QUASAR ELECTRONICS KIT No. 1112

LOUDSPEAKER PROTECTION SYSTEM WITH DELAY

General Description

This is a very easy to build circuit, which when it is connected between the output of your amplifier and the loudspeakers will protect the speakers from signal peaks that could sometimes destroy them. The circuit will also keep the speakers disconnected for a short time at power on in order to protect the speakers from the destructive «thump» noise which is often produced while the power capacitors are charging or discharging.

Technical Specifications - Characteristics

Working voltage: 12 V DC
Current: 100 mA

How it Works

The part of the circuit that protects the speakers from the signal peaks detects any exceptionally high output level and disconnects the speakers till the dangerous condition is over. While the output signal is maintained within the preset limits the circuit remains inactive. The input sensitivity of the circuit is variable and can be adjusted for different amplifier/speaker combinations by means of the trimmer R8. The signal is applied to the input of the circuit through the resistors R6 & R7 which correspond to the right and left channels respectively according to the schematic diagram. When a peak signal appears in one of the inputs (or at both of them) the two capacitors C2 & C3 which are connected in series charge and the voltage across them increases. When this voltages becomes sufficiently high the transistor Q2 is biased through R8 and is turned ON. This brings the collector of Q1 at a very low potential and the transistor is switched off. When this happens Q3 is turned OFF and the relays are deactivated disconnecting the speakers from the output of the amplifier. If the output signal falls below the critical level the voltage across C2 & C3 is reduced accordingly and Q2 is turned off allowing Q1 & Q3 to turn on activating the relays and connecting the speakers back to the output of the amplifier. The capacitors are there to filter out any very short duration peaks which are not dangerous and to keep the circuit off slightly longer than the duration of the dangerous peak (while the capacitors are discharging through R8 and R3) to ensure that the danger has passed. During power on the circuit should be wired in such a way as to receive power at the same time as the amplifier. (It can be done if you power it from the same power supply as the amplifier or by a separate supply which is controlled by the same mains switch). When the circuit is off the relays are deactivated and the speakers are disconnected. As soon as the circuit is powered up the capacitor C1 starts charging through R1. As long as the capacitor is partly charged the voltage across R5 is maintained low and the transistor Q2 is kept off. As soon

as the value of this voltage reaches the biasing voltage of Q1 the transistor is turned on and biases the output transistor Q3 which in turn activates the relays. The diode D1 protects the circuit from any back emf that could appear across the relay windings when the circuit is switched off. The capacitor C4 is there to smooth the supply voltage in order to avoid spurious triggering of the circuit which could be annoying.

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 can not 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 the area around the hole evenly 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 let the solder 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 may still remain on it.

The circuit is relatively simple, as it has a low component count and no critical or delicate parts. Solder first of all the pins and the resistors, continue with the relays and the capacitors and finish your work soldering very carefully the transistors and the diode in their places. Make sure that the capacitors (which are electrolytic all of them), the diode and the transistors are inserted the right way round and that they do not get overheated when you are soldering them. Make a very careful inspection of the circuit, clean the board from flux residues and check for any short circuits across adjacent tracks which, because of the high power involved, could cause very serious problems if they happen to be in the part of the circuit which is connected across the output of the amplifier. If everything appears to be all right make the following connections:
3, 4 (L & R signal) & 6 common to the outputs of the amplifier.
1, 2 (L & R signal) & 6 common with the speakers.
- 5 (+) & 6 (-) to the power supply (12 VDC)

Make sure that the connections are OK and turn the power on.
You should not hear anything from the speakers during the first 3-5 seconds after power on. Then you should hear the relays clicking and the speakers should be connected across the output of the amplifier. Now select a program and increase the volume of the amplifier abruptly. The relays should be deactivated immediately and the speakers should turn off to indicate that the circuit has detected a peak and the protection is on. Depending on the power rating of your amplifier you must adjust the trimmer R8 so that the circuit is activated only by the peak signals that exceed the rating of your speakers. If you do not adjust the circuit care fully it is possible that it becomes activated even by high passages of the music which in normal listening levels are not dangerous to the speakers.

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

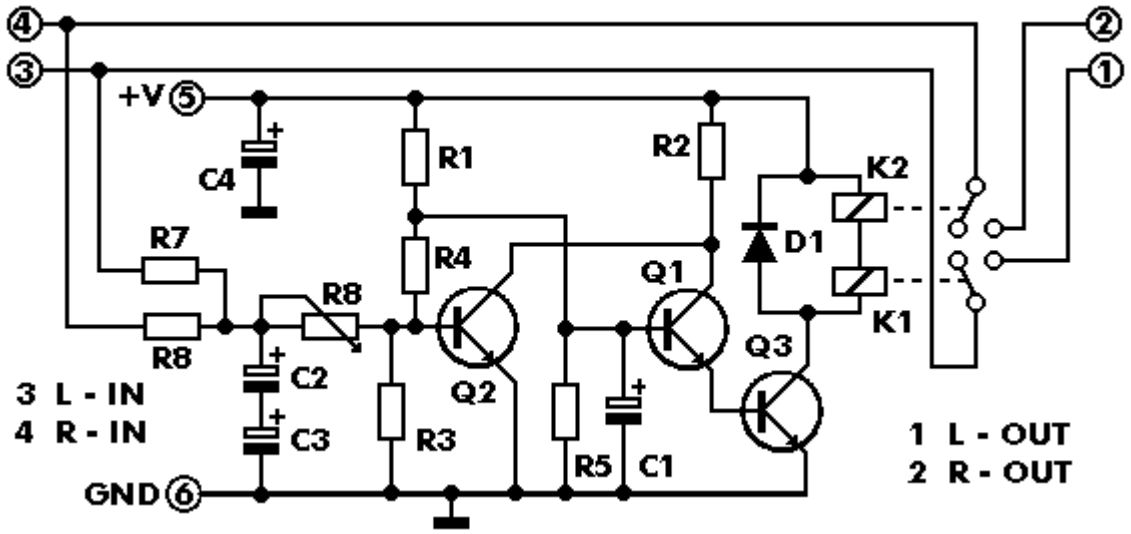
bears no responsibility.

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 everything checks out and your project still fails to work, please contact us for information on 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/1112.htm

For further info please contact us by e-mail:

mailto: sales@QuasarElectronics.com

E&OE