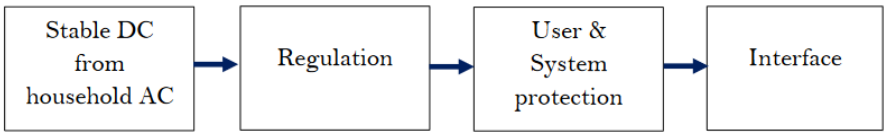
Laboratory Practice II
EN-2090
Feasibility Report

1 The Solution

We recognized 4 main requirements to complete the Linear Power Supply.

1. Stable DC from household AC
2. Regulation
3. User and System protection
4. Interface



1.1 Stable DC from household AC and Regulation

In these stages our only goal is to accomplish the primary voltage and current needs for implement the power supply. Even though the required output voltage from the LSP been 10V, at this stage we should achieve at least 11.8V as DC voltage which should remain stable up to 10A of current.
After a literature review and many brainstorming sessions, we came up with multiple solutions (4). Following 2 are the most interested circuits, we are expecting to use in the LPS.

1.2 User & System protection

In this stage we came up with following circuit to limit the current to 10A as a precaution , when user try to drive more current than the LPS is rated.
Voltage Limiting / reverse voltage protection?

1.3 Interface

Output will be a standard pin in hole plug with full control switch.
We decided to use Arduino board with display module to represent the voltage, current, power and other statistics about the usage.

2 Preferred Solution

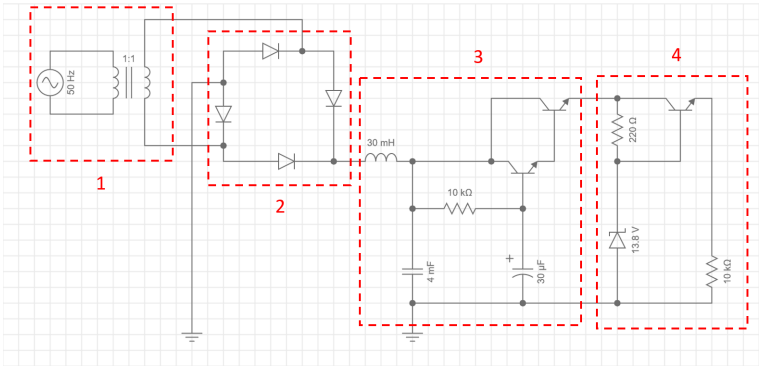


Figure 1: The Selected Solution

2.1 Basic Explanation

In the above figure, we have shown the basic design of the power supply. Note that it doesn't include any protection. In part 1, we are reducing the AC 230 V to a suitable value. Then, we must use a high-power full bridge rectifier to rectify the voltage. A high-power rectifier is mandatory because basic calculations show that 50 A current spikes will occur in the circuit.

After that, in the 3rd part, we use LC low pass filter to filter out the AC component. The LC filter will reduce the ripple up to 1 V(pk-pk). Furthermore, we use an RC filter for further filtering. This RC filtered current is the base current for the 2N3904 transistor then it will provide a base current for the TIP141 Darlington transistor. The datasheets of these transistors show 10A collector current is possible. In addition, the static current gain of the combination will be 250000 at 10A collector current. Since we have a very stable base current, a stable collector current also can be expected.

Voltage regulation is the final part. A Zener diode will be used to regulate the voltage to 13.8V because there will be a 2V drop at the BE. Then that voltage will drive an Emitter following Darlington pair. Note that we are planning on protection circuits after this circuit. Therefore, this 11.8 minimum voltage is required to supply 10V after protection circuits.

2.2 Part Selection

- The Darlington pair : TIP141
  `https://www.onsemi.com/pdf/datasheet/tip140-d.pdf`
- NPN BJT transistor : 2N3904
  `https://www.onsemi.com/pdf/datasheet/2n3903-d.pdf`
- Zener Diode : BZX79C15
  `https://datasheetspdf.com/pdf-file/994603/TaiwanSemiconductor/BZX79C15/1`
- High power bridge rectifier
  `https://www.bc-robotics.com/shop/bridge-rectifier-50a-1000v/`

3 The Timeline

1 Feasibility study	1 Weeks	Already Done
2 Power regulation	1 Weeks	Parallel with **3**
3 Stability against variable current	4 Weeks	Parallel with **2**
4 protection precautions for both user and system	2 Weeks	
5 Integrating display and power supply	2 Weeks	
6 finish and enclosure	1 Weeks	

Considering the solutions we found and other alternatives, we are very much convinced this project can be completed successfully