QUASAR ELECTRONICS KIT No. 1095

LEAD-ACID BATTERY CHARGER

General Description

This circuit is a classic design for a lead-acid battery charger. It has a rectifier and a voltage stabiliser, and also features an electronic switch to change its state from quick to slow charge giving a visual indication of the state of its operation by means of an LED. The circuit is easy to build and very reliable.

Technical Specifications - Characteristics

Working voltage: 12V DC
Current: 100 mA

How it Works

Before trying to explain the operation of the charger let us first have a look at lead-acid battery and its operation.
The lead acid battery is not a source of electricity in the sense that it does not generate electricity itself. This type of battery is an accumulator, it must be charged first in order to be able to release the stored energy. A typical lead-acid battery consists of cells, each of which has a voltage across its poles, of 2.2 VDC when fully charged. A 6 V battery consists of three such cells and a 12 V one as those used in most cars today consists of 6 cells.
Inside every cell there are specially built lead plates which form the electrodes and a solution of sulphuric acid (H2SO4) diluted in distilled water.
A typical characteristic of this type of battery is that it requires a constant voltage for its charge and this is 2.2 V for slow and 2.3 V for quick charge.
This type of battery is widely used in cars, motorbikes, alarm systems, emergency lighting etc.
The circuit of the charger is very simple. The four diodes D3,4,5,6 connected as a rectifier bridge convert the AC input to DC and the capacitor C3 smoothes it. The DC current is then taken to the voltage regulator IC LM317 which stabilises the output voltage. The trimmer P2 is used to adjust the output voltage of the LM317.
The trimmer P1 is used to set the current limit for the operation of the thyristor in order to achieve the automatic switching from quick to slow charge. If the output current is very high as is the case when we connect a discharged battery to the charger the voltage across the THYRISTOR gate is low, the device is cut off and the output voltage is high in order to maintain the quick charge rate. If the voltage in the battery rises above a certain level as charge progresses the current logically falls, the voltage drop across R7 becomes lower and this triggers the THYRISTOR. When the THYRISTOR is on the resistor R4 is connected in parallel with R6 and P2 and this makes the output voltage to drop slightly and the circuit passes in the slow charge state.
For the AC input is used a 12 V/2 A transformer the secondary winding of which is connected across the input of the circuit at points 1 and 2. The output is taken from points

5 (+) and 9 (-).
The button switch is used to force the circuit to the quick charge state.

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 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.

First of all identify the components and make sure nothing is missing. Start building the circuit by soldering the pins in their places on the board. Continue the construction by soldering the resistors in their places and then solder the capacitors as well, taking care not to insert the electrolytic the wrong way round. The diodes and the THYRISTOR are then soldered in place carefully as overheating can cause them serious damage. These components are also polarised and should be inserted in their places the right way round. Finally mount the IC on the heatsink that comes with the kit and using short pieces of cable connect it to points 3, 4 and 6 of the circuit taking care not to apply too much heat on its leads as it is also very sensitive to heat. When all the components have been soldered on the p.c. board, make a visual inspection of the work done so far and then make the following connections:
Points 1 and 2 of the circuit to the secondary of the transformer.
Points 7 and 8 to the push button, and points 5 (+) and 9 (-) to the output connectors.
Connect the transformer's primary to the mains and measure the voltage across the output of the circuit. Provided that the LED is glowing adjust the trimmer P2 till you get a reading of 13.2 Volts in the output. If you now press the button, the LED should turn itself OFF and the voltage should rise to 13.8 volts which is the voltage for the quick charge. The trimmer P1 is used to adjust the circuit according to the capacity of the battery to change its charging rate automatically when the current drops under a certain minimum level.
This circuit is NOT designed for recharging a car battery overnight or fully charging a new battery. It has been designed with the small capacity batteries in mind, as they are the ones used in alarms, safety lighting etc. It is also very good for maintaining the charge of a battery that is not in use but must be always ready to enter in service.

Adjustments

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

Warning

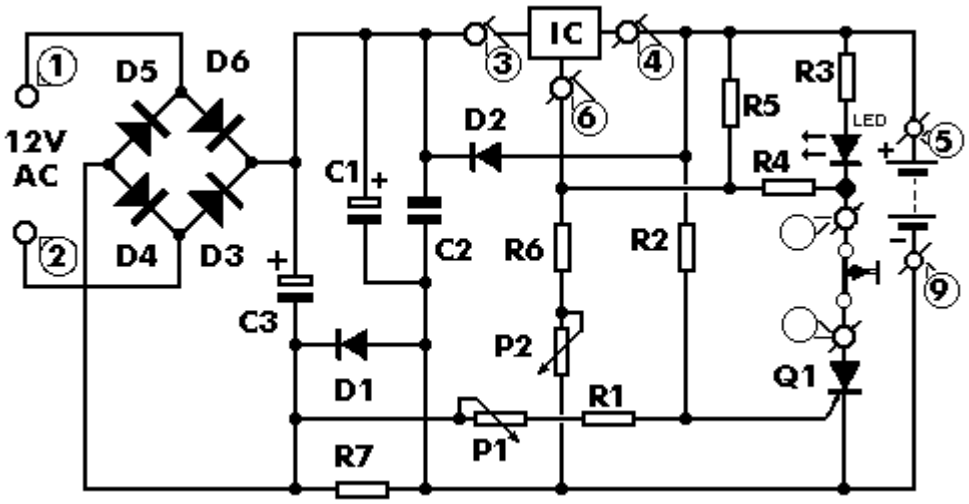
QUASAR ELECTRONICS kits are sold as stand alone training kits.
If they are used as part of a larger assembly and any damage is caused, our company bears no responsibility.

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

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.

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:

http://www.quasarelectronics.com/1095.htm

For further info please contact us by e-mail:

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