ZERO CROSSING SWITCH

MOST of the functions of this switch are contained inside the IC, so let's take a look at the zero-voltage switch IC first.

Three zero-voltage switches are made by RCA — the CA3058, CA3059 and CA3079. They are all designed to control a thyristor in a variety of AC power switching applications for AC input voltages of 24,230, 230 and 277 V at 50, 60 and 400 Hz. Each incorporates four functional blocks as follows (refer to the block diagram here):

- Limited-Power Supply — permits operation directly from an AC line.
- Directional On/Off Sensing Amplifier — tests the condition of external sensor or command signals. Hysteresis or proportional-control capability may easily be implemented in this section.
- Zero-Crossing Detector — synchronizes the output pulses of the circuit at the time when the AC cycle is at zero voltage point; thereby eliminating radio-frequency interference (RFI) when used with resistive loads.
- Triac Gating Circuit — provides high-current pulses to the gate of the power controlling thyristor.

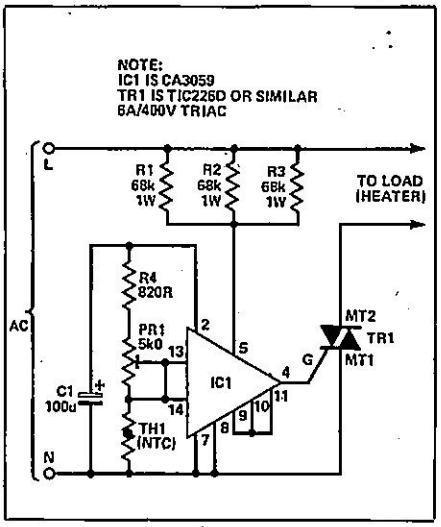
In addition, the CA3058 and CA3059 provide the following important auxiliary functions:

- A built-in protection circuit that may be actuated to remove drive from the triac if the sensor opens or shorts.
- High power DC comparator operation is provided by overriding the action of the zero-crossing detector. This is accomplished by connecting pin 12 to pin 7. Gate current to the thyristor is continuous when pin 13 is positive with respect to pin 9.

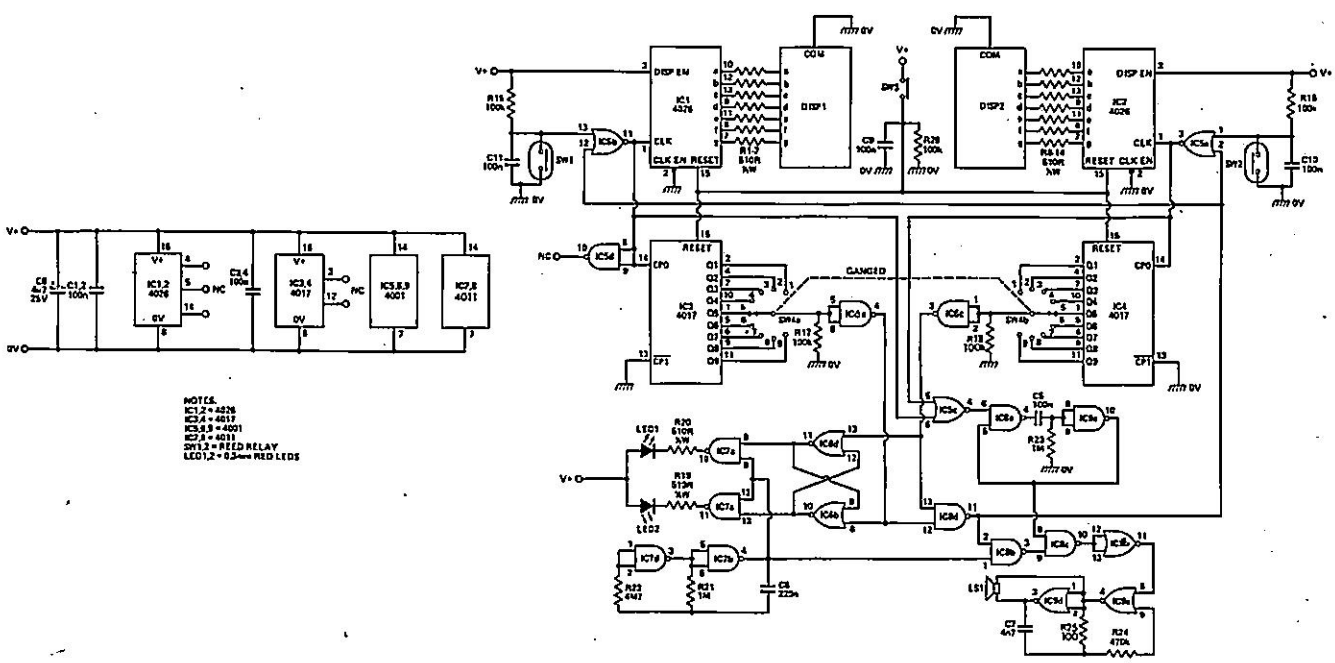
Because the CA3079 does not incorporate the built-in protection circuit, the CA3058 or CA3059 have been specified for this project. If the project is used to control a fish tank heater, one doesn't want to boil one's finny friends in the event of a thermistor failure!

Now we know what's inside the IC, how is it put to work in the circuit?

Initially, consider the triac to be turned off. Some current flows into pin 5 of the IC and this is limited by R1-3 and rectified within the IC to provide about 8 V DC for the operation of the circuit. Capacitor C1 smooths this supply. Inside the IC are a number of separate subcircuits centered on a comparator ('On/Off Sensing Amp'). Connection of pins 9, 10 and 11 uses internal resistors to establish half supply rail (about 4 V) as one of the levels to be compared. When the voltage on pin 13 exceeds half rail potential, the comparator activates a circuit which turns the triac on at the next supply zero, and each subsequent zero until the voltage falls below half rail.



Clearly then, PR1/R4 must be selected so that they add up to the resistance of the sensing thermistor at the temperature for which it is desired to regulate. Thus, then the temperature reaches the preset point, the voltage across TH1 corresponds to half rail potential on pin 13.



SLOT CAR LAP COUNTER

The counter is operated via SW1 and SW2, using small magnets cemented to the underside of the cars. The supply voltage can be 9 V DC to 15 V DC unregulated.