

Phase Control from Logic (DC) Inputs

Triacs can also be phase-controlled from pulsed DC unidirectional inputs such as those produced by a digital logic control system. Therefore, a microprocessor can be interfaced to AC load by using a sensitive gate triac to control a lamp's intensity or a motor's speed.

There are two ways to interface the unidirectional logic pulse to control a triac. Figure AN1003.19 illustrates one easy way if load current is approximately 5 A or less. The sensitive gate triac serves as a direct power switch controlled by HTL, TTL, CMOS, or integrated circuit operational amplifier. A timed pulse from the system's logic can activate the triac anywhere in the AC sine-wave producing a phase-controlled load.

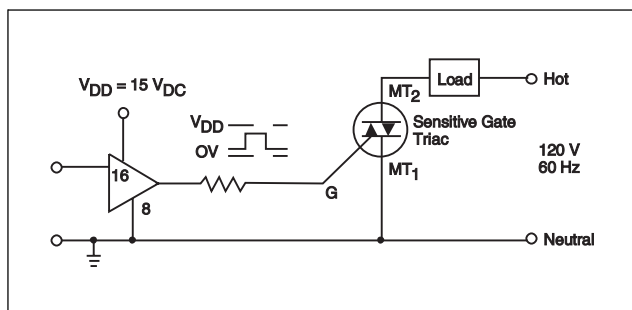


Figure AN1003.19 Sensitive Gate Triac Operating in Quadrants I and IV

The key to DC pulse control is correct grounding for DC and AC supply. As shown in Figure AN1003.19, **DC ground and AC ground/neutral must be common plus MT1 must be connected to common ground.** MT1 of the triac is the return for both main terminal junctions as well as the gate junction.

Figure AN1003.20 shows an example of a unidirectional (all negative) pulse furnished from a special I.C. that is available from LSI Computer Systems in Melville, New York. Even though the circuit and load is shown to control a Halogen lamp, it could be applied to a common incandescent lamp for touch-controlled dimming.

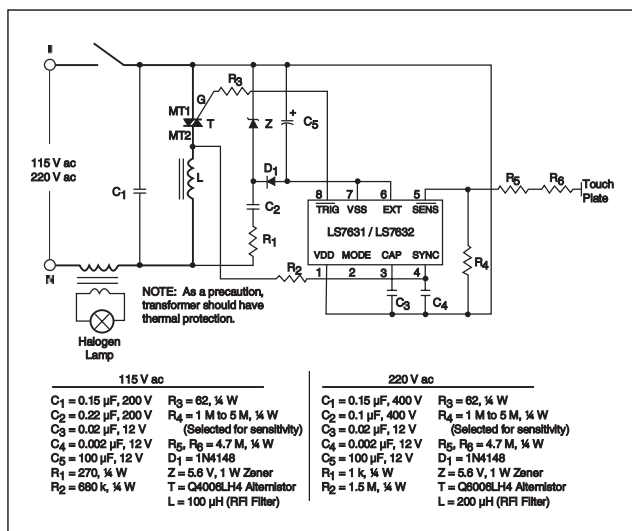


Figure AN1003.20 Typical Touch Plate Halogen Lamp Dimmer

For a circuit to control a heavy-duty inductive load where an alternistor is not compatible or available, two SCRs can be driven by an inexpensive TO-92 triac to make a very high current triac or alternistor equivalent, as shown in Figure AN1003.21. See "Relationship of IAV, IRMS, and IPK" in AN1009 for design calculations.

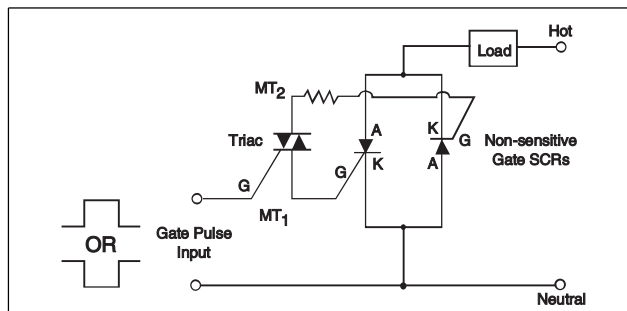


Figure AN1003.21 Triac Driving Two Inverse Parallel Non-Sensitive Gate SCRs

Figure AN1003.22 shows another way to interface a unidirectional pulse signal and activate AC loads at various points in the AC sine wave. This circuit has an electrically-isolated input which allows load placement to be flexible with respect to AC line. In other words, connection between DC ground and AC neutral is not required.

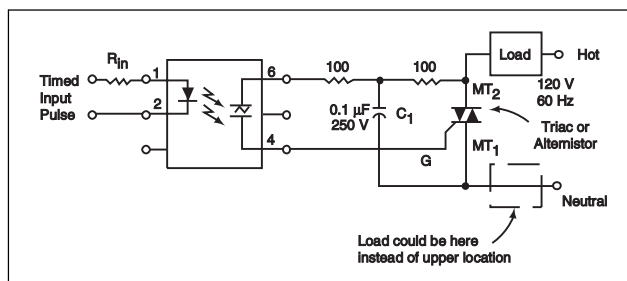


Figure AN1003.22 Opto-isolator Driving a Triac or Alternistor

Microcontroller Phase Control

Traditionally, microcontrollers were too large and expensive to be used in small consumer applications such as a light dimmer. Microchip Technology Inc. of Chandler, Arizona has developed a line of 8-pin microcontrollers without sacrificing the functionality of their larger counterparts. These devices do not provide high drive outputs, but when combined with a sensitive triac can be used in a cost-effective light dimmer.

Figure AN1003.23 illustrates a simple circuit using a transformerless power supply, PIC 12C508 microcontroller, and a sensitive triac configured to provide a light dimmer control. R_3 is connected to the hot lead of the AC power line and to pin GP_4 . The ESD protection diodes of the input structure allow this connection without damage. When the voltage on the AC power line is positive, the protection diode from the input to V_{DD} is forward biased, and the input buffer will see approximately $V_{DD} + 0.7$ V. The software will read this pin as high. When the voltage on the line is negative, the protection diode from V_{SS} to the input pin is forward biased, and the input buffer sees approximately $V_{SS} - 0.7$ V. The software will read the pin as low. By polling GP_4 for a change in state, the software can detect zero crossing.