ANTENNA EXTENDER

If you intend to buy (or already own) a motorised antenna then you shouldn't be without this intelligent gadget which automatically controls your aerial's ups and downs.

THERE IS A LARGE PROPORTION of motorists who have had the misfortune of losing their car aerial through a car-wash, through accidental breakage or maybe to the young vandal eager to add another victim to his list.

Judging by the number of coathangers that have found their way out of the family wardrobe and into the orifice where the chrome rod once stood, one only has to wait anxiously for the coathanger industry to replace the car aerial. It is not surprising that with these catastrophic events prevailing, drivers are reluctant to replace their aerial. However, if you install a motorised antenna incorporating the ETI antenna controller, it will reduce the risk of losing your aerial.

The unit is designed to replace the manual operation of 'holding' the antenna switch in the 'on' position to activate the aerial. The ETI controller overcomes this hindrance by sensing whether the radio is 'on' or 'off' state and automatically extending or retracting the aerial.

Better Safe Than Sorry

There are also certain fail-safe features which are incorporated to comply with the manufacturer's instructions. These are:

(i) when the antenna has extended it should not be switched from up to down or vice versa without waiting for at least 3 s before the next operation.

(ii) switching the radio on and off repeatedly will have no effect while the aerial is operation.

With these features our project supersedes most commercial units already available.

Construction And Setting Up

Construction is straightforward. All components, including the relays, are mounted on a single PCB. Begin construction by inserting all low profile components, ie wire links, Veropins and sockets, followed by resistors, diodes, capacitors and transistors, observing the orientation of all polarised components. R15 is soldered underneath the PCB between the junction of PR2/PR3, and the positive end of C5.

Before you fit the PCB in its box the following setting-up procedure should be carried out:

1) Fit IC1 and link points B and C. (This is used for setting up only.)
2) Connect a 12 V power supply to the PCB supply terminals.
3) Adjust PR1 until LED1 just turns on; mark this position.
4) Connect R_{TEST} as shown on the circuit diagram. Adjust PR1 until LED1 turns off; mark this position.

HOW IT WORKS

IC1 is configured as a voltage comparator with a fixed reference voltage at pin 3; pin 2 is arranged in the same way except that D1 is included as the sensor. If a load is present (ie the car radio is switched on), the voltage at pin 2 will fall to a value of (V_{cc} – 600) mV, this being the forward voltage drop of the diode. This change of voltage is now compared to the reference at pin 3. As the voltage has decreased the output of IC2 will switch to approximately the supply voltage.

PR1 is incorporated in the circuit to balance the tolerances of R4, 5, 6 and 7 so that with any extreme changes of voltage or temperature, the comparator will reliably detect a change at pin 2.

The output of IC1 is fed to IC2a and b (bilateral switches). These switches are normally closed, but with a low signal at their controls (pins 12 and 13) the switches will open, breaking the connection to the rest of the circuit and providing the necessary inhibit facility. ZD1 is added to suppress transients that might cause false triggering.

If the car radio is switched on the output of IC2b is high; this voltage is fed to the input of a non-inverting gate (IC3a). The output of this gate determines the relay direction via Q3, as well as providing the input to the edge detector IC3b. The function of this gate is to give a positive-going pulse whenever its input changes state. R14 and C4 are added for protection against spikes that occur during switching. IC3 squares the output of the edge detector, so a reasonably narrow pulse is available to trigger the first monostable (IC4a, IC4b). The output of IC4b energises RLB via Q4 for a period set by PR2 and C5 (this is not more than 5s). RLB is now supplying power to the motor antenna with a polarity determined by RLA, so while the monostable is turned on the antenna will extend. When this period has ended, pin 4 of IC4a will assume a high state, triggering the second monostable (IC4c, IC4d). The outputs of both monostables are fed to a diode OR gate and inverted by Q2 to open the bilateral switches. This gives a total inhibit time of approximately 6 s, allowing 3 s for the antenna to extend, plus a further 3 s delay before the next operation can take place.

D6 ensures that C5 is fully discharged at the end of the monostable period, to prevent false triggering by residual charge.

When the radio is switched off, the output of the comparator and IC3a will be low. As pin 8 of IC3d is at 0 V, its output will be high which closes IC2c; at the same time IC2d opens and the down sequence is activated. The monostable and RLB follow the same mode of operation as already described.

Q1 and associated components (R3, C1 and ZD1) provide a regulated supply for the CMOS devices.

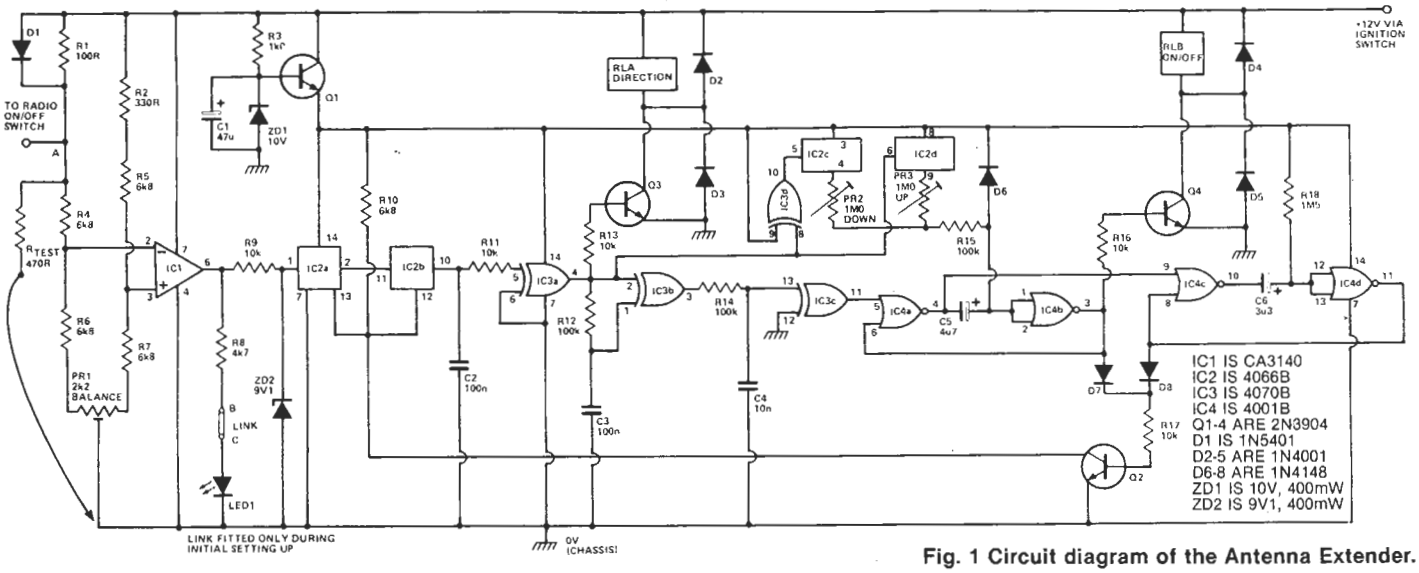
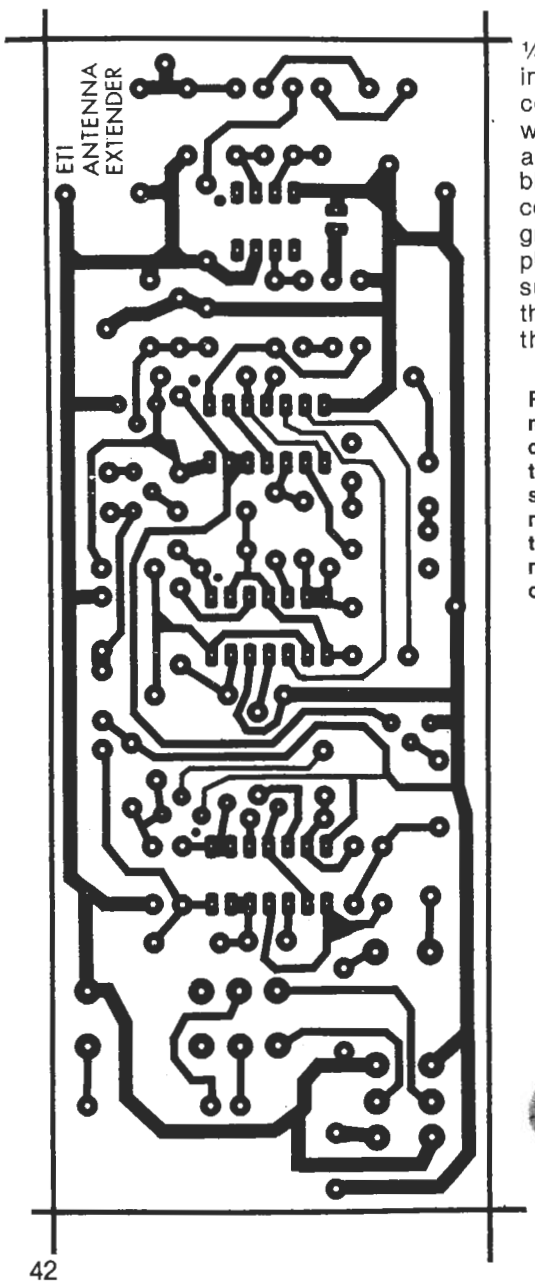
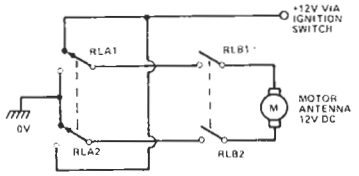


Fig. 1 Circuit diagram of the Antenna Extender.



We mounted our PCB on three ¼" spacers. When it comes to hooking up the unit, there should be no complications as there are only four wire connections to consider. These are made via a four-way terminal block on the side of the case. The 0 V connection is made to the internal ground terminal of the case. The completed unit can be secured in a suitable place underneath the hood, thus completing the ground return to the battery through the chassis.



Right: the finished PCB mounted in its weatherproof case. The ground terminal for the 0 V connection can be seen in the top left-hand corner. The remaining connections are made via the terminal block on the side of the case.

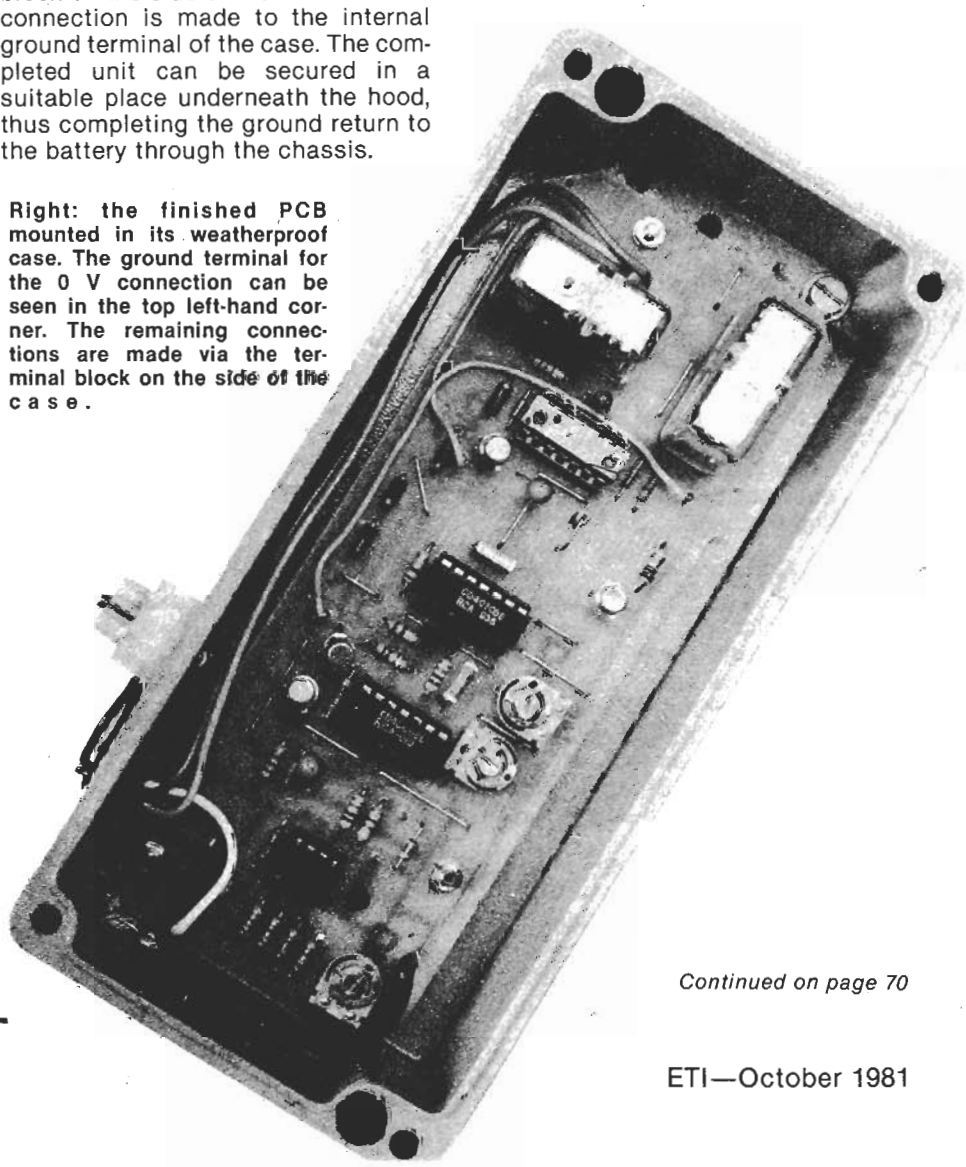


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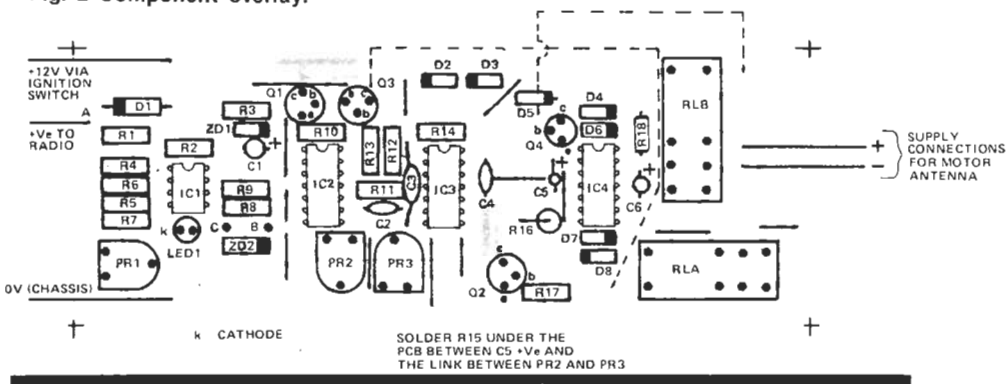
Fig. 2 Component overlay.



5) Diconnect R_{TEST}. PR1 should now be adjusted to the mid-way setting of steps 3 and 4.
6) For a final check, R_{TEST} can be reconnected and LED1 will switch on; if all is well the remaining ICs can now be fitted.

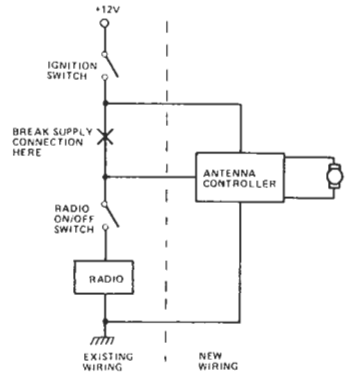


Fig. 3 How to wire up the unit. The radio power supply is taken via the controller board.

PARTS LIST

Resistors (all ¼ W, 5%)

R1	100R
R2	330R
R3	1k0
R4,5,6,7,10	6k8
R8	4k7
R9,11,13 16,17	10k
R12,14,15	100k
R18	1M5

Potentiometers

PR1	2k2 miniature horizontal preset
PR2,3	1M0 miniature horizontal preset

Capacitors

C1	47u 16V tantalum
C2	100n polycarbonate
C3	100n ceramic
C4	10n polycarbonate
C5	4u7 35 V tantalum
C6	3u3 16 V tantalum

Semiconductors

IC1	CA3140
IC2	4066B
IC3	4070B
IC4	4001B
Q1-4	2N3904
D1	1N5401
D2-5	1N4001
D6-8	1N4148
ZD1	10V, 400mW
ZD2	9V1, 400mW

Miscellaneous

RLA,B	double pole changeover, coil resistance 205R.

Four-way terminal block, case.