

QUASAR ELECTRONICS KIT 1132

3-CHANNEL SOUND TO LIGHT MODULATOR WITH OPAMPS AND OPTOCOUPERS

General Description

A very useful and essential light effects device that may be used in parties and discos, alike. It is easily connected to any audio amplifier, cassette player, or any other audio equipment. It creates very impressive light effects, but it also imposes no danger to the amplifier, or the speakers, thanks to the optocoupler circuit used.

Three separate channels are provided, each of which offers very good frequency separation between low, medium and high frequency signals. Each channel is able to drive up to 1 kW of load power. It may be connected to any amplifier whose output may vary from 1W up to 100W.

Technical Specifications - Characteristics

- Operating voltage :220V/50Hz
 - Power output per channel :1KW (peak)
 - Input signal level :2.5V to 28V AF
 - Ability to adjust the input sensitivity
 - Filter frequency response:
 - LOW :10 Hz - 160 Hz
 - MIDDLE :350 Hz - 850 Hz
 - HIGH :1.8 KHz - 12 KHz
 - Full isolation of the audio signal from the mains supply.
 - Circuit power consumption :4 VA AC
 - Input impedance :500 K ohm
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How it Works

The input signal coming from the amplifier is made up of a number of audio frequencies whose amplitudes differ from one another. Therefore, the input signal must first be amplified so as to ensure an equal signal amplitude for all the existing frequencies. Operational Amplifier (opamp) A1, is used for this purpose and it prepares the input signal for use by the rest of the circuit. Note that A1, A2, A3 and A4, are members of a single integrated circuit, IC1, which is of the LM324 type.

The sensitivity of the input may be set by adjusting the variable resistor P1.

Op amp A1 has been connected in a variable gain amplifier circuit. The gain of the circuit is set by resistors R2 and R3.

The gain is determined by formula (1), below:

$$\text{Gain} = (R2+R3) / R2$$

Resistor R1 determines the input impedance of the opamp's circuit. This has been set at 10 k ohm.

The signal obtained at pin 8 of IC1, which corresponds to the output of opamp A1, is large enough in order to drive the output stage of the unit. This is made up of TRIACs which drive a number of lamps which form the circuit's load.

The signal is also split into three separate audio frequency bands. The three components are derived from three separate audio filters that are built around opamp's A2, A3, and A4. Each filter allows a different frequency band to pass through it.

In this way, opamp A2, capacitors C4 and C5, and resistors R4, R5 and R6, form the low pass filter of the unit. Frequencies between 10 Hz and 160 Hz are allowed to pass through it. Similarly, opamp A3, capacitors C6, C7 and C8, and resistors R9, R10, R11 and R12, form the medium frequency filter of the unit. Frequencies between 350 Hz and 850 Hz are allowed to pass through it.

Finally, opamp A4, capacitor C9 and resistors R15, R16, R17 and R18, form the high frequency filter. Frequencies between 1.8 KHz and 12 KHz, are allowed to pass through it.

In this way, the outputs of the three opamp's (found at pins 7, 1 and 14, of IC1) provide three separate signals which depend on the frequency content of the signal present at the unit's input. All three signals are fed onto a variable resistor (P2, P3 and P4, for each channel respectively). This is done via the corresponding resistor (resistor R7, R13 and R19, respectively). Each variable resistor adjusts the sensitivity level of each one of the three audio filters.

The output of each filter is used in order to drive the corresponding TRIAC stage. Each TRIAC stage then drives its load. Loads of up to 1 KW may be handled by each TRIAC stage. Each TRIAC is driven by one of the optocoupler circuits OC1, OC2 and OC3. Each optocoupler circuit ensures full isolation between the 220V AC circuit of the loads and the +/- 5 Volts DC, supplying the filter circuit. In this way, there is no chance of the 220 V AC supply crossing onto the audio device (e.g. audio amplifier) providing the audio signal to the unit. The TRIACS may be either ON, or OFF. They are ON whenever the voltage present at their Gate connection is higher than the triggering voltage. In that case, the corresponding load lamps will also be ON. On the other hand, they are OFF whenever the voltage present at their Gate connection is lower than their triggering voltage. In that case, the corresponding lamp is also OFF.

The Gate voltage of each TRIAC stage is provided in this circuit by the corresponding optocoupler OC1, OC2 or OC3. Its magnitude depends on the frequencies present at the output of each one filter.

Finally, a power supply circuit has been provided for the kit. This supply circuit is made up of T1, a 2x10 V AC transformer, D1, the circuit's rectifying bridge and the filtering capacitors C1 and C2. C10 suppresses any electric noise that may be present at the secondary coil of the transformer. Thus, a symmetrical output of +/- 13V is obtained from this power supply circuit.

Construction

Although there are quite a few components to be installed onto the PCB, assembling the circuit should cause no problems, provided the basic rules of assembly work are applied. All components must lie flat on the printed circuit board. Their leads must be tightly bended underneath the PCB so as to keep them in place until they are properly soldered. When installing the components on the PCB, it is preferable to follow the sequence at which they

appear in the parts list, so as to avoid any possible errors.

When installing the IC base, make sure that its characteristic dot matches the one shown at the circuit assembly schematic diagram.

Install all small-sized components first. Make sure that the polarity of the electrolytic capacitors matches the one shown at the circuit schematic diagram.

As soon as all the components are installed on the PCB, a thorough check must be performed in order to spot any components that have been installed improperly or have wrong values. The soldering of the component leads should also be checked.

Use a low power soldering iron, but do not use any soldering flux. Make sure you heat both the component lead and the PCB copper pad at the same time. Pour only a small quantity of solder onto the pad. When this cools down, it should have a shiny, metallike look and should cover the whole of the pad.

The integrated circuits should be installed at their bases (IC1), or their respective positions (OC1, OC2 and OC3). Make sure that their characteristic dot matches the one shown at the circuit schematic layout diagram.

Screw the TRIAC heatsinks into their places.

Finally, the thorough, visual, check should be repeated in order to spot any possible errors, omissions, or even dry joints.

Adjustments

Pay special attention during the adjustment process so as to avoid touching any of the connecting wires or the parts of the PCB that carry the 220 V supply. The circuit operates at 220 V, which is lethal in the case that a human being touches the wires.

Connect the input of the unit to the output of the audio amplifier. Turn the amplifier's volume level at about mid way through its scale. Connect the unit to the 220 V supply.

From this point onwards, the voltage present at the PCB, becomes dangerous for anyone that is not cautious enough.

By using a well insulated screwdriver, set the trimmers P2, P3 and P4 at a point close to their mid point. Adjust the variable resistor P1 so as to see the load lamps, or at least some of them, being turned on and off, depending on the audio signal provided by the amplifier.

The sound to light modulator is now ready to operate. No further adjustments are necessary.

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.

CABLING

Install the PCB into a small plastic box. Check the connections made on the PCB: the lamps are connected to the following points:

- channel 1: points 3 and 4,
- channel 2: points 5 and 6,
- channel 3: points 7 and 8.

It is preferable to use lamps of various colours so as to achieve even better light effects. The 220 V AC supply is connected to points 1 and 2. The audio signal input is connected to points 9 (+) or 10 (-).

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 correct mains lead with the correct plug and earth your circuit correctly.

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.

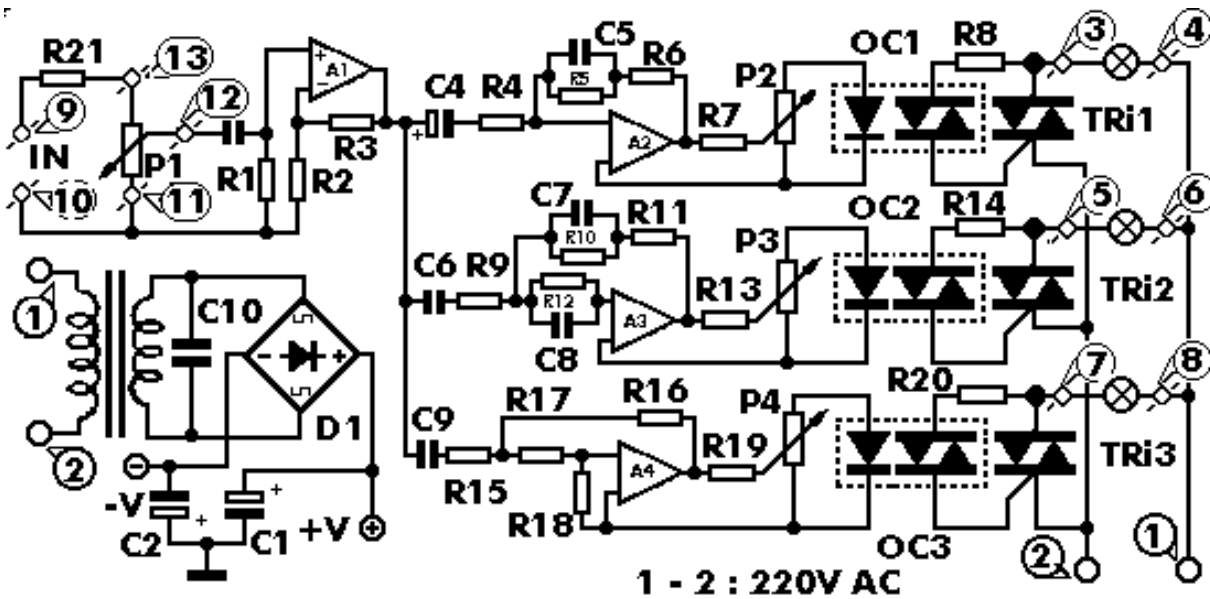
- Make sure that all the polarised components have been soldered the right way round. -

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/1132.htm>

For further info please contact us by e-mail:

[mailto: sales@QuasarElectronics.com](mailto:sales@QuasarElectronics.com)

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