PROJECT

Signal Activated AMPLIFIER

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This article describes a versatile general-purpose amplifier with a particularly useful feature – it automatically switches into a power saving standby mode following a preset delay if no signal is present on the input, yet switches back into action (almost) immediately if an input signal again becomes present.

The amplifier has many applications where power saving when the system is not in use is an important consideration, and/or where the amplifier is little used but needs to be active instantly when required. This amplifier will fulfil these requirements without a time-wasting switch-on routine to go through beforehand.

In addition, the amplifier is designed to operate from either an internal battery, or an external power supply. If the optional rechargeable sealed lead-acid battery is installed, the power supply can also be used to trickle charge the battery, even when the amplifier is switched off. This enables the amplifier to be ready for use whenever it is needed. The specified mylar loudspeaker is water resistant, therefore, operation in inclement weather (but not a downpour!) is possible.

PROJECT RATING 2

Kit Available
Order as LT93B
Price £39.99

FEATURES

- Automatic power-saving function
- Adjustable timeout period
- Amplifier active indicator LED
- Built in internal battery charger
- Water-resistant loudspeaker

APPLICATIONS

- Intercoms
- Announcers
- Telephone amplifiers

The completed unit.

Circuit Description

Refer to the block and circuit diagrams, shown in Figures 1 and 2, respectively. The sections are described individually for clarification of their operation.

Amplifier

The TDA2005M (IC1) is a stereo power amplifier IC (optimised for bridged mono, hence the 'M' designation), connected in a non-bootstrapped bridge configuration to increase output swing capability, i.e. one inverting and one non-inverting amplifier with the load (speaker) connected between the two outputs.

The input signal from JK1 is applied to the volume control RV1, then to the input of the non-inverting amplifier, the gain of which is determined by (R1/R4)+1. The feedback signal to the non-inverting amplifier is sniffed off by R3 and applied to the inverting amplifier input, the gain of which is determined by R2/R3+R4.

Connecting a capacitor (C8) to pin 3 of IC1 (the Supply Voltage Ripple Rejection input) will stabilise the ICs internal

bias network; the value of the capacitor is a compromise between 'turn on delay' and 'switch on thump' – larger values for C8 will increase the turn on delay and reduce thump, smaller values will have the opposite effect.

Trigger

The signal from the input socket (JK1) is also applied to RV2, the sensitivity control. TR1 combined with R8 & R9 form a common emitter amplifier, C11 & C13 AC couple the signal in to and out of the amplifier, blocking the DC component; diode D2 half-wave rectifies (clips off the negative half of the waveform) signal, while resistor R10 prevents the input of IC2 from floating.

IC2 is a programmable timer configured in a monostable mode which is retriggerable; when pin 6 is taken high, the output will become active low,

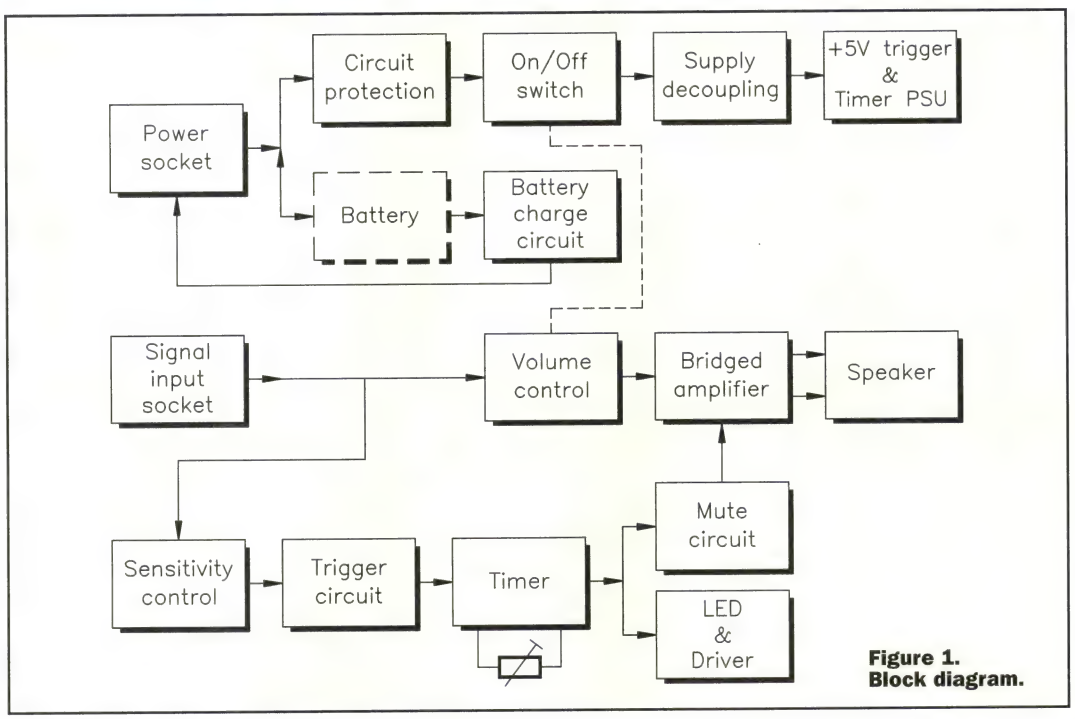


Figure 1. Block diagram.

SPECIFICATION

Operating voltage:	8-15V DC (12V nominal) external PSU or internal sealed lead-acid battery
Standby current consumption:	2·3mA @ 8V 3·7mA @ 12V 39mA @ 15V
Maximum current consumption:	1·2A (activated)
Maximum power consumption:	18W
Delay before standby state activated:	variable, between approximately 25-180 seconds (3 minutes)
Input impedance:	20kΩ
PCB dimensions:	88 × 91mm (before snapping) 88 × 45mm (each PCB when separated)

and the timeout period begins when pin 6 is returned to logic 0. Should the input become high again during the timeout period, the output will remain low but the timeout sequence will be aborted; a new timeout sequence will begin when the input returns to a low condition.

The output period 't' can be calculated from the formula:
$t = 65{,}536 \times 2{\cdot}3 \times (R11 + RV3) \times C14$

With the values given, the minimum timeout period is 24·87 seconds and the maximum period is 180·73 seconds (3 minutes).

Transistor TR2 is used to short circuit C8, keeping the power amp (IC1) in a standby condition until the timer (IC2) is activated. TR3 is used as a power switch for the LED (LD1), which illuminates only when the timer is active.

PSU

Power for the unit can either be derived from the power socket or the internal battery; NOTE that when using an +15V external supply, the internal battery will be trickle charged – even when the unit is switched off. (Note: lower voltage external PSUs will not charge the internal battery.)

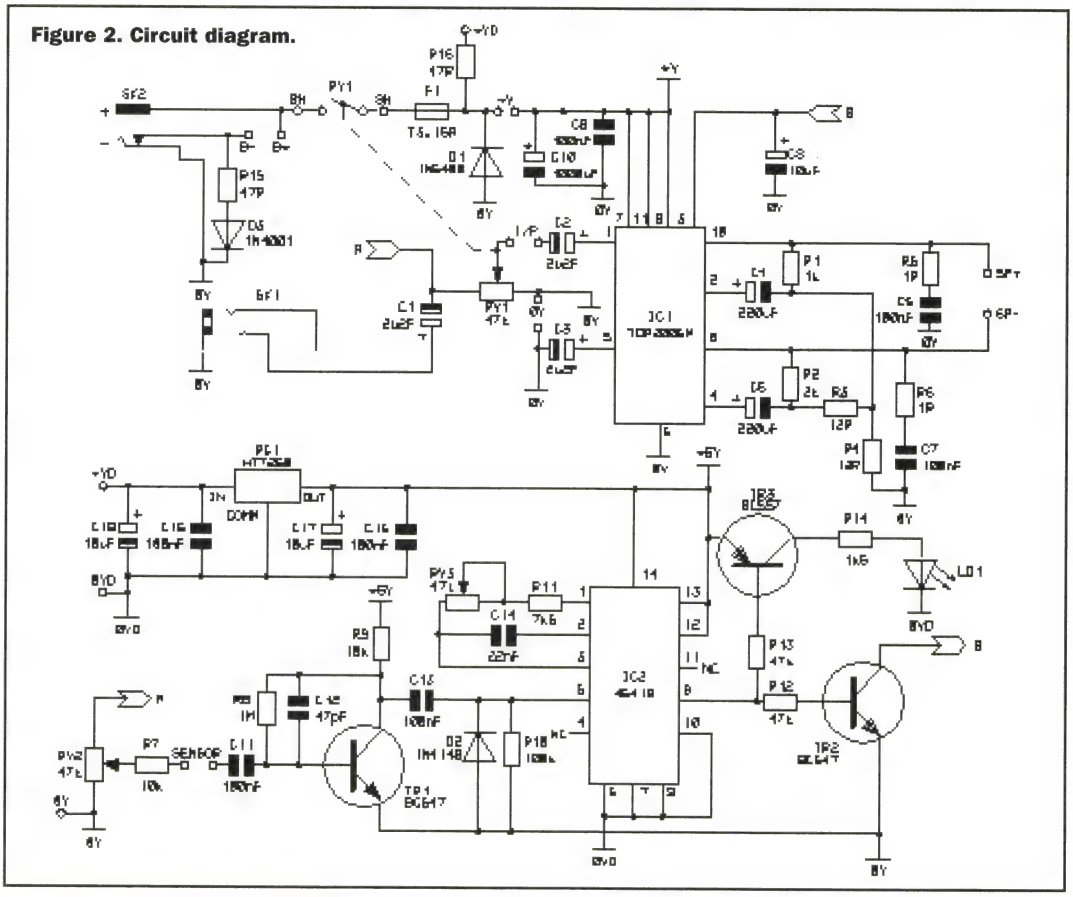
Construction

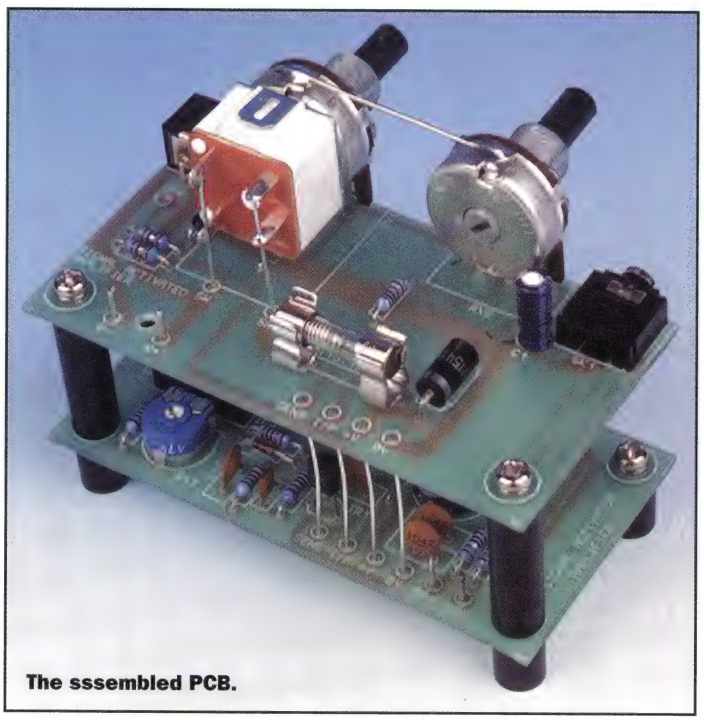
Refer to the PCB legend and track drawing, shown in Figure 3. Construction is fairly straightforward, but a few pointers may be helpful.

Begin with the smallest components first, working up in size to the largest. Be careful to correctly orientate the polarised devices, i.e. electrolytic capacitors, diodes, transistor, regulator and timer IC, which should be inserted into its socket (ensuring the end notches of both align with the PCB legend marking) last of all. Use the component lead offcuts for the PCB links.

The four PCB pins are fitted to B+, B–, SPK+ and SPK–. Fit the clips to the fuse, then insert

Figure 2. Circuit diagram.





The sssembled PCB.

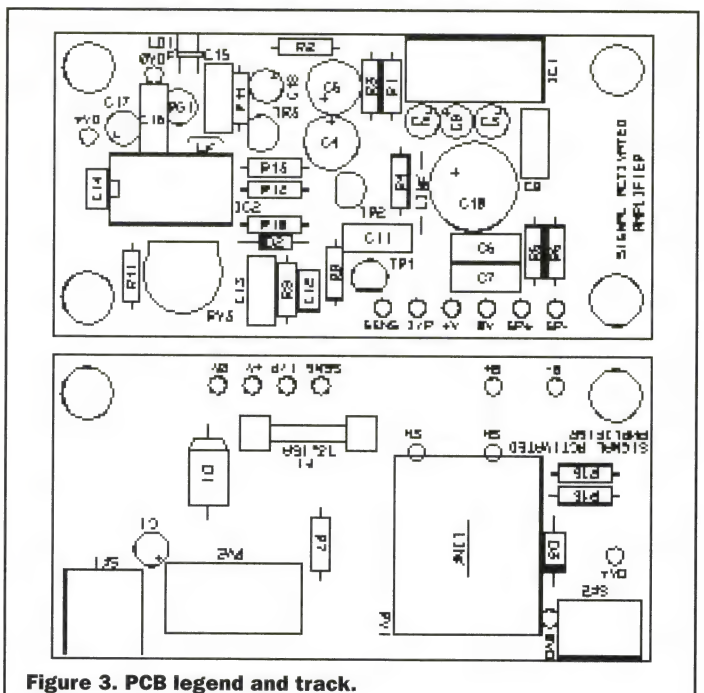


Figure 3. PCB legend and track.

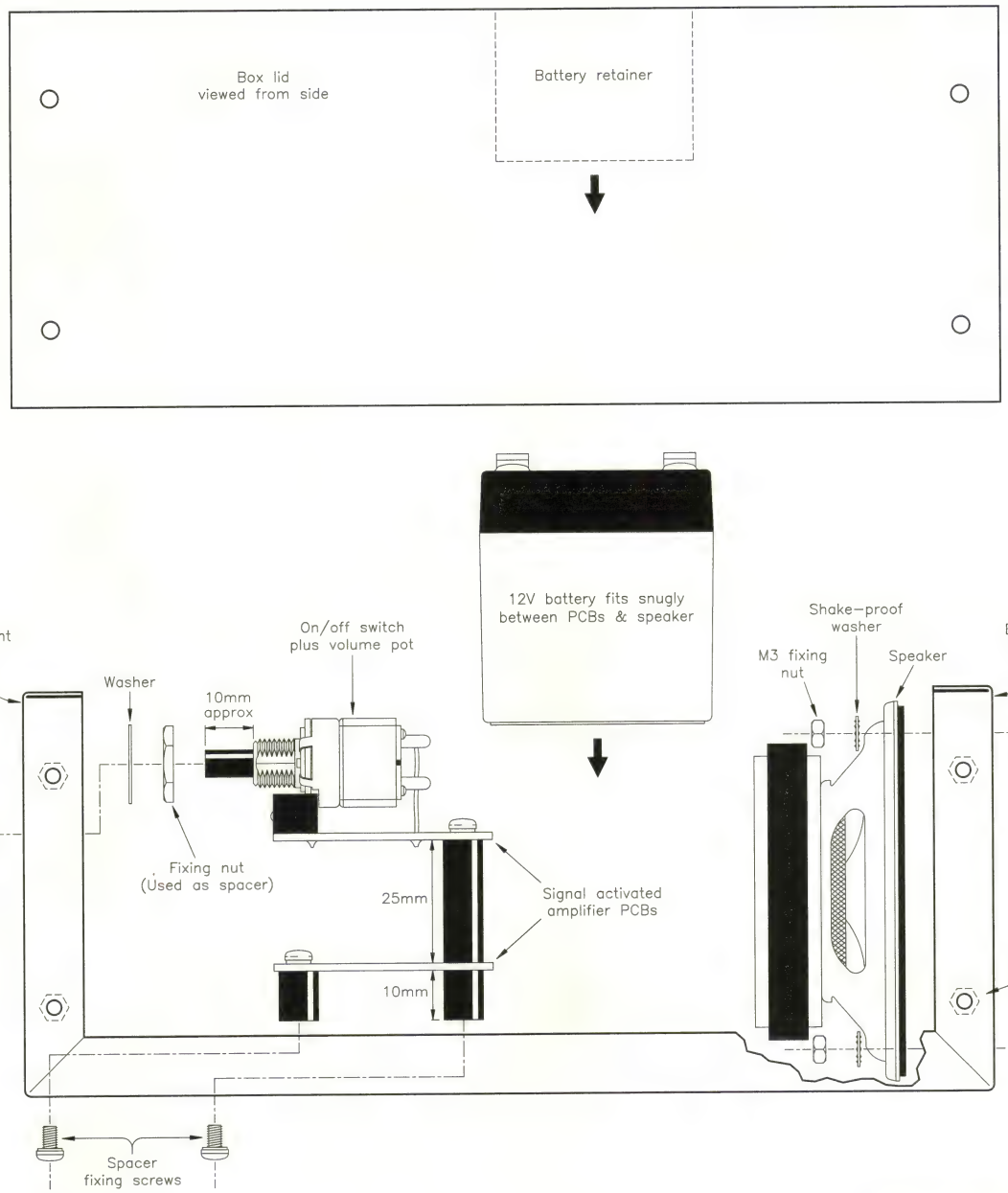


Figure 4. Exploded assembly.

into the PCB. Temporarily fit the 10mm spacers to the bottom PCB, insert the power amp (IC1) and the preformed LED into the PCB; adjust the height of the LED & IC1 to align with the holes in the enclosure, then solder in place. Trim the potentiometer shaft lengths to 10mm before installing into the PCB.

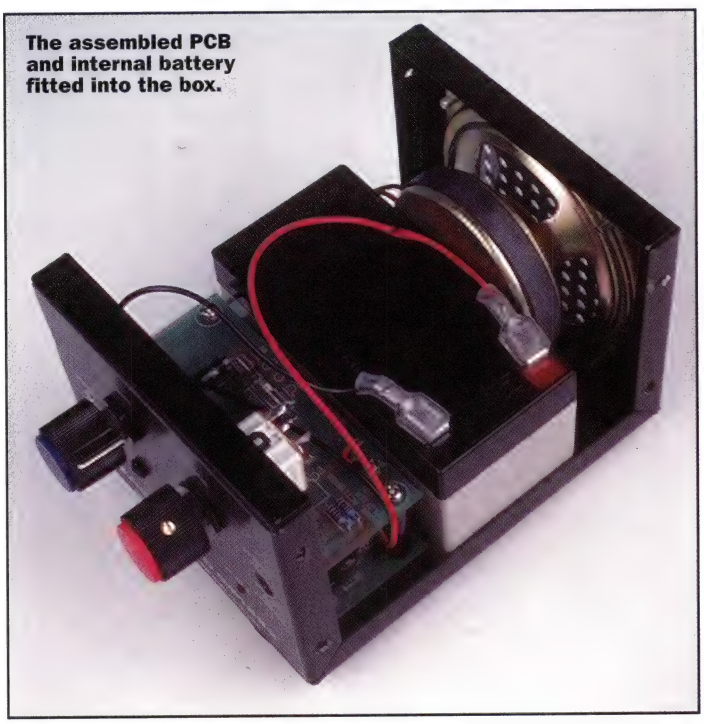
When each PCB is fully populated, thoroughly check your work for misplaced components, solder whiskers, bridges and dry joints. Finally, clean all the flux off the PCB using a suitable solvent.

Refer to Figure 4, the exploded assembly diagram. Prepare the 25mm spacers as shown, then assemble the two PCB's together. Straighten out the tinned copper wire and make the six inter-PCB connections; NOTE that the 0VD connection is also used to connect to the screening cans of the potentiometers. Fit two more links from the top PCB to the switch connections of RV1. Fit the module and speaker into the enclosure.

Referring to Figure 5, complete the wiring to the speaker and internal battery – do not forget to fit the terminal insulators. Finally, fit the knobs to the potentiometer and the rubber feet to the base of the box. Before going any further, double-check EVERYTHING!

Testing

Begin by setting both potentiometers to their fully anticlockwise wiper positions, then put the battery on charge (use a constant voltage charger; Ni-Cd & car battery chargers are NOT suitable for this lead-acid



The assembled PCB and internal battery fitted into the box.

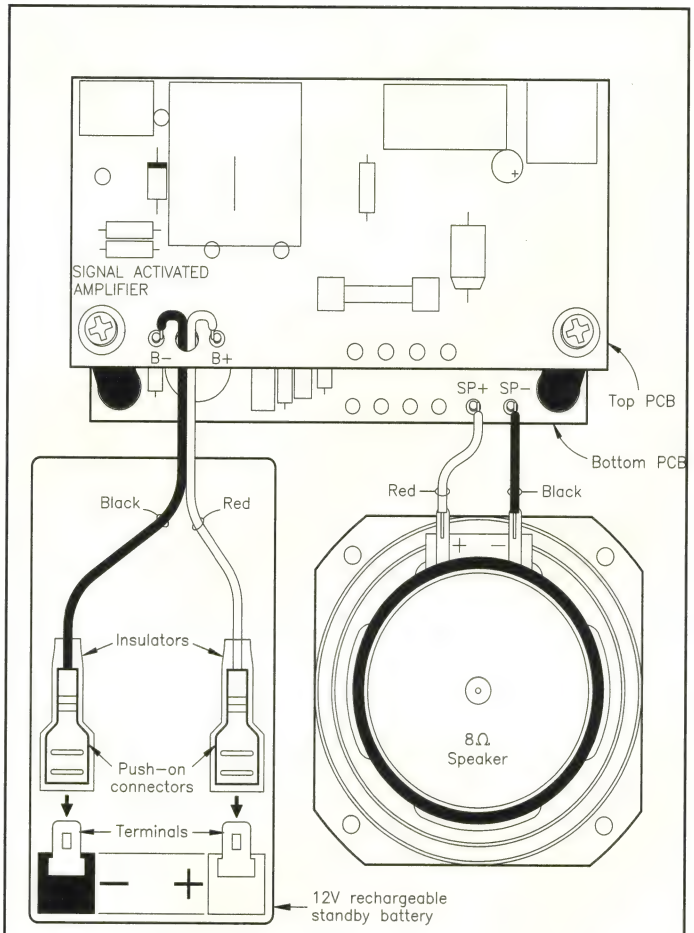


Figure 5. Wiring diagram.

type of battery). Once the battery is fully charged, install it into the enclosure and fit the lid. Switch on the unit by turning the volume control clockwise; a small click from the speaker will be heard and the LED will illuminate. The length of time the unit is active for is determined by the preset potentiometer RV3; adjust the preset for the desired timeout period.

Allow the unit to 'time out', then apply a signal to the input jack socket – refer to Figure 6, showing the wiring for a typical application. Turn up the volume slightly, then slowly turn the sensitivity control clockwise until the unit triggers; listen to the speaker for any unexpected distortions (bearing in mind that the sound quality is not Hi-Fi).

The unit is now fully tested and is ready for use. ELECTRONICS

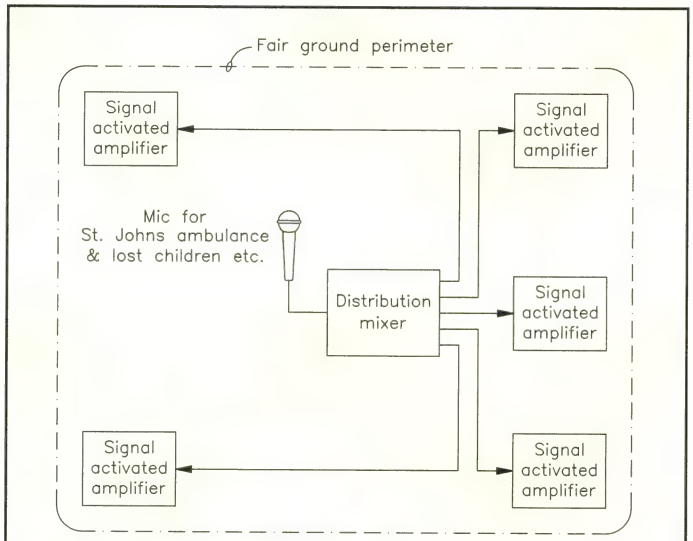


Figure 6. Typical application setup.

PROJECT PARTS LIST

RESISTORS (All 0·6W 1% Metal Film, Unless Stated)

R1	1k	1	(M1K)
R2	2k	1	(M2K)
R3,4	12Ω	2	(M12R)
R5,6	1Ω	2	(M1R)
R7,9	10k	2	(M10K)
R8	1M	1	(M1M)
R10	100k	1	(M100K)
R11	7k5	1	(M7K5)
R12,13	47k	2	(M47K)
R14	1k5	1	(M1K5)
R15,16	47Ω	2	(M47R)
RV1	47k Logarithmic Potentiometer with Switch	1	(FW65V)
RV2	47k Linear Potentiometer	1	(FW04E)
RV3	47k Horizontal Enclosed Preset Potentiometer	1	(UH05F)

CAPACITORS

C1,2,3	2μ2F 63V Radial Electrolytic	3	(AT75S)
C4,5	220μF 25V Radial Electrolytic	2	(AT49D)
C6,7,9,11, 13,15,16	100nF 50V Ceramic Disc	7	(BX03D)
C8,17,18	10μF 63V Radial Electrolytic	3	(AT77J)
C10	1,000μF 25V Radial Electrolytic	1	(AT52G)
C12	47pF Ceramic Disc	1	(WX52G)
C14	22nF Mylar Film	1	(WW19V)

SEMICONDUCTORS

D1	1N5400	1	(QL81C)
D2	1N4148	1	(QL80B)
D3	1N4001	1	(QL73Q)
LD1	Miniature Red LED 2mA	1	(CZ28F)
TR1,2	BC547	2	(QQ14Q)
TR3	BC557	1	(QQ16S)
IC1	TDA2005M	1	(YY70M)
IC2	4541B	1	(QQ47B)
RG1	HT7250	1	(LE79L)

MISCELLANEOUS

SK1	3·5mm PCB-mounting Stereo Socket	1	(JM23A)
SK2	2·5mm PCB-mounting DC Power Socket	1	(FK06G)
F1	3·15A 20mm Time Lag Glass Fuse	1 Pkt	(DA01B)
	20mm Fuse Clip Type 2	2	(KU27E)
	1mm Single-ended PCB Pin	1 Pkt	(FL24B)
	14-pin DIL Socket	1	(BL18U)
	0·71mm 22swg Tinned Copper Wire	1	(BL14Q)
	16/0·2 Wire 10m Red	1	(FA33L)
	16/0·2 Wire 10m Black	1	(FA26D)
	M3 10mm Insulated Spacer	1 Pkt	(FS36P)
	M3 25mm Insulated Spacer	1 Pkt	(FS39N)
	M3 10mm Steel Screw	1 Pkt	(JY22Y)
	M3 16mm Steel Screw	1 Pkt	(JY24B)
	M3 Steel Nut	1 Pkt	(JD61R)
	M3 Shakeproof Washer	1 Pkt	(BF44X)
	Mylar Speaker 76mm Square	1	(YN01B)
	Red Knob Type RN15	1	(FE76H)
	Blue Knob Type RN15	1	(FE74R)
	Push-on Receptacle	1 Pkt	(HF10L)
	Push-on Receptacle Covers	1 Pkt	(FE65V)
	Stick-on Feet Square	1 Pkt	(FD75S)
	¼in. Hole Plug	1	(JX60Q)
	PCB	1	(GJ75S)
	Box	1	(BL96E)
	Instruction Leaflet	1	(XZ28F)
	Constructors' Guide	1	(XH79L)

OPTIONAL (Not in Kit)

	12V 1·2Ah Lead-Acid Battery	1	(YJ69A)

The Maplin 'Get-You-Working' Service is available for this project, see Constructors' Guide or current Maplin Catalogue for details.

The above items (excluding Optional) are available as a kit, which offers a saving over buying the parts separately.

Order As LT93B (Signal Activated Amplifier) Price £39.99

Please Note: Where 'package' quantities are stated in the Parts List (e.g., packet, strip, reel, etc.), the exact quantity required to build the project will be supplied in the kit.

The following new items (which are included in the kit) are also available separately, but are not shown in the 1996/97 Maplin Catalogue.

Signal Activated Amplifier PCB **Order As GJ75S Price £3.69**

Signal Activated Amplifier Box **Order As BL96E Price £17.99**