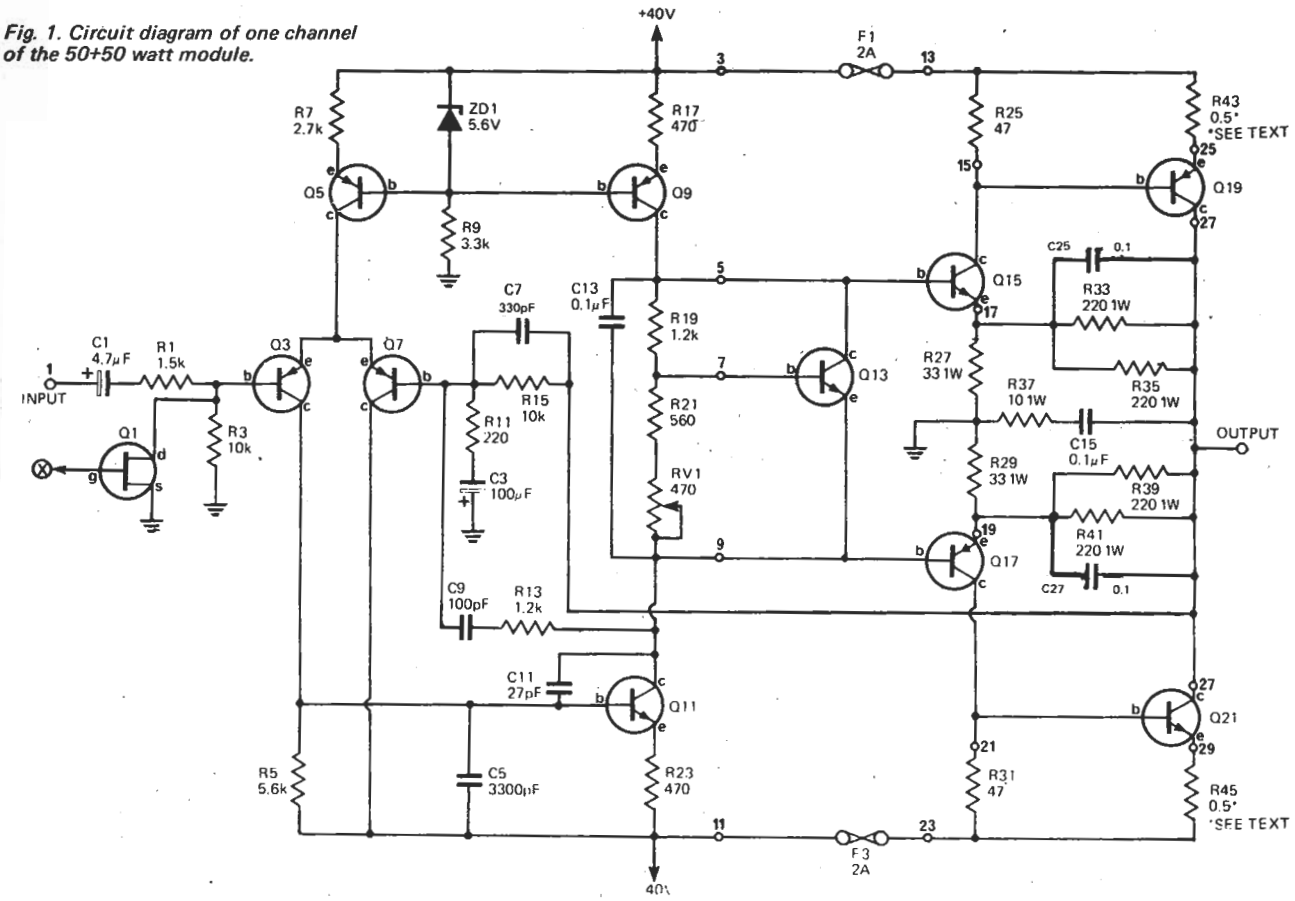
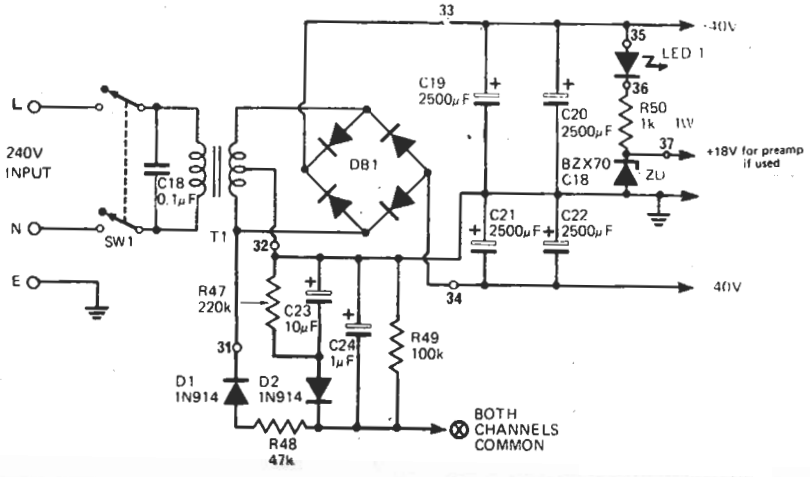
50+50 WATT POWER MODULE

422

Details of the basic amplifier used in the Crossover amplifier. The module can be used to boost the output of a low power stereo to 50W per channel!

Fig. 1. Circuit diagram of one channel of the 50+50 watt module.





NOTES
Q1 2N5485
Q3,5,7 BC557,BC177
Q9,17 BD140
Q11,15 BD139
Q13 PN3643
Q19 MJ2955
Q21 2N3055

RIGHT CHANNEL ONLY SHOWN
LEFT CHANNEL IS IDENTICAL EXCEPT COMPONENT NUMBERS ARE THE EVEN NUMBERS ie, R16 IS THE SAME AS R15

COMPONENTS D1,2 Q1,2 R47,48,49, C23,24 ARE ARE FOR THE DETHUMP CIRCUITRY AND MAY NOT BE REQUIRED

LED 1, R50 AND ZD3 ARE USED ONLY IF THE 422 PREAMPLIFIER IS USED

THE CROSSOVER AMPLIFIER described in this issue uses the power amplifier module out of the International 422 amplifier – described in the August 1974 issue of Electronics Today. For new readers who do not have this issue we are publishing details here.

Most of the electronics is mounted on either the printed circuit-board or on the heatsinks. The board may be assembled in accordance with the component overlay diagram given. Note that capacitors C25, 26, 27 and 28 do not have holes provided for them and they are therefore mounted directly across resistors R33, 34, 41 and 42 respectively.

The heatsink should be assembled as shown in the photograph and the drawing. The transistors Q13 and 14 should each be epoxied into a hole in one of the heatsinks to ensure good thermal contact. Also secure all leads to the heatsink with epoxy. The interconnections between the printed circuit board and the heatsink should be carried out in accordance with the wire numbering on the diagrams. Final wiring details are given in the respective separate projects.

text continues on page 36.

HOW IT WORKS –

The input signal is fed via C1 and R1 to the base of Q3 which, with Q7, forms a differential pair. Transistor Q5 is a constant current source where the current is [5.6 V (ZD1) – 0.6 (Q5)]/2700 (R7) – that is about 2 mA. This current is shared by Q3 and Q7. Transistor Q9 is also a constant current source supplying about 10 mA which, if no input signal exists, flows through Q13 and Q11. The differential pair controls Q11 and thus the voltage at its collector.

The resistors R19 and R21, together with potentiometer RV1, control the voltage across Q13 and maintain it at about 1.9 volts. But as Q13 is mounted on the heatsink, this voltage will vary with heatsink temperature. Assuming that the voltage at points 5 and 9 is equally spaced about zero volts (ie ± 0.95 volts), the current will be set at about 12 mA through Q15 and Q17. The voltage drop across the 47 ohm resistors (R25 and R31) will be enough to bias the output transistors, Q19 and Q20, on slightly to give about 10 mA quiescent current. This quiescent current is adjustable by means of potentiometer RV1.

Local feedback is applied to the output stage by the network R33, R35, R39 and R41, giving the output stage a voltage gain of about four. The overall feedback resistor, R15, gives the required gain control.

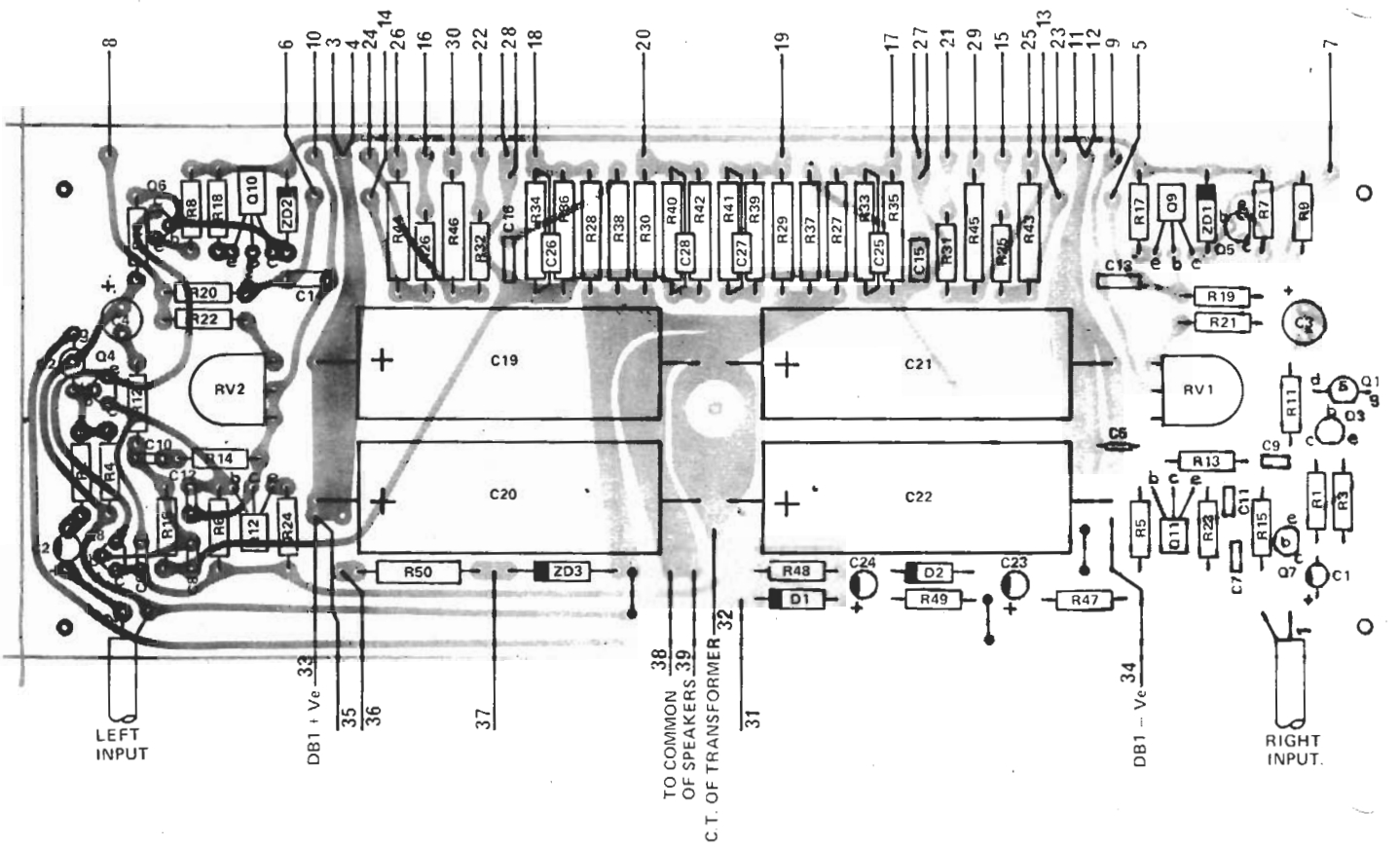
Protection to the amplifier, against shorted output leads, is provided by fuses in the positive and negative supply rails to both amplifiers.

Temperature stability is obtained by mounting Q13 on the heatsink. Q13 will thus automatically adjust the bias voltage. Frequency stability is ensured by C9/R13, C5, C7, C11, C25 and C27.

Although the power amplifier itself does not produce a thump in the loudspeakers on switch on, the preamplifier used may. To reduce any thump to an acceptable level, Q1 is used to short the input for about two seconds on switch-on and immediately after switch-off.

The power supply is a conventional full-wave bridge with centre tap, providing + 40 volts and –40 volts. Diode D1 is used to rectify a second negative supply which is used to control the FETs. Due to the resistance in series with the diode, the charge of C24 is slow. In addition, during the charge period, C23 is also being charged increasing the delay. On switch off, however, C23 cannot assist the voltage on C24 and the off-timing is much shorter than the on-timing.

Fig.3. Component overlay.



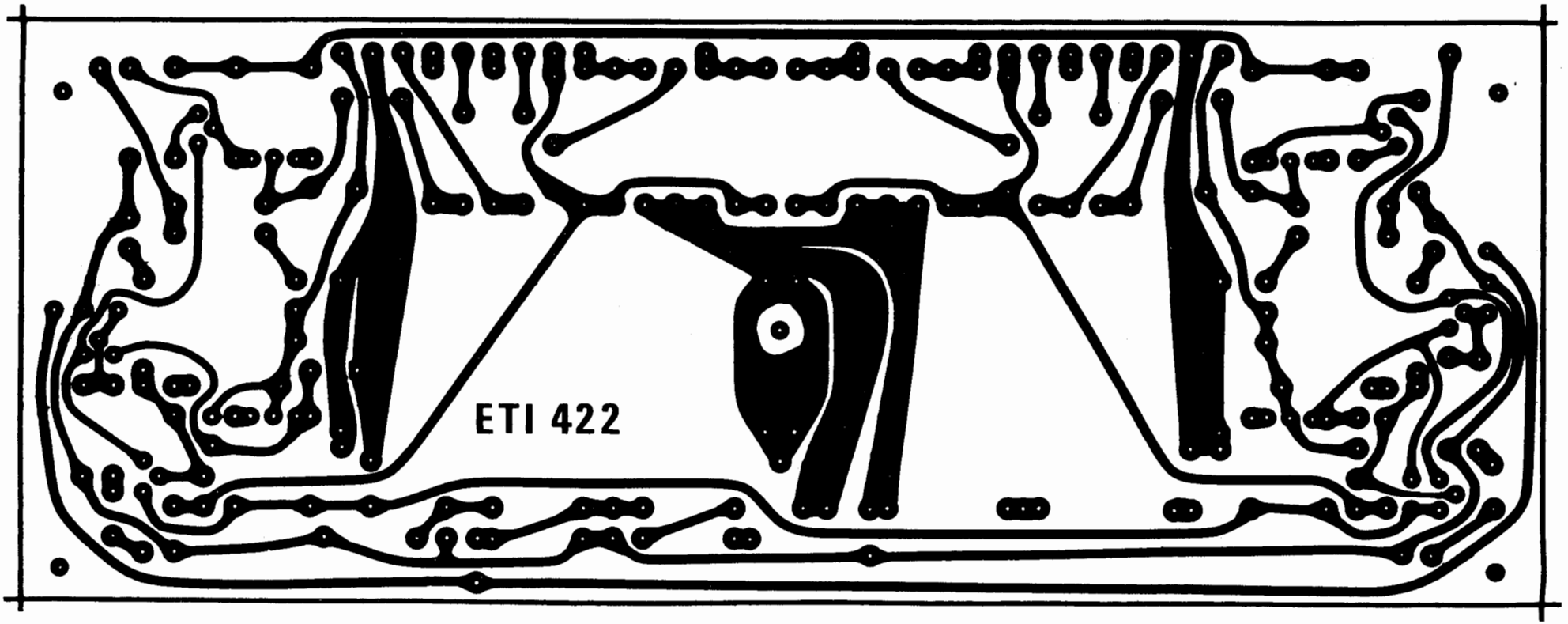


Fig. 4. Printed circuit layout for the amplifier. Full size 255 x 97 mm.

PARTS LIST
ETI 422

R43,44,45,46	Resistor	0.5 ohm	2W*	
R37,38	"	10	"	1W 5%
R27,28,29,30	"	33	"	" "
R25,26,31,32	"	47	"	½W "
R11,12	"	220	"	" "
R33,34,35,36	"	220	"	1W "
R39,40,41,42	"	220	"	" "
R17,18,23,24	"	470	"	½W "
R21,22	"	560	"	" "
R13,14,19,20	"	1 k2	"	"
R1,2	"	1 k5	"	"
R7,8	"	2 k7	"	"
R9,10	"	3 k3	"	"
R5,6	"	5 k6	"	"
R3,4,15,16	"	10 k	"	"

*If difficult to obtain, these resistors may be fabricated from a short length of electric fire element—about 90mm is sufficient for each. Wind securely around a 1 watt resistor (100 ohms or higher) and solder into place.

RV1,2 Potentiometer 470 ohm Trim

C11,12	Capacitor	27 pF	ceramic
C9,10	"	100 pF	ceramic
C7,8	"	330 pF	ceramic
C5,6	"	0.0033 µF	polyester
C13,14,15,16	"	0.1 µF	"
C25,26,27,28	"	0.1 µF	"
C18	"	0.1 µF 250 Vac	
C1,2	"	4.7 µF 10V	Electro-
C3,4	"	100 µF 10V	lytic
C19,20,21,22	"	2500 µF 50V	"

Q1,2	Transistor	2N5485
Q3,4,5,6,7,8	"	BC177,2N3645
Q9,10,17,18	"	BD140
Q11,12,15,16	"	BD139
Q13,14	"	BC177
Q19,20	"	MJ2955*
Q21,22	"	2N3055*

*with mounting hardware

ZD1,2 Zener diode 5.6V 400mW

DB1 Diode bridge min 100V PIV, 1.5A

PC Board ETI-422
F1-F4 Chassis mounting Fuse holders and 2 Amp. Fuses.
T1 Transformer 56V CT 1.5A
Heatsinks 2off 75mm of 35D or 40D (Mullard)

If the dethump circuitry is required add the following components.

R47 Resistor 220 k

R47	Resistor	220 k	½W	5%
R48	"	47 k	"	"
R49	"	100 k	"	"

D1,2	Diode	1N914
Q1,2	Transistor	2N5485
C23	Capacitor	10µF 25V electrolytic
C24	"	1µF 25V "

NB Heatsinks' The Mullard 40D Heatsinks are available from Syace of Blyth Road, Maltby, Yorks S66 8HZ. Quote Ref. 40D N00750A100 and send £3.24 (includes P&P and VAT) for four 75mm pieces (2 pieces, £1.64; 1 piece 85p).

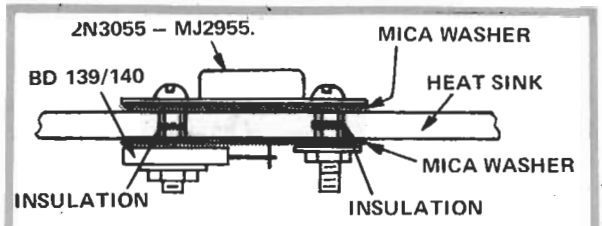
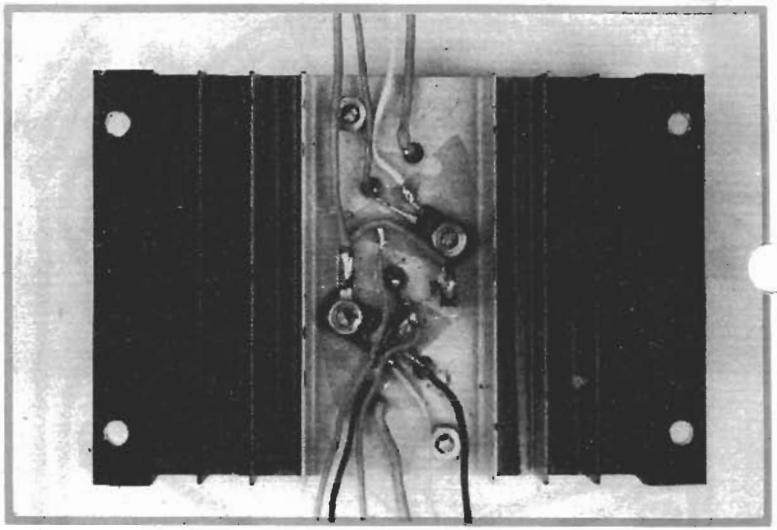
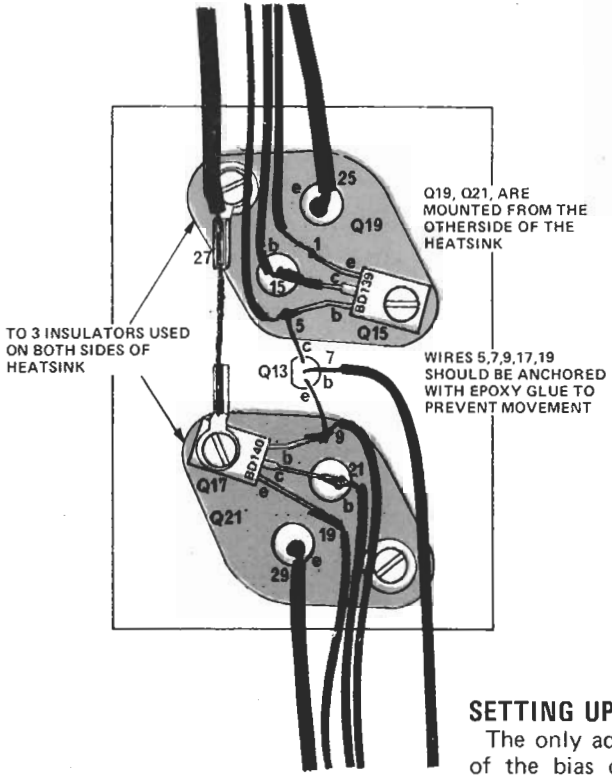


Fig. 5. How the heatsinks are assembled.



How the completed heatsink assembly appears.



SETTING UP

The only adjustment required is that of the bias current. This is normally done with an ammeter in the power-supply lead to the output stage and, with the speaker disconnected and no signal, RV1 is adjusted to obtain a current of about 20 milliamps. However if a major fault exists, or occurs, with the above method the meter as well as the output transistors may be damaged.

To obviate this we recommend a different approach as follows. Take out the fuses and temporarily connect a 220 ohm half-watt resistor across the fuse holder. Adjust RV1 to obtain about four volts across these resistors. If a major fault exists these resistors will get hot and possibly burn out. However no other damage will occur to the amplifier as the resistors limit the maximum current that can flow. After bias adjustment these resistors are removed and the fuses replaced.

It may be found that the voltage across the resistor in the positive lead is slightly different from that across the resistor in the negative lead. This is due to a slight offset in the output voltage but as long as the average is about four volts it will be satisfactory.●