Quasar Project 3019 - 220-240VAC Light Dimmer / AC Motor Controller

This is a standard circuit which can be used to adjust the brightness of mains lights and the speed of AC motors. It uses a triac, diac and has a radio-frequency interference (RFI) noise suppression circuit built into it as well.

Caution: this Kit connects directly to mains power supply. You must know what you are doing as mains voltages can be lethal. The board must be put in a suitable enclosed box before using.

The kit is constructed on a single-sided printed circuit board (PCB). Protel Autotrax and Schematic were used to design the board.

ASSEMBLY INSTRUCTIONS

It is generally best to add the lowest height components to the board first; the resistors. Make sure to get the triac in the correct way - the metal back of the triac goes in above the bar marked on the overlay. The diac looks like a glass diode but it has a mark around the centre, not at one end. The choke (wire wound ferrite coil) can be soldered in either way around.

CIRCUIT DESCRIPTION

This is a standard text-book circuit. A triac may be considered as two SCR's (Silicon Controlled Rectifiers) connected in opposite directions. A diac is a gate trigger device. Triacs, diacs & SCR's are different types of Thyristors.

A triac is a 3 terminal ac semiconductor switch which is triggered ON when a low energy signal is applied to its Gate. Switching is fast. The low energy of switching means that a wide range of low cost control circuits can be used, for example, optically coupled switches. Since the triac is bilateral (2 SCR's connected in opposite directions) the terms anode and cathode have no meaning. So the terms Main Terminal 1 and 2 (MT1, MT2) are used. It is standard to use MT1 as a reference point.

The circuit here controls the average power to a load through the triac by phase control. The ac supply is applied to the load for only a controlled fraction of each cycle. The triac is held in an OFF condition for a portion of its cycle then is triggered ON at a time determined by the circuit. The main problem with this circuit is radio frequency interference (RFI.)

RFI. Each time the triac is turned on the load current changes very quickly - a few micro seconds - from zero to a value determined by the lamp resistance and the value of the mains voltage at that instant in time. This transition generates RFI. It is greatest when the triac is triggered at 90° and least when it is triggered at close to zero or 180° of the mains AC waveform.

Since there may be long lengths of mains wire between the triac and the lamp load which will radiate this RFI an L-C RFI suppression network is usually built into these types of circuits. You may detect this RFI by bringing an FM radio close to the dimmer circuit. Short out the choke coil and notice that the RFI increases. The wire-wound coil and C1 provide the RFI suppression network.

WHAT TO DO IF IT DOES NOT WORK

Poor soldering is the most likely reason that the circuit does not work. Check all solder joints carefully under a good light. Next check that all components are in their correct position on the PCB.

COMPONENTS

Resistors (1/4W, 5% carbon):		
2K2	red red red	1
10K	brown black orange	1
180K	brown violet yellow	1
Capacitors:		
150nF/400V	dipped polyester	1
47nF/630V	" "	1
0.22uF/250V AC	" "	1
Potentiometer 250K		1
Triac 2N6075 or BT136-500D		1
Diac (HT-32)		1
Choke coil (100uH)		1
Terminal Blocks		2
2A or 3A fuse + holder		1
3019 PCB		1