Tail-biting one-shot keeps car-door light on

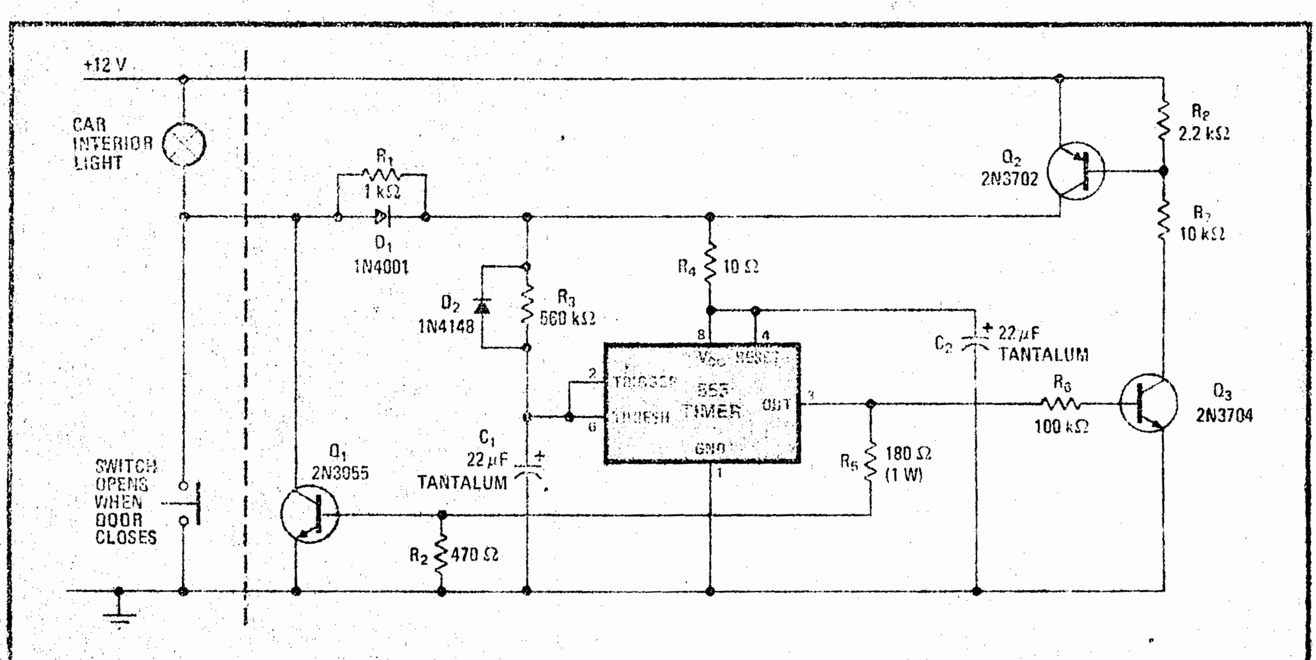
by B. D. Redmile
Salisbury, Rhodesia

A one-shot multivibrator that drives the same line it is sensing is useful for such applications as burglar alarms and switch-action delays because it can be fitted at any point in the circuit. Full reliability of the original circuit is retained, since connection of the one-shot across it does not break it. In the arrangement shown in the schematic, a 555 timer keeps the interior light of a car turned on for 10 seconds after the car doors are closed.

In the idle condition (door closed, light off), the 12-volt line charges capacitor C_1 and supplies power to the 555. The current drain is only about 10 milliamperes, so the light does not go on. The threshold terminal of the 555 is held high by R_3, so its output is low and all the rest of the circuit is off. When a door is opened, the light goes on in the usual way and the power to the one-shot is removed. Capacitor C_1 then discharges rapidly through D_2 and R_1.

When the door is closed and the lamp starts to turn off, power flows to the 555. With C_1 discharged, the threshold terminal is at low voltage, so the output goes high. This turns on transistors Q_1, Q_2, and Q_3. Q_2 maintains power to the 555 while Q_1 furnishes a path for current to flow to keep the light on. After a delay set by C_1 charging through R_3, the 555 output goes low, restoring the circuit to its idle state.

The combination of C_2 and R_4 prevents transients on the battery supply from damaging the 555 or prematurely terminating the one-shot high output pulse. □



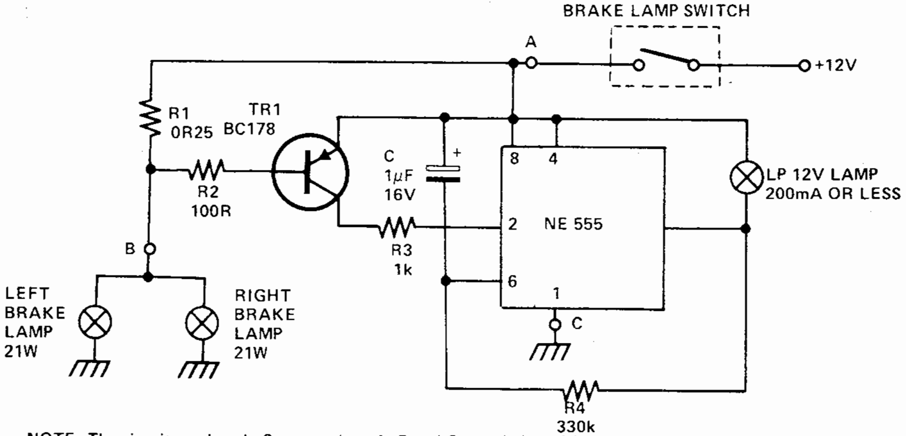
Holds the light. When car door closes, output current pulse from 555 timer turns on transistor Q_1 to keep interior light on for about 10 seconds. This type of one-shot arrangement, driving the line that is sensed, can be added at any point in the circuit. It is useful in alarm systems, process controls, automatic machinery, safety circuits, and convenience circuits such as this one.

BRAKE LAMP FAILURE INDICATOR

Here is yet another application for the NE555 timer.

If both brake lamps are working the lamp LP lights but if one or both are open circuit the lamp will flash at 2Hz, alerting the driver.

When both lamps are good the current through R1 turns on TR1 preventing C from charging, and keeping pins 2 and 6 at rail potential. Under these circumstances pin 3 is low and LP is on, however if one or both lamps are faulty TR is not turned on and the NE555 time oscillates freely at 2Hz, flashing LP.



NOTE: The circuit needs only 3 connections A, B and C to existing wiring.

R1 is calculated on the basis of two 21W brake lamps (42W total). If a different total wattage is used, use the formula:

$R1 = 10.5/P$ where P is the total wattage of two lamps.

Darlington-switched relays link car and trailer signal lights

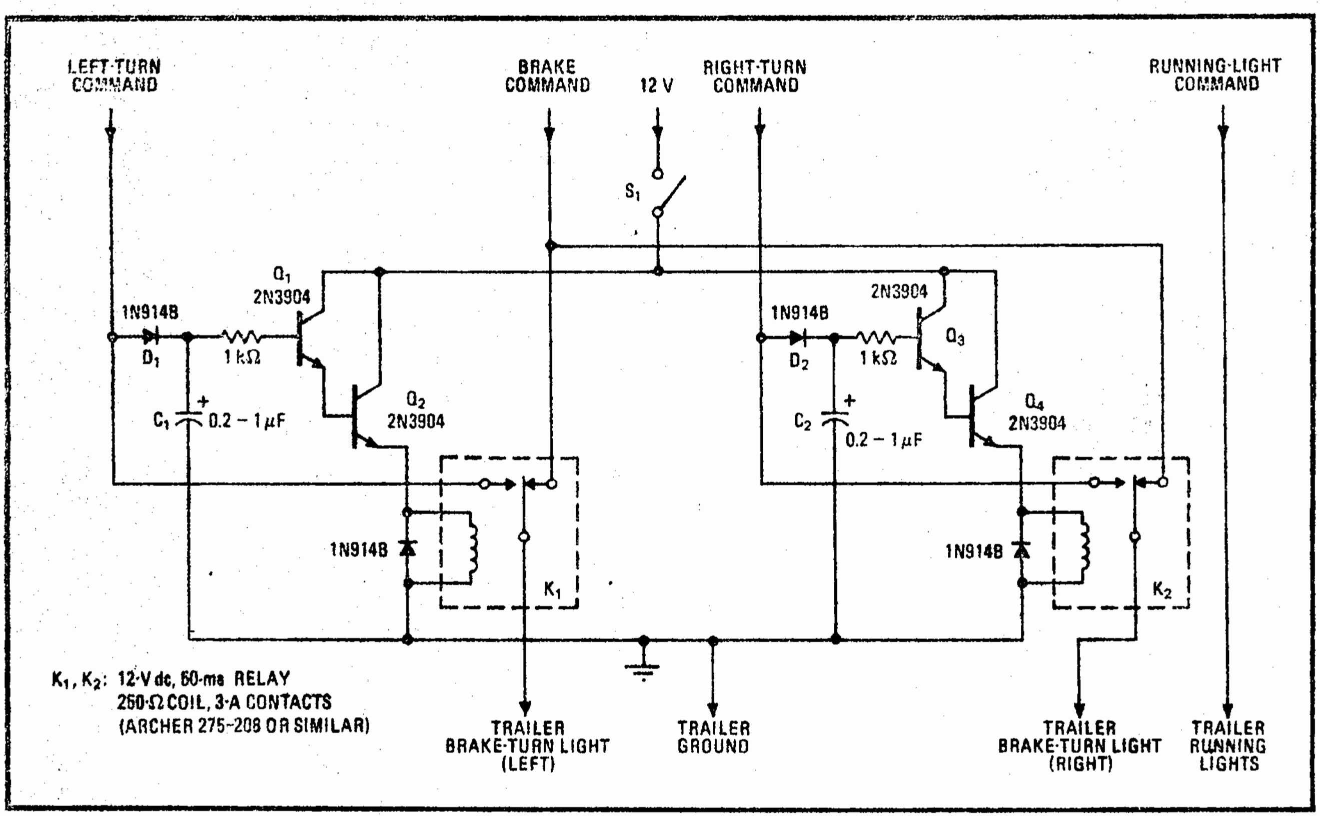
by M. E. Gilmore, and C. W. Snipes
Florence, Ala.

New cars with separate turn and brake signals—a safety feature—require a special circuit to properly drive the combination turn-and-brake lights on a trailer; otherwise, if the trailer lights are connected to the brake command, the turn signal will not work, and connecting the lights to the turn command will not yield a brake signal. But two relays and low-cost transistors will combine the signals onto a common bus again, ensuring that the trailer's lights respond to both commands.

As shown in the figure, the brake-command line is normally connected to the trailer lights through relays K_1 and K_2 during normal operation. However, a left- or right-turn command will turn on the respective Darlington amplifier, Q_1Q_2 or Q_3Q_4, thus activating K_1 or K_2. The turn signal is then routed to the lights.

Capacitors C_1 and C_2 charge to the peak amplitude of the turn signal, which flashes at one to two times per second. C_1 and C_2 should therefore be selected to hold the relay closed between these flash intervals (0.5 to 1.0 second), but no longer. If the capacitance is too large, the brake signal cannot immediately activate the trailer lights after the turn signal is canceled. Diodes D_1 and D_2 prevent capacitor discharge through the left or right turn-signal lines, respectively. □

Engineer's notebook is a regular feature in *Electronics*. We invite readers to submit original design shortcuts, calculation aids, measurement and test techniques, and other ideas for saving engineering time or cost. We'll pay $50 for each item published.



Auto-to-trailer interface. Relays multiplex brake and turn commands onto common bus line, permit control of brake-turn lights on trailer. Darlington amplifiers provide high command-line isolation and sufficient drive for the relays.

Tri-level indicator monitors automobile's electrical system

by S. K. Wong
Torrance, California

The battery voltage of a car in operation indicates a great deal about the condition of the alternator, the voltage regulator, and the battery itself. Expensive sports cars are routinely equipped with gages to monitor voltage. Sedans may be optionally equipped with these voltmeters, but a good gage usually costs more than $30, and its size may make it difficult to install on the instrument panel.

Fortunately, exact voltage readings are not necessary to indicate the condition of the electrical system, even if a precise value could be read while the car is running. An instrument that shows three levels of voltage can give enough information to indicate that (1) a major component of the electrical system is faulty; (2) the battery voltage is fairly low, and the electrical system should be checked; or (3) the battery voltage is adequate for efficient functioning of the system.

A solid-state tri-level voltage indicator that uses light-emitting diodes to show three voltage ranges can be built for $5 to $10, depending on the quality of the parts used, and it is a bargain for the purpose it serves. The circuit shown in the diagram uses, in addition to the three LEDs of different colors, three npn switching transistors, two zener diodes, one blocking diode, and a handful of 0.5-watt resistors. The red and yellow combination indicates a battery voltage of less than 11.7 V, yellow shows 11.7 to 12.7 V, and the green light shows that the battery voltage is 12.7 V or more.

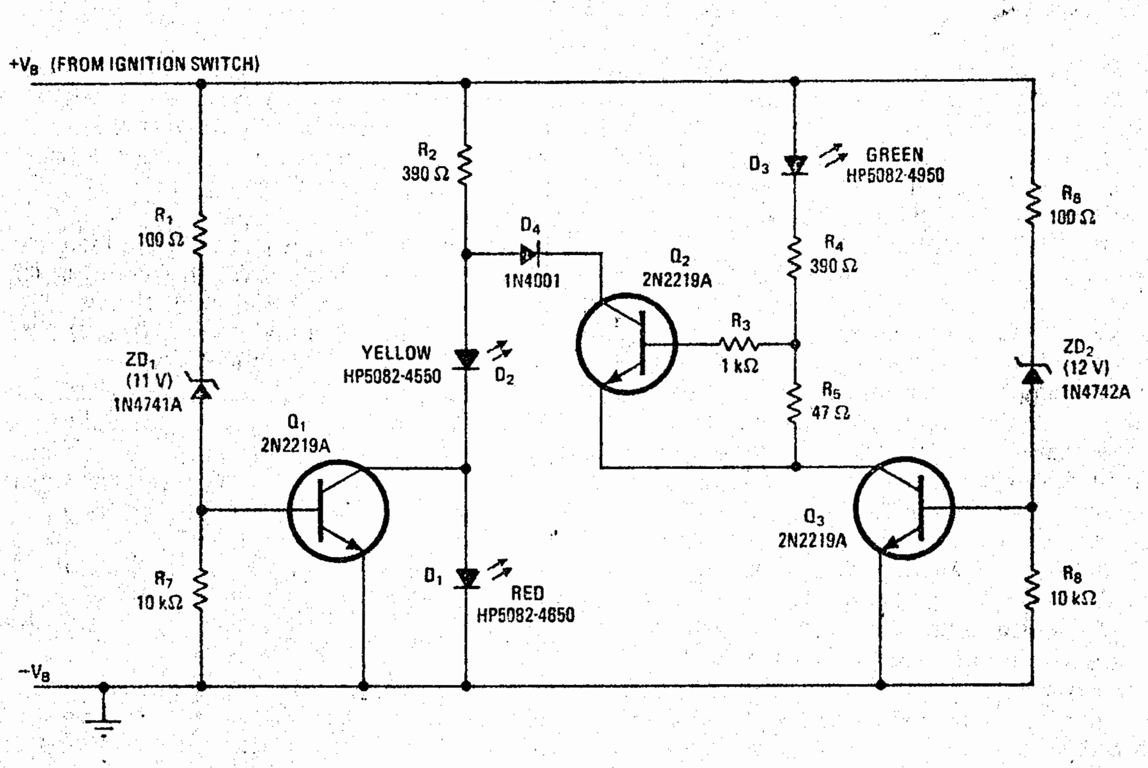
If the battery voltage is below 11.7 V, all of the transistors are turned off. Diode D_4 blocks the current path through green LED D_3, the base and collector of Q_2, D_2, and D_1, so that current flows only through R_2, D_2, and D_1. The red and yellow LEDs light up to indicate that the battery, voltage regulator, alternator, or any combination of the three, is bad.

If the voltage is between 11.7 and 12.7 V, transistors Q_2 and Q_3 are still turned off, but zener ZD_1 conducts and lets Q_1 turn on to shunt out the red LED. Thus only the yellow LED lights up, warning the driver of a fairly low battery voltage. Unless this low-voltage situation improves after a few miles of driving, the electrical system of the car should be inspected for faults or high contact resistances.

If the battery voltage quickly reaches 12.7 V or more after the car is started, Q_3 also turns on. Current through Q_3 lights the green LED and also turns on Q_2 to shunt out the yellow LED. The resulting green light assures the driver of a functioning electrical power system in his car.

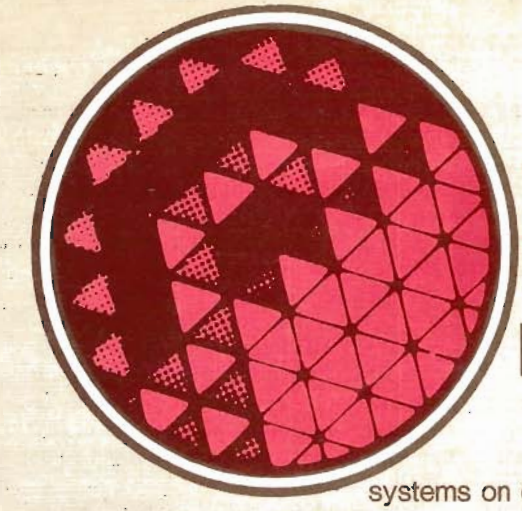
The user may choose zener diodes with somewhat different breakdown voltages if he wants to shift the three indication levels to fit his own requirements. □

Designer's casebook is a regular feature in Electronics. We invite readers to submit original and unpublished circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. We'll pay $50 for each item published.



BATTERY VOLTAGE	LEDs LIGHTED
$V_B \leq 11.7$ V	RED AND YELLOW
$11.7\text{ V} \leq V_B \leq 12.7$ V	YELLOW
$V_B \geq 12.7$ V	GREEN

Battery-voltage indicator. Colored LEDs indicate three ranges of battery voltage in car. A weak battery turns on red and yellow, a stronger battery breaks down 11-V zener to light only yellow, and a strong battery turns on green as both zeners conduct. Resistors R_7 and R_8 provide high-temperature stability. This unit can warn of need for corrective maintenance of car's electrical system.



BY IMRE GORGENYI

TURN/BRAKE INDICATOR FOR TRAILERS

Simple solid-state circuit pérmits use of 3-wire systems on older trailers with 4-wire systems on new cars

ON AUTOMOBILES manufactured after 1977, the turn-indicator and brake lights are independent. This may present a problem when one wants to haul a trailer that is equipped with the older 3-wire system in which turning and braking are indicated by the same rear light.

The interface circuit shown here permits coupling the old 3-wire system to a modern car. The circuit for only one side is shown so it must be duplicated for the other side. When using this circuit, the car light flasher does not have to be replaced with a heavy-duty version as in some trailer systems. As a further advantage, there are no moving or electromechanical parts such as relays that can be affected by moisture or vibration encountered on the highway.

Operation. Each time the vehicle turn signal is operated, its line alternately goes high and low as determined by the flasher. When the line goes high, diode *D1* is forward-biased, turning on the *Q3/Q4* combination and causing the common turn-brake lamp to glow. When this line goes low, the transistor pair is turned off and the turn/brake lamp is extinguished. Thus, the turn/brake lamp glows in step with the lamp flasher.

When the brake is applied, that line goes high and forward biases *D2*. The transistor pair is turned on and the turn/brake lamp glows. Since the brake line remains high as long as the brake is depressed, the lamp remains lit.

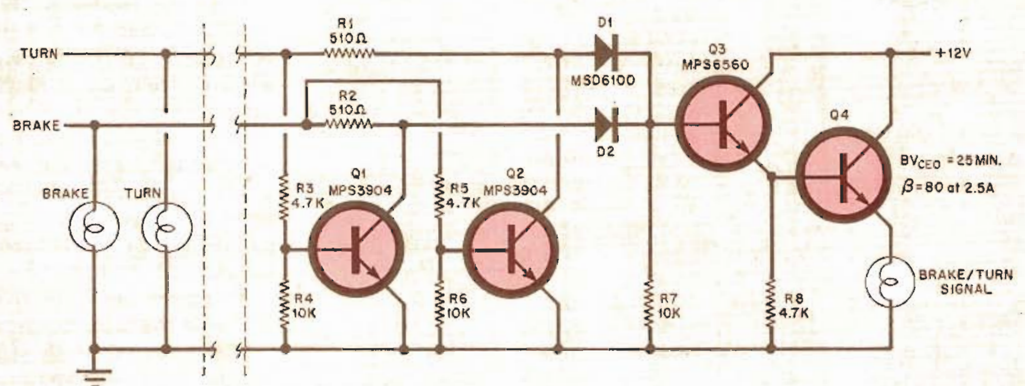
Now let us consider what happens when the turn indicator level is actuated and the brake is applied at the same time. Initially, the turn signal drives the *Q3/Q4* pair through *R1* and *D1* with the base voltage for *Q3* developed across *R7*. Each positive voltage signal on the turn line causes the lamp to go on. Note that the pulsating signal on the turn line is also applied to the base of *Q1* through *R3* and *R4*. This signal does nothing to *Q1* since the brake line (collector source of power) is low, and reverse-biased *D2* keeps the positive voltage across resistor *R7* from appearing on the turn line.

When the brake line goes high, the transistor pair is driven through *R2* and *D2* with the base voltage for *Q3* developed across *R7*. Transistor *Q2* is also turned on by the positive voltage applied to its base through *R5* and *R6*, making *Q2* draw current through *R1* each time the line goes high, thus bringing the *D1/R1* connection effectively to ground. In essence, this action shuts off the turn signal input to *Q3/Q4*. But then *Q1* takes over. Driven by the "turn" line, it alternately releases and pulls down the "brake" voltage at its collector. Therefore, one trailer light flashes but it is 180 degrees out of phase with the car's orange light. The other is on steadily, indicating that the brakes are on.

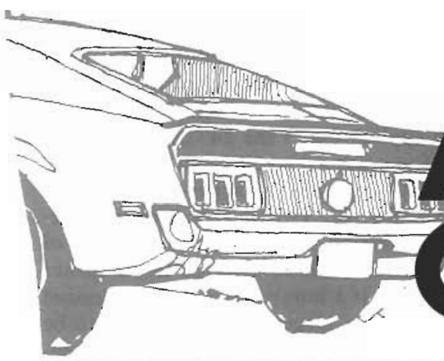
Construction. Since the circuit is relatively insensitive, it can be fabricated in any desired fashion. Two identical systems should be made, one for each side of the trailer. The turn signal is taken from the appropriate line, while the common brake signal is used.

A power Darlington can be substituted for the *Q3/Q4* combination as long as you make sure that the output transistor in the last stage can carry the current required by the lamp.

The circuit can be mounted in the car with the two lamp wires, battery wire and ground fed to the trailer. Taking the taillight wire, electric brake, and backup light connection into account, we should use a seven-pole connector. ◇



The conversion circuit above must be built twice—one for each side of the car.



TRANSIENT PROTECTION FOR AUTOMOBILE CIRCUITS

BY ROBERT PEASE
National Semiconductor

ˈafeguards for solid-state circuits in your car

ˈT CAN be very frustrating to have a ˌnew circuit you built for your car ılfunction when the engine is being ırted or even running smoothly—espe- :lly when it checked out fine with the ˉ parked. What went wrong? Chances are the problem is at the power source.

A 12-volt battery by itself is a very well-behaved power supply. But when the engine runs and the alternator charges the battery, a variety of things can happen to upset electronic circuitry.

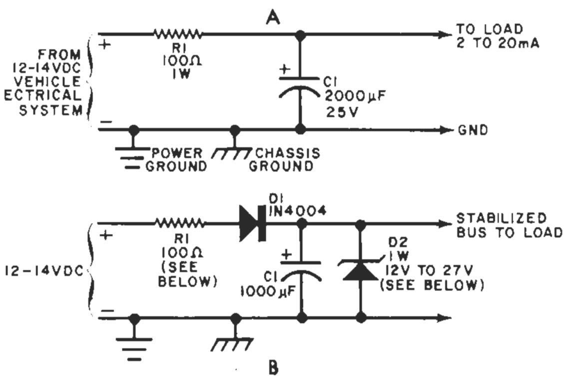


Fig. 1. The simple R-C filter at A will provide adequate protection against transients for low-power applications. For better protection, the circuit at B is recommended. Ratings for D2 and R1 are determined from the Table as described in the text.

VALUES FOR D2 AND R1

D2			R1	Rated
ɔlts	Watts	Type	Ohms	Output Current
2	½	1N759 or 1N963	300	8 mA
ˈ	½	1N971A or 1N5254	150	15 mA
²	1	1N4742	150	15 mA
7	1	1N4750	75	30 mA
2	5	1N5349A	27	75 mA
²7	5	1N5361A	15	150 mA
2 or	50	1N2810A or	1.5	1.5 A
27		1N3311A		
27	75	Motorola MR2525	1	2 A

For example, transients measuring 1 to 10 volts P-P are commonly found in the 12-volt automotive power-supply. These will not usually harm semiconductor circuits, but they can cause severe noise and instability problems and false-triggering of sensitive logic circuits.

Larger transients that can cause damage also appear at various times, as when a battery is temporarily disconnected or when battery terminals become corroded. These transients, sometimes known as "load dump," can reach +60 to +80 volts for a few-hundred milliseconds. When the engine is running, and the alternator is delivering power to the battery, the voltage regulator holds the output to about 13.8 V. When the battery (load) is removed, the output overshoots until the voltage regulator can reduce the alternator field, which takes time to decay, and re-establish the correct output voltage. Another severe transient, which usually occurs when the ignition is turned off, can go to −50 volts for 100 milliseconds. This

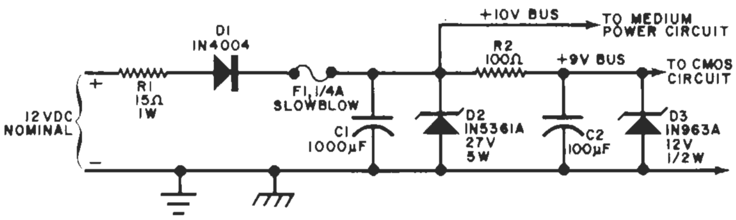


Fig.2. Sometimes, if your circuit contains parts requiring protection at different levels (such as CMOS components), it can be partitioned. Double protection is actually provided for the CMOS.

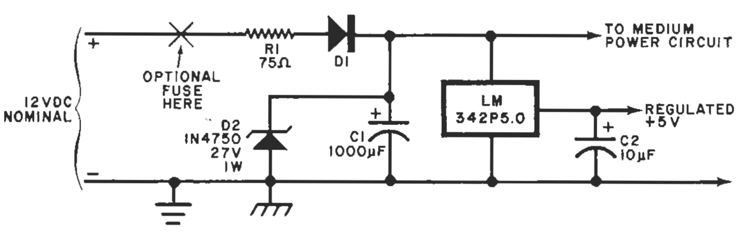


Fig. 3. CMOS components can be protected along with medium-power circuits by using a three-terminal regulator to provide separation.

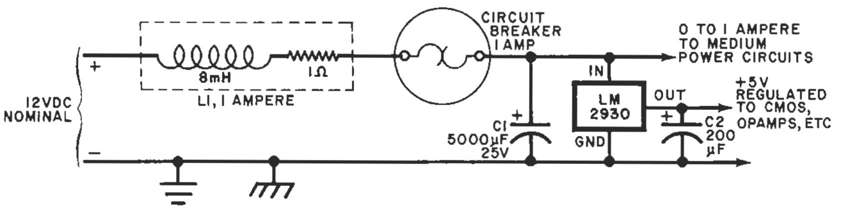


Fig. 4. The tops in decoupling and regulation provided by an inductor, circuit breaker, capacitors and regulator.

"field decay" results as the excitation in the alternator field dies away.

Other random transients can reach ± 200 to 400 volts for a few microseconds. Such peaks can be reached when inductive elements connected to the vehicle power bus are switched on or off, thus producing rather large back-emf spikes. No ordinary solid-state circuits can survive this kind of transient onslaught without protection. As a prime example, popular CMOS circuits, which are ideal for low-power designs, can be destroyed by supply voltages outside the range of +15 and −1 volt. Obviously, some form of protection is required to keep electronic equipment operating reliably in a car. But what kind? And how much?

Levels of Protection. One criterion for deciding how well protected a circuit should be is its importance to the system. The inconvenience caused by an inoperative car stereo system is of a different order from that caused by the untimely discovery—when you are miles from the nearest telephone—of a failure in a newly installed solid-state ignition system. It would make sense to protect the latter circuit more rigorously than the former.

Manufacturers, too, have reason to be concerned about intercepting transients before they cause trouble. How much immunity should be provided for a run of 10,000 radar detectors? What will warranty repairs cost if they are needed? And what about microprocessor-controlled systems to be installed in 3 million cars? An epidemic of malfunctions here could be calamitous. Clearly, protective systems in which you can place a high degree of confidence are called for in these situations.

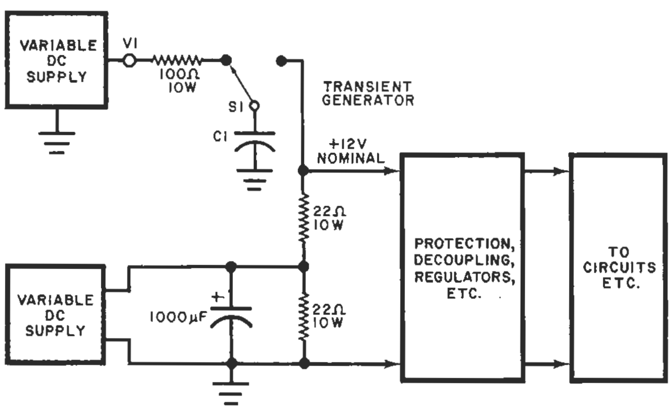
Trapping the Spikes. Now, let's discuss several circuit approaches for protecting a hobbyist's circuits and/or store-bought hardware. The first technique is simple decoupling and bypassing. There are many low-power circuits which will run reliably and well in a car if you simply add a large R-C filter in the supply line. As the cost of a 2000-μF capacitor is very reasonable, circuit A of Fig. 1 is a good basic scheme. All the positive and negative transients mentioned above will be heavily attenuated by the simple *R1C1* filter. For low-power applications, Fig. 1A provides adequate protection. But the circuit in Fig. 1B is better and costs little more.

In Fig. 1B, diode *D1* will provide full tolerance of negative transients on the 12-volt bus; and positive transients will cause less ripple, too. Also, this diode will guard against inadvertently reversed supply connections. Zener diode *D2* prevents the stabilized bus from rising too high. If you use a 27-volt zener, this circuit will be highly resistant to any short-term 60-volt transients on the input. It will also withstand connection of a 24-volt battery, which some mechanics use for emergency starting. (Obviously, placing 24 volts on a 12-volt system can damage any electrical or electronic elements connected to the bus. For safety sake, *all* circuit elements other than those necessary to start the vehicle should be switched off during the application of the 24 volts.)

If you use a 12-volt zener to limit output voltage, use a larger-valued resistance for *R1*. This is recommended because during fault conditions, most of the current will be diverted to *D2* rather than *C1*. If a lower value of *R1* is needed to permit a larger output current to be drawn, the dissipation rating of the zener diode should be increased accordingly. (See Table.) In normal operation, a low-power zener will never get warm but it can be destroyed by a load-dum transient if the value of *R1* is too low For good reliability, therefore, the resis tor values in the Table should be treate as the lower limits.

The use of a 27-volt zener presume your circuit can tolerate a +30-volt sup ply. What if your circuit includ CMOS components that are rated fo +16 volts absolute maximum? Yo might be able to partition your circuit. the high-current portion can tolerat +27 volts briefly, and the CMOS is, o course, drawing only a small curren then the circuit of Fig. 2 will do nicely The path to the CMOS circuitry is now doubly protected.

Note that a fuse has been added t



V1	C1
+60 to +80V	2,000 to 10,000μF, 100V
−50V	1,000 to 5,000μF, 60V
+200V	1μF, 400V
−200V	1μF, 400V
+400V	0.1μF, 600V
−400V	0.1μF, 600V

Fig. 5. Circuit to be used in testing your transient protection system. Throwing the switch provides transients on the regular supply. Be sure the polarity and rating of the capacitor agree with those of the transient voltage.

this circuit. Resistor *R1* will normally prevent the fuse from blowing, but the fuse is intended to open up in case of severe overload, such as repetitive 60-volt pulses, or a short on the 10-volt bus. Should you use a fast-blow or a slow-blow fuse? The latter will be more suitable for critical systems where you really don't want the fuse to blow. An instrument-type fuse can open up quickly and provide better protection to delicate circuits. The choice of fuse type depends on the "level of confidence" you want.

Another good way to run CMOS along with medium-power circuits is shown in Fig. 3. A three-terminal regulator that can put out 0.2 or 0.5 ampere costs less than a dollar—and often less :han a 1-watt zener. The 5-volt bus in his circuit will be much less noisy than he protected but unregulated voltages hown in Figs. 1 and 2. Most 5-volt reglators are rated to 25 or 30 volts input, nd voltage transients will be rejected / 60 dB or more.

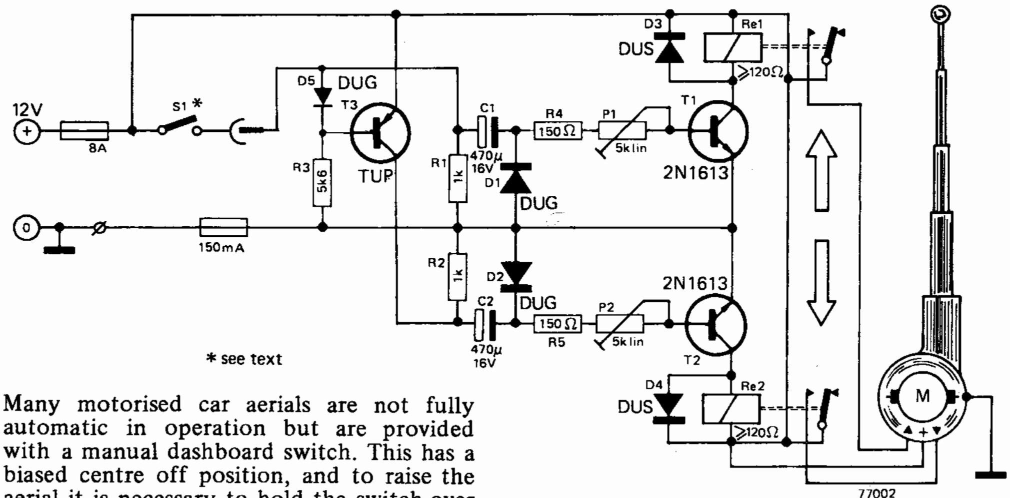
The circuit of Fig. 4 represents an :imate in protection and reliability. It :orporates several moderately priced :tures, and while you may not want to : all of them, you can pick the ones ı consider advantageous. In case of a ·volt load-dump, the output voltage l not rise above 40 volts because in:tor *L1* will prevent the current from ng for 10 to 20 milliseconds. Capaci- *C1* prevents the brief pulse through from pulling the output line to an :essive level. A circuit breaker proes instant reset—no searching for ıre fuses—and the LM2930 provides 5.0-volt regulated output for critical cuits while withstanding transients as ·ge as +40 volts. As the LM2930 was ɔecially designed for automotive uses, will not be damaged by −12 volts on input bus. Thus in this case, a diode is t needed in the power path (presum- ȝ that the medium-power circuits can erate supply reversal). Other Nation- 3-terminal regulators such as 1317HV will tolerate as high as +66- t inputs with a well-regulated 6-volt put.

ıl Testing. How do we ensure that cuit is adequately protected against notive transients? When your 'board or prototype is running rly, connect it as shown in the test it of Fig. 5, and throw *S1*, for sev- "transients" at each voltage. If the ıit keeps on running during and afhese tests, you'll know that the proion circuit is really doing its job! ıt way, circuits you add to your vehiwill operate at least as reliably as ɔse installed at the factory. ◇

33

automatic car aerial

U. Behrendt

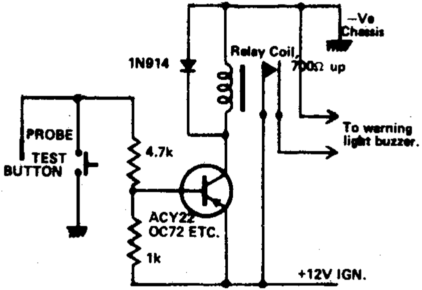


Many motorised car aerials are not fully automatic in operation but are provided with a manual dashboard switch. This has a biased centre off position, and to raise the aerial it is necessary to hold the switch over to one side until the aerial is fully extended. To lower the aerial the switch is held over to the other side until the aerial is fully retracted. It is quite easy to forget to lower the aerial when leaving the car, thus losing the vandal-resistant advantage of a motorised aerial.

The circuit described here will raise the aerial automatically when the car radio is switched on and lower it when the radio is switched off. S1 can be the special switch contact provided for this purpose in some car radios, or an extra lead may be taken from the normal on-off switch, since little extra current is drawn through this contact.

T3 is normally turned on. When the radio is switched on (S1 closed) T3 is turned off. Current flows from S1, charging up C1 through R4, P1 and the base of T1. T1 turns on, energising Re1 and causing the aerial to extend. The time for which the aerial motor runs can be adjusted to the correct value by P1. When the radio is turned off T3 turns on and C2 charges through T3, R5, P2 and the base of T2. T2 turns on, Re2 is energised and the aerial retracts. The time can again be adjusted (by P2).

COOLANT LEVEL WARNING DEVICE



A simple circuit is shown for indicating a drop in radiator coolant level. A variety of transistors and relays can be used and the probe can be made quite easily. The coolant and anti-freeze resistance to earth is about 100Ω and with the level below the probe, infinity.

On the mechanical side the hole in the top tank of the radiator was cut with a pair of sharp pointed dividers.

4-TO 3-WIRE TAILLIGHT CONVERSION

Connect brake and turn signal lights of trailers to foreign cars

BY MICHAEL S. CRANMER

VIRTUALLY all foreign cars and trucks have taillights that use separate bulbs for the turn signals and brakes. This type of system uses a 4-wire configuration, which makes it possible to have the turn-signal light blinking and the brake light on at the same time on the same side. A problem occurs, however, if you want to hook up a U.S.-made trailer to the foreign car or truck. Trailer lights are usually wired on a standard 3-wire system. That is, the turn signal and brake light share the same bulb. With this configuration, if the brake is on and the right signal is on, the right bulb blinks while the left bulb indicates brake operation.

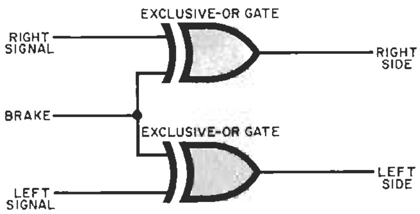


Fig. 1. Basic signal connections to the EXCLUSIVE-OR logic gates.

The problem of connecting a 4-wire signal system to a 3-wire system can be solved by using an EXCLUSIVE-OR gate between the two systems. The truth table for this logic gate is given in Table I while the basic connections to the gate are shown in Fig. 1. Figure 2 shows all possible input conditions of left or right signal and brake light with the resultant output of the EXCLUSIVE-OR gate. Note that the ground wire is not shown in Fig. 2. The complete schematic of the circuit is shown in Fig. 3.

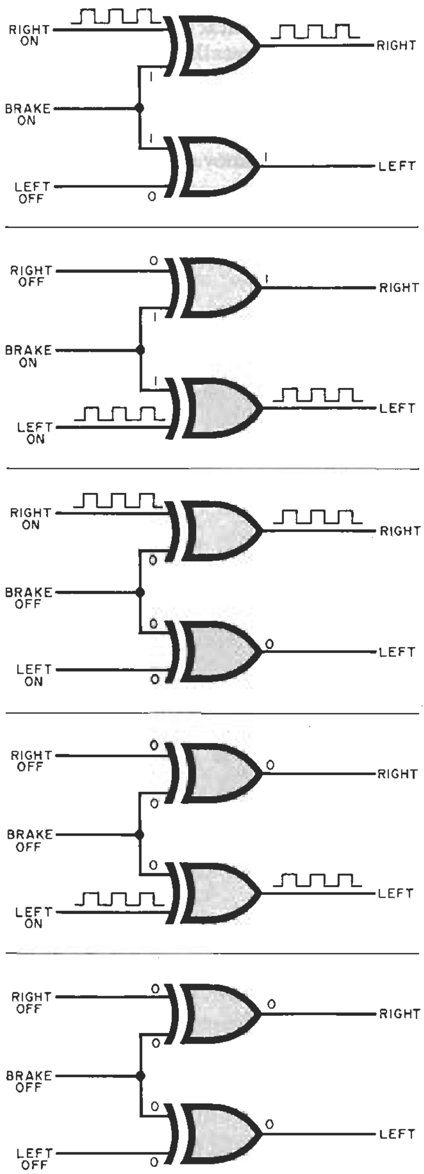


Fig. 2. All possible input conditions of directional and brake signals.

Circuit Operation. The circuit is powered by the signal display system on the foreign car or truck. The three diodes, in parallel with the inputs, conduct current to the power Darlingtons and the EX-OR power supply pin. The diodes also prevent current from conducting back to another gate input. (These diodes are not needed if a separate 12-volt line is run from the battery.) The three 1-kilohm resistors, tied to the inputs of the gates, are used to pull to ground the input gate voltage. (This is needed to keep the gate inputs from floating high.) The other 1-kilohm resistors are used as current limiters. Unused input pins on each gate must be tied to V_{cc} or ground. Also it would be advisable to place an in-line fuse on the 12-volt supply.

TABLE I—EXCLUSIVE-OR TRUTH TABLE

Inputs		Output
0	0	0
0	1	1
1	0	1
1	1	0

Construction. Building this circuit is simple and inexpensive. Most of the parts can be mounted on a piece of perfboard with the power Darlingtons mounted on heat sinks. Usual care should be taken with the CMOS IC to insure that it is not damaged by static electricity. ◇

PARTS LIST

D1-D3—1N4004 diode
IC1—quad 2-input exclusive-or gate
R1-R5—1-kΩ, ¼-watt resistor
Q1,Q2—2N6388 power Darlingtons, (Radio Shack 276-2068 or similar)
Misc.—Case, perfboard.

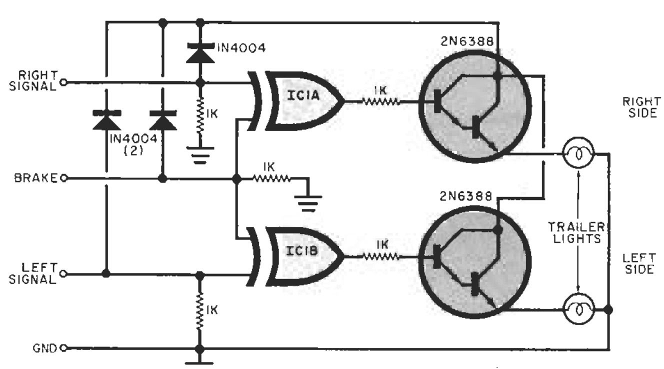


Fig. 3. Complete schematic of the circuit between car and trailer lights.

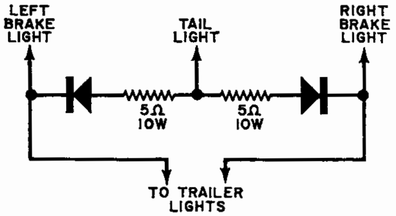
Single-Filament Tail Light Converter

BY MARVIN BEIER

MUST YOU RESTRICT your trailer hauling to daylight hours because you don't have the safety lights required by law for night hauling? If so, a simple converter circuit, installed in your trailer lamp circuit, can allow any single-filament trailer light to operate as tail and brake lights, four-way safety flashers, and individual turn signal indicators.

The converter circuit, shown in the schematic diagram, consists of two 10-watt resistors and two 25-volt, 5-ampere silicon diodes. These few components can be housed in a 4″ × 2″ × 2″ metal utility box, which can then be bolted in any convenient location near the trailer lights. Connections to and from the converter circuit should be through a screw-type barrier block.

The cables from your car brake and tail lights and to the trailer lights should be #16 or heavier wire. Use spade lugs on the ends of the wires that connect to the barrier block.



Only "hot" lead hookups are shown; circuit must be completed by connecting a cable between trailer and car chassis.

Once installed between the car and trailer lights, the converter operates as follows: with the car lights turned on, current flows through the tail light lead and both pairs of resistors and diodes to the trailer lights. The brilliance of the trailer lights is somewhat subdued as a result of the voltage drops across the resistors.

Now, when the car brake is operated, current flow bypasses the resistors and diodes, going directly to the trailer lights via the left and right brake-light leads. Here, full current is delivered, and the trailer lights operate at full brilliance. The diodes are in reverse bias, preventing current from circulating through the diode/resistor circuit.

When the directional signal or four-way safety lights are operated, the trailer lights again glow at full brilliance. Each lamp can operate singly since the diodes again restrict the current flow in one direction.

You will notice from the schematic diagram that only one connection is shown to each of the trailer lights from the car. The diagram assumes that the trailer and car grounds are coupled together to complete the circuit. -30-

Headlight Delay

Use your car headlights to give post-parking illumination with this simple unit.

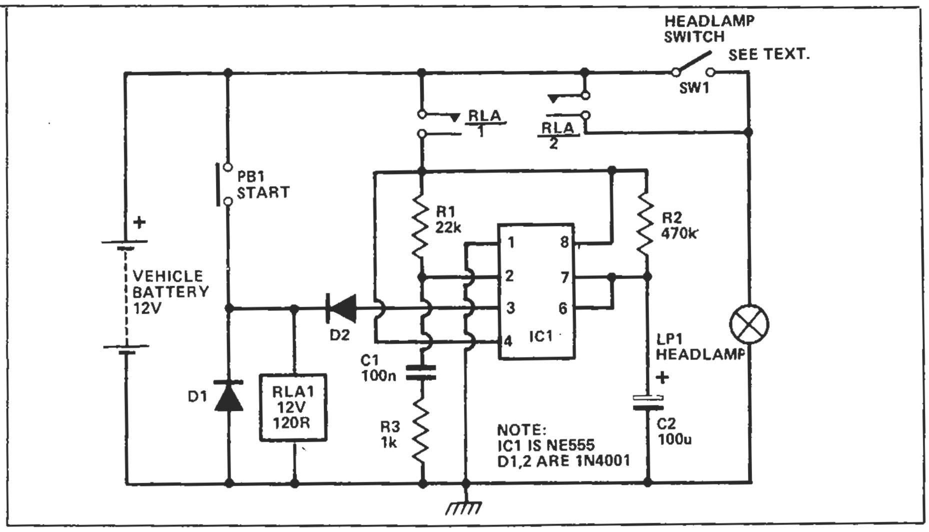
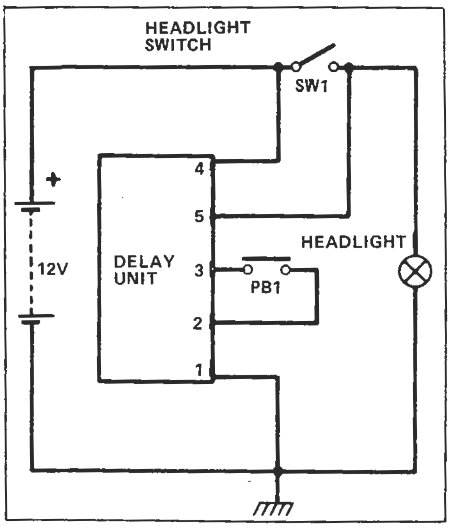


Fig. 1 Circuit diagram of the unit.

THIS SIMPLE LITTLE UNIT lets you use your car headlights to illuminate your pathway for a pre-set period of about 50 seconds after you have parked the vehicle. At the end of this period the unit turns the lights off automatically.

The unit thus enables you to avoid walking into trash cans or tripping over junk that may be obstructing your private driveway, and helps you avoid stepping into various nasties that may be laying on the public sidewalk. The unit is easy to install in the vehicle.



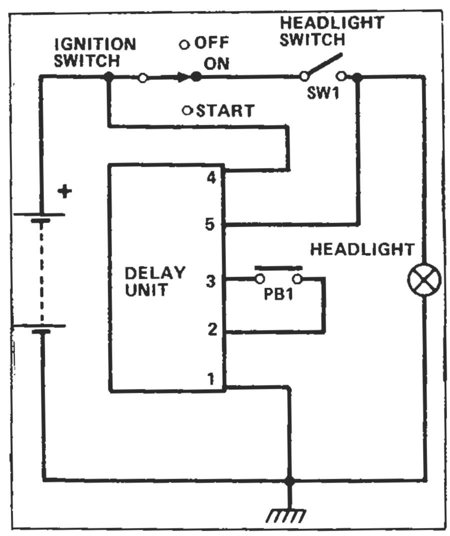


Fig. 2a (Left): Connection of the dealy unit to a car system where the headlights are independent of the ignition switch.
Fig. 2b (Right): Connection to all other systems.

Construction and Use

Construction of the unit should present no problems at all. The relay can be any 12V type with a coil resistance of 120 ohms or greater, and with two or more sets of N.O. contacts that are rated at 3 amps or greater.

When it comes to installing the unit, note that two methods of connection to the vehicle are possible. On some vehicles the headlight switch is connected directly to the battery so that the headlights operate even when the ignition is turned off (see Fig. 2a). In this case take connection 4 of the 5 way terminal block directly to the live side of headlamp switch SW1, and connection 5 to the headlamp side of SW1.

The alternative connection is shown in Fig. 2b. Here, the headlight switch is wired in series with the vehicle's ignition switch, so that the headlights only operate when the ignition is turned on. If your vehicle uses this type of connection, take connection 4 of the 5 way terminal block to the live side of the ignition switch, and take connection 5 to the headlamp side of SW1.

How It Works

The unit is designed around a type-555 timer with a relay output. The relay has two sets of normally-open contacts. Normally, START switch PB1 and the relay contacts are open, so zero power is fed to the timer circuit and (assuming that HEADLIGHT switch SW1 is open) the headlights are off. Circuit action is initiated by briefly closing push-button switch PB1.

When PB1 is momentarily closed power is fed directly to the relay coil, and the relay turns on. As the relay turns on contacts RLA/2 close and apply power to the headlights and contacts RLA/1 close and apply power to the timer circuit, but pin 2 of the IC is briefly tied to ground via C1 and R3 at this moment, so a negative trigger pulse is immediately fed to pin 2 of the IC and a timing cycle is initiated. Consequently, pin 3 of the IC switches high at the moment that the relay contacts close, and thus locks the relay on irrespective of the subsequent state of switch PB1.

The 555 is wired as a one-shot timer or monostable with a timing period of about 50 seconds (determined by R2 and C2). Thus, the relay and headlights are held on for the duration of this 50 second timing period. At the end of the timing period pin 3 of the IC switches to the low state, so the relay turns off and contacts RLA/1 and RLA/2 open, removing power from the timing circuit and the headlights. The operating sequence is then complete.

Headlight Delay

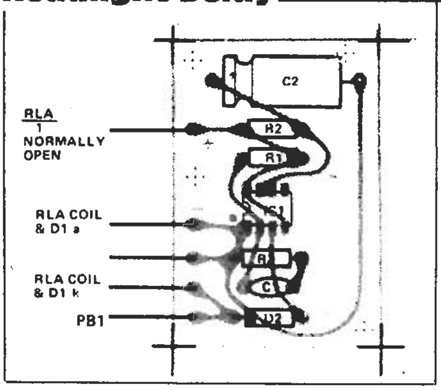


Fig. 3 Component overlay for the delay unit.

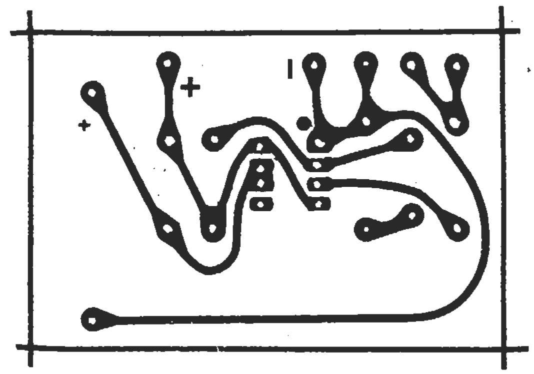


Fig. 5 Full size foil pattern of the headlight delay PCB.

Parts List

RESISTORS

R1	22k
R2	470k
R3	1k

CAPACITORS

C1	100n polyester
C2	100u elect.

SEMICONDUCTORS

IC1	NE555
D1,2	1N4001

MISCELLANEOUS

Relay rated at 3A 2 pole n/o 120 ohms or more SPST push button 5 way terminal block rated at 5A case.

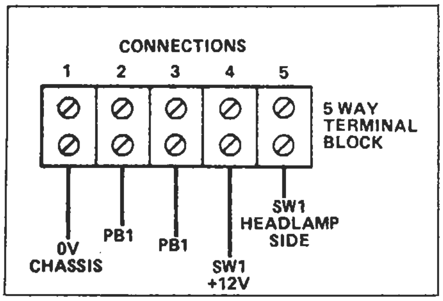


Fig. 4 Wiring of the delay unit to a 5 terminal connection block.

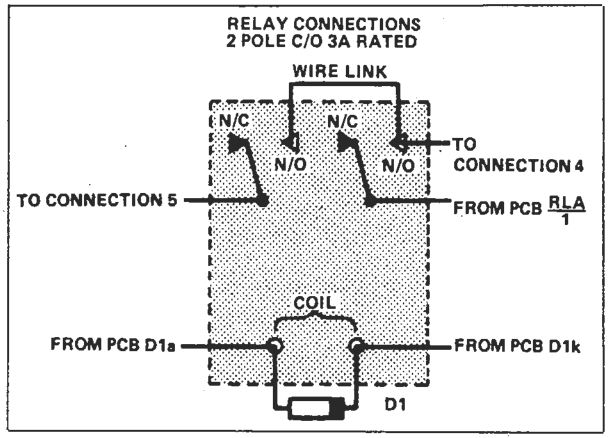
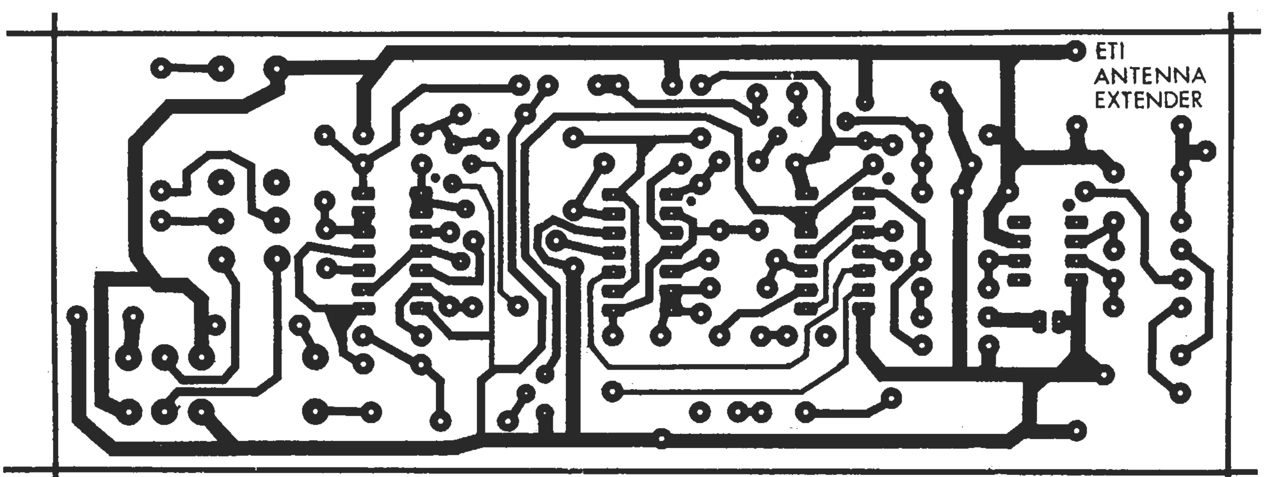


Fig. 6
The relay and D1 wiring.

Antenna Extender

Continued from page 112



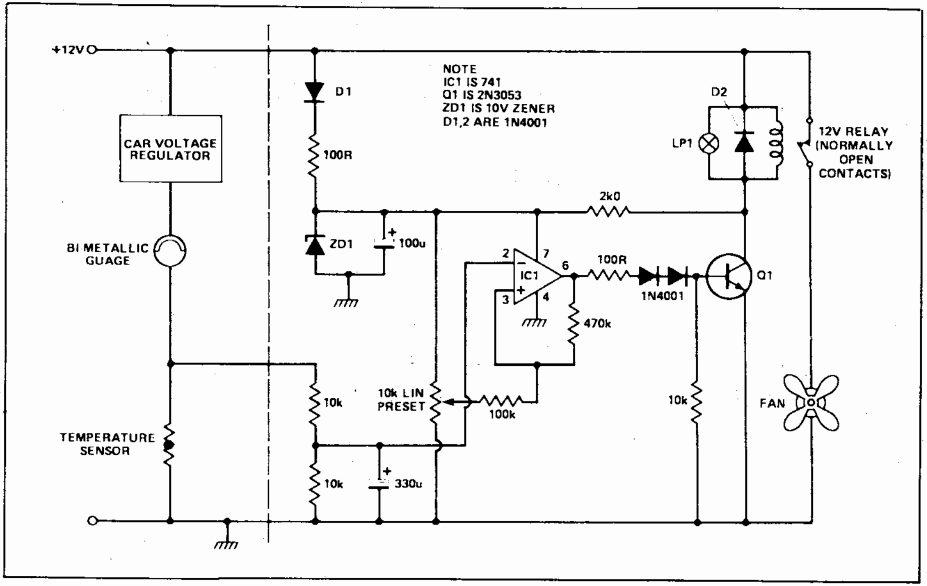
CAR FAN CONTROL

by J.N. Swanson

If, like me, you own an old car with a conventional fan, driven from the engine, a worthwhile improvement can be obtained by fitting an electric fan in its place. These can readily be bought from a scrap yard. The advantages gained are better fuel consumption and lower engine noise particularly at high revs.

A problem arises in finding a suitable switch to operate the fan at the required temperature. Most of the switches fitted to cars are fitted in a threaded hole in the side of the radiator, which means that most scrap yards are unwilling to separate the two. For this reason I have designed a circuit to switch on the fan using the existing temperature sensor for the temperature gauge.

The voltage regulator on the car usually works by interrupting the supply so as to provide an average level of about 10V. Because of this, a fair bit of smoothing is required in order to stop the fan switching on and off with the regulator. A zener diode provides a 10V supply for the op-amp and the reference voltage. The 470k and 100k resistors provide a certain amount of hysteresis and the two diodes prevent the transistor turning on due to offset of the op-amp. The fan may run for a few seconds when the ignition is intially turned on. This may be prevented by increasing the 100uF capacitor to a few thousand uF, but I find this useful as otherwise in winter the fan may not run for weeks on end.



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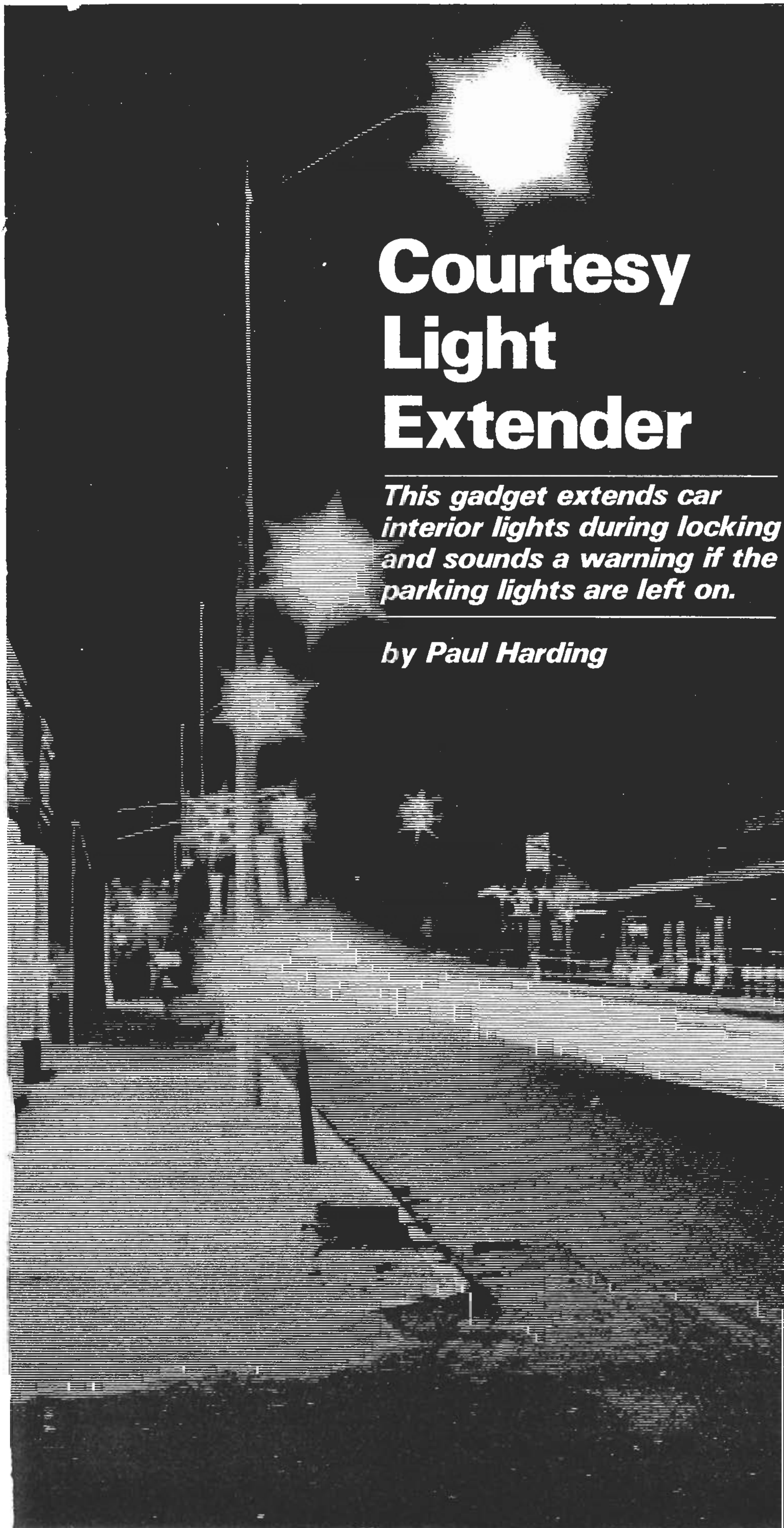


Courtesy Light Extender

This gadget extends car interior lights during locking and sounds a warning if the parking lights are left on.

by Paul Harding

IF you have ever left your car lights on, only to return to find the battery resolutely flat, or had to grope around in the dark to find the ignition switch after you have closed the car door, or even both, then this is the circuit for you. On the one hand, it holds the courtesy light on the twenty seconds after the car door has first been opened, and on the other hand it bleeps if the car door is opened while a light (any light you designate) is still on. Up to five lights can be monitored, and to cause minimum inconvenience, both functions are cancelled when the ignition (phase 1) is turned on.

The completed project is small enough to fit in almost any nook or cranny, and since it only used CMOS chips, it requires no power switch. A light reminder that has been switched off is no use to anybody.

The Circuit

Looking at the block diagram first, it can be seen that the circuit falls in to three main parts: a monostable, a gated oscillator and some mixed logic.

The monostable drives a relay, which in turn simulates the closing of a door switch, keeping the courtesy light switched on. It is triggered by opening any of the car doors.

The logic decides when the gated oscillator should be on; i.e, when any light is on, a door is open and the ignition is off.

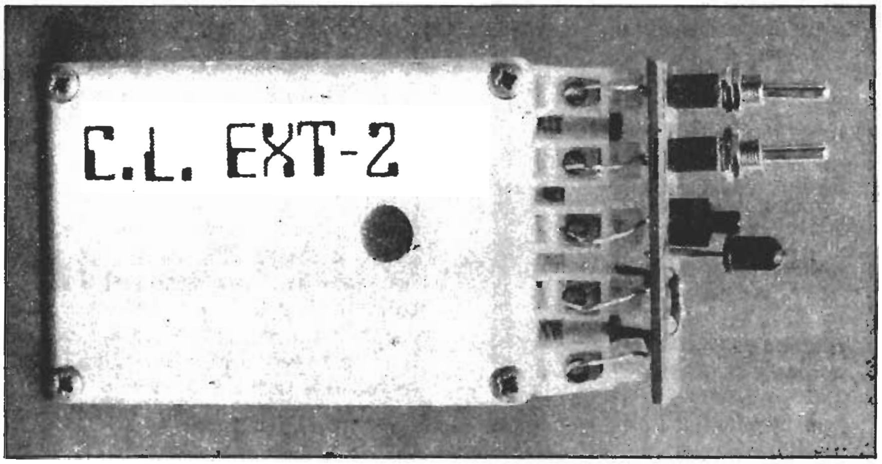
The gated oscillator is merely a tone generator feeding a piezo element, switched on and off by a slow (2Hz) astable.

When the ignition is on, both the monostable and the oscillator are held off.

Now look at the circuit diagram (Figure 2). Since a negative going input is generated at CL when a door is opened, and a positive triggered monostable is used, an inverter (IC1a) is placed at he latter's input. The monostable consists of IC1b and c, and C1 and R3. A negatively triggered monostable is not used here because another NOR gate is required elsewhere in the circuit. R1 holds IC1a's input high; although the courtesy light will do this itself, a bulb failure would otherwise cause this input to float, leading to unpredictable circuit behaviour, and possible static discharge damage. Q1 buffers the monostable's output so that RLA1 can be driven.

The IGN line is tied to one of IC1's inputs, and this forces the monostable into a reset state when the former is high.

The lights reminder has five wired-or inputs, which will go high when a light is turned on. Opening a door will bring IC1a's output high, and these simultaneous high states will be inverted by IC1d, and the slow oscillator around IC2b is gated on. This, in turn, will gate



on the fast oscillator around IC2d, via IC2c, activating X1.

R1, 2,5,6,9, 10 and 11, and D7 protect the CMOS ICs from static damage. C4 is a supply decoupling capacitor, and D6 removes inductive spikes from the relay coil.

Construction and Installation

Construction is simplicity itself, since all the components, except for X1, fit onto one PCB. There are two wire links, one of which goes under the board (shown as a dotted line on the overlay diagram, Figure 3), and these should be fitted first. Next, insert and solder the resistors, diodes, transistor, relay and capacitors, in that order. Remember to observe the polarity of the diodes, and the electrolytic and tantalum capacitors. Some of the components are mounted too close to the ICs to allow sockets to be used for the latter, even though they are CMOS. Remember to use a grounded soldering iron, solder pins 7 and 14 first (to allow the internal, protection devices to work) orientate them correctly, and install them last.

Short lengths of wire can be soldered into the holes for off-board connections, and flexible leads attached to these. Insulate the connections with rubber sleeving, and terminate the leads at a terminal block screwed to the outside of the case.

The connections to the various existing wires can be made using connectors, or by stripping the insulation off at a convenient point and soldering. Such connections must be insulated to avoid possible pyrotechnics.

The wiring diagram clarifies the connection details.

The circuit will work on any negative-

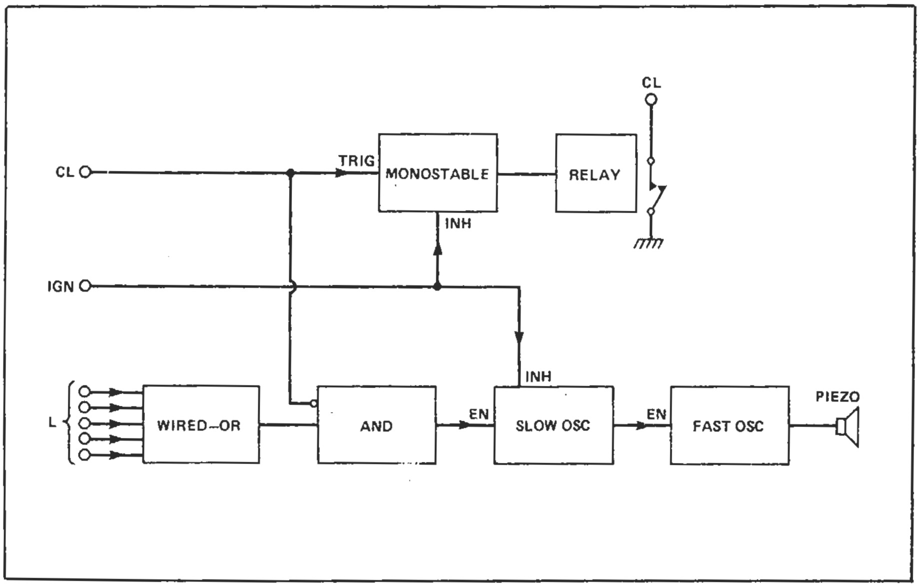


Fig. 1 The block diagram

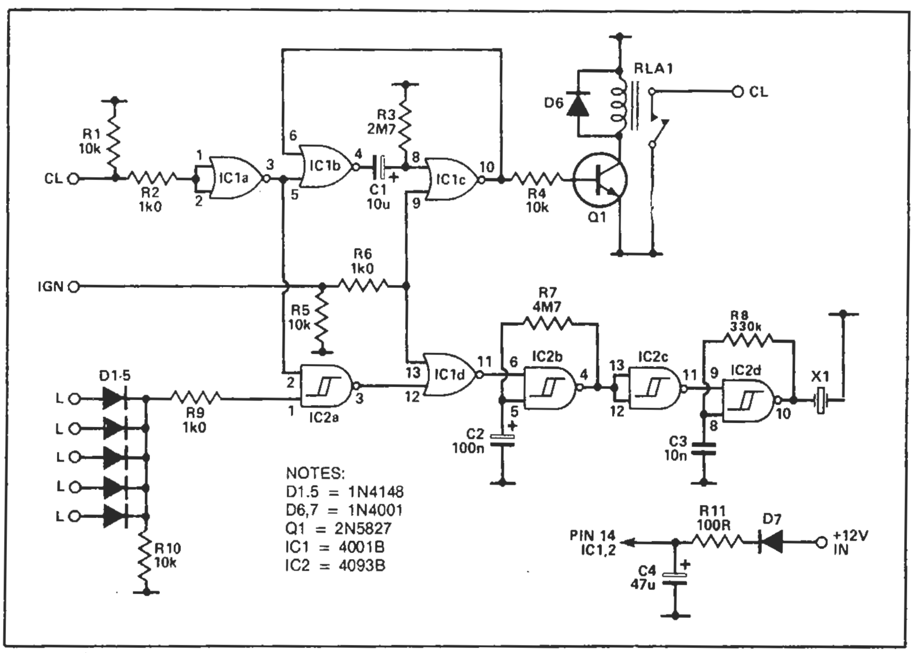
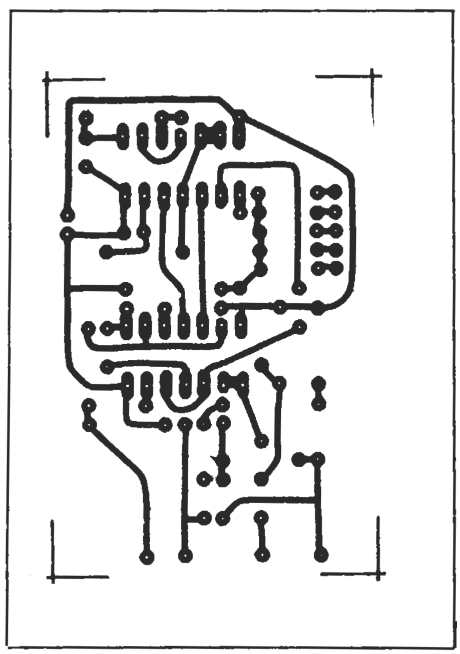


Fig. 2 The circuit diagram.



The PCB artwork.

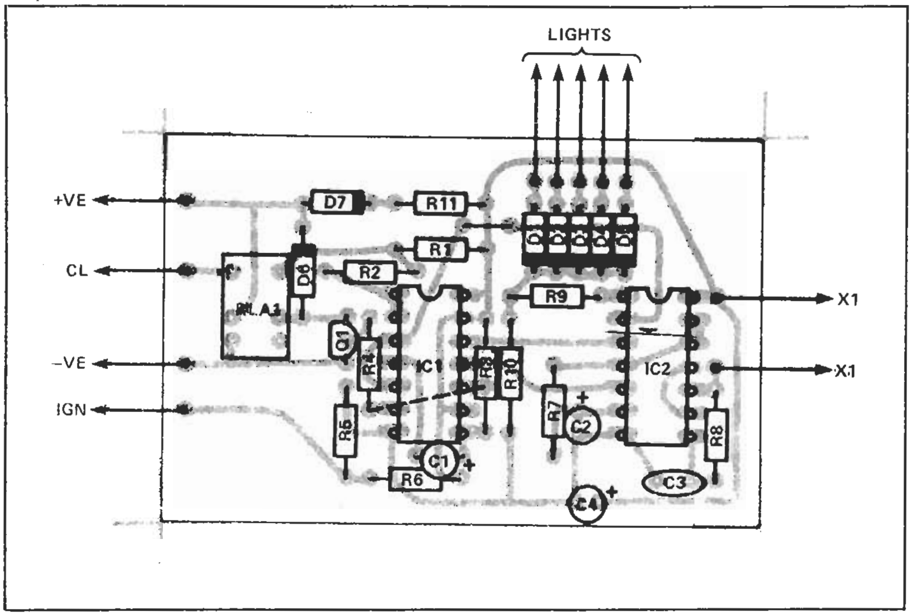


Fig. 3 The component layout. Note the wire links (one under and one above the board). Sockets cannot be used for the CMOS ICs, so note the handling precautions in the text.

Parts List

Resistors (All 1/4W, 5 percent)

R1,4,5,10	10k
R2,6,9	1k
R3	2M7
R7	4M7
R8	330k
R11	100R

Capacitors

C1	10u, 16V tantalum bead
C2	100n film type
C3	10n film type
C4	47u 16V electrolytic

Semiconductors

D1-5	1N4148, 1N914
D6,7	1N4001 or equiv
Q1	2N5827
IC1	4001B
IC2	4093B

Miscellaneous

RLA1	12V, 2A contacts
X1	piezoelectric sounder

Utility case, terminal block, wire, etc.

ground car whose lights are switched positive, and whose courtesy light is grounded when a door opens, i.e, most cars.

If the specified case is used, it will be necessary to trim off the corners of the PCB to ensure adequate clearance.

X1 can either be a cased or uncased piezo element. The former is screwed to the outside of the case, while the latter is stuck inside the lid of the case, over an 8mm hole to let out the sound. Remember to insulate the bare element to prevent short circuits.

Testing

Switch on any one of the lights being monitored, and open the car door. The piezo device should sound. Close the door, and the courtesy light should then remain lit for twenty seconds or so. Both functions should cease when the ignition key is turned to phase 1.

It will be found that the buzzer continues to sound even when the door has been closed. This is because the relay is holding the CL input low, and is unavoidable. ■

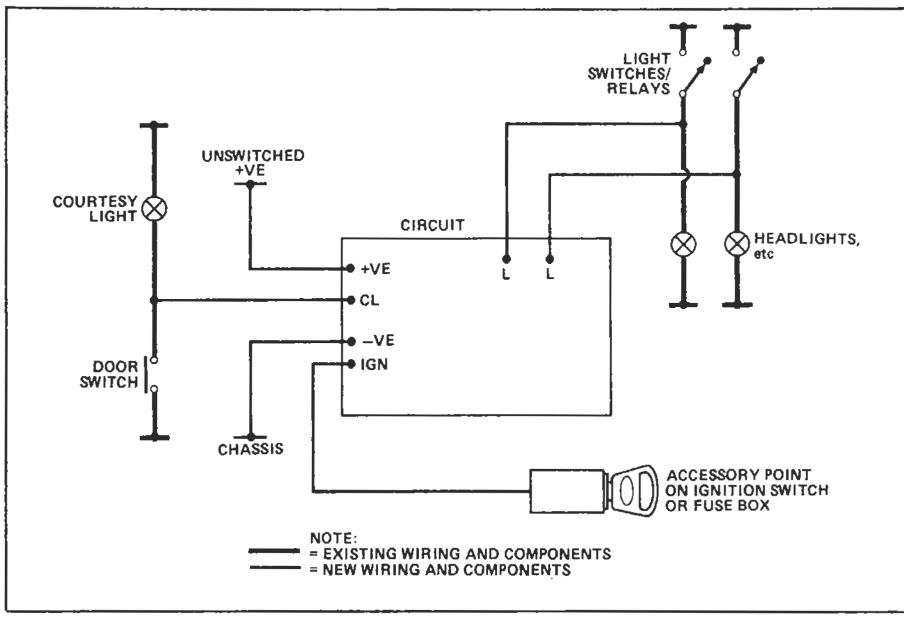


Fig. 4 The wiring diagram. The circuit will work for cars with negative ground, whose lights switch positive when a door opens. This includes most cars.