

Hifi Auto-Switch

Turns your system off automatically

Do you often inadvertently leave your hifi system running for days on end? Do you have a problem with a messy array of power plugs "piggy-backed" into a wall socket? Would you like your entire system to switch off automatically at the conclusion of a record or tape? If the answer to any of these questions is "Yes" then our Hifi Auto-Switch presents a neat solution to your problem.

by JOHN CLARKE

Anyone who owns a hifi system must have often had the experience of inadvertently leaving the system on for long periods of time, even for days on end. Perhaps the phone rings or someone knocks at the door; or one of your children falls out of a tree. Some event like that causes you to stop the tape or record, just for a the time being. Thus distracted, you forget to restart the system or turn it off. Or maybe the cassette or record has come to an end, leaving the gear still on.

Our Hifi Auto-Switch solves that problem neatly: it senses that the system is no longer handling a signal and, after a 30-second delay, turns all the equipment off. When power is first applied, there is a full one minute delay, for a record or tape to be started, before the unit will turn off.

Of course, if your equipment is well designed and reliable it should make no difference if it is left on indefinitely. But there are many people who do not like the thought of having their equipment left on inadvertently, and needlessly consuming power. In these days, when we are more conscious of energy waste, that is a good attitude to have.

Maybe you are not worried about energy wastage (shame) but are one of those people who find it irksome to have to switch on or turn off three, four or more pieces of equipment in your system. Our Hifi Auto-Switch solves that problem as well as neatly solving the untidy tangle of power cords from the various pieces of equipment.

Maybe you are one of those few remaining purists who persists in using a manual turntable. Isn't it annoying to be greeted by a constant "cher-wuffle-squeak . . . cher-wuffle-squeak . . ." at the end of the record? Our Hifi Auto-Switch can solve that problem too.

The unit has been tested on many records and works well on all except the old shellac 78's. The surface noise

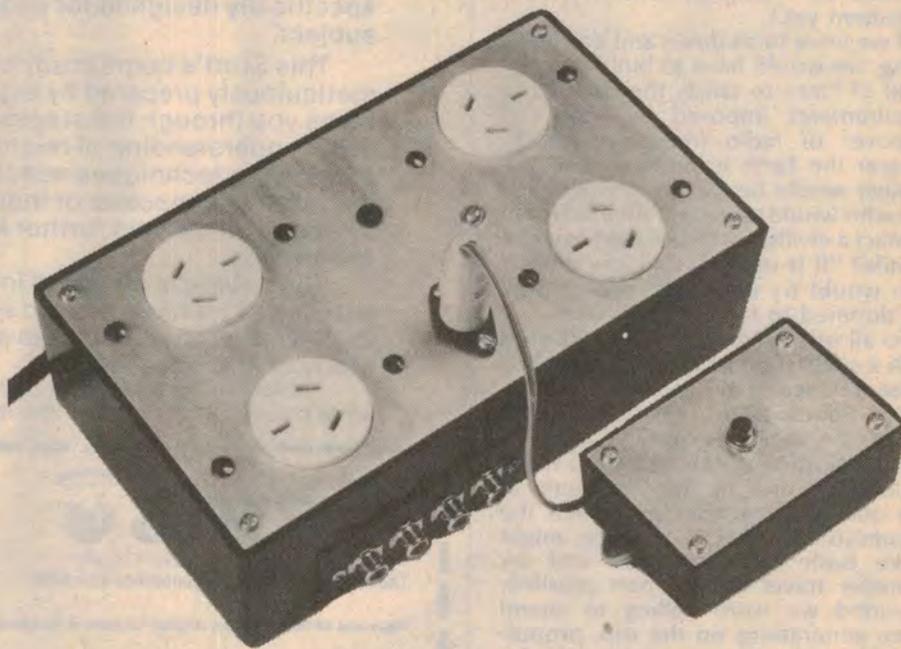
from these was so high that it is impossible to distinguish the program from the surface noise! Records with a pronounced click at the end of the record did not affect the operation of the turn off mechanism.

The Hifi Auto-Switch is split into two parts. One, a box with four flush-mounting AC outlets is hidden away behind your system. The idea is to connect the power cords of your equip-

the signal present, in one channel, at the tape recording outputs of the amplifier or receiver. So that you still have full use of the recording facilities, the Auto-Switch has parallel connected RCA sockets which duplicate the tape outputs from the amplifier.

With the tape out facility in use, there is no degradation in signal-to-noise ratio compared to using the "tape-out" directly from the amplifier. The loading effect of the circuit upon the tape output was -0.25dB — a negligible effect.

The circuit of the Auto-Switch is simple and uses cheap and readily available components. Three low-cost ICs, one relay, two transistors and a few diodes comprise the major part of the circuitry. Refer now to the circuit diagram. The Auto-Switch is permanently connected to the mains. Its power consumption, about two watts, is negligible.

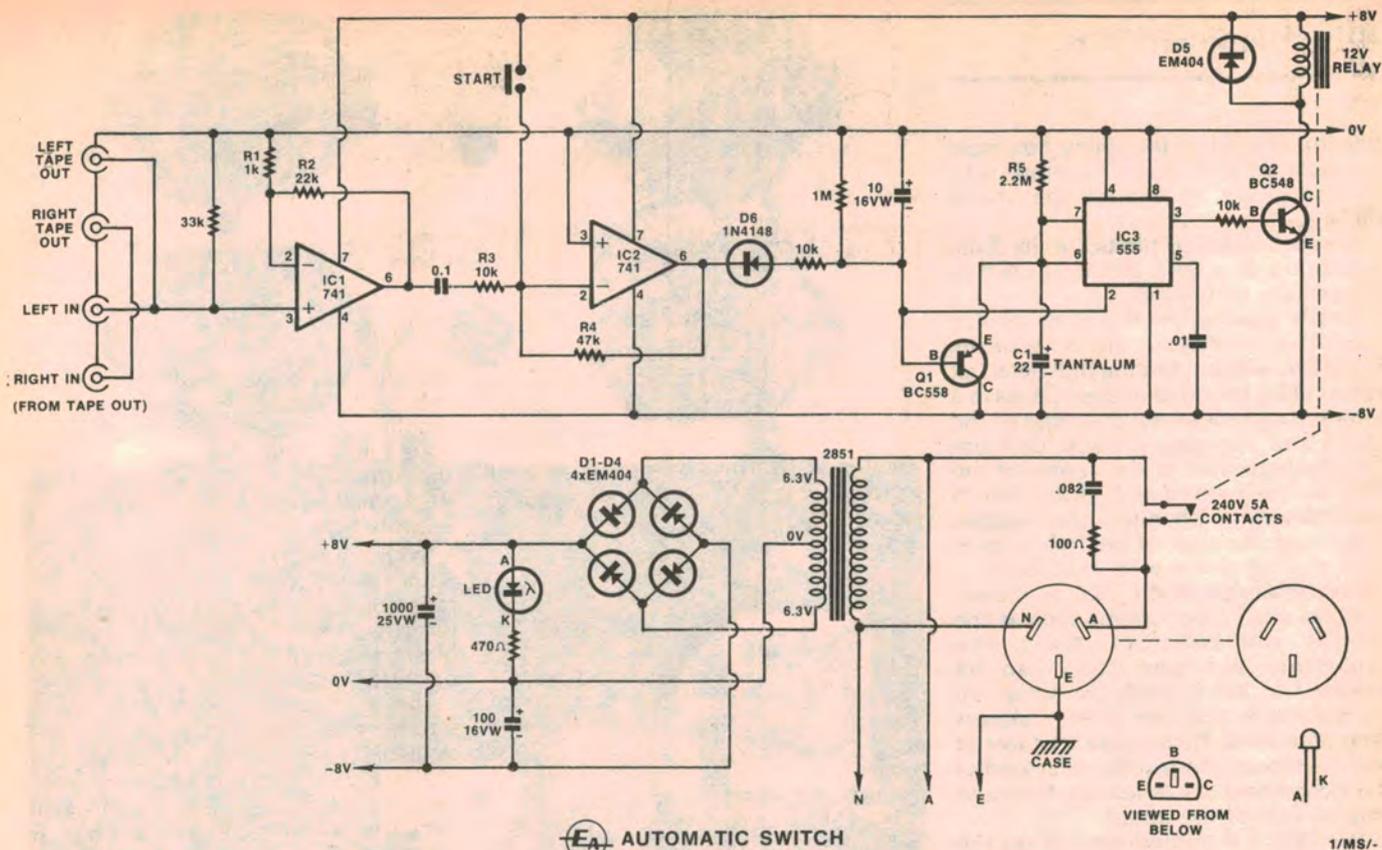


The larger box can be placed out of sight behind your hifi system.

ment to this box so that they can be all turned off automatically. You then turn the system on by pushing a button on a small remote control box which can take its place unobtrusively on a shelf next to your amplifier or receiver.

There is no need to modify any of your existing equipment to use the Hifi Auto-Switch. It works by monitoring

A small transformer with centre-tapped 12.6V secondary winding feeds a bridge rectifier to provide supply rails of $\pm 8\text{V}$ (nominal) with an unusual connection of the electrolytic filter capacitors. Note that the 1000 μF filter capacitor is connected across the full 16V supply while the 100 μF is connected between 0V and -8V.



E-A AUTOMATIC SWITCH

The Auto-Switch circuit monitors the amplifier tape outlets and switches off the power 30 seconds after the signal ceases.

This unusual filter arrangement is used because the relay, which accounts for most of the current drain, and the sensitive low-power signal circuitry both run from the full 16V supply. Only the 555 timer IC runs from the -8V supply.

The audio signal present at the amplifier tape outputs is amplified and detected by two 741 operational amplifier ICs which provide a total gain of over 100. IC1 is a non-inverting amplifier with an input impedance of 33k. This relatively low value of input impedance is provided to ensure stability. The output of IC1 is capacitively coupled to inverting amplifier IC2. The output of IC2 is rectified by diode D6.

Now consider IC3, the 555 timer IC and transistor Q1. As long as D6 is maintaining the voltage at the base of Q1 negative with respect to its emitter, Q1 will be conducting and C1 will be discharged. This will mean that the output of the 555 (pin 3) will be high with respect to the -8V supply rail and so Q2 will conduct and maintain the relay in an energised condition. This means that power is supplied to the external hifi equipment.

If the input signal to IC1 is removed, D6 will no longer be able to hold Q1 off and so, after a minimum delay of about 30 seconds, (depending on the charge on the 10uF capacitor) C1 will charge to the point where the 555 triggers and its output at pin 3 goes low. This turns off

Q2 and the relay contacts are opened, turning off the hifi equipment. Diode D5 protects Q2 from damage caused by inductive kickback when the relay is turned off.

We estimate that the current cost of parts for this project is approximately

\$29

including sales tax.

To turn on the hifi equipment, the remote switch is closed which pulls the inverting input of IC2 high. The output IC2 goes fully negative (almost to -8V) as a result which causes Q1 to discharge and reset the 555 so that its output is high once again. This causes Q2 to conduct and energise the relay so that power is applied to the hifi equipment.

60 SECOND INITIAL DELAY

Because the starting sequence charges the 10uF capacitor to almost -8V, (which turns Q1 fully on) there is an extra time delay involved before the relay can turn off, if no audio signal appears. So, whereas, the minimum time delay for switch-off after cessation of the audio signal is about 30 seconds, a full minute after initial switch-on will pass before the relay opens if no audio signal appears at the input.

The RC network across the relay contacts is there to prevent mains transients at switch-off from producing loud "bangs" through your loudspeakers. They are not mounted on the PCB but are accommodated on the insulated mains terminal block.

The sensitivity of the circuit has been selected to suit the signal levels present at the tape recording outputs of most stereo amplifiers and receivers. To maintain the relay in a closed condition, the audio signal must exceed 20 millivolts RMS for brief periods at intervals of no more than about 30 seconds.

If some adjustment is necessary, R2 can be increased for more gain, but do not increase it past 100k.

We should also mention that the Hifi Auto-Switch can be used as a Vox control. It can monitor for the presence of audio signal and, if present, will turn on the equipment. The signal threshold for this mode is 40 millivolts RMS for "turn-on" and 20 millivolts RMS for "turn-off".

CONSTRUCTION

Our prototype was assembled into a plastic utility box supplied by Dick Smith Electronics. Measuring 196 x 113 x 60mm, the box has multiple internal slots for mounting printed circuit boards or other hardware. The PCB is designed to fit these slots or, if a different box is used, can be mounted conventionally using spacers. The PCB is coded 80au3 and measures 56 x

HIFI AUTO-SWITCH

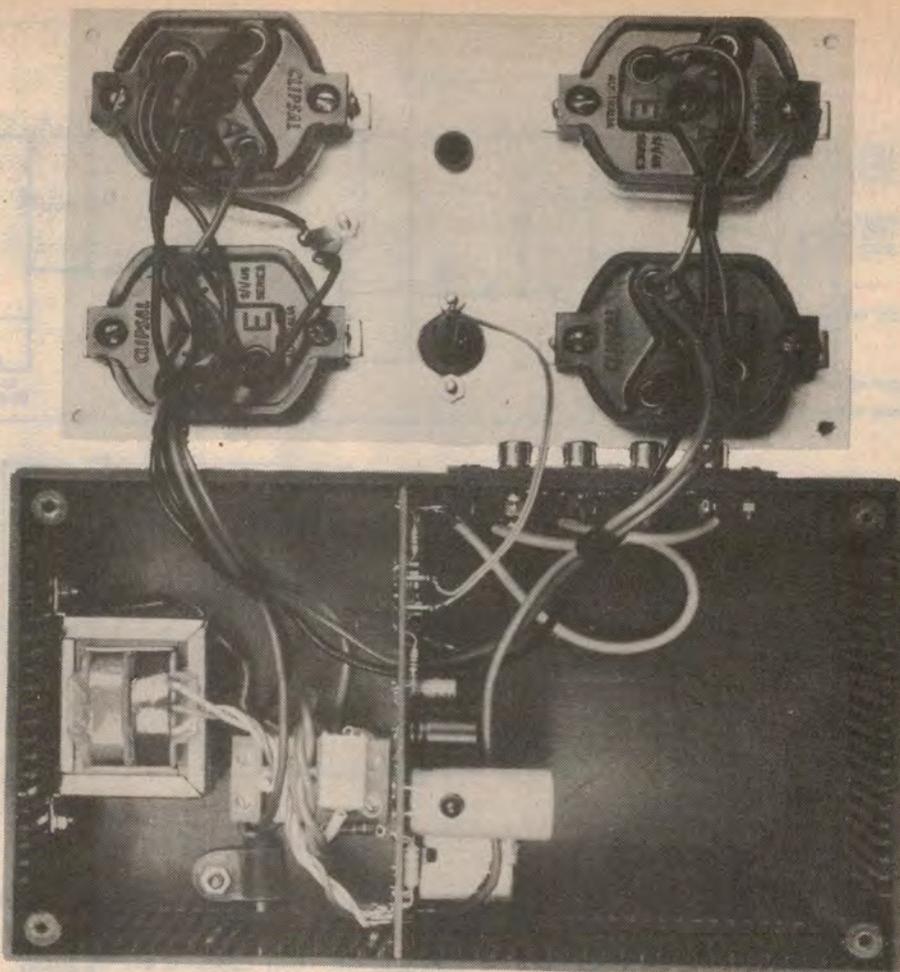
106mm. The lid of the utility box must be replaced with one of a more substantial gauge to mount the mains sockets.

A much smaller plastic utility box, measuring 83 x 54 x 28mm, is used as the remote switch box.

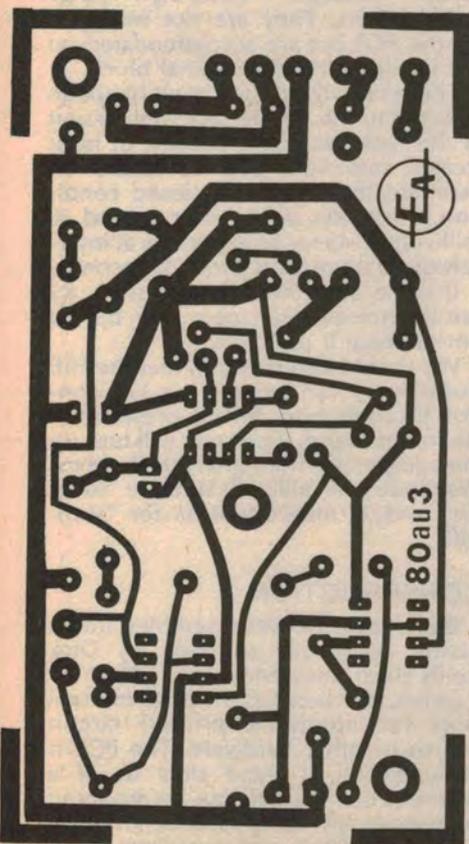
Before assembling the PCB, its size should be trimmed so that it fits neatly in the box without fouling the metal lid. When filing the edge of the PCB leave a ½mm margin between the edge of the board and the copper track. Drill the 5mm hole located at the centre of the PCB, for the neutral and earth wires to pass through. Chamfer the copper away from the edge of the hole to prevent chafing of the wire insulation.

Start assembly of the PCB by mounting the small components such as the diodes and resistors. Next, the capacitors and transistors can be soldered in place. Lastly the relay can be mounted. The use of PC stakes is recommended. Please note that five of the six connections on the relay end of the board have wires leaving from the copper side of the board.

The LED is mounted directly on the PCB and has to line up with the hole on the metal lid. Bend the LED leads virtually flush with the plastic moulding and solder the LED in place at about



Below is the actual size artwork for the PCB while above right is the internal view of the Auto-Switch wiring.



PARTS LIST

- 1 sheet of 1.5mm aluminium, 190 x 107mm
- 1 plastic utility box 83 x 54 x 28mm
- 1 plastic utility box 196 x 113 x 60mm
- 4 3-pin flush-mount mains sockets (Clipsal S/1/415 series)
- 1 transformer, 12.6V CT 150mA, Ferguson 2851, DSE2851 or similar.
- 1 PC mounting 12V relay, SPDT 5A 240V contacts, 265-12-C2 or similar
- 1 PCB 80au3 56 x 106mm
- 1 4-way RCA socket panel
- 1 2-pin DIN panel socket
- 1 2-pin DIN line plug
- 1 4-way mains terminal strip
- 1 miniature pushbutton switch
- 1 mains cord and three-pin plug
- 2 solder lugs
- 2 grommets, 2 small, 2 large
- 1 cord clamp
- 1 short length of shielded cable
- 1 length of two-core flex (low voltage)
- ½ metre of each: red, black and green 23 x 0.19mm 250V hook-up wire.

SEMICONDUCTORS

- 5 EM404, 1N4004 1A 400V PIV silicon diodes
- 1 0.5mm red LED and bezel

- 1 1N4148 small signal diode
- 1 BC548 NPN transistor
- 1 BC558 PNP transistor
- 2 741 operational amplifiers (8 pin)
- 1 555 DIL package timer (8 pin)

CAPACITORS

- 1 1000uF/25VW PC mount electrolytic capacitor
- 1 100uF/16VW PC mount electrolytic capacitor
- 1 10uF/16VW PC mount electrolytic capacitor
- 1 22uF/35VW tantalum capacitor
- 1 0.1uF metallised polyester (greencap) capacitor
- 1 0.01uF metallised polyester (greencap) capacitor
- 1 0.082uF/630VW or 250VAC polycarbonate capacitor

RESISTORS

- (¼W unless otherwise noted)
- 1 x 2.2M, 1 x 1M, 1 x 47k, 1 x 33k, 1 x 22k, 3 x 10k, 1 x 1k, 1 x 470 ohm, 1 x 100 ohm 1W.

MISCELLANEOUS

Screws, nuts, 10 PC stakes, solder.

NOTE: Components with higher ratings may be used provided they are physically compatible.

