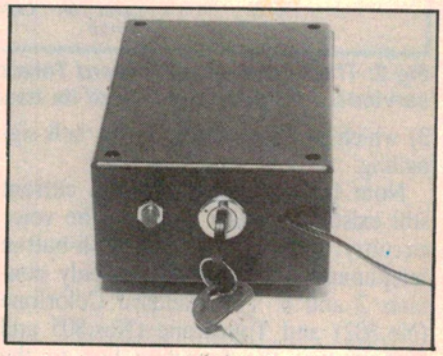
Improve the protection of your house or car with this

Satellite siren

Building this low cost unit and adding it to an existing security alarm system will give greatly increased protection. It's easy to build, and is compatible with virtually any alarm — whether commercial or home built. The end result compares very favourably with commercial units costing much more.

by BRANCO JUSTIC



Alarm systems which are approved by organisations such as insurance companies recommend the addition of a backup battery and/or a satellite siren for greatly improved protection. The siren described here effectively provides both of these features, in the one unit and can easily be added to any existing alarm system.

It is operated from only four small nicad penlite cells and uses a solid state DC-DC converter to provide the necessary voltage (12V) to power a mini piezo siren. The resultant inexpensive unit is able to power the siren continuously for more than 30 minutes. It's charging system only consumes about 10mA from your power supply or vehicle battery.

Alternative alarm systems

Car alarm systems are usually built around one of the following three arrangements:

(1) Single central control unit without battery backup.

(2) Central control unit with backup battery.

(3) Central control unit and satellite siren.

The cheaper systems of course employ a single central control unit. This type of alarm system should be effective with the less professional burglar. Since most thieves fall into this category, many people argue in favour of this type of simple and inexpensive alarm system.

Some of us however prefer the extra protection obtained from a control unit with backup battery. This provides the advantage of still having an active alarm in the event of the main supply being disconnected i.e., the car battery disconnected by the thief.

In this type of system, careful consideration should be given to the placement of the control unit and the siren, in order to make it difficult for the thief to get at. And of course since we are considering a thief who is either a professional, or perhaps a non-professional who doesn't give up easily, the alarm unit with its associated battery, siren and interwiring should be mechanically very rigid, making it difficult to destruct.

As an add-on to a simple alarm system it would be therefore logical to contain the backup battery facility and its associated siren in a rigid enclosure, and it is this combination that is commercially termed as either a "Backup siren" or a "Satellite siren".

The benefits of adding a satellite siren are numerous. Firstly there is the added protection of a self-contained second system. Secondly there is the automatic benefit of "backup battery operation", even if the main alarm does not have this feature; the "satellite siren" will come into action immediately in the event of the supply (e.g., vehicle battery) being disconnected. Also there is a certain degree of protection against a burglar who doesn't hesitate to hack into your system (vandalises). The satellite siren will come into operation if the wiring to the main alarm is cut!

In summary it could be said that an economical system which employs a satellite siren would comprise a simple and easy to get at mains alarm, which is connected to a more rigid and remotely placed satellite siren, like that described here. Some of the locations that could be considered are in the boot, behind the rear seats, under seats which are hard to remove, under the dashboard etc.

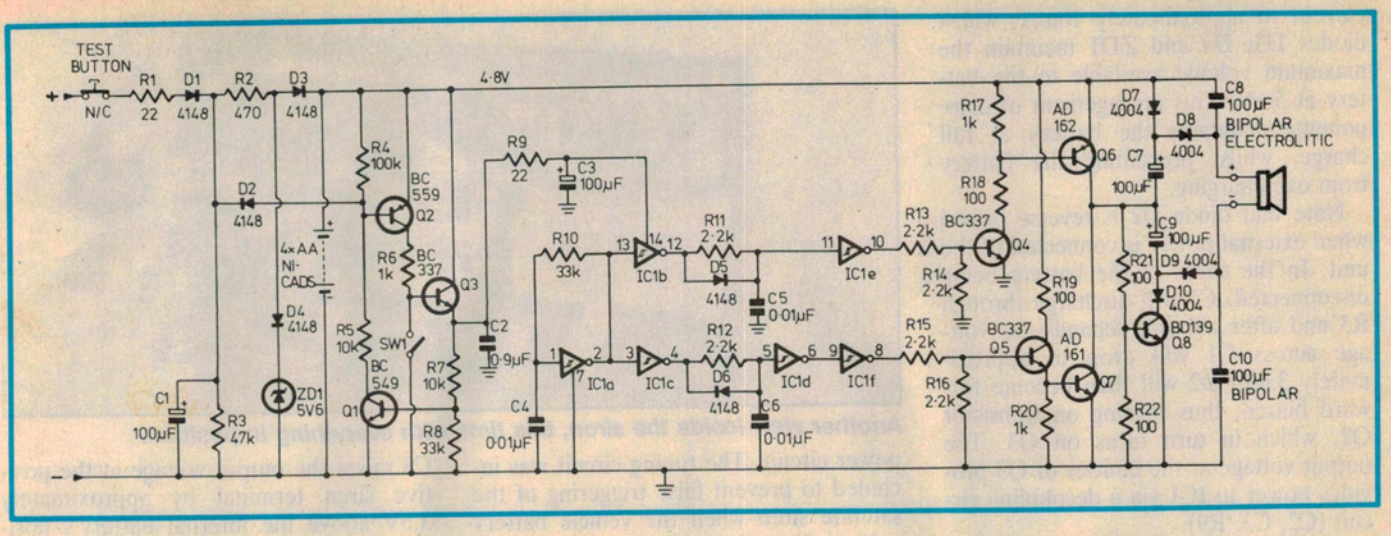
Simple to connect and operate

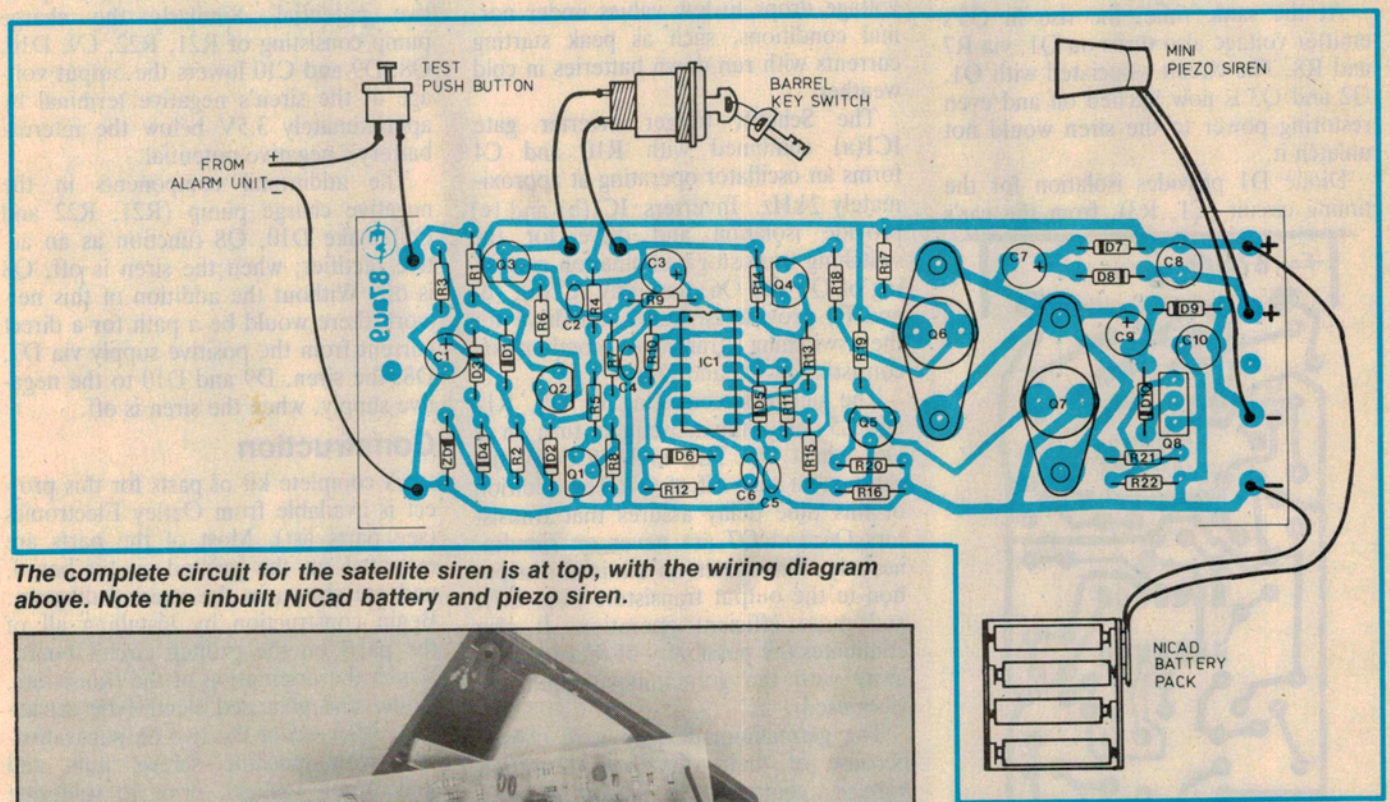
The unit is connected via only two wires to the existing alarm system. The two wires are actually the power supply connections (+ and –), and they are connected to the existing alarm system. Therefore it can be said that the satellite siren derives its power from the existing alarm system.

It is in the event of failure of this power that the satellite siren comes into action, sounding its siren continuously. Actually once power failure has occurred there is no way the siren can be stopped, unless you have the key to switch the unit off. Even the restoration of power to the unit does not stop it.

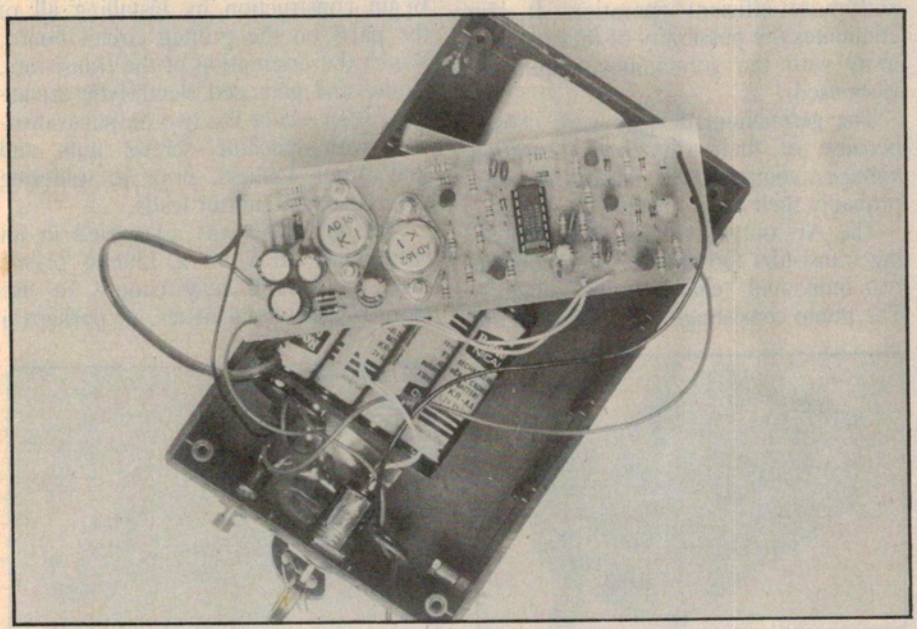
How it works

In basic terms, the siren uses a combined battery charging and voltage drop detector circuit to charge the batteries





The complete circuit for the satellite siren is at top, with the wiring diagram above. Note the inbuilt NiCad battery and piezo siren.



Inside the prototype, with the PCB swung out so you can see the components. The NiCad cells and siren are visible underneath.

and activate a latching circuit, in the case of the power to this unit being interrupted. The latching circuit when operated enables an oscillator which in turn drives switching transistors to produce an AC output voltage. The AC output from this stage is then applied to a voltage multipler circuit which produces sufficient output voltage to drive the 12V piezo siren. Once the latching circuit is operated the only external way of stopping siren operation is by operating the key switch (SW1).

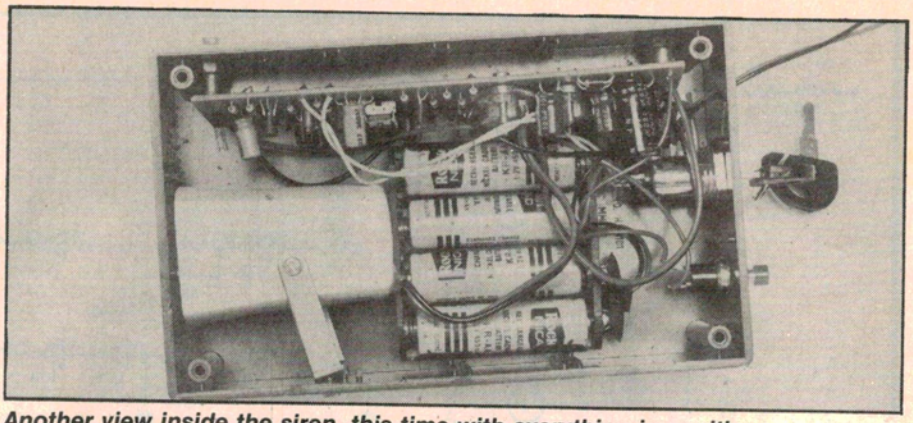
In more detail, the input voltage which is derived from the main alarm is applied via R1, D1, R2 and D3 to the 4.8V nicad battery pack (4x1.2V penlite batteries). R1 and R2 limit the charging

current to approximately 10mA, whilst diodes D3, D4 and ZD1 maintain the maximum voltage available to the battery at 5.6V. This arrangement of components maintains the battery at full charge, whilst preventing the battery from overcharging.

Note that diode D2 is reverse biased when external power is connected to the unit. In the event of the battery being disconnected, C1 will discharge through R3 and after about 5 seconds the voltage across C1 will drop to approximately 3.6V. D2 will then become forward biased, thus turning on transistor Q2, which in turn turns on Q3. The output voltage at the emitter of Q3 provides power to IC1 via a decoupling circuit (C2, C3, R9).

At the same time, the rise in Q3's emitter voltage also turns on Q1, via R7 and R8. The circuit associated with Q1, Q2 and Q3 is now latched on and even restoring power to the siren would not unlatch it.

Diode D1 provides isolation for the timing circuit (C1, R3), from the car's power circuit. The timing circuit was included to prevent false triggering of the satellite siren when the vehicle battery voltage drops to low values under normal conditions, such as peak starting currents with run down batteries in cold weather.



Another view inside the siren, this time with everything in position.

The Schmitt trigger inverter gate IC1(a) combined with R10 and C4 forms an oscillator operating at approximately 2kHz. Inverters IC1(b) and (e) provide isolation and drive for the switching transistor combination consisting of Q4 and Q6. Similarly IC1(c), (d) and (f) provide isolation and drive for the switching transistor combination consisting of Q5 and Q7.

The network consisting of D5, R11 and C5 delays the subsequent turn on of Q6, whilst D6, R12 and C6 delay the subsequent turn off of Q7. The addition of this time delay assures that transistors Q6 and Q7 are never on simultaneously. This results in minimal dissipation in the output transistors (Q6, Q7), and more efficient operation. It also eliminates the possibility of thermal runaway with the germanium output devices used.

The germanium devices were chosen because of their very low saturation voltage, compared to silicon devices; probably their only advantage.

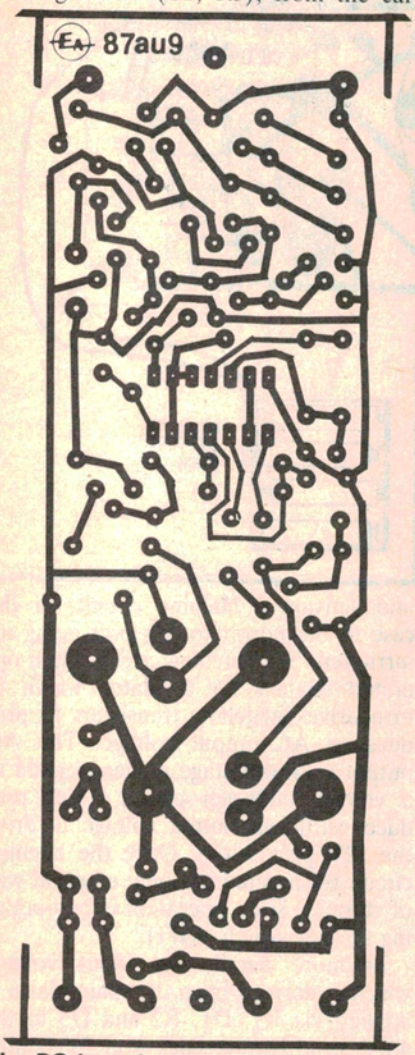
The AC output voltage from switching transistors Q6 and Q7 is applied to two individual "charge pump" circuits. The pump consisting of C7, D7, D8 and C8 raises the output voltage at the positive siren terminal by approximately 3.5V above the internal battery's positive potential. Similarly the charge pump consisting of R21, R22, C9, D10, Q8, D9 and C10 lowers the output voltage at the siren's negative terminal by approximately 3.5V below the internal battery's negative potential.

The additional components in the negative charge pump (R21, R22 and Q8) make D10, Q8 function as an active rectifier; when the siren is off, Q8 is off. Without the addition of this network there would be a path for a direct current from the positive supply via D7, D8, the siren, D9 and D10 to the negative supply, when the siren is off.

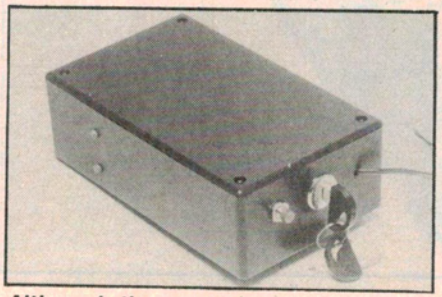
Construction

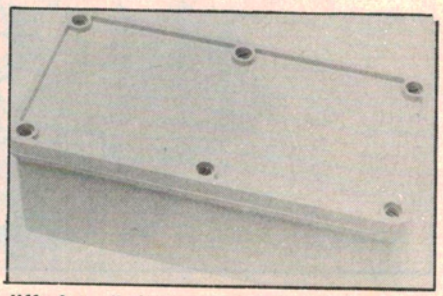
A complete kit of parts for this project is available from Oatley Electronics (see parts list). Most of the parts are mounted on the printed circuit board, and are shown in the overlay diagram. Begin construction by installing all of the parts on the printed circuit board. Watch the orientation of the transistors, diodes and polarised electrolytic capacitors. Also secure the two output transistors with machine screws nuts and shakeproof washers, prior to soldering their base and emitter leads.

The prototype was assembled in an economical 50 x 90 x 150mm plastic case. Individuals may choose to use more rugged metal boxes, or perhaps a



The PC board pattern, actual size.





Although the prototype was housed in a jiffy box (left), you could alternatively use a rugged junction box like that shown at right.

very strong electrical junction box such as the one shown. Assemble all the necessary parts into the chosen box as illustrated in our diagram. To test the unit connect power to the unit, switch the key to the on position and remove the power by operating the "Test" push button. After a few seconds the siren should operate and it should continue to do so even if the test push button is released. Switch the key to the off, position and check that the siren stops operating. Of course we are assuming the batteries were fully charged to start with, if this isn't the case, you'll need to connect the unit to a 12V power supply or battery for a while before testing it.

PARTS LIST

1 PCB, code 87ms9
1 Plastic box 50x90x150mm
1 1 Piezo siren (12V — 150mA)
1 AA 4 cell battery holder
4 AA nicad batteries
1 Pushbutton switch (normally closed)
1 Barrel key switch
1 Battery snap connector
Screws, nuts, washers, hook-up wire

1 BC549 Si NPN transistor
1 BC559 Si PNP transistor
3 BC337 Si NPN transistors
1 BD139 Si NPN transistor
1 AD161 Ge NPN transistor
1 AD162 Ge PNP transistor
1 74C14 or 74HC14 integrated CCT (Hex Schmitt trigger)
6 1N4148 Si diodes
4 1N4001 Si diodes
1 5.6V 400mW zener diode

Capacitors

4 0.01uF ceramics or greencaps
4 100uF, 16V electrolytics
2 100uF, 16V bipolar electrolytics

Resistors - 0.25W 5%
2 x 22Ω, 4 x 100Ω, 1 x 470Ω, 3 x 1kΩ, 6 x 2.2kΩ, 2 x 10kΩ, 1 x 33kΩ, 2 x 47kΩ, 1 x 100kΩ

Where to buy parts: a kit of parts for this project is available from Oatley Electronics, 5 Lansdowne Pde (PO Box 89) Oatley, NSW 2223. Telephone: (02) 579 4985.
PCB kit only (with components) — $17.00
Piezo siren — $16.00
Barrel key switch — $6.50
NiCad batteries — $3.00 each
Complete kit — $55.00 (add $2.00 for P&P)