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DESIGN AND ENGINEERING NEWSLETTER

Keep Devices the Right Temperature with Thermal Control Systems

We are seeing a significant number of programs that involve fluid flow and control systems. Part of the uptick is due to the increasing popularity of microfluidic and lab-on-a-chip devices. We have been engaged in a number of development opportunities in those areas, and have engineered fluid and thermal subsystem controls for a variety of other projects.

Thermoelectric cooler modules

A typical method we use for thermal control is with Peltier TECs (thermoelectric cooler modules). One project was in a detector cooling system for a client's infrared spectrometer prototype. Another was a PCR fluorescence reader utilizing a cartridge that required a thermal ramp rate we optimized through the use of well-considered circuit design and an appropriate Peltier TEC solution. We completed the cartridge interface mechanics and the thermo-cycler design utilizing our client's proprietary technology. Our team also fabricated and assembled scores of instrument prototypes that used the test cartridges.

Temperature control without overshoot

Other projects have required temperature control engineering to achieve warming to a specific target fluid temperature, without overshoot. We usually solve the challenge with a closed PID loop system to regulate the heating control. This was the method our team used to control an air bath that used a Kapton heater and heat exchanger combination as a thermal source to rapidly warm and maintain bottled sterile fluids at a consistent temperature.

Custom design solution

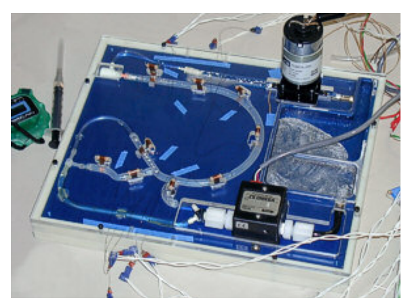
For one project we are particularly proud of, the team designed a miniature dual probe flow-through system, again with a dynamic feedback loop, to heat a component in a mass spectrometer. The heating sub-system in this case was engineered as a custom design.

Heat transfer circuit

We design thermal subsystems for many different types of projects. Some are for POC devices, as the work we did for the Halo NAF sample acquisition system. It utilized a liquid-based heat transfer circuit and a custom thermal platen, where the temperature control specifications included multiple level hardware and firmware-based fault mitigation.

Proof of concept

Another example is a proof-of-concept fixture we designed to test a proprietary arterial catheter. Our challenge was to create a model that could simulate conditions the catheter would encounter in the human body. The integrated heater maintained a system temperature of 37 degrees Celsius (98.6 F). Miniature heater modules were mounted at certain points along the "arterial path", used to simulate arterial "hot spots" the catheter had been designed to identify.



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