Background

The Bulls Eye High Performance Test System features a compression interface that simplifies mating/un-mating to a PCB. Precision RF Cable Assemblies interface between a VNA and a Device Under Test (DUT) PCB. By moving 2 pairs of these test cables successively through several test points on the DUT PCB, multiple channels could be tested sequentially with a single 4-port VNA.

- 3-axis automated PCB probing environment
- 2-axis SAMTEC BullsEye® Connector alignment system
- Single-axis Device Under Test (DUT) board platform movement mechanism
- Rotation alignment mechanism to allow for up to 90° rotation of dual-probe assembly
- Reduces the financial and engineering complexity of testing with RF relays and multiplexers

Software Flow

- Raspberry Pi
  - Hosting FAST API server to interact with system via web queries.
  - Hooked up to 4K camera that has ultra-low distortion of copper pad fiducials
- OpenCV/Calibration
  - Used to get accurate reading of copper pad fiducials
  - Used to map the known board coordinates
  - Able to step to coordinates relative to system through geometric transformations
  - Once calibrated, can use same mapping for all known probing points
  - This gives us absolute motor step location of each probe pair.
- BERT
  - Finally, drive motors to point to initiate test on BERT + save result for later analysis

System Overview/Objectives

- Raspberry Pi communicates via UART to the ATMega which controls the stepper motors and servo
- BullsEye Connectors will be moved along X and Y coordinates with margin of error of ±0.002"
- Z-axis mates BullsEye Connector with the test points
  - Pressure sensors alert ATMega to stop raising the DUT Platform
  - Raspberry Pi uses API calls to the BERT to conduct measurements

Motor Control PCB

- Motors controlled by ATMega328 Microcontroller
- Will step all the necessary motors including the rotation axis to allow for the most precise movements.

Output/Results

- Both are driven from the same PWM, moving entire Y axis
- Z axis
  - Single motor raises the lab jack until the probe head cables make contact with the probe point.
- System
  - Uses stepper motors, lead screws, and anti-backlash nuts to actuate the probe head
  - Stepper motors drive the lead screw at 0.25 mils/step,
  - ±8 steps of error in the system.
- Load cells
  - 4 main cells to detect pressure from the probe on DUT platform
  - Used to take measurements to ensure a good connection

Hardware Design

- Bullseye Axes
  - X axis
  - Single motor
  - Y axis
  - 2 identical motors, lead screws, and drivers, one on each side of the system
  - Both are driven from the same PWM, moving entire Y axis
- Z axis
  - Single motor raises the lab jack until the probe head cables make contact with the probe point.
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Acknowledgements

This project was sponsored by SAMTEC. We would like to thank Jean-Remy Bonnefoy, Kevin David, Adam Page and Matthew Burns from SAMTEC for all their guidance, help and support they have provided us throughout the duration of this project. We would also like to thank Professor Eric Bogatin and our TA, Mason Huyge, for all the great insights and lessons.