QUASAR ELECTRONICS KIT No. 1056

8-20 V/8 A STABILIZED POWER SUPPLY

General Description

A heavy duty power supply capable to meet the power requirements of the most demanding circuits. It has a power rating of 150 W and its output will stay constant under any type of load. Its high stability and the use of special RF filters to make the filter immune to RF interference make it particularly suitable for LINEAR amplifiers, and CB and FM transmitters.
The kit contains all the components necessary to build the power supply and the only thing that is extra is the mains transformer which should have a secondary winding of at least 24 V/8 A if you want to cover all the voltage range the circuit was designed for.

Technical Specifications – Characteristics

- Stabilised output voltage even at maximum current.
- Shorted output current limited and adjustable from 3 to 5 A.
- Fully protected against overloading and short circuits.
- RF filters incorporated to protect the circuit from interference that could affect its stability.

How it Works

The circuit is fairly simple as it consists of various different stages which have a different use each. First of all there is a bridge rectifier with its smoothing capacitors, there is a voltage control stage which drives a circuit consisting of four power transistors that keep the voltage constant and can handle quite heavy currents, and finally there is an electronic current limiter which constantly monitors the current drawn from the out put of the circuit and if that exceeds a certain level it switches the supply off to prevent any possible damage to the output transistors or to the circuit connected to the supply.
In more detail Q2,3 act as a voltage regulator which according to the setting of P2 biases the output driver Q6. The voltage at the base of Q6 controls directly the output voltage of the circuit. Q6 together with Q4 and Q5 form a Darlington pair with the two output transistors connected in parallel for greater power. The remaining transistor Q1 is biased from the variable potential divider P1,R6. When Q1 is on the output voltage is limited, and logically the output current is also limited to protect the supply and the devices connected to it. The shorted output current can be adjusted from 3 to 5 A by means of P1. What happens really is that the circuit around Q1 monitors the voltage drop across the output resistors R1,2 and if it exceeds a certain limit the transistor Q1 is made conductive and effectively shorts through D1 the regulator transistor Q3 reducing this way the out put voltage.

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 allow 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.

Because of the very high currents involved the construction of the power supply calls for a bit of skill and care. The leads which are expected to curry heavy currents must be thicker than average, solder joints must be very good if they are to withstand the currents and extra care should be taken to avoid short circuits or other mistakes which at such heavy currents can only cause serious and ...expensive damage to the circuit if they pass through to the testing stage without being detected.
There is also some mechanical work involving the mounting of the power transistors on the heatsinks. The power transistors get quite hot during operation especially if the circuit is called to supply low voltages at high currents which increase the power dissipation in the output transistors considerably.
As it is standard practice in building electronic circuits the least sensitive components are mounted on the board first and the semiconductors which are the most easily damaged by heat are soldered last to avoid overheating them. Solder first of all the pins on the board, then the resistors leaving some space between the p.c. board and the output resistors R1-4 which could get hot and damage the board. Solder the RF chokes, the capacitors taking care to insert the electrolytic with their poles as they are marked on the p.c. board. Solder then very carefully as they are sensitive to heat, the diodes and the transistors which go on the board. Using the insulators as it is shown in the diagram mount the power transistors on their heatsinks, tightening the mounting screws as much as you can, to ensure that there is good contact between the transistor's body and the surface of the heatsink. The driver transistor Q6 must be mounted alone on the smaller of the two heatsinks. To increase the heat conductivity of the two surfaces, smear some heat transfer compound (a special silicon grease) on all the touching surfaces. When everything is properly mounted on the heatsinks use heavy gauge multi-strand flexible cable to interconnect the transistors with the corresponding points on the p.c. board. Be very careful in making these connections as it is very easy to make a mistake which could damage the output transistors. Keep the cable runs as short as possible and it is better and easier to make these connections after you have placed the board and the heatsinks in the box that is going to house the project.
The connections that should be made, although they are shown in the practical wiring diagram are the following:
At points 6 (+) and 7 (-) connect the DC from the rectifier bridge, from points 1 (+) and 7 (-) you take the output voltage, points 2 and 3 should be connected with the emitters of the transistors Q4 and Q5 respectively, point 4 should be connected with the base of the driver transistor Q6, and point 5 is connected with the collectors of Q4,5,6 which should also be connected together. The secondary winding of the transformer should be connected to the pins marked AC of the rectifier bridge. Depending on the internal layout of the case you are using the potentiometer P2 can be connected directly on the p.c. board or, if this is not possible, you may use a short piece of cable to connect it with the board.
The trimmer P1 will be used to set the maximum current when the circuit's output is shorted and can be adjusted to limit the current between 3 and 5 A. If you wish to have a different output voltage range, and provided that you have a suitable mains transformer you can try changing the value of the Zener diode D4 from 5.6 V to a lower or higher voltage depending if you wish to have a lower minimum or a higher maximum output voltage. To make the use of the power supply safer and easier it is advisable to use two panel meters to monitor the output voltage and current. The voltmeter should have an FSD of 25-30 V and should be connected across the output connectors. The ammeter should have a 10 A FSD and must be connected in series with the output of the circuit (pin 1) and the output connector.
Don't forget to insert a fuse in series with the mains lead to protect the transformer. The fuse shouldn't be greater than 1 A.

After you have made all these connections make a VERY CAREFUL visual inspection, clean your p.c. board from flux residues checking at the same time for short circuits between adjacent tracks or other mistakes. Check again all the connection from and to the p.c. board for mistakes and only when you are absolutely sure that everything is OK connect the transformer's primary to the mains. Do not forget that the primary of the transformer will be at mains potential as long as the test lasts and touching it could prove lethal. Because of the high currents that the circuit can supply it is also not recommended to tamper with the circuit while it is under power. If you have to change or repair something please do so with the power OFF and having discharged the capacitors C5,6. If you have done everything properly the panel meter or the voltmeter across the output of the circuit should give you an indication and this should change if you turn the potentiometer P2. Connect a load to the circuit and leave it on for sometime till the output transistors are quite warm to the touch. At this point tighten the mounting screws again because they sometimes become slack with the heat.

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 proper mains lead with the correct plug and earth your circuit properly.
- If the case of your project is made of metal make sure that it is properly earthen.
- 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.

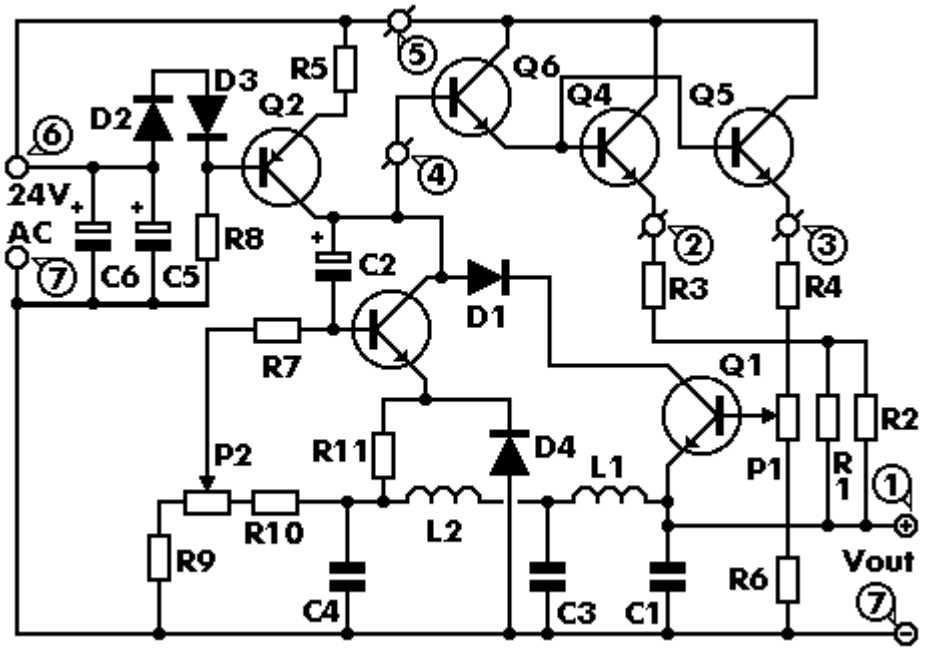
If you take all the above precautions you are reducing the risks you are taking to a minimum and this way you are protecting yourself and those around you.
A carefully built and well insulated device does not constitute any danger for its user.
BEWARE: ELECTRICITY CAN KILL IF YOU ARE NOT CAREFUL.

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 that 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 everything checks out and your project still fails to work, please contact us for information on 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/1056.htm

For further info please contact us by e-mail:

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