

**sdmay18-13: Measuring Voltage and Wire Continuity**

Week 8 Report

October 22 - November 4

**Team Members**Aaron Eaton — *Chief Engineer*Mohamed Almansoori — *Report Manager*Christopher Williams — *Test Engineer*Samuel Kline — *Meeting Facilitator*Matthew Kelly — *Meeting Scribe***Summary of Progress this Report**

Voltage: Schmitt triggers could be useful in future design proposals. Simulated capacitor voltage dividers. Eliminated a three phase rectifier circuit and usage of a full wave rectifier as possible elements of our design.

Wire Continuity: found a promising method of checking for an open circuit if we can find a way to measure a reflection.

**Pending Issues**

Voltage: Since we can't use a three phase rectifier or a full wave rectifier, some designs we have been considering have been eliminated and we need to come up with a new approach.

Wire Continuity: we do not know how to measure a reflection

**Plans for Upcoming Reporting Period**

Voltage: Refine capacitor divider design and conduct more detailed simulations. Look into an approach recommended by our clients that uses three phase transformers.

Wire Continuity: find a way to measure a reflection

**Individual Contributions**

Team Member	Contribution	Weekly Hours	Total Hours
Aaron Eaton	Found out that to use a solution like ethernet over power we would need 2 wires so it is not something we want to look into anymore. Read more about reflection coefficients, learned that there would be two ways to use a reflection. One way would be to send a signal, receive the signal and measure the phase difference, this i think is the same as time domain reflectometry, i would like to further research what type of signal is required for this method and what type of	8	50

	<p>sampling would be required to measure the reflection. The other method of using a reflection would be to look at the amplitude of the reflection. The reflection would have very different amplitudes based on if the circuit connects to the power line like it should or if it is an open circuit and i think we could use that to determine if the wire is connected to the power lines or not. I need to find a way to measure a reflection signal still.</p>		
Mohamed Almansoori	<p>I have been researching about the handheld Ethernet cable tester and I find out it requires two access points to the cable. This contradicts with our project as we will only be able to use one access point. Therefore, I start looking more into the reflection coefficient which turned to be a very good solution for checking wire continuity. Basically, reflection coefficient measure the amplitude of the reflected wave versus the amplitude of the incident wave. In other words, it will describe how much of an electromagnetic wave is reflected by impedance discontinuity. As we will only be checking for an open circuit, the energy pulse reflected back will be a significant portion of the injected signal in the same polarity as the injected pulse. I will be researching more on how can we implement reflection coefficient in checking wire continuity.</p>	5	46
Christopher Williams	<p>During this period I worked on a variety of things. The first week I worked on making a three phase rectifier circuit for reading DC and AC voltages. Unfortunately, it doesn't look like that design will provide the device with enough information to know if there is voltage or not in every situation. Additionally, we learned that we shouldn't use a full wave rectifier at voltages greater than 300V because it will require greater spacing on the printed circuit boards. I also looked into some non ideal properties of the arduino, and discovered that its input pins have a resistance of about 100 M ohm and a recommended load impedance of 20 k ohm. The next thing to look into is the transformer circuit shown by Grave Eng.</p>	11	53

<p>Samuel Kline</p>	<p>Researched how zener diode could be used to clip AC instead of DC. Drew capacitive voltage divider circuit to show to team members. Researched how 3-phase bridge rectifiers work. Met with voltage team to discuss feasibility of a solution involving switching between capacitor dividers of different values. Worked on capacitor divider circuit diagram, calculated some possible capacitor values based on previously calculated conversion ratios. Continued learning how to use PLECS simulation tool by constructing and simulating some basic voltage dividers.</p>	<p>7</p>	<p>43.5</p>
<p>Matthew Kelly</p>	<p>I looked at schmitt triggers as they require specific voltage levels to swap between a logic 1 and logic 0. This could help eliminate or ignore noise that may cause frequent bouncing between logic 1 and logic 0 if the value would hover around 3V. The schmitt trigger would force the input to go beyond a value in order to swap. For example, we could have the schmitt trigger only swap to a 0 when the voltage goes below 2.9V and will stay a 0 until it reaches 3.1V. This would also be true for a logic 1 where the voltage would stay a 1 after reaching 3.1V until the voltage goes below 2.9V. A selector switch could be used to change the ratio of the capacitor divider when the output voltage is too small. I designed a capacitor divider using simulink which should be redone using a more professional and exact circuit simulation. To test the AC voltage properly, the capacitor divider should be before a full-wave rectifier to allow only positive voltage to the Arduino since it can only handle positive voltage.</p>	<p>8</p>	<p>46</p>