Abstract
The purpose of the project was to resolve a compatibility issue between the main control system and the Indradrive servo controllers on the 2nd generation portable Electron Beam Free-Form Fabrication (EBF3) system. The strategy utilized to resolve the issue was to understand the functionality of each unit through review of documentation for each unit provided by the vendor and previous interns. System integration and test engineering was necessary to resolve incompatibility.

What is EBF3?
EBF3 is a layer additive manufacturing process. It involves using an electron beam to create a melt pool to weld a metal wire. Potential to provide cheap, portable, custom and fast manufacturing of any part or tool.

Applications in aeronautics, manufacturing process and space exploration. Currently being developed at the NASA Langley Research Center.

Issue in the 2nd Generation Portable System
- Currently being assembled
- Left: Sciaky main control unit of the overall system.
- Middle: Rexroth Indradrives to act as emulators to control servo motors.
- Right: Vacuum chamber housing Rexroth servo motors for manufacture process.
- Problem: Lack of communication between the vendors resulted in two systems incompatible with each other.
- Objective: Have the Sciaky unit control the servos in the chamber by successfully interfacing with Rexroth Indradrives.

Understanding the System’s Functionality
- By reviewing the documentation provided by the vendors and previous interns to understand the functionality of each unit.
- Necessary to connect the appropriate expected I/O’s between the Sciaky main controller and Rexroth Indradrives for 8 servos responsible for an axis of motion.
- In other words, how do these relate to each other:
  - Left: Sciaky I/O’s expected to communicate to an older model of the Rexroth Indradrives for X-axis
  - Right: Rexroth Indradrive I/O to expected to communicate with a Sciaky controller for X-axis.

System Integration and Testing
- A sample of how the nomenclatures from the two schematics relate to each other in the proposed wiring.
- Once the relationships were understood, it was necessary to relay the connections through a junction box to test connections and ensure functionality.
  - The junction box is expected to relays ~200 signals from the Sciaky main controller through the Rexroth Indradrives to control the servos in the vacuum chamber to move the electron beam and weld plate.
  - Junction box was connected to the servos in the chamber and the Rexroth Indradrives.
  - Performed continuity tests to ensure connections were well made and were at their appropriate pins.
  - Simulated inputs for the Rexroth to confirm continuity and functionality in an attempt to move servos in the chamber.

Status of Project
- At the end of the internship, servos were not able to be moved. It required the consultation of the engineer who built the Rexroth Indradrives.
- The junction box was connected and documentation on a proposed wiring chart was made to continue the integration to resolve the compatibility issue.

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