Project Design Specification:

LCR Meter

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# Background

There are only three LCR meters in the ECE labs that I know of. Some are portable but they are locked into the lab via cable. Some of these only test devices at a low frequency which can create inaccuracies for certain devices. Test circuits can also be created and measured but this takes up too much time when trying to quickly validate a component’s value.

# Need

Students would like a more accurate and portable LCR meter that is usb powered for quick and easy component testing.

# Objective

Design and build a portable and affordable LCR meter that runs off usb which accurately displays the device under test’s value on a digital display. It should be small enough to pack into bag or toolbox.

# Requirements

## Marketing

The LCR meter should provide the user with a quick, accessible, accurate and easy way to test the impedance, inductance, capacitance, or resistance of any inductor, capacitor, or resistor.

## Functionality

This LCR meter will be able to measure the resistance, capacitance, or inductance to within ±10%. This LCR meter will be able to measure resistances in the range of 1Ω to 1MΩ, inductors in the range of 1uH to 15mH, and capacitors in the range of 1pF to 100uF to within 10% accuraccy. The LCR meter will measure the given component and display its value on an LCD display. This LCR meter will use three buttons. One button is to set the meter to measure capacitance, one button to measure inductor as well as resistance, and one button is used for calibration.

It will also be easy to use with clear output of the capacitance, resistance, or inductance of the component. This sentence does not make any sense.

## Performance

This LCR meter will take a minimal amount of time to evaluate and output the resistance, capacitance, or inductance of a component (less than 10 seconds). It will also have a clear and easy to read display. It will also be portable and easy to use.

## Economic

This product will be both affordable to create and affordable to purchase. This product will involve a few IC chips, a few discrete components, and an LED display. We hope to be able to make a product that can be sold in market for less than $50. We would also like to make it relatively easy to produce.

## Health and Safety

The product will not cause harm to the environment except after end of cycle of the product in which it will most likely end up in the dumpster. Using the test points, the user could evaluate what component no longer works and easily replace it.

Solder contains 37 percent lead (Pb) and this can cause a health and respiratory problems in the long time exposure to the fumes while manufacturing it. According to a datasheet found in <http://elexp.com/Images/Health_Hazards.PDF>, “Lead can cause a wide range of adverse health effects. These include fatigue, irritation and anemia along with other reproductive effects such as spontaneous abortion and sterility.”

No harm to anyone through use of product. Overall, it is very safe to manufacture and to use the product.

## Maintainability

Low maintenance to use and to repair the product. A short document and datasheet can be created to help the user troubleshoot it on their own. To maintain and troubleshoot the product, the user will need lab equipment such as a voltage supply or battery, oscilloscope, function generator, and a digital multimeter.

The parts are easily available to purchase online or can be obtained by recycling other electronic products out of use.

## Manufacturability

The product is easy to manufacture. We may use a subcontractor to make the PCB board. The system must be manufactured on a printed circuit board no larger than 2” x 8”. We will use Eagle CAD or other applications to design the board and create a file to send to a manufacturing company. When the design is accomplished, we can use multiple factories or subcontractors to manufacture the end product if needed.

It can be made in a small factory using regular lab equipment. The system’s design will permit user replacement of all replaceable parts.

## Usability

The user should be able to use the LCR meter without having to look at documentation. It should be take the user no longer than three minutes to turn on the device, calibrate the device and test a component.

## Reliability

This device can be used reliably within given specs (1ohm - 1Mohm, 1uH - 15mH, and 1pF - 50uF) to accurately (within 10%) measure the given component and display that given value.