LOOKING FOR a professional-quality low-voltage power supply? Here's one that puts out 0-10 volts at half an ampere or less, is fully regulated, and automatically protects both itself and your circuits from any possible damage. An adjustable current limiter sets the absolute maximum current that can possibly be delivered to the circuits—no high damaging currents are possible should an accidental short circuit or polarity reversal occur. The power supply can even run short-circuited overnight with no harm!

This power supply circuit (Fig. 1) is ideal for IC experiments, where you can easily set the 3.6 or 4.5 volts at the high-current levels you will need in multiple circuits. You'll also find it handy as a battery eliminator for transistor radio servicing, and a general replacement for "D" cells or similar batteries in bench experiments, and anywhere else you're working with transistor or IC circuitry.

The performance specs are very impressive: less than 1 millivolt of r.m.s. output ripple; regulation better than 300 millivolts, no load to full load. There are dual meters, one for voltage and one for current, with no confusion over what scale you are reading. Two controls are provided—one for adjusting voltage, the other to set the short-circuit current limit. And the split output terminal design gives you either a positive or negative case ground. All this in a three-pound 3" x 4" x 5" package you can easily put together in several evenings for $15 to $30, depending upon how fancy you care to get.

Construction. The power supply will just fit in a 3" x 4" x 5" metal box. Holes for the meters are cut with a nibbling tool. Color-coded five-way binding posts are used at the output, red for +, yellow for −, and black for the case. If you use exactly 3⁄4" mounting centers between the binding posts, you can use a standard double banana plug connector to your experimental projects. Line switch S1 mounts on the rear of voltage-adjust potentiometer R6.

Although not essential, a small printed circuit board greatly simplifies the wiring and makes all the small parts easy to mount. The board should be laid out and drilled as shown in Fig. 2. Component layout and interconnections are shown in Fig. 3. Be very careful of all circuit and component polarities. The PC board mounts on the chassis spacers with four #6 screws.

To bleed the heat from Q3, use a Wakefield NC623K heat sink drilled to suit the 2N3766 unit specified, and an insulated
mounting kit. (As this heat sink is a $1.50 item, you might prefer to build your own with 1/8" aluminum or some other low-priced material.) Use silicone grease on Q3, and check to be certain the transistor is insulated from the heat sink proper. The heat sink mounts on the rear of the case with pop rivets or #6 hardware.

Assembly. The various elements are assembled in the case in accordance with the layout selected. Figure 4 shows the author's unit before wiring. The printed board is mounted at the top, directly above the two meters, and the fuse holder is at the rear. The two potentiometers and three binding posts are also visible. The transformer (T1) and filter capaci-
HOW IT WORKS

The power supply circuit uses full-wave, capacitor-filtered, 16-volt, unregulated d.c. generated by 12-volt, 3-ampere filament transformer T1, rectifier bridge module D1, and filter capacitor C1. Transistors Q2 and Q3, and 12-volt zener diode D2 make up a voltage regulator. Together Q1 and Q2 have a gain of around 10,000, effectively “amplifying” the filtering effect of capacitor C2. Voltage-adjust potentiometer R6 across D2 permits setting the output voltage smoothly from zero to 10 volts. A heat sink is required for Q3 as it will dissipate about 16 watts in the short-circuit mode.

A silicon transistor needs 0.6 volt between base and emitter before it will conduct current. To get short-circuit protection, a 0.62-ohm current-sensing resistor (R2) is placed in series with the output, and transistor Q1 is connected across this resistor. As long as the current is less than 1 ampere, the voltage drop across R2 is less than 0.6 volt, and Q1 stays off. If too much current flows, Q1 immediately turns on, and robs the zener diode of its supply voltage; the output voltage drops immediately, thus preventing any fault currents. A wire-wound control potentiometer (R3) connected in series with the 0.62-ohm resistor permits setting the maximum short-circuit current to be delivered to a load.

Capacitors C1 are mounted on the rear wall of the case. Long leads are used to interconnect these two components, and to wire Q3 to the PC board.

Wiring should present no major problems. Use ±18 wire on the high-current portions of the instrument—between the collector of Q3 and meter M2, from M2 to terminal F of the PC board, from the emitter of Q3 to the red (+) binding post, and between the yellow (-) binding post and R3. R3 to R2 (R3 can be soldered directly to R2), and R2 to term-

(Continued on page 105)
point is moved, mentally, one or two places to the left (as the setting of the Range switch requires) and, when necessary (on the 1.5- and 15-volt ranges), the reading is multiplied by three.

**POWER SUPPLY**

(Continued from page 73)

For good heat dissipation, mount transistor Q3 on a heat sink and bolt both to outside rear of cabinet.

minal E of the PC board. Four ±10 nylon cup washers serve as feet.

**Current Limiting.** The current limit can be preset from 50 to 500 mA. Up to about three-quarters of the current limit, the power supply produces a constant-

(Continued on page 110)

For good heat dissipation, mount transistor Q3 on a heat sink and bolt both to outside rear of cabinet.

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**Current Limiting.** The current limit can be preset from 50 to 500 mA. Up to about three-quarters of the current limit, the power supply produces a constant-

(Continued on page 110)

Use long leads when connecting transformer T1, capacitor C1, and power transistor Q3 in the circuit.

November, 1967

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voltage output. When the predetermined critical current value is reached, the regulator automatically switches over from constant voltage to constant current. For instance, suppose your circuit takes 60 mA of current under normal conditions. You would simply set your current limit about double, say 120 mA.

As long as the circuit is working properly, you get constant voltage out of the supply. Should a polarity reversal or a fault occur, the supply will provide no more than 120 mA, even to a short circuit, thus automatically protecting both itself and your circuits from a careless mistake or an inadvertent wiring error. The response time to a fault is measured in microseconds—much faster than any fuse or circuit breaker could possibly respond.

COLOR CODE QUIZ ANSWERS

(Quiz appears on page 70)

A Axial Lead Resistor
Value: 27,000 ohms Tolerance: ± 5%

B Molded Tubular Paper Capacitor
Value: 0.1 uF Tolerance: ± 30%
Voltage: 1200 volts

C Molded Flat Mica Capacitor
Value: 470 pf Tolerance: ± 10%
Code: JAN Class: C

D Temperature-Compensated Tubular Ceramic Capacitor
Value 8 pf Tolerance: ± 0.1 pf
Temp. Coef.: -75 PPM/°C

E Mylar/Polyester Film Capacitor
Value: 5600 pf

F Radial Lead Resistor
Value: 3.6 megohms Tolerance: ± 10%

G Standoff Ceramic Capacitor
Value: 68 pf Tolerance: ± 5%
Temp. Coef.: -220 PPM/°C

H Ceramic Disc Capacitor
Value: 720 pf Tolerance: ± 5%
Temp. Coef.: -150 PPM/°C

J Molded Choke Coil
Value: 1.5 uH Tolerance: ± 10%
Code: MIL

K Button Silver Mica Capacitor
Value: 391 pf Tolerance: ± 10%