

When running a speaker system it is useful to have an idea of the approximate level of power being used. In particular it is important that the loud speaker manufacturer's specification is not exceeded as this could result in severe damage to the speaker. The Watt Watcher is a simple circuit that may be fitted into a speaker cabinet to provide an indication of the relative power level and uses three LED's: a green LED lights when the power is at a relatively low level indicating that the system is running; a second (orange) LED indicates an intermediate level of power and a third (red) indicates an overload condition. The level at which the orange and red LED's (LD2 and LD3) light is set by fitting resistors of selected value, depending on the required power range. The Watt Watcher derives its power from the speaker line and hence requires no external power supply.

Circuit Description

With reference to the circuit diagram of Figure 1 it may be seen that the Watt Watcher effectively consists of three similar transistor switches. Each switch is biased to switch on LEDs LD1 to LD3 at different input voltages and these correspond to different power levels

depending on speaker impedance. The power, which is taken from the speaker terminals, is rectified and smoothed by two separate networks: R1, D1 and C1 provide a relatively smooth DC voltage for the supply rail, while R2, D2 and C2 provide a less smooth DC voltage for the transistor bias resistors to allow for fast changes in audio power level. Bias resistors R3, R4 and R5 determine the voltage at which the transistor will switch on and light the LED; TR1 is biased to switch on at the lowest voltage and TR3 at the highest. Zener diodes ZD1 to ZD3, serve to limit the brightness of the LEDs at higher voltage levels. Diodes D3 and D4 increase the voltage threshold at which LD2 and LD3 light, as orange and red LEDs have a lower voltage threshold than the green type. The current through the LEDs is limited to a few mA by R6, R10 and R14.

PCB Assembly

Insert and solder the components onto the PCB referring to the legend shown in Figure 2, starting with the resistors. R9 and R13 should be selected, depending on the speaker impedance and the power with which the Watt Watcher is to be used (refer to Table 1). The levels of power



shown (RMS) refer to the approximate power at which LD3 will light. Capacitors C1 and C2 are fitted observing the correct polarity; the negative lead is indicated by a negative sign (-) on the side of the capacitor which goes away from the hole marked positive (+) on the PCB legend. Diodes D1 to D4 are then inserted with the correct polarity (the cathode is marked by a band at one end of the diode). Transistors TR1 to TR3 are positioned so

that their cases correspond exactly with the outline on the PCB legend. LEDs LD1 to LD3 are then installed on the track side of the board (see Figure 3). The length of the LED leads may be cut to suit individual needs, depending where the unit is to be fitted; it is important that they are inserted with the correct polarity (the short lead on the flat side of the LED is the cathode). Finally insert PCB pins P1 and P2. For more detailed information on construction

techniques please refer to the Constructor's Guide included in the kit.

Testing

Before testing the unit make sure that all components are soldered and that there are no dry joints or solder short circuits. If a multimeter is available the DC resistance between P1 and P2 can be measured; this should read several thousands of ohms. Connect P1 and P2 to

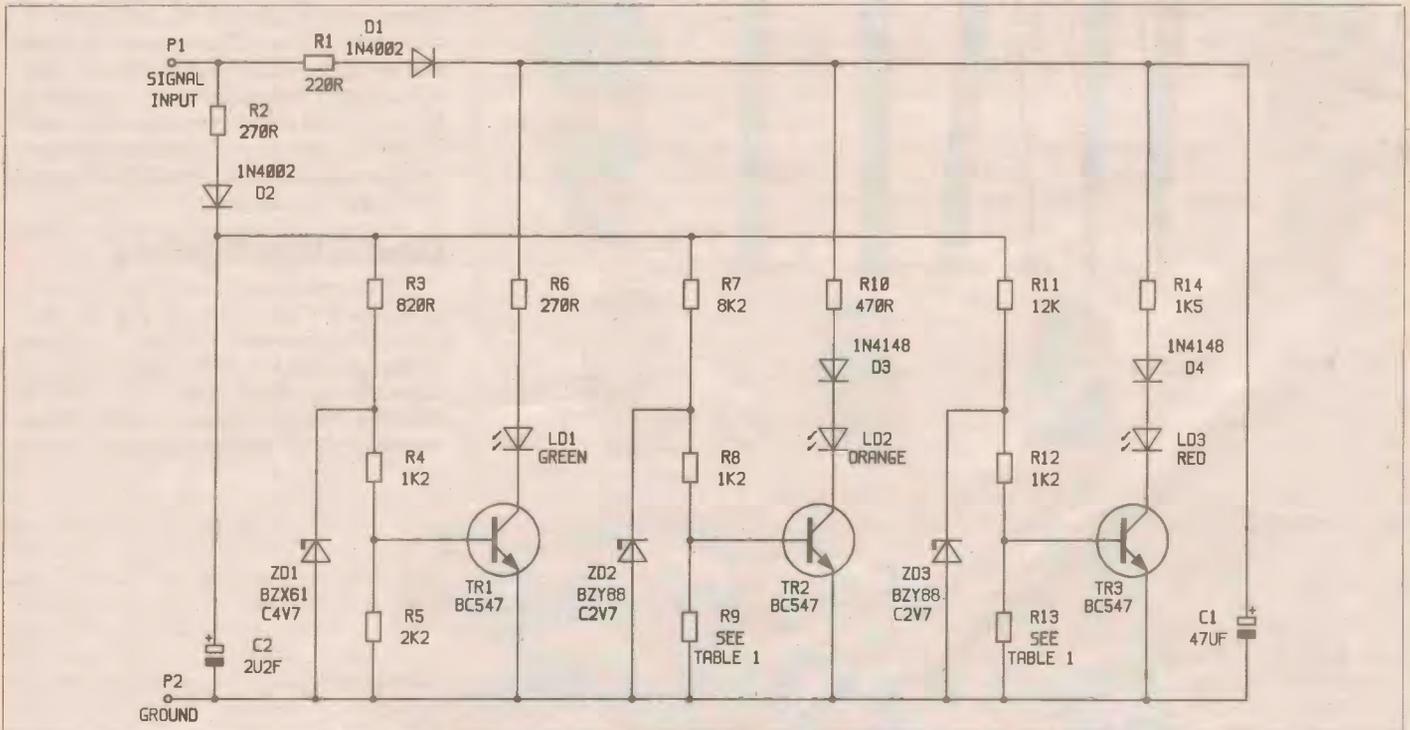


Figure 1. Circuit Diagram.

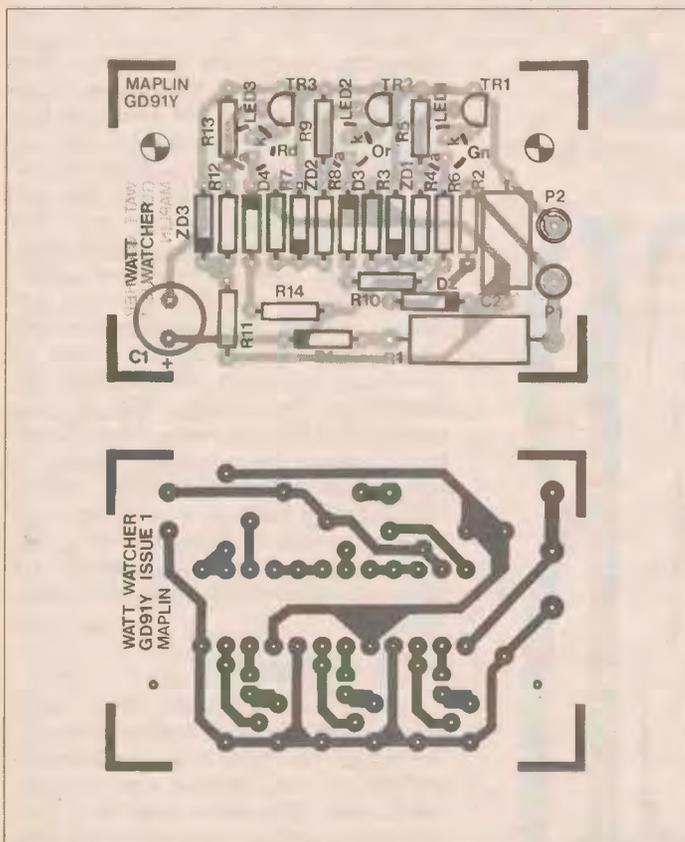


Figure 2. PCB Track and Overlay.

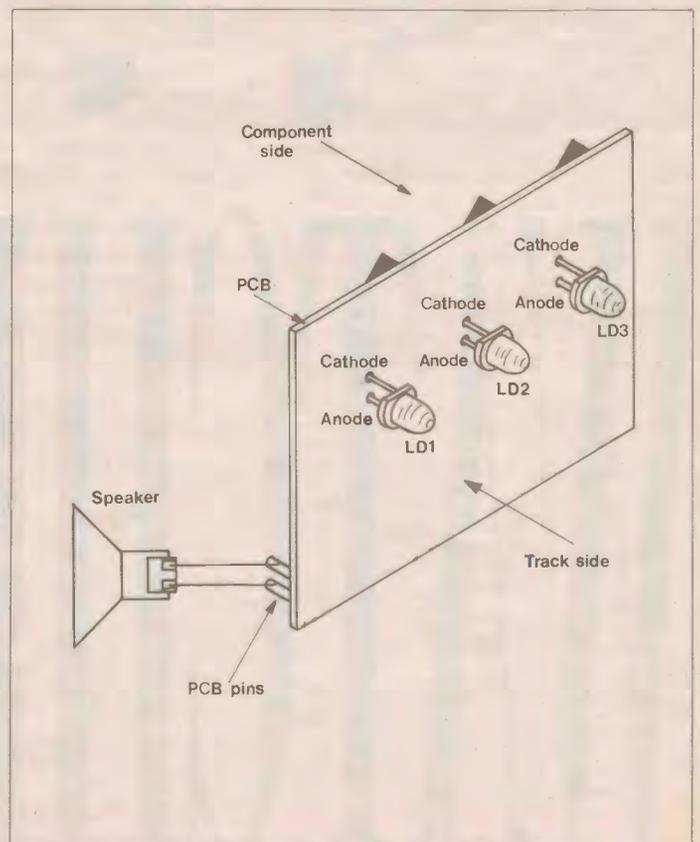


Figure 3. Mounting the LEDs.

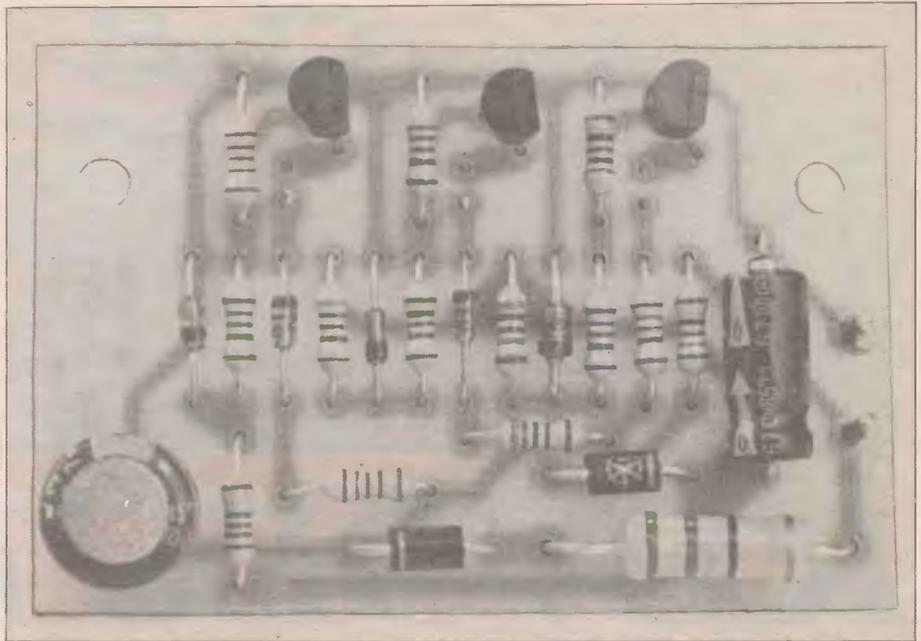
the speaker terminals using insulated wire. Switch on and slowly increase the volume. The green LED LD1 should start to light at around 3 to 5 watts depending on speaker impedance. As the volume is increased LD2 should start to light indicating an intermediate level of power. The red LED LD3 should only light when the power level chosen from Table 1 is reached; this is intended to indicate an overload condition and under normal operating conditions should not light (other than perhaps an occasional flicker). An overload condition is indicated when LD3 is lit for the majority of the time. Table 2 shows the approximate input voltage levels at which LD2 and LD3 light for each power range. If all is well the Watt Watcher may be installed into the speaker cabinet or alternatively can be housed in a separate box. It should be noted that the Watt Watcher should not be used with systems running at power levels above the chosen range or with speaker impedances other than those specified as severe damage could result.

POWER		Resistor Value	
		8R Speaker	4R Speaker
25 Watts	R9	1k5	2k2
	R13	1k0	1k5
50 Watts	R9	1k0	1k5
	R13	820R	1k0
100 Watts	R9	820R	1k0
	R13	680R	820R

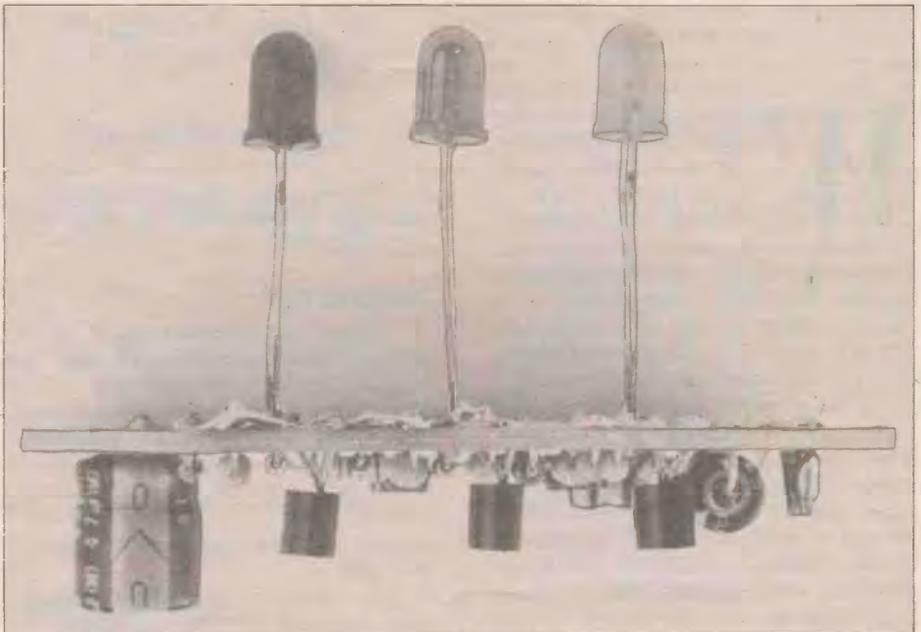
Table 1. Resistor values for various power levels and speaker impedances.

POWER RANGE (RMS)		Input Voltage (RMS)	
		8R Speaker	4R Speaker
25 Watts	LD2	9V	7V
	LD3	14V	10V
50 Watts	LD2	14V	9V
	LD3	20V	14V
100 Watts	LD2	18V	14V
	LD3	28V	20V

Table 2. Approximate input voltage levels required for LD2 and LD3 to light. Values shown for input frequency - 1kHz (sinewave).



Component side of pcb.



Side view of pcb.

WATT WATCHER PARTS LIST

RESISTORS: All 0.6W 1% Metal Film (unless specified)

R1	220Ω	1 Watt Carbon Film	1	(C220R)
R2,6	270Ω		2	(M270R)
R3	820Ω		1	(M820R)
R4,8,12	1k2		3	(M1K2)
R5	2k2		1	(M2K2)
R7	8k2		1	(M8K2)
R9,13	See Miscellaneous and Table 1			
R10	470Ω		1	(M470R)
R11	12k		1	(M12K)
R14	1k5		1	(M1K5)

CAPACITORS

C1	47μF	63V P.C. Electrolytic	1	(FF09K)
C2	2μ2F	100V Axial Electrolytic	1	(FB15R)

SEMICONDUCTORS

D1,2	1N4002		2	(QL74R)
D3,4	1N4148		2	(QL80B)
ZD1	BZX61C4V7		1	(QF45Y)
ZD2,3	BZY88C2V7		2	(QH00A)

LD1	LED Green	1	(WL28F)
LD2	LED Orange	1	(WL29G)
LD3	LED Red	1	(WL27E)
TR1,2,3	BC547	3	(QQ14Q)

MISCELLANEOUS

	Constructor's Guide	1	(XH79L)
	P.C. Board	1	(GD91Y)
	Pin 2141	1 Pkt	(FL21X)

Select R9 and R13 from the following:

680Ω	1	(M680R)
820Ω	1	(M820R)
1k	1	(M1K)
1k5	1	(M1K5)
2k2	1	(M2K2)

A complete kit of parts is available:
Order As LM57M (Watt Watcher Kit) Price £3.98
 The following item in the above kit is also available, but is not shown in our 1988 catalogue:
Watt Watcher PCB Order As GD91Y Price £2.95