the Mains Manager

by Mark Price

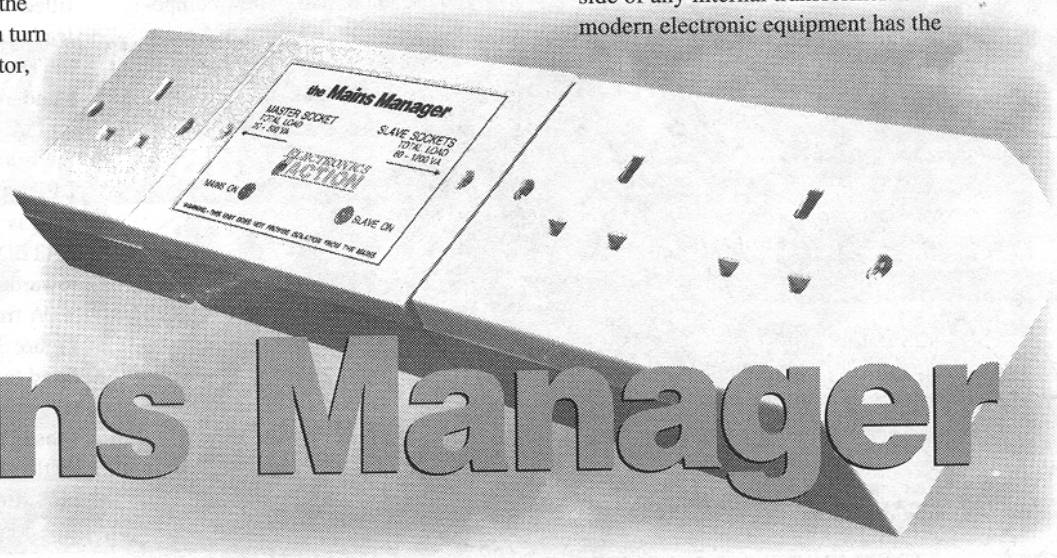
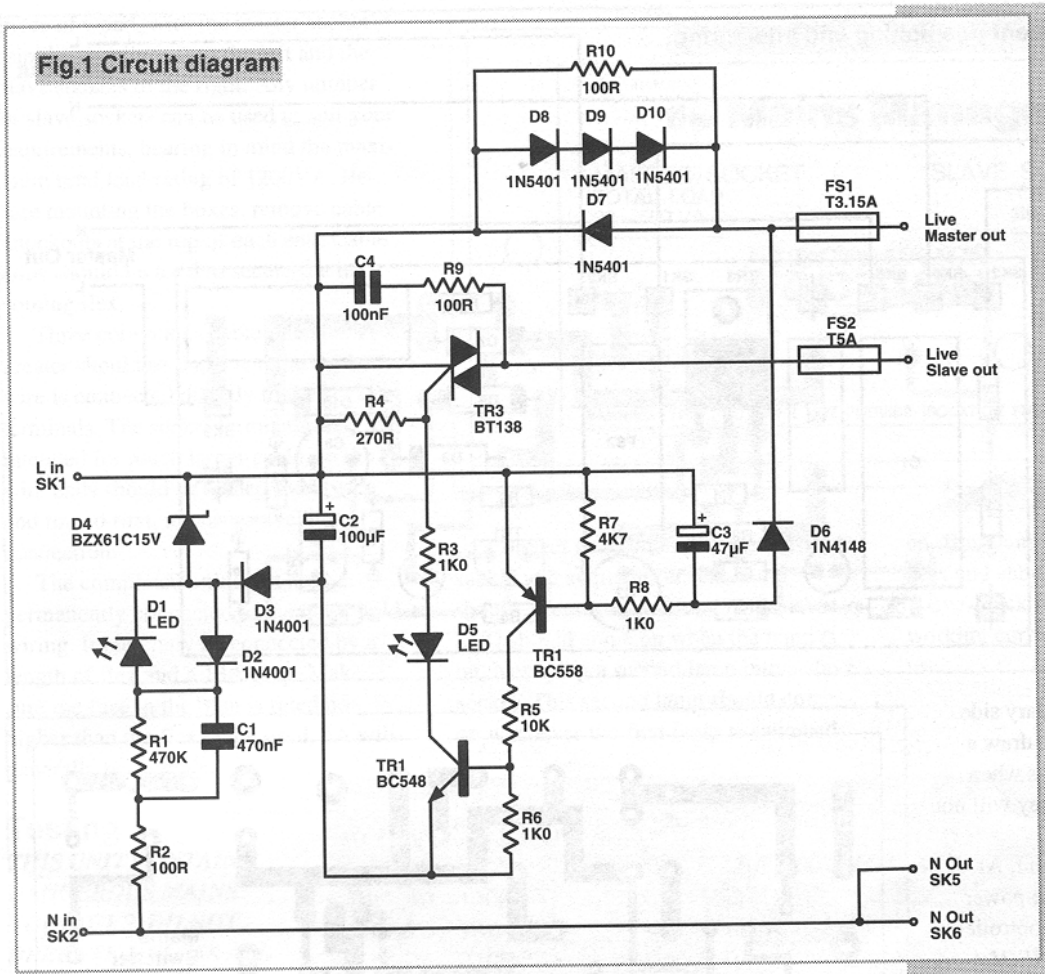


Fig.1 Circuit diagram



The Works

The full circuit is shown in Figure 1. The unit operates by sensing current from the master socket. D8, D9 and D10 act as the sensor and will drop about 1.8V when current is drawn. D7 carries the current on the opposite half cycles. The resulting 1.8V half cycle pulses charge C3 via D6. This capacitor will retain sufficient charge to hold TR2 on for about 200ms after the controlling load is switched off.

When TR2 is on, TR1 will also be switched on. This turns on triac TR3, which will then power the slave load. C4 and R9 form a snubber network to ensure the triac turns off cleanly with an inductive load. LED D5 indicates that the unit is operating.

C1 and D4 are effectively in series across the mains. The resulting -15V pulses across D4 are rectified by D3 and smoothed by C2. R2 limits the switch-on surge current, and R1 rapidly discharges C1 when the unit is unplugged. D1 will light whenever the unit is plugged into the mains; the current on the opposite half cycles are carried by D2.

If you've got a computer system, do you forget to switch off the printer sometimes. The problem is the number of separate power switches to turn off each night - PC, monitor, printer, modem, table lamp, radio - the list goes on! Normally these are connected to one of those four way trailing sockets, which will be plugged into one wall socket. If that socket is accessible, the equipment could be switched off there. In my case the socket is in the corner, behind the desk.

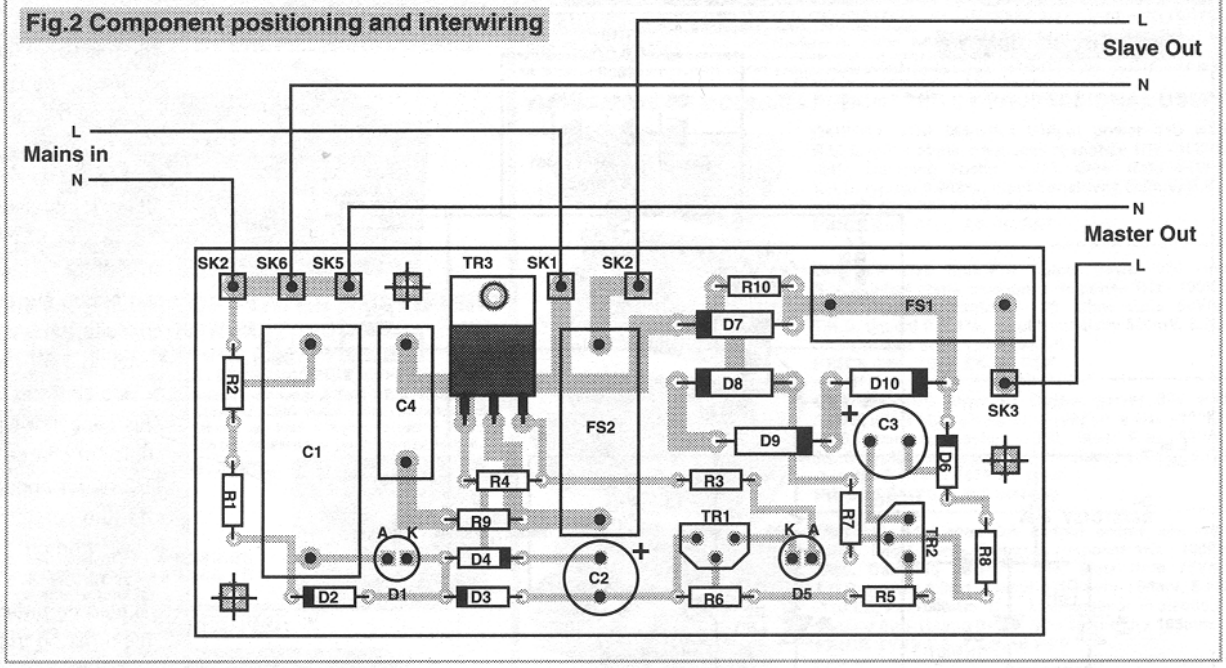
So what's the solution? This Mains Switcher will allow you to turn all the equipment on or off, by operating the switch on just one item. When you turn off the switch on the PC, the monitor, printer and other bits are powered down automatically. You can choose which item controls the system, by plugging it into the master socket - so you can use the table lamp to control everything if you want.

The unit works by sensing if current is being drawn from the master socket, if so it powers up the other (slave) sockets. The load on the master socket can be anything between 20 and 500VA, and the load on the slave sockets can be between 60 and 1200VA. None of the equipment used requires modification.

The unit may be useful for controlling hi-fi equipment, or your electronic test equipment. At Christmas time, you could use your indoor flashing tree lights to flash the lights on the tree outside! The options are limited only by your imagination.

The item connected to the master socket must be switched on the primary side of any internal transformer. Some modern electronic equipment has the

Fig.2 Component positioning and interwiring



power switch on the secondary side. Since these will continue to draw a small current from the mains when supposedly switched off, they will not control this unit correctly.

One important safety point. Although this unit removes the power from the equipment being controlled, ***IT DOES NOT PROVIDE ISOLATION FROM THE MAINS***. Before working inside any piece of equipment connected to this unit, it must be unplugged.

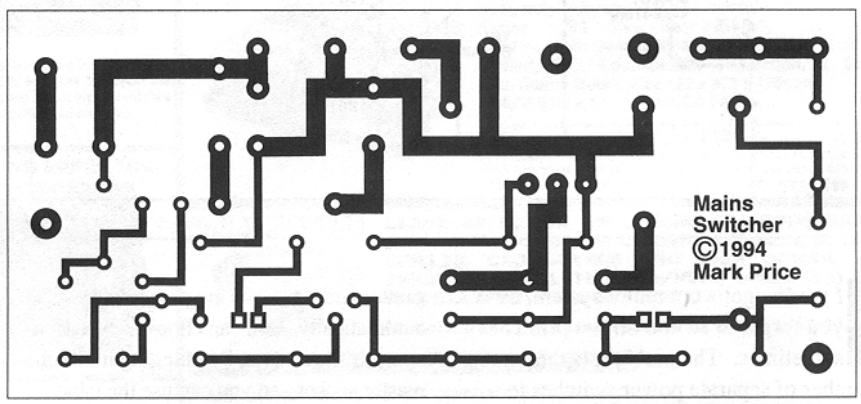


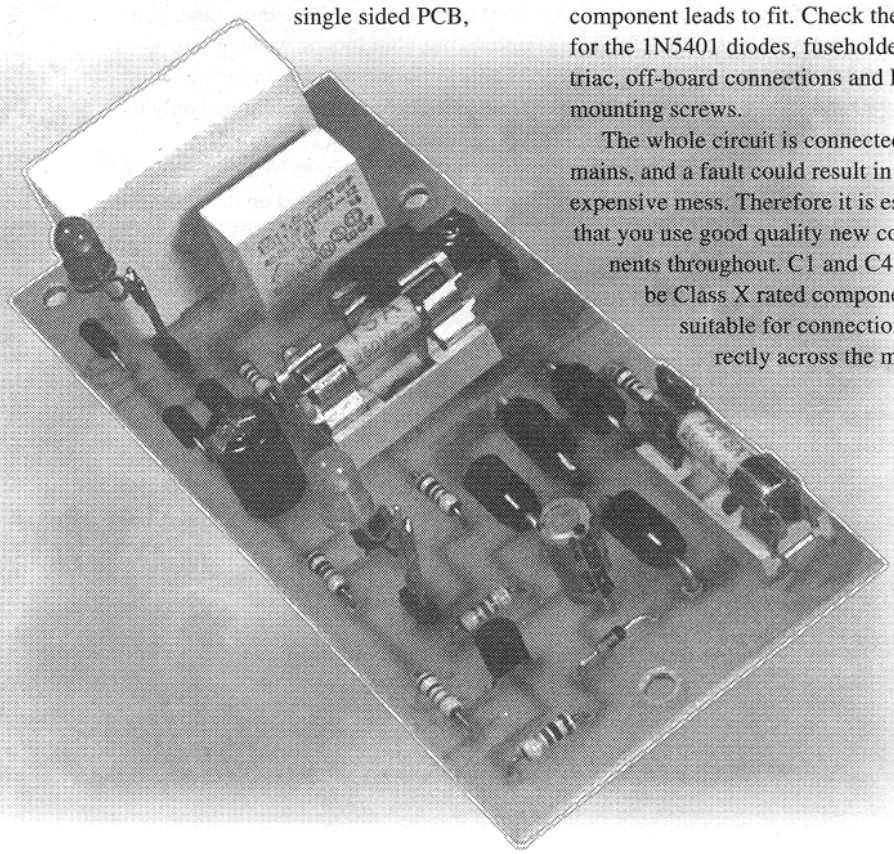
Fig.3 Foil Pattern

Construction

The PCB component overlay and track layout are shown in Figure 2.

The circuit is constructed on a small single sided PCB, which is available from Electronics in Action. You may need to enlarge some of the holes in the PCB, to allow the component leads to fit. Check the holes for the 1N5401 diodes, fuseholders, triac, off-board connections and PCB mounting screws.

The whole circuit is connected to the mains, and a fault could result in an expensive mess. Therefore it is essential that you use good quality new components throughout. C1 and C4 must be Class X rated components, suitable for connection directly across the mains.



Take extra care when assembling the PCB, to ensure that all components are fitted correctly and all soldered joints are sound. All the wide PCB tracks carry significant current, and should be reinforced by adding solder along their whole length.

The LED positions should be fitted with terminal pins. Once the PCB is fitted behind the front panel, the LED leads can be soldered to the pins.

The PCB is designed to fit into a standard electrical double socket surface box. A double blanking plate is used as the front panel, and is drilled to suit the LEDs and PCB mounting screws. The PCB is mounted on 25mm long INSULATED spacers, with the components towards the panel.

A front panel overlay is given in Figure 3. This may be photocopied and fixed to the panel with clear self adhesive vinyl sheet. Note that if this overlay is used the LED holes will not be directly above the LED positions on the PCB. Bend the LED leads to suit.

Screw the mounting box to a suitable

piece of wood, with the master socket (single unswitched) to the left and the slave sockets to the right. Any number of slave sockets can be used to suit your requirements, bearing in mind the maximum total load rating of 1200VA. Before mounting the boxes, remove cable knockouts at the top of each end. Cable clips should be used to secure the incoming flex.

Three core mains cable rated at 5A or greater should be used, and the earth wire is connected directly to the socket terminals. The socket terminals are intended for much larger cable, so the wire ends should be folded over twice and tinned first, to ensure a reliable connection.

The completed unit must not be permanently connected to the household wiring. It may only be connected by a length of flex and a 13A plug. Make sure the fuse in the plug is rated no higher than the flex being used, 5A will generally be suitable.

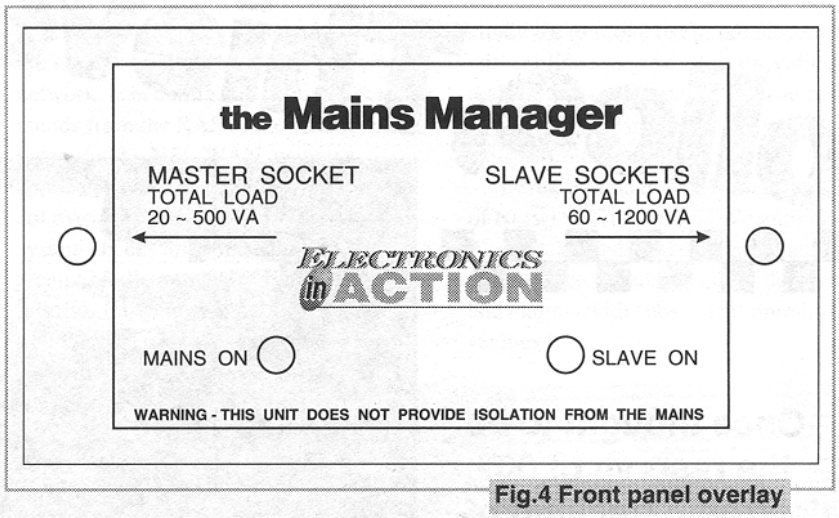


Fig.4 Front panel overlay

Testing

THIS UNIT CONTAINS DANGEROUS MAINS VOLTAGES. DO NOT OPERATE UNLESS ALL COVERS ARE IN PLACE. MAINS ELECTRICITY CAN KILL. PLEASE BE VERY CAREFUL.

If the unit has been carefully constructed there is no reason why it should not work first time.

Do not plug anything into the master or slave sockets initially. Plug the unit into the mains, via an RCD or earth leakage circuit breaker if possible. The Mains LED (D1) should light and the Slave LED (D5) should remain off.

Connect a table lamp to the master socket and switch it on. The lamp should operate as usual, and the Slave LED should come on when the lamp is on. Now plug a second lamp into a slave socket. This second lamp should come on whenever the first lamp is switched on. Both lamps should be at full brightness and should not be flickering. If the above check is successful, the unit is working correctly, and can be put into use.

Parts

Resistors

(0.25W 5% or better)

R1	470K
R2,9,10	100R
R3,6,8	1K0
R4	270R
R5	10K
R7	4K7

Capacitors

C1	0.47µF 250VAC Class X
C2	100µF 25V
C3	47µF 16V
C4	0.1µF 250VAC Class X

Semiconductors

TR1	BC548
TR2	BC558
TR3	BT138-600 or other 10A 600V triac
D1	Green LED
D5	Yellow LED
D2,3	1N4001
D4	BZX61C15V (15V 1.3W zener)
D6	1N4148
D7,8 D9,10	1N5401

Additional Components

FU1	T3.15A 20mm Fuse in PCB fuseholder
FU2	T5A 20mm Fuse in PCB fuseholder

PCB Double blanking plate and 30mm surface box.
Single unswitched socket and 30mm surface box.
Sockets and 30mm surface boxes as required for slave sockets.
13A plug with 5A fuse.
5A (or greater) 3 Core mains flex.
Piece of wood for backing board.
Wood screws.
Cable tacks.
M3 screws and 25mm insulated spacers.