

# Electronics

**THE MAPLIN MAGAZINE**



14-Channel, 2-wire

## MODEL TRAIN CONTROLLER

Full construction details inside

### HOME BURGLAR ALARM

New digital approach gives superior protection.

### MILES PER GALLON METER

Continuous display of mpg to help you save petrol.

### LATEST MAPLIN PRICE LIST

Plus many more Projects, Features, Special Offers and News from Maplin.

**CB RIG only £49.95**



Ready-made CB equipment including this 40-channel FM rig. Full details inside.

# Electronics

## THE MAPLIN MAGAZINE

### OVER 10,000 SUBSCRIPTIONS IN SIX WEEKS

We'd like to take this opportunity to say thanks to all of you who gave us your overwhelming vote of confidence in the new magazine. Over ten thousand of you in the first few weeks!

It is, of course, excellent value for money. In this issue alone we feature four projects, each one of which would probably have been a front cover article in the monthly electronics magazines - and the longer ones would have been spread over two months or more. Another great advantage with building our projects is that we make available the PCB's and front panels - so that the finished project can look as nice as a factory made one. Also this time you'll note that we've made ordering easy for you by making available a complete kit of each section of each project. So now you no longer need to order long lists of components, just one number orders the whole kit for you.

Selling in this way also keeps down our costs and we've passed the saving on to you. In some cases, the kit prices are many pounds cheaper than buying all the parts separately. The details of the kits are at the end of each parts list.

In this issue we also have the first of our sets of special offers. The three in this issue alone will save you nearly £30! over previous selling prices. And we promise you many more like these in the months to come.

Perhaps the most amazing offer this time is the CB set featured on the front cover. A full £30 cheaper than equivalent sets in the shops at the moment. We are importing these directly in order to make the saving and each one will be individually tested in our laboratory before it is dispatched to you. We have also introduced a whole range of CB equipment to complement our new rig, so now you can get all you need from Maplin.

We're already working on issues three and four and we've got lots of exciting and interesting projects and bargains lined up for you. The Maplin Magazine is essential reading for all electronics and computer enthusiasts. Don't miss it place your subscription now.

#### Cover Picture

The superb colour photograph by W. Sharman shows the 80135 leaving Levisham with the 09:50 from Grosmont for Pickering. Our thanks to Mr Sharman for his permission to use that photograph and the ones in the Train Controller article.

March to May 1982 Vol. 1. No. 2

### CONTENTS

#### Projects

##### Burglar Alarm

A home security system offering reliable, long-term protection.

##### Miles-Per-Gallon Meter

Save petrol when you learn to drive economically with the aid of this invaluable meter.

##### Stopwatch

Multi-mode stopwatch with 8-digit readout.

##### Train Controller

Control up to 14 locomotives on one 2-wire circuit - up to four simultaneously.

#### Features

##### Basically BASIC

Another slice from this popular computing series.

##### CB Equipment

All the gear at tremendous prices.

##### Circuit Maker

More electronic building blocks and improvements.

##### Starting Point

Working With Op-Amps

#### News

Amendments to Catalogue

Atari Computer News

Atari Video Games

Back Issues

Classified Advertisements

Corrigenda

Maplin News

Matinee Update

New Books

Next Issue

Price List of Catalogue Items

Price List of Items Since Catalogue

Price List of New Items in This Issue

Readers Letters

Solar Cells

Special Offers

Subscriptions

Top Twenty Books

#### Editorial & Production

**Editor** Doug Simmons

**Production Manager** Ian Miller

**Technical Editors** Robert Kirsch

Dave Goodman

**Art Editor** Peter Blackmore

**Technical Artists** Roy Smith

John Dudley

**Photography** Chris Barlow

**Published by** Maplin Publications  
282 London Road  
Westcliff-on-Sea  
Essex SS0 7JG

**Printed by** Eden Fisher  
(Southend) Limited

**Typeset by** Quillset Typesetting

# DIGITAL MULTI - TRAIN CONTROLLER

by Robert Kirsch

- 14 locomotives individually controlled on the same track
- Any 4 locomotives controlled simultaneously
- Automatic short-circuit protection
- Supply always present for carriage lighting etc.
- Remote control and computer interfacing
- Low cost two wire system

Railway enthusiasts have for many years appreciated the need for a control system that enables trains to be driven as if the operator were in the driving cab of the locomotive. This not only means control of speed and direction of that locomotive, but also the ability to move anywhere on the layout without the need for track isolating or switching, thus making the wiring of the layout much simpler.

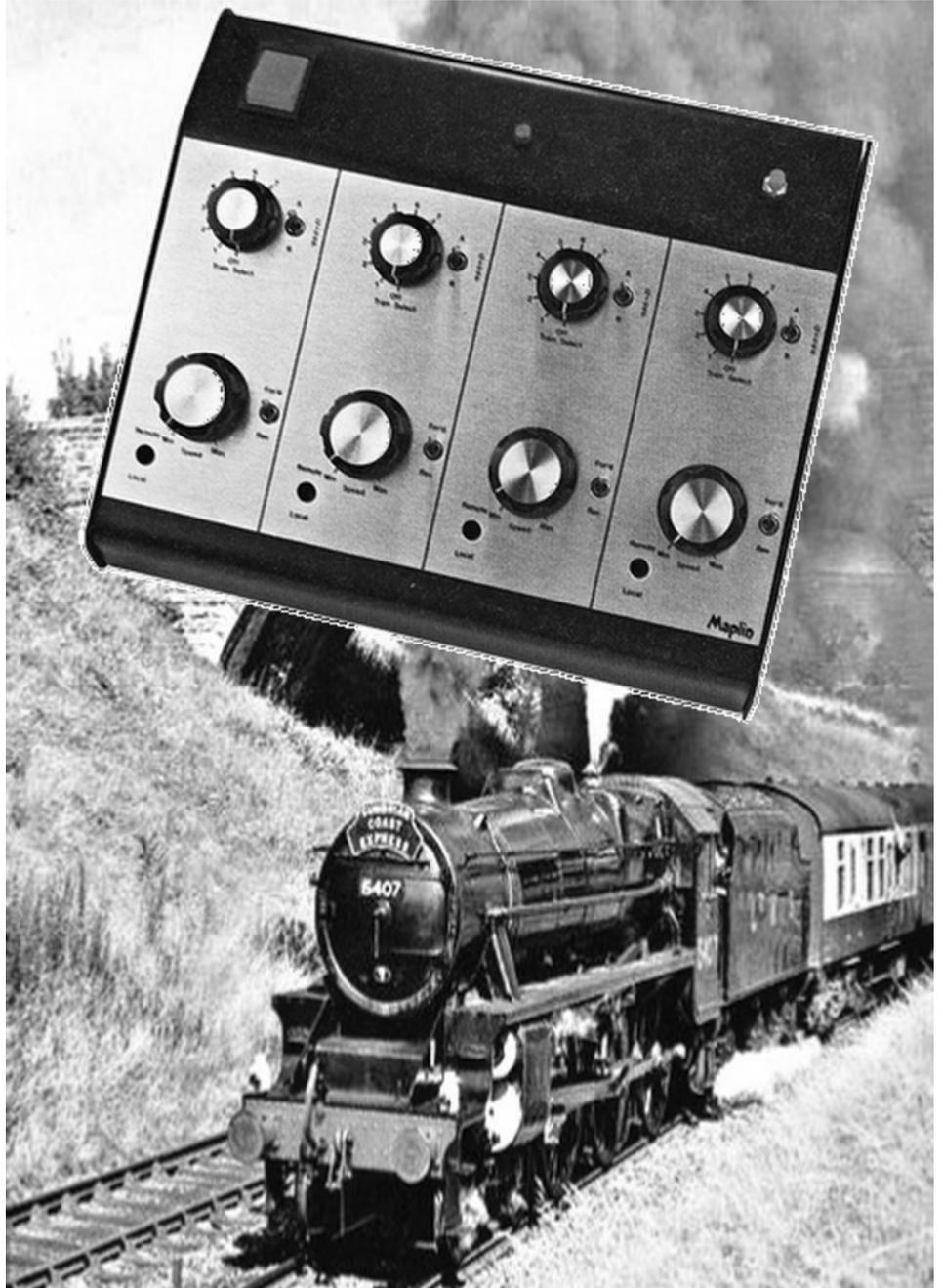
The system described in this article fulfils all these needs by producing a constant 18 volts DC on the track with digital information superimposed on it, to which only the selected train or trains will respond. The permanent track voltage also means that locomotive headlights, carriage lighting and many accessories may be used unaffected by the speed of the trains.

This system can control up to 14 locomotives all on the same track, and any four of these may be driven independently at one time. Provision is also made for any or all, of the four control units to be operated by a 7 bit digital input, thus enabling remote control either from hand-held units (using wire or radio) or from a home computer, giving full control of direction and speed.

Details of the remote control and computer interfacing will be described in later articles.

## Circuit Description

Refer to Figures 1 to 5 when following the circuit description.



The most important consideration in the design of a system like this is to keep the receiver module as small as practical to enable it to fit in as many 2 locomotives as possible. This has been achieved by using a small 8 pin IC, the ML 926/7, IC1 as the receiver. Decoding and control is accomplished by IC2, a 40106 CMOS IC leaving two transistors, TR2 and TR3 as input amplifiers, the six transistors TR4 to TR9 for motor control and one transistor, TR1 as a voltage stabiliser.

The ML 926 and ML 927 are pulse position modulation (PPM) receivers

with built-in error detection circuits. There are four outputs from each IC, three of which are decoded by IC2 to control one of the seven receivers. (000 is used as the all off condition.) The fourth output is used to control the direction of travel. A fifth bit is transmitted by the control unit to select either the ML 926 or the ML 927 ICs, thus giving fourteen channels.

As it is only possible to decode one signal at a time the receiver is addressed for one period out of four (called its time slot) and it retains the

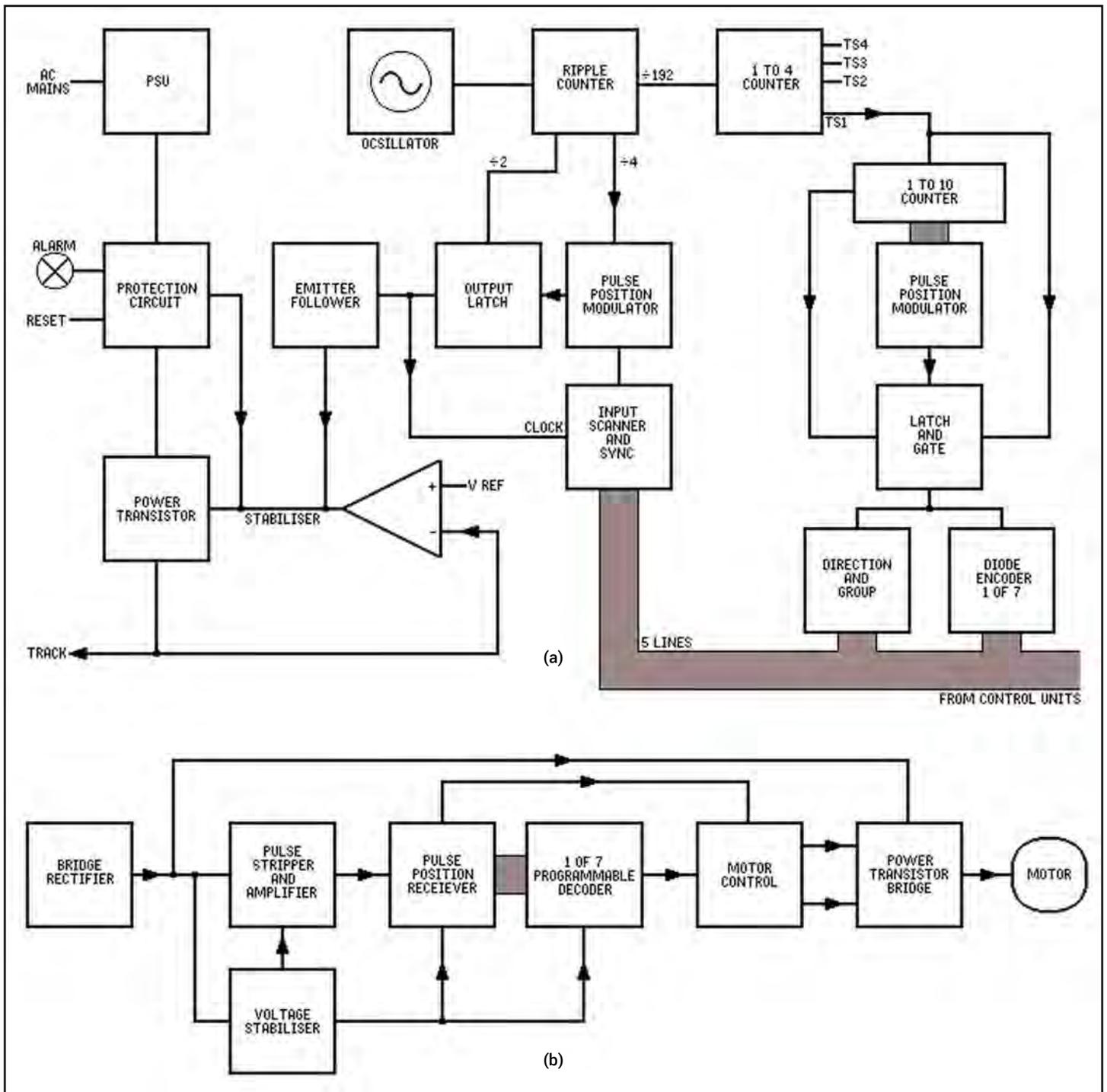


Figure 1. Block diagram (a) Common and control boards. (b) Receiver.

information received until the next address is due.

The speed of a locomotive is controlled by allowing any number of coded time slots (from 1 to 10) to be transmitted during a period of 10 time slots (TS), thus controlling the on to off ratio of pulses fed to the motor. Minimum speed is with one TS pulse and nine blank periods, half speed is with five TS pulses and five blank periods and full speed is with a continuous string of TS pulses being sent thus keeping the motor driven at full power.

The transmitter IC normally used with the ML 926/7 is the SL490 but

several of the built in features of that IC make it undesirable to use in this application.

The PPM system uses a frame of six pulses followed by a sync period. Digital information is transmitted by varying the time between two consecutive pulses in the following ratio: DATA 1 = 2, DATA 0 = 3, SYNC = 6.

The pulse timing is controlled by resetting a counter IC4 after 2, 3 or 6 clock pulses have been received depending on whether the data to be sent is 1, 0 or sync. In order to transmit each one of the five data bits in their correct order another counter, IC8 scans the five AND gates IC3c and IC7

in turn and then at the sixth count causes the sync period to be sent at the same time resetting the counter for the next scan. The timing point of the pulse to be transmitted is detected by monitoring the resetting point of this counter. This causes the latch IC3d to be triggered which allows a pulse of twice the clock period to be sent.

The ripple counter, IC5 provides all timing pulses required by the controller. It is fed by the CMOS relaxation oscillator formed by IC6 a,b,c and d. This oscillator is divided by 192 by IC5 to produce a TS trigger pulse approximately every 850µs. Each frame of data takes about 380µs, so that two

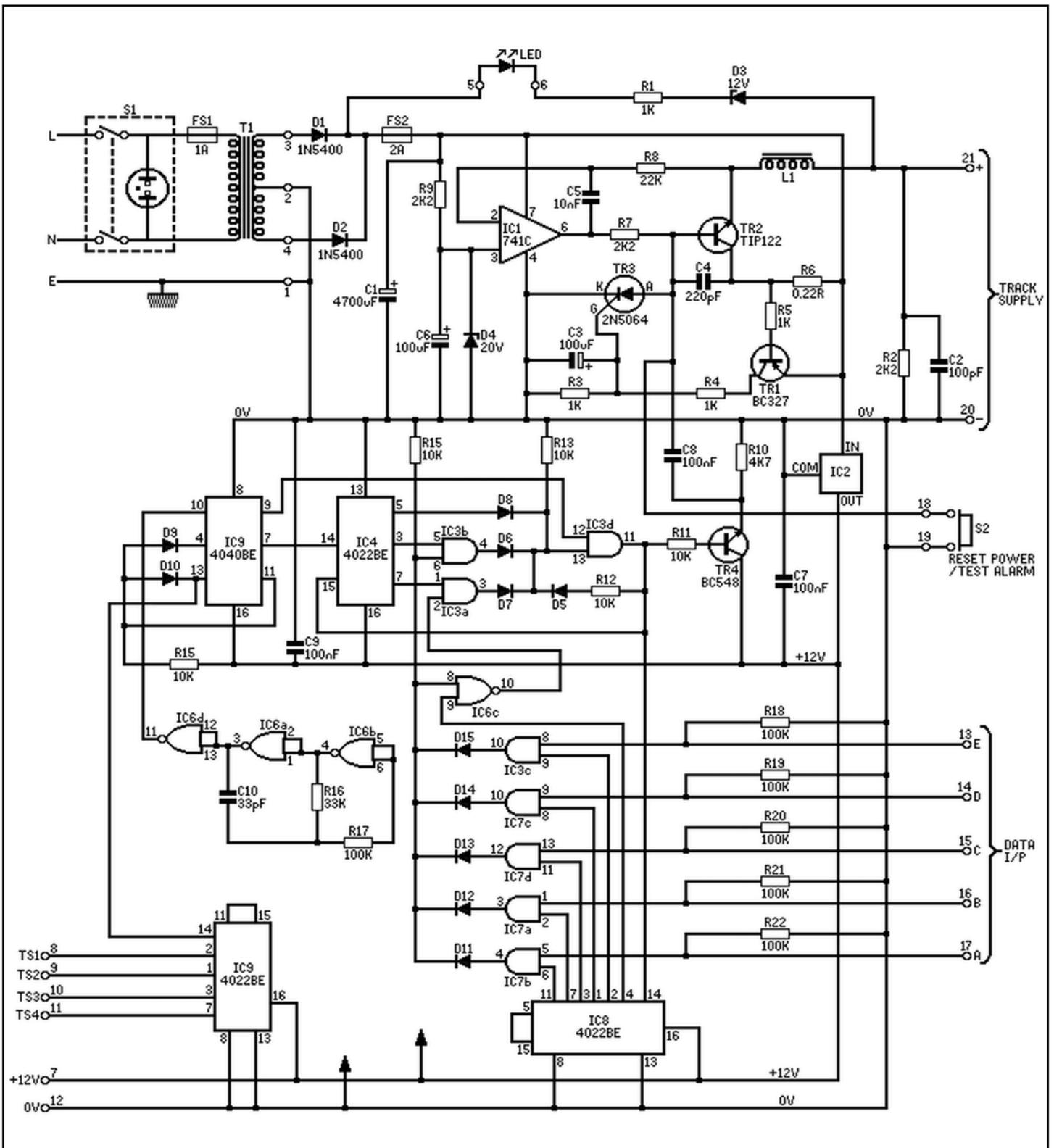
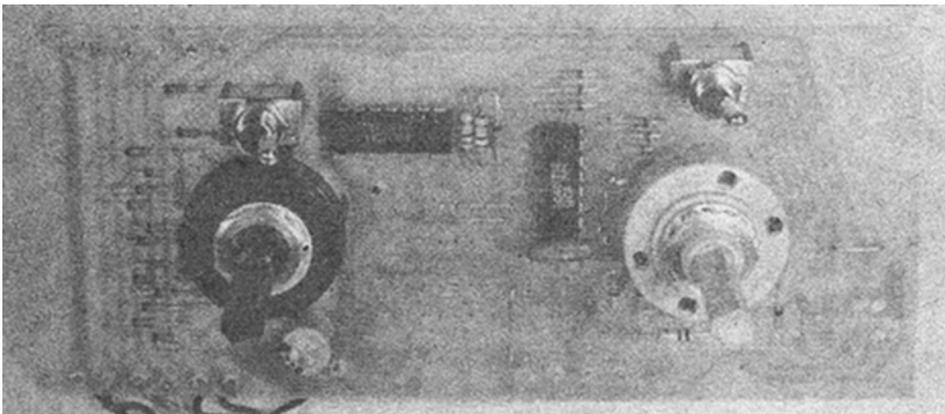


Figure 2. Common board. PSU circuit diagram.



Completed control PCB.

complete frames can be sent in one TS period.

The trigger pulse denoted above is used to clock the counter IC9 and produce four separate, consecutive output pulses, TS1-4 each approximately 850µs long. Each of the four control boards is fed with one of these TS pulses and this pulse is used to step the counter IC1 (control board). The counter steps from one to ten and then resets itself for the next count. The first output from the counter sets the

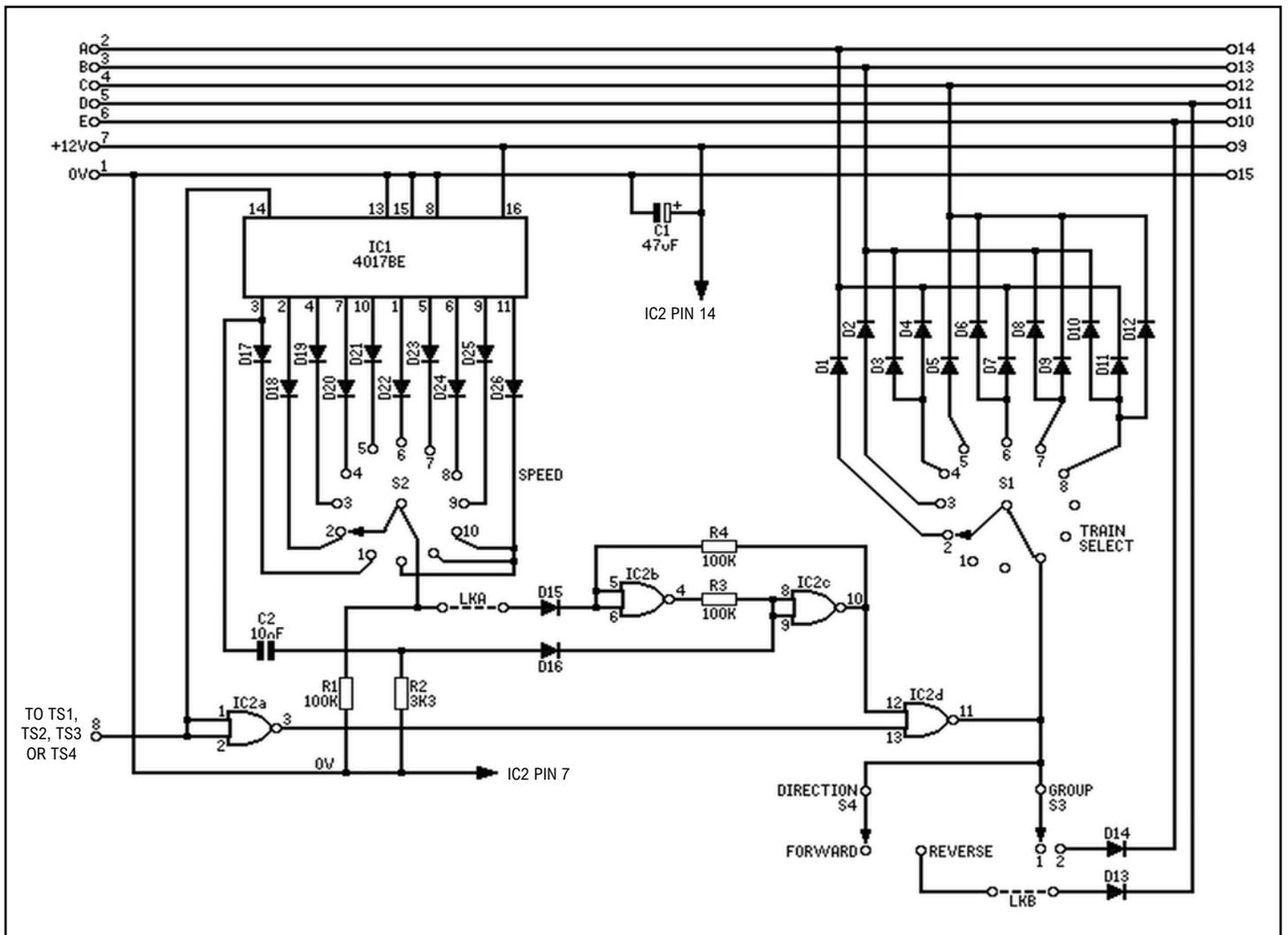


Figure 3. Control board circuit diagram.

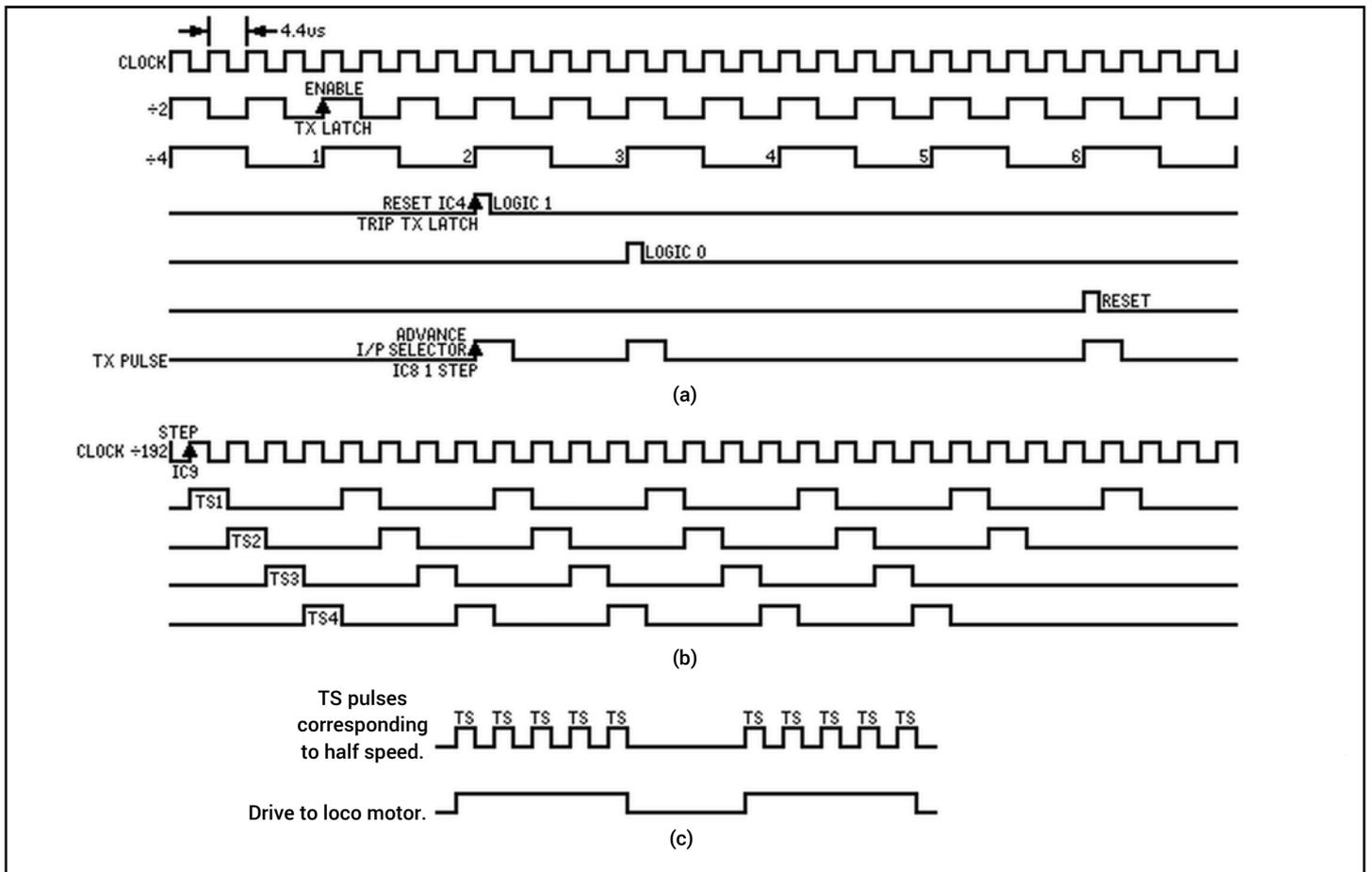


Figure 4. Timing diagram.

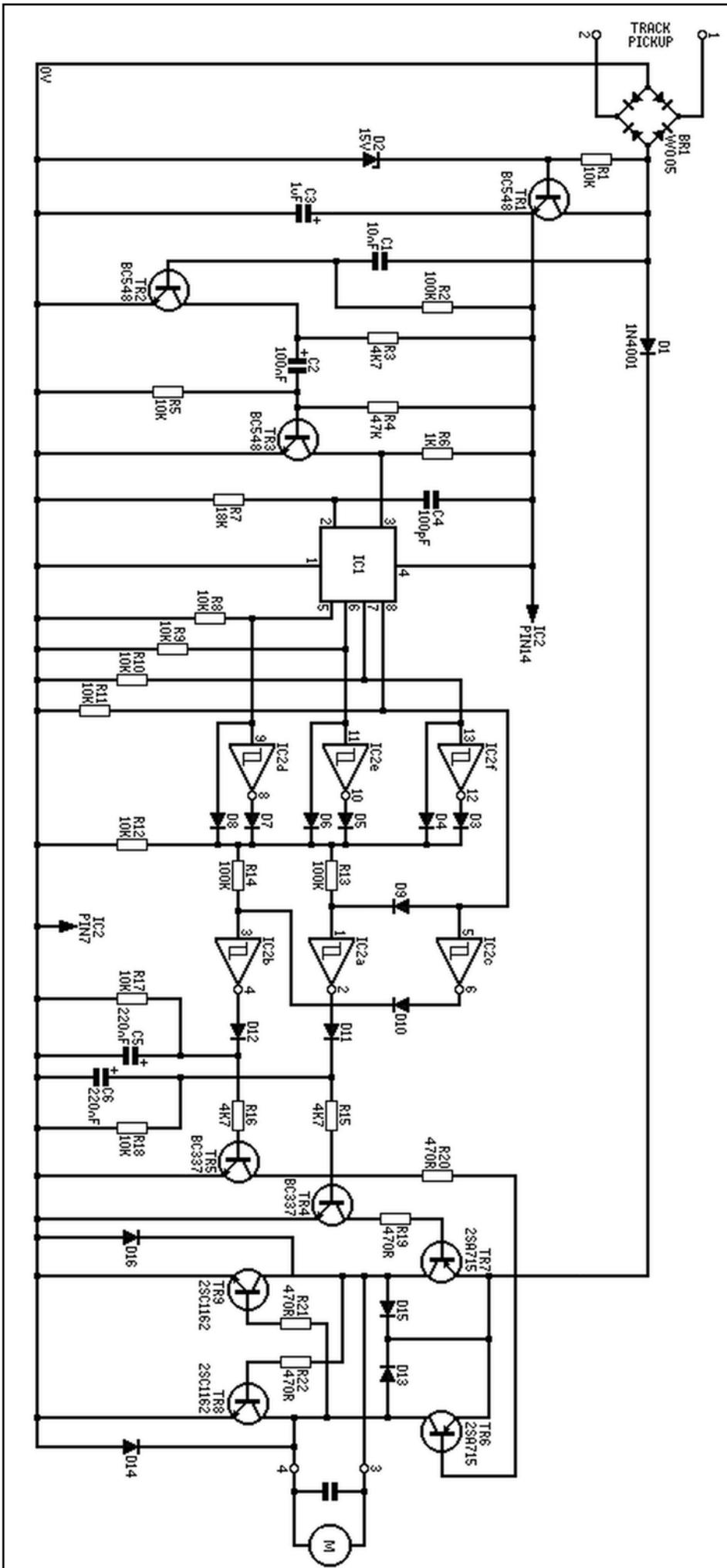


Figure 5. Receiver circuit diagram.

latch IC2b and c which is reset when the counter reaches the number set by the speed control thus holding the latch open for one to ten pulses. The latch gates TS pulses which are fed to the diode encoder. The pulses are connected onto one or more of the three data lines depending on the code of the receiver being addressed. If the reverse switch is operated or group 2 is selected the TS pulse is switched onto the appropriate data lines.

The DC supply fed to the track is stabilised by IC1 (common board) at about 18 volts and data signals from the emitter follower TR4 are superimposed on it and used to control the power Darlington transistor, TR8 which supplies current to the track. In order to protect the controller from damage due to accidental short circuiting of the track the current flowing through R6 is monitored by TR1. When this current exceeds the preset limit the transistor conducts and fires the SCR TR3 thus removing the drive to TR2 and turning off the supply to the track.

The SCR remains latched until it is reset by shorting it with S2. If the fault is still present the circuit will trip immediately and cause no damage.

When the track supply falls more than 12 volts below the power units output, either due to the protection circuit being tripped or due to a fuse failure the indicator LED 1 will light. Provision is also made for a buzzer to be fitted if an audible indication of track supply failure is required. A timer may be used to reset the protection circuit automatically after a short delay and this will be described in a later article.

### Construction

Build all PCBs referring to legends and parts list.

### Common Board

The track layout and component overlay for the common board are shown in Figure 6. Fit Veropins and PCB mounting fuse holders and solder. Insert and solder all resistors, diodes, capacitors and the choke. Insert the two plastic transistors, regulator and SCR into their correct positions. Push the leads of the power transistor TR2 through the PCB just far enough to allow it to be soldered and bend the leads as shown in Figure 7. Finally, insert and solder all ICs observing the usual CMOS precautions and making sure that they are the correct way round.

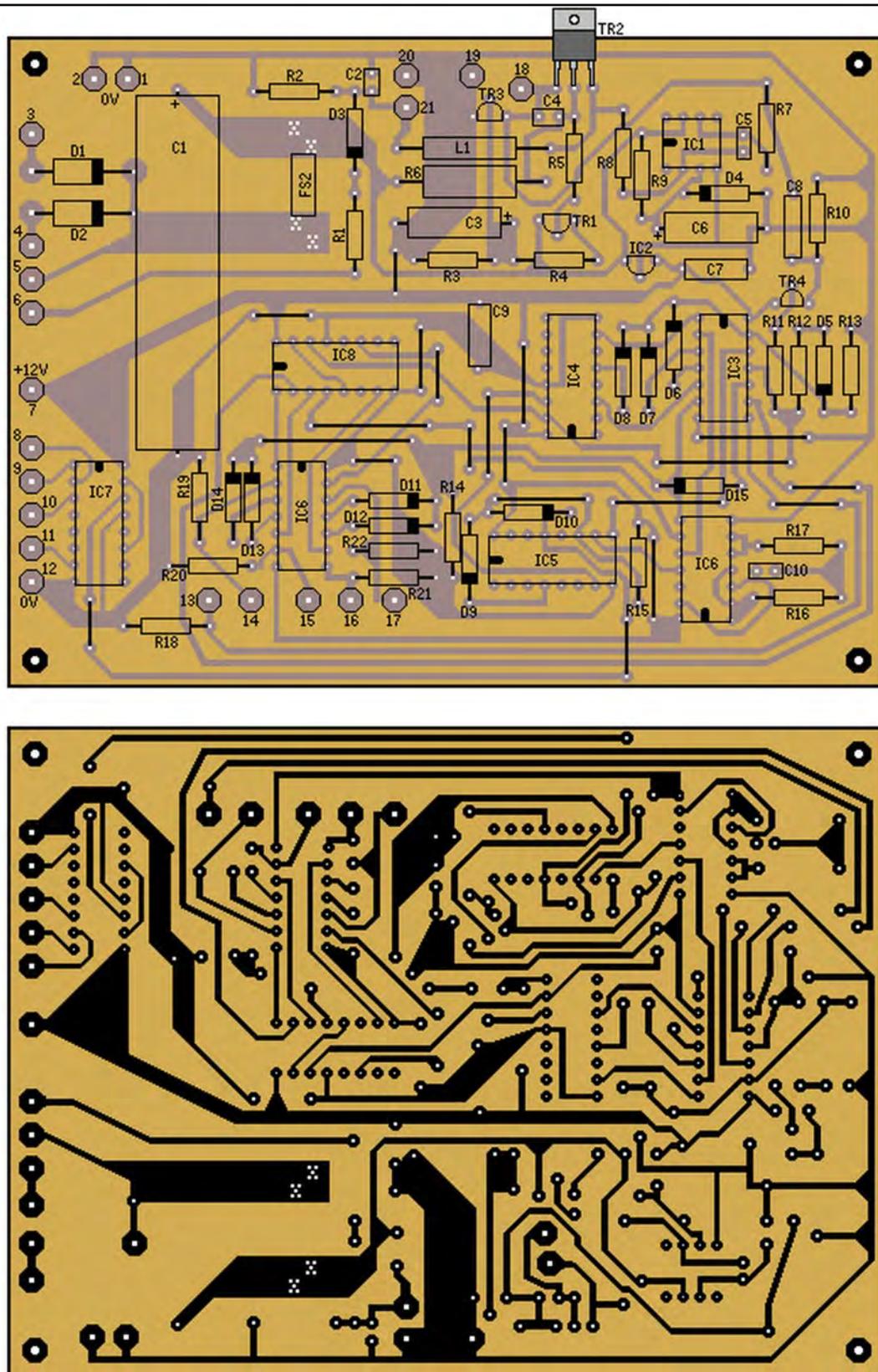
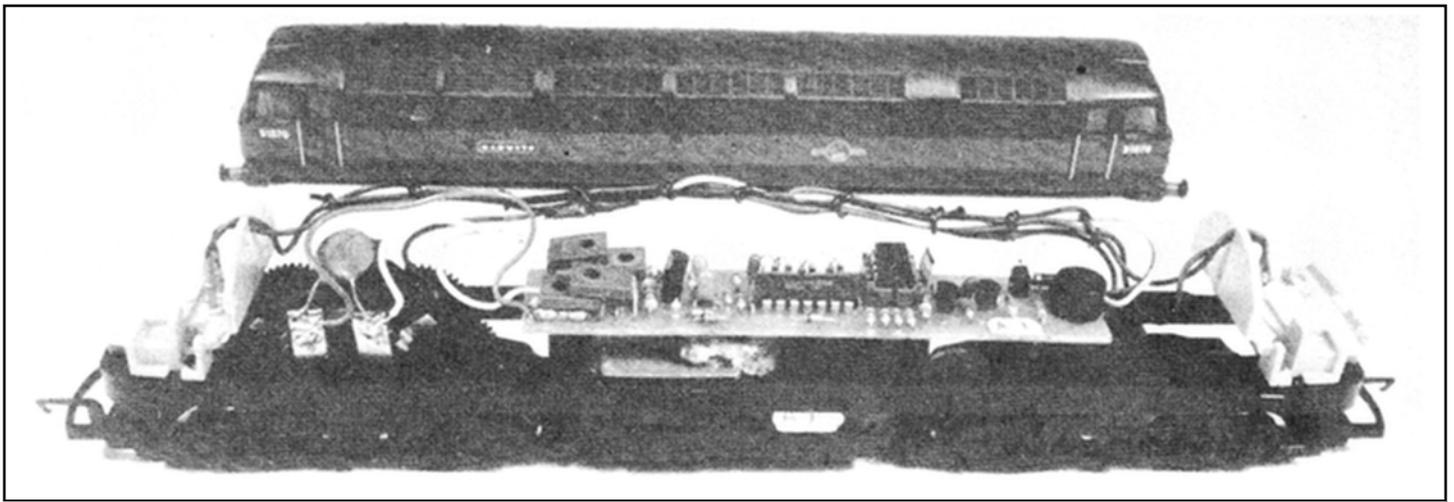
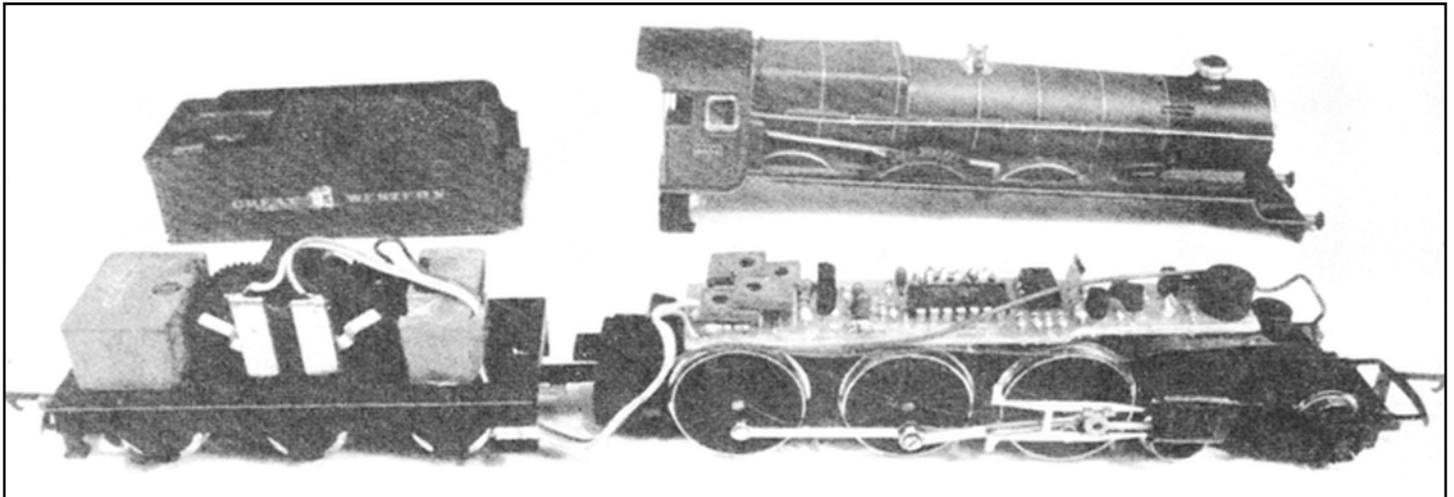


Figure 6. Common board track layout and component overlay.



Receiver board 1 installed in a diesel locomotive.



Receiver board 1 installed in a tender drive locomotive.

### Control Board

The track layout and component overlay for the Control Board are shown in Figure 8. Fit and solder all components in order as described above but in this case fit the Veropins from the component side of the PCB to enable ease of wiring when the boards are fitted to the front panel. The rotary switch without the click stops is mounted next to IC1. Note the unused component positions on the board are for the remote control option which may be added later.

### Assembly

Mount the transformer, mains switch, fuse holder, LED, push button and terminals on the case. Fit the common board and control boards. (Note that only one control board need be fitted initially.) The self-adhesive penal legend may be used as a template for drilling the front panel.

Wire all boards and components together referring to Figure 13. Insert the fuses noting that the 1 amp antisurge fuse is fitted in the panel fuse holder.

### Receiver board

There are initially two receiver boards available to fit varying size locomotives. See Figures 10 and 11. The dimensions of these boards are shown in Figure 9. Fit and solder all capacitors and resistors noting that some resistors do not lay flat on the board. Insert and solder all diodes other than D3 to D8 and fit all transistors taking special care with the positioning of TR6, 7, 8 and 9 as shown in Figures 10b and 11b. Insert and solder IC2.

Decide which channel the receiver is to use and insert the appropriate diodes referring to Figure 12. If the receiver is to be group A then insert an ML 926, if group B an ML 927. Carefully check all soldering and positioning of components before testing.

### Testing Procedure

#### Controller

Switch on power with nothing connected to the output terminals. The neon indicator in the mains switch should now be illuminated. Using a meter set to 20 volts DC or above check that there is approximately 18 volts at the output terminals.

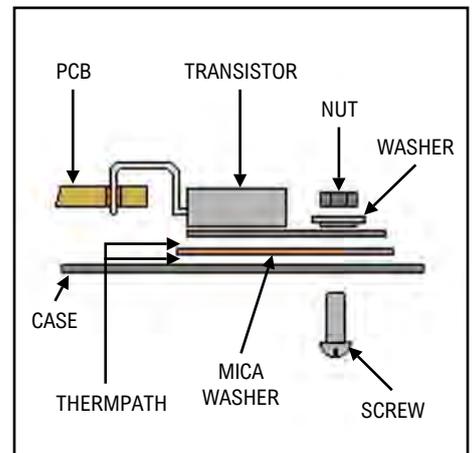


Figure 7. Power transistor mounting

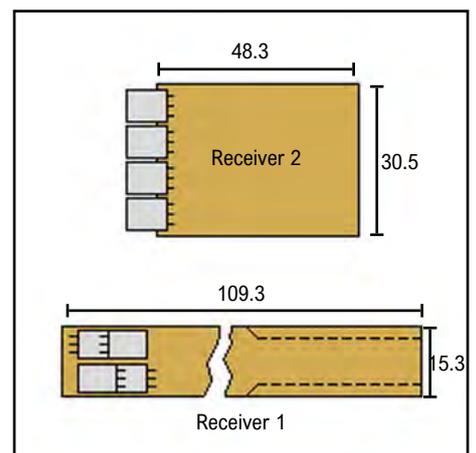


Figure 9. Receiver board dimensions.

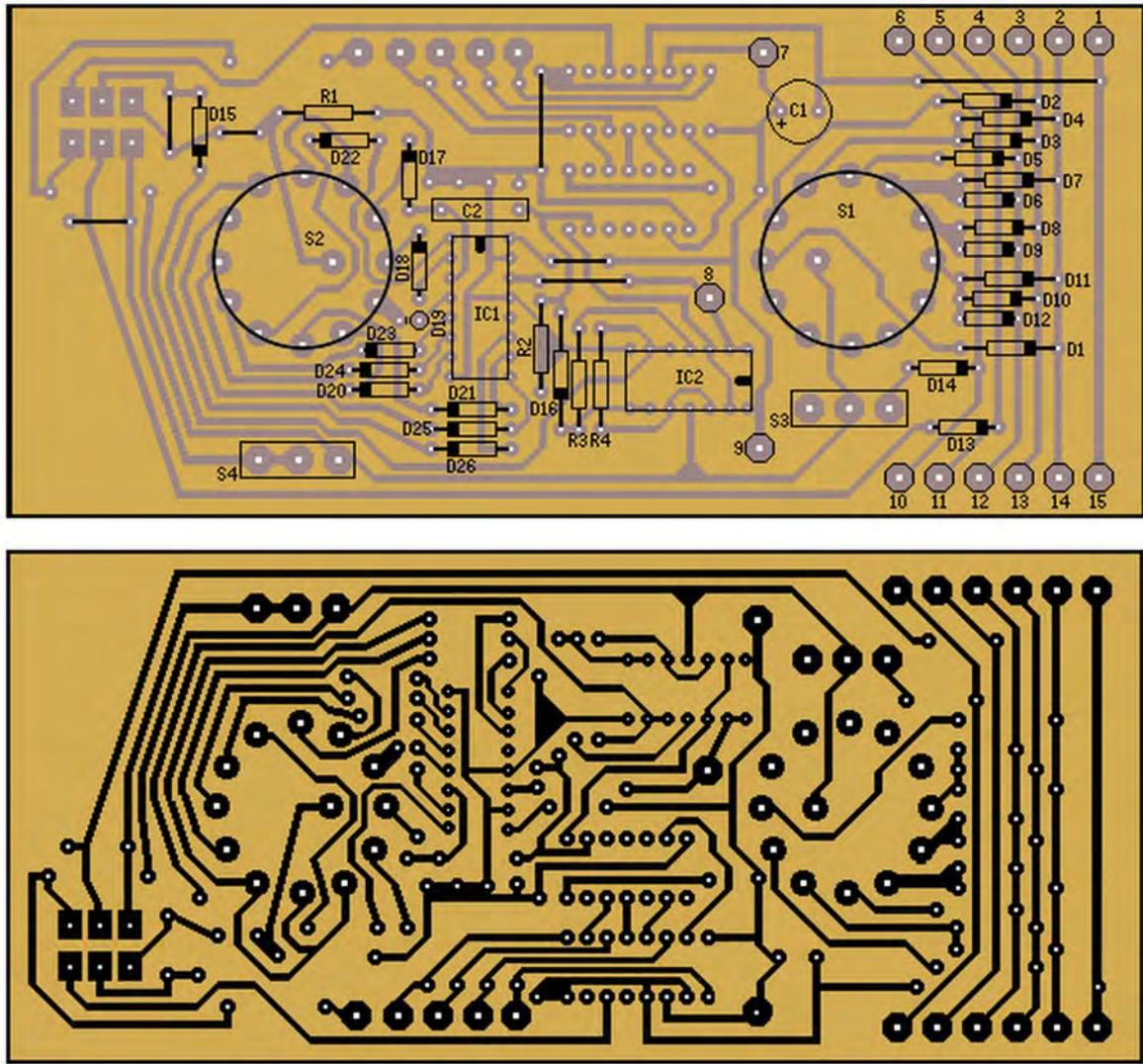
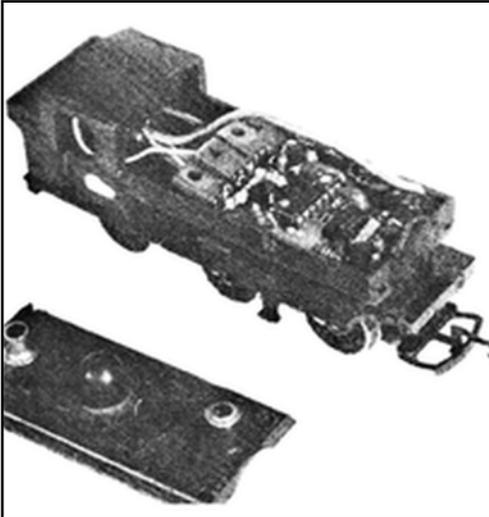


Figure 8. Control board track layout and component overlay.



Receiver board 2 installed in a tank locomotive.

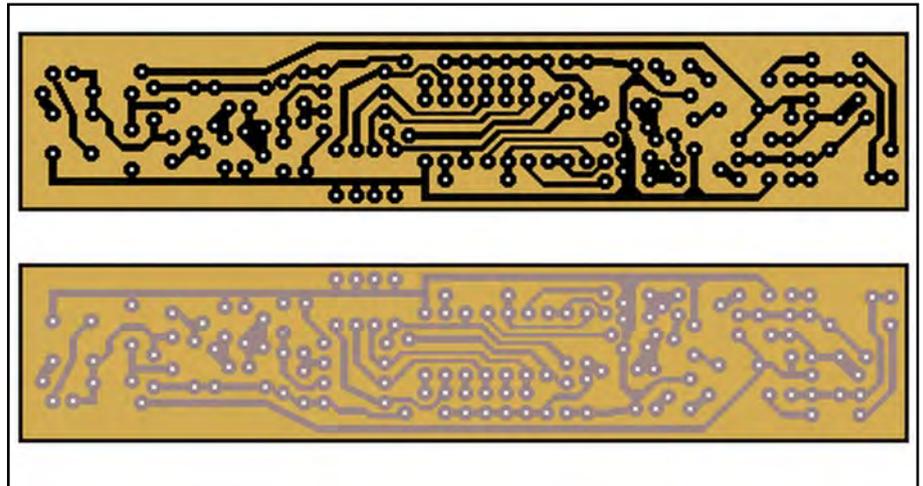


Figure 10(a). Receiver board 1 track layout and component overlay.

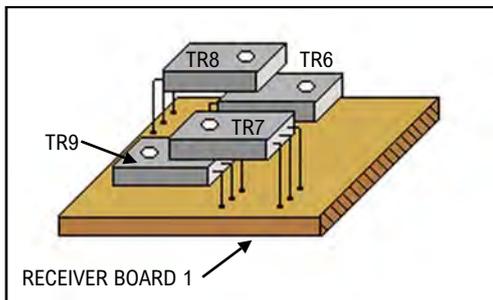


Figure 10(b). Receiver board 1 transistor mounting.

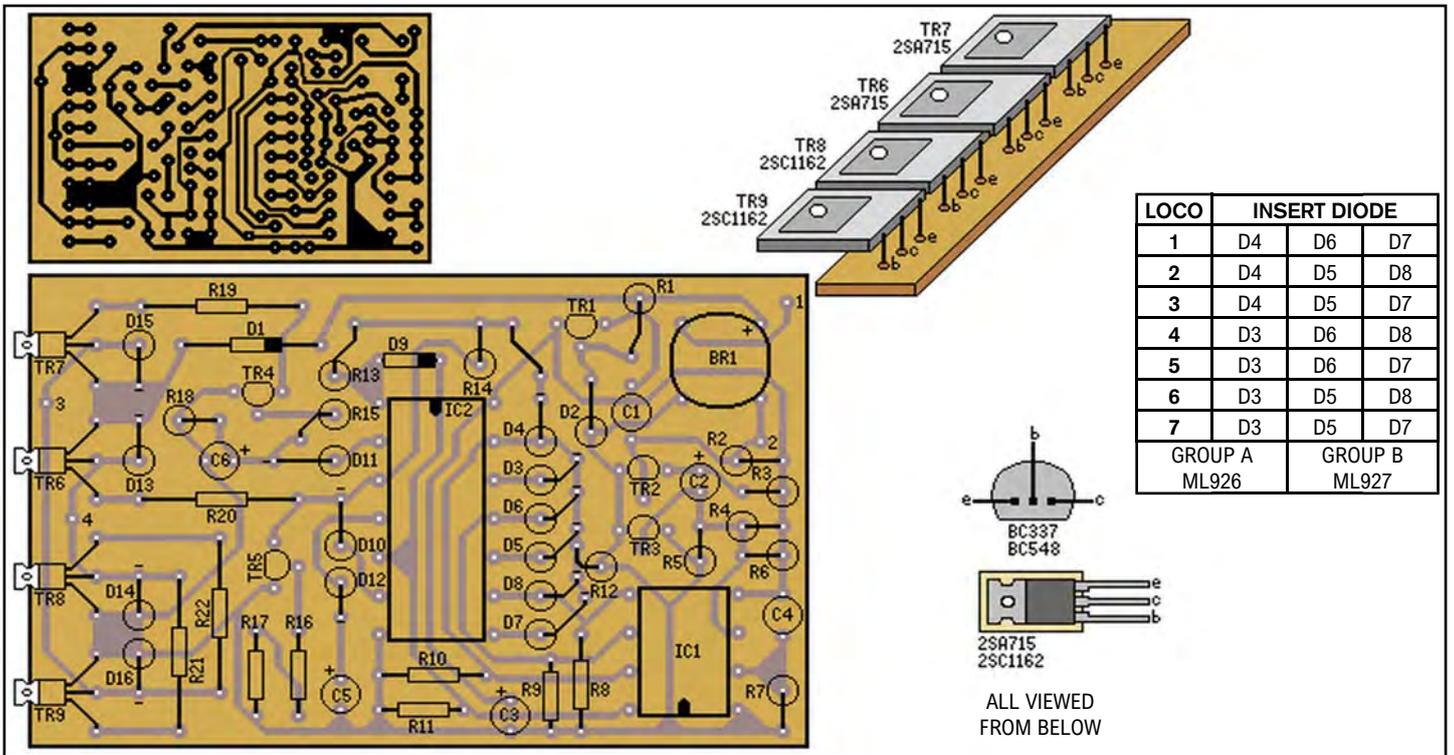


Figure 11(a). Receiver board 2 track layout and component overlay. (b). Receiver board 2 transistor mounting.

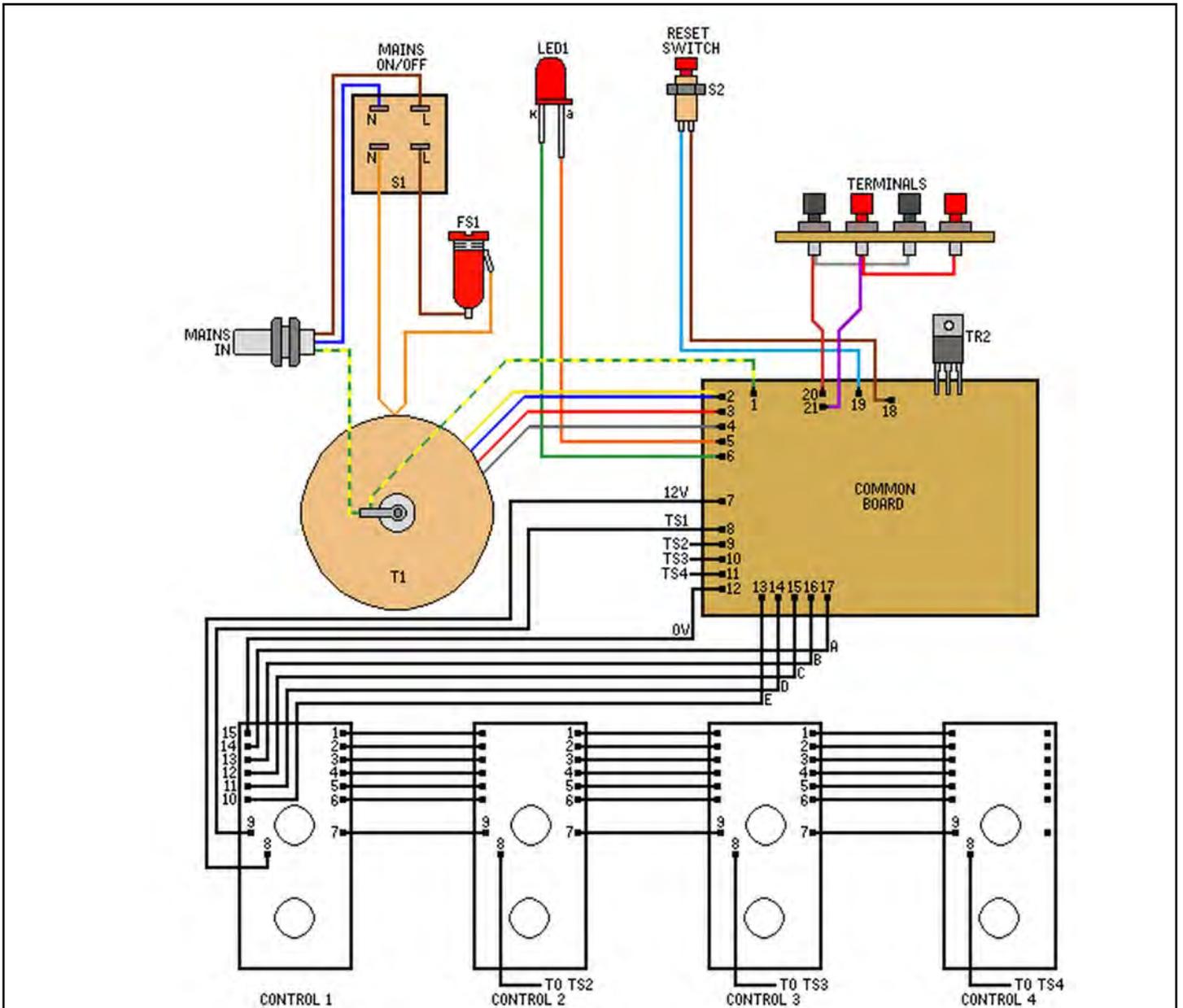


Figure 13. Controller wiring diagram.

Press the reset button and the "Track Supply Fail" LED should light and extinguish when the button is released. If this test is satisfactory, short circuit the output terminals and the LED should again light brightly while the short circuit is present and dimly when the short circuit is removed. Press the reset button. The LED should be extinguished and 18 volts restored to output terminals.

### Receiver

Connect the receiver to the control unit as shown in Figure 14. Select the channel number and group of the receiver on a control unit and advance

the speed control. One of the two lamps should light with its brightness depending upon the speed set. Switch over the reverse switch to the opposite position and repeat the test. In this case the other lamp should respond. Switch the control unit to the other channels and groups and ensure that the lights remain extinguished. If these tests are satisfactory the module is ready to be inserted in the locomotive.

### Installing Receivers in Locomotives

All locomotives designed for use with conventional control systems have the two sides of the motor connected directly to the wheels on each side of

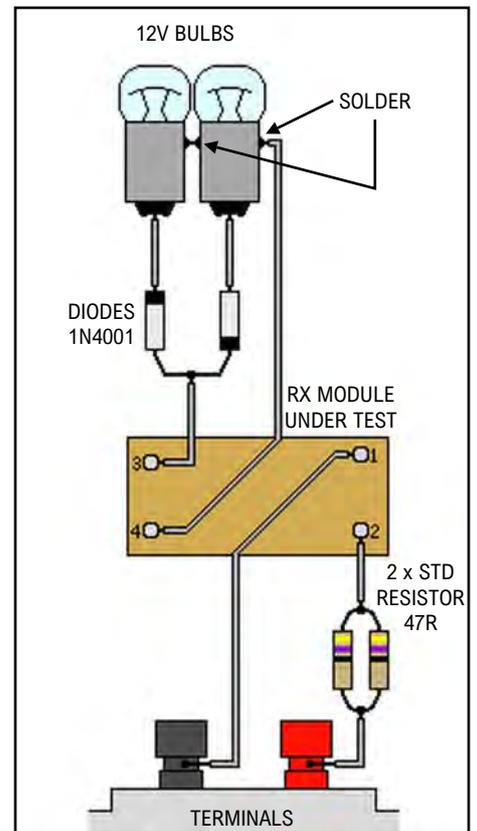
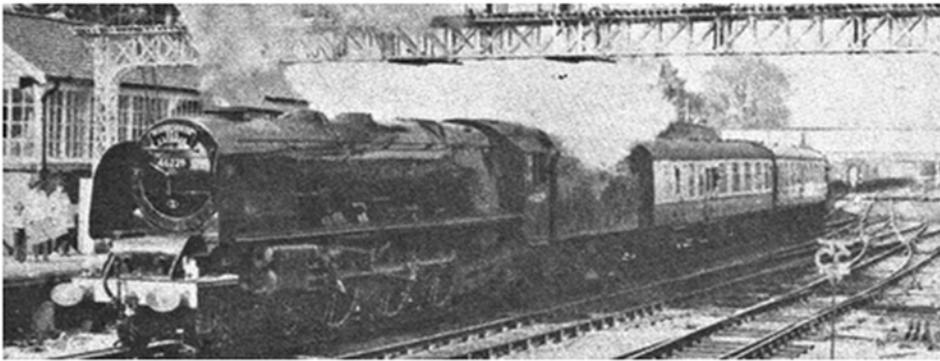


Figure 14. Receiver testing.

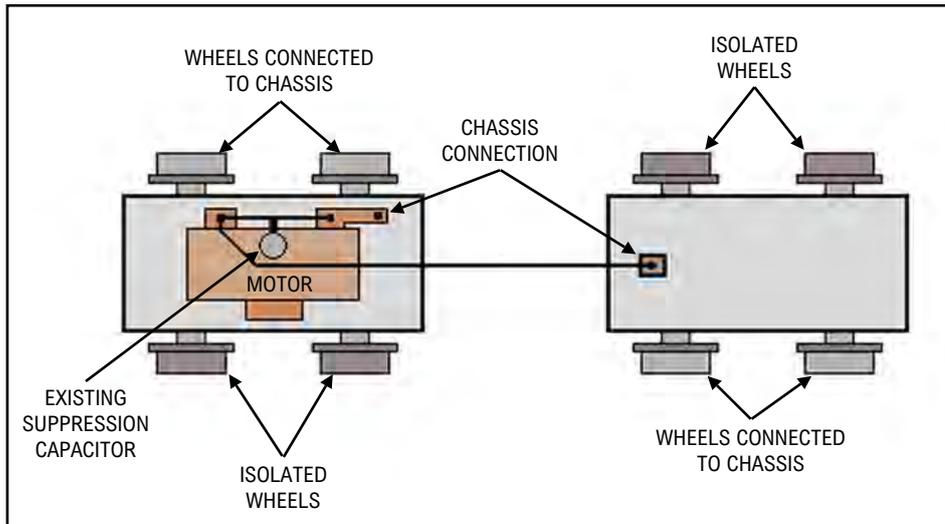


Figure 15. Wiring of a conventional locomotive.

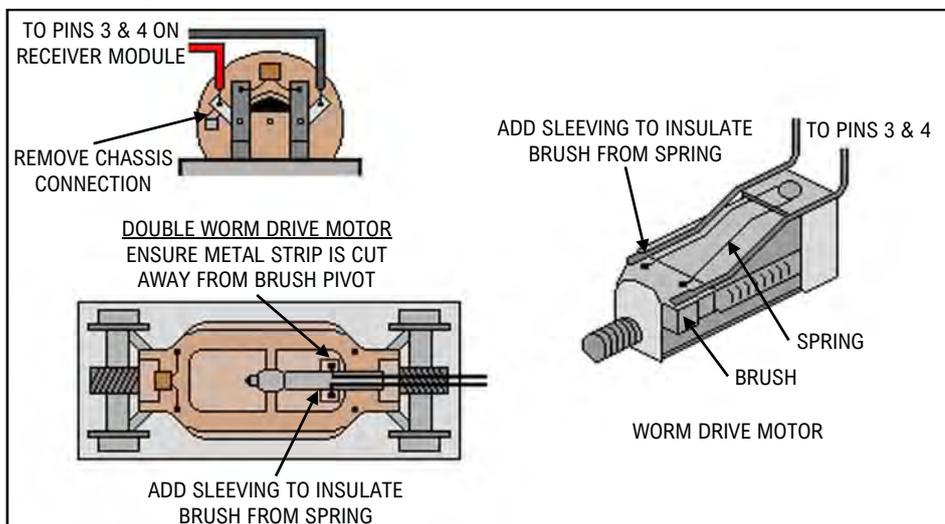


Figure 16. Modifications to various motors.

the locomotive Figure 15. To install the receiver module, the motor must be completely isolated from the wheels. In many modern models this is accomplished by removing a wire link but in some of the older models there is a permanent connection from one side of the motor to the chassis. In all cases by careful modification this connection can be removed. Some examples are shown in Figure 16. It is most important to ensure that the motor is completely isolated and it is worth checking this with a meter set to ohms before installing the module.

In most cases there will be a wire coming from one of the pickups, this is connected to one input of the module and the other input is connected to the chassis at a suitable point as shown in Figure 17. After installation, if it is found that the locomotive travels in the wrong direction in relation to the controller switch, the wires to the motor should be reversed.

To ensure reliable operation of this system, as with any other, the locomotives should be in good condition, and it is often worth replacing brushes and cleaning wheels and pickups before use. The track needs to be kept fairly clean although the receiver will respond to signals as long as there is enough power to drive the motor.

The next article in this series will describe the remote control facilities and computer interfacing.

Future articles will describe track circuiting (train position detection) point control and detection of position, interlocking and control of signals, automatic loop switching, and many other useful circuits as well as constructional hints for the railway modeller.

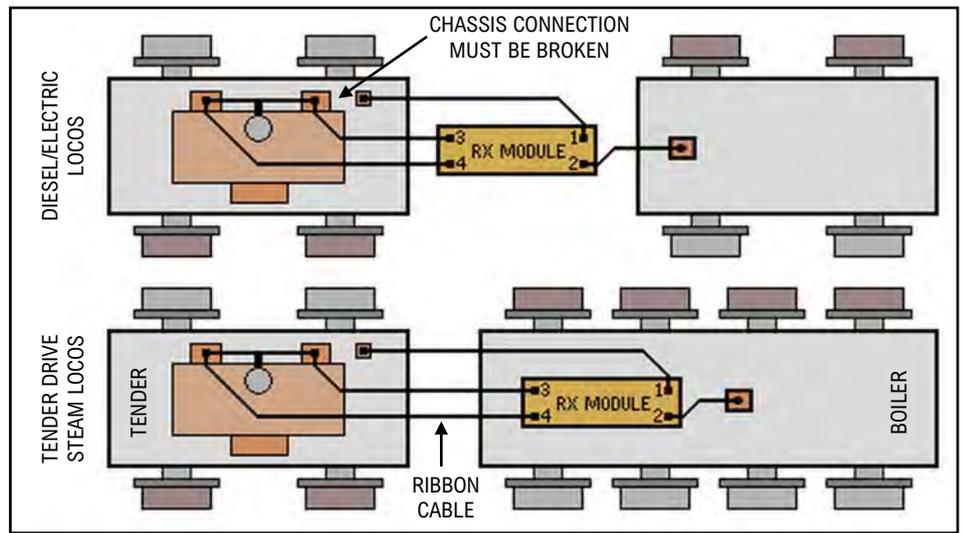


Figure 17. Installation of the receiver into the locomotive.

### TRAIN CONTROL MODULE PARTS LIST

Resistors - All ½ watt 5% Metal Film

R1, R3, R4	100k	Brown Black Yellow	3
R2	3K3	Orange Orange Red	1

#### Capacitors

C1	47µF 25V PC electrolytic	1
C2	10nF polyester	1

#### Semiconductors

D1 to D26	1N4148	26
IC1	4017BE	1
IC2	4001UBE	1

#### Miscellaneous

S1	Rotary switch 1 pole 12 way	1
S2	Rotary switch 1 pole 12 way non-click stop	1
S3, S4	Sub-miniature toggle switch	2
	Single-sided terminal pins	15
	Knob 23 mm x 16 mm (for S1)	1
	Knob 33 mm x 16 mm (for S3)	1

### TRAIN COMMON/PSU PARTS LIST

Resistors - all ¼ W 5% carbon unless specified

R1, R3, R4, R5	1K	Brown Black Red	4
R2, R7, R9	2K2	Red Red Red	3
R6	0.22R (3W) wirewound	1	
R8	22K	Red Red Orange	1
R10, R17	4K7	Yellow Violet Red	2
R11, R12, R14, R15	10K	Brown Black Orange	4
R13, R17, R18 to R22	100K	Brown Black Yellow	7
R16	33K	Orange Orange Orange	1

#### Capacitors

C1	4700µF 25V axial electrolytic	1
C2	100pF ceramic	1
C3	100µF 10V axial electrolytic	1
C4	220pF ceramic	1
C5	10nF ceramic	1
C6	10µF 25V axial electrolytic	1
C7, C8, C9	100nF polyester	3
C10	33pF ceramic	1

#### Semiconductors

D1, D2	IN5400	2
D3	BZX61C12	1
D4	BZY88C20	1
D5 to D15	1N4148	11
TR1	BC327	1
TR2	TIP122	1
TR3	MCR102 Thyristor	1
TR4	BC548	1
IC1	UA741C (8-pin)	1
IC2	UA78L12 AWC	1
IC3, IC7	4081BE	2
IC4, IC8, IC9	4022BE	3
IC5	4040BE	1

IC6	4001BE	1
<b>Miscellaneous</b>		
L1	RF suppressor choke 2A	1
T1	Toroidal Transformer 80VA 18V	1
LED1	LED red	1
FS1	Fuse anti-surge 1 amp	1
FS2	Fuse 20 mm 2 amp	1
S1	Dual rocker switch with neon	1
S2	Push switch	1
	PCB fuseholder 20 mm	1
	Fuse clip	2
	Strain relief grommet	1
	Single-sided terminal pins	21
	LED clip	1
	4-way speaker terminals	1
	Mains lead 3 amp	3 metre
	10-way ribbon cable	1 metre
	Equipment wire type 7/02 black	1 metre
	Equipment wire type 7/02 red	1 metre
	TO220 Transistor mounting kit	1
	Bolt 6BA x ½"	7
	Washer 6BA	3
	Spacer 6BA x 1/8"	4
	Nut 6BA	7
	Tag 2BA	2
	Heatsink compound	1 tube
	Stick-on feet	4

### TRAIN RECEIVER MODULE PARTS LIST

Resistors - all ¼ watt 5% carbon

R1, R5, R8 to R12			
R17, R18	10K	Brown Black Orange	9
R2, R13, R14	100K	Brown Black Yellow	3
R3, R15, R16	4K7	Yellow Violet Red	3
R4	47K	Yellow Violet Orange	1
R6	1K	Brown Black Red	1
R7	18K	Brown Grey Orange	1
R19, R20, R21, R22	470R	Yellow Violet Brown	4

#### Capacitors

C1	10,000pF ceramic	1
C2	100nF 35V tantalum	1
C3	1µF 35V tantalum	1
C4	100pF ceramic	1
C5, C6	220nF 35V tantalum	1

#### Semiconductors

D1	1N4001	1
D2	BZY88C15V	1
D3 to D16	1N4148	14
BR1	W005	1
IC1	ML926 (Group A)	1
	ML927 (Group B)	1
IC2	40106BE	1
TR1, TR2, TR3	BC548	3
TR4, TR5	BC337	2
TR6, TR7	2SA715	2
TR8, TR9	2SC1162	2

# WORKING WITH OP-AMPS

by Graham Dixey

C. Eng., M.I.E.R.E.

Not many years ago the OP-AMP was an expensive and specialised device. To give it its full title of 'operational amplifier' is to emphasise that its original role was to perform mathematical operations. It was the active component of the analogue computer, which largely appears to have taken a back seat these days.

The reason for the current popularity of the operational amplifier (or op-amp) is its cheapness and versatility in the form in which it is now to be found; that is as a monolithic integrated circuit. Of course, it can still be used for its original applications such as integration, differentiation, addition, subtraction, etc., but generally the field of application is much wider. It is used in purely linear fashion e.g. in audio amplifiers and instrumentation amplifiers, but it can also be used in pulse circuits and various other more exotic guises.

In this article, some of the op-amps uses in a variety of roles will be examined and will assume the reader has little previous knowledge of either the electronics or mathematics involved. Examples of circuit design will be presented along with the necessary theory.

## The Ideal Op-Amp

In electronics it is frequently necessary to make sensible approximations in order to present a particular topic intelligibly. It is amazing how very complex and unwieldy formulae often become quite simple when some sort of approximation is made. This is certainly true of op-amps and the resulting formulae are then very readily applied to practical situations. Listing the main features of an ideal op-amp gives us:

- a. infinite gain
- b. infinite input impedance
- c. zero output impedance
- d. infinite bandwidth

This looks a very formidable specification at first sight. Of course, we cannot actually expect to realise these parameters, but the real values are relatively close enough to have little practical significance. For example, a typical voltage gain  $A$  might be 200000 which is a lot less than infinity, but if we compare  $A$  with  $A + 1$  the difference is insignificant. It is this sort of comparison that allows us to make worthwhile simplifications.

## Enter the 741

I decided to base this article on one particular chip, the 741, for several reasons; it is very cheap, easily obtainable and does not need a host of compensating components in order to make it work. It also has a short-circuit proof output. There are other op-amps that can outperform it in one way or another but it

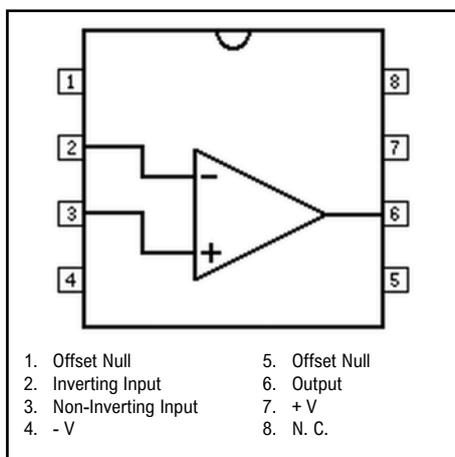
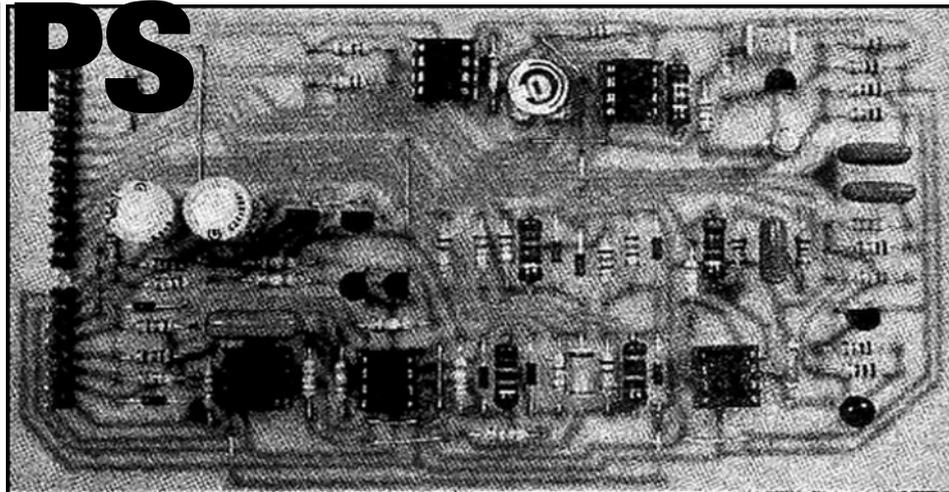


Figure 1. Pin-out diagram of the  $\mu A741CP$  op-amp.

will serve well enough to introduce the basic principles of op-amps and their applications.

Figure 1 shows the pin-out diagram for the 8-pin version (there is also a 14-pin version), from which we see that the connections fall into three groups, according to function:

- a. power supplies +V and -V
- b. offset-null terminals
- c. inputs and output

## Input and Output

There are two inputs and one output and the usual symbol showing these terminals appears in Figure 2. The input marked with a - sign is known as the 'inverting input' ( $180^\circ$  phase-shift between this input and the output); the input marked with a + sign is known as the 'non-inverting input' ( $0^\circ$  phase-shift between this input and the output). Figure 3 illustrates

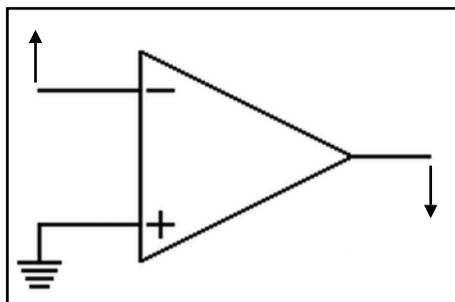


Figure 3(a). Action of inverting input

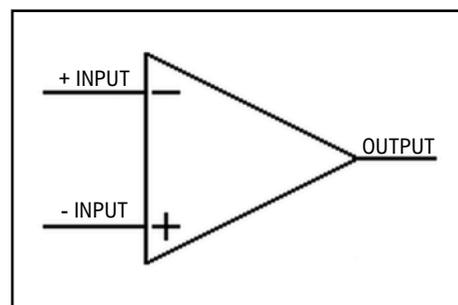


Figure 2. Basic op-amp symbol.

the action of each input considered separately, the other input then being taken to 0V.

The arrows are used to represent signals in a general manner e.g. the 'up-arrow' can signify the positive half-cycle of a sine-wave, a positive DC level, a positive ramp etc. Similarly the 'down-arrow' signifies any negative waveform. So a positive signal applied to the inverting input produces a corresponding negative. Signal at the output and a positive signal applied to the non-inverting input produces a corresponding positive signal at the output.

Suppose now that the inputs are energised simultaneously and, to keep things simple, the signals are of equal amplitude. The two possible configurations are shown in Figure 4.

The question is, of course, what is the direction of the output in each case?

Consider the case of in-phase inputs shown in Figure 4(a). The output changes due to each input will be equal and opposite and the output will therefore remain unchanged.

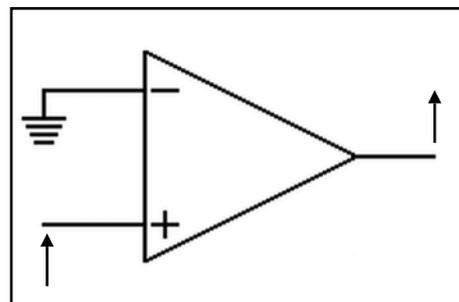


Figure 3(b). Action of non-inverting input

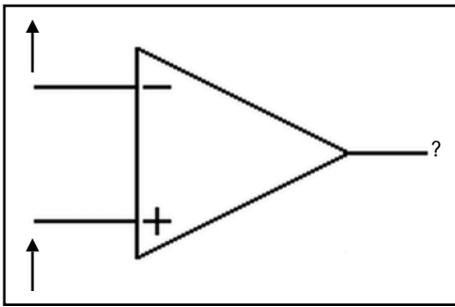


Figure 4(a). Equal in-phase inputs.

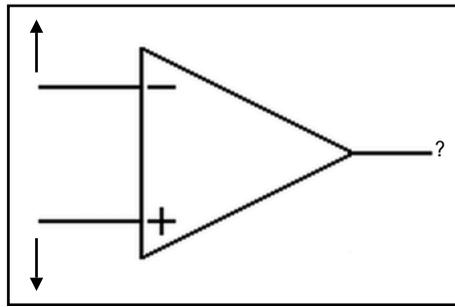


Figure 4(b). Equal anti-phase inputs.

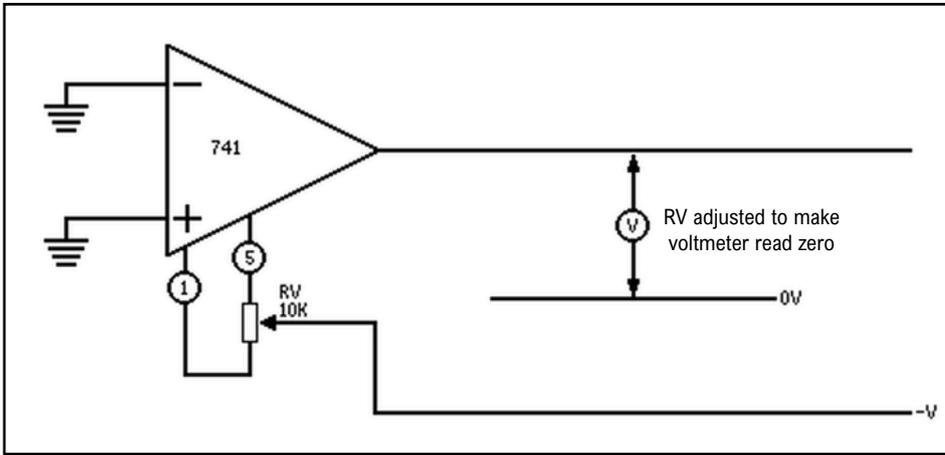


Figure 5. Using the 'offset null' facility.

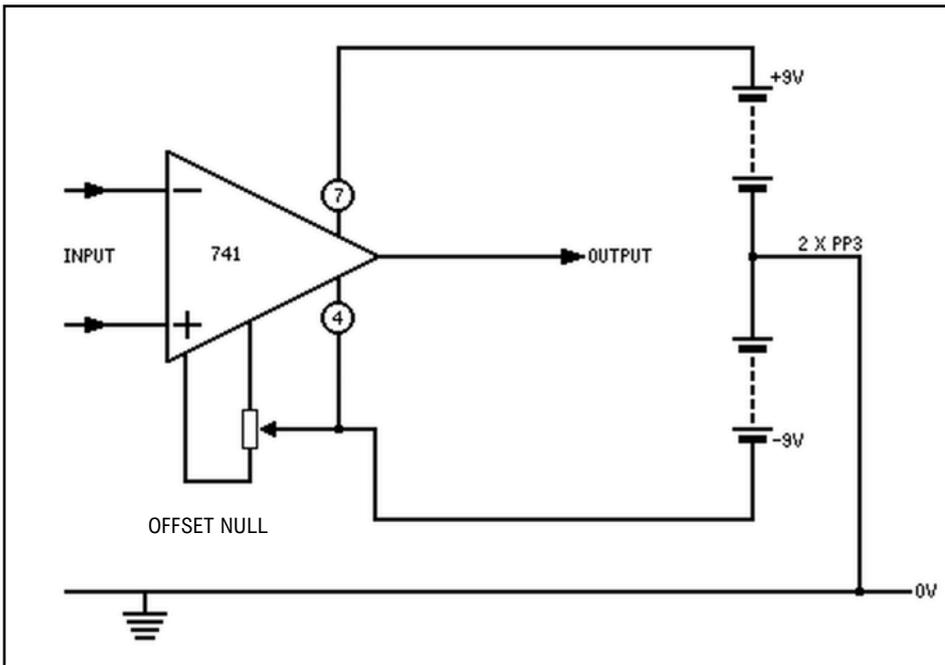


Figure 6. Power supply connections.

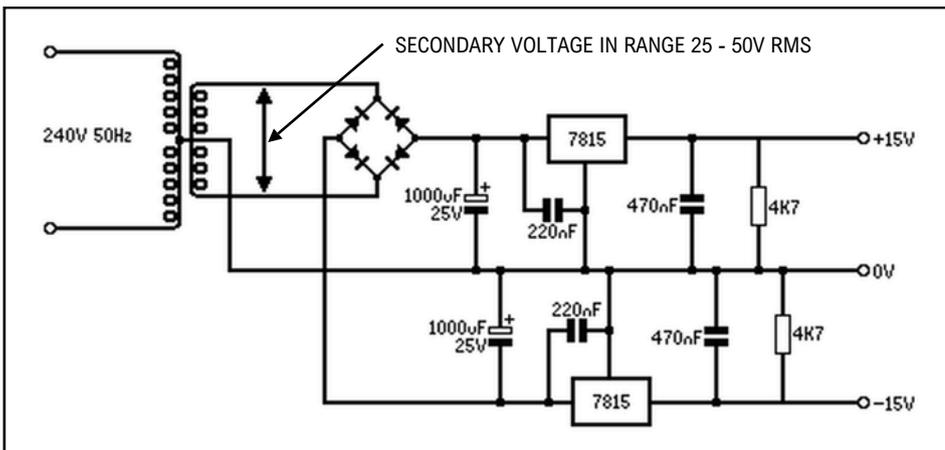


Figure 7. Mains operated dual 15V op-amp power supply.

In the case of anti-phase inputs, the positive signal at the - input will produce a negative output and the negative signal at the + input will also produce a negative output. So the two effects are additive, and a large output change occurs.

These two ways of driving the inputs are known as the differential-mode (anti-phase inputs) and common-mode (in-phase inputs) respectively. From this we can see that a principal characteristic of an op-amp is to amplify the former but reject the latter. This has great practical significance as we shall see in due course.

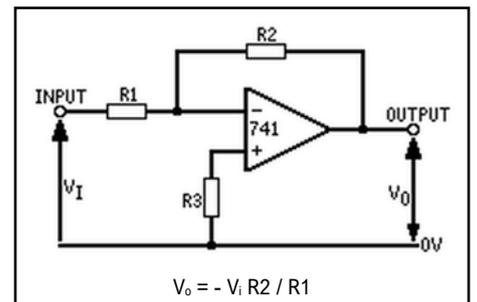
### Offset Null

Having now discussed briefly the signal connections, we can consider the function of the two pins marked offset null.

Suppose we were to connect both inputs to 0V; we should expect the output to be also 0V, since there is nothing to amplify in order to produce an output. We might well be surprised, therefore, to find that the output was not in fact 0V at all but slightly offset from it, either above or below the 0V level. This arises because of the impossibility of manufacturing a perfectly symmetrical amplifier. However, the manufacturers allow for this by providing the 'offset null' facility. This is utilised in practice by connecting a potentiometer between the two offset null pins, with the wiper taken to -V. This would be a skeleton preset and is adjusted to bring the output to zero with both inputs also at zero. Figure 5 illustrates the technique.

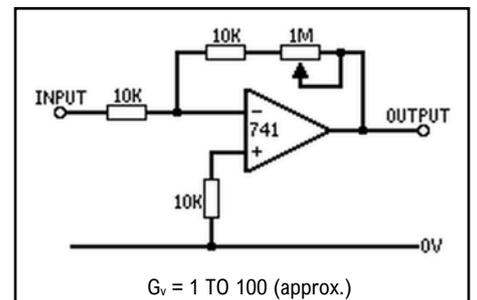
### Common-Mode Rejection Ratio

As stated previously there is a high gain in the differential mode of operation and zero gain in the common mode. However, the latter statement is not quite true; because of the imperfections already mentioned, the gain in common mode is small but it is not zero. This means that common-mode inputs will produce an output but it will be very small. In many practical situations, the signal is applied differentially but unwanted noise signals are picked up at both + and - inputs and present a common-mode input to the amplifier. Thus



$$V_o = -V_i R_2 / R_1$$

Figure 8. The inverting amplifier.



$$G_v = 1 \text{ TO } 100 \text{ (approx.)}$$

Figure 9. Inverting amplifier with variable gain.

the signal is subject to very high gain and produces a large output, while the unwanted noise voltages have very low gain and produce very little output. How well the amplifier is able to separate signal and noise in this way is expressed by a factor known as the 'Common-Mode Rejection Ratio' (CMRR).

The CMRR can be calculated as follows:  

$$CMRR = 20 \log \frac{[DIFFERENT MODE GAIN]}{[COMMON MODE GAIN]} \text{ dB}$$

So in practice the gain figures were 200000 and 4 respectively, the CMRR would equal  $20 \log (200000/4)$ , which gives 94 dB; this would be a very good figure.

### Power Supplies

The power supply pins are marked +V and -V since, in general, it is expected that the op-amp will develop outputs that swing either side of 0V. A typical pair of supplies would be  $\pm 15$  volts, giving a possible output swing of 30 volts peak to peak. However, a convenient arrangement when experimenting consists of two PP3 batteries giving  $\pm 9$  volts, as shown in Figure 6. PP3 batteries will give adequate current for our purposes; one op-amp takes very little current.

For those who prefer a mains power supply, I have given a low-cost design in Figure 7. It uses a couple of small regulator chips to give  $\pm 15$  volts at up to 100 mA.

To explore the possibilities of the op-amp fully, access to some test equipment will be required. For example, an oscilloscope for examining waveforms, an audio sine/ square-wave generator for providing inputs, and a multimeter for measuring current and voltage levels. Also some form of breadboard will be required such as the 'solderless plug-in types', or just a piece of Veroboard with an 8-pin IC socket and a few terminal pins.

### Amplifier Configurations

#### Inverting

Figure 8 shows an inverting amplifier. The term inverting amplifier implies a  $180^\circ$  phase-shift between input and output. To define the input/output relationship fully the voltage gain must be known as well.

This is given by Voltage gain =  $R_2/R_1$ , which shows that for a certain value of  $R_1$ , the gain is determined by the choice of  $R_2$ . Apart from using fixed resistor values, a potentiometer would give continuous control of gain or  $R_2$  could be switched to give gain changes in steps.

The unused + input is tied to 0V by  $R_3$ . The value of this resistor is not usually particularly critical but it can be obtained from the formula  $R_3 = R_1 R_2 / (R_1 + R_2)$ , which gives the value for best 'drift-free' performance. Unless this is a particular criterion, a good rule of thumb is to let  $R_1 = R_3 = 10K$  and select  $R_2$  for the required gain. Figure 9 shows an inverting

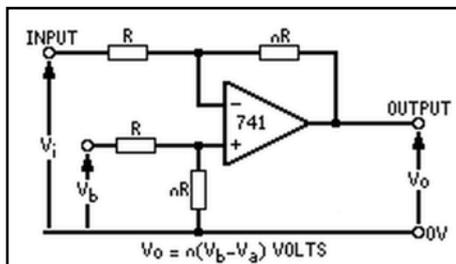


Figure 13. The subtractor amplifier.

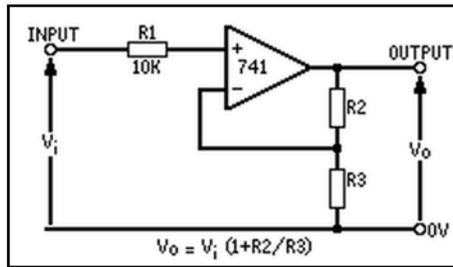


Figure 10. The non-inverting amplifier.

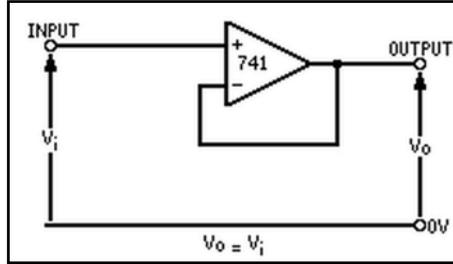


Figure 11. The voltage follower.

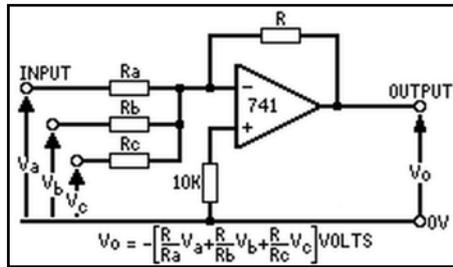


Figure 12. The summing amplifier.

amplifier in which the gain is continuously variable from 1 to 100 (approximately).

#### Non-inverting

An amplifier may be needed whose gain can be just as easily defined but which has zero phase-shift. An amplifier of this type is shown in Figure 10.

The gain of the non-inverting amplifier is also defined by the ratio of two resistors,  $R_2$  and  $R_3$ . However, the expression for gain is slightly different from the previous case; it is now given by  $1 + R_2/R_3$ . A very wide range of gain is feasible. The minimum value is clearly 1, which occurs when  $R_2 = 0$ . If, at the same time,  $R_3$  is made equal to infinity (i.e. removed entirely), the circuit becomes that of the voltage follower.

#### Voltage Follower

Figure 11 shows a voltage follower which is so-called because it has a voltage gain of one and zero phase-shift. A circuit in which the input and output are identical may not, at first, seem very useful. Its value derives from the fact that it has a very high input impedance and a very low output impedance. This means that it can be used as a matching device between points of high and low impedance.

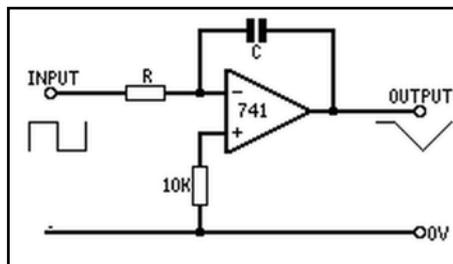


Figure 14. The integrator.

### Summing and Subtracting

Sometimes it is necessary to add two or more voltages together, or obtain the difference of two voltages. The summing amplifier (Figure 12) and the subtractor amplifier (Figure 13) meet these requirements.

In the case of the summing amplifier, the gain for each input separately is determined by the ratio  $R/R_a$ ,  $R/R_b$ , etc. If these ratios are all equal to one, then the output voltage is equal, literally, to the sum of the input voltages. But it is obvious that the input voltages can be scaled up (or down) by some factor  $R/R_x$ , either equally for all inputs or preferentially.

The same facility for scaling the gains for each of the inputs is also available for the subtractor, as Figure 13 should illustrate.

### Integrator

The last basic configuration to examine is the integrator, which is shown in Figure 14.

This circuit performs the mathematical operation of integration. However, there is no need to become involved in integral calculus. In practical terms, the circuit responds to a step input voltage by producing a ramp of opposite sign. The slope of the ramp depends upon the amplitude of the step and the 'integrator gain'  $1/RC$  volts/sec per volt of input.

Figure 14 also shows a full cycle of the square-wave input; the integrator output consists of alternate negative and positive ramps, corresponding to the leading and trailing edges, respectively, of the input. If the input was a continuous square-wave, the output would be a triangular waveform.

Given the right data, it is a simple matter to calculate the amplitude of the output, as follows: if  $R = 100k$  and  $C = 100nF$ , the integrator gain is  $10^7 / 10^8 = 100V/s$  per volt of input. This is more conveniently expressed as  $0.1 V / ms$  per volt. If the input was a 100 Hz square-wave of 2 V amplitude, then the slope of the ramp would equal  $0.1 V / ms \times 2 = 0.2 V / ms$ . Since the time of a half-cycle at 100 Hz is 5 ms, the amplitude of the output is  $0.2 V / ms \times 5 ms$ , which equals 1 volt.

The integrator principle has many applications. One of them appears in Figure 15, the circuit shown performing a time to voltage conversion.

The amplitude of the ramp output is proportional to the duration of a negative input pulse. In the absence of such a pulse, both diodes conduct and hold the output at 0V. The arrival of a pulse reverse-biases both diodes and the ramp starts running. The rate at which it runs is set by  $RV_1$ , which acts as a form of 'sensitivity control'. Since the ramp runs until the pulse finishes (if  $RV_1$  has been set correctly), the final amplitude of the output is proportional to the length of the input pulse.

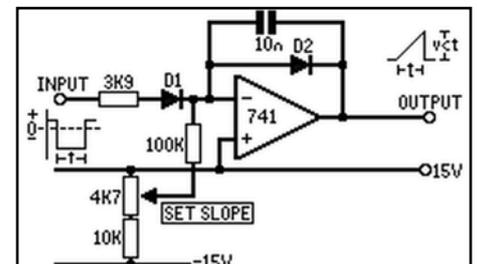


Figure 15. Circuit for time to voltage conversion.

# MULTI-MODE DIGITAL STOPWATCH



- Accurate to 100<sup>th</sup> of a second.
- Large, eight digit display.
- Times up to 24 hours can be displayed.
- Four modes of operation: Standard, Sequential, Split and Rally.

by L. Harrold

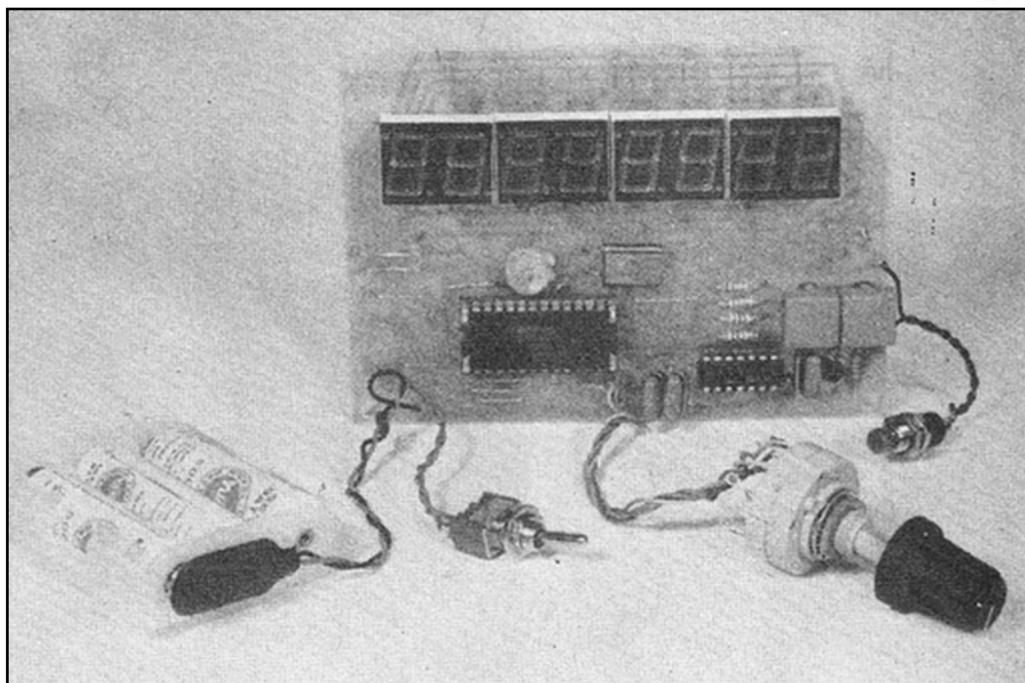
This electronic stopwatch is a comprehensive timer which is more robust than a mechanical stopwatch and can measure accurately to 100th of a second. It has a remote start/stop facility which enables it to be triggered by the interruption of a light beam or the sound of a starting pistol etc.

The stopwatch has a large LED display which can be turned off while the clock is running to save battery power. It has four modes of operation: Standard - each timed event starts from zero, Sequential - the time between each operation of the start/ stop switch is displayed (lap times etc.), Split - the timer counts continuously although timings can be displayed whilst this occurs, Rally - the same as Standard except that the clock is not reset to zero but continues from when it was stopped.

## Circuit

The circuit diagram of the stopwatch is shown in Figure 1. The main component is the Intersil ICM 7045 IC which contains an oscillator, high frequency divider, low frequency counter, latches, multiplexor, decoder and control circuitry. The oscillator frequency is set by the external crystal and trimmer capacitor to 6.5536 MHz. This is divided down to 100 Hz to drive the low frequency counter. The counter outputs are connected to the latches so that the display can be held and read while the counter is still running. The outputs from the latches are multiplexed to drive an eight digit common cathode display. The ICM 7045 also contains the seven segment decoder and the digit and segment drivers so that the display can be connected directly.

The 4093 and associated components provide de-bounce circuits for the push switches. When a push switch is operated it discharges the capacitor in less than one millisecond. The two Schmitt trigger gates



change state which takes the appropriate pin of IC1 low. The Schmitt triggers are inhibited until the capacitor has re-charged. The time constant of (R1+R2) and C1 is large compared to the bounce time of the switches.

The remote control input switches 5 volts which turns on the transistor and therefore has the same effect as the start/stop switch. The eight digit display can count up to 23 hours 59 minutes 59.99 seconds. After this the display carries on counting from zero.

The reset button sets the counter to zero, i.e. displays two zeros in the decimal part of the seconds. The seconds, minutes and hours part of the display are blank and remain so until that part of the display is not zero. The display switch turns the LED display on and off.

With the display on the current consumption is 70 to 130 mA, depending on how many digits are on. When the display is off the consumption drops to a

maximum of 2 mA. Therefore if nickel cadmium batteries are used, which have a capacity of 500mA hours, this should give a life of several hundred hours.

The start/stop switch controls the counter and the four position switch selects the mode of operation.

## Construction

The components are mounted on a single sided PCB and should be fitted as follows. The LED displays first: Note that on the side of the displays, that the 'M' of the code number is nearest to pin 1. IC holders should be used, especially for IC1, and these are fitted next. When the click switches are viewed from underneath, one side has a flat, and the PCB legend shows correct mounting orientation. The crystal and trimmer capacitor C5 are mounted next. The crystal should be folded over flat next to the PCB. Next the resistors can be fitted and the switches wired.

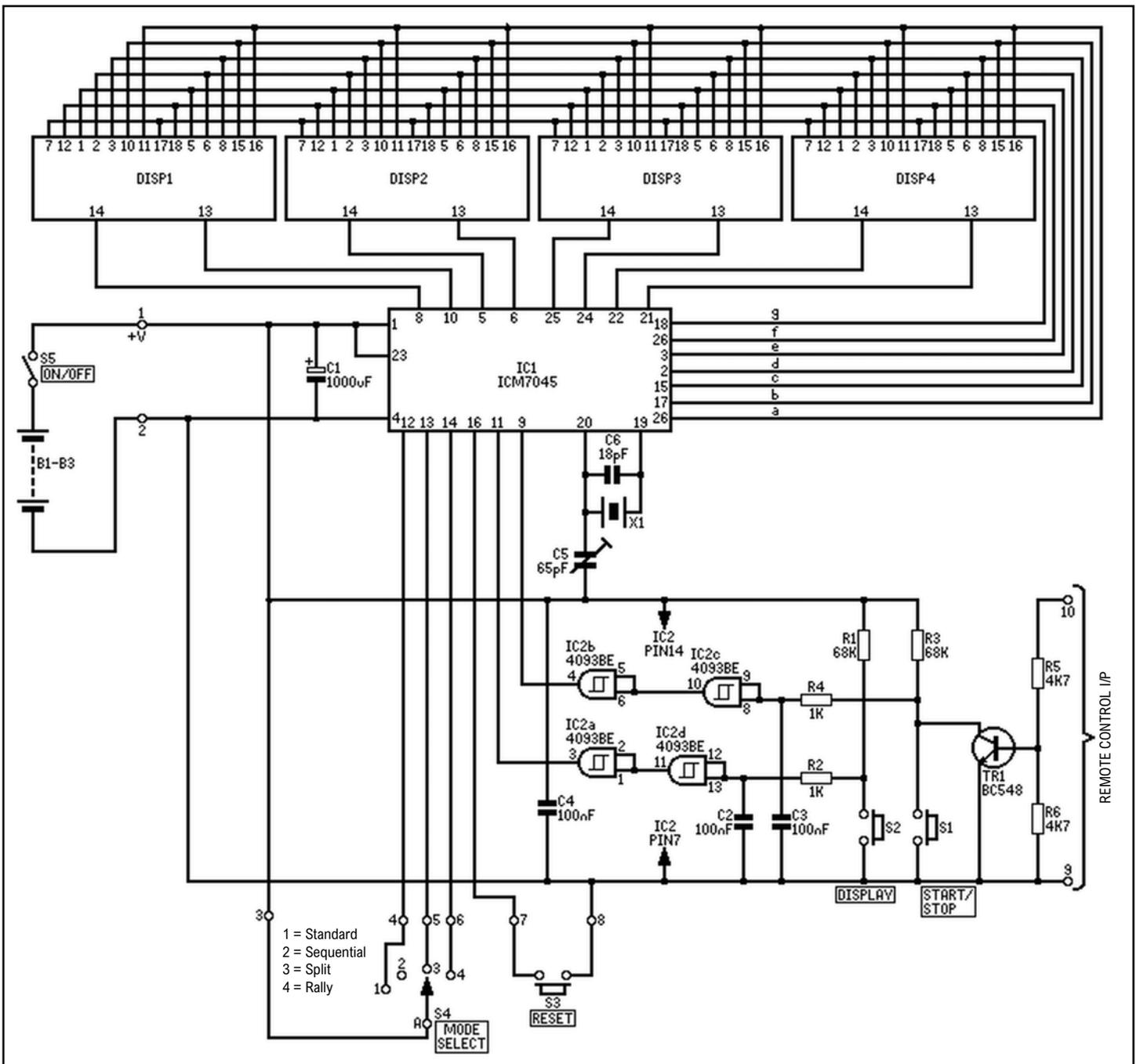


Figure 1. Circuit diagram of the Stopwatch.

Capacitors C2 to C4 and TR1 should be mounted and bent over at 45 degrees to give enough clearance for a front panel. Finally the wire links are wired and soldered, and C1 fitted underneath the PCB. The LED display is improved considerably when viewed through a red filter and it is recommended that one is used.

### Setting up

For accurate timing the crystal should run at 6.5536 MHz and is adjusted by C5. If a frequency counter is available, this is easily checked without loading the oscillator as follows. A 10K pull up resistor should temporarily be connected between pin 22 of IC1 and the positive supply. The display should be switched on and the counter reset. The frequency on pin 22 should be 800 Hz. To get the required accuracy, the frequency counter should be switched to period and the period for one cycle

measured as 1250.00 microseconds. Adjust the trimmer capacitor to give the right frequency. If a frequency counter is not available, then C5 should be set half way and the stopwatch checked over several hours, using the radio or speaking clock. C5 can then be adjusted accordingly; more capacitance to slow the stopwatch down.

### Operation

#### Standard Mode

1. Press the reset switch to zero the counter.
2. Start the counter by pressing the start/stop switch.
3. Stop the counter by again pressing the start/stop switch. The time is now displayed. When start/stop is pressed again the counter is momentarily reset then starts timing another event. In this mode the display can be turned off.

#### Sequential Mode

1. Reset the counter.
2. Start the counter.
3. Press start/stop to read the display. This time is held on the display but the counter continues running. When start/stop is next pressed the time since it was last pressed is displayed. This enables lap times to be taken. The display cannot be turned off in this mode, however, if standard mode is selected it can be, but remember to switch back to sequential mode before pressing the start/stop switch.

#### Split Mode

1. Reset the counter.
2. Start the counter.
3. Press start/stop to read the display. This time is held on the display but the counter continues running. Each time the start/stop is pressed the display

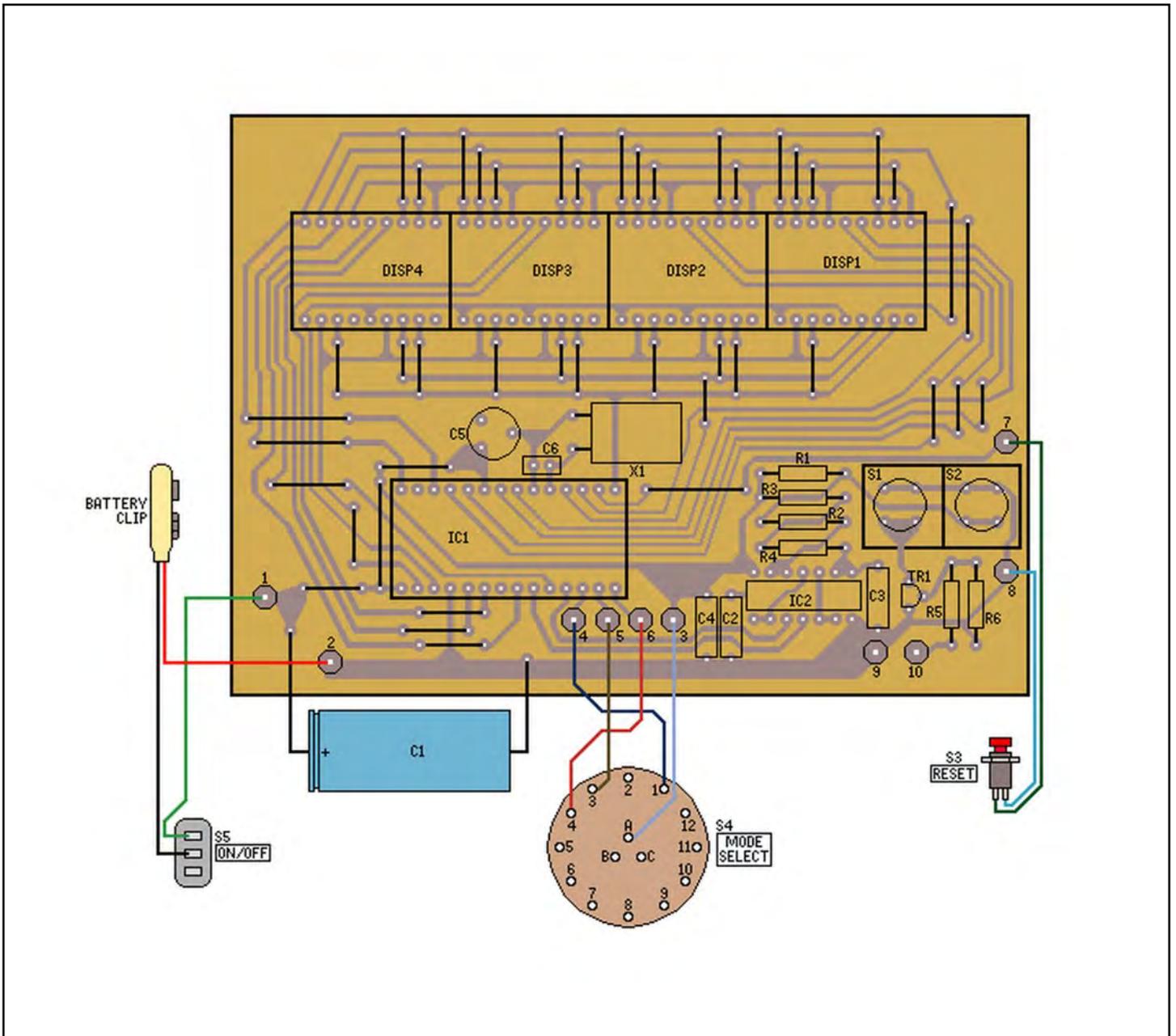


Figure 2. Component overlay and wiring diagram of the Stopwatch.

shows the total time since the start/stop was first pressed. The count can only be stopped by pressing reset. The display can only be blanked if the same procedure as described for the sequential mode is carried out.

#### Rally Mode

1. Reset the counter.
2. Start the counter. The reset switch is now automatically disabled thus

preventing accidental resets during long timing intervals.

3. Stop the counter.
4. Press start/stop again allowing the counter to continue. The display can be turned off in this mode.

#### STOPWATCH PARTS LIST

##### Resistors - All ½ watt 5% Metal Film

R1, R3	68K	Blue Grey Orange	2
R2, R4	1K	Brown Black Red	2
R5, R6	4K7	Yellow Violet Red	2

##### Capacitors

C1	1000µF 10V axial electrolytic	1
C2, C3, C4	100nF polyester	3
C5	Trimmer 65pF	1
C6	18pF ceramic	1

##### Semiconductors

TR1	BC548	1
IC1	ICM7045	1
IC2	4093BE	1
X1	Crystal 6.5536 MHz	1

##### Miscellaneous

DISP 1-4	DD display type C	4
S1, S2	Click switch	2
S3	Push switch	1
S4	3 pole 4 way rotary switch	1
S5	Sub-min toggle 'A'	1
B1, B2, B3	Ni Cad AA	3
	4V5 battery box	1
	PP3 battery clip	1
	Single-sided terminal pins	10
	Click cap blue	2
	Knob	1
	Knob cap blue	1
	DIL Socket 28 pin	1
	DIL Socket 14 pin	1
	Display filter red	1

# NEW BOOKS

**ZX81 Basic Book**  
by Robin Norman



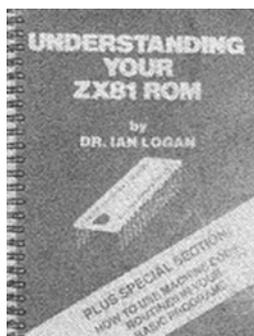
If you have a ZX81 or are thinking of buying one, this book will tell you all you need to know to get the best from it. The book covers the basic version, the expansion RAM and the ZX printer. There are 14 original programs for the ZX81 and a glossary of technical terms. The undemanding writing style makes this a perfect beginner's introduction.  
1982. 176 pages. 210 x 132 mm. Illustrated.  
**Order As WG74R (Book NB178)**  
**Price £5.95NV**

**Byteing Deeper Into Your ZX81**  
by Mark Harrison



If you are thinking of buying a ZX81 this book will tell you what a ZX81 will do and what it is like to use one. If you already own a ZX81 the book shows how to program it efficiently and includes 37 programs that will work on the standard (unexpanded) version. Packed with useful information.  
1981. 160 pages. 210 x 148 mm. Illustrated.  
**Order As WG83E (Book JW413)**  
**Price £5.95NV**

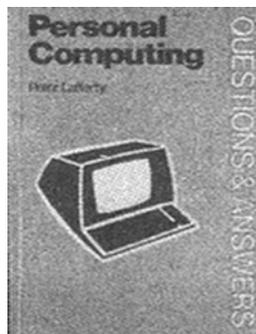
**Understanding Your ZX81 ROM**  
by Dr. Ian Logan



The book explains Z80 machine code language and discusses the workings of the 8K monitor program. The attraction of machine code programming is that it offers the programmer the possibility of producing programs that run at great speed and can be as complicated, for their size, as any

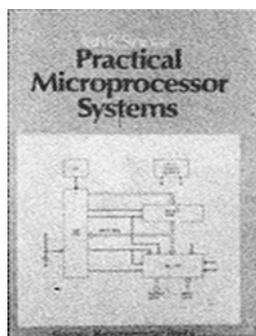
programs written for larger machines. 1981. 164 pages. 214 x 148 mm.  
**Order As WG75S (ZX81 ROM by Logan)**  
**Price £9.95NV**

**Questions & Answers On Personal Computing**  
by Peter Lafferty



The book discusses the cpu, peripheral devices, programming and also looks at several of the popular personal computers available at the moment. The book answers questions that puzzle the beginner and student from first principles to a useful level of practical knowledge.  
1981. 96 pages. 165 x 110 mm. Illustrated.  
**Order As WG76H (Book NB555)**  
**Price £2.75NV**

**Practical Microprocessor Systems**  
by Ian R. Sinclair



The book provides a description of how a microprocessor is connected to its supporting chips and how programs are written and developed for such units. The author deals with hardware, software and firmware through a rudimentary 'build-it-yourself' assessment unit which will help the reader grasp the practicalities involved in microprocessor system design.  
1981. 144 pages. 217 x 136 mm. Illustrated.  
**Order As WG78K (Book NB496)**  
**Price £5.95NV**

**Software Secrets**  
by Graham Beech



programs written for larger machines. 1981. 164 pages. 214 x 148 mm.

The book covers techniques of programming with particular emphasis on screen output, keyboard input and file handling. The book is intended primarily for Sharp MZ-80K users and about 30 programs and sub-routines are included. The techniques shown are seldom covered in programming books. An understanding of them will help you to produce computer games and other graphics software and show you how to store and process data on cassette or disk.  
1981. 144 pages. 210 x 147 mm. Illustrated.  
**Order As WG84F (Book JW415)**  
**Price £6.95NV**

**How To Tune The Secret Shortwave Spectrum**  
by H. L. Helms



Have you ever wondered what coded messages used by spies sound like? Or about an echo that comes back from nowhere, with a time-lag unexplainable with our present knowledge of propagation and transmitter power? If your curiosity is stirred by the subject of unusual signals then this is the book for you. It's a shortwave listener's bible.  
American book.  
1981. 182 pages. 210 x 130 mm. Illustrated.  
**Order As WG80B (Book FT1185)**  
**Price £5.75NV**

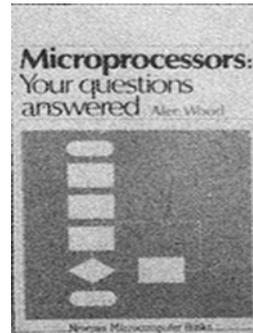
**Teaching Your Computer To Talk**  
by E. R. Teja



The book describes and explains the principles of speech synthesis and recognition and looks at some of the ready-made systems available. Interfacing to microprocessors is described and some sample programs are shown. American book.  
1981. 208 pages. 210 x 130 mm. Illustrated.  
**Order As WG81C (Book FT1330)**  
**Price £6.95NV**

**Microprocessors: Your Questions Answered**  
by Alec Wood

A plain language answer to most of the questions that baffle the newcomer to the subject, whether student or hobbyist. The book explains the microprocessor and binary arithmetic and how the microprocessor uses it to carry out arithmetical operations. The book then



describes the rest of the hardware and software needed to build up a complete microprocessor system.  
1982. 160 pages. 216 x 137 mm. Illustrated.  
**Order As WG79L (Book NB580)**  
**Price £5.95NV**

**Questions & Answers On Video**  
by Steve Money



What are VHS, Betamax, V2000 and LVR? How is a television picture displayed? What are SECAM and PAL? How does a video camera work? What are the basic types of video recorder? How is a picture contained in a video disc? These and many more questions are answered clearly and concisely.  
1981. 116 pages. 165 x 110 mm. Illustrated.  
**Order As WG77J (Book NB553)**  
**Price £2.85NV**

**Designing, Building & Testing Your Own Speaker System**  
by D. B. Weems



The book contains many detailed plans for speaker-box construction, from one, two or three-way systems. Simplified design charts are provided so that it is easy to design your own system. Full circuit details of many different types of crossover networks are given and much of the theory is also explained. American book.  
1981. 192 pages. 210 x 130 mm. Illustrated.  
**Order As WG82D (Book FT1364)**  
**Price £6.45NV**

# STARTING POINT

by Robert Penfold

Introducing the fundamentals of electronics for the constructor.

## Amplifying Modes

We have looked at the basic characteristics and configurations of the three amplifying modes possible using a transistor, and we will now consider each mode of operation in greater detail.

### Common Emitter

The output impedance of a common emitter amplifier is easily determined and is simply equal to the value of the collector load resistor. The required base bias resistor value can be calculated by taking the collector load value and multiplying it by the typical current gain of the transistor in use (which can be found by referring to the data sheet for the device concerned). This assumes that there is an equal voltage across the collector and base bias resistors, but this is not quite the case with the quiescent output voltage at half the supply voltage, due to the 0.6 volts or so developed across the base-emitter junction of the transistor. This voltage reduces the voltage across the base bias resistor by about 0.6 volts, with a consequent reduction in the base bias current and the collector voltage being a little higher than the ideal voltage.

In practice this can be overcome by using a value slightly lower than the calculated one. For example, if the calculated figure was 1.7 megohms, in practice a 1.5 megohm component should give good results. If a low supply voltage is employed, such as a 3 volt supply for example, the base-emitter voltage becomes a substantial fraction of required collector voltage of 1.5 volts, and this simple method of calculation becomes decidedly inaccurate.

A more accurate method is to take the required quiescent collector current and then divide this by the typical current gain of the transistor to obtain the necessary base current. Taking 0.6 volts from half the supply voltage gives the potential across the bias resistor, and dividing this by the base current gives the bias resistor

value in ohms. This is, of course, just a simple application of Kirchhoffs Voltage Law and Ohm's Law.

A problem when calculating bias resistor values is that the calculations are based on the typical current gain figure for a transistor, whereas in a practical circuit the transistor used could actually have a gain which is considerably higher or lower than the typical figure. The tolerance of the base bias and collector load resistors could also result in errors in the bias levels.

These errors are corrected to a certain extent by negative feedback. If the gain of the transistor is higher than the typical figure and (or) the bias resistor has a lower value than its nominal one, the collector voltage will be lower than expected. This reduces the voltage across the base bias resistor and produces a lower base current which tends to increase the collector voltage. Similarly, if the transistor has a current gain which is lower than the typical figure and (or) the bias resistor is slightly high in value, this gives a higher collector voltage than expected. This gives increased voltage across the bias resistor, increased base current, and reduced collector voltage.

This negative feedback will not fully compensate for errors in gain or bias resistor values, but it is normally sufficient to keep the effect of these errors down to a level which renders them of no practical significance. It is in order to obtain the negative feedback that the bias resistor is connected between the collector and base of the transistor, rather than the more obvious method of connecting it between the base and the appropriate supply rail, which would not give any regulating feedback.

The input impedance of a common emitter stage is controlled mainly by the collector current and current gain of the transistor. High gain gives high input impedance, but high collector current gives low input impedance. Approximate input impedance is given by the equation:

$$\frac{25}{\text{collector current in mA}} h_{FE}$$

The voltage gain of a common emitter stage is roughly equal to:

$$\frac{\text{Load Resistance}}{25 \div \text{collector current in mA}}$$

However, voltage gain varies somewhat with changes in supply voltage (higher supply voltages giving higher gains) and this does only give an approximate figure for voltage gain.

### Emitter Resistor

The input impedance of a common emitter amplifier can be increased by the inclusion of an emitter resistor, as shown in Figure 1, but the negative feedback that this introduces also reduces the voltage gain of the circuit. There is no obvious feedback path introduced by the emitter resistor, but it does in fact introduce negative feedback. If the input signal takes the base of TR1 more positive, this gives an increase in the collector and emitter currents, and the voltage across R3 increases. This counteracts the increase in base voltage of TR1 to a certain extent and reduces the voltage gain of the circuit. Similarly, a reduction in the base voltage of TR1 gives reduced voltage across R3 and a partial cancelling of the change in input potential. Again, this gives a reduction in the voltage gain of the circuit.

The collector and emitter currents of a transistor are practically the same, and the only difference between the two is that the emitter current is actually equal to the sum of the collector current and the small base current, and is therefore marginally higher than the collector current. When discussing the emitter follower mode the voltage gain of approximately unity from the base to the emitter of the transistor was explained, and the same occurs in this configuration. If R2 and R3 have the same value, any change in voltage across R3 will be matched by a practically identical voltage change across R2, and the circuit has roughly unity voltage gain from the base to the collector as well as from the base to the emitter. If R2 is made higher in value than R3, the voltage change across R2 will be

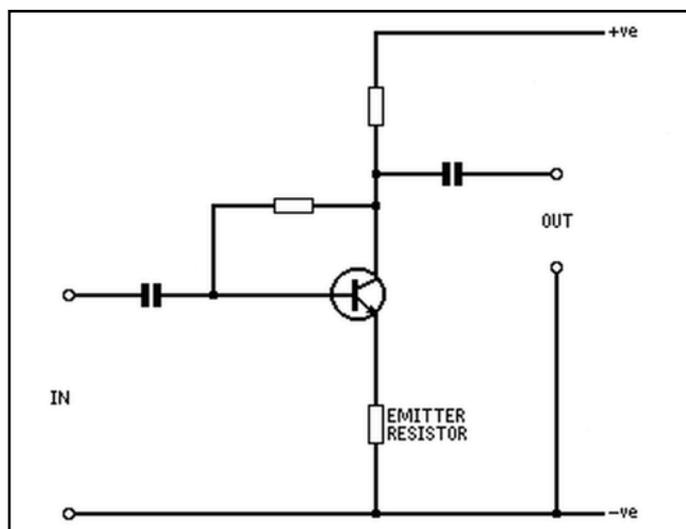


Figure 1. Adding an emitter resistor introduces negative feedback.

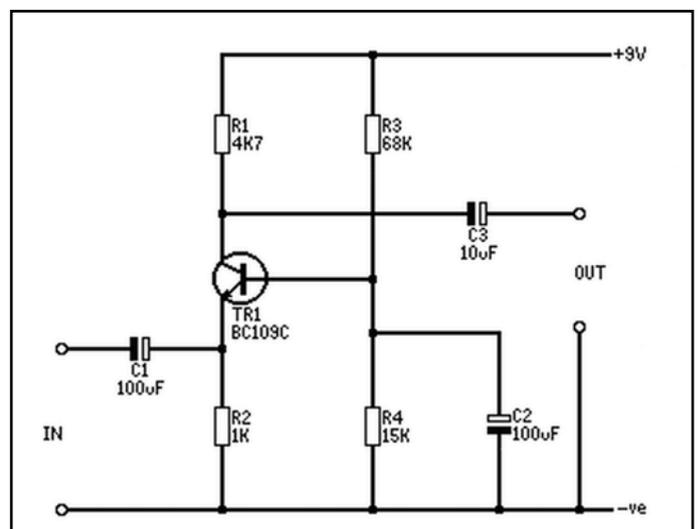


Figure 2. The circuit of a practical common emitter stage.

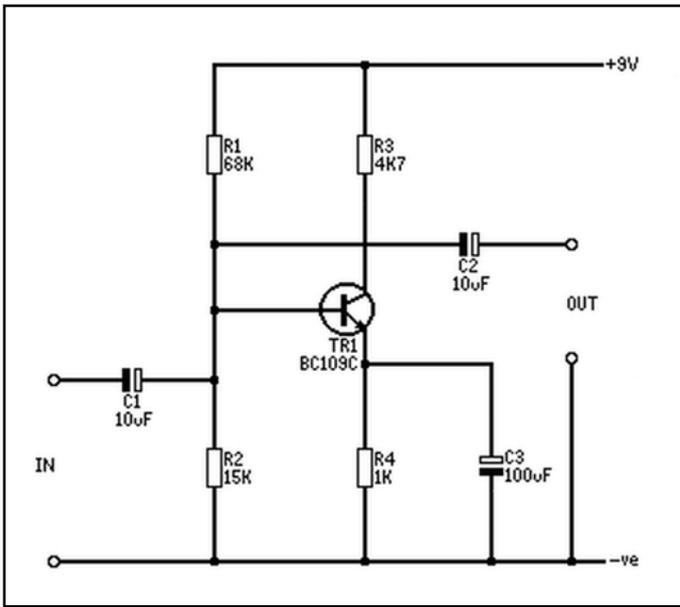


Figure 3. A common emitter stage using potential divider biasing.

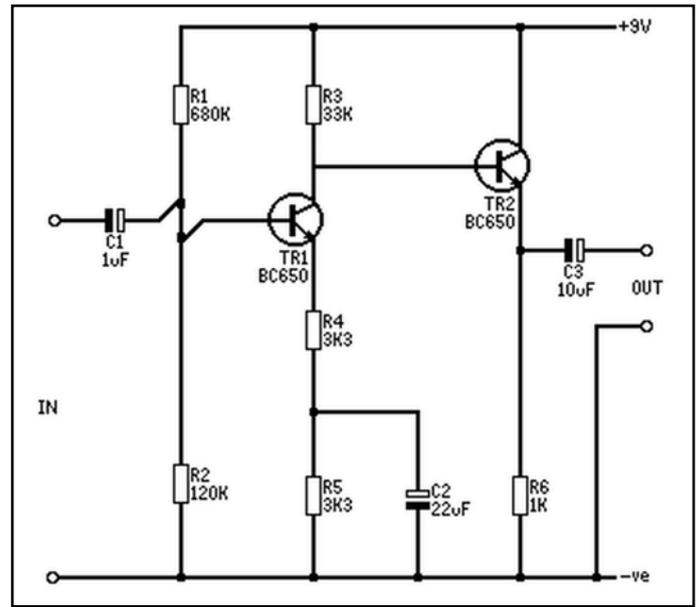


Figure 4. A simple two stage direct coupled preamplifier circuit.

proportionally higher than that across R3. On the face of it this gives the circuit a voltage gain of R2/R3, but this is not the case if R3 is made very low in value when compared to R2.

The reason for this is the innate emitter resistance of TR1 which must be added to any external emitter resistance. This resistance varies with collector current, and is approximately equal to 25 divided by the collector current in milliamps. In the voltage gain equation given earlier the innate emitter resistance was calculated using this method and then divided into the collector load resistance in order to give the voltage gain figure. With an external emitter resistance present, the sum of this resistance and the innate emitter resistance must be divided into the collector load resistance in order to obtain the voltage gain of the circuit.

#### Input Impedance

In the input impedance equation given earlier the innate emitter resistance of the transistor is first calculated, and is then multiplied by the current gain of the transistor in order to give the input impedance. If an external emitter resistor is present, the sum of this resistance and the innate emitter resistance of the transistor must be multiplied by the current gain of the transistor in order to give the input impedance. This gives the input impedance to the base of the transistor and does not take into account the effect of any components at the input such as biasing and coupling components.

#### Emitter Follower Mode

The input impedance of an emitter follower stage is calculated in the same way as the input impedance of a common emitter amplifier having an emitter resistor. As the internal emitter resistance of the transistor is often far lower than the emitter load resistor's value, simply multiplying the load resistance by the current gain of the transistor usually gives a reasonably accurate figure for input impedance. An important point to note, however, is that the input impedance of any circuit following the amplifier is effectively in parallel with the emitter resistor, and the combined impedance of the emitter resistor and the input impedance of the driven circuit must be used when calculating the input impedance of the stage.

The emitter follower mode gives an output impedance which is approximately equal to the source impedance of the input signal divided by

the current gain of the transistor. In practice this often gives a very low output impedance, and the output signal reduces little in amplitude even if it is feeding a quite low impedance load. However, it is important to bear in mind that an AC emitter follower can only give a peak output current equal to the quiescent current of the transistor. Thus, if it is feeding into a load impedance which is much lower than the emitter load resistor value, but much higher than the output impedance of the stage, the maximum peak-to-peak output voltage available will be far less than the supply voltage.

The two bias resistors for an emitter follower stage ideally have values which bias the base to about 0.6 volts more than half the supply voltage, but the shunting effect of the input resistance of the stage must not be overlooked, and this is effectively connected in parallel with the lower bias resistor and reduces its value. For good predictability of the bias voltage it is preferable to have bias resistors which are low in value when compared to the input resistance of the amplifier, since resistor tolerances are usually much smaller than those of transistor gain figures (where tolerances of around  $\pm 100\%$  are not unknown!).

Unfortunately, the input signal drives a current through the bias resistors as well as into the base of the transistor, and the input impedance of the amplifier is equal to the parallel impedance of the two bias resistors and the input impedance of the transistor. In many cases a high input impedance is needed, and the severe shunting effect of low value bias resistors is undesirable. This may necessitate a compromise and the use of bias resistors of comparatively high values, or as we shall see in a subsequent 'Starting Point' there are alternative forms of buffer amplifier that can be used. Of course, in any circuit where highly accurate biasing is needed a preset resistor can be used in the bias circuit so that the output bias voltage can be set at precisely the required level.

#### Common Base Stage

We will not consider this type of amplifier in great detail since it is rarely encountered in practice. Figure 2 shows the method of biasing often employed with common base stages, and gives practical circuit values which help to show the mathematics of this type of biasing. This type of biasing can also be used for common emitter amplifiers, as shown in Figure 3.

Taking Figure 2 first, R3 and R4 bias the base of TR1 to a little over 1.5 volts, and the shunting

effect of the input resistance of TR1 does not significantly reduce this as the input resistance is high in relation to the value of R3. There is a voltage drop of about 0.6 volts or so from the base of TR1 to its emitter, and this gives a little under 1 volt across R2. The potential across R1 will be about 4.7 times this voltage as it is 4.7 times higher in value and passes a similar current to R2. This gives approximately the required potential of 4.5 volts across R1.

C1 is the input coupling capacitor and needs to have a quite high value as it is feeding into a low input impedance. C2 also needs to have a fairly high value as it must provide a low impedance path to earth for the base of TR1. C3 is the output coupling capacitor, and although the value shown here is a typical one, the value would be chosen to suit the input impedance of the subsequent stage in practice.

The voltage gain of a circuit of this type is comparable to that of a common emitter stage having the same collector load value, bias current, and using the same transistor type. The output impedance is equal to the collector load resistor's value.

The biasing of the common emitter amplifier of Figure 3 operates in exactly the same way as the biasing of the common base stage of Figure 2. The point of this type of biasing is that the current gain of the transistor has very little effect on the bias voltages, and this enables predictable results to be obtained. In Figure 3 emitter resistor R4 has been bypassed by C3, the latter providing a low impedance path from TR1's emitter to earth so that no significant negative feedback is applied over the amplifier. Negative feedback can be applied to this type of circuit by omitting the bypass capacitor, or by having two emitter resistors in series and only bypassing one of them if the full amount of negative feedback is not required.

Sometimes it is possible for one stage of an amplifier to be biased from the output of this is shown in Figure 4. Here an emitter follower output stage is driven direct from the output of a common emitter stage. The quiescent potential of about 4.5 volts at the collector of TR1 is obviously a suitable bias voltage for TR2. This simple preamplifier has an input impedance of about 100k, a voltage gain of approximately ten, and the output impedance is only about 40 ohms.

# SPECIAL OFFERS



## SET OF FOUR PROJECTS BOOKS

Here are the first four titles in MacMillan's "Electronic Projects" series offered at a saving of 50% on our current list price if you buy all four books together. You save nearly 70% on cover prices! Just look at what you get in this amazing package.

### Electronic Projects No. 1: Cost Effective Projects Around The Home

by John Watson

The book contains 26 useful and well-designed projects and full construction and testing details are given along with layout drawings, mechanical details and photographs. The main feature is an excellent model radio control system that has 7 fully proportional, simultaneous channels. We can supply PCB's for this project and some of the other projects in this book. A complete list is shown on our current catalogue. Other projects include an automatic porch light, a circuit to automatically turn off the bedroom TV set when you turn out the bedside lamp, a feedback-type drill speed controller, a sound improver and stereo simulator, an infra-red burglar alarm, a ray gun, a temperature alarm for boiler or freezer, a tape-slide synchroniser and many more useful circuits and information.

### Electronic Projects No. 2: Projects For The Car And Garage

by Graham Bishop

This book contains more than 30 projects and circuits for the car owner. Construction details and circuit layouts are provided, together with hints on installation. The projects are divided into five groups. Ignition circuits, beginning with a description of a conventional system and its problems, then continuing with a description of a complete electronic ignition system. A timing light and dwell meter are described, there are some hints on ignition

suppression and an ignition booster is shown. Section two encompasses car immobilising and alarm circuits and section three describes ten lighting projects such as interior light extender, lights-on reminder, emergency flasher etc. Section four includes an audio booster, an aerial amplifier, rev counter, wiper delay and several more. Finally section five describes a battery charger, ice warning device, car ice alarm, gauge alarm circuits, parking meter reminder and an accelerometer. Again we can supply PCB's for some of the projects in this book. See catalogue page.

### Electronic Projects No. 3: Audio Circuits And Projects

by Graham Bishop

This book whose cover price on its own is more than we are asking for the whole set contains a wealth of useful audio circuits and projects. Details are given of over 20 preamplifiers to suit almost any application. There are over a dozen power amplifiers ranging from 1W up to 100W and loudspeaker crossover networks are shown including an active one. Circuits are shown and described for noise and rhythm circuits such as a modulator, envelope shaper, rhythm generator and drum voices, a phasing unit, a peak detector and others. There are circuits of a sound-to-light unit, a colour organ, a stylophone, an electronic composer, an electronic organ generator, an astro-laugh, a siren and a fuzz box. We can supply PCB's for some of the projects in this book. See catalogue page.

### Electronic Projects No. 4: Test Gear Projects

by Terry Dixon

This final book in the series describes more than 30 useful items of test gear. There are power supplies including one showing you how to generate 200 volts from a PP3 battery. There is a signal generator, logic probe, audio signal generator, crystal reference oscillator, waveform generator and white noise generator. Test meter projects include a dc multimeter, a high input impedance voltmeter, and an RF probe. Other circuits described include a simple capacitance bridge, an electrolytic capacitor tester, a transistor tester, an oscilloscope calibrator and a dual trace adaptor, a soldering-iron saver, a buffer amplifier, a bench test amplifier, a timer circuit and many more.

All the books are written in a very readable style and are packed with useful information in addition to all the circuits. So here's a chance to add a really interesting set of books to your bookshelf at an amazingly low price.

**Yes, we'll send you the complete set of four books for only £4.70 including postage and packing.**

**Don't delay, order your set now!**

**Order As SP86T (Set of 4 Project Books) Price £4.70 NV  
OFFER CLOSES MAY 29<sup>th</sup> 1982**

## ELECTRONICS FOR ALL KIT

Now's the time to pick up this fantastic bargain. Our enormously popular 'Electronics For All' kit is available to you at a huge discount. We'd like to clear up our remaining stocks prior to making some more for next Christmas. So hurry - this offer is strictly while stocks last.

With this kit, you and your children can get started in this fascinating hobby. You will build projects using the latest micro-chips and you will learn to use the actual components (it's not all in little plastic boxes like most other kits). But you can still use the components over and over again. It is completely safe for children as there is no soldering and there are no dangerous voltages.

Even if you've never touched a transistor before, the superb book contained in the kit will show you exactly how to build the projects. You will build a two-waveband radio, a two-octave organ and lots more interesting projects. Even a nine year old, following the simple instructions, should be able to get every project working first time. The kit is superbly packaged in a full colour box.

**Order now and save £10 off our previous price!  
Order As SP88V (Electronics For All) Price £19.95  
OFFER CLOSES MAY 29<sup>th</sup> 1982**



# DIGITAL MULTIMETER

An introductory offer on our new digital multimeter. To be included in our range of multimeters, this one will sell for £39.95, but we are offering it for three months for £5 off - just £34.95. You've probably seen digital multimeters with the same styling and specification for nearly twice this price from some suppliers. Well, we've slashed that price and given you an extra £5 discount into the bargain.

The meter is attractively styled in a two-tone brown plastic case with a tilt stand and front panel printed in five colours for easy function identification. The easy-to-use push-button range selectors permit one hand operation. Now just look at this incredible specification.

## Specification:

### General

Display: 3½ digit LCD with auto-zero and auto-polarity.  
Operating temperature: 0°C to 50°C  
Storage temperature: -35°C to 65°C, battery removed  
Low battery indicator: "LO BAT" appears on display during last 20% of battery life  
Weight including battery: 400 grams  
Size: 170 x 89 x 38 mm  
Calibration adjustment: 3 readings per second.  
Accuracies are + (% of reading + no. of digits).

### DC Voltage

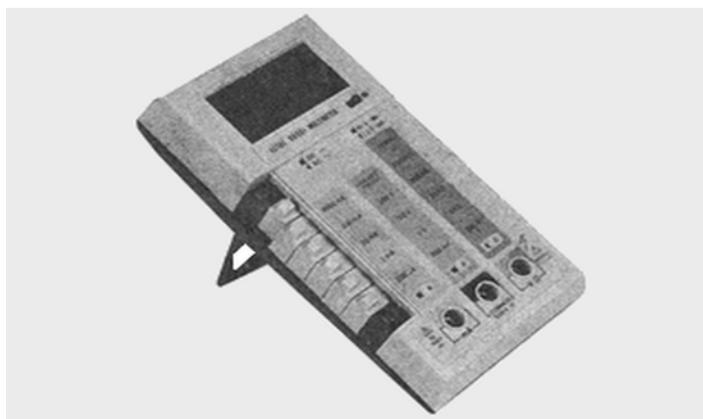
Ranges: 200mV, 2V, 20V, 200V, 1000V  
Resolution: 100µV on 200mV range  
Accuracy: 0.5% + 1 digit  
Input impedance: 10 Megohms  
Normal mode rejection >60dB at 50Hz  
Common mode rejection:>100dB at DC and 50Hz  
Response time: <1 second  
Overload protection: 63mA fuse

### DC Current

Ranges: 200µA, 2mA, 20mA, 200mA, 2A  
Resolution: 100nA on 200µA range  
Accuracy: 1% + 1 digit on 200µA, 2mA and 20mA ranges, 2% + 2 digits on 200mA and 2A ranges  
Burden voltage: 200mV max at full scale except 700mV on 2A range full scale  
Response time: <1 second  
Overload protection: A pair of fast switching, high current silicon diodes and a 2A fuse

### AC Voltage

Ranges: 200mV, 2V, 20V, 200V, 750V  
Resolution: 100µV on 200mV range  
Accuracy: 45Hz to 400Hz 1% + 5 digits  
Conversion type: Average sensing, calibrated to read RMS of sine wave



Input impedance: 10 Megohms <100pF  
Overload protection: 63mA fuse

### AC Current

Ranges: 200µA, 2mA, 20mA, 200mA, 2A  
Resolution: 100nA on 200µA range  
Accuracy: 45Hz to 400Hz  
3% + 5 digits on 200µA range  
2% + 5 digits on 2mA range  
3% + 2 digits on other ranges  
Burden voltage: 250mV max at full scale, 700mV on 2A range full scale  
Response time: <2 seconds  
Overload protection: A pair of fast switching, high current silicon diodes and a 2A fuse

### Resistance

Ranges: 200R, 2K, 20K, 200K, 2M, 20M  
Resolution: 0.1 ohms on 200 ohms range  
Accuracy: 0.5% + 1 digit on 2000 range, 0.5% + 2 digits on 2K to 2M ranges, 2% + 1 digit on 20M range  
Open circuit voltage: Selectable - high<2.8V, low<0.54V  
Overload protection: 63mA fuse

In addition to the various overload protection devices described above, the meter has transient protection on all voltage and resistance ranges up to 6 kilovolts. Also the input to the AC converter is protected against over voltage. The meter requires a standard PP3 battery (not supplied), but there is a socket for connecting a 9V adaptor for mains operation and this input is protected against over voltage and reverse polarity. The meter is supplied with a pair of test probes and a circuit diagram. In fact we think you'll agree that it's a bargain not to be missed. So order now!

**Order As SP87U (Multimeter DD601) Price £34.95**  
**OFFER CLOSES MAY 29<sup>th</sup> 1982**

# SOLAR CELLS

Never has there been more interest in solar power than now. The hazards of nuclear power and the pollution caused by burning hydrocarbon fuels as well as the fact that they may run out in the near future have made the search for clean, safe power sources all the more urgent. The solar cell was first made in quantity to supply power for satellites, but it was soon realised that they could be used as an endless power source on earth. Now you can investigate the possibilities with our new range of solar cell panels.

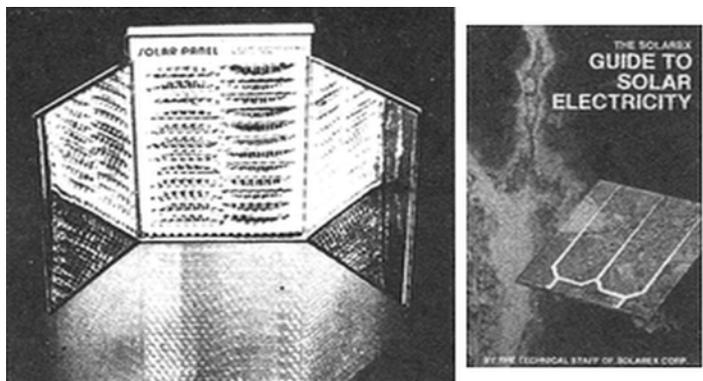
Each solar panel contains crescent shaped silicon solar cells connected so as to supply 6V, 9V or 12V at 50mA when the incident light is about 100mW/sq cm. The cells are mounted in an attractive and sturdy black plastic case. The plastic faceplate comprises hundreds of bubble magnifiers which maximise cell performance as they enhance the light striking the solar cells. Two reflector panels fit on either side of the case and increase cell efficiency even more.

Three solar panels are available 6V, 9V and 12V DC all at 50mA

**Order As RK22Y (Solar Panel 6V) Price £7.95**  
**RK23A (Solar Panel 9V) Price £9.95**  
**RK24B (Solar Panel 12V) Price £8.45**

## Guide To Solar Electricity

This excellent book by the manufacturers of the solar panels described above discusses the solar cell in detail, yet is easy to read and understand.



The book briefly discusses sunlight, then describes the photovoltaic effect, practical solar electric generators, how to use solar cells and applications of solar cells. It is interesting to note from this fascinating book that the solar energy reaching less than one percent of the Sahara desert is more than all the electrical energy used in the world today!

**Order As WG85G (Guide To Solar Elect) Price £4.95NV**

# BASICALLY BASIC

Graham Hall, B. Sc.

## BASIC Functions

One of the features of the BASIC language which makes it suitable for such a wide range of applications, is the set of pre-written instructions that can perform commonly used operations. These instructions are called 'Functions'. The functions to be described are the more common ones available on most personal computer systems. The list is not exhaustive, and the way in which they are used in the particular version of BASIC used by your machine may be slightly different from the description here. You should check the users reference manual, for your computer for the complete description of functions available in your machines version of BASIC.

There are three types of functions: math, print and string. Math functions perform mathematical operations, print functions cause operations on terminal output and string functions perform operations on quoted strings or string variables. String functions will be described later in this series.

## Math Functions

There are two types of math function - arithmetic and trigonometric. Table 1 lists and summarises the common math functions which are fully described below.

## ABS Function

To use the ABS (Absolute value) function the function keyword is followed by an argument enclosed in parenthesis, on a statement line. The result returned is the magnitude, regardless of sign, of the argument. For example the absolute value of both +15 and -15 is 15. The following program demonstrates this:

```
10 PRINT ABS(15), ABS(-15), ABS(0-10)
20 END RUN
15 15 10
```

The argument of the function can be any valid BASIC expression, variable or constant. The ABS function is useful for scientific applications where the magnitude of a number is required and not its sign.

## EXP Function

The EXP (Exponential) function computes the value of the mathematical constant 'e' raised to the power of the numeric argument specified to the function within parentheses. The constant 'e' is the base of natural logarithms (to six significant digits,  $e = 2.71828$ ). For example, to raise e to the power of two the EXP function can be written in a program as: 10 PRINT EXP(2). The inverse of the EXP function is the LOG function, which computes the logarithm to the base e of an argument (this is known as the 'natural logarithm'). This relationship can be demonstrated by combining the EXP and LOG functions:

```
10 PRINT "EXP (2) = " : EXP(2)
20 PRINT "LOG(2) = " ; LOG(2)
30 PRINT "LOG (EXP(2)) = " ; LOG (EXP(2))
40 PRINT "EXP (LOG(2)) = " ; EXP (LOG(2))
50 END RUN
```

EXP(2) = 7.38906 LOG(2) = 0.69315 LOG(EXP(2)) = 2 EXP(LOG(2)) = 2

Lines 30 and 40 of the above function program are the inverse of each other. They illustrate how the argument to a function can be another function. The EXP function is useful for scientific applications.

## INT Function

The argument to the INT (Integer) function can be any valid constant, variable, function or expression. The value returned is the largest integer less than or equal to the argument, i.e. the integer part of the argument is separated from the fractional part. For example:

INT (3.142) = 3, INT (0.69) = 0 and INT (-4.15) = -5

Note the value returned for a negative argument is a greater negative integer.

## LOG Function

The LOG (Logarithm) function computes the natural logarithm (logarithm to the base e) of its argument. The argument can be any positive

constant, variable, function or expression which evaluates to a positive number. An error message will be printed if the argument is equal to or less than zero.

Some versions of BASIC also have a logarithm function which determines logarithms to the base ten (common logarithm). However, if your version of BASIC does not include this facility it is possible to convert the arguments natural logarithm to another base by dividing the natural logarithm of the argument by the natural logarithm of the new base. For example to find the logarithm of five to the base ten (common logarithm):

```
10 PRINT "LOGARITHM TO BASE 10 of 5 = " ; LOG(5)/LOG(10)
```

```
20 END RUN
```

LOGARITHM TO BASE 10 of 5 = 0.69897

## RND Function

The RND (Random) function generates a random number between zero and one (but not including zero or one). The argument of the RND function can be any positive integer, zero or negative integer. The way the argument determines the operation of the RND function differs for different versions of BASIC. Usually, any positive integer within parentheses gives a new random number each time the RND function is used in a program. With zero or a negative integer specified, the same random numbers are generated. This is useful for debugging a program because if the numbers generated by the RND function is varied for each execution, program errors would be difficult to find. Some versions of BASIC do not require the RND function to be specified with an argument. In this case a RANDOMISE statement is included in a program before the RND statement, if different random numbers are required for each program execution. The random numbers generated by the RND function can be modified by expressions involving other BASIC functions and operators. For example, to generate a random integer between one and one hundred:

```
10 PRINT INT(100 * RND(I)) + 1
```

The argument of the INT function is '100 \* RND(I)' which is an expression consisting of a constant, 100, multiplying a random number generated by the RND function. The result of this combination of functions is a random integer between zero and ninety-nine. The range, is adjusted from one to a hundred by adding the constant one to each number generated.

The RND function is especially useful for games programs and simulations.

## SGN Function

The SGN (Sign) function returns a result which depends on the sign of the argument. The argument can be any valid constant, variable or expression. If the argument evaluates to a positive value the SGN function returns a 1; a zero would be returned if the argument evaluates to zero; otherwise a -1 is returned when the argument evaluates to a negative value. An example of this is:

```
10 ON SGN (x) + 2 GOTO 200,300,400
```

Here the constant two is added to the result returned by the SGN function. The result is now a positive integer (1,2 or 3) which is used as an argument to the ON GOTO statement to make a branch.

If X is negative, the result of SGN (X) +2 is 1, which directs program control to line 200. If X is 0, the result of SGN (X) +2 is 2, which directs program control to line 300. A branch is made to line 400 when X is positive because then the result of SGN (X) +2 is 3.

## SQR Function

The SQR (Square Root) function determines the square root of its argument. The argument can be a positive constant, variable or expression. An error message will be returned if the argument specified is negative. However, some versions of BASIC convert a negative argument to its absolute value and return the square root of the converted value. For example, PRINT SQR(4) will output a 2 to the terminal. The command PRINT SQR(-4) will cause an error message to be output unless the absolute value of the argument is taken by the SQR function.

## Trigonometric Functions

### ATN Function

The ATN (Arctangent) function is a trigonometric function that accepts a numeric argument. The ATN function computes and returns the principal value of the arctangent of the argument in radians (or angular measure). This will be within the range:  $-\pi/2 < \text{ATN}(x) < \pi/2$

The relationship between the radian and degree is:

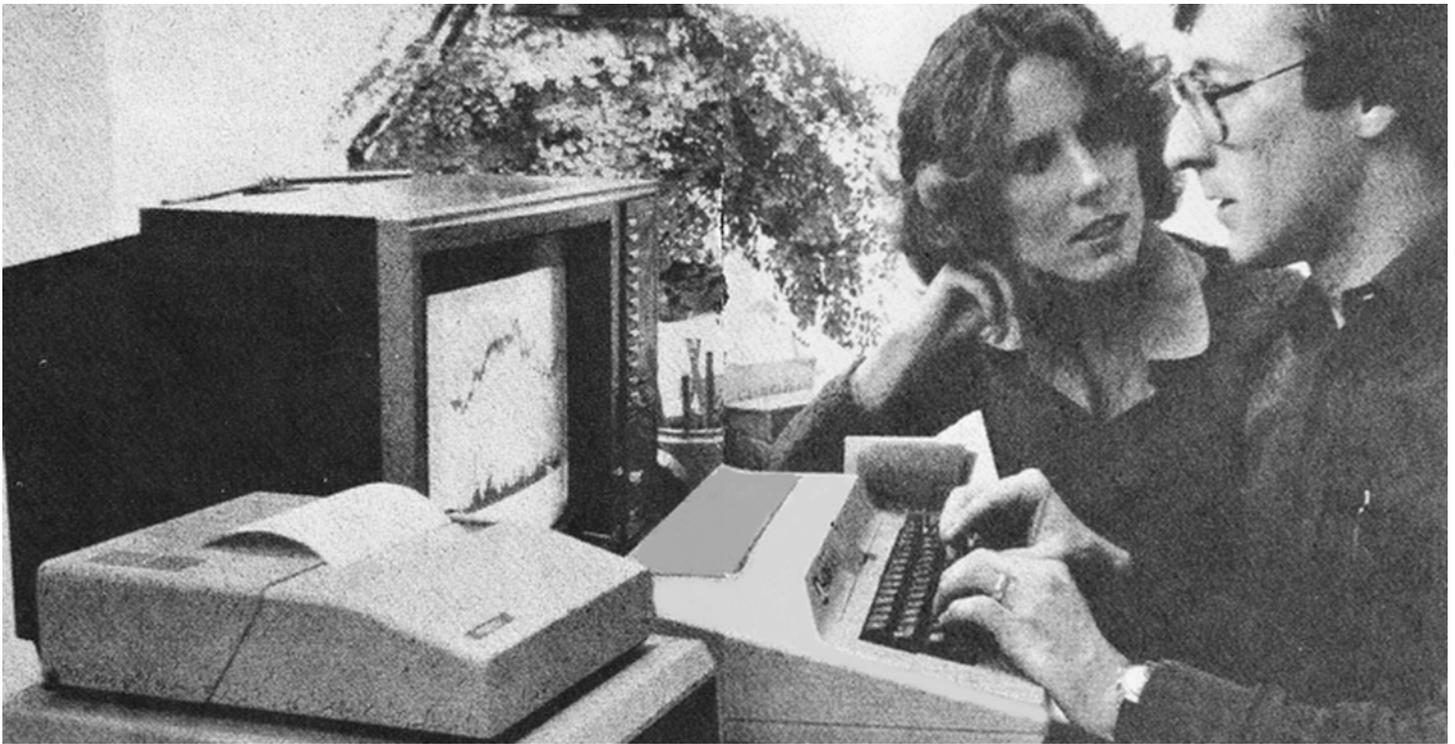
1 degree =  $\pi / 180$  radians, where  $\pi$  represents the circular constant 3.1415927.

To convert the result of the ATN function from radian measure to degrees the value returned is multiplied by  $180 / \pi$  (i.e. 57.2957795). For example, the command PRINT ATN (10)

prints the arctangent of 10 in radians. The command

```
PRINT ATN (10) * 57.2957795
```

will print on the terminal the arctangent of 10 in degrees.



**ABS(X)** Returns the absolute value of X.  
**ATN(X)** Returns the arctangent of the value X in radian measure.  
**COS(X)** Returns the cosine of the radian value X.  
**EXP(X)** Returns the constant V (2.72828) raised to the power of X.  
**INT(X)** Returns the largest integer value of X.  
**LOG(X)** Returns the natural logarithm of the value X.  
**RND(X)** Returns pseudo random numbers.  
**SGN(X)** Returns an indication of the sign of X.  
**SIN(X)** Returns the sine of the radian value X.  
**SQR(X)** Returns the square root of X.  
**TAB(X)** Positions output to the terminal beginning at column X on the output line.  
**TAN(X)** Returns the tangent of the radian value X.

**Table 1. Common Math and Print Functions.**

The ATN Function is the inverse of the TAN (Tangent) function. This is shown by the following short program:

```

10 PRINT "ATN(10) = "; ATN(10)
20 PRINT "TAN(ATN(10)) = "; TAN(ATN(10))
30 END
  
```

The expression TAN(ATN(10)) will evaluate to 10 because of the inverse relationship between the ATN and TAN functions.

#### **COS Function**

The COS (Cosine) function requires an angular argument in radian measure and returns the cosine of the angle. To convert an angle from degrees to radian measure so that it can be used as an argument to the COS function, the angle in degrees is multiplied by the ratio  $\pi / 180$  (i.e. 0.0174533).

For example, the command PRINT COS (45 \* 0.0174533) will print the cosine of the 45 degree angle.

#### **SIN Function**

The SIN (Sine) function requires an angular argument in radian measure and returns the sine of the angle. The same method as described above can be used to convert an angle from degrees to radians. For example, the command PRINT SIN(45\* 0.0174533) will print the sine of the 45 degree angle.

#### **TAN Function**

The TAN (Tangent) function requires an angular argument in radian measure and returns the tangent of the angle. This is the inverse of the arctangent (ATN) function previously described. For example, to print the tangent of a 30 degree angle the command PRINT TAN (30 \* 0.0174533) can be used.

#### **Print Functions**

##### **TAB Function**

The TAB (Tabular) function is used to position output on the terminal. The argument that the TAB function is numeric and moves the start of

printing to the specified column. For example, the command PRINT TAB (20); "MESSAGE" outputs the string MESSAGE beginning at the twenty-first column. On most personal computer systems an output line is divided into 72 columns numbered from 0.

#### **User Defined Functions**

BASIC allows the programmer to name and formulate a function using the DEF (Define) statement. The DEF statement has the following format:

```
line number DEF FN n (x) = expression
```

For example, you may wish to define a function which would return the area of a circle given the radius. Such a function would be;

```
10 DEF FN A (x) = 3.1415927 * X ^2 (since area of a circle =  $\pi$  x radius squared).
```

The function name consists of three letters. The first two F and N must always be present but the last can be any letter from A to Z. This allows defined functions in one program (although some systems allow a letter immediately followed by a single number as a function identifier).

The argument to the function is the 'dummy variable' within the parenthesis (x). This reserves memory space for the arguments given to the function later in the program. Any legal variable name can be used as a dummy variable.

The expression on the right hand side of the equal sign is the calculation the function is to perform. The following program demonstrates how the function would be defined and then used to calculate the area of ten circles:

```

10 REM - CALCULATE AREA OF CIRCLES OF RADIUS 7-10 cm
20 DEF FN A (x) 3.1415927 * X ^ 2
30 PRINT TAB (5); "RADIUS (CM)"; TAB (20); "AREA (CM 2)"
40 FOR X = 1 to 10
50 PRINT TAB (8); X; TAB (22); FN A (x)
60 NEXT X
70 END
  
```

The program is composed of the following lines:

Line 10 - The REM statement outlines the programs function. The characters following REM are ignored by the computer.

Line 20- This is the function definition. The function is named FN A and is equal to the expression  $\pi X^2$ , where X is the functions argument. It is advisable to place all function definitions at the beginning of a program so that the program is easier to read and follow.

Line 30 - The TAB function is used to format the output to the terminal. The heading 'RADIUS (CM)' will begin at the sixth output line column and 'AREA (CM 2)' will begin at the twenty-first column.

Line 40- The FOR statement initialises the loop index to one and sets the range to ten.

Line 50 - The PRINT statement outputs the value of X (underneath the heading 'RADIUS (CM)' because of the formatting of the TAB function) followed by the value of the area of the circle of radius X computed by the FN A function defined on line 20.

Line 60 - The next statement increments the value of X by one and directs program execution back to line 40.

Line 70 - The END statement signifies program completion.

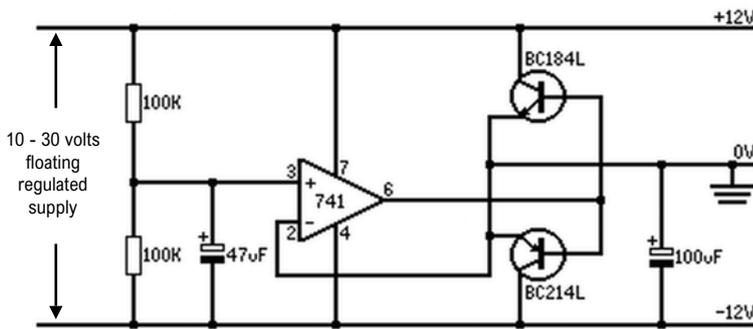
# CIRCUIT MAKER

## Single rail to dual rail for op-amps

Most op-amps require a split power supply of some form because both positive and negative output voltage swings are needed. In some applications it is possible to connect the op-amp across a single supply and bias all the inputs up to half the rail voltage but this implies the use of large numbers of DC blocking capacitors. It is more economical and often better to generate a half-rail voltage using another op-amp and if necessary, a couple of transistors. Provided that the input rails are

floating from earth the new half-rail voltage may be connected to earth, giving in effect a dual supply with centre earth which is ideal for audio applications.

The circuit itself is very obvious. The op-amp is connected as a voltage follower, the input voltage being set at half-rail by the resistor divider and smoothing capacitor. Two transistors are connected to the output of the op-amp to provide current boosting if necessary; the feedback loop being made after these. Note that the maximum voltage supply is limited by the op-amp, in this case 30 volts being the wisest maximum. If the supply is to be used for other op-amps this limit is not relevant.

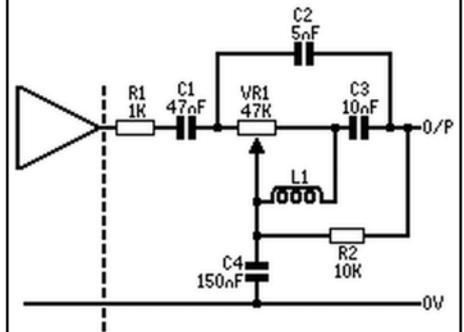


## Pseudo phaser

Dave Rogers-Walton

Tone stops allow the electronic organ player to select from different fixed filters whilst playing and so are really a type of performance control. There is no reason why a similar facility should not be added to the more usual performance controls (e.g. pitch bend) found on synthesisers. What is needed is some form of one-knob, complex tone control which, unlike standard tone circuits, should be able to shift the balance within the important mid-band as well as at the extremes, so varying the whole character of the sound. The circuit shown does exactly this. It has also been found to have a useful effect at the output of guitar overdrive circuits.

RV1 simultaneously alters the time constants of several high and low-pass signal paths which are then remixed at the output. One of the results of this is the formation of a notch which varies in centre frequency as well as depth, depending on the setting of RV1. L1 forms resonant



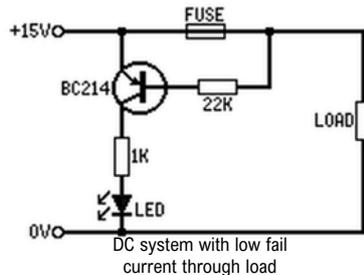
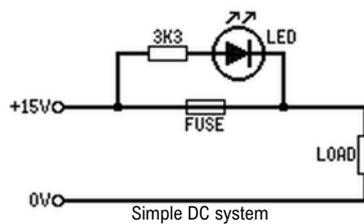
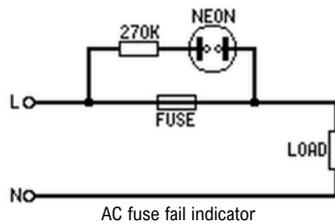
circuits with the capacitors over most of RV1's range but is effectively faded out of circuit towards either end, thus adding another variable element to the frequency response contouring.

Used with a reasonably bright audio input, the perceived loudness is then similar for all settings, so a small turn of this single control can be used to obtain a distinct change in timbre without having to readjust the volume, while a back and forth rotation during a sound gives an effect like a manually swept one-notch phaser. A bypass switch is not needed since with RV1 fully anticlockwise, the tonal response is almost identical to a 'straight through' path. For best results this circuit must: (1) feed into an impedance of 47k or over, for example, a non inverting op-amp, which if given a gain of X5 will also more than make up for the insertion loss of the passive circuit. (2) be driven from a low impedance stage, designated 'A' in the diagram. This may already exist within a piece of equipment (emitter follower, op-amp, etc) in which case the present circuit can simply be added on passively. If the available output impedance is more than a few hundred ohms, however, a simple buffer stage should be included.

## Fuse failure indication

The failure of a fuse either as a result of a fault or simple ageing and over-heating can be quite alarming because the piece of equipment in question usually stops working with no indication as to why. It is thus useful to arrange for some form of indicator to light when a fuse fails. The simplest indicator is for mains when a neon (together with a 270K resistor if not built into the neon) is strapped across the fuse. Obviously when the fuse blows the voltage at the load end drops and the neon lights. The small leakage current through the neon will be of little consequence to the following circuit, even in the event of a major fault. Failures in DC circuits can be a little more tricky depending on the nature of the following circuits. If a current of say 5 mA is acceptable, even in event of fuse failure, a LED may be connected across the fuse in the same way as the neon. The polarity of the LED should be altered if the fuse is in a negative supply line. If even low current is not acceptable a transistor must be used to drive the LED. A PNP type for a positive rail system can be connected across the fuse with the base connected to the load side. A LED and suitable resistor are added to the collector. If the fuse fails the base voltage falls, switching on the transistor and causing the LED to light.

While on the subject of failures, the usefulness of connecting a small neon across the mains supply as soon as it enters a piece of equipment should not be underestimated. Such a neon will give immediate indication as to the state of the mains supply thus saving valuable time if the fault is in the mains lead, as it often is.



Such miniature neon lamps are cheap to buy and easy to fit. They also provide an added reminder when servicing that mains is supplied even though the equipment is switched off - something that it is all too easily forgotten.

# READERS LETTERS

## Computer Interface Data Wanted

Dear Sir,  
I have just purchased your December/February issue from W H. Smith and find it very interesting I own a micro computer, an Acorn Atom and like many micro owners have searched in vain for books or magazines which give practical circuits for use with computer outputs and do not require much knowledge of electronics.

I hope therefore that "Electronics" will publish such articles, not only for the Atari but other micros, and am looking forward to your model train controller.

D. M. GRIFFITHS  
Nottingham

## Bicycle Radio

Dear Sir,  
I am a beginner and a few things have got me stumped. Please could you tell me how to make square holes in the front panels of cases. What do you use to cut up Veroboard? In the USA you can buy a "Germanium Crystal Diode". You clip one end to a bike frame, the other to an earphone, and you have a crystal radio. Is this available in the UK? and if so, do you stock it?

DAVID HARRISON  
Burgess Hill  
West Sussex

*To make square holes, first drill a round one, then file out using a miniature flat warding file. Veroboard can be cut with a sharp knife or deeply scored and snapped off. See our next issue for details of a new book on crystal sets to be published shortly. A suitable diode would be the OA91 with our crystal earpiece. However, don't expect the quality to be to Hi-Fi standards, though reception of whistles, crackles and other assorted garbage should be excellent.*

*Careful adjustment of the frame should tune different stations, though for best reception of Radio 1 a 70 metre long bicycle will be needed and these are hard to find (to say nothing of cornering difficulties). Raising or lowering the handlebars could prove to be an excellent fine tune control, though it may be best not to re-tune the radio whilst going along.*

## Price Increases?

Dear Sir,  
I note that your price list is liberally sprinkled with "price reduced" symbols. Very good - but just so we can see what you are really doing, why not add a "price increased" symbol?

R. M. TOBIN  
Birmingham  
West Midlands

*How many times have you seen a shop window with "Price increased" signs on its window amongst the price reduction signs? If you did see a shop like that I'm sure we'd all think they were being very fair. I am also sure that most people would think they were pretty silly as well. You have to remember that as far as mail order is concerned our price list is our shop window.*

## More Radio Projects

Dear Sir,  
Congratulations on an excellent first number. May I make a suggestion, however, that a proportion, say, up to a quarter of the projects should relate to radio, e.g. a modern communications receiver etc.

L. W. SMITH  
Walmer  
Kent

## Suggestions For Future Projects

Dear Sir,  
I'm just writing to let you know how much I enjoyed reading the first

issue of "ELECTRONICS" and I am already looking forward to issue No. 2.

May I make a few suggestions for projects in future issues as follows.

- (1) Electrified fence pulser (this will prove useful to gardeners pestered with cats)
  - (2) Digital multi meter
  - (3) 900 MHz CB rig
  - (4) 27 MHz CB rig
  - (5) Digital temperature gauge
  - (6) Frequency meter up to 50 MHz with possible range extension up to 900 MHz
  - (7) Digital wind speed indicator
- Wishing you every success with future issues.

F. J. BROWN  
Wirral  
Merseyside

## Multicolour LED Can Be Improved

Dear Sir,  
Congratulations on your new magazine-good for Maplin customers who are not necessarily music makers! A pity it is not a monthly.

I have a tip for users of the original multicolour LED (which has gone up by 52% in one go-is this fair?) a much better effect is obtained by painting the surface with two coats of enamel matt varnish. This diffuses the out-coming light very well. Keep up the good work.

C. W. DUDLEY  
Bromley  
Kent

*The new price of this LED is in fact the price it should always have been, but the manufacturer misquoted us on our first shipment and we passed on this error to keep the price down.*

## More Suggestions For Stock And Projects

Dear Sir,  
Suggestions for stock items:  
(a) To enable readers of book XW07H "How to Build Your Own Solid State Oscilloscope", to construct this item, it would be advantageous to be able to purchase the cathode ray tubes and their bases, or even a complete kit, through Maplin. It will be seen that the book is currently number 3 in

the Top Twenty. The smaller of the two oscilloscopes has also been deleted from the Maplin catalogue.

- (b) DIN plugs and sockets:  
Add a further 5-pin configuration as projects in future issues as follows: These plugs and sockets are in common use in Philips equipment. Suggestions for project articles in Maplin Publications:  
(a) Passive Infra Red Movement Detector Alarm System.  
(b) Microwave.

E. J. T. HITCHIN  
Dartford  
Kent

## Maplin Mag Disliked

Dear Sir,  
I expect you are interested in reactions to your new magazine "Electronics" which replaces the newsletters, and whose first issue has arrived.

For my part, it is not of much interest to have yet another magazine of relatively low-grade technical difficulty. Nor am I interested in your other music-orientated magazine.

On the other hand, your components catalogue is important to me, and to be able to obtain the up-to-date price lists by sending a stamped-addressed envelope (or by paying £1.00) was perfectly satisfactory.

However, let the first year's subscription stand, but I shall probably not renew it.

Your components service is first-rate, and highly regarded.

J. R. BARKER  
Bath  
Avon

*We ought to point out that the price list is still available by sending a stamped-addressed envelope or by paying £1 in advance for seven issues.*

If you have any interesting comments to make about your hobby in general or Maplin in particular then please write to: The Editor, Maplin Mag, P.O. Box 3, Rayleigh, Essex SS6 8LR. Please write clearly and keep your letters brief and to the point. Thank you.

## NEW ITEMS USED IN PROJECTS IN THIS MAGAZINE

GA04E	Stopwatch PCB	Price £2.95
GA44X	Burglar Alarm PSU PCB	Price £2.40
GA45Y	Burglar Alarm Main PCB	Price £6.75
GA46A	Break Contact PCB	Price £1.95
GA47B	External Horn PCB	Price £1.60
GA72P	Train Common PCB	Price £2.90
GA73Q	Train Control PCB	Price £2.20
GA74R	Train Receiver 1 PCB	Price £1.35
GA75S	Train Receiver 2 PCB	Price £1.35
GA76H	MPG Meter Main PCB	Price £2.45
GA77J	MPG Meter Display PCB	Price £1.75
LW57M	Burglar Alarm Kit	Price £44.95
LW58N	External Horn Kit	Price £29.95
LW59P	Break Contact Kit	Price £2.99
LW61R	Train PSU/Common Kit	Price £27.50

LW62S	Train Control Kit	Price £6.45
LW63T	Train Receiver 1-ML926	Kit Price £5.95
LW64U	Train Receiver 2-ML926	Kit Price £5.95
LW65V	Stopwatch Kit	Price £34.95
LW67X	MPG Meter Kit	Price £24.95
LW68Y	Train Receiver 1-ML927	Kit Price £5.95
LW69A	Train Receiver 2-ML927	Kit Price £5.95
QR56L	2SA715	Price 45p
QR57M	ML926	Price £2.45
QR58N	ML927	Price £2.45
QR59P	2SC1162	Price 45p
XG06G	Burglar Alarm Box	Price £12.50
XG07H	External Horn Box	Price £14.50
XG09K	Train Control Case	Price £12.50
XG14Q	Electronic Siren	Price £19.95
XX45Y	Switchpot 1 pole 12 way	Price 85p
XX47B	Train Control Front Panel	Price £3.75

# PRICE LIST

All prices shown in this list are valid from 15<sup>th</sup> February 1982 to 15<sup>th</sup> May 1982

Please note new telephone number for Sales Only (0702) 552911

Prices shown in this list include VAT at 15% where applicable. Items marked NV are rated at 0% and the price shown applies both to inland and export orders. Overseas customers should add up the total cost of all items except those marked NV and deduct 13% to arrive at the total price excluding VAT. Alternatively multiplying the total price (except NV items) by 0.87 will give the total price excluding VAT.

Although postage charges to customers living in the Republic of Ireland and in the UK, but not on the UK mainland, are the same as to mainland addresses we regret that we must levy an additional charge of £5 on each order containing any items marked "Delivery by Carrier".

Will customers from the Republic of Ireland please add 40p and then 35% to the cost of their order now that the Irish pound is not equivalent to sterling, to cover the rate difference and negotiation fees. We will refund any difference; please state cheque or credit note. Alternatively if you pay by bank draft drawn in pounds sterling on a London bank, then you need add nothing extra. Bank drafts drawn in pounds sterling on a London bank should be readily available from your local bank.

## Prices charged will be those ruling on the day of despatch

**Page 11**

TS08J	Parts T-Shirt LC.....	DISC
TS09K	Parts T-Shirt S.....	£3.95
TS10L	Parts T-Shirt M.....	£3.95
TS11M	Parts T-Shirt L.....	£2.95
XF30H	Pirate Attack Poster.....	£1.00 NV
XF12N	Maplin Poster.....	£1.00 NV

### AERIALS

**Page 15**

XQ22Y	Mushkiller FM224.....	£12.25
XQ23A	Mushkiller FM234T.....	£16.50
XQ24B	Mushkiller FM235T.....	£17.60
XQ25C	Mushkiller FM244T.....	£17.80
XQ27E	Mushkiller FM264T.....	£24.50
XQ28F	Mushkiller FM284T.....	£30.50
XQ29G	Trucolour TC10 Grp A.....	£10.50
XQ30H	Trucolour TC10 Grp B.....	£9.40
XQ31J	Trucolour TC10 Grp C/D.....	£9.95
XQ32K	Trucolour TC13 Grp A.....	£11.85
XQ33L	Trucolour TC13 Grp B.....	£10.90
XQ34M	Trucolour TC13 Grp C/D.....	£11.45
XQ35Q	Trucolour TC18 Grp A.....	£13.95
XQ36P	Trucolour TC18 Grp B.....	£13.85
XQ37S	Trucolour TC18 Grp C/D.....	£13.25

**Page 16**

XQ38R	Extragain XG5.....	£16.50
XQ39N	Extragain XG8 GroupA.....	£21.30
XQ40T	Extragain XG8 GroupB.....	£21.50
XQ41U	Extragain XG8 GrpC/D.....	£20.50
XQ42V	Extragain XG8 Wdbnd.....	£21.95
XQ43W	ExtragainXG14 GroupA.....	£35.50
XQ44X	ExtragainXG14 GroupB.....	£36.35
XQ45Y	ExtragainXG14 GrpC/D.....	£34.85
XQ46A	ExtragainXG14 Wdbnd.....	£35.95
XQ47B	ExtragainXG21 GroupA.....	£47.90
XQ48C	ExtragainXG21 GroupB.....	£47.90
XQ49D	ExtragainXG21 GrpC/D.....	£47.90
XQ50E	ExtragainXG21 Wdbnd.....	£47.90
XQ51F	Super Set Top.....	£8.95
XY30H	Toptenna.....	£5.55
XQ52G	Caratenna CA7.....	£9.50

**Page 17**

BW42V	Univ. Clamp Type 1.....	£1.95
BW43W	Mast Bracket Type 2.....	£2.55
XQ53H	Mast Bracket Type 3.....	£8.50
XQ54J	Mast Bracket Type 8.....	£12.75
BW44X	Mast Bracket Type 14.....	£4.65
BW45Y	Loft Bracket EM4.....	£2.65
XQ55K	Lashing Kit Type 4.....	£9.85
XQ56L	Lashing Kit Type 6.....	£15.95
XQ57M	Lashing Kit Type 7.....	£14.90
XQ58N	Lashing Kit Type 9.....	£11.50
XQ59P	Mast C.....	£3.95
XQ60Q	Mast O.....	£3.75
XQ61R	Mast E.....	£7.45
XQ62S	Mast G.....	£15.95
XQ63T	Mast M.....	£5.79
XQ64U	Mast R.....	£9.45
BW46A	Masthead UP1300/W.....	£10.90
BW49D	Masthead UPI300/V.....	£10.95

**Page 18**

BW50E	Power Unit PU1240.....	£14.65
YQ22Y	XtraSetAmp.....	£14.45

YX73Q	XtraBoost Amp.....	£15.80
RW36P	Plugpak 200.....	£0.88
BW51F	Diplexer UF2.....	£5.55
BW52G	Splitter CS100.....	£8.95
BW53H	Splitter SB2.....	DISC
HX88V	Aerial Splitter SB11.....	£3.20
YQ23A	Splitter CS200.....	£4.45

**Page 19**

HX87U	Surface Co-Ax Outlet.....	£0.75
BW54J	Sfce Dble Co-Ax Outlet.....	£2.70
BW55K	Flush Co-Ax Outlet.....	£0.75
BW56L	Fish Dbl Co-Ax Outlet.....	£2.65
BW57M	TV/FM Outlet.....	£4.65
BW58N	Aerial Switch.....	£4.35
LB09K	75/300 Balun.....	£1.30
BW59P	Attenuator 6 dB.....	£1.95
BW60Q	Attenuator 12 dB.....	£1.95
BW61R	Attenuator 18 dB.....	£1.95
LB11M	FM Tape Aerial.....	£0.60
YG20W	Ferrite Rod 810.....	£0.35
YG21Y	Ferrite Rod 814.....	£0.38
YG22Y	Ferrite Rod 101.....	£0.45
YG23A	Ferrite Rod 102.....	£0.73

**Page 20**

LB12N	MW/LW Aerial.....	£2.35
LB10L	Telescope Aerial 54 m.....	£3.30
XB54J	Aerial Rotator.....	£59.90
YB00A	LOW Pass RF Filter.....	£4.45
YB01B	RF Antenna Switch.....	£6.34
YG15R	2m Rubber Duck.....	£4.75
YG16S	Mag Mount.....	£8.50

### BATTERIES

**Page 21**

YG00A	Ni Cad AA.....	£1.25
LR74R	Ni Cad Fast AA.....	£1.55
YG01B	Ni Cad SC.....	£2.50
YG02C	Ni Cad C.....	£3.95
YG03D	Ni Cad D.....	£5.99
WY22Y	Ni Cad Charger.....	£7.85
HF27E	Clips PP9.....	£0.10
HF28F	PP3 Clip.....	£0.09

**Page 22**

YR59P	15V Battery Box.....	£0.13
YR60Q	3V Battery Box.....	£0.15
YR61R	4.5V Battery Box.....	£0.30
HF29G	6V Battery Box.....	£0.22
HF94C	Long HP7 Battery Box.....	£0.22
HQ01B	9V Battery Holder.....	£0.30
YR62S	Long 9V Battery Box.....	£0.32
HF95D	HP11 Battery Box.....	£0.37
HF96E	Long HP11 Battery Box.....	£0.45
HF97F	HP2 Battery Box.....	£0.79
YB22Y	AC Adaptor 3DC.....	£4.45
XX09K	AC Adaptor BR300.....	£4.75
YB23A	AC Adaptor MVA31.....	£9.95
YB24B	TV Game Mains Adaptor.....	£5.25
XX33L	PP3 Battery Holder.....	£1.25
YX92A	Dummy Battery.....	£0.20

### BOOKS

**Page 23**

RL27E	Book NB147.....	£6.95 NV
RH64U	Book NB047.....	£2.85 NV

All prices are for the unit quantity shown in the catalogue (unless shown otherwise on this list) i.e. each, per pack, per metre etc. All prices include postage and packing. There is a 30p handling charge which must be paid on all orders having a total value of under £4.00.

The price list is intended for use with our 1981 catalogue and applies to all mail orders. Prices in our shop are generally lower on heavy items as mail order prices include postage and packing costs.

Copies of manufacturers' data sheets are available for most IC's - price 40p each.

### Notes:

NYA	Not yet available
DISC	Discontinued
TEMP	Temporarily out of stock
OOP	Out of print
FEB	Out of stock, new stock expected in month shown
NV	Indicates that item is zero rated for VAT purposes

RL31J	Book NB157.....	£4.35 NV
RL29G	Book NB152.....	£2.56 NV
RH24B	Book BP31.....	DISC
RQ22Y	Book NB245.....	£4.65 NV
RR02C	Book NB200.....	£2.82 NV
RQ72P	Book FT832.....	£6.85 NV
XW31J	Book MM639.....	£1.95 NV
XW12N	Book NB386.....	£4.10 NV
RH65V	Book NB048.....	£3.90 NV
XW00A	Book FT882.....	£6.10 NV
RL13P	Book NB099.....	£2.55 NV
XW21X	Book NB344.....	£5.65 NV
RL35Q	Book NB190.....	DISC
RF19V	Book NB286.....	£4.20 NV

**Page 24**

RL06G	Book NB0740.....	£4.25 NV
RH05F	Book BP7.....	£0.50 NV
RL02C	Book NB059.....	£5.15 NV
RH04E	Book BP6.....	£0.85 NV
RQ23A	Book BP53.....	£3.20 NV
RH21X	Book BP27.....	£0.65 NV
RH32K	Book BP196.....	OOOP
RH53H	Book BP160.....	MAY 82
XX10L	Basic Electronic Set.....	£11.75NV
XW53H	Book NB454.....	£3.75 NV
XW63T	Book JM671.....	£2.95 NV
RL19V	Book NB126.....	£4.55 NV
XW64U	Book NB449.....	£4.55 NV
RR06G	Book NB209.....	£6.75 NV
RH63T	Book NB041.....	£2.75 NV
RF10L	Book BP228.....	£1.50 NV
RL33L	Book NB188.....	£6.95 NV
XW87U	Book AG530.....	£3.95 NV

**Page 25**

RR39N	Towers Transistor Book.....	£10.75NV
RL74R	Book NB187.....	£6.85 NV
RH00A	Book BP1.....	SEPT
RH11M	Book BP14.....	£2.15 NV
RH44X	Book BP211.....	£1.55 NV
RQ68Y	Book FT938.....	£4.25 NV
RQ24B	Book BP41.....	£3.25 NV
RQ69A	Book FT986.....	£7.75 NV
RF11M	Book BP40.....	JULY
RH35Q	Book BP202.....	£1.75 NV
XW56L	Book FT1037.....	£14.95

**Page 26**

RV		
RL25L	Book NB145.....	£4.35 NV
RR17T	Book NB327.....	£6.65 NV
RR26D	Book NB1619.....	£2.75 NV
RL03D	Book NB061.....	DISC
RL32K	Book NB185.....	£11.46NV
RL20W	Book NB130.....	£9.25 NV
RQ25C	Book NB278.....	£4.38 NV
RL07H	Book NB076.....	£6.55NV
RL17T	Book NB115.....	£2.75 NV
RQ26D	Book NB319.....	TEMP
RR28F	Book NB2028.....	£14.25NV
RL08J	Book NB077.....	OOOP
RQ67X	Book BP61.....	£1.05 NV
RB25C	Book BP225.....	£1.45 NV

**Page 26**

RR21X	Book NB879.....	£4.15 NV
RR37S	Photocell Apps Book.....	£4.15 NV

RF12N	Book BP42.....	£0.95 NV
LY05F	Book BP45.....	JUNE
XW34M	Book BP67.....	£2.05 NV
XW62S	Book BP82.....	£2.25 NV
XW77J	Book FT1118.....	£4.80 NV
RR03D	Book NB201.....	£3.65 NV
RR27E	Book NB2026.....	£4.15 NV
RR09K	Book NB229.....	£4.20 NV
RF09K	Book BP227.....	£1.75 NV
RR10L	Book NB230.....	£4.15 NV
XW89W	Book AG437.....	£3.85 NV
RR11M	Book NB231.....	£4.15 NV
RL35Q	Book NB190.....	DISC
XW90X	Book AG475.....	£3.95 NV
RH17T	Book BP23.....	£0.95 NV
RQ28F	Book BP48.....	£1.60 NV
RQ29G	Book BP49.....	£1.65 NV
XW67X	Book BP80.....	£2.25 NV
RB21X	Book BP221.....	£1.45 NV
RH29G	Book BP36.....	£0.90 NV
RR19V	Book NB864.....	£5.40 NV

**Page 27**

RF08J	Book BP39.....	£1.90 NV
RH30H	Book BP37.....	£1.45 NV
RL05F	Book NB074.....	£5.45 NV
XW17T	Book HD760.....	£6.85 NV
RH36P	Book BP203.....	DISC
RL36P	Book NB345.....	£4.10 NV
RL41U	Book NB354.....	£4.10 NV
RH40T	Book BP207.....	OOOP
RH19V	Book BP25.....	OOOP
RH25C	Book BP32.....	SEPT
RH18U	Book BP24.....	£1.35 NV
RL30H	Book NB153.....	£5.45 NV
LY04E	Book BP44.....	£2.10 NV
XW38R	Book NB480.....	£4.75 NV
RQ27E	Book BP50.....	£1.60 NV
RB23A	Book BP223.....	£1.45 NV
RB24B	Book BP224.....	£1.55 NV
RQ66W	Book BP59.....	£1.75 NV
RR07H	Book NB216.....	£5.35 NV
RL44X	Book BP58.....	£1.55 NV
XW20W	Book BP65.....	£1.75 NV
RL01B	Book NB058.....	£5.25 NV
RH28F	Book BP35.....	£1.45 NV

**Page 28**

XW30H	Book MM700.....	£2.39 NV
XW44X	Book BP71.....	£1.90 NV
RL42V	Book NB346.....	£4.05 NV
XW10L	Book NB383.....	£4.05 NV
RL43W	Book BP56.....	£1.65 NV
RB10L	Book NB269.....	£5.45 NV
RF20W	Book HD734.....	£4.85 NV
RH34M	Book BP201.....	DISC
XW08J	Book BP60.....	£1.65 NV
XW46A	Book MM513.....	£2.90 NV
RL40T	Book NB338.....	£3.95 NV
RH52G	Book BP220.....	£1.05 NV
RH22Y	Book BP29.....	£1.20 NV
RR23A	Book NB953.....	OOOP
XW37S	Book BP69.....	£1.85 NV
XW11M	Book NB379.....	£4.10 NV
RH16S	Book BP22.....	OOOP
RH51F	Book BP219.....	£1.05 NV

<b>Page 29</b>	
XW47B	Book MM396.....£2.19 NV
XW51F	Book BP75.....£2.00 NV
RH50E	Book BP218.....£1.05 NV
XW07H	Book BP57.....£1.75 NV
RQ30H	Book NB353.....£5.45 NV
XW52G	Book BP76.....£2.05 NV
RH49D	Book 8P217.....OOP
RQ71N	Book FT905.....OOP
RH45Y	Book 8P213.....OOP
RQ80B	Book FT926.....£5.25 NV
W600A	Book FT1021.....£5.55 NV
XW39N	Book BP73.....£2.25 NV
XW66W	Book BP79.....£2.05 NV
XW76H	Book FT1174.....£5.55 NV
XW06G	Book FT1071.....£6.65 NV
RL46A	Book HD681.....£7.65 NV
XW28F	Book FT841.....£5.35 NV
XW73Q	Book FT1241.....£6.25 NV

<b>Page 30</b>	
RL04E	Book NB071.....£8.95 NV
RR00A	Book NB195.....£7.45 NV
XW86T	Book AG471.....OCT 82
RR05F	Book NB204.....DISC
XW54J	Book NB439.....£3.00 NV
XW92A	Book WDXG.....£5.55 NV
XW27E	Book NB402.....£5.25 NV
XW99H	Book FT1054.....£4.88 NV
RH47B	Book BP215.....DISC
RB22Y	Book BP222.....£1.45 NV
RB26D	Book BP226.....£1.50 NV
RF18U	Book BP43.....£1.75 NV
XW74R	Book FT1120.....OOP
XW02C	Book FT714.....OOP
RQ58N	Book BP55.....£2.00 NV
XW43W	Book NB467.....£4.20 NV
XW91Y	Book WRTV.....£10.25NV
RQ33L	Book BP52.....£2.25 NV
R149D	Book FT999.....DISC
XW96E	Book FT933.....£2.05 NV
XW97F	Book FT868.....OOP

<b>Page 31</b>	
RH59P	Book NB016.....£4.50 NV
RH66W	Book NB054.....£2.80 NV
RL18U	Book NB116.....DISC
RL24B	Book NB144.....£5.50 NV
XW88V	Book AG569.....£3.70 NV
XW32K	Book BP70.....£0.60 NV
RQ59P	Book NB367.....£2.75 NV
RQ31J	Book NB268.....£9.20 NV
LW28F	Book BP46.....£1.60 NV
RH57M	Book NB001.....£8.65 NV
RH60Q	Book NB018.....OOP
XW22Y	Book FT 1042.....OOP
RQ76H	Book FT716.....DISC
RQ77J	Book FT732.....£5.75 NV
XW84F	Book AG353.....£6.25 NV
RL10L	Book NB084.....£4.45 NV
RL14Q	Book NB101.....£4.45 NV
RL24B	Book NB970.....£4.75 NV
RH58N	Book NB014.....£2.80 NV
RQ32K	Book NB228.....OOP
RL15R	Book NB102.....OOP
XW29G	Book NB378.....£6.30 NV

<b>Page 32</b>	
RH62S	Book NB033.....£8.77 NV
RL12N	Book NB089.....£11.55NV
RL21X	Book NB134.....£11.45NV
RF17T	Book NB240.....£11.65NV
RL23A	Book NB137.....£9.45 NV
RH27E	Book BP34.....£1.70 NV
RQ75S	Book FT1028.....£5.95 NV
RQ74R	Book FT780.....OOP
RL11M	Book NB085.....DISC
RR12N	Book NB236.....OOP
RF14Q	Book NB274.....£4.40 NV
RL22Y	Book NB136.....£2.75 NV
RL28F	Book NB150.....£10.25NV
XW13P	Book NB429.....£7.25 NV
RH46A	Book BP214.....£1.05 NV
RQ73Q	Book FT879.....OOP
RR13P	Book NB237.....£4.35 NV
XW36P	Book BP68.....£1.95 NV
XW93B	Book AG582.....£3.90 NV

<b>Page 33</b>	
XW26D	Book NB336.....£8.65 NV
RH41U	Book BP208.....£0.95 NV
LW29G	Book BP47.....£1.50 NV
RQ35Q	Book NB330.....£3.95 NV
XW85G	Book AG510.....£5.80 NV
RR14Q	Book NB238.....£4.45 NV
RF13P	Book NB2441.....£4.55 NV
XW83E	Book AG512.....£5.95 NV
RF15R	Book NB252.....£11.25NV
RF16S	Book NB253.....£11.25NV
RQ36P	Book BP51.....£1.45 NV
RR16S	Book NB262.....£3.95 NV
RQ79L	Book FT546.....£4.85 NV
XW55K	Book AG695.....£5.15 NV
XW06Y	Book BP81.....£2.06 NV
XW09K	Book NB391.....£3.55 NV
XW40T	Book BP74.....£2.05 NV
RQ78K	Book FT503.....OOP

<b>Page 34</b>	
RH38R	Book BP205.....£1.15 NV
RR01B	Book NB196.....£12.35NV
RQ34M	Book NB369.....£4.45 A/V
RF22Y	Book HD942.....£5.25 NV
RH26D	Book BP33.....£1.75 NV
RF07H	Book BP38.....£0.90 NV
RQ37S	Book BP54.....£1.65 NV
XW95D	Book FT1088.....£6.45 NV
RQ38R	Book NB359.....£4.35 NV
XW33L	Book BP66.....£2.05 NV
XW45Y	Book 8P72.....£1.95 NV
RQ08J	Book Sybex L4.....OOP
XW25C	Book N8414.....£3.95 NV
XW41U	Book ITN1.....£5.25 NV
RQ40T	Book HD678.....£7.55 NV
RQ01B	Book Sybex C201.....£12.75NV
XW14Q	Book MM604.....£5.75 NV
RQ00A	Book Sybex C200.....£8.15 NV
RQ12N	Book Sybex M1.....£7.75 NV

<b>Page 35</b>	
RQ13P	Book Sybex M11.....£11.35NV
RQ14Q	Book Sybex M12.....OOP
XW98G	Book FT1070.....£7.85 NV
RQ02C	Book Sybex C207.....£13.25NV
RQ49D	M6800 Applications.....OOP
RQ48C	8085 Systems Manual.....DISC
RQ54J	Z80 Data.....£3.45 NV
XW65V	Book BP78.....£2.05 NV
XW15R	Book HD813.....£3.75 NV
RQ62S	Book R3.....DISC
RQ60Q	Book R1.....£8.95 NV
RQ61R	Book R2.....£8.95 NV
RQ44X	Book HD761.....£9.10 NV
XW57M	Book HD177.....£5.75 NV
XW19V	Book HD166.....£6.15 NV
XW03D	Book FT574.....OOP
XW79L	Book C300.....£12.45NV
XW80B	Book C202.....£11.45NV
XW81C	Book D302.....£10.25NV
RQ56L	M6800 Programming.....DISC

<b>Page 36</b>	
XW70M	Book M3.....£12.75NV
RQ16S	Book Sybex M14.....OOP
RQ06G	Book Sybex L2.....£9.24 NV
RQ46A	8080 Assembler Manual.....DISC
XW69A	Book M2.....£12.75NV
RQ15R	Book Sybex M13.....£6.95 NV
RQ07H	Book Sybex L3.....£9.09 NV
RQ11M	Book Sybex 17.....OOP
RQ10L	Book Sybex 16.....OOP
RQ09K	Book Sybex 15.....OOP
R139N	Book Sybex L8.....£4.15 NV
XW71N	Book M4.....£13.25NV
XW72P	Book C280.....£14.35NV
RQ17T	Book Sybex M15.....£7.83 NV
XW78K	Book C281.....£11.70NV
XW58N	Book NB415.....£4.25 NV
RQ41U	Book NB528.....£6.60 NV
XW16S	Book FT952.....£6.95 NV
XW49D	Book MM304.....£3.95 NV
XW50E	Book MM286.....£5.50 NV
RL45Y	Book HD106.....£10.45NV

<b>Page 37</b>	
RQ42V	Book HD585.....£8.25 NV
XW04E	Book FT1055.....£3.85 NV
XW42V	Book HD115.....£5.25VV
RQ43W	Book HD682.....£6.60 NV
XW24B	Book HD124.....£5.80 NV
XW59P	Book HD154.....£8.65 NV
XW60Q	Book HD762.....£7.85 NV
XW94C	Book FT1095.....£3.96 NV
RQ64U	Book Sybex P10.....£9.20 NV
RL48C	Book HD112.....£6.70 NV
RQ63T	Book R5.....OOP
RQ21Y	Book Sybex R4.....£6.92 NV
XW48C	Book R6.....£6.84 NV
RL47B	Book HD109.....£7.45 NV
XW18U	Book HD170.....£5.48 NV
XW05F	Book FT1085.....£4.95 NV
XW75S	Book FT1062.....£4.45 NV
XW61R	Book HD160.....£5.80 NV
XW23A	Book HD155.....£13.65NV
RL37S	Book Sybex L9.....DISC
XW82D	Book G402.....£11.35NV

**BOXES**

<b>Page 38</b>	
LH56L	Potting Box Mm.....£0.10
LH57M	Potting Box Small.....£0.19
LH58N	Potting Box Medium.....£0.25
LH59P	Fitting Box Large.....£0.28
LF01B	Box PB1 White.....£1.45
LH14Q	Box PB1 Grey.....£1.55
LH20W	ABS Box MB 1.....£1.10
LH21X	ABS Box MB 2.....£1.20
LH22Y	ABS Box MB 3.....£1.45
LH23A	ABS Box MB 4.....£3.25
WY03D	ABS Box 2002.....£1.15
LH60Q	ABS Box 2004.....£1.60
LH61R	ABS Box 2005.....£1.90
LH62S	ABS Box 2006.....£3.35
LH63T	ABS Console M1005.....£2.40
LH64U	ABS Console M1006.....£3.90

LH65V	ABS Console M6005.....£2.75
LH66W	ABS Console M6006.....£3.55
LH67X	ABS Console M6007.....£4.95

<b>Page 39</b>	
LH68Y	ABS Console M8005.....£4.55
LH69A	ABS Console M8007.....£6.85
WY00A	Metal Panel Box M4003.....£1.50
WY01B	Metal Panel Box M4004.....£1.85
WY02C	Metal Panel Box M4005.....£2.65
YR72P	PCB Guide Adaptor.....£0.18
LH09K	Foot Switch Box.....£4.75
LF03D	Box PB301.....£1.85

<b>Page 41</b>	
HQ45Y	Tilt Leg Small.....£1.25
HQ46A	Tilt Leg Medium.....£1.22
HQ47B	Tilt Leg Large.....£1.50
LH00A	Verobox 101.....£4.25
LH01B	Verobox 102.....£4.85
LL00A	Verobox 103.....£5.75
LL01B	Verobox 104.....£12.95
LL02C	Verobox 105.....£6.39
LL03D	Verobox 106.....£3.25
LL04E	Verobox 107.....£3.55
LL05F	Verobox 201.....£5.35
LL06G	Verobox 202.....£6.25
LL07H	Verobox 203.....£7.95
LL08J	Verobox 211.....£4.35
LL09K	Verobox 212.....£5.25
LL10L	Verobox 213.....£5.49
LQ07H	Verobox 214.....£5.25
LQ08J	Verobox 215.....£5.95
LQ09K	Verobox 216.....£5.49
LL11M	Verobox 217.....£5.55
LH24B	Verobox 221.....£3.75
LH25C	Verobox 222.....£4.95
LH26D	Verobox 223.....£4.65
LL12N	Verobox 301.....£0.68
LL13P	Verobox 302.....£0.68
LH50E	Verobox 303.....£1.45
LH51F	Verobox 305.....£2.15
LL14Q	Verobox 401.....£0.95
XB88V	Verocase 501.....£14.95
XB89W	Verocase 502.....£29.95
XY15R	Verobox 503.....£15.20
LQ03D	Flip-Top Box 601 Black.....£3.55
LQ05F	Flip-Top Box 602 Black.....£5.25
LH27E	Verobox 701.....£5.35
LH28F	Verobox 702.....£5.55
LH29G	Verobox 704.....£7.95
LH30H	Verobox 705.....£7.25
LH31J	Verobox 707.....DISC
LH32K	Verobox 708.....DISC
LH33L	Verobox 713.....DISC
LH34M	Verobox 716.....DISC
LH35Q	Verobox 719.....£9.65

<b>Page 42</b>	
LF08J	Box AB7.....£1.25
LF09K	Box AB8.....£1.25
LF10L	Box AB9.....£1.15
LF11M	Box AB10.....£1.35
LF12N	Box AB11.....£1.15
LF13P	Box AB12.....£0.90
LF14Q	Box AB13.....£1.65
XB71N	Box AB15.....£3.25
LF15R	Box AB23.....£1.65
LF16S	Box AB24.....£1.75
LH10L	Box AB28.....£1.50
XB69A	Box AB31.....£2.25
XB65L	Chassis AC64.....£2.10
XB68Y	Chassis AC86.....£3.25
LF02C	Case WB1 Vinyl.....£1.90
LH37S	Case WB2 Vinyl.....£2.80
LH38R	Case WB3 Vinyl.....£3.45
LH39N	Case WB4 Vinyl.....£3.95
LH40T	Case WB5 Vinyl.....£4.95
LH41U	Case WB6 Vinyl.....£6.25
LH42V	Case WB7 Vinyl.....£6.95
LH43W	Case TP1 Teak.....£1.85
LH44X	Case TP2 Teak.....£2.85
LH45Y	Case TP3 Teak.....£3.55
LH46A	Case TP4 Teak.....£4.20
LH47B	Case TP5 Teak.....£4.95
LH48C	Case TP6 Teak.....£6.45
LH70M	Box DCM5002.....£2.40
LH71N	Box DCM5004.....£3.25
LH72P	Box DCM5007.....£4.55
LH73Q	Box DCM5005.....£4.40
LH74R	Box DCM5006.....£5.75
XQ08J	G-Range 2A.....£10.95
XQ09K	G-Range 3G.....£14.40
XQ10L	G-Range 4B.....£21.95

<b>Page 43</b>	
XY61R	Centurion DX1.....£6.95
XY62S	Centurion DX2.....£7.85
XY63T	Centurion DX3.....£8.65
XY64U	Centurion WX3.....£11.95
XY65V	Centurion WX4.....£13.25
XY66W	Centurion DX4.....£9.85
XY67X	Centurion DX5.....£10.45
XY68Y	Centurion DX6.....£11.95
XY69A	Centurion WX1.....£14.65
XY70M	Centurion WX2.....£14.95
XQ11M	Centurion EX1H.....£12.74
XQ12N	Centurion EX2H.....£13.85

XQ13P	Centurion EX3H.....£14.95
XQ14Q	Centurion EX4H.....£16.50
XY59P	Console 103.....£10.95
XY60Q	Console 108.....£16.45

<b>Page 44</b>	
XB73Q	Blue Case 227.....£4.55
XY40T	Blue Case 230.....£4.95
XY41U	Blue Case 235.....£5.40
XY42V	Blue Case 209.....£4.65
XY43W	Blue Case 212.....£5.35
XY44X	Blue Case 231.....£5.95
XB67X	Blue Case 236.....£6.45
XY45Y	Blue Case 222.....£5.85
XY46A	Blue Case 226.....£6.85
XB70M	Blue Case 232.....£6.45
XY47B	Blue Case 237.....£7.90
XY48C	Blue Case 233.....£7.70
XY49D	Blue Case 238.....£9.80
XY50E	Wood End Case 625.....£10.45
XY51F	Wood End Case 635.....£11.45
XY52G	Wood-End Case 645.....£12.30
XY53H	Wood-End Case 926.....£13.90
XY54J	Wood-End Case 936.....£14.95
XY55K	Wood-End Case 947.....£16.50
XY56L	Wood-End Case 1426.....£16.50
XY57M	Wood-End Case 1437.....£18.95
XY58N	Wood-End Case 1449.....£22.80
XY38R	19 in Card Frame.....£35.50
XY39N	19 in Frame Case.....£24.95
YR49D	3E Front Panel.....£4.25
YR50E	6E Front Panel.....£4.65
YR51F	12E Front Panel.....£4.95
YR52G	24E Front Panel.....£7.35

<b>Page 45</b>	
LH52G	3E Module.....£6.49
LH53H	6E Module.....£6.79
LH54J	12E Module.....£9.93
LH55K	24E Module.....£12.93
YR54J	Eurocard Guide.....£0.22
YR55K	Mod Int Card Guide.....£0.22
FW19V	Feet Cab.....£0.08
FW38R	Stick on Feet.....£0.18
FW39N	HD Feet.....£0.10
HH23A	Recess Plate.....£0.08
YR53H	Card Frame Brackets.....£0.50
YR56L	Card Frame Heat Sink.....£1.69
FX96E	Castors.....£2.75
FX05F	Castor Cup.....£0.49
XY31J	Piano Legs.....£24.51

<b>Page 46</b>	
FX06G	Cool Grille.....£0.32
FW81C	Handle.....£0.64
FW82D	HD Strap Handle.....£1.55
FX03D	Inst Handle Plastic.....£0.59
FX00A	Inst Handle Small.....£2.61
FX01B	Inst Handle Large.....£2.75
FX02C	Ferrule.....£0.31
LH08J	Recess Handle.....£0.40
LH11M	Heavy Duty Handle.....£2.59
YL05F	Flip Handle.....£4.95
YX00A	Cab Corners Small.....£0.20
FX04E	Cab Corner Large.....£0.12
FX94C	Corner Two Side.....£0.29
FX95D	Corner Three Side.....£0.36
HB20W	Flexihinge.....£0.08
YL24B	Small Hinge.....£1.55

<b>Page 47</b>	
YL04E	Lift off Hinge.....£1.85
YL25C	Lockable Catch.....£1.98
YL06G	Butterfly Catch.....£4.79
XY17T	Laminate Japan Teak.....£3.75
XY18U	Laminate Penang W/Nu.....£3.75
XY19V	Laminate Alum Small.....£1.59
XY20W	Laminate Alum Large.....£2.11
RY00A	Black Tygan 45 in.....£1.96
RY01B	

BL47B	L/C Wire Blue.....	£1.18
BL48C	L/C Wire Brown.....	£1.18
BL49D	L/C Wire Green.....	£1.18
BL50E	L/C Wire Grey.....	£1.18
BL51F	L/C Wire Orange.....	£1.18
BL52G	L/C Wire Pink.....	£1.18
BL53H	L/C Wire Red.....	£1.18
BL54J	L/C Wire Violet.....	£1.18
BL55K	L/C Wire White.....	£1.18
BL56L	L/C Wire Yellow.....	£1.18
BL00A	Wire 10M Black.....	£0.35
BL01B	Wire 10M Blue.....	£0.35
BL02C	Wire 10M Brown.....	£0.35
BL03D	Wire 10M Green.....	£0.35
BL04E	Wire 10M Grey.....	£0.35
BL05F	Wire 10M Orange.....	£0.35
BL06G	Wire 10M Pink.....	£0.35
BL07H	Wire 10M Red.....	£0.35
BL08J	Wire 10M Violet.....	£0.35
BL09K	Wire 10M White.....	£0.35
BL10L	Wire 10M Yellow.....	£0.35
XL10L	Wire 11C.....	£3.75
YR00A	Bicol Green/Red.....	£0.34
YR01B	Bicol Green/Yellow.....	£0.34
YR02C	Bicol Grey/Black.....	£0.34
YR03D	Bicol Grey/Blue.....	£0.34
YR04E	Bicol Orange/Black.....	£0.34
YR05F	Bicol Orange/Red.....	£0.34
YR06G	Bicol Pink/Black.....	£0.34
YR07H	Bicol Purple/Red.....	£0.34
YR08J	Bicol Red/Black.....	£0.34
YR09K	Bicol Red/Blue.....	£0.34
YR10L	Bicol Red/Brown.....	£0.34
YR11M	Bicol Red/Green.....	£0.34
YR12N	Bicol White/Black.....	£0.34
YR13P	Bicol White/Red.....	£0.34
YR14Q	Bicol Yellow/Black.....	£0.34
YR15R	Bicol Yellow/Green.....	£0.34
YR16S	Bicol Yellow/Red.....	£0.34
XR32K	Wire 3202 Black.....	£0.17
XR33L	Wire 3202 Blue.....	£0.17
XR34M	Wire 3202 Brown.....	£0.17
XR35P	Wire 3202 Green.....	£0.17
XR36P	Wire 3202 Red.....	£0.17
XR37S	Wire 3202 White.....	£0.17
XR38R	Wire 3202 Green/Yellow.....	£0.17

**Page 49**

XR57M	HC Wire Black.....	£0.38
XR58N	HC Wire Green.....	£0.38
XR59P	HC Wire Red.....	£0.38
XR40T	Extra Flex Black.....	£0.16
XR41U	Extra Flex Blue.....	£0.16
XR43W	Extra Flex Green.....	£0.16
XR44X	Extra Flex Red.....	£0.16
XR45Y	Extra Flex Yellow.....	£0.16
XR22Y	EHT Wire.....	£0.32
BL11M	Strapping Wire 16 swg.....	£0.82
BL12N	Strapping Wire 18 swg.....	£0.87
BL13P	Strapping Wire 20 swg.....	£1.15
BL14Q	Strapping Wire 22 swg.....	£0.94
BL15R	Strapping Wire 24 swg.....	£0.96
BL16S	EC Wire 14 swg.....	£0.70
BL24B	EC Wire 16 swg.....	£0.79
BL25C	EC Wire 18 swg.....	£0.88
BL26D	EC Wire 20 swg.....	£0.89
BL27E	EC Wire 22 swg.....	£0.93
BL28F	EC Wire 24 swg.....	£1.05
BL29G	EC Wire 26 swg.....	£1.07
BL39N	EC Wire 28 swg.....	£1.07
BL40T	EC Wire 30 swg.....	£1.10
BL41U	EC Wire 32 swg.....	£1.12
BL42V	EC Wire 34 swg.....	£1.16
BL43W	EC Wire 36 swg.....	£1.25
BL44X	EC Wire 38 swg.....	£1.25
BL60Q	EC Wire 40 swg.....	£1.50
BL61R	EC Wire 42 swg.....	£1.49
BL62S	EC Wire 44 swg.....	£2.20
BL63T	EC Wire 48 swg.....	£4.95
XR39N	Zip Wire.....	£0.14
XR60Q	HD Loudspeaker Cable.....	£0.36
YG08J	Litz Speaker Leads.....	£8.99
XR06G	Ribbon Cable 10-Way.....	£0.60
XR07H	Ribbon Cable 20-Way.....	£1.20
XR65V	IDC Cable 12-Way.....	£2.11

**Page 50**

XR47B	Twin Mains DS Black.....	£0.28
XR00A	Twin Mains DS White.....	£0.17
XR61R	Twin 6A Mains Orange.....	£0.49
XR62S	Twin 6A Mains White.....	£0.49
XR01B	Min Mains Black.....	£0.35
XR02C	Min Mains White.....	£0.36
XR03D	6A Mains Black.....	£0.56
XR04E	6A Mains White.....	£0.56
XR05F	6A Mains Orange.....	£0.70
XR09K	HD Mains Black.....	£0.99
XR10L	HD Mains White.....	£0.80
XR11M	HD Mains Orange.....	£0.90
XR24H	Cotton Mains.....	£0.94
BL71N	Stretch flex 1A.....	£1.05
BL72P	Stretch flex 6A.....	£5.95
XR48C	4-Core Mains.....	£1.05

**Page 51**

XR49D	1.0 mm TE Cable.....	£0.43
XR50E	1.5 mm TE Cable.....	£0.48
XR51F	2.5 mm TE Cable.....	£0.65

XR52G	6 mm TE Cable.....	£1.75
XR53H	1 mm Triple & ECC Cable.....	£0.65
XR15R	Mm Screened.....	£0.15
XR12N	Cable Single Black.....	£0.19
XR13P	Cable Single Grey.....	£0.19
XR14Q	Cable Single White.....	£0.19
XR16S	Single Mic Cable.....	£0.42

**Page 52**

XR18U	Low Noise Send.....	£0.40
XR19V	Low C Cable.....	£0.55
XR63T	UR67RF Cable.....	£1.95
XR08J	Twin Mic Cable.....	£0.78
XR20W	Lapped Pair.....	£0.20
XR21X	Cable Twin.....	£0.29
XR23A	Cable Quad.....	£0.28
XR25C	Multi Core 4-Way.....	£0.60

**Page 53**

XR26D	Multi-Core 6-Way.....	£0.65
XR27E	Multi-Core 9 Way.....	£0.86
XR28F	Multi-Core 15 Way.....	£1.25
XR46A	Multi-Core 25 Way.....	£1.74
XR54J	Multi-Core 36 Way.....	£2.31
BH30H	Scr Stretch-flex Black.....	£1.80
BH31J	Scr Stretch-flex Blue.....	£1.80
BH33L	Scr Stretch-flex Psychdic.....	DISC
BH34M	Scr Stretch-flex Red.....	£1.80
HQ49D	Twin Stretch-flex.....	£2.40
XR30H	Standard Co-Ax.....	£0.48
XR29G	Low Loss Co-Ax.....	£0.50
XR31J	Bal Feeder.....	£0.19
YR19V	Marker A0.....	£0.09
YR20W	Marker A1.....	£0.09
YR21X	Marker A2.....	£0.09
YR22Y	Marker A3.....	£0.09
YR23A	Marker A4.....	£0.09
YR24B	Marker A5.....	£0.09
YR25C	Marker A6.....	£0.09
YR26D	Marker A7.....	£0.09
YR27E	Marker A8.....	£0.09
YR28F	Marker A9.....	£0.09
YR29G	Marker B0.....	£0.10
YR30H	Marker B1.....	£0.10
YR31J	Marker B2.....	£0.10
YR32K	Marker B3.....	£0.10
YR33L	Marker B4.....	£0.10
YR34M	Marker B5.....	£0.10
YR35Q	Marker B6.....	£0.10
YR36P	Marker B7.....	£0.10
YR37S	Marker B8.....	£0.10
YR38R	Marker B9.....	£0.10
YR39N	Marker C0.....	£0.10
YR40T	Marker C1.....	£0.10
YR41U	Marker C2.....	£0.10
YR42V	Marker C3.....	£0.10
YR43W	Marker C4.....	£0.10
YR44X	Marker C5.....	£0.10
YR45Y	Marker C6.....	£0.10
YR46A	Marker C7.....	£0.10
YR47B	Marker C8.....	£0.10
YR48C	Marker C9.....	£0.10

**Page 54**

BF86T	Heat Shrink CP 16.....	£0.55
BF87U	Heat Shrink CP 24.....	£0.65
BF88V	Heat Shrink CP 32.....	£0.30
BF89W	Heat Shrink CP 48.....	£0.32
BF90X	Heat Shrink CP 64.....	£0.34
YR17T	Heat Shrink CP 95.....	£0.50
YR18U	Heat Shrink CP 127.....	£1.10
BL66W	Heat-Resist Sleeve Black.....	£0.12
BL69A	Heat-Resist Sleeve Green.....	£0.12
BL70M	Heat-Resist Sleeve Red.....	£0.12
BH00A	Systoflex 1 mm Black.....	£0.06
BH01B	Systoflex 1 mm Blue.....	£0.06
BH02C	Systoflex 1 mm Green.....	£0.06
BH03D	Systoflex 1 mm Red.....	£0.06
BH04E	Systoflex 1 mm White.....	£0.06
BH05F	Systoflex 1 mm Yellow.....	£0.06
BH06G	Systoflex 2 mm Black.....	£0.09
BH07H	Systoflex 2 mm Blue.....	£0.09
BH08J	Systoflex 2 mm Green.....	£0.09
BH09K	Systoflex 2 mm Red.....	£0.09
BH10L	Systoflex 2 mm White.....	£0.11
BH11M	Systoflex 2 mm Yellow.....	£0.09
BH12N	Systoflex 4 mm Black.....	£0.15
BH13P	Systoflex 4 mm Blue.....	£0.15
BH14Q	Systoflex 4 mm Green.....	£0.15
BH15R	Systoflex 4 mm Red.....	£0.15
BH16S	Systoflex 4 mm White.....	£0.15
BH17T	Systoflex 4 mm Yellow.....	£0.15
BH42V	Systoflex 6 mm Black.....	£0.17
BH43W	Systoflex 10 mm Black.....	£0.24
BL65V	Lacing Cord.....	£0.98
BL57M	Spirawrap 1/8 m.....	£0.18
BL58N	Spirawrap 1/4 m.....	£0.21
BL59P	Spirawrap 1/2 m.....	£0.46
BF91Y	Tie Wrap 92.....	£0.02
BF92A	Tie Wrap 140.....	£0.03
BF93B	Tie-Wrap 186.....	£0.03
BF94C	Cable Tie Base.....	£0.19
BH26D	Safix 4.....	£0.09
BH27E	Safix 8.....	£0.10
BH28F	Safix 12.....	£0.13

**Page 55**

LR44X	Cable P Clip 3/16.....	£0.03
-------	------------------------	-------

LR45Y	Cable P Clip 1/4.....	£0.03
LR46A	Cable P Clip 5/16.....	£0.03
LR04E	Cable Clip 3/8.....	£0.03
BH18U	Hiatt Rd 2 1/2 mm.....	£0.20
BH19V	Hiatt Rd 3 1/2 mm.....	£0.24
BH20W	Hiatt Rd 4 mm.....	£0.24
BH21X	Hiatt Rd 5 mm.....	£0.24
BH22Y	Hiatt Rd 6 mm.....	£0.25
BH23A	Hiatt Rd 7 mm.....	£0.28
BH24B	Hiatt Rd 8 mm.....	£0.28
BH36P	Hiatt Rd 9 mm.....	£0.37
BH25C	Hiatt Flat 4 mm.....	£0.20
BH37S	Hiatt Flat 5 mm.....	£0.23
BH38R	Hiatt Flat 7 mm.....	£0.27
BH39N	Hiatt Flat 9 mm.....	£0.32
BH40T	Hiatt Flat 10 mm.....	£0.32
BH41U	Hiatt Flat 14 mm.....	£0.38

**Page 59**

WX35Q	Ceramic 1.8.....	£0.06
WX36P	Ceramic 2.2.....	£0.06
WX37S	Ceramic 2.7.....	£0.06
WX38R	Ceramic 3.3.....	£0.06
WX39N	Ceramic 3.9.....	£0.06
WX40T	Ceramic 4.7.....	£0.06
WX41U	Ceramic 5.6.....	£0.06
WX42V	Ceramic 6.8.....	£0.06
WX43W	Ceramic 8.2.....	£0.06
WX44X	Ceramic 10.....	£0.06
WX45Y	Ceramic 12.....	£0.06
WX46A	Ceramic 15.....	£0.06
WX47B	Ceramic 18.....	£0.06
WX48C	Ceramic 22.....	£0.06
WX49D	Ceramic 27.....	£0.06
WX50E	Ceramic 33.....	£0.06
WX51F	Ceramic 39.....	£0.06
WX52G	Ceramic 47.....	£0.06
WX53H	Ceramic 56.....	£0.06
WX54J	Ceramic 68.....	£0.06
WX55K	Ceramic 82.....	£0.06
WX56L	Ceramic 100.....	£0.06
WX57M	Ceramic 120.....	£0.06
WX58N	Ceramic 150.....	£0.06
WX59P	Ceramic 180.....	£0.06
WX60Q	Ceramic 220.....	£0.06
WX61R	Ceramic 270.....	£0.06
WX62S	Ceramic 330.....	£0.06
WX63T	Ceramic 390.....	£0.06
WX64U	Ceramic 470.....	£0.06
WX65V	Ceramic 560.....	£0.06
WX66W	Ceramic 680.....	£0.06
WX67X	Ceramic 820.....	£0.06
WX68Y	Ceramic 1000.....	£0.06
WX69A	Ceramic 1200.....	£0.06
WX70M	Ceramic 1500.....	£0.06
WX71N	Ceramic 1800.....	£0.06
WX72P	Ceramic 2200.....	£0.06
WX73Q	Ceramic 2700.....	£0.06
WX74R	Ceramic 3300.....	£0.06
WX75S	Ceramic 3900.....	£0.06
WX76H	Ceramic 4700.....	£0.06
WX77J	Ceramic 10,000.....	£0.06
WX78K	Ceramic 22,000.....	£0.06
YY24B	Monocap 0.001µF.....	£0.19
YY25C	Monocap 0.0022µF.....	£0.20
YY07H	Monocap 0.0047µF.....	£0.20
YY08J	Monocap 0.01µF.....	£0.21
YY09K	Monocap 0.022µF.....	£0.25
YY10L	Monocap 0.047µF.....	£0.28
YY11M	Monocap 0.1µF.....	£0.36
YR73Q	Minidisc 0.01µF.....	£0.05
YR74R	Minidisc 0.047µF.....	£0.05
YR75S	Minidisc 0.1µF.....	£0.07
YR76H	Minidisc 0.47µF.....	£0.15
BX00A	Disc 0.01µF.....	£0.10
BX01B	Disc 0.022µF.....	£0.10
BX02C	Disc 0.047µF.....	£0.12
BX03D	Disc 0.1µF.....	£0.12

**Page 60**

BX05F	HV Disc 10.....	£0.14
BX06G	HV Disc 47.....	£0.19
BX07H	HV Disc 100.....	£0.22
BX10L	HV Disc 470.....	£0.11
BX12N	HV Disc 1000.....	£0.11
BX13P	HV Disc 2200.....	£0.11
BX14Q	HV Disc 4700.....	£0.22
BL15R	HV Disc 10,000.....	£0.19
HY18U	1000V Disc 4700pF.....	£0.18
BX16S	Feed Thro Cap.....	£0.08
WX00A	Mica 2.2pF.....	£0.27
WX01B	Mica 3.3pF.....	£0.27
WX02C	Mica 5pF.....	£0.27
WX03D	M.ca 10pF.....	£0.27
WX04E	Mica 18pF.....	£0.27
WX05F	Mica 22pF.....	£0.27
WX06G	Mica 27pF.....	£0.28
WX07H	M.ca 33pF.....	£0.28
WX08J	Mica 39pF.....	£0.28
WX09K	Mica 47pF.....	£0.28
WX10L	Mica 56pF.....	£0.28
WX11M	Mica 68pF.....	£0.28
WX12N	Mica 82pF.....	£0.28
WX13P	Mica 100pF.....	£0.28
WX14Q	Mica 120pF.....	£0.28
WX15R	Mica 150pF.....	£0.28
WX16S	Mica 180pF.....	£0.28

WX17T	Mica 220pF.....	£0.28
WX18U	Mica 270pF.....	£0.49
WX19V	Mica 330pF.....	£0.49
WX20W	Mica 390pF.....	£0.49
WX21X	Mica 470pF.....	£0.49
WX22Y	Mica 560pF.....	£0.49
WX23A	Mica 680pF.....	£0.51
WX24B	Mica 820pF.....	£0.51
WX25C	Mica 1000pF.....	£0.56
WX26D	Mica 1500pF.....	£0.65
WX27E	Mica 1800pF.....	£0.72
WX28F	Mica 2200pF.....	£0.79
WX29G	Mica 2700pF.....	£0.92
WX30H	Mica 3600pF.....	£0.96
WX3		

BX81C	Polyester 0.68µF.....	£0.27
BX82D	Polyester 1µF.....	£0.31
BX83E	Polyester 1.5µF.....	£0.56
BX84F	Polyester 2.2µF.....	£0.64

**Page 62**

WW15R	Mylar 0.001.....	£0.05
WW16S	Mylar 0.0022.....	£0.05
WW17T	Mylar 0.0047.....	£0.05
WW18U	Mylar 0.01.....	£0.06
WW19V	Mylar 0.022.....	£0.06
WW20W	Mylar 0.047.....	£0.08
WW21X	Mylar 0.1.....	£0.10
WW83E	Mylar 0.22.....	£0.16
FF53H	IS Cap 0.01µF.....	£0.22
FF54J	IS Cap 0.022µF.....	£0.23
FF55K	IS Cap 0.047µF.....	£0.23
FF56L	IS Cap 0.1µF.....	£0.32
FF57M	IS Cap 0.22µF.....	£0.45
FF58N	IS Cap 0.47µF.....	£0.78
BX22Y	Mix D 0.001µF 1500V.....	£0.25
BX42V	Mix D 0.0047µF 1000V.....	DISC
BX43W	Mix D 0.01 1000V.....	DISC
tBX44X	Mix D 0.022µF 1000V.....	£0.56
BX45Y	Mix D 0.047µF 1000V.....	DISC
BX67X	Mix D 0.1µF 600V.....	DISC
tBX68Y	Mix D 0.1µF 1000V.....	£0.65
BX69A	Mix D 0.22µF 1000V.....	DISC
BX90X	Mix D 0.47µF 1000V.....	DISC
BX91Y	Mix D 1.0µF 600V.....	DISC
WW54J	Tant 0.1µF 35V.....	£0.13
WW55K	Tant 0.15µF 35V.....	£0.13
WW56L	Tant 0.22µF 35V.....	£0.16
WW57M	Tant 0.33µF 35V.....	£0.18
WW58N	Tant 0.47µF 35V.....	£0.17
WW59P	Tant 0.68µF 35V.....	£0.17
WW60Q	Tant 1.0µF 35V.....	£0.18
WW61R	Tant 1.5µF 35V.....	£0.18
WW62S	Tant 2.2µF 35V.....	£0.23
WW63T	Tant 3.3µF 35V.....	£0.19
WW64U	Tant 4.7µF 16V.....	£0.21
WW65V	Tant 4.7µF 35V.....	£0.23
WW66W	Tant 6.8µF 16V.....	£0.21
WW67X	Tant 6.8µF 35V.....	£0.24
WW68Y	Tant 10µF 16V.....	£0.25
WW69A	Tant 10µF 25V.....	£0.28
WW70M	Tant 10µF 35V.....	£0.36
WW72P	Tant 22µF 16V.....	£0.39
WW73Q	Tant 22µF 25V.....	£0.65
WW74R	Tant 33µF 10V.....	£0.32
WW75S	Tant 47µF 10V.....	£0.57
WW76H	Tant 47µF 16V.....	£0.95
WW78K	Tant 100µF 3V.....	£0.35
WW79L	Tant 100µF 10V.....	£1.25
YY29G	Mini elect 0.1µF 50V.....	£0.13
YY30H	Mini elect 0.47µF 50V.....	£0.13
YY31J	Mini elect 1µF 50V.....	£0.15
YY32K	Mini elect 2.2µF 50V.....	£0.15
YY33L	Mini elect 4.7µF 25V.....	£0.21
YY34M	Mini elect 10µF 16V.....	£0.13
YY35Q	Mini elect 10µF 25V.....	£0.16
YY36P	Mini elect 22µF 16V.....	£0.18
YY37S	Mini elect 47µF 16V.....	£0.22

**Page 63**

FF00A	PC Elect 0.47µF 100V.....	£0.11
FF01B	PC Elect 1µF 100V.....	£0.11
FF02C	PC Elect 2.2µF 63V.....	£0.10
FF03D	PC Elect 4.7µF 63V.....	£0.10
FF04E	PC Elect 10µF 35V.....	£0.10
FF05F	PC Elect 10µF 63V.....	£0.11
FF06G	PC Elect 22µF 16V.....	£0.10
FF07H	PC Elect 22µF 63V.....	£0.12
FF08J	PC Elect 47µF 25V.....	£0.12
FF09K	PC Elect 47µF 63V.....	£0.14
FF10L	PC Elect 100µF 10V.....	£0.10
FF11M	PC Elect 100µF 25V.....	£0.12
FF12N	PC Elect 100µF 63V.....	£0.22
FF13P	PC Elect 220µF 16V.....	£0.12
FF14Q	PC Elect 220µF 63V.....	£0.33
FF15R	PC Elect 470µF 16V.....	£0.20
FF16S	PC Elect 470µF 25V.....	£0.25
FF59P	PC Elect 470µF 63V.....	£0.56
FF17T	PC Elect 1000µF 16V.....	£0.27
FF18U	PC Elect 1000µF 25V.....	£0.33
FF60Q	PC Elect 2200µF 16V.....	£0.42
FB11M	Axial 0.47µF 250V.....	£0.21
FB12N	Axial 1µF 63V.....	£0.08
FB13P	Axial 1µF 450V.....	£0.25
FB14Q	Axial 15µF 63V.....	£0.10
FB15R	Axial 2.2µF 63V.....	£0.10
FB16S	Axial 2.2µF 450V.....	£0.30
FB17T	Axial 3.3µF 63V.....	£0.10
FB18U	Axial 4.7µF 63V.....	£0.12
FB19V	Axial 4.7µF 450V.....	£0.33
FB20W	Axial 6.8µF 40V.....	£0.15
FB21X	Axial 6.8µF 63V.....	£0.16
FB22Y	Axial 10µF 25V.....	£0.09
FB23A	Axial 10µF 63V.....	£0.11
FB24B	Axial 10µF 100V.....	£0.18
FB25C	Axial 10µF 450V.....	£0.45
FB26D	Axial 15µF 16V.....	£0.09
FB27E	Axial 15µF 40V.....	£0.11
FB28F	Axial 15µF 63V.....	£0.16
FB29G	Axial 22µF 10V.....	£0.10
FB30H	Axial 22µF 25V.....	£0.11
FB31J	Axial 22µF 63V.....	£0.16
FB32K	Axial 22µF 100V.....	£0.24

FB33L	Axial 22µF 450V.....	£0.55
FB34M	Axial 33µF 6.3V.....	£0.10
FB35Q	Axial 33µF 16V.....	£0.11
FB36P	Axial 33µF 40V.....	£0.12
FB37S	Axial 47µF 4V.....	£0.14
FB38R	Axial 47µF 10V.....	£0.10
FB39N	Axial 47µF 25V.....	£0.13
FB40T	Axial 47µF 40V.....	£0.14
FB41U	Axial 47µF 63V.....	£0.17
FB42V	Axial 47µF 100V.....	£0.32
FB43W	Axial 47µF 450V.....	£0.85
FB44X	Axial 68µF 6.3V.....	£0.15
FB45Y	Axial 68µF 16V.....	£0.16
FB47B	Axial 100µF 6.3V.....	DISC
FB48C	Axial 100µF 10V.....	£0.11
FB49D	Axial 100µF 25V.....	£0.14
FB50E	Axial 100µF 40V.....	£0.18
FB51F	Axial 100µF 63V.....	£0.22
FB52G	Axial 100µF 100V.....	£0.52
FB53H	Axial 100µF 250V.....	£0.85
FB54J	Axial 150µF 6.3V.....	£0.18
FB55K	Axial 150µF 16V.....	£0.13
FB56L	Axial 150µF 25V.....	£0.15
FB58N	Axial 150µF 63V.....	£0.32
FB59P	Axial 220µF 6.3V.....	DISC
FB60Q	Axial 220µF 10V.....	£0.12
FB61R	Axial 220µF 16V.....	£0.14
FB62S	Axial 220µF 25V.....	£0.18
FB63T	Axial 220µF 40V.....	£0.27
FB64U	Axial 220µF 63V.....	£0.32
FB65V	Axial 220µF 100V.....	£0.55
FB66W	Axial 330µF 6.3V.....	DISC
FB67X	Axial 330µF 10V.....	£0.14
FB68Y	Axial 330µF 25V.....	£0.20
FB69A	Axial 330µF 63V.....	£0.44
FB70M	Axial 470µF 6.3V.....	£0.15
FB71N	Axial 470µF 10V.....	£0.22
FB72P	Axial 470µF 16V.....	£0.26
FB73Q	Axial 470µF 25V.....	£0.30
FB74R	Axial 470µF 63V.....	£0.55
FB75S	Axial 470µF 100V.....	£0.89
FB77J	Axial 680µF 16V.....	£0.30
FB78K	Axial 680µF 25V.....	£0.38
FB79L	Axial 680µF 40V.....	£0.68
FB80B	Axial 1000µF 6.3V.....	£0.29
FB81C	Axial 1000µF 10V.....	£0.25
FB82D	Axial 1000µF 16V.....	£0.32
FB83E	Axial 1000µF 25V.....	£0.40
FB84F	Axial 1000µF 63V.....	£1.00
FB85G	Axial 1500µF 6.3V.....	£0.32
FB86T	Axial 1500µF 10V.....	£0.38
FB87U	Axial 1500µF 16V.....	£0.42
FB89W	Axial 2200µF 10V.....	£0.40
FB90X	Axial 2200µF 25V.....	£0.57
FB91Y	Axial 2200µF 40V.....	£0.98
FB92A	Axial 2200µF 63V.....	£1.54
FB93B	Axial 3300µF 6.3V.....	£0.58
FB94C	Axial 3300µF 25V.....	£0.94
FB95D	Axial 4700µF 10V.....	£0.60
FB96E	Axial 4700µF 25V.....	£1.25

**Page 64**

FB97F	Reversolytic 1µF.....	£0.29
FB00A	Reversolytic 1.5µF.....	£0.32
FB01B	Reversolytic 2.2µF.....	£0.36
FB02C	Reversolytic 3.3µF.....	£0.42
FB03D	Reversolytic 4.7µF.....	£0.46
FB04E	Reversolytic 6.8µF.....	£0.54
FB06G	Reversolytic 10µF.....	£0.58
FB07H	Reversolytic 15µF.....	£0.66
FB08J	Reversolytic 22µF.....	£0.68
FB09K	Reversolytic 33µF.....	£0.70
FF19V	Can 1000µF 100V.....	£1.86
FF20W	Can 1500µF 63V.....	£1.95
FF21X	Can 2200µF 40V.....	£1.86
FF22Y	Can 2200µF 63V.....	£3.25
FF24B	Can 3300µF 40V.....	£2.15
FF25C	Can 3300µF 63V.....	£3.55
FF26D	Can 4700µF 25V.....	£1.45
FF27E	Can 4700µF 40V.....	£4.35
FF28F	Can 4700µF 63V.....	£3.85
FF29G	Can 4700µF 100V.....	£5.35
FF30H	Can 6800µF 40V.....	£4.55
FF31J	Can 10,000µF 25V.....	£4.95
FF32K	Can 10,000µF 63V.....	£5.45
FF33L	Clip Can 25.....	£0.15
FF34M	Clip Can 35.....	£0.19
FF35Q	Clip Can 40.....	£0.19
FF36P	Clip Can 50.....	£0.45
FF37S	Horiz Clip 25.....	£0.18
FF38R	Horiz Clip 35.....	£0.18
WL68Y	Trimmer 5.5pF.....	£0.30
WL69A	Trimmer 10pF.....	£0.30
WL70M	Trimmer 22pF.....	£0.26
WL72P	Trimmer 65pF.....	£0.29
WL71N	Trimmer 40pF.....	£0.19
WL73Q	Trimmer 500pF.....	£0.35
YQ24B	AM Varitone.....	£1.32

**Page 65**

FF39N	Vari 0.....	£4.45
FF40T	DG Vari.....	£6.35
FF41U	Twin 00.....	£5.60
FF42V	SW Trim 10pF.....	£4.45
FF43W	SW Trim 15pF.....	£4.45
FF44X	SW Trim 25pF.....	£4.80
FF45Y	SW Trim 50pF.....	£4.45
FF46A	SW Trim 60pF.....	£5.35

FF47B	SW Trim 75pF.....	£4.45
FF48C	SW Trim 100pF.....	£5.35
FF49D	SW Trim 150pF.....	£4.97
FF50E	Dilecon 300pF.....	£4.45
FF51F	Dilecon 500pF.....	£4.35
FY77J	FS Crystal 100 kHz.....	£4.55
HX62S	FS Crystal 1 MHz.....	£5.95
FY78K	FS Crystal 10 MHz.....	£2.95
FY79L	MP Crystal 1 MHz.....	£4.45
FY80M	MP Crystal 2 MHz.....	£3.55
FY81C	MP Crystal 2.4576 MHz.....	£3.35
FY82D	MP Crystal 4 MHz.....	£1.80
FY83E	MP Crystal 6.144 MHz.....	£2.45
FY84F	MP Crystal 18.432 MHz.....	£2.65
HX30H	MCR Crystal Brown Pairs.....	£2.96
HX31J	MCR Crystal Red Pair.....	£2.96
HX32K	MCR Crystal Orange Pair.....	£2.96
HX33L	MCR Crystal Yellow Pair.....	£2.96
HX34M	MCR Crystal Green Pair.....	£2.96
HX35Q	MCR Crystal Blue Pair.....	£2.96
FY85G	Colour TV Crystal.....	£1.20

**Page 66**

FY86T	Crystal 50 Hz X 2.16.....	£3.15
FY87U	Crystal 1 Hz X 2.22.....	£3.15
HX60Q	Crystal Socket 25µ.....	£0.23
HX61R	Crystal Socket 6µ.....	£0.45
HX99H	Ceramic Filter 10.7 MHz.....	£0.60

**CAR EQUIPMENT**

HW18U	Car Aerial Pull Up.....	£1.99
YB67X	Car Aerial Rod Top.....	£5.75
LH99H	Windscreen Aerial.....	£2.69
XX37S	Car Aerial Booster.....	£6.70
RW29G	Pluggpak R.....	£1.95
RW30H	Pluggpak S.....	£2.35
HW11M	Cigar Lighter.....	£2.65
YX75S	Accessory Socket.....	£1.55
HW12N	Car Accessory Plug.....	£0.45
YB68Y	Car Lighter Ext Lead.....	£2.25
YW59P	Car Power Lead.....	£2.70
FQ73Q	Map Light.....	£0.64

**Page 68**

HW22Y	12V Inspection Lamp.....	£1.60
FQ76H	Inspection Lamp L86.....	£2.60
WY10L	Front Fog Lamp.....	£11.55
LY07H	Fog Lamp.....	£5.65
LQ13P	Wiper Kit.....	£21.75
LY08J	Reversing Lamp.....	£4.55
LQ14Q	Washer Kit.....	£11.95
WY09K	Demister.....	£7.35
HQ30H	Wiper Control.....	£9.65
FQ78K	Car Ammeter.....	£4.45

**Page 69**

HQ35Q	Charger Ammeter.....	£1.35
HW16S	Car Flash 4 Lamp.....	£1.63
HW17T	Car Flash 6 Lamp.....	£1.55
FQ79L	Caravan Flasher.....	£6.30
FQ92A	7-Pin Trailer Plug.....	£2.35
FQ93B	7-Pin Trailer Socket.....	£2.98
XR55K	7-Core Trailer Cable.....	£1.15
FQ94C	Trailer Socket Bolts.....	£0.33
YB7CW	Trailer Lamp Cluster.....	£4.97
YB71N	Trailer Reflector.....	£1.45
FQ95D	Sign 50 mph.....	£0.29
FQ96E	Sign GB.....	£0.29
FQ88V	Plug Top Supp Strut.....	£0.42
FQ89W	Plug Top Supp Angle.....	£0.50
FQ90X	In-Line Plug Supp.....	£0.25

**Page 70**

HW01B	Supp Cap Small Lucar.....	£0.59
HW02C	Supp Cap Large Lucar.....	£0.69
HW03D	Supp Cap Spade.....	£0.59
FQ87U	Supp Cap 3µF.....	£1.12
FQ91Y	Suppressor Choke.....	£0.84
FQ77J	Jumper Leads.....	£4.40
YL02C	Magnifying Lamp.....	£0.95
FQ97F	Anti Glare Strip.....	£0.95
FQ98G	Luggage Elastic.....	£0.45
FQ99H	Ice Scraper.....	£0.28
YB72P	Tow Rope.....	£4.25
FY00A	Keep Clean Kit.....	DISC
YB94C	Plug Spanner.....	£1.75
FY01B	Tyre Pressure Gauge.....	£1.55
XY74R	Electric Pump.....	£18.79

**Page 71**

XB44X	Car Speakers Shelf.....	£6.75
XB42V	Car Speakers Door.....	£5.85
XY73Q	10W Shelf Speakers.....	£18.25
XQ75S	10W Car Stereo Speakers.....	£14.70
XQ76H	20W Air Suspen Speakers.....	£19.49
LY06G		

BW79L	Chro Stereo Jack Socket.....	£0.35
HF93B	Stereo Open Socket.....	£0.35
BW80B	DPDT Jack Socket.....	£0.48
HH19V	Line Jack Plastic.....	£0.24
HH20V	Scr Line Jack.....	£0.38
HH21X	Stereo Line Socket.....	£0.30
HH22Y	Scr Stereo Line Socket.....	£0.58
HH07H	Co-ax Plug Aly.....	£0.24
HH06G	Co ax Plug Plastic.....	£0.15
YW08J	Co-ax Plug Imp.....	£0.15
HH08J	Co-ax Socket Pan.....	£0.37
HH09K	Co-ax Socket Flush.....	£0.29
YW09K	Co-ax Line Socket.....	£0.43
HH11M	Co-ax Connector.....	£0.12
HH13P	Skeleton Car Plug.....	£0.14
HH12N	Car Plug Plastic.....	£0.49
HH14Q	Chassis Car Socket.....	£0.24
HH15R	Car Line Socket.....	DISC
HH16S	FM Aerial Plug.....	£0.17
HH17T	BNC Plug.....	£0.98
HH18U	BNC Socket.....	£0.98

**Page 77**

YW00A	BNC Square Socket.....	£0.85
YW01B	BNC Line Socket.....	£1.10
YW02C	BNC Straight Adaptor.....	£1.37
YW03D	BNC T Adaptor.....	£2.95
BW81C	Plug PL 259.....	£0.51
BW82D	UHF Reducer Small.....	£0.17
BW83E	UHF Reducer Large.....	£0.17
BW84F	UHF Socket Round.....	£0.49
BW85G	Socket S0239.....	£0.53
BW86T	UHF Elbow Adaptor.....	£1.32
BW87U	UHF Straight Adaptor.....	£0.59
BW88V	UHF T Adaptor.....	£1.55
YW04E	Adaptor 239.....	£1.12
YW05F	Adaptor 259.....	£1.40
YX51F	Audio Connector 2 way.....	£1.15
YX52G	Audio Connector 3 way.....	£1.35
YX53H	Audio Connector 4-way.....	£1.26
YX54J	Audio Connector 5-way.....	£1.55
YX55K	Audio Connector 6-way.....	£1.75
BW89W	XLR Line Plug.....	£1.82

**Page 78**

BW90X	XLR Chassis Socket.....	£2.62
BW91Y	XLR Line Socket.....	£2.15
BW92A	XLR Chassis Plug.....	£1.45
BW94C	DIN Latch 5-pin A Plug.....	£1.30
BW98G	DIN Latch Socket 5 pin A.....	£0.69
HH24B	DIN L/S Plug.....	£0.10
HH25C	DIN Plug 3-pin.....	£0.16
HH26D	DIN Plug 4-pin.....	£0.30
HH27E	DIN Plug 5 pin A.....	£0.15
HH28F	DIN Plug 5-pin B.....	£0.19
HH29G	DIN Plug 6-pin.....	£0.39
HH30H	DIN Plug 7-pin.....	£0.19
HH31J	DIN L/S Socket.....	£0.07
HH32K	DIN Socket 3-pin.....	£0.16
HH33L	DIN Socket 4 pin.....	£0.16
HH34M	DIN Socket 5-pin A.....	£0.14
HH35Q	DIN Socket 5-pin B.....	£0.18
HH36P	DIN Socket 6-pin.....	£0.21
HH37S	DIN Socket 7-pin.....	£0.19
HH40T	DIN Line Socket 2-pin.....	£0.15
HH41U	DIN Line Socket 3-pin.....	£0.16
HH42V	DIN Line Socket 4-pin.....	DISC
HH43W	DIN Line Socket 5-pin A.....	£0.16
HH44X	DIN Line Socket 5-pin B.....	£0.21
HH45Y	DIN Line Socket 6-pin.....	£0.20
HH46A	DIN Line Socket 7-pin.....	DISC
YX90X	PC DIN Socket 2-pin.....	£0.25
YX91Y	PC DIN Socket 5-pin A.....	£0.25

**Page 79**

YQ48C	D-Range 25-Way Plug.....	£2.15
YQ49D	D-Range 25-Way Socket.....	£2.35
YQ50E	D-Range 25-Way Cover.....	£2.25
YQ51F	D-Range Latch.....	£0.33
WQ14Q	PCB Connectors 45.....	£0.07
WQ15R	PCB Connectors Vertical.....	£0.07
WQ16S	PCB Connectors Horizontal.....	£0.07
FL83E	Edge Connector 108.....	£0.40
FL84F	Edge Connector 116.....	£0.76
FL85G	Edge Connector 124.....	£0.92
FL86T	Edge Connector 132.....	£1.95
FL87U	Edge Connector 140.....	£1.86
FL91Y	Edge Connector Feet 6.....	£0.15
FL92A	Edge Connector Feet H.....	£0.14
FL93B	Edge Connector Feet L.....	DISC
FL90H	Edge Connector Silver.....	£1.99
YR57M	Card Frame Edge Connector.....	£3.95
YR58N	Edge Connector End Bracket.....	£0.23

**Page 80**

HL01B	Octal Ch Plug.....	£0.75
HL00A	Octal Ch Socket.....	£0.50
HL02C	8 way Rug.....	£0.85
HL03D	8 way Socket.....	£0.90
HF35Q	Voltage Selector Socket.....	DISC
HF37S	Voltage Selector.....	£0.95
YX33L	Multicon Plug 2-way.....	£0.15
YX34M	Multicon Plug 4-way.....	£0.19
YX35Q	Multicon Plug 9-way.....	£0.29
YX36P	Multicon Plug 15-way.....	£0.43
YX37S	Multicon Plug 24-way.....	£0.58
YX38R	Multicon Plug 36-way.....	£0.78
YX39N	Multicon Socket 2-way.....	£0.18

YX40T	Multicon Socket 4-way.....	£0.19
YX41U	Multicon Socket 9-way.....	£0.27
YX42V	Multicon Socket 15-way.....	£0.45
YX43W	Multicon Socket 24-way.....	£0.59
YX44X	Multicon Socket 36-way.....	£0.68
YX45Y	Multicon Plug Round.....	£0.03
YX46A	Multicon Socket Pin.....	£0.03

**Page 81**

YW10L	Minicon Plug 3-pin.....	£0.20
YW11M	Minicon Plug 4-pin.....	£0.22
YW12N	Minicon Plug 6-pin.....	£0.29
YW13P	Minicon Plug 8-pin.....	£0.39
YW14Q	Minicon Plug 12-pin.....	£0.48
YW15R	RA Minicon Pl 3-pin.....	£0.31
YW16S	RA Minicon Pl 4-pin.....	£0.38
YW17T	RA Minicon Pl 6-pin.....	£0.47
YW18U	RA Minicon Pl 8-pin.....	£0.52
YW19V	RA Minicon R 12-pin.....	£0.74
YW20W	Minicon Housing 3-pin.....	£0.10
YW21X	Minicon Housing 4-pin.....	£0.10
YW22Y	Minicon Housing 6-pin.....	£0.12
YW23A	Minicon Housing 8-pin.....	£0.15
YW24B	Minicon Housing 12-pin.....	£0.17
YW25C	Minicon Terminal.....	£0.03
YW26D	Minicon Socket 3-way.....	£0.24
YW27E	Minicon Socket 4-way.....	£0.30
YW28F	Minicon Socket 6-way.....	£0.36
YW29G	Minicon Socket 8-way.....	£0.50
YW30H	Minicon Socket 12-way.....	£0.59
YW31J	Polar Connector 0.1 in.....	£0.06
YW95D	IDC Con 3 way.....	£0.20
YW96E	IDC Con 4 way.....	£0.26
YW97F	IDC Con 6 way.....	£0.38
YW98G	IDC Con 8 way.....	£0.50
YW99H	IDC Con 12-way.....	£0.88
YX49D	IDC Insertion Tool.....	£1.85
HL04E	Wafercon Plug 3-pin.....	£0.12
HL05F	Wafercon Plug 4-pin.....	£0.14
HL06G	Wafercon Plug 6-pin.....	£0.19
HL07H	Wafercon Plug 8-pin.....	£0.19
HL08J	Wafercon Plug 12-pin.....	£0.29

**Page 82**

HL09K	Wafercon Socket 3-way.....	£0.11
HL10L	Wafercon Socket 4-way.....	£0.10
HL11M	Wafercon Socket 6-way.....	£0.16
HL12N	Wafercon Socket 8-way.....	£0.17
HL13P	Wafercon Socket 12-way.....	£0.25
HL14Q	Wafercon Terminal.....	£0.03
YW32K	Polarcon 0.2 in.....	£0.06
YW40T	Compactboard.....	£13.50
YY22Y	CB Pin Blue.....	£0.37
YY23A	CB Pin Red.....	£0.37
YY26D	CB Pin White.....	£1.26
YY27E	AT Pin Black.....	£1.33
YR63T	CB Plug Extractor.....	£7.50
YB08J	Large Patch board.....	£111.00
WQ10L	Large Patch Plug.....	£0.37
HH39N	Multi-position Plug.....	£0.67
HH38R	Universal Plug.....	£0.85

**Page 83**

HH60Q	Std Power Plug 2.1.....	£0.14
HH61R	Long Power Plug 2.1.....	£0.16
HH62S	Std Power Plug 2.5.....	£0.15
HH63T	Long Power Plug 2.5.....	£0.14
HH85G	Power Socket 2.1.....	£0.20
HH86T	Power Socket 2.5.....	£0.22
HH87U	Cassette Socket Nivico.....	£0.39
HH88V	Cassette Socket Paros.....	£0.46
HL17T	USA Mains Plug.....	£0.20
HL18U	Flat Pin M/S.....	£0.27
HL19V	Flat Pin Connector.....	£0.31
RW56L	Cassette Lead Crown.....	£0.60
RW57M	Cassette Lead Hitachi.....	£0.60
RW58N	Cassette Lead Nat Pan.....	£0.60
RW59P	Cassette Lead Nivico.....	£0.60
RW60Q	Cassette Lead Otake-Orion.....	£0.60
RW61R	Cassette Lead Paros.....	£0.65
RW62S	Cassette Lead Philips.....	£0.75
RW63T	Cassette Lead Sanyo.....	£0.60
RW64U	Cassette Lead Sharp.....	£0.60

**Page 84**

RW65V	Cassette Lead Sony.....	£0.60
RW66W	Cassette Lead Telefunken.....	£0.65
YX62S	Cassette Lead OS219.....	£0.60
YX63T	Cassette Lead 955.....	£0.60
HL16S	Euro Socket.....	£0.75
HL15R	Euro Plug.....	£0.48
HL42V	Euro Facility Outlet.....	£1.55
HL43W	Euro Facility Plug.....	£0.75
BW99H	Euro Conn Lead.....	£1.75
WY16S	Euro Board 4 way.....	£7.35
WY17T	Euro Board 6 way.....	£10.75
HL20W	Mains Plug P429.....	£0.64
HL44X	Mains Socket P646.....	£1.39
HL23A	Mains Socket P430SE.....	£1.15
HL45Y	Mains Plug P649.....	£1.15
HL46A	Mains Socket P650.....	£0.98
HL47B	Mains Plug SA2403.....	£1.36
HL48C	Mains Socket SA2404.....	£0.79
HL27E	Mains Plug SA2190.....	£0.49

**Page 85**

HL28F	Mains Socket SA1862.....	£0.52
HL49D	Mains Socket SA2111.....	£1.75

HL30H	Mains Plug SA2019A.....	£1.48
HL31J	Mains Socket SA2020.....	£1.34
HL33L	Mains Plug SA2367.....	£1.55
HL34M	Mains Socket SA2368.....	£0.93
HL36P	Mains Plug P635.....	£1.05
HL37S	Mains Socket P636.....	£1.22
HL39N	Mains Plug P551.....	£2.97
HL40T	Mains Socket P552.....	£0.98
HL50E	Sleeve 8037.....	£0.12
HL51F	Boot 9455.....	£0.27
HL52G	Boot 8878.....	£0.38

**Page 86**

RW04E	Adaptor E.....	£0.45
RW01B	Adaptor B.....	£0.40
YV38R	Adaptor W.....	£0.59
YV39N	Adaptor X.....	£0.56
RW07H	Adaptor H.....	£0.38
RW030	Adaptor D.....	£0.40
RW11M	Adaptor M.....	£0.39
RW06G	Adaptor G.....	£0.46
RW08J	Adaptor J.....	£0.37
RW00A	Adaptor A.....	£0.42
YV34M	Adaptor S.....	£0.55
YV35Q	Adaptor T.....	£1.25
RW05F	Adaptor F.....	£0.40
RW09K	Adaptor K.....	£0.40
RW02C	Adaptor C.....	£0.45
YV37S	Adaptor V.....	£1.55
RW12N	Adaptor N.....	£0.39
YV33L	Adaptor R.....	£1.28
HL53H	Adaptor P.....	£1.30
YV36P	Adaptor U.....	£0.99
RW27E	Din Pak P.....	£0.60
RW26D	Din Pak N.....	£1.20
RW15Y	Din Pak 273.....	£1.25
RW44X	Din Pak 262.....	£0.75
RW47B	Din Pak 275.....	£0.95
RW25C	Din Pak M.....	£1.55
RWA6A	Din Pak 274.....	£1.50
RW48R	Din Pak B.....	£1.55
RW14Q	Din Pak A.....	£1.10
RW43W	Din Pak 254.....	£1.10
RW16S	Din Pak C.....	£1.10
RW22Y	Din Pak J.....	£0.69

**Page 87**

RW23A	Din Pak K.....	£0.65
RW24B	Din Pak L.....	£0.81
RW18U	Din Pak E.....	£0.82
RW19V	Din Pak F.....	£0.95
RW17T	Din Pak D.....	£1.42
RW20W	Din Pak G.....	£1.34
RW49D	Din Pak 280.....	£1.55
RW37S	Din Pak 205.....	DISC
RW48C	Plug Pak 279.....	£0.98
RW50E	Plug Pak 282.....	£0.89
RW51F	Plug Pak 283.....	£1.85
RW28F	Plug Pak Q.....	£0.65
RW31J	Plug Pak T.....	£2.25
RW32K	Plug Pak V.....	£1.35
RW34M	Plug Pak X.....	£2.48
RW35Q	Plug Pak HD Guitar.....	£2.45

**CONSUMER**

<b>Page 88</b>		
AF18U	Canon LC31.....	£6.95
AF19V	Canon LC52.....	£11.85
AF20W	Canon FC42.....	£13.95

**Page 89**

AF21X	Canon LC61T.....	£16.95
AF22Y	Canon P7D.....	DISC
YX88V	P7 Paper Roll.....	£0.46
YX89W	P7 Ink Cassette.....	£2.75

**Page 90**

AF02C	Atari 800 Computer.....	£645.00
-------	-------------------------	---------

**Page 91**

AF03D	Atari 400 8K Computer.....	DISC
AF28F	Recorder 410.....	£50.00
AF04E	Printer 822.....	£265.00

**Page 92**

AF06G	Disc Drive 810.....	£345.00
YX87U	Mini Floppy Disc.....	£2.75
AF29G	Interface 850.....	£135.00
AF07H	8K Memory Module.....	NYA
AF08J	16K Memory Module.....	£64.00
AF05F	Printer 825.....	NYA
AF30H	Modem 830.....	NYA
AC38R	See YG48C.....	See
AC39N	See YG63T.....	note
AC40T	See YG66W.....	below

**Page 93**

WF20W	Mag Headset.....	£4.85
LH81C	Education Headphone.....	£5.75
LH82D	Boom Mic Headphone.....	£12.35
LH83E	Stereophone OH150P.....	£4.25
WF13P	Stereophone HP110C.....	£5.40
WF14Q	Stereophone DH207.....	£7.99
LH84F	Stereophone M110B.....	£8.60
LH85G	Stereophone HS310.....	£12.50

**Page 94**

WF19V	Stereophone Elec 100.....	DISC
-------	---------------------------	------

LB13P	Headphone Adaptor.....	£3.95
LB72P	Intercom 2-Station.....	£8.75
XY78K	FM Intercom Pair.....	DISC
XY77J	4-Channel FM Intercom.....	£29.95

**Page 95**

WY11M	Compact PA Amp.....	£21.50
WY12N	10W PA Amp.....	£29.95
XY81C	40W PA Amp.....	£65.50
XY82D	60W PA Amp.....	£106.75

**Page 96**

AF09K	AM Radio.....	£1.95
AF10L	AM/FM Radio.....	£4.95
AF11M	AM/FM/Air Radio.....	£12.95
AF		

HL80B	Cooker Outlet C.....	£2.10
H181C	Cooker Outlet T.....	£3.20
HL82D	Flex Outlet Unswitched.....	£3.75
HL83E	Switched Flex Outlet.....	£4.25
HL84F	Clock Connector S.....	DISC
HL85G	Clock Connector B.....	£4.75
HL86T	Blanking Plate.....	£0.85
HL87U	20A Plate Switch.....	£3.20
HL88V	20A Water Heater Switch.....	£4.85
HL89W	Light Switch ST Single.....	£1.08
HL90X	Light Switch DT Single.....	£1.49
HL91Y	Light Switch Dual.....	£2.25
HL92A	Light Switch Triple.....	£2.95
HL93B	Light Switch Quad.....	DISC

**Page 107**

FQ10L	250W Rotary Dimmer.....	£7.30
FQ12N	250W Push Dimmer Single.....	£9.95
FQ13P	250W Push Dimmer Double.....	£19.49
FQ14Q	250W Touch Dimmer.....	£15.95
XX35Q	Remote Control Dimmer.....	£29.45
XX36P	Dimmer Control Box.....	£15.75
FQ15R	Security Dimmer.....	£14.95
FQ16S	Auto Security Switch.....	£13.25
YB09K	Fi Pattress 16 mm Single.....	£0.70
YB10L	Fi Pattress 25 mm Single.....	£0.70
YB11M	Fi Pattress 25 mm Double.....	£1.06
YB12N	Fi Pattress 35 mm Double.....	£1.25
YB13P	Steel Pattress 47 mm.....	£2.55
YB14Q	Sur Pattress 20 mm Single.....	£0.78
YB15R	Sur Pattress 29 mm Single.....	£0.92
YB16S	Sur Pattress 29 mm Double.....	£1.65
YB17T	Sur Pattress 47 mm Double.....	£2.75
YB18U	Conversion Pattress.....	£2.50

**Page 108**

FQ00A	Ceiling Switch 1-way.....	£2.65
FQ01B	Ceiling Switch 2-way.....	DISC
FQ02C	Lampholder 702.....	£0.75
FQ03D	Lampholder 254 CG.....	DISC
FQ04E	Lampholder 252 1/2.....	£0.65
LB63T	Bayonet Lampholder.....	£0.88
FQ05F	Ceiling Rose.....	£1.20
FQ06G	BC Adaptor.....	DISC
FQ07H	Starter 80W.....	£0.25
YB19V	Time Switch.....	£16.95
RW69A	Power Controller.....	£20.95
YB20W	Room Thermostat.....	£8.25
XY08J	Extn Lead 5A.....	£13.80
XY09K	Extn Lead 13A.....	£17.95

**HARDWARE**

**Page 109**

BF00A	Bolt 2BA 1/2 in.....	£0.33
BF01B	Bolt 2BA 1 in.....	£0.85
BF02C	Bolt 4BA 1/2 in.....	£0.25
BF03D	Bolt 4BA 1/2 in.....	£0.28
BF04E	Bolt 4BA 1 in.....	£0.30
LR52G	Bolt 4BA 1 1/2 in.....	£0.33
BF05F	Bolt 6BA 1/2 in.....	£0.12
BF06G	Bolt 6BA 1/2 in.....	£0.14
BF07H	Bolt 6BA 1 in.....	£0.38
LR53H	Bolt 6BA 1 1/2 in.....	£0.63
BF08J	Bolt 8BA 1/2 in.....	£0.28
BF09K	Bolt 8BA 1/2 in.....	£0.24
LR54J	C/S Screw 2BA 1/2 in.....	£0.14
LR55K	C/S Screw 4BA 1/2 in.....	£0.14
BF10L	C/S Screw 4BA 1/2 in.....	£0.17
BF11M	C/S Screw 4BA 1 in.....	£0.32
LR56L	C/S Screw 6BA 1/2 in.....	£0.09
BF12N	C/S Screw 6BA 1/2 in.....	£0.19
BF13P	C/S Screw 6BA 1 in.....	£0.35
LR00A	C/S Screw 8BA 1/2 in.....	£0.29
BF14Q	Panel Screw.....	£0.03
LR75S	C/S Panel Screw.....	£0.05
BF16S	Nut 2BA.....	£0.19
BF17T	Nut 4BA.....	£0.19
BF18U	Nut 6BA.....	£0.12
BF19V	Nut 8BA.....	£0.12
BF20W	Washer 2BA.....	£0.12
BF21X	Washer 4BA.....	£0.09
BF22Y	Washer 6BA.....	£0.09
BF23A	Washer 8BA.....	£0.09
LR76H	Cup Washer.....	£0.02
BF24B	Shake 2BA.....	£0.09
BF25C	Shake 4BA.....	£0.09
BF26D	Shake 6BA.....	£0.09
LR01B	Shake 8BA.....	£0.08
BF27E	Tag 2BA.....	£0.12
BF28F	Tag 4BA.....	£0.09
BF29G	Tag 6BA.....	£0.13
LR02C	Tag 8BA.....	£0.11
BF30H	Pozi Screw M5 6 mm.....	£0.23
BF31J	Pozi Screw M5 12 mm.....	£0.33
BF32K	Pozi Screw M5 25 mm.....	£0.33
BF33L	Pozi Screw M4 6 mm.....	£0.25
BF34M	Pozi Screw M4 12 mm.....	£0.32
BF35Q	Pozi Screw M4 25 mm.....	£0.27
BF36P	Pozi Screw M3 6 mm.....	£0.13
LR57M	Pozi Screw M3 9 mm.....	£0.13
BF37S	Pozi Screw M3 12 mm.....	£0.15
BF38R	Pozi Screw M3 25 mm.....	£0.27
LR58N	Pozi Screw M3 40 mm.....	£0.33
BF39N	Pozi Screw M2.5 6 mm.....	£0.15
BF40T	Pozi Screw M2.5 12 mm.....	£0.18
BF41U	Pozi Screw M2 6 mm.....	£0.29
BF46A	Isobolt M5 12 mm.....	£0.55
BF48C	Isobolt M4 6 mm.....	£0.26

BF49D	Isobolt M4 12 mm.....	£0.33
BF50E	Isobolt M4 25 mm.....	£0.57
BF51F	Isobolt M3 6 mm.....	£0.20
BF52G	Isobolt M3 12 mm.....	£0.26
BF53H	Isobolt M3 25 mm.....	£0.35
BF54J	Isobolt M2.5 6 mm.....	£0.19
BF55K	Isobolt M2.5 12 mm.....	£0.24
BF56L	Isonut M5.....	£0.20
BF57M	Isonut M4.....	£0.20
BF58N	Isonut M3.....	£0.15
BF59P	Isonut M2 5.....	£0.14
LR59P	Isonut M2.....	£0.10
BF60Q	Isonut M5.....	£0.15
BF61R	Isonut M4.....	£0.09
BF62S	Isonut M3.....	£0.09
BF63T	Isonut M2.5.....	£0.09
LR60Q	Isonut M2.....	£0.07
BF62V	Isonut M5.....	£0.12
BF43W	Isonut M4.....	£0.09
BF44X	Isonut M3.....	£0.09
BF45Y	Isonut M2.5.....	£0.09
LR61R	Isonut M2.....	£0.09

**Page 110**

LR62S	Isotag M5.....	£0.18
LR63T	Isotag M4.....	£0.20
LR64U	Isotag M3.....	£0.12
LR65V	Isotag M2 5.....	£0.12
LR66W	Isotag M2.....	£0.08
BF68Y	Self Tapper No 8 x 3/8 in.....	£0.22
BF69A	Self Tapper No 8 x 1/2 in.....	£0.25
LR67X	Self Tapper No 6 x 3/8 in.....	£0.20
BF67Z	Self Tapper No 6 x 1/2 in.....	£0.22
BF65V	Self Tapper No 4 x 3/8 in.....	£0.15
BF66W	Self Tapper No 4 x 1/2 in.....	£0.16
BF64U	Self Tapper No 2 x 3/16 in.....	£0.12
LR68Y	Self Tapper No 2 x 3/8 in.....	£0.14
BF70M	Nylon 2BA 1/2 in.....	£0.86
BF71N	Nylon 2BA 1 in.....	£0.95
BF72P	Nylon 4BA 1/2 in.....	£0.39
BF73Q	Nylon 4BA 1 in.....	£0.55
BF74R	Nylon 4BA 1 1/2 in.....	£1.55
BF75S	Nylon 6BA 1/2 in.....	£0.50
BF76H	Nylon 6BA 1 in.....	£0.60
BF77J	Nylon 8BA 1/2 in.....	£0.60
BF78K	Nylon Nut 2BA.....	£0.55
BF79L	Nylon Nut 4BA.....	£0.55
BF80B	Nylon Nut 6BA.....	£0.53
BF81C	Nylon Nut 8BA.....	£0.55
BF82D	Nylon Washer 2BA.....	£0.18
BF83E	Nylon Washer 4BA.....	£0.18
BF84F	Nylon Washer 6BA.....	£0.18
BF85G	Nylon Washer 8BA.....	£0.26
WH18U	Nylon C/S Screw M3 x 12 mm.....	£0.38
WH19V	Nylon Nut M3.....	£0.34
BF15R	Spring Clip.....	£0.04
YW94C	Batten Clip.....	£0.04
LB99H	Black Woodscrew No 4 1/2 in.....	£0.15
BH44X	Plastic Fixing.....	£0.12
YL23A	Hand Wheel Bolt.....	£0.35
FW10L	Spade 2BA.....	£0.26
FW11M	Spade 4BA.....	£0.23
FW13P	Studding 2BA.....	£0.32
FW14Q	Studding 4BA.....	£0.30
FW15R	Studding 6BA.....	£0.30
FW30H	4BA Spacer 1/8 in.....	£0.35
FW31J	4BA Spacer 1/4 in.....	£0.48
FW32K	4BA Spacer 1/2 in.....	£0.48
FW33L	6BA Spacer 1/8 in.....	£0.32
FW34M	6BA Spacer 1/4 in.....	£0.35
FW35Q	6BA Spacer 1/2 in.....	£0.49
LR69A	8BA Spacer 1/8 in.....	£0.28
LR70M	8BA Spacer 1/4 in.....	£0.32
LR71N	Threaded Spacer 4BA.....	£0.78
LR72P	Threaded Spacer 6BA.....	£0.59

**Page 111**

FW16S	Standoff Short.....	£0.05
FW17T	Standoff Medium.....	£0.06
FW18U	Standoff Long.....	£0.07
LR03D	Terry Clip 1/2 in.....	£0.10
LR73Q	Terry Clip 1 1/2 in.....	£0.26
FW59P	Grommet Small.....	£0.02
FW60Q	Grommet Large.....	£0.02
LR47B	SR Grommet 3P 4.....	£0.06
LR48C	SR Grommet 5M-3.....	£0.07
LR49D	SR Grommet 6W 1.....	£0.10
LR50E	SR Grommet 7K 2.....	£0.26
LR51F	Sealing Grommet.....	£0.08
BL74R	Flexigrommet A.....	£0.24
BL75S	Flexigrommet B.....	£0.29
BL76H	Flexigrommet C.....	£0.31
FW36P	Hole Plug 1/4 in.....	£0.05
FW37S	Hole Plug 3/8 in.....	£0.07
H822Y	Quickstick Pads.....	£0.09
H821X	Velcromounts.....	£0.12
LQ12N	Sealing Strip.....	£0.79

**Page 112**

LH12N	Aly Sheet 18 swg.....	£1.59
LH13P	Aly Sheet 16 swg.....	£3.85
LW21X	Mixer Trim 4.....	DISC
LW22Y	Mixer Trim 8.....	DISC
LW23A	Mixer Trim 12.....	DISC
LW24B	Mixer Trim 16.....	DISC
LW17T	Mixer Mounting Tube 4.....	£1.10
LW18U	Mixer Mounting Tube 8.....	£1.65
LW19V	Mixer Mounting Tube 12.....	DISC

LW20W	Mixer Mounting Tube 16.....	DISC
WH48C	Mains Warning Label.....	£0.15
XX31J	PCB Guides.....	£0.25
XH39N	Transfer 1/8 in Black.....	£1.35
XH40T	Transfer 1/8 in Red.....	£1.56
XH41U	Transfer 1/8 in White.....	£1.56
XH42V	Transfer 1/4 in Black.....	£1.56
XH43W	Transfer 1/4 in Red.....	£1.35
XH44X	Transfer 1/4 in White.....	£1.35
XH45Y	Panel Transfer Black.....	£1.56
XH46A	Panel Transfer Red.....	£1.56
XH47B	Panel Transfer White.....	£1.35

**KNOBS**

**Page 113**

RW75S	Knob BK12.....	£0.16
RW77J	Knob PN20.....	DISC
RX99H	Knob RN92.....	£0.25
RW87U	Knob KB4.....	£0.22
RW86T	Knob KB3.....	£0.45
RX09K	Knob R78.....	£0.58
HB23A	Knob K1.....	£0.29
HB24B	Knob K2.....	£0.37
HB19V	Knob RK401.....	£0.95
HB57M	Knob RK403.....	£1.55
RW88V	Knob MI.....	£0.38
RW89W	Knob M2.....	£0.30
RW90X	Knob M3.....	£0.26
RX00A	Knob M4.....	£0.45
RX10L	Knob R81.....	£0.45
RX11M	Knob 82.....	£0.55

**Page 114**

RW78K	Knob F10.....	£0.33
HB26D	Knob F11.....	£0.31
RX01B	Knob NK2.....	£0.45
RX02C	Knob PK2.....	£0.45
YX01B	Knob K7A.....	£0.24
YX02C	Knob K7B.....	£0.27
YX03D	Knob K7C.....	£0.32
YX04E	Knob K7D.....	£0.49
HB28F	Knob R51.....	£0.52
HB29G	Knob R52.....	£0.53
RX07H	Knob R76.....	£0.55
RX08J	Knob R77.....	£0.64
HB30H	Knob R53.....	£0.69
HB31J	Knob R54.....	£0.96
YR64U	Knob K8A.....	£0.43
YR65V	Knob K8B.....	£0.56
YR66W	Knob K8C.....	£0.64
HB34M	Knob K105L.....	£0.95
HB35Q	Knob K106L.....	£1.74
HB32K	Knob K105.....	£0.59
HB33L	Knob K106.....	£0.95
HB36P	Knob K15.....	£0.55
HB37S	Knob K24.....	£0.75
HB38R	Knob K30.....	£0.72
HB39N	Knob K44.....	£0.69
HB40T	Knob K45.....	£0.79
HB41U	Knob K46.....	£1.15

**Page 115**

RX16S	Collet Knob Black.....	£0.38
RX17T	Collet Knob Grey.....	£0.43
WL45Y	15 mm Collet Cap Black.....	£0.05
WL46A	15 mm Collet Cap Blue.....	£0.05
WL47B	15 mm Collet Cap Green.....	£0.05
WL48C	15 mm Collet Cap Grey.....	£0.05
WL49D	15 mm Collet Cap Red.....	£0.05
WL50E	15 mm Collet Cap Yellow.....	£0.05
WL51F	15 mm Collet Pointer Black.....	£0.05
WL52G	15 mm Collet Pointer Blue.....	£0.05
WL53H	15 mm Collet Pointer Green.....	£0.05
WL54J	15 mm Collet Pointer Grey.....	£0.05
WL55K	15 mm Collet Pointer Red.....	£0.05
WL56L	15 mm Collet Pointer Yellow.....	£0.05
RX18U	15 mm Collet Nut Cover.....	£0.12
RX19V	15 mm Collet Indicator.....	£0.16
RX20W	15 mm Collet Skirt.....	£0.19
RX21X	15 mm Collet Stator.....	£0.17
WL43W	Collet Rd Nut 3/8 in.....	£0.16
WL44X	Collet Rd Nut 10 mm.....	£0.16
RX22Y	Slide Knob A.....	£0.15
YG09K	Slide Knob B.....	£0.19
YG10L	Slide Knob C Black.....	£0.20
YG11M	Slide Knob C Chrome.....	£0.29
RX24B	Slide Knob F Black.....	£0.17
RX25C	Slide Knob F Blue.....	£0.17
RX26D	Slide Knob F Green.....	£0.17
RX27E	Slide Knob F Grey.....	£0.17
RX28F	Slide Knob F Red.....	£0.17
RX29G	Spindle Coupler.....	£0.49
RX30H	Ext Spindle.....	£0.69
RX38R	Nylon Rod.....	£0.14
RX45Y	Cord Drive Brass.....	£0.89
RX46A	Cord Drive Steel.....	£1.39

**Page 116**

RX31J	Brass Bush.....	£0.53
8L73Q	Drive Cord.....	£0.07
RX43W	Cord Drum Small.....	£1.05
RX94C	Cord Drum Large.....	£1.05
RX44X	Flywheel.....	£2.75
RX39N	Vernier Dial Small.....	£2.05
RX40T	Vernier Dial Medium.....	£2.95
RX41U	Vernier Dial Large.....	MAY 82
RX42V	Ball Drive.....	£2.35
HB42V	Min Ball Drive.....	£1.95

HB43W	DR Drive Scale.....	£9.75
HB45Y	Aluminium Dial.....	£4.75
HL46A	White Pointer.....	£0.35
HB47B	Ball Drive Pointer.....	£0.55
HB48C	Spring Short.....	£0.09
HL49D	Spring Medium.....	£0.09
HB50E	Spring Long.....	£0.09
RX95D	Pulley 1/2 in.....	£0.14

**MICROPHONES**

**Page 117**

FF69A	Fluted Lampholder Red.....	£0.30
YY00A	LES Cover Amber.....	£0.06
YY01B	LES Cover Blue.....	£0.06
YY02C	LES Cover Green.....	£0.06
YY03D	LES Cover Purple.....	£0.06
YY04E	LES Cover Red.....	£0.06
YY05F	LES Cover White.....	£0.06
YY06G	LES Cover Yellow.....	£0.06
RX82D	Pan Neon Amber.....	£0.75
RX83E	Pan Neon Red.....	£0.75
RX81C	Square Neon Red.....	£0.33
RX98G	Square Neon Green.....	£0.33
RX70M	Wire Neon.....	£0.14
WQ13P	Wire Bulb 12V.....	£0.30
WL74R	LES Bulb 6V.....	£0.17
WL75S	LES Bulb 12V.....	£0.15
RX84F	Neon Bulb.....	£0.99

**Page 126**

WL76H	Bulb MES 3.5V.....	£0.35
WL77J	Bulb MES 6V 0.24W.....	£0.36
WL78K	Bulb MES 6V 6W.....	£0.31
WL79L	Bulb MES 6.5V.....	£0.25
WL80B	Bulb MES 12V 1.2W.....	£0.28
WL81C	Bulb MES 12V 2.2W.....	£0.29
WL82D	Bulb MES 24V.....	£0.36
LQ10L	Portable Lamp.....	£6.95
XY71N	Caravan Lamp.....	£9.65
LQ11M	12V Tube.....	£1.38
LL15R	240V Inspection Lamp.....	£5.60
XQ15R	Bulkhead.....	£4.35
XR64U	Festoon Cable.....	DISC
YW45Y	Festoon Lampholder.....	DISC
HB52G	Pygmy Bulb Blue.....	£0.90
HB53H	Pygmy Bulb Green.....	£0.90
HB54J	Pygmy Bulb Red.....	£0.90
HB55K	Pygmy Bulb White.....	£0.70
HB56L	Pygmy Bulb Yellow.....	£0.90
XY25C	Stay Put Lamp.....	DISC
YB29G	Spot Holder.....	£3.85

**Page 127**

XY00A	3-Bank Lampholder.....	£13.95
XB31J	BC Clip-On Holder Single.....	£4.99
XB32K	BC Clip-On Holder Twin.....	£6.95
WF25C	Spot Lamp Amber.....	£2.85
WF26D	Spot Lamp Blue.....	£2.85
WF27E	Spot Lamp Clear.....	£2.35
WF28F	Spot Lamp Green.....	£2.85
WF29G	Spot Lamp Red.....	£2.85
WF30H	Spot Lamp Violet.....	£2.85
WF22Y	Gooseneck Lamp.....	£5.32
WL32K	Mini LED Red.....	£0.10
WL33L	Mini LED Green.....	£0.19
WL34M	Mini LED Orange.....	£0.27
YY38R	Mini LED Yellow.....	£0.19
YY39N	Mini LED Clip.....	£0.02
WL27E	LED Red.....	£0.12
WL28F	LED Green.....	£0.19
WL29G	LED Orange.....	£0.33
WL30H	LED Yellow.....	£0.17
YY40T	LED Clip.....	£0.02
QW96E	Square LED Red.....	£0.36
YH60Q	Square LED Green.....	£0.36
YH61R	Square LED Yellow.....	£0.40
YH62S	Square LED Clip.....	£0.07
YY41U	Large LED Red.....	£1.49
YY42V	Large LED Clip.....	£0.21

**Page 128**

YY45Y	Shape LED R1 Red.....	£0.20
YY46A	Shape LED R1 Green.....	£0.25
YY47B	Shape LED R1 Orange.....	£0.37
YY48C	Shape LED R1 Yellow.....	£0.27
YY49D	Shape LED S2 Red.....	£0.20
YY50E	Shape LED S2 Green.....	£0.27
YY51F	Shape LED L3 Red.....	£0.21
YY52G	Shape LED L3 Green.....	£0.26
YY53H	Shape LED L3 Yellow.....	£0.26
YY54J	Shape LED T4 Red.....	£0.22
YY55K	Shape LED T4 Green.....	£0.26
YY56L	Shape LED T4 Yellow.....	£0.26
YY57M	Shape LED A5 Red.....	£0.23
YY58N	Shape LED A5 Green.....	£0.27
YY43W	Illuminator Orange.....	JULY 82
YY44X	Illuminator Yellow.....	JULY 82
YH53H	Cliplite Amber.....	£0.16
YH54J	Cliplite Clear.....	£0.16
YH55K	Cliplite Green.....	£0.16
YH56L	Cliplite Red.....	£0.16
YH57M	Cliplite Yellow.....	£0.16
YY61R	Multicolour LED.....	£0.59
YY59P	Chrome LED Small.....	£0.52
YY60Q	Chrome LED Large.....	£0.54
YG65V	Red Bargraph Display.....	£3.25
YG33L	Green Bargraph Display.....	£2.95
YG34M	Orange Bargraph Display.....	£2.95
YG35Q	Yellow Bargraph Display.....	£3.35

**Page 129**

FR36P	7 Seg Red Type 1.....	£1.07
FR37S	7 Seg Red Type 3.....	DISC
FR38R	7 Seg Red Type 4.....	£1.25
FR39N	½ in Display Type 1.....	£0.99
FR40T	½ in Display Type 3.....	£1.98
FR41U	½ in Display Type 4.....	£1.07
BY66W	DD Display Type A.....	£1.98
BY67X	DD Display Type AF.....	£0.50

BY68Y	DD Display Type C.....	£1.98
-------	------------------------	-------

**Page 130**

XX08J	4-Dig Display Cmn Cath.....	£2.69
BY70M	4 Dig Display Cmn Anode.....	£1.50
HQ36P	Mult Common Cath Display.....	£3.45
FR32K	Filter Amber.....	£0.85
FR33L	Filter Green.....	£1.20
FR34M	Filter Red.....	£0.85
FR35Q	Filter Yellow.....	£0.85
FY89W	Liquid Crystal Display.....	£5.50

**Page 131**

WL35Q	Opto-isolator.....	£0.69
YY62S	Dual Opto-Isolator.....	£1.31
YY63T	Quad Opto-Isolator.....	£2.86
WQ70M	Darlington Isolator.....	£1.52
YY64U	SCR Isolator.....	£2.12
QQ10L	Triac Isolator.....	£1.55

**Page 132**

YH70M	IR Emitter TIL38.....	£0.49
YH71N	Photodiode TIL100.....	£0.89
YY65V	Infra Red Source.....	£0.38
YY66W	Infra-Red Sensor.....	£0.31
BL23A	MS4A.....	£2.95
QF30H	BPX25.....	£1.98

**Page 133**

HQ61R	MEL 12.....	£0.38
YQ62S	Xenon Tube.....	£2.40
YQ63T	Trigger Transformer.....	£0.49
XR56L	1 mm Light Guide.....	£0.67
XL11M	Laser Tube.....	£124.00
HY19V	5KV Laser PCB.....	£4.50
HQ63T	Lens.....	£2.15
HQ64U	Lens Holder.....	£0.69

**ORGAN PARTS**

<b>Page 134</b>		
QL02C	SAM 77.....	£1.20

**Page 135**

XB10L	DM02.....	£14.82
XB11M	DM02T.....	£16.82

**Page 136**

XL08J	Short Spring Line.....	£5.53
XB84F	Long Spring Line.....	£11.13
XB85G	MES Driver Module.....	£6.95
YL17T	Reverb PSU Module.....	£4.73
XB17T	Mid Keyboard 49 Note C-C.....	£20.87
XB13P	KB Mounting Strip.....	£0.39

**Page 137**

XB14Q	Keyboard 48-Note.....	£23.94
XB15R	Keyboard 49 Note.....	£23.95
XB16S	Keyboard 61 Note.....	£28.95
XB94C	Contact Block 1WG.....	£0.25
X801B	Contact Block GJ.....	£0.37
X802C	Contact Block GB2.....	£0.67
XB03D	Contact Block GC3.....	£0.63
XB04E	Earth Bar.....	£0.23
XB00A	Gold Wire.....	£1.10
XB86T	Space-sound Mid Range.....	£52.66

**Page 138**

XB87U	Rotating Horns Unit.....	£79.30
FL66W	Stop Tab Black.....	£0.75
FL67X	Stop Tab Blue.....	£0.75
FL68Y	Stop Tab Green.....	£0.75
FL69A	Stop Tab Grey.....	£0.75
FL70M	Stop Tab Ivory.....	£0.75
FL71N	Stop Tab Maroon.....	£0.75
FL72P	Stop Tab Orange.....	£0.75
FL73Q	Stop Tab Red.....	£0.75
FL74R	Stop Tab White.....	£0.75
FL75S	Stop Tab Yellow.....	£0.75
BR05F	S Tab Acc Del Tremolo.....	£1.10
8R47B	S Tab Bass Guitar.....	£1.10
BR67X	S Tab Bourdon 8.....	£1.10
BR06G	S Tab Cello 16'.....	£1.10
BR07H	S Tab Clarinet 8'.....	£1.10
BR08J	S Tab Clarion 4'.....	£1.10
BY00A	S Tab Clavichord.....	£1.10
BY01B	S Tab D/B to Rotor.....	£1.10
BY02C	S Tab Delay Vibrato Acc.....	£1.10
BY03D	S Tab Delay Vibrato Solo.....	£1.10
BR09K	S Tab Diapason 8'.....	£1.10
8R68Y	S Tab Diapason 16'.....	£1.10
BR10L	S Tab Drawbars Acc.....	£1.10
BR11M	S Tab Drawbars Solo.....	£1.10
BR12N	S Tab Duiciana 8'.....	£1.10
BR13P	S Tab Flute IV.....	£1.10
BR14Q	S Tab Flute 2'.....	£1.10
BR15R	S Tab Flute 2 2/3'.....	£1.10
BR16S	S Tab Flute 4'.....	£1.10
BR17T	S Tab Flute 5 1/3'.....	£1.10
BR18U	S Tab Flute 8'.....	£1.10
BR19V	S Tab Flute 16'.....	£1.10
BR20W	S Tab French Horn 8'.....	£1.10
BR21X	S Tab Gedeckt 8'.....	£1.10
BY05F	S Tab Gedeckt 16'.....	£1.10
BY06G	S Tab Honky Tonk.....	£1.10
BR22Y	S Tab Horn 8.....	£1.10
BY07H	S Tab Mixture 16'.....	£1.10
BR23A	S Tab Oboe 8'.....	£1.10
BR24B	S Tab Octave 4'.....	£1.10

BR25C	S Tab Pedal Sustain.....	£1.10
BY08J	S Tab Piano.....	£1.10
BY09K	S Tab Presets Cancel.....	£1.10
BY10L	S Tab Presets to Rotor.....	£1.10
BY11M	S Tab Reed 4.....	£1.10
BR26D	S Tab Reverb.....	£1.10
BY12N	S Tab Rotor Fast.....	£1.10
BY13P	S Tab Rotor To Mam.....	£1.10
BR27E	S Tab Salicet 4.....	£1.10
BR28F	S Tab Salicional 8'.....	£1.10
BR29G	S Tab Saxophone 16'.....	£1.10
BR30H	S Tab Solo Del Trem.....	£1.10
BR31J	S Tab String 4.....	£1.10
BR32K	S Tab String 8'.....	£1.10
BR33L	S Tab Sub Bass 16'.....	£1.10
BY14Q	S Tab Sustain Acc.....	£1.10
BY15R	S Tab Sustain Solo.....	£1.10
BR34M	S Tab Tremulant.....	£1.10
BR35Q	S Tab Trumpet 8'.....	£1.10
BR36P	S Tab Tuba 16'.....	£1.10
BY16S	S Tab Vibrato.....	£1.10
BR37S	S Tab Vox Angleca 8'.....	£1.10
BR38R	S Tab Vox Humana 8.....	£1.10
BY17T	Mar Key Tab Cello 16'.....	£2.95
BY18U	Mar Key Tab Clar 8'.....	£2.95
BY19V	Mar Key Tab Clrion 4'.....	£2.95
BY20W	Mar Key Tab Clav.....	£2.95
BY21X	Mar Key Tab D/B to Rtr.....	£2.95
BY22Y	Mar Key Tab Delay Vbr Acc.....	£2.95
BY23A	Mar Key Tab Delay Vbr Slo.....	£2.95
BY24B	Mar Key Tab Diap 8'.....	£2.95
BY25C	Mar Key Tab Diap 16'.....	£2.95
BY26D	Mar Key Tab Dbar Acc.....	£2.95
BY27E	Mar Key Tab Dbar Solo.....	£2.95
BY28F	Mar Key Tab Dulc 8'.....	£2.95
BY29G	Mar Key Tab Flute 1'.....	£2.95
BY30H	Mar Key Tab Flute 2'.....	£2.95
BY31J	Mar Key Tab Flute 2.2/3'.....	£2.95
BY32K	Mar Key Tab Flute 4'.....	£2.95
BY33L	Mar Key Tab Flute 5.1/3'.....	£2.95
BY34M	Mar Key Tab Flute 8'.....	£2.95
BY35Q	Mar Key Tab Flute 16'.....	£2.95
BY36P	Mar Key Tab French Horn 8'.....	£2.95
BY37S	Mar Key Tab Gedckt 8'.....	£2.95
BY38R	Mar Key Tab Gedckt 16'.....	£2.95
BY39N	Mar Key Tab Honky Tonk.....	£2.95
BY40T	Mar Key Tab Horn 8'.....	£2.95

**Page 139**

BY41U	Mar Key Tab Mix 16'.....	£2.95
BY42V	Mar Key Tab Oboe 8'.....	£2.95
BY43W	Mar Key Tab Octave 4'.....	£2.95
BY44X	Mar Key Tab Pedal Sustain.....	£2.95
BY45Y	Mar Key Tab Piano.....	£2.95
BY46A	Mar Key Tab Prsts Cncl.....	£2.95
BY47B	Mar Key Tab Prsts To Rr.....	£2.95
BY48C	Mar Key Tab Reed 4'.....	£2.95
BY49D	Mar Key Tab Reverb.....	£2.95
BY50E	Mar Key Tab Rtr Fst.....	£2.95
BY51F	Mar Key Tab Rtr To Main.....	£2.95
BY52G	Mar Key Tab Salicet 4'.....	£2.95
BY53H	Mar Key Tab Salic 8'.....	£2.95
BY54J	Mar Key Tab Sax 16'.....	£2.95
BY55K	Mar Key Tab Strng 4'.....	£2.95
BY56L	Mar Key Tab Strng 8'.....	£2.95
BY57M	Mar Key Tab Sb-Bss 16'.....	£2.95
BY58N	Mar Key Tab Sus Acc.....	£2.95
BY59P	Mar Key Tab Sus Solo.....	£2.95
BY60Q	Mar Key Tab Trmpt 8'.....	£2.95
BY61R	Mar Key Tab Tuba 16'.....	£2.95
BY62S	Mar Key Tab Vibrato.....	£2.95
BY63T	Mar Key Tab Vox Ang 8'.....	£2.95
BY64U	Mar Key Tab Vox Hum 8.....	£2.95
FL76H	Key Tab.....	£0.90
BR46A	ST Strip.....	£1.35
XX13P	KT Strip.....	£1.50
BR41U	Draw Bar Red.....	£1.35
BR42V	Draw Bar White.....	£1.35
XR18U	Contact Pedal Board.....	£22.30
XB19V	Free-Standing Pedal Board.....	£63.00

**Page 140**

XB99H	Pedal Unit Front Panel.....	£2.95
XB96E	32-Note Pedal Board.....	£135.41
XB22Y	Control Lever.....	£7.73
XB21X	Piano Pedal.....	£9.85
XB20W	Swell Pedal.....	£8.50
XY28F	Remote Foot Control.....	£9.85

**PANEL METERS**

<b>Page 141</b>		
RW74R	Level Meter.....	£4.35
LB80B	Signal Strength Meter.....	£1.95
L879L	Tuning Meter.....	£1.95
RW73Q	VU Meter V41.....	£2.20
YQ47B	Dual VU Meter.....	£3.90
RW97F	2 in Pan Meter 50-0 50µA.....	£6.65
RW98G	2 in Pan Meter 100-0-100µA.....	£6.65
RW99H	2 in Pan Meter 500-0-500µA.....	£6.65
RW91Y	2 in Pan Meter 50µA.....	£5.55
RW92A	2 in Pan Meter 100µA.....	£5.55
RW93B	2 in Pan Meter 500µA.....	£6.45
RW94C	2 in Pan Meter 1 mA.....	£6.45
RW95D	2 in Pan Meter 5 mA.....	£6.45
RW96E	2 in Pan Meter 10 mA.....	£6.45
RX32K	2 in Pan Meter 50 mA.....	£6.65
RX33L	2 in Pan Meter 100 mA.....	£5.5
RX34M	2 in Pan Meter 500 mA.....	£6.45

RX35Q	2 in Pan Meter 1 A.....	£6.65
RX36P	2 in Pan Meter 50V.....	£6.65
RX37S	2 in Pan Meter 300V.....	£5.90
RX52G	2 in Pan Meter 'S'.....	£6.65
RX53H	2 in Pan Meter 'VU'.....	£6.65

**Page 142**

FX17T	Meter MS45 100µA.....	DISC
YG18U	Meter MS45 1 mA.....	DISC
YG19V	Meter MS45 VU.....	£4.45
RX54J	Large Panel Meter.....	£7.59
RX55K	Illuminating Kit.....	DISC
RX92A	Meter MI 15V.....	£6.75
RX87U	Meter MI 60V.....	£6.35
RX88V	Meter MI 30	

HX68Y	Transfer Sheet 11.....	£0.42
HX83E	Transfer Sheet 12.....	£0.42
HX84F	Transfer Sheet 13.....	£0.42
HX44X	Transfer Kit.....	£3.75

**PROJECTS**

**Page 148**

XF11M	MES12.....	£2.00 NV
XH24B	MES15.....	£0.15 NV
XH27E	MES16.....	£0.15 NV
XH18U	MES22.....	£0.25 NV
XH06G	MES24.....	FREE
XH20W	MES25.....	£0.25 NV
XF03D	MES26.....	£1.20 NV
XH51F	MES30.....	£0.20 NV
XH07H	MES32.....	£0.20 NV
XH48C	MES33.....	£0.40 NV
XH21X	MES37.....	£0.25 NV
XF04E	MES41.....	£0.40 NV
XH23A	MES42.....	£0.25 AV
XH49D	MES47.....	DISC
XH19V	MES49.....	DISC
XH00A	MES51.....	£0.15 NV
XH02C	MES52.....	£0.15 NV
XH04E	MES53.....	£0.35 NV
XH31J	MES54.....	£0.30 NV
XH33L	MES55.....	£0.30 NV
XH35Q	MES56.....	NYA
XH26D	MES71.....	£0.30 NV
XH50E	MES93.....	DISC
XF36P	Maplin Catalogue.....	£1.25 NV
XF08J	MES120.....	FREE
LW50E	Electronics For All.....	£29.95

**Page 150**

BR45Y	AS314.....	£0.33
BR88V	Mk/Space Adaptor Kit.....	£3.95
YL20W	Master Tuning Module.....	£19.87
BB00A	Divider Board A.....	£4.35
BB01B	Divider Board B.....	£3.20
BB02C	Tone Board A.....	£4.45
BB03D	Tone Board B.....	£1.98
BB07H	Control Board A.....	£4.25
BB08J	Control Board B.....	£2.98
BB09K	Sawtooth Board A.....	£4.25
BB10L	Sawtooth Board B.....	£4.85
BB11M	Gate Board.....	£0.44
BB04E	Tone Board C.....	£4.85
BB05F	Tone Board D.....	£4.82
BB06G	Tone Board E.....	£4.55
BB12N	Pedal PCB A.....	£2.20
BB15R	Mother Board A.....	£10.30
BB13P	A/B Switch Board.....	£1.68
BB14Q	MES Amp Board A.....	£0.72
BB77J	Divider MO & Frq Gen.....	£4.95
BB78K	Pedal PCB B.....	£3.87
BB79L	32-Note Pedal Voice.....	£4.45
BB80B	Pedal Diode PCB.....	£1.65
HQ72P	Auto Ogn Gen/Cik PCB.....	£3.95
HQ73Q	Auto Ogn Crd Cdr PCB.....	£3.75
HQ74R	Auto Ogn Auto St PCB.....	£5.95
HQ75S	Auto Ogn PA/PSU PCB.....	£4.35
YLOOA	Organ Mixer PCB.....	£3.25
YL18U	Power Supply 2G05.....	£1.35
YL21X	32 Note Pedal PSU PCB.....	£2.95
XX38R	Downbeat Indicator PCB.....	£2.20
XH00A	MES51.....	£0.15 NV
XH02C	MES52.....	£0.15 NV
XH04E	MES53.....	£0.35 NV
XH31J	MES54.....	£0.30 NV
XH33L	MES55.....	£0.30 NV

**Page 152**

XF11M	MES12.....	£2.00 NV
BB41U	Synth Mixer PCB.....	£3.95
BB44X	Synth VCA PCB.....	£1.36
BY87U	Synth Preset Mtg Board.....	£0.65
BY88V	Synth 1979 Kybd Cont.....	£5.95
BY89W	Synth Binary Encoder.....	£7.95
BB40T	Synth PSU Mk 2 PCB.....	£4.95
BY90X	Synth Sample & Noise PCB.....	£3.95
BB43W	Synth Trns Gen 1 PCB.....	£3.20
BB45Y	Synth Trns Gen 2 PCB.....	£3.20
BY81C	Synth Trns Rept PCB.....	£1.24
BY82D	Synth Rvrb & Phs PCB.....	£3.20
BY83E	Synth Trns 1 Env PCB.....	£6.65
BB38R	Synth Oscillator PCB.....	£3.25
BB48C	Synth Ext I/Fs PCB.....	£1.54
BB65V	3600 VCF PCB.....	£2.17
BB64U	4600 Hinge.....	£0.63
BB63T	Synth Ext I/P Bracket.....	£0.64
BB49D	Synth Oscilr Mtg Bracket.....	£0.67
BB52G	Synth Mixer Chassis.....	£2.10
BB51F	Synth Pwr Sply Heatsink.....	£1.30
BB56L	Synth Mixer Mtg Bracket.....	£0.16
BB58N	Synth Trns 1 Env Bracket.....	£0.69
BB59P	Synth Trns 2 Mtg Bracket.....	£1.20
BB60Q	Synth VCA Mtg Bracket.....	£0.52
BB61R	Synth VCF Mtg Bracket.....	£0.64
BF95D	Joy Lever PCB.....	£0.99
XQ01B	5600 Front Panel.....	£13.50
BY84F	5600 Rear Panel.....	£4.55
XQ02C	5600 Cabinet.....	£55.23
XB77H	Teak 5600 Cabinet.....	£55.70

**Page 154**

BY86T	3800 Interface PCB.....	£2.29
BB47B	Synth Opt Stge PCB.....	£4.55

XQ03D	3800 Front Panel.....	£9.73
BF96E	3800 Sp Ext I/P Bracket.....	£0.55
BF98G	3800 VCA Bracket.....	£0.55
BF99H	3800 Intface Mtg Bracket.....	£0.55
BB67X	3600 VCF Mtg Bracket.....	£0.59
BY85G	3800 Rear Panel.....	£4.56
XQ04E	3800 Cabinet.....	£49.60
YQ46A	Synth Demo Tape.....	£4.50
XF41U	Synth Guide Book.....	£2.00 NV
XF42V	5600S Patch Chart.....	£0.07 NV
XF43W	3800 Patch Chart.....	£0.07 NV
XF10L	ETI Top Project No 5.....	£1.25 NV
BB76H	Touch Organ PCB.....	£5.99

**Page 155**

XH18U	MES22.....	£0.25 NV
BY78K	Piano PSU/Voice PCB.....	£4.45
BY79L	Piano Top Oct PCB.....	£4.95
BY80B	Piano Two-Oct PCB.....	£5.55
XF03D	MES26.....	£1.20 NV
BB28F	RC Coder PCB.....	£1.95
BB29G	RC Xm.tter PCB.....	£1.92
BB30H	RC Receiver PCB.....	£1.45
BB31J	RC Interface PCB.....	£1.55
BB32K	RC Decoder PCB.....	£1.35
BB33L	RC Relay Drive PCB.....	£0.94
BB34M	RC Servo Drive PCB.....	£0.82
BB35Q	RC Servo Amp PCB.....	£0.92
BB36P	RC Tone Gen PCB.....	£0.85
BB37S	RC Tone Decoder PCB.....	£0.85
YQ03D	McM Encoder PCB.....	£1.10
YQ04E	McM Receiver PCB.....	£1.18
YQ05F	McM Rcvr Ccdr PCB.....	£1.05
YQ07H	McM Transmitter PCB.....	£1.95
YQ06G	McM Stereophoner PCB.....	£1.10
XQ06G	Piano Cabinet Black.....	£54.60
XY11M	Piano Cabinet Teak.....	£63.63
YQ08J	McM Elect Ig/Cnv PCB.....	£1.60
YQ09K	McM Flasher PCB.....	£1.10
YQ19V	LM380 Amp PCB.....	£1.25
YQ20W	20W Amp PCB.....	£1.50
YQ18U	Tone Con PCB.....	£1.55
YQ21X	Sound/Light Convert PCB.....	£2.10

**Page 156**

XH20W	MES25.....	£0.25 NV
BB16S	Orgn/Gtar Bass PCB.....	£10.50
XH19V	MES49.....	DISC
XL13P	OrumsetteKit.....	DISC
XL16S	Drumsette 1 PCB.....	DISC
XX17T	Drumsette 2 PCB.....	DISC
IY01B	Drumsette Frnt Panel.....	DISC
hLY02C	Drumsette Rear Panel.....	£1.93
hY02C	Drumsette Bkt Set.....	£2.65
XB98G	Drumsette Cabinet.....	DISC

**Page 157**

XH48C	MES33.....	£0.40 NV
FL94C	Hi-Fi Amp Sel Mthr PC.....	£4.20
FL95D	Hi-Fi Amp Sel PCB.....	£2.29
FL96E	Hi-Fi Amp Eql Mthr PC.....	£2.95
FL97F	Hi-Fi Amp Eql PCB.....	£1.97
FL98G	Hi-Fi Amp Pk Det PCB.....	£0.95
FL99H	Hi-Fi Amp PSU PCB.....	£1.65
XX32K	H/Phones Socket Bracket.....	£0.52
XY21X	Hi-Fi Amp Chassis.....	£18.93
XY22Y	Hi-Fi Amp Screen.....	£1.85
XY23A	Hi-Fi Amp Front Panel.....	£8.30
XY24B	Hi-Fi Amp Cover Black.....	£6.95

**Page 158**

LW40T	Tuner Metalwork Kit.....	£42.88
LW41U	Tuner PSU Module.....	£23.95
LW42V	Tuner Switching Mod.....	£18.95

**Page 159**

LW45Y	TV Sound Tuner.....	£39.55
LW44X	Tuner Head EF5600U.....	£23.79
LW43W	Tuner IF Module.....	£18.98
LW46A	AM Tuner.....	£17.95
LW48C	Stereo Tuner Kit.....	£161.00
YQ00A	IF Tuner Mono Module.....	£9.50
YQ10L	12/30V PSU Module.....	£6.70

**Page 160**

XH07H	MES32.....	£0.20 NV
BB55K	Dyn Noise Filter PCB.....	£2.20
XB05F	Dyn Noise Filter Metalwork.....	£9.95

**Page 161**

XH21X	MES37.....	£0.25 NV
XX03D	10 Channel GE PCB.....	£1.95
XB74R	10 Channel Eqlsr Metalwork.....	£10.45
XB75S	10 Channel Eqlsr Woodwork.....	£5.50
HY21X	Clock Timer PCB.....	DISC
HW30H	Clock Timer Case.....	£12.90
LW31J	Clock Timer Kit.....	£43.57
XY32K	Cassette Mechanism.....	£14.95
XY34M	Stereo Tape Module.....	£19.73
YQ30H	Tape Switch Board.....	£0.42
YQ33L	Tape Switch Bracket.....	£0.51
YQ31J	Tape PSU PCB.....	£0.39
XY35Q	Cassette Parts Kit.....	£12.98
XY36P	Cassette Recorder Kit.....	£39.95

**Page 163**

XF04E	MES41.....	£0.40 NV
XB76H	Disco Front Panel.....	£11.50

BB26D	Motor Switch PCB.....	£1.15
BB27E	Light Mod Board.....	£4.85
BB18U	Heatsink DR 2.....	£0.74
XB77J	Disco Cabinet.....	£48.44
BB81C	Disco Pre-Amp Tone PCB.....	£4.45
BB19V	Disco PSU PCB.....	£1.95
BB20W	100W Amp Board.....	£2.35
XY26D	Heatsink Mtg Plate.....	£3.95
XY27E	Heatsink Cover.....	£6.45
BB22Y	FET-Ceramic PU Board.....	£1.65
BB24B	Disco Fader Board.....	£1.95
BB25C	VUM & HP Amp Board.....	£2.35
XH23A	MES42.....	£0.25 NV
XB37S	Sound To Light Case.....	£11.50

**Page 164**

LR13P	HQ Mixer PCB No 2.....	£1.96
LR14Q	HQ Mixer PCB No 3.....	£1.55
LR15R	HQ Mixer PCB No 4.....	£1.35
LR34M	HQ Mixer PCB No 24.....	£1.98

**Page 165**

LR16S	HQ Mixer PCB No 5.....	£0.99
LR35Q	HQ Mixer PCB No 25.....	£1.60
LR21X	HQ Mixer PCB No 6.....	£0.88
LR22Y	HQ Mixer PCB No 7.....	£1.75
LR23A	HQ Mixer PCB No 8.....	£1.60

**Page 166**

LR24B	HQ Mixer PCB No 9.....	£0.99
LR42V	HQ Mixer PCB No 29.....	£1.98
LR25C	HQ Mixer PCB No 10.....	£1.85
LR26D	HQ Mixer PCB No 14.....	£1.87

**Page 167**

LW35Q	50W Amp Kit.....	£14.96
-------	------------------	--------

**Page 169**

HQ68Y	50W Hi-Fi PCB.....	£2.85
LW32K	150W Power Amp Kit.....	£17.95

**Page 170**

BY74R	Michron MkII PCB.....	DISC
YB92A	Michron MkII Case.....	£6.81
LW37S	Michron MkII Clock Kit.....	£19.40

**Page 172**

XL07H	MA1003.....	DISC
YL19V	LC Clock Module.....	£13.40

**Page 173**

LW39N	Burglar Alarm Kit.....	DISC
LW38R	Ultrasonic Detector Kit.....	DISC
XH49D	MES47.....	DISC
YQ52G	Ultrasonic Tx PCB.....	DISC
YQ53H	Ultrasonic Rx PCB.....	DISC
BY92A	Burglar Alarm PCB.....	DISC
BY93B	External Alarm F-PCB.....	DISC
BY95D	Alarm Box Bracket.....	DISC
XY14Q	External Alarm Box.....	£12.80
XY13P	Burglar Alarm Box.....	DISC
BB72P	Sine/Square Gen PCB.....	£2.95
BB73Q	Audio Osc Frt Panel.....	£1.74
XH24B	MES15.....	£0.15 NV
XH27E	MES16.....	£0.15 NV
XX40T	Ignition PCB.....	£1.30
XX41U	Ignition Mounting Plate.....	£1.28

**Page 174**

XH26D	MES71.....	£0.30 NV
BB82D	Keyboard PCB.....	£7.35
BB83E	VDU Logic PCB.....	£9.50
BB98G	VDU PSU PCB.....	£2.98
XY12N	VDU Front Panel.....	£7.90
XX05F	UHF Mod No 2.....	£4.99
XF44X	Magnum Booklet.....	£0.50 NV
YQ44X	Magnum 1 PCB.....	£2.95
YQ45Y	Magnum 2 PCB.....	£2.95

**PROTECTION**

RX96E	Safuseholder 20.....	£0.45
RX97F	Safuseholder 1/4 in.....	£0.75
RX49D	Chassis F/H 20 mm.....	£0.11
RX50E	Chassis F/H 1/4 in.....	£0.17
WH49D	Fuse Clip.....	£0.02
RX51F	F/H Car.....	£0.10
WR93R	Fuse 20 mm 50 mA.....	£0.06
WROOA	Fuse 20 mm 100 mA.....	£0.06
WR94C	Fuse 20 mm 150 mA.....	£0.06
WR01B	Fuse 20 mm 250 mA.....	£0.06
WR02C	Fuse 20 mm 500 mA.....	£0.06
WR03D	Fuse 20 mm 1 A.....	£0.08
WR04E	Fuse 20 mm 15 A.....	£0.06
WR05F	Fuse 20 mm 2 A.....	£0.08
WR06G	Fuse 20 mm 3 A.....	£0.08
WR07H	Fuse 20 mm 5 A.....	£0.06
WR18U	Fuse A/S 500 mA.....	£0.12
WR19V	Fuse A/S 1 A.....	£0.12
WR20W	Fuse A/S 2 A.....	£0.12
WR95D	Fuse 1/4 50 mA.....	£0.04
WR08J	Fuse 1/4 100 mA.....	£0.06
WR96E	Fuse 1/4 150 mA.....	£0.08
WR09K	Fuse 1/4 250 mA.....	£0.07
WR10L	Fuse 1/4 500 mA.....	£0.06
WR11M	Fuse 1/4 1 A.....	£0.06
WR12N	Fuse 1/4 1.5 A.....	£0.06
WR13P	Fuse 1/4 2 A.....	£0.07

WR14Q	Fuse 1/4 3 A.....	£0.06
WR15R	Fuse 1/4 5 A.....	£0.06
WR16S	Fuse 1/4 10 A.....	£0.06
WR17T	Fuse 1/4 15 A.....	£0.12
HQ31J	Plug Fuse 2 A.....	£0.15
HQ32K	Plug Fuse 3 A.....	£0.14
HQ33L	Plug Fuse 5 A.....	£0.15
HQ34M	Plug Fuse 13 A.....	£0.14
HB51F	Fuse Wire.....	£0.30
HW04E	RF Supp Choke 1 A.....	£0.26
HW05F	RF Supp Choke 2 A.....	£0.29
HW06G	RF Supp Choke 3 A.....	£0.39

**Page 176**

HR42V	Stylus BSR ST10.....	£0.70
HR45V	Stylus BSR ST15.....	£0.99
HR47B	Stylus BSR BT17 DD.....	£0.89
HR74R	Stylus BSR ST21.....	£0.95
HR75S	Stylus Decca Deram.....	£2.45
YX11M	Stylus Dual DN201.....	£4.95
YX12N	Stylus Garrard GA150.....	£9.65
HR76H	Stylus D110E.....	£4.55
HR77J	Stylus D110H.....	£1.95
HR48C	Stylus D110SR.....	£1.95
HR49D	Stylus D120SR.....	£2.45
HR78K	Stylus Hitachi ST101.....	£4.85
HR79L	Stylus Hitachi ST103.....	£5.70
YX13P	Stylus Hitachi ST104.....	£4.35
YX14Q	Stylus JVC DT2IS.....	£4.35
FQ54J	Stylus Victor DT33.....	£4.35
YX15R	Stylus JVC DT36.....	£4.35
HR81C	Stylus LV65977D.....	£1.25
HR83E	Stylus NP EPS36.....	£1.85
HR84F	Stylus NP EPS52.....	£4.55
YX16S	Stylus NP EPS53.....	£4.75
YX17T	Stylus Philips AG3306.....	£0.99
HR87U	Stylus Philips GP200DD.....	£1.10
HR89W	Stylus Philips GP205.....	£1.25
YX18U	Stylus Philips GP213.....	£1.10
HR90X	Stylus Philips GP400.....	£4.35
YX19V	Stylus Philips GP400Mk2.....	£4.32
YX20W	Stylus Philips GP401Mk2.....	£5.95

**Page 183**

HR93B	Stylus RIG-2SB DD.....	£1.22
HR51F	Stylus BF40D.....	£1.25
HR96E	Stylus DM500/7.....	£4.95
YX22Y	Stylus Sanyo ST10J.....	£4.35
HR95D	Stylus Sansui.....	£4.35
YX23A	Stylus Sansui SN41.....	£4.35
YX24B	Stylus Sanyo ST7D.....	£4.75
HR97F	Stylus Sanyo 2611.....	£3.95
FQ48C	Stylus Sony ND128.....	£1.85
YX25C	Stylus Sharp 101.....	£4.75
HR98G	Stylus Sharp 706.....	£4.75
HR99H	Stylus Sharp 717.....	£4.35
HR60Q	Stylus 9TAHC DD.....	£0.99
HR61R	Stylus Sonotone V100.....	£4.75
YX26D	Stylus Sonotone V101.....	£4.35
FQ45Y	Stylus 2509.....	£0.99
FQ43W	Stylus 2529 DD.....	£1.30
HR53H	Stylus KS40A DD.....	£0.99
HR55K	Stylus KS4 IB DD.....	£1.35
HR57M	Stylus KS41C DD.....	£1.10
YX27E	Stylus Sony XL15.....	£4.35
YX28F	Stylus Sony ND126.....	£4.75
FQ49D	Stylus Sony ND133.....	£4.85
FQ50E	Stylus Sony ND134.....	£2.95
FQ51F	Stylus Tenorel N200ID.....	£2.37
YX29G	Stylus Tenorel N2001DM.....	£2.75
FQ52G	Stylus Tenorel N2001ED.....	£7.45
YX30H	Stylus Tetrad 51.....	£2.15
FQ53H	Stylus Toshiba N3C.....	£1.75
YX31J	Stylus Toshiba N55.....	£4.35
YX32K	Stylus Toshiba N58.....	£4.85
YX21X	Stylus Toshiba N550.....	£4.35

**Page 184**

YB47B	Record Care Kit C106.....	£4.95
LX03D	Music Centre Kit C113.....	£6.45
LX06G	Cleaning Arm C100.....	£3.25
LR89W	Cleaning Arm C108.....	£4.55
FR44X	Roller Pack C93.....	£0.35
YW80B	Roller Pack C96.....	£0.48
YW81C	Cleaning Cloth C104.....	£0.78
FR48C	Dust Off C101.....	£0.99
YW82D	Cleaner C92.....	£4.65
YX93B	Stylus Microscope.....	£2.45
YW83E	Stylus Brush C103.....	£0.12
YW84F	Stylus Brush C97.....	£0.28
FR46A	Stylus Cleaner C95.....	£0.80
YB55K	Cleaning Kit C116.....	£2.42

**Page 185**

FR52G	Anti-Stat Fluid 69S.....	£0.49
LX10L	Anti-Stat Mat C119.....	£1.95
LX04E	Anti-Stat Gun.....	£5.25
FQ60Q	Spirit Level 44.....	£3.65
FR49D	Stylus Balance PX1.....	£2.45
YW85G	Record Grip C206.....	£1.28
FR50E	Gram Speed Indicator.....	£0.09
YW86T	Cassette Kit C115.....	£1.85
YB56L	Cassette Kit C107.....	£4.25
RB04E	Cass Head Clnr C118.....	£1.25
YW87U	Cleaning Stick C109.....	£0.23
YW88V	Tape Cleaning Fluid.....	£0.58

**Page 186**

FR54J	Cassette Cleaner Tape.....	£0.55
YW89W	Cassette Clean & Demag.....	£2.25
FR62S	Straight Demagnetiser.....	£3.35
FQ62S	Curved Demagnetiser.....	£3.85
YW90X	Cassette Splicer.....	£4.25
YW91Y	Splicing Block.....	£1.85
LX17T	Splicing Tape.....	£0.65
RB03D	Cassette Case.....	£0.23
FR60Q	Index Cards.....	£1.40
RB01B	Cassette Fast Winder.....	£2.35
FR59P	Test Cassette 53.....	£4.98
YG25C	Cassette Tape C60.....	£0.61
YG26D	Cassette Tape C90.....	£0.65

**Page 187**

RB05F	Cassette Tray 52A.....	£1.87
RB07H	RotaRack.....	£2.45
LH91Y	Cassettebox.....	£4.65
LH92A	Videocassettebox.....	£9.88
FQ63T	GF Cassette Head.....	£11.80
FQ64U	Mono Cassette Head.....	£4.55
FQ66W	Cassette Erase Head.....	£2.55
FQ65V	Stereo Cassette Head.....	£4.75
FQ67X	Tape Hd Two-Track RP.....	£15.50

**Page 188**

FQ68Y	Tape Head Two-Track Erase.....	£8.95
FQ69A	Tape HD Four-Track RP.....	£15.25
FQ70M	Tape HD Four Track Erase.....	£8.85
FQ71N	2-Head Bracket.....	£4.65
FQ72P	3-Head Bracket.....	£5.39

**RESISTORS**

**Page 189**

U	Micro Res.....	£0.03
M	Min Res.....	£0.02
S	Std Res.....	£0.03
C	1W Res.....	£0.05

**Page 190**

X	Oxide.....	£0.05
T	1% Res.....	£0.09
XL05F	Colour Wheel.....	£0.25
W	W/W Min Res.....	£0.19

**Page 191**

L	7W W/W.....	£0.24
H	10W W/W.....	£0.29
P	25 W/W Res.....	£1.49
V	HV Res 1M-33M.....	£0.12
V	HV Res 47M.....	£0.22
BL64U	Constantan 28 swg.....	£3.35
YY12N	Resnet 100R.....	£0.85
YY13P	Resnet 220R.....	£0.85
YY14Q	Resnet 470R.....	£0.85
YY15R	Resnet 1K.....	£0.85
YY16S	Resnet 2K2.....	£0.85
YY17T	Resnet 4K7.....	£0.85
YY18U	Resnet 10k.....	£0.85
YY19V	Resnet 22k.....	£0.85
YY20W	Resnet 47k.....	£0.85
YY21X	Resnet 100k.....	£0.85
WR52G	Hor S-Min Preset 100R.....	£0.10
WR53H	Hor S-Min Preset 220R.....	£0.10
WR54J	Hor S-Min Preset 470R.....	£0.10
WR55K	Hor S-Min Preset 1K.....	£0.10
WR56L	Hor S-Min Preset 2K2.....	£0.10
WR57M	Hor S-Min Preset 4K7.....	£0.10
WR58N	Hor S-Min Preset 10K.....	£0.10
WR59P	Hor S-Min Preset 22K.....	£0.10
WR60Q	Hor S-Min Preset 47K.....	£0.10
WR61R	Hor S-Min Preset 100K.....	£0.10
WR62S	Hor S-Min Preset 220K.....	£0.10
WR63T	Hor S-Min Preset 470K.....	£0.10
WR64U	Hor S-Min Preset 1M.....	£0.10
WR65V	Vrt S-Min Preset 100R.....	£0.11
WR66W	Vrt S-Min Preset 220R.....	£0.11
WR67X	Vrt S-Min Preset 470R.....	£0.11
WR68Y	Vrt S-Min Preset 1K.....	£0.11
WR69A	Vrt S-Min Preset 2K2.....	£0.11
WR70M	Vrt S-Min Preset 4K7.....	£0.11
WR71N	Vrt S-Min Preset 10K.....	£0.11
WR72P	Vrt S-Min Preset 22K.....	£0.11
WR73Q	Vrt S-Min Preset 47K.....	£0.11
WR74R	Vrt S-Min Preset 100K.....	£0.11
WR75S	Vrt S-Min Preset 220K.....	£0.11
WR76H	Vrt S-Min Preset 470K.....	£0.11
WR77J	Vrt S-Min Preset 1M.....	£0.11

**Page 192**

WR78K	Hor Skeleton 100R.....	£0.14
WR79L	Hor Skeleton 220R.....	£0.14
WR80B	Hor Skeleton 470R.....	£0.26
WR81C	Hor Skeleton 1K.....	£0.26
WR82D	Hor Skeleton 2K2.....	£0.26
WR83E	Hor Skeleton 4K7.....	£0.26
WR84F	Hor Skeleton 10K.....	£0.26
WR85G	Hor Skeleton 22K.....	£0.26
WR86T	Hor Skeleton 47K.....	£0.26
WR87U	Hor Skeleton 100K.....	£0.26
WR88V	Hor Skeleton 220K.....	£0.26
WR89W	Hor Skeleton 470K.....	£0.26
WR90X	Hor Skeleton 1M.....	£0.26
WR91Y	Hor Skeleton 2M2.....	£0.26
WR92A	Hor Skeleton 4M7.....	£0.26
WW00A	Vrt Skeleton 100R.....	£0.24
WW01B	Vrt Skeleton 220R.....	£0.24
WW02C	Vrt Skeleton 470R.....	£0.24
WW03D	Vrt Skeleton 1K.....	£0.24
WW04E	Vrt Skeleton 2K2.....	£0.24
WW05F	Vrt Skeleton 4K7.....	£0.24
WW06G	Vrt Skeleton 10K.....	£0.24
WW07H	Vrt Skeleton 22K.....	£0.24
WW08J	Vrt Skeleton 47K.....	£0.24
WW09K	Vrt Skeleton 100K.....	£0.24
WW10L	Vrt Skeleton 220K.....	£0.24
WW11M	Vrt Skeleton 470K.....	£0.24
WW12N	Vrt Skeleton 1M.....	£0.28
WW13P	Vrt Skeleton 2M2.....	£0.24
WW14Q	Vrt Skeleton 4M7.....	£0.24
WR38R	Cermet 100R.....	£0.98
WR39N	Cermet 500R.....	£0.98

WR40T	Cermet 1K.....	£0.98
WR41U	Cermet 5K.....	£0.98
WR42V	Cermet 10K.....	£0.98
WR43W	Cermet 50K.....	£0.98
WR44X	Cermet 100K.....	£0.98
WR45Y	Cermet 1M.....	£0.98
WR46A	15-Turn Cermet 500R.....	£1.20
WR47B	15-Turn Cermet 1K.....	£1.20
WR48C	15-Turn Cermet 5K.....	£1.20
WR49D	15-Turn Cermet 10K.....	£1.20
WR50E	15-Turn Cermet 50K.....	£1.20
WR51F	15 Turn Cermet 100K.....	£1.20
BW06G	Edge Control Pot.....	£0.65
BW07H	Edge Knob Small Black.....	£0.08
BW08J	Edge Knob Small Grey.....	£0.08
BW09K	Edge Knob Large Black.....	£0.08
BW10L	Edge Knob Large Grey.....	£0.08
FW00A	Pot Lin 1K.....	£0.37
FW01B	Pot Lin 4K7.....	£0.37
FW02C	Pot Lin 10K.....	£0.37
FW03D	Pot Lin 22K.....	£0.37
FW04E	Pot Lin 47K.....	£0.37
FW05F	Pot Lin 100K.....	£0.37
FW06G	Pot Lin 220K.....	£0.37
FW07H	Pot Lin 470K.....	£0.37
FW08J	Pot Lin 1M.....	£0.37
FW09K	Pot Lin 2M2.....	£0.37
FW21X	Pot Log 4k7.....	£0.37
FW22Y	Pot Log 10k.....	£0.37
FW23A	Pot Log 22k.....	£0.37
FW24B	Pot Log 47k.....	£0.37
FW25C	Pot Log 100k.....	£0.37
FW26D	Pot Log 220k.....	£0.37
FW27E	Pot Log 470k.....	£0.37
FW28F	Pot Log 1M.....	£0.37
FW29G	Pot Log 2M2.....	£0.37

**Page 193**

FW41U	Sw Pot Lin 4K7.....	£0.95
FW42V	Sw Pot Lin 10K.....	£0.95
FW43W	Sw Pot Lin 22K.....	£0.95
FW44X	Sw Pot Lin 47K.....	£0.95
FW45Y	Sw Pot Lin 100K.....	£0.95
FW46A	Sw Pot Lin 220K.....	£0.95
FW47B	Sw Pot Lin 470K.....	£0.95
FW48C	Sw Pot Lin 1M.....	£0.95
FW49D	Sw Pot Lin 2M2.....	£0.95
FW62S	Sw Pot Log 4K7.....	£0.95
FW63T	Sw Pot Log 10K.....	£0.95
FW64U	Sw Pot Log 22K.....	£0.95
FW65V	Sw Pot Log 47K.....	£0.95
FW66W	Sw Pot Log 100K.....	£0.95
FW67X	Sw Pot Log 220K.....	£0.95
FW68Y	Sw Pot Log 470K.....	£0.95
FW69A	Sw Pot Log 1M.....	£0.95
FW70M	Sw Pot Log 2M2.....	£0.95
FW50E	W/W Pot 10R.....	£2.15
FW51F	W/W Pot 20R.....	£1.99
FW52G	W/W Pot 50R.....	£2.15
FW71N	W/W Pot 100R.....	£2.55
FW72P	W/W Pot 200R.....	£1.98
FW73Q	W/W Pot 500R.....	£1.85
FW93B	W/W Pot 1K.....	£1.85
FW96E	W/W Pot 2K.....	£0.59
FW94C	W/W Pot 5K.....	£0.99
FW95D	W/W Pot 10K.....	£2.29
FX18U	W/W Pot 50K.....	£2.79
FW84F	Dual Pot Lin 4K7.....	£0.99
FW85G	Dual Pot Lin 10K.....	£0.99
FW86T	Dual Pot Lin 22K.....	£0.99
FW87U	Dual Pot Lin 47K.....	£0.99
FW88V	Dual Pot Lin 100K.....	£0.99
FW89W	Dual Pot Lin 220K.....	£0.99
FW90X	Dual Pot Lin 470K.....	£0.99
FW91Y	Dual Pot Lin 1M.....	£0.99
FW92A	Dual Pot Lin 2M2.....	£0.99
FX08J	Dual Pot Log 4k7.....	£1.10
FX09K	Dual Pot Log 10k.....	£1.10
FX10L	Dual Pot Log 22k.....	£1.10
FX11M	Dual Pot Log 47k.....	£1.10
FX12N	Dual Pot Log 100k.....	£1.10
FX13P	Dual Pot Log 220k.....	£1.10
FX14Q	Dual Pot Log 470k.....	£1.10
FX15R	Dual Pot Log 1M.....	£1.10
FX16S	Dual Pot Log 2M2.....	£1.10
FX40T	L/S Control 20R.....	£0.55
FX97F	L/S Control 50R.....	£0.55
FX98G	L/S Control 100R.....	£0.55
FX99H	L/S Control 200R.....	£0.55
YG04E	Rheostat 50R.....	£4.90
YG05F	Rheostat 100R.....	£4.90
YG06G	Rheostat 150R.....	£4.90
YG07H	Rheostat 200R.....	£4.90

**Page 194**

FX32K	Slide Pot Lin 5K.....	£0.79
FX33L	Slide Pot Lin 10K.....	£0.79
FX34M	Slide Pot Lin 25K.....	£0.79
FX35Q	Slide Pot Lin 50K.....	£0.79
FX36P	Slide Pot Lin 100K.....	£0.79
FX37S	Slide Pot Lin 250K.....	£0.79
FX38R	Slide Pot Lin 500K.....	£0.79
FX53H	Slide Pot Log 5K.....	£0.79
FX54J	Slide Pot Log 10K.....	£0.79
FX55K	Slide Pot Log 25K.....	£0.79
FX56L	Slide Pot Log 50K.....	£0.79
FX57M	Slide Pot Log 100K.....	£0.79
FX58N	Slide Pot Log 250K.....	£0.79

FX59P	Slide Pot Log 500K.....	£0.79
FX76H	Dual Slide Lin 5K.....	£1.25
FX77J	Dual Slide Lin 10K.....	£1.25
FX80B		

Q874R	BC650.....	£0.29	YG37S	CL8960.....	£29.95	WQ53H	MVAM115.....	£1.85	QQ27E	VK10KM.....	£0.99
QF00A	BCY70.....	£0.18	QH30H	CI060.....	£0.42	WQ54J	NE531.....	£1.65	QQ28F	VK1010.....	£1.35
QF01B	BCY71.....	£0.18	WQ22Y	CI16D.....	£0.99	WQ55K	NE544.....	£2.18	QQ29G	VK1011.....	£1.35
QF03D	BD131.....	£0.49	WQ23A	CI260.....	£1.63	QH66W	NE555.....	£0.21	WQ96E	VN46AF.....	£1.27
QF04E	BD131/132 MP.....	£1.19	WQ24B	C206D.....	£1.27	QH67X	NE556.....	£0.62	WQ97F	VN66AF.....	£1.55
QF05F	BD132.....	£0.50	WQ25C	C226D.....	£0.85	WQ56L	NE565.....	£1.34	WQ98G	VN88AF.....	£1.37
QF06G	BD135.....	£0.45	QL14Q	C246D.....	£1.24	QH68Y	NE566.....	£1.93	QQ11M	VQ1000CJ.....	£4.90
QF75S	BD136.....	£0.40	QO01B	DAC0801LCN.....	£2.45	QH69A	NE567.....	£1.60	QL37S	W005.....	£0.33
QF07H	BD139.....	£0.40	YY82D	DF412.....	£6.45	YY87U	NE571.....	£4.77	QL38R	W01.....	£0.34
QF08J	BD140.....	£0.40	QQ21X	DV1202W.....	£8.35	YY68Y	NE5534A.....	£2.45	QL39N	W02.....	£0.38
WH15R	BD711.....	£0.68	QQ22Y	DV1205W.....	£10.70	YY67X	NE5539.....	£7.85	QL40T	W04.....	£0.39
WH16S	BD712.....	£0.68	QQ23A	DV1210W.....	£13.63	YG38R	NSM4000A.....	£9.85	QL41U	ZN414.....	£1.25
QF09K	BF115.....	£0.38	QQ24B	DV1220W.....	£16.88	QH70M	OA47.....	£0.12	QL42V	ZS120.....	£0.44
QF10L	BF167.....	£0.38	QQ25C	DV1230W.....	£21.30	QH71N	OA90.....	£0.09	QL43W	ZTX107.....	£0.15
QF11M	BF180.....	£0.45	QQ26D	DV1240W.....	£25.50	QH72P	OA91.....	£0.08	QL44X	ZTX108.....	£0.15
QF15R	BF200.....	£0.32	WQ26D	ER1400.....	£9.99	QH73Q	OA95.....	£0.08	QL45Y	ZTX109.....	£0.19
QF16S	BF244.....	£0.30	WQ27E	ER3401.....	£19.58	QH74R	OA200.....	£0.08	Q146A	ZTX300.....	£0.16
QF17T	BF258.....	£0.33	WQ28F	H5CH1001.....	£0.55	QH75S	OA202.....	£0.13	QL47B	ZTX301.....	£0.20
QF18U	BF259.....	£0.39	YH59P	ICL7109.....	£16.55	QH77J	OC28.....	DISC	QL48C	ZTX302.....	£0.22
QF19V	BF337.....	£0.40	YY75S	ICL7660CPA.....	£2.75	QH78K	OC35.....	£1.35	QL50E	ZTX304.....	£0.24
QQ19V	BF494.....	£0.25	YY93B	ICM7045IPI.....	£14.95	QH82D	OC45.....	£0.47	QL54J	ZTX326.....	£1.10
QQ20W	BF495.....	£0.25	YY94C	ICM7216DIPI.....	£17.45	QH83E	OC70.....	£0.38	QL56L	ZTX330.....	£0.26
QF20W	BFW10.....	£1.43	YY95D	ICM7226BIPI.....	£21.90	QH84F	OC71.....	£0.31	QL57M	ZTX331.....	£0.28
QF21X	BFX29.....	£0.33	YH63T	ICM7555.....	£1.25	QH85G	OC72.....	£0.42	QL60Q	ZTX500.....	£0.21
QF22Y	BFX30.....	£0.35	QH32K	IR122A.....	DISC	QH87U	OC81.....	£0.42	QL62S	ZTX502.....	£0.19
QF23A	BFX84.....	£0.34	QH33L	IR1220.....	£3.95	QH89W	OC83.....	£0.45	QL64U	ZTX504.....	£0.27
QF24B	BFX85.....	£0.31	BH45Y	J005.....	£1.75	QH91Y	OC170.....	£0.95	QL66W	ZTX530.....	£0.29
QF25C	BFX87.....	£0.32	BL36P	J02.....	£1.80	QH92A	OC171.....	£0.99	QL67X	ZTX531.....	£0.33
QF260	BFX88.....	£0.36	BH46A	J04.....	£1.95	QH93B	PN3643.....	£0.30	QL68Y	ZTX541.....	£0.31
QF27E	BFY50.....	£0.30	BH47B	K01.....	£3.15	WQ57M	PW01.....	£0.95	QL69A	ZTX542.....	£0.33
QF28F	BFY51.....	£0.29	BH48C	K04.....	£4.25	WQ58N	PW06.....	£0.99	QL70M	Z5J.....	£2.75
QF29G	BFY52.....	£0.31	YY74R	L200.....	£2.69	WQ59P	RO 3-2513.....	£8.95	QW00A	Z80-CPU.....	£7.95
QF30H	BPX25.....	£1.98	WQ29G	LF347.....	£2.55	QL00A	R2008B.....	£2.25	QW01B	Z80-CTC.....	£4.50
QF31J	BRY39.....	£0.42	WQ30H	LF351.....	£0.56	QL02C	SAM77.....	£1.20	QW03D	Z80-PIO.....	£4.25
QF32K	BSX20.....	£0.26	WQ31J	LF353.....	£0.99	QL05F	SC146D.....	£1.45	QW04E	Z80-SIO.....	£19.00
QF33I	BSX21.....	£0.29	YY69A	LF13741.....	£0.55	WQ60Q	SFF96364.....	£9.45	QL71N	1N914.....	£0.04
QF34M	BSY95A.....	£0.26	QH35Q	LH0042C.....	£4.95	QL06G	SG1495D.....	£3.95	QL72P	1N916.....	£0.05
QF35Q	BT109.....	£1.49	QH36P	LM301A.....	£0.27	QL07H	SG3402.....	£3.78	QL73Q	1N4001.....	£0.05
QF37S	BU205.....	£1.90	QH37S	LM308.....	£0.95	WQ61R	SH120A.....	£6.65	QL74R	1N4002.....	£0.05
QF38R	BU206.....	DISC	WQ32K	LM334.....	£1.10	YH66W	SL490.....	£3.35	QL75S	1N4003.....	£0.06
QF39N	BU208.....	£2.99	YY73Q	LM335Z.....	£1.23	QL08J	ST2.....	£0.25	QL76H	1N4004.....	£0.06
QF41U	BY126.....	£0.21	QH38R	LM377.....	£1.77	QL09K	S005.....	£0.47	QL77J	1N4005.....	£0.06
QF42V	BY127.....	£0.13	QH39N	LM379S.....	£5.29	QL10L	S04.....	£0.52	QL78K	1N4006.....	£0.06
QF43W	BY164.....	£0.76	QH40T	LM38C.....	£0.75	WQ62S	TAA550.....	£0.35	QL79L	1N4007.....	£0.07
QF44X	BY206.....	£0.30	QH41U	LM381.....	£1.90	QL11M	TAG1/100.....	£1.45	QL80B	1N4148.....	£0.04
QF45Y	BZX61C4V7.....	£0.17	YY84F	LM382.....	£1.43	QL12N	TAG1/600.....	£1.20	QL81C	1N5400.....	£0.14
QF46A	BZX61C5V1.....	£0.17	WQ33L	LM383.....	£1.61	BL35Q	TBA651.....	£2.25	QL82D	1N5401.....	£0.16
QF47B	BZX61C5V6.....	£0.17	WQ34M	LM384.....	£1.44	QL13P	TBA810P.....	£0.95	QL83E	1N5402.....	£0.16
QF48C	BZX61C6V2.....	£0.17	WQ35Q	LM387.....	£1.25	WQ63T	TBA820M.....	£0.70	QL84F	1N5404.....	£0.19
QF490	BZX61C6V8.....	£0.17	WQ36P	LM389.....	£1.09	YY79L	TCA350Z.....	£3.95	QL85G	1N5406.....	£0.20
QF50E	BZX61C7V5.....	£0.17	YY85G	LM1818.....	£1.95	WQ64U	TCA4500A.....	£3.35	QL86T	1N5407.....	£0.21
QF51F	BZX61C8V2.....	£0.17	YY99H	LM1830.....	£2.65	WH20W	TDA1022.....	£6.75	QL87U	1N5408.....	£0.19
QF52G	BZX61C9V1.....	£0.17	YY71N	LM1871.....	£5.20	YY76H	TDA1024.....	£1.49	QL88V	1S921.....	£0.09
QF53H	BZX61C10.....	£0.17	YY72P	LM1872.....	£5.20	YY70M	TDA2005M.....	£8.25	QH46A	1458C.....	£0.45
QF54J	BZX61C11.....	£0.17	WQ38R	LM2917.....	£2.29	WQ66W	TDA2006.....	£1.65	WQ05F	1702 1000ns.....	£4.10
QF55K	BZX61C12.....	£0.17	WQ37S	LM1820.....	£1.80	WQ67X	TDA2030.....	£1.95	QQ10A	2N697.....	£0.39
QF56L	BZX61C13.....	£0.17	QH42V	LM3900.....	£0.57	YY86T	TDA3410.....	£1.90	QR01B	2N706.....	£0.26
QF57M	BZX61C15.....	£0.17	WQ39N	LM3909.....	£0.97	QH5R	TIP31A.....	£0.39	QR03D	2N708.....	£0.35
QF58N	BZX61C16.....	£0.17	WQ40T	LM3911.....	£1.31	QL16S	TIP32A.....	£0.39	QR04E	2N1302.....	DISC
QF59P	BZX61C18.....	£0.17	WQ41U	LM3914.....	£2.41	WQ71N	TIP33A.....	£0.78	QR05F	2N1303.....	DISC
QF60Q	BZX61C20.....	£0.17	YY96E	LM3915.....	£2.53	WQ72P	TIP34A.....	£0.99	QR06G	2N1304.....	DISC
QF61R	BZX61C22.....	£0.17	YY97F	LM3916.....	£3.46	QL17T	TIP41A.....	£0.45	QR09K	2N1711.....	£0.39
QF62S	BZX61C24.....	£0.17	YH64U	LM13600N.....	£1.39	QL18U	TIP42A.....	£0.45	QR10L	2N1893.....	£0.32
QF63T	BZX61C27.....	£0.17	YY81C	M083.....	£4.75	WQ73Q	TIP122.....	£0.65	QR11M	2N2219.....	£0.31
QF64U	BZX61C30.....	£0.17	WH22Y	M087.....	£4.95	WQ74R	TIP127.....	£0.75	QR12N	2N2369A.....	£0.22
QF65V	BZX61C33.....	£0.17	YY90X	M108.....	£18.25	QL19V	TIS43.....	£0.55	QR13P	2N2484.....	£0.28
QF66W	BZX61C36.....	£0.17	YY91Y	M147.....	£6.51	WQ75S	TL170C.....	£0.49	QR14Q	2N2646.....	£0.55
QF67X	BZX61C39.....	£0.17	QH71N	M251.....	£12.20	WQ76H	TL172C.....	£0.76	QR15R	2N2647.....	£0.95
QF68Y	BZX61C43.....	£0.17	QH64U	M252.....	£8.95	YY77J	TL430C.....	£0.85	QR16S	2N2904.....	£0.31
QF69A	BZX61C47.....	£0.17	WH21X	M254.....	£7.49	YY78K	TL497A.....	£1.65	QR17T	2N2905.....	£0.31
QF70M	BZX61C51.....	£0.17	XL07H	MA1003.....	DISC	YY88B	TMS1121.....	£8.95	QR18U	2N2906.....	£0.26
QF71N	BZX61C56.....	£0.17	XL14Q	MA1023.....	DISC	QL20W	µA709C.....	£0.75	QR19V	2N2907.....	£0.26
QF72P	BZX61C62.....	£0.17	QH43W	MCR102.....	£0.59	BL22Y	µA723C T099.....	£0.85	QR20W	2N2926 Orange.....	£0.12
QF73Q	BZX61C68.....	£0.17	QH44X	MC1303.....	DISC	QL21X	µA723C 14-pin DIL.....	£0.55	QR21X	2N2926 Yellow.....	£0.12
QF74R	BZX61C75.....	£0.17	QH45Y	MC1310P.....	£2.30	QL22Y	µA741C 8-pin DIL.....	£0.23	QR22Y	2N2926 Green.....	£0.12
QH00A	BZY88C2V7.....	£0.09	QH47B	MC1496.....	£0.89	QL23A	µA741C 14-pin DIL.....	£0.78	QR23A	2N3053.....	£0.34
QH01B	BZY88C3V0.....	£0.09	QH48C	MC3302P.....	£0.80	QL24B	µA747C.....	£0.75	QR24B	2N3054.....	£0.66
QH02C	BZY88C3V3.....	£0.09	QH49D	MC3340P.....	£1.27	QL25C	µA748C.....	£0.52	BL45Y	2N3055.....	£0.75
QH03D	BZY88C3V6.....	£0.09	<b>Page 197</b>			QL26D	µA78L05AWC.....	£0.45	QR25C	2N3525.....	£1.85
QH04E	BZY88C3V9.....	£0.09	QH50E	MC3360P.....	DISC	WQ77J	µA78L12AWC.....	£0.45	QR26D	2N3702.....	£0.13
QH05F	BZY88C4V3.....	£0.09	WQ42V	MCM4027 250ns.....	£1.88	QL27E	µA78L15AWC.....	£0.45	QR27E	2N3703.....	£0.10
QH06G	BZY88C4V7.....	£0.09	WQ43W	MC6800P.....	£4.31	QL28F	µA78M05UC.....	£0.79	QR28F	2N3704.....	£0.10
QH07H	BZY88C5V1.....	£0.09	WQ44X	MC6802P.....	£5.99	QL29G	µA78M12UC.....	£0.79	QR29G	2N3705.....	£0.12
QH08J	BZY88C5V6.....	£0.09	WQ45Y	MC6810AP 450ns.....	£1.98	QL30H	µA78M15UC.....	£0.79	QR30H	2N3706.....	£0.14
QH09K	BZY88C6V2.....	£0.09	WQ46A	MC6821P.....	£1.99	WQ78K	µA78MGU1C.....	£1.25	QR31J	2N3707.....	£0.12
QH101	BZY88C6V8.....	£0.09	QO03D	MC6845.....	£11.21	QL31J	µA7805UC.....	£0.78	QR32K	2N3708.....	£0.11
QH11M	BZY88C7V5.....	£0.09	WQ48C	MC6850P.....	£2.99	QL32K	µA7812UC.....	£0.78	QR34M	2N3711.....	£0.11
QH12N	BZY88C8V2.....	£0.09	WQ49D	MC6852P.....	£2.95	QL33L	µA7815UC.....	£0.78	QW07H	2N3772.....	£1.95
QH13P	BZY88C9V1.....	£0.09	WQ50E	MC6875L.....	£6.32	WQ79L	µA78GU1C.....	£1.25	QR35Q	2N3773.....	£2.94
QH14Q	BZY88C10.....	£0.09	H061R	MEL12.....	£0.38	QL34M	µA7805KC.....	£1.65	QR36P	2N3819.....	£0.32
QH15R	BZY88C11.....	£0.09	QH54J	MJE340.....	£0.75	QL35Q	µA7815KC.....	£1.65	QR37S	2N3823.....	£0.65
QH16S	BZY88C12.....	£0.09	WQ51F	MJE350.....	£1.15	WQ808	µA78H05KC.....	£6.49	QR38R	2N3866.....	£1.36
QH17T	BZY88C13.....	£0.09	QH55K	MJE2955 = TIP2955.....	£0.99	WQ81C	µA78H12KC.....	£6.49	QR39N	2N3903.....	£0.17
QH18U	BZY88C15.....	£0.09	QH56L	MJE3055 = TIP3055.....	£0.88	WQ82D	µA78H15KC.....	DISC	QR40T	2N3904.....	£0.17
QH19V	BZY88C16.....	£0.09	QH57M	MJ2501.....	£3.20	WQ83E	µA78HGKC.....	£6.25	QR41U	2N3905.....	£0.15
QH20W	BZY88C18.....	£0.09	BL38R	MJ2955.....	£0.99	WQ84F	µA78P05SC.....	£8.25	QR42V	2N3906.....	£0.14
QH21X	BZY88C20.....	£0.09	QH58N	MJ3001.....	£2.40	WQ85G	µA79L05AWC.....	£0.58	QR43W	2N4058.....	£0.12
QH22Y											

QQ33L	2SD756	£0.30
QQ34M	2SJ48	£2.50
QQ35Q	2SJ49	£2.90
QW09K	2SJ50	£4.54
QQ36P	2SK133	£2.50
QQ37S	2SK134	£2.90
QW10L	2SK135	£4.30
QW11M	2102 450ns	£2.30
QW12N	2114 450ns	£1.30
QW13P	2708 450ns	£2.75
QQ07H	2716 450ns	£3.23
QQ08J	2732 450ns	£15.65
QQ09K	2764 450ns	NYA
QR52G	3N140	£1.12
QR53H	3N141	DISC
QH51F	3403	£0.88
QX00A	4000 BE	£0.24
QX01B	4001 BE	£0.17
QL03D	4001 UBE	£0.17
QX02C	4002 BE	£0.16
QX03D	4006 BE	£0.68
QX04E	4007 UBE	£0.18
QW14Q	4008 BE	£0.62
QX05F	4011 BE	£0.16
QL04E	4011 UBE	£0.24
QX06G	4012 BE	£0.18
QX07H	4013 BE	£0.35
QW15R	4014 BE	£0.89
QW16S	4015 BE	£0.66
QX08J	4016 BE	£0.32
QX09K	4017BE	£0.48
QX10L	4018 BE	£0.68
QW17T	4019 BE	£0.42
QX11M	4020 BE	£0.61
QW18U	4021 BE	£0.49
QW19V	4022 BE	£0.66
QX12N	4023 BE	£0.23
QX13P	4024 BE	£0.45
QX14Q	4025 BE	£0.22
QX15R	4026 BE	£1.20
QX16S	4027 BE	£0.38
QX17T	4028 BE	£0.58
QW20W	4029 BE	£0.77
QW21X	4031 BE	£1.70
QW22Y	4032 BE	£0.75
QW23A	4033 BE	£0.95
QW24B	4034 BE	£1.95
QW25C	4035 BE	£0.60
QW26D	4038 BE	£0.85
QW27E	4040 BE	£0.59
QW28F	4041 UBE	£0.83
QX19V	4042 BE	£0.60
QW29G	4043 BE	£0.70
QW30H	4044 BE	£0.65
QW31J	4045 BE	£1.40
QW32K	4046 BE	£0.75
QX20W	4047 BE	£0.75
QW33L	4048 BE	£0.60
QX21X	4049 UBE	£0.30
QX22Y	4050 BE	£0.30
QW34M	4051 BE	£0.78
QW35Q	4052 BE	£0.78
QW36P	4053 BE	£0.78
QW37S	4054 BE	£0.95
QW38R	4055 BE	£0.85

**Page 198**

QW39N	4056 BE	£1.12
QW40T	4060 BE	£1.20
QW41U	4063 BE	£0.85
QX23A	4066 BE	£0.36
QW42V	4067 BE	£3.69
QX24B	4068 BE	£0.23
QX25C	4069 UBE	£0.20
QX26D	4070 BE	£0.26
QW43W	4071 BE	£0.21
QX27E	4072 BE	£0.21
QW44X	4073 BE	£0.21
QW45Y	4075 BE	£0.28
QW46A	4076 BE	£0.60
QW47B	4077 BE	£0.26
QX28F	4078 BE	£0.26
QW48C	4081 BE	£0.24
QW49D	4082 BE	£0.21
QW50E	4085 BE	£0.65
QW51F	4086 BE	£0.65
QW52G	4089 BE	£1.40
QW53H	4093 BE	£0.43
QW54J	4094 BE	£1.20
QW55K	4095 BE	£0.75
QW56L	4097 BE	£3.20
QX29G	4098 BE	£0.85
QW57M	4099 BE	£0.95
QW58N	4100 BE	£1.49
QW59P	4101 BE	£0.90
QW60Q	4102 BE	£1.50
QW61R	4103 BE	£0.85
QW62S	4104 BE	£0.85
QW63T	4105 BE	£0.85
QW64U	4106 BE	£0.75
QW65V	4107 BE	£0.60
QW66W	4108 BE	£4.30
QW67X	4109 BE	£0.95
QW68Y	4110 BE	£1.10
QW69A	4160 BE	£1.25
QW70M	40161 BE	£1.20
QW71N	40162 BE	£0.85
QW72P	40163 BE	£0.85

QW73Q	40174 BE	£0.85
QQ38R	40175	£0.95
QW74R	40181 BE	£1.99
QW75S	40182 BE	£0.85
QW76H	40192 BE	£1.25
QW77J	40193 BE	£0.80
QW78K	40194 BE	£0.85
QW79L	40257 BE	£1.10
QX34M	40673	£1.75
QW93B	4116 250ns	£1.30
QQ05F	4118 250ns	£3.23
QQ06G	4164 250ns	£9.20
XX01B	4136	£0.75
QW80B	4151	£0.89
XX02C	4195	£1.45
QQ39N	4412 VP	£8.00
QX30H	4416 BE	£1.92
QQ40T	4459	£0.80
QW81C	4502 BE	£1.19
QQ41U	4503	£0.95
QW82D	4508 BE	£2.10
QW83E	4510 BE	£0.68
QX31J	4511 BE	£0.68
QW84F	4512 BE	£1.49
QW85G	4514 BE	£1.55
QW86T	4515 BE	£1.55
QW87U	4516 BE	£0.60
QX32K	4518 BE	£0.63
QX33L	4520 BE	£0.78
QQ42V	4521	£2.00
QQ43W	4522	£1.25
QQ44X	4526	£0.95
QW88V	4527 BE	£1.15
QQ45Y	4529	£1.42
QQ46A	4530	£0.97
QW89W	4532 BE	£1.10
QQ47B	4541	£1.40
QQ48C	4551	£1.59
QW90X	4555 BE	£0.50
QW91Y	4556 BE	£0.58
QQ49D	4568	£3.15
QQ50E	4583	£1.79
QQ51F	45100	£2.90
QX350	5W Zener 5V6	£1.27
QX36P	5W Zener 8V2	£1.27
YH31J	5101 L1	£3.48
QQ04E	6402	£5.80
QQ02C	6502	£5.48
QX37S	7400	£0.19
YF00A	74LS00	£0.21
QX38R	7401	£0.21
YF01B	74LS01	£0.21
QX39N	7402	£0.23
YF02C	74LS02	£0.23
QX74R	7403	£0.25
YF03D	74LS03	£0.23
QX40T	7404	£0.21
YF04E	74LS04	£0.22
OX41U	7405	£0.22
YF05F	74LS05	£0.22
QX75S	7406	£0.24
QX76H	7407	£0.25
QX42V	7408	£0.31
YF06G	74LS08	£0.22
QX77J	7409	£0.34
YF07H	74LS09	£0.75
QX43W	7410	£0.25
YF08J	74LS10	£0.22
QX44X	7411	£0.24
YF09K	74LS11	£0.22
YF10L	74LS12	£0.24
QX45Y	7413	£0.43
YF11M	74LS13	£0.47
QX46A	7414	£0.57
YF12N	74LS14	£0.44
YF13P	74LS15	£0.24
QX78K	7416	£0.31
QX79L	7417	£0.26
QX47B	7420	£0.28
YF14Q	74LS20	£0.24
QX48C	7421	£0.86
YF15R	74LS21	£0.26
YF16S	74LS22	£0.26
QX80B	7425	£0.28
QX81C	7426	£0.22
YF17T	74LS26	£0.29
QX49D	7427	£0.29
YF18U	74LS27	£0.29
YF19V	74LS28	£0.44
QX50E	7430	£0.24
YF20W	74LS30	£0.22
QX51F	7432	£0.36
YF21X	74LS32	£0.22
YF22Y	74LS33	£0.40
YF23A	74LS37	£0.26
QX82D	7438	£0.26
YF24B	74LS38	£0.48
QX53H	7440	£0.24
YF25C	74LS40	£0.44
QX54J	7442	£0.66
YF26D	74LS42	£0.26
QX55K	7447A	£0.85
QQ52G	74LS47	£0.80
QQ53H	74LS48	£0.80
QX83E	7451	£0.30
YF27E	74LS51	£0.35
QX84F	7454	£0.30
YF28F	74LS54	£0.40

YF29G	74LS55	£0.40
QX56L	7470	£0.36
QX57M	7472	£0.39
QX58N	7473	£0.32
YF30H	74LS73	£0.36
QX59P	7474	£0.32
YF33E	74LS74	£3.35
YF31J	74LS74	£0.32
QX60Q	7475	£0.71
YF32K	74LS75	£0.38
QX61R	7476	£0.32
YF33L	74LS76	£0.36
YF34M	74LS78	£0.39
QX62S	7481	£1.75
QX85G	7483	£0.58
QX63T	7485	£0.77
YF35Q	74LS85	£0.74
QX64U	7486	£0.31
YF36P	74LS86	£0.33
QX65V	7489	£3.10
QX66W	7490	£0.35
YF38R	74LS90	£0.44
QX86T	7491	£1.20
QX67X	7492	£0.42
YF39N	74LS92	£0.59
QX68Y	7493	£0.79
YF40T	74LS93	£0.42
QX69A	7494	£0.39
QX70M	7495	£0.54
YF41U	74LS95	£1.20
QX87U	7496	£0.52
YF42V	74LS96	£1.69
QX71N	74107	£0.26
YF43W	74LS107	£0.36
QX88V	74109	£0.96
YF44X	74LS109	£0.36
YF45Y	74LS112	£0.36
YF46A	74LS113	£0.40
YF47B	74LS114	£0.50
QX72P	74118	£2.30
QX73Q	74121	£0.55
WH00A	74122	£0.76
QQ54J	74LS122	£0.66
WH01B	74123	£0.42
YF48C	74LS123	£0.68
WH02C	74LS124	£2.15
YF49D	74LS125	£0.45
YF50E	74LS126	£0.45
WH030	74132	£0.76
YF51F	74LS132	£0.49
YF52G	74LS136	£0.57
QQ55K	74LS137	£2.20
YF53H	74LS138	£0.49
YF54J	74LS139	£0.47
WH05E	74141	£0.65
WH06G	74145	£0.67
YF55K	74LS145	£1.65
QX89W	74150	£0.75
WH07H	74151	£0.65
YF56L	74LS151	£0.50
YF57M	74LS153	£0.52
WH08J	74154	£1.15
YF58N	74LS154	£0.98
YF59P	74LS155	£0.55
YF60Q	74LS156	£0.57
YF61R	74LS157	£0.42
YF62S	74LS158	£0.50
WH09K	74160	£0.72
YF63T	74LS160	£0.72
YF64U	74LS161	£0.95
YF65V	74LS162	£1.40
YF66W	74LS163	£0.60
WH10L	74164	£0.90
YF67X	74LS164	£0.70
YF68Y	74LS165	£1.40
YF69A	74LS166	£1.95
YF70M	74LS168	£1.20
YF71N	74LS169	£0.99
YF72P	74LS170	£2.99
YF73Q	74LS173	£0.65
WH11M	74174	£0.99
YF74R	74LS174	£0.55
YF75S	74LS175	£0.55
YF76H	74LS181	£2.95
YF77J	74LS189	£4.95
YF78K	74LS190	£0.75
YF79L	74LS191	£0.75
WH12N	74192	£0.95
YF80B	74LS192	£1.65
QX90X	74193	£1.95
YF81C	74LS193	£0.70
WH13P	74194	£0.95
YF82D	74LS194	£0.85
YF83E	74LS195	£1.30
WH14Q	74196	£0.95
YF84F	74LS196	£2.35
YF85G	74LS197	£1.65
YF86T	74LS221	£0.63
YF87U	74LS240	£0.99
YF88V	74LS241	£0.99
YF89W	74LS242	£1.75
YF90X	74LS243	£2.55
QQ56L	74LS244	£1.15
YF91Y	74LS245	£1.95
YF92A	74LS251	£0.75
YF93B	74LS253	£1.65
YF94C	74LS256	£1.36
YF95D	74LS257	£0.55

YF96E	74LS258	£0.55
YF97F	74LS259	£2.15
YF98G	74LS261	£2.25
YF99H	74LS266	£0.32
YH00A	74LS273	£1.50
YH01B	74LS279	£0.44
YH02C	74LS283	£0.69
YH03D	74LS290	£1.30
YH04E	74LS293	£0.96
YH05F	74LS295	£2.35
YH06G	74LS298	£1.75
YH07H	74LS299	£4.25
YH08J	74LS323	£6.75
YH09K	74LS363	£3.25
YH10L	74LS364	NYA
YH11M	74LS365	£0.39
YH12N	74LS366	£0.72
YH13P	74LS367	£0.69
YH14Q	74LS368	£0.43
YH15R	74LS373	£1.15
YH16S	74LS374	£1.30
YH17T	74LS375	£1.30
YH18U	74LS377	£2.90
YH19V	74LS378	£1.40
YH20W	74LS379	

BR02C	5W Amp PCB.....	£1.45
YY70M	TDA2005M.....	£8.25

**Page 230**

WQ67X	TDA2030.....	£1.95
YQ43W	15W Amp Kit.....	£6.45
YQ35Q	15W Amp PCB.....	£1.25
YQ36P	15W Amp Bracket.....	£0.65
YQ38R	30/2 PSU PCB.....	£1.40
YQ37S	15W Amp Module.....	£6.49

**Page 231**

WQ66W	TDA2006.....	£1.65
QH44X	MC1303.....	DISC
QH41U	LM381.....	£1.90
BR04E	LM381 PCB.....	£2.15

**Page 232**

YY84F	LM382.....	£1.43
YY87U	NE571.....	£4.77
YY86T	TDA3410.....	£1.90
WQ35Q	LM387.....	£1.25

**Page 233**

QH49D	MC3340P.....	£1.27
YY85G	LM1818.....	£1.95
QB21X	AY-1-0212.....	£7.89
YY81C	M083.....	£4.75
WH22Y	M087.....	£4.95

**Page 234**

HQ51F	AY-1-5050.....	£1.99
HQ53H	Piano IC Kit.....	£38.44
HQ52G	AY-1-1320.....	£4.99
HQ71N	M251.....	£12.20
tQH64U	M252.....	£8.95
WH21X	M254.....	£7.49
YY90X	M108.....	£18.25

**Page 235**

YY91Y	M147.....	£6.51
YY89W	AY-3-1350.....	£7.85
WH20W	TDA1022.....	£6.75
YH33L	76489.....	£4.75

**Page 236**

YY79L	TCA350Z.....	£3.95
YH32K	76477.....	£2.90
YQ42V	Sound Effects PCB.....	£1.10

**Page 238**

WQ61R	SH120A.....	£6.65
QD27E	CA3089E.....	£2.700
WQ20W	CA3189E.....	£1.95

**Page 239**

WQ37S	LM1820.....	£1.80
BL35Q	TBA651.....	£2.25
WQ64U	TCA4500A.....	£3.35
QH45Y	MC1310P.....	£2.30
BR03D	Decoder PCB.....	£1.72

**Page 240**

WQ17T	AY-3-8115.....	£9.95
QL41U	ZN414.....	£1.25

**Page 241**

QH47B	MC1496.....	£0.89
QL06G	SG1495D.....	£3.95
QL07H	SG3402.....	£3.78
QH26D	CA3046.....	£0.99

**Page 242**

YH66W	SL490.....	£3.35
YH67X	ML922.....	£5.25

**Page 243**

YH68Y	ML928.....	£2.40
YH69A	ML929.....	£2.40
YY71N	LM1871.....	£5.20
YQ69A	LM1871 Xmitter PCB.....	£0.98

**Page 244**

YY72P	LM1872.....	£5.20
YQ70M	LM1872 Receiver PCB.....	£0.95
WQ55K	NE 544.....	£2.18
YQ71N	Servo Driver PCB.....	£0.85
WQ76H	TL172C.....	£0.76

**Page 245**

WQ75S	TL170C.....	£0.49
YG37S	CL8960.....	£29.95
YY99H	LM183C.....	£2.65
YY73Q	LM335Z.....	£1.23
WQ40T	LM3911.....	£13.10

**Page 246**

YY98G	AY-3-1270.....	£8.30
WQ41U	LM3914.....	£2.41
YY96E	LM3915.....	£2.53
YY97F	LM3916.....	£3.46
YQ66W	LM3914 PCB.....	£0.85

**Page 247**

YH30H	74C917.....	£8.85
YY82D	DF412.....	£6.45
QB248	AY-5-1224.....	£3.30
BB53H	4 Dig Clock PCB A.....	£1.10

**Page 248**

FY90X	Crystal 6.5536 Mhz.....	£2.98
YY93B	ICM7045IPI.....	£14.95
QB25C	AY-5-1230.....	£5.27

**Page 249**

YY88V	TMS1121.....	£8.95
YY92A	MK50395.....	£8.30
QB26D	AY-5-4007D.....	£6.90

**Page 250**

YY94G	ICM7216DIPI.....	£17.45
YY95D	ICM7226BIPI.....	£21.90
YH63T	ICM7555.....	£1.25

**Page 251**

QH66W	NE555.....	£0.21
QH67X	NE556.....	£0.62
QH68Y	NE566.....	£1.93
WQ56L	NE565.....	£1.34

**Page 252**

QH69A	NE567.....	£1.60
WQ39N	LM3909.....	£0.97
YY76H	TDA1024.....	£1.49
YH43W	8211 CPA.....	£3.25
WQ32K	LM334.....	£1.10
YH39N	8069 DCQ.....	£2.35
WQ62S	TAA550.....	£0.35

**Page 253**

YY78K	TL497A.....	£1.65
YY77J	TL430C.....	£0.85
YY75S	ICL7660CPA.....	£2.75
XX02C	4195.....	£1.45
XX04E	15V Supply PCB.....	£0.75
BL22Y	µA723C T099.....	£0.85
QL21X	µA723C 14-pin DIL.....	£0.55

**Page 255**

YQ39N	0.1A Reg PSU PCB.....	£1.05
YQ40T	0.5/1A Reg V PSU PCB.....	£0.85
YQ41U	0.5/1A Reg -V PSU PCB.....	£0.85
YQ54J	0.5/1A Vareg Pos PCB.....	£0.85
YQ55K	0.5/1A Vareg Neg PCB.....	£0.85
YY74R	L200.....	£2.69

**Page 256**

QO02C	6502.....	£5.48
WQ43W	MC6800P.....	£4.31
WQ44X	MC6802P.....	£5.99
WQ46A	MC6821P.....	£19.90
WQ48C	MC6850P.....	£2.99
WQ49D	MC6852P.....	£2.95
WQ50E	MC6875L.....	£6.32
QW00A	Z80 CPU.....	£7.95
QW03D	Z80 PIO.....	£4.25
QW04E	Z80-SIO.....	£19.00
QW01B	Z80-CTC.....	£4.50

**Page 257**

YH40T	8080A.....	£4.95
YH41U	8085A.....	£5.99
YH46A	8224.....	£2.68
YH47B	8228.....	£4.45
YH50E	8255A.....	£4.40
YH49D	8251.....	£4.60
YH48C	8250.....	£9.95
YH51F	8279.....	£9.95
YH44X	8212.....	£1.95
YH45Y	8216.....	£1.95
YH34M	8T28.....	£3.30
YH35Q	8T95.....	£2.55
YH36P	8T97 = 74LS367.....	£0.63
YH37S	8T98.....	£2.35
WQ19V	AY-5-2376.....	£9.95

**Page 258**

WQ18U	AY-5-1013A.....	£5.98
QO04E	6402.....	£5.80
WQ60Q	SFF96364.....	£9.45
QO03D	MC6845.....	£11.21
YH31J	5101-L1.....	£3.48
QW11M	2102 450ns.....	£2.30
WQ45Y	MC6810AP 450ns.....	£1.98
QW12N	2114 450ns.....	£1.30
QO05F	4118 250ns.....	£4.45
WQ42V	MCM4027 250ns.....	£1.88

**Page 259**

QW93B	4116 250ns.....	£1.30
QO06G	4164 250ns.....	£9.20
QW05F	1702 1000ns.....	£4.10
QW13P	2708 450ns.....	£2.75
QO07H	2716 450ns.....	£3.23

**Page 260**

QO08J	2732 450ns.....	£15.65
QO09K	2764 450ns.....	NYA
XY84F	Softy.....	£142.50
XY85G	Softy PSU.....	£24.95
XY83E	EPROM Eraser.....	£42.95

**Page 261**

WQ26D	ER1400.....	£9.99
WQ27E	ER3401.....	£19.58
YH52G	82S126M1.....	£3.49

WQ59P	R0-3-2513.....	£8.95
YH38R	8038 CCPD.....	£4.69

**Page 262**

YQ65V	8038 PCB.....	£0.85
QW80B	4151.....	£0.89
QO01B	DAC0801LCN.....	£2.45
QO00A	ADC0804LCN.....	£4.45
YH59P	ICL7109.....	£16.55
WQ38R	LM2917.....	£2.29

**Page 263**

YQ67X	LM2917 PCB.....	£0.85
QW94C	7106.....	£8.95
QW95D	7107.....	£8.45
BY76H	7106/7 PCB.....	£1.45
WR29G	Transkt 3 Lead T018.....	£0.16
WR30H	Transkt 4-Lead T018.....	£0.31
WR31J	Transkt 3-Lead T05.....	£0.19
WR32K	IC Socket 8-Lead.....	£0.52
WR33L	IC Socket 10-Lead.....	£0.67

**Page 264**

WR24B	Kit T03.....	£0.08
WR25C	Kit T066.....	£0.09
WR27E	Kit S055.....	£0.09
WR26D	Kit TO 126.....	£0.05
WR23A	Kit (P) Plastic.....	£0.06
BL17T	DIL Socket 8-pin.....	£0.09
BL18U	DIL Socket 14-pin.....	£0.11
BL19V	DIL Socket 16-pin.....	£0.12
HQ76H	DIL Socket 18-pin.....	£0.16
HQ77J	DIL Socket 20-pin.....	£0.17
HQ78K	DIL Socket 22-pin.....	£0.20
BL20W	DIL Socket 24-pin.....	£0.19
BL21X	DIL Socket 28-pin.....	£0.24
HQ38R	DIL Socket 40-pin.....	£0.31
YX50E	ZIF Socket 24 Way.....	£3.40
XX14Q	Soldercons.....	£0.90
YG27E	Header 14-pin.....	£0.54
YG28F	Header 16-pin.....	£0.63
YG29G	Header 24-pin.....	£1.10
FR25C	Insertion Tool.....	£0.80

**Page 265**

FL56L	Transistor Cover.....	£0.10
HQ79L	Heatsink 92F.....	£0.14
HQ80B	Heatsink 18F.....	£0.19
FL78K	Heatsink Clip-On.....	£0.16
WR34M	T05 Chassis Heatsink.....	£0.89
FL59P	Vaned Heatsink T03.....	£0.46
FL58N	Vaned Heatsink Plas Pwr.....	£0.34
FL57M	Vaned Heatsink IC.....	£0.72
HQ70M	Heatsink 2E.....	£2.55
FL41U	Heatsink 4Y.....	£1.70
HQ69A	50W Hi-Fi Heatsink.....	£1.95

**Page 266**

HQ81C	8W Hi-Fi Heatsink.....	£1.17
FL42V	Flat Heatsink.....	£3.25
FL54J	Heatsink 10DN.....	£2.15
FL55K	Heatsink 10DNDR.....	£2.60
FL77J	Heatsink 6W-1.....	£5.50
YB26D	Heatsink 60DN.....	£13.95
FL79L	Thermpath.....	£3.60
HQ00A	Small Thermpath.....	£0.90
WY08J	Standard Fan.....	£15.50

### SPEAKERS

**Page 267**

HY12N	Ultrasonic Transducer.....	£6.20
FL39N	Buzzer 6V.....	£0.88
FL40T	Buzzer 12V.....	£0.88
FL38R	AC Bell.....	£1.90
FL37S	Bell X Former.....	£4.95
QO08J	Bell Push.....	£1.10
QO09K	Nameplate Bell Push.....	£0.55
YB25C	Baby Siren.....	£9.25
LH96E	Plastic Siren.....	£5.50
LH97F	Star War Siren.....	£5.95

**Page 268**

LH98G	Hawaii Five-0-Siren.....	£24.95
XQ71N	Re-entrant Horn Sounder.....	£26.50
XQ72P	Megaphone.....	£49.95
XY76H	Pistol Grip Megaphone.....	£44.95
XQ73Q	Car PA 8W.....	£8.25
XQ74R	Car PA 15W.....	£12.95

**Page 269**

YW52G	2m Piezo Tweeter.....	£2.49
WF54J	Direct Rad Piezo.....	£4.55
WF09K	Piezo Horn Flush.....	£5.25
WF55K	Piezo Horn Recessed.....	£5.25
WF56L	Wide Angle Piezo.....	£7.90
LB23A	Mag Earpiece 2.5 mm.....	£0.25
LB248	Mag Earpiece 3.5 mm.....	£0.25
LB25C	Crystal Earpiece.....	£0.55
YW57M	Stethoscope.....	£0.75
WB04E	L/S lo Z 388.....	£0.85
WB05F	L/S Lo Z 458.....	£0.89
WB08J	L/S Lo Z 508.....	£0.89
WB09K	L/S Lo Z 568.....	£0.89
WB13P	L/S Lo Z 668.....	£0.89
WF57M	H-Z L/S 64 R.....	£0.99
YW53H	L/S Lo Z 768.....	£0.99
WF58N	3 inch Tweeter.....	£1.45

**Page 270**

YW54J	15W Cone Tweeter.....	£2.85
WF24B	Multi-Cell Tweeter.....	£5.95
WF33L	Free Stand Tweeter.....	£5.95
WF43W	Dome Tweeter.....	£5.45
WF44X	Rectangular Tweeter.....	£5.45
WF02C	Crossover 2-Way.....	£4.20
WF03D	Crossover 3-Way.....	£5.20

**Page 271**

WF45Y	Escutcheon Crossover.....	£4.99
WF46A	Controlled Crossover.....	£10.69
WF47B	Low-Cost 4in Speaker.....	£1.98
WB27E	Rd Speaker CM420.....	£2.56
YW55K	Plastic Car Grille.....	£0.90
YW56L	Metal Car Grille.....	£0.90
WF48C	Heavy Duty Car Speaker.....	£6.45
WF50E	Elliptical Speaker CM641.....	£3.35
WF18U	Elliptical Speaker CM742.....	£4.45
WF23A	Elliptical Speaker CM852.....	£5.20
WY13P	Elliptical Speaker LT853.....	£6.45

**Page 272**

WF00A	Rd Speaker LT530.....	£6.95
WF52G	Rd Speaker LT610.....	£5.75
WF08J	Rd Speaker CM820.....	£5.95
WF11M	Rd Speaker LT830.....	£7.30
WF12N	Rd Speaker LT840.....	£11.45
WF53H	20W Squawker.....	£3.25
WY15R	40W Squawker.....	£5.25
XQ77J	Fane 50 4R.....	£19.95
XB26D	Fane 50 8R.....	£21.45
XQ78K	Disco 80 4R.....	£29.45
XB27E	Disco 80 8R.....	£29.45
XQ79L	Forte 1250TC 8R.....	£21.75
XQ80B	Forte 1250TC 16R.....	£21.75
XQ81C	Forte C1285TC 8R.....	£28.45
XQ82D	Forte C1285TC 16R.....	£28.45

**Page 277**

Table with 2 columns: Item Name and Price. Items include Rotary SW12B, Rotary SW6B, Rotary SW4B, Rotary SW3B, Rotary SW12, Rotary SW6, Rotary SW4, Rotary SW3, Thumb Wheel Decimal, Thumb Wheel BCD, Thumb Wheel Mounting Kit, Push Wheel BCD, Push Wheel Spacer, Push Wheel End Cheeks, Key Switch, Rotary Mains, and Roller Micro-switch.

**Page 278**

Table with 2 columns: Item Name and Price. Items include Maka Shaft, Maka Wafer 1P 12 way, Maka Wafer 2P 6 way, Maka Wafer 2P 9 way, Maka Wafer 4P 3 way, Maka Wafer 6P 2 way, Maka Wafer 1P 12 way MB, Maka Wafer 2P 6 way MB, Maka Wafer 2P 9 way MB, Maka Mains, Maka Screen, Click Switch, Click Cap Black, Click Cap Blue, Click Cap Green, Click Cap Grey, Click Cap Ivory, Click Cap Red, Click Cap White, Click Cap Yellow, Keyboard Switch, Key Top 1 Position, Key Top 2 Position, Key Top 3 Position, ASCII Transparency, and Switch Contact Sheet.

**Page 279**

Table with 2 columns: Item Name and Price. Items include SP Slide, Sub Min Slide, Long Chrome Slide, Std Slide Switch, 4 Pole Slide, HQ Push Switch, Push Switch, Break Push, Motor Start Press, Square Push Black, Square Push Green, Square Push Red, Square Push Yellow, Square Push Lock Black, Square Push Lock Green, Square Push Lock Red, Square Push Lock Yellow, Pushlock SPCO, Pushlock DPCO, and Pressil Switch.

**Page 280**

Table with 2 columns: Item Name and Price. Items include Press Toe Switch Type 1, Press Toe Switch Type 2, Foot Switch 2.5 mm Jack, Mains Push, Flasher Unit 2-Way, Beginners Morse Key, Professional Morse Key, Touch Pads Rectangle, Touch Pads Triangle, Solenoid 12V, and Solenoid 240V AC.

**Page 281**

Table with 2 columns: Item Name and Price. Items include Latch Switch 2-pole, Latch Switch 4-pole, Latch Switch 6-pole, Latch Switch 8-pole, Latch Switch 10 pole, Latch Soft 2 pole, Latch Soft 4 pole, Latch Dummy, Mains Latch Switch, Latch Bracket Single, Latch Bracket 2-way, Latch Bracket 4-way, Latch Bracket 6-way, Latch Bracket 8-way, and Latch Bracket 10-way.

**Page 282**

Table with 2 columns: Item Name and Price. Items include Rd Latch Button Black, Rd Latch Button Green, Rd Latch Button Grey, Rd Latch Button Red, Rd Latch Button White, Rd Latch Button Chrome, and Sm Latch Button Black.

Table with 2 columns: Item Name and Price. Items include Sm Latch Button Chrome, Ret Latch Button Black, Ret Latch Button Grey, Ret Latch Button Red, Ret Latch Button White, Magic Light Button Bi, Magic Light Button Green, Magic Light Button Orange, Magic Light Button Yellow, Latch Bush Blue, Latch Bush Green, Latch Bush Orange, and Latch Bush Yellow.

**Page 283**

Table with 2 columns: Item Name and Price. Items include Ultra Min Relay SPDT, Ultra Min Relay DPDT, 3A Min Relay, 10A Mains Relay, and 5A Mains Relay.

**Page 284**

Table with 2 columns: Item Name and Price. Items include 12V 30A Relay, Open Relay 6V, Open Relay 12V, 2p Sub Mm Relay 6V, 2p Sub Mm Relay 12V, 2p Sub Mm Relay 24V, and 4p Sub-Min Relay 12V.

**Page 285**

Table with 2 columns: Item Name and Price. Items include Relay Flat 12V, Power Relay 12V, Power Relay 230V AC, Car Relay Single, Reed Relay 6 to 9V, Reed Relay 9 to 12V, Reed Relay 12 to 18V, Reed Relay 18 to 30V, DIL Reed Relay 1p 5V, DIL Reed Relay 1p 2V, DIL Reed Relay 2p 5V, DIL Reed Relay 2p 2V, DIL Reed Relay 1p C/O 5V, DIL Reed Relay 1p C/O 12V, Reed SW Standard, Reed SW Compact, Reed SW Miniature, Magnet Small, Magnet Large, Sw Former Stan One, Sw Former Min One, and Sw Former Comp One.

**Page 286**

Table with 2 columns: Item Name and Price. Items include DIL Reed Relay 1p 5V, DIL Reed Relay 1p 2V, DIL Reed Relay 2p 5V, DIL Reed Relay 2p 2V, DIL Reed Relay 1p C/O 5V, DIL Reed Relay 1p C/O 12V, Reed SW Standard, Reed SW Compact, Reed SW Miniature, Magnet Small, Magnet Large, Sw Former Stan One, Sw Former Min One, and Sw Former Comp One.

**TEST GEAR**

Table with 2 columns: Item Name and Price. Items include Test Prod Black, Test Prod Red, Min Probe Black, Min Probe Blue, Min Probe Green, Min Probe Red, Min Probe Yellow, Probe Clips, Pistol Probe Black, Pistol Probe Red, Low Cost Test Probe, Moulded Test Probe, 4 mm Test Probe, AVO type Test Lead, Test Lead Kit, Logic Probe, Continuity Probe, Signal Injector, Scope Probe BNC, Scope Probe 4 mm, IC Test Clip, Safe Bloc, and Lo-Cost Scope Probe.

**Page 288**

Table with 2 columns: Item Name and Price. Items include Continuity Probe, Signal Injector, Scope Probe BNC, Scope Probe 4 mm, IC Test Clip, Safe Bloc, and Lo-Cost Scope Probe.

**Page 289**

Table with 2 columns: Item Name and Price. Items include Calscope Super 6 and Scopex 14D-10.

**Page 290**

Table with 2 columns: Item Name and Price. Items include 500 MHz Frequency Counter, Transistor Tester HFE, LCR Bridge, Seesure Signal Gen, Low Cost Multimeter, and Pocket Multimeter.

**Page 291**

Table with 2 columns: Item Name and Price. Items include Small Multimeter, Multimeter Type 320, Taut-Band Multimeter, and 100K Multi-tester.

**Page 292**

Table with 2 columns: Item Name and Price. Items include Micro-test 80, Super-tester 680G, and Super-tester 680R.

**Page 293**

Table with 2 columns: Item Name and Price. Items include Clamp Meter, DMM200, and DMM100.

**Page 294**

Table with 2 columns: Item Name and Price. Items include HV Probe, Shunt 25A, Shunt 100A, Ham Multimeter, and SWR Meter 310.

**Page 295**

Table with 2 columns: Item Name and Price. Items include SWR Meter 110, Transtest UH74, SWR Meter 178, and Grid Dip Meter.

**TOOLS**

**Page 296**

Table with 2 columns: Item Name and Price. Items include Hobby Box, Storage Drawer, Hex Trimmer, Trim Tool, Preset Trimmer, Trim TT5, Min Screwdriver Set, Jewellers Screwdriver Set, Interchangeable Driver Set, Mm Tool Set, and Utility Set.

**Page 297**

Table with 2 columns: Item Name and Price. Items include Min Screwdriver, Small Screwdriver, Large Screwdriver, Driver S2, Driver S3, Driver S5, Driver S6, Pozidriver P1, Pozidriver P2, Mains Tester, Spiral Driver, Ratchet Socket Set, Cushion Grip Driver Set, Low Cost Min Cutters, and Ins Min Cutters.

**Page 298**

Table with 2 columns: Item Name and Price. Items include Box Joint Min Cutter, Box Joint End Cutter, Low-Cost Cutters, Large Low Cost Cutters, Side Cutters, Box Joint Side Cutters, Side Cutters S55, High Leverage Cutter, Tweezers, Low Cost Min Pliers, Ins Min Snipe, Box Joint Min Pliers, Bright Pliers, Low Cost Pliers, and Box Combined Pliers.

**Page 299**

Table with 2 columns: Item Name and Price. Items include Low-Cost Long Pliers, Combination Pliers, Long Snipe Pliers, Box Radio Pliers, Low Cost Electrician Pliers, Low Cost HD Pliers, Electricians Pliers, Pincers, Crimp Tool, End Action Strippers, Wire Strippers 3A, Wire Strippers 8B, Wire Strippers 9, Shipmaster, Blade L5361, and Blade L4421.

**Page 300**

Table with 2 columns: Item Name and Price. Items include Hand Wrap Tool, Vero-wire Pen, Vero-wire Spool, Vero-wire Comb, Allen Keys AF, Allen Keys Metric, Mm Spanner Set, Mm Spanner 24, Mm Spanner 68, Ring Spanner 02, Ring Spanner 46, Box Spanner Set, PSD6 Spanner Set, Crescent Wrench 160, and Crescent Wrench 210.

**Page 301**

Table with 2 columns: Item Name and Price. Items include Box Spanner 2BA, Box Spanner 4BA, Box Spanner 6BA, Box Spanner 8BA, Quick Grips, Adjustable Wrench, and Needle File Set.

Table with 2 columns: Item Name and Price. Items include Needle File Flat Ward, Needle File Hand, Needle File Half Round, Needle File Round, Junior Hacksaw, 6m Hacksaw Blades, Wire Brush, Wet & Dry Fine, Wet & Dry Med, Wet & Dry Course, Polish Block, Utility Knife, Retractable Knife, Knife Blades, and Snap-Off Blade Knife.

**Page 302**

Table with 2 columns: Item Name and Price. Items include Scalpel Handle, Scalpel Bid Type 2, Punch 3/8 in, Punch 7/16 in, Punch 1/2 in, Punch 9/16 in, Punch 5/8 in, Punch 3/4 in, Punch 1 in, Punch 1 1/2 in, Mini Vice, Reliant Kit, Reliant Drill, Titan Drill, Mini Mains Drill, Drill Stand, Reliant Collar, and Drill Power Supply.

**Page 303**

Table with 2 columns: Item Name and Price. Items include Twist Burr 0.8 mm, Twist Burr 1.4 mm, HS Twist Drill 0.8 mm, HS Twist Drill 1 mm, HS Twist Drill 1.4 mm, Long Life Drill 1 mm, 20 Piece Tool Kit, 40 Piece Tool Kit, Washbone Sharpener, Pin Drill, HS Drill 1/16 in, HS Drill 5/64 in, HS Drill 3/32 in, HS Drill 7/64 in, HS Drill 1/8 in, HS Drill 9/32 in, HS Drill 5/32 in, HS Drill 11/64 in, HS Drill 3/16 in, HS Drill 13/64 in, HS Drill 7/32 in, HS Drill 15/64 in, HS Drill 1/4 in, HS Drill 17/64 in, HS Drill 9/32 in, HS Drill 19/64 in, HS Drill 5/16 in, HS Drill 21/64 in, HS Drill 11/32 in, HS Drill 23/64 in, HS Drill 3/8 in, HS Drill 25/64 in, HS Drill 13/32 in, HS Drill 27/64 in, HS Drill 7/16 in, HS Drill 29/64 in, HS Drill 15/32 in, HS Drill 1/2 in, Round Tape Rule, Retractable Rule, Feeler Gauge Imp, and Feeler Gauge Metric.

**Page 304**

Table with 2 columns: Item Name and Price. Items include Iron CX, Element CX, Bit 6/1106, Bit 1100, Bit 1101, Bit 7/1101, Bit 1102, Bit 1103, Element Type CN, Handle Type CN, Bit 102, Bit 104, Bit 106, Bit 820, Bit 821, Bit 822, Iron X25, 12V Iron MLX12, Element X25, Element MLX12, Bit No 50, Bit No 51, Bit No 52, Stand ST3, Sponge, and Kit SK3.

**Page 305**

Table with 2 columns: Item Name and Price. Items include Kit SK4, Rechargeable Iron, B50 Bit Round, B50 Bit Angled, B50 Bit Flattened, B50 Lamp, B50 Holder, B50 Sponge, Heat Sink Tweezers, Solder Sucker, Sucker Tiptel, Desolder Tool, Desolder Nozzle Type 2, Desolder Washer Type 2, Desolder Washer, Desolder Nozzle, Solda-Mop, Solder D622, Alum Reel Solder, Alum Solder 1m Pack.

**Page 306**

Table with 2 columns: Item Name and Price. Items include Conductive Paint, Freeze it, Switch Cleaner, Servisol, Aero Klene, Aero Duster, Silicone Grease, Plastic Seal, Foam Cleanser, Excel Polish, Anti-Static Spray, Fire Extinguisher, Evostik Impact.

**Page 307**

Table with 2 columns: Item Name and Price. Items include Cyanoacrylate, Potting Compound, Araldite Rapid, Double Bubble Sachet, PVC Tape Black, PVC Tape Blue, PVC Tape Brown, PVC Tape Green, PVC Tape Red, PVC Tape White, PVC Tape Yellow.

**WOUND PARTS**

**Page 308**

Table with 2 columns: Item Name and Price. Items include 9.5 Coil Former, Former 351, Former 450, Former 722/1, Former 722/2, Former 722/8, Former 722/4, Dust Core Type 4, Dust Core Type 6, Dust Core Type 8, Former Base, Screening Can 10, Screening Can 13, Screening Can 15, Screening Can 14, A/P Beads, Small Pot Core, Core Type 2.

**Page 309**

Table with 2 columns: Item Name and Price. Items include Bobbin Type 2, Clips Type 2, Type 3 Core, Type 3 Bobbin, Type 3 Clips, Large Pot Core, Bobbin Type 4, Mounting System Type 4, GE Coil L15, GE Coil L9, GE Coil L8, GE Coil L14, GE Coil L7, GE Coil L6, GE Coil L5, GE Coil L12, GE Coil L11.

**Page 310**

Table with 2 columns: Item Name and Price. Items include Choke 0.5H, Choke 1H, Choke 2H, Choke 4H, Filter Pot Core, Equaliser Pot Core, Choke 10 H, Choke 5µH HC, Choke 1.5 mH, Choke 2.5 mH, Choke 5 mH.

Table with 2 columns: Item Name and Price. Items include Choke 7.5 mH, Choke 10 mH, Choke RFC5, Choke RFC9A, Choke 0.22µH, Choke 0.47µH, Choke 1.0µH, Choke 1.5µH, Choke 2.2µH, Choke 3.3µH, Choke 4.7µH, Choke 6.8µH, Choke 10.0µH, Choke 15.0µH, Choke 22.0µH, Choke 33.0µH, Choke 47.0µH, Choke 100µH, Choke 470µH, Choke 1 mH, Crystal Set Coil PCC1.

**Page 311**

Table with 2 columns: Item Name and Price. Items include Toko YRCS 11098, Toko YRCS12374, Toko YRCS 11100, Toko CSK3464, Toko YMC517104, Toko ACS 34342, Toko ACS 34343, Toko KAC8448, Toko KAC8449, IFT 13, IFT 14, IFT 16, IFT 17, IFT 15, IFT 18 465 kHz, IFT 18 1.6 MHz, Toc 1, Trans Coil IT Blue, Trans Coil IT Red, Trans Coil IT White, Trans Coil IT Yellow, Trans Coil 2T Blue, Trans Coil 2T Red, Trans Coil 2T White, Trans Coil 2T Yellow, Trans Coil 3T Blue, Trans Coil 3T Red, Trans Coil 3T White.

Table with 2 columns: Item Name and Price. Items include Trans Coil 3T Yellow, Trans Coil 4T Blue, Trans Coil 4T Red, Trans Coil 4T White, Trans Coil 4T Yellow, Trans Coil 5T Blue, Trans Coil 5T Red, Trans Coil 5T White, Trans Coil 5T Yellow.

**Page 312**

Table with 2 columns: Item Name and Price. Items include Min Tr LT44, Mm Tr LT700, Mm Tr LT800, Sub-Min Tr 6V, Sub-Min Tr 9V, Sub-Min Tr 12V, Min Tr 6V, Min Tr 9V, Min Tr 12V, Min Tr 15V, Tr 10VA 15V, Min Tr 20V, Min Tr 24V, Min Tr 36V, Tr 12V 1A, Tr 12V 2A, Tr 9V 1 1/2A, Tr 20V 1A, Tr 28V 1 1/2A, Tr 32032/6 1/2A, Transformer Mounting Plate.

**Page 313**

Table with 2 columns: Item Name and Price. Items include Tr 34V 1A, Tr 34V HP, 15/22V Power Tran, Tr 240V Isotran, Pulse Transformer, Clock Transformer, Line Transformer, Mic Xformer MX5, Mic Xformer MX6, Mic Xfrm Typ2 20-30R, Mic Xfm Typ2 200-600R, Z-Changer.

**Page 314**

Table with 2 columns: Item Name and Price. Items include Min Motor, Small Motor, Servo Mechanism.

# NEW ITEMS PRICE LIST

The following is a list of all items introduced prior to this price list, but since publication of our 1981/82 catalogue and includes all special items for projects that appeared in the March 1981 to February 1982 issues of Electronics & Music Maker.

**AERIALS & AMATEUR RADIO**

Table with 2 columns: Item Name and Price. Items include 27 MHz Rubber Duck, 2m Scanning Receiver.

**BATTERIES**

Table with 2 columns: Item Name and Price. Items include Nicad PP3, PP3 Nicad Charger, Large Battery Holder.

**BOOKS, MAGAZINES AND LEAFLETS**

Table with 2 columns: Item Name and Price. Items include Analog Subscription, Practical Electronics Handbook, Newnes Book of Video by K. G. Jackson, Introduction To Pascal by Rodney Zaks, A Basic Approach to BASIC by Henry Mullish, Atari BASIC by Albrecht, Consumers Guide To Personal Computing & Microcomputers by Freiburger, Beat The Odds by Hans Sagan, BASIC With Business Applications by Lott, Introduction to Computer Music by Bateman, Basic Electricity by C. Ryan, Electronics by H. Kybett, BASIC by Albrecht Price, BASIC for Home Computers by Albrecht, TRS80 BASIC by Albrecht, Using CP/M by Fernandez, Flowcharting by N. Stern.

Table with 2 columns: Item Name and Price. Items include The S-100 Bus Handbook by D. Bursky, Telephone Accessories You Can Build by J. H. Gilder, 60 Challenging Problems with BASIC Solutions by D. Spencer, The Best Book On CB by E. Herbert, Z80 & 8080 Assembly Language Programming by K. Spracklen, Intel Memory Book, Intel 8080/8085 Book, 8086 Primer by S. Morse, Writing Interactive Compilers & Interpreters by P. Brown, Foundations of Programming with Pascal by L. Moore, What To Do After You Hit Return by The People's Computer Company, VMOS Projects by R. A. Penfold, Digital IC Projects by F. G. Rayer, International Transistor Equivalents Guide by Adrian Michaels, Fifty BASIC Exercises by J. P. Lamotier, The Pascal Handbook by Jacques Tiberghien, Learning BASIC With Your Sinclair ZX80 by Robin Norman, Oscilloscopes: How To Use Them: How They Work by Ian Hickman, More Telephone Accessories You Can Build by Jules H. Gilder, The Joy Of Minis And Micros by Philip Stein and Howard Shapiro, Problem Solving Principles For Programmers by William E. Lewis, Computer Programs That Work by J. D. Lee, G. Beech and T. D. Lee, Successful Software For Small Computers by Graham Beech, Musical Applications of Microprocessors

Table with 2 columns: Item Name and Price. Items include Apple II Users Guide by Lon Poole, An Introduction To BASIC Programming Techniques by S. Daly, 50 Simple LED Circuits Book 2 by R. N. Soar, Introducing Amateur Electronics by Ian R. Sinclair, 33 Challenging Computer Games For TRS80/Apple/PET by David Chance, Audio Projects by F. G. Rayer, Robot Intelligence . . . With Experiments by David L. Heiserman, BASIC Computer Programs For Business Vol. 1 by Charles D. Sternberg, Inside BASIC Games by Richard Mateosian, Electronic Projects In Photography by R. A. and J. W. Penfold, More Electronic Projects In The Home by Andy Flind, Projects In Amateur Radio by F. G. Rayer, Electronic Test Equipment Projects by Alan C. Ainslie, Electronic Projects For Home Security by Owen Bishop, Atari Basic Learning By Using by Thomas E. Rowley, Atari OPSYS Users Manual, The Giant Handbook Of Electronic Circuits by Raymond A. Collins, The Master IC Cookbook by Clayton L. Hallmark, An Introduction To Radio DXing by R. A. Penfold, Model Railway Projects by R. A. Penfold, Android Design by Martin Bradley Weinstein.

WG62S	My Micro Speaks BASEX (And Loves It) by Paul Warne.....	Price £8.85
WG63T	Programmer's Guide To The 1802 by Tom Swan.....	Price £6.85
WG64U	Programs For Beginners On The TRS80 by Fred Blechman.....	Price £8.25
WG65V	Karel The Robot by Richard E. Pattis	Price £5.75
WG66W	Introduction To 8080/8085 Assembly Language Programming by Fernandez/ Ashley.....	Price £7.45
WG67X	Programming in Basic-Plus by Swatzky/Chen.....	Price £11.75
WG68Y	Introducing Microprocessors by Ian R. Sinclair.....	Price £4.95
WG69A	Public Address Handbook by Vivian Capel.....	Price £8.75
WG70M	The British CB Book by Peter Chippindale.....	Price £4.45
WG71N	Electronic Projects For Cars And Boats by R. A. Penfold.....	Price £2.10
WG72P	Electronic Timer Projects by F. G. Rayer.....	Price £2.10
WG73Q	CB Projects by R. A. Penfold.....	Price £2.10
XA00A	Maplin Magazine Subscription.....	Price £2.40
XA01B	Maplin Magazine Vol. 1 No. 1.....	Price £0.60
XA02C	Maplin Magazine Vol. 1 No. 2.....	Price £0.60
XF45Y	E&MM March 1981 Issue.....	Price £1.00
XF46A	E&MM April 1981 Issue.....	Price £1.00
XF47B	E&MM May 1981 Issue.....	Price £1.00
XF48C	E&MM June 1981 Issue.....	Price £1.00
XF49D	E&MM July 1981 Issue.....	Price £1.00
XF50E	E&MM August 1981 Issue.....	Price £1.00
XF51F	E&MM September 1981 Issue.....	Price £1.00
XF52G	E&MM October 1981 Issue.....	Price £1.00
XF53H	E&MM November 1981 Issue.....	Price £1.00
XF54J	E&MM December 1981 Issue.....	Price £1.10
XF55K	E&MM January 1982 Issue.....	Price £1.10
XF56L	E&MM February 1982 Issue.....	Price £1.10
XH52G	Atari Software Leaflet (Issue 2).....	Free
XH53H	Matinee Component ID Leaflet.....	Price £0.40
XH54J	Atari Hardware Leaflet.....	Free
XH55K	Matinee Organ Book.....	Price £2.50
XH56L	Spectrum Synthesiser Book.....	Price £1.00

## BOXES

HY25C	Display Box.....	Price £0.50
YK24B	Calculator Style Verobox.....	Price £4.45

## CONNECTORS

BH61R	Minicon Latch Plug 17-Way.....	Price £0.58
BH64U	Minicon Plug 17-Way.....	Price £0.46
BH65V	Minicon Latch Housing 6-Way.....	Price £0.13
BH66W	Minicon Latch Housing 5-Way.....	Price £0.11
BH67X	Right-Angle Minicon Plug 15-Way....	Price £0.65
BX96E	Minicon Latch Plug 3-Way.....	Price £0.23
BX97F	Minicon Latch Housing 3-Way.....	Price £0.11
BX98G	Jumper Cable 17-Way.....	Price £3.65
FB99H	Right-Angle Latch Minicon Plug 6.....	Price £0.40
FH86T	Reset Spring.....	Price £0.03
FY91Y	Right-Angle Latch Minicon Plug 4W.	Price £0.33
FY92A	Right-Angle Latch Minicon Plug 2W.	Price £0.26
FY93B	Minicon Latch Plug 5-Way.....	Price £0.26
FY94C	Minicon Housing 10-Way.....	Price £0.18
HB58N	Minicon Latch Housing 4-Way.....	Price £0.10
HB59P	Minicon Latch Housing 2-Way.....	Price £0.08
HB60Q	Latch Bracket 5-Way.....	Price £0.27
HF98G	Stereo Plastic 3.5 mm Plug.....	Price £0.25
HQ85G	Minicon Plug 10-way.....	Price £0.47
HY26D	Latch Bracket 16-Way.....	Price £0.72
HY27E	Reset Bar 15-Way.....	Price £0.35
HY28F	Latch Bracket 9-Way.....	Price £0.39
HY29G	Reset Bar 6-Way.....	Price £0.16
YK06G	Pedal Board Cable Form.....	Price £2.98

## CONSUMER GOODS

AC41U	Othello Video Game Cartridge.....	Price £18.95
AC42V	Video Pinball Cartridge.....	Price £29.95
AC43W	Asteroids Video Game Cartridge.....	Price £29.95
AC44X	War Lords Game Cartridge.....	Price £29.95
AC45Y	Le Stick.....	Price £24.95
AC46A	Missile Command Video Game Cartridge.....	Price £29.95
AC47B	Flag Capture Video Game Cartridge..	DISC
AF36P	Atari 400 with 16K RAM.....	Price £345.00
AF37S	Atari 400 with 32K RAM.....	Price £395.00
AF38R	Epson MX80T.....	Price £414.00
AF39N	Epson MX80F/T.....	Price £458.85
AF40T	Epson MX80F/T Mk II.....	Price £516.35
AF41U	Centronics Interface for Atari 400....	Price £49.95
AF42V	Centronics Interface for Atari 800....	Price £49.95
AF43W	Versawriter for Atari 400/800.....	Price £169.00
AF44X	32K RAM Module.....	Price £125.35

AF45Y	32K Upgrade for Atari 400.....	Price £75.00
HY24B	2 Roll Pack of Paper for Printer 822.	Price £4.95

## ELECTRICAL

WY23A	Timetouch Electronic Time Switch....	Price £24.80
-------	--------------------------------------	--------------

## HARDWARE

HY30H	Isobolt M3 x 9 mm (pack of 10).....	Price £0.12
HY31J	Steel Washer 4BA (pack of 10).....	Price £0.11

## KNOBS

QY00A	LC Cap Black.....	Price £0.05
QY01B	LC Cap Blue.....	Price £0.05
QY02C	LC Cap Green.....	Price £0.05
QY03D	LC Cap Grey.....	Price £0.05
QY04E	LC Cap Red.....	Price £0.05
QY05F	LC Cap White.....	Price £0.05
QY06G	LC Cap Yellow.....	Price £0.05
YG40T	Low-Cost Collet Knob.....	Price £0.27

## MICROPHONES

HY33L	Crystal Mic Insert (metal body).....	Price £0.84
-------	--------------------------------------	-------------

## OPTO-ELECTRICAL

QR54J	Rectangular Multicolour LED.....	Price £0.75
-------	----------------------------------	-------------

## ORGAN COMPONENTS

BH49D	Tablet Rocker Grey.....	Price £0.96
BH50E	Tablet Rocker Orange.....	Price £0.96
BH51F	Tablet Rocker Red.....	Price £0.96
BH62S	Spacer Block.....	Price £0.04
BH63T	Keyboard Spacer.....	Price £0.02
BR98G	Drawbar Blue.....	Price £1.55
BR99H	Drawbar Green.....	Price £1.55
FB98G	Rubber Coupling.....	Price £0.66
QY07H	Contact Springs.....	Price £0.08
XB95D	Organ Stool.....	Price £29.50
XG00A	Roll-Top Guides (pair).....	Price £2.50
XG01B	Music Stand.....	Price £4.75
XY89W	Switched Swell Pedal.....	Price £11.45
XY92A	Twin Keyboard and Frame.....	Price £49.90
XY97F	Keyboard Separator.....	Price £1.95
XY98G	Swell Pedal Housing and Trim.....	Price £3.75
XY99H	Roll Top.....	Price £19.50

## PCB EQUIPMENT

HQ84F	Verobloc Bracket.....	Price £0.63
XX42V	MP Euro Breadboard.....	Price £21.75

## PROJECTS AND MODULES

BH60Q	Syntom Front Panel.....	Price £1.10
BX99H	Synwave Front Panel.....	Price £1.10
GA00A	Direct Input PCB.....	Price £1.10
GA01B	Line Driver PCB.....	Price £1.48
GA02C	Line Receiver PCB.....	Price £1.51
GA03D	Spectrum PSU PCB.....	Price £2.40
GA05F	Syntom PCB.....	Price £1.18
GA06G	PA Controller PSU PCB.....	Price £3.70
GA07H	PA Controller Limiter PCB.....	Price £2.85
GA08J	Woofers PCB.....	Price £2.00
GA09K	24-Way Contact PCB.....	Price £2.80
GA10L	25-Way Contact PCB.....	Price £2.87
GAUM	Continuity Tester PCB.....	Price £1.32
GA12N	Crossover PCB.....	Price £2.50
GA13P	Balanced Line Driver PCB.....	Price £2.10
GA14Q	PA Controller Display Component PCB.....	Price £1.25
GA15R	PA Controller Display LED PCB.....	Price £1.45
GA18U	Matinee PSU PCB.....	Price £2.10
GA19V	Battery Monitor PCB.....	Price £1.20
GA20W	Workshop PSU PCB.....	Price £4.30
GA21X	Workshop Control PCB.....	Price £2.20
GA22Y	Strobe Main PCB.....	Price £2.20
GA23A	Strobe HT PCB.....	Price £1.20
GA24B	Guitar Tuner PCB.....	Price £1.65
GA25C	Power Control PCB.....	Price £1.15
GA26D	Digital Tacho Main PCB.....	Price £1.75
GA27E	Digital Tacho Display PCB.....	Price £1.25
GA28F	75W Mosfet Amp PCB.....	Price £1.80
GA29G	Mosfet Amp Mounting Bracket.....	Price £1.15
GA30H	Noise Reduction Main PCB.....	Price £3.20
GA31J	Noise Reduction PSU PCB.....	Price £1.60
GA32K	Hexadrum PCB.....	Price £2.60
GA33L	Select-A-Match PCB.....	Price £1.80
GA34M	Power-Control Peripherals PSU PCB..	Price £3.95
GA35Q	Synwave PCB.....	Price £1.10
GA36P	Spectrum VCO PCB.....	Price £4.75
GA40T	Car Aerial Booster PCB.....	Price £1.35
GA41U	Combo Amp PCB.....	Price £5.75
GA42V	Partylite PCB.....	Price £2.25
GA43W	Noise Gate PCB.....	Price £1.30
GA48C	Harmony Generator PCB.....	Price £2.25
GA50E	Effects Link PCB.....	Price £2.20

GA51F	Soundbooster PCB.....	Price £1.85
GA52G	FX-Swell PCB.....	Price £1.35
GA53H	Spectrum LFO PCB.....	Price £2.50
GA54J	Sync Lock PCB.....	Price £1.65
GA55K	Spectrum Controller PCB.....	Price £2.10
GA56L	MPC Board.....	Price £5.75
GA57M	Spectrum VCF PCB.....	Price £2.95
GA58N	The Bomb PCB.....	Price £1.55
GA59P	Spectrum Shaper PCB.....	Price £2.95
GA60Q	Percussion Sound Gen PCB.....	Price £4.72
GA61R	Timer Main PCB.....	Price £2.80
GA62S	Timer Switch Board.....	Price £3.85
GA63T	Timer Relay PCB.....	Price £1.10
GA64U	Timer Front Panel.....	Price £3.85
LW51F	75W Mosfet Amp Kit.....	Price £11.49
LW52G	Wordmaker Kit.....	Price £99.95
LW53H	5600S Synthesiser Kit.....	Price £599.95
LW54J	3800 Synthesiser Kit.....	Price £336.75
LW55K	Synclock Kit.....	Price £19.75
LW60Q	Spectrum Synth Kit.....	Price £167.50
XG03D	Combo Amp Front Panel.....	Price £3.35
XG05F	Matinee Modular Organ Kit.....	Price £399.45
XG08J	Spectrum Front Panel.....	Price £14.95
XX43W	Matinee Demonstration Cassette....	Price £1.99
XX44X	Synclock Front Panel.....	Price £1.50
XX46A	Spectrum Joystick Panel.....	Price £2.25
XY86T	Matinee Main PCB.....	Price £50.00
XY88V	Matinee Contact PCB.....	Price £7.30
XY90X	Spectrum Bus-bar Set.....	Price £2.20
XY91Y	Matinee Organ Kit.....	Price £299.95
XY93B	Matinee Cabinet Kit.....	Price £39.50
XY94C	Matinee Front Panel.....	Price £17.95
XY95D	Matinee Metalwork Mounting Kit....	Price £9.50
XY96E	End Cheeks (set of 4).....	Price £6.75
YK04E	Matinee PSU Bracket.....	Price £1.60
YK05F	Matinee Pot Mounting Bracket.....	Price £0.79
YL26D	Guitar Tuner Front Panel.....	Price £1.10
YQ72P	Magnum Mode Change PCB.....	Price £1.65

## RESISTORS

FX87U	Thermistor KR152CW.....	Price £0.73
-------	-------------------------	-------------

## SEMICONDUCTORS

QR55K	634SS2.....	Price £4.95
QY08J	74C925.....	Price £6.75
QY09K	LM311N 8-pin.....	Price £0.55
QY10L	NE570.....	Price £4.65
QY11M	2SC2547E.....	Price £0.28
QY12N	2SA1085E.....	Price £0.28
QY14Q	UAA170L.....	Price £2.50
QY15R	2716/M2.....	Price £10.50

## SPEAKERS

QY13P	Piezo Transducer 27 mm.....	Price £0.30
QY16S	Rubber Disk 27 mm.....	Price £0.05
XG02C	Loudspeaker 12 in 30W TC30.....	Price £19.75

## SWITCHES

BH58N	Co-ax Switch S0239.....	Price £6.99
BH59P	Co-ax Switch PL259.....	Price £6.99
HQ83E	Foot Micro-switch.....	Price £3.25
HY34M	Click Key Black.....	Price £0.24
YK26D	Pedal Switch Box.....	Price £5.95

## TEST GEAR

YK01B	RF Frequency Meter.....	Price £69.95
-------	-------------------------	--------------

## TOOLS

YK27E	Chassis Punch Set.....	Price £13.45
-------	------------------------	--------------

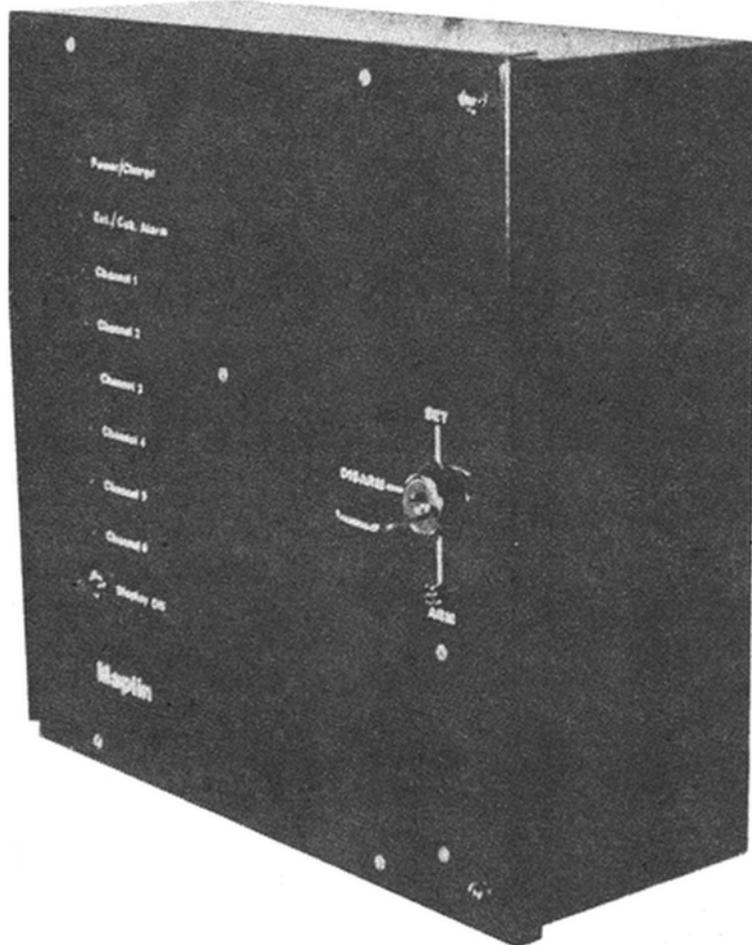
## WOUND COMPONENTS

YK02C	Transformer 2A 32-0-32V.....	Price £13.45
YK03D	Matinee Transformer.....	Price £13.75
YK07H	Transformer 4A 32-0-32V.....	Price £22.25
YK08J	Toroidal 30VA 0-6, 0-6V.....	Price £6.80
YK09K	Toroidal 30VA 0-9, 0-9V.....	Price £6.80
YK10L	Toroidal 30VA 0-12, 0-12V.....	Price £6.80
YK11M	Toroidal 30VA 0-15, 0-15V.....	Price £6.80
YK12N	Toroidal 30VA 0-18, 0-18V.....	Price £6.80
YK13P	Toroidal 50VA 0-6, 0-6V.....	Price £7.46
YK14Q	Toroidal 50VA 0-9, 0-9V.....	Price £7.46
YK15R	Toroidal 50VA 0-12, 0-12V.....	Price £7.46
YK16S	Toroidal 50VA 0-15, 0-15V.....	Price £7.46
YK17T	Toroidal 80VA 0-18, 0-18V.....	Price £8.35
YK18U	Toroidal 80VA 0-22, 0-22V.....	Price £8.35
YK19V	Toroidal 80VA 0-30, 0-30V.....	Price £8.35
YK20W	Toroidal 120VA 0-30, 0-30V.....	Price £9.57
YK21X	Toroidal 160VA 0-35, 0-35V.....	Price £12.28
YK22Y	Toroidal 300VA 0-35, 0-35V.....	Price £16.41
YK23A	Toroidal 500VA 0-35, 0-35V.....	Price £21.22
YK25C	12VA 15V Transformer (PCB).....	Price £7.49
YK28F	Transformer 12V 1/4A.....	Price £4.25

# HOME SECURITY SYSTEM

Dave Goodman

- Six independent channels with two groups per channel
- Two or four wire operation with line sensing of open or short circuit or resistance change (jumping)
- Tamper-proof main cabinet
- External horn loop control has its own open/short circuit and jumping protection
- Presetable entry and exit delay timers



This new home security system offers a high degree of protection for domestic or commercial premises coupled with excellent long-term reliability. The unit is mains operated, but will run off its small internal nickel-cadmium rechargeable battery pack for 2 to 3 days depending on the size of the system. The internal battery is continuously charged when the mains is present and changeover from mains to battery and vice-versa has no effect on the system. CMOS circuitry is used throughout to minimise current drain.

There are sockets for six separate plug-in channels so that for example all downstairs windows could be connected to one input, all downstairs doors to another, all upstairs windows to another and perhaps shed and garage doors and windows to another. When setting the system you know immediately where to look for the window left open accidentally if the system will not set. Or parts of the system only may be set. For example, during the late evenings, the shed and garage circuit only could be set. Whatever your requirements this system offers the fullest possible flexibility for complete security.

The external horn is also fully protected when fitted with dry batteries. Its prominent position alone will deter most burglars, but any attempt to tamper with it will set it off. If the wires to it are cut or tampered with, the horn will sound. Even ripping the box off the wall will not stop the alarm. The recommended dry batteries will sound the alarm at full power for at least four hours even if the wires are cut.

The alarm is extremely easy to build, with internal wiring kept to an absolute minimum. Operation is by a single key-switch and exit and entry delays may be preset to suit your requirements. There is an LED for each channel, giving monitoring facilities and an internal sounder giving 'alarm condition' tones. Even the main cabinet is protected, by a micro-switch fitted to the PSU PCB.

## Circuit Description Mains PCB

The key switch S9, which is shown in Figure 1 with its contacts made, controls the 'disarm' and 'set' conditions of the alarm unit. TR1 is conducting and thus inhibiting the exit delay timer oscillator IC1 c and d, and IC2, a 14 stage counter/divider, is held reset.

The oscillator IC1 c and d is frequency variable between 25 Hz (40 ms) and 10 kHz (100 us). This clock signal is divided down by IC2 by 8192 giving a minimum time out period of 0.8 seconds and a maximum period of 5.5 minutes. So allowing for variations in tolerances, IC1 c, d and IC2 function as an exit delay timer presetable by RV1 giving periods of between 0 and 6 minutes.

IC1 a, b and IC3 function as described above but are used as an entry delay timer, presetable by RV2.

In the disarm mode IC2 pin 3 is at 0V and D2 is conducting. Consequently exit delay tone modulator IC5 c and d is inhibited. IC10 a output is high, holding TR5 and LED 9 ('ARM' LED) off. Latch IC10 b and d output is high. Entry delay timer is held off via D4 and IC10 b output low. Counter IC3 pin 3 is low and alarm tone modulator IC5 a and b is inhibited via D7 conducting.

Latches IC7, 8 and 9 have normally high outputs connected to LED buffer IC11 preventing channel LEDs 3 to 8 from turning on. A positive trigger pulse greater than 25 ms in duration present at any of the inputs to the latches from switches S3 to 8 allows the channel LEDs to turn on for the duration of the triggering signal.

Switch S2 operates TR7 which discharges C13 and operates TR6, the LED display. TR6 remains on for the time constant set by R43 and C13, approximately 90 seconds.

Operating switch S9 (contacts open) in the 'set' mode turns TR1 off. This removes the inhibit on the exit delay oscillator IC1 c and d allowing it to run at the frequency determined by RV1. IC2 divides this signal and IC2 pin 3 goes high. While IC2 is counting, D2 is not conducting and IC5 c and d run at a frequency of approximately 8 Hz. The inhibit on the tone generator IC6 b and c is removed allowing it to run at approximately 3 kHz modulated at 8 Hz.

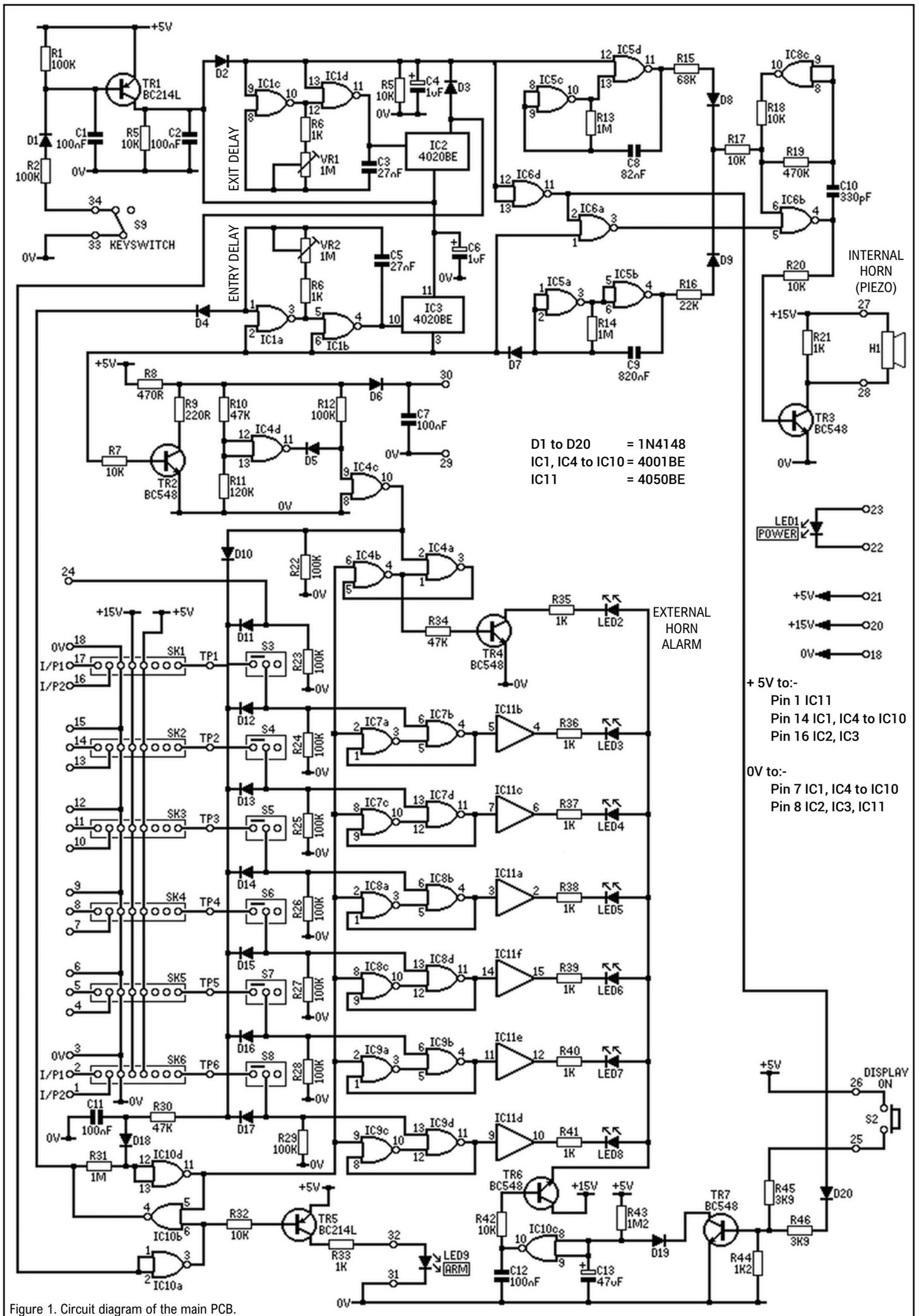


Figure 1. Circuit diagram of the main PCB.



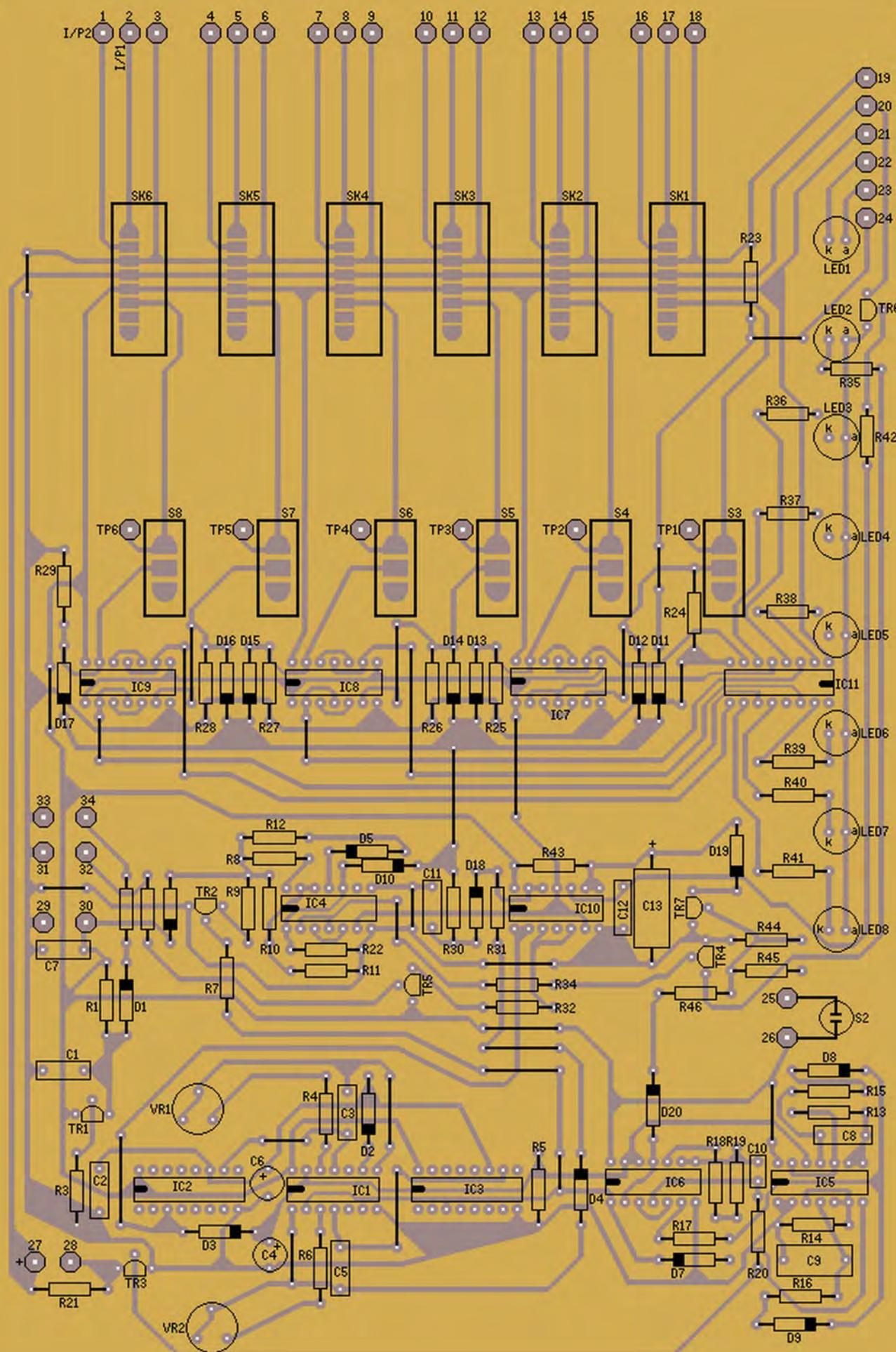


Figure 5. Component overlay of the main PCB.



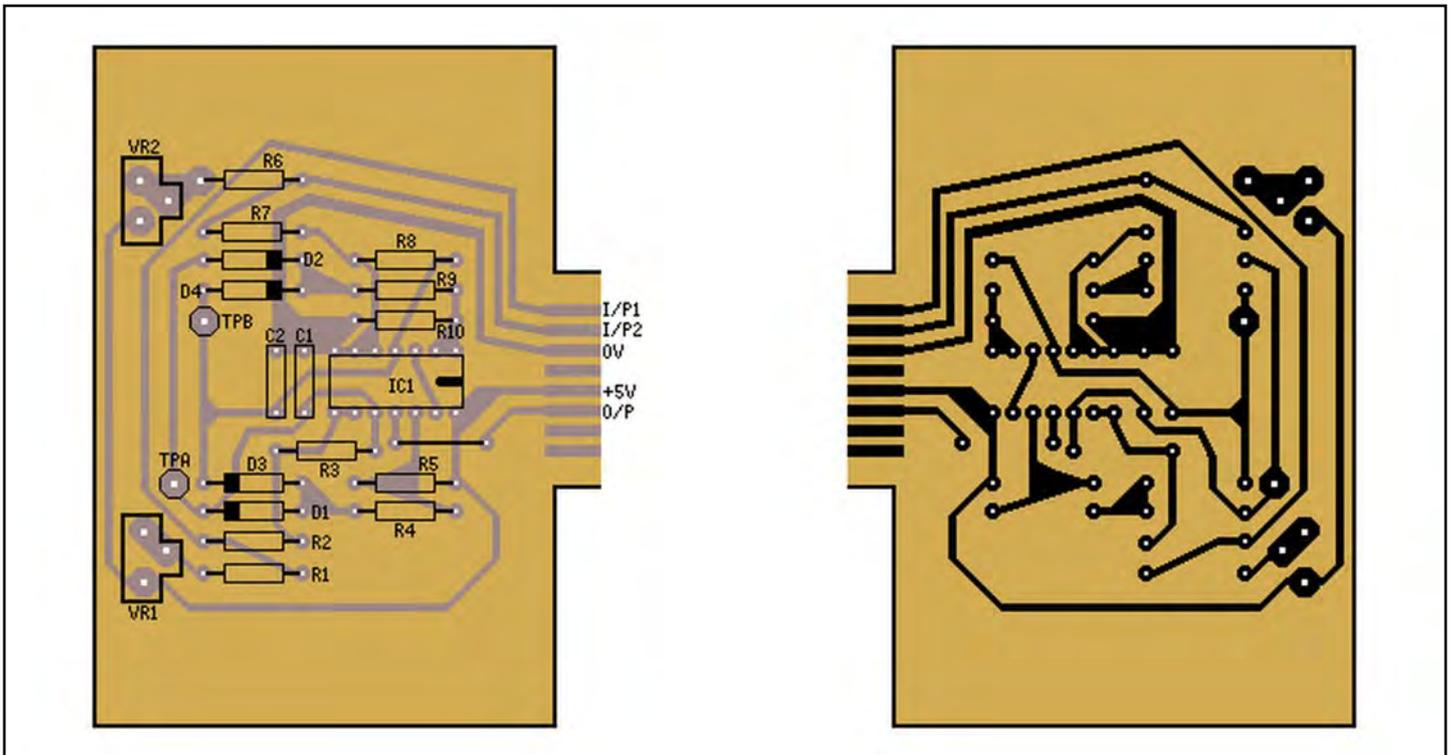


Figure 7. Track layout and component overlay of the Break Contact Module.

32 (Figure 10). Mount key switch S9 and the Piezo horn HI using two ¼ inch x 6BA CSK nuts, bolts, washers. Wire H1 to pins 27 and 28.

#### Power Supply Unit

Next refer to the parts list and Figure 12 and 13 for the PSU assembly. Mount the three resistors, three diodes, BR1, TR1, and REG 1. Ensure correct orientation of these components before soldering. Fit the 13 Veropins, C2 and C3 noting the polarity. Mount T1 with two 6BA ¼ inch bolts, nuts and washers. Mount FS1 using a ¼ inch x 6BA nut and bolt and a three-way terminal block, using two 1 inch x 6BA bolts, nuts and washers. Wire T1 to FS1 and the terminal block 'N'. Wire the opposite end of FS1 to terminal block 'L'. Place heat shrink sleeving over C1 leads, and fit to terminal block 'N' and 'L'. The battery clip (PP3) is

connected to pin 5 (+ve lead red) and pin 4 (-ve lead black). The T1 secondaries connect to adjacent pins 1, 2 and 3.

Insert three 6BA x ½ inch CSK screws through the cabinet base holes (Figure 15), at front left, rear left and rear right hand side. The two front right hand side holes are for mounting the micro switch. Insert two 1 inch x 6BA CSK screws and tighten all five with 6BA washers and nuts. Place the PSU PCB over the five screws and position the micro switch with the roller arm behind the angle bracket. Tighten down with two 6BA washers and nuts. Place a 6BA tag washer over the front left screw, and two 6BA washers over the remainder. Tighten down with three 6BA nuts. Connect a piece of wire from the 6BA (chassis earth) tag washer to terminal block 'E'. Wire the micro switch (S1) to adjacent pins 12 and 13.

#### Break Contact Module

Refer to the parts list and Figure 7 for the break contact PCB. The board is very simple to construct and requires no explanation. Once assembled, and checked, plug into any one of the six channel sockets on the main PCB. Ensure switches S3 to S8 are 'out' of circuit.

#### External Horn

Refer to the parts list and Figures 8, 9 and 17 for the external horn PCB and wiring. Again, the construction is simple. Note the orientation of the tantalum C2 and the FET TR1. The crinkly heatsinks fits over TR2. Do not connect to main PCB at this stage.

#### Testing

Place a 20 mm, 100 mA fuse into FS1 position. Connect a length of three-way mains cable to the PSU terminal block.

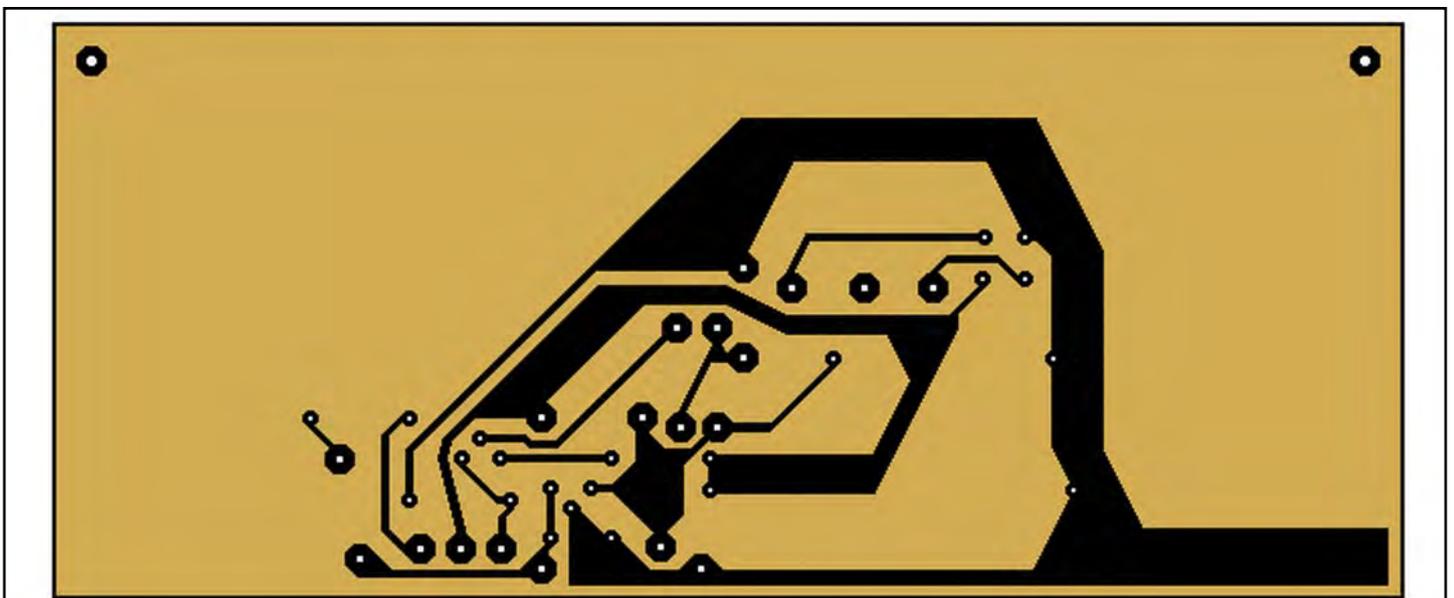


Figure 6(a). Track layout of the PSU PCB.

Ensure S1 is fully operated, and that no other wiring is connected to the PSU.

Place a voltmeter between 0 volt pin 6 and +15 volt pin 7. Apply mains power to the PSU, and check for a reading of 15 volts DC. Check for +5 volts between pin 6 (0 volt) and pin 8 and between 0 volt and pin 11 when S1 (micro switch) is released (slacken the 2BA bolt). Re-operate S1 and check for zero volts on the meter. Remove the mains supply.

Connect 22 inches of six-way ribbon cable between the PSU and main PCB as follows:

	PSU	To	Main PCB
(0V)	P6		P19
(+15)	P7		P20
(+5)	P8		P21
LED1	P9		P22
LED1	P10		P23
(S1)	P11		P24

Set the meter to 'amps' range and connect to pins 4 and 5 (or battery clip). Re-apply mains power and check for a reading of approximately 4 mA and ensure LED 1 lights up. Remove the meter and LED 1 should extinguish. If the standby batteries are to be used, connect the NiCad pack to the PP3 clip.

A voltmeter connected across pins 4 and 5 should indicate a reading of between 7.2 to 7.8 volts depending on the batteries state of charge. Note that LED 1 will stay on with the batteries part or fully charged, also an incorrectly placed battery, within the pack, will allow LED 1 to stay on, but the reading across pins 4 and 5 will be lower than +7 volts. (Rectify immediately as NiCad batteries do not like short circuits or reversed connections placed on them.)

For reliability, ensure that the battery pack is fully charged before use. The trickle charger keeps them topped up over a period of time and is not a fast charger.

### Main PCB

With power on, and key-switch disarmed, LED 1 only should be on, and no alarm tones heard. Ensure RV1 and 2 are both fully clockwise, and turn key to 'set'. A high pitched tone will sound immediately lasting for no more than two seconds. When the tone stops, LED 9 ('ARM') comes on, showing that the alarm is now primed and ready. Note that the warble tone, sounds for the duration of the exit timer delay period and is pre-settable by adjusting RV1 anticlockwise. The PCB legend has scaled from 0 to 6 minutes and the small circle, on top of the cermet pot, acts as a pointer. If the exact time out periods are required, check the calibration scale with a watch or clock.

Once LED 9 has come on, further adjustment of RV1 will only be effective when the key is turned to 'disarm' and then back to 'set', starting the exit timer again.

### Points

Connect a length of wire from P21 (+5 volt) to test point 1 (TP1). Operate S3 to the "IN" position. Press S2, display on and

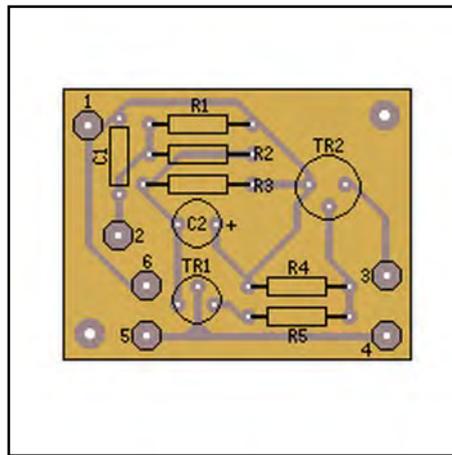


Figure 8. Track layout and component overlay of the External Horn PCB.

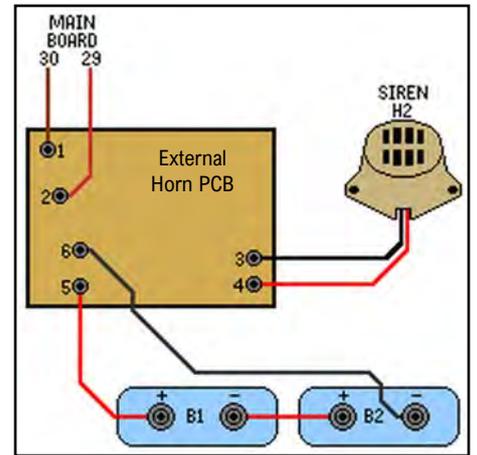
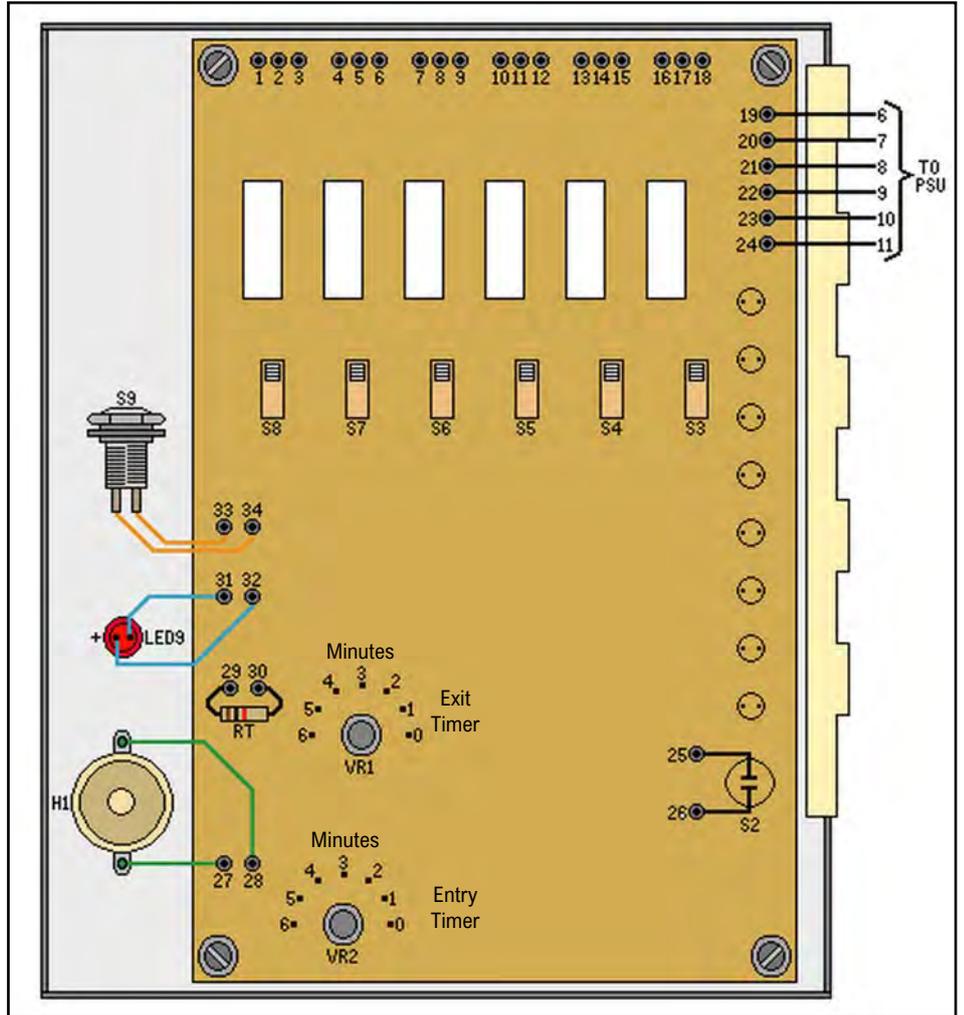


Figure 9. External Horn wiring diagram.



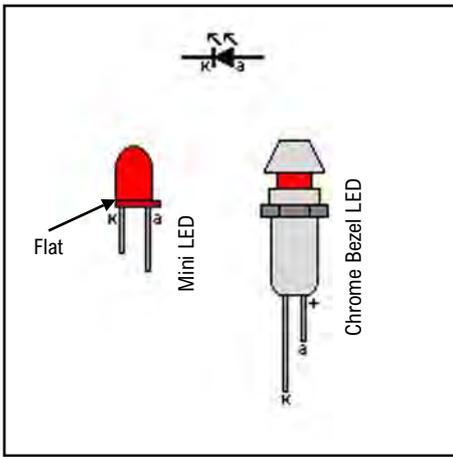


Figure 13. LED lead outs.

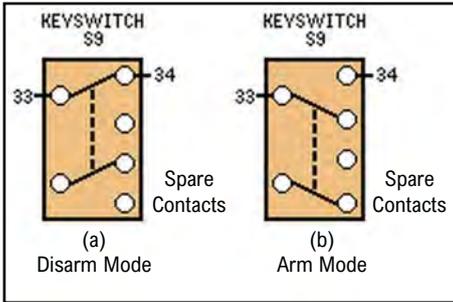


Figure 14. Key switch wiring.

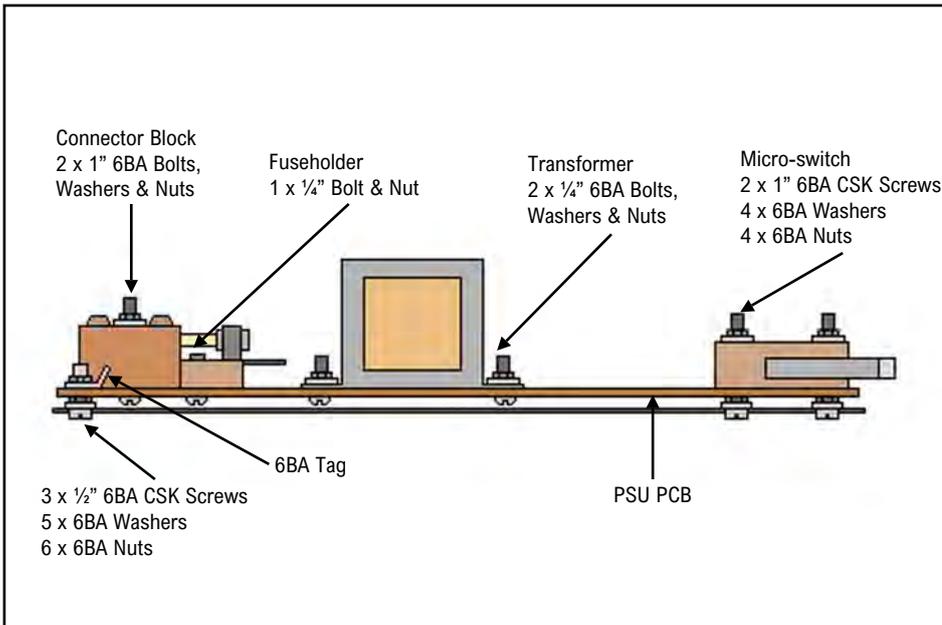


Figure 15. Mounting the PSU PCB and components.

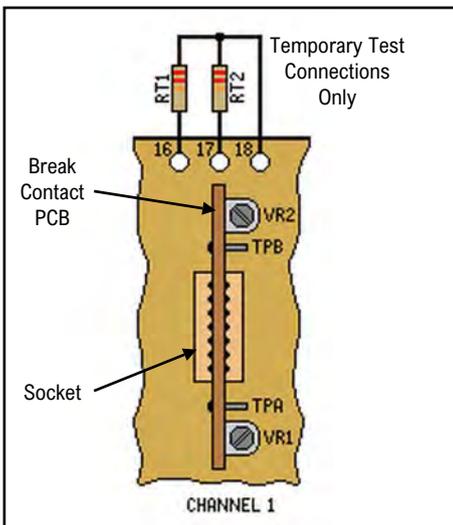


Figure 16. Testing the Break Contact Module.

release. Channel 1 LED 3 will come on. Place S3 to the "OUT" position. LED 3 will go out. Repeat the above tests from P21 (+5 volt) to TP2 to TP6 and S4 to S8 checking the channel LEDs 4 to 8. Note that pressing S2 allows the channel LEDs to light up, once triggered, for approximately 90 seconds. S2 will have to be re-operated for a continued display etc.

Remove the test lead from the test point, but leave attached to P21 (+5 volt). Turn the key switch to "set". Once the "armed" LED has come on, place switches S3 to S8 to the "IN" position (note - remove any plug-in PCBs). Check that no tone is heard and that LEDs 1 and 9 only are on. Touch the +5 volt test lead to test points 1 to 6 in turn, all channel LEDs should come on, followed by a slow, two-tone alarm signal. Ext/Cab alarm, LED 2, will come on, indicating that the external horn trigger circuit has been operated. This alarm tone continues until the key switch is set to "disarm". Leave the alarm sounding and check that after 90 seconds the display goes off (preserving batteries on standby). The alarm tone should still continue. Press S2, check original display is returned.

### Ext. Alarm

Place a short circuit across test resistor RT (1K) between pins 29 and 30. Press S2, LED 2 will light, indicating that the external loop sensing circuit has been tampered with. Remove the short circuit; LED 2 will go out. Remove one end of resistor RT and press S2. LED 2 will, again, come on. Re-connect RT and LED 2 should go out.

Turn the key switch to "set" and replace the short circuit across resistor RT. When the alarm sounds, remove the short circuit. LED 2 will stay on and the alarm will continue to sound. Return key switch to "disarm".

### Power Failure

Note that if standby batteries are fitted and mains power is removed, LED 1 will go out. If the alarm unit is set and armed prior to removal of mains power, the system will stay armed, unless triggered appropriately. When running on standby power, the alarm tones will be slightly quieter than normal.

### Entry Timer

Set RV2, entry delay timer, for the required time out period. Turn the key switch to "set" and trigger any channel (+5 volt to a test point). The selected channel LED should come on and stay on. The alarm tone will not be present until the time out period has been reached, then the alarm tone will sound and LED 2 will light. Reset the key switch.

### Break Contact PCB

This module may be plugged into any of the sockets in channels 1 to 6 on the main PCB. Note correct orientation of the module, when fitting; the component side is to the right and the track side, to the left.

Remove all power to the system, turn the key switch to "disarm" and S3 to S8 to the "OUT" position. Connect two test resistors, RT1 and RT2 (22K) between pins 17 and 18 and pins 16 and 18, as shown in Figure 16. These resistors are used for test purposes only and will be removed when the circuit is to be used.

Connect a voltmeter between TPA, on the module, and a convenient zero volt point, with the +ve lead to TPA. Apply power to the system, and adjust VR1 for a reading of half the supply rail, i.e. +2.5 volts.

Repeat the test on TPB using VR2, and remove meter. Re-connect the meter between zero volt and TP1 to 6 (main PCB) depending on channel chosen for setting up the module, and check for zero volts. Short circuit resistor RT1, and check for +5 volts on the appropriate test point (main PCB). Remove the short circuit and repeat the test for RT2. Set the chosen channel switch (S3 to S8) to the "IN" position. Turn the key switch to "set" and remove one end of RT1. The appropriate channel LED will come on etc. Re-connect RT1; reset the key switch and repeat the test for RT2.

Reset the key switch and remove test resistors RT1 and 2.

### Circuit Monitor

Turn the key switch to "disarm". The tone and all displays will be cancelled. Note that in the disarm mode and with S2 pressed, the unit gives a useful monitor facility of doors, windows etc, which can be checked before arming the system. Loosen the 2BA bolt holding off micro switch S1. Ensure the roller-arm releases, and turn the key switch to "set". After the time out period and LED 9 has come on, the Ext/Cab alarm LED 2 will light, showing that the cabinet has been tampered with, and the alarm tone will sound. Reset the key switch to "disarm". The alarm tone will cancel, but LED 2 will remain on for 90 seconds; display timeout. Re-operate S1 by tightening the 2BA bolt and LED 2 will go out.

### External Horn PCB

Figures 8 and 9 show the connections for using an external horn. For test purposes remove all power from the system (disconnect all batteries) and wire the PCB to pins 29 and 30 (remove resistor RT). Any changes made to these connections will trigger the alarm so ensure correct wiring. Connect the electronic siren to pins 3 and 4; the black lead is negative and the red +ve. Since the siren is inside a box, its own cover is not required and should be removed to assist wiring and make the sound output as great as possible. Connect batteries B1 and B2 to pin 5 (+ve) and 6 (-ve). The battery supply should be 12 volts and various types of dry cell (6 volts each) are available. Note that no charging current is available to these batteries.

The horn (H2) will sound immediately, so return power to the alarm unit as soon as possible. Place a short circuit across pins 29 and 30 (main PCB); H2 will sound. Remove the short circuit and H2 will cease.

Turn the key switch to "set" and repeat the test. Both internal and external horns will sound along with LED 2. Turn the key

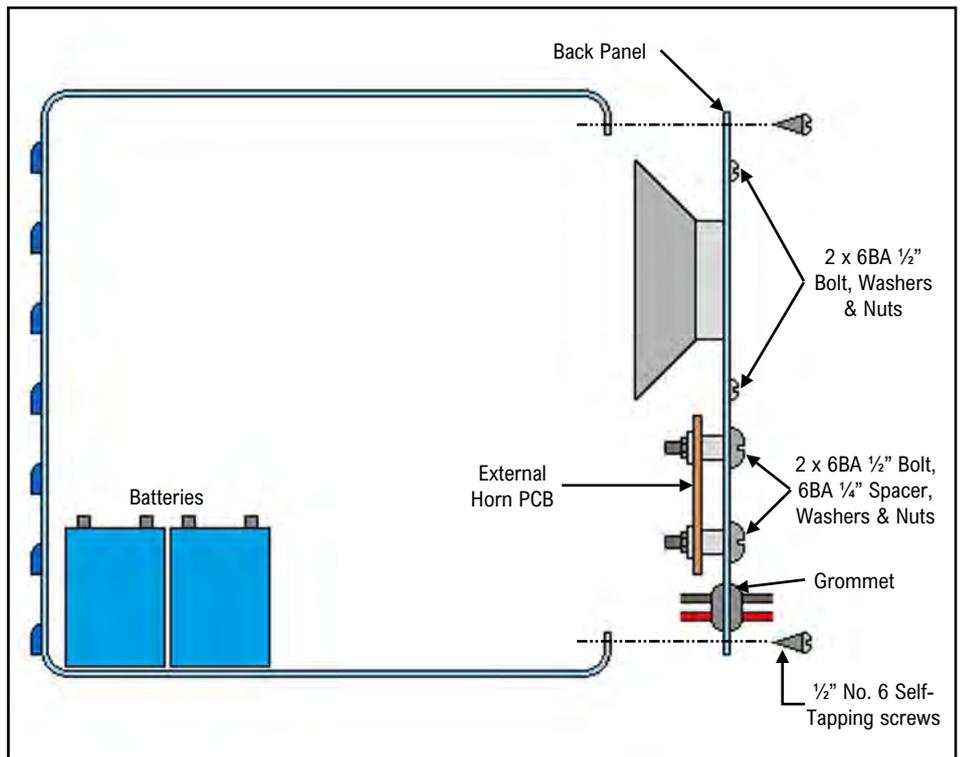


Figure 17. Assembly of the External Horn Box.

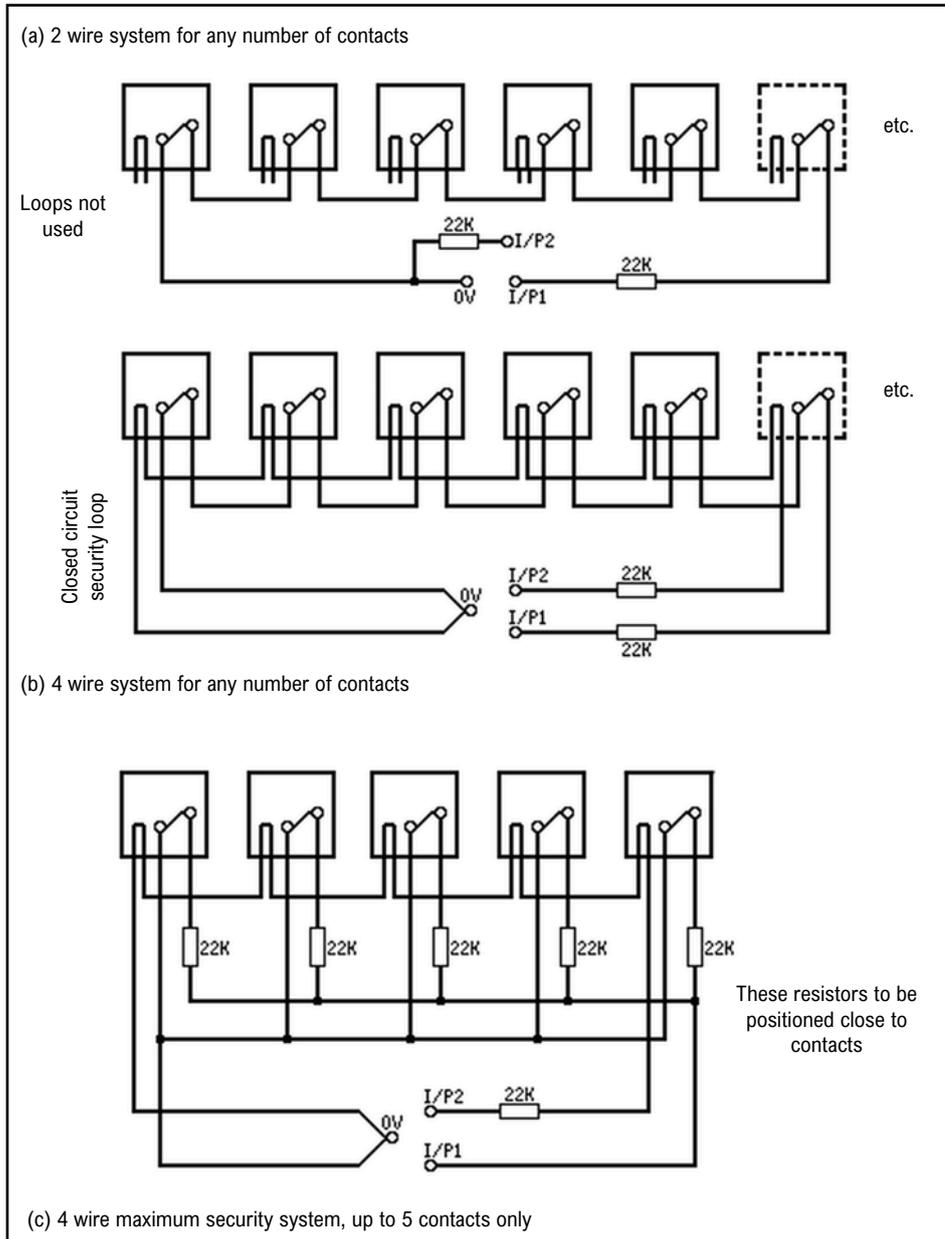


Figure 18. Methods of wiring alarm contacts.

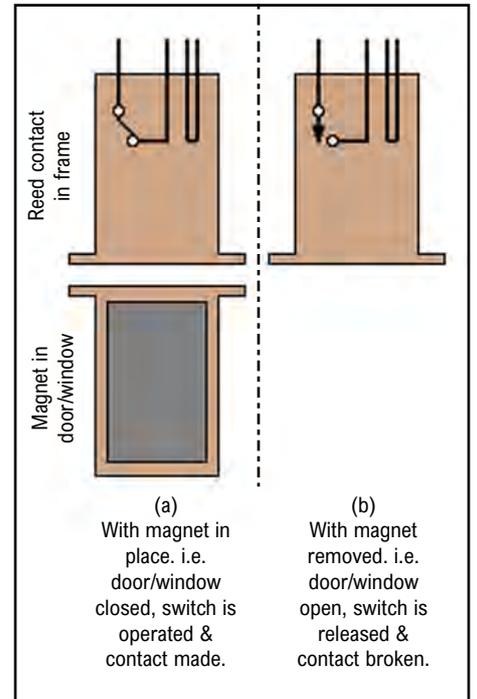


Figure 19. Reed switch connections.

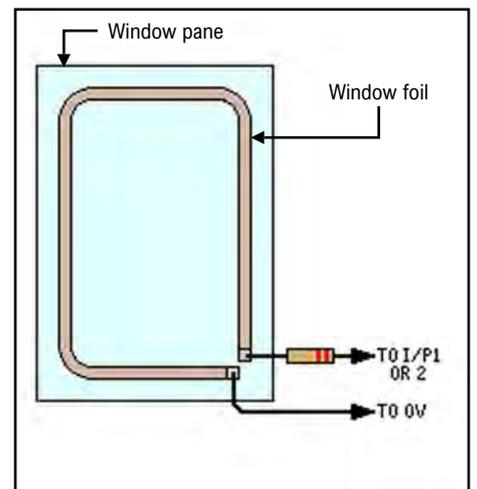


Figure 20. Window foil connections.

switch to "disarm" and both horns should stop sounding. Note that the 12 volt external batteries supply the horn only, via TR2. When not in use, the current drain from B1 and B2 is approximately 5µA and will not effect the shelf life of the batteries greatly.

### Using The System

Various systems for sensing and triggering the alarm unit are available and are listed in the parts list. Typical connections are shown in Figures 18,19 and 20. Note that for maximum security only five switches, each with a 22K resistor, should be used per input (10 switches per module) and connected as in Figure 18(c). With 6

modules in use, up to 60 switches can be accommodated, using a two wire system, or 30 switches using the 4 wire system. Whatever method is favoured, refer to the break contact setting up procedure and adjust RV1 and RV2 on each module for half the supply voltage. Any form of shorting, bridging, reversing or cutting connections will trigger the alarm.

If one input only, per module, is to be used, terminate the remaining input with a 22K resistor (see Figure 16) otherwise the alarm will keep sounding, with that channel switched in. Magnetic reed switches can be mounted into door frames and the magnet into the door directly opposite. Surface type

reeds are available for metal frame works. Pressure mats should be placed under carpets etc ensuring adequate clearance from furniture and metal foil strip can be fitted to glass panels. There will shortly be ultra sonic and micro-wave doppler detectors available and those will interface directly to the break contact module.

Finally, remember that setting the modules to half (+2.5 volt) supply rail will allow detection of short circuits or open circuits, within the contact loop so make or break contacts may be accommodated, using suitably placed 22K resistors.

### BURGLAR ALARM MAIN PARTS LIST

#### Resistors - All ¼ watt 5% Metal Film

R1, R2, R12, R22 to R29	100K	Brown Black Yellow	11
R3, R5, R7, R17, R18, R20			
R32, R42	10K	Brown Black Orange	8
R4, R6, R21, R33, R35 to R41	1K	Brown Black Red	11
R8	470R	Yellow Violet Brown	1
R9	220R	Red Red Brown	1
R11	120K	Brown Red Yellow	1
R13, R14, R31	1M	Brown Black Green	3
R15	68K	Blue Grey Orange	1
R16	22K	Red Red Orange	1
R19, R30	470K	Yellow Violet Yellow	2
R10, R34	47K	Yellow Violet Orange	2
R43	1M2	Brown Red Green	1
R44	1K2	Brown Red Red	1
R45, R46	3K9	Orange White Red	2
RT (Test Resistor)	1K	Brown Black Red	1
VR1, VR2	1M	Cermet	2

#### Capacitors

C1, C2, C7, C11, C12	100nF disc ceramic	5
C3, C5	27nF Polycarbonate	2
C4, C6	1µF 35V tantalum	2
C8	82nF Polycarbonate	1
C9	820nF Polycarbonate	1
C10	330pF ceramic	1
C13	47µF 10V axial electrolytic	1

#### Semiconductors

D1 to D20	1N4148	20
TR1, TR5	BC214L	2
TR2, TR3, TR4, TR6, TR7	BC548	5
IC1, IC4 to IC10	4001BE	8
IC2, IC3	4020BE	2
IC11	4050BE	1

#### Miscellaneous

LED 1 to LED 8	Mini LED red	8
LED 9	Chrome LED small	1
S2	High quality push switch	1
S3 to S8	Slide switch	6
S9	Key switch	1
H1	Piezo horn	1
SK1 to SK6	8-way edge connector	6
	6BA 1 inch CSK screw	5
	6BA ½ inch CSK screw	2
	2BA 1 inch bolt	2
	6BA washer	12
	6BA nut	12
	6BA x ¼ inch spacer	5
	Small grommet	2
	Single-sided terminal pins	40
	10-way ribbon cable	
	1M	
	DIL socket 14 pin	8
	DIL socket 16 pin	3

### BURGLAR ALARM PSU PARTS LIST

#### Resistors - All ¼ watt 5% Metal Film

R1	220R	Red Red Brown	1
R2	10K	Brown Black Orange	1
R3	6K8	Blue Grey Red	1

#### Capacitors

C1	100nF suppression capacitor	1
C2	2200µF 25V axial electrolytic	1
C3	100µF 25V axial electrolytic	1

C4	100nF disc ceramic	1
<b>Semiconductors</b>		
D1, D2, D3	1N4001	3
BR1	W005	1
REG 1	µA78L05AWC	1
TR1	BC214L	1
<b>Miscellaneous</b>		
T1	Transformer 6-0-6 100 mA	1
S1	Micro switch	1
FS1	20 mm fuse 100 mA	1
	Chassis fuseholder	1
	Terminal block 5 amp (3 sections)	
	6BA tag	
	6BA 1 inch bolt	2
	6BA ¼ inch bolt	3
	6BA 1 inch CSK screw	2
	6BA ½ inch CSK screw	3
	6BA washer	13
	6BA nut	15
	Insulated sleeving	3"
	Single-sided terminal pins	13

### BURGLAR ALARM EXTERNAL HORN PARTS LIST

#### Resistors - All ¼ watt 5% Metal Film

R1, R5	1K	Brown Black Red	2
R2, R4	100K	Brown Black Yellow	2
R3	1M	Brown Black Green	1

#### Capacitors

C1	100nF disc ceramic	1
C2	1µF 25V tantalum	1

#### Semiconductors

TR1	2N3819	1
TR2	BC441	1

#### Miscellaneous

H2	Electronic Siren	1
B1, B2	6 volt Lantern Battery	2
	Heatsink 5F	1
	Single-sided terminal pins	6
	Small grommet	1
	Self-tapping screws No. 6 ½ inch	10
	6BA ½ inch bolt	4
	6BA washer	4
	6BA nuts	4
	6BA x ¼ inch spacer	2

### BURGLAR ALARM BREAK CONTACT MODULE PARTS LIST

#### Resistors - All ¼ watt 5% Metal Film

R1, R2, R6, R7	2K2	Red Red Red	4
R3, R4, R8, R9	100K	Brown Black Yellow	4
R5, R10	180K	Brown Grey Yellow	2
RT1, RT2 (Test Resistors)	22K	Red Red Orange	2
VR1, VR2	22K	Vertical sub-min preset	2

#### Capacitors

C1, C2	100nF disc ceramic	2
--------	--------------------	---

#### Semiconductors

D1, D2, D3, D4	1N4148	1
IC1	4011BE	1

#### Miscellaneous

TPA, TPB	Single-sided terminal pins	2
	DIL socket 14 pin	1

# ATARI COMPUTER NEWS

by Graham Daubney

Details this month of the amazing Atari Word Processor software package that includes its own training programme! , and a review of an excellent new game you can really get your teeth into: Jawbreaker. Also this time a Morse tutor program that will greatly help all CB breakers to move onto finer and farther things - there's nowhere in the world you can't talk to once you've got an amateur radio licence with Morse code.

## ATARI WORD PROCESSOR SYSTEM

This word processor requires the following hardware:

ATARI 800 Personal computer system

ATARI 810 Disk Drive

ATARI 850 Interface module

ATARI PRINTER

TV set or Monitor

The package consists of an extremely large training manual, master diskette, data diskette, backup master diskette and to cap it all a training cassette.

The documentation supplied is both extensive and comprehensive and takes the form of lessons. Add to this the training cassette and anyone of medium intelligence supplied with this lot can learn to process words in a very short time indeed, though as will become apparent during this review, to completely master the many functions provided would take perhaps a few weeks.

The opening lesson assumes absolutely no knowledge of either word processing or computer systems and is a step by step guide of how to back up your data diskettes and how to load and get running the software provided. The basic cursor controls are then explained in some detail followed by how to enter text and then save your document onto disk. A brief description of how to print out your text is also given, this means that anyone who is familiar with both computers and word processing can at least get started.

Lesson two covers moving the viewing window (this is necessary as the screen acts as a window onto a portion of your document and you can move this window around to examine various parts), deleting words and lines or parts of lines, using the page layout control display and text formatting.

Lesson three explains how to paginate, search-for and replace specific words, delete text and movement of a block of text. At this point you use one of the pieces of text supplied on the data disk.

Lesson four covers text alignment, centering of text, setting and use of tabs and text justification when printing out.

Lesson five deals with repagination, removal of headers, renaming of - documents and use of the disk utilities.

The last lesson deals with some of the trickier functions, i.e. entering of subscripts and superscripts, creation of text in elongated print, alignment of columns of figures, positioning text outside the set margin, addressing of envelopes and printing in double column format. The word processor is based on a system of menus, each offers a list of choices, many menus lead to sub menus, I found this system very easy to get used to especially as it is possible to page back through the menus using the escape key until you find the function that you are looking for. The top of the screen is separated from the work area by a blank line in which there is a cursor. I found this cursor confusing at first and wondered why it was there at all, as you have no control over it, however it does fly about within the dividing line when the machine is performing certain functions and so I assume its presence is merely to tell you that something is happening. Right at the top of the screen is the status line which gives you useful information about the document that you are working on, i.e. its name, which page you are working on, the current cursor column.

The quantity of control codes used to perform editing and formatting functions is huge and this is one area where the beginner may flounder at first. I got to grips with the more commonly used ones within an hour or two and some of the less common ones come with practice. It seems that ATARI have thought of just about anything you could possibly wish to do with a document and the control codes and their functions are reprinted here for your examination.

Print formatting is selected by hitting the select key, which will present you with a graphical representation of your text on a page and also a menu of

ATARI 800

## ATARI WORD PROCESSOR



ATARI

MODEL C74M  
USE WITH ATARI® 800  
PERSONAL COMPUTER SYSTEM  
ACCESSORIES REQUIRED

### CONTROL CHARACTER SUMMARY

#### Centering Text

CTAL V Center line of text

#### Saving Blocks of Text

CTAL N Mark the beginning of text

CTAL M Mark the end of text

CTAL S Save text block

#### Insert Saved Text Block

SHIFT INSERT Insert saved text block (position cursor at point of insertion)

#### Delete Text Block

CTAL N Mark the beginning of text

CTAL M Mark the end of text

SHIFT CLEAR Delete text block

NOTE: Saving, inserting, and deleting blocks of text can also be done in Text Memory mode of the Extended Functions menu.

#### Changing Character Case

CTAL C Change character from lower case to upper case and vice versa

#### Underlining

CTAL I Change character from normal to underlined and vice versa. Inverse video characters on the screen display represent underlined characters during printout

#### Subscripts and Superscripts

CTAL INSERT CTAL ↓ Subscripts (half line down)

CTAL INSERT CTAL ↑ Superscripts (half line up)

#### Elongated Print

Text to be printed with elongated characters must be bracketed by special characters. Both CTAL and INSERT keys must be pressed at the same time and released before the next key is pressed.

CTAL INSERT then TAB Start elongated print

CTAL INSERT then DELETE BACK S Stop elongated print

#### Line Terminators

RETURN Insert fixed line terminator. Line will be formatted (indented, line spacing, paragraph spacing, margin alignment, etc.)

CTAL J Insert fixed line terminator. Line will not be formatted

#### Page Break

CTAL K Automatically breaks page during pagination

#### Cursor Movement

CTAL ← One space left

CTAL → One space right

CTAL ↑ One space up

CTAL ↓ One space down

#### Quick Cursor Movement

CTAL A Beginning of line

CTAL E End of line

CTAL G Left Margin

CTAL H Right Margin

CTAL I Top of page

CTAL B Bottom of page

CTAL : End of text

#### Window Movement

CTAL TAB Fast scroll left

SHIFT TAB Fast scroll right

CTAL V Fast scroll up

CTAL O Fast scroll down

CTAL L Viewing window left

CTAL R Viewing window right

CTAL U Viewing window up

CTAL D Viewing window down

#### Deleting Characters

DELETE BACK S Delete character to left of cursor

SHIFT DELETE BACK S Delete character to right of cursor

#### Deleting Words Or Lines

CTAL W Delete current word (word over cursor)

CTAL P Delete prior word (word prior to cursor)

CTAL DELETE BACK S Delete from cursor to beginning of line

CTAL F Delete from cursor to end of line

CTAL X Delete entire line

CTAL Z Restores edited line to its original state

#### Inserting Characters, Words, Or Lines

To insert characters or words, position the cursor at the point of insertion and begin typing.

CTAL J Insert blank line (terminated but not formatted)

CTAL O Insert blank line (formatted but not terminated)

RETURN Insert blank line (formatted and terminated)

#### Margin Alignment

CTAL [ Align line to left margin

CTAL ] Align line to right margin

alterable functions, again this menu is very comprehensive and allows you to format your text very effectively. The following functions can be adjusted from this menu: top, left and right margins, line, paragraph and indentation spacing, page size, justification (on or off), characters per inch and tabs. All data storage is on a standard 5 1/4 inch floppy diskette which can hold up to 63 pages of text, obviously this is dependent on the size of your pages. As you have the ability to work on one document a page at a time it is possible to store one document split into pages and spread over a number of diskettes so for all practical purposes you can work on a document of any size. In practice I found the storage more than adequate for my purposes which consist mostly of standard letters or at least paragraphs, memos (mostly to myself!) and writing of leaflets or reviews, in fact this review was written using this processor although it has of course been type set and printed since. If anyone wishes to see the original of this article as produced straight from the ATARI system I will of course be pleased to provide one if you write to me with a self addressed envelope.

To date the software has not crashed on me or given any strange results and I have found it to be very user friendly with descriptive error messages that soon put you back on the right track. In fact, during use there are a number of safety features built into the software. For instance it is impossible to overwrite the text you are working on accidentally so you are asked to confirm that it is O.K. before the machine goes ahead.

In conclusion, this word processor is powerful and has many features and functions not found on packages costing up to 3 times as much. As price is obviously a prime consideration for a small business the cost of



the hardware necessary to implement this package ensures that this is the cheapest way to get your secretary automated.

I particularly liked the training cassette idea and feel sure that this idea will be mimicked by software producers in the future. The documentation, as stated earlier, is superb to learn from although once the basics had been digested I found it a little difficult to find an explanation of specific functions quickly although the idea of a removable plastic covered 'crib sheet' helped later on.

The complete Atari Word Processor software package is available now. Order As YG42V (Word Processor) Price £85.00.

## MORSE TUTOR PROGRAM FOR ATARI

by Chris Barlow

Morse code was developed for use in electric telegraphy in 1838 by Samuel F. B. Morse.

The earliest Transatlantic radio signal was received by Marconi at Poldhu, Cornwall, from a 10kW transmitter at Newfoundland, Canada, on the 12<sup>th</sup> December 1901. The highest speed ever recorded for receiving Morse code is 75.2 words per minute and 175 wpm for sending by hand.

Morse transmissions can be received on various short wave bands, amateur radio and shipping signals etc. These Morse signals can be between 8 to 14 wpm or even greater speeds.

This program generates random Morse characters, letters and/or numbers at 5 to 30 wpm. You can control the delay between Morse characters and the tone (pitch).

C. W. signal sets the strength of the Morse received, 5/9 a strong signal to 5/1 a weak signal. As the Morse gets weaker then more interference is heard on the received signal.

Tutor length sets the number of Morse characters generated from 10 to 430 but you can stop at anytime by pressing the option key.

At the conclusion of generated Morse, an end bleep will sound and you may then read the screen to check your accuracy.

You may then use the start key to repeat the exercise or press select key for the setup menu.

When the program is running use option/select/start keys to control the program and here is a brief description of the working program.

### MORSE TUTOR PROGRAM

1000 to 1540 read random line of data.

1550 and 1560 C.W. tone and Q.R.M. sound

1600 print Morse characters and delay/length routine.

1700 to 1760 end of Morse and set colour to read screen.

2000 to 2035 Morse data dit dah and space. Last number is character string value.

2500 and 2510 setup routine for tone and speed etc.

3000 to 3140 print graphics page 2 the menu/setup.

3150 to 3525 select/start routines tone speed etc.

4000 to 4230 print graphics page 1 the Morse code.

5000 start Morse sounds routine.

The complete program is shown below.

```
20 GOSUB 2500
1000 A = INT(RND<1) * TYPE)
1005 IF TYPE > 10 AND A < 10 AND MIXED = 0 THEN 1000
1010 IF PEEK (53279) = 3 THEN 1700
1040 RESTORE A + 2000
1500 READ B
1510 IF B = 1 THEN C = TONE : X=1
1520 IF B = 2 THEN C = TONE : X=3
1530 IF B = 3 THEN C = 0 : X=1
1540 IF B > 3 THEN C = 0 : X=3
1550 SOUND 0 ,C,10,SIGNAL : SOUND 1,17,8 , QRM : SOUND 2,1,4 , QRM : SOUND
3,18,10,QRM
1560 FOR T = Q TO X * RATE : NEXT T
1570 IF B > 3 THEN 1600
1580 GOTO 1500
1600 POKE 77,0 : PRINT CHR$(B) ; " " ; : FOR T = 0 TO DELAY * 360 : NEXT T : LENGTH =
LENGTH + 1 : IF LENGTH = TIME THEN 1700
```

```
1610 GOTO 1000
1700 SOUND 1,0,0,0 : SOUND 2,0,0,0 : SOUND 3,0,0,0 : SETCOLOR 1,0,10 : SETCOLOR 2,7,0
1710 FOR T = 0 TO 10 : SOUND 0,70,10,5 : SOUND 1,71,10,5 : SOUND 2,72,1,0,5 : SOUND
3,73,10,5
1720 FOR C = 0 TO 30 : NEXT C : SOUND 0,0,0,0 : SOUND 1,0,0,0 : SOUND 2,0,0,0 : SOUND
3,0,0,0
1730 FOR C = 0 TO 30 : NEXT C : NEXT T
1740 IF PEEK (53279) = 5 THEN GOSUB 3000
1745 IF PEEK (53279) = 6 THEN GOSUB 5000
1750 IF LENGTH = 0 THEN 1000
1760 GOTO 1740
2000 DATA 2,3,2,3,2,3,2,3,2,48
2001 DATA 1,3,2,3,2,3,2,3,2,49
2002 DATA 1,3,1,3,2,3,2,3,2,50
2003 DATA 1,3,1,3,1,3,2,3,2,51
2004 DATA 1,3,1,3,1,3,1,3,2,52
2005 DATA 1,3,1,3,1,3,1,3,1,53
2006 DATA 2,3,1,3,1,3,1,3,1,54
2007 DATA 2,3,2,3,1,3,1,3,1,55
2003 DATA 2,3,2,3,2,3,1,3,1,56
2009 DATA 2,3,2,3,2,3,2,3,1,57
2010 DATA 1,3,2,65
2011 DATA 2,3,1,3,1,3,1,66
2012 DATA 2,3,1,3,2,3,1,67
2013 DATA 2,3,1,3,1,68
2014 DATA 1,69
2015 DATA 1,3,1,3,2,3,1,70 #
2016 DATA 2,3,2,3,1,71
2017 DATA 1,3,1,3,1,3,1,72
2018 DATA 1,3,1,73
2019 DATA 1,3,2,3,2,3,2,74
2020 DATA 2,3,1,3,2,75
2021 DATA 1,3,2,3,1,3,1,76
2022 DATA 2,3,2,77
2023 DATA 2,3,1,78
2024 DATA 2,3,2,3,2,79
2025 DATA 1,3,2,3,2,3,1,80
2026 DATA 2,3,2,3,1,3,2,81
2027 DATA 1,3,2,3,1,82
2028 DATA 1,3,1,3,1,83 20-29 DATA 2,84
2030 DATA 1,3,1,3,2,85
2031 DATA 1,3,1,3,1,3,2,86
2032 DATA 1,3,2,3,2,87
2033 DATA 2,3,1,3,1,3,2,88
2034 DATA 2,3,1,3,2,3,2,89
2035 DATA 2,3,2,3,1,3,1,90
2500 SIGNAL = 10 : QRM = 0 : DELAY = 0 : TONE=10 : SPEED = 12 : TYPE = 36 : TIME=30 :
CODE = 0 : CAL=100 : RX = 9 : CWL = 1 : CWN=1
2510 RATE = INT(CAL / SPEED * 2)
3000 REM *****MENU*****
3010 GRAPHICS 2+16 : SETCOLOR 4,7,1 : SETCOLOR 0,4,8
3020 FOR D = 0 TO 19 : POSITION D,0 : PRINT #6;"*": NEXT D
3030 FOR D = 0 TO 19 : POSITION D,10 : PRINT #6;"*": NEXT D
3040 FOR D = 0 TO 9 : POSITION 0,D : PRINT #6;"*": NEXT D
3050 FOR D = 0 TO 9 : POSITION 19,D : PRINT #6;"*": NEXT D
3060 POSITION 1,1 : PRINT #6;"THE CODE..... ?"
3062 IF CODE = 1 THEN POSITION 14,1 : PRINT #6;"YES"
3065 IF CODE = 0 THEN POSITION 14,1 : PRINT #6;"NO"
3070 POSITION 1,2 : PRINT #6;"SPEED (WPM) . . .:SPEED;""?"
3072 IF SPEED < 10 THEN POSITION 15,2 : PRINT #6;".. ?"
3080 POSITION 1,3 : PRINT #6;"DELAY < SEC >:;DELAY;""?"
3085 IF DELAY = INT(DELAY) THEN POSITION 15,3 : PRINT #6;"?"
3090 POSITION 1,4 : PRINT #6;"C. W. TONE;";TONE;""?"
3100 POSITION 1,5 : PRINT #6;"C. W. SIGNAL...5;";RX;""?"
3110 POSITION 1,6 : PRINT #6;"C. W. LETTERS.... ?"
3112 IF CWL = 1 THEN POSITION 14,6 : PRINT #6;"YES"
3115 IF CWL = 0 THEN POSITION 14,6 : PRINT #6;"NO"
3120 POSITION 1,7 : PRINT #6;"C.W.NUMBERS....?"
3122 IF CWN = 1 THEN POSITION 14,7 : PRINT #6;"YES"
3125 IF CWN = 0 THEN POSITION 14,7 : PRINT #6;"NO"
3130 POSITION 1,8 : PRINT #6;"TUTOR LENGTH;";TIME
```

```

3132 IF TIME < 100 THEN POSITION 16,8 : PRINT #6;" ?"
3135 IF TIME > 99 THEN POSITION 17,8 : PRINT #6;" ?"
3140 POSITION 1,9 : PRINT #6;"USE SELECT/START ?"
3150 REM xxxxxxxxSELECT/STARTxxxxxxxx
3155 POSITION 17,1 : PRINT #6;"<"
3160 IF PEEK (53279) = 5 AND CODE = 1 THEN CODE = 0 : POSITION 14,1 : PRINT #6;"NO" :
SOUND 0,150,10,5 : FOR I = 0 TO 50 : NEXT I
3165 IF PEEK (53279) = 5 AND CODE = 0 THEN CODE = 1 : POSITION 14,1 : PRINT #6;"YES" :
SOUND 0,20,10,5 : FOR I = 0 TO 30 : NEXT I
3166 SOUND 0,0,0,0
3170 IF PEEK (53279) = 6 AND CODE = 1 THEN 4000
3175 IF PEEK (53279) = 6 AND CODE = 0 THEN POSITION 17,1 : PRINT #6;" " : SOUND 0,30,10,5
: FOR I = 0 TO 30 : NEXT I : GOTO 3185 3180 GOTO 3160
3185 SOUND 0,0,0,0 : POSITION 17,2 : PRINT #6;"<"
3190 IF PEEK (53279) = 5 THEN SOUND 0,20,10,5 : GOSUB 3210
3195 IF PEEK (53279) = 6 THEN Z=Z+1 : IF Z > 10 THEN 3220
3200 GOTO 3190
3210 SPEED = SPEED +1 : IF SPEED > 30 THEN SPEED = 5
3211 RATE = INT(CAL / SPEED * 2)
3215 POSITION 15,2 : PRINT #6;" " : POSITION 14,2 : PRINT #6;SPEED : FOR I = 0 TO 30 : NEXT
I : SOUND 0,0,0,0 : RETURN
3220 Z = 0 : SOUND 0,30,10,5 : POSITION 17,2 : PRINT #6;" " : FOR I = 0 TO 30 : NEXT I : SOUND
0,0,0,0
3225 POSITION 17,3 : PRINT #6;"<"
3230 IF PEEK (53279) = 5 THEN DELAY = DELAY + 0.1 : SOUND 0,30,10,5 : GOSUB 3234
3232 IF PEEK (53279) = 6 THEN Z = Z + 1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3240
3233 GOTO 3230
3234 IF DELAY > 4 THEN DELAY = 0
3235 POSITION 16,3 : PRINT #6;"0" : POSITION 14,3 : PRINT #6;DELAY : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0 : RETURN
3240 Z = 0 : POSITION 17,3 : PRINT #6;" " : POSITION 17,4 : PRINT #6;"<" : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0
3245 IF PEEK (53279) = 5 THEN TONE = TONE + 1 : GOSUB 3260
3250 IF PEEK (53279) = 6 THEN Z=Z+1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3270
3255 GOTO 3245
3260 IF TONE > 99 THEN TONE = 10
3265 POSITION 14,4 : PRINT #6;TONE : SOUND 0,TONE,10,10 : FOR I = 0 TO 10 : NEXT I :
SOUND 0,0,0,0 : RETURN
3270 Z = 0 : POSITION 17,4 : PRINT #6;" " : POSITION 17,5 : PRINT #6;"<" : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0
3275 IF PEEK (53279) = 5 THEN RX = RX - 1 : GOSUB 3285
3280 IF PEEK (53279) = 6 THEN Z = Z + 1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3350
3284 GOTO 3275
3285 IF RX < 1 THEN RX = 9
3290 POSITION 16,5 : PRINT #6;RX : SOUND 0,30,10,5 : FOR I = 0 TO 30 : NEXT I : SOUND
0,0,0,0
3295 IF RX = 9 THEN SIGNAL = 10 : QRM = 0
3300 IF RX = 8 THEN SIGNAL = 10 : QRM = 1
3305 IF RX = 7 THEN SIGNAL = 9 : QRM = 2
3310 IF RX = 6 THEN SIGNAL = 9 : QRM = 3
3315 IF RX = 5 THEN SIGNAL = 8 : QRM = 4
3320 IF RX = 4 THEN SIGNAL = 7 : QRM = 5
3325 IF RX = 3 THEN SIGNAL = 5 : QRM = 6
3330 IF RX = 2 THEN SIGNAL = 4 : QRM = 7
3340 IF RX = 1 THEN SIGNAL = 3 : QRM = 7
3345 RETURN
3350 Z=0 : POSITION 17,5 : PRINT #6;" POSITION 17,6 : PRINT #6;"<" : FOR I = 0 TO 30 : NEXT I
: SOUND 0,0,0,0
3355 IF PEEK (53279) = 5 AND CWL = 1 THEN SOUND 0,150,10,5 : GOSUB 3380
3360 IF PEEK (53279) = 5 AND CWL = 0 THEN SOUND 0,30,10,5 : GOSUB 3390
3365 IF PEEK (53279) = 6 THEN Z = Z + 1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3400
3370 GOTO 3355
3380 POSITION 14,6 : PRINT #6;"NO." : CWL = 0 : TYPE = 10 : FOR I = 0 TO 30 : NEXT I : SOUND
0,0,0,0 : RETURN
3390 POSITION 14,6 : PRINT #6;"YES" : CWL = 12 TYPE = 36 : FOR I = 0 TO 30 : NEXT I : SOUND
0,0,0,0 : RETURN
3400 Z = 0 : POSITION 17,6 : PRINT #6;" " : POSITION 17,7 : PRINT #6;"<" : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0
3405 IF PEEK (53279) = 5 AND CWN = 1 THEN SOUND 0,150,10,5 : GOSUB 3430

```

```

3410 IF PEEK (53279) = 5 AND CWN = 0 THEN SOUND 0,30,10,5 : GOSUB 3440
3415 IF PEEK (53279) = 6 THEN Z = Z + 1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3450
3420 GOTO 3405
3430 POSITION 14,7 : PRINT #6;"NO. " : CWN = 0 : FOR I = 0 TO 30 : NEXT I : SOUND 0,0,0,0 :
RETURN
3440 POSITION 14,7 : PRINT #6;"YES" : CWN = 1 : FOR I = 0 TO 30 : NEXT I : SOUND 0,0,0,0 :
RETURN
3450 IF CWL = 0 AND CWN = 0 THEN SOUND 0,70,10,5 : FOR I = 0 TO 40 : NEXT I : SOUND
0,0,0,0 : GOTO 3470
3455 IF CWL = 1 AND CWN = 1 THEN MIXED = 1
3460 IF CWL < CWN OR CWL > CWN THEN MIXED = 0
3460 GOTO 3430
3470 POSITION 17,7 : PRINT #6;" " : GOTO 3350
3480 Z = 0 : POSITION 17,7 : PRINT #6;" " : POSITION 17,8 : PRINT #6;"<" : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0
3485 IF PEEK (53279) = 5 THEN TIME = TIME + 10 : SOUND 0,30,10,5 : GOSUB 3500
3490 IF PEEK (53279) = 6 THEN Z = Z + 1 : IF Z > 10 THEN SOUND 0,30,10,5 : GOTO 3510
3495 GOTO 3485
3500 IF TIME > 430 THEN TIME = 10 : POSITION 16,8 : PRINT #6;" "
3505 POSITION 14,8 : PRINT #6;TIME : FOR I = 0 TO 15 : NEXT I : SOUND 0,0,0,0 : RETURN
3510 Z = 0 : POSITION 17,8 : PRINT #6;" " : POSITION 17,9 : PRINT #6;"<" : FOR I = 0 TO 30 :
NEXT I : SOUND 0,0,0,0
3515 IF PEEK (53279) = 5 THEN SOUND 0,70,10,5 : FOR I = 0 TO 30 : NEXT I : GOTO 3000
3520 IF PEEK (53279) = 6 THEN SOUND 0,30,10,5 : FOR I = 0 TO 30 : NEXT I : SOUND 0,0,0,0 :
GOTO 5000
3525 GOTO 3515
4000 REM xxxxx THE MORSE CODE xxxxxxxxxxxx
4005 GRAPHICS 1+16 : SETCOLOR 4,4,1 : SETCOLOR 0,13,10
4010 FOR D = 0 TO 19 : POSITION D,0 : PRINT #6;"x" : NEXT D
4015 FOR D = 0 TO 19 : POSITION D,22 : PRINT #6;"x" : NEXT D
4020 FOR D=0 TO 22 : POSITION 0,D : PRINT #6;"x" : NEXT D
4025 FOR D=0 TO 22 : POSITION 19,D : PRINT #6;"*" : NEXT D
4030 POSITION 1,1 : PRINT #6;" A x- V xxx-"
4035 POSITION 1,2 : PRINT #6;" B -xxx W *-"
4040 POSITION 1,3 : PRINT #6;" C -* X -x-"
4045 POSITION 1,4 : PRINT #6;" D -x Y -x-->"
4050 POSITION 1,5 : PRINT #6;" E x Z -- xx"
4055 POSITION 1,6 : PRINT #6;" F xx-x"
4060 POSITION 1,7 : PRINT #6;" G -- 1 x--"
4065 POSITION 1,8 : PRINT #6;" H xxx 2 xx--"
4070 POSITION 1,9 : PRINT #6;" I xx 3 xxx --"
4075 POSITION 1,10 : PRINT #6;" J x- 4 xxx-"
4080 POSITION 1,11 : PRINT #6;" K -x- 5 xxx-"
4095 POSITION 1,12 : PRINT #6;" L x-xx 6 -xxx"
4090 POSITION 1,13 : PRINT #6;" M -- 7 --xx"
4095 POSITION 1,14 : PRINT #6;" N -x 8 --xx"
4100 POSITION 1,15 : PRINT #6;" O -- 9 --x"
4105 POSITION 1,16 : PRINT #6;" P x-- 0-----"
4110 POSITION 1,17 : PRINT #6;" G --"
4115 POSITION 1,18 : PRINT #6;" R *-**"
4120 POSITION 1,19 : PRINT #6;" S xxx x = DIT"
4125 POSITION 1,20 : PRINT #6;" T - - = DAH"
4130 POSITION 1,21 : PRINT #6;" U xx-"
4150 IF PEEK (53279) <> 7 THEN 4200
4160 GOTO 4150
4200 FOR T = 0 TO 5
4210 FOR 0 = 20 TO 10 STEP - 20
4220 SOUND 0,V,10,5 : SOUND 1,V+1,10,5 : SOUND 2,0+2,10,5 : SOUND 3,0+3,10,5 : NEXT V :
NEXT T
4230 SOUND 0,0,0,0 : SOUND 1,0,0,0 : SOUND 2,0,0,0 : SOUND 3,0,0,0 : CODE=0 : GOTO 3000
5000 LENGTH = 0 : GRAPHICS 0 : SETCOLOR 4,12,7 : SETCOLOR 2,0,0 : SETCOLOR 1,0,0 :
POKE 752, 1 : RETURN
5010 REM xxxxxxxxx C.S.BARLOW xxxxxxxx
5020 REM xxxxxxxxx C.S.BARLOW xxxxxxxx
5030 REM xxxxxxxxx C.S.BARLOW xxxxxxxx
5040 REM xxxxxxxxx C.S.BARLOW xxxxxxxx
5050 REM xxxxxxxxx C.S.BARLOW xxxxxxxx
5060 REM xxxxxxxxx C.S.BARLOW xxxxxxxx

```

## JAWBREAKER

Jawbreaker is a fascinating new disk based game for the ATARI personal computer.

It will run on an 800 machine with an 810 disk drive and a joystick. The object of the game is to move your player through a maze whilst 'eating' sweets in the process. Quite a simple game it may appear at first sight, however things are made more difficult by the fact that you are being chased by a number of unfriendly faces, who if successful in catching you, promptly remove all your teeth, without which you cannot continue to 'eat' sweets.

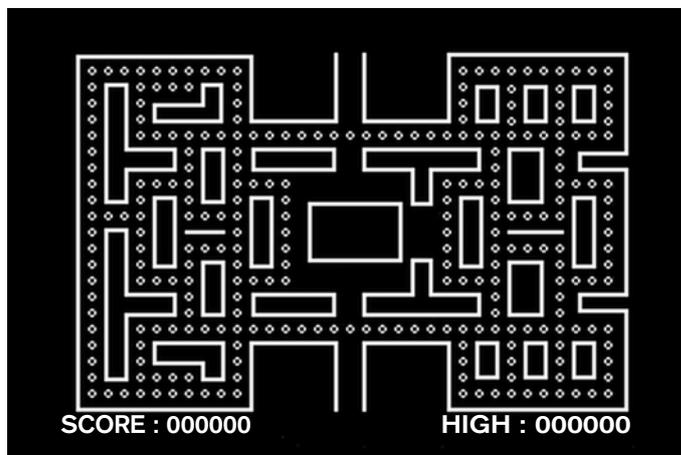
You have only three sets of teeth before the game ends. If you manage to eat all the sweets on the screen your teeth are given a quick brush (guaranteed to bring a smile to your face).

Each screen full of sweets gets progressively more difficult to eat as the chasing faces get faster and faster. Some help is given to you in the form of a spare set of teeth if you survive the third round.

A combination of speed, colour and some highly amusing graphics characters results in a totally riveting game.

Character movement through the maze is achieved by using player missile graphics so that movement is both continuous and very smooth.

Order As BQ26D (Jawbreaker) Price £22.95.



## THE UK ATARI COMPUTER OWNER'S CLUB

(An independent user's group)

Now you can join the UK Atari Computer Owner's Club for just £1.60 a year. Every three months you'll receive a copy of the club's own magazine packed with information about your Atari. If you own an Atari, join the club now! Please send your subscription to: Graham, Maplin Electronic Supplies Ltd, Box 3, Rayleigh, Essex SS6 8LR. (If paying with an order, use order code GG25C.)

# ATARI NEWS

## ATARI VIDEO GAME

### Latest cartridge details

This month, details of five new cartridges and some advance information on cartridges to be released during 1982.

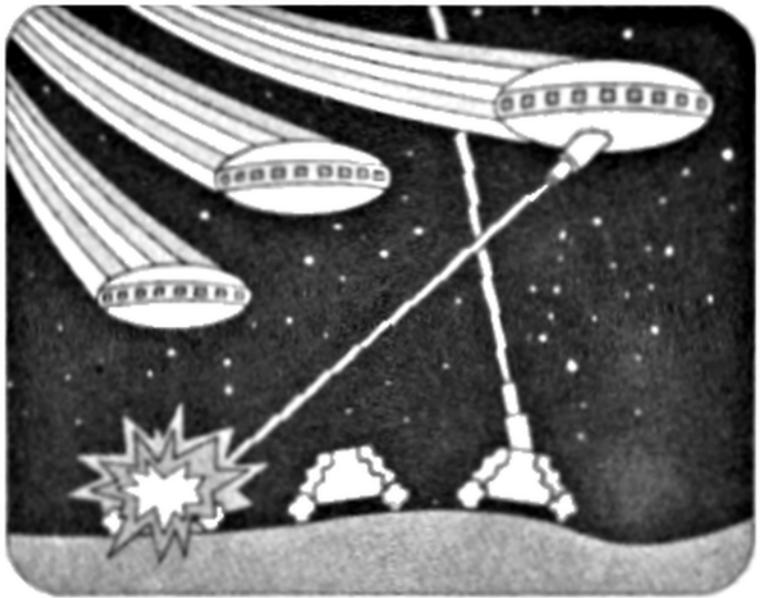
#### Super Breakout

For one or two players using paddles, this game cartridge contains nine different games. Games 1, 3, 5, 7 and 8 are for one player whilst games 2, 4, 6 and 9 are for 2 players. Games 1 and 2 are standard Breakout. In games 3 and 4 you have two paddles and two balls are served: this is Double Breakout. Games 5 and 6 are Cavity Breakout. You have two paddles, but only one ball is served. However, two other balls are trapped in the wall. You must knock the bricks out to release the balls, then use those balls as well.

Game 7 is Progressive Breakout. When this game begins the play field contains four rows of bricks at the top of the screen, followed by four blank rows, then four more rows of bricks. As the game progresses the walls move towards the bottom of the screen and new bricks enter the top of the play field. Games 8 and 9 are especially easy versions of standard Breakout for young children. Order As AC48C (Super Breakout) Price £29.95

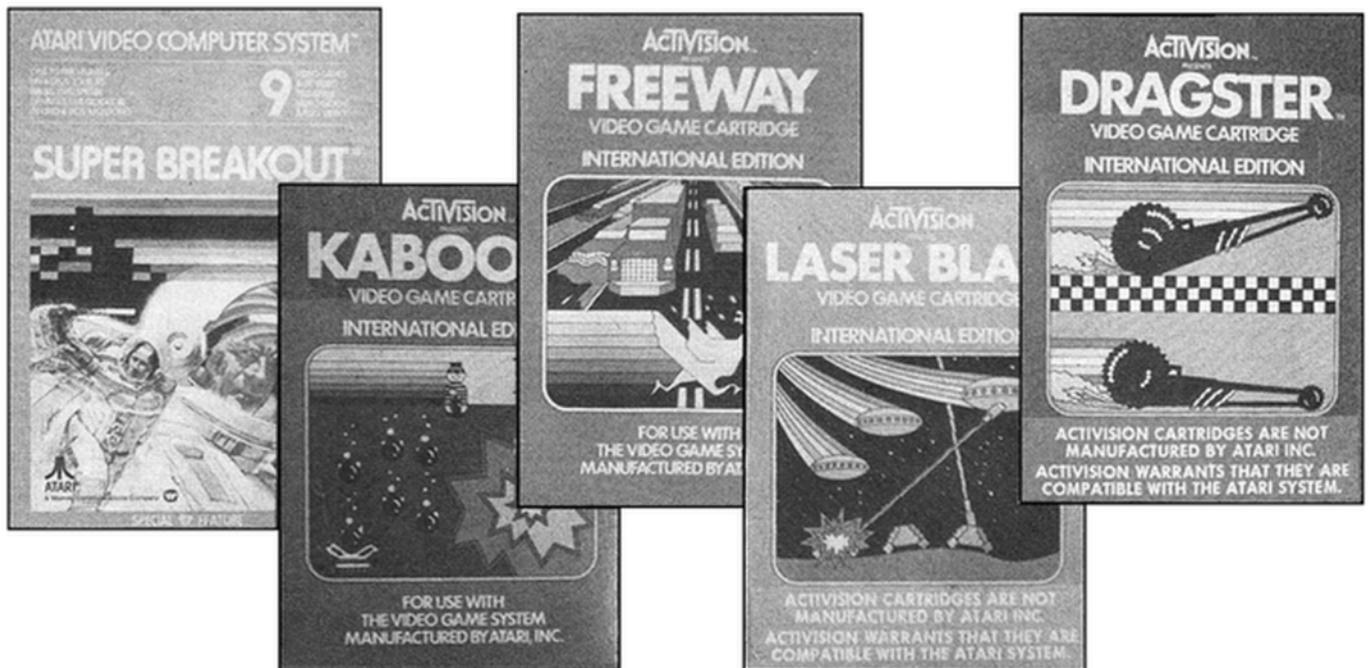
#### Freeway

For one or two players using joysticks, this game cartridge contains eight games. In each game there are ten lanes of traffic, five in each direction. Your task is to get your chicken across the road in the shortest possible time. In games 1 to 4 the amount of traffic on the road and the speed at which they move gets higher as the game number gets higher. Games 5 to 8 are similar, but the speed of the traffic in each lane changes at random. Each game is accompanied by the sounds of a freeway: the drone of car and lorry engines and the toots from the horns of the vehicles. All games are for 1 or 2 player's. Order As AC51F (Freeway) Price £19.95



#### Dragster

For one or two players using joysticks, this game cartridge contains 2 games. In game 1 the dragster steers straight ahead, but in game 2 you can steer it. Both games are for one or two players. You're on the starting line and the clock is counting down to zero. You must get to the finish line in the shortest possible time. To do this you must clutch and shift through four gears always keeping your revs as high as possible. But watch your tachometer. If the revs stay too high for too long, you'll blow up. Order As AC52G (Dragster) Price £19.95



#### Kaboom!

For one or two players using paddles, this game cartridge contains two games. Game 1 is you versus the "Mad Bomber" and game 2 is you and a friend taking turns against the Mad Bomber. The bombs are falling all around you and you must catch them in one of your three buckets of water. Each group of bombs dropped is more difficult to catch than the group before, but it scores more points. If you drop a bomb, all the bombs explode and you lose one of your buckets. Score over 3,000 points and you can join the Activision "Bucket Brigade", but to reach maximum points may be more difficult as the game scores up to 999,999! Order As AC49D (Kaboom!) Price £19.95

#### Laser Blast

For one player using a joystick controller, this game cartridge contains one game with four levels of play. The difference between games is how rapidly the speed and firing rate of the enemy ground attackers improves as the game progresses. You control a spacecraft, firing your laser blaster at the enemy forces on the ground. Flying low to the ground will help you keep under the enemy's radar and undetected. However, each new wave of enemy attackers has a stronger force field which gradually pushes you away from the ground making you an easier and easier target. Now you must be very quick to avoid the enemy fire. Order As AC50E (Laser Blast) Price £19.95

#### Coming Soon

##### War Lords

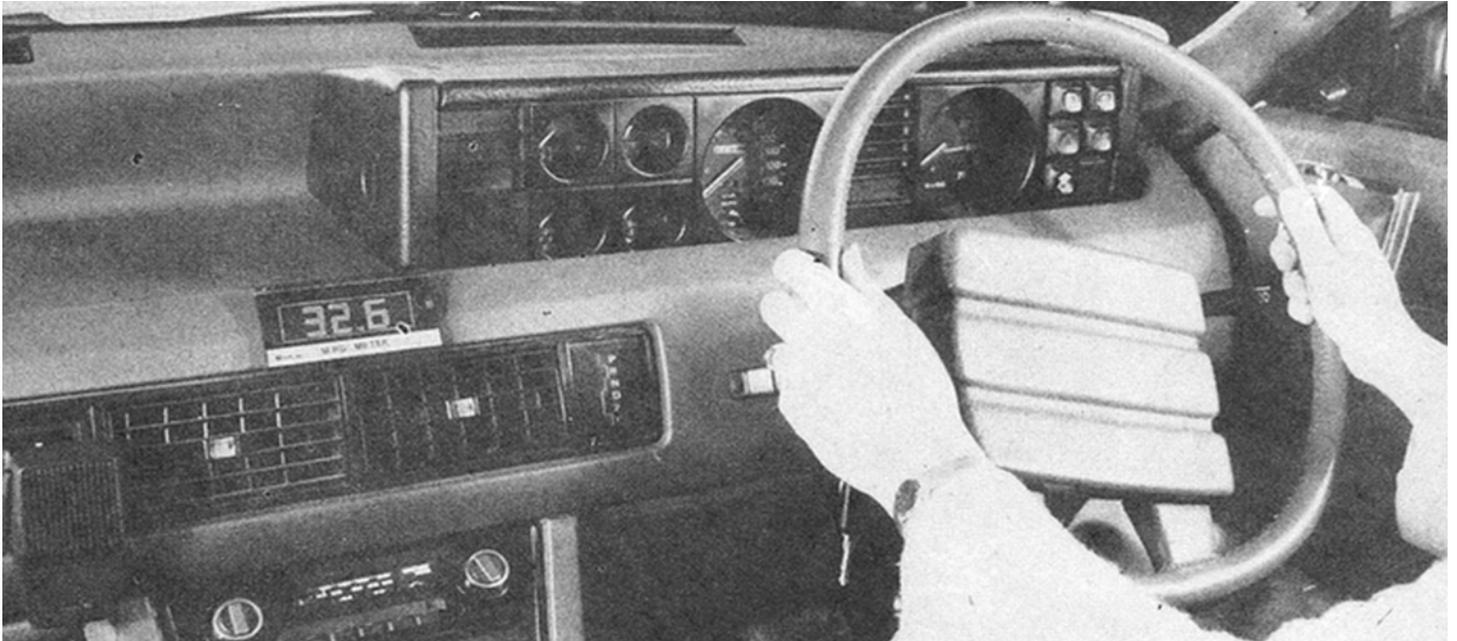
Now planned for release in early February this cartridge has 28 games and uses paddle controllers. Order As AC44X (War Lords) Price £29.95

#### Lots More Titles

There are lots more exciting new titles planned for release this year including Hot Rox, Berserk, Yar's Revenge, Pacman, Defender, Foxbat, Adventure I, Adventure II and Bridge. Full details in the next Maplin Magazine.

# DIGITAL MILES-PER-GALLON METER

by M. Wharton



- Save petrol with this easy to build device.
- Discover your car's most economical cruising speed.
- Large easy to read LED display.

With the price of petrol continuing on its upward spiral, any device which can offer some means of economising on fuel consumption must be a winner! This mph meter uses readily available transducers and produces a continuous display of fuel consumption under all driving conditions. Using the meter, it is thus possible to compare the petrol used when accelerating and cruising at speed; it is also possible to find the driving conditions which yield the optimum fuel consumption.

The basis of the design is two transducers; one transducer produces a signal in response to the flow of fuel, whilst the other is connected into the speedometer drive cable and gives an output which corresponds to road speed. The meter takes these two signals and produces a continuous digital display of miles per gallon of fuel.

## Circuit

The signal from the speed transducer is first "cleaned up" and then used to trigger a monostable, formed by IC1(c) and IC1(d), which has a very short time constant. At the same time, the signal from the fuel transducer is used to clock the divider, IC6. The chosen output from the divider is then used to trigger the dual monostable, IC5, in the following manner; a positive going edge

on pin 4 produces an output positive pulse of about 1 ms duration on pin 6; this is connected both to pin 11 of IC5 and pin 2 of IC6, triggering the second monostable on the falling edge and also resetting the divider. The same output is used as the latch signal for the display counter/divider. The two outputs, Q2 and Q2, from the second monostable are used to reset the display counter/divider and inhibit the scaling oscillator circuit via IC2(c) and IC2(d).

The purpose of the oscillator formed by IC1(a), IC1(b) and IC2(c) and the gated flip-flop formed by IC2(a), IC2(b) and IC2(d) is to enable the display to be calibrated to give a true reading and provides a means of taking into account the variety of different gearing ratios between engine and road wheels and the speedometer drive cable.

During the counting period, set according to the position of link 'A', this oscillator, in combination with IC3 and IC4, produces a series of pulses which are counted by IC7. By selecting a suitable link 'B', a wide variety of gear ratios may be accommodated and the unit calibrated accordingly to give an accurate reading of miles per gallon. The series of pulses counted by IC7 are then displayed at the end of the counting period by applying the latch signal. When IC6 is reset and the whole process commences again. IC7 and the associated transistors TR2, 3 and 4

provides all the necessary signals to drive an LED display.

## Construction

### Fuel Flow Transducer

This has to be fitted into the fuel line between the pump and the carburettor; it is not sensitive to the direction of fuel flow but it is recommended that it be positioned with the flow axis vertical to allow air bubbles to escape. It should not be mounted where it will be subjected to excessive heat (obviously!) or where ingress of water could

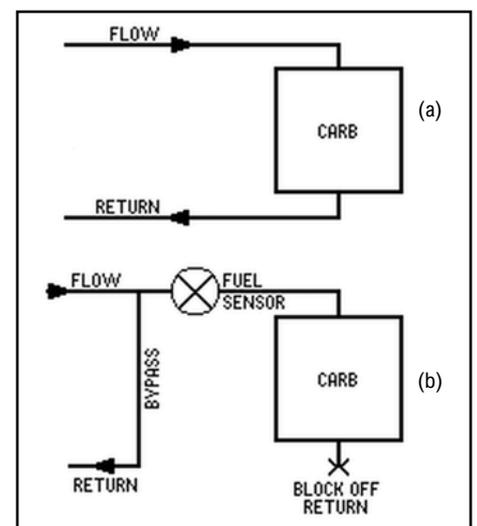


Figure 2. Pipe work for fuel circulation systems.



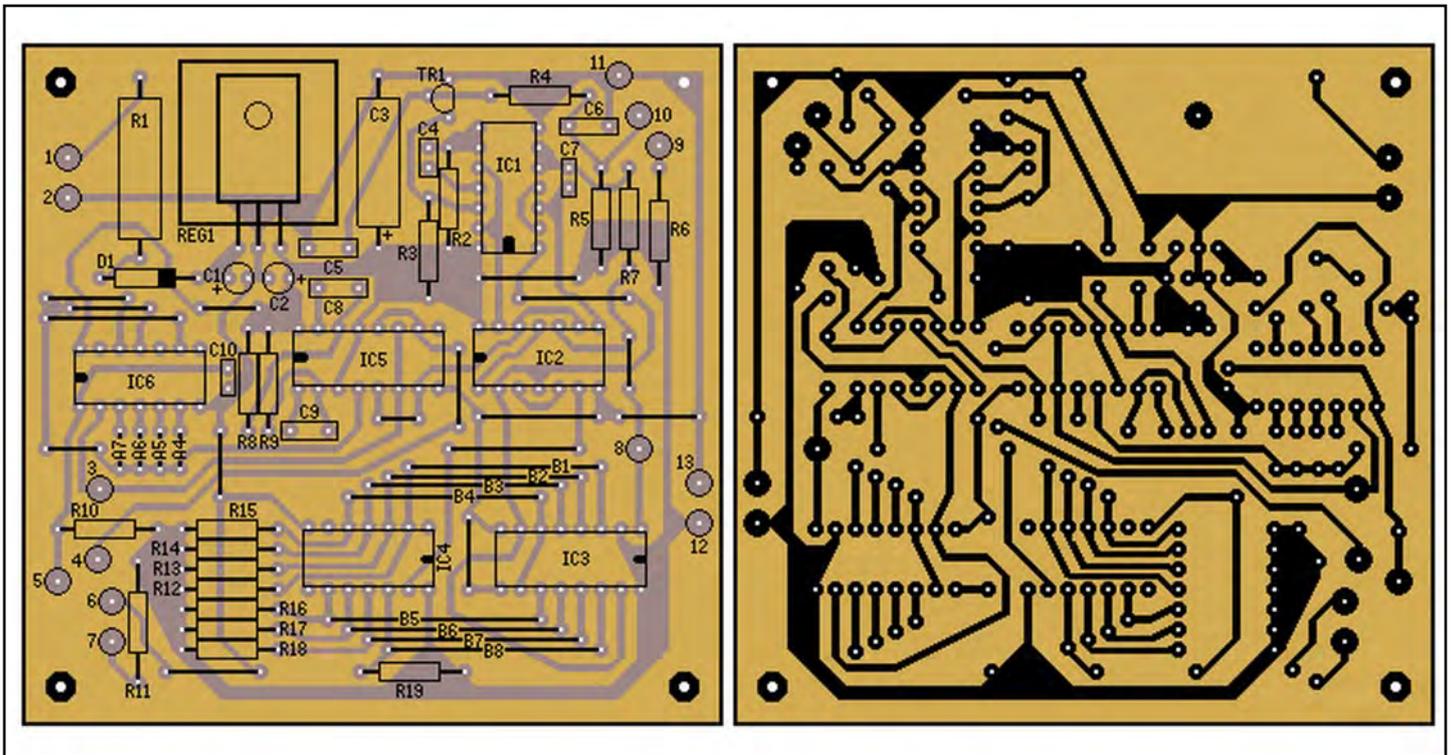


Figure 3. Main PCB track layout and component overlay.

line. (CAUTION: Under no circumstances attempt to fit it in the high pressure injector lines!) Care needs to be exercised here as the feed pressure is important to ensure correct filling of the metering pump and without a constant flow through the pump, trapped air or vapour bubbles can present a problem.

### Speed Transducer

To fit this, remove the speedometer cable and cut the outer sheath at the point where it is intended to fit the transducer; again, keep it away from heat and/or water. Make a second cut, removing ½ inch of the sheath from one of the cut ends and discard. Remove any burrs from the sheath ends. Remove any oil or grease from the inner core and replace it into the short sheath section. Place the transducer cable clamps, (use small jubilee clips or similar) on both ends of the transducer. Insert the loose end of the cable core into the single terminal end of the transducer and push through the internal friction bushing. This can be a tight fit, so take care not to kink or distort the inner cable. Tighten the clamp, but make sure the core is still free to rotate; some sheaths will require insulating tape wrapped over the end to make up the diameter to obtain a firm grip. Feed the loose cable core into the long sheath section until it also seats into the transducer and tighten the clamp carefully. Before refitting the speedometer cable to the vehicle make sure the inner core does not bind in any way - there should be about 1 mm of free movement along the axis of the transducer. Any tightness or binding will cause excessive cable wear or oscillation of the speedometer indicator needle. This is an operation which needs to be performed with care, making sure, for example, that there will be enough room for the

transducer in the position it is intended to fit before cutting the outer sheath.

Two PCBs are required. One is a display board and ideally should be fitted into the car dashboard, the other is the main logic board which holds all the major components and may be mounted in any convenient place out of sight. It is connected to the display board by only 5 wires. Note that one of the corner fixing holes in the main board is in the PCB 0V line, so that if the PCB is fixed to the car chassis the 0V line will be grounded.

Construct the main PCB. First insert all links (only some of links A1-7 and B1-8 will need to be made). Next fit IC holders, resistors, diode, transistor and capacitors, taking note of polarisation. Mount the regulator REG1 onto the PCB. Smear the mica washer both sides with heatsink compound and position onto the T0126

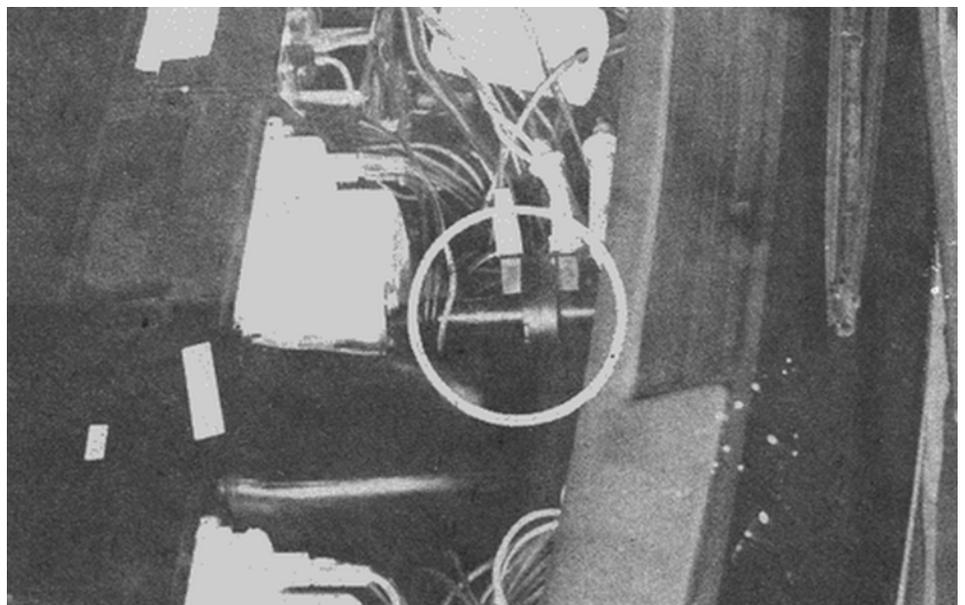
heatsink. Bend the regulator REG1 over onto the heatsink and bolt through the PCB. Finally, fit the Veropins and ICs.

Now construct the display board. Fit all links, resistors and transistors, then fit displays noting that on the side of display 1, the 'M' in the code number relates to pin 1 and for display 2 the dot on the display is next to pin 4.

Finally fit the IC holder and IC7 and insert Veropins from the component side so they protrude from the rear for ease of wiring.

### Calibration

To ensure that the display gives a true reading, it is necessary to set the links between IC3 and IC4 to give the required scaling factor. To do this accurately the speed of rotation of the speedometer cable needs to be known at, say, 30 mph.



Speed transducer fitted in the speedometer cable.

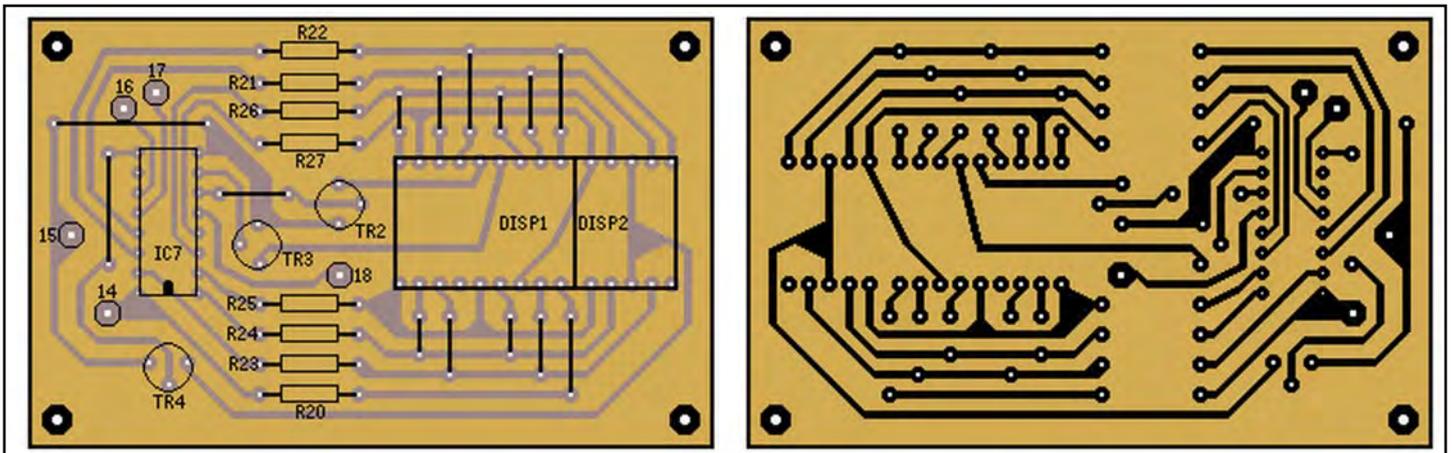


Figure 4. Display PCB track layout and component overlay.

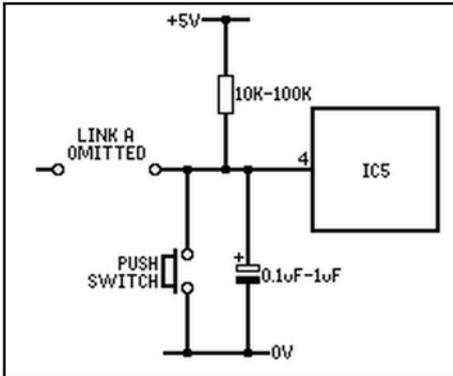


Figure 5. Calibration circuit.

Sometimes it is possible to obtain such information from the manufacturers, when it is often given as the number of turns per mile travelled. If this is not known, then the meter itself may be used to measure the required output frequency from the speed transducer. To do this, omit IC6 and set link 'B' temporarily to position T. The circuit shown in Figure 5 can then be used to provide pulses for IC5.

Measurement of the output frequency is obtained by first driving the car at a constant speed of 30 mph, indicated by the speedometer; the push switch is closed and then opened at the start of a timed interval of 10 seconds. At the end of this time the switch is closed and allowed to open on the ten second mark. The display should then show the required frequency (ignoring the decimal point on the display). The value should be expected to be in the range 100 Hz to 200 Hz and it would be a good idea to take an average of several such readings.

The scaling factor for the counter circuit can then be found from the following equation using the appropriate values:

$$\frac{8.5 \times 3000}{X \times Y} = n$$

where X is the division ratio of the 4024 divider selected, Y is the frequency obtained above and n is the scaling factor. For example, if the divider is set on '8' and the frequency at 30 mph is 140 Hz, then

$$\frac{8.5 \times 3000}{8 \times 140} = 22.76$$

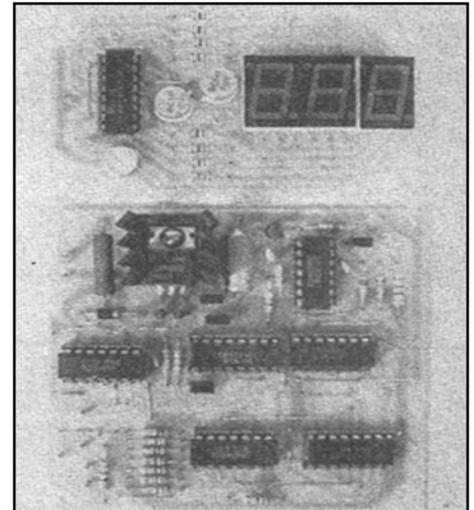
This must be rounded to the nearest whole number, in this case 23.

The factor is set by connecting the appropriate links between IC3 and IC4, each link having the following "value":

LINK B	1	2	3	4	5	6	7	8
VALUE	1	2	4	8	16	32	64	128

So to set a scaling value of 23, the links number 1, 2, 3 and 5 would be made; i.e. value = 1+2+4+16 = 23.

If it is chosen to set the 4024 divider to some ratio other than 8, then the scaling factor would need to be altered accordingly. The choice is not critical, but it should be remembered that whilst low division ratios will give a more instantaneous reading of mpg, such variations as fuel pump surges will give a fluctuating display; higher division ratios will allow more time for these variations to be averaged out, and a ratio of 8 is suggested as a starting point.



### MPG METER PARTS LIST

**Resistors** - All ¼ watt 5% carbon unless specified

R1	10R	3W Wirewound	1
R2	47K	Yellow Violet Orange	1
R3, R10	4K7	Yellow Violet Red	2
R4, R5,			
R12 to R19	10K	Brown Black Orange	10
R6, R11	56R ½W	Green Blue Orange	2
R7	15K	Brown Green Orange	1
R8, R9	220K	Red Red Yellow	2
R20	220R	Red Red Brown	1
R21 to R27	22R	Red Red Black	7

### Capacitors

C1, C2	680nF 35V tantalum	2
C3	100µF 10V axial electrolytic	1
C4, C7, C10	470pF ceramic	3
C5, C6, C8, C9	10nF monicap	4

### Semiconductors

IC1	4001BE	1
IC2	4011BE	1
IC3	4520BE	1
IC4	4068BE	1
IC5	4098BE	1
IC6	4024BE	1
IC7	74C925	1
REG 1	µA7805UC	1
D1	1N4001	1
TR1	BC548	1
TR2, TR3, TR4	BC141	3

### Miscellaneous

DISP 1	DD display type C	1
DISP 2	½ inch display type 4	1
	T0126 heatsink	1
	Transistor mounting kit	1
	Heatsink compound	1
	DIL Socket 14-pin	4
	DIL Socket 16-pin	3
	Single-sided PCB pins	18

# CB EQUIPMENT FROM MAPLIN



## 40-Channel FM Transceiver

A good quality CB transceiver to the UK specification (CB 27/81). Similar to sets selling at £79.95 we have cut out the importers and wholesalers margins by importing direct, to save you up to £30. All units are tested in our laboratory before despatch. Here's a run-down on the facilities offered.

- 40-channel 27 MHz FM
- Transmit power/received signal strength meter
- Public address/CB switch
- LED channel indicator with dim control
- Receive volume control
- 4 watts output

- RF gain control
- Squelch control
- Microphone with curly lead and locking connector
- Extension speaker socket (3.5 mm jack required)
- PA speaker socket (3.5 mm jack required)
- Supplied complete with microphone, fixing brackets for unit and microphone, connecting leads with fuse and instruction leaflet with 10-code etc.

This excellent unit will be available from mid-March at this amazing price inclusive of VAT and P&P.

**Order As AF46A (CB Model GT-868)**



## TVI Filter

A high quality filter designed to be inserted in the aerial leads of TV sets suffering from interference from CB transmissions. The filter is peaked to reject signals from transmitters operating on 27 MHz to 28 MHz while giving a very low insertion loss to UHV TV signals. The unit plugs directly onto the end of the existing TV aerial lead.

**Order As YL43W (TVI Filter) Price £5.25**

## CB Power Supply

Many of the lower priced power units offered for sale are very dangerous, but this unit meets the British safety standards. The unit will easily drive any CB set and all accessories. The power unit will deliver a regulated 13.8 volts at any current up to 3A continuous, 5A surge. It is short-circuit protected and is fitted with a fuse. There is an on/off switch and power on indicator and approx. 2 metres of 3-core flex for connection to 240V mains. Overall size 155 x 115 x 60 mm.

**Order As XG10L (12V 3A Power Unit)**

**Price £16.95**

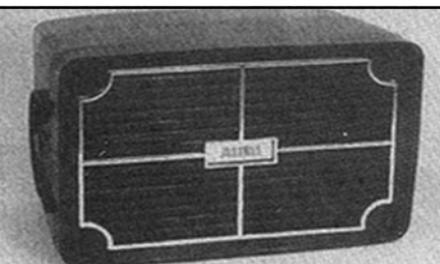


## CB Extension Speaker

A deluxe CB extension speaker in a black plastic cabinet with silver trim. Fitted with a 5 inch x 3 inch speaker rated at 8 watts, 8 ohms. Supplied complete with adjustable mounting bracket and approx. 2.5 metres lead terminated in a 3.5 mm plug. Overall size 147 x 104 x 100 mm.

**Order As YK29G (Ext CB Speaker)**

**Price £7.45**



## Car Stereo and CB Noise Filter

A high inductance choke designed to be connected in series with the 12V power supply line of a car stereo or CB set. A capacitor is also included which between them reduce alternator and ignition noise. Supplied with instructions.

**Order As YL42V (Filter Choke)**

**Price £1.99**



## Noise Filter System

A unique combination of filters designed to eliminate interfering noises from various sources in the car. The ignition noise suppressor plugs directly into the distributor cap and is inductive rather than the usual resistive type thus keeping the DC spark voltage high, but offering very high resistance to high frequency signals. The normal, type of resistive suppressor does reduce the efficiency of the engine and makes the car harder to start in cold weather. A large filter is included for connection in the live and return paths of the power supply to the CB set giving a very high immunity to noise entering the set by this route. An alternator noise filter and generator noise filter are also included. The one not required by your car can be used to suppress for example the turn indicators, or windscreen wiper motor etc. The units are attractively packaged and supplied with detailed instructions.

**Order As YK30H (Noise Filter System)**

**Price £10.95**

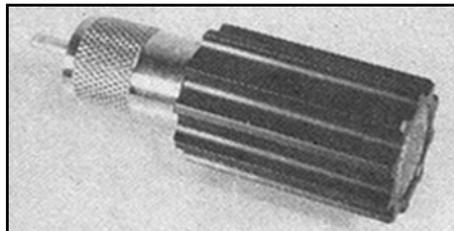
# CB EQUIPMENT FROM MAPLIN



## CB Antenna Converter

Now you can use your existing car aerial to receive and transmit from your CB set. Simply unplug aerial from radio and connect the three leads supplied with the converter as shown in the instructions. The leads are ready terminated with correct plugs and sockets for direct connection. A mounting kit is also supplied. The front panel of the converter has a switch for CB or radio, an SWR adjustment control and an indicator lamp that should light when transmitting. Overall dimensions 85 x 60 x 50 mm.

**Order As YL44X (CB Aerial Converter) Price**

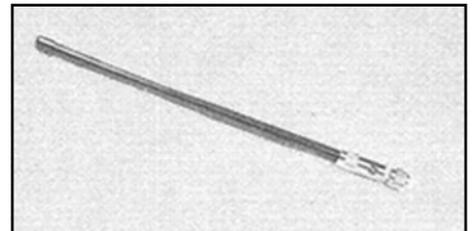


## Dummy Load

A dummy load rated at 30 watts for testing and setting-up CB and amateur radio transceivers. The dummy load has a nominal 50 ohms impedance and is terminated in a PL259 plug.

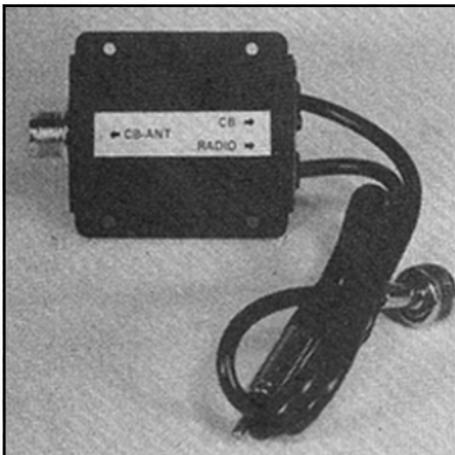
**Order As HL94C (30W Dummy Load)**

**Price £6.75**



## SWR Meters, Mount and Rubber Duck

Check out our large range of excellent SWR meters and testers shown on pages 294 and 295 of our catalogue, our magnetic base on catalogue page 20 and our 27 MHz rubber duck that was described in a recent newsletter. The price of the rubber duck is shown under 'Aerials' in our new item price list on page 29 of this magazine.



## CB/Car Radio Aerial Coupler

This unit enables the CB and radio set to share the one CB aerial. The existing CB aerial connects directly to the socket on the coupler whilst two leads are provided, one terminated in a standard plug for direct connection to the CB set and one terminated in a car aerial plug for direct connection to the radio set. Trimmers for the CB and the radio can be adjusted through holes in the front of the coupler. Overall size 67 x 46 x 30 mm.

**Order As YQ73Q (CB/Car Radio Aerial Coupler)**

**Price £5.49**

## More UHF Plugs and Sockets

In addition to our existing range of UHF-type plugs and sockets shown on page 77 of our current catalogue, we are introducing five new types.

### Right-Angle Plug (PL259)

A standard PL259 plug with a right angle cable input and reducer for connection to RG58/UR76-type cable.

**Order As HL95D (RA PL259 Plug)**

**Price 85p**

### Quick-Connect Plug (PL259)

This adaptor has a S0239 socket into which a standard PL259 plug connects. The other end of the adaptor is a PL259 plug without the usual screw fixing. Instead there is a sprung surround so that the plug may be push fixed onto the socket for quick connection and disconnection.

**Order As HL96E (Quick-Connect PL259)**

**Price 99p**

## Female T-Adaptor

Adaptor to couple three PL259 plugs together.

**Order As RK00A (UHF Female T Adaptor)**

**Price £1.75**

## Lightning Arresters Adaptors

On both these adaptors a terminal is attached for connection to earth. In the event of a lightning strike, the current is diverted to earth thus protecting the equipment. Two types are available.

### Female/Female

A straight through adaptor for connecting two PL259 plugs together with provision for connecting an earth wire.

**Order As RK01B (UHF Adaptor FFLA)**

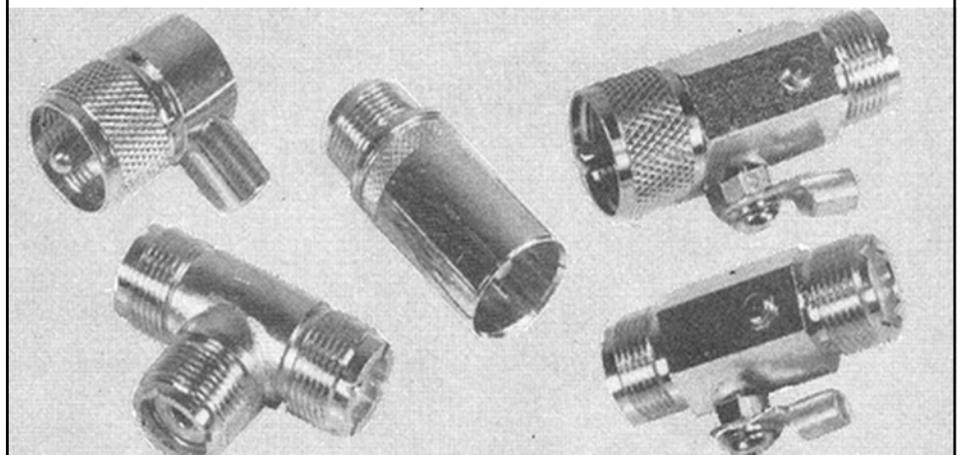
**Price £1.65**

### Male/Female

A straight through adaptor for connecting a PL259 plug to an S0239 socket, but with provision for connecting an earth wire.

**Order As RK02C (UHF Adaptor FMLA)**

**Price £1.75**



## CB Aerial Matcher

A very useful accessory for all CB sets as careful adjustment can greatly improve matching of rig to aerial. Fitted with two S0239 sockets, the unit is rated at 100W. Overall size 78 x 55 x 40 mm.

**Order As YQ74R (CB Aerial Matcher)**

**Price £5.25**

## GROUND PLANES

For aerials not mounted on vehicles, a ground plane must be provided which could consist of two or more pieces of 32/02 wire (or similar) stretched away from a metal plate on which the aerial is mounted. The wires should be connected to the plate (which should already be in connection with the outer screen of the feeder cable via the aerial mounting) and each should be at least 2 metres long. Adjust the lengths and position the wires to obtain the lowest SWR reading. The position of the feeder may also have an effect. It should be easy to obtain readings better than 1.5:1.

Note that large metal objects such as water tanks will affect the performance. It is also important to note that if the SWR reading is worse than 3:1 when you begin, then transmit for as short a time as possible. You will need to have the metal plate supported about 3 cm above the ground in order to give clearance for the fixing and connector. There are two allen screws in our CB aerial which when loosened allow the rod to be extended or shortened slightly. This adjustment may also be used to improve the SWR. It should therefore be possible to reach an SWR of 1:1 on channel 20 by careful adjustment.

# CB EQUIPMENT FROM MAPLIN

## CB Microphones

With all these microphones, a plug to suit your CB set is required.

### Hand-Held Power Microphone With Roger Beep

A hand-held microphone with internal preamplifier powered by a standard PP3 battery (not supplied). An internal switch is provided that may be changed over if battery is flat or not installed so that microphone may still be used, but not amplified. A slide volume control is fitted and a red LED lights when transmitting (if the battery is OK).

When the transmit switch is released, a "Roger" beep is transmitted to alert the other party.

#### Specification:

Type: Dynamic moving-coil omni-directional  
Impedance: 10K

Output level: -35 dB (with pre-amp)  
-78 dB (without pre-amp)

Max output: 1.5 volts

Frequency response:

300 Hz to 6 kHz (with pre-amp)

300 Hz to 8 kHz (without pre-amp)

Cable: 1.8 metres coiled 4-core screened lead  
Dimensions: 92 x 60 x 38 mm  
Weight: 210 grams

Supplied with connection diagram.

Order As **RK03D (Power Mic DM313P)**

Price **£11.75**

### Base Station Microphone With Compressor

A base station microphone with built-in preamplifier and compressor amplifier powered by a standard PP3 battery (not supplied). A slide volume control is fitted and a red LED lights when transmitting (if battery OK). The compressor allows maximum power signals (full deviation) at all times without distortion. A switch is provided in the base so that the same connections may be utilised whether the transceiver utilises relay or electronic switching. A large transmit plate is provided along with a locking facility. The microphone head is vertically adjustable and the whole unit is built in a bronze-colour Diecast metal body.

#### Specification:

Type: Dynamic moving coil uni-directional  
Output level: -25 dB Impedance: 4K

Frequency response: 200 Hz to 5 kHz

Compression level: 40 dB

Cable: 1.8 metres coiled 4-core screened lead

Height: 235 mm

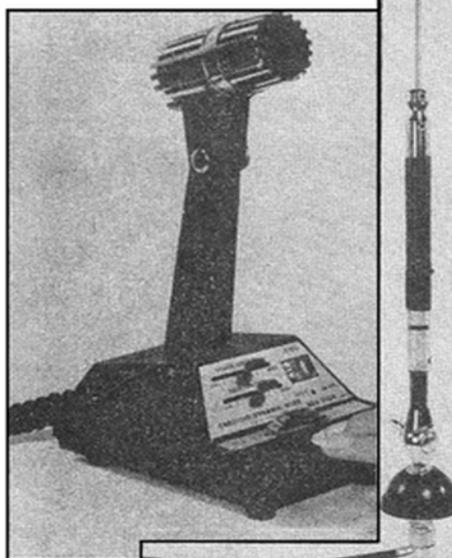
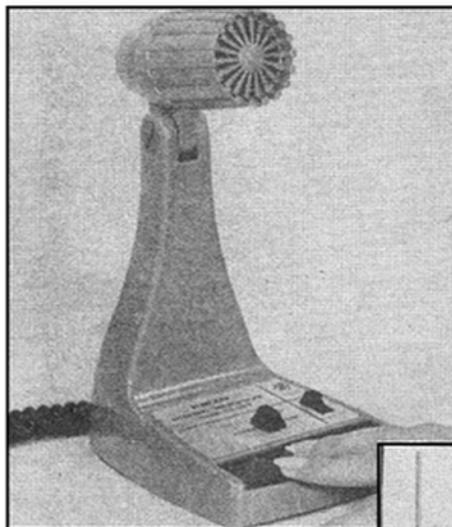
Supplied with connection diagram.

Order As **XG11M (Base Station Mic DX357)**

Price **£33.50**

### Other CB Microphones and Holders

A range of other microphones designed for use with CB transceivers including some



holders for hand-held microphones are shown in our current catalogue.

### Hand-Held Power Microphone With Compressor And Roger Beep

A hand-held microphone with internal preamplifier and compressor amplifier powered by a standard PP3 battery (not supplied). A slide volume control is fitted and a red LED lights when transmitting (if the battery is OK). The compressor allows maximum power signals (full deviation) at all times without distortion. When the transmitter switch is released, a "Roger" beep is transmitted to alert the other party.

#### Specification:

Type: Dynamic moving coil omni-directional

Output level: -28 dB Max output: 40 mV

Impedance: 3K

Frequency response: 300 Hz to 8 kHz

Compression level: 40 dB

Cable: 1.8 metres coiled 4-core screened lead

Dimensions: 96 x 60 x 40 mm

Weight: 225 grams

Supplied with connection diagram.

Order As **RK04E (Power Mic DM311P)**

Price **£13.95**

### Base Station Microphone With Level Meter

A base-station microphone with built-in preamplifier powered by a standard PP3 battery (not supplied). A slide volume control is fitted and a red LED lights when transmitting (if battery OK). A slide tone control is also included and a transmitted signal level meter so that volume can be set accurately. A large transmit plate is provided along with a locking facility. The microphone head is vertically adjustable and the whole unit is built in a black Diecast metal body.

#### Specification:

Type: Dynamic moving coil unidirectional

Output level: -35 dB Max output: 1.5 volts

Frequency response: 250 Hz to 8 kHz

Impedance: 1K

Tone control: +10 dB at 1 kHz

Cable: 1.8 metres coiled 4-core screened lead

Height: 225 mm

Supplied with connection diagram.

Order As **XG12N (Base Station Mic BSA610A)**

Price **£33.50**

### CB Aerial

A CB aerial that meets the UK legal requirements. The aerial has a 1.5 metre long stainless steel rod and a loading coil at the base. The unit is supplied with a ball mount, connector and a 5 metre lead terminated with a PL259 plug.

Order As **XG13P (1.5m CB Aerial)**

Price **£13.95**

# AMENDMENTS TO CATALOGUE

Please amend your 1981 catalogue as follows:

## Page 17/18

BW46A, 47B and 48C are replaced by the UP1300/W which is a wide band amp covering the whole UHF band. The new amp gives a typical gain of 13 dB and a much improved noise figure of typically 2.5 dB.

BW49D is replaced by the UP1300/V which has a typical gain of 19 dB and a 2.5 dB noise figure.

BW50E is replaced by the PU1240 which is electrically the same as the PU102, but is in a box like YQ22Y and has coax sockets for both sides of the aerial lead, instead of screw terminals, making connection simpler.

## Page 20

Telescopic Aerial (LB10L) now only 4 foot long and slightly thicker at base.

## Page 22

Mains adaptor (YB22Y) and (XX09K) are now the same item and should be ordered as (XX09K). This new adaptor will deliver 300 mA max and may be switched to any of the following voltages: 3V, 4.5V, 6V, 7.5V, 9V and 12V DC.

## Page 38

Box PB1 Black (LH14Q) is now being supplied moulded in grey not black plastic.

## Page 47

XY17T and XY18U are now being supplied in a smaller size. New size is 33 x 12 inch (835 x 305 mm).

## Page 70

Electric pump XY74R is now supplied complete with a pressure gauge. Suppressor capacitor HW02C is 1 $\mu$ F.

## Page 93

Stereo headphone (LH85G) is now styled slightly differently from the one shown in the catalogue.

## Page 104

5A Plug (HL57M) is Bakelite and not nylon.

## Page 107

Touch Dimmer(FQ14Q) is 250 watts (not 630 watts).

## Page 115

Order codes for Slotted Nuts are WL43W (Collet Rd Nut 3/8 inch) and WL44X (Collet Rd Nut 10 mm).

RX38R, Ebonite Rod is now being supplied in nylon.

## Page 133

1 mm light guide (XR56L) now being supplied with black protective sheath. Overall diameter 2.2 mm.

## Page 137

The space sound units are now being supplied in slightly different sizes.

## Page 154

BB67X (3600 VCF Mtg Bkt) should be included in the list under the heading "Mounting Brackets".

## Page 182

Please note picture of stylus 29 is incorrect. The shaft is round not square. The picture of stylus 31 is also incorrect.

## Page 184

Musicentre kit C113 (LX03D) is supplied with one bottle of fluid only.

## Page 186

Cassette Splicer (YW90X) is now being supplied with one reel of splicing tape.

## Page 201

QH55K (MJE2955) is now being supplied as TIP2955 and QH56L (MJE3055) as TIP3055. Please note Vcbo is now 100V, Vebo is now 7V, Ic (max) is now 15A, and the pin-out is now style P3c.

## Page 229

In suggested PSU for LM383, the top end of the Std Res 100R should be connected to the collector of Q1 NOT the emitter.

## Page 232

The pin-outs for the NE571 and TDA3410 are swapped over.

## Page 235

The delay given by the TDA1022 is between 512us and 51.2ms and not as stated in line 2.

## Page 243

In Parts List C11 is BX11M price 9 pence.

## Page 245

The IC pin numbers in the right-hand drawing under the heading LM3911 are incorrect. The left-hand drawing is correct.

## Page 255

The pin numbers on the IC package drawing under the heading L200 are in reverse order. They should be in sequence with 5 at the top and 1 at the bottom.

## Page 258

QQ04E 6402 UART is now being supplied coded CDP1854ACE. These two parts are identical.

## Page 266

Small Thermopath (HQ00A) is now supplied in 10 gram tubs.

## Page 276

Dual rocker neon (YR70M) requires a panel cut-out 29 mm x 22 mm.

## Page 282

Footswitch (LB64U) is supplied with a 2.5 mm plug fitted to the lead.

## Page 299

Crimp tool (FY31J) is improved with an additional 1 mm stripper and crimps for 1.5, 2.5, 4 and 6 mm press terminals.

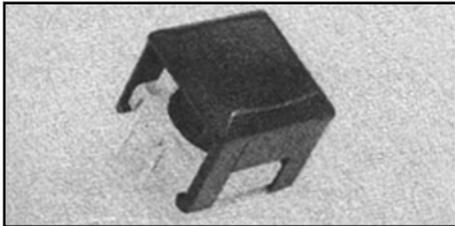
## Page 301

Needle file set (YW63T) now contains only 10 files; there is one flat warding and one hand file, not two of each.

## Page 319

The alphabetical order under S is incorrect. "Semiconductor Finder" should come after "Self-Tapper's" and "Stand-offs" after "SRBP".

# MAPLIN NEWS



## Click Switch

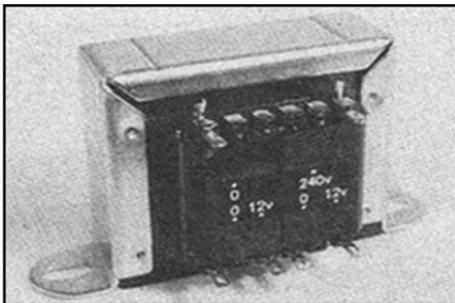
A neat, small and very low-cost push-switch in a matt black finish for direct PCB mounting. The switch has a smooth, gentle, but positive action with a clock-effect to let you know switch has operated. Action is single-pole push-to-make non-locking and one contact is connected to two pins, one on either side of the switch to ease PCB track layout.

Specification:

Contact rating:	10 mA max.
Contact resistance:	< 1 Ω
Bounce:	< 5ms
Life:	>2.5 x 10 operations
Key travel:	0.5 mm
Size of button:	12.3 mm x 12.3 mm
Height from PCB	11.5 mm
Pin length:	3.5 mm
Pin diameter:	0.8 mm
Pin spacing:	10 x 4 mm

Order As HY34M (Click Key Black)

Price 24 pence



## 12V 1/2A Mains Transformer

A 240V mains transformer to complement the range shown on catalogue page 312. Conforms to BS415. The transformer has two secondaries 0 to 12V at 0.5 A plus 0 to 12V at 0.5 A. Total rating: 12 VA. Overall size (w x d x l); 55 mm x 45 mm x 42 mm. Fixing centres: 70 mm.

Order As YK28F (Tr 12V 0.5A)

Price £4.25



## Rectangular Multicolour LED

A single LED with three leads that can be made to emit light of any colour in the spectrum from green through to red. The LED is encapsulated in a rectangular 5 mm x 2.5 mm package of clear resin.

Specification:

	Red	Green
Forward current	20 mA	20 mA
Forward voltage	2.2 V	2.4 V
Light intensity	2mcd	2mcd
Wavelength	630nm	560nm
Max forward current	30 mA	30 mA
Centre lead:	Red and green cathode (-) Outer long lead:	
Green anode (+)		
Outer short lead:	Red anode (+)	

Order As QR54J (Rect Multicolour LED)

Price 75 pence

## The Spectrum Synthesiser

A new monophonic, switch-linked, two oscillator synthesiser featuring advanced specification, constructional simplicity and low cost. Modulation, timbre control and interface facilities not found on any comparable synthesiser make it extremely powerful and versatile for keyboard playing, sound effects and many other home, stage or studio applications. Construction is simplified by the use of integrated circuits that each perform major synthesiser functions with few external components. The six CEM3300 series IC's are available from Digisound Ltd., 13 The Brooklands, Wrea Green, Preston, Lancs PR4 2NQ for £32.43 including VAT and P&P, but all the rest of the components for the Spectrum are now available from Maplin as a complete kit for just £167.50 including VAT and P&P! A book containing all the construction details, circuit descriptions etc. is also available from Maplin for just £1.

Order As XH56L (Spectrum Synth Book)

Price £1 NV

LW60Q (Spectrum Synth Kit)

Price £167.50

## Sheet-Metal Punch For Quick-Fit Meters

A punch for sheet metal up to 16 swg mild steel, to suit our quick-fit panel meters. Punch is supplied with alien key and full instructions for use.

Order As RK20W (Punch 27.5mm)

Price £5.65

## Quick-Fit Panel Meters

A new range of square-faced meters requiring just one round fixing hole to mount. A special punch is available to suit this meter and details are given below. The meter barrel is threaded and is tightened to a panel by a single large nut. A large PVC washer is also supplied to enable a tight fix without straining the plastic moulding. The front of the meter is a clear acrylic which may be unclipped.

Dimensions: 32 mm x 32 mm face; overall depth 34 mm; depth from back of front face 23 mm. Fixing hole required: 27.5 mm diameter.

The following types are available:

Full Scale	Internal Resistance	Type
50-0-50µA DC	20000	Quick-fit Meter 50-0-50
100-0-100µA DC	15000	Quick-fit Meter 100-0-100
50µA DC	45000	Quick-fit Meter 50µA
100µA DC	20000	Quick-fit Meter 100µA
500µA DC	4000	Quick-fit Meter 500µA
1mA DC	1000	Quick-fit Meter 1mA
5mA DC	100	Quick-fit Meter 5mA
10mA DC	100	Quick-fit Meter 10mA
50mA DC	100	Quick-fit Meter 50mA
100mA DC	100	Quick-fit Meter 100mA
500mA DC	100	Quick-fit Meter 500mA
1A DC	100	Quick-fit Meter 1A
5A DC	100	Quick-fit Meter 5A
25V DC	1000	Quick-fit Meter 25V
50V DC	1000	Quick-fit Meter 50V
VU Meter	1500	Quick-fit Meter VU

Order As

RK21X (Quick-fit Meter 50-0-50) Price £2.95

RK05F (Quick-fit Meter 100-0-100) Price £2.95

RK06G (Quick-fit Meter 50µA) Price £2.95

RK07H (Quick-fit Meter 100µA) Price £2.95

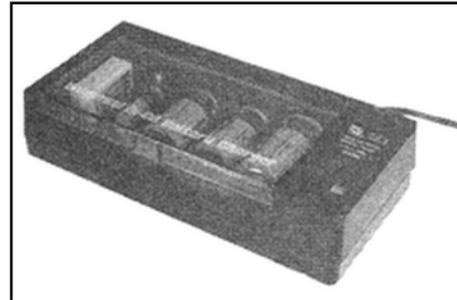
RK08J (Quick-fit Meter 500µA) Price £2.95

RK09K (Quick-fit Meter 1mA) Price £2.95

RK10L (Quick-fit Meter 5mA) Price £2.95

RK11M (Quick-fit Meter 10mA) Price £2.95

RK12N (Quick-fit Meter 50mA) Price £2.95

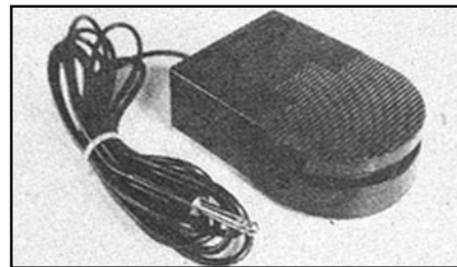


## Universal Ni-Cad Battery Charger

An attractively finished nickel-cadmium battery charger capable of charging up to one PP3 and any four AA, C or D cells or any combination of these simultaneously. A test position is provided for AA, C or D cells which gives an indication of current state of charge. Each of the five battery positions has its own LED "charge" indicator. The unit is housed in a black plastic moulding with a hinged clear plastic dust cover. Overall size: 210 x 100 x 50 mm. Supplied with approx. 1.8 metres lead for connection to 240V AC mains and full instructions.

Order As YK31J (Universal Ni-Cad Charger)

Price £8.95



## Foot Switch

A tough shatterproof ABS box with scratch resistant textured finish and non-slip rubber base pads. Large, easy-to-use foot-operated actuator has push-on, push-off action. Specification:

Max voltage: 125 volts

Max current: 0.5 A

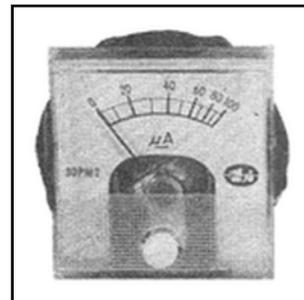
Switch life: 100,000 operations

Contact resistance: 5 M Ω

The box has a knock-out to fit an LED and a position to stick on a name or logo, and is supplied with 2.5 metres of single core screened lead terminated in a standard (1/4 inch) mono jack plug. Overall size: 121 x 82 x 46 mm.

Order As YK26D (Pedal Switch Box)

Price £5.95



RK13P (Quick-fit Meter 100mA) Price £2.95

RK14Q (Quick-fit Meter 500mA) Price £2.95

RK15R (Quick-fit Meter 1A) Price £2.95

RK16S (Quick-fit Meter 5A) Price £2.95

RK17T (Quick-fit Meter 25V) Price £2.95

RK18U (Quick-fit Meter 50V) Price £2.95

RK19V (Quick-fit Meter VU) Price £2.95

# CLASSIFIED

## MUSICAL FOR SALE

**TRANSCENDENT 2000** synthesiser for sale, fully working. £250. Phone Ilminster (04605) 2950.

**MAPLIN 3800** synthesiser fully assembled and tested. Includes Mike Beecher's "How to Play", and construction manual. Tel. (0429) 81264 after 6 p.m.

**MAPLIN 4600** synthesiser in 5600 case. Excellent instrument with unlimited variation of sounds. Will accept £450 o.n.o. Mark Ingram, 70, Westwood Hill, East Kilbride, G75 8DW, Scotland.

**LOWREY TEENIE** Genie electronic organ and stool. Many voices including vibra-harp, Hawaiian guitar, mandolin etc. Very good condition. Bargain at £300 o.n.o., Tel. (09924) 62931.

**UNUSED PARTS.** Spring line XL08J £4, MES Driver XB85G £5; Keyboard XB15R with contacts £25. Or £30 the lot. N. Burroughs, Luton (0582) 598131, after 6 p.m.

**SELLING DM02T** and six SAM77, never used. E. Matthews, 63 The Oval, Otley, West Yorks, LS21 2EE.

**JEN SX2000** synth, fair condition, £100. A. Cox, The Vicarage, South Petherwin, Launceston, Cornwall, PL15 7JA.

**32-NOTE RCO** pedal board with jacks, oscillator, tone forming and power units, keyer kit, all unassembled, offers. Parkins, 12, Moor Lane, Ponteland, Northumberland.

If you would like to place an advertisement in this section then here's your chance to tell Maplin's 120,000 customers what you want to buy or sell, absolutely free of charge. We will publish as many advertisements as we have space for. To give everyone a fair share of the limited space, we will print 30 words free of charge. Thereafter, the charge is 10 pence per word.

Please note that only private individuals will be permitted to advertise. Commercial or trade advertising is strictly prohibited in the Maplin Magazine.

Please print all advertisements in bold capital letters. Box numbers are available at £1.50 each. Please send your advertisement with any payment necessary to: Classifieds, Maplin Mag, PO Box 3, Rayleigh, Essex SS6 8LR. For the next issue your ad must be in our hands by 9th April 1982.

To reply to box numbers address your letter to: The Advertisement Manager (Box.....), Maplin Mag, P.O. Box 3, Rayleigh, Essex, SS6 8LR.

## COMPUTERS FOR SALE

**PET 2001**, new ROMs 8K. Manuals, programs, TIS workbooks. Excellent condition, £290 o.n.o. Carrickfergus 66516 (Co. Antrim).

**ZX81 SOFTWARE** - 10 1K games on cassette - £2.50, listings 20 pence each, e.g. Canyon! (uses M/C), Destroyer, Galaxians, Shuttle. Holo, Lander. (16K coming soon, see for details). C.W.O. to A. Laird, 9 Franklin Road, Saltcoats, Ayrshire, KA21 5AT.

**TEXAS INSTRUMENTS** home computer: advice, lists, debugs, bespoke programs, assistance of any kind. Please send see to Stephen Shaw, 10 Alstone Road, Stockport, Cheshire SK4 5AH.

**ZX81 + 16K RAM** pack, Sinclair tapes, other taped software, books, PSU and all leads. £90. Tel. 01-455 1652 evenings only.

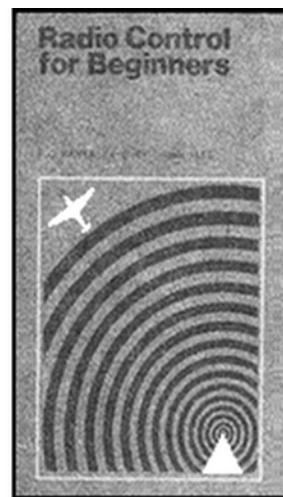
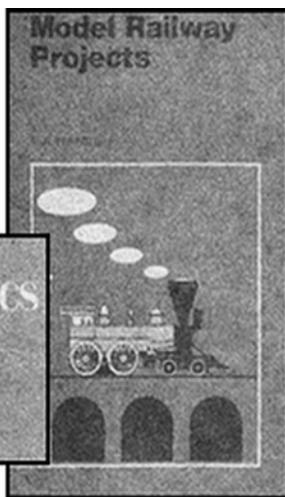
## VARIOUS FOR SALE

**ICOM IC260E** 2m multimode transceiver with accessories, manual. 18 months old. Good, clean condition. £230. Andrew Stone, 01-399 0147 (term time only).

**MABUCHI RS380** 6V motors and variable resistor speed controllers. Ideal for Robots and other models. Both items ex. new equipment, £1.75 per item. D. Nicholls, 'Haulfre', Tan Lan, Ffynnongroew, Holywell, Clwyd.

**P.E. VDU (built)**, additional IC's, TTL cookbook, £15. Reply to Box No. 1 (see note in column 2).

## MAPLIN'S TOP TWENTY BOOKS



- (-) Atari Basic Learning By Using by T. E. Rowley (WG55K)
- (1) Z80 IC's Data Sheets (RQ54J)
- (2) How To Make Walkie-Talkies by F. G. Rayer (RF18U)
- (10) Adventures With Microelectronics by Tom Duncan (XW63T)
- (-) Model Railway Projects by R. A. Penfold (WG60Q)
- (6) IC555 Projects by E. A. Parr (LY04E)
- (-) CB Projects by R. A. Penfold (WG73Q)
- (4) Power Supply Projects by R. A. Penfold (XW52G)
- (3) How to Build Your Own Solid State Oscilloscope by F. G. Rayer (XW07H)

- (9) Towers' International Transistor Selector Update 2 by T. D. Towers (RR39N)
- (29) Newnes Radio And Electronics Engineer's Pocket Book (RL06G)
- (15) Basic Electronics Set (XX10L)
- (11) Programming The Z80 by Rodnay Zaks (XW72P)
- (16) Programming The 6502 by Rodnay Zaks (XW80B)
- (5) Remote Control Projects by Owen Bishop (XW39N)
- (7) Electronic Synthesiser Projects by M. K. Berry (XW68Y)
- (24) Radio Control For Beginners by F. G. Rayer (XW66W)
- (30) Beginners Guide To Digital Electronics by I. R. Sinclair (XW64U)

- (13) BASIC Computer Games by D. H. Ahl (RQ21X)
- (19) Z80 Instruction Handbook by Nat Wadsworth (RL39N)

Note. For prices see page 29 of this magazine. Full details were published in issue 1. These are our top twenty best-selling books based on mail-order and shop sales during November, December 1981 and January 1982. Our own publications and magazines are not included. We stock over 325 different books relating to electronics and the full range is shown in this magazine and on pages 23 to 37 of our 1981/2 catalogue.

# MATINEE ORGAN UPDATE

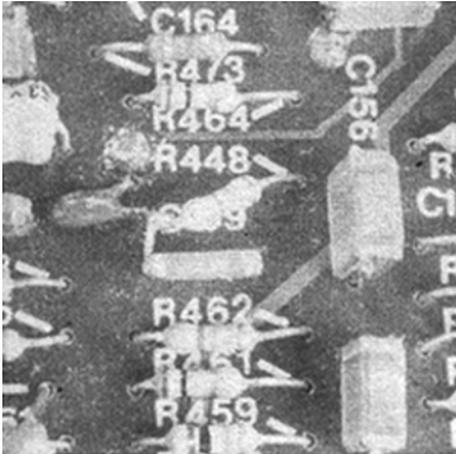


Figure 1. Connecting capacitor in series with R448. See note 5.

The Matinee help-line has been found very useful by constructors and at the same time we have been able to keep closely in touch with the kinds of problems experienced by constructors. If you are suffering from any of the following problems then here are the cures suggested by ourselves and other constructors.

- 1 If the delayed vibrato preset RV29 range is not very useful, change C126 to a 33 $\mu$ F 16V to give more control over the useful range.
- 2 If you are suffering from a click when S36 is operated, then fit a 0.1  $\mu$ F polyester capacitor between pins 1 and 2 of PL6.
- 3 If the overall volume of the flute draw bars is too

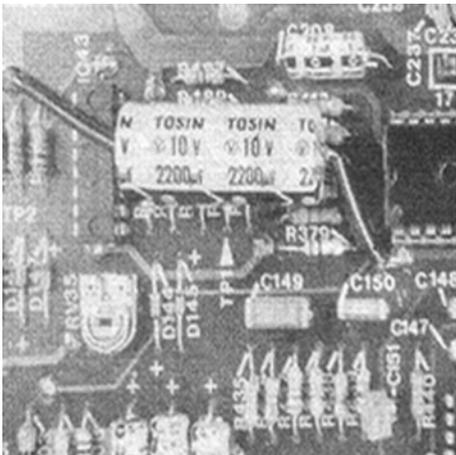


Figure 2. Decoupling power rail. See note 6.

- low then change R486 to 12K Resistor
- 4 Some constructors feel that the cello sound is enhanced by making C159 a 12nF carbonate capacitor.
- 5 The setting of RV36 is sometimes affected by the position of the cello draw bar. If you have this problem, connect a 1 $\mu$ F 35V tantalum capacitor in series with R448. Lift the left-hand end of the resistor and connect the negative of the capacitor to it with the positive of the capacitor connected to the PCB as shown in Figure 1.
- 6 If background hum is noticeable, add a 2200 $\mu$ F, 10V axial with the positive end connected to the track pin near the legend "C213" and the

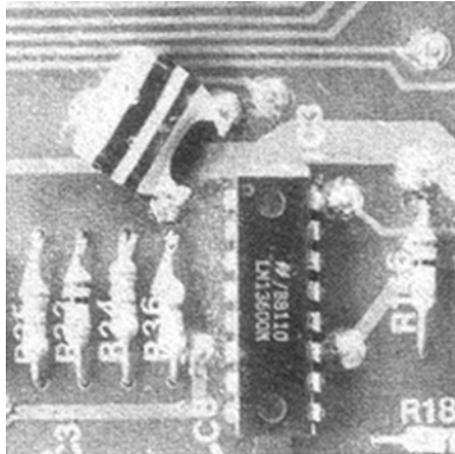


Figure 3. Reduction of interference from sampling clock on pedal wires. See note 8.

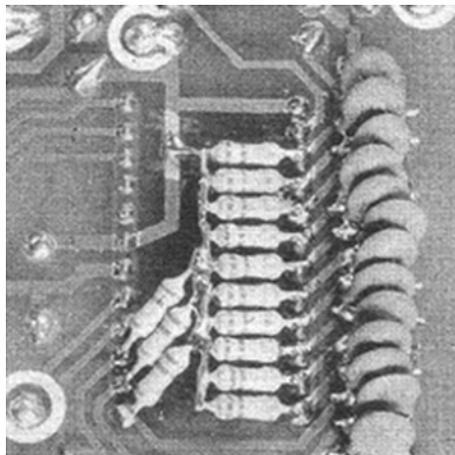


Figure 4. Decoupling the inputs to IC1. See notes 9 & 10.

negative end connected to the track pin near pin 1 of IC44 as shown in Figure 2.

- 7 If the harpsichord is too loud in relation to other preset stops then change R554 to a Resistor 4K7.
- 8 If you notice a background whistle when the pedals are pressed then connect a 0.1 $\mu$ F polyester capacitor to the track pin at the top of R36 and the track pin next above it to the right. See Figure 3.
- 9 If you hear an odd discordant rasping sound occasionally whilst playing the pedals then fit 13 Resistors 220K to pins 3 through 15 of IC1 and join the other ends of the resistors together and connect them to the track going to pin 19 of IC1 by carefully scratching off the solder resist. See Figure 4.



Figure 5. Providing a discharge path for C11. See note 11.

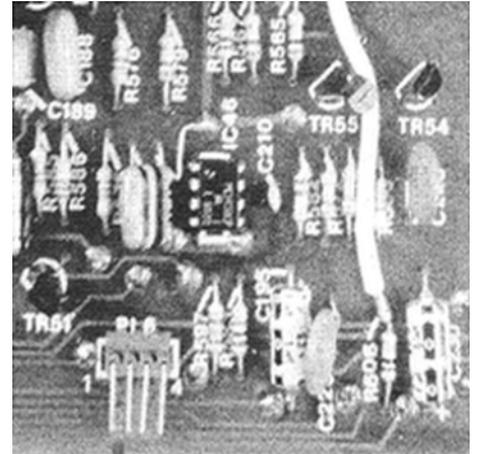


Figure 6. Decoupling sampling clock. See note 16.

- 10 If the pedal notes occasionally cut-off suddenly during sustain time, this is due to mains interference being picked up on the ribbon cable. To eliminate the problem, connect 13 mini-disc capacitors 0.01 $\mu$ F to PL1 from pins 3 through 15, to the track nearest the edge of the PCB by carefully scratching off the solder resist coating. See Figure 4.
- 11 If there is a residual rumble after the last note played when bass guitar operated then fit a Resistor 100K across C11 under the PCB and a Resistor 1M under the PCB, from the positive end of C11 to the track going to RV13 by carefully scratching off the solder resist. See Figure 5.
- 12 To increase the bass response of the organ change C31 to a 1 $\mu$ F 35V tantalum capacitor with the positive end connected to the end where the line is marked to the legend "C31".



Figure 7. Reduction of mains hum. See note 18.

- 13 If the green LED is not as bright as the red, make R163 a Resistor 150R.
- 14 If a faint clicking is heard when the rhythms are running, but the rhythm volume is off then change C206 to an axial 2200 $\mu$ F 10V.
- 15 If the bass drum is too loud make R285 a Min Res 120K. If the high bongo is too loud make R330 a Resistor 180K.

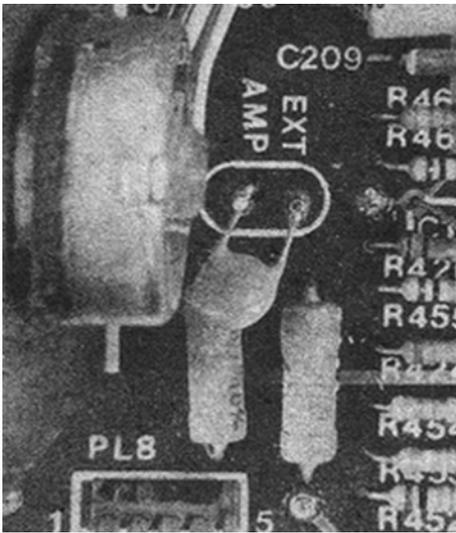


Figure 8. Reduction of illegal AM CB interference. See note 21.

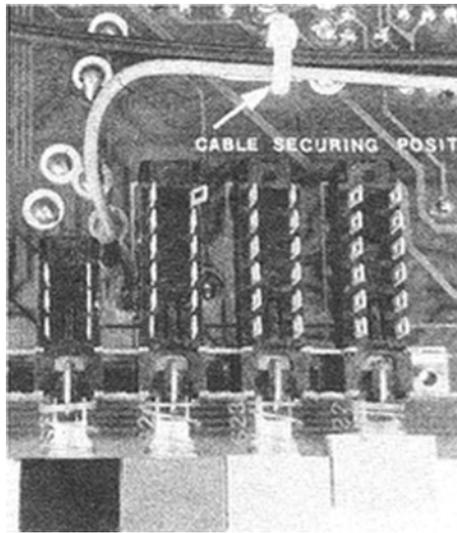


Figure 10. Underside of part of the PCB shown in Figure 9. See note 22.

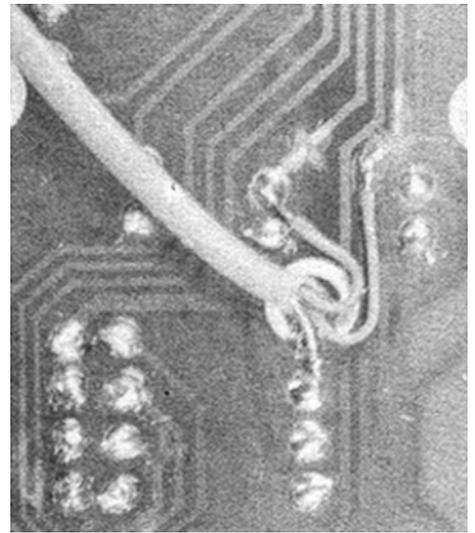


Figure 12. IC4 end of cable run. See note 22.

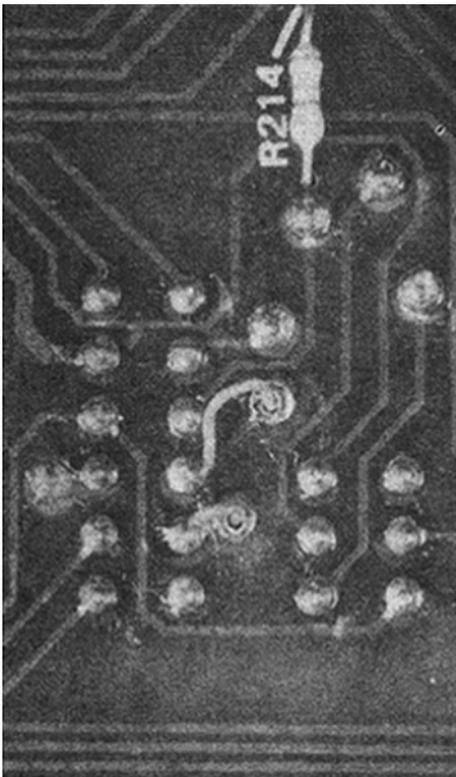


Figure 9. Connections to S24b. See note 22.

- 16 If a very high frequency whistle is apparent at all times then connect a 0.1 $\mu$ F polyester capacitor between the track pin near pin 1 of IC46 and the track pin near pin 4 of IC46. See Figure 6.
- 17 If the pedals are too loud in relation to the rest of the organ change R572 to a Resistor 470K.
- 18 If after making change described in note 16 there is a noticeable mains hum, connect a piece of wire between the end of R606 farthest from edge of PCB and the track pin close to the right-hand front corner of RV44. See Figure 7.
- 19 If distortion is heard on peak signals through the reverb then change C225 to a 0.047 $\mu$ F polyester capacitor.
- 20 If you feel the rotor sound needs improvement at high frequency then change C69 to a 10nF ceramic capacitor.
- 21 If you are suffering from interference from illegal AM CB connect a 470pF ceramic capacitor across the pins marked "Ext. Amp". See Figure 8.
- 22 If a high frequency whistle increases in volume when rhythm draw bar is advanced and S24 (auto accompaniment) pressed then proceed as follows. First remove the two track pins which connect to pins 2 and 3 of S24b, and enlarge the holes if necessary so that you can pass through from the underside the two unstripped

centre wires of a 1 metre length of screened wire as shown in Figure 9. Connect the red wire to pin 2 and the blue wire to pin 3 of S24b. On the underside of the PCB cut back the screen and insulate it. See Figure 10. Run the cable as shown in Figure 11. At the other end cut the track by scratching it away with a small screwdriver or sharp point close to the point where D83 and D84 are joined. Also cut the track which leads to pin 33 of IC4. Connect the red wire to the end of D83 or D84 closest to the cut track and the blue wire to the track between the cut and pin 33 of IC4 after carefully scratching off the solder resist. Connect the screen to the track pin marked by the white circle near D83 and D84. See Figure 12.

- 23 If you wish to run the Matinee into an external amp, Hi-Fi system or tape recorder then proceed as follows. Connect a Resistor 4K7 at the headphone socket to the wire coming from pin 1 on SK9 and a Resistor 47K to the wire coming from pin 2 on SK9; Connect the other ends of the resistors together, then connect the centre conductor of a piece of screened cable to the point where the two resistors join and the screen to the other end of the 4K7 resistor. Connect the other end of the cable to the radio, tape or aux input of a Hi-Fi amp. If the signal is too loud, reduce the value of the 4K7 and if too soft, increase the value.

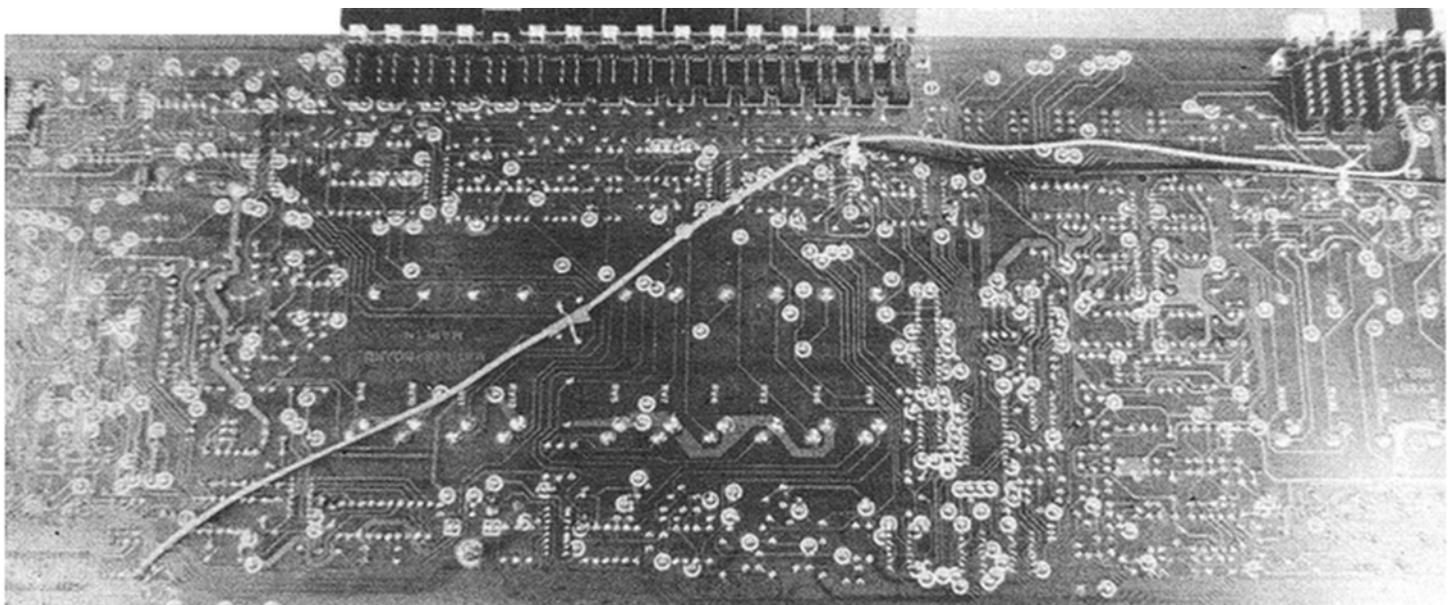


Figure 11. Cable run. See note 22.

# SUBSCRIBE NOW!

For just £2.40 a year we'll deliver every issue of the Maplin Magazine to your door.

We've got dozens of exciting projects and features coming in the next four issues. And more amazing special offers like the ones in this issue. Plus, of course, all our new products and our complete price list.

**All this for just £2.40 a year!**

**(Overseas: surface mail £2.76, airmail £5.88)**

**DON'T DELAY - SEND YOUR  
CHEQUE OR POSTAL ORDER NOW!!**

**ISSUE TWO ON SALE 15<sup>th</sup> FEBRUARY 1982**

Send this coupon with your cheque/PO to:

Maplin Magazine Subscriptions Dept.,  
Maplin Electronic Supplies Ltd.,  
P.O. Box 3, Rayleigh, Essex SS6 8LR

I enclose £2.40 (plus post overseas) for 1 year's subscription to the Maplin Magazine.

Customer No. (if known) .....

Name .....

Address .....

.....

.....

.....

Post Code .....

## MAPLIN ELECTRONIC SUPPLIES LTD

require a

# SHOP MANAGER IN BIRMINGHAM

Providing negotiations are successful, Maplin will be opening a new component shop in the Birmingham area within the near future. We are therefore inviting applications from those people with a good knowledge of electronics and preferably management experience. This position offers an interesting career with an expanding company. There is an excellent salary, a company pension scheme and other employee benefits. If you think you have the initiative and drive for this job, then write now including details of experience and qualifications to: Mr D. M. Snoad, Maplin Electronic Supplies Ltd, P.O. Box 3, Rayleigh, Essex SS6 8LR.

## CORRIGENDA

We regret that the following errors occurred in issue 1 of the Maplin Magazine.

- In the Combo Amp parts list, the order code for C24 should be WW26D and the order code for the Combo Front Panel should be XG03D. Also the quantity of Cabinet Cloth is 2 metres.
- In the Peak Level Indicator Parts List, IC1 is a CA3240E (WQ21X).
- The order code for the Verobloc Bracket should be HQ84F.

## DID YOU MISS ISSUE 1?

Copies of issue 1 are still available for just 60 pence, and includes all these interesting projects:



### Universal Timer

A comprehensive programmable controller for up to 4 mains appliances. There is storage for up to 18 program times, on or off and relay outputs. Complete construction details.

### Combo Amplifier

Superb 120W MOSFET power amp with low-noise BI-FET pre-amp having built-in flanger, inputs for guitars, keyboards or microphones, and five step equaliser. Complete construction details.

### Temperature Gauge

Coloured LED indication of -10°C to 100°C. Complete construction details.

### Pass The Bomb!

Low-cost easy to build electronic version of pass-the-parcel - keeps the kids amused for hours!

### Plus six easy to build projects on Veroboard:

Car Battery Monitor - Colour Snap Game - CMOS Logic Probe - Peak Level Indicator - Games Timer - Multi-Colour Pendant

Issue 1 also included features on Videotext and How To Solder and feature series, Basically BASIC, Starting Point and Circuit Maker.

**All this for just 60 pence.**

**Order As XA01B (Maplin Mag Vol. 1 No. 1) Price 60 pence.**

## MAPLIN CATALOGUE PRICES OVERSEAS

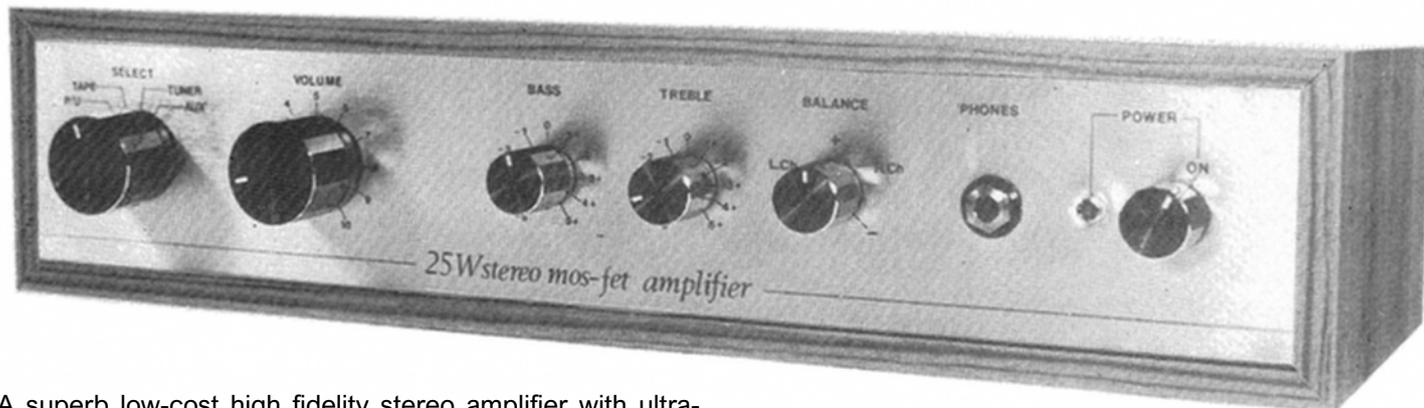


Our current 1981/82 catalogue is available overseas by post at the following prices:

Europe surface mail	£1.68
Europe air mail	£2.75
Outside Europe surface mail	£1.68
Outside Europe air mail (depending on distance)	£3.26 / £4.23 / £4.88

For surface mail anywhere in the world you may send 12 International Reply Coupons.

# LOW COST HI-FI STEREO AMPLIFIER



A superb low-cost high fidelity stereo amplifier with ultra-reliable MOSFET power amps capable of delivering a continuous 25 watts per channel into 8 ohms at 1 kHz (both channels driven).

Extremely low total harmonic distortion.

Extremely low noise.

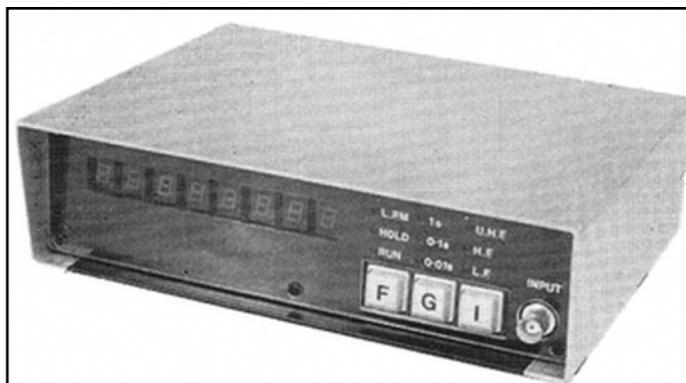
Inputs for magnetic pick-up (5 mV at 47K), tape,

tuner and aux (all 100 mV at 100K).

Very easy to build with almost everything mounted on one PCB - in fact there's less than a dozen wires in the whole thing!

Complete kit available including front panel, chassis and wooden cabinet.

**ALL THESE EXCITING PROJECTS IN OUR  
NEXT PACKED ISSUE. DON'T MISS IT!  
ON SALE 14<sup>th</sup> MAY 1982**



## FREQUENCY COUNTER

Range 10 Hz to 650 MHz with electronically switched ranges and high sensitivity input (approx 10 mV). Mains operation or 12V DC input. Complete kit available including front panel.



## MORE MODEL TRAIN PROJECTS

Part 2 of our model train controller shows how to build the interface for a home computer or remote control unit. Software details are given. The remote control unit is described with wired, radio or infra-red connection!

## RADAR DOPPLER INTRUDER DETECTOR

Up to four radar units may be connected to one controller which can be used as an alarm in its own right or it can easily be connected to our Home Security System described in this issue.

The unit has a tamper-proof two-wire connection and the sensitivity is adjustable to give a (cardioids) detection range from 2 metres to well over 20 metres!

## PLUS

Our superb 600-note sequencer (held-over through lack of space).

All our regular features and of course the complete Maplin price list.

