

Short Circuits

DRILL SPEED CONTROLLER

IF YOU'VE EVER HAD TO USE your drill for anything but holes in aluminium panels, you will know how useful a speed controller is! Masonry bits need a very slow speed to be effective (they work at high speed, but not for very long); wood drills need a medium speed (too fast and the wood bursts into flames!); metalwork usually needs the full speed but better control can be obtained with the exact speed for the drill/bit combination.

The circuit used is not the most sophisticated available but it is reliable and cheap. As mains voltages are involved in all parts of the circuit, extreme care should be taken, when constructing, to make sure nothing can come loose or touch anything it shouldn't. Also all exposed metalwork *must* be connected to mains earth.

Because of the simplicity of the circuit, some juddering may occur at low speed. Inserting capacitor C1 across RV1 will reduce this effect, however, the torque will be slightly reduced. The value of C1 can be from 1uF to 4uF (63 VWG at least).

CONSTRUCTION

We used a PCB as this ensures that the parts can't move around (very dangerous at mains voltage), also the SCR uses it as a small heatsink. A 13 amp socket was used as the prototype as this gives maximum flexibility - however, your drill could be wired straight in if you intend to use the same drill all the time.

R1 is specified as a 10W device. Don't use one with lower rating as it will get very hot - as rated it gets warm so keep all wires away from it.

If C1 is used, make sure it's positive side is connected to R1 (point X on PCB overlay), otherwise it will self-destruct!

SCR1 is bolted to the PCB and must make electrical contact with the copper side, which also acts as a heatsink. Because of this, the PCB *must* be mounted on insulating pillars.

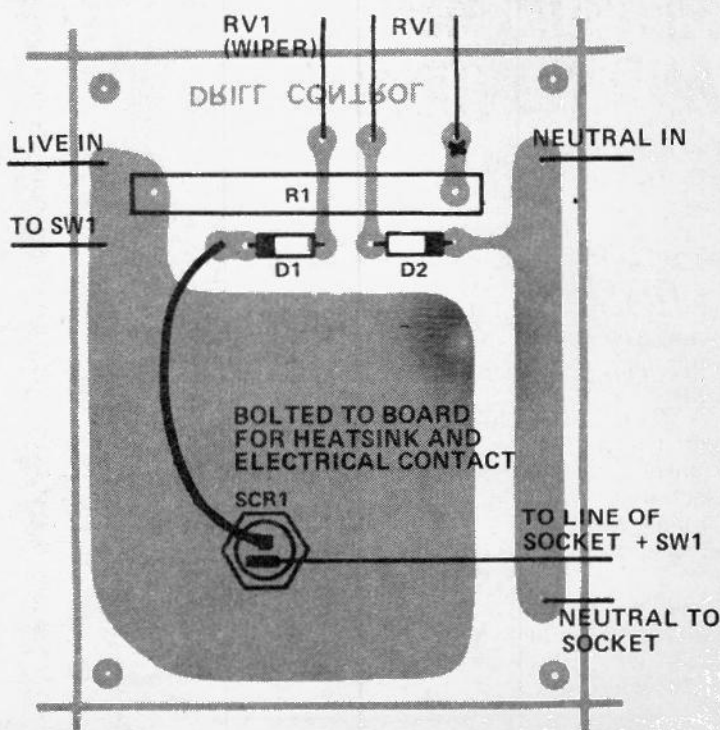
A 3 amp fuse should be fitted to the controller's mains plug to protect the circuit from any faults in the drill.



How it works

The silicon-controlled rectifier conducts in one direction only, and then only when it has a voltage at its gate. This triggering signal is provided by the voltage from RV1 wiper rising enough to forward bias D2. Hence RV1 provides the trigger at different parts of the mains cycle, so turning on the SCR for different amounts of time according to its setting - hey presto: speed control!

As the back EMF from the motor tends to reverse bias D2, this affects the trigger point as well. In fact at low speeds the motor back EMF is lower, and so the gate voltage is higher, providing earlier triggering - more power. This to some extent compensates for excessive loading of the drill. Switch SW1 bypasses the SCR to give full speed.



Component overlay for Speed Controller

Parts List

RESISTORS:

R1 10k 10W wire wound
RV1 470R 3W wire wound

CAPACITOR:

C1 See text

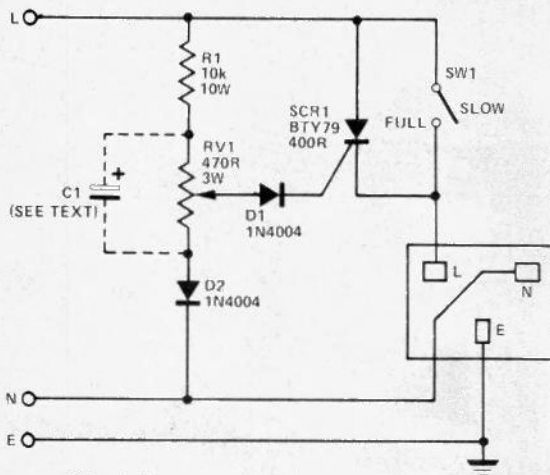
SEMICONDUCTORS:

D1, D2 1N4004
SCR1 BTY79/400R or similar
(6A 400 PIV)

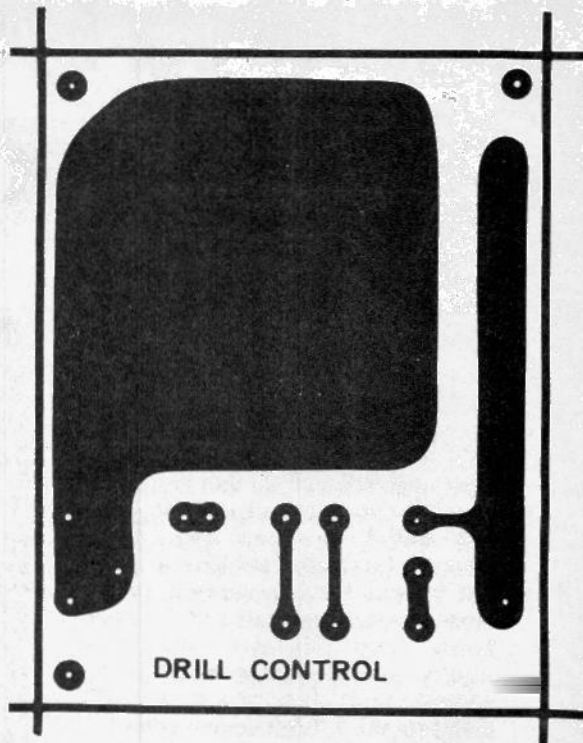
MISCELLANEOUS:

SW1 Single pole on/off
240V 5A
Case 6 x 3½ x 2in.
155 x 94 x 50mm.
3-pin mains outlet to suit
3-core mains cable
PC board, spacers, nuts, bolts, etc.
Cable grommet, clip, knob.

Cost around £6.00.



Circuit Diagram — Drill Speed Controller



DRILL CONTROL

Speed Controller — Foil Pattern — shown full size.

TRANSDUCERS IN MEASUREMENT AND CONTROL

TRANSDUCERS IN MEASUREMENT AND CONTROL

by PETER H SYDENHAM
M.E., Ph.D., M. Inst. M.C., F.I.C.A.

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