

ANALOG VOLTMETER

Team HERTZ

EN 2091 LABORATORY PRACTICE AND PROJECTS



Introduction

Project Objective:

- Develop a high-precision voltmeter addressing common voltage drop and circuit loading issues.

Key Focus:

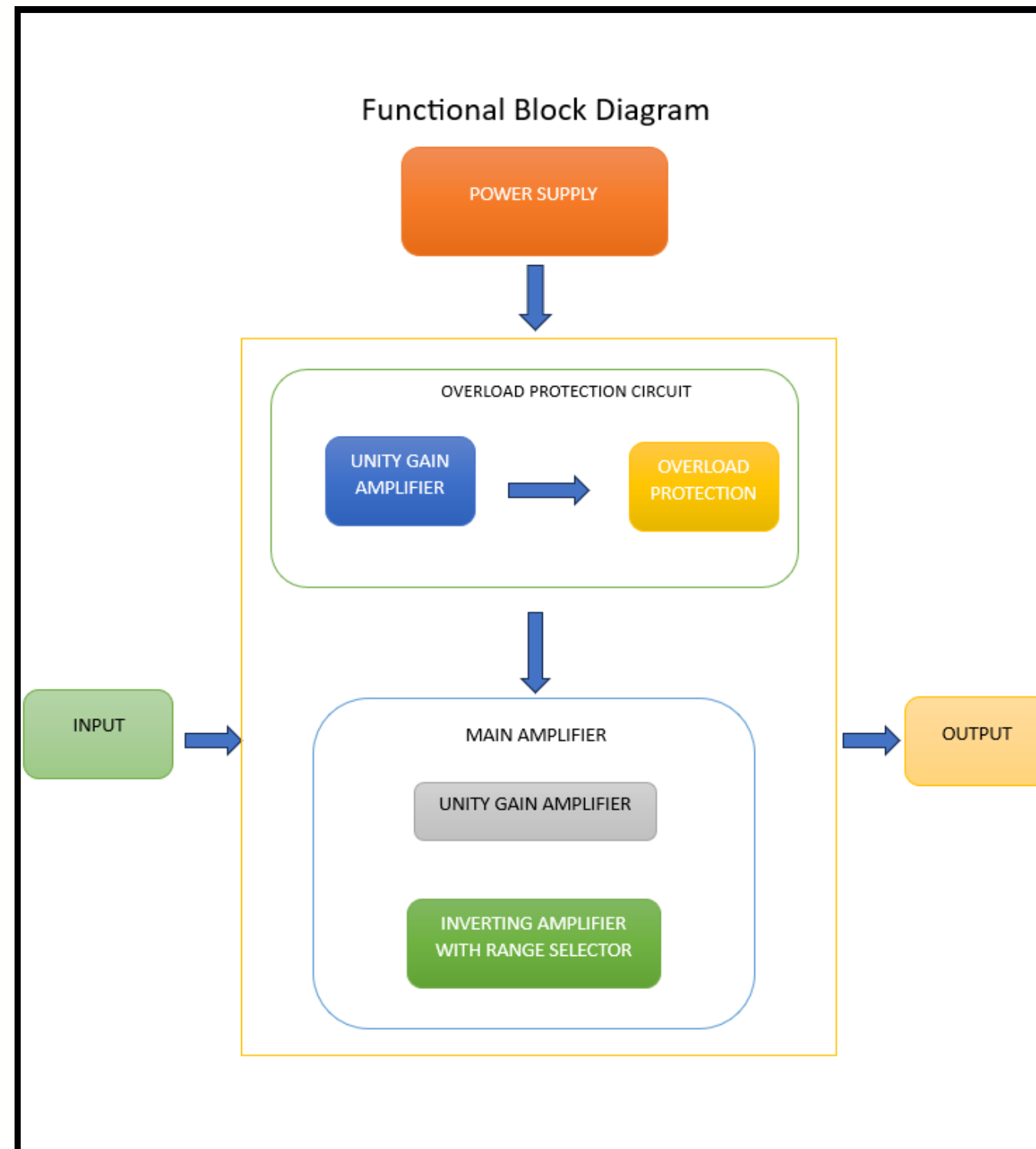
- Ensure accurate voltage measurements while minimizing impact on the tested circuit.

Functionality

Achieve high input impedance to minimize impact on the measured circuit in our analog voltmeter project.



System Model



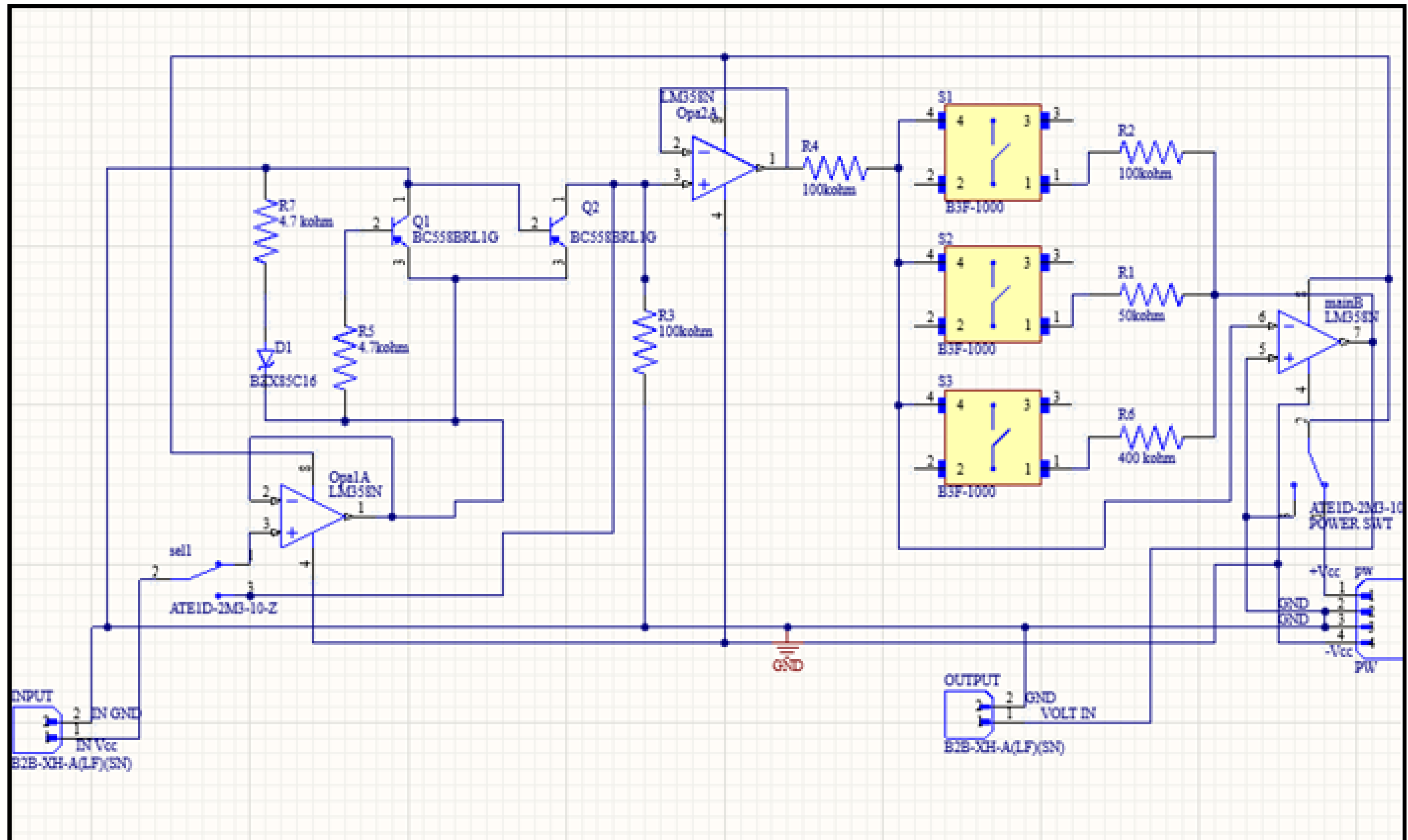
Maintaining a high Input Impedance

Overload Protection

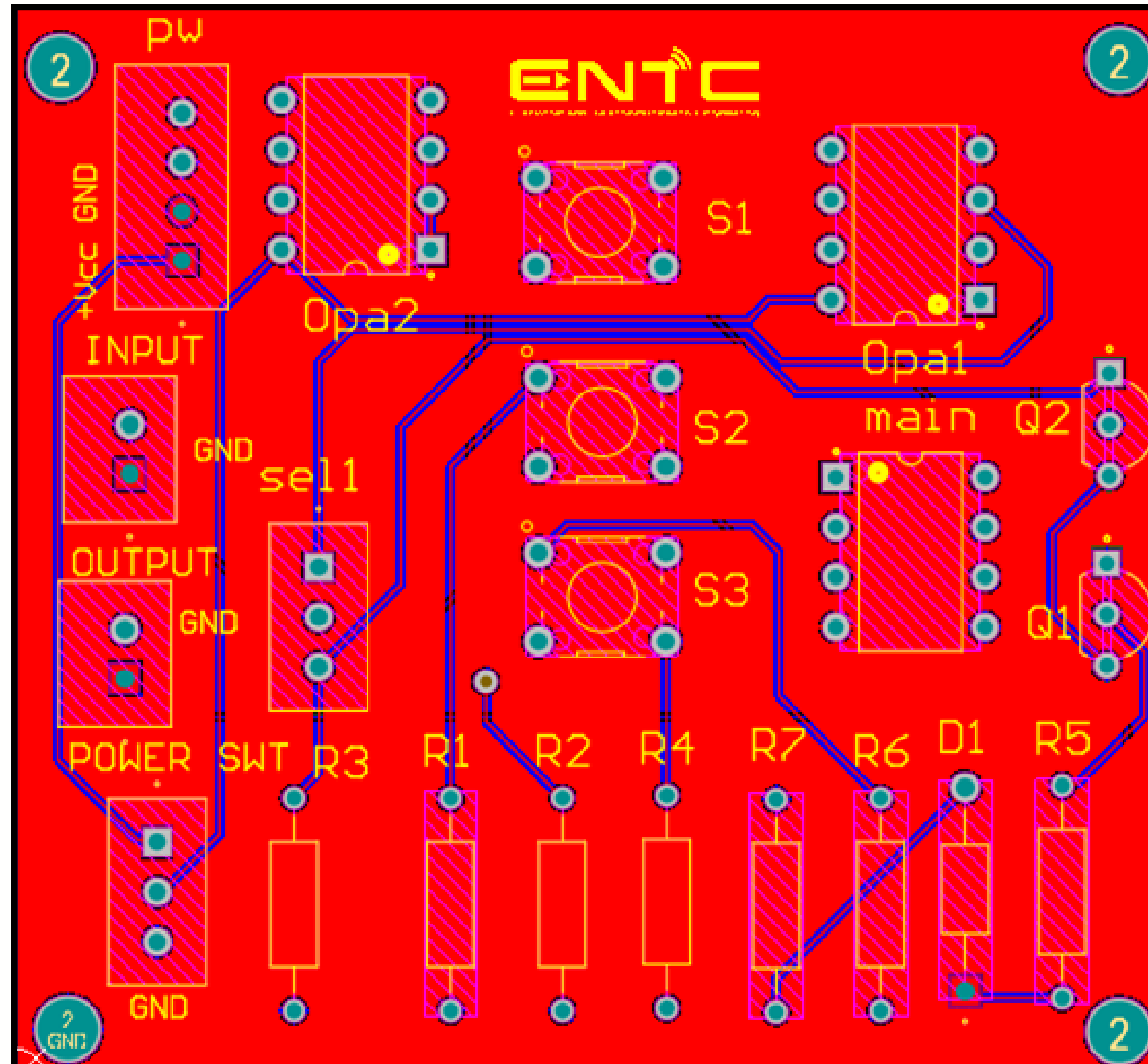
Variable Measurement Range

Analog Display Customization

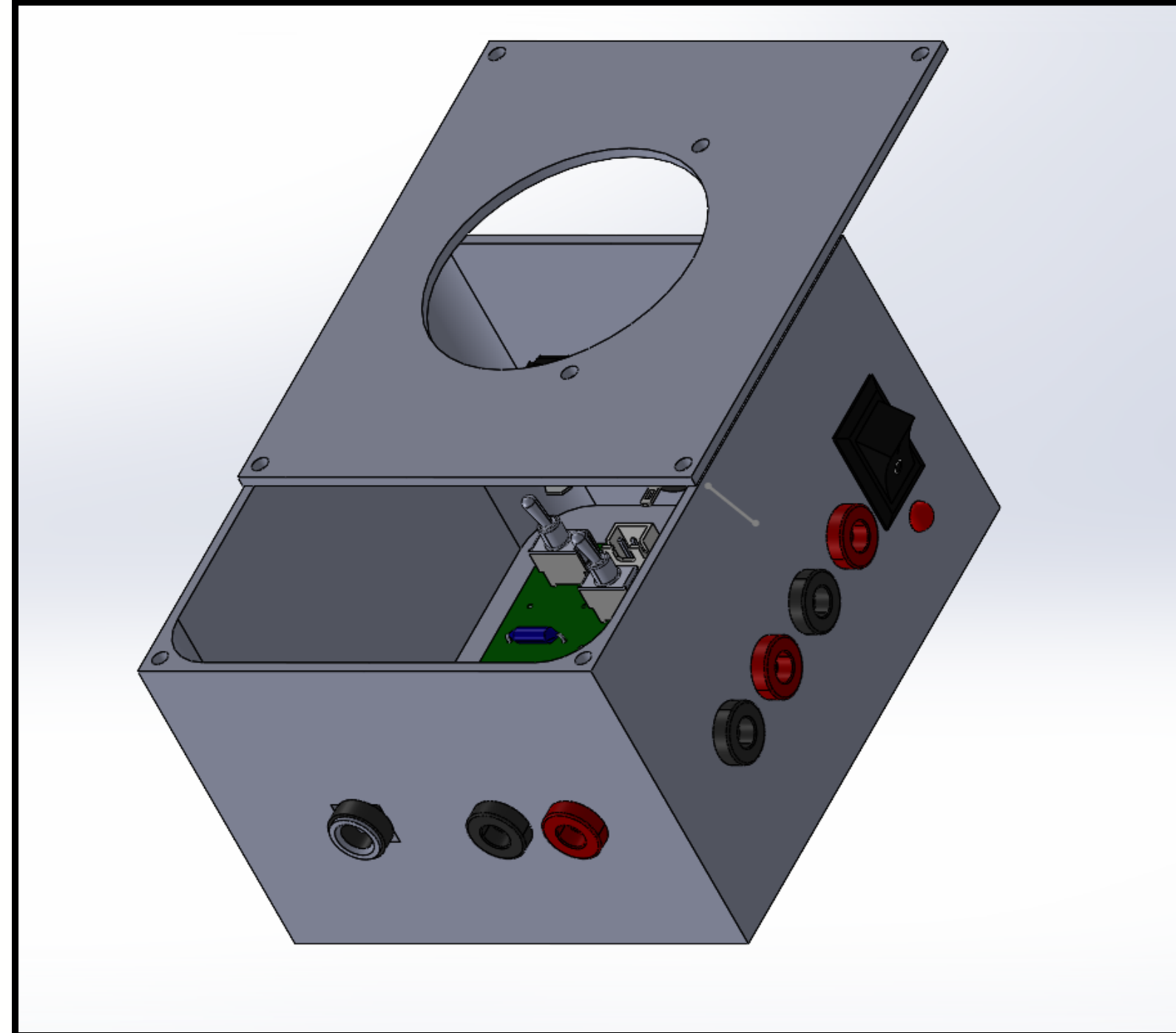
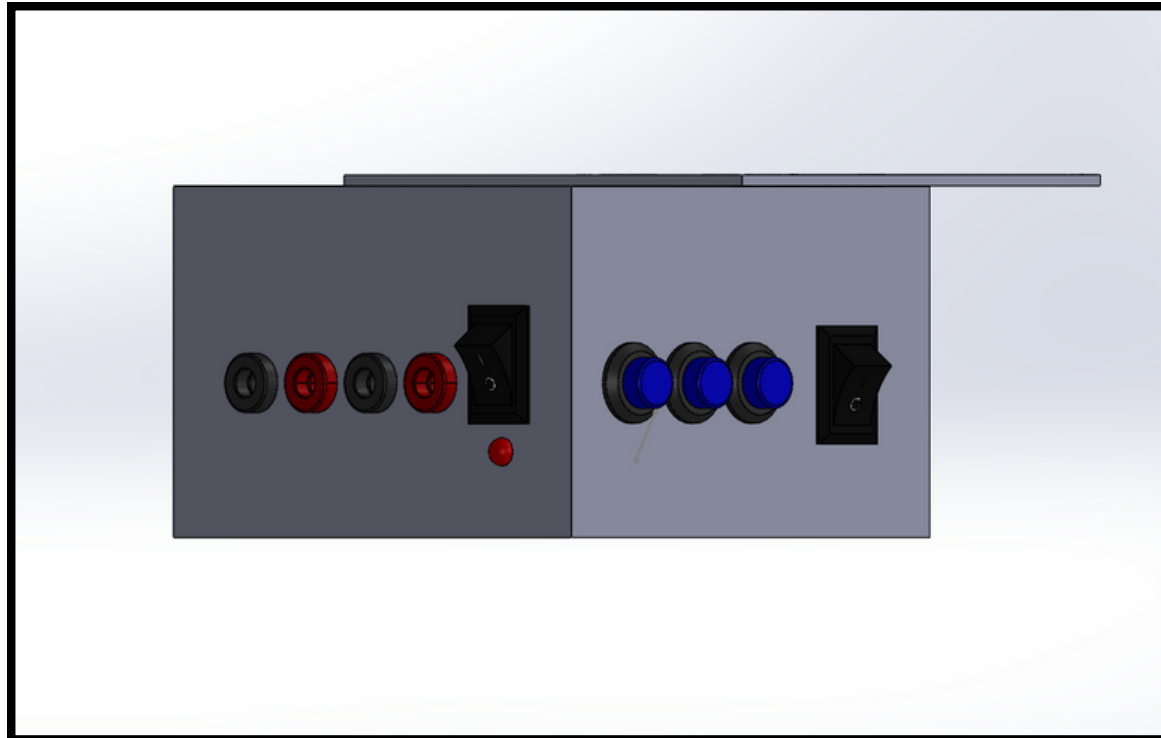
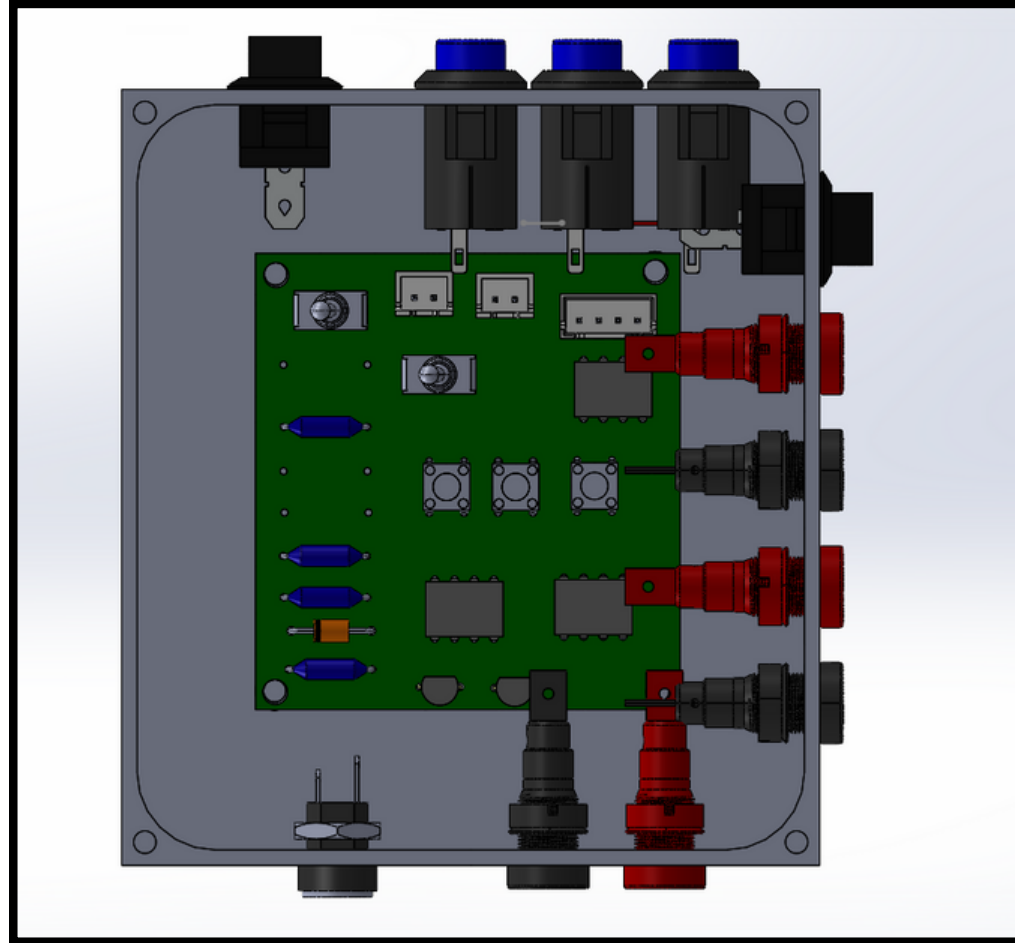
Schematic Diagram



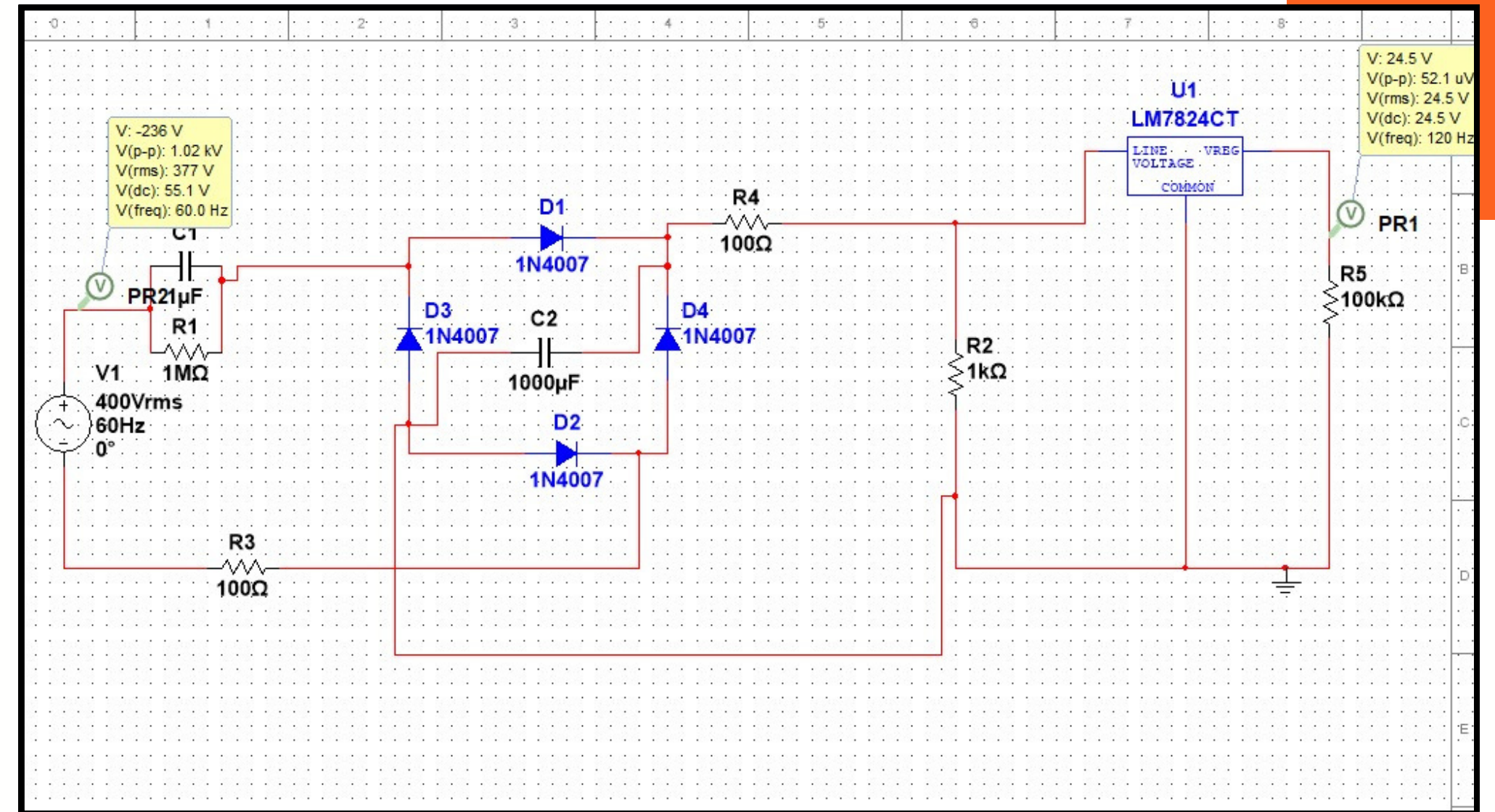
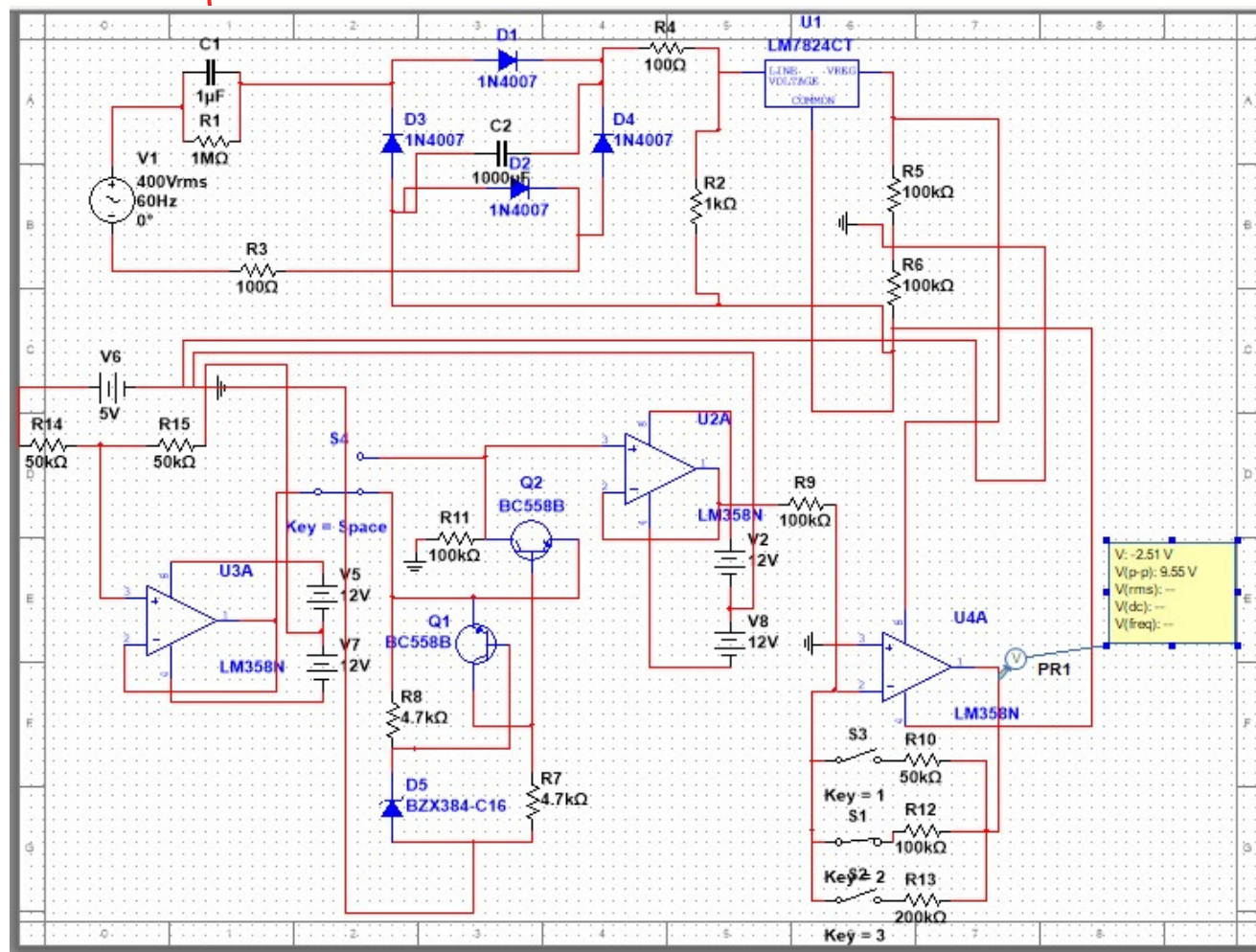
PCB Design



Enclosure Design



Simulation Results



Future Works

PCB Implementation

Finalize the in-house power supply for the voltmeter by developing a printed circuit board (PCB) for the designed power supply

Boost Converter Integration

Implement a boost converter to elevate the DC voltage, enabling the use of rechargeable batteries. This enhancement promotes increased mobility and compactness of the voltmeter

Improved Measurement Parameters

Enhance the voltmeter's functionality by lowering the minimum voltage measurement to 50mV.

Achieve a tolerance level of $\pm 0.5\%$ to ensure precision and accuracy in voltage readings.

Conclusion and Discussion

Project fulfills most requirements, but faced some constraints.

Main challenge: Power supply for op-amps.

Solution: Designed custom power supply for direct wall and voltmeter connection.

PCB printing issues led to using a dual-channel power supply in the lab.

Overload protection circuit limitation: Cannot measure below 500mV.

Solution: Added a separate switch for ON/OFF control when measuring 100mV.

Transistor change required to fully overcome the limitation, but suitable model not found.

Achieved required accuracy of $\pm 1\%$ and minimum measurement of 100mV.

Overall, successful project for a high-impedance analog voltmeter.

Individual Contributions

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- Enclosure Design and Assembling

- Circuit Building, Breadboard
Implementation

- PCB Design and Testing

- Power Management, Soldering



***Thank
You***

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