Car Back-Up Alarm

Sounds an audible alert to warn pedestrians and other drivers when you move your car in reverse gear

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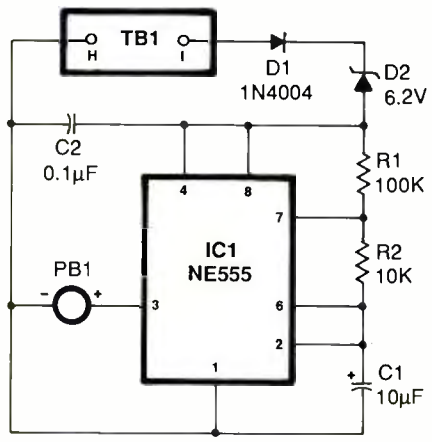
Over the years, a number of safety features have been introduced by the automotive industry. One of the most practical among these is the device that audibly alerts pedestrians and other drivers that a vehicle is backing up. Every motor vehicle should have such a device in it—not just certain commercial vehicles. If you wish to have your family car sound an alert when you place the transmission in reverse gear, you can do so by installing our Car Back-Up Alarm.

This Back-Up Alarm automatically sounds an intermittent, piercing tone when you put your vehicle in reverse. The Alarm immediately silences when the shift lever is taken out of reverse position. The circuit that accomplishes this is very simple and can be built for less than $20 in readily available components.



PARTS LIST

Semiconductors

D1—1N4004 or equivalent rectifier diode

D2—1N4735A or equivalent 6.2-volt, 1-watt zener diode

IC1—NE555 timer

Capacitors

C1—10-µF, 16-volt electrolytic

C2—0.1-µF, 25-volt ceramic

Resistors (¼-watt, 5% tolerance)

R1—100,000 ohms

R2—10,000 ohms

Miscellaneous

PB1—Piezoelectric buzzer (Murata Erie PKB8-4A0)

Printed-circuit board or perforated board with holes on 0.1" centers and suitable Wire Wrap or soldering hardware (see text); terminal board (Mouser Cat. No. ME153-2102); suitable enclosure (see text); splice connectors; hookup wire; solder; etc.

Note: The following items are available from BALLco, Inc., P.O. Box 1078, Snellville, GA 30278-1078 (Tel. 404-979-5900): Printed-circuit board No. 881101-B,$9.95; complete kit of parts not including enclosure, $19.95. When ordered with the kit, price of the enclosure is $3.95. Printed-circuit board is postpaid in U.S.; for other items, add $2.50 P&H postage and handling. Georgia and Florida residents, please add sales tax.

Fig. 1. Complete schematic diagram of the Back-Up Alarm circuit.

About the Circuit

The Back-Up Alarm's circuit, shown schematically in Fig. 1, is built around the 555 timer integrated circuit. In this circuit, *IC1* is connected in the astable configuration.

When you move the shift lever of your vehicle to the reverse-gear position, the circuit to the back-up lights becomes active and, hence, is at +12 volts. This potential is fed through rectifier diode *D1* and zener diode *D2* to timer *IC1* and actuates the timer.

Diode *D1* provides protection in the event of reversal of polarity when power is connected to the circuit. Zener diode *D2* reduces the +12 volts delivered by the electrical system in the vehicle in which the project is installed to a safe operating level for audible piezoelectric buzzer *PB1*.

The output of the timer chip is fed to *PB1*, which has internal electronics to provide a warning tone whenever sufficient voltage appears across the terminals of the piezo buzzer. The duty cycle, or alarm on/alarm off time, can be tailored by changing the values of resistors *R1* and *R2* and capacitor *C1*. Capacitor *C2* filters out any electrical noise that might appear on the back-up light circuit line.

Assembly & Checkout

Because of its simplicity, the Back-Up Alarm circuit can be built using just about any traditional assembly technique. If you wish, you can assemble the circuit on perforated board that has holes on 0.1-inch centers using suitable Wire Wrap or soldering hardware. Alternatively, you can assemble it on a printed-circuit board that can be purchased from the source given in the Note at the end of the Parts List or by fabricating your own using the actual-size etching-and-drilling guide given in Fig. 2.

Assuming printed-circuit assembly of the project, wiring diagram Fig. 3 shows component placement and orientation. If you are assembling your Back-Up Alarm project on perforated board, use Fig. 3 as a

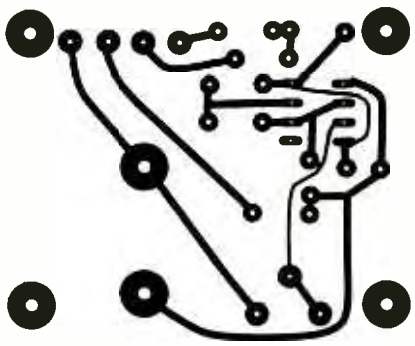


Fig. 2. Actual-size etching-and-drilling guide to use for fabricating the project's printed-circuit board.

rough guide to component placement and orientation.

Due to the typically rough mechanical environment of a motor vehicle, a socket is *not* recommended for *IC1*. If a socket is used, mechanical vibration is likely to cause the IC to work loose from it. Therefore, begin project assembly by installing and soldering into place the resistors. This done, install the capacitors and diodes. Make certain that electrolytic capacitor *C1* and both diodes are properly oriented before soldering their leads to the copper pads on the bottom of the board.

Next, install the piezo buzzer on the board. Actually, you can mount this buzzer either on the board, as illustrated in the Fig. 3 wiring diagram, or off the board and wire it to the appropriate pads on the board via stranded hookup wires. (Note: In this project use only *stranded* hookup wire.) Once the buzzer has been installed, plug the pins of the timer chip into the holes in the *IC1* location and solder each into place. Make certain that the IC is properly oriented and that each pin goes into the appropriate hole in the board before soldering any pins into place. Then install and solder into place terminal board *TB1*.

At this point, it is a good idea to check operation of the circuit. To do so, connect the terminals H and I of *TB1* to the positive (+) and negative (−) terminals, respectively, of a 12-volt dc power source. If all is okay, the alarm should alternately sound and silence for about 2 and 3 seconds, respectively, and repeat this cycle for as long as power is applied to the circuit. (If you used different values than those specified for *R1*, *R2* and/or *C1*, the on/off periods will, of course, be different.)

If your circuit fails to operate as described, power it down and rectify the problem before proceeding. Check particularly for components installed in the wrong locations and in improper orientation. Flip over the board and check all soldered connections. If you see a connection you missed, solder it now. Also, if any connection appears suspicious, reflow the solder on it, and use desoldering braid or a vacuum-type desoldering tool to remove any solder bridges you find.

Once you are certain that the circuit is operating properly (and *after* attaching to it appropriate-length power leads, spray several coats of clear acrylic over the entire circuit-board assembly (but *not* the piezo buzzer and *TB1*) to protect against moisture.

Once weather sealed, the Back-Up Alarm assembly can be installed in your vehicle in a protected location as-is or in an enclosure. If you plan

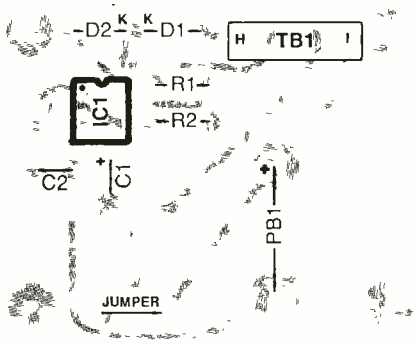


Fig. 3. Wiring guide for pc board. Use the layout shown here as a rough guide to component placement if you assemble the circuit on perforated board.

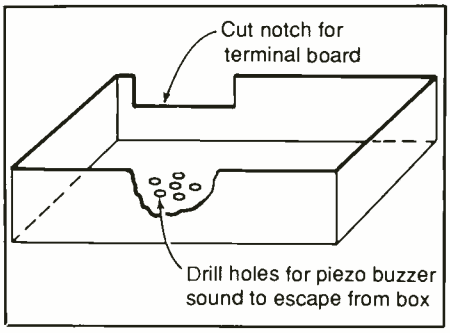


Fig. 4. Machining details for the project's enclosure.

on using an enclosure, prepare it as shown in Fig. 4. The cutout required for the terminal board can be made with a nibbling tool. Make sure you check the orientation of the circuit-board assembly *before* making the cutout (the enclosure has only two posts for mounting the board). Position the assembly with the component side down and the two mounting holes lining up with the mounting posts to determine which part of the enclosure to cut!

If you mounted the piezo buzzer directly on the circuit-board assembly, drill five 3/16-inch-diameter holes to permit the sound to escape. On the other hand, if you have decided to mount the buzzer outside the enclosure, drill only one 3/16-inch-diameter hole for the wires that are to go to the buzzer to exit the enclosure.

Caution: Plastic is a tricky material to drill, and some plastics are easier to drill than others. The plastic used to make the box specified in the Parts List will chip, crack, grab or self destruct if large-size bits are used. Drill speed is important, slower speeds being generally better.

Once you have prepared the enclosure for the project, route the back-up lights and vehicle ground wires and the cable for the piezo buzzer (if you mounted this externally) through the appropriate holes. Position the circuit-board assembly inside the enclosure, with the components facing down and *TB1* lined up with the cut-out. Secure the assembly in place

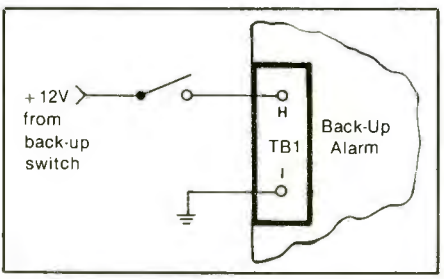


Fig. 5. Details for installing Back-Up Alarm in a vehicle.

with two screws and then mount the cover on the enclosure, using the remaining four screws.

Installation

Refer to Fig. 5 for details on installing the Back-Up Alarm in a motor vehicle. Note here that terminal H on *TB* connects to the back-up light conductor located at the back-up switch in your vehicle. If your vehicle has a column shift lever, this switch is normally located on the steering column. For other shifting arrangements, refer to the owners or shop manual or check with your dealer to determine where the back-up switch is located.

The wire coming from terminal H on *TB1* is easy to connect to the back-up switch conductor without having to make any cuts in the existing vehicle wiring with the aid of parallel splice connectors. These connectors are available at your local Radio Shack store and most hardware stores.

Connect terminal I to any convenient chassis ground point in your vehicle, using a suitable length wire.

You can mount the project in any convenient location inside your vehicle near the rear bumper. The location selected should place the project out of the way of direct water spray. Use double-sided foam tape or Velcro strips to fasten the enclosure in place in the selected location.

Since the sound from the piezoelectric buzzer is fairly directional, you may want to mount the electronics package of the Back-Up Alarm in the trunk and fabricate a bracket to mount the buzzer on the bumper. ME