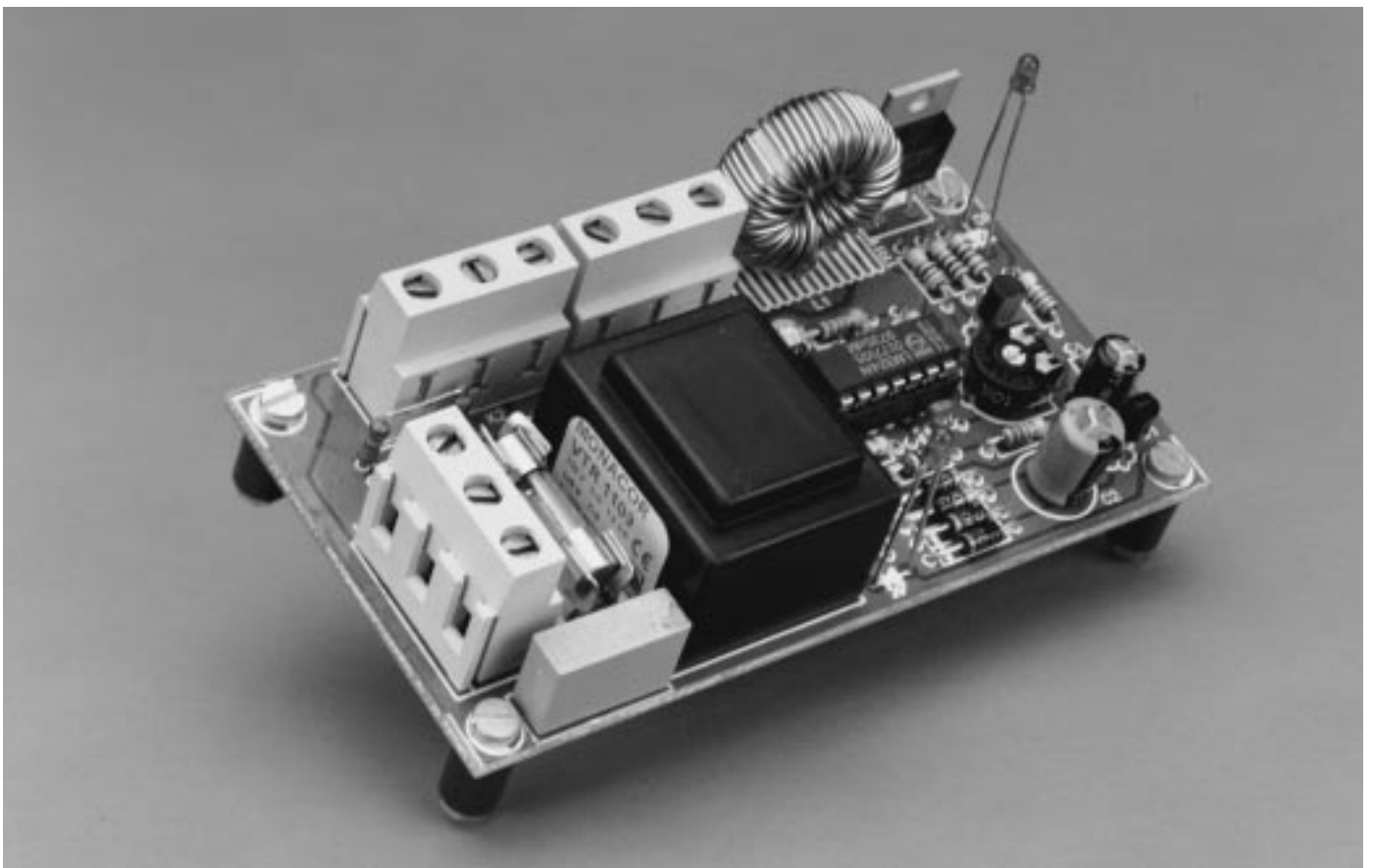


Many PCs have a switched mains outlet that enables your computer and monitor to be switched on at the same time. However, because it is not designed to supply high currents, this outlet should not be used to switch on too many peripherals. If you want to use the on/off switch on your PC to power up the whole computer workstation, you should use a so-called master/slave switch. Unfortunately, most commercial models and kits offer poor performance when switch-mode power supplies are hooked up as the master equipment.

Design by T. Scherer

master/slave switch 'deluxe'

switch on slave devices
safely and automatically



To enable the large number of peripherals connected to his Macintosh to be switched on together with the computer, the author "got hold of a master/slave switch DIY kit that came com-

plete with a printed circuit board, and an enclosure with the necessary plug and sockets. Alas, such gizmos do not work very well when the master device is a switch-mode power sup-

ply. I heard crackling and ticking sounds, and sometimes the monitor and other peripherals would suddenly come to life with the computer switched off."

Musing on this problem the author started to design a master/slave switch which is virtually immune to voltage surges and other irregularities, and sent his practical circuit to *Elektor Electronics*.

The circuit

The circuit shown in **Figure 1** may be thought of as consisting of three parts: an ordinary 5-V power supply, a current sensor and a comparator with a power output driver. The mains voltage is connected to K1, the master, to K2, and the slave, to K3. Apart from a fuse, F1, there is only the current sense resistor, R5, between K1 and K2. As soon as current starts to flow to the master, R5 drops an alternating voltage which is limited to ± 0.7 V by D5 and D6. R5, incidentally, allows a master power consumption of up to 600 watts. Low-pass filter R7-C4 removes high-frequency noise from the alternating voltage. As mentioned above, it is particularly this type of noise that wreaks havoc in commercial master/slave switches. IC2a amplifies the positive half-cycles about 3 times, while D7 blocks the negative half-cycles. In this way, a pulsating direct voltage is created whose peak value is stored in capacitor C6. Buffer IC2b completes the current-sense sub-circuit.

The next comparator, IC2c, defines the switch-on threshold of the circuit. The green low-current LED D8 not only acts as an on/off indicator (i.e. circuit connected to the mains), but also provides a stable reference voltage of about 2 volts. Preset P1 allows a threshold to be set that corresponds to any master power consumption between 10 W and 100 W. Resistor R9 adds a little hysteresis to the comparator, preventing its output from 'chattering'. The red LED, also a low-current type, lights when the comparator output drops low. This means that the circuit is active. Inverter stage T1, finally, is included to provide sufficient gate current for triac Tri1.

The triac used here is an SGS-Thomson device marked by an extremely sensitive gate — the device is triggered by a current as low as 5 mA. Moreover, the BTA04-600T does not require a so-called snubber network that is normally indispensable with triacs. The triac is capable of switching up to 4 A, allowing slave equipment with a power consumption of just under 1 kW to be connected. A ready-made suppressor coil, L1, is included to attenuate transients and RF interference. The same triac family

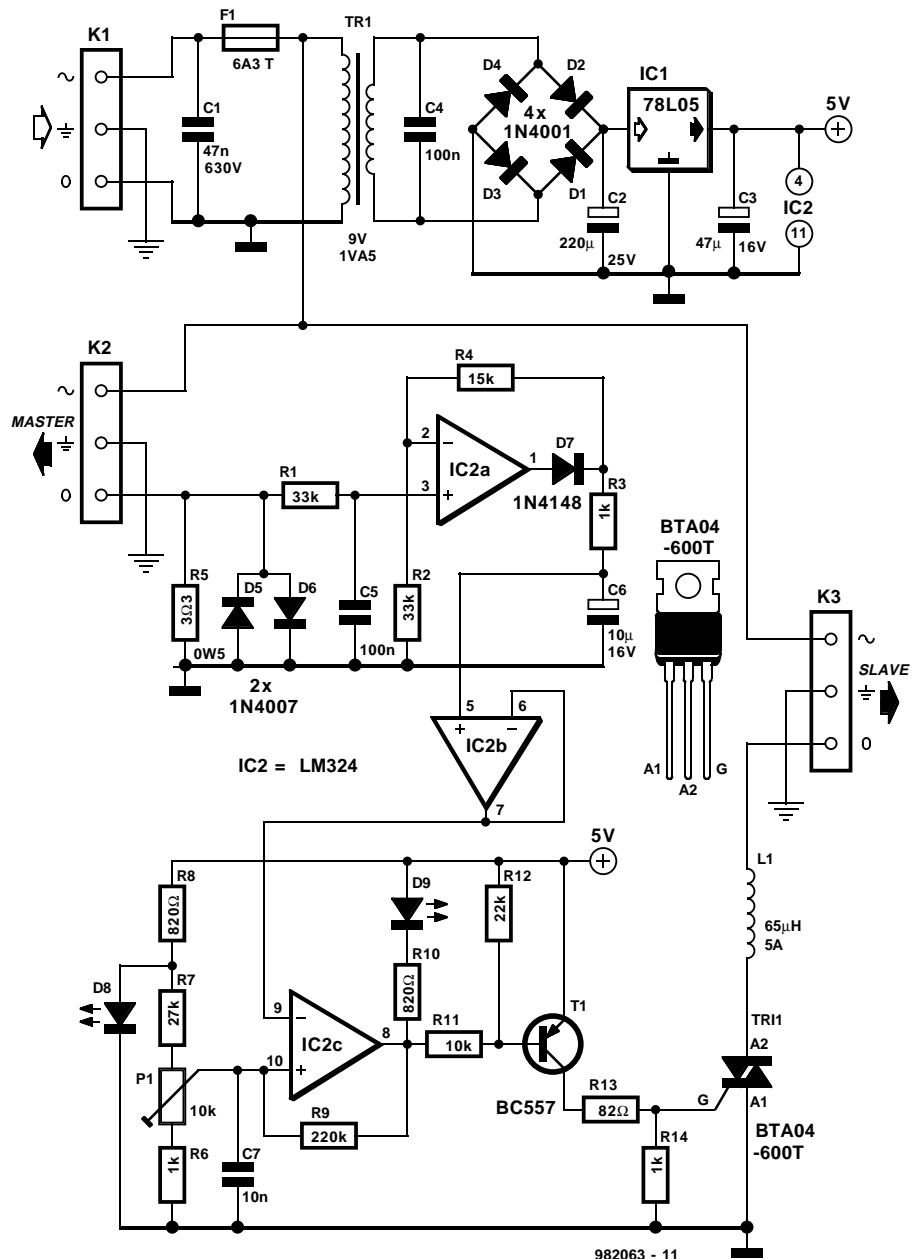


Figure 1. The circuit of the master/slave switch consists of three functional sections.

includes types with a switching capacity of 6 A (BTA06-600T), and 8 A (BTA08-600S). Although it is possible, in principle, to use these devices in the present circuit, the PCB then has to be modified to cope with the higher currents: strengthen the high-current tracks by soldering solid wire over them, increase the wire diameter of L1 from 1.0 mm to 1.5 mm, and exchange the fuse with a type rated for the higher current.

The circuit has a conventional power supply. A small mains transformer, Tr1, a rectifier, D1-D4, and a reservoir capacitor, C2, provide a raw direct voltage which is stepped down and stabilised at 5 V by fixed-voltage regulator IC1. By the way, the circuit itself has a modest power consumption of just 200 mW.

Construction: safety first

Before you start soldering away, do take note of the following: the circuit, including the low-voltage section, is not electrically isolated from the mains. The circuit must, therefore, not be built on any other circuit board than the one shown in **Figure 2**, which has been designed to comply with every requirement in respect of electrical safety.

Start the construction of this project by fitting the low-profile parts, and work your way 'up' to the taller parts, with the transformer soldered as the last component. The two LEDs are mounted at such a height that they fit snugly in the holes drilled in the enclosure top panel. Two properly isolated, transparent lenses not only contribute

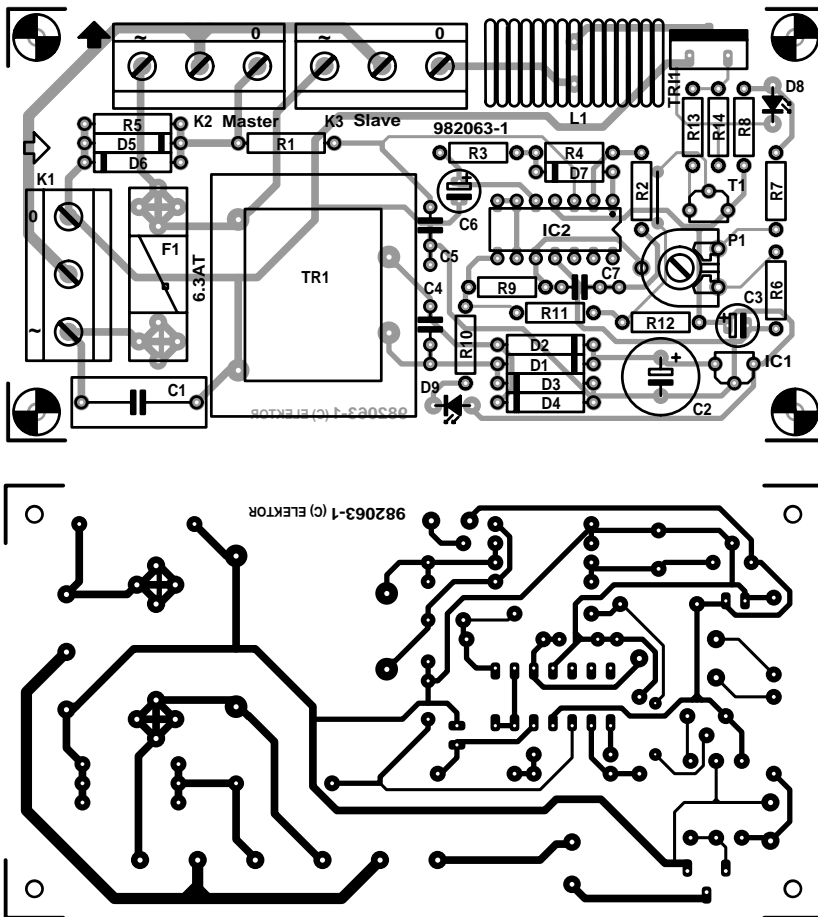
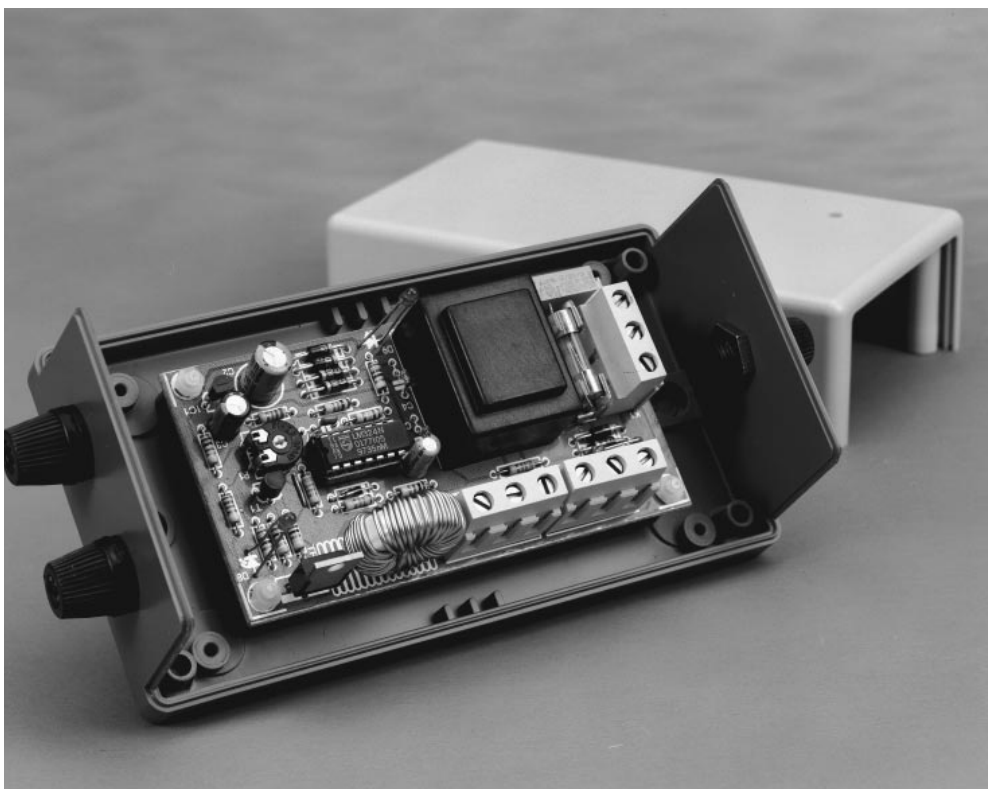


Figure 2. The carefully designed PCB ensures safe constructing.

Figure 3. It is essential that the circuit be mounted so that it can not be touched when in operation.



COMPONENTS LIST

Resistors:

- R1,R2 = 33k Ω
- R3,R6,R14 = 1k Ω
- R4 = 15k Ω
- R5 = 3 Ω , 0.5 W
- R7 = 27k Ω
- R8,R10 = 820 Ω
- R9 = 220k Ω
- R11 = 10k Ω
- R12 = 22k Ω
- R13 = 82 Ω
- P1 = 10k Ω preset H

Capacitors:

- C1 = 47nF 630V (Class X2)
- C2 = 220 μ F 25V radial
- C3 = 47 μ F 16V radial
- C4,C5 = 100nF
- C6 = 10 μ F 16V radial
- C7 = 10nF

Semiconductors:

- D1...D4 = 1N4001
- D5,D6 = 1N4007
- D7 = 1N4148
- D8,D9 = LED
- T1 = BC557
- Tri1 = BTA04-600T (SGS-Thomson)
- IC1 = 78L05
- IC2 = LM324

Miscellaneous:

- F1 = Fuse 6.3A slow with PCB mount holder
- K1,K2,K3 = 3-way PCB terminal block, pitch 7.5mm
- Tr1 = mains transformer, PCB mount (Conrad Electronics o/n 506052)
- L1 = suppressor choke 65 μ H/5 A (Conrad Electronics o/n 534439)
- Heatsink for Tri1 (Fischer SK59)
- 2 LED lenses, transparent (Conrad Electronics o/n 539910)
- PCB, order code 982063-1 (see Readers Services page).

to the 'professional' look of the master/slave switch, but also afford touch protection — after all, the LEDs, too, may be at mains potential!

The completed and (visually inspected) circuit board is mounted 'touch-proof' in an ABS case. Our lab prototype is shown in Figure 3. Please be sure to undertake the adjustment of P1 with an insulated screwdriver — we do want to keep you as a reader!

(982063-1)