

# PROJECT HELIOS

## A User-Friendly and High-Performance Surgical Stapling Test System that Controls 3 DC Brushless Motors

### Special Thanks To:

Medtronic: Keith Malang, Madelyn Polly, Steven McGraw  
CU: Professor Eric Bogatin, Hardik Minocha, John Lettang

### Team ResistHer++:

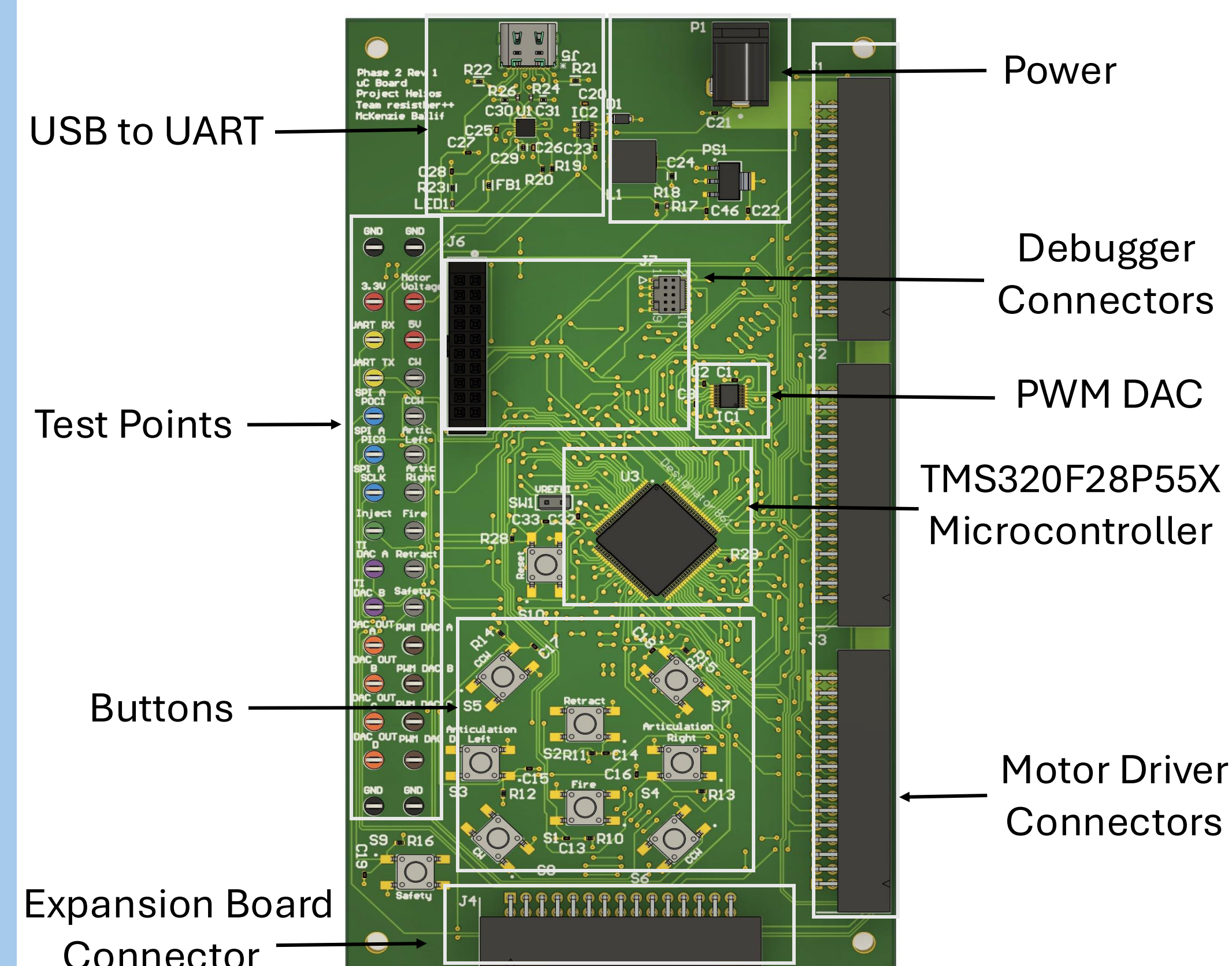
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## Signia Surgical Stapler

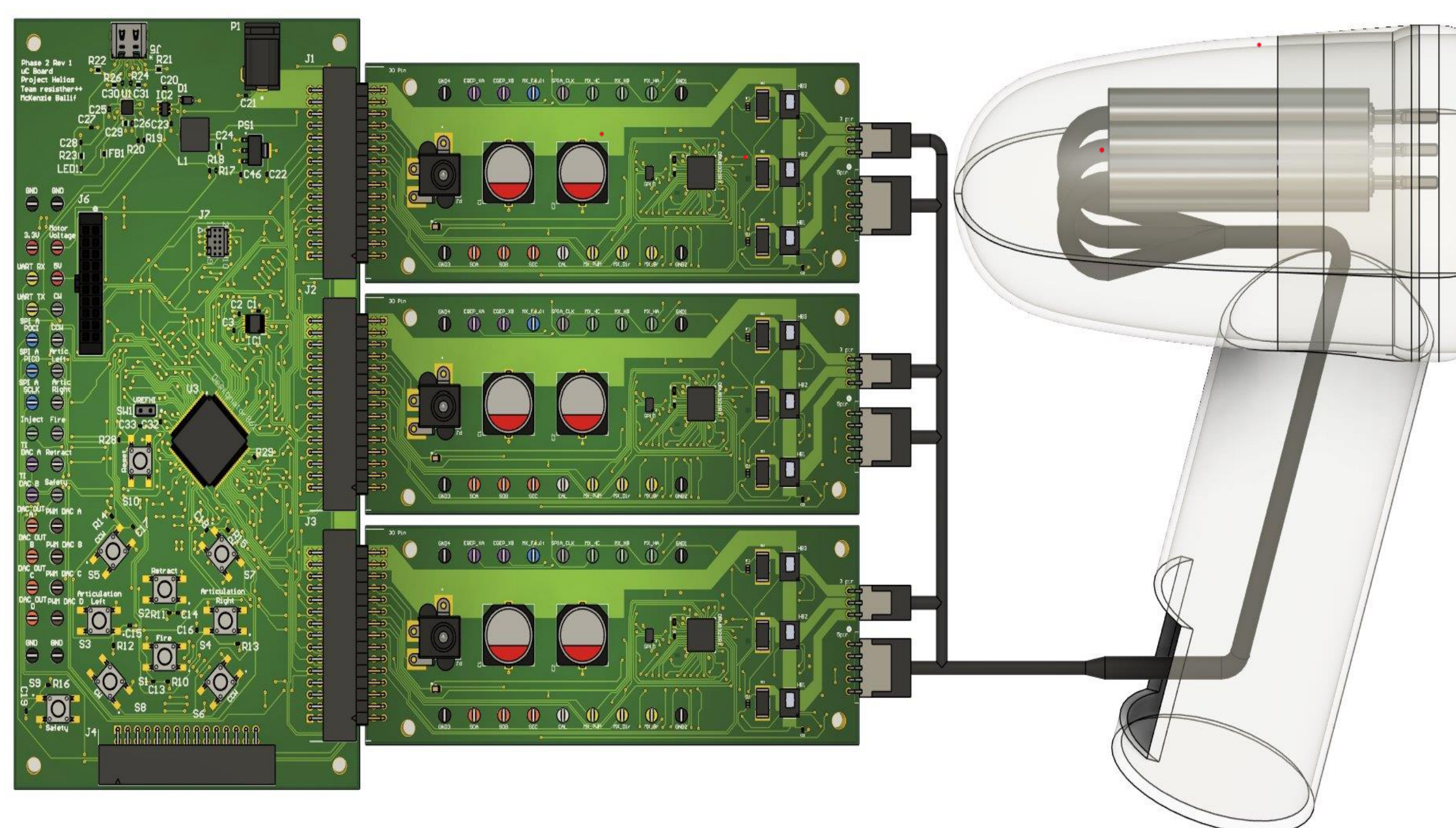
Laparoscopic Surgical Device  
that Seals, Cuts, and  
Bisects Tissue



## Microcontroller PCB



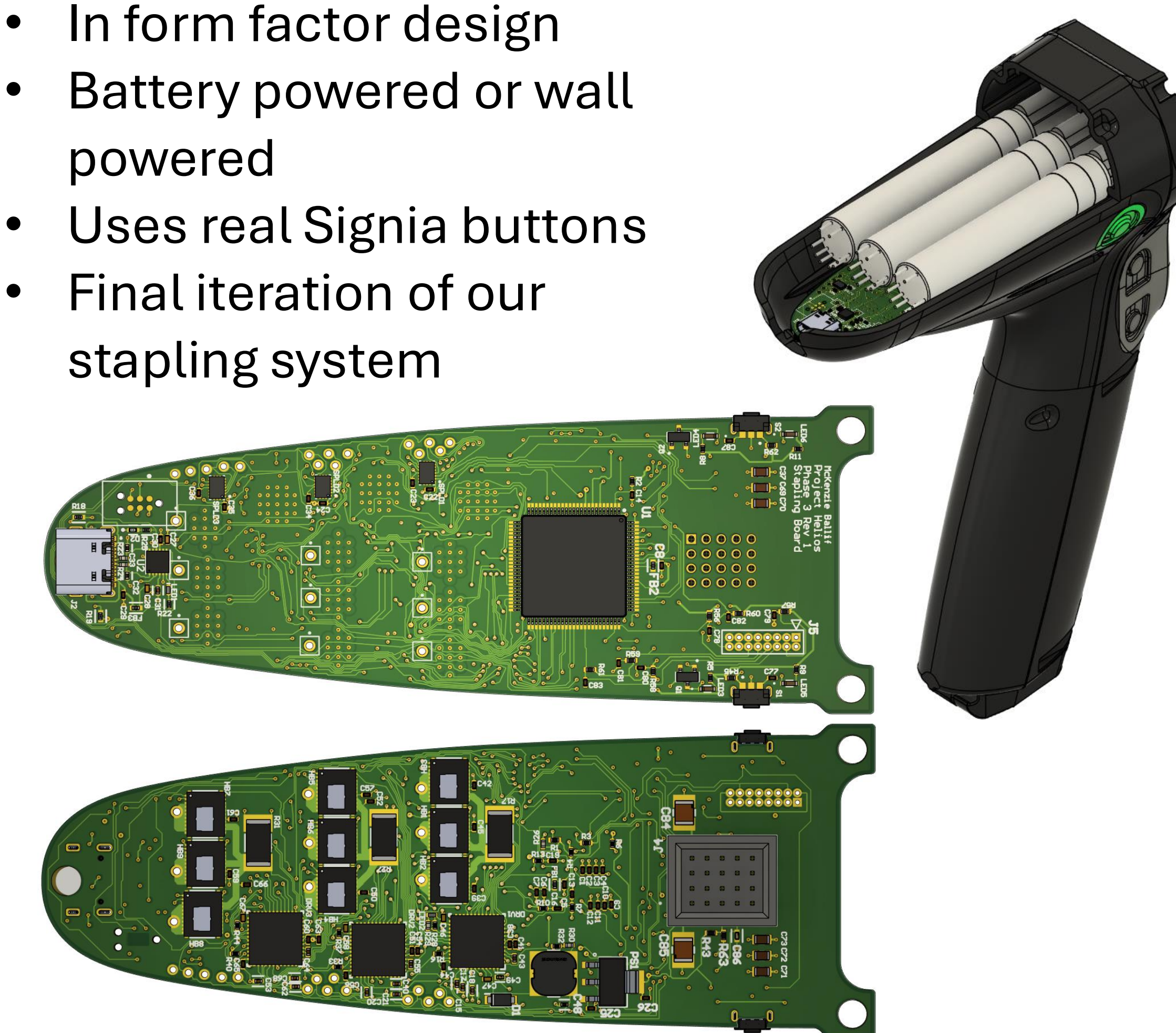
## Test Bench System



- Our system allows for control of 3 Sensored BLDC motors to fire surgical staples while recording relevant data with our custom MATLAB Interface.
- Allows for testing, tuning, and development of motors, staple cartridges, and control loop algorithms.
- This version was a necessary tool for firmware development of the Portable System.

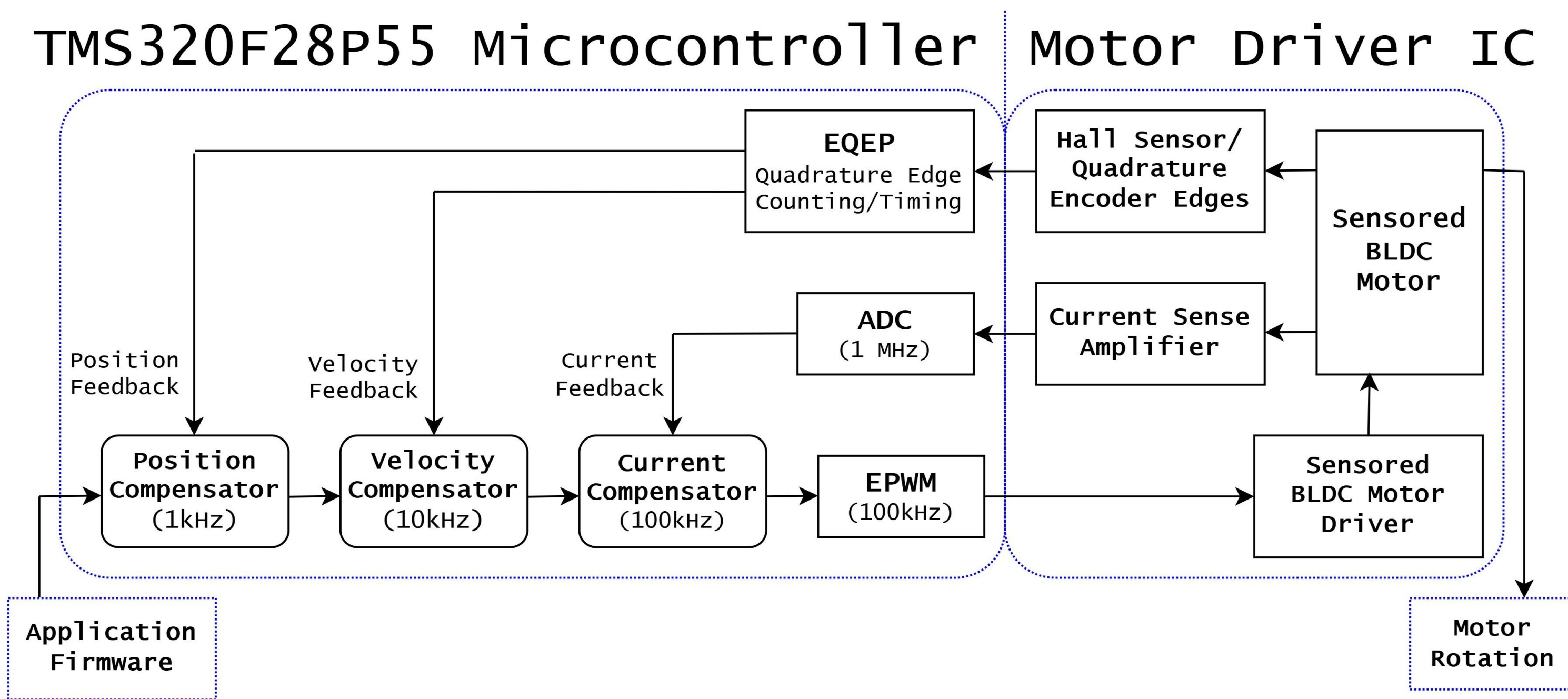
## Portable System

- In form factor design
- Battery powered or wall powered
- Uses real Signia buttons
- Final iteration of our stapling system



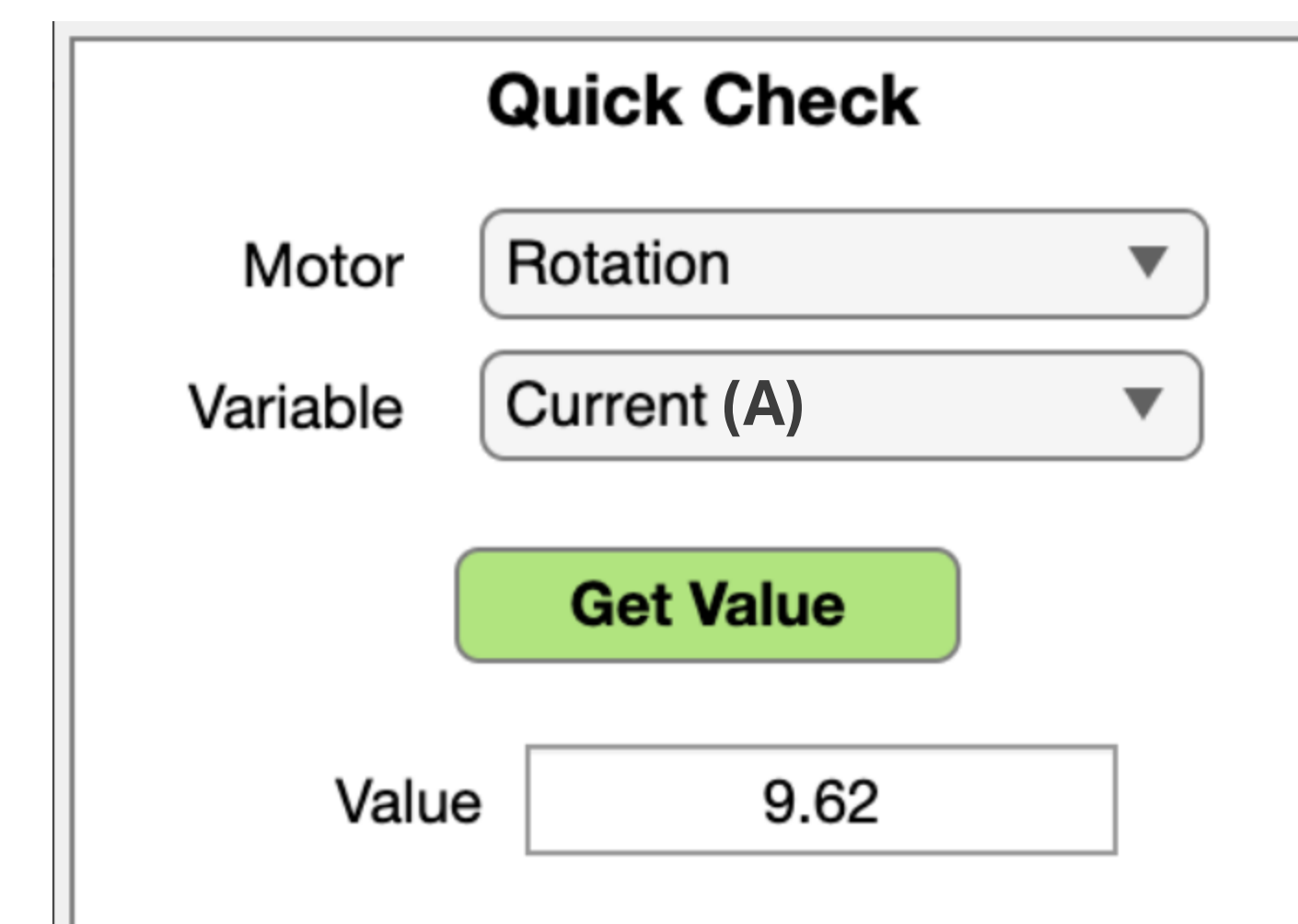
## Firmware & Control Loops

- The system operates using 3 cascaded PI Control Loops:



- The firmware can directly command each control loop, allowing for current, velocity, or position control of each of the 3 motors simultaneously.
- Firmware was developed iteratively, and hardware was designed to make firmware easily portable between Revs.

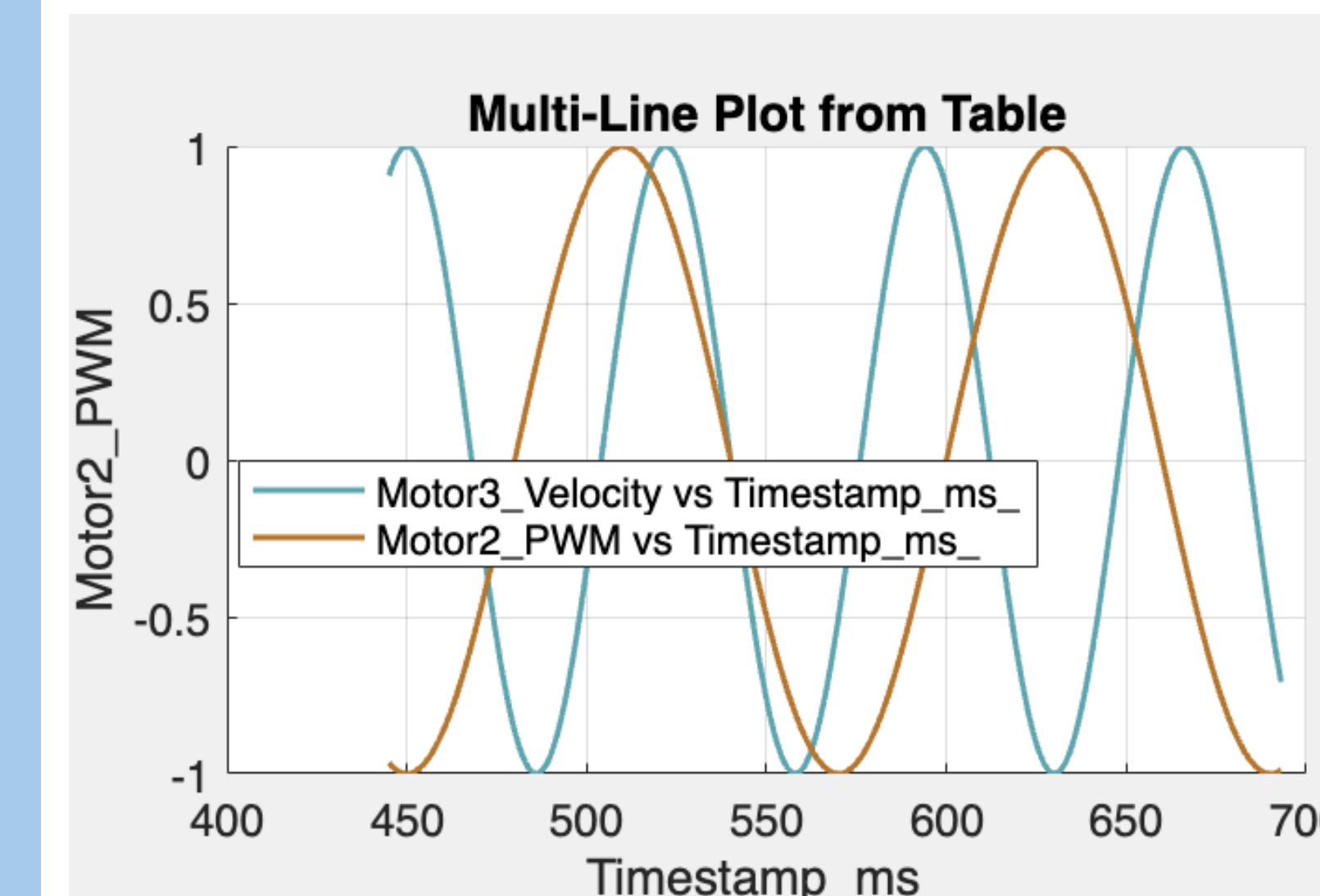
## Data Collection



- Data acquired via a serial interface.
- Enables performance tracking, live validation, and full export of data for analysis.
- The GUI was split between collection and analysis to allow for parallel development.

## Data Analysis

- A verification tool for analyzing system performance
- Offers deeper analysis beyond real-time monitoring



## Motor Driver PCB

