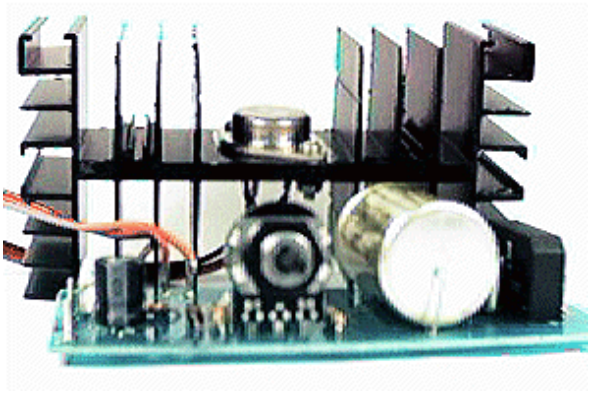
QUASAR ELECTRONICS KIT No. 1007

3 - 30V DC, 2.5 Amp STABILISED VARIABLE POWER SUPPLY

General Description

This is a very useful project for anyone working in electronics. It is a versatile power supply that will solve most of the supply problems arising in the everyday work of any electronics work shop. It covers a wide range of voltages being continuously variable from 30 V down to 3 V. The output current is 2.5 A maximum, more than enough for most applications. The circuit is completely stabilised even at the extremes of its output range and is fully protected against short-circuits and overloading.



Technical Specifications - Characteristics

Input voltage: 24V AC
Output current: 2.5 A
Output voltage: 3 - 30V DC

How it Works

The 24V AC supply voltage is first passed through a bridge rectifier and smoothing stage. The variable power supply circuit is based around a well-known and popular voltage regulator IC the LM 723. The IC can be adjusted for output voltages that vary continuously between 2 and 37V DC and has a current rating of 150 mA which is of course too low for any serious use. In order to increase the current handling capacity of the circuit the output of the IC is used to drive a Darlington pair formed by two power transistors the BD 135 and the 2N3055. The use of the transistors to increase the maximum current output limits the range of output voltages somewhat and this is why the circuit has been designed to operate from 3 to 30V DC. The resistor R5 that you see connected in series with the output of the supply is used to protect the circuit from overloading. If an excessively large current flows through R5, the voltage across it increases. Any voltage greater than 0.3V across it has as a result to cut the supply off, thus effectively protecting it from overloads. This protection feature is built in the LM723 and the voltage drop across R5 is sensed by the IC itself between pins 2 and 3. At the same time the IC is continuously comparing the output voltage to its internal reference and if the difference exceeds the designer's standards it corrects it automatically. This ensures great stability under different loads. The potentiometer P1 is used to adjust the output voltage at the desired level. If the full range from 3 to 30V is desired then you should use a mains transformer with a secondary winding having a rating of 24V AC, 3A. If the maximum voltage output is not desired you can of course use a transformer with a lower secondary voltage output. However, once rectified, the voltage across the capacitor C2 should exceed by 4-5 volts the maximum output expected from the circuit.

General Soldering Advice

First of all let us consider a few basics in building electronic circuits on a printed circuit board. The board is made of an 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.

Soldering components to the board is the only way to build your circuit and doing this properly is the key to success. The work is not difficult and if you stick to a few rules, you should have no problems. The soldering iron must be designed for electronic use and its power should not exceed 25 Watts. The tip should be fine and must be kept clean at all times by wiping the hot tip on a damp sponge to remove residues that tend to accumulate.

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 additional soldering flux. The solder supplied has a no-clean flux built into it. Additional flux can cause many problems and is one of the main causes of circuit malfunction. If you have to use extra flux, as is the case when you have to tin copper wires, use one designed for electronic use and clean it very thoroughly after you finish your work.

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

- If component leads look dirty or tarnished clean them with emery paper.
- Bend component leads at the correct distance from the component's body and insert the component in its place on the board.
- 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 PCB.
- When the solder starts to melt, the flux boils and flows out of the solder. Wait until the solder flows evenly over the pad around the hole. 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 board. A correctly soldered joint will have a bright metallic finish and its edges should end smoothly on the lead and board pad. 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 desoldering braid) and redo it.
- Take care not to overheat the tracks as it is very easy to lift them from the board and break them.

- Make sure that you do not use more solder than 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 component leads about 1mm above the solder mound.

Construction

Start building the circuit by placing the pins on the board and soldering them. You must be very careful when soldering the components that are going to carry heavy currents as your joints must be capable of withstanding the maximum current without getting hot. Solder the IC socket in its place taking care not to insert it the wrong way round and then put the resistors in their places on the board. Resistor R5 should be soldered in such a way as to keep its body slightly separated from the p.c. board to let the air circulate around the component and cool it. Continue your work with the capacitors. Be careful not to insert the electrolytic the wrong way round. The polarity is marked on the capacitors and the p.c. board is also marked accordingly. Insert the rectifier bridge in its place. The bridge is a heavy-duty type and has leads made of heavier gauge wire than usual. If you have any difficulty inserting them in the p.c. board you can enlarge the holes with a mini drill. (Automatic production of p.c. boards requires all the holes on the board to be of the same diameter.)
Do not however make the holes too wide as you are going to find soldering the leads much more difficult afterwards. Solder TR1 in its place and mount TR2 on the heatsink following the diagram and making sure there is no electrical connection between the heat sink and the transistor. Don't forget the insulators, and use heat transfer compound between the transistor body and the heat sink. Using heavy gauge wires connect TR2 to the board and finally, using a flat ribbon cable, connect the potentiometer with the rest of the circuit. Insert the VOLTAGE REGULATOR in its socket and your power supply is ready. Now make a final inspection of your work to ensure that there are no mistakes that could cause a lot of trouble later. If everything looks OK you can connect the input of the circuit (it is marked "24 VAC" on the board) to the secondary winding of the transformer. Connect a voltmeter to the pins marked "OUT 3-30 V" and using a mains lead connect, the primary of the transformer to a convenient power out let. If everything was done properly the voltmeter should give a reading and turning the potentiometer should make it change.
Slight variations from the minimum and maximum voltages specified are normal and are caused by component tolerances and should not worry you.

Although the circuitry on the board works at low voltages, it needs a mains transformer to supply this low voltage and the primary of the transformer is connected to the mains voltage which makes it very dangerous. A suitable isolating enclosure must be used to house the transformer and board to safely protect against electric shock.

Adjustments

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

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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 – MAINS ELECTRICITY CAN KILL
This circuit works from the mains and there are 220 VAC present in some of its parts. Voltages above 45V are DANGEROUS and could even be LETHAL. In order to avoid accidents that could be fatal to you or others please observe the following rules:

- DO NOT work if you are tired or in a hurry, double check every thing 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. USE ALWAYS the correct mains lead with the correct plug and earth your circuit correctly. If the case of your project is made of metal make sure 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 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 your self and those around you. A carefully built and well insulated device does not constitute any danger for its user.
- **BEWARE: ELECTRICITY CAN KILL IF PROPER SAFETY PRACTICES ARE NOT FOLLOWED.**

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 you have inserted the IC in its socket correctly and that you have not bent any pins during insertion.
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.

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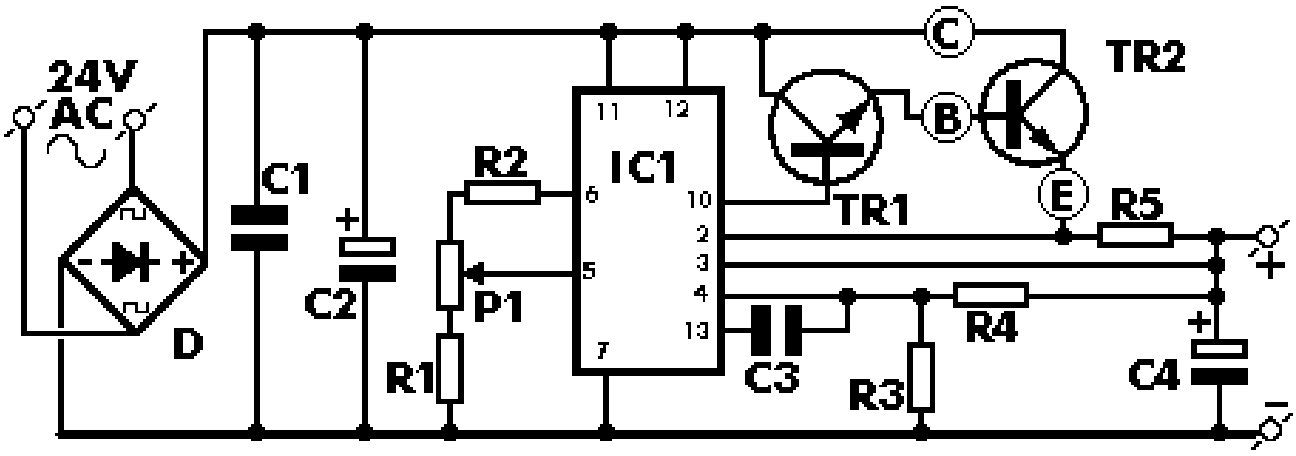
Electronic Diagram.



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:

quasarelectronics.co.uk/1007.htm

For further info please contact us by e-mail:

sales@QuasarElectronics.co.uk

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