TEC temperature drift in the LDC500 series

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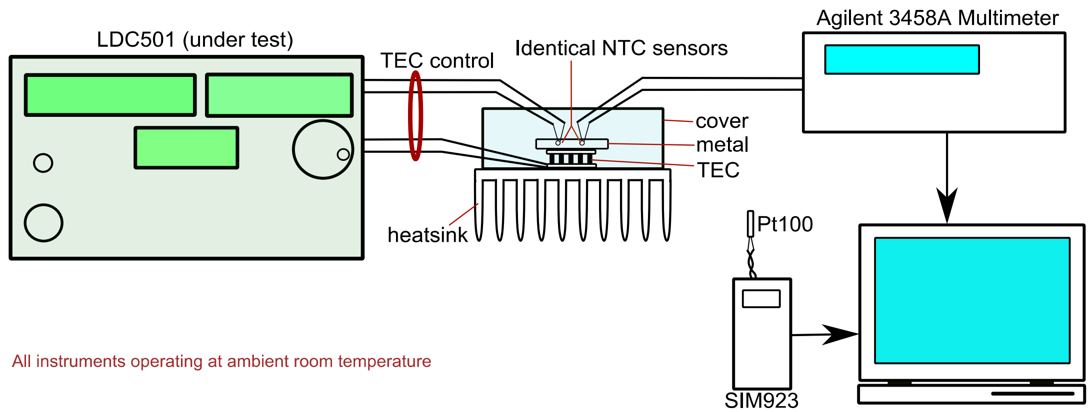

Figure 1: TEC temperature drift test setup

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

The TEC controller in LDC500 series shows a thermal drift of less than 0.5mK/°C, which is much better than its competitors.

This note describes how to test 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 to ambient room temperature – no thermal chambers is used.

Two GE NTC thermistors (MC65F103C) are used whose nominal values are 10kΩ at 25°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 Steinhart-Hart equation. Room temperature was monitored with a Pt100 sensor.

Using a LDC501, we set TEC cooled metal plate to 5°C and PID parameter 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°C/°C, or -0.28mK/°C.

The same test was done using competitor's TEC controller, which doesn't have an auto-tuning function. Following instructions in its manual, we first set loop gain to ×10, and monitor the temperature, then change to higher gain until ×300. We notice that the temperature became unstable (oscillations). So the gain was set back to ×100.

Figure 3 shows the results of this test: a thermal drift of 2.2mK/°C, which is nearly an order of magnitude worse than the LDC501.

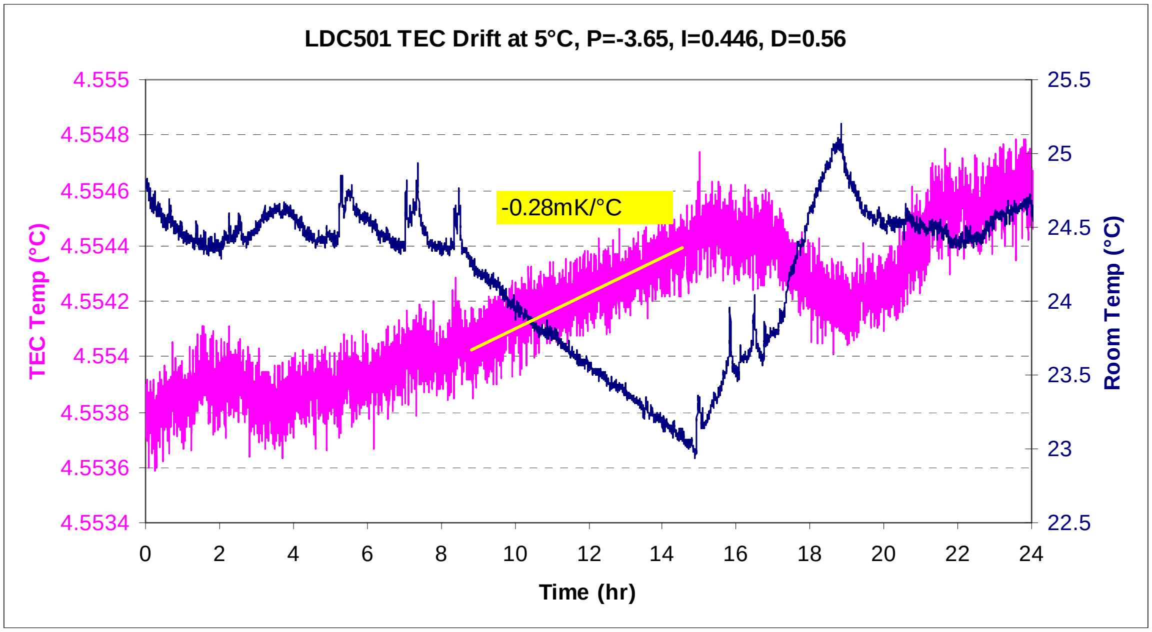

Figure 2: Overnight drift of SRS LDC501 TEC controller

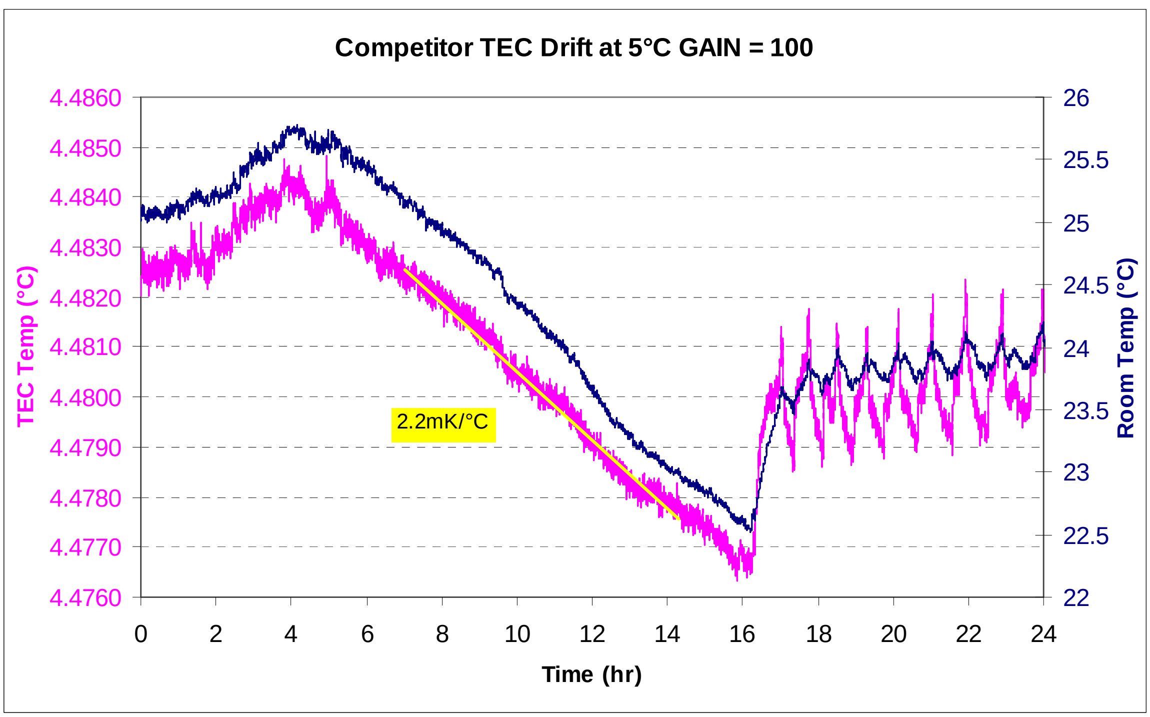

Figure 3: Overnight drift of competitor's TEC controller (8 times worse)