

## TEC Temperature Drift in the LDC501 Laser Diode Controller

Thermal drift in TEC controllers is the relative TEC temperature change with respect to ambient temperature changes. Units for measurement are  $^{\circ}\text{C}/^{\circ}\text{C}$ , or  $\text{mK}/^{\circ}\text{C}$ . Laser wavelength is highly dependent on its junction temperature and ambient temperature, which could change as much as  $5^{\circ}\text{C}$  in 24 hours. An ultra-low thermal drift TEC controller is obviously necessary to achieve stable laser output.

The TEC controller in the LDC500 series shows a thermal drift of less than  $0.5 \text{ K}/^{\circ}\text{C}$ , which is much better than its competitors.

This note describes how to test the TEC controller's thermal drift, and compares the results of the LDC500 with that of a competitor's. Figure 1 is the test setup. All the instruments are on a lab bench to expose them to ambient room temperature – no thermal chamber is used.

Two GE NTC thermistors (MC65F103C) are used whose nominal values are  $10 \text{ k}\Omega$  at  $25^{\circ}\text{C}$ . One thermistor is in the control loop, the other works as a monitor sensor whose resistance is measured with an Agilent 3458A and converted to Celsius through the Steinhart-Hart equation. Room temperature was monitored with a Pt100 sensor.

Using an LDC501, we set the TEC cooled metal plate to  $5^{\circ}\text{C}$  and PID parameters to auto-tune. The test was started after a one hour warm-up period, and ran for 24 hours.

Figure 2 shows the LDC501 test results - measured thermal drift of  $-0.00028^{\circ}\text{C}/^{\circ}\text{C}$ , or  $-0.28 \text{ mK}/^{\circ}\text{C}$ .

The same test was done using a competitor's TEC controller. Figure 3 shows the results of this test - a thermal drift of  $2.2 \text{ mK}/^{\circ}\text{C}$ .

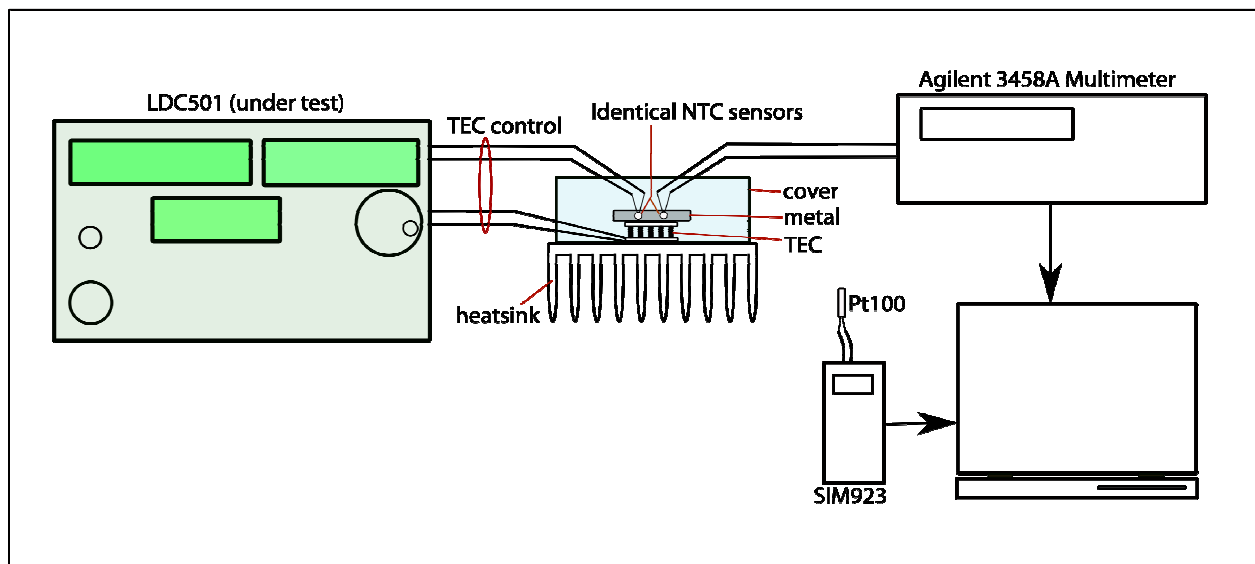


Figure 1: TEC thermal drift test setup

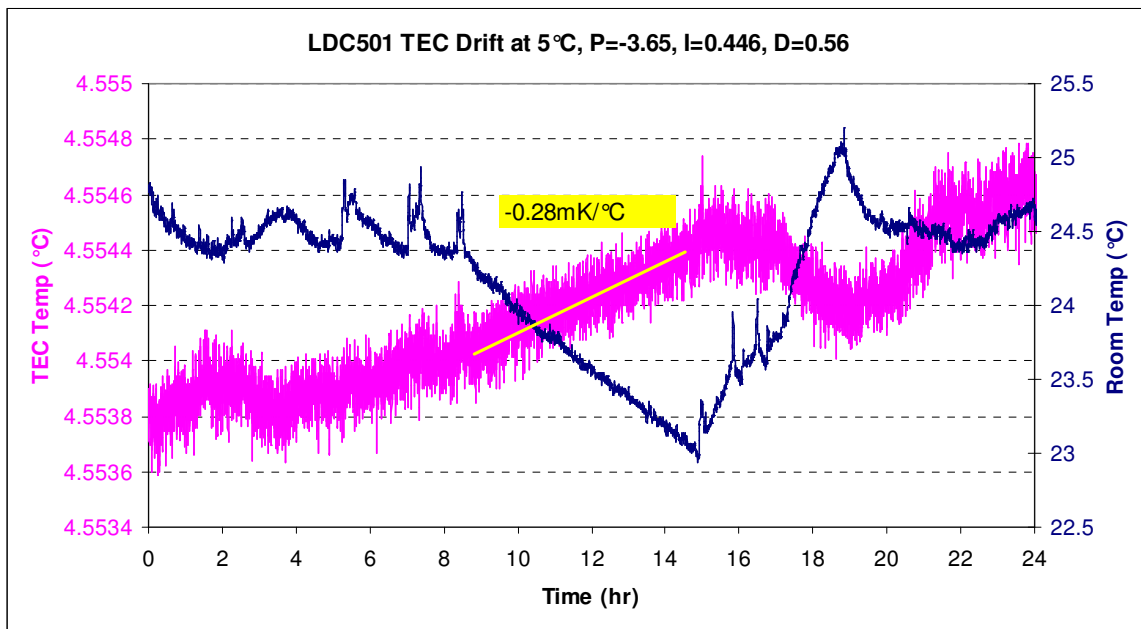


Figure 2: Overnight drift of SRS LDC501 TEC controller

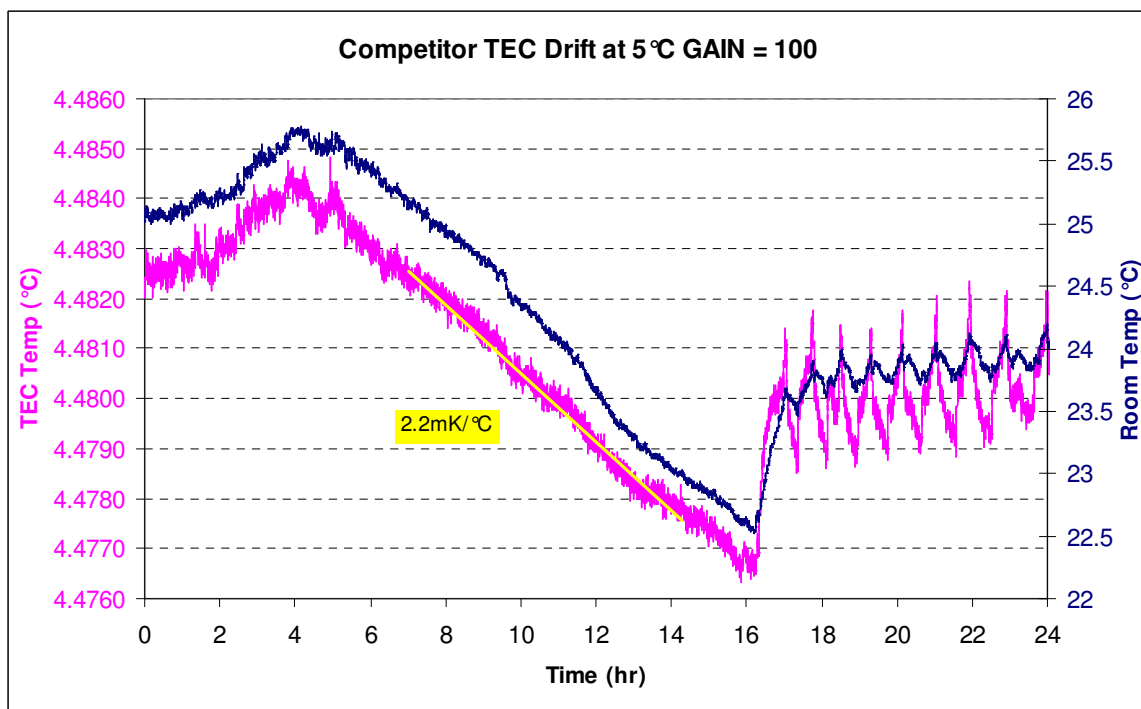


Figure 3: Overnight drift of competitor's TEC controller