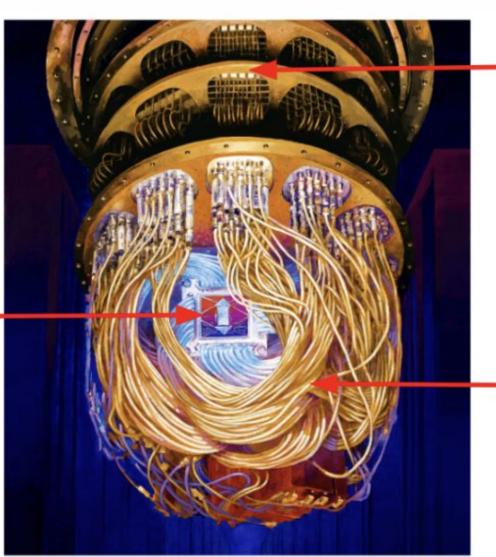


Precision Soldering for Quantum Innovation

Background

- Use of coaxial cables for control/readout lines has become spatially inefficient
- Solution is to replace coaxial cables with flex PCBs
- W/ flex PCBs the number of lines per fridge port increase from 55 to 192
- Current integration process for flex PCBs is slow and manual

Processor



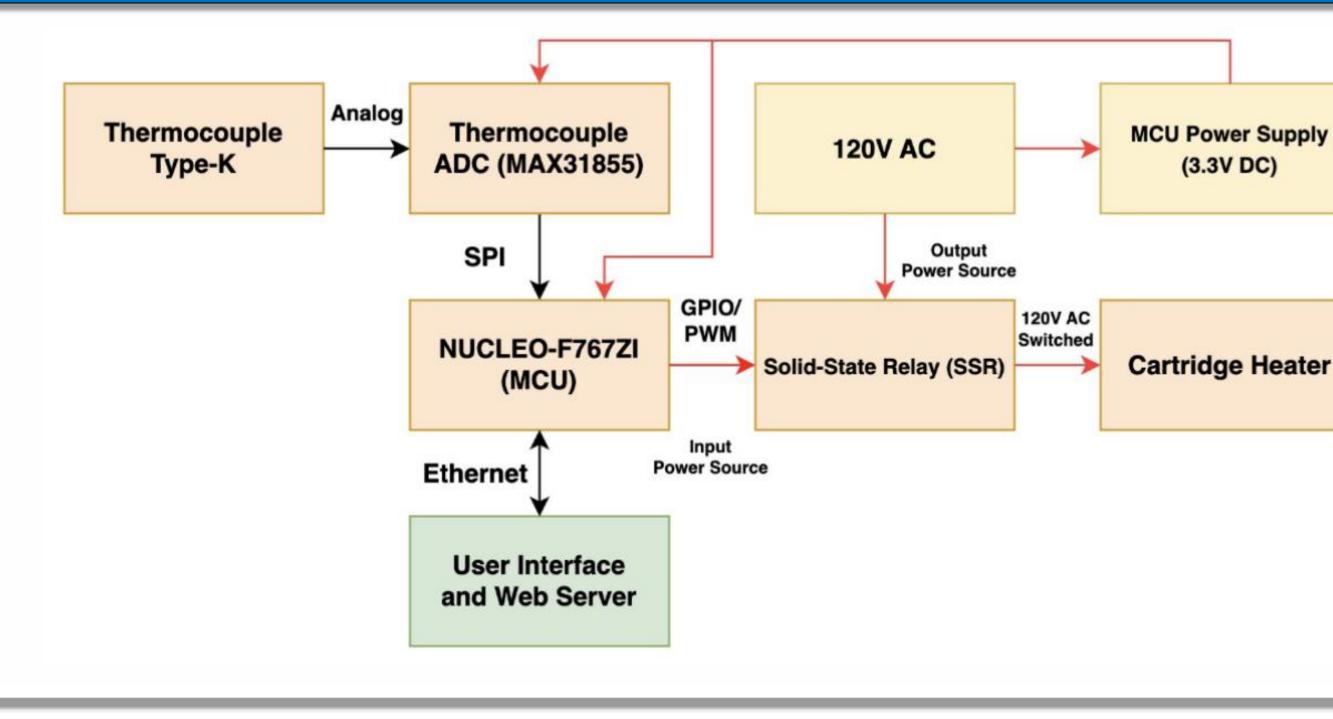
Cooling System

Control/Read out lines

System Overview

- Automated temperature regulation of jig during reflow
- •Heating across jig at $190^{\circ}C \pm 3^{\circ}C$ of variation
- PID control firmware to regulate power delivery
- Web-server hosted user interface
- Solder job runtime input and start/stop buttons
- PID parameters and temperature data monitoring abilities
- Custom PCB design
- Our new system will increase daily solder jobs by 5-10 times

System Block Diagram



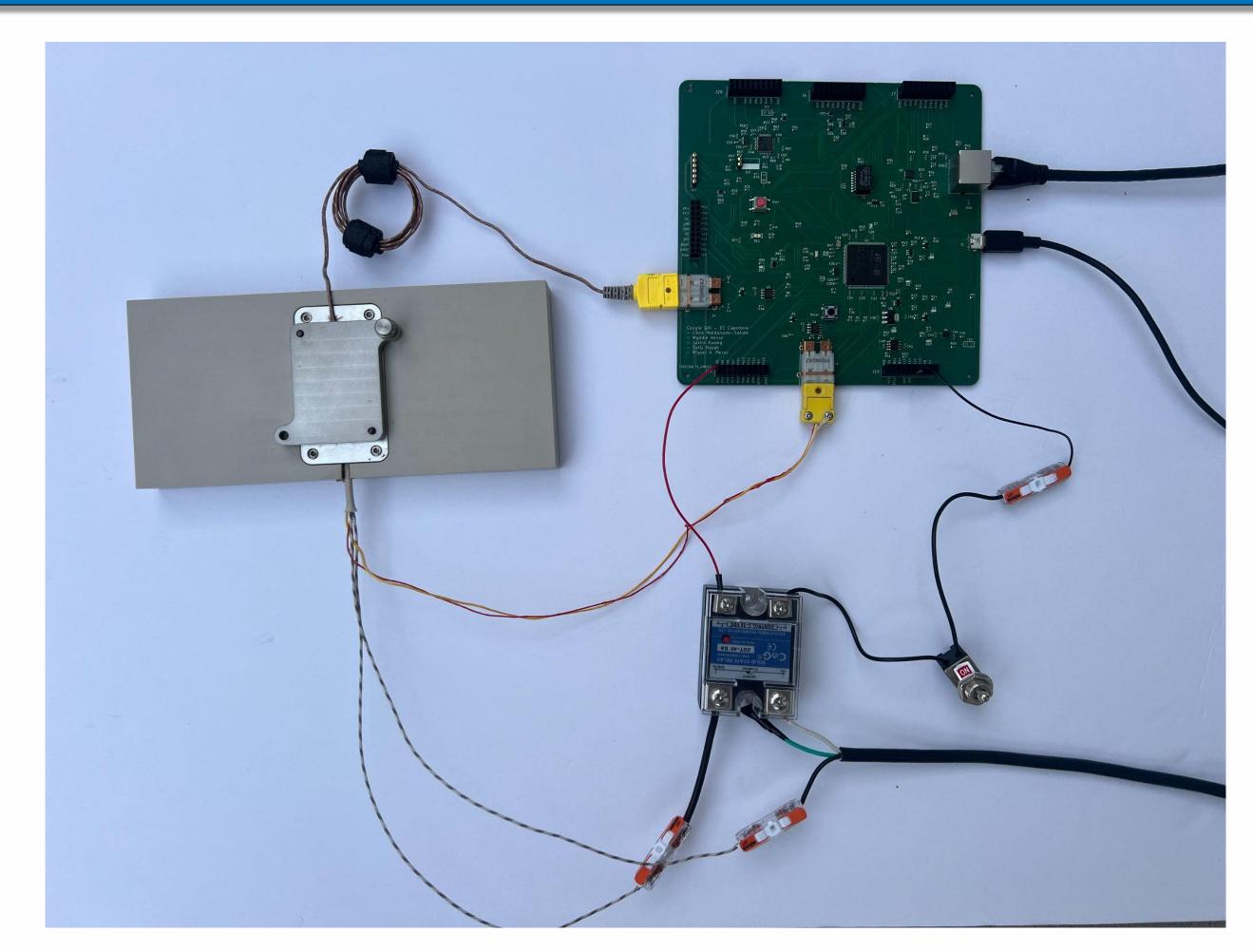


Sponsor: Google Quantum AI

Acknowledgements: Special thanks to our Project Advisors: Frank Arute and Jenna Bovaird, our Capstone Advisor: Ilan Ben-Yaacov, and our TA: Camille Wardlaw

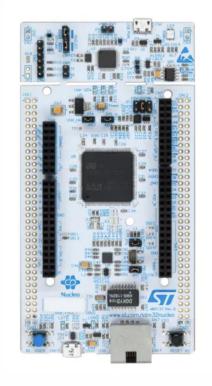
Google QAI – Production Solder Jig Chris Maldonado-Salido | Miguel Meraz | Maddie Hesse | Sally Nayak | Justin Kwong

Design



Final system setup

Hardware / Key Components



Microcontroller: NUCLEO-F767ZI





Heater Element: ¹/₈ inch Watlow Cartridge Heater





Solder Jig Google QAI Design



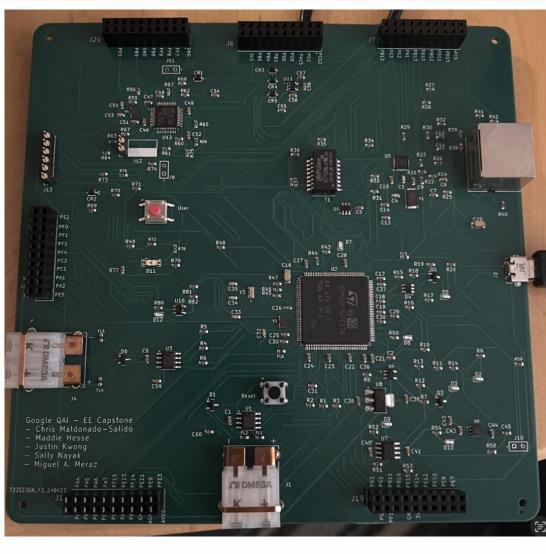
(3.3V DC)

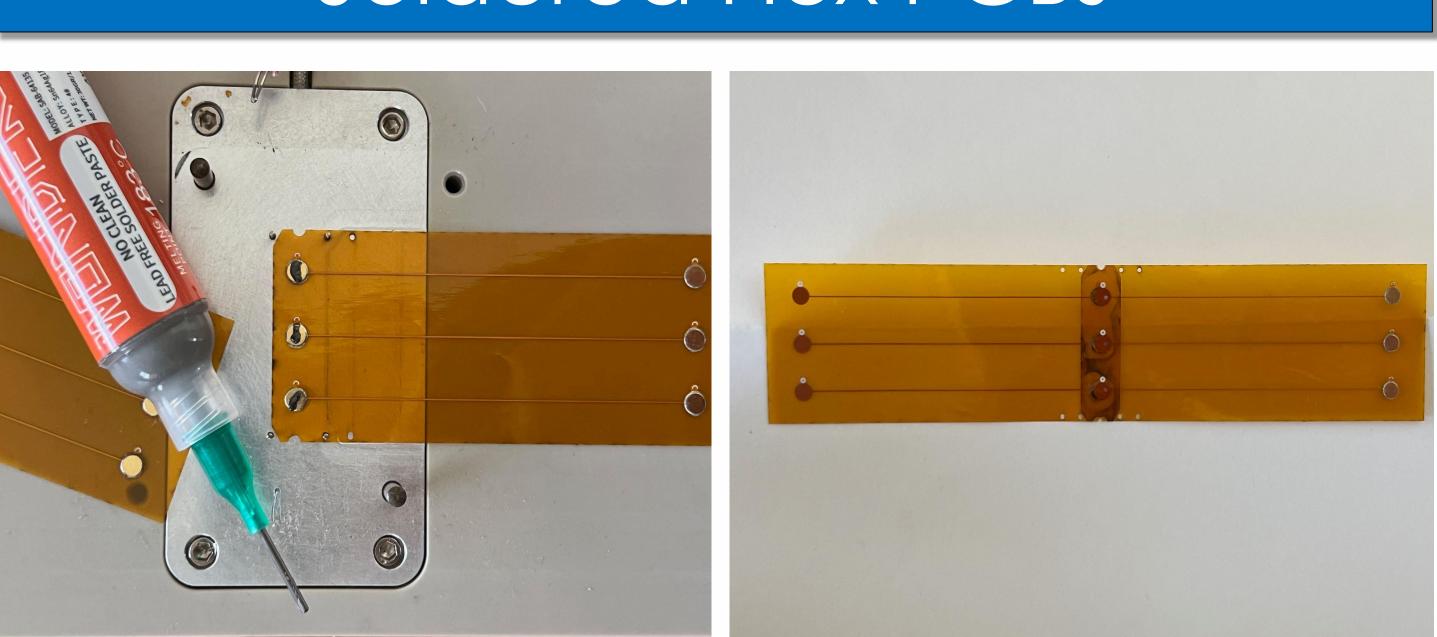
Solid-State Relay: 6410AXXSZS-DC3

Thermocouples: K-type

Analog-to-Digital Converter: MAX31855PMB1







The left image shows solder on the flex PCB's pads, and the right image shows a successful connection.

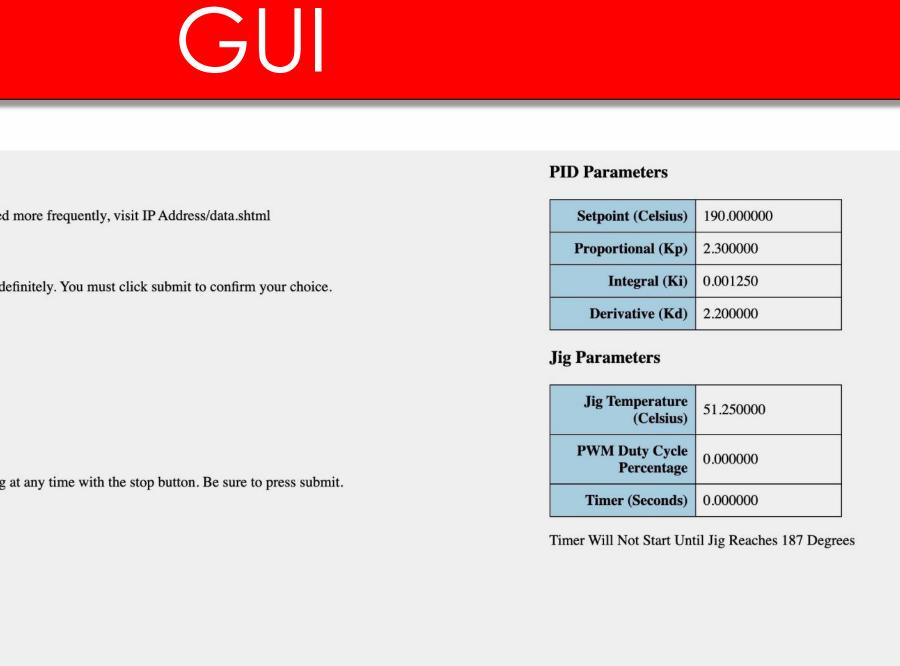
Solder Jig Controls
This page updates values every 2.5 seconds. To see the data update
Runtime
Set a runtime below. If you do not set a runtime, the jig will run ind
Minutes: Seconds:
Submit
Start and Stop
To initiate the heating process, click start. You may stop the heating
□ Start □ Stop
Submit
JIG IS HOT DO NOT TOUCH!
e server-hosted H ⁻

ITTP web page uses lightweight IP, CGI, and SSI for real -time control over the jig and parameter display.

PCB

PCB design to streamline wiring.

Soldered Flex PCBs



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