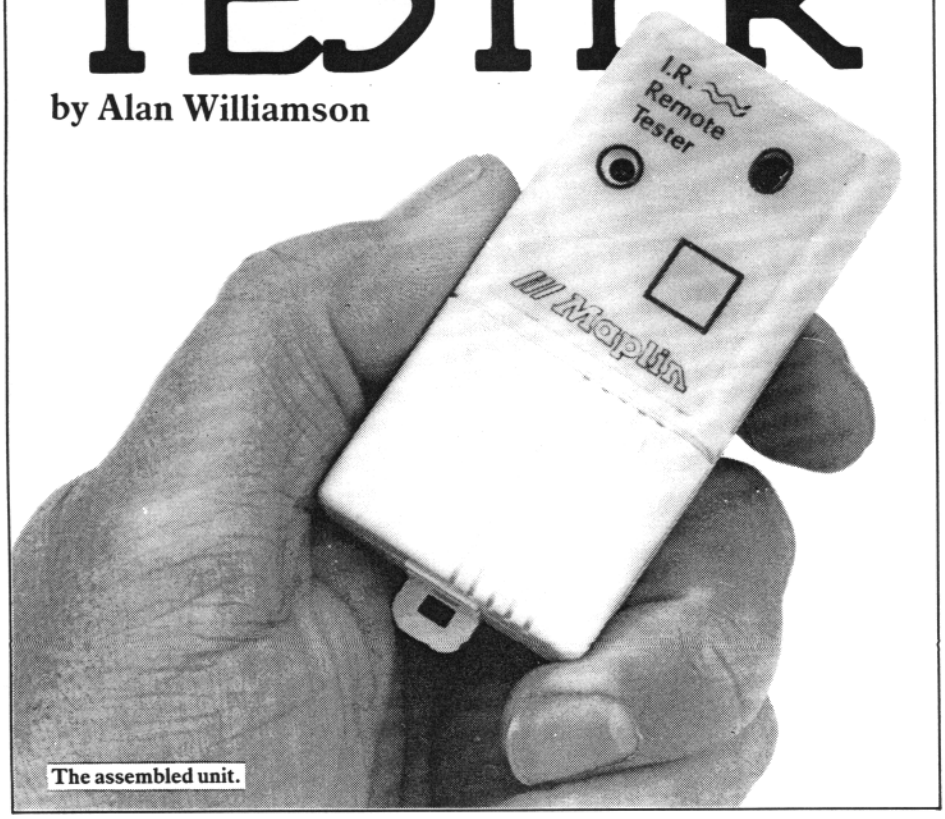
INFRA-RED REMOTE CONTROL TESTER

by Alan Williamson



The assembled unit.

Introduction

This handy little project first saw the light of day in the NICAM Infra-red Remote Control project (Issue 41) as the experimental infra-red detector.

So what exactly does this project do? Well basically it checks to see if a remote control unit (or any other pulsed infra-red source) is transmitting an infra-red carrier or data stream. The Infra-red Remote Control Tester ignores any ambient infra-red energy, so it can be used in full sunlight. The tester works by detecting changes in the ambient infra-red level and converts this into visible red light by means of an amplifier and red LED.

The Infra-red Tester is not just a simple yes/no device, it can show the strength of a transmission, by the distance from which the remote control is able to operate the tester. A TV/Video remote control with a fresh set of batteries will operate the tester from approximately half a metre away, whereas a remote control with almost exhausted batteries may work from only a few centimetres away.

The tester also checks its own battery; by pressing the switch on the front panel, a single flash from the LED will be seen, thus indicating sufficient battery power for the unit to operate.

TV and Video repair engineers will find this Infra-red Tester an invaluable addition to their toolbox. It is also a cheaper and more versatile alternative to the infra-red sensitive 'cards' that serve the same purpose.

Circuit Description

Figure 1 shows the circuit diagram of the Infra-red Remote Control Tester.

Infra-red transmissions are detected by the photodiode PD1, which operates in the reverse biased mode. Incident infra-red energy causes a leakage current to flow through the photodiode, thus developing a

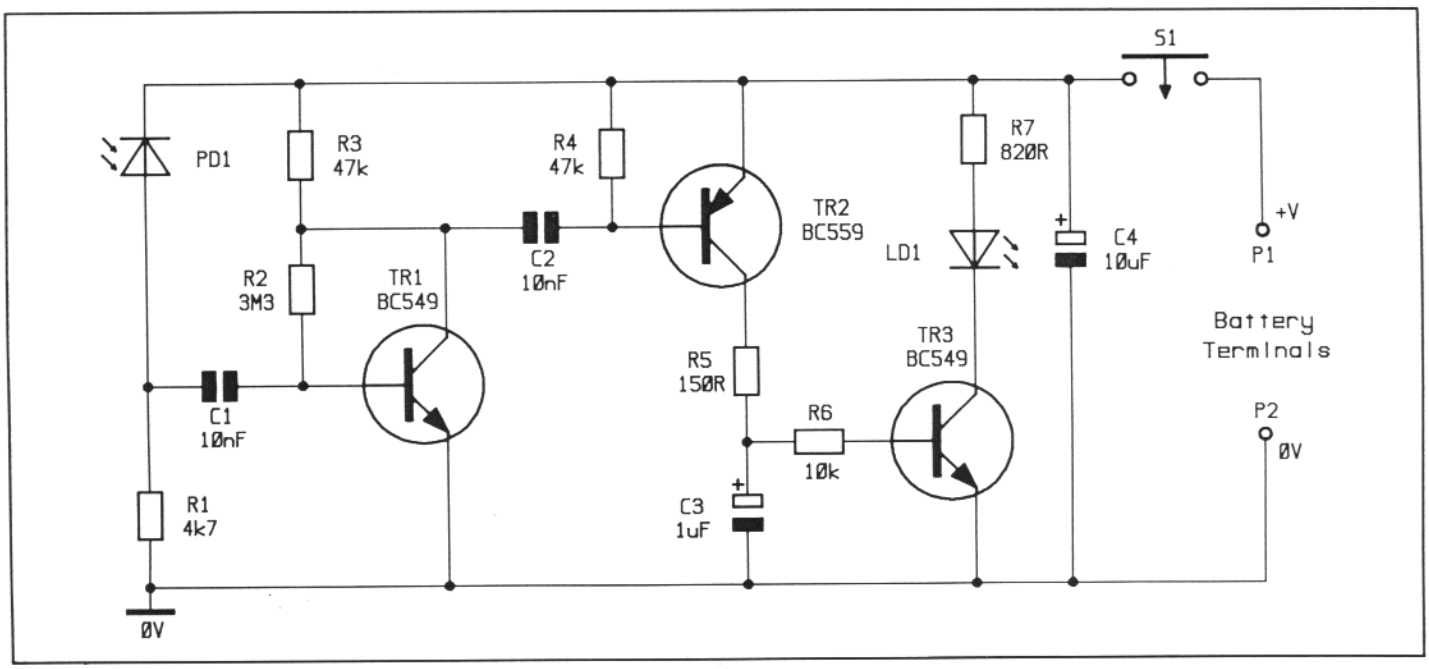
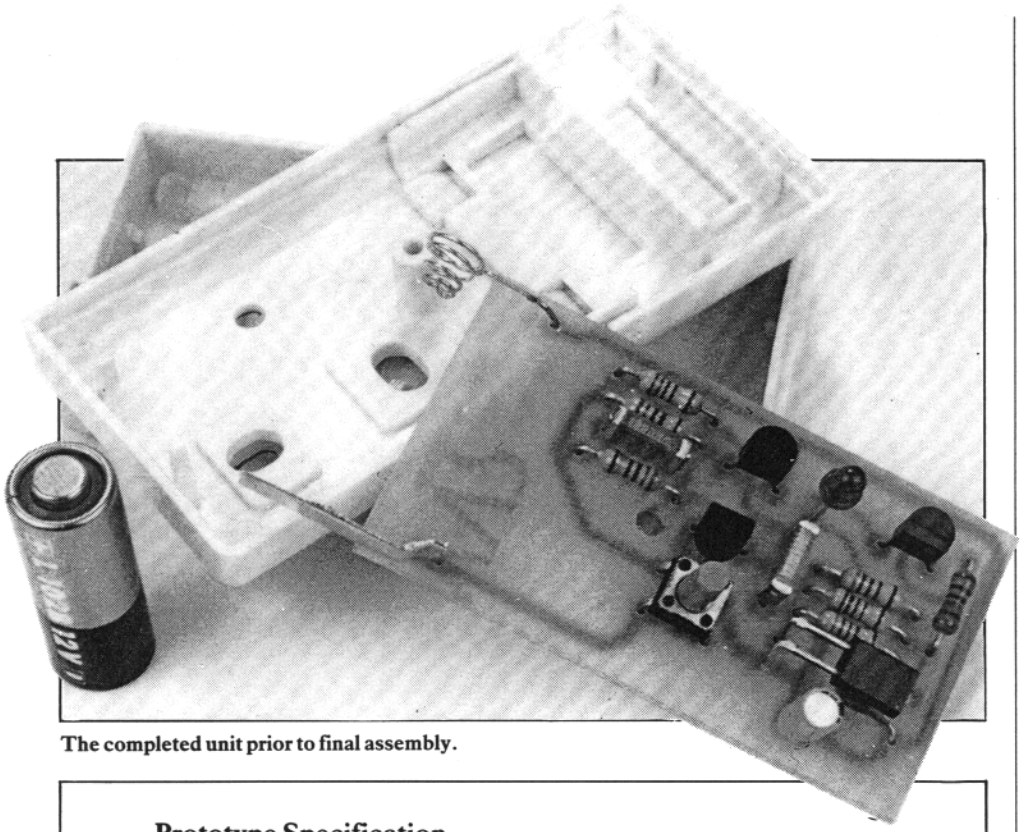


Figure 1. Circuit diagram.



The completed unit prior to final assembly.

Prototype Specification.

Supply voltage range:	6 - 12V DC
Battery type:	12V lighter battery 23A
Operating current:	11·4 mA
Operating frequency:	10Hz to 100kHz
Minimum pulse width:	1μs
Detector peak spectral response:	940nm
PCB size:	31mm x 55mm

voltage across R1. Pulsed infra-red energy will produce voltage pulses across R1 and these are AC coupled by capacitor C1 to the common emitter amplifier based around TR1. R2 and R3 serve to provide bias for TR1. C2 is employed to couple the signal to the next stage without upsetting the bias of either stage. R4, TR2, C3, R5 and R6 form a pulse extending circuit. Carrier frequencies and or data streams present at the base of TR2 will be smoothed out by C3 which will slowly discharge via R6 turning on TR3 and lighting LD1.

Construction

For those with very little constructional experience, a constructors' guide has been included in the kit to help you identify components, it also gives hints and tips on soldering and constructional techniques.

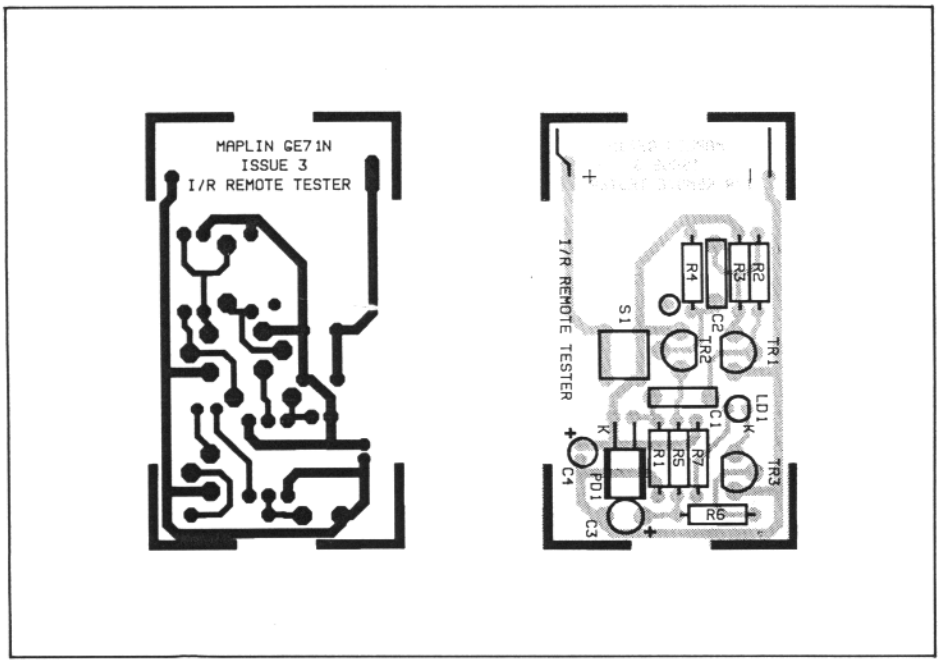


Figure 2. PCB legend and track.

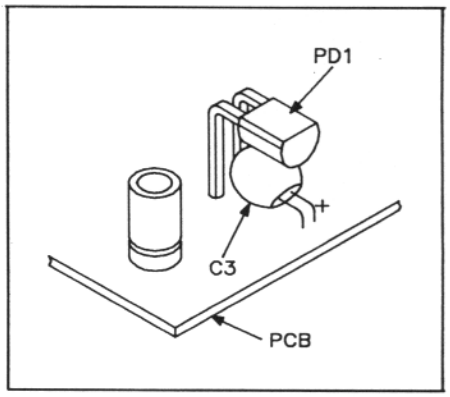


Figure 3. Fitting C3.

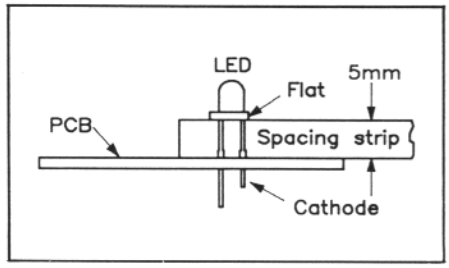


Figure 4. Fitting LD1.

Referring to Figure 2 begin construction with the resistors, followed by the capacitors, C3 and C4 are polarised devices and must be correctly orientated, C3 is fitted laying on its side positioned underneath the photodiode, see Figure 3.

The LED cathode, denoted by a 'flat' on the package and the short lead, must be aligned with the flat on the legend, also marked with the letter 'K'. Insert the LED into the holes in the PCB and position it 5mm above the PCB, this can be easily achieved by using a 5mm spacer strip (piece of card, etc), this is illustrated in Figure 4.

The transistors are the next devices to be installed, locate the BC559 transistor and fit it into the TR2 position, fit the other two transistors (BC549) into TR1 and TR3 positions.

A nylon washer is fitted underneath S1 which serves to raise the height of the switch; when fitted, the switch legs should only just protrude through the PCB, if the switch is fitted too low, it will be found that it is difficult to operate the switch when the unit is fully assembled.

Next insert the photodiode, bend the leads 5mm from the body as shown in Figure 5. Insert the photodiode with the bend in the lead 7mm above the PCB, then solder.

Last but not least are the battery terminals, identify each terminal; the positive is the strip and the negative is the 'spring' terminal which will require modification somewhat, see Figure 6. Modify

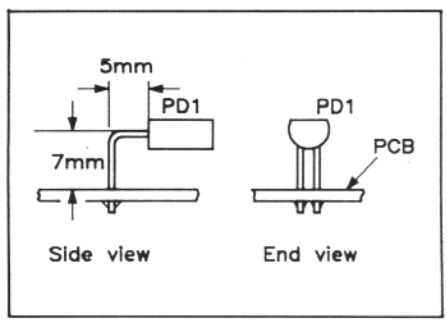


Figure 5. Fitting PD1.

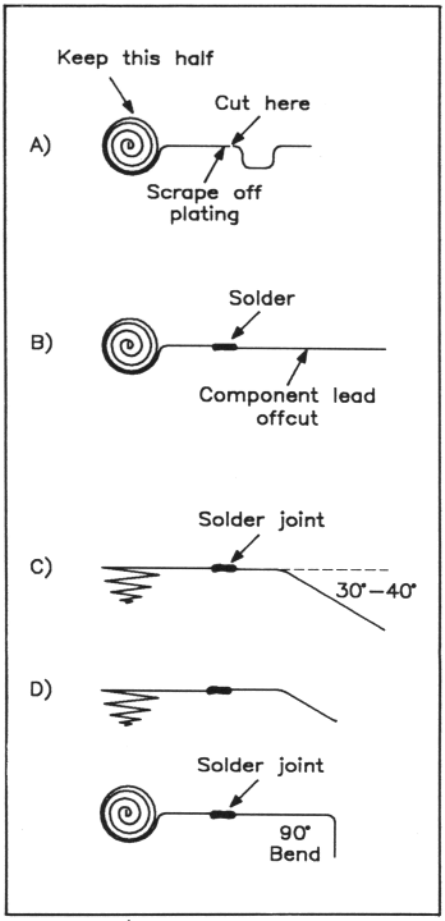


Figure 6. Spring modification.

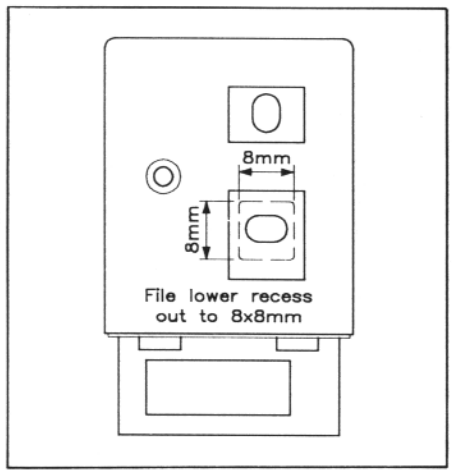


Figure 7. Box filing.

the spring and fit both the spring and strip to the PCB as follows: A Cut off the 'U' shaped bend in the spring. B Scrape away the plating, to allow solder to adhere, and solder a short length of BTC wire or component lead offcut to the prepared end. C Bend the wire to an approximate angle of 30°. D Add a 90° bend to the wire-end and insert into the PCB.

Finish the PCB by cleaning-off any flux residue with PCB Cleaner, check for dry joints and solder 'whiskers' which could cause short circuits and reliability problems.

The case also requires some modification, this is illustrated in Figure 7. Fit the PCB into the case (after filing out the hole). Clip the two halfs together and fit the case fixing screw. Place the battery into the battery compartment taking note of the symbol in the bottom of the case and replace the battery cover. The final job is to stick the panel onto the front of the case. The tester is now complete and ready for testing.

Testing and Use

To test the Infra-red Tester, a known working remote control is required. First push the switch on the tester; a single flash from the LED should be seen, keeping your finger on the switch, point the remote control towards the photodiode on tester (a few centimetres away). Push any button on the remote control, the LED on the tester should flash or stay permanently illuminated (depending on the transmission rate), slowly increase the distance between the remote control and the tester to determine the strength of transmission. As mentioned before, a TV/Video remote control with a fresh set of batteries will operate the tester from approximately half a metre away. Please note that remote controls with a single infra-red emitter LED are highly directional.

INFRA-RED REMOTE CONTROL TESTER PARTS LIST

RESISTORS: All 0·6W 1% Metal Film			
R1	4k7	1	(M4K7)
R2	3M3	1	(M3M3)
R3,4	47k	2	(M47K)
R5	150R	1	(M150R)
R6	10k	1	(M10K)
R7	820R	1	(M820R)
CAPACITORS			
C1,2	Poly Layer 0·01μF	2	(WW29G)
C3	Tant. 1·0μF 35V	1	(WW60Q)
C4	Minelect 10μF 16V	1	(YY34M)
SEMICONDUCTORS			
TR1,3	BC549	2	(QQ15R)
TR2	BC559	1	(QQ18R)
LD1	Mini LED Red	1	(WL32K)
PD1	Infra-red Photodiode	1	(YH71N)

MISCELLANEOUS			
S1	Tact Switch Type A	1	(JR89W)
	Keyring Remote Case	1	(JR90X)
	I/R Rem. Tester Panel	1	(JX52G)
	PC Board	1	(GE71N)
	Nyl Washer 6BA	1 Washer	(BF84F)
	Instruction Leaflet	1	(XK33L)
	Constructors' Guide	1	(XH79L)
OPTIONAL (Not in kit)			
	12V Lighter Battery 23A	1	(JG91Y)

The above items, excluding Optional, are available as a kit:
Order As LP53H (I/R Remote Tester)
The following special items are also available separately:
Keyring Remote Case **Order As JR90X**
I/R Rem. Tester Panel **Order As JX52G**
I/R Rem. Tester PCB **Order As GE71N**