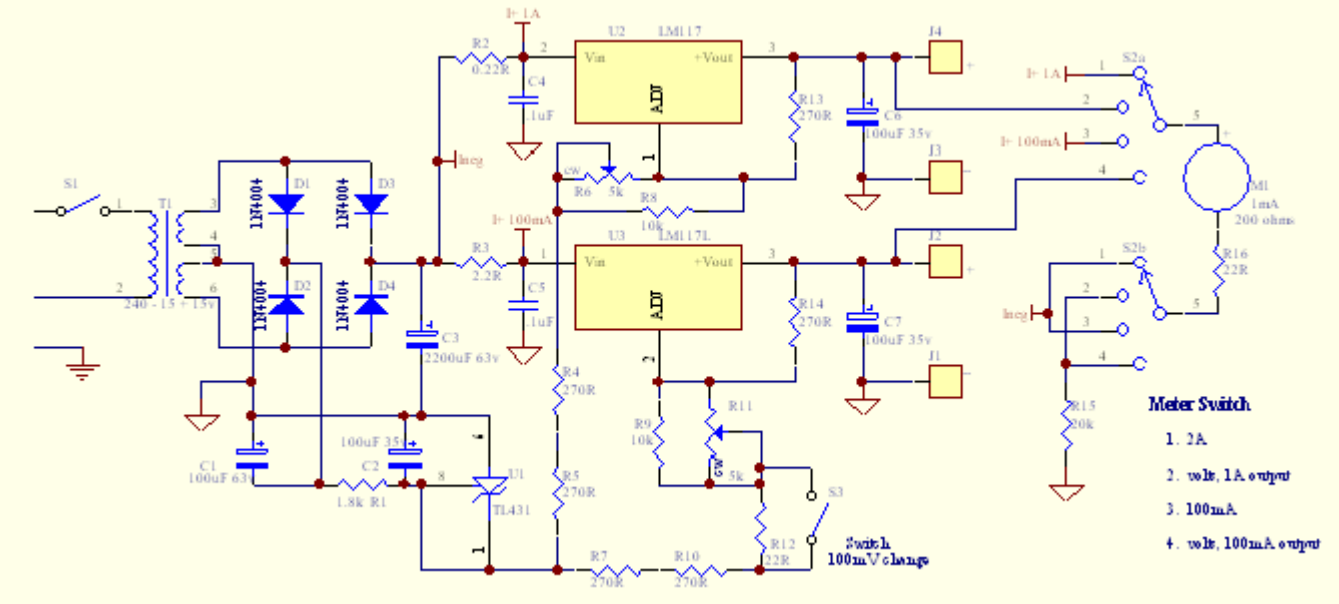
A handy Bench Test Power Supply. By VK3ZAV
Every experimenter will need some sort of power supply to test circuits, and it needs to be useful & safe.

There are a great many variations, but this one is about the most simple, but useful combination,
Two outputs, with the negative terminals common
each output voltage adjustable from 0 to 15v
output (1) current 100mA max
output (2) current 1.5A max
meter switched to read volts & current of both outputs

The reason for the separate 100mA output, adjustable down to zero volts is so that, when testing a new circuit, there might be a problem, such as an I/C chip plugged in backwards. By testing with a low current supply, you are much less likely to see melted tracks and smoke.

If you turn the volts up from zero, watching the current on the meter, and get a steep rise of current at about 0.6 volts, you probably have a silicon junction turned on forward, which may be a diode or I/C reversed, or some other fault, but if that was put straight on say, a 5v 1A supply with a 7805, then your circuit could be really damaged.

Of course you might have a circuit that needs more current than 100mA, so use the 1A output, which can pass up to 1.5A depending on the output volts.



The circuit starts with a transformer, in this case I've used one with two 15v secondary windings, but up other voltages can be used. The diodes D3 & D4 rectify the transformer volts, and C3 filters the ripple. This then feeds into the two regulator chips, an LM317L (TO-92) low current, 100mA output, and an LM317 (TO-220) for the 1A output. Each regulator is current metered on its input via R2 & R3, and each output is independently adjustable via the pots R6 and R8.

These regulator chips normally go down to 1.25 volts minimum, but by adding a negative polarity rectifier D1 & D2, and a low cost (30c) TL431 shunt regulator, the voltage setting resistors (R4, 5, 7, 9) return to a negative 2.5v supply, so that with the resistors shown, the output volts go down to zero with the pot at minimum resistance.

An interesting use for this regulator, with a minor addition, is for testing FETs or valves. By inserting a 22 ohm resistor R12 in series with the pot, and wiring a shorting switch across that resistor, you can step the output volts up by 100mV, regardless of the setting of the output voltage pot. If this voltage is used to bias a FET or a valve, and another power supply is used to provide drain or anode volts, with a digital multimeter measuring the current, then the transconductance is measured by the difference in current with the 100mV change of gate/grid bias.

Many variations are possible, but care is needed, as these regulators produce heat, and need some kind of heatsink for cooling. With the circuit as shown, a diecast aluminium box is suitable as both container & heatsink, but boxes of steel would not. There are higher current regulator chips too, the 3A LM350 and the 5A LM338 could be used, but the transformer and diode current ratings will need increasing, and the heatsink becomes much larger.

There is even a 10A version, but at that size an SMPS (Switch Mode Power Supply) becomes much more practical, probably at 5A too.

If you really want to separate the two supplies, then using a separate bridge rectifier on each winding can achieve this, with a simple “voltage doubler” connection for the negative references.

Higher voltages are possible, but this can raise the heat generated. The voltage rating of the normal LM317 is 37, so a 42v transformer should be safe. The voltage setting pot resistance would need to be changed to allow up to 30v output. There is no reason why a standard 7805 and 7812 fixed voltage regulators can't be added, and the meter switch extended to measure them too. Make sure that the transformer, rectifier, filter cap combination will handle the total load. There is also a high voltage version, the LM317HV, available only in the expensive TO3 metal case, but rated up to 57 volts.

I have also used the LM337 negative regulator in this type of circuit too.