QUASAR KIT No. 1133

2X800 Watt MUSIC TO LIGHT MODULATOR

General Description

A music to light modulator is an electronic circuit that is used to control the intensity of one or more lamps and make them follow the rhythm of the music. This is usually done by connecting the modulator with the output of the amplifier. The problem with poorly designed modulators is that if there is a fault the mains that is used to power the lamps may flow through the amplifier causing very serious damage, creating a fire hazard, and even being harmful or lethal to people that may be using the amplifier at that moment.
This problem has been solved in this project as there is no direct link between the circuit and the amplifier used. A relatively new device is used to link the modulator to the sound source isolating at the same time the two circuits completely. This device is an OPTOCOUPLER and will be discussed in detail in the «How it works» section below.
Besides that to make the project more interesting the circuit you are about to build contains two identical light modulators, one for each channel of your amplifier. The total power that the circuit can handle is 2 x 800 = 1600 Watts.

Technical Specifications - Characteristics

Working voltage:.....220 VAC
Max. current:.....3.5 A
Max. output power: .....800 Watts
Input sensitivity:.....2-60 Watts
- Adjustable input sensitivity. - Complete isolation from the mains thanks to the OPTOCOUPLER used. - Safe and reliable operation. - Simple and inexpensive to build.
CHARACTERISTICS OF THE MOC3010 OPTOISOLATOR
Transmitter (LED)
Working voltage: ..... 1.2-1.5 V
Reverse current: ..... 100 mA
Internal capacitance: ..... 50 pF
Signal transmission: ..... IR
Receiver (TRIAC).
Maximum voltage A1/A2:..... 250 V
Maximum current: ..... 1.2 A
Maximum power dissipation: 300 mW

CHARASTERISTICS OF THE TRIAC BT136			
BT136	**500R**	**600R**	**800R**
Maximum voltage A1/A2	**500V**	**600V**	**800V**
Maximum current	**4A**	**4A**	**4A**
Maximum transient current	**25A**	**25A**	**25A**

The triac is a bi-directional silicon controlled rectifier. It has three leads which are A1 (anode 1), A2 (anode 2), and G (gate). It can control relatively high AC voltages and currents between A1 and A2 with the help of small control voltages which are applied to its gate G.

How it Works

Let us first discuss this new component that is used in the modulator, the OPTOCOUPLER or OPTOISOLATOR. This is a device that includes in the same casing a LED and a PHOTOTRANSISTOR or a light sensitive SCR or a TRIAC. The LED is used as the input and the signal is transmitted optically to the output device which converts it back to electrical signal. Thanks to this arrangement it is possible to achieve total isolation between input and output and the device is used extensively in cases where the two stages to be linked have a great voltage difference.
The circuit is identical for both channels so we are only going to discuss one channel and everything will apply to the other one as well.
As you can see from the circuit diagram of the modulator the signal is applied across the LED of the optocoupler (pins 1 and 2 of the IC) through a resistor R1 and a potentiometer P1. The potentiometer adjusts the input sensitivity of the circuit and the resistor is used to protect the optocoupler from very high input signals when the potentiometer is set for the maximum sensitivity.
When an audio signal is applied at the input of the circuit the LED will flicker following its changes in amplitude. The LED is emitting in the infrared part of the spectrum and is used to drive a TRIAC inside the package that is sensitive to the same type of radiation. This TRIAC is in turn used as a TRIAC driver in order to control another TRIAC capable of handling larger currents.
The resistor R3 that you can see connected in series with the driver and the TRIAC gate is used to protect the optoisolator and the gate from excess current at the signal peaks. If you connect a lamp in series with the TRIAC at points 7 and 8 and the mains supply at points 5 and 6 of the board this lamp will follow the variations of the input signal and the result will be a simple but effective light modulator.
The isolation between the two parts of the OPTOCOUPLER is greater than 1500 V and this makes it totally safe for any installation.

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 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 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 increase the diameter of 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.
- After finishing 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 construction of the modulator is very simple as it only uses ten electronic components. First of all insert the pins in their places on the board and solder them. Solder the resistors then in their places and insert the TRIAC's with the printed side of their casing towards the 220 V indication on the board. Solder small pieces of wire to the leads of the potentiometer, insert them in the respective holes on the p.c. board and solder them there. Finally insert the OPTOISOLATORS carefully and solder them taking care not to overheat it. You can also use an IC socket if you wish so but as there are no 6 DIL sockets, you must use an 8 DIL one and

cut two of the pins away.
The work is finished here and you should stop to make one final VERY CAREFUL inspection before making the connections and proceeding with the testing of the project under power.
Make sure there are no mistakes as they can be very dangerous considering the voltages involved in the circuit.
If everything looks right, connect 220 V lamps across the points 7 - 8 and 9 - 10 on the board and a twin mains lead to the two points marked 220 V, 5 and 6.
Connect then the outputs of an amplifier, radio, or cassette recorder across the inputs of the circuit, points 1 - 2 and 3 - 4 of the board.
It is a good idea to use a switch and a 10 A fuse in series with the mains for more protection.
If you have made all the connections correctly then plug the mains lead to a convenient mains outlet and turn the music on. The lamps should start flickering following the rhythm of the music. If nothing happens turn the potentiometers to increase the input sensitivity of the circuit or increase the output of your amplifier if the former is not possible.
DURING ALL THE TESTS DO NOT TOUCH ANY PART OF THE CIRCUIT
WHILE IT IS CONNECTED TO THE MAINS.

Adjustments

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

Warning

Quasar 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 earthed.

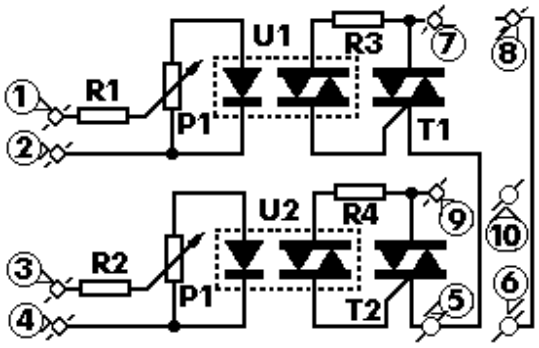
- If it is possible use a mains transformer with a 1:1 ratio to isolate your circuit from the mains.
- When you are testing a circuit that works off the mains wear shoes with rubber soles, stand on dry non conductive floor and keep one hand in your pocket or behind your back.

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/1133.htm

For further info please contact us by e-mail:

mailto: sales@QuasarElectronics.com
