ECAL Power Supply Tests

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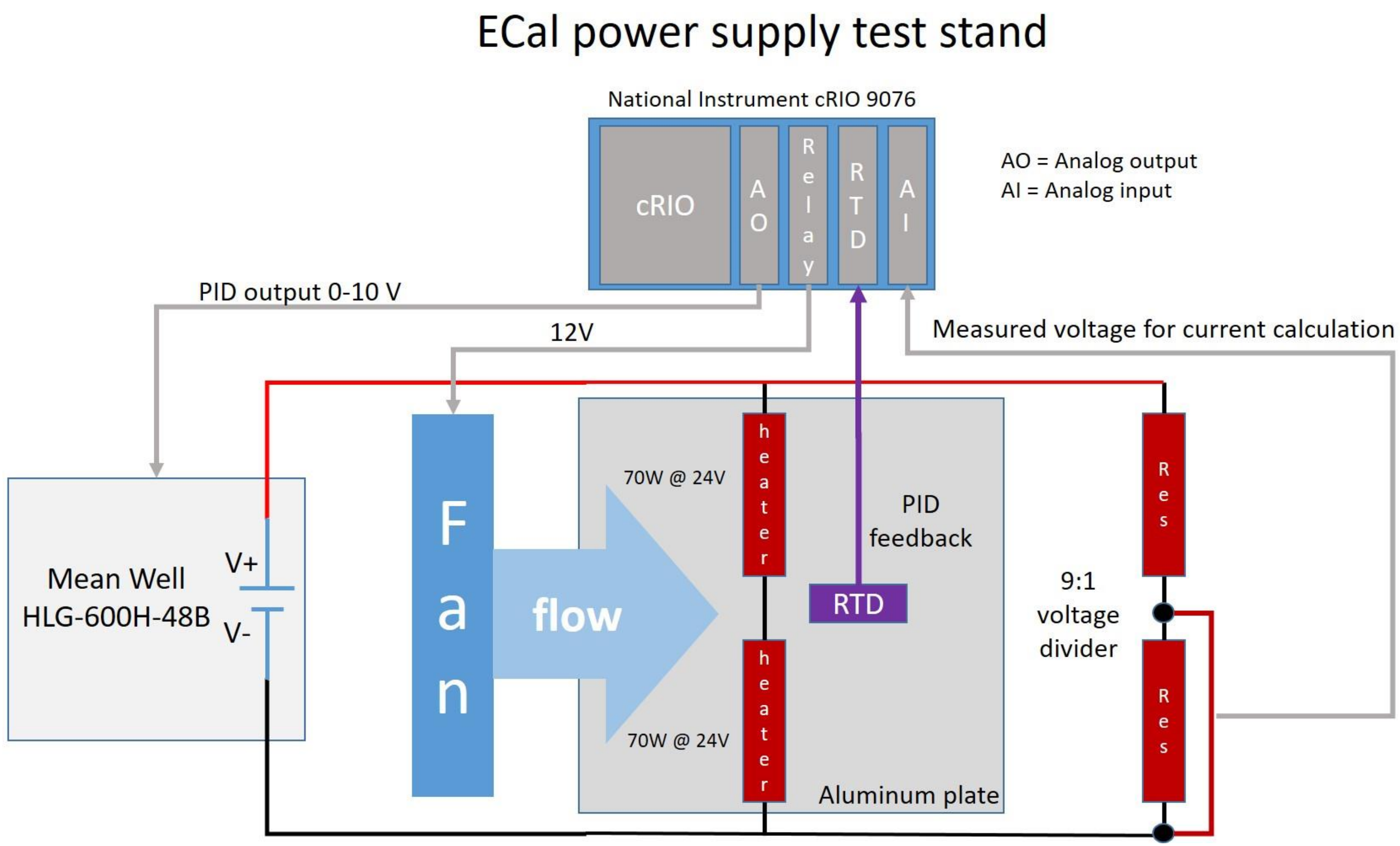
Objective

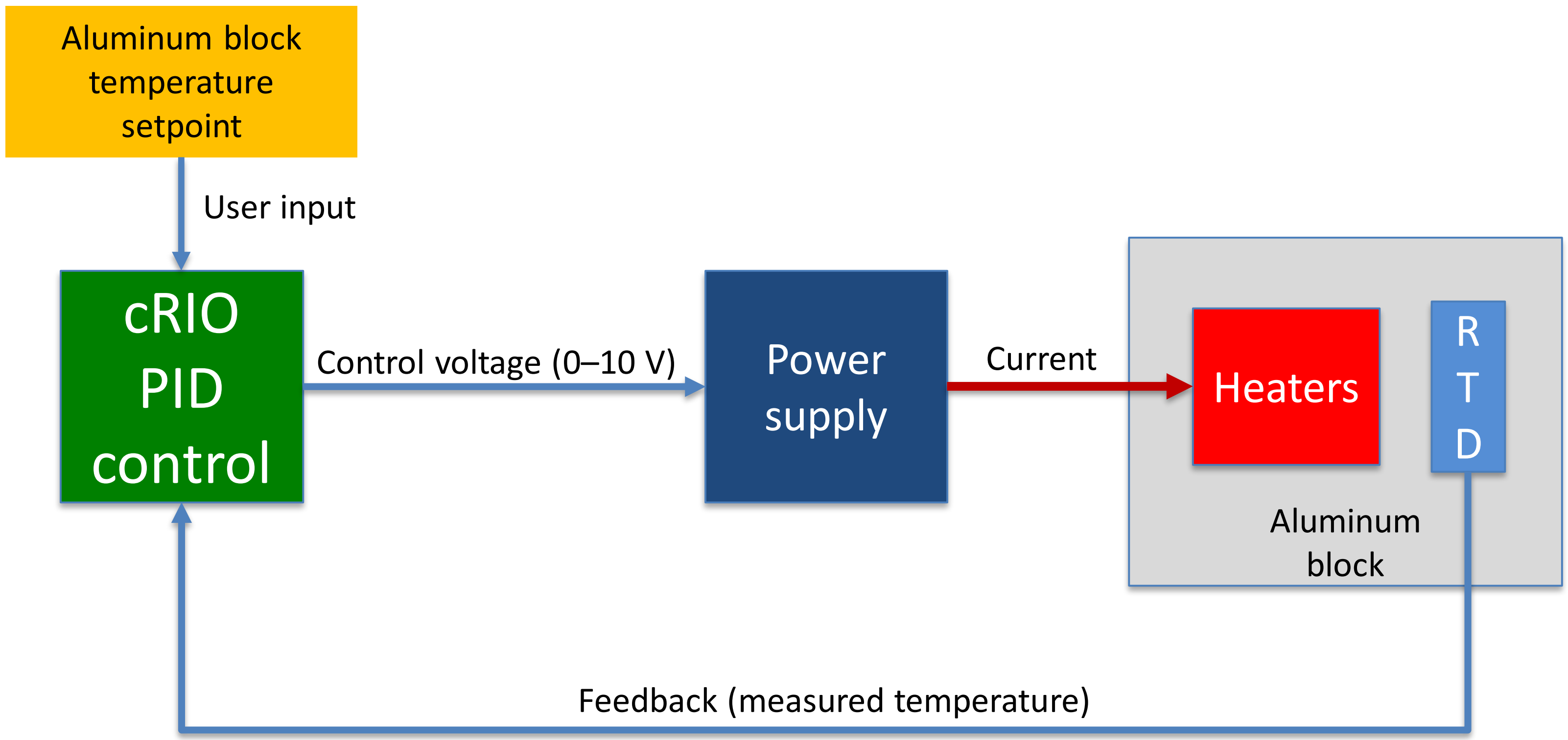
- Develop instrumentation to test an adjustable power supply
- Develop automated controls for power supply
- Test power supply and plot results for review

Test Stand



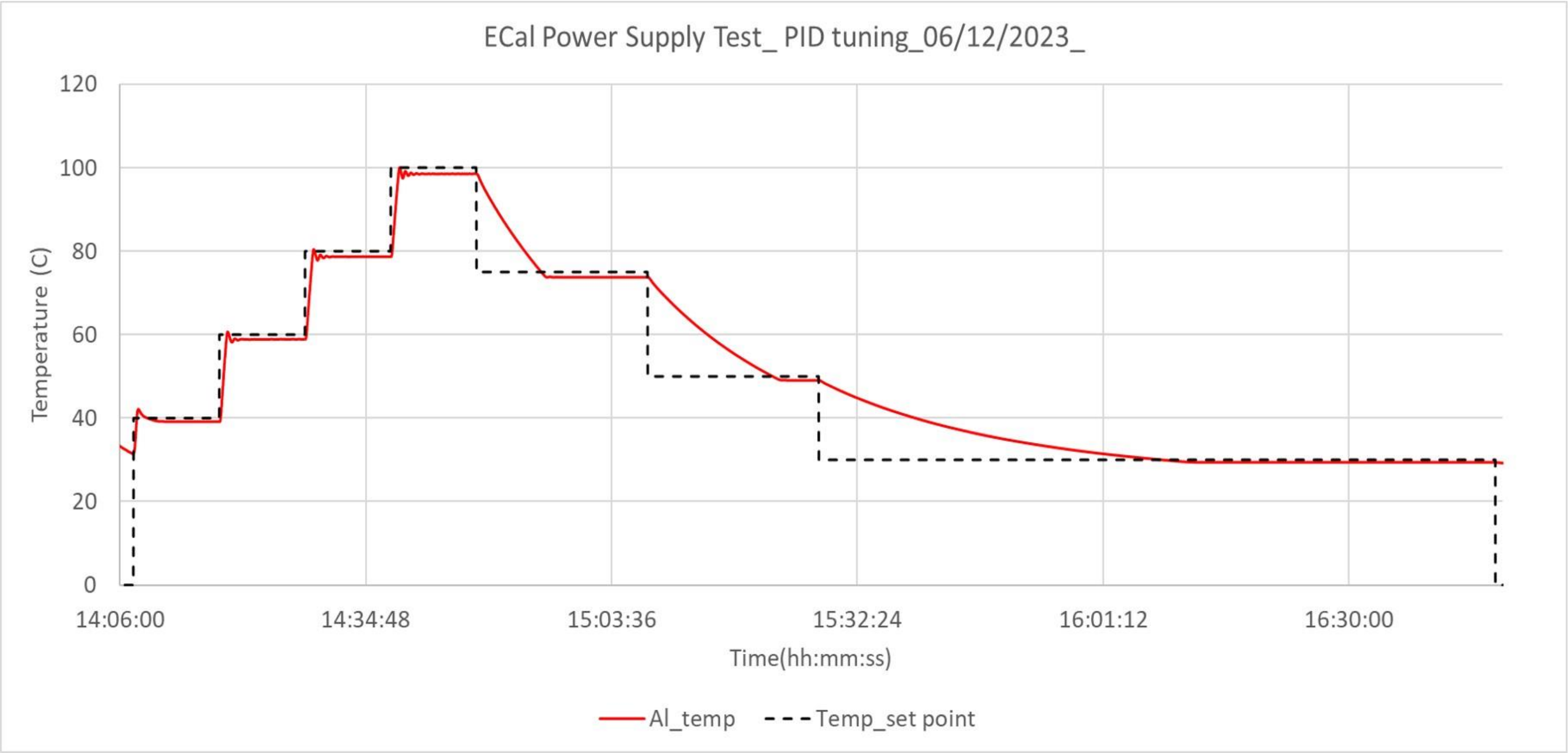
The test stand uses the Mean Well HLG-600H-48B (48 V, 600 W) supply to provide power to the two 70-W heaters. The PID controls software runs on the cRIO, which uses an RTD for feedback. Current and voltage are monitored by the cRIO as it reads ~10% of the output voltage using a voltage divider circuit. A fan is used to quickly lower the temperature, when needed.

PID Controls Software



The controls software receives the aluminum block temperature setpoint from the user input and the actual temperature of the aluminum block as feedback. It provides an analog signal to the power supply (0–10 V) and proportionally controls the output of the supply in percentage.

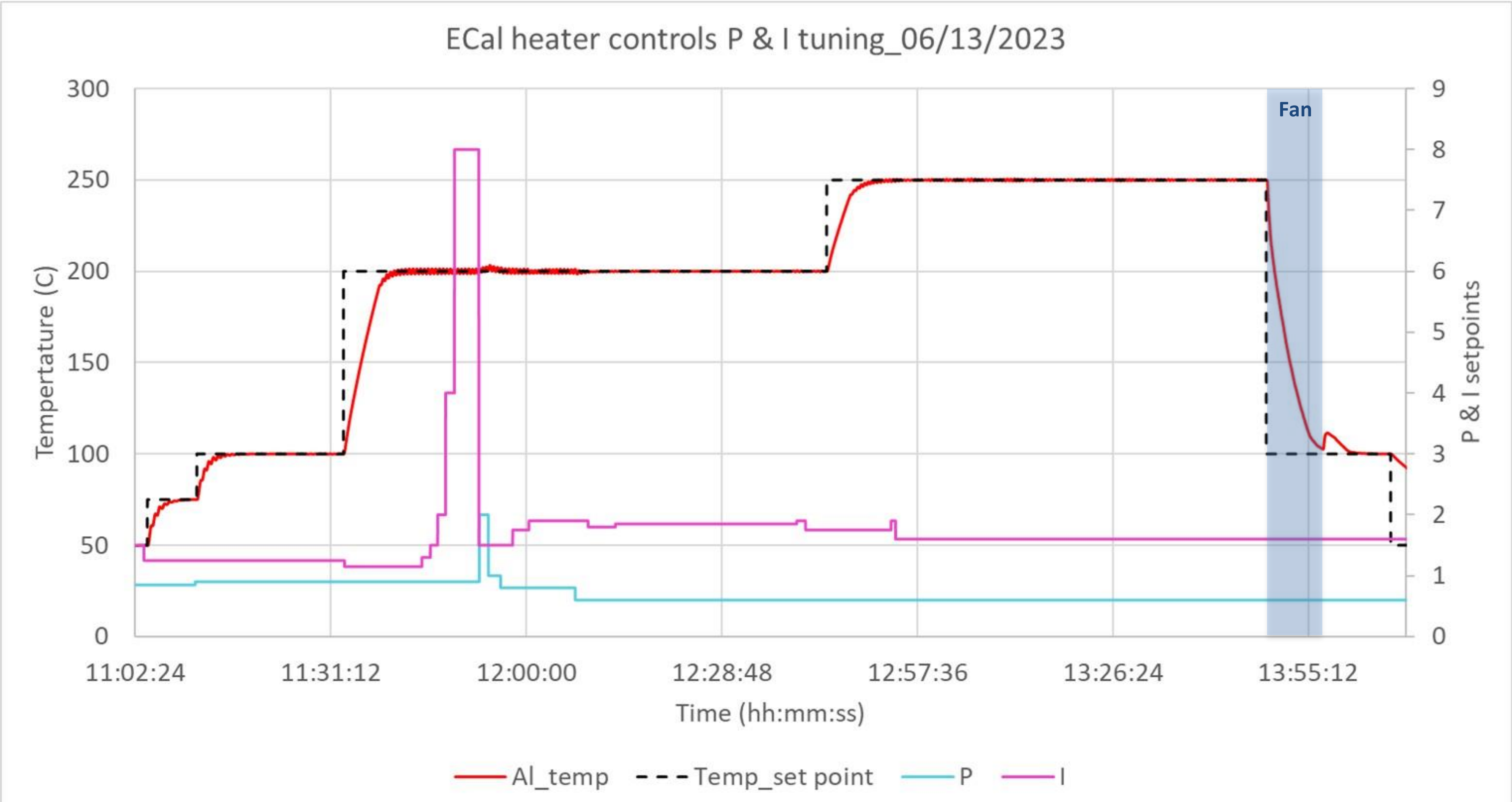
Controls Testing



Tested the software over a range of temperature setpoints to ensure the PID controls work

- Temperature settings in °C (40, 80, 100, 75, 50, and 30)
- Proportional gain = 1, integral and derivative = 0
- Tuning of the PID parameters is needed to reduce initial overshoot of the setpoint

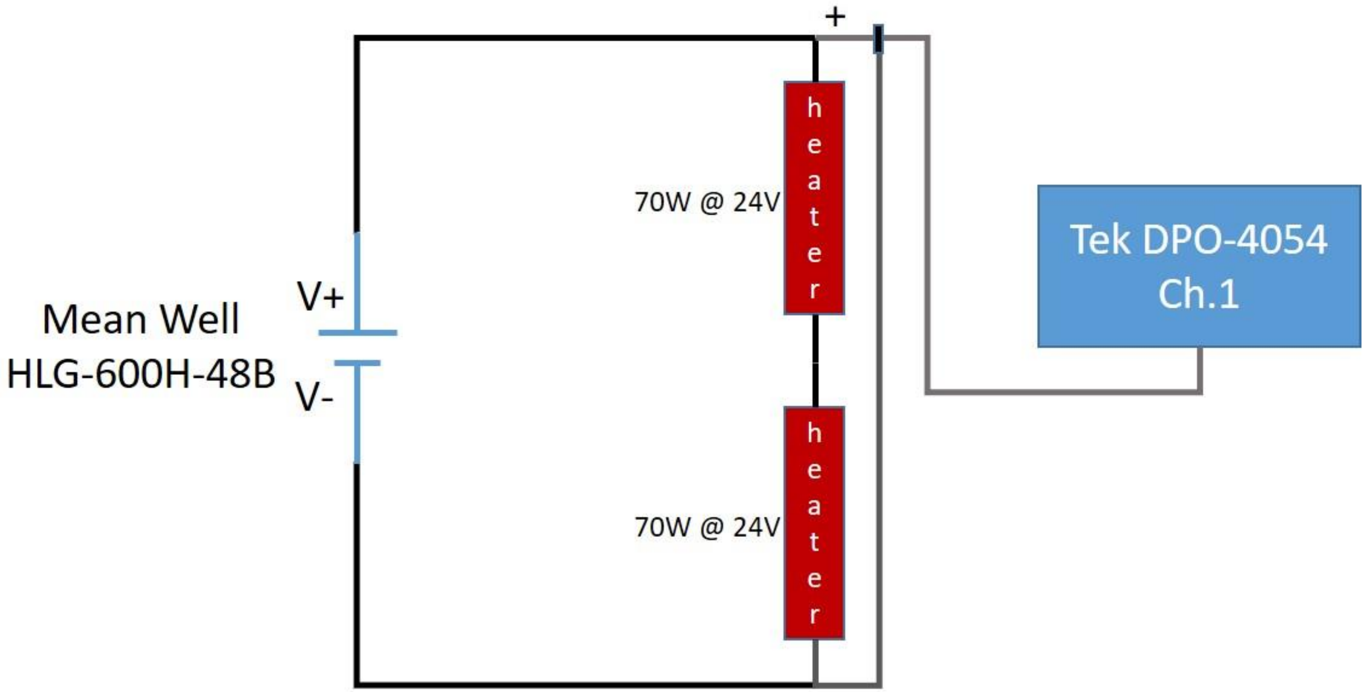
Controls Testing : PID Tuning



Fine tuning of the proportional and integral gains were done at temperatures up to 250°C

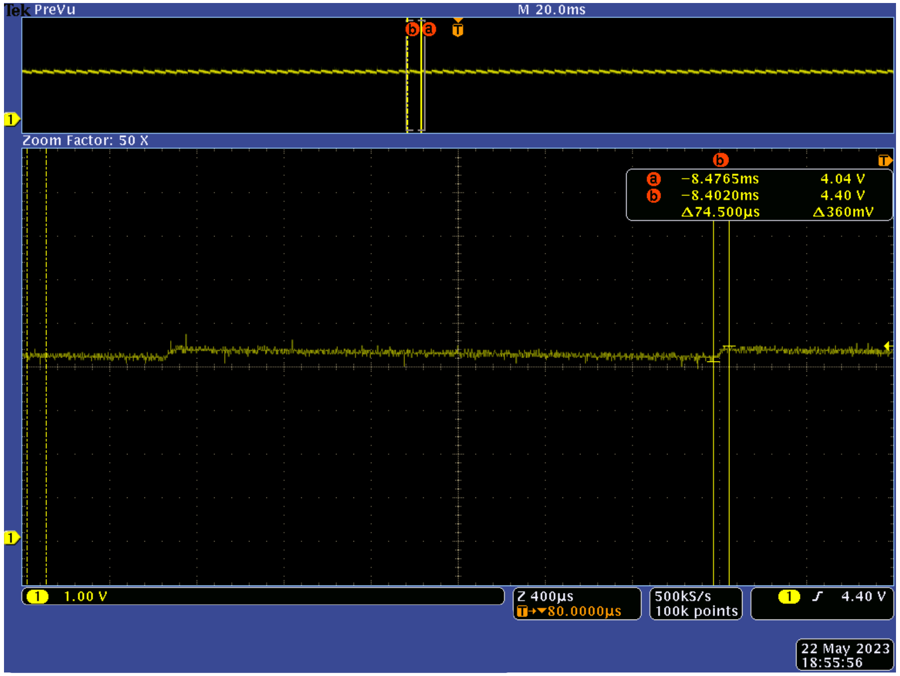
- Final proportional and integral settings are P = 0.6, I = 1.6
- Derivative = 0

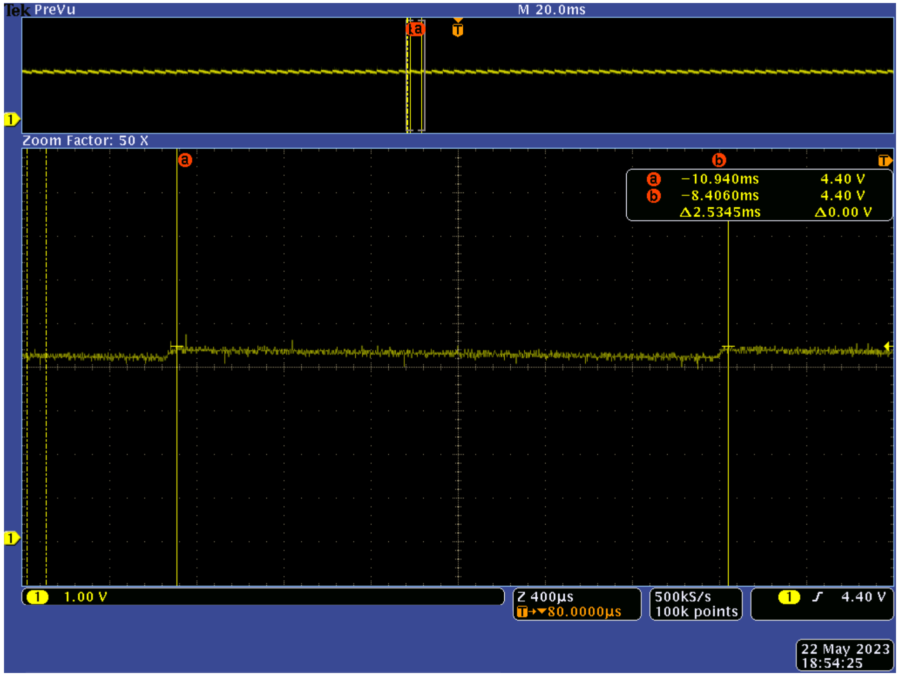
Oscilloscope Measurement Setup



Measurement Results		
Supply output (%)	Peak-to-peak (mV)	Period (Hz)
5	360	395
6	200	593
10	400	1306

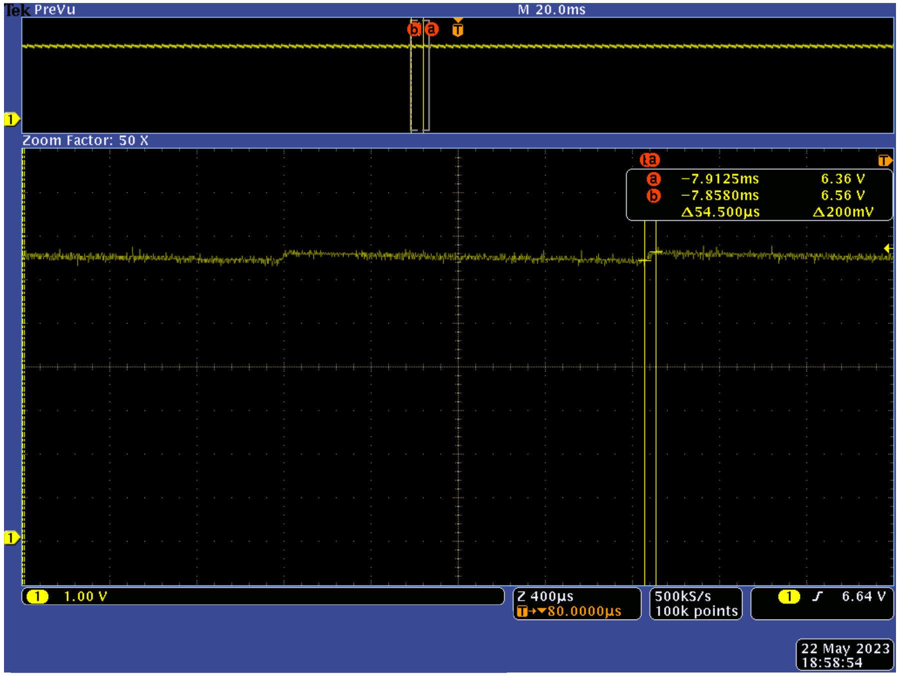
Oscilloscope Screenshot, 5% of Supply Output

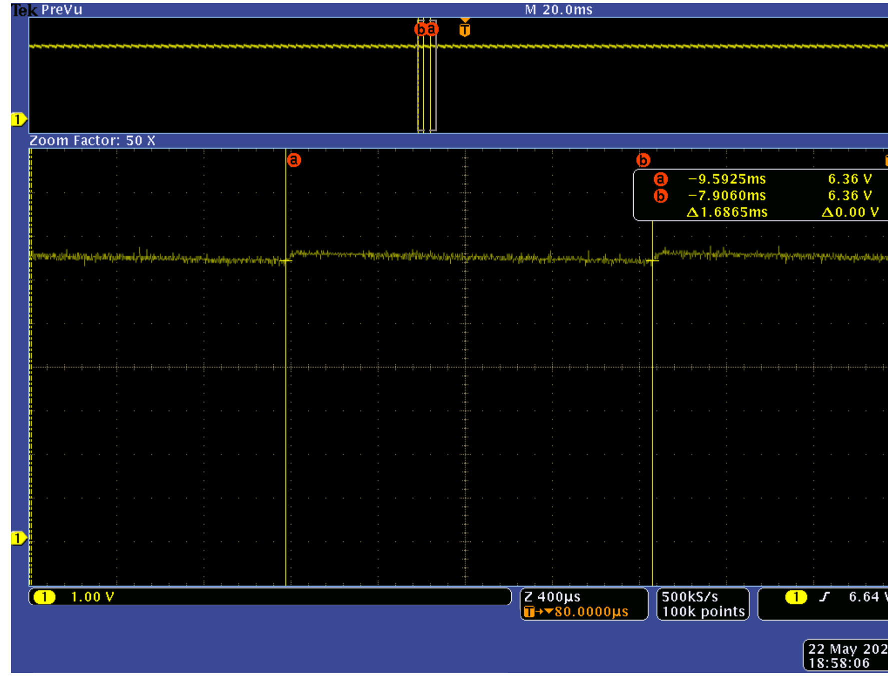




- 5% supply output measures 360 mV peak to peak, with a period of 395 Hz

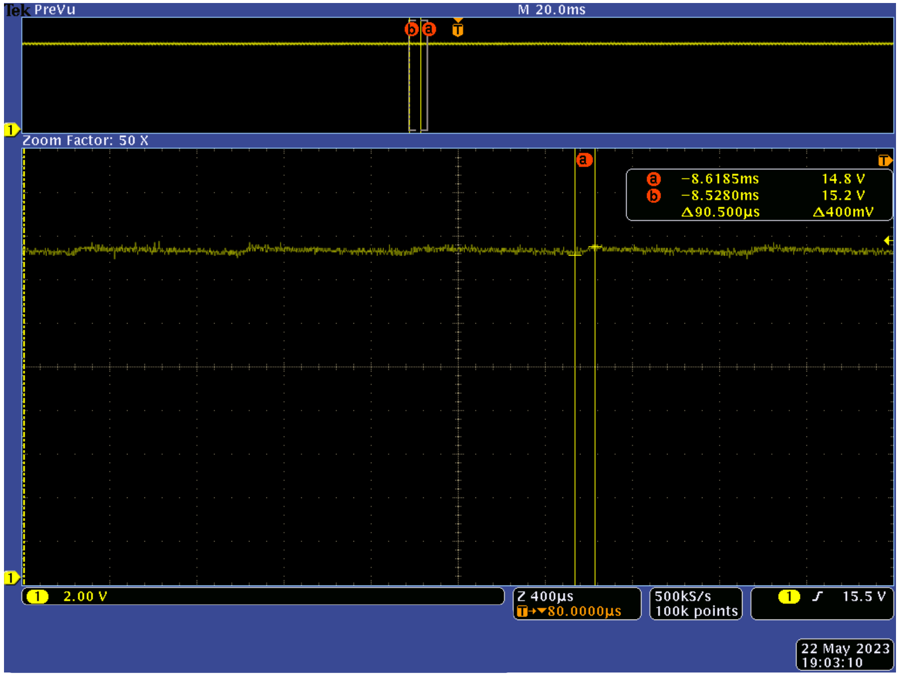
Oscilloscope Plots, 6% of Supply Output

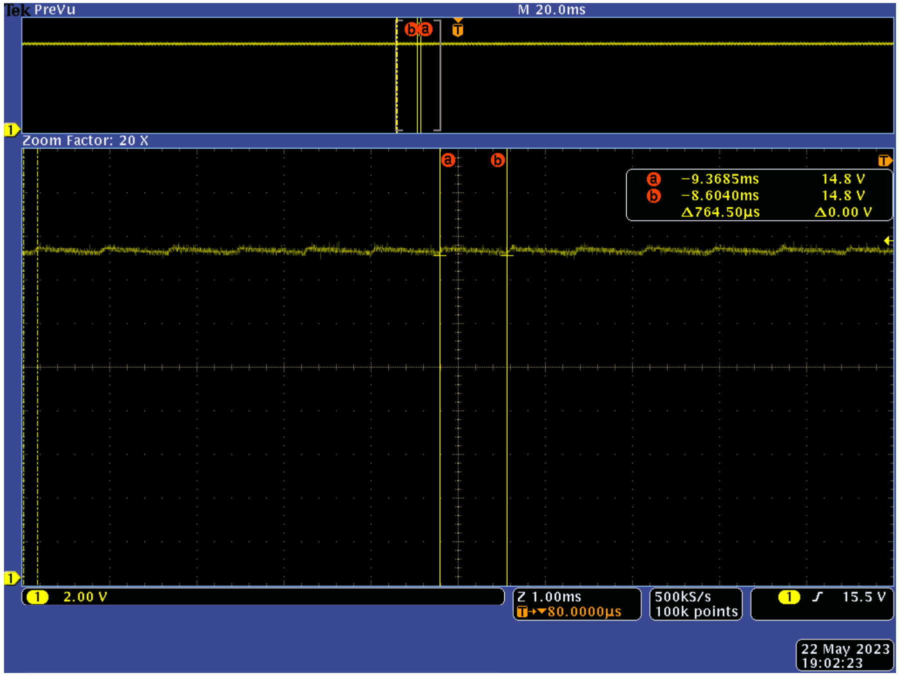




- 6% supply output measures 200 mV peak to peak, with a period of 593 Hz

Oscilloscope Plots, 10% of Supply Output





- 10% supply output measures 400 mV peak to peak, with a period of 1306 Hz

Conclusion

- DSG developed a test stand to verify the output of the supply, under load
  - The test stand was used to verify the operation of the controls software
- DSG developed and tested PID-based software to control the supply output
  - The supply was controlled over a range of temperature setpoints
  - DSG measured the output signal (peak-to-peak and period)
  - The oscilloscope measurements are completed

The End