

QUASAR ELECTRONICS KIT No. 1074

DRILL SPEED CONTROLLER

General Description

If you work with an electric drill and unless you are lucky enough to own one of the most sophisticated models with speed control, you must have wished more than once that there were some means for adjusting the speed of the drill to suit the job at hand.

The project you are about to build will solve this problem and will provide you with a very useful tool for your workshop.

Technical Specifications - Characteristics

Working voltage: 220 V AC

Current: 3 Amps max.

Power: 700 Watts max.

How it Works

The circuit uses a thyristor to control the output voltage, and two transistors which are used to drive its gate. The output voltage is adjustable from few volts to the full input voltage of 220 V. The potentiometer P1 is used to adjust the output voltage and therefore the r.p.m. of the drill.

The power handling capacity of the circuit is 700 Watts and is supplied directly from the mains.

Construction

First of all let us consider a few basics in building electronic circuits on a printed circuit board. The board is made of a thin insulating material clad with a thin layer of conductive copper that is shaped in such a way as to form the necessary conductors between the various components of the circuit. The use of a properly designed printed circuit board is very desirable as it speeds construction up considerably and reduces the possibility of making errors. QUASAR ELECTRONICS Kit boards also come pre-drilled and with the outline of the components and their identification printed on the component side to make construction easier. To protect the board during storage from oxidation and assure it gets to you in perfect condition the copper is tinned during manufacturing and covered with a special varnish that protects it from getting oxidised and also makes soldering easier. Soldering the components to the board is the only way to build your circuit and from the way you do it depends greatly your success or failure. This work is not very difficult and if you stick to a few rules you should have no problems. The soldering iron that you use must be light and its power should not exceed the 25 Watts. The tip should be fine and must be kept clean at all times. For this purpose come very handy specially made sponges that are kept wet and from time to time you can wipe the hot tip on them to remove all the residues that tend to accumulate on it.

DO NOT file or sandpaper a dirty or worn out tip. If the tip cannot be cleaned, replace it. There are many different types of solder in the market and you should choose a good quality one that contains the necessary flux in its core, to assure a perfect joint every time. DO NOT use soldering flux apart from that which is already included in your solder. Too much flux can cause many problems and is one of the main causes of circuit malfunction. If nevertheless you have to use extra flux, as it is the case when you have to tin copper wires, clean it very thoroughly after you finish your work.

In order to solder a component correctly you should do the following:

- Clean the component leads with a small piece of emery paper.
- Bend them at the correct distance from the component's body and insert the component in its place on the board.
- You may find sometimes a component with heavier gauge leads than usual, that are too thick to enter in the holes of the p.c. board. In this case use a mini drill to enlarge the holes slightly. Do not make the holes too large as this is going to make soldering difficult afterwards.
- Take the hot iron and place its tip on the component lead while holding the end of the solder wire at the point where the lead emerges from the board. The iron tip must touch the lead slightly above the p.c. board.
- When the solder starts to melt and flow, wait till it covers evenly the area around the hole and the flux boils and gets out from underneath the solder. The whole operation should not take more than 5 seconds. Remove the iron and leave the solder to cool naturally without blowing on it or moving the component. If everything was done properly the surface of the joint must have a bright metallic finish and its edges should be smoothly ended on the component lead and the board track. If the solder looks dull, cracked, or has the shape of a blob then you have made a dry joint and you should remove the solder (with a pump, or a solder wick) and redo it.
- Take care not to overheat the tracks as it is very easy to lift them from the board and break them.
- When you are soldering a sensitive component it is good practice to hold the lead from the component side of the board with a pair of long-nose pliers to divert any heat that could possibly damage the component.
- Make sure that you do not use more solder than it is necessary as you are running the risk of short-circuiting adjacent tracks on the board, especially if they are very close together.
- When you finish your work cut off the excess of the component leads and clean the board thoroughly with a suitable solvent to remove all flux residues that still remain on it.

The circuit should not present any great difficulty to the constructor and the only word of caution that should be kept in mind is that as the circuit operates directly from the mains the construction should be very neat and careful if you wish to avoid future complications. Start building the circuit from the pins, solder then the resistors, the potentiometer and the capacitors in their places and continue your work with the semiconductors. The thyristor should be mounted on the heatsink provided in order to protect it from overheating if the circuit is used under heavy loads. The pins of the thyristor should be bend carefully in order to pass through the oval shaped hole of the heatsink and then through the holes of the p.c. board. Tighten the screw first to make sure that the thyristor makes good contact with the heatsink and then solder it taking care not to overheat it. Insert the two diodes as indicated on the component side of the board and solder them care fully. Finally solder the transistors taking care not to swap them around and avoiding prolonged heating of their leads.

Make a VERY CAREFUL visual inspection, clean the board thoroughly and connect your drill across points 3 and 4 of the circuit. Using a properly insulated and fused mains lead

apply 220 VAC at points 1 and 2 of the circuit. The drill should start and turning the spindle of the potentiometer should change its speed.

During all the testing treat the circuit as if it were at mains potential and do not touch any part of it. For the potentiometer you should use a plastic knob and if it is possible make your tests using a mains isolation transformer to reduce the risk of receiving an electric shock which at such voltages can be LETHAL.

For continuous use and after you make sure that the circuit is working properly we recommend that you use a plastic case to house your project. There is a suitable case made by QUASAR ELECTRONICS Kit for this project. Ask your dealer about QUASAR ELECTRONICS Box No. 2074. The circuit can also be used as a dimmer for resistive loads of up to 1 kW.

Adjustments

This kit does not need any adjustments, if you follow the building instructions.

Warning

QUASAR ELECTRONICS kits are sold as stand alone training kits.

If they are used as part of a larger assembly and any damage is caused, our company bears no responsibility.

While using electrical parts, handle power supply and equipment with great care, following safety standards as described by international specs and regulations.

CAUTION

This circuit works from the mains and there are 220 VAC pre sent in some of its parts. Voltages above 50 V are DANGEROUS and could even be LETHAL.

In order to avoid accidents that could be fatal to you or members of your family please observe the following rules:

- DO NOT work if you are tired or in a hurry, double check everything before connecting your circuit to the mains and be ready to disconnect it if something looks wrong.
- DO NOT touch any part of the circuit when it is under power.
- DO NOT leave mains leads exposed. All mains leads should be well insulated.
- DO NOT change the fuses with others of higher rating or replace them with wire or aluminium foil.
- DO NOT work with wet hands.
- If you are wearing a chain, necklace or anything that may be hanging and touch an exposed part of the circuit BE CAREFUL.
- ALWAYS USE a correct mains lead with the correct plug and earth your circuit correctly.
- If the case of your project is made of metal make sure that it is properly earthed.
- If it is possible use a mains transformer with a 1:1 ratio to isolate your circuit from the mains.
- When you are testing a circuit that works off the mains wear shoes with rubber soles, stand on dry non conductive floor and keep one hand in your pocket or behind your back.

If you take all the above precautions you are reducing the risks you are taking to a minimum and this way you are protecting yourself and those around you.

A carefully built and well insulated device does not constitute any danger for its user.

BEWARE: ELECTRICITY CAN KILL IF YOU ARE NOT CAREFUL.

If it does not work

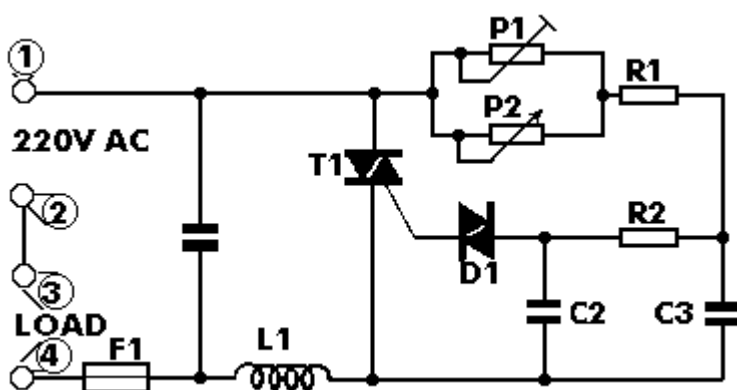
Check your work for possible dry joints, bridges across adjacent tracks or soldering flux residues that usually cause problems.

Check again all the external connections to and from the circuit to see if there is a mistake there.

- See that there are no components missing or inserted in the wrong places.
- Make sure that all the polarised components have been soldered the right way round. -
- Make sure the supply has the correct voltage and is connected the right way round to your circuit.
- Check your project for faulty or damaged components.

If your project still fails to work, please contact us for information about our Get-You-Going service.

Schematic Diagram



Parts List

All components including printed circuit board, assembly instructions including schematics and detailed parts list are supplied when you purchase the kit.

Ordering

For pricing info and online ordering please visit:

<http://www.quasarelectronics.com/1074.htm>

For further info please contact us by e-mail:

[mailto: sales@QuasarElectronics.com](mailto:sales@QuasarElectronics.com)

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