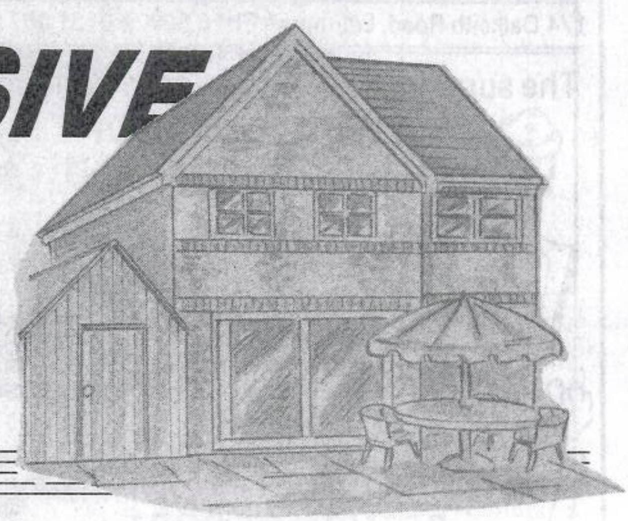
COMPREHENSIVE SECURITY SYSTEM



DUNCAN BOYD

All-round protection for the garden shed, garden furniture, garage and the home.

House break-ins have been a problem for a long time, but in recent years the problem of theft from gardens, garden sheds and garages has escalated dramatically.

This is probably partly due to the fact that a garden shed may be quite easy to break into and therefore offer an opportunity for the thief where there is a low risk of being caught. Furthermore, the average garden shed is now home to a great many expensive items such as mountain bikes, lawnmowers, power tools, etc.

The total value of the items in many cases may well exceed a thousand pounds. Thieves know this, and they also know that they can sell such items quickly for "easy money". Many readers will relate to this problem from bitter personal experience – as does the author, which is how the idea for this project came about.

The design is mains powered but a rechargeable battery is used as a backup if the mains fails or if any of the wires are cut. The battery and the siren are housed outside in a standard alarm bell-box. If someone tries to tamper with the bell-box the siren will sound. An internal buzzer is included. The basic sensor system is in the form of a balanced resistive loop, although provision has been made for passive infra-red (PIR) sensors to be used as well.

HOW IT WORKS

The basic operation of the alarm is shown in the block diagram in Fig. 1. It comprises internal and external sensor circuits, both partly interlinked. Considering the internal section of the alarm first, in which PIR sensors can be used, when the keyswitch is opened there is a 30 second delay before the alarm becomes active. This allows the householder to switch the alarm on and leave the house without it being triggered.

If, after this delay, one of the sensors is triggered, there is a 15 seconds delay before the alarm is set off, which should allow enough time for the householder to switch the alarm off after re-entering the house. If the external siren is set off, it continues to sound for 20 minutes before being automatically switched off.

For the external alarm, a resistive wire loop is used as the sensor. The operation of this circuit is controlled by a switch. When the switch is opened, there is a delay of approximately seven minutes before the alarm becomes active. This allows plenty of time to switch on the alarm, leave the house, take the car out of the garage, and so on, before the alarm becomes active.

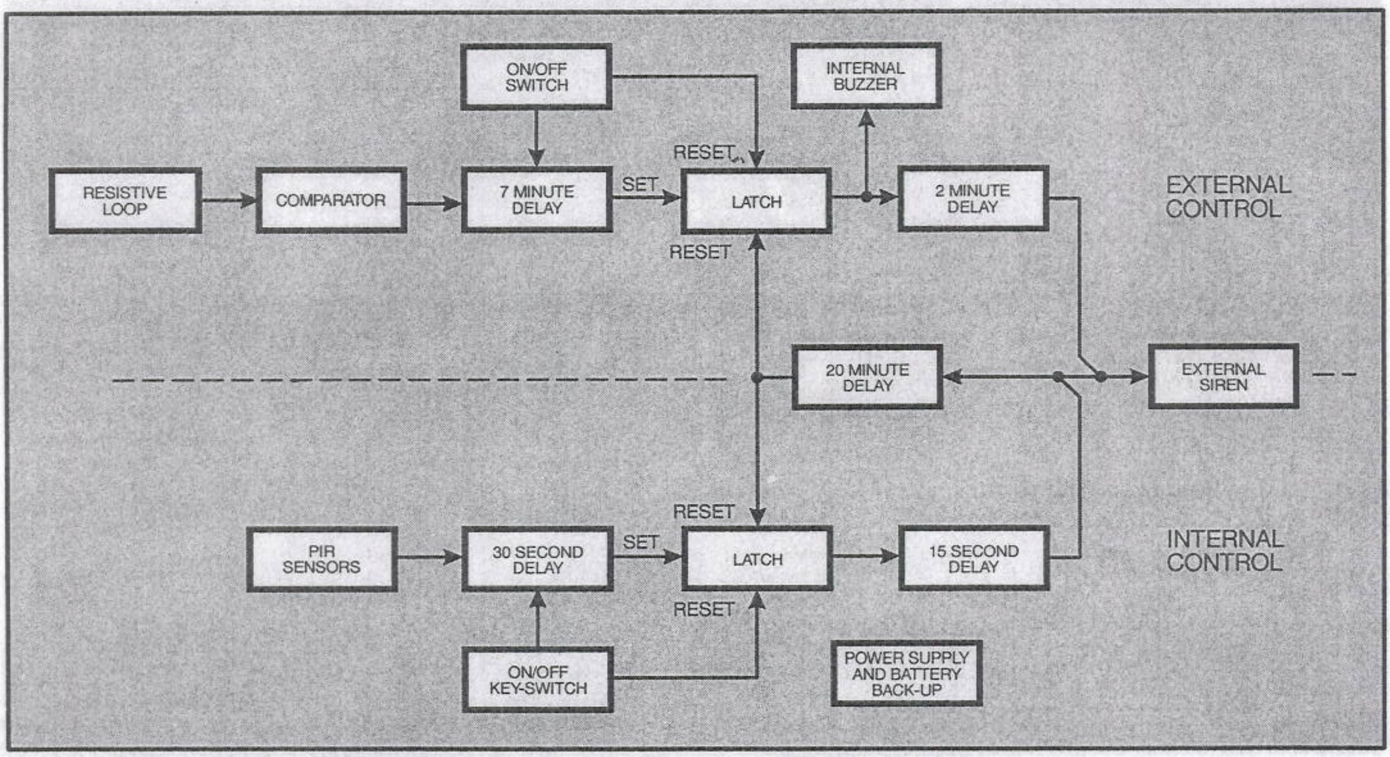


Fig. 1. Block diagram for the Comprehensive Security System.

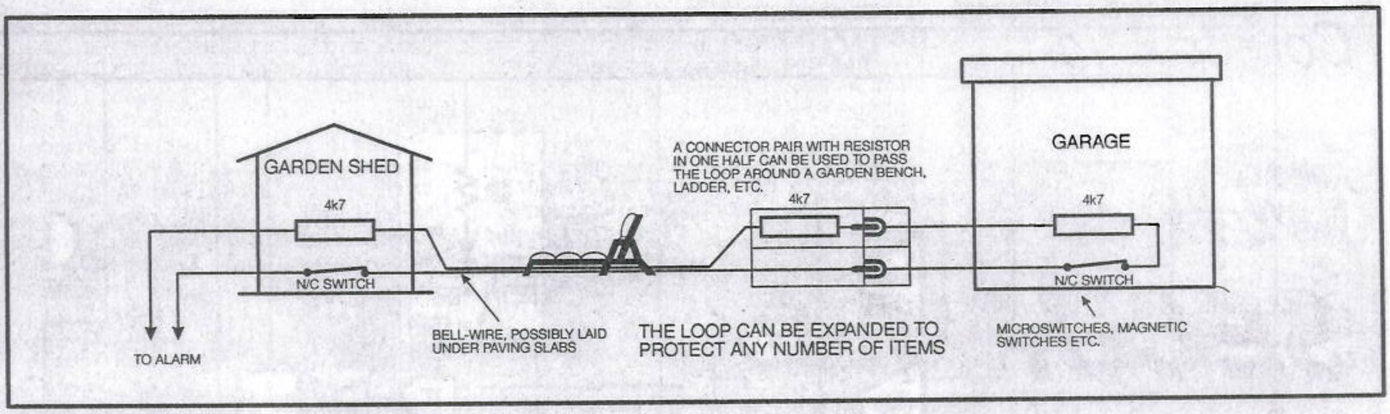


Fig. 2. How the resistive loop might be routed. The options are limitless.

After this period, if the alarm is tripped, the buzzer inside the house will sound, but there will be a delay of about two minutes before the external siren sounds.

There several advantages to configuring the alarm in this way. First of all, it allows time to put the car back in the garage, enter the house and switch off the alarm before the external siren sounds thereby "crying wolf" to the displeasure of neighbours.

Also, if someone raids the garden shed in the middle of the night, the internal buzzer will go off immediately, but the thief will not know that he has been rumbled. There is then a choice: switch off the alarm and telephone the police, hoping they will arrive before the thief disappears with the best power drill. Alternatively, the alarm could be left on, allowing the external siren to sound, which would hopefully encourage the thief to make a hasty retreat.

All delay times can be changed during construction.

SENSORS

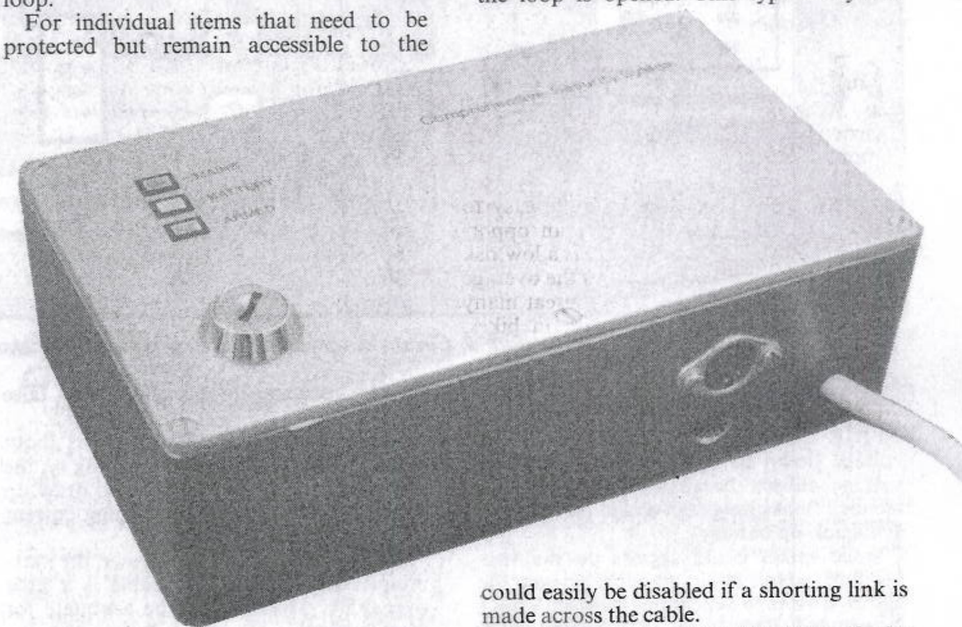
The internal section of the alarm is intended to be used with commercially available PIR sensors. These can be powered from the alarm's 13·8V power supply. The sensors contain normally-closed relay contacts and any number of sensors can be wired in series. Using this type of sensor offers the minimum fuss since there is little wiring. Microswitches, magnetic switches or pressure pads and the like could be used instead.

Externally, bell wire is used to form the resistive loop around the garden shed, garden bench, garage and tools, etc., as shown in Fig. 2. Taking the example of the garden shed, microswitches or magnetic switches can be fitted to the doors (magnetic switches are usually better since they tolerate more play).

If the shed window is large enough to need protecting, conductive tape could be used, or a fine piece of wire stretched across it, supported by nails. If the window is broken, the wire will break, opening the loop.

For individual items that need to be protected but remain accessible to the owner, the garden bench for example, a phono line plug and socket pair can be inserted into the loop. The loop can then be passed through one of the bars in the bench. Each connector pair has a resistor wired into it.

The resistive loop forms one arm of a potential divider, the resultant potential being fed to a "windowed" comparator. In conventional loop alarms, the loop is a short circuit and the alarm will only trip if the loop is opened. This type of system



could easily be disabled if a shorting link is made across the cable.

In the system described here, if the loop is opened, shorted or its resistance changed, the potential at the sensing comparator will change and the comparator will trip. Using this technique, almost any item can be protected. It is very difficult to bypass this type of loop.

With the prototype, the bell wire was laid under the garden path, a spade being used to prise up the slabs just enough to tuck the wire underneath. This meant that no part of the wire could be seen, which was desirable though not completely necessary.

There is no reason why the wire should not be suspended overhead, or laid under a hedge, for example. However, it would be a good idea to protect sensitive areas of the wire by passing it through a length of thin-bore plumbing pipe, or similar. This would prevent the local rabbit population from chewing through the loop during the night!

POWER SUPPLY

The circuit diagram for the mains operated power supply used in the alarm system is shown in Fig. 3. The secondary a.c. voltage from transformer T1 is bridge

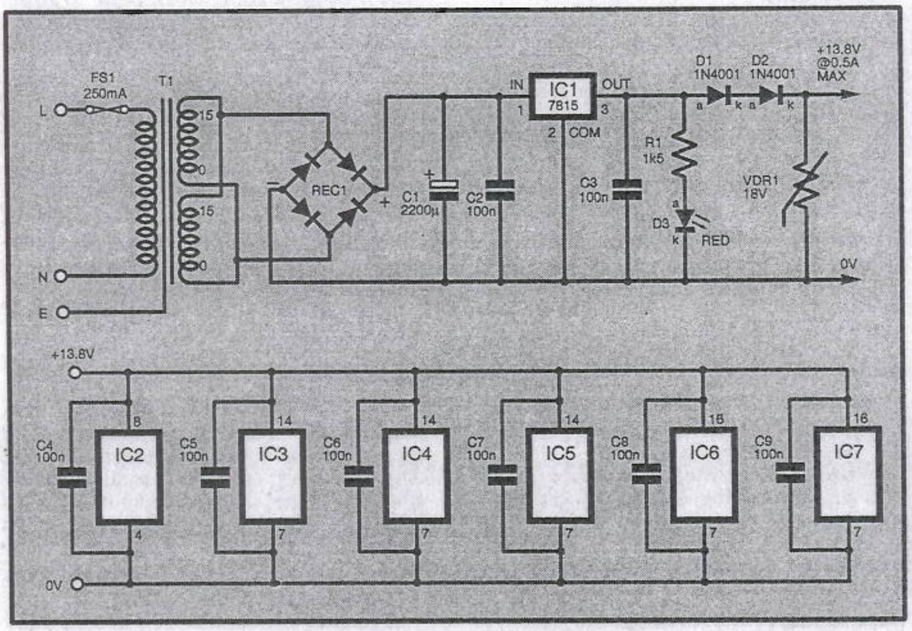


Fig. 3. Power supply and decoupling capacitor details.

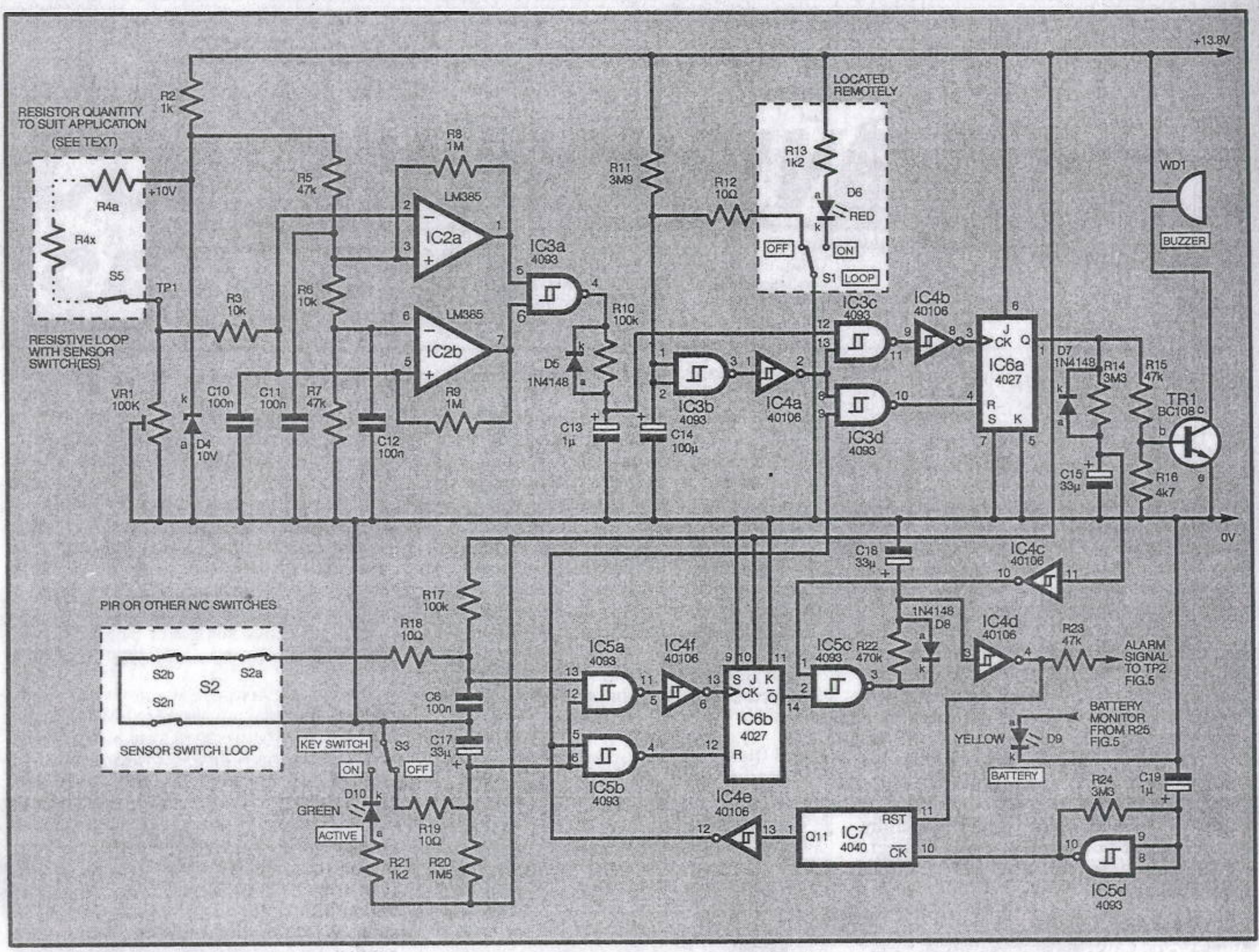


Fig. 4. Circuit diagram for the main part of the alarm sytem.

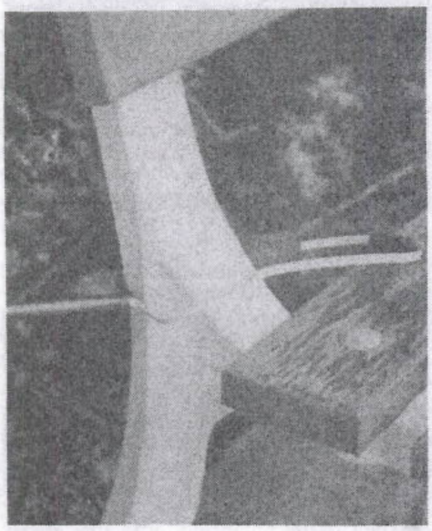
rectified by REC1, smoothed by capacitors C1 and C2, and regulated down to 15V d.c. by IC1. Diodes D1 and D2 then drop this voltage down to approximately 13·8V, a voltage chosen because it is the recommended float charging voltage for the lead acid back-up battery.

Since spikes could appear on the supply line, which could possibly trigger the alarm, a voltage dependent resistor, VDR1 is included. This is an 18V device which reduces spike levels should they occur, thereby reducing the possibility of a false alarm.

The siren used in the system draws about 300mA when operating. Depending on the type used, the PIR sensors could draw up to 40mA each. The float charging current for the battery is about 10mA.

Using a 15V 12VA transformer, the maximum output current available is a little over 0·5A, which should be adequate for most systems.

Also shown in Fig. 3 are the decoupling capacitors placed across the i.c. power supply pins. The capacitors help to reduce noise and to stabilise the voltage across the devices whilst they are switching.



Unplugging the connector looped around the garden bench will automatically set off the active alarm.

ALARM CIRCUIT DIAGRAM

The circuit diagram for the main part of the alarm system is shown in Fig. 4. Taking the internal section of the alarm first, with the keyswitch S3 in the OFF state, input pin 6 of Schmitt NAND gate IC5b is held low via resistor R19. Regardless of the logic level on the other input, pin 5, the gate's output at pin 4 will be high, thereby holding the JK bistable IC6b reset via its pin 12. In this state, the condition of the sensors has no effect.

When the keyswitch is switched to the ON state, enabling the alarm, capacitor C17 starts to charge up via resistor R20. After around 30 seconds, when C17 has charged up sufficiently, IC5b pin 4 goes low, removing the reset signal from IC6b. This timing forms the exit delay to allow the house to be left after the alarm is switched on. Light emitting diode (l.e.d.) D10 is turned on when the circuit is active, resistor R21 limiting the current drawn.

After this exit delay, if any of the sensor switches (S2a, S2b etc.) are opened, input pin 13 of Schmitt NAND gate IC5a will rapidly rise from logic 0 (low) to logic 1 (high). Since IC5a pin 12 is already held high via resistor R20, IC5a output pin 11 will go low and, via inverter IC4f, send a positive-going clock pulse to IC6b. Capacitor C16 is included to provide filtering of the loop line to protect against minor noise levels.

The clock pulse triggers the bistable such that its $\overline{Q}$ output pin 14 goes low, which in turn causes NAND gate IC5c output pin 3 to go high (IC5c pin 1 is already held high at this time). Capacitor C18 now starts to charge up via resistor R22. After about 15 seconds, when C18 has been charged sufficiently, the output of Schmitt inverter IC4d will go low. This timing forms the entry delay so that the alarm can be switched off after re-entering the house.

When output pin 4 of inverter IC4d goes low (an action which causes the siren to sound), reset pin 11 of counter IC7 also goes low, so enabling the counter. The counter is now clocked via its pin 10 by the output signals from the astable multivibrator formed around Schmitt NAND gate IC5d. Resistor R24 and capacitor C19 set the clock frequency to a little less than 1Hz. (Decreasing the value of either component will increase the frequency.)

Once enabled, counter IC7 counts 1024 pulses and then its output Q11, pin 1, goes high. Inverted by IC4e, output Q11 now causes bistable IC6b to be reset via IC5b. This action propagates through the circuit, resetting counter IC7, and also turning off the siren control line.

When IC5c output pin 3 goes low, capacitor C18 is rapidly discharged via diode D8, so there is no delay in the alarm switching off. The clock frequency as described provides a siren sounding time of around 20 minutes. With the counter once again reset, the alarm is reprimed and ready to be triggered if a sensor is tripped.

OUTDOOR CIRCUIT

Still referring to Fig. 4, the outdoor section of the alarm works as follows:

Resistor R2 and Zener diode D4 set a 10V reference voltage. Via the chain of resistors R5 to R7, this voltage is divided down to provide 5·5V at the non-inverting input of op.amp IC2a (pin 3) and 4·5V at the inverting input of op.amp IC2b (pin 6). Both op.amps are configured as "windowed" comparators, in this instance, the "window" being the 1V differential between the 4·5V and 5·5V reference voltages.

The external loop total resistance is designated as R4 in the dotted box to the top left of Fig. 4. Between them, resistance R4 and preset variable resistor VR1 form a potential divider, whose junction voltage (at test point TP1) is set for approximately 5V. Via resistor R3, this voltage is applied equally to IC2a pin 2 and IC2b pin 5.

Feedback resistors R8 and R9 provide hysteresis for the two comparators so as to ensure a clean switching action. Decoupling capacitors C10 to C12 are used to reduce the possibility of false triggering by noise signals.

With the potential at TP1 set for 5V, the outputs of both comparators are both close to the positive supply line voltage, providing a logic 1 level to the inputs of Schmitt NAND gate IC3a.

If the resistance of the sensor loop is increased, the voltage at TP1 will drop. Should it go below 4·5V, comparator IC2b will be triggered and its output go low. Similarly, if the loop resistance decreases, the voltage at TP1 will rise. If it rises above 5·5V the output of comparator IC2a will go low.

If either comparator output is triggered low, IC3a pin 4 will go high, applying the same level to pin 12 of Schmitt NAND gate IC3c. Resistor R10, capacitor C13 and diode D5 are included to reduce the possibility of a false alarm. Provided that this end of the circuit is active, the high output of IC3a will propagate through IC3c and IC4b providing a positive-going clock signal to pin 3 of bistable IC6a.

When triggered by the clock pulse, output Q of IC6a goes high, turning on transistor TR1 via resistor R15. As a result, buzzer WD1 is activated. Additionally, capacitor C15 starts to charge up via resistor R14. After about 105 seconds, or so, the output from Schmitt inverter IC4c goes low, causing the output from NAND gate IC5c to go high. From this point on, the operation of the circuit is exactly the same as for the internal section of the alarm. Diode D7 speeds up the discharging of C15 at the end of the 20 minutes delay.

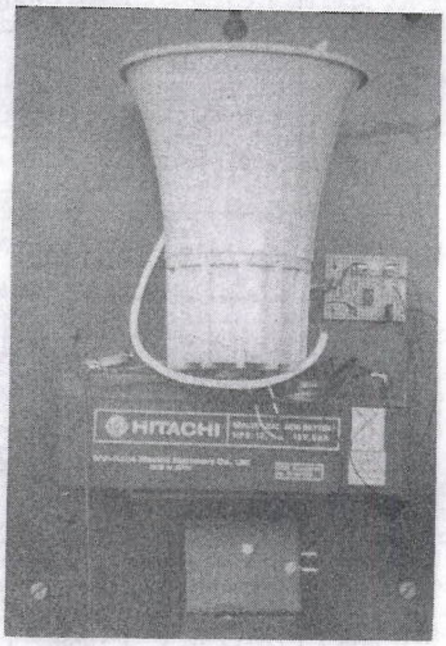
The delay caused by the combination of R14/C15 and R22/C18 gives a total delay time of about two minutes between the sounding of the internal buzzer and the sounding of the external siren.

Activation of this part of the circuit is controlled by switch S1. With S1 in the OFF condition, the two inputs to Schmitt NAND gate IC3b are held low via resistor R12. When this circuit section is first switched on by S1, capacitor C14 starts to charge up through resistor R11. Then, after about seven minutes, IC3b output pin 3 goes low, and via inverter IC4a, takes IC3c pin 13 and IC3d pin 8 high. This period provides the required exit delay.

At the end of the delay, IC3d output pin 10 goes low, removing the Reset level from bistable IC6a pin 4. After this, if the loop resistance changes enough to trip either of the comparators, the output of IC4b will go high, triggering IC6a.

SIREN DRIVER CIRCUIT

The circuit diagram for the siren driver is shown in Fig. 5. This uses a windowed comparator in the same way as the loop sensor, formed here around op.amps IC8a and IC8b. The reference voltages are provided by the potential divider formed by resistors R26, R28 and R30. The alarm signal voltage is brought to the junction of resistors R27 and R29 (test point TP2). It is then fed via R27 equally to the two op.amps. Capacitor C20 mops-up minor noise signals.



The siren, its sub-assembly board and back-up battery may be mounted in the same housing.

If the wire between the main alarm circuit and the siren driver is tampered with, or if the alarm signal line goes low (from IC4d via R23) due to one of the sensors being tripped, the voltage at TP2 changes. One or other of the comparators (depending on the polarity of the voltage change) then trips and its output goes high, turning on MOSFET TR2 and so sounding the siren, WD2. Diodes D11 and D12 prevent conflict between the two op.amp outputs. Resistor R31 provides a discharge path for TR2's gate capacitance.

This section of the alarm, together with the lead acid battery, is housed externally in a bell-box. The fuse protects the battery from short circuit should the wire from the main alarm circuit to the bell-box be cut.

Resistor R25 couples the power rail back to l.e.d. D9 in the main circuit. Together with l.e.d. D3 of the power supply, this gives a positive indication that the supply rail throughout the alarm system is healthy. On the front of the bell-box l.e.d. D13 gives a visual indication to passers-by that the bell-box is not empty! When the siren sounds, l.e.d. D14, which is also on the front of the bell-box, flashes thereby giving a visual fix on where the noise of the siren is coming from.

Diode D15 reduces the voltage across l.e.d. D14 to around 10V. The latter's maximum working voltage is 12V so the 13.8V supply could destroy it if D15 was omitted.

Should someone try to remove the lid-retaining screw from the bell-box, micro-switch S4 will close, so changing the voltage at TP2 and setting off the alarm.

DELAY CHANGING

The various delays incorporated into the alarm were designed for a specific user and these delays may not meet the requirements of all readers. Table. 1 shows which components are responsible for the delays and can be used to calculate component values for other timings.

All quoted delays are approximate, especially the seven minute one, since

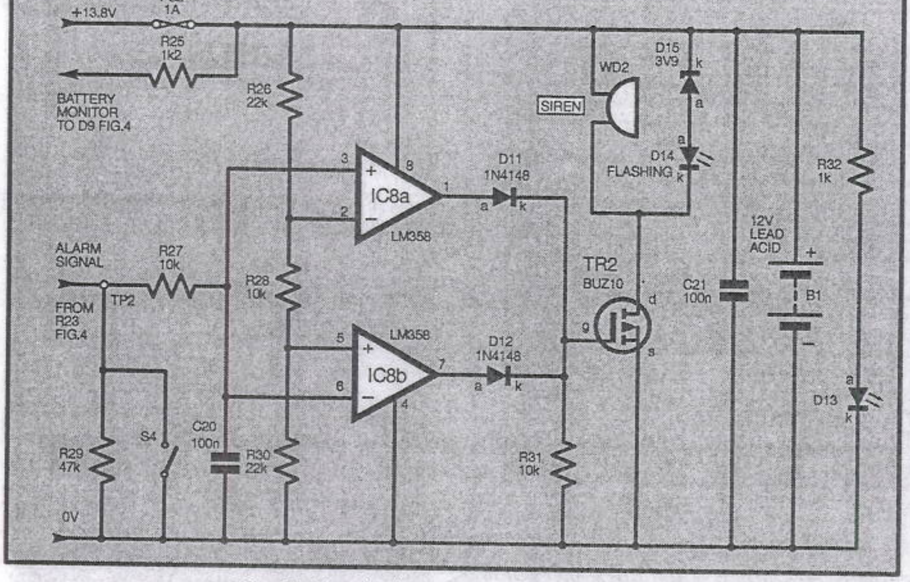


Fig. 5. Circuit diagram for the siren driver.

capacitor tolerances are quite wide and the higher capacitor values have larger leakage currents. Furthermore, the exact delay is dependent on the logic threshold of the Schmitt trigger gates, a level which may vary between devices from different manufacturers and between production batches.

The 20 minutes siren sounding delay can be changed in two ways: one of the other counter outputs could be used instead of output Q11, or the clock frequency generated by IC5d could changed. Smaller values of either resistor R24 or capacitor C19 will result in shorter delay times.

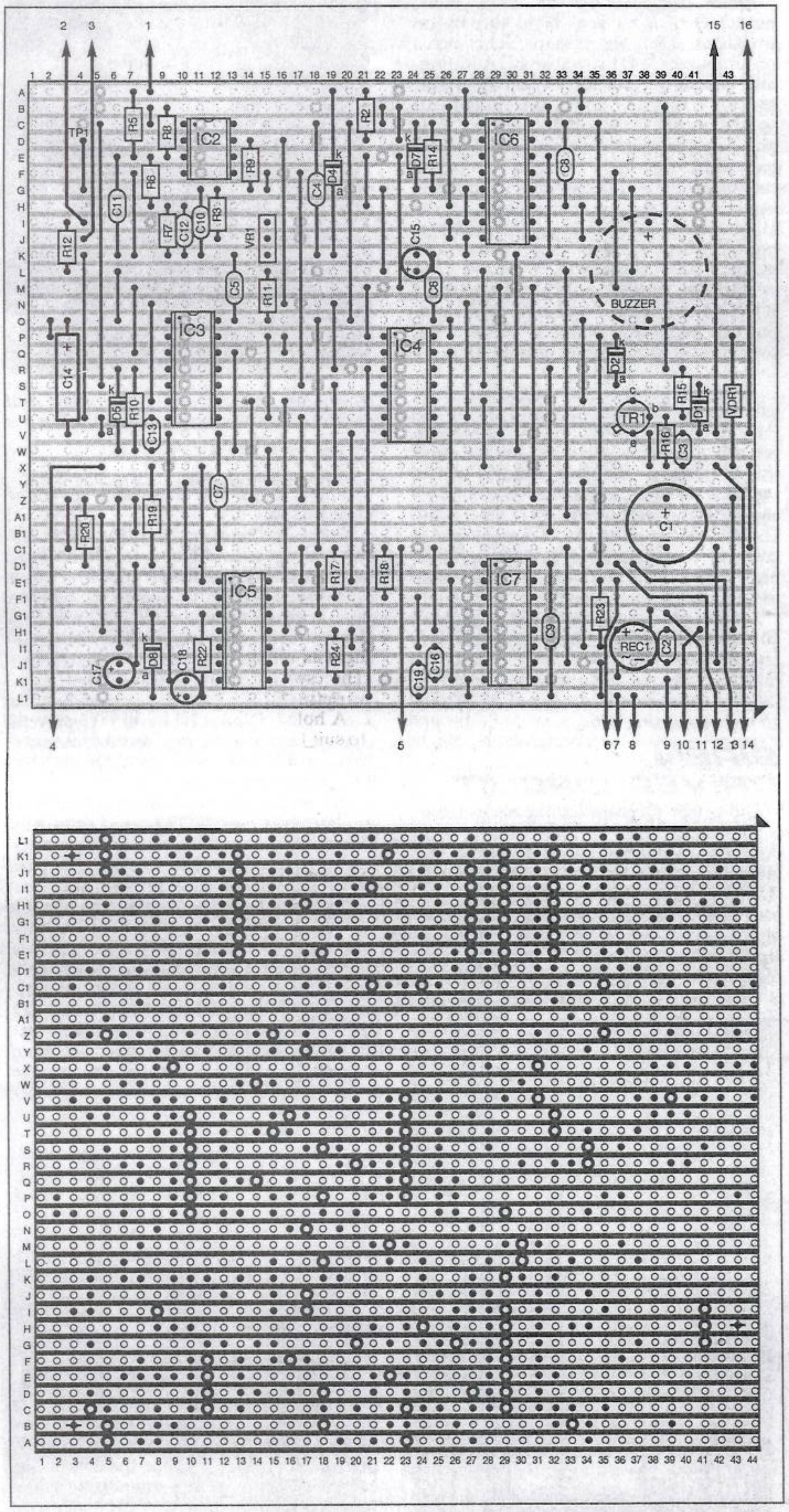


Fig. 6. Topside component layout and underside stripboard track cuts and solder joints for the main alarm circuits.

CONSTRUCTION

The alarm system is constructed on two pieces of 0·1 inch grid stripboard. Component layout, soldering points and track cutting details for the main circuit are shown in Fig. 6. Similar details for the siren driver circuit are given in Fig. 7.

There are many track cuts to be made and it is probably best if they are cut after assembling the components. Beware not to exert too much pressure on the stripboard when making the cuts – it is fragile and could break, especially when several cuts are in line. The use of a proper track cutting tool is recommended. Make sure that the tracks are cut cleanly and that there are no whiskers of copper left dangling loose.

Assembly of the components can be carried out in any order you feel content with, ideally starting with the lowest profile components. Remember to include all of the link wires shown. The use of i.c. sockets is strongly recommended.

Take care over the polarities and orientations of the electrolytic capacitors and semiconductors. Treat all the i.c.s as CMOS devices, taking the usual precautions to discharge static electricity from your body before handling them. Following assembly, thoroughly check that soldered joints are satisfactorily made and that the components are indeed correctly orientated.

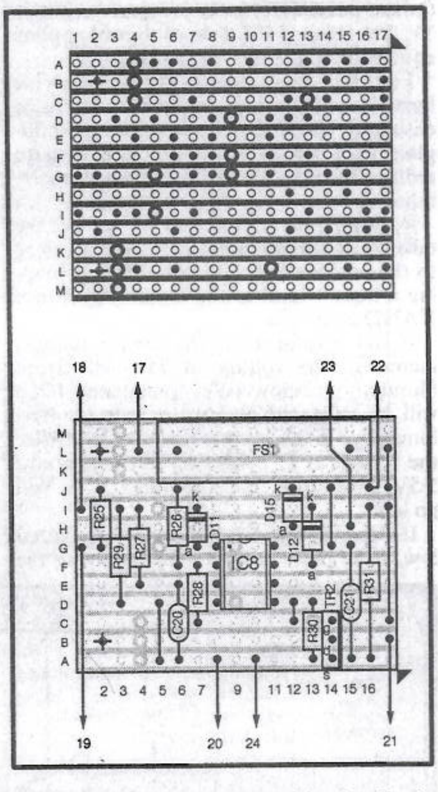
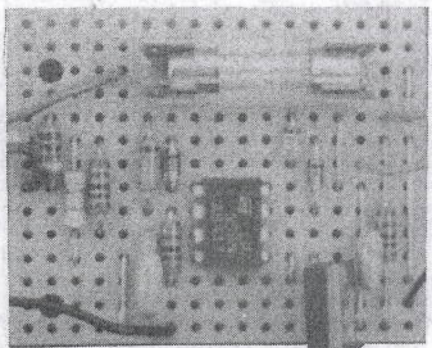


Fig. 7. Stripboard assembly details for the siren driver circuit.



COMPONENTS

See SHOP TALK Page

Resistors

R1	1k5
R2, R32	1k (2 off)
R3, R6, R27, R28, R31	10k (5 off)
R4	4k7 (see text)
R5, R7, R15, R23, R29	47k (5 off)
R8, R9	1M (2 off)
R10, R17	100k (2 off)
R11	3M9
R12, R18, R19	10Ω (3 off)
R13, R21, R25	1k2 (3 off)
R14, R24	3M3 (2 off)
R16	4k7
R20	1M5
R22	470k
R26, R30	22k (2 off)
VDR1	18V voltage dependent resistor

Potentiometer

VR1	100k multi-turn preset

Capacitors

C1	2200µ elect. 25V
C2 to C12, C16, C20, C21	100n (14 off)
C13, C19	1µ elect. 63V (2 off)
C14	100µ elect. 16V
C15, C17, C18	33µ elect 16V (2 off)

Semiconductors

D1, D2	1N4001 diode (2 off)
D3, D6, D10	l.e.d., red (3 off)
D4	BZY88C 10V Zener diode
D5, D7, D8, D11, D12	1N4148 signal diode (5 off)
D9	l.e.d., yellow, 10mm, rectangular plus holder
D13	l.e.d., green, 10mm, rectangular plus holder
D14	l.e.d., red, flashing, 10mm, rectangular plus holder
D15	BZY88C 3V9 Zener diode
TR1	BC108 *npn* transistor
TR2	BUZ10 MOSFET *n*-channel power transistor
IC1	7815 voltage regulator
IC2, IC8	LM385 dual op.amp (2 off)
IC3, IC5	4093 quad 2-input Schmitt NAND gate
IC4	40106 hex Schmitt inverter
IC6	4027 dual JK bistable
IC7	4040 12-stage counter
REC1	50V 1A bridge rectifier

Miscellaneous

T1	15V-0V 15V-0V, 12VA mains transformer
FS1	250mA 20mm fuse and panel mounting fuseholder
FS2	1A 20mm fuse and p.c.b. mounting holder
WD1	buzzer (see text)
WD2	siren (see text)
S1	dual light switch (see text)
S2	see text
S3	s.p.d.t. keyswitch
S4	s.p.c.o. microswitch
S5	see text
SK1	8-pin phono line socket
SK2	8-pin DIN chassis socket
PL1	8-pin phono line plug
PL2	8-pin DIN line plug

Stripboard, 0·1 inch matrix 19 holes x 16 strips, stripboard 0·1 inch matix 45 holes x 40 strips; diecast metal box 190mm x 108mm x 60mm; 12V lead acid battery; commercial detectors as appropriate (see text); bell-box to suit; connecting cable; wire; solder, etc.

Approx cost guidance only **£55**

Table 1. Delay Times.

Delay	Calculation	Time
House Exit	0·6 × R20 × C17 Seconds	0·6 × 1·5M × 33µ = 30 Seconds
House Entry	R22 × C18 Seconds	470k × 33µ = 15·5 Seconds
Loop Exit	1·1 × R11 × C14 Seconds for large C with high leakage 0·6 × R11 × C14 Seconds for small C with low leakage	1·1 × 3·9M × 100µ = 429 Seconds = 7 Minutes
Loop Entry	R14 × C15 Seconds + House Entry Delay	3·3M × 33µ + 15·5 Seconds = 108 + 15·5 = 123·5 Seconds = 2 Minutes

The main alarm circuit board should be housed in a suitable metal box which provides screening. Holes should be drilled to suit the l.e.d.s, keyswitch, mains cable and the DIN socket used to connect to the rest of the system.

Holes should also be drilled to mount the transformer and, if required, to allow the box to be mounted on the wall. Holes are needed as well to allow the buzzer to be heard. The main stripboard can be used as template for the positions of the holes for the spacers on which the board is mounted.

Once all the holes have been drilled and filed as required, the front panel can be finished off. The front panel can be sprayed using car touch-up paint, for example. Rub-down lettering can be used to provide suitable legends on the front panel, then spraying it with a clear protective lacquer.

The board, transformer and the rest of the hardware can now be fitted to box and wired up as shown in Fig. 8. The Live and Neutral wires of the mains cable can be soldered directly to the transformer terminals. The Earth wire should be secured to the case using a solder tag. A locking cable grommet should be used to secure the cable to the case.

If the suggested transformer is used the two secondary windings should be wired in parallel (as shown) to provide the required output current.

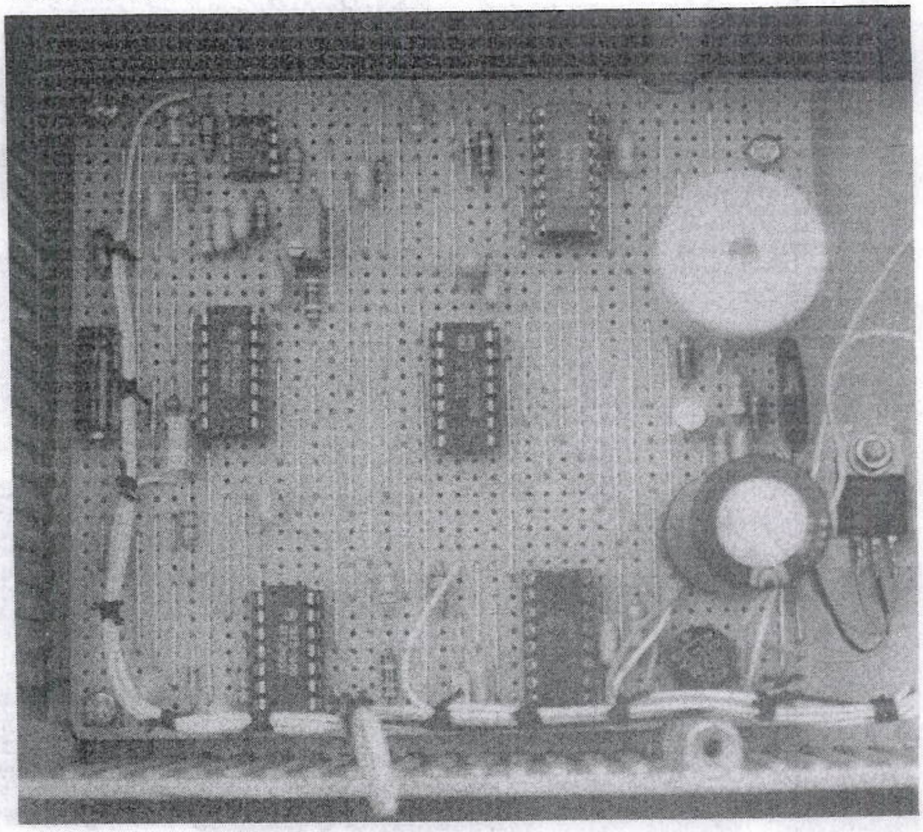
An insulating bush and washer should be used when mounting the voltage regulator to the case. The latter provides heat sinking for the regulator.

EXTERNAL CONTROL SWITCH

With the prototype, a conveniently located domestic wall-mounted switch, normally used to control an outside light, was modified for use as switch S1. The original single-switch unit was removed and replaced with a double-switch unit. One switch was used to control the light as before, the other was used as S1. The switch must be the changeover variety.

A hole was drilled into the switch plate to suit l.e.d. D6. Ensure that the l.e.d. cannot be dislodged and come into contact with the mains wiring of the light switch.

If preferred, S1 could be an ordinary s.p.d.t. toggle switch located in the main alarm box.



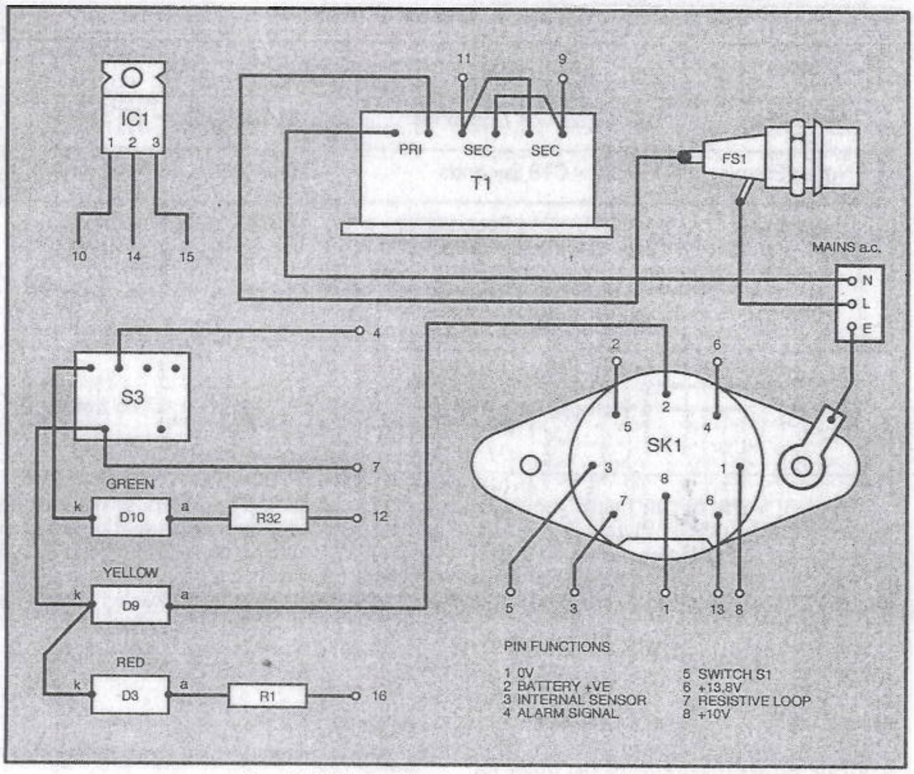


Fig. 8. Wiring details for the control box.

INSTALLATION

The main alarm box can be located in any convenient position. The prototype was located in the cupboard containing the household mains fusebox and the alarm was wired directly into this.

The siren drive board was housed in a ready-made bell-box along with the backup battery, siren and anti-tamper switch S4. Holes can be drilled to take spacers on which the circuit board can be mounted. It would be a good idea to spray the board with protective coating since it is likely to be exposed to damp conditions outside.

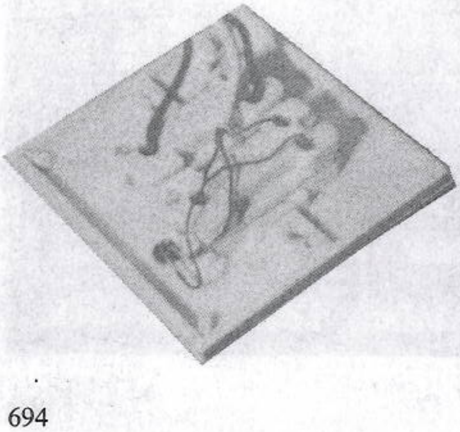
The siren was bolted to appropriate mounting holes in the box and the battery was placed on the shelf provided. An existing hole was used for mounting switch S4. Two holes were drilled in the front of the box to take l.e.d.s D13 and D14.

The inside of the bell-box should be wired as per Fig. 9, but leaving the siren and switch S4 disconnected. The box can be fitted to the side of the house, using a masonry drill to drill holes into which Rawlplugs, or similar, can be inserted. The bell-box can then be secured to these.

Referring to the interconnection diagram of Fig. 10, the cable for the DIN plug should be routed from the main alarm unit up to the roof space where it can be wired into an 8-way junction box. Four-core cable is used to connect between the junction box and the bell-box.

Using a suitable masonry drill, the wire could be passed from the bell-box straight through the wall into the roof space and then to the junction box. If this is not possible, the wire should be routed through the eaves as unobtrusively as possible.

Similar cable can be used to connect PIR sensors, although care should be taken to avoid running this cable parallel to mains wiring. Bell wire for the sensor loop can be brought straight into the roof space and connected up in the junction box. Once the wiring has been completed the unit can be tested. After which the front of the bell-box can be secured.



TESTING

When testing, beware that mains voltages are present. Extreme care should be taken. If in any doubt, consult a qualified electrician.

Before powering up the alarm, the resistance across the d.c. supply lines should be checked. This should be in excess of six kilohms (6k). If it differs greatly check the position and orientation of all components and ensure that all the tracks are correctly cut.

With the keyswitch (S3) and switch S1 turned off, switch on the mains supply. The three l.e.d.s D3, D9 and D13 should light, and there should be no sound from the buzzer. Check that the power supply is delivering an output of 13·8V at the junction of D2 and VDR1.

With the external loop complete – no doors open, etc. – measure the voltage at test point TP1. Adjust preset VR1 until a reading of 5V is obtained. Check that the voltage on IC3 pin 12 is zero (logic 0). The voltage on IC6 pin 4 should be high (13·8V). Open switch S1 and verify that l.e.d. D6 lights and that IC6 pin 4 goes to logic 0 after around seven minutes.

Open and then close the resistive loop and verify that the internal buzzer sounds immediately and the alarm signal line (at TP2) goes low about two minutes later. It might be a good idea to muffle the buzzer during this test!

Open the loop once more and verify that again the buzzer starts to sound. Switch off S1 – the buzzer should stop and l.e.d. D6 should turn off.

Connect the external siren and then switch on keyswitch S3. Check that l.e.d. D10 turns on and that IC6 pin 12 goes low about 30 seconds later. Trip one of the sensors and ensure that after 15 seconds the external siren sounds and that l.e.d. D14 flashes. Switching off the keyswitch should

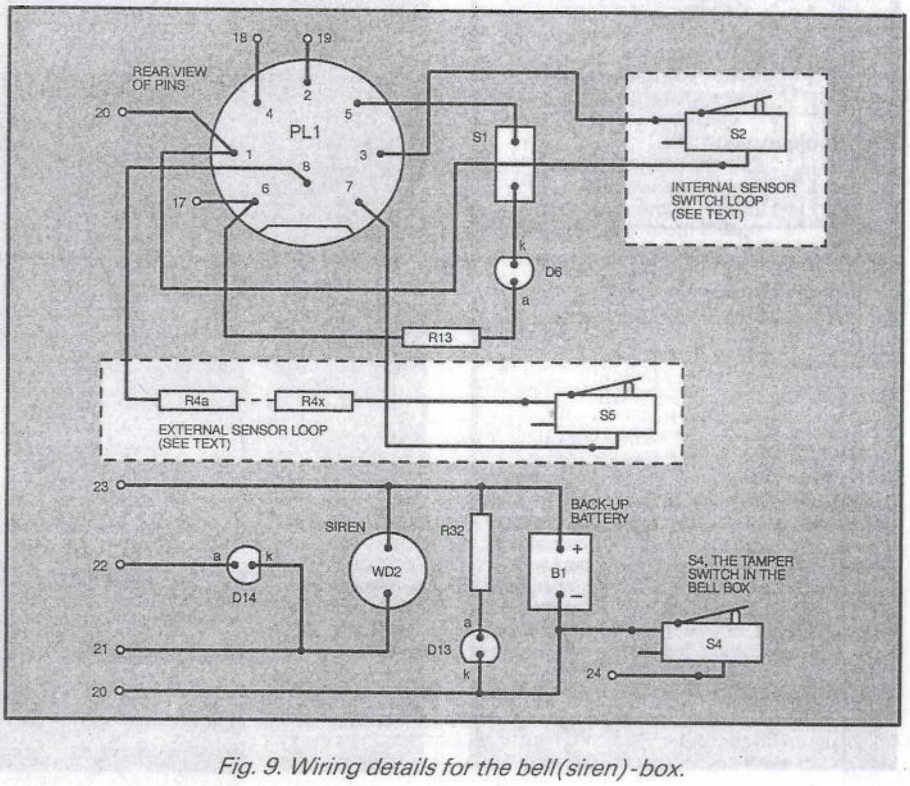


Fig. 9. Wiring details for the bell(siren)-box.

turn off the siren, D10 and D14. Switch off the mains power and verify that l.e.d. D3 goes out.

Anti-tamper switch S4 can now be connected, at which juncture the siren will sound! Ignoring the noise, fit the front panel to the bell-box. Once the main screw is firmly screwed in the siren should become silent.

Note that it is unwise to connect or disconnect the DIN connector whilst the alarm is powered up since this may upset the CMOS i.c.s.

The alarm can now be put into permanent operation.

FINALLY

The author's alarm has been in operation for many months and fortunately there has been no attempted break-in during that time. There was a false alarm during this period but this was found to be due to excessive play in one of the doors of the garden shed. The author thus assumes that the system is extremely reliable, which is an important feature – too many false alarms would destroy the perceived effectiveness of the system.

If the internal buzzer is found to be too quiet it could be replaced by a buzzer located outside the main alarm box, replacing the 8-pin connector by a 13-pin type. Two of the spare pins on the replacement connector can be used to take the buzzer wires through the box. The current consumption of any buzzer should not exceed 100mA.

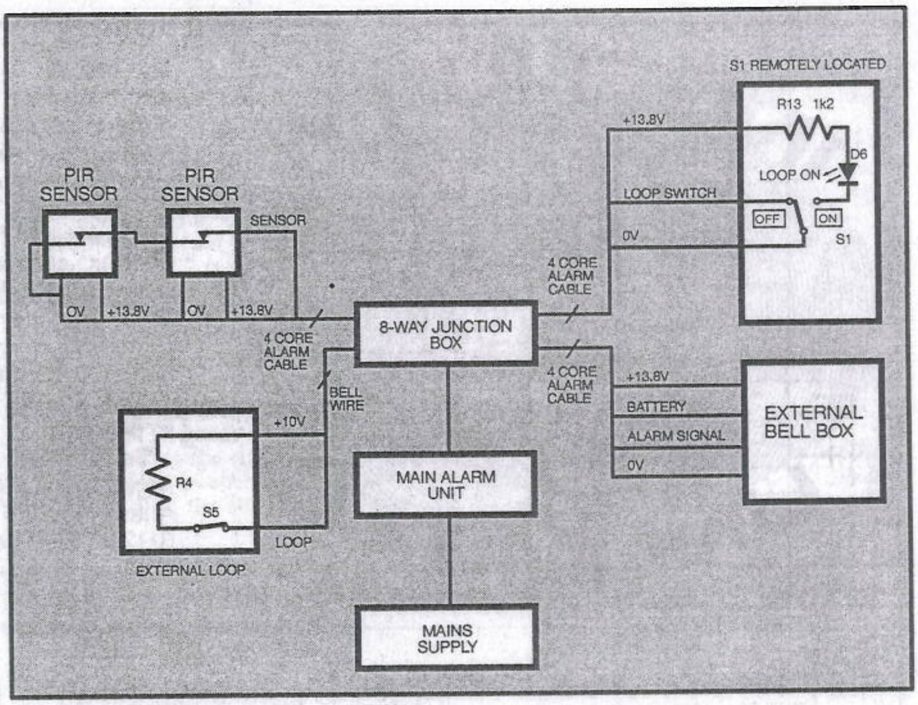
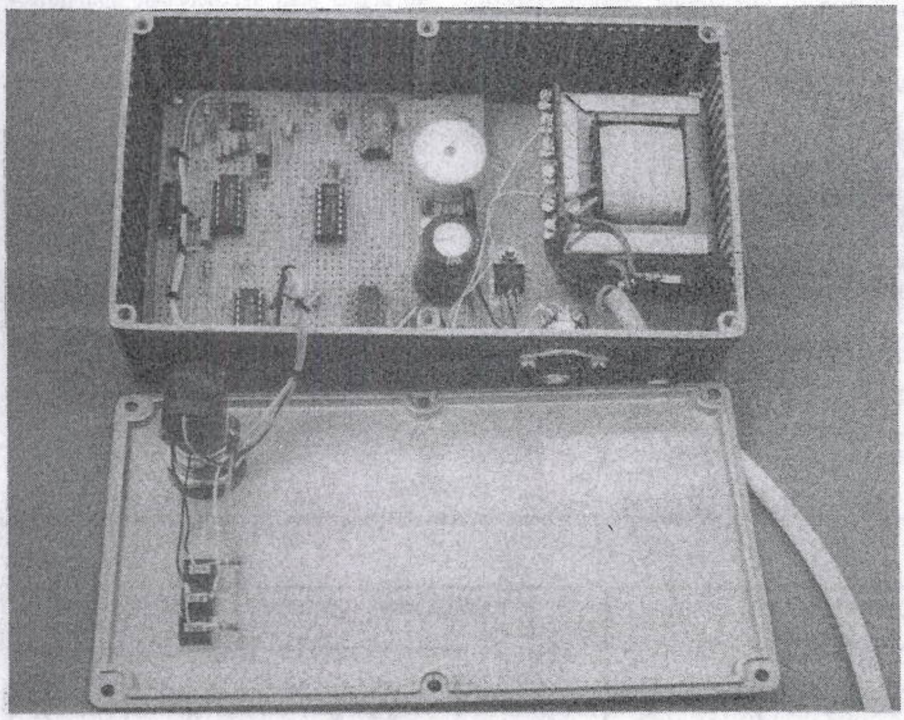


Fig. 10. Suggested system interconnection details.



Usually in alarm systems a strobe light is used instead of a flashing l.e.d. The latter was chosen here because it was much cheaper than a strobe light, although still surprisingly effective. However, if a strobe light is preferred in place of l.e.d. D14, it should be wired in parallel to the siren. In this case both D14 and D15 can be omitted.

The system can be easily adapted to include a panic switch. The normally closed contacts of this switch could be wired into the loop, or the normally open contacts could be wired between the alarm signal line and the 0V line. Similarly, the unit could be expanded to include a fire alarm by using a smoke alarm having relay contacts which should be wired in the same way as suggested for the panic switch. □

NEXT MONTH

Security Tagging – A special feature on the equipment and how it detects shoplifters.