



# ACTS

## Automated Cable Transitioning System

### ELECOMP Capstone Design Project 2023-2024

#### Sponsoring Company:

**VoltServer Inc.**

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<http://www.voltserver.com>

#### Company Overview:

VoltServer Inc. is developing and delivering to market, an innovative power distribution platform based on the company's patented Digital Electricity™ technology, which is reinventing how electrical energy is distributed by safely delivering electricity where, when, and how it is needed. VoltServer's Digital Electricity™ solutions began shipping in 2015 and are powering 4G/LTE/5G mobile services, converged desktops, LED lighting, and IoT applications in over 1000 large stadiums, airports, convention centers, office towers, hotels, condominiums, hospitals, and indoor gardens.

#### Technical Directors:



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## Project Motivation:

In the process of developing Digital Electricity, VoltServer Inc has also invented an internal semi-automated test procedure for certifying cables to be compatible with Digital Electricity systems. This test consists primarily of electrically characterizing the cable under test at 100' increments up to 600' in total length. The tests take place at VoltServer headquarters where the cables under test are loaded into our one-of-a-kind "cable farm". To test a cable VoltServer divides the 600' section of the cable under test into one of each: 100', 200', and 300' sections. While we currently have a solution for managing the changing of different lengths of cable, there is a manual aspect of this test that up until now has not been automated. Currently to complete a test, somebody must physically walk over to the tester to change the length of cable that is connected to the test at several points throughout the process. This causes tests to run longer than necessary since it requires a human actively watching and waiting for the test to prompt them to change the cable length. The biggest inefficiency lies in the fact that normally the person in charge of swapping the cable lengths is also working on some other tasks simultaneously and is bound to be distracted from the cable tester. To that end, VoltServer is proposing the Automated Cable Transitioning System, with the purpose of automating the process by which our state-of-the-art cable tester swaps between cable lengths.

## Anticipated Best Outcome:

The Anticipated Best Outcome consists of the delivery of a system which uses a controller like a LabJack or Arduino and can interface with our cable tester to automatically change the length of cable during tests. The device must be able to connect single runs of cable to the outputs but also string together bigger lengths of cable. For example, for 100' tests we only need to connect the two ends of the 100' cable. However, for 600' tests we must connect the 100' run to the 200', then the 200' run to the 300'. Then the tester must connect to both ends of this 600' combination. ABO should have proper channels for communicating with our existing cable tester hardware.

Other deliverables to accompany the hardware include:

- Schematics, layout, fabrication, and assembly files for PCBs and mechanicals, as needed
- A complete bill of materials for the system
- Well commented software source code and compiled binaries
- A system user manual describing the hardware and software



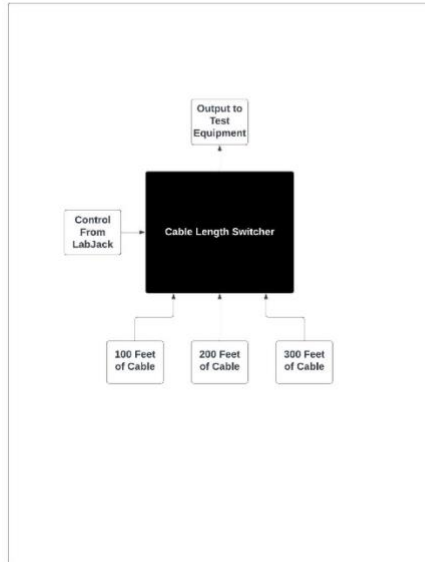
## Project Details:

### Automated Cable Length Switcher

- Develop a device which can mount to or around the cable farm and swap between lengths of cable as the test requires.
  - The device must not use relays to change the cable, or other devices which would alter the results of the cable under test.
  - The device must make use of 8-pin LLT cable whips for both the input and output so that this can be used with any of our previously tested cables.
  - The device must have some kind of enclosure/housing to protect both the contents of the device and humans working around the device.
- Develop accompanying SW for LabJack:
  - SW must allow for a computer to send a command and change the length of cable connected.

### OPTIONAL:

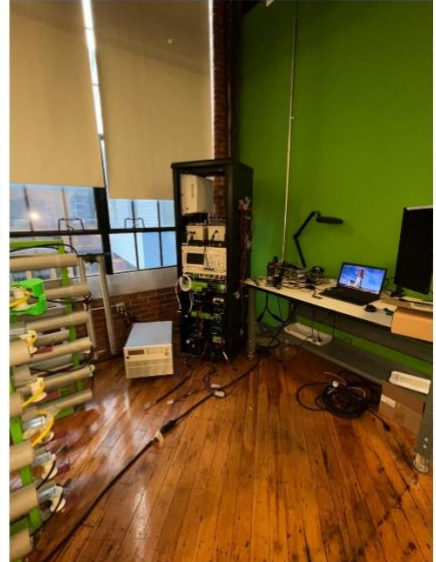
- Depending on the size of the device, having the ability to mount within a standard server rack would be a beneficial feature since the rest of the test equipment is already mounted in a rack.



Cable Switcher Diagram



Cable Run Ends



Overall Cable Testing Setup

### Hardware and Electrical Tasks:

- Identify potential major system components: stepper motor, pogo contacts, connectors, etc.
- Develop schematics for overall unit design, identifying how all system requirements are being met.
- Layout and assemble PCBs if needed
- Document all aspects of the hardware development and subsequent testing.

### Software Tasks:

- Establish communication between computer and LabJack.
- Connect/disconnect lengths through commands from the LabJack.



## **Composition of Team:**

3 Electrical Engineers & 1 Computer Engineer.

## **Skills Required:**

### **Electrical Engineering Skills Required:**

- Design of electro-mechanical systems
- Logic behind connecting different pairs of cables
- Schematic capture
- PCB layout (designers taking the PCB class will be given preference.)

### **Computer Engineering Skills Required:**

- Development of set of LabJack controls for changing length.
- Documentation on how to operate device/what commands to send during testing

## **Anticipated Best Outcome's Impact on Company's Business, and Economic Impact**

By being able to expedite the cable testing process for VoltServer, the project will allow for faster turn-arounds in cable testing results. This will allow VoltServer to certify more cables as working with our systems, which will allow customers more flexibility in choice of cable when designing a Digital Electricity installation.

## **Broader Implications of the Best Outcome on the Company's Industry:**

With the introduction of Class 4 (Fault Managed Power) in the 2023 National Electric Code, in the coming years we will see greater development of these systems. By testing and certifying cables at VoltServer, it is possible that this work can have implications for others in the industry of their technology has similar cabling requirements as Digital Electricity.