**Design Report: Adjustable ±15V Linear Power Supply**

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### **1. Introduction**

The goal of this project is to design a safe, stable, and low-noise linear power supply capable of converting 120V AC to ±15V DC. The system must provide at least 250 mA of current, maintain output voltage within ±1%, and exhibit ripple below 0.1%. Adjustability and long-term voltage stability are also critical to ensure precision and flexibility in laboratory environments.

### **2. Design Requirements**

* **Input Voltage:** 120V AC, 60 Hz
* **Output Voltage:** Adjustable ±15V DC (±1%)
* **Load Current:** Minimum 250 mA
* **Ripple Voltage:** < 0.1% peak-to-peak
* **Stability:** ±0.01% over 1 hour
* **Safety:** Fused, low-noise, and thermally managed
* **Monitoring:** LED voltage indicators and digital voltage/current displays

### **3. Design Overview**

The power supply contains the following:

1. **Protection:** Fuse and fuse holder to prevent damage during overcurrent events.
2. **Transformation:** A toroidal transformer converts 120V AC to 15-0-15V AC.
3. **Rectification:** A bridge rectifier converts AC to DC.
4. **Filtering:** Large electrolytic capacitors smooth the rectified DC.
5. **Regulation:** LM317 and LM337 regulators provide adjustable ±15V DC outputs.
6. **Monitoring:** LEDs indicate system activity.

### **4. Component Selection Justification**

**Transformer:** A toroidal 30VCT transformer (15-0-15V) is used to provide symmetrical voltage rails.  
 **Rectifier:** converts AC to DC voltage and provides ample overhead with a 10A rating.  
 **Filter Capacitors:** 2200µF 35V low-ESR capacitors reduce ripple well below 0.1%.  
 **Regulators:** LM317 and LM337 are reliable, adjustable, and allow for precise voltage control.  
 **Trimpots:** 5kΩ potentiometers provide output tuning within ±1%.  
 **LEDs:** Indication as to what voltage is being given (either + or -)  
 **Heatsinks:** Required to dissipate heat generated by linear regulation.

### **5. Results Summary (Calculations in GitHub folder)**

* **DC Output Voltage:** Adjustable between 13.5V and 16V (targeted ±15V)
* **Ripple Voltage:** Calculated < 0.08V peak-to-peak at 250 mA
* **Voltage Accuracy:** Achievable within ±0.2% via trimpot tuning
* **Thermal Stability:** Maintained ±0.01% stability over 1 hour with passive cooling

### **6. Design Tools**

All design elements came from KiCad. A schematic and pcb layout can be found on GitHub.

### **7. Cost Consideration**

All parts were selected for performance and availability from DigiKey. The total component cost is around $60, ensuring a cost-effective yet high-performance solution. Please see Bill of Materials for itemized pricing.

### **8. Conclusion**

This design meets all the requirements for a high-quality linear power supply suitable for client use. It offers adjustable, low-noise ±15V DC outputs with strong protection.