Simple circuit uses two 3-terminal regulators

±12V rails for the Lab Power Supply

Here is an inexpensive addition to the 50V 5A Lab Power Supply which should prove its worth many times over. It provides additional fixed ±12V outputs for low power applications, in particular for powering integrated circuits.

by JEFF SKEEN

In many applications where a high output power supply is used, it is also desirable to provide power to some associated low voltage circuitry. This circuitry often contains integrated circuits which require dual power supplies. Our low cost addition uses the two 15V windings on the power transformer to provide fixed ±12V outputs.

This idea was in fact canvassed in a letter to the Editor from Ferguson Transformers Pty Ltd in the June issue. (Great minds do think alike!). As outlined in the letter on page 100 of the June issue, the two 15V windings can be earthed and used as an electrostatic shield while still leaving them available to provide auxiliary supply rails. By using a bridge rectifier, balanced positive and negative 20V supplies are provided.

After filtering with 1000μF electrolytic capacitors, the ±20V supplies are stabilised to ±12V with three terminal regulators. While the regulators themselves and the relevant windings on the transformer can easily deliver one amp or so, the actual maximum output current will depend to a large extent upon the total power being delivered from the main 36V windings on the transformer.

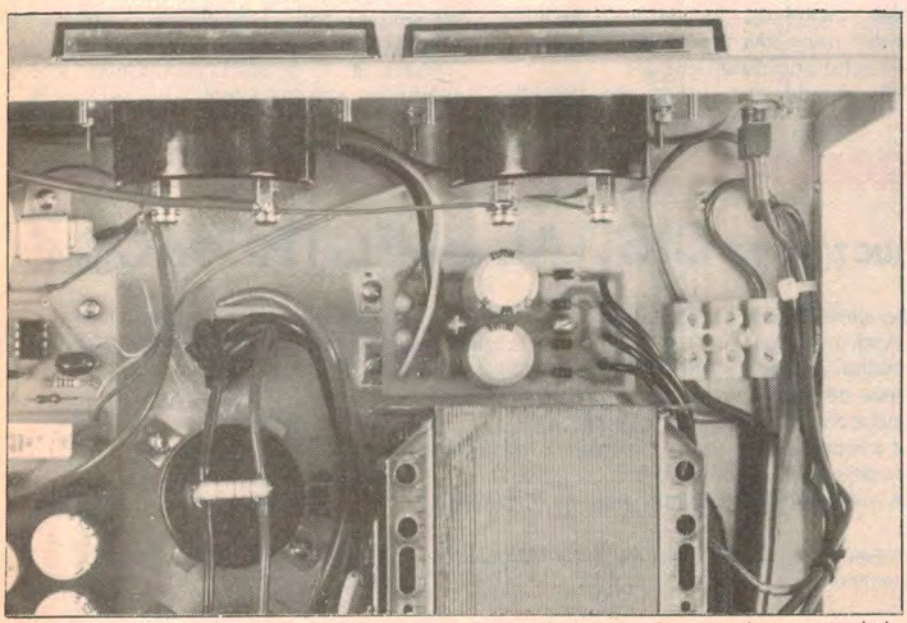
Even so, unless the main supply is delivering 100 watts or more, the output of the fixed ±12V regulators will not be significantly reduced below one amp. Note that if the ±12V regulators do drop out of regulation, there will be no indication on the front panel of the supply. (The regulator "drop out" indicator applies only to the main supply.)

A pair of 0.1μF capacitors provides high frequency unregulated filtering of the ±20V supply rails, ensuring that no spurious frequencies from the switchmode circuits get into the regulators.

In common with other three terminal regulators, these are proof against output short circuits and overheating, which makes them essentially indestructible. A 10μF tantalum capacitor has been placed on the output of each regulator to bypass any high frequencies picked up by the wires leading to the output terminals.

This also keeps the regulator stable, prevents oscillation, and provides a bonus by improving the transient response of the regulator.

One disadvantage of connecting the centre of the winding to earth is that the ±12V output does not float but is tied to earth. This connection does not affect the high power output which remains floating with respect to earth. However, we do not regard this as a serious drawback.



This view shows how the new PCB is mounted between the transformer and the voltmeter. The two 3-terminal regulators are bolted to the chassis (see Fig. 1).

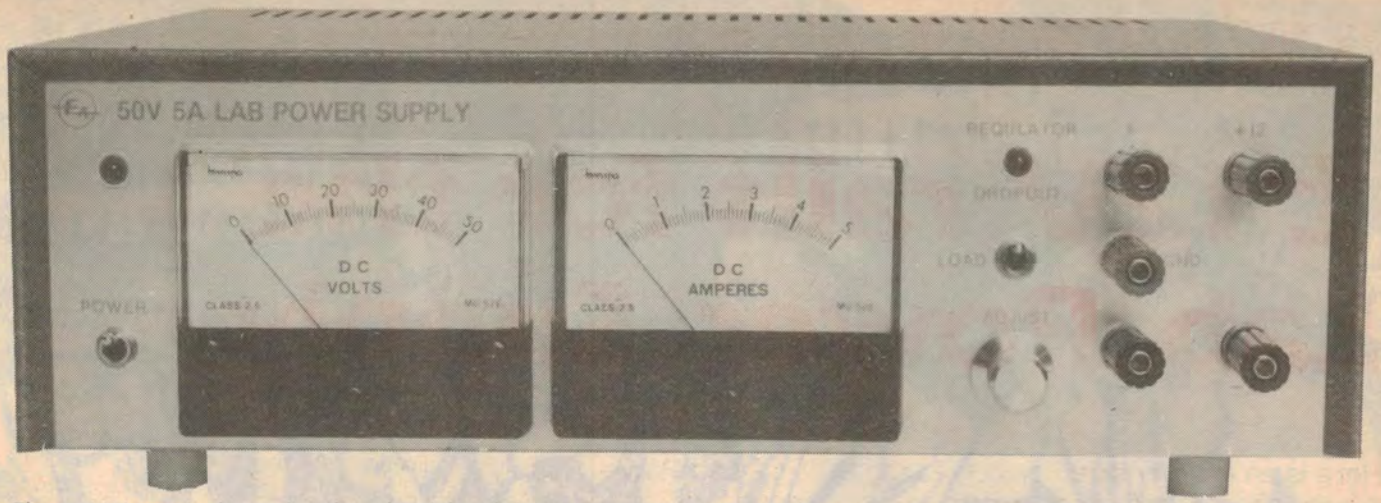
Construction

We assume that most kit suppliers will supply a front panel with provision for the ±12V supply terminals. If you have an old front panel the two new output terminals can be squeezed in alongside the old terminals or placed underneath them.

The circuit is built on a small printed circuit board (PCB) coded 83ps7 and measuring 66 x 36mm. The PCB fits in the space between the transformer and the voltmeter and the first step is to lay out and drill the PCB mounting holes in the chassis, using the blank board as a template.

If you are adding this project to an already completed power supply, take care to remove all metal drill shavings from the interior of the case at the completion of drilling.

Now mount all components, except



The ± 12V terminals are fitted to the right of the existing output terminals.

PARTS LIST

1 PCB measuring 66 x 36mm, code 83ps7
2 12mm tapped, insulated PCB standoffs
4 6mm machine screws to suit standoffs
2 TO-220 mounting kits, with screws to suit
1 metre hookup wire
1 red binding post terminal
1 black binding post terminal

SEMICONDUCTORS

4 1N4001 diodes
1 7812 three-terminal regulator
1 7912 three-terminal regulator

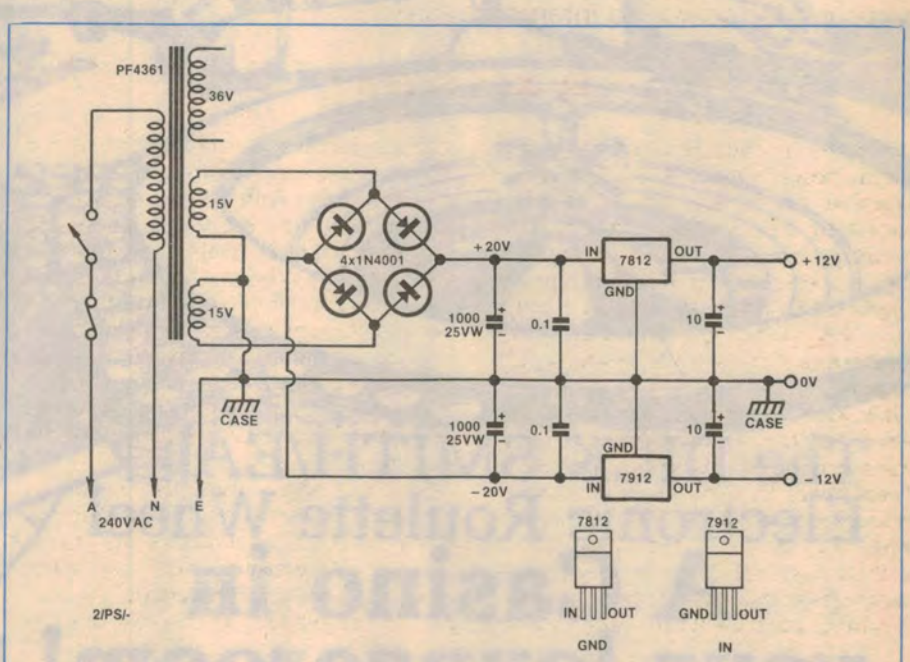
CAPACITORS

2 1000µF 25VW electrolytic
2 10µF 16VW tantalum or low leakage electrolytic
2 0.1µF ceramic

MISCELLANEOUS

Nuts, bolts, heatsink compound for mounting regulators, etc.

PRICE ESTIMATE: We estimate that the cost of parts for this project is $13.



The circuit uses a bridge rectifier followed by two 3-terminal regulators.

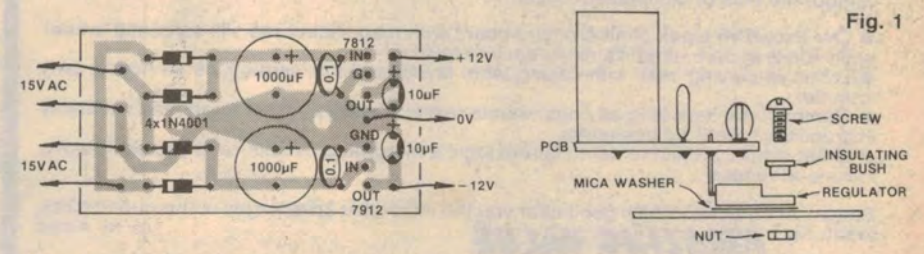


Fig. 1

Parts layout diagram (above) and regulator mounting method (right).

the regulator ICs, on the PCB. Since most of the components are polarised, double check the orientation before soldering each one into place.

The regulators are mounted from the copper side of the PCB. First, bend the regulator leads at 90° to the body, at the point where they leave the body, and toward the plastic side of the body.

Attach the two insulated standoffs to the PCB then place the regulators in position from the copper side of the PCB. Sit the entire assembly on a flat surface, such as a table top, and adjust each regulator so that its back (or metal tab) sits flat on the table. (See accompanying diagram).

The three regulator leads extending through the PCB are now bent over so that each regulator is temporarily held in position. The entire assembly is then turned over and the regulators soldered in place.

The PCB should now be screwed to the chassis and the holes in the regulator tabs used to locate the regulator mounting holes. The holes, when drilled, should be carefully deburred, using a large diameter drill. Measure out appropriate lengths for the PCB input and output wires then solder these to the PCB while it is out of the chassis.

Smear heatsink compound onto both sides of two TO-220 mica washers then place them in position on the chassis so that the holes in the washers and the

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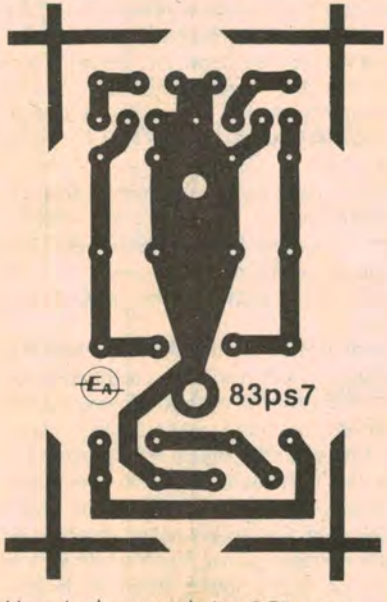
chassis line up. The PCB assembly is now placed in position and the regulators bolted to the chassis using insulating bushes on the mounting bolts. (See regulator mounting diagram for details).

After mounting the regulators use an ohmmeter to check for any short circuit between the tab and the chassis. The PCB is now screwed to the chassis, the mounting screws being selected so that their ends do not touch inside the insulated standoff. For 12mm standoffs the mounting screws can be up to 6mm in length.

The free ends of the PCB connecting wires are now soldered into place as per the wiring diagram and construction is complete.

Addenda

We have been informed by some electronics retailers that there is a shortage of 0.1μF 60V ceramic capacitors in Australia at the moment. We have tested the prototype supply with 0.1μF greencaps and found that they perform just as well as the specified ceramic capacitors. Kits supplied with greencaps instead of ceramics will have the same specifications as the prototype.



Here is the actual size PCB pattern.