for quick setup of the Newport 350B temperature controller that does not require consideration of the heat load, the specific mount, or the environmental conditions. Using these starting values the user can then make changes to better optimize the 350B for their application.