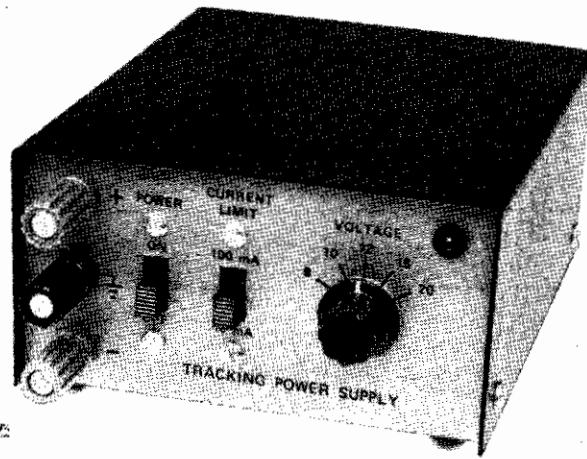


HIGH-QUALITY BENCH POWER SUPPLY



BY MICHAEL S. ROBBINS

*Single positive/negative
supply has
regulation better than 0.06%*

IF YOU are convinced that the op amp is here to stay and that two power supplies (positive and negative) are one too many, you need the compact single power supply described here. It uses a sophisticated IC to provide both positive and negative outputs which remain within 300 millivolts of each other; and it has line and load regulations of better than 0.06%. To keep the supply compact and easy to use, five pairs of switch-selected output voltages (± 9 , ± 10 , ± 12 , ± 15 and ± 20) and two current limits (10 mA and 100 mA) are provided instead of a control and a meter.

Circuit Operation. The IC used here is unique in that it contains two voltage regulators—one for positive and one for negative output. The portion that is the negative regulator is the key to the provision for variable-voltage outputs from both supplies. By varying the value of a single external resistor, the output can be changed over a wide range. Since the positive regulator "tracks" the negative regulator, the two outputs are the same—with opposite polarities.

Since the small pass transistors in the IC can dissipate only 0.68 watt, their outputs

are used to drive external high-power pass transistors, Q1 and Q2, as shown in Fig. 1. Current-limiting circuits in both sides of the IC regulator sense the voltage developed across R4, R5, R6, and R7. If this voltage exceeds 0.6 V, the output voltage drops.

Construction. Layout of the supply is straightforward and many variations are possible. The use of the printed circuit board shown in Fig. 2 is suggested, to avoid oscillations. Leads between the panel and the circuit board can be bundled, for neatness, as shown in the photograph.

The cabinet can be fabricated from two pieces of 0.050-in. thick aluminum, although a standard utility box can be used. The two pass transistors (Q1 and Q2) must be heat sunk to the cabinet, insulated with a mica washer coated with heat sink compound, and fastened with screw, nut, and lock washer.

If the Triad F-90X transformer is used, cut off or tape the blue, black, black/white, and black/green leads. The red and green are the ends of the secondary while the yellow is the center tap. The black/red and black/yellow leads are the primary.

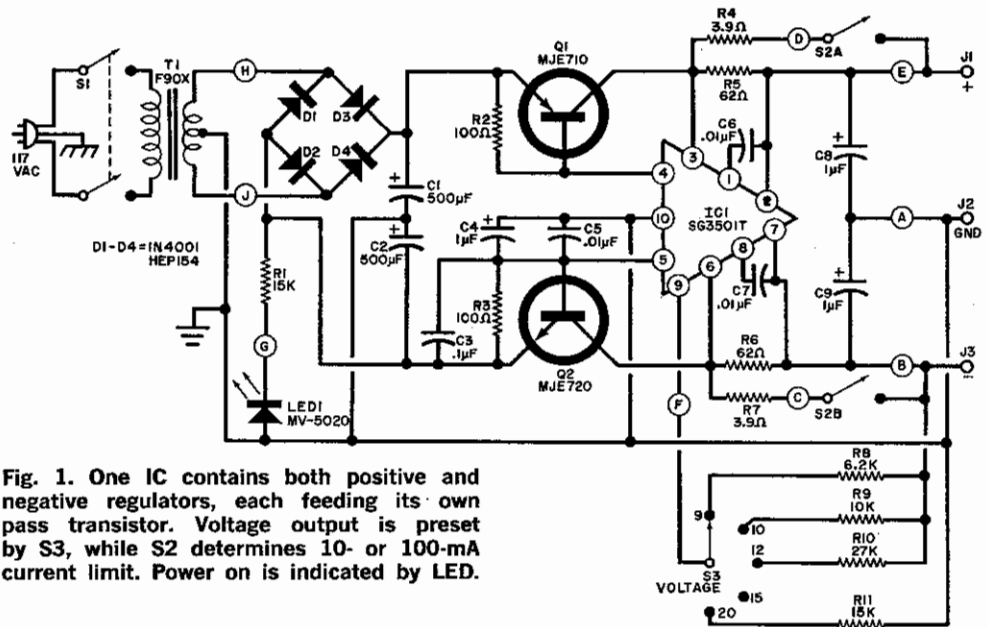
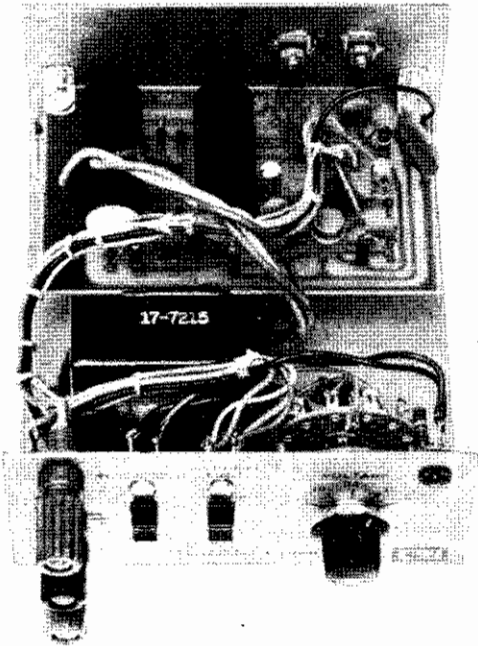


Fig. 1. One IC contains both positive and negative regulators, each feeding its own pass transistor. Voltage output is preset by S3, while S2 determines 10- or 100-mA current limit. Power on is indicated by LED.

PARTS LIST

- C1,C2—500- μ F, 25-V electrolytic capacitor
 C3—0.1- μ F, 25-V disc ceramic capacitor
 C4,C8,C9—1- μ F, 25-V PC-type electrolytic capacitor
 C5-C7—0.01- μ F, 25-V disc ceramic capacitor
 D1-D4—Silicon rectifier (1N4001, HEP154, or similar)
 IC1—Dual regulator (Silicon General SG3501T)
 J1-J3—Binding post (red, black, and blue)
 LED1—Light-emitting diode with mounting clip (Monsanto MV-5020)
 Q1—Transistor (pnp) (Motorola MJE710)
 Q2—Transistor (npn) (Motorola MJE720)
 R1—15,000-ohm, 10%, $\frac{1}{2}$ -watt resistor
 R2,R3—100-ohm, 10%, $\frac{1}{2}$ -watt resistor
 R4,R7—3.9-ohm, 5%, $\frac{1}{2}$ -watt resistor
 R5,R6—62-ohm, 5%, $\frac{1}{2}$ -watt resistor
 R8—6200-ohm, 5%, $\frac{1}{2}$ -watt resistor
 R9—10,000-ohm, 5%, $\frac{1}{2}$ -watt resistor
 R10—27,000-ohm, 5%, $\frac{1}{2}$ -watt resistor
 R11—15,000-ohm, 5%, $\frac{1}{2}$ -watt resistor
 S1,S2—Dpdt switch
 S3—One-pole, 5-position shorting-type rotary switch (Oak 399-418K or Centralab PA-1000)
 T1—Power transformer (40 VCT @ 0.1A) (Triad F-90X or similar)
 Misc.—Suitable cabinet, ac cord, mounting hardware, wire, solder, etc.
- Note—The following are available from Caringella Electronics, Inc., Box 327, Upland, CA 91786: PC board, drilled and etched, No. TPS-1PC, at \$5.95, postpaid in USA; set of all semiconductors at \$14.00, postpaid in USA; complete kit including cabinet, wire, etc., No. TPS-1K, at \$49.95 plus 1.50 handling and shipping. California residents add 6% sales tax on all items.



Prototype photo shows how two transistors are mounted using back wall as heat sink.

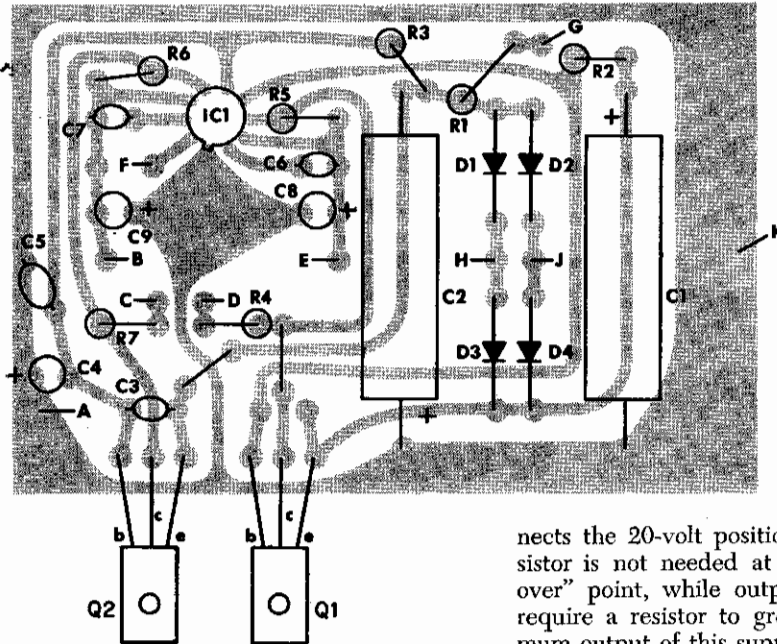
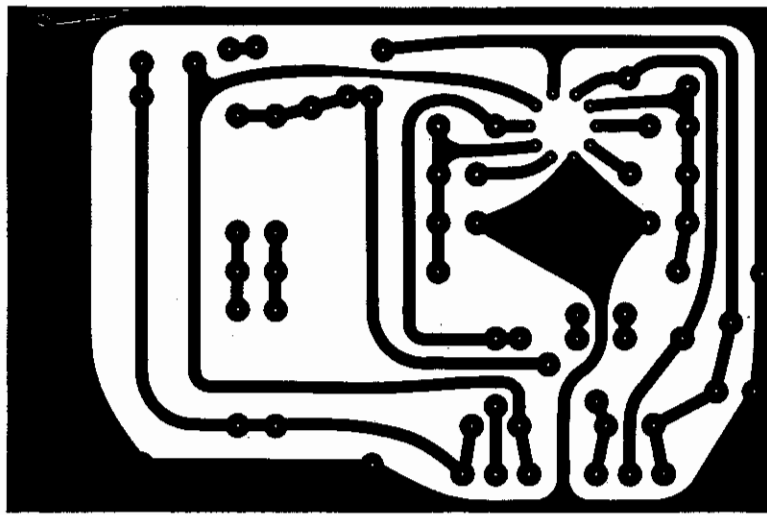


Fig. 2. Actual-size foil pattern and component installation for the power supply.

Care should be taken when mounting the electrolytic capacitors, diodes, transistors, and IC. The leads on *Q1* and *Q2* should be left full length so that the transistor body can be mounted on the metal chassis.

Output voltages other than the five provided are made possible by changing the values of *R8*, *R9*, *R10*, and *R11*. Note that *R8*, *R9*, and *R10* connect between *S3* and the negative supply, while the 15-volt position does not have a resistor and *R11* con-

nects the 20-volt position to ground. A resistor is not needed at the 15-volt "cross-over" point, while outputs above 15 volts require a resistor to ground. As the maximum output of this supply is approximately 20 volts, the minimum value of resistor is used for *R11*.

The PC board is laid out so that it can be used independently of the switches. It can be used as the internal power supply in any piece of equipment and can regulate currents up to about 1 ampere with suitable resistors.

Operation. The supply is ideal for use with IC's and hybrid circuits requiring regulated positive and negative voltages. It can also be used single-ended, since balanced loads are not required. ♦