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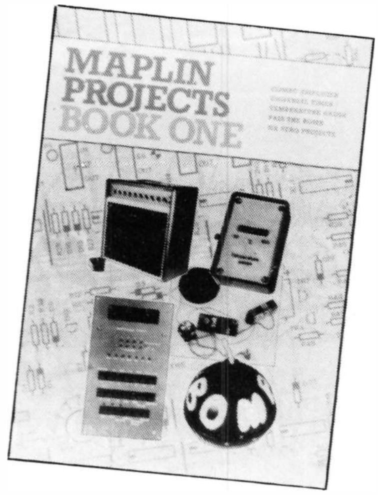

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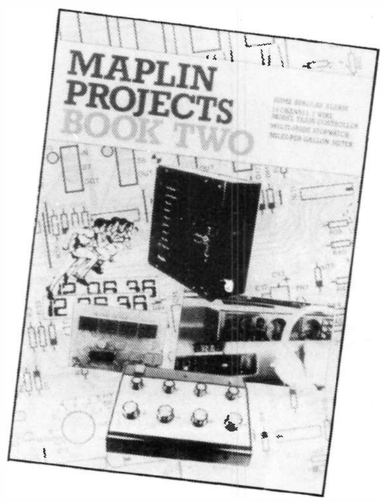

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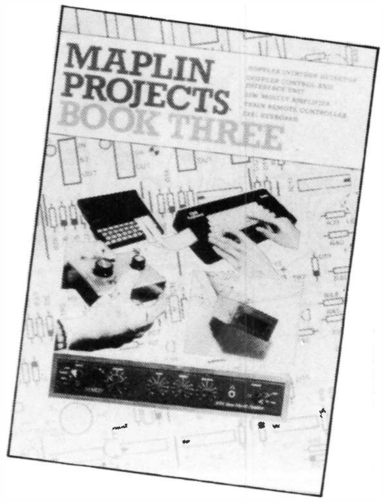

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Since we're one of the first companies in the UK to offer this service we've even had to invent a name for it. We call it Cashtel: Computer-Aided SHopping by TELephone. The Maplin Cashtel service begins on June 1st and you can reach it by dialling 0702 552941. For further information see page 26.

You will, of course, need a modem like the one we published in issue 5 and if your micro doesn't have an RS232 interface then you'll need an interface as well. In this issue we've got interfaces and communications programs for the ZX81 and VIC20 and we'll have details of interfaces for most of the popular home micros in later issues.

In this issue we are pleased to launch our new range of Heathkit products. These superbly documented kits and educational courses are now available exclusively through Maplin in the UK. Over the next six months we shall be taking on most of the Heathkit range and in future issues of this magazine, we shall be looking at some of the more unique kits in greater depth.

Certainly the most fascinating new kit is the robot Hero 1. This incredible little fellow will, we hope, be with us at forthcoming exhibitions from about July onwards. In between times he'll be in our shops in rotation, but probably not until August. Your local store will know when Hero will be visiting them after August.

Finally, we're pleased to tell you that all the back issues of this magazine from our first year are now available again, reprinted as Projects Books. These are proving incredibly popular and we're actually on our third reprint of issue 2! We're also very pleased that the circulation of this magazine continues to increase by leaps and bounds, but more about that in our smashing next issue!

Cover illustration by Tony Worsfold

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Production Manager	Sue Clark
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Technical Artists	Roy Smith John Dudley
Published by	Maplin Electronic Supplies Ltd, P.O. Box 3, Rayleigh, Essex
Printed by	Eden Fisher (Southend) Ltd
Typeset by	Quillset Typesetting
Distributed by	Spotlight Magazine Distribution Ltd, 1-11 Benwell Road, London N7

Vic20-RS232 Interface

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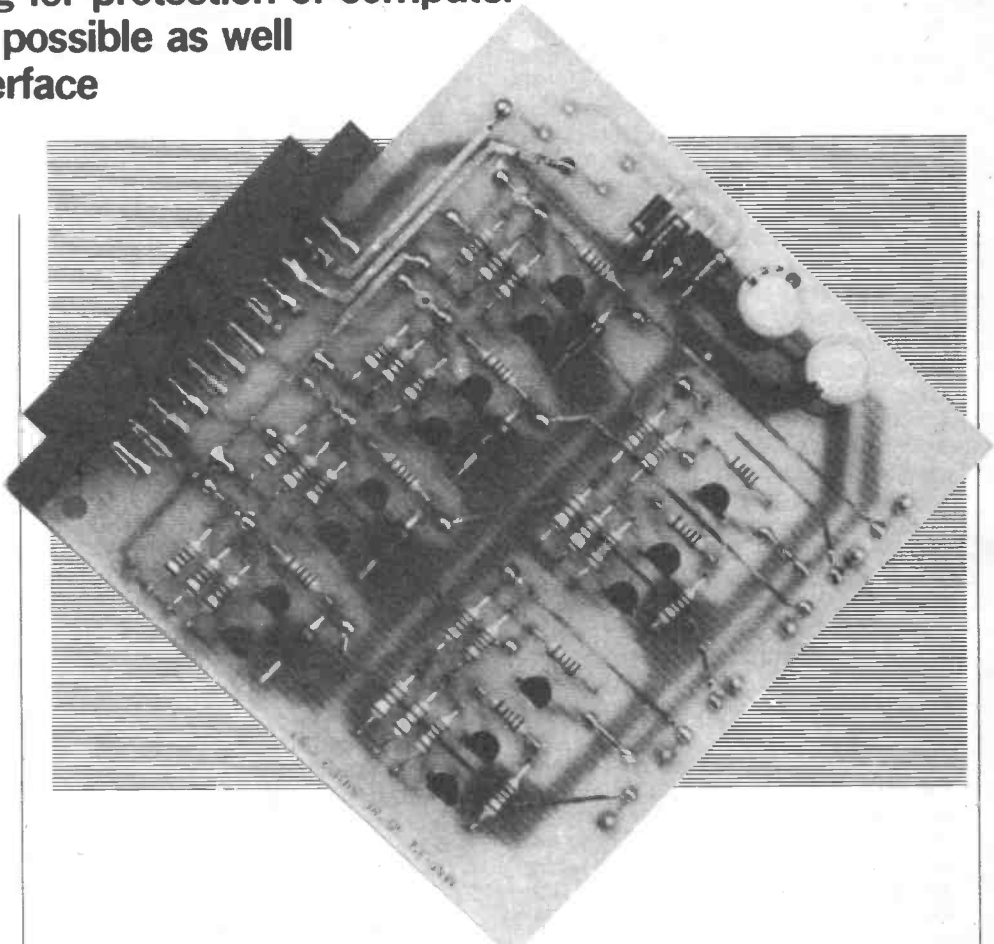


by Mark Brighton

RS232 is the name given to an industry standard form of serial data communication which is used on many peripheral devices to interface them with a computer.

A byte of serial data is represented by a series of transitions between +12V and -12V on a serial data line. The marks and spaces created by these transitions contain the information for the byte of data as well as some other signals, the purpose of which is to synchronise the receiving device to the serial data stream.

The format of a 'word' of data, including these synchronising signals, is as follows:

1. The start bit. This signal alerts the receiving device that a byte of data follows, and synchronises the receiver circuitry to the incoming data.
2. Data bits. This is the ASCII encoded data, and may consist of seven or eight bits as selected by the user. It is sent least significant bit first.
3. The parity bit. This is an optional error checking bit selected by the user to conform with the requirements of the receiving set. It may be set for odd or even parity, or disabled.
4. Stop bit(s). These are one or two bits of data which are transmitted at the end of a word to separate it from the next word.

The polarity of these signals may be selected by sending normal or inverted data, either of which may be required by different devices. Apart from the serial data lines (SIN and SOUT), several other status and handshake signals are provided.

Those available on the VIC 20 are:

1. Data terminal ready (DTR). This signal is sent to indicate that the data terminal is ready to send or receive data.
2. Data set ready (DSR). This indicates that the data set is ready to send or receive data.
3. Request to send (RTS). This signal tells the receiving device (usually called the 'data set') that the VIC (data terminal) wishes to send data.
4. Clear to send (CTS). This allows the data set to signal that it is ready to pass data from the data terminal.
5. Carrier detect (DCD). This lets the data set tell the data terminal that the communication link is established.

In addition to those lines already mentioned, there are two ground lines, protective ground and signal ground. Signal ground must always be connected, since RS232 requires that both devices have equal ground potential. Any equipment which cannot meet this requirement is not RS232 compatible.

Circuit Description

The circuit consists of two transmit channels and four receive channels, with a power supply which provides approximately +12 and -12V from the 9V AC output on pins 10 and 11 on the user port.

Transmit Mode

SOUT from the VIC (pin M, user port) is connected to the base of TR9 via a 10kΩ resistor, R17. As TR9 turns on, bringing its collector down to 0V, TR10 turns on, raising its collector voltage to +12V. The normal, or non-inverting, output is taken via R23, a 330Ω resistor which limits the current that may be drawn from this output to about 30mA.

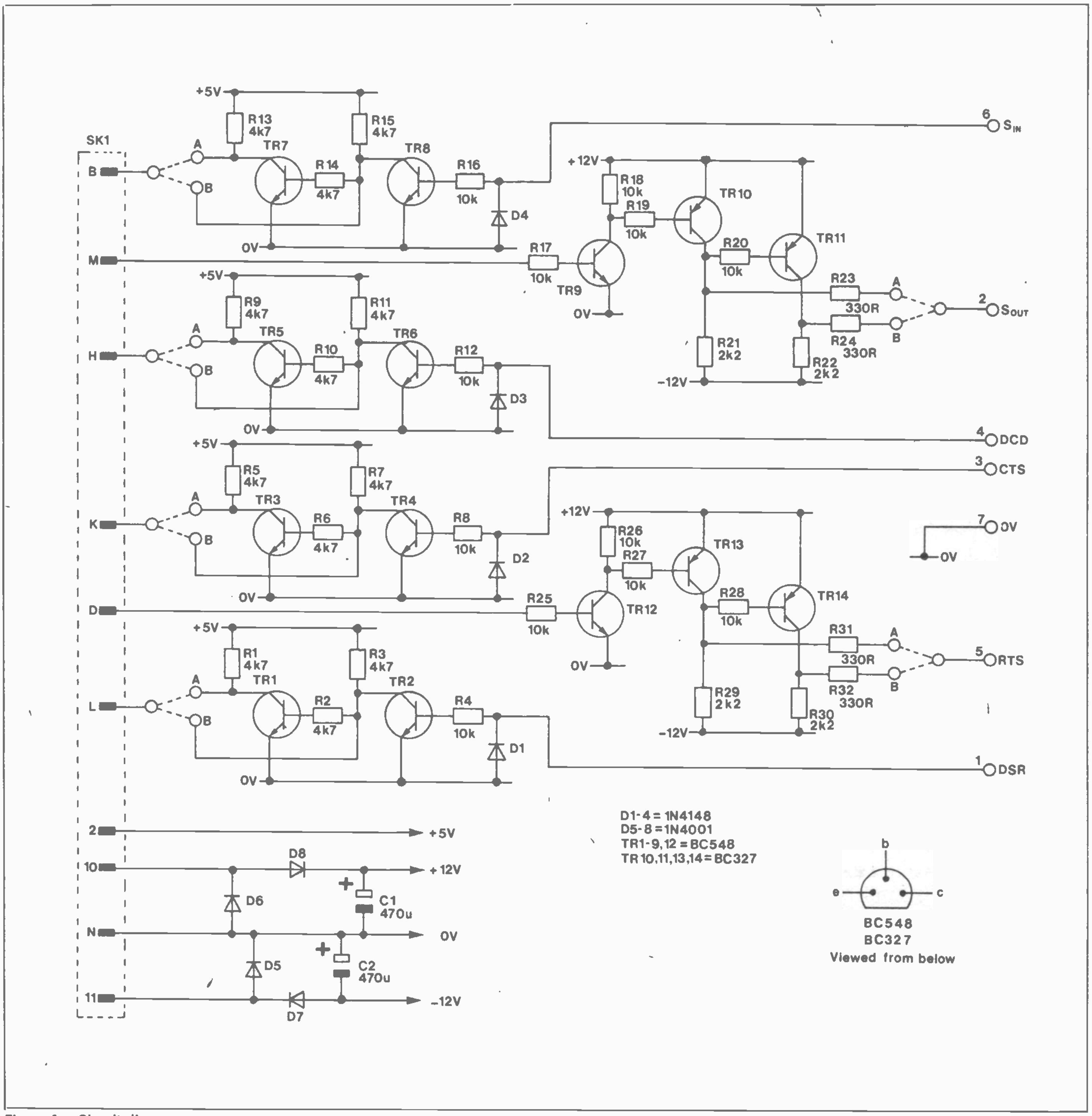


Figure 1. Circuit diagram

A second output stage is also driven from the collector of TR10, and this is identical in operation except that the output is inverted with respect to the input. The output that is used depends on the requirements of the data set.

Receive Mode

The incoming signal first has any negative content removed by D1. It then turns TR2 on and off via R4. The inverting output of the receive circuit is taken from the collector of TR2 which also drives TR1 via R2 to obtain a non-inverting output at the collector of TR1. The choice of which output to wire to the VIC is determined by the polarity of the incoming data. The VIC requires a signal which sits high between 'words' and drops low for data. SIN is on pins B and C on the port, and these are connected together.

Construction

Referring to the circuit diagram and parts list, first insert all through pins (see figure 1 for signal polarity pins) and Veropins. Solder them in, not forgetting to solder both sides of the through pins. Insert all other components and solder them in. Attach the edge connector to the board, bending its pins flush with the pads on the board, and solder. Clean the board thoroughly and inspect for dry joints, shorts etc.

Testing

Plug the board into the user port, component side upwards, and switch the computer on. If the computer fails to initialise, switch off and re-check carefully for incorrectly placed components, etc. After the computer initialises, measure test points 1 to 4 with a multimeter. These readings should be approximately as follows:

TP1 — 0V
TP2 — +5V
TP3 — +12V
TP4 — -12V

If all is well, switch off the VIC and remove the interface card. Wire the board to the data set. Reconnect to the VIC, switch both the VIC and data set on, and type in program A. Run the program, and the receiving party should receive the message 'the quick brown fox jumps over the lazy dog' continuously. Also included is a program to make the VIC act like a 'dumb terminal', for use with a modem, to call information and ordering services such as the Maplin on-line computer, Southend (0702) 552941.

7	6 5	4	3 2 1 0
STOP BITS	WORD LENGTH	UNUSED BIT	BAUD RATE

STOP BITS
0 – 1 STOP BIT
1 – 2 STOP BITS

WORD LENGTH

BIT 6	BIT 5	DATA WORD LENGTH
0	0	8 BITS
0	1	7 BITS
1	0	6 BITS
1	1	5 BITS

UNUSED BIT

BAUD RATE

3	2	1	0	BAUD RATE
0	0	0	0	USER RATE (NI)
0	0	0	1	50 BAUD
0	0	1	0	75
0	0	1	1	110
0	1	0	0	134.5
0	1	0	1	150
0	1	1	0	300
0	1	1	1	600
1	0	0	0	1200
1	0	0	1	1800 2400
1	0	1	0	2400
1	0	1	1	3600 (NI)
1	1	0	0	4800 (NI)
1	1	0	1	7200 (NI)
1	1	1	0	9600 (NI)
1	1	1	1	19200 (NI)

(NI) Not implemented in the VIC-20 system

Table 1. Function of bits in the VIC RS-232 Control Register

7 6 5	4	3	2	1	0
PARITY OPTIONS	DUPLEX	UNUSED	UNUSED	UNUSED	HANDSHAKE

PARITY OPTIONS

BIT 7	BIT 6	BIT 5	OPERATIONS
		0	Parity disabled, none Generated/Received
0	0	1	Odd Parity Receiver/Transmitter
0	1	1	Even Parity Receiver/Transmitter
1	0	1	Mark Transmitted Parity Check Disabled
1	1	1	Space Transmitted Parity Check Disabled

DUPLEX
0 = FULL DUPLEX
1 = HALF DUPLEX

UNUSED

HANDSHAKE
0 = 3 LINE
1 = X LINE

Table 2. Function of bits in the VIC RS-232 Command Register

```
10 REM***PROGRAM A ****
20 OPEN200,2,0,CHR$(166)+CHR$(0)
30 PRINT#200,"THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG."
40 GOTO30
```

```
0 REM******************     * V.D.U. PROGRAM*     *****************
1 POKE36879,8:PRINTCHR$(5):WAIT 203 ,64
5 POKE36876,200:PRINTCHR$(147);" VIC 20 V.D.U. PROGRAM"
10 R$=CHR$(166)+CHR$(0)
20 OPEN200,2,0,R$
25 IFPEEK(203)<>64THEN500
30 GET#200,A$
35 IFA$=""THENGOTO25
40 IF ASC(A$)>95THENGOTO25
50 IF A$=CHR$(13)THENPRINTA$;:GOTO25
60 IF ASC(A$)<32THENGOTO25
70 PRINTA$;:GOTO25
500 POKE203,64: GETS$
510 IFS$=CHR$(17)THENS$=CHR$(10)
520 IFS$=CHR$(19)THENS$=CHR$(140)
530 PRINT#200,S$;:POKE203,64:S$="":GOTO30
```

PARTS LIST FOR VIC 20 RS232 INTERFACE

Resistors — All 0.4W 1% Metal Film

R1,2,3,4,5,6,7,9, 10,11,13,14,15	4K7	12 off	(M47K)
R4,8,12,16,17,18, 19,20,25,26,27, 28	10K	12 off	(M10K)
R21,22,29,30	2k2	4 off	(M2K2)
R23,24,31,32	330R	4 off	(M330R)

Capacitors

C1,2	470uF 16V P.C. Electrolytic	2 off	(FF15R)

Semiconductors

D1-4 inc.	1N4148	4 off	(QL80B)
D5-8 inc.	1N40001	4 off	(QL73Q)
TR1-9 inc., 12	BC548	10 off	(QB73Q)
TR10,11,13,14	BC327	4 off	(QB66W)

Miscellaneous

SK1	P.C. Edgecon 2 x 12 way		(BK74R)
	Veropin 2141	1 Pkt	(FL21X)
	Track Pin	1 Pkt	(FL82D)
	P.C.B.		(GB28F)

A complete kit of all parts is available.
Order As LK11M (VIC 20/RS232 Interface kit). Price £9.45.

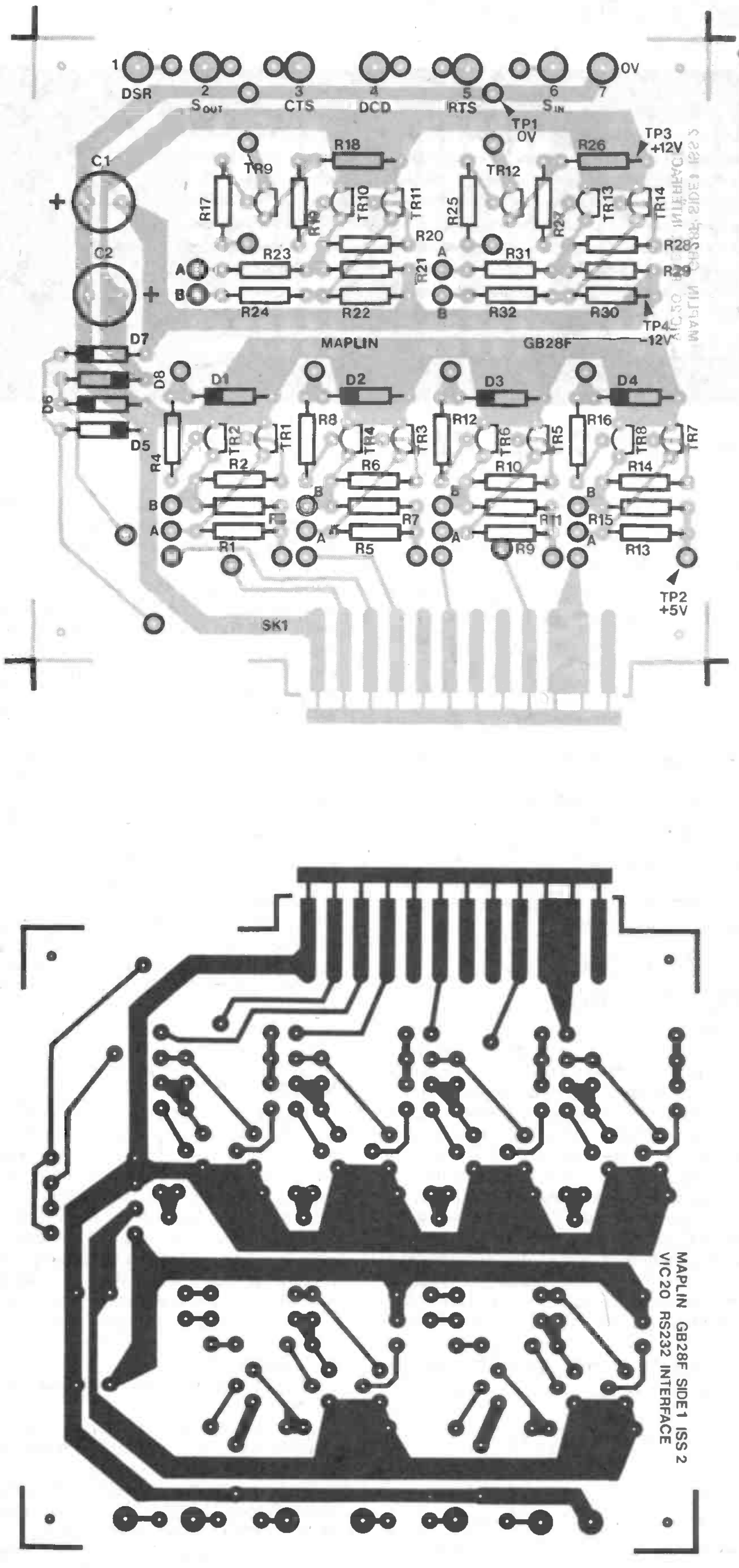
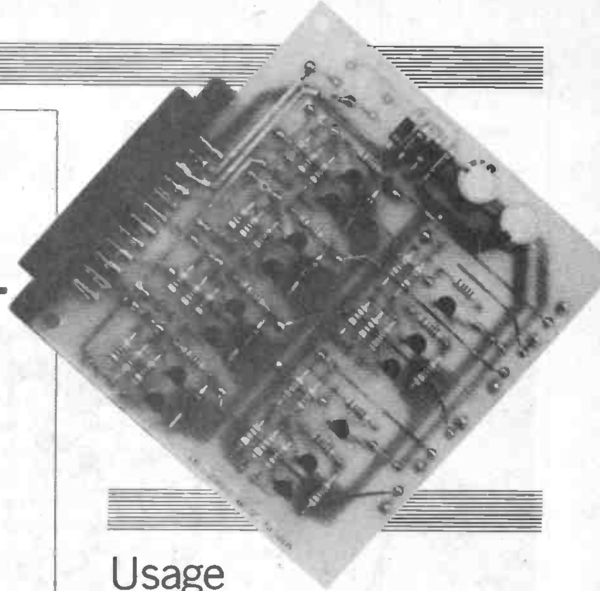


Figure 2. PCB layout



Usage

To use the RS232 serial data port on the VIC the channel must first be opened as a file, specifying Baud rate (speed), number of bits per character, number of stop bits, and odd/even or disabled parity bit. This information is given by two characters after the 'OPEN' command in the form:

OPEN LF,2,Ø,A$. Where LF is the logical file number, i.e., any number between 1 and 255 (if LF is greater than 127, then linefeed follows carriage return), and A$ is two characters sent to control register and command register, the functions of which are explained in tables 1 and 2. So, for example, we can see that to set Baud rate to 300, 7 bits per character, 2 stop bits, and no parity, the OPEN command would be:

OPEN 2ØØ,2,Ø,CHR$(166)+CHR$(0).

Having opened the RS232 channel, data is sent and received using 'PRINT LF,DATA $' and 'GET LF,DATA $',.

Note: To type 'PRINT' do not use the abbreviation '?'. Instead, use 'P shift R' followed by logical file number etc. It is possible to list through the RS232 port, to send a program to a friend for instance, by typing 'CMD LF : LIST', where LF=logical file number.

Remember when programming that the VIC allocates two 256 byte buffers (for transmit and receive) in the 506 bytes below RAMTOP, so there is less memory available to BASIC. Also 'DIM' statements or variables should be left until after the 'OPEN' command, as the computer per,orms an automatic 'CLR' before allocating the buffers.

Bibliography:

VIC Revealed by Nick Hampshire
VIC Programmers Reference Guide, Commodore

Connecting to the Maplin Modem

With reference to figure 5, page 5, issue 5 of Electronics, the following connections should be made:

VIC 20 Interface	Maplin Modem
pin 2 (SOUT)	to pin 17 (RS232 IN)
pin 6 (SIN)	to pin 10 (RS232 OUT)
pin 7 (SGROUND)	to pin 21 or 22 (SGROUND)

Ensure that the link on the Modem is in the RS232 position.

MACHINE CODE PROGRAMMING WITH THE 6502

Part One

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

Introduction

The 6502 MPU from MOS Tech is one of the most popular microprocessor chips and is used in a number of well known microcomputers including PET and Apple. However, in machines of this type the MPU is usually wedded to BASIC software and interfaced to an ASCII keyboard and VDU. Apart from the addition of a cassette deck and a printer and, for the more affluent, a 'floppy disc' system most people regard this as the limit of their peripherals. In such 'high level language' operation, memory capacities from 4K to 64K are the rule; in fact more exotic games, for example, demand large amounts of memory. Therefore, some may be surprised to learn that MPUs can perform a whole variety of interesting and useful functions with only 1K to 2K of RAM. A VDU is quite unnecessary and the man/machine interface consists solely of a HEX keypad and a seven-segment display. This was the concept of such microcomputers as Science of Cambridge's Mk14, AIM 65 Acorn's System One, KIM, etc, the last three all using the 6502. But the more sophisticated computers such as PET and Apple can also usually be programmed in machine code. One result of this is that, since they also contain an input/output chip, they can be used for control functions as well as the more usual keyboard/VDU usage.

There have been many series and there are many books that teach BASIC programming, since this is a very popular high-level language. What this series aims to show is that machine-code programming is an entirely logical process which is not too difficult to learn and which can also be great fun and a source of satisfaction. Therefore, if you feel like a change from 'Pacman' or nested FOR/NEXT loops, this series will offer you the chance to write effective programs in 6502 machine code. Using the computer in this way will teach you a lot more about it at 'grass roots' level than you will ever learn in programming in BASIC and will greatly increase your ability to realise your computer's potential more fully.

The Choice of Chip

The 6502 has been chosen for this series for several reasons:

(i) there are many microcomputers using this chip

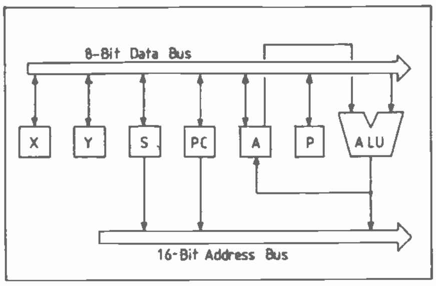


Figure 1. Simplified Architecture of the 6502.

(ii) the architecture and instruction set are both quite straightforward and easily learnt

(iii) the author has, for the past couple of years, been teaching machine-code programming on a 6502-based machine and has demonstrated its capabilities in a practical environment.

Why Machine-Code Programming?

There is no doubt that a program written in machine-code to perform even a fairly simple function takes very much longer to write and encode than its equivalent in BASIC. This is not because there is some magic about BASIC that permits this; it is not super-efficient, far from it in fact. There is one fundamental fact that is so obvious that it is likely to be overlooked — *every MPU, no matter what function it is performing, is working in binary and using machine-code.* It is the presence of software, in the form of a BASIC interpreter, that allows the user to bypass the low-level operation and enter the commands, etc in English. This need to interpret the high-level input actually slows down the computer when the program is run.

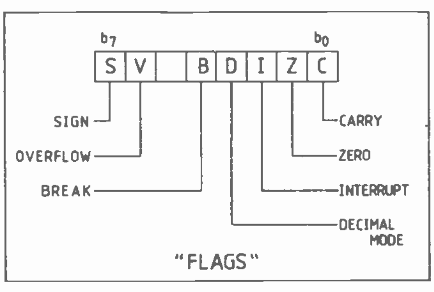


Figure 2. The 6502 Processor Status Register.

When the BASIC interpreter is not used, all commands are entered in machine-code and the programmer has the utmost flexibility in the use of the machine, limited almost entirely by his own imagination and wits. Programs, although taking longer to write, will run very much faster than high-level programs. The low-level language is directly concerned with data transfers between MPU registers, memory locations and input/output ports. As a result, inputs from various types of transducer, switches, etc are processed and decisions made from the input data that will produce signals on output lines to energise relays, motors, solenoids, lamps, etc or even generate a variety of output waveforms. Because of the sequential nature of the program, control sequences are possible giving rise to completely automatic decision-making systems, hence MPU-controlled washing machines, robotics, process-control systems, safety systems, etc. Machine-code programming, in short, opens up a whole new world of possibilities.

Enter the 6502

A good starting point for learning about the 6502 is its 'architecture'. This is shown, in simplified form, in Figure 1. For programming purposes the essential details are the various registers and the arithmetic/logic unit (ALU), the full functions of which will be made clear as the ideas of programming develop. For the moment, a simple statement about each will suffice as an introduction. There is also the system 'clock', which is usually crystal-controlled and can be thought of as the co-ordinator of events in the computer.

The 6502 has only six registers, as follows:—

The Accumulator (A): This, the first in importance, is an 8-bit register which is used in most computer operations. Like any other register or memory location, it is nothing more than a 'string' of flip-flops arranged to store a byte of binary information.

The Index Registers (X & Y): These two registers, which are more or less identical, are also eight bits wide and are extremely useful in a variety of ways, which will be introduced fully as the series develops.

The Program Counter (PC): This is a 16-

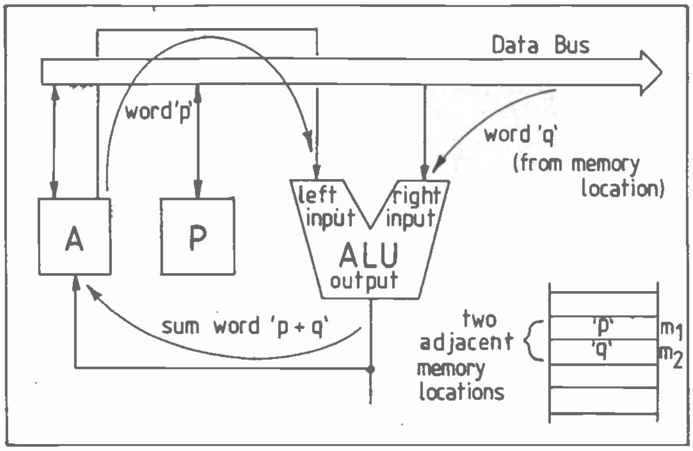


Figure 3. The Arithmetic-Logic Unit: flow of data during an addition.

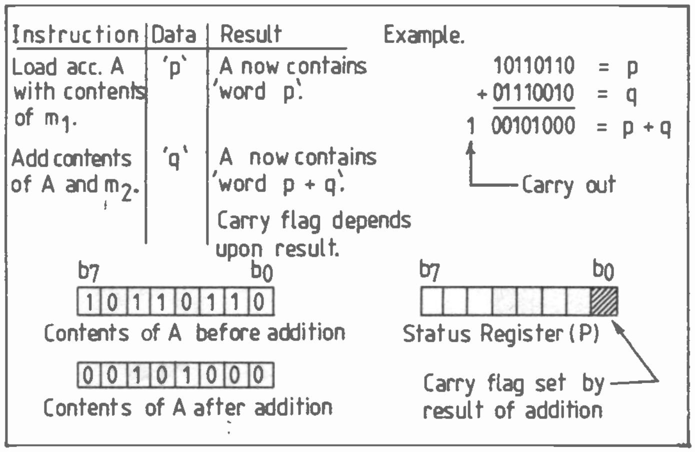


Figure 4. Example of addition and effect on the 'carry' flag.

bit register, which holds, sequentially, the addresses at which the program is stored during the normal course of running a program. Otherwise it may be thought of as holding the address of the next instruction to be accessed. As it is 'incremented' the computer steps through the program.

The Processor Status Register (P): Another 8-bit register, each bit of which is an independent 'flag'. Because of its particular importance and usage, this register is shown in more detail in Figure 2. Each flag is nothing more than a flip-flop which is either SET (equal to 1) or CLEAR (equal to 0). Whether a flag is SET or CLEAR depends upon the result of some previous computer operation.

For example, if a number held in the accumulator is negative, the negative flag (N) will be set; otherwise it is clear.

If, however, the number held is zero, then the zero flag (Z) is set.

If, during an addition, a 'carry' is produced, the carry flag (C) will be set.

From these few examples it is possible to see that decisions can be made during the course of a program by testing various flags to see if a particular result has occurred.

The Stack Pointer Register (S): In the 6502 this is a 9-bit register with its most significant bit set permanently at '1'. Its purpose is to 'point' to an address in an area of the RAM known as the 'stack'. The purpose of the stack will be made clear in due course but, for now, it will be stated that it is a reserved area of RAM used to 'stack' data during certain aspects of computer operation. Because the 9th bit is always set, the 6502 stack occupies the range of addresses from 0100 to 01FF in HEX.

The Arithmetic Logic Unit, or ALU for short, is where the computing is really carried out. It is shown in Figure 3 in association with the Data Bus, Accumulator and Status Register. The ALU has two 'input ports' and an 'output port'. The arrows show the flow of data during the addition of two bytes of data. If the bytes or 'words' to be added are known as 'p' and 'q' respectively, then 'p' may be placed or 'loaded' into the accumulator initially and 'q' arrives on the data bus from some memory location at a subsequent interval of time later. At the moment that the addition operation is actually carried out, both 'p' and 'q' enter the ALU by their respective input ports, and their sum then leaves the ALU by the output port where it is placed in the accumulator, thus replacing the original contents 'p'. If the addition operation yields a 'carry bit', which is effectively the 9th bit of the result, this will set the carry flag C in the Status Register (P). Thus, at least temporarily, the carry is stored for subsequent use. An example of this series of operations with sample binary data is illustrated in Figure 4.

Binary and Hexadecimal Numbers

Since computing, whatever its aim, is essentially concerned with the manipulation of numbers, the user of a computer must be fully conversant with the number systems used. As already stated, the MPU itself does all of its work in binary i.e. using '1s' and '0s' only. However, since binary numbers tend to be rather long, addresses and data are specified and entered via the keypad in hexadecimal (HEX for short), this being much more compact and less prone to error. To appreciate how binary and HEX number systems work (or indeed how any number system works) it is necessary to appreciate how a number is made up. Consider the following examples:

The denary number 255
$= (2 \times 10^2) + (5 \times 10^1) + (5 \times 10^0)$,
$= 200 + 50 + 5$ (N.B. $10^0 = 1$),
$= 255$
The binary number 11111111
$= (1 \times 2^7) + (1 \times 2^6) + (1 \times 2^5)$
$+ (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2)$
$+ (1 \times 2^1) + (1 \times 2^0)$,
$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1$,
$= 255$ (denary)

Thus, denary 255 means the same thing as binary 11111111.

It should be noted that each column has a 'weighting' or power to which the base of the system is raised. In binary the base is 2 and in denary it is 10. It will be noticed in diagrams of registers that the bit position in a register is identified by its power of two. For example, in an 8-bit register the least significant bit position is called b_0 (power of $2 = 0$) while the most significant bit position is called b_7 (power of $2 = 7$).

How then does HEX work? The base is sixteen and since there are only ten individual digits available (0-9), it is necessary to provide six more to make up the set and this is done in practice by using the first six letters of the alphabet (A-F). Thus, these letters have to be thought of as representing numbers, such that A = 10, B = 11 . . . F = 15. As an example, the HEX number
$FF = (F \times 16^1) + (F \times 16^0)$,
i.e. $FF = (15 \times 16^1) + (15 \times 16^0)$,
$= 255$ (denary).

Thus, FF is the HEX way of writing 255 (denary) or 11111111 (binary).

The problem with HEX, of course, is its unfamiliarity. It takes some practice to get to grips with it properly but, gradually, one gets the hang of it. **continued on page 13**

Binary	HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal
0001	0001	1	0010	16	0100	256	1000	4 096
0010	0002	2	0020	32	0200	512	2000	8 192
0011	0003	3	0030	48	0300	768	3000	12 288
0100	0004	4	0040	64	0400	1 024	4000	16 384
0101	0005	5	0050	80	0500	1 280	5000	20 480
0110	0006	6	0060	96	0600	1 536	6000	24 576
0111	0007	7	0070	112	0700	1 792	7000	28 672
1000	0008	8	0080	128	0800	2 048	8000	32 768
1001	0009	9	0090	144	0900	2 304	9000	36 864
1010	000A	10	00A0	160	0A00	2 560	A000	40 960
1011	000B	11	00B0	176	0B00	2 816	B000	45 056
1100	000C	12	00C0	192	0C00	3 072	C000	49 152
1101	000D	13	00D0	208	0D00	3 328	D000	53 248
1110	000E	14	00E0	224	0E00	3 584	E000	57 344
1111	000F	15	00F0	240	0F00	3 840	F000	61 440

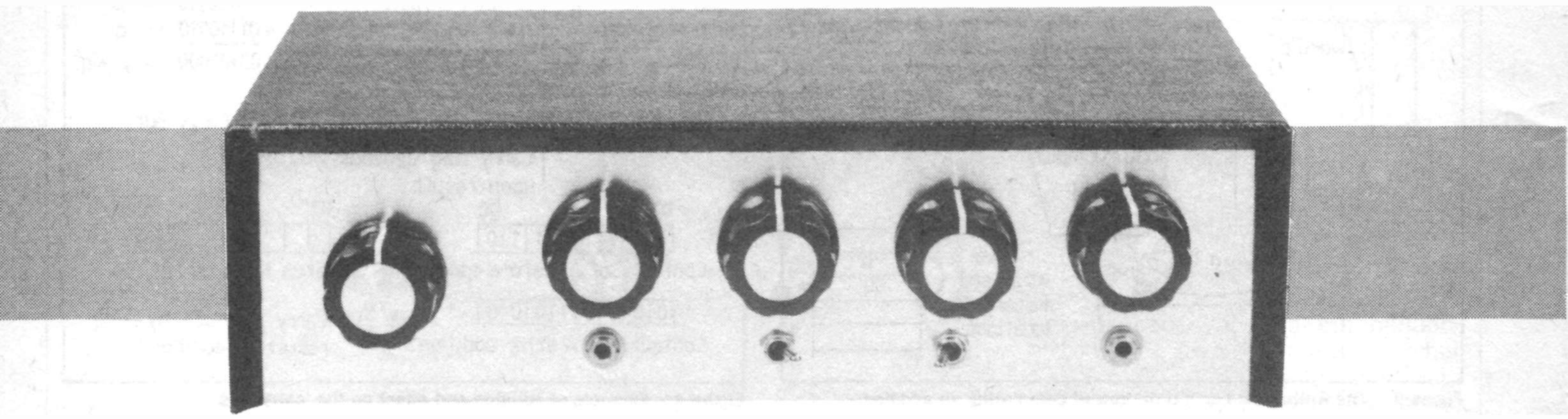
HEX to decimal: Add equivalent decimal values of each HEX digit in turn.

Decimal to HEX: Find largest HEX number less than or equal to decimal number required. Subtract decimal value of this number from decimal number required. Repeat successively for remainder until it is zero. Add HEX equivalents.

Binary to HEX and vice-versa: Replace each HEX digit with 4-bit binary group and vice-versa.

Binary to decimal and vice-versa: Convert to HEX first, as above.

Table 1. Binary — HEX — Decimal Conversion Chart.



A SIMPLE SWEEP OSCILLATOR

by Robert Penfold

For frequency response measurements most electronics enthusiasts use an audio sinewave generator plus an A.C. millivoltmeter or some other piece of equipment capable of measuring audio frequency signals. A quicker way of obtaining audio frequency response graphs is to use a sweep oscillator plus a pen recorder. Here the audio oscillator is automatically swept up through the entire audio frequency band while the pen in the recorder responds to the output signal level from the equipment under test. As the oscillator is swept upwards in frequency the paper is moved past the pen so that the required frequency response graph is drawn out, and units of this type normally have the X and Y axes accurately calibrated in terms of frequency and relative gain in decibels so that a meaningful graph is produced.

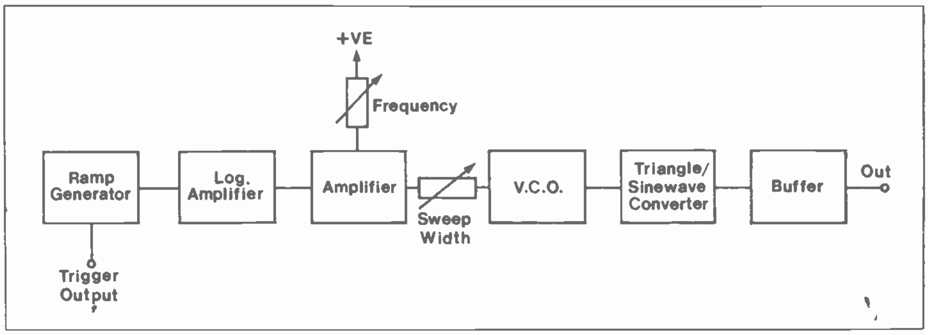


Figure 1. The simple sweep generator block diagram.

While this method obviously saves a great deal of time by avoiding the need to write down numerous results and then (if necessary) draw a graph on the basis of these, the cost of such equipment makes it impractical for the amateur user. However, useful results can be obtained using a simple sweep oscillator in conjunction with an oscilloscope, and a suitable sweep generator can be built at quite a modest cost. With this system the Y input of the oscilloscope is fed with the output of the equipment under test, and the spot is

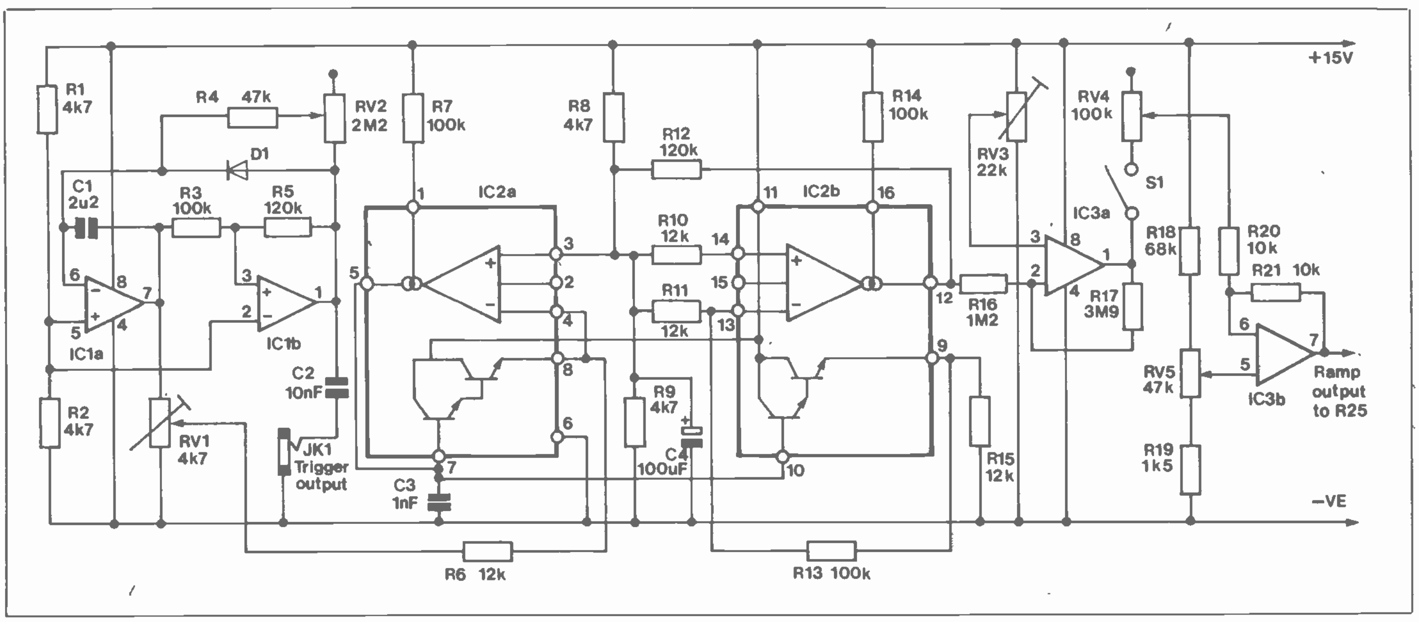


Figure 2. The ramp generator and log amplifier circuits.

swept across the screen as the oscillator is swept over the audio frequency range. The spot can either be swept across the screen using triggered sweep with the trigger signal being obtained from the sweep oscillator, or the ramp signal from the sweep oscillator can be fed to the X input of the oscilloscope.

This gives what is only a comparatively crude representation of the frequency response of the equipment under investigation, but the results obtained are perfectly adequate for making quick checks on tone controls, equalisation amplifiers, testing for irregularities in filter responses, and so on. If necessary, checks using the sweep oscillator and oscilloscope can be followed up by detailed measurements using an ordinary sinewave generator and a millivoltmeter. The accompanying oscillographs show a few examples of results obtained using the simple sweep oscillator featured in this article.

Block Diagram

A voltage controlled oscillator (V.C.O.) is at the heart of the unit, as can be seen from the block diagram of Figure 1. In this application it is not necessary for the oscillator to have a very pure output, and a distortion level of around 2% is perfectly adequate. The V.C.O. used in this design has a triangular output waveform and not the required sinewave output, and the distortion on a triangular waveform is too high to give really good results. A triangular waveform can be converted to a reasonable sinewave signal by either using a filter to attenuate the unwanted harmonics, or by using a soft

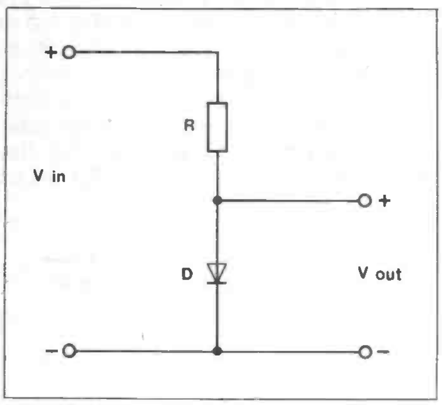
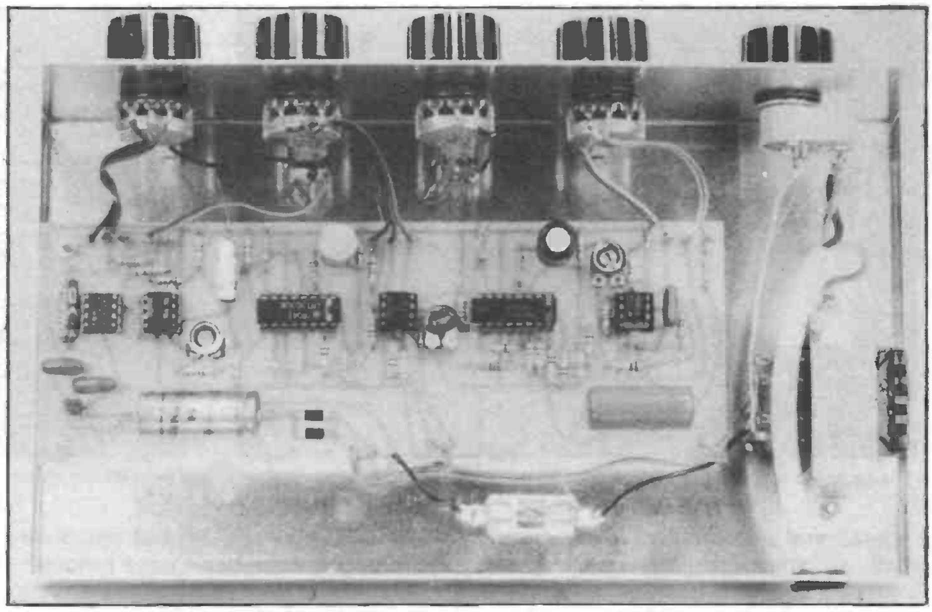


Figure 3. The basis of a log amplifier.



clipping circuit to round off the waveform to give the desired shape. In this circuit a soft clipping circuit is used, and one of the oscillographs shows the effect of this circuit. A buffer stage is used at the output of the unit to give a low output impedance.

Although it might at first appear that controlling the V.C.O. from a linear ramp (sawtooth) signal would give acceptable results, this is not in fact the case. The V.C.O. has an almost linear relationship between control voltage and output frequency, and the output frequency would therefore increase in a linear fashion using a linear ramp waveform as the control signal. Audio frequency response graphs are normally drawn with a logarithmic frequency scale so that (for example) 50Hz to 100Hz occupies the same space as 500Hz to 1kHz and 5kHz to 10kHz. Using a logarithmic frequency scale rather than a linear one gives results that are much clearer and easier to interpret, and ideally a sweep oscillator should have a logarithmic frequency scale.

A suitable sweep waveform is obtained by first generating a linear sawtooth waveform and then feeding this to a logarithmic amplifier which provides suitable shaping of this signal. One of the accompanying oscillographs shows the processed and unprocessed ramp waveforms.

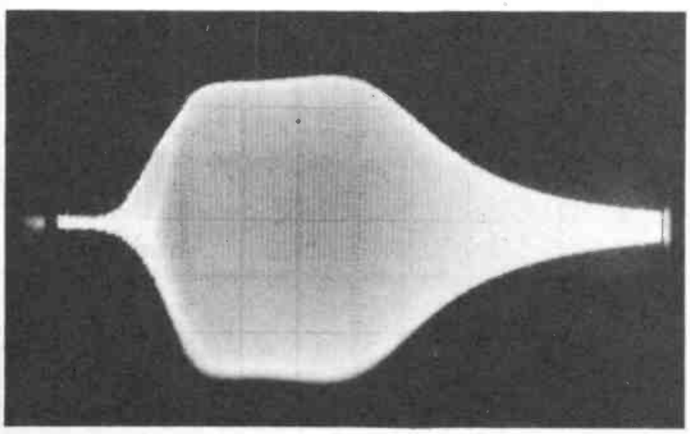
An amplifier is used to boost the output from the logarithmic amplifier to a suitable level, and this represents a convenient point in the unit to add frequency and sweep width controls.

The Circuit

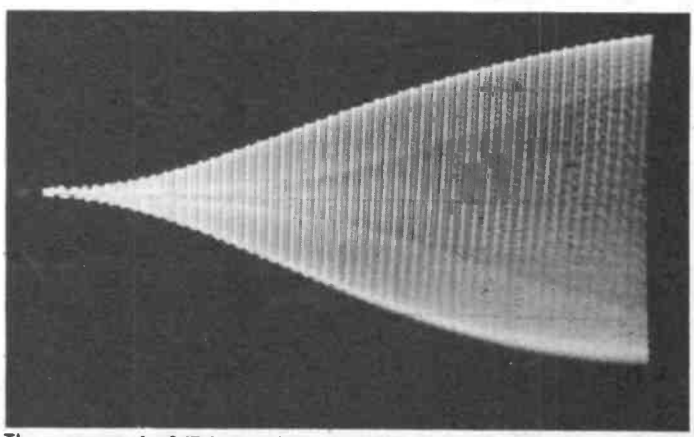
Figure 2 shows the circuit diagram of the ramp generator, logarithmic amplifier, and amplifier stages of the unit.

The ramp generator uses what is almost the standard triangular and squarewave generator circuit with IC1a acting as the integrator and IC1b operating as the trigger circuit. However, the inclusion of D1 in the charge path of C1 results in C1 charging almost instantly, giving a sawtooth waveform rather than a triangular output at the output of IC1a. RV2 controls the discharge time of C1 and acts as the sweep frequency control. This gives a frequency range of approximately 0.2Hz to 10Hz. The output waveform IC1b is a brief positive pulse, and this is used as the trigger signal for the sweep generator of the oscilloscope. The output from IC1a could be fed to the X input of the oscilloscope, but there could be problems in interfacing this signal to the X input. Using the triggered sweep method of operation should give good results with virtually any oscilloscope and is not difficult to set up.

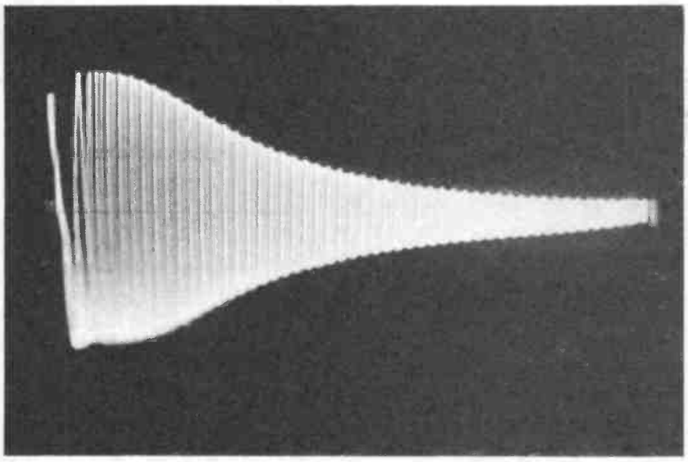
IC2 is a dual transconductance



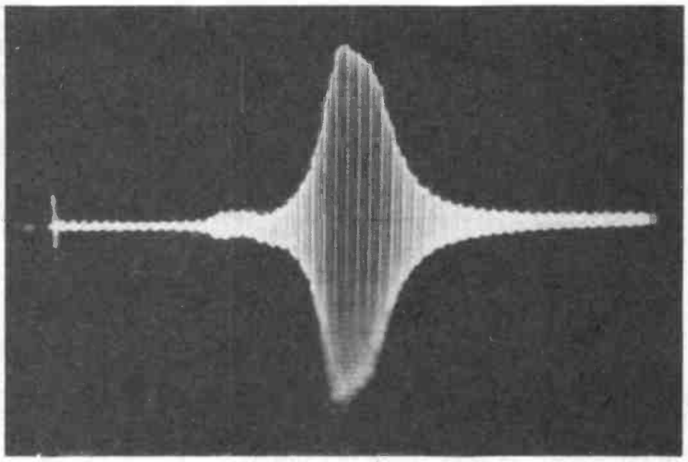
The response of a speech processor having high and low pass filters.



The response of a 6dB/octave high pass filter.



The response of a 6dB/octave low pass filter.



The response of a narrowband bandpass filter.

operational amplifier, but in this circuit both amplifiers are fed with fixed bias currents and are used as straightforward operational amplifiers. These are used in the logarithmic amplifier, and Figure 3 shows the basic circuit which is invariably used in amplifiers of this type. This is simply a forward biased silicon diode, and this provides an output voltage of about 0.6 volts or so provided the input voltage is at about this figure or higher. Although this circuit is often used as a simple voltage stabiliser there is some change in output voltage with variations in input potential. In fact, raising the input voltage by a factor of ten gives an increase in the output voltage of about 100 millivolts, and successive increases in the input potential give an almost identical rise in the output voltage.

This gives a good logarithmic response, but the gain of the circuit is reducing with increased input voltage, whereas this application requires a circuit which gives increased gain with rising input potential. The necessary transformation is obtained by using the resistor and diode in the negative feedback circuit of an amplifier. In this case R6 is the resistor and the diode is actually the emitter - base junction of what would normally be the Darlington Pair output buffer stage of IC2a.

Apart from bias current, the voltage across a forward biased semiconductor junction also varies significantly with changes in temperature, and the logarithmic amplifier incorporates a temperature compensation circuit to minimise drift. IC2b and its Darlington Pair are used to provide this temperature compensation, and excellent results are obtained since the amplifier and compensation components are on the same chip and are therefore maintained at the same temperature.

IC3a is used as a simple inverting amplifier which boosts the output from the logarithmic amplifier by a factor of just over three times. IC3b is used as an inverting amplifier which converts the negative ramp output of IC3a back to the required positive ramp signal. The closed loop voltage gain of IC3b can be varied from unity with RV4 at minimum value down to a loss of over 20dB with RV4 at maximum value, and this enables the sweep range to be adjusted. S1 enables the ramp signal to be disconnected from the V.C.O. so that the oscillator can be used at a fixed frequency which is set using frequency control RV5.

V.C.O. Circuit

The circuit diagram of the V.C.O., waveform shaper and output stages of the unit are shown in Figure 4. The V.C.O. uses IC4a to charge and discharge C5 at a constant rate, and IC4b is used as a trigger circuit. The charge and discharge current of C5 (and the operating frequency of the V.C.O.) is controlled by the bias current fed to pin 16 of IC4a. A resistor is used in series with this input so that voltage rather than current controlled operation is obtained, and this resistor is fed from the output of IC3b. The V.C.O. provides two output waveforms; a roughly squarewave signal at the output of IC4b, and a good quality triangular waveform at the output of IC4a.

It is the triangular waveform that is used in this application, and it is fed to IC5 which is used as a triangle to sinewave converter. IC5 is another operational transconductance amplifier, and it is used here as a fixed gain amplifier which is overdriven by the triangular input signal. Unlike most

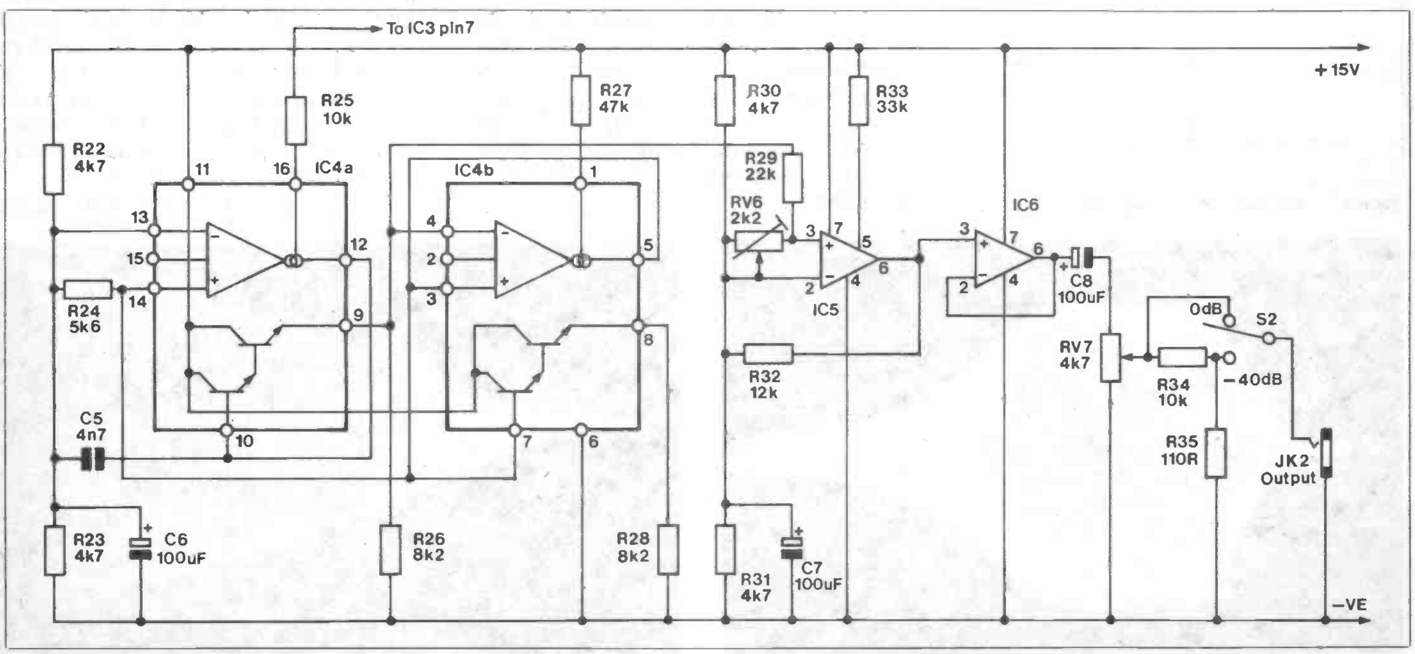
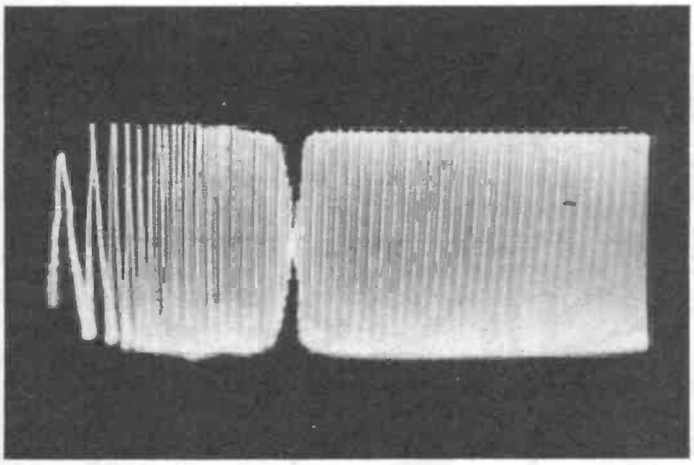
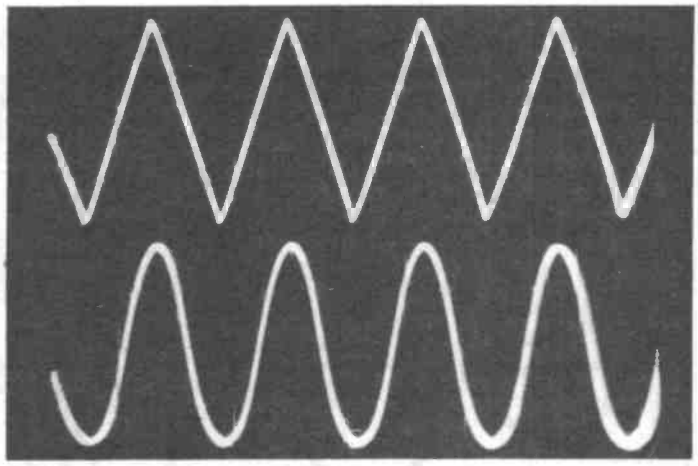


Figure 4. The VCO, waveform converter, and buffer amplifier circuits.



The response of a notch filter.



Top: The triangular output of the V.C.O.
Bottom: Output of the triangle/sine converter.

amplifiers, which provide hard clipping, an overdriven transconductance amplifier gives soft clipping, and in this case gives the required rounding of the input signal. RV6 is adjusted to give the best possible output waveform.

As the output impedance of IC5 is fairly high, IC6 is used as a straight forward unity gain buffer stage at the output. RV7 is the output level control, and S1 can be adjusted to reduce the output signal by about 40dB (by a factor of one hundred times). This makes it easier to adjust RV7 for very low output levels. The maximum output signal level is approximately ten volts peak to peak.

Mains P.S.U.

The unit requires a supply voltage of between about 12 and 18 volts, and a suitable 15 volt stabilised power supply circuit is given in Figure 5.

This is a straight forward circuit using a push-pull rectifier and a three terminal monolithic voltage regulator. A small (100mA) voltage regulator is more than adequate since the supply current is only about 15mA. C9 is the smoothing capacitor and C10 plus C11 are needed to aid the stability of voltage regulator IC7.

Construction

A metal instrument case which has approximate outside dimensions of 229 by 133 by 63.5mm is ideal for this project. The general layout of the front panel can be seen from the photographs, and the final wiring of the unit will be more straight forward if this layout is not radically altered.

Apart from T1, FS1, and the components fitted on the front panel, the components are all mounted on a printed circuit board, as detailed in Figure 6. Construction of the printed circuit board is mostly straightforward, but be careful not to omit the link wire (next to R28). Also, IC3 has a MOSFET input stage, and this device should therefore be fitted in a socket, and should not be plugged into circuit until the board is in other respects complete. Fit Veropins to the board at points where connections to the controls and other off-board components will eventually be made.

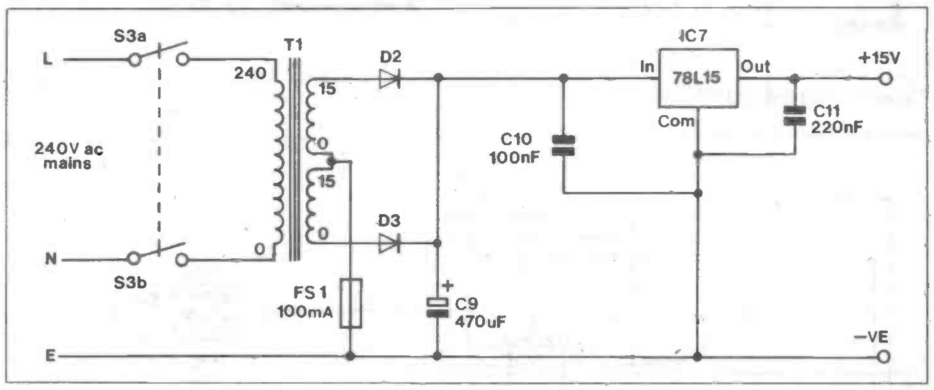


Figure 5. Mains power supply circuit.

The completed board is mounted on the base panel of the cabinet, on the right hand side, leaving space for T1 to be mounted on the left side of the unit with the fuseholder for FS1 to the rear of the board. The component panel is mounted using one inch 6BA bolts plus ½ inch 6BA spacers. The fuseholder for FS1, and T1 are both mounted using ¼ inch 6BA bolts. The mountings screws for the top and sides section of the case protrude about ½ inch into the case, and T1 must be position where it will not obstruct one of these fixing screws.

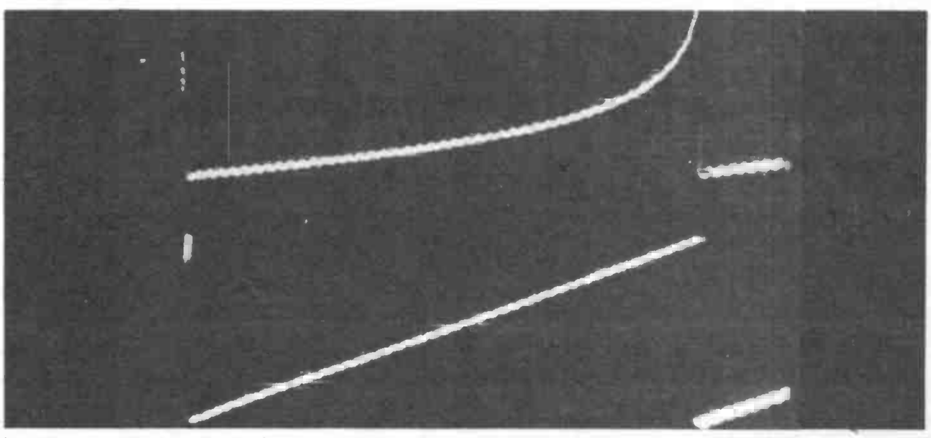
An entrance hole for the mains lead is made in the rear panel of the case near to T1, and this hole is fitted with a small grommet.

Figure 7 shows the point-to-point wiring of the unit. The identification letters in Figure 7 correspond with those in Figure 6, so that point 'A' in Figure 6 connects to point 'A' in Figure 7, point 'B' connects to point 'B', and so on.

Adjustment

Thoroughly check all the wiring before initially testing the unit, paying particular attention to the wiring around T1, S3 and FS1. Start with all three preset resistors at a roughly mid-point setting.

If an oscilloscope is used to monitor the signal at pin 12 of IC2 a non-linear ramp waveform should be present. If clipping of the signal is evident RV1 should be backed-off slightly in an anticlockwise direction so as to eliminate the clipping, but it should not be turned back much further than is absolutely necessary. If no clipping is evident, advance RV1 as far as possible in a clockwise direction without clipping being produced.



Top: Processed ramp signal.
Bottom: The linear ramp signal.

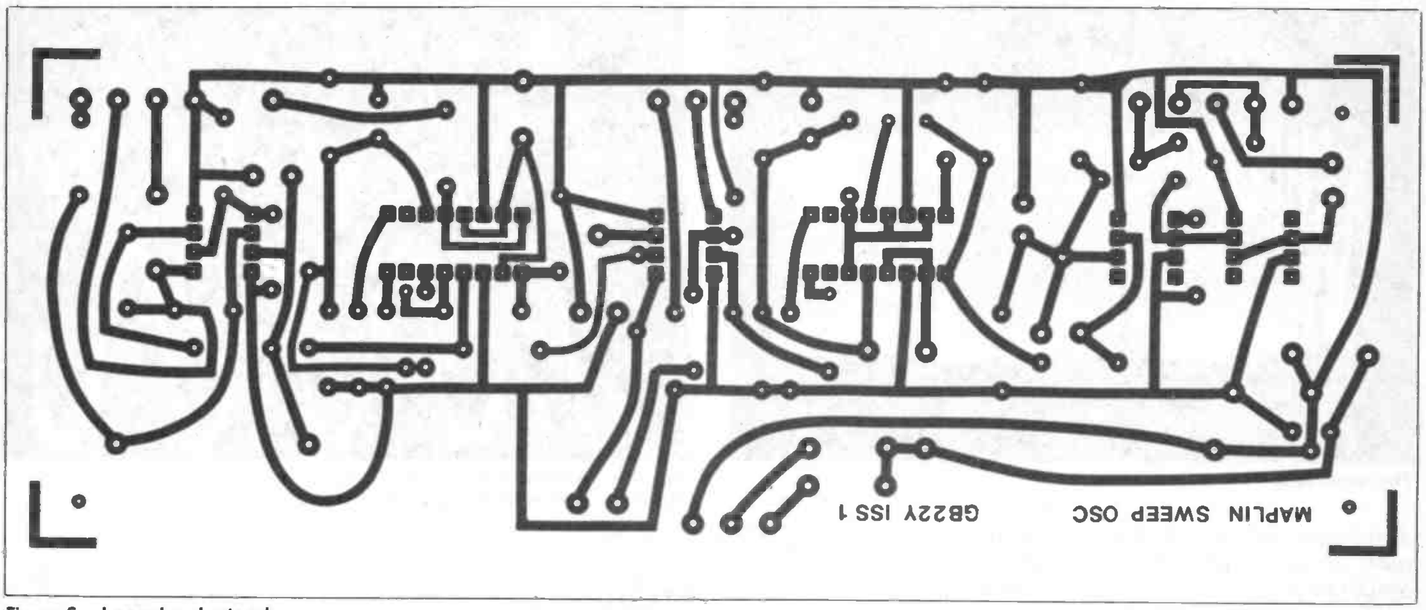


Figure 6. Legend and artwork.

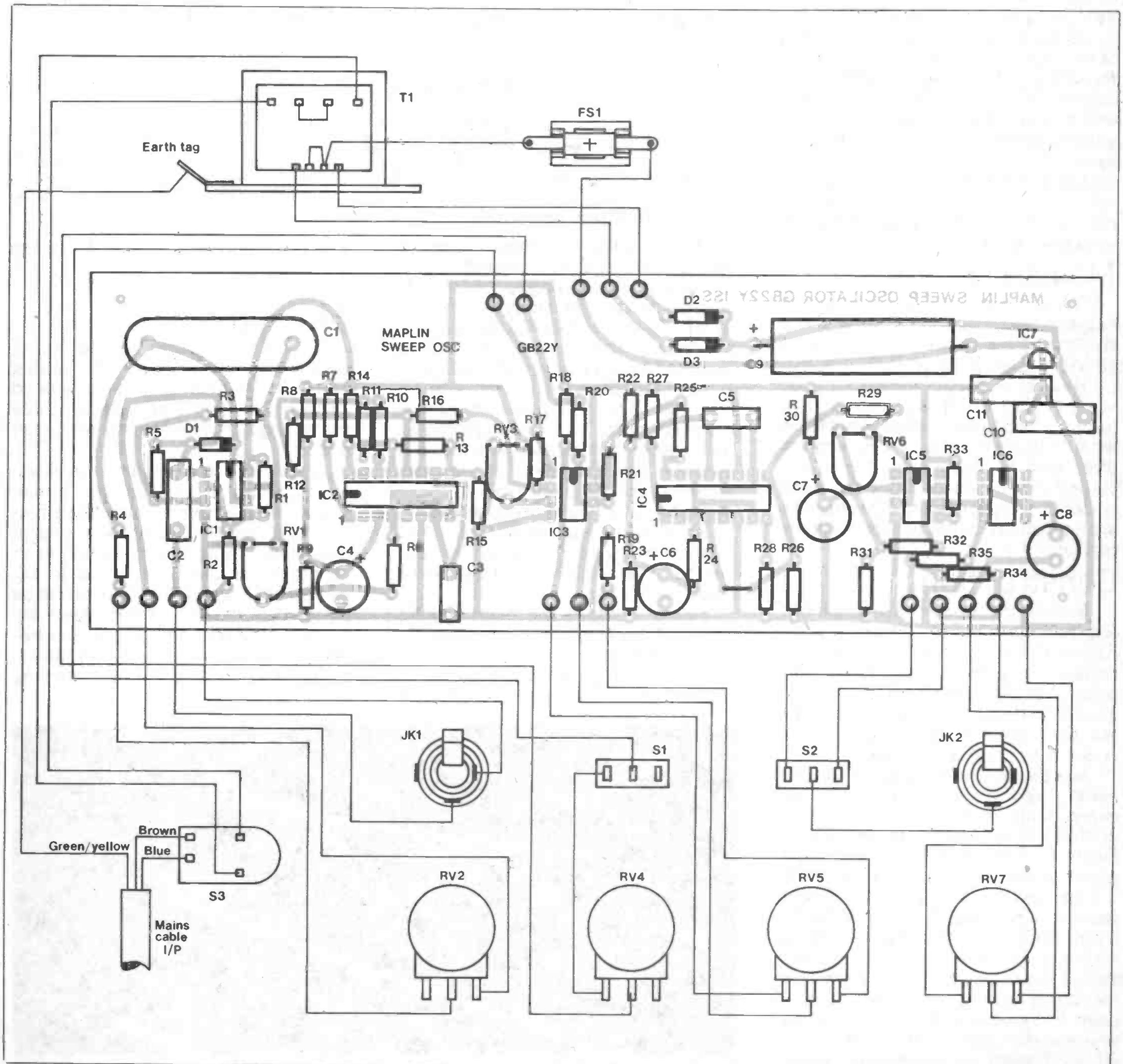


Figure 7. Wiring diagram.

RV3 is given a setting that gives an unclipped output signal at pin 7 of IC3, and the setting of this component will probably not be very critical.

With S1 set to cut off the V.C.O. from the ramp generator circuit so that a fixed output frequency is obtained, an oscilloscope is used to monitor the output waveform of the unit and RV6 is adjusted for the optimum output waveform. Alternatively a crystal earphone can be plugged into SK2 so that the output of the unit can be monitored by ear, and with RV5 set for a fairly low operating frequency it should be possible to hear the fundamental frequency plus the harmonics at higher frequencies. RV5 is then adjusted to minimise the harmonics.

Normally the unit will probably be used to cover the whole audio frequency over each sweep, and this requires RV4 to be set for maximum sweep range, or very nearly so (i.e. set in a fully clockwise direction). RV5 must be set so that the unit is swept over the appropriate range of frequencies, and it is helpful here to use a slow sweep speed and to monitor the output of the unit using an earphone.

SK1 is coupled to the trigger input of the oscilloscope, and if the latter has a positive/negative trigger switch this should be set to the "positive" position. SK2 is coupled to the input of the equipment under test, and the output of this equipment is coupled to the Y input of the oscilloscope. S2 and RV7 are adjusted to give a suitable input signal level for the equipment under test, and the Y gain control(s) of the oscilloscope are set for a satisfactory trace height. A sweep speed of about 1HZ is suitable, and RV2 must be adjusted to match the sweep rate of the oscillator to that of the oscilloscope with reasonable accuracy. There is no real advantage in using a sweep frequency of less than about 1HZ. It is not advisable to use a higher sweep frequency since this would result in the oscillator being swept over the low frequency range before there had been any significant output at these frequencies, and misleading results would consequently be produced. A higher sweep frequency can be employed if the unit is only being used at output frequencies of a few hundred Hertz or more.

For detailed investigation over only a small section of the audio frequency band RV4 is backed off in an anticlockwise direction and RV5 is adjusted to give coverage of the appropriate section of the audio spectrum.

Most oscilloscopes have a green medium persistence cathode ray tube, and with the low sweep speeds used in this application the left hand section of the trace fades out before the right hand portion is completed. Despite this the shape of the trace can be seen quite clearly without having to resort to a storage oscilloscope of some kind or oscillographs.

SIMPLE SWEEP OSCILLATOR

Resistors — All 0.4W 1% metal film			
R1,2,8,9,22,23, 30,31	4k7	(8 off)	(M4K7)
R3,7,13,14	100k	(4 off)	(M100K)
R4,27	47k	(2 off)	(M47K)
R5,12	120k	(2 off)	(M120K)
R6,10,11,15,32	12k	(5 off)	(M12K)
R16	1M2		(B1M2)
R17	3M9		(B3M9)
R18	68k		(M68K)
R19	1k5		(M1K5)
R20,21,25,34	10k	(4 off)	(M10K)
R24	5k6		(M5K6)
R26,28	8k2	(2 off)	(M8K2)
R29	22k		(M22K)
R33	33k		(M33K)
R35	110R		(M110R)
RV1	4k7 min horiz preset		(WR57M)
RV2	2M2 lin pot		(FW09K)
RV3	22k min horiz preset		(WR59P)
RV4	100k lin pot		(FW05F)
RV5	47k lin pot		(FW04E)
RV6	2k2 min horiz preset		(WR56L)
RV7	4k7 lin pot		(FW01B)
Capacitors			
C1	2u2 polyester		(BX84F)
C2	10nF polyester		(BX70M)
C3	1nF carbonate		(WW22Y)
C4,6,7,8	100uF 10V radial elect	(4 off)	(FF10L)
C5	4n7 carbonate		(WW26D)
C9	470uF 25V axial elect		(FB73Q)
C10,11	100nF polyester	(2 off)	(BX76H)

Semiconductors			
D1	1N4148		(QL80B)
D2,3	1N4002	(2 off)	(QL74R)
IC1	LF353		(WQ31J)
IC2,4	LM13700N	(2 off)	(YH64U)
IC3	CA3240E		(WQ21X)
IC5	CA3080E		(YH58N)
IC6	741C (8 pin DIL)		(QL22Y)
IC7	uA78L15AWC		(QL27E)
Miscellaneous			
S1,2	Min SPDT toggle	(2 off)	(FH00A)
S3	Rotary mains switch		(FH57M)
T1	Mains primary, twin 15 volt 200mA secondaries		(WB15R)
SK1,2	3.5mm jack sockets	(2 off)	(HF82D)
FS1	20mm 100mA quick-blow		(WR00A)
	Printed circuit board		(GB22Y)
	20mm chassis mounting fuseholder		(RX49D)
	Case type WB4		(LH39N)
	Knob type K7B	(5 off)	(YX02C)
	8 pin DIL socket		(BL17T)
	13A mains plug		(RW67K)
	Min mains cable 2m		(XR01B)
	Hook-up wire black		(BL00A)
	Cabinet feet		(FW19V)
	Grommet small		(FW59P)
	Spacer 6BA ½in		(FW35Q)
	Bolt ¼in 6BA		(BF05F)
	Bolt 1in 6BA		(BF07H)
	Nut 6BA		(BF18U)
	Tag 6BA		(BF29G)
	Veropins type 2145		(FL24B)

A complete kit of all parts, excluding the case, is available for this project.
Order As LK06G (Sweep Oscillator Kit). Price £18.95.

6502 Machine Code Programming from page 7

What, for example, do you make of the number (yes, number!) DEAD?

If you followed what went before, you will realise that this is simply equal to:

$(D \times 16^3) + (E \times 16^2) + (A \times 16^1) + (D \times 16^0)$,
$= (13 \times 16^3) + (14 \times 16^2) + (10 \times 16^1) + (13 \times 16^0)$,
$= 53\,248 + 3\,584 + 160 + 13$,
$= 57\,005$ (denary).

HEX numbers can always be converted to denary in this way but, to make life a bit easier, Table 1 is included.

Conversion from binary to HEX is very easy. The golden rule is as follows — 'starting from where the binary point would be, divide the binary number into four-bit groups; convert each four-bit group into a separate HEX digit'. If you find that the 'highest' group doesn't have four bits, include zeros to make it up, if it helps to see the corresponding HEX digit more easily.

For example, consider the binary number 10110111. This 'byte' divides into two 'nibbles' (as half-bytes or four-bit groups are called).

Thus, we have 1011 0111. Now all you have to do is consider these as if they were BCD (Binary Coded Decimal) groups, write down the denary equivalent and, from this, the HEX equivalent. Of course you can miss out the denary stage and write HEX straight away if you wish, but you may need practice to do this consistently and without error. The two groups are seen to be equal to 11 (denary) and 7 (denary) respectively. Since 11 (denary) = B (HEX), the binary number 10110111 is written as B7 in HEX.

To take one further example to emphasise the point, take the case of the Stack Pointer Register mentioned earlier. It was said, in effect, that this could point to any address in the range 0100 to 01FF. However, the register itself has only nine bits, the 9th bit being permanently SET. Obviously the eight bits b_0-b_7 can take up any values in the range 00000000 to 11111111 (in binary), while b_8 is always '1'. Therefore, the contents of the Stack Pointer Register must lie between the limits:

0001 0000 0000 = 100 (HEX)
and 0001 1111 1111 = 1FF (HEX)

Note that three zeros have been added to the highest bit to complete this nibble and, since addresses are usually written with four HEX digits, another nibble of four zeros should be added to the left to give the address range as 0100 to 01FF, as previously stated.

If machine-code programming was something entirely new to you, then perhaps this article has given you enough to think about for the time being. For anyone who cannot wait to find out more, I suggest they buy one of the several 6502 programming manuals available; it would be a good idea anyway for the serious programmer. My personal preference is for 'Programming the 6502' by Rodney Zaks from Sybex, but at the time of writing it is about £10.50.

The Rolls-Royce of Electronic Kits

Heathkit

Now available in the UK exclusively through Maplin

Fifty-seven years ago, Ed Heath, a young aviation enthusiast designed a low-cost, light plane in kit form that you built yourself at home. The company he set up in 1926 to sell the kits was The Heath Airplane Company based in Chicago. Although Ed was killed in a crash just five years later, his name lives on and he became synonymous with a range of superb do-it-yourself electronics kits and training courses renowned for their excellence.

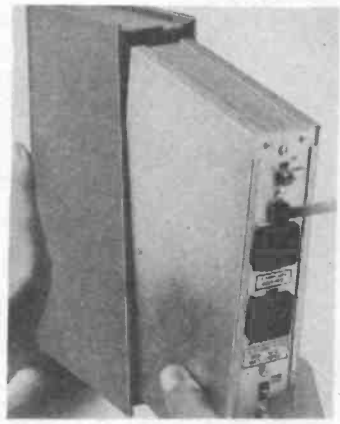
Each kit contains a "tell-all" guide for first time builders, a highly detailed step-by-step assembly manual and all the components and hardware you need. Every component, from the lowliest resistor to the most complex IC is thoroughly tested at the Heath factory in America prior to inclusion in the kit.

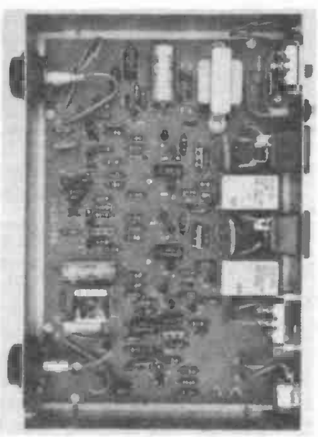
Now this superb product range will be available in the UK through Maplin. Over the next year we shall be stocking a large range of Heathkit products and we begin this month with some of the established products.

ULTRASONIC INTRUSION ALARM

An ultrasonic intruder alarm that looks like a book! It will protect any room in your house, detecting an intruder's movements up to 7.5m (25ft) from the unit. Two alarm outlets are provided, one triggers after a short delay, and the other after 30 seconds. The total load permissable on these two outlets is 3A either individually or shared. The short delay gives time for you to leave the room after activation and time to deactivate the alarm when you re-enter the room.

The alarm can be set to turn off automatically after 30 seconds or to remain on until switched off.





Thus it could be used as an automatic light switch for your garage, basement attic or any place where you want entry into an area to turn on the light. It could be used to sound a buzzer when movement occurs, such as a child leaving its bed.

The intruder alarm is completely enclosed in metal and can be installed anywhere that a power socket is available. A further case is provided that looks like a book cover and helps to disguise the identity of the device. Size in book cover: 257 x 191 x 60mm.

Order As HK02C (Informer Alarm) Price £69.95

Digital Alarm Clock

One of Heathkits' simplest kits and ideal for beginners. This budget-priced digital alarm clock features a pleasant blue-green display that automatically adjusts to ambient light conditions. You can wire the clock for 12 or 24 hour display with AM and PM indication. The clock also shows when the alarm is set and alerts you if there has been a power failure.

The alarm is a pleasant electronic tone to start your day right and there's a snooze control to switch the alarm off for nine minutes. The clock has a built-in speaker and is styled in a handsome simulated wood-grain finish that fits any decor. Size is 168 x 120 x 60mm (7 x 5 x 2½in.).

Order As HK01B (Dig Clock Kit) Price £34.95

ALARM BELL

A 240V AC alarm bell that can be connected directly to the output of the ultrasonic alarm HK02C. The bell is fully weatherproof for external use.

Order As YK58N (Large Dome Bell) Price £24.95

HEATHKIT FEATURE

Infra-Red Intruder Detector

Your home is most vulnerable during the night when intruders can approach unseen and can damage or steal from your garden or outbuildings even before they break into your house itself. Now here's a revolutionary new device that can detect the movement of a person at night in the open air over an 80 square metre (875 square feet) area and keep your dwelling safe from breaking and entry.

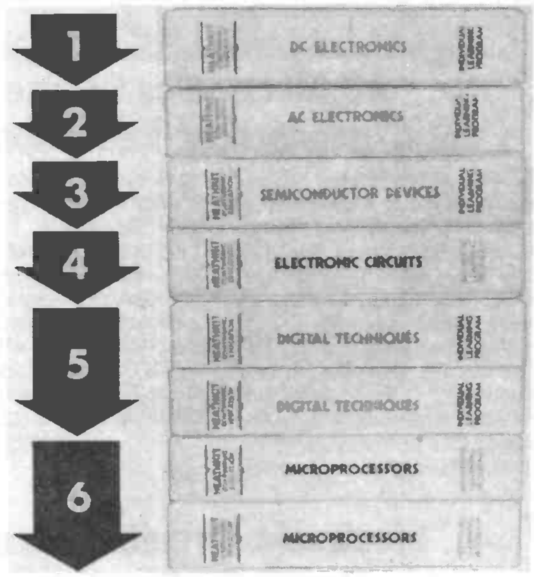
When a warm-bodied object moves into the protected area, the alarm relay operates and can be used to operate floodlights or an alarm/light combination making a burglar or vandal think he has been observed. The alarm relay remains operated for four minutes, then resumes its silent, sleepless protective work.

A built-in phototransistor deactivates the device during the daytime. As darkness falls, the six infra-red sensing elements are re-activated. In cold weather, the infra-red rays from a person's exposed hand or face is enough to trigger it. A manual sensitivity control adjusts the temperature differential so that pets and small animals won't cause accidental alarms.

The unit can be mounted on an outside wall and measures just 206 x 133 x 76mm. Up to 500W load may be connected directly to the relay in the unit.

Order As HK03D (Infra-Red Alarm) Price £149.95

SUPERB HEATHKIT EDUCATIONAL COURSES



Heathkit's programmed self-study courses are ideal for students, hobbyists and for technical staff in companies large and small. The easy-to-follow format saves time and costs far less than comparable adult education or vocational courses.

Heathkit's programmed self-study courses are ideal for students, hobbyists and for technical staff in companies large and small. The easy-to-follow format saves time and costs far less than comparable adult education or vocational courses.

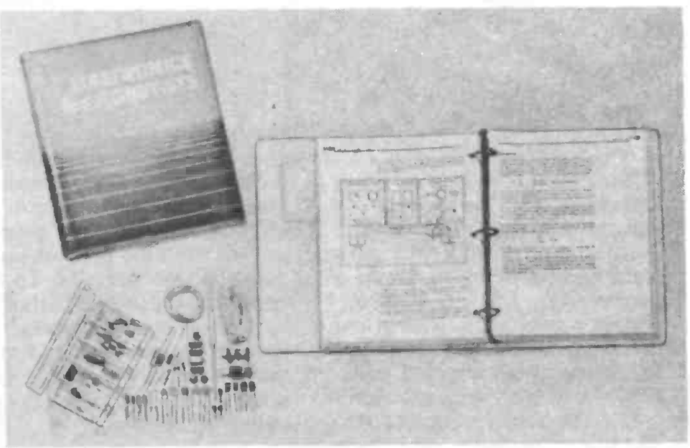
Clearly written, well-illustrated programmed-learning texts speed learning, and experiments provide the hands-on ingredient so important for learning. Courses range from basic electronics to robotics. You can brush up on a specific area of electronics or stay abreast of new technological advances as they unfold: Heathkit's new course on Fibre Optics will be available soon.

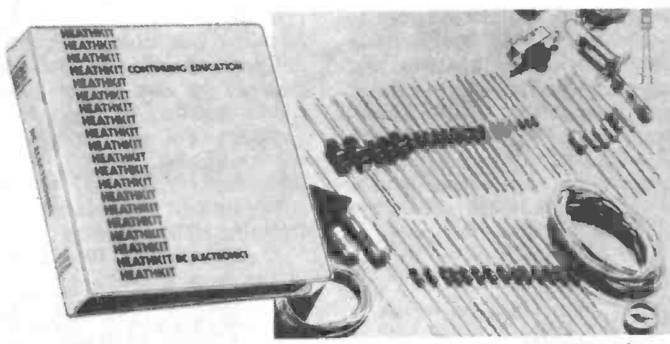
Concepts of Electronics for Hobbyists

Learn the basic principles of direct current, alternating current, active devices, electronic circuits, digital electronics and digital computers. Experiments assure your understanding of do-it-yourself electronic projects and all components required are included. To do the experiments you will need the ET3100 Trainer described on page 17 and a multimeter. No prior knowledge of electronics required.

Over a thousand pages of simple to understand text and illustrations in a durable binder are provided.

Order As HK04E (Course EE3140) Price £64.95





DC ELECTRONICS COURSE FOR BEGINNERS

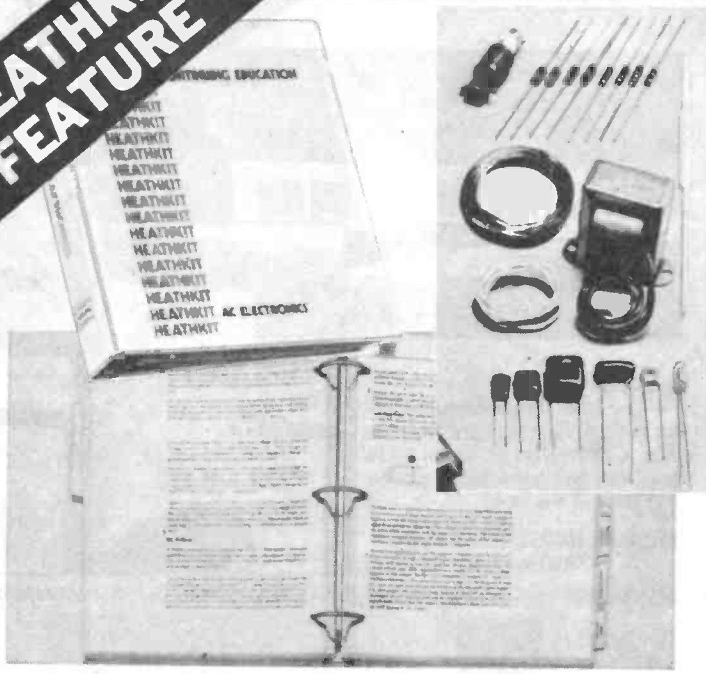
This course forms an excellent starting point for those just beginning to learn electronics. The course covers current, voltage, resistance, magnetism, Ohm's Law, electrical measurements, inductance and capacitance. It has been completely updated to ensure that you learn the most up-to-date material available.

This professionally-designed course leads you step-by-step to a complete understanding of DC electronics, and allows you to learn at your own pace. Hands-on experiments increase your knowledge by putting your newly-gained information to work immediately on practical exercises.

The course includes the comprehensive text in a durable vinyl binder and all the components needed for the experiments. To complete the experiments you will need the ET3100 Trainer described on page 17 and a multimeter.

Order As HK05F (Course EE3101) Price £49.95

HEATHKIT FEATURE



AC Electronics Course Expands Your Education

An easy-to-understand self instruction course to advance your knowledge of electronics theory from the point where the DC course finished. The course covers generating AC, waveforms, measurements, capacitive circuits and their applications, inductive circuits including an understanding of Q, bandwidth and filters. The course concludes with a detailed look at transformers. The concepts you learn will come to life as you conduct experiments that turn theory into practical experience. The course includes the comprehensive text in a durable vinyl binder and all the components needed for the experiments. To complete the experiments you will need the ET3100 Trainer described on page 17 and a multimeter.

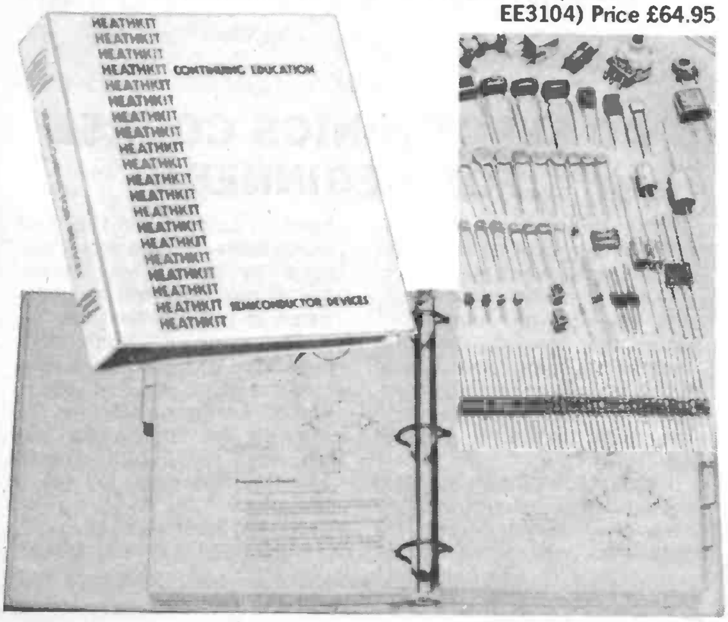
Order As HK06G (Course EE3102) Price £54.95

Electronic Circuits Course Theory To Practice

Put the knowledge you've learned in previous Heathkit courses to work. The course covers basic amplifiers including biasing, and coupling, then goes on to explain audio amplifiers, power amplifiers, video amplifiers and RF and IF amplifiers. There are detailed sections on operational amplifiers, power supplies, oscillators, pulse circuits and modulation.

The well-illustrated and concise text comes complete with an attractive and durable vinyl binder and over 100 electronic components for use in the experiments outlined in the text. To complete the experiments you will need the ET3100 Trainer described on page 17 a multimeter and an oscilloscope.

Order As HK08J (Course EE3104) Price £64.95

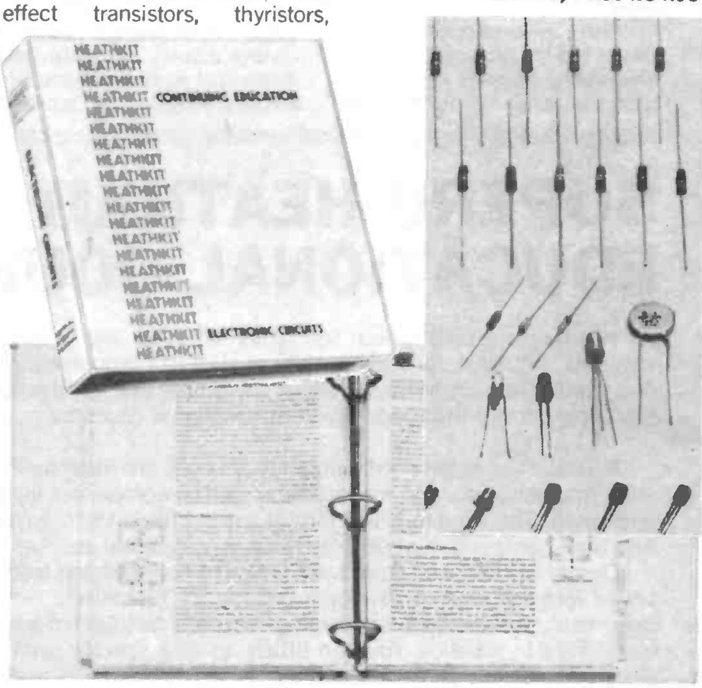


Semiconductor Devices Course The Third Step

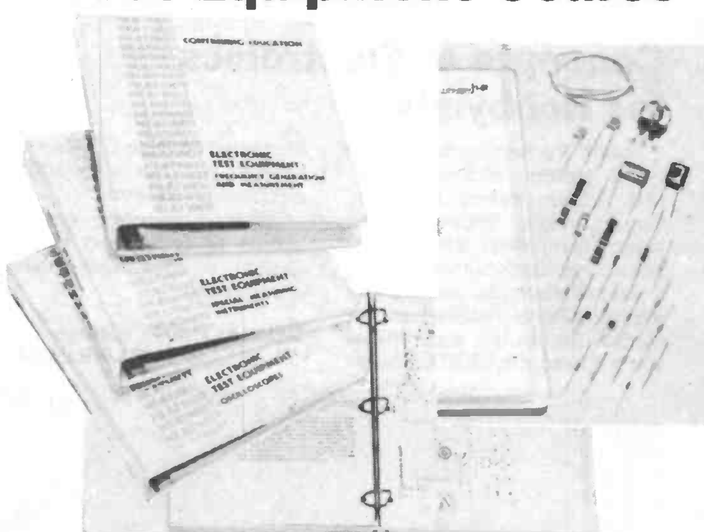
Carrying on from the AC Electronics course, this completely up-dated course continues to build your understanding of electronics. This course continues to build your understanding of electronics. This course covers the fundamentals of semiconductors then looks in detail at diodes, zener diodes, tunnel diodes, varactor diodes, PIN diodes and others. You will learn about the operation of bipolar transistors and their characteristics, field effect transistors, thyristors, triacs, unijunctions and opto-electronic devices. There is also a brief introduction to integrated circuits.

Hands-on experiments using the components supplied with the course give you first hand experience with semiconductor devices. To complete the experiments you will need the ET3100 Trainer described on page 17 and a multimeter.

Order As HK07H (Course EE3103) Price £54.95



Test Equipment Course



Learn to use a wide variety of test equipment. The course gives you the knowledge you need to make measurements with analogue and digital meters, explains the operation and use of oscilloscopes in electronic testing and servicing. You'll also learn to use frequency generators and counters. A further section covers bridge circuits, curve tracers, spectrum analysers and logic probes.

The course is split into four sections, each with its own vinyl binder. In addition to the texts and electronic components supplied you will need the ET3100 Trainer described on page 17. To fully appreciate the various parts of the text, it will also be necessary to have access to an analogue multimeter, a digital multimeter, oscilloscope, frequency generator and frequency counter.

Order As HK09K (Course EE3105) Price £64.95

HEATHKIT FEATURE

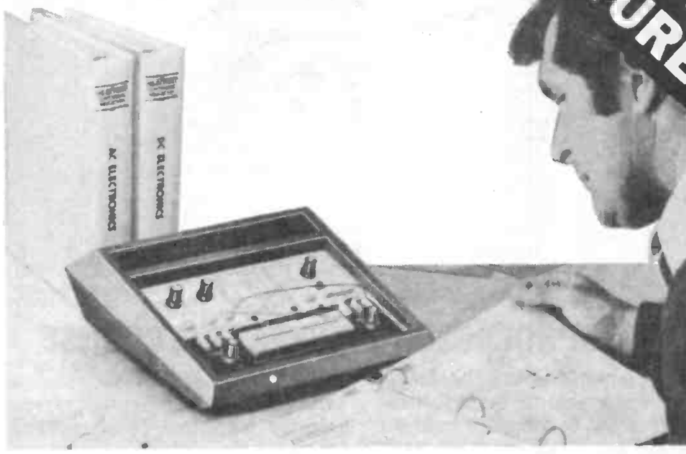
EXPERIMENTER TRAINER ET3100

You'll get maximum benefit out of the six courses, DC, AC, Semiconductor, Electronic Circuits, Test Instruments and Electronics for Hobbyists by doing the hands-on experiments on this Trainer.

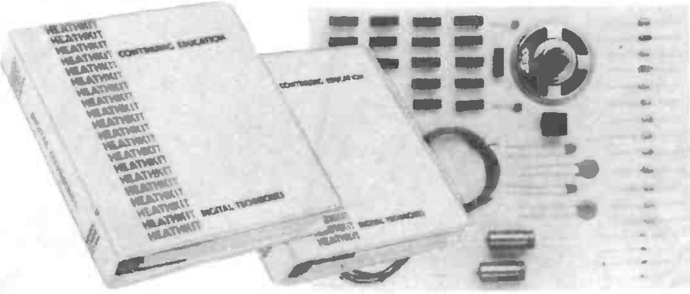
The Trainer features solderless breadboard sockets for ease of component substitution, a 2-range variable sine and square wave generator (200-20,000Hz), dual variable power supplies for positive and negative voltages from 1.2V to 16V up to 120mA, 1k and 100k linear potentiometers. A centre-tapped transformer provides 30 volts rms for AC experiments.

The Trainer measures 308 x 298 x 89mm and is available in kit form or ready-built.

Order As HK10L (Trainer ET3100 Kit) Price £74.95
HK11M (Trainer ETW3100 Built) Price £159.95



Digital Techniques Course

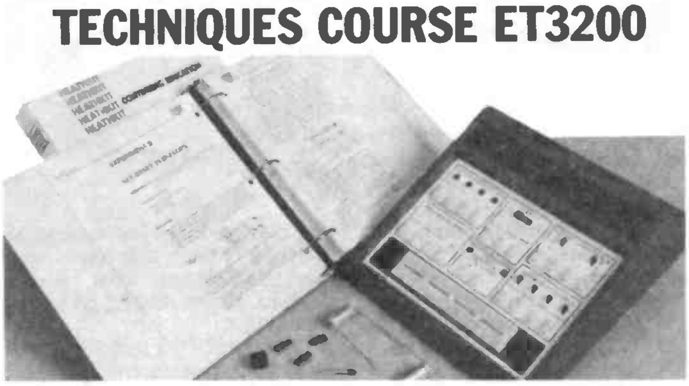


Learn to design and apply modern digital circuitry. This advanced course is a comprehensive treatment of the subject, beginning with fundamentals and theory and guiding you through digital logic circuits, Boolean algebra, flip-flops and registers, sequential logic circuits, combinational logic circuitry and digital design.

As you complete each step-by-step section, hands-on experiments and tests will further aid your understanding of digital techniques. The course includes the text in two heavy-duty vinyl binders and electronic components for performing the experiments. The ET3200 Trainer described below is required to complete the experiments. A multimeter is also needed and an oscilloscope is recommended.

Order As HK12N (Digital Techniques) Price £79.95

TRAINER FOR DIGITAL TECHNIQUES COURSE ET3200



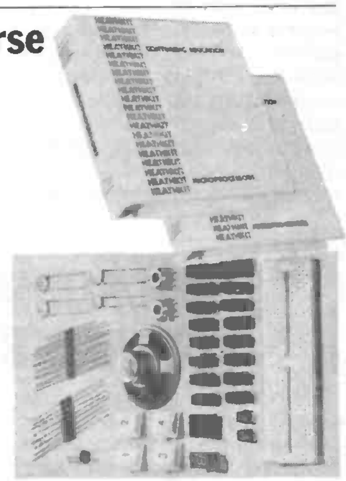
This versatile trainer lets you put your digital knowledge to work and allows you to build and test prototypes, confirm circuit operation and test digital IC's. Solderless breadboard sockets make experimenting and design easier and faster with a flexible capacity for eight 14-pin or 16-pin dual-in-line IC's and 24-pin, 28-pin and 40-pin IC's.

The trainer has four binary data switches to pulse logic circuits, a three-frequency pulse clock generator and four LEDs. The built-in regulated power supplies furnish +12V at 500mA, -12V at 100mA and +5V at 500mA.

The trainer measures 308 x 298 x 89mm and is available in kit form or ready-built.

Order As HK13P (Trainer ET3200 Kit) Price £89.95
HK14Q (Trainer ETW3200 Built) Price £169.95

Microprocessor Course Teaches Latest Technology



This superb introduction to microprocessors won first prize from the International Award Society for Technical Communication. You will learn about microprocessors, microcomputers and computer programming in a complete efficient and well-organised way. You'll understand microprocessor basics, computer arithmetic, programming and interfacing.

The course adopts the finest models of successful self-instruction techniques with concise steady-paced textbooks and hardware experiments that make important microprocessor theory, application and design, easier for you to understand.

The course is organised in ten learning units. Unit 1 covers decimal, binary, octal and hexadecimal numbering systems; conversions, binary codes and positional notation. Unit 2 teaches you terms and conventions, introduces you to several instructions and shows how programs are written and executed. Unit 3 covers binary addition, subtraction, multiplication and division, twos-complement arithmetic and Boolean logical operators like NOT, AND, OR, Exclusive-OR and INVERT.

The fourth unit of the course is an introduction to programming including branching, conditional branching, algorithms and programming instructions. The 6800 microprocessor is covered in units 5 and 6 and includes a study of architecture, instruction set, addressing modes, stack operations, subroutines, input/output operations and interrupts. In units 7 and 8 you'll learn the fundamentals of interfacing, interfacing random access memory (RAM), interfacing displays, interfacing with switches, the peripheral interface adaptor (PIA) and using the PIA.

You will write and experiment with a wide variety of increasingly complex programs in unit 9. In experiments you will turn the ET3400 trainer into a teaching machine that will give you drills and practice in computer numbering systems. You will use all instructions and addressing modes and experiment with subroutines, stack operations etc.

In the final unit you will use the electronic components supplied with the course to convert the ET3400 trainer into a digital clock, a musical instrument and a digital voltmeter. You will experiment with address decoding, PIA's, input and output of data, parallel-to-serial conversion techniques, digital-to-analogue and analogue-to-digital conversion techniques, and interrupts.

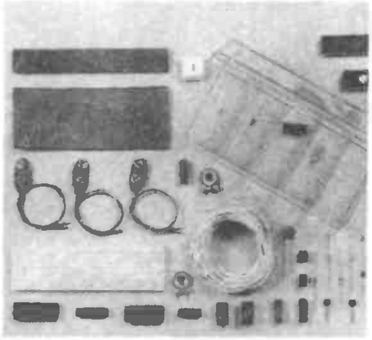
Units 7, 8 and 10 assume knowledge equivalent to the Digital Techniques Course whilst the remainder of the course requires no prior knowledge.

The course comes complete with text, two binders and 62 electronic components including RAM's, a PIA chip, a digital-to-analogue convertor, op-amps and a variety of other microprocessor-oriented devices. The ET3400 trainer is required to perform the experiments.

With the computer age upon us, now is the time to begin your education in microcomputers and programming by ordering this tried and proven course today.

Order As HK15R (Microprocessor Course) Price £99.95

HEATHKIT FEATURE



MICROPROCESSOR INTERFACING COURSE

Beginning where the Microprocessor Course ended, these 750 pages of complete and detailed text contain eleven learning units and ten hands-on experiments teach you the fundamentals of microprocessor interfacing. Topics covered include Advanced Peripheral Interface Adaptor and analogue conversion, serial data communications, peripheral devices, memory devices, programmable timers, an in-depth discussion of the 6809 advanced microprocessor and the 16-bit 68000 microprocessor.

The text is contained in two vinyl binders and the course comes complete with a variety of components required for the experiments. The trainer ET3400 is required to complete the experiments.

Order As HK16S (Interfacing Course) Price £99.95

MICROPROCESSOR TRAINER ET3400

Functioning as a miniature digital computer, this trainer used with the Microprocessor, Advanced Microprocessor and Interfacing courses, features a 1K ROM monitor program and a six-digit hexadecimal 7-segment display for address and data readouts and monitoring internal logic states.

A 17-key hex keyboard permits you to access a memory location to examine contents, step forward or backward, change the contents of memory, examine and alter any of the MC6808's internal registers, set break points for program debugging, or reset the MPU. The flexible instruction set of the MC6808 permits five addressing modes and uses two accumulators, an index register and stack pointer.

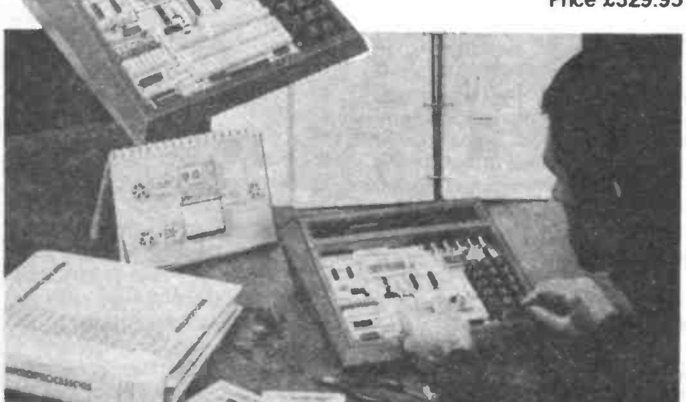
The trainer has 512 bytes of random access memory, 8 buffered LED's for display of breadboard logic states, 8 SPST DIL-switches for binary input and a breadboard for prototyping memory and interface circuits.

All microprocessor address, control and data busses are terminated on the front panel and there is provision for a 40-pin external connector to expand memory and I/O capacity. The trainer is therefore ideal for any applications that require a microprocessor-based software development system or as a design aid for developing special interfaces.

An accessory containing a VDU interface, BASIC interpreter, RS232 output and more RAM will be available later this year to extend the trainer.

The trainer measures 310 x 298 x 89mm and is available in kit form or ready-built.

Order As HK18U (Trainer ET3400 Kit) Price £189.95
HK19V (Trainer ETW3400 Built) Price £329.95



Advanced Microprocessor Course Introduces The 6809

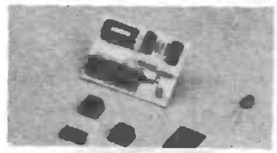
This course covers 6809 programming and interfacing completely. The text is split into seven units. Unit 1 teaches fundamental 6809 concepts and chip structure. 6809 addressing modes are discussed in unit 2 and unit 3 covers registers and data movement instructions, while artithmetic, logic and test instructions for 6809 are taught in unit 4.

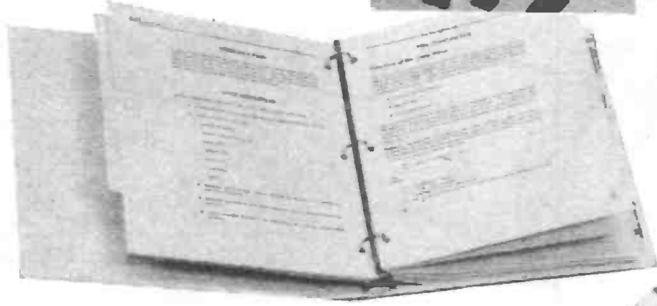
Unit 5 covers branch and miscellaneous instructions, unit 6 covers I/O and interfacing and applications for the 6809 is the subject of unit 7. The 6809 has a flexible instruction set with over 1,400 different commands available.

The course includes a special adaptor module that converts the ET3400 trainer into a 6809-based microprocessor trainer. This assembled module includes a handy debugging routine contained in the 2K ROM monitor program.

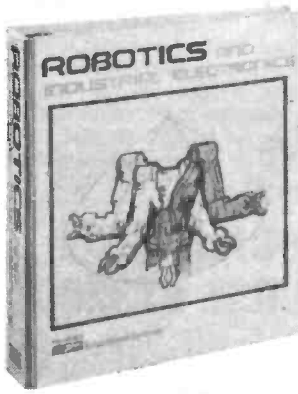
Ten optional programming exercises reinforce the concepts presented in the course, and the ET3400 trainer is required for these.

Order As HK17T (Advanced Micro Course) Price £99.95





Robot Technology Course



A 1,200 page self-instruction text with 11 sections covering robotics from fundamentals. Optional experiments give you hands-on experience with the HERO 1 teaching robot. Subject areas covered are:

1 Robot fundamentals
2 AC and fluidic power
3 DC power and positioning
4 Microprocessor fundamentals
5 Robot programming
6 Heathkit robot microprocessor
7 Data acquisition (sensors)
8 Data handling and conversion
9 Voice synthesis
10 Interfacing
11 Industrial robots at work

The programmed self-study materials guide the student, step-by-step, until important concepts are mastered. Self-test reviews at the end of each unit make sure you understand what you've studied, before moving on to the next unit.

Using HERO 1 lets you apply what you've just learned and you get the type of reinforcement that makes learning-by-doing one of the most effective education methods ever devised. The course is also fully functional without the robot.

You should have at least a basic knowledge of DC and AC electronics, digital techniques and basic microprocessors before starting the robotics course.

Order As HK21X (Robotics Course) Price £99.95

HEATHKIT FEATURE

Introducing HERO 1: The World's First Sophisticated Robot

HERO 1 is one of the most important microprocessor-controlled devices ever conceived. It is the perfect robotics training system for industry and schools.

HERO 1 is a completely self-contained electromechanical robot capable of interacting with its environment. It can see, hear, speak, detect moving and stationary objects and determine their distance, pick up small objects, move in any direction and can learn from your instructions!

Controlled by a programmable on-board computer, HERO 1's 6808 microprocessor can guide the robot through various complex manoeuvres, activate the robot's sensors and modify the robot's behaviour in response to inputs from its on-board sensors and real-time clock. The straightforward programming process allows step-by-step debugging and other corrections, as needed.

HERO 1 can be programmed in three different ways. Through the keyboard mounted on the robot's head, with its hand-held remote-control teaching pendant, or through its serial cassette port using a program previously stored on a conventional audio cassette tape recorder. The computer can store programs with over 1,000 individual steps.

Use HERO 1 to guard your home or office. It could automatically detect intruders in its range and warn them away verbally. And HERO 1 can remain on guard for extended periods of time, using its power-conserving "sleep" mode.

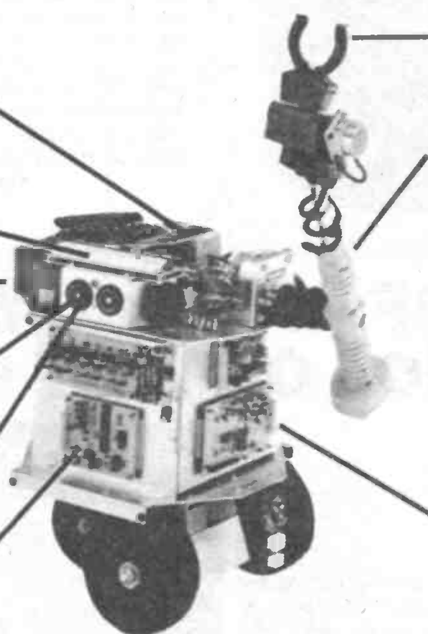
You can program HERO 1 to pick up small objects with its arm and gripper mechanism capable of seven axes of motion. The arm extends, retracts and turns, performing mechanical tasks with precision. The robot can also be programmed to speak complete sentences with its phoneme based speech synthesiser.

Expand HERO 1's capabilities to the limit of your skill and imagination with the on-board experimental breadboard. This board allows you to design circuits for interfacing with the robot's computer.

When HERO 1 tells you that its batteries need charging, simply plug in the external battery charger. HERO 1 can continue to be used while its batteries are charging.

Use HERO 1 with the robotics course described on page 18. You'll quickly get a hands-on grasp of industrial electronics, mechanics, computer theory and programming as applied to robots by putting them into action.

Exceptional capabilities!



Convenient Control Panel: Control HERO 1 from the keyboard on his head. You can also use the remote teaching pendant, or a program written on cassette tape.

Experimenting Circuit Board included: HERO 1's breadboarding area provides direct access to an I/O port, user-defined interrupt, CPU control lines and power.

HERO 1 can see: The robot's light sensor beam can detect ambient light over the entire visible spectrum, with excellent resolution - down to one part in 256.

HERO 1 can hear: The robot's omnidirectional sound sensor can hear ambient sound from 200 to 5,000 Hz, with the same one-part-in 256 resolution.

Detects still and moving objects: HERO 1's ultrasonic sensors can "see" movement up to 15 feet away, and can determine the range of an object up to eight feet away.

HERO 1 can talk: With the Phoneme Speech Synthesizer, the robot can simulate human speech - with four levels of inflection.

Highly manoeuvrable: HERO 1's three-wheel drive system, with one wheel both driving and steering, allows the robot to move any where - and to turn in a 12-inch radius.

HERO 1's Hand grips small objects: The gripper can hold up to a pound when fully retracted and horizontal - pivots up to 350 degrees.

Arm: Rotates up to 250 degrees, pivots wrist up to 180 degrees, extends or retracts gripper over a five-inch track.

"Learn" mode lets you teach HERO 1: Just switch to "Learn" mode and take the robot through your task. It remembers - and repeats the steps at your command.

"Sleep" mode conserves power: This makes HERO 1 ideal for home and plant security duty - when it sees intruders, it "wakes up," and warns them away verbally.

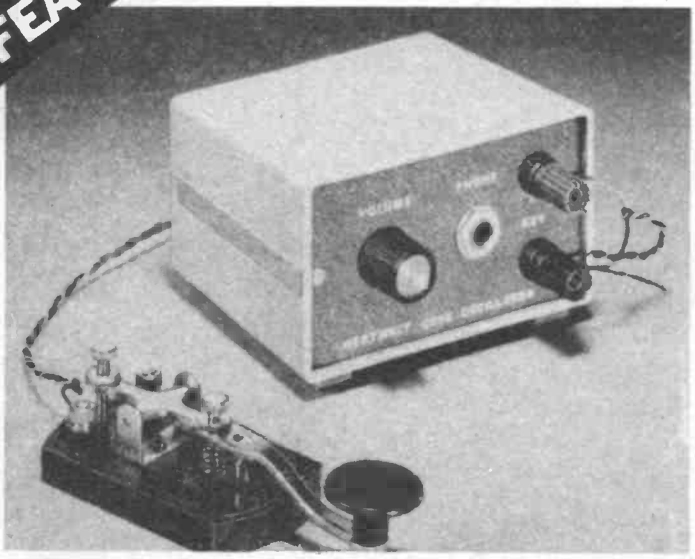
Self-contained rechargeable batteries: Two separate power systems - one for the logic circuits and a second for the drive system. External recharger included.

World-famous Heathkit manual: Easy-to-follow instructions from the world's largest builder of electronics kits guide you through each kitbuilding step.

Order As HK20W (Hero 1 Robot Kit) Price £1,599.95

HEATHKIT FEATURE

HEATHKIT'S SUPERB RADIO ACCESSORY KITS



Morse Code Practice Oscillator

Use this practice oscillator to learn morse code and pass the RAE for the HF bands. Most components mount on a single circuit board for easy assembly. The unit operates from a PP3 9V battery (not supplied) and is complete with a telegraph key with adjustable rebound. There is a built-in speaker, volume and tone controls and a headphone jack for private listening.

The manual includes sections on operation, application and learning the code. Once you get your licence, use the kit as a sidetone oscillator for any transmitter using negative grid-block keying. The two-tone emerald/grey cabinet measures 111 x 105 x 67mm.

Order As HK22Y (Morse Code Kit) Price £24.95

SOLID-STATE DIP METER

One of the best solid-state dip meters around, this kit features a MOSFET paraphase amplifier and hot-carrier diodes for more sensitivity and a better dip. The Colpitts oscillator cover 1.6 to 250MHz in fundamentals and uses a Q multiplier for greater detector sensitivity and a responsive 150uA meter movement for positive resonance indications.

The meter operates from a 9V battery (not supplied) and is completely portable. A moulded grey carrying case protects the rugged aluminium meter and the seven colour-coded, pre-adjusted, plug-in coils. The assembly manual has a detailed section on operation.

Order As HK23A (Dip Meter Kit) Price £79.95

Cantenna 1kW RF Dummy Load

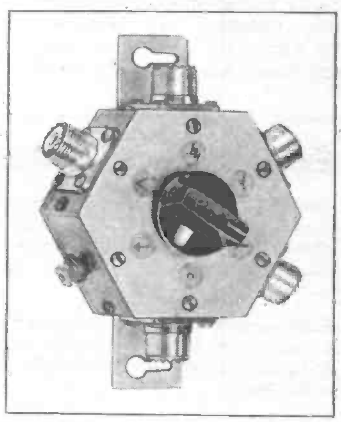
This improved dummy load now handles 1kW RF energy (2kW PEP) with VSWR's less than 1.5:1 up to 450MHz. Cool, stable element works to eliminate unnecessary QRM during tune-up, maintenance or alignment. Holds one gallon of transformer oil (not supplied). For the smart operator - the finest 50 ohm impedance you can buy. Save your finals!

Order As HK24B (Cantenna HN31A) Price £29.95

Antenna Coax Switch

Designed to switch one RF source to any one of four antennas or RF loads while grounding the unused outputs. Standing wave ratio to 250MHz is 1.1:1 max. Power capability is 1kW (2kW PEP). A bracket is provided for mounting on equipment cabinets, desk or wall.

Order As HK25C (Co-ax Switch Kit) Price £24.95



A SELECTION OF KITS FROM HEATHKITS SUPREME RANGE OF TEST GEAR

RF Oscillator For Radio/TV Alignment

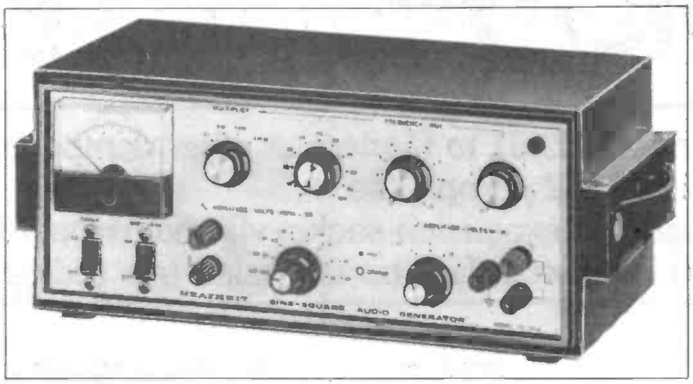
This unit which includes probes is suitable for use in alignment of tuned stages in AM, FM and TV receivers. Output is divided into five bands, from 310kHz to 110MHz and features an extra 100 to 220MHz band of calibrated harmonics. An added feature is the 1kHz audio output at 2V rms.

This signal available at a front panel jack is ideal for tracing and isolation of circuit defects in receiver audio stages and also serves as a source of internal AM modulation. Test leads are included. Requires two PP3 batteries (not supplied). Size: 279 x 197 x 146mm.

Order As HK26D (RF Oscillator Kit) Price £54.95

HEATHKIT FEATURE

Low-Distortion, Sine-Square Wave Audio Generator



This superb instrument is ideal for gain and frequency response measurements in audio amplifiers, as a signal source for harmonic distortion measurements or as an external modulator for RF signal generators. A meter calibrated in both volts and dB, monitors the sine wave output.

Specifications:
Sine wave output
Frequency range: 1Hz to 100kHz
Output voltage: 8 ranges - 3mV to 10V rms (up to 1V there is 600 internal load).
dB ranges: -62dB to +22dB
-12dB to +2dB on meter
-50dB to +20dB in eight 10dB switch positions
+2dB max into 600 load
Output variation: ±1dB from 10Hz to 100kHz
Output indication: Two voltage scales and one dB scale on front panel meter
Ouput impedance:
10V range: 0-1000Ω
3V range: 800-1000Ω
1V range and lower: 600Ω
Meter accuracy: ±10% full scale
Distortion: Less than 0.1% from 10Hz to 20kHz
Square wave output
Frequency range- 5Hz to 100kHz
Output voltage ranges: 0.1V, 1V 10V peak-to-peak into 2000Ω or greater
Output impedance: 52Ω on 0.1V and 1V ranges
Up to 220Ω on 10V range
Rise time: Less than 50ns
General
Frequency selection: First two significant figures on 0 to 100 and 0 to 10 switches each in ten steps. Third figure on 0 to 1 control. Multiplier switch x1, x10, x100, x1000.
Frequency error: Within ±5% of first and second digit.
Power requirements: 240V AC, 50Hz, 6W
Dimensions: 337 x 178 x 130mm

Order As HK27E (Sin-Square Gen Kit) Price £145.95

Hand-Held Digital Capacitance Meter

This compact hand-held meter will measure capacitance on its easy-to-read LCD display from 0.1pF to 199,900uF. The auto-range feature automatically selects the correct range of measurement from a choice of ten ranges. Four separate LED's indicate the correct unit of measure i.e. pF, nF, uF or mF.

The built-in polarised "Kelvin" terminals allow for direct measurement and a remote extension lead allows capacitors to be measured in situ. A zero offset control equalises the display level to compensate for stray capacitance within the meter.

Protection from excessive current is provided by clamp diodes and a 0.25A fuse when the instrument is turned on and by a 2.2 ohm, 2W resistor across the input when the instrument is off.

The meter can test capacitors with a low operating voltage; it can detect leaky capacitors and it can measure electrolytic capacitors as a low bias voltage is superimposed on the test voltage.

Specifications
Ranges: 199.9pF, 1999pF, 19.99nF, 199.9nF, 1.999uF, 19.99uF, 199.9uF, 1999uF, 19.99mF, 1999.9mF.
Accuracy: With standards supplied:
Ranges up to 199.9nF ±(0.5% of reading +1 count +0.5pF)
Ranges over 199.9nF ±(5% of reading +1 count)
With laboratory standard:
Ranges up to 199.9nF ±(0.2% of reading +1 count +0.5pF)
Ranges over 199.9nF ±(5% of reading +1 count)
(Over temperature range 19 to 25°C).
Display rate: Up to 1999uF: less than 1.5 seconds
Over 1999uF : less than 10 seconds
Operating temperature: 0 to 40°C
Battery: 9V PP3 (not supplied)
Battery indicator: Displays "LO BAT" when voltage drops to 5V.
Test voltage: 2V DC max. 0.6V to 1.4V DC typical.
Dimensions: 191 x 83 51mm.
Weight: 450G including battery.

Order As HK28F (Cap Meter Kit) Price £139.95

More Heathkit items will become available from Maplin. Watch this magazine for details.

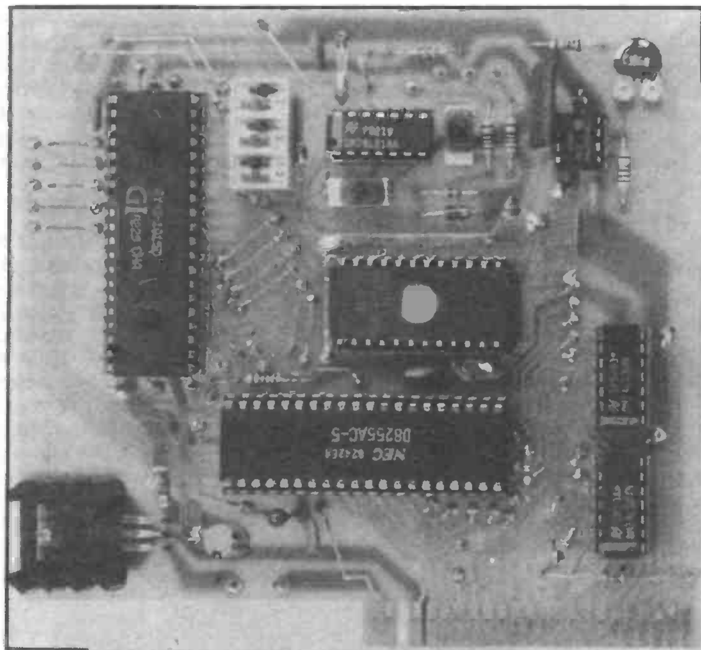
ZX81/MODEM INTERFACE

ZX81/MODEM INTERFACE

ZX81/MODEM INTERFACE

★ **Connects ZX81 to Modem or other computers**
★ **TTL/RS232 compatible**
★ **Plugs into expansion socket via motherboard**
★ **300 Baud standard transmission rate (adjustable)**

by Dave Goodman



The immense popularity of our Modem project has prompted us to develop a series of connecting interfaces for most of the popular home microcomputers. This will enable two-way communication, either direct to other computers or via telephone links to systems such as the Maplin on line computer.

The ZX81/Modem interface utilises an EPROM code translator for converting ASCII coded signals to ZX code and vice versa, as the ZX81 is not ASCII coded.

Included in the article is a machine code program for running our interface with the ZX81. Perhaps the thought of machine code programming is anathema to many Sinclair BASIC users, but don't be put off. All that you need to do is type in the codes given, store the program on tape for future use, and RUN. If you so wish, the program can be used as a basis for further development by the more experienced programmer.

Circuit Description

REG 1 is fitted so that the power supply can be taken from the unregulated side of the computer PSU (+9V). This saves undue loading on the internal regulator of the ZX81, and, if link 1 is not used, any external supply of +8V to +30V may be connected to P2 instead.

Serial data transmissions enter the UART (IC6) via level change triggers from pin 3 and 6 (0V). All signals are TTL level, and may be connected direct or inverted by S7 to suit the system. IC7 is a 4.8kHz astable multivibrator, and supplies the UART, which needs a clock frequency of sixteen times the required Baud rate. Dividing 4800Hz by sixteen will give the standard Baud rate of 300.

Receive Mode

The I/O port IC3 has three ports designated A, B, and C. For the computer to access these ports it is necessary to make room in the memory map, so that IC1 and IC2 decode address lines A3 to A15 for addresses 8312 to 8315, which appear in the 'ghost' ROM area in the ZX81. D1 deselects the internal ROM area for use by the interface. IC3 is an 8255, which has quite a comprehensive operating instruction set, but for our application all that is necessary is to set Port A to output mode, Port B to input mode, Port C upper (pins 10 and 11) to input mode, and Port C lower (pins 14 to 17) to output mode.

To do this a control code must be placed on the computer DØ to D7 data lines at address 8315, and the control code to set the mode is 138. Of course, setting the control code must be done immediately at the beginning of programs used to control the port, and would be something like POKE 8315, 138.

Port C, address 8314, is set next to disable the EPROM output (OE HIGH-IC4), and prevent IC6 from transmitting data DS HIGH and setting RDE low. This allows data from IC6 to be placed into Port B (address 8313). The DAV (data available) output goes high when serial data enters IC6, and this acts as a FLAG to tell the computer that information is ready to be read from Port B.

Unfortunately, the ZX81 code system is not compatible with ASCII, so received CHR$ will need to be translated. Port B is read and this data is placed into Port A (address 8312) and EPROM IC4, where it is translated and

ZX81/MODEM INTERFACE
ZX81/MODEM INTERFACE

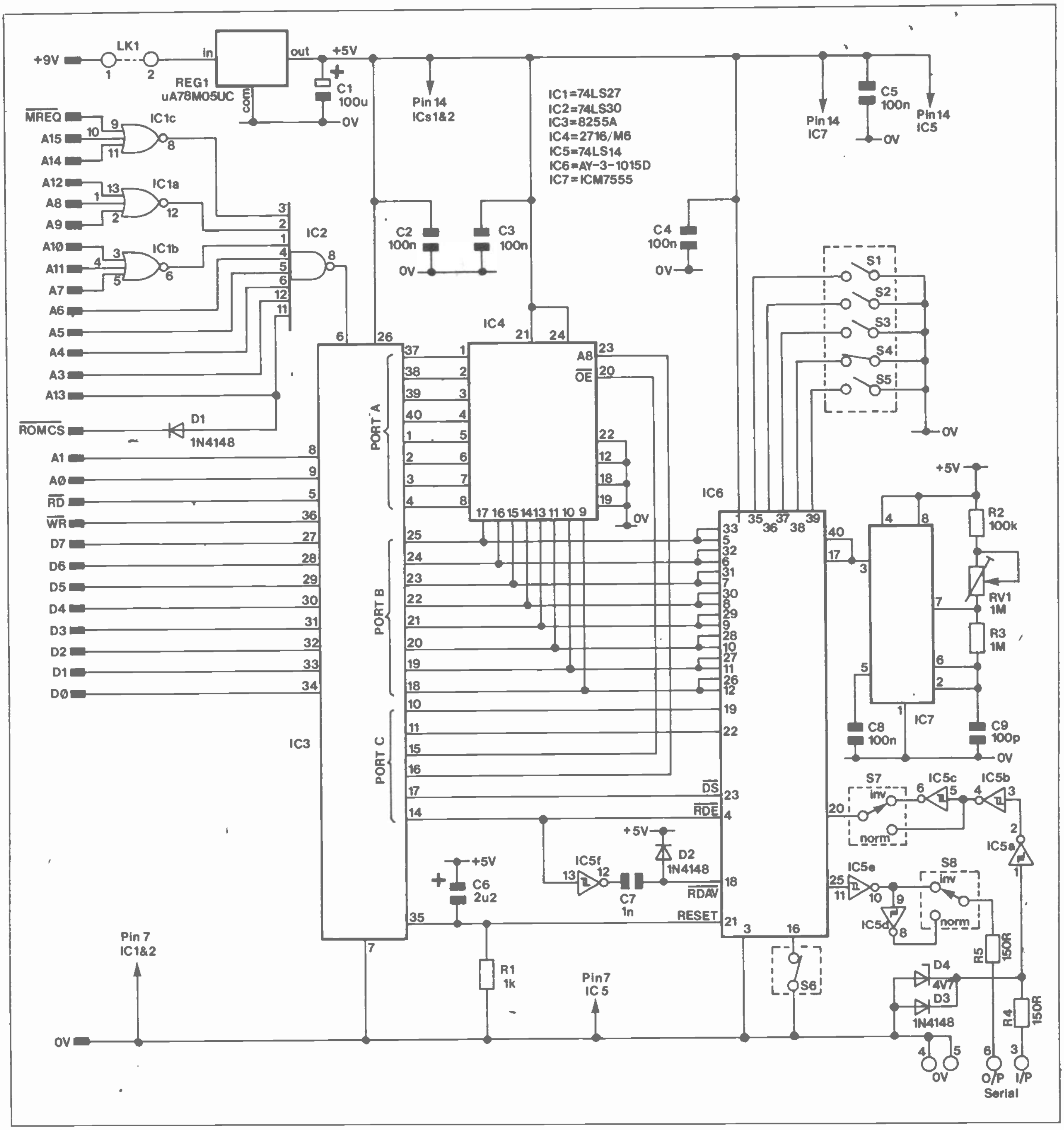


Figure 1. Circuit diagram.

placed into Port B again. Reading Port B will produce the required character for printing to the screen display. Using an EPROM for code translation makes programming much simpler and reduces memory requirements, although IC4 could be omitted and data read from Port B direct. This arrangement would be used when communicating with another ZX81.

Transmit Mode

Port C is used to reset the DAV output via IC5. Disable the receive data lines P5 to P12 by taking RDE high, hold IC4-A8 high (this address line must be high for Tx codes and low for Rx codes) and enable IC4 output by taking OE low. ZX codes for transmitting are then placed into Port A and IC4, and hence to the UART. DS (transmit data strobe) is taken low, to latch data from pins 26 to 33 into IC6, then DS is taken high to transmit data in serial form via IC5, S8, to pins 6 and 4 (0V).

Switches S1 to S6 set various status bits, character length and parity as shown in Tables 1a and b. Switches S7 and S8 allow the user to select either normal or inverted signals for receive or transmit, depending on the system connected. R1 and C6 reset both UART and I/O port when first switched on, and D2 and C7 apply a fast negative pulse for resetting DAV output.

Switch	Closed	Open
1	parity	no parity
2	one stop bit	two stop bits
5	odd parity	even parity

Table 1a.

Bits per character	Switch 3	Switch 4
5	closed	closed
6	closed	open
7	open	closed
8	open	open

Table 1b.

A standard switch setting would be switches 1, 2, 3, and 5 open and switches 4 and 6 closed. This gives 7 bits per character, 2 stop bits and no parity. S6 would normally be left closed, as this places all status bits onto the output lines.

Address	Description	Function
8315	Control address	Data 138 — set mode
8314	Port C	Lower output — Upper input
8313	Port B	Input only
8312	Port A	Output only

Table 2. All Port addresses and their functions.

Construction

Start construction by fitting all 83 track pins. They are inserted through the holes in the PCB marked with a circle. Press them home and apply solder to both sides of the board. Next fit the five resistors and four diodes. Around one end of the diode body is a black band, and this should be lined up with the white bar on the PCB legend.

Now place all seven IC sockets in position. ICs 3 and 6 use 40-pin sockets, IC4 uses a 24-pin socket, ICs 1, 2, and 5 use 14-pin sockets, and IC7 uses an 8-pin socket. Solder these into place to prevent them falling out whilst you are completing the assembly.

Insert the DIL switches S1 to S6. They are of dual construction, and have two switches per package. Each switch is operated by moving one of the plastic arrows on the top, the numbers 1 and 2 being the 'on' position. The arrow crossbar is shown on the PCB legend to assist with correct orientation. Switches S7 and 8 are of a different construction, being the changeover type of switch, and these have a large plastic cap on top with three small arrows. Again, the legend will assist you in locating these components.

Insert the disc and plate ceramic capacitors. C9 is a silver mica type, and, being much larger than the others is easily recognised. When fitting C1 and 6 ensure correct polarity. Preset RV1 can now be fitted, as can the six veropins. Finally, insert a ½in 6BA bolt through the PCB, from the track side, and place a vaned heatsink in position over it. Mount REG 1 onto the heatsink, ensuring that the bolt goes through the mounting tab on the regulator body. No mounting kit or silicon compound is necessary here. Use a 6BA washer and nut to clamp REG 1 to the heatsink and PCB. All three leads can now be bent and inserted through the board for soldering. Solder all components carefully in place, cut off the excess leads and inspect for bad joints and short circuits.

Scrubbing excess flux from the track, using thinners and a stiff brush, will make inspection easier and often remove solder blobs and whiskers otherwise overlooked.

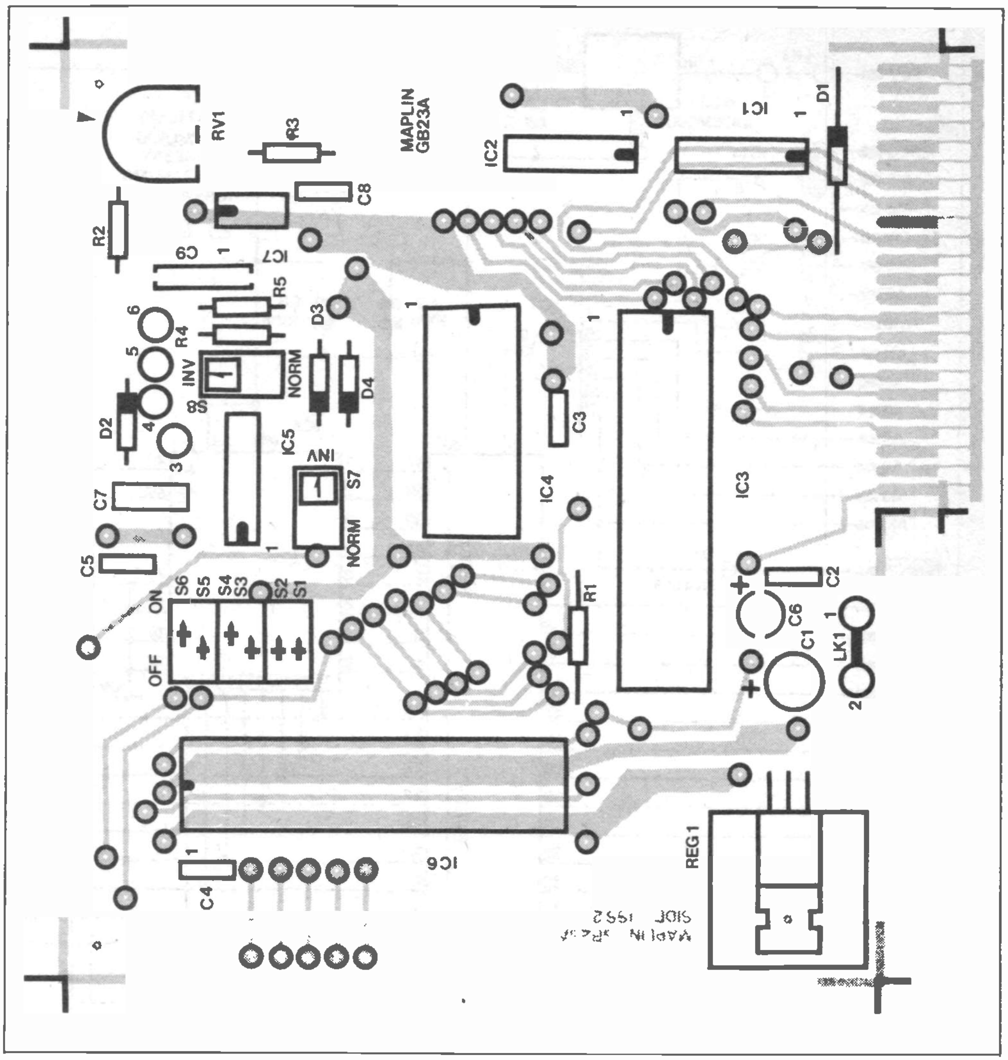


Figure 2. PCB legend and artwork.

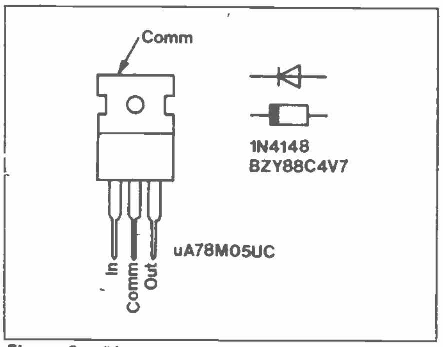


Figure 3. Pinouts.

Testing

Do not insert any ICs at this stage. Solder a connecting wire between pins 1 and 2, set RV1 wiper with its centre pointing to the arrow legend on the PCB. Set S4 to 'on', that is with the brown arrow at 1, and also set S6 to 'on'. Switches 1, 2, 3, and 5 are set to the 'off'

```
1 PRINT TAB 6; "RECEIVE CODES"
2 LET T = 0
3 LET H$ = "0123456789ABCDEF"
4 POKE 8315, 138
5 POKE 8314, 9
10 FOR I = 0 TO 255
15 PRINT AT 9,5; "ADDRESS   DEC   HEX"
20 POKE 8312, I
25 LET P = PEEK 8313
30 PRINT TAB 7; I+T; TAB 14; P; "    "; TAB 19;
35 PRINT H$(1+INT(P/16));H$(1+P-(16*INT(P/16)))
40 NEXT I
45 IF T = 256 THEN STOP
50 CLS
55 PRINT TAB 6; "TRANSMIT CODES"
60 LET T = 256
65 POKE 8314, 13
70 GOTO 10
```

Program 1.

```
5 REM TEST PROGRAM 2.
10 LET CW=8315
15 LET C=8314
20 LET B=8313
25 LET A=8312
30 POKE CW, 138
35 POKE C, 15
40 IF INKEY$<>"" THEN GOTO 40
45 IF INKEY$= "" THEN GOTO 45
50 LET W$=INKEY$
55 POKE A, (CODE W$)
60 POKE C, 13
65 POKE C, 5
70 POKE C, 15
75 IF PEEK C<128 THEN GOTO 75
80 POKE C, 14
85 POKE A, (PEEK B)
90 POKE C, 8
95 PRINT CHR$(PEEK B))
100 GOTO 40
```

Program 2.

ZX81 MODEM INTERFACE PARTS LIST

Resistors — All 0.4W 1% Metal Film.

R1	1k		(M1K)
R2	100k		(M100K)
R3	1M		(M1M)
R4,5	150R	2 off	(M150R)
RV1	1M Hor-sub min Preset		(WR64U)
Capacitors			
C1	100uF 10V PC Electrolytic		(FF10L)
C2-5 inc. 8	100nF Minidisc	5 off	(YR75S)
C6	2u2F Tantalum		(WW62S)
C7	1nF Ceramic		(WX68Y)
C9	100pF Silvered Mica		(WX13P)
Semiconductors			
D1,2,3	1N4148	3 off	(QL80B)
D4	BZY88C4V7		(QH06G)
REG 1	uA78M05UC		(QL28F)
IC1	74LS27		(YF18U)
IC2	74LS30		(YF20W)
IC3	8255A		(YH50E)
IC4	2716/M6		(QY52G)
IC5	74LS14		(YF12N)
IC6	AY-3-1015D		(WQ18U)
IC7	ICM7555		(YH63T)
Miscellaneous			
S1-6 inc.	DIL Switch SPST Dual	3 off	(XX26D)
S7,8	DIL Switch SPDT Single	2 off	(XX28F)
	8-Pin DIL Skt		(BL17T)
	14-Pin DIL Skt	3 off	(BL18U)
	24-Pin DIL Skt		(BL20W)
	40-Pin DIL Skt	2 off	(HQ38R)
	Vaned Heatsink		(FL58N)
	Bolt 6BA x ½"	1 Pkt	(BF06G)
	Nut 6BA	1 Pkt	(BF18U)
	Veropin 2141	1 Pkt	(FL21X)
	Track Pin	2 Pkts	(FL82D)
	PCB		(GB23A)

A complete kit of all parts is available for this project.
Order As LK08J (ZX81/Modem Interface). Price £24.95.

position, and switches 7 and 8 to 'INV'. With no power attached, plug the interface PCB into your ZX81 or Extendiboard, and switch on. Use a voltmeter connected to 0V (pin 4/5), and check for +5V on the output pin (right-hand side) of REG 1. Switch off, insert ICs and re-apply power. You should be rewarded with a cursor on the screen, as normal. If a frequency counter or oscilloscope is available, check for a 4.8kHz signal on pins 17 and 40 of IC6, and adjust RV1 to suit. When testing programs, note that on a 1K only machine the interface will still function, although you will not be able to run the machine code program and have a full screen display.

Now enter and run test program 1. This will test all port locations, along with the EPROM addresses 0 to 511. The display data, printed in decimal and hexadecimal, shows ASCII and ZX81 CHR$ codes stored in IC4.

After typing the program enter RUN/NEWLINE. The program will stop after printing EPROM address 511; with an error 9 at line 45, which is all right. If, however, your test program fails before this make sure that you have entered all eighteen lines correctly. If you still have problems the Port may be faulty, in which case you will need to POKE data into Port A and PEEK Port B to get an indication of the failure.

Next, enter and run program 2. Connect pins 3 and 6 together on the module, and press any key. Data will be transmitted and received, then printed on the TV display, proving that the module is functioning correctly. The display is limited to around 400CHR$ in 1KB.

Using the Interface

As mentioned previously, the program and working system require a minimum of 1050 bytes of memory, which means that to display a full screen of data a RAM extension is required. You could, however, write a simple receive only routine, for testing your interface with modem systems, but BASIC is too slow for this application, so machine code programs become necessary. Program 3, entered into a REM statement, will allow two-way communication with the Maplin on-line computer, and also several other commercial data links. The TV display will be blank until data is received, whereupon the bottom line will fill with characters and scroll when full.

Carriage return codes will scroll the display while line feed codes are trapped and not used. Once you have established a data link, transmission can be direct from the keyboard — no transmit or receive mode control codes are required here. Provided that systems connected to the interface have echo facilities, you may print to the screen via the transmission path, not directly from the keyboard. Many shift characters are valid, but some of them will be decoded as question marks, along with all the unused EPROM address codes.

Function and Graphics modes are not used, and should generate either shifted or direct key characters. Facilities do not exist for deleting characters or for clearing the screen. The BREAK key returns a space and NEWLINE gives carriage return when typing program 3.

Once the last character has been entered the program will stop running. Return to SLOW mode and press NEWLINE. You will see line 20 full of characters and symbols. Parts of the line will be blank due to code 118 being entered, but this is all right. Now check the data by changing line 40 to PRINT I, and line 50 to PRINT PEEK I. Now RUN 30 and a check list giving each address and the number stored there will fill the screen. To continue press CONT-NEWLINE.

When you are happy with your efforts RUBOUT lines 30 to 60 and type in line 30 LETA=USR 16524. The function USR is below key L, and 16524 is the starting address of the machine code program. You would be well advised at this stage to save 'MI' on cassette a few times. 'MI' is short for Modem Interface, although obviously any recognition code could be used. If line 10 REM statement length is increased, the starting address 16524 will also be increased, so you must calculate this when changing the program name, or all will be lost!

To operate the system, hook up the modem, or whatever you are trying to communicate with, to pins 3 (serial input), 4 (0V), and 6 (serial output), and load the program. Type RUN-NEWLINE and make the communicating link. You may now receive or transmit data as required.

```
10 REM "MI"
20 REM (Type in 110 full stops)
30 FOR I = 16524 TO 16632
40 INPUT A
50 POKE I,A
60 NEXT I


Go into FAST mode, press RUN then NEWLINE
and enter the following Decimal codes.
(Enter each code then NEWLINE.)
Each code is a number between 0 & 255 inc.

62 138 50 123 32 205 14 12 14 0 33 122 32
54 11 54 10 126 230 128 40 28 58 121 32 254
10 40 237 50 120 32 54 9 58 121 32 254 118
40 220 215 62 32 12 185 40 213 24 216 229
197 237 75 37 64 33 255 255 167 237 66 40
40 17 0 1 167 237 82 40 32 205 189 7 126 237
75 37 64 33 255 255 191 237 66 32 244 50 120
32 33 122 32 203 118 40 252 54 13 54 5 54 10
193 225 191 24 164
```

Program 3.

CASHTEL — THE NEW WAY OF SHOPPING

Maplin's brand new Computer Aided SHopping by TELephone service (CASHTEL) opens on June 1st. After this date, the message currently available on 0702 552941 will be replaced by a real time computer order system.

After accessing the system you will be able to enter stock codes and check the current price and whether we have sufficient stock to meet your requirements. If you wish, you may then place an order. You will only be able to do this if you have already bought from us by mail order and have been allocated a Customer Number. Alternatively, please send or phone your name and address to us and we will allocate a number for you. A credit card is also necessary.

You will then be asked to enter your Customer Number and name and address. You must enter them exactly as they appear on the label on the order form returned to you. If what you enter matches what is on file, you will then be able to enter your order.

Type in the stock code and quantity of all the items you want. When this is completed, you will be asked for your credit card number (Access, American Express, Barclaycard or Mapcard). Note that goods will only be sent to the cardholders address as advised by the credit card company.

You will then be told exactly how much you will be charged and if you accept, when you hang up the order you have placed will be passed to the printer in our warehouse. A few minutes later your order will be collected, packed and despatched.

Any European standard (CCITT) 300 baud modem will be able to communicate with our computer. Our computer is a Digital Equipment (DEC) PDP11/70 with 2Mbytes of MOS memory and 200Mbytes of on-line disk memory. Although you will not notice (our computer's response will appear instantaneously), there will be around 36 other interactive users accessing the system at the same time you are.

If the main computer is not available, you will receive a message showing the times when Cashtel is operating. If you continually receive busy tone or have any operational problems, please telephone 0702 554155 and ask for the DP manager. If he is not available, please leave a message with the switchboard operator. This will help us to monitor the service and provide more lines if necessary.

Try our Cashtel service today - it's tomorrow's way of shopping!

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2. (1) Games for the Atari by S. Roberts (WA47B) (cat. P62)
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6. (6) Projects for the Car and Garage by Graham Bishop (XW31J) (cat. P30)
7. (12) VIC Programmers Reference Guide (WA33L) (cat. P63)
8. (-) The 6809 Companion by M. James (WG88V) (cat. P55)
9. (9) The BBC Micro - An Expert Guide by Mike James (WK04E) (cat. P63)
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20. (-) Practical Repair and Renovation of Colour TV's by Chas E. Miller (RH27E) (cat. P48)

These are our top twenty best-selling books based on mail-order and shop sales during November and December 1982 and January 1983. Our own publications and magazines are not included. We stock over 450 different books relating to electronics or computing, and the full range is shown on pages 29 to 65 of our 1983 catalogue. For prices see page 29 of this magazine.

NEW ITEMS IN THIS ISSUE

BK74R	P.C. Edgecon 2 × 12 Way	**Price £3.86**
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GB21X	CMOS Crystal Calibrator PCB	**Price £2.72**
GB22Y	Sweep Oscillator PCB	**Price £3.25**
GB23A	ZX81 Modem Interface PCB	**Price £4.75**
GB24B	Enlarger Timer PCB	**Price £1.40**
GB28F	VIC20 RS232 Interface PCB	**Price £2.90**
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LK08J	ZX81 Modem Interface Kit	**Price £24.95**
LK10L	Crystal Calibrator Kit	**Price £15.95**
LK11M	VIC 20/RS232 Interface Kit	**Price £9.45**
QY52G	2716/M6	**Price £8.50**
QY53H	BF173	**Price £0.19**

MANCHESTER SHOP OPENS SOON

Our new Manchester superstore offering the full range of Maplin's electronic components, computers and software will be opening in mid-August 1983. Part of the new store will be a self-service area where you can browse around and choose the parts you want. Counter service will be available as well. Upstairs you will find our computer demonstration area with displays of hundreds and hundreds of different software packages for Atari, BBC, Commodore 64, Dragon, Microprofessor, Sord M5, Spectrum and VIC20.

You will find us at 8, Oxford Road opposite the BBC, between Piccadilly and UMIST. We're just a few steps from Manchester's Oxford Road station and about five minutes walk from the city centre. There is excellent parking on meters in the adjacent sideroads and we're about five minutes drive straight in from junction 10 on the M63 at the start of the M56. We'll have more details for you in our next issue.

CORRIGENDA

Vol. 1 No. 2 Burglar Alarm

The value of C8 on the Main PCB is now 68nF (WW39N).

Vol. 1 No. 4 Remote Controller for Amplifier

In Figure 2, Pin 14 of IC1 goes to S2/6/5 (Note PCB is correct).

Vol. 2. No. 5 Modem

D9 Function is "LOCK"
D10 Function is "Tx DATA"
D11 Function is "Rx DATA"
D12 Function is "ON LINE"

On cct dia. IC10a & IC10c should be swapped (IC10a drives TTL O/P).

In Setting Up instructions, the signal at TR2 emitter should be a stepped sinewave of 800mV (not TR1).

On some PCB's the "+" sign of C33 is shown incorrectly, the positive should go the outside of the board.

Vol. 2 No. 6 VIC20 Talkback

In Parts List, C8 should be 10,000pF not "nF".

ZX81 Talkback

In text on page 8, second paragraph in the centre column "with suitable programming IC6 will place DØ to D8 to.......etc", should read "DØ to D7".

First Base

In text on page 21, in last sentence of paragraph before "CONSTRUCTION" heading, "D5" should be "LED 1".

In Figure 10, on page 25, the value of D5 is "6V2".

In Figure 4, the arrows shown on D10 should be in the opposite direction.

COMING SHORTLY

I/O Ports for the Dragon 32 and Spectrum
TTL/RS232 Converter
1K RAM extension for the ZX81, which can be easily expanded up to 7K
Part 2 of the Telephone Exchange
VIC Extendiboard with an optional 3K RAM
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Synchime unit to go with Synclock, Synwave and Syntom
Minilab project Doorbell for the Deaf
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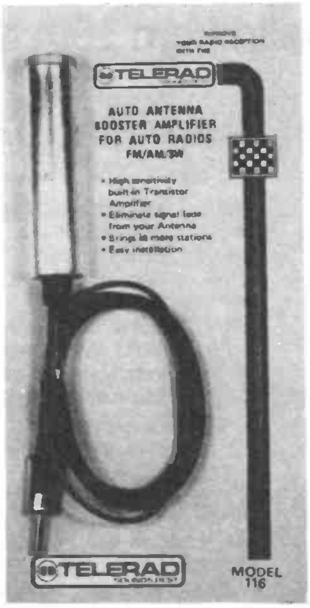
SPECIAL OFFERS

CAR AERIAL BOOSTER



A high gain car aerial booster amplifier covering the Long, Medium, Short and VHF wavebands. The unit simply plugs into your radio and the existing aerial lead, plugs into the amplifier. We have measured gains of 20dB at 90MHz, which should give largely noise-free reception on previously noisy FM stations and a big increase in signal strength on weak AM stations. The unit is only suitable for use with negative earth cars, and the red lead from the amplifier must be connected to +12V DC.

Specification:
Supply: +12V DC @ 10mA
Frequency range: 150 kHz to 106MHz
Body dimensions: 85mm long x 18mm dia.
Coax cable: 300mm long terminated in car aerial plug
Supply wire: 450mm long
Our usual price £6.95
Order As SP02C (Car Aerial Booster) Price £3.45
and get one for less than half price!

MULTIMETER 2050

This meter has 14 ranges, and features a 20,000 ohms per volt DC and 10,000 ohms per volt AC movement, making it more accurate on transistorised circuits. Overall size: 120 x 85 x 30mm

Ranges:	
DC Volts:	5, 25, 125, 500, 1000 at 20,000 ohms per volt.
AC Volts:	10, 50, 250, 1000 at 10,000 ohms per volt.
DC Current:	50uA, 250mA
Resistance:	0-6kΩ , 0 to 6MΩ (300Ω and 30kΩ at centre scale)
Decibels:	(switch at 10V AC)-20 to +22dB (ref: 0dB=1mW in 600Ω)

Supplied complete with detailed operating instructions, one red and one black test lead with probes and one battery replacement type HP7).
Our usual price £11.95
Order As SP03D (Multimeter 2050) Price £9.95
and save yourself £2.

LOW-COST DIGITAL MULTIMETER

This digital multimeter offers excellent value for money at our normal price, and with our special offer it is even better. The meter features automatic zero and polarity, full overload protection, 10MΩ input impedance, and low battery indication 'BT' on left side of display. It has a basic accuracy of 1%, and 13 ranges. The last three digits are blanked to indicate that the input is over range.

Overall size:	138 x 86 x 36mm
Weight:	300gms
Input Impedance:	10MΩ
Accuracy:	DC Volts: ±1% +1 digit
	AC Volts: ±2% +1 digit
	DC Current: ±1.5% +1 digit
	Resistance: ±1.5% +1 digit
Ranges:	
DC Volts:	2, 20, 200, 1000V
AC Volts:	200, 500V
DC Current:	2, 20, 200mA
Resistance:	2kΩ 20kΩ , 200kΩ 2MΩ

Supplied complete with operating instructions, one red and one black test lead with probes, carrying case, wrist strap, and battery (replacement type PP3).
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All prices shown in this price list are valid from 16th May 1983 to 13th August 1983
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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.

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 50p handling charge which must be paid on all orders having a total value of under £5.00.

The price list is intended for use with our 1983 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.

NYA	Not yet available
NA	Not available
DIS	Discontinued
TEMP	Temporarily out of stock
OOP	Out of print
FEB	Out of stock, new stock expected in month shown
†	While stocks last
NV	Indicates that item is zero rated for VAT purposes
★	See Amendments to Catalogue
$	Please add £6 carriage if your order contains one or more items marked thus

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity. Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.
Most items in the price list have a letter in brackets after the price which indicates the trade quantity as follows:

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(B)	Trade quantity	10
(C)	Trade quantity	25
(D)	Trade quantity	50
(E)	Trade quantity	100
(F)	Trade quantity	250
(G)	Trade quantity	500
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XF12N	Maplin Poster	DIS
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XQ24B	Mushkiller FM235T	DIS
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XQ30H	Trucolour TC10 Grp B	£10.62 (B)
XQ31J	TrucolourTC10 GrpC/D	£9.94 (B)
XG23A	Trucolour TC10 Grp E	£9.94 (B)
XQ32K	Trucolour TC13 Grp A	£11.85 (A)
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HF29G	6v Batt Box	22p (G)
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Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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XW89W	Book AG437	£3.85NV

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WA53H	Book BP110	£2.15NV
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RQ28F	Book BP48	£1.92NV
†WA34M	Book BP92	£1.75NV
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WA35Q	Book BP99	£1.95NV
WA36P	Book BP103	£1.95NV
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†RH29G	Book BP36	£1.50NV
RR19V	Book NB864	£6.16NV
RF08J	Book BP39	£1.90NV
RH30H	Book BP37	£1.92NV
RL05F	Book NB074	£5.99NV
XW17T	Book HD760	£7.64NV
RL36P	Book NB345	DIS
†RL41U	Book NB354	£4.10NV
RH25C	Book BP32	£1.95NV
WA37S	Book BP105	£1.95NV
XW52G	Book BP76	£2.05NV
WG72P	Book BP93	£2.10NV

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WG50E	Book NB500	£4.56NV
WG18U	Book HD748	£7.45NV
WG35Q	Book HD893	£7.36NV
WG94C	Book FT1349	£11.69NV
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RL30H	Book NB153	£6.82NV
WA50E	Book BP106	£2.15NV
LY04E	Book BP44	£2.10NV
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†RB23A	Book BP223	£1.45NV
†WA30H	Book BP97	£1.95NV
XW20W	Book BP65	£1.75NV
RL01B	Book NB058	£6.78NV
RH28F	Book BP35	OOP
WG29G	Book BP84	£2.15NV
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RR07H	Book NB216	£6.92NV
RL44X	Book BP58	£1.72NV
WA62S	Book NB769	£5.56NV
RL43W	Book BP56	£1.95NV
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RF20W	Book HD734	£6.80NV
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XW44X	Book BP71	£1.90NV
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XW10L	Book NB383	£4.54NV
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WG46A	Book BP90	£2.15NV
XW46A	Book MM513	£2.90NV
RL40T	Book NB338	£4.34NV

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†RH52G	Book BP220	£1.05NV
†RH22Y	Book BP29	£1.20NV
XW37S	Book BP69	£1.85NV
†XW11M	Book NB379	£4.10NV
†RH51F	Book BP219	£1.05NV
XW47B	Book MM396	£2.19NV
WG53H	Book NB529	£4.56NV
XW51F	Book BP75	£2.00NV
RH50E	Book BP218	DIS
XW07H	Book BP57	£2.15NV
RQ30H	Book NB353	£6.94NV
WG60Q	Book BP95	£2.15NV

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RQ80B	Book FT926	£6.60NV
WG00A	Book FT1021	£6.64NV
XW39N	Book BP73	£2.25NV
XW66W	Book BP79	£2.05NV
XW06G	Book FT1071	£8.20NV
RL46A	Book HD681	£10.99NV
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WA60Q	Book FT1076	£6.40NV
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RR00A	Book NB195	£10.20NV
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XR41U	Extra Flex Blue	20p (G)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.

Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

1983 Catalogue Page No.		VAT inclusive PRICE
XR43W	Extra Flex Green	20p (G)
XR44X	Extra Flex Red	20p (G)
XR45Y	Extra Flex Yellow	20p (G)
XR68Y	Min Extra Flex Black	15p (G)
XR69A	Min Extra Flex Red	15p (G)
XR22Y	EHT Wire	32p (G)
BL11M	Strappg Wire 16swg	82p (E)
BL12N	Strappg Wire 18swg	87p (E)
BL13P	Strappg Wire 20swg	95p (E)
BL14Q	Strappg Wire 22swg	94p (E)
BL15R	Strappg Wire 24swg	96p (E)
BL16S	EC Wire 14 swg	70p (E)
BL24B	EC Wire 16 swg	79p (E)
BL25C	EC Wire 18 swg	88p (E)
BL26D	EC Wire 20 swg	89p (E)
BL27E	EC Wire 22 swg	93p (E)
BL28F	EC Wire 24 swg	£1.05 (D)
BL29G	EC Wire 26 swg	£1.07 (D)
BL39N	EC Wire 28 swg	£1.07 (D)
BL40T	EC Wire 30 swg	£1.10 (D)
BL41U	EC Wire 32 swg	£1.12 (D)
BL42V	EC Wire 34 swg	£1.16 (D)
BL43W	EC Wire 36 swg	£1.25 (D)
BL44X	EC Wire 38 swg	£1.25 (D)
BL60Q	EC Wire 40 swg	£1.50 (D)
BL61R	EC Wire 42 swg	£1.68 (D)
BL62S	EC Wire 44 swg	£2.20 (C)
BL63T	EC Wire 48 swg	£5.34 (C)
XR39N	Zip Wire	14p (G)
XR60Q	HD Loudspeaker Cable	37p (G)
YG08J	Litz Speaker Leads	£6.84 (B)
XR06G	Ribbn Cable 10-Way	60p
XR07H	Ribbn Cable 20-Way	£1.20
XR67X	Ribbon Cable 30 Way	£1.80 (D)

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XR65V	IDC Cable 12-Way	£2.28
RK30H	Flexicable 7-way	54p (G)
RK31J	Flexicable 10-way	65p
XR47B	Twn Mains DS Black	28p (G)
XR00A	Twn Mains DS White	20p (G)
XR61R	Twin 6A Mains Orange	49p (E)
XR62S	Twin 6A Mains White	49p (E)
XR01B	Min Mains Black	35p (E)
XR02C	Min Mains White	36p (E)
XR03D	C6A Mains Black	56p (E)
XR04E	C6A Mains White	56p (E)
XR05F	C6A Mains Orange	70p (E)
XR09K	HD Mains Black	99p (E)
XR10L	HD Mains White	80p (E)
XR11M	HD Mains Orange	99p (E)
XR24B	Cotton Mains	94p (E)
BL71N	Stretchflex 1A	£1.05 (D)
BL72P	Stretchflex 6A	£4.95 (C)

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XR48C	4-Core Mains	£1.28 (E)
XR49D	1.0mm TE Cable	43p (E)
XR50C	1.5mm TE Cable	48p (E)
XR51F	2.5mm TE Cable	65p (E)
XR52G	6mm TE Cable	£1.75 (E)
XR53H	1mm Trpl & ECC Cbl	74p (E)
XR15R	Min Screened	17p (G)
XR12N	Cable Single Black	19p (G)
XR13P	Cable Single Grey	19p (G)
XR14Q	Cable Single White	19p (G)

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XR16S	Single Mic Cable	42p (G)
XR18U	Low Noise Scnd	42p (G)
XR19V	Low C Cable	55p (G)
XR63T	UR67 RF Cable	£2.20 (D)
XR08J	Twin Mic Cable	82p (E)
XR20W	Lapped Pair	21p (G)
XR21X	Cable Twin	29p (G)
XR23A	Cable Quad	38p (G)

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XR25C	Multi-Core 4-Way	60p (E)
XR26D	Multi-Core 6-Way	65p (E)
XR27E	Multi-Core 9-Way	86p (E)
XR28F	Multi-Core 15-Way	£1.25 (E)
XR46A	Multi-Core 25-Way	£1.74 (E)
XR54J	Multi-Core 36-Way	£2.31 (E)
XR66W	4-Wire Phone Cable	21p (G)
XR55K	7-Core Trailer Cable	£1.19 (E)
BH30H	Scr Strtchflx Blck	£1.80
BH31J	Scr Strtchflx Blue	£1.80 (D)
BH34M	Scr Stretchflex Red	£1.80 (D)
HQ49D	Twin Stretchflex	£2.40 (C)
XR30H	Standard Co-Ax	52p (G)
XR29G	Low Loss Co-Ax	50p (G)

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XR31J	Bal Feeder	19p (G)
YR19V	Marker A0	14p (G)
YR20W	Marker A1	14p (G)
YR21X	Marker A2	14p (G)
YR22Y	Marker A3	14p (G)
YR23A	Marker A4	14p (G)
YR24B	Marker A5	14p (G)
YR25C	Marker A6	14p (G)
YR26D	Marker A7	14p (G)
YR27E	Marker A8	14p (G)
YR28F	Marker A9	14p (G)
YR29G	Marker B0	14p (G)
YR30H	Marker B1	14p (G)
YR31J	Marker B2	14p (G)
YR32K	Marker B3	14p (G)
YR33L	Marker B4	14p (G)
YR34M	Marker B5	14p (G)
YR35Q	Marker B6	14p (G)
YR36P	Marker B7	14p (G)
YR37S	Marker B8	14p (G)
YR38R	Marker B9	14p (G)
YR39N	Marker C0	14p (G)
YR40T	Marker C1	14p (G)
YR41U	Marker C2	14p (G)
YR42V	Marker C3	14p (G)
YR43W	Marker C4	14p (G)
YR44X	Marker C5	14p (G)
YR45Y	Marker C6	14p (G)
YR46A	Marker C7	14p (G)
YR47B	Marker C8	14p (G)
YR48C	Marker C9	14p (G)
BF86T	Heat Shrink CP 16	55p (E)
BF87U	Heat Shrink CP 24	65p (E)
BF88V	Heat Shrink CP 32	30p (F)
BF89W	Heat Shrink CP 48	32p (F)
BF90X	Heat Shrink CP 64	34p (F)
YR17T	Heat Shrink CP95	50p (E)
YR18U	Heat Shrink CP127	£1.10 (E)
BL66W	Ht-Resist Sleeve Blk	12p (G)
BL69A	Ht-Resist Sleeve Grn	12p (G)
BL70M	Ht-Resist Sleeve Red	12p (G)
BH00A	Systoflex 1mm Black	6p (H)
BH01B	Systoflex 1mm Blue	6p (H)
BH02C	Systoflex 1mm Green	6p (H)
BH03D	Systoflex 1mm Red	6p (H)
BH04E	Systoflex 1mm White	8p (H)
BH05F	Systoflex 1mm Yellow	8p (H)
BH06G	Systoflex 2mm Black	9p (H)
BH07H	Systoflex 2mm Blue	9p (H)
BH08J	Systoflex 2mm Green	9p (H)
BH09K	Systoflex 2mm Red	9p (H)
BH10L	Systoflex 2mm White	11p (H)
BH11M	Systoflex 2mm Yellow	11p (H)
BH12N	Systoflex 4mm Black	15p (H)
BH13P	Systoflex 4mm Blue	15p (H)
BH14Q	Systoflex 4mm Green	15p (H)
BH15R	Systoflex 4mm Red	15p (H)
BH16S	Systoflex 4mm White	24p (H)
BH17T	Systoflex 4mm Yellow	24p (H)
BH42V	Systoflex 6mm Black	17p (H)
BH43W	Systoflex 10mm Black	24p (H)
BL65V	Lacing Cord	£1.10 (H)
BL57M	Spirawrap 1/8in.	18p (G)
BL58N	Spirawrap 1/4in.	21p (F)
BL59P	Spirawrap 1/2in.	46p (F)

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BF91Y	Tie-Wrap 92	2p (H)
BF92A	Tie-Wrap 140	3p (H)
BF93B	Tie-Wrap 186	4p (H)
BF94C	Cable Tie Base	19p (G)
RK59P	Re-Usable Cable Tie	2p (H)
BH26D	Safix 4	12p (G)
BH27E	Safix 8	13p (G)
BH28F	Safix 12	14p (G)
LR44X	Cable P Clip 3/16in	3p (H)
LR45Y	Cable P Clip 1/4in	3p (H)
LR46A	Cable P Clip 5/16in	3p (H)
LR01E	Cable P Clip 3/8in	3p (H)
BH18U	Hiatt Rd 2.3/4mm	25p (G)
BH39N	Hiatt Rd 3.1/2mm	36p (F)
BH19V	Hiatt Rd 3mm	29p (F)
BH20W	Hiatt Rd 4mm	29p (F)
BH21X	Hiatt Rd 5mm	29p (F)
BH22Y	Hiatt Rd 6mm	32p (F)
BH23A	Hiatt Rd 7mm	32p (F)
BH24B	Hiatt Rd 8mm	34p (F)
BH36P	Hiatt Rd 9mm	37p (F)
BH25C	Hiatt Flat 4mm	32p (G)
BH37S	Hiatt Flat 5mm	32p (F)
BH38R	Hiatt Flat 7mm	36p (F)
BH39N	Hiatt Flat 9mm	32p (F)
BH40T	Hiatt Flat 10mm	38p (F)
BH41U	Hiatt Flat 14mm	45p (F)

CAPACITORS

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WX35Q	Ceramic 1.8	8p (H)
WX36P	Ceramic 2.2	8p (H)
WX37S	Ceramic 2.7	8p (H)
WX38R	Ceramic 3.3	8p (H)
WX39N	Ceramic 3.9	8p (H)
WX40T	Ceramic 4.7	8p (H)
WX41U	Ceramic 5.6	8p (H)
WX42V	Ceramic 6.8	8p (H)
WX43W	Ceramic 8.2	8p (H)
WX44X	Ceramic 10	8p (H)
WX45Y	Ceramic 12	8p (H)
WX46A	Ceramic 15	8p (H)
WX47B	Ceramic 18	8p (H)
WX48C	Ceramic 22	8p (H)
WX49D	Ceramic 27	8p (H)
WX50E	Ceramic 33	8p (H)
WX51F	Ceramic 39	8p (H)
WX52G	Ceramic 47	8p (H)
WX53H	Ceramic 56	8p (H)
WX54J	Ceramic 68	8p (H)
WX55K	Ceramic 82	8p (H)
WX56L	Ceramic 100	8p (H)
WX57M	Ceramic 120	8p (H)
WX58N	Ceramic 150	8p (H)
WX59P	Ceramic 180	8p (H)
WX60Q	Ceramic 220	8p (H)
WX61R	Ceramic 270	8p (H)
WX62S	Ceramic 330	8p (H)
WX63T	Ceramic 390	8p (H)
WX64U	Ceramic 470	8p (H)
WX65V	Ceramic 560	8p (H)
WX66W	Ceramic 680	8p (H)
WX67X	Ceramic 820	8p (H)
WX68Y	Ceramic 1000	8p (H)
WX69A	Ceramic 1200	8p (H)
WX70M	Ceramic 1500	8p (H)
WX71N	Ceramic 1800	8p (H)
WX72P	Ceramic 2200	8p (H)
WX73Q	Ceramic 2700	8p (H)
WX74R	Ceramic 3300	8p (H)
WX75S	Ceramic 3900	8p (H)
WX76H	Ceramic 4700	8p (H)
WX77J	Ceramic 10,000	8p (H)
WX78K	Ceramic 22,000	8p (H)
YY24B	Monocap 0.001uF	28p (F)
YY25C	Monocap 0.0022uF	28p (F)
YY07H	Monocap 0.0047uF	28p (F)
YY08J	Monocap 0.01uF	28p (F)
YY09K	Monocap 0.022uF	34p (F)
YY10L	Monocap 0.047uF	36p (F)
YY11M	Monocap 0.1uF	43p (F)
YR73Q	Minidisc 0.01uF	5p (H)
YR74R	Minidisc 0.047uF	5p (H)
YR75S	Minidisc 0.1uF	7p (H)
YR76H	Minidisc 0.47uF	15p (G)
BX00A	Disc 0.01uF	10p (G)
BX01B	Disc 0.022uF	10p (G)
BX02C	Disc 0.047uF	12p (G)
BX03D	Disc 0.1uF	12p (G)

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BX05F	HV Disc 10	14p (G)
BX06G	HV Disc 47	19p (G)
BX07H	HV Disc 100	22p (G)
BX10L	HV Disc 470	11p (G)
BX12N	HV Disc 1000	11p (G)
BX13P	HV Disc 2200	11p (G)
BX14Q	HV Disc 4700	22p (G)
BX15R	HV Disc 10,000	19p (G)
HY18U	1000V Disc 4700pF	26p (F)
BX16S	Feed Thro Cap	8p (H)
WX02C	Mica 5pF	27p (F)
WX03D	Mica 10pF	27p (F)
WX05F	Mica 22pF	27p (F)
WX07H	Mica 33pF	28p (F)
WX09K	Mica 47pF	28p (F)
WX11M	Mica 68pF	28p (F)
WX12N	Mica 82pF	28p (F)
WX13P	Mica 100pF	28p (F)
WX14Q	Mica 120pF	28p (F)
WX15R	Mica 150pF	28p (F)
WX16S	Mica 180pF	28p (F)
WX17T	Mica 220pF	28p (F)
WX19V	Mica 330pF	49p (F)
WX21X	Mica 470pF	49p (F)
WX23A	Mica 680pF	51p (E)
WX25C	Mica 1000pF	56p (E)
WX31J	Mica 4700pF	£1.25 (D)
BX24B	Polystyrene 22	13p (G)
BX25C	Polystyrene 33	8p (H)
BX26D	Polystyrene 47	8p (H)
BX27E	Polystyrene 68	8p (H)
BX28F	Polystyrene 100	8p (H)
BX29G	Polystyrene 150	8p (H)
BX30H	Polystyrene 220	8p (H)
BX31J	Polystyrene 330	8p (H)
BX32K	Polystyrene 470	8p (H)
BX33L	Polystyrene 560	8p (H)
BX34M	Polystyrene 680	8p (H)
BX35Q	Polystyrene 1000	8p (H)
BX36P	Polystyrene 1500	8p (H)
BX37S	Polystyrene 2200	8p (H)
BX38R	Polystyrene 3300	8p (H)
BX39N	Polystyrene 4700	8p (H)
BX40T	Polystyrene 5600	10p (G)
BX41U	Polystyrene 6800	10p (G)
BX92A	Polystyrene 10,000	14p (G)
BX93B	Polystyrene 22,000	19p (G)
BX94C	Polystyrene 47,000	25p (F)
BX95D	Polystyrene 100,000	49p (F)

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BX46A	1% Polysty 100	27p (F)
BX47B	1% Polysty 150	27p (F)
BX49D	1% Polysty 220	27p (F)
BX50E	1% Polysty 270	29p (F)
BX51F	1% Polysty 330	29p (F)
BX52G	1% Polysty 390	29p (F)
BX53H	1% Polysty 470	29p (F)
BX54J	1% Polysty 560	29p (F)
BX55K	1% Polysty 750	29p (F)
BX56L	1% Polysty 1000	29p (F)
BX57M	1% Polysty 1200	29p (F)
BX58N	1% Polysty 1500	29p (F)
BX59P	1% Polysty 1800	29p (F)
BX60Q	1% Polysty 2200	29p (F)
BX61R	1% Polysty 2700	29p (F)
BX62S	1% Polysty 3300	29p (F)
BX63T	1% Polysty 3900	29p (F)
BX64U	1% Polysty 4700	37p (F)
BX65V	1% Polysty 5600	37p (F)
BX66W	1% Polysty 6800	37p (F)
BX85G	1% Polysty 8200	37p (F)
BX86T	1% Polysty 10,000	42p (F)
BX87U	1% Polysty 22,000	48p (F)
WW22Y	Carbonate 0.001	9p (H)
WW23A	Carbonate 0.0015	9p (H)
WW24B	Carbonate 0.0022	9p (H)
WW25C	Carbonate 0.0033	9p (H)
WW26D	Carbonate 0.0047	9p (H)
WW27E	Carbonate 0.0068	9p (H)
WW28F	Carbonate 0.0082	9p (H)
WW29G	Carbonate 0.01	9p (H)
WW30H	Carbonate 0.012	9p (H)
WW31J	Carbonate 0.015	9p (H)
WW32K	Carbonate 0.018	9p (H)
WW33L	Carbonate 0.022	9p (G)
WW34M	Carbonate 0.027	11p (G)
WW35Q	Carbonate 0.033	11p (G)
WW36P	Carbonate 0.039	11p (G)
WW37S	Carbonate 0.047	11p (G)
WW38R	Carbonate 0.056	11p (G)
WW39N	Carbonate 0.068	12p (G)
WW40T	Carbonate 0.082	DIS
WW41U	Carbonate 0.1	11p (G)
WW42V	Carbonate 0.12	13p (G)
WW43W	Carbonate 0.15	20p (G)
WW44X	Carbonate 0.18	20p (G)
WW45Y	Carbonate 0.22	20p (G)
WW46A	Carbonate 0.27	20p (G)
WW47B	Carbonate 0.33	22p (G)
WW48C	Carbonate 0.39	22p (G)
WW49D	Carbonate 0.47	25p (F)
WW50E	Carbonate 0.56	27p (F)
WW51F	Carbonate 0.68	27p (F)
WW52G	Carbonate 0.82	27p (F)
WW53H	Carbonate 1	27p (F)
BX70M	Polyester 0.01uF	8p (H)
BX71N	Polyester 0.015uF	9p (H)
BX72P	Polyester 0.022uF	9p (H)
BX73Q	Polyester 0.033uF	9p (H)
BX74R	Polyester 0.047uF	9p (H)
BX75S	Polyester 0.068uF	9p (H)
BX76H	Polyester 0.1uF	9p (H)
BX77J	Polyester 0.15uF	15p (G)
BX78K	Polyester 0.22uF	13p (G)
BX79L	Polyester 0.33uF	18p (G)
BX80B	Polyester 0.47uF	21p (G)
BX81C	Polyester 0.68uF	34p (F)
BX82D	Polyester 1uF	42p (F)
BX83E	Polyester 1.5uF	56p (E)
BX84F	Polyester 2.2uF	64p (E)

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WW15R	Mylar 0.001	5p (H)
WW16S	Mylar 0.0022	5p (H)
WW17T	Mylar 0.0047	5p (H)
WW18U	Mylar 0.01	5p (H)
WW19V	Mylar 0.022	6p (H)
WW20W	Mylar 0.047	8p (H)
WW21X	Mylar 0.1	10p (G)
WW83E	Mylar 0.22	16p (G)
FF53H	IS Cap 0.01uF	24p (G)
FF54J	IS Cap 0.022uF	25p (F)
FF55K	IS Cap 0.047uF	28p (F)
FF56L	IS Cap 0.1uF	45p (F)
FF57M	IS Cap 0.22uF	45p (F)
FF58N	IS Cap 0.47uF	78p (E)
YY29G	Minelect 0.1uF 50V	13p (G)
YY30H	Minelect 0.47uF 50V	13p (G)
YY31J	Minelect 1uF 50V	13p (G)
YY32K	Minelect 2.2uF 50V	15p (G)
YY33L	Minelect 4.7uF 35V	21p (G)
YY34M	Minelect 10uF 16V	13p (G)
*YY35Q	Minelect 10uF 40V	16p (G)
YY36P	Minelect 22uF 16V	18p (G)
YY37S	Minelect 47uF 16V	22p (G)
RK50E	Minelect 100uF 6.3V	22p (G)
WW54J	Tant 0.1uF 35V	13p (G)
WW55K	Tant 0.15uF 35V	13p (G)
WW56L	Tant 0.22uF 35V	16p (G)
WW57M	Tant 0.33uF 35V	18p (G)
WW58N	Tant 0.47uF 35V	17p (G)
WW59P	Tant 0.68uF 35V	17p (G)
WW60Q	Tant 1.0uF 35V	18p (G)
WW61R	Tant 1.5uF 35V	18p (G)
WW62S	Tant 2.2uF 35V	23p (G)
WW63T	Tant 3.3uF 35V	18p (G)
WW64U	Tant 4.7uF 16V	18p (G)
WW65V	Tant 4.7uF 35V	19p (G)
WW66W	Tant 6.8uF 16V	21p (G)
WW67X	Tant 6.8uF 35V	23p (G)
WW68Y	Tant 10uF 16V	25p (F)
WW69A	Tant 10uF 25V	28p (F)
WW70M	Tant 10uF 35V	36p (F)
WW72P	Tant 15uF 16V	39p (F)
WW73Q	Tant 22uF 25V	65p (E)
WW74R	Tant 33uF 10V	32p (F)
WW75S	Tant 47uF 10V	57p (E)
WW76H	Tant 47uF 16V	75p (E)
WW78K	Tant 100uF 3V	35p (F)
WW79L	Tant 100uF 10V	£1.25 (D)

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FF00A	PC Elect 0.47uF 100V	8p (G)
FF01B	PC Elect 1uF 100V	8p (G)
FF02C	PC Elect 2.2uF 63V	8p (G)
FF03D	PC Elect 4.7uF 63V	8p (G)
FF04E	PC Elect 10uF 35V	8p (G)
FF05F	PC Elect 10uF 63V	9p (G)
FF06G	PC Elect 22uF 16V	8p (G)
FF07H	PC Elect 22uF 63V	9p (G)
FF08J	PC Elect 47uF 25V	9p (G)
FF09K	PC Elect 47uF 63V	10p (G)
FF10L	PC Elect 100uF 10V	10p (G)
FF11M	PC Elect 100uF 25V	9p (G)
FF12N	PC Elect 100uF 63V	18p (G)
FF13P	PC Elect 220uF 16V	10p (G)
FF14Q	PC Elect 220uF 63V	24p (F)
FF15R	PC Elect 470uF 16V	18p (G)
FF16S	PC Elect 470uF 25V	23p (F)
FF59P	PC Elect 470uF 63V	32p (E)
FF17T	PC Elect 1000uF 16V	24p (F)
FF18U	PC Elect 1000uF 25V	28p (F)
FF60Q	PC Elect 2200uF 16V	28p (F)
FB11M	Axial 0.47uF 250V	21p (G)
FB12N	Axial 1uF 63V	8p (H)
FB13P	Axial 1uF 450V	25p (F)
FB14Q	Axial 1.5uF 63V	10p (G)
FB15R	Axial 2.2uF 63V	10p (G)
FB16S	Axial 2.2uF 450V	30p (F)
FB17T	Axial 3.3uF 63V	10p (G)
FB18U	Axial 4.7uF 63V	12p (G)
FB19V	Axial 4.7uF 450V	33p (F)
FB20W	Axial 6.8uF 40V	15p (G)
FB21X	Axial 6.8uF 63V	16p (G)
FB22Y	Axial 10uF 25V	9p (H)
FB23A	Axial 10uF 63V	11p (G)
FB24B	Axial 10uF 100V	18p (G)
FB25C	Axial 10uF 450V	45p (F)
FB26D	Axial 15uF 16V	9p (H)
FB27E	Axial 15uF 40V	11p (G)
FB28F	Axial 15uF 63V	16p (G)
FB30H	Axial 22uF 25V	11p (G)
FB31J	Axial 22uF 63V	16p (G)
FB32K	AXial 22uF 100V	24p (F)
FB33L	Axial 22uF 450V	55p (E)
FB34M	Axial 33uF 6.3V	10p (G)
FB35Q	Axial 33uF 16V	11p (G)
FB36P	Axial 33uF 40V	12p (G)
FB38R	Axial 47uF 10V	10p (G)
FB39N	Axial 47uF 25V	13p (G)
FB41U	Axial 47uF 63V	17p (G)
FB42V	Axial 47uF 100V	32p (F)
FB43W	Axial 47uF 450V	85p (E)
FB44X	Axial 68uF 6.3V	15p (G)
FB45Y	Axial 68uF 16V	16p (G)
FB48C	Axial 100uF 10V	11p (G)
FB49D	Axial 100uF 25V	14p (G)
FB50E	Axial 100uF 40V	18p (G)
FB51F	Axial 100uF 63V	22p (G)
FB52G	Axial 100uF 100V	52p (E)
FB53H	Axial 100uF 250V	85p (E)
FB54J	Axial 150uF 6.3V	21p (G)
FB56L	Axial 150uF 25V	15p (G)
FB58N	Axial 150uF 63V	32p (F)
FB60Q	Axial 220uF 10V	12p (G)
FB61R	Axial 220uF 16V	14p (G)
FB62S	Axial 220uF 25V	18p (G)
FB63T	Axial 220uF 40V	27p (F)
FB64U	Axial 220uF 63V	32p (F)
FB65V	Axial 220uF 100V	55p (E)
FB67X	Axial 330uF 10V	14p (G)
FB68Y	Axial 330uF 25V	20p (G)
FB69A	Axial 330uF 63V	44p (F)
FB71N	Axial 470uF 10V	22p (G)
FB72P	Axial 470uF 16V	26p (F)
FB73Q	Axial 470uF 25V	30p (F)
FB74R	Axial 470uF 63V	55p (E)
FB75S	Axial 470uF 100V	89p (E)
FB77J	Axial 680uF 16V	30p (F)
FB78K	Axial 680uF 25V	38p (F)
FB79L	Axial 680uF 40V	68p (E)
†FB80B	Axial 1000uF 6.3V	29p (F)
FB81C	Axial 1000uF 10V	25p (F)
FB82D	Axial 1000uF 16V	32p (F)
FB83E	Axial 1000uF 25V	40p (F)
FB84F	Axial 1000uF 63V	£1.00 (D)
FB85G	Axial 1500uF 6.3V	32p (F)
FB86T	Axial 1500uF 10V	38p (F)
FB87U	Axial 1500uF 16V	42p (F)
FB89W	Axial 2200uF 10V	40p (F)
FB90X	Axial 2200uF 25V	57p (E)
FB91Y	Axial 2200uF 40V	98p (E)
FB92A	Axial 2200uF 63V	£1.54 (D)
FB93B	Axial 3300uF 6.3V	58p (E)
FB94C	Axial 3300uF 25V	94p (E)
FB95D	Axial 4700uF 10V	60p (E)
FB96E	Axial 4700uF 25V	£1.25 (D)
RK26D	Axial 4700uF 40V	£1.40 (D)

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FB97F	Reversolytic 1uF	25p (F)
FB01B	Reversolytic 2.2uF	25p (F)
FB02C	Reversolytic 3.3uF	25p (F)
FB03D	Reversolytic 4.7uF	25p (F)
FB06G	Reversolytic 10uF	25p (E)
FB08J	Reversolytic 22uF	35p (E)
FB09K	Reversolytic 33uF	39p (E)
FB10L	Reversolytic 47uF	39p
RK83E	Reversolytic 100u	69p (E)
FF19V	Can 1000uF 100V	£1.86 (D)
FF20W	Can 1500uf 63V	£1.95 (D)
FF21X	Can 2200uF 40V	£1.86 (D)
FF22Y	Can 2200uF 63V	£3.25 (C)
FF24B	Can 3300uF 40V	£2.15 (C)
FF25C	Can 3300uF 63V	DIS
FF26D	Can 4700uF 25V	£1.45 (D)
FF27E	Can 4700uF 40V	£4.35 (C)
*FF28F	Can 4700uF 63V	£3.85 (C)
*FF29G	Can 4700uF 100V	£5.62 (B)
*FF30H	Can 6800uf 40V	£4.85 (C)
*FF31J	Can 10,000uF 25V	£4.95 (C)
*FF32K	Can 10,000uF 63V	£5.45 (B)
FF33L	Clip Can 25	15p (G)
FF34M	Clip Can 35	22p (G)
FF35Q	Clip Can 40	19p (G)
FF36P	Clip Can 50	55p (F)
FF37S	Horiz Clip 25	18p (G)
FF38R	Horiz Clip 35	18p (G)
WL68Y	Trimmer 5.5pF	DIS
WL69A	Trimmer 10pF	30p (F)
WL70M	Trimmer 22pF	26p (F)
WL72P	Trimmer 65pF	29p (F)
WL71N	Trimmer 40pF	19p (G)
WL73Q	Trimmer 500pF	33p (F)
YQ24B	AM Varitune	£1.32 (C)

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FF39N	Vari O	£4.62 (C)
FF40T	DG Vari	£6.99 (B)
FF41U	Twin OO	£7.16 (B)
FF42V	SW Trim 10pF	£5.23 (B)
FF43W	SW Trim 15pF	£5.23 (B)
FF44X	SW Trim 25pF	£5.23 (B)
FF45Y	SW Trim 50pF	£5.23 (B)
FF46A	SW Trim 60pF	£6.15 (B)
FF48C	SW Trim 100pF	£6.10 (B)
FF49D	SW Trim 150pF	£6.76 (B)
FF50E	Dilecon 300pF	£4.45 (C)
FF51F	Dilecon 500pF	£4.35 (C)
FY77J	FS Crystal 100kHz	£4.55 (C)
HX62S	FS Crystal 1MHz	£5.95 (B)
FY78K	FS Crystal 10MHz	£2.95 (C)
FY79L	MP Crystal 1MHz	£4.75 (C)
FY80B	MP Crystal 2MHz	£2.20 (C)
FY81C	MP Crystal 2.4576MHz	£3.35 (C)
FY82D	MP Crystal 4MHz	£1.80 (D)
FY83E	MP Crystal 6.144MHz	£1.25 (D)
FY84F	MP Crystal 18.432MHz	£2.65 (C)
HX30H	MCR Crys Brown Pairs	£3.62 (C)
HX31J	MCR Crystal Red Pair	£2.96 (C)
HX32K	MCR Crys Orange Pair	£2.96 (C)
HX33L	MCR Crys Yellow Pair	£2.96 (C)
HX34M	MCR Crystal Green Pr	£2.96 (C)
HX35Q	MCR Crys Blue Pair	£2.96 (C)
FY85G	Colour TV Crystal	£1.20 (D)

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FY86T	Crystal 50HzX 2.16	£3.15 (C)
FY87U	Crystal 1HzX 2.22	£3.15 (C)
HX60Q	Crystal Socket 25u	26p (G)
HX61R	Crystal Socket 6u	45p (F)
HX99H	Ceramic Fltr 10.7MHz	85p (E)

CAR ACCESSORIES

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HW18U	Car Aerial Pull Up	£1.99 (D)
LH99H	Windscreen Aerial	£2.69 (C)
XX37S	Car Aerial Booster	£6.95 (B)
HW12N	Car Accessory Plug	45p (F)
YB68Y	Car Lighter Ext Lead	£2.25
YW59P	Car Power Lead	£2.70 (C)
FQ73Q	Map Light	69p (E)
HW22Y	12V Inspection Lamp	£1.71 (D)
HQ30H	Wiper Control	£9.65 (B)

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WY09K	Demister	TEMP
FQ78K	Car Ammeter	£2.95 (C)
HQ35Q	Charger Ammeter	£1.47 (D)
†HW16S	Car Flash 4-Lamp	£1.63 (D)
†HW17T	Car Flash 6-Lamp	£1.55 (D)
†HW01B	Supp Cap Small Lucar	59p (E)
HW03D	Supp Cap Spade	DIS
†FQ87U	Supp Cap 3uF	£1.12 (D)
†FQ88V	Plug-Top Supp Strt	38p (F)
†FQ89W	Plug-Top Supp Ang	50p (E)
†FQ90X	In-Line Plug Supp	25p (F)
FQ91Y	Suppressor Choke	84p (E)
YL02C	Magnilamp	£1.95 (E)
FY01B	Tyre Pressure Gauge	£1.95 (D)
XB44X	Car Speakers Shelf	£6.75 (B)
XG26D	Slim Line Car Spkers	£12.60 (A)

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XY73Q	10W Shelf Spkrs	£18.25 (A)
XQ75S	10W Car Stereo Spkrs	£13.95 (A)
XG27E	15W Shelf Speakers	£16.99 (A)
XG25C	20W Shelf Speakers	£26.95 (A)
AF00A	Booster Amp	£17.99 (A)
AF01B	Booster Equaliser	£39.99 (A)

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YX85G	Speed Sensor	£12.98 (A)
YX86T	Flow Sensor	£17.20 (A)

COMMUNICATIONS

Page 98

AF46A	CB Model GT-868	£49.95 (A)
XG10L	12V 3A Power Unit	£16.95 (A)
YK29G	Ext CB Speaker	DIS
YL42V	Filter Choke	TEMP
YK30H	Noise Filter System	£7.34 (A)
YB00A	Low-Pass RF Filter	£3.95 (C)

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YL43W	TVI Filter	£5.25 (B)
YL44X	CB Aerial Converter	£5.96 (B)
YQ73Q	CB/Radio Aerial Cplr	£3.66 (B)
YB01B	RF Antenna Switch	£6.34 (B)
YQ74R	CB Aerial Matcher	£5.25 (B)
XG13P	1.5m CB Aerial	£13.95 (A)
YG41U	27MHz Rubber Duck	£4.75 (C)
YG15R	2m Rubber Duck	£4.75 (C)

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YG16S	Mag Mount	£8.95 (B)
HL94C	30W Dummy Load	£6.75 (B)
YK00A	2m Scanning Receiver	£56.95 (A)
WY11M	Compact PA Amp	£22.70 (A)
WY12N	10W PA Amp	£29.95 (A)

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XY81C	40W PA Amp	£84.20 (A)
XY82D	60W PA Amp	£119.20 (A)
XQ72P	Megaphone	£52.60 (A)
XY76H	Pistol Grip Megphone	£49.95 (A)
XQ73Q	Car PA 8W	£8.25 (B)
XQ74R	Car PA 15W	£13.98 (A)

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LB72P	Intercom 2-Station	£9.60 (B)
RK81C	FM Door Phone Set	£49.95 (A)
XY77J	4-Channel FM Intrcom	£29.95 (A)
XG18U	PB Telephone	£21.90 (B)
XG19V	Set 4 PB Telephones	£69.99 (A)
AF09K	AM Radio	£1.95 (C)
AF10L	AM/FM Radio	£4.95 (C)

COMPUTERS

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AF02C	Atari 800 with 48K	£399.00

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AF36P	Atari 400 with 16K	£199.95
AF37S	Atari 400 with 48k	£299.00
AF28F	Atari 410 Cass Rcdr	£50.00
AF06G	Atari 810 Disk Drive	£299.95
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HY24B	Printer 822 Paper	£4.95

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AF41U	400 Cent I/F	£59.95
AF42V	800 Cent I/F	£59.95
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AC30H	Games Paddles	£13.95
AC45Y	Le Stick	£24.95

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The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.
Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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YG49D	Touch Typing	£19.95
YG56L	States & Capitals	£14.95
YG57M	Euro Country & Caps	£14.95
BG00A	Kids 1 Cassette	£11.75
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BG02C	Kids 2 Cassette	£11.75
BG03D	Kids 2 Disk	£11.75
YG43W	Inv To Prog 1	£19.95
BQ67X	Inv To Prog 2	£22.95
BQ68Y	Inv To Prog 3	£22.95
BQ57M	Basic Animation Cass	£14.50
BQ58N	Basic Animation Disk	£14.50
BQ59P	PM Graphics Cass	£21.25
BQ60Q	PM Graphics Disk	£21.25
BQ51F	Display Lists Cass	£14.50
BQ52G	Display Lists Disk	£14.50
BQ53H	Scrolling Cassette	£14.50
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BQ55K	Page Flipping Cass	£14.50
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BG06G	Tricky Tutorial Cass	£69.95
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BQ23A	Invasion Orion Cass	£17.25
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KB04E	Goodcode Cavern Disk	£21.95
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BQ87U	Upper Reaches Cass	£13.80
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BQ89W	Curse of Ra Cass	£13.80
BQ90X	Curse Of Ra Disk	£13.80
BG73Q	Empire Ovr-Mind Cass	£21.95
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BG63T	Battle Shiloh Cass	£28.95
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BG87U	Nukewar Cassette	£11.95
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BQ62S	Galactic Chase Cass	£16.95
BQ61R	Galactic Chase Disk	£19.95
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BQ20W	Race in Space Disk	£16.95
BG42V	Space Chase Cassette	£10.95
BG43W	Space Chase Disk	£12.95
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BG50E	Angle Worms Cassette	£10.95
BQ16S	Lunar Lander Cass	£10.95
BG49D	Lunar Lander Disk	£14.50
BG35Q	Rasterblaster	£22.95
BG36P	Shoot Gallery Cass	£14.95
BG19V	Shoot Gallery Disk	£16.95
BG15R	Shoot Arcade Cass	£23.50
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BG32K	Matchracer Disk	£22.50
BG99H	Roadracer Cassette	£11.95
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KB16S	K-razy Antiks	£34.95
BQ64U	Ghost Hunter	£19.95
BQ71N	Pac-Man	£29.95
KB03D	Wizard of Wor Disk	£34.95
YL34M	Tank Trap Cassette	£9.95
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KB13P	Nautilus Cassette	£27.50
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BG13P	Pacific Hiway Cass	£23.50
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KB07H	Preppie Cassette	£21.95
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BG27E	Chicken Cassette	£21.80
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BG45Y	Canyon Climber Disk	£23.50
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BG47B	Ricochet Cassette	£13.80
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*BQ32K	BASIC A+ & Op-Sys A+	£59.95
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BQ75S	Pilot Educator	£89.95
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KB15R	SAM Disk	£47.19
BG60Q	Program Aids Pack	£10.95
YL30H	Disassembler Cass	£9.95
YL31J	Disassembler Disk	£11.95
BQ27E	Atari World	£47.95
BQ29G	3D-Supergraphics Cas	£31.95
BQ28F	3D-Supergraphics Dsk	£31.95
BG64U	The Next Step Disk	£27.54
BG10L	File-It 2 Disk	£33.87
Page 120		
BG59P	Filemanager 800	£75.00
BQ76H	K-DOS	£59.95
BG58N	Disk Manager	£27.50
BG57M	Disk Detective	£23.50
*BQ30H	MAC65 & Op-Sys A+	£59.95
YG59P	Telelink	£21.95
GG24B	Analog Subscription	£9.00NV
XH60Q	Mapsoft Catalogue	£1.00

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AF57M	Dragon 32 Computer	£199.50
BC31J	Dragon Cassette Cabl	£2.95
BC30H	Dragon Joysticks	£19.95
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BC41U	Quest	£7.95
BC43W	Graphics Animator	£7.95
BC35Q	Ghost Attack	£24.95
BC42V	Madness & Minotaur	£7.95
BC33L	Meteoroids	£19.95
BC32K	Berserk	£19.95
BC34M	Cosmic Invaders	£19.95
BC39N	Dragon Selection 1	£7.95
BC44X	Computavoice	£7.95
BC36P	Cave Hunter	£19.95
BC38R	Starship Chameleon	£19.95
BC37S	Tube Frenzy	TEMP
BC40T	Dragon Selection 2	£7.95
BC45Y	Maze Craze	TEMP
AF58N	Commodore Max	DIS
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AF56L	Commodore 64 Computr	£339.00
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AF47B	VIC20 Colour Computr	£129.95
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AF48C	VIC20 Cassette C2N	£44.95
AF49D	VIC20 Printer	£230.00
AF50E	VIC20 Disk Drive	£299.99
AF51F	VIC 3K RAM	£29.95
AF52G	VIC 8K RAM	£44.95
AF53H	VIC 16K RAM	£59.95
AC54J	Super Expander	£34.95
AC55K	Programmers Aid	£34.95
AC56L	Machine Code Mon	£34.95
Page 126		
AC57M	Intro To Basic Part1	£14.95
AC58N	Intro To Basic Part2	£14.95
AC59P	VIC Avenger	£19.95
AC60Q	VIC Star Battle	£19.95
AC61R	VIC Super Slot	£19.95
AC86T	VIC Adventureland	£24.95
AC84F	VIC Pirate Cove	£24.95
AC87U	VIC Mission Impossbl	£24.95
AC88V	VIC Voodoo Castle	£24.95
AC89W	VIC The Count	£24.95
AC77J	VIC Sargon II Chess	£24.95
AC80B	VIC Cosmiads	£7.00
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AC79L	VIC Panic	£7.00
AC78K	Another VIC in Wall	£7.00
AC62S	VIC Jelly Monsters	£19.95
AC63T	VIC Alien	£19.95
AC64U	VIC Superlander	£19.95
AC65V	VIC Road Race	£19.95
AC67X	VIC Blitz	£4.99
AC66W	VIC Rat Race	£19.95
AC85G	VIC Mole Attack	£19.95
AC81C	Vicgammon	£7.00
AC83E	VIC Asteroids	£7.00
BC46A	VIC Race	£4.99
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BC47B	VIC Hoppit	£4.99
BC48C	VIC Strategic Advnc	£4.99
AC92A	Simplicalc Disk	£24.95
AC93B	Simplicalc Cassette	£19.95
AC94C	VIC Stock Control	£19.95
AC95D	VIC File	£24.95
AC96E	VIC Writer Disk	£24.95
AC97F	VIC Writer Cassette	£19.95
AC98G	English Language	£9.99
AC99H	VIC Maths 1	£9.99
BC00A	VIC Maths 2	£9.99
BC02C	VIC Chemistry	£9.99
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BC01B	VIC Biology	£9.99
BC03D	VIC Physics	£9.99
BC11M	Quizmaster	£9.99
BC12N	Know Your Own IQ	£9.99
BC13P	Junior IQ	£9.99
BC15R	VIC Menu Planner	£9.99
BC14Q	Know Yr Personality	£9.99
BC16S	VIC Money Manager	£9.99
BC17T	VIC Highway Code	£9.99
BC21X	VIC Mastermind	£9.99
BC22Y	MM Data 1	£2.50
BC23A	MM Data 2	£2.50
BC24B	MM Data 3	£2.50
BC25C	MM Data 4	£2.50
BC26D	MM Wine & Food	£2.50
BC27E	MM Music	£2.50
BC28F	MM Sport & Games	£2.50
BC29G	MM Films & TV	£2.50
BC49D	Type-A-Tune	£4.99
AC90X	Gorf Cartridge	£24.95
AC91Y	Omega Race Cartridge	£24.95
BC04E	Computer Studies	£9.99
BC05F	Geography	£9.99
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BC07H	Arithmetic	£9.99
BC08J	Reading	£9.99
BC09K	General Knowledge	£9.99
BC10L	Spelling	£9.99
BC18U	Garden Planner	£9.99
BC19V	Interior Designer	£9.99
BC20W	BBC "Ask the Family"	£9.99
BC50E	VIC Letter Writer	£19.95
BC51F	VIC Pinball	NYA
BC52G	VIC Cosmic Jailbreak	£19.95
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XG28F	MENTA	£115.00 (A)
AF38R	Epson MX80T Mk III	£399.95 (A)
AF40T	Epson MX80F/T Mk III	£447.35 (A)
YX87U	Mini Floppy Disc	£2.50 (C)
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AC00A	Vid Gme Cnsl	£99.95
AC01B	Air Sea Battle Game	£18.95
AC02C	Space War Game	£14.95
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AC03D	Outlaw Game	£14.95
AC04E	Video Olympics Game	£18.95
AC05F	Breakout Game	DIS
AC06G	Basketball Game	£14.95
AC07H	Surround Game	£14.94

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AC09K	Basic Maths	£14.95
AC10L	Codebreaker	£18.95
AC11M	Hunt & Score	£18.95
AC12N	Miniature Golf	£14.95
AC13P	Skydiver	£14.95
AC14Q	Street Racer	£18.95
AC15R	Bowling	£18.95
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AC16S	Brain Games	£24.95
AC18U	Golf	£18.95
AC19V	Slot Racers	£14.95
AC21X	Superman	£24.95
AC22Y	Adventure Game	£18.95
AC24B	Indy 500	£29.95
AC25C	Backgammon	£18.95 (A)
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AC26D	Space Invaders	£24.95
AC27E	Programming	£18.95
AC28F	Chess	£18.95
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AC20W	Circus Atari Game	£24.95 (A)
AC17T	Human Cannonball	£14.95
AC23A	Casino Game	£18.95
AC31J	Night Driver Game	£24.95 (A)
AC32K	Dodge Em	£18.95 (A)
AC33L	Pele Soccer Game	£24.95
AC34M	Hangman	£14.95
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AC35Q	Video Checkers	£18.95 (A)
AC36P	Maze Craze	£24.95 (A)
AC41U	Othello Game	£18.95
AC42V	Video Pinball	£24.95 (A)
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AC43W	Asteroids	£29.95 (A)
AC44X	Warlords	£29.95
AC46A	Missile Command	£29.95 (A)
AC48C	Super Breakout	£29.95
AC49D	Kaboom!	£19.95 (A)
AC50E	Laser Blast	£19.95 (A)
AC51F	Freeway	£19.95 (A)
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AC52G	Dragster	£19.95 (A)
AC68Y	Pac Man	£29.95
AC69A	Haunted House	£18.95
AC71N	Yar's Revenge	£29.95
AC73Q	Defender	£29.95
AC70M	Demons To Diamonds	£18.95
AC72P	Berzerk	£29.95
AC74R	Adventure I	DIS
AC75S	Adventure II	DIS
AC76H	Raiders Of Lost Ark	£29.95
AC29G	Video Game Keyboard	£13.95
CONNECTORS		
Page 140		
HF25C	Croc Clips	10p (G)
HF23A	Alligator Clip Black	14p (G)
HF24B	Alligator Clip Red	14p (G)
HF26D	Charger Clip	25p (F)
BW69A	Croc Lead Kit	£1.45 (D)
HF10L	Push-On Receptacle	33p (F)
HF11M	Push-On Blade	33p (F)
HF12N	Push-On Covers	64p (E)
YX47B	Comcon Block 5-way	45p (F)
YX48C	Comcon Terminal	5p (H)
HF02C	Terminal Post Black	39p (F)
HF03D	Terminal Post Blue	39p (F)
HF04E	Terminal Post Brown	39p (F)
HF05F	Terminal Post Green	39p (F)
HF06G	Terminal Post Grey	39p (F)
HF07H	Terminal Post Red	39p (F)
HF08J	Terminal Post White	39p (F)
HF09K	Terminal Post Yellow	39p (F)
HF13P	Press Terminal Black	28p (F)
HF15R	Press Terminal Green	28p (F)
HF16S	Press Terminal Red	28p (F)
HF17T	Press Terminal White	30p (F)
HF18U	Press Terminal Yellw	28p (F)
†HF14Q	Press Terminal Blue	28p (F)
BW72P	Quickterm Type A	49p (F)
YR92A	Quickterm Type B	62p (E)
BW71N	Quickterm Push	62p (E)
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WL57M	1mm Plug Black	20p (G)
WL58N	1mm Plug Red	20p (G)
WL59P	1mm Socket Black	15p (G)
WL60Q	1mm Socket Red	15p (G)
HF38R	2mm Plug Black	17p (G)
HF39N	2mm Plug Blue	18p (G)
HF40T	2mm Plug Green	17p (G)
HF41U	2mm Plug Red	17p (G)
HF42V	2mm Plug White	17p (G)
HF43W	2mm Plug Yellow	18p (G)
HF44X	2mm Socket Black	15p (G)
HF45Y	2mm Socket Blue	15p (G)
HF46A	2mm Socket Green	15p (G)
HF47B	2mm Socket Red	15p (G)
HF48C	2mm Socket White	15p (G)
HF49D	2mm Socket Yellow	15p (G)
HF50E	Wander Plug Black	17p (G)
HF51F	Wander Plug Blue	17p (G)
HF52G	Wander Plug Green	17p (G)
HF53H	Wander Plug Red	17p (G)
HF54J	Wander Plug White	17p (G)
HF55K	Wander Plug Yellow	17p (G)
HF56L	Wander Socket Black	14p (G)
HF57M	Wander Socket Blue	14p (G)
HF58N	Wander Socket Green	14p (G)
HF59P	Wander Socket Red	14p (G)
HF60Q	Wander Socket White	14p (G)
HF61R	Wander Socket Yellow	14p (G)
HF62S	4mm Plug Black	15p (G)
HF63T	4mm Plug Blue	15p (G)
HF64U	4mm Plug Brown	15p (G)
HF65V	4mm Plug Green	15p (G)
HF66W	4mm Plug Red	15p (G)
HF67X	4mm Plug White	15p (G)
HF68Y	4mm Plug Yellow	15p (G)
HF69A	4mm Socket Black	15p (G)
HF70M	4mm Socket Blue	16p (G)
HF71N	4mm Socket Brown	16p (G)
HF72P	4mm Socket Green	16p (G)
HF73Q	4mm Socket Red	16p (G)
HF74R	4mm Socket White	16p (G)
HF75S	4mm Socket Yellow	16p (G)
HF34M	4mm Patch Cord	£1.98 (D)

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HQ54J	Screw-Cap Phono Blk	12p (G)
HQ55K	Screw Cap Phono Blue	12p (G)
HQ58N	Screw Cap Phono Red	12p (G)
HQ59P	Screw Cap Phono White	12p (G)
HQ60Q	Screw Cap Phono Yell	12p (G)
HH01B	Scr Phono	17p (G)
YW06G	Threaded Phono Skt	15p (G)
HH02C	Phono Socket Single	12p (G)
HH03D	Phono Socket Twin	16p (G)
BW74R	Phono Socket Quad	35p (F)
BW75S	Phono Socket 5-way	DIS
BW76H	Phono Socket 6-way	55p (E)
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HH04E	Line Phono	20p (G)
HH05F	Phono Conn	19p (G)
HF76H	2.5 Plug Plas	16p (G)
HF77J	2.5 Plug Scr	22p (G)
HF78K	2.5 Jack Socket	11p (G)
HF79L	2.5 Line Socket	30p (F)
HF80B	Plug Plas 3.5	13p (G)
HF98G	Stereo Plas 3.5 Plug	25p (F)
HF81C	Plug Scr 3.5	22p (G)
HF82D	Jack Socket 3.5	14p (G)
HF83E	Line Socket Plas 3.5	15p (G)
RK51F	Stereo Plas 3.5 Skt	25p
HF84F	Line Socket Scr 3.5	24p (G)
HF85G	Jack Plug Plas	19p (G)
HF86T	Side Jack Plas	24p (F)
HF87U	Jack Plug Scr	43p (F)
YW07H	SR Jack Plug	41p (F)
YL03D	Side Jack Screened	29p (F)
HF88V	Jack Pl Sto Plas	32p (F)
HF89W	Jack Pl Sto Scr	52p (F)
HF90X	Jack Skt Brk	21p (G)
BW78K	Chro Mono Jack Skt	39p (F)
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HF91Y	Jack Skt Open	19p (G)
HF92A	Jack Skt Sto	25p (F)
BW79L	Chro Stereo Jack Skt	35p (F)
HF93B	Stereo Open Skt	35p (F)
BW80B	DPDT Jack Socket	52p (E)
HH19V	Line Jack Plas	24p (F)
HH20W	Scr Line Jack	42p (F)
HH21X	Stereo Line Skt	30p (F)
HH22Y	Scr Stereo Line Skt	58p (E)
RK80B	Mono 0.25in Jk Cplr	49p (F)
HH07H	Co-ax Plug Aly	24p (F)
HH06G	Co ax Plug Plas	DIS
YW08J	Co-ax Plug Imp	15p (G)
HH08J	Co-ax Socket Pan	29p (F)
HH09K	Co-ax Socket Flush	25p (F)
YW09K	Co-ax Line Skt	43p (F)
HH11M	Co-ax Conn	15p (G)
HH13P	Skeleton Car Plug	14p (G)
HH12N	Car Plug Plas	49p (F)
HH14Q	Chassis Car Socket	24p (F)
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HH16S	FM Aerial Plug	17p (G)
HH17T	BNC Plug	98p (E)
HH18U	BNC Socket	98p (E)
YW00A	BNC Square Socket	93p (E)
QY22Y	BNC Earth Tag	20p
YW01B	BNC Line Socket	£1.10 (D)
YW02C	BNC Straight Adaptor	£1.37 (D)
YW03D	BNC T Adaptor	£2.95 (C)
BW81C	Plug PL259	51p (E)
BW82D	UHF Reducer Small	17p (G)
BW83E	UHF Reducer Large	17p (G)
HL95D	RA PL259 Plug	85p (E)
HL96E	Quick-Connect PL259	99p (E)
BW84F	UHF Socket Round	49p (F)
BW85G	Socket SO239	53p (E)
BW86T	UHF Elbow Adaptor	£1.32 (D)
BW87U	UHF Straight Adaptor	59p (E)
BW88V	UHF T Adaptor	£1.55 (D)
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RK00A	UHF Female T Adaptor	£1.75 (D)
RK01B	UHF Adaptor FFLA	£1.65 (D)
RK02C	UHF Adaptor FMLA	£1.75 (D)
YW04E	Adaptor 239	£1.35 (D)
YW05F	Adaptor 259	£1.40 (D)
YX51F	Audio Conn 2-way	£1.15 (D)
YX52G	Audio Conn 3-way	£1.35 (D)
YX53H	Audio Conn 4-way	£1.36 (D)
YX54J	Audio Conn 5-way	£1.55 (D)
YX55K	Audio Conn 6-way	£1.75 (D)
RK52G	10 Way Line Skt	£2.85 (C)
RK53H	10 Way Line Plug	£2.75
RK54J	10 Way Chassis Skt	£1.95
BW89W	XLR Line Plug	£1.82 (D)
BW90X	XLR Chassis Socket	£3.28 (C)
BW91Y	XLR Line Socket	£2.35 (C)
BW92A	XLR Chassis Plug	£1.45 (D)
RK76H	Mic Con with S R	55p (E)
RK79L	Min Mic SR Connector	55p (E)
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RK77J	Mic Jck Plug Adaptor	42p (F)
RK78K	Mic Jck Skt Adaptor	65p (E)
BW94C	Dinlatch 5-pin A Plg	£1.73 (D)
BW98G	Dinltch Sckt 5-pin A	76p (E)
HH24B	DIN L/S Plug	10p (G)
HH25C	DIN Plug 3-pin	16p (G)
HH26D	DIN Plug 4-pin	34p (F)
HH27E	DIN Plug 5-pin A	14p (G)
HH28F	DIN Plug 5-pin B	19p (G)
RK64U	DIN Plug 5-pin C	28p (F)
HH29G	DIN Plug 6-pin	39p (F)
HH30H	DIN Plug 7-pin	19p (G)
HH31J	DIN L/S Socket	7p (H)
HH32K	DIN Socket 3-pin	16p (G)
HH33L	DIN Socket 4-pin	16p (G)
HH34M	DIN Socket 5-pin A	14p (G)
HH35Q	DIN Socket 5-pin B	18p (G)
HH36P	DIN Socket 6-pin	21p (G)
HH37S	DIN Socket 7-pin	20p (G)
HH40T	DIN Line Skt 2-pin	15p (G)
HH41U	DIN Line Sckt 3-pin	16p (G)
HH43W	DIN Line Skt 5-pin A	29p (F)
HH44X	DIN Line Skt 5-pin B	21p (G)
HH45Y	DIN Line Sckt 6-pin	21p (G)
YX90X	PC DIN Skt 2-pin	25p (F)
YX91Y	PC DIN Skt 5-pin A	25p (F)
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RK60Q	D-Range 9 Way Plug	79p (E)
BK58N	D-Range 15-Way Plug	£1.45
YQ48C	D-Range 25-Way Plug	£1.49 (C)
RK61R	D-Range 9 Way Skt	£1.20 (D)
BK59P	D-Range 15-Way Skt	£1.60 (D)
YQ49D	D-Range 25W Socket	£2.35 (C)
RK62S	D-Range 9 Way cover	£1.20 (E)
BK60Q	D-Range 15 Way cover	£1.20 (D)
YQ50E	D-Range 25-Way Cover	£1.32 (D)
WQ14Q	PCB Conns 45	7p (H)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price shown is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.

Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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WQ15R	PCB Conns Vertical	7p (H)
WQ16S	PCB Conns Horizontal	7p (H)
RK63T	D Range 9 Way Latch	28p (F)
BK61R	D Range 15 Way Latch	33p (F)
YQ51F	D-Range Latch	28p (F)
RK35Q	PC Edgeconn 2x23-way	£2.39 (C)

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FL83E	Edge Conn 108	52p (E)
FL84F	Edge Conn 116	£1.08 (D)
FL85G	Edge Conn 124	£1.29 (D)
FL86T	Edge Conn 132	£1.95 (D)
FL87U	Edge Conn 140	DIS
FL91Y	Edge Conn Feet G	15p
FL92A	Edge Conn Feet H	14p
FL93B	Edge Conn Feet L	DIS
FL30H	Edge Conn Silver	£1.99 (D)
YR57M	Card Frame Edge Conn	£4.36 (C)
YR58N	Edge Conn End Bkt	26p (F)
YX33L	Multicon Plug 2-way	18p (G)
YX34M	Multicon Plug 4-way	20p (G)
YX35Q	Multicon Plug 9-way	29p (F)
YX36P	Multicon Plug 15-way	43p (F)
YX37S	Multicon Plug 24-way	75p (E)
YX38R	Multicon Plug 36-way	78p (E)
YX39N	Multicon Skt 2-way	18p (G)
YX40T	Multicon Skt 4-way	22p (G)
YX41U	Multicon Skt 9-way	27p (F)
YX42V	Multicon Skt 15-way	56p (E)
YX43W	Multicon Skt 24-way	68p (E)
YX44X	Multicon Skt 36-way	68p (E)
YX45Y	Multicon Plug Pin	3p (H)
YX46A	Multicon Skt Pin	3p (H)

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HL01B	Octal Ch Plug	75p (E)
HL00A	Octal Ch Skt	50p (E)
HL02C	8-way Plug	95p (E)
HL03D	8-way Socket	99p (E)
RK65V	Minicon Latch Pl 2w	13p (G)
BX96E	Minicon Latch Pl 3w	23p (G)
YW11M	Minicon Latch Pl 4w	22p (G)
FY93B	Minicon Latch Pl 5w	29p (F)
YW12N	Minicon Latch Pl 6w	29p (F)
YW13P	Minicon Latch Pl 8w	29p (F)
RK66W	Minicon Latch Pl 10w	70p (E)
YW14Q	Minicon Latch Pl 12w	48p (F)
BH61R	Minicon Latch Pl 17w	78p (E)
FY92A	RA Lch Minicn Pl 2w	26p (F)
YW15R	RA Lch Minicn Pl 3w	31p (F)
FY91Y	RA Lch Minicn Pl 4w	33p (F)
RK67X	RA Lch Minicn Pl 5w	29p (F)
FB99H	RA Lch Minicn Pl 6w	40p (F)
YW18U	RA Lch Minicn Pl 8w	52p (E)
RK68Y	RA Lch Minicn Pl 10w	45p (F)
YW19V	RA Lch Minicn Pl 12w	74p (E)
HB59P	Mncn Ltch Hsg 2way	8p (H)
BX97F	Mncn Ltch Hsg 3-way	11p (G)
HB58N	Mncn Ltch Hsg 4way	10p (G)
BH66W	Mncn Ltch Hsng 5-way	11p (G)
BH65V	Mncn Ltch Hsng 6-way	13p (G)
YW23A	Mncn Ltch Hsng 8-way	15p (G)
FY94C	Mncn Ltch Hsng 10way	18p (G)
YW24B	Mncn Ltch Hsng 12way	17p (G)
RK69A	Mncn Ltch Hsng 17way	25p (F)
YW26D	Minicon Skt 3-way	24p (F)
YW27E	Minicon Skt 4-way	30p (F)
YW28F	Minicon Skt 6-way	36p (F)
YW29G	Minicon Skt 8-way	50p (E)
YW30H	Minicon Skt 12-way	65p (E)
YW31J	Polarcon 0.1in	6p (H)
YW25C	Minicon Terminal	3p (H)
YW95D	IDC Con 3-way	20p (G)
YW96E	IDC Con 4-way	26p (F)
YW97F	IDC Con 6-way	38p (F)
YW98G	IDC Con 8-way	68p (E)
YW99H	IDC Con 12-way	88p (E)
YX49D	IDC Insertion Tool	£2.32 (D)

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HL04E	Wafercon Plug 3-pin	12p (G)
HL05F	Wafercon Plug 4-pin	14p (G)
HL06G	Wafercon Plug 6-pin	19p (G)
HL07H	Wafercon Plug 8-pin	19p (G)
HL08J	Wafercon Plug 12-pin	29p (F)
HL09K	Wafercon Skt 3-way	11p (G)
HL10L	Wafercon Skt 4-way	10p (G)
HL11M	Wafercon Skt 6-way	16p (G)
HL12N	Wafercon Skt 8-way	17p (G)
HL13P	Wafercon Skt 12-way	25p (F)
HL14Q	Wafercon Terminal	3p (H)
YW32K	Polarcon 0.2in	9p (H)
RK72P	3 way PC Terminal	34p (F)
RK73Q	4 way PC Terminal	37p (F)
RK38R	8-Way PC Terminal	55p (E)
RK74R	12 way PC Terminal	98p (E)
†YW40T	Compactboard	£13.50 (A)
YY22Y	CB Pin Blue	38p (F)
YY23A	CB Pin Red	38p (F)
YY26D	CT Pin White	£1.46 (D)
YY27E	AT Pin Black	£1.46 (D)
YB08J	Large Patchboard	£111.00 (A)
HH39N	Multi-position Plug	67p (E)
HH38R	Universal Plug	85p (E)
HH60Q	Std Power Plug 2.1	14p (G)
HH61R	Long Pwr Plug 2.1	16p (G)
HH62S	Std Power Plug 2.5	15p (G)
HH63T	Long Pwr Plug 2.5	15p (G)
HH85G	Power Skt 2.1	20p (G)
HH86T	Power Skt 2.5	22p (G)
RK37S	PC Mtg Power Socket	28p (F)
HH87U	Cassette Skt Nivico	39p (F)
HH88V	Cassette Skt Paros	46p (F)
HL17T	USA Mains Plug	28p (G)
HL18U	Flat Pin M/S	27p (F)
HL19V	Flat Pin Conn	31p (F)

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HL16S	Eurosocket	69p (E)
HL15R	Europlug	48p (F)
HL42V	Euro Facility Outlet	89p (E)
HL43W	Euro Facility Plug	94p (D)
BW99H	Euroconn Lead	£1.75 (D)
RW56L	Cas Lead Crown	60p (E)
RW57M	Cas Lead Hitachi	60p (E)
RW58N	Cas Lead Nat Pan	60p (E)
RW59P	Cas Lead Nivico	60p (E)
RW60Q	Cas Lead Otake-Orion	65p (E)
RW61R	Cas Lead Paros	65p (E)
RW62S	Cas Lead Philips	75p (E)
RW63T	Cas Lead Sanyo	60p (E)
RW64U	Cas Lead Sharp	60p (E)
RW65V	Cas Lead Sony	60p (E)
RW66W	Cas Lead Telefunken	65p (E)
YX62S	Cassette Lead OS219	60p (E)

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YX63T	Cassette Lead 955	60p (E)
WY16S	Euroboard 4-way	£7.35 (B)
WY17T	Euroboard 6-way	£6.72 (A)
HL20W	Mains Plug P429	71p (E)
HL44X	Mains Socket P646	£1.64 (D)

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HL23A	Mains Socket P430SE	£1.25 (D)
HL45Y	Mains Plug P649	£1.34 (D)
HL46A	Mains Socket P650	£1.10 (D)
HL47B	Mains Plug SA2403	£1.56 (D)
HL48C	Mains Socket SA2404	94p (E)
HL27E	Mains Plug SA2190	49p (F)
HL28F	Mains Socket SA1862	52p (E)
HL49D	Mains Socket SA2111	99p (C)
HL30H	Mains Plug SA2019A	£1.48 (D)
HL31J	Mains Socket SA2020	£1.36 (D)
HL33L	Mains Plug SA2367	£1.78 (D)
HL34M	Mains Socket SA2368	93p (E)
HL36P	Mains Plug P635	£1.05 (D)
HL37S	Mains Socket P636	£1.29 (D)
HL39N	Mains Plug P551	£2.97 (C)

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HL40T	Mains Socket P552	98p (E)
HL50E	Sleeve 8037	12p (G)
RK71N	Video Kopy Kit	£11.95 (A)
HL51F	Boot 9455	35p (F)
HL52G	Boot 8878	38p (F)
RK84F	Video Lead 1	£2.94 (E)
RK85G	Video Lead 2	£2.16 (D)
RK70M	Video Lead 3	£2.64 (C)
RK86T	Video Lead 4	£1.32 (D)
RK87U	Video Lead 5	£2.15 (C)
RK88V	Video Lead 6	£1.92 (D)

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RW04E	Adaptor E	45p (F)
RW01B	Adaptor B	52p (F)
YW38R	Adaptor W	59p (E)
YW39N	Adaptor X	56p (E)
RW07H	Adaptor H	38p (F)
RW03D	Adaptor D	40p (F)
RW11M	Adaptor M	39p (F)
RW06G	Adaptor G	46p (F)
RW08J	Adaptor J	37p (F)
RW00A	Adaptor A	38p (F)
YW34M	Adaptor S	55p (E)
YW35Q	Adaptor T	£1.25 (D)
RW05F	Adaptor F	40p (F)
RW09K	Adaptor K	40p (F)
RW02C	Adaptor C	45p (F)
YW37S	Adaptor V	£1.55 (D)
RW12N	Adaptor N	38p (F)
YW33L	Adaptor R	£1.28 (D)
HL53H	Adaptor P	£1.30 (D)
YW36P	Adaptor U	99p (E)
RK55K	Adaptor Z	42p (F)
RK56L	Adaptor Z	48p (F)
RW27E	Dinpak P	60p (E)
RW26D	Dinpak N	£1.20 (D)
RW45Y	Dinpak 273	£1.45 (D)
RW44X	Dinpak 262	75p (E)
RW47B	Dinpak 275	95p (E)
RW25C	Dinpak M	£1.55 (D)
RW46A	Dinpak 274	£1.50 (D)
RW15R	Dinpak B	£1.55 (D)
RW14Q	Dinpak A	£1.10 (D)
RW43W	Dinpak 254	£1.10 (D)
RW16S	Dinpak C	£1.24 (D)
RW22Y	Dinpak J	69p (E)

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RW23A	Dinpak K	65p (E)
RW24B	Dinpak L	96p (E)
RW18U	Dinpak E	82p (E)
RW19V	Dinpak F	95p (E)
RW17T	Dinpak D	£1.42 (D)
RW20W	Dinpak G	£1.34 (D)
RW49D	Dinpak 280	£1.55 (D)
RW48C	Plugpak 279	89p (E)
RW50E	Plugpak 282	96p (E)
RW51F	Plugpak 283	£1.85 (D)
RW28F	Plugpak Q	65p (E)
RW31J	Plugpak T	£2.25 (C)
RW34M	Plugpak X	£2.48 (C)
RW35Q	Plugpak HD Guitar	£4.45 (C)
RK58N	Plugpak Y	£1.55 (D)
RK27E	Plugpak Z	96p (E)
RK57M	Plugpak W	£1.45 (D)

ELECTRICAL

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HF01B	Terminal Block 5A	35p (F)
HL54J	Terminal Block 15A	69p (E)
HL55K	Terminal Block 30A	£1.10 (D)
HL56L	Terminal Block Conn	£1.47 (D)
HL57M	5 Amp Plug Nylon	59p (E)
RW67X	13 Amp Plug Nylon	75p (E)
HL58N	Rubber 13A Plug	£1.10 (D)
HL59P	15A Plug Nylon	DIS
HL60Q	Kettle Connector	£1.94 (D)
HL61R	Flex Connector	£1.40 (D)
HL62S	Mains Adaptor 2-way	£2.20 (C)
HL63T	Mains Adaptor 3-way	£2.95 (C)
HL64U	Shaver Adaptor	£1.15 (D)

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HL65V	Junction Box Small	54p (D)
HL66W	Junction Box Lge	£1.35 (E)
HL67X	Junction Box RM	£1.65 (D)
HL68Y	Single Skt Unswitched	£2.14 (D)
HL69A	Dble Skt Unswitched	£3.99 (C)
HL71N	Single Sw Socket	£2.72 (C)
HL72P	Double Sw Socket	£5.20 (B)
HL73Q	Trailing Skt Single	£1.75 (D)
HL74R	Trailing Dble Skt	£3.75 (C)
RW68Y	Dis Board 4-way	£9.98 (B)
HL76H	Cooker Switch	£8.45 (B)
HL78K	Shaver Skt Isolated	£18.75 (A)
HL79L	Shaver Socket	82p (E)
HL82D	Flex Outlet Unswchd	£3.95 (C)

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HL83E	Switched Flex Outlet	£4.38 (C)
HL86T	Blanking Plate	85p (E)
HL87U	20A Plateswitch	£3.20 (C)
HL88V	20A Water Htr Switch	£4.95 (C)
HL89W	Light Swch ST Single	£1.28 (D)
HL90X	Light Swch DT Single	£1.49 (D)
HL91Y	Light Swch Dual	£2.72 (C)
HL92A	Light Switch Triple	£3.84 (C)
FQ10L	250W Rotary Dimmer	£7.30 (B)
FQ12N	250W Push Dmr Sngl	£9.24 (B)
XX35Q	Remote Control Dmmr	£29.95 (A)

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XX36P	Dmmr Control Box	£15.75 (A)
FQ15R	Security Dimmer	£16.95 (A)
FQ16S	Auto Security Switch	£16.50 (A)
YB09K	Fl Pattress 16mm Sgl	96p (E)

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YB10L	Fl Pattress 25mm Sgl	73p (E)
YB11M	Fl Pattress 25mm Dbl	£1.20 (D)
†YB12N	Fl Pattress 35mm Dbl	£1.34 (D)
YB13P	Steel Pattress 47mm	DIS
YB14Q	Sur Patt 20mm Sngl	78p (E)
YB15R	Sur Patt 29mm Sngl	98p (E)
YB16S	Sur Patt 29mm Dble	£1.72 (D)
YB17T	Sur Patt 47mm Dble	£3.68 (C)
YB18U	Conversion Pattress	£2.62 (C)
FQ00A	Ceiling Switch 1-way	£2.84 (C)
FQ02C	Lampholder 702	79p (E)
FQ04E	Lampholder 252 1/2in	65p (E)
LB63T	Bayonet L/Hldr	64p (E)
FQ05F	Ceiling Rose	£1.24 (D)
FQ07H	Starter 80W	25p (F)
YB19V	Time Switch	£17.62 (A)
WY23A	Timetouch	£24.80 (A)

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YB20W	Room Thermostat	£8.90 (B)
XY08J	Extn Lead 5A	£10.50 (A)
XY09K	Extn Lead 13A	£17.95 (A)

HARDWARE

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BF00A	Bolt 2BA 1/2in	33p (F)
BF01B	Bolt 2BA 1in	85p (E)
BF02C	Bolt 4BA 1/4in	25p (F)
BF03D	Bolt 4BA 1/2in	28p (F)
BF04E	Bolt 4BA 1in	30p (F)
LR52G	Bolt 4BA 1.1/2in	33p (F)
BF05F	Bolt 6BA 1/4in	12p (G)
BF06G	Bolt 6BA 1/2in	14p (G)
BF07H	Bolt 6BA 1in	43p (F)
LR53H	Bolt 6BA 1.1/2in	63p (E)
BF08J	Bolt 8BA 1/4in	28p (F)
BF09K	Bolt 8BA 1/2in	38p (F)
LR54J	C/S Screw 2BA 1/2in	14p (G)
LR55K	C/S Screw 4BA 1/4in	14p (G)
BF10L	C/S Screw 4BA 1/2in	17p (G)
BF11M	C/S Screw 4BA 1in	32p (F)
LR56L	C/S Screw 6BA 1/4in	9p (H)
BF12N	C/S Screw 6BA 1/2in	19p (G)
LR02C	C/S Screw 6BA 1in	35p (F)
LR00A	C/S Screw 8BA 1/2in	29p (F)
BF14Q	Panel Screw	3p (H)
LR75S	C/S Panel Screw	5p (H)
BF16S	Nut 2BA	19p (G)
BF17T	Nut 4BA	19p (G)
BF18U	Nut 6BA	12p (G)
BF19V	Nut 8BA	12p (G)
BF20W	Washer 2BA	12p (G)
BF21X	Washer 4BA	9p (H)
BF22Y	Washer 6BA	9p (H)
BF23A	Washer 8BA	9p (H)
LR76H	Cup Washer	2p (H)
BF24B	Shake 2BA	9p (H)
BF25C	Shake 4BA	9p (H)
BF26D	Shake 6BA	9p (H)
LR01B	Shake 8BA	8p (H)
BF27E	Tag 2BA	12p (G)
BF28F	Tag 4BA	9p (H)
BF29G	Tag 6BA	13p (G)
LR02C	Tag 8BA	11p (G)
BF30H	Pozi Screw M5 6mm	30p (G)
BF31J	Pozi Screw M5 12mm	33p (F)
BF32K	Pozi Screw M5 25mm	54p (F)
BF33L	Pozi Screw M4 6mm	25p (F)
BF34M	Pozi Screw M4 12mm	32p (F)
BF35Q	Pozi Screw M4 25mm	27p (F)
BF36P	Pozi Screw M3 6mm	20p (G)
LR57M	Pozi Screw M3 9mm	13p (G)
BF37S	Pozi Screw M3 12mm	20p (G)
BF38R	Pozi Screw M3 25mm	27p (F)
LR58N	Pozi Screw M3 40mm	33p (F)
BF39N	Pozi Screw M2.5 6mm	15p (G)
BF40T	Pozi Screw M2.5 12mm	18p (G)
BF41U	Pozi Screw M2 6mm	29p (F)
BF46A	Isobolt M5 12mm	55p (E)
BF48C	Isobolt M4 6mm	26p (F)
BF49D	Isobolt M4 12mm	33p (F)
BF50E	Isobolt M4 25mm	57p (E)
BF51F	Isobolt M3 6mm	20p (G)
HY30H	Isobolt M3 9mm	12p (G)
BF52G	Isobolt M3 12mm	26p (F)
BF53H	Isobolt M3 25mm	35p (F)
BF54J	Isobolt M2.5 6mm	19p (G)
BF55K	Isobolt M2.5 12mm	24p (F)
BF56L	Isonut M5	20p (G)
BF57M	Isonut M4	20p (G)
BF58N	Isonut M3	15p (G)
BF59P	Isonut M2.5	14p (G)
LR59P	Isonut M2	10p (G)
BF60Q	Isowasher M5	15p (G)
BF61R	Isowasher M4	9p (H)
BF62S	Isowasher M3	9p (H)
BF63T	Isowasher M2.5	9p (H)
LR60Q	Isowasher M2	7p (H)
BF42V	Isoshake M5	12p (G)
BF43W	Isoshake M4	9p (H)
BF44X	Isoshake M3	9p (H)
BF45Y	Isoshake M2.5	9p (H)
LR61R	Isoshake M2	9p (H)

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LR62S	Isotag M5	18p (G)
LR63T	Isotag M4	20p (G)
LR64U	Isotag M3	12p (G)
LR65V	Isotag M2.5	12p (G)
LR66W	Isotag M2	9p (H)
BF68Y	Slf-Tpr No.8 x 3/8in	22p (G)
BF69A	Slf-Tpr No.8 x 1/2in	25p (F)
LR67X	Slf-Tpr No.6 x 3/8in	20p (G)
BF67X	Slf-Tpr No.6 x 1/2in	22p (G)
BF65V	Slf-Tpr No.4 x 3/8in	15p (G)
BF66W	Slf-Tpr No.4 x 1/2in	16p (G)
BF64U	Slf-Tpr No.2 x 3/16"	12p (G)
LR68Y	Slf-Tpr No.2 x 3/8in	14p (G)
BF70M	Nyl 2BA 1/2in	86p (E)
BF71N	Nyl 2BA 1in	95p (E)
BF72P	Nyl 4BA 1/2in	42p (F)
BF73Q	Nyl 4BA 1in	55p (E)
BF74R	Nyl 4BA 1.1/2in	£1.55 (D)
BF75S	Nyl 6BA 1/2in	50p (E)
BF76H	Nyl 6BA 1in	60p (E)
BF77J	Nyl 8BA 1/2in	60p (E)
BF78K	Nyl Nut 2BA	94p (E)
BF79L	Nyl Nut 4BA	94p (E)
BF80B	Nyl Nut 6BA	94p (E)
BF81C	Nyl Nut 8BA	55p (E)
BF82D	Nyl Washer 2BA	18p (G)
BF83E	Nyl Washer 4BA	18p (G)
BF84F	Nyl Washer 6BA	18p (G)

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BF85G	Nyl Washer 8BA	32p (F)
WH18U	Nyl C/S Scw M3 x12mm	6p (H)
WH19V	Nylon Nut M3	4p (H)
BF15R	Spring Clip	4p (H)
YW94C	Batten Clip	4p (H)
LB99H	Blk Wdscrw No 4 1/2"	15p (G)
BH44X	Plas Fixing	12p (G)
YL23A	Hand Wheel Bolt	35p (F)
FW10L	Spade 2BA	28p (F)
FW11M	Spade 4BA	23p (G)
FW13P	Studding 2BA	32p (F)
FW14Q	Studding 4BA	34p (F)
FW15R	Studding 6BA	30p (F)
FW30H	4BA Spacer 1/8in.	38p (F)
FW31J	4BA Spacer 1/4in.	48p (F)
FW32K	4BA Spacer 1/2in.	59p (E)
FW33L	6BA Spacer 1/8in.	35p (F)
FW34M	6BA Spacer 1/4in.	38p (F)
FW35Q	6BA Spacer 1/2in.	49p (F)
LR69A	8BA Spacer 1/8in.	32p (F)
LR70M	8BA Spacer 1/4in.	36p (F)
LR71N	Thrded Spcr 4BA	78p (E)
LR72P	Thrded Spcr 6BA	59p (E)

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FW16S	Standoff Short	8p (H)
FW17T	Standoff Medium	8p (H)
FW18U	Standoff Long	8p (H)
LR03D	Terry Clip 1/2in.	10p (G)
LR73Q	Terry Clip 1.1/2in.	29p (F)
FW59P	Grommet Small	2p (H)
FW60Q	Grommet Large	2p (H)
LR47B	SR Grommet 3P-4	6p (H)
LR48C	SR Grommet 5M-3	7p (H)
LR49D	SR Grommet 6W-1	10p (G)
LR50E	SR Grommet 7K-2	26p (F)
LR51F	Sealing Grommet	8p (H)
BL74R	Flexigrommet A	28p (F)
BL75S	Flexigrommet B	30p (F)
BL76H	Flexigrommet C	31p (F)
FW36P	Hole Plug 1/4in.	10p (G)
FW37S	Hole Plug 3/8in.	12p (G)
HB22Y	Quickstick Pads	9p (H)
HB21X	Velcromounts	15p (G)
LQ12N	Sealing Strip	79p (E)

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LH12N	Aly Sheet 18 swg	£1.59 (D)
LH13P	Aly Sheet 16 swg	£3.85 (C)
WH48C	Mains Warning Label	15p (G)
XX31J	PCB Guides	28p (F)
YX88V	P7 Paper Roll	46p (F)
YX89W	P7 Ink Cassette	£2.75 (C)
XH39N	Transfer 1/8in Black	£1.56 (D)
XH40T	Transfer 1/8in Red	£1.56 (D)
XH41U	Transfer 1/8in White	£1.56 (D)
XH42V	Transfer 1/4in Black	£1.56 (D)
XH43W	Transfer 1/4in Red	£1.45 (D)
XH44X	Transfer 1/4in White	£1.45 (D)
XH45Y	Panel Transfer Black	£1.56 (D)
XH46A	Panel Transfer Red	£1.56 (D)
XH47B	Panel Transfer White	£1.56 (D)

KNOBS

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RW75S	Knob BK12	16p (G)
RX99H	Knob RN92	28p (F)
RW87U	Knob KB4	22p (G)
RW86T	Knob KB3	45p (F)
†RX09K	Knob R78	58p (E)
HB23A	Knob K1	32p (F)
HB24B	Knob K2	39p (F)
HB19V	Knob RK401	95p (E)
HB57M	Knob RK403	£1.55 (D)
RW88V	Knob M1	29p (F)
RW89W	Knob M2	29p (F)
RW90X	Knob M3	26p (F)
RX00A	Knob M4	45p (F)
RX10L	Knob R81	45p (F)
RX11M	Knob 82	55p (E)
LR75S	C/S Panel Screw	5p (H)

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RW78K	Knob F10	35p (F)
HB26D	Knob F11	35p (F)
RX01B	Knob NK2	45p (F)
RX02C	Knob PK2	49p (F)
YX01B	Knob K7A	28p (F)
YX02C	Knob K7B	27p (F)
YX03D	Knob K7C	32p (F)
YX04E	Knob K7D	58p (E)
HB28F	Knob R51	52p (E)
HB29G	Knob R52	53p (E)
RX07H	Knob R76	55p (E)
RX08J	Knob R77	64p (E)
HB30H	Knob R53	69p (E)
HB31J	Knob R54	96p (E)
YR64U	Knob K8A	43p (F)
YR65V	Knob K8B	56p (E)
YR66W	Knob K8C	72p (E)
RK89W	Knob K10A	45p (F)
RK90X	Knob K10B	59p (E)
RK91Y	Knob K10C	75p (E)
HB34M	Knob K105L	95p (E)
HB35Q	Knob K106L	£1.74 (D)
HB32K	Knob K105	59p (E)
HB33L	Knob K106	£1.42 (E)
HB36P	Knob K15	55p (E)
HB38R	Knob K30	78p (E)

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HB39N	Knob K44	69p (E)
HB40T	Knob K45	79p (E)
HB41U	Knob K46	£1.15 (D)
RX16S	Collet Knob Black	41p (F)
WL45Y	15mm Collet Cap Blk	5p (H)
WL46A	15mm Collet Cap Blue	5p (H)
WL47B	15mm Collet Cap Grn	5p (H)
WL48C	15mm Collet Cap Grey	5p (H)
WL49D	15mm Collet Cap Red	5p (H)
WL50E	15mm Collet Cap Yllw	5p (H)
WL51F	15mm Collet Pntr Blk	5p (H)
WL52G	15mm Collet Pntr Blu	5p (H)
WL53H	15mm Collet Pntr Grn	5p (H)
WL54J	15mm Collet Pntr Gry	5p (H)
WL55K	15mm Collet Pntr Red	5p (H)
WL56L	15mm Collet Pntr Ylw	5p (H)
RX18U	15mm Collet Nut Cvr	15p (G)
RX19V	15mm Collet Indctr	20p (G)
RX20W	15mm Collet Skirt	24p (G)
RX21X	15mm Collet Stator	24p (F)
WL43W	3/8in Nut	16p (G)
WL44X	10mm Nut	21p (G)
YG40T	Low-Cost Collet Knob	31p (F)
QY00A	LC Cap Black	7p (H)
QY01B	LC Cap Blue	7p (H)
QY02C	LC Cap Green	7p (H)
QY03D	LC Cap Grey	7p (H)
QY04E	LC Cap Red	7p (H)

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QY05F	LC Cap White	7p (H)
QY06G	LC Cap Yellow	7p (H)
RX22Y	Slide Knob A	18p (G)
YG09K	Slide Knob B	18p (G)
YG10L	Slide Knob C Black	20p (G)
YG11M	Slide Knob C Chrome	29p (F)
RX24B	Slide Knob F Blk	17p (G)
RX25C	Slide Knob F Blue	17p (G)
RX26D	Slide Knob F Green	17p (G)
RX27E	Slide Knob F Grey	17p (G)
RX28F	Slide Knob F Red	17p (G)

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RX29G	Spindle Coupler	82p (E)
RX30H	Ext Spindle	74p (E)
RX38R	Nylon Rod	14p (G)
RX46A	Cord Drive Steel	£1.51 (D)
RX31J	Brass Bush	29p (E)
BL73Q	Drive Cord	7p (H)
RX43W	Cord Drum Small	92p (D)
RX94C	Cord Drum Large	£1.05 (D)
RX44X	Flywheel	£3.68 (C)
HB45Y	Aluminium Dial	£6.60 (B)
RX42V	Ball Drive	£2.71 (C)
HB42V	Mini Ball Drive	£1.95 (D)
RX39N	Vernier Dial Small	£2.35 (C)
RX40T	Vernier Dial Medium	£2.95 (C)
RX41U	Vernier Dial Large	£3.84 (C)
HB46A	White Pointer	38p (F)
HB47B	Ball Drive Pointer	62p (E)
HB48C	Spring Short	9p (H)
HB49D	Spring Medium	9p (H)
HB50E	Spring Long	9p (H)
RX95D	Pulley 1/2in	14p (G)

MICROPHONES

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LB92A	Phone Coil	95p (E)
LB93B	Crystal Mic In Plas	50p (E)
HY33L	Crystal Mic In Metal	84p (E)
LB68Y	Lapel Mic	£1.28 (D)
YB31J	Cassette Mic Jacks	£1.95 (D)
YB32K	Cassette Mic DIN	£2.75 (C)
YB33L	Electret Cssette Mic	£2.95 (C)
WF35Q	Dynamic Ball Mic	£10.60 (B)
LH87U	Dynamic Stereo Mics	£10.25 (A)
WF05F	Communications Mic	£5.75 (B)

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YW70M	Diff Comm Mic	£8.25 (B)
RK03D	Power Mic DM313P	£12.60 (A)
YW77J	Mic Hldr Screw-Fix	28p (F)
YW78K	Mic Hldr Adhesive	49p (F)
YW79L	Mic Hldr Magnetic	52p (E)
RK04E	Power Mic DM311P	£14.20 (A)
XY72P	Base Station Mic	£29.60 (A)

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XG11M	Base Stn Mic DX357	DIS
XG12N	Base Stn Mic BSA610A	£34.40 (A)
LB69A	Tie-Clip Mic	£6.79 (B)
YW71N	UM Tie-Clip Mic	£13.84 (A)
YB35Q	Eletret Mic EM507	£11.98 (A)

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WF34M	Electret Mic Dual-Z	£16.75 (A)
YB36P	Unisound Mic EM82D	£19.17 (A)
YB37S	Unisound Mic EM83D	£21.40 (A)
WY06G	Super Cardroid Mic	£24.60 (A)
WY07H	Stereo Electret Mic	£19.75 (A)
YB38R	Unisnd Dyn DM-31011	£37.90 (A)

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LB94C	Screen S15	£6.58 (B)
LB95D	Mic Unit U15	£10.75 (A)
BK01B	FM Mic	£19.50 (A)
BK02C	FM Mic Adaptor	£22.80 (A)
LB35Q	Mic Windshield	45p (F)
RK92A	Universal Mic Holder	£1.85 (D)
RK93B	Tapered Mic Holder	£1.49 (D)
YW72P	Gsneck Mic Stand 8in	£2.21 (D)
LH88V	Gsneck Mic Stnd 13in	£2.95 (C)
WF36P	Gsneck Mic Stnd 19in	£3.45 (C)
YW73Q	Plastic Gsneck Base	DIS
YW74R	Metal Gsneck Base	£3.25 (C)
WF37S	Bkt For Gsnk Stand	£1.95 (D)
YW75S	Cast Base Mic Stand	£3.85 (C)
YW76H	Extra Hgt Mic Stand	£7.64 (B)

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LB96E	Table-Top Mic Stand	£2.25 (C)
XB45Y	5-Foot Mic Stand	£13.45 (A)
XB46A	Boom Arm	£12.65 (A)

MUSIC & EFFECTS

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LB97F	Pre-Amp EQ2S	£3.45 (C)
YB39N	Pre-Amp CS5	£8.43 (B)
XB30H	Mono Mic Mixer	£8.65 (B)
YK55K	Stereo Mixer MM2	£10.75 (A)
XB29G	Stereo Mixer	£23.90 (A)

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AF60Q	Graphic Eqlizr GE206	£59.95 (A)
AF27E	GE1305 Equaliser	£84.20 (A)
AF59P	Graphic Eq. GE909	£124.50 (A)
LB66W	Mini-Phaser	£21.80 (A)
YB30H	Fuzz Box	DIS

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XB41U	Fuzz-Wah Pedal	£29.50 (A)
XB34M	Vibra Chorus	£57.30 (A)
YB88V	Mini Compressor	£21.20 (A)
XB33L	Echo Chamber	£69.60 (A)
LB67X	Echo Chamber Tape	£4.99 (C)
XY80B	BBD Echo Machine	£76.40 (A)

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YB40T	Cry Guitar Pick-Up	£3.93 (C)
YB42V	Steel Mag Pick-up	£8.45 (B)
YL08J	Pickup Transl.AJ21	£27.95 (A)
YL09K	Pickup Transl.AJ51	£19.95 (A)
YL07H	Pickup Switch	£3.24 (C)
LB98G	Strap Button	61p (E)
LB60Q	Guitar Strings Steel	£1.72

OPTO

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RX86T	MES Batten Hldr	21p (G)
RX57M	Holder MES Amber	£1.45 (D)
RX58N	Holder MES Blue	DIS
RX59P	Holder MES Clear	£1.45 (D)
RX60Q	Holder MFS Green	£1.45 (D)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.

Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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RX61R	Holder MES Red	£1.45 (D)
RX76H	Dmd LES Lhldr Blue	35p (F)
RX77J	Dmd LES Lhldr Green	35p (F)
RX78K	Dmd LES Lhldr Red	35p (F)
RX79L	Dmd LES Lhldr White	35p (F)
RX80B	Dmd LES Lhldr Yellow	35p (F)
RX67X	Flt-Tp LES Lhldr Blu	38p (F)
RX68Y	Flt-Tp LES Lhldr Grn	35p (F)
RX69A	Flt-Tp LES Lhldr Red	35p (F)
FF66W	Fluted Lhldr Amber	30p (F)
FF67X	Fluted Lhldr Clear	30p (F)
FF68Y	Fluted Lhldr Green	30p (F)
FF69A	Fluted Lhldr Red	30p (F)
YY00A	LES Cover Amber	8p (H)
YY01B	LES Cover Blue	8p (H)
YY02C	LES Cover Green	8p (H)
YY03D	LES Cover Purple	8p (H)
YY04E	LES Cover Red	8p (H)
YY05F	LES Cover White	8p (H)
YY06G	LES Cover Yellow	8p (H)
BK52G	Min Neon Red	38p
BK53H	Min Neon Green	38p
BK54J	Min Neon Amber	38p
RX82D	Pan Neon Amber	29p (F)
RX83E	Pan Neon Red	29p (F)
BK51F	Pan Neon Green	31p
RX81C	Square Neon Red	33p (F)
RX98G	Square Neon Green	33p (F)
BK55K	Chrome Neon Red	59p
BK56L	Chrome Neon Green	58p

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RX70M	Wire Neon	14p (G)
WQ13P	Bulb Wire 12V	30p (F)
WL74R	LES Bulb 6V	17p (G)
WL75S	LES Bulb 12V	15p (G)
RX84F	Neon Bulb	99p (E)
WL76H	Bulb MES 3.5V	35p (F)
WL77J	Bulb MES 6V 0.24W	36p (F)
WL78K	Bulb MES 6V 0.6W	31p (F)
WL79L	Bulb MES 6.5V	27p (F)
WL80B	Bulb MES 12V 1.2W	28p (F)
WL81C	Bulb MES 12V 2.2W	29p (F)
WL82D	Bulb MES 24V	36p (F)
LQ10L	Portable Lamp	£6.95 (B)
XY71N	Caravan Lamp	£9.65 (B)
LQ11M	12V Tube	£1.38 (D)
LL15R	240V Inspection Lamp	£5.60 (B)
HB52G	Pygmy Bulb Blue	90p (E)
HB53H	Pygmy Bulb Green	90p (E)
HB54J	Pygmy Bulb Red	90p (E)
HB55K	Pygmy Bulb White	70p (E)
HB56L	Pygmy Bulb Yellow	90p (E)
WF25C	Spot Lamp Amber	£2.85 (C)
WF26D	Spot Lamp Blue	£2.85 (C)
WF27E	Spot Lamp Clear	£1.84 (C)
WF28F	Spot Lamp Green	£2.85 (C)
WF29G	Spot Lamp Red	£2.85 (C)
WF30H	Spot Lamp Violet	£2.85 (C)
YB29G	Spot Holder	£3.96 (C)
XB31J	BC Clip-On Hdr Sngl	TEMP
XB32K	BC Clip-On Hdr Twin	TEMP

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WF22Y	Gooseneck Lamp	£5.86 (B)
YK39N	Alarm Beacon	£18.95 (A)
WL32K	Mini LED Red	10p (G)
WL33L	Mini LED Green	19p (G)
WL34M	Mini LED Orange	17p (F)
YY38R	Mini LED Yellow	19p (G)
YY39N	Mini LED Clip	3p (H)
WL27E	LED Red	12p (G)
WL28F	LED Green	19p (G)
WL29G	LED Orange	33p (F)
WL30H	LED Yellow	17p (G)
YY40T	LED Clip	3p (H)
QY96E	Square LED Red	36p (F)
YH60Q	Square LED Green	36p (F)
YH61R	Square LED Yellow	43p (F)
YH62S	Square LED Clip	7p (H)
YY41U	Large LED Red	£1.49 (D)
YY42V	Large LED Clip	21p (G)
YY45Y	Shape LED R1 Red	20p (G)
YY46A	Shape LED R1 Green	25p (F)
YY47B	Shape LED R1 Orange	37p (F)
YY48C	Shape LED R1 Yellow	27p (F)
YY49D	Shape LED S2 Red	20p (G)
YY50E	Shape LED S2 Green	27p (F)
YY51F	Shape LED L3 Red	21p (G)
YY52G	Shape LED L3 Green	26p (F)
YY53H	Shape LED L3 Yellow	26p (F)
YY54J	Shape LED T4 Red	20p (G)
YY55K	Shape LED T4 Green	26p (F)
YY56L	Shape LED T4 Yellow	26p (F)
YY57M	Shape LED A5 Red	23p (G)
YY58N	Shape LED A5 Green	27p (F)

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YH53H	Cliplite Amber	16p (G)
YH54J	Cliplite Clear	16p (G)
YH55K	Cliplite Green	16p (G)
YH56L	Cliplite Red	16p (G)
YH57M	Cliplite Yellow	16p (G)
YY61R	Multicolour LED	TEMP
QR54J	Rect Multicolour LED	75p (E)
YY59P	Chrome LED Small	49p (F)
YY46A	Chrome LED Small Gn	53p
YY60Q	Chrome LED Large Red	54p (E)
QY47B	Chrome LED Large Gn	56p
QY48C	Black Bezel LED Red	38p
QY49D	Black Bezel LED Gn	47p (F)
BY65V	Red Bargraph Dslpy	£3.25 (C)
YG33L	Green Bargraph Dslpy	£3.22 (C)
YG34M	Ornge Bargraph Dsply	£3.22 (C)
YG35Q	Yllow Bargraph Dsply	£3.35 (C)
FR36P	7-Seg Red Type 1	£1.07 (D)
FR38R	7-Seg Red Type 4	£1.25 (D)

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FR39N	"1/2" Display Type 1	99p (E)
FR41U	"1/2" Display Type 4	£1.07 (D)
BK03D	Vertisocket Type 1	£1.15 (D)
BK04E	Vertisocket Type 2	£2.45 (C)
BY66W	DD Display Type A	£1.98 (D)
BY67X	DD Display Type AF	50p (E)
BY68Y	DD Display Type C	£1.98 (D)
XX08J	4-Dig Dspy Cmn Cath	£2.95 (C)
BY70M	4 Dig Dis Cmn Anode	£1.50 (D)

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HQ36P	Mult Cmn Cath Disply	£3.45 (C)
FR32K	Filter Amber	DIS
FR33L	Filter Green	£1.20 (D)
FR34M	Filter Red	85p (E)
FR35Q	Filter Yellow	65p (E)
FY89W	Lqd Crystal Display	£4.82 (C)

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WL35Q	Opto-Isolator	69p (E)
YY62S	Dual Opto-Isolator	£1.48 (D)
YY63T	Quad Opto-Isolator	£2.96 (C)
WQ70M	Darlington Isolator	74p (E)
YY64U	SCR Isolator	£2.12 (C)
QQ10L	Triac Isolator	£1.55 (D)
YY65V	Infra-Red Source	38p (F)
YY66W	Infra-Red Sensor	31p (F)

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RK22Y	Solar Panel 6V	£7.95 (B)
RK23A	Solar Panel 9V	£9.74 (B)
RK24B	Solar Panel 12V	£12.20 (A)
YH70M	IR Emitter TIL38	49p (F)
YH71N	Photodiode TIL100	£1.10 (E)
BL23A	Solar Cell MS4A	£2.95 (C)
QF30H	BPX25	£4.20 (C)

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HQ61R	MEL 12	38p (F)
YQ62S	Xenon Tube	£2.40 (C)
YQ63T	Trigger Transfmr	49p (F)
XR56L	1mm Light Guide	67p (E)
XL11M	Laser Tube	£124.00 (A)
HY19V	5KV Laser PCB	£4.80 (C)
HQ63T	Lens	£2.45 (C)
HQ64U	Lensholder	£1.12 (E)

ORGAN

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QL02C	SAM77	£1.20 (D)

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XB10L	DMO2	£14.82 (A)
XB11M	DMO2T	£15.82 (A)

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XL08J	Short Spring Line	£5.53 (B)
FB98G	Rubber Coupling	66p (E)
XB84F	Long Spring Line	£11.13 (A)
XB85G	MES Driver Module	£6.95 (B)
YL17T	Reverb PSU Module	£4.73 (C)
XB17T	Mid Kbd 49-Note C-C	£26.50 (A)
XB13P	KB Mounting Strip	46p (F)

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XB14Q	Keyboard 48-Note	£23.94 (A)
XB15R	Keyboard 49-Note	£33.20 (A)
XB16S	Keyboard 61-Note	£39.95 (A)
$XY92A	Twin Kbd & Frame	£49.90 (A)
$XY97F	Kbd Separator	£1.95 (D)
BH62S	Spacer Block	4p (H)
BH63T	Keyboard Spacer	2p (H)
XB94C	Contact Block 1WG	29p (F)
XB01B	Contact Block GJ	45p (F)
XB02C	Contact Block GB2	78p (E)
XB03D	Contact Block GC3	DIS
QY07H	Contact Springs	8p (H)
XB00A	Gold Wire	£1.10 (D)

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XB04E	Earth Bar	23p (G)
FL66W	Stop Tab Black	75p (E)
FL67X	Stob Tab Blue	75p (E)
FL68Y	Stop Tab Green	75p (E)
FL69A	Stop Tab Grey	75p (E)
FL70M	Stop Tab Ivory	75p (E)
FL71N	Stop Tab Maroon	75p (E)
FL72P	Stop Tab Orange	75p (E)
FL73Q	Stop Tab Red	75p (E)
FL74R	Stop Tab White	75p (E)
FL75S	Stop Tab Yellow	75p (E)
BR05F	S Tab Acc Del Trem	£1.10 (D)
BR47B	S Tab Bass Guitar	£1.10 (D)
BR67X	S Tab Bourdon 8'	£1.10 (D)
BR06G	S Tab Cello 16'	£1.10 (D)
BR07H	S Tab Clarinet 8'	£1.10 (D)
BR08J	S Tab Clarion 4'	£1.10 (D)
BY00A	S Tab Clavichord	£1.10 (D)
BY01B	S Tab D/B to Rotor	£1.10 (D)
BY02C	S Tab Dly Vbrato Acc	£1.10 (D)
BY03D	S Tab Dly Vbrto Solo	£1.10 (D)
BR09K	S Tab Diapason 8'	£1.10 (D)
BR68Y	S Tab Diapason 16'	£1.10 (D)
BR10L	S Tab Drawbars Acc	£1.10 (D)
BR11M	S Tab Drawbars Solo	£1.10 (D)
BR12N	S Tab Dulciana 8'	£1.10 (D)
BR13P	S Tab Flute 1'	£1.10 (D)
BR14Q	S Tab Flute 2'	£1.10 (D)
BR15R	S Tab Flute 2 2/3'	£1.10 (D)
BR16S	S Tab Flute 4'	£1.10 (D)
BR17T	S Tab Flute 5 1/3'	£1.10 (D)
BR18U	S Tab Flute 8'	TEMP
BR19V	S Tab Flute 16'	£1.10 (D)
BR20W	S Tab French Horn 8'	£1.10 (D)
BR21X	S Tab Gedeckt 8'	£1.10 (D)
BY05F	S Tab Gedeckt 16'	£1.10 (D)
BY06G	S Tab Honky Tonk	£1.10 (D)
BR22Y	S Tab Horn 8'	£1.10 (D)
BY07H	S Tab Mixture 16'	£1.10 (D)
BR23A	S Tab Oboe 8'	£1.10 (D)
BR24B	S Tab Octave 4'	£1.10 (D)
BR25C	S Tab Pedal Sustain	£1.10 (D)
BY08J	S Tab Piano	£1.10 (D)
BY09K	S Tab Presets Cancel	£1.10 (D)
BY10L	S Tab Prsts to Rotor	£1.10 (D)
BY11M	S Tab Reed 4'	£1.10 (D)
BR26D	S Tab Reverb	£1.10 (D)
BY12N	S Tab Rotor Fast	£1.10 (D)
BY13P	S Tab Rotor To Main	£1.10 (D)
BR27E	S Tab Salicet 4'	£1.10 (D)
BR28F	S Tab Salicional 8'	£1.10 (D)
BR29G	S Tab Saxophone 16'	£1.10 (D)
BR30H	S Tab Solo Del Trem	£1.10 (D)
BR31J	S Tab String 4'	£1.10 (D)
BR32K	S Tab String 8'	£1.10 (D)
BR33L	S Tab Sub Bass 16'	£1.10 (D)
BY14Q	S Tab Sustain Acc	£1.10 (D)
BY15R	S Tab Sustain Solo	£1.10 (D)
BR34M	S Tab Tremulant	£1.10 (D)
BR35Q	S Tab Trumpet 8'	£1.10 (D)
BR36P	S Tab Tuba 16'	£1.10 (D)
BY16S	S Tab Vibrato	£1.10 (D)
BR37S	S Tab Vox Anglica 8'	£1.10 (D)
BR38R	S Tab Vox Humana 8'	£1.10 (D)
BH49D	Tablet Rocker Grey	96p (E)
BH50E	Tablet Rocker Orange	96p (E)
BH51F	Tablet Rocker Red	96p (E)
BY17T	Mar Ky Tab Cello 16'	£3.45
BY18U	Mar Key Tab Clar 8'	DIS
BY19V	Mar Ky Tab Clrion 4'	DIS
BY20W	Mar Key Tab Clav	£3.45
BY21X	Mr Ky Tb D/B to Rtr	£3.45
BY22Y	Mr Ky Tb Dly Vbr Acc	DIS
BY23A	Mr Ky Tb Dly Vbr Slo	£3.45
BY24B	Mar Key Tab Diap 8'	DIS

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BY25C	Mar Key Tab Diap 16'	DIS
BY26D	Mar K Tab Dbar Acc	£3.45
BY27E	Mar K Tab Dbar Solo	£3.45
BY28F	Mar Key Tab Dulc 8'	DIS
BY29G	Mar Key Tab Flute 1'	£3.45
BY30H	Mar Key Tab Flute 2'	DIS
BY31J	Mr Ky Tb Flte 2 2/3'	DIS
BY32K	Mar Key Tab Flute 4'	DIS
BY33L	Mr Ky Tb Flte 5 1/3'	DIS
BY34M	Mar Key Tab Flute 8'	DIS
BY35Q	Mar Ky Tab Flute 16'	DIS
BY36P	Mr Ky Tb Frch Hrn 8'	£3.45
BY37S	Mar Key Tab Gedkt 8'	£3.45
BY38R	Mar Key Tab Gedkt 16'	£3.45
BY39N	Mar Key Tab Hnky Tnk	£3.45
BY40T	Mar Key Tab Horn 8'	DIS
BY41U	Mar Key Tab Mix 16'	DIS
BY42V	Mar Key Tab Oboe 8'	£3.45
BY43W	Mar Key Tab Octve 4'	DIS
BY44X	Mar Key Tab Pdl Sus	£3.45
BY45Y	Mar Key Tab Piano	£3.45
BY46A	Mr Ky Tb Prsts Cncl	£3.45
BY47B	Mr Ky Tb Prsts To Rr	£3.45
BY48C	Mar Key Tab Reed 4'	DIS
BY49D	Mar Key Tab Reverb	DIS
BY50E	Mar Key Tab Rtr Fst	£3.45
BY51F	Mr Ky Tb Rtr To Main	£3.45
BY52G	Mar Ky Tab Salict 4'	DIS
BY53H	Mar Key Tab Salic 8'	£3.45
BY54J	Mar Key Tab Sax 16'	DIS
BY55K	Mar Key Tab Strng 4'	£3.45
BY56L	Mar key Tab Strng 8'	DIS
BY57M	Mr Ky Tb Sb-Bss 16'	£3.45
BY58N	Mar Key Tab Sus Acc	£3.45
BY59P	Mar Key Tab Sus Solo	£3.45
BY60Q	Mar Key Tab Trmpt 8'	DIS
BY61R	Mar Key Tab Tuba 16'	DIS
BY62S	Mar Key Tab Vibrato	£3.45
BY63T	Mar K Tab Vox Ang 8'	£3.45
BY64U	Mar K Tab Vox Hum 8'	DIS
FL76H	Key Tab	90p (E)
BR46A	ST Strip	£1.35 (D)
XX13P	KT Strip	£1.50 (D)
BR41U	Drawbar Red	£1.35 (D)
BR42V	Drawbar White	£1.55 (D)
BR98G	Drawbar Blue	£1.55 (D)
BR99H	Drawbar Green	£1.55 (D)
XB18U	Contact Pedal Board	£26.20 (A)

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XB19V	Free-Stdg Pedalboard	£63.00 (A)
XB99H	Pdl Unit Front Panel	£2.95 (C)
XB96E	32-Note Pdlbd	£135.41 (A)
	Carr in UK with XB96	£14.30
XB21X	Piano Pedal	£11.85 (A)
XB20W	Swell Pedal	£11.95 (B)
XY89W	Switched Swell Pedal	£11.45 (A)
XY98G	Swell Pdl Hsg & Trim	£3.75 (C)
XY28F	Remote Foot Control	£12.60 (A)

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$XY99H	Roll Top	£19.50 (A)
XG00A	Roll Top Guides (pr)	£2.50 (C)
XG01B	Music Stand	£4.75 (C)
XB95D	Organ Stool	£29.50 (A)

PANEL METERS

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RW74R	Level Meter	£4.35 (C)
LB80B	Sig Strength Meter	£1.95 (D)
LB79L	Tuning Meter	£1.95 (D)
RW73Q	VU Meter V41	£2.20 (C)
YQ47B	Dual VU Meter	£3.90 (C)
RK21X	Quick Ft Mtr 50-0-50	£2.95 (C)
RK05F	Qck Ft Mtr 100-0-100	£2.95 (C)
RK06G	Quick Fit Meter 50uA	£2.95 (C)
RK07H	Quick Fit Mtr 100uA	£2.95 (C)
RK08J	Quick Fit Mtr 500uA	£2.95 (C)
RK09K	Quick Fit Meter 1mA	£2.95 (C)
RK10L	Quick-Fit Meter 5mA	£2.95 (C)
RK11M	Quick-Fit Meter 10mA	£2.95 (C)
RK12N	Quick-Fit Meter 50mA	£2.95 (C)
RK13P	Quick-Ft Meter 100mA	£2.95 (C)
RK14Q	Quick-Ft Meter 500mA	£2.95 (C)
RK15R	Quick-Fit Meter 1A	£2.95 (C)
RK16S	Quick-Fit Meter 5A	£2.95 (C)
RK17T	Quick-Fit Meter 25V	£2.95 (C)
RK18U	Quick-Fit Meter 50V	£2.95 (C)
RK19V	Quick-Fit Meter VU	£2.95 (C)
RK20W	Punch 27.5mm	£6.58 (B)

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RW98G	2inPn Mt 100-0-100uA	£6.65 (B)
RW99H	2inPn Mt 500-0-500uA	£6.65 (B)
RW91Y	2in. Pan Meter 50uA	£6.45 (B)
RW92A	2in. Pan Meter 100uA	£6.45 (B)
RW93B	2in. Pan Meter 500uA	£6.45 (B)
RW94C	2in. Pan Meter 1mA	£6.45 (B)
RW95D	2in. Pan Meter 5mA	£6.45 (B)
RW96E	2in. Pan Meter 10mA	£6.45 (B)
†RX32K	2in. Pan Meter 50mA	£6.65 (B)
RX33L	2in. Pan Meter 100mA	£6.20 (B)
RX34M	2in. Pan Meter 500mA	£5.99 (B)
RX35Q	2in. Pan Meter 1A	£6.20 (B)
RX36P	2in. Pan Meter 50V	£6.65 (B)
RX37S	2in. Pan Meter 300V	£6.95 (B)
†RX52G	2in. Pan Meter 'S'	£6.65 (B)
RX53H	2in. Pan Meter 'VU'	£6.65 (B)
RX54J	Large Panel Meter	£7.59 (B)
RX92A	Meter Ml 15V	£7.62 (B)
RX88V	Meter Ml 300V	£8.64 (B)
RX89W	Meter Ml 500uA	£7.38 (B)
RX90X	Meter Ml 5A	£7.24 (B)
RX91Y	Meter Ml 15A	£7.65 (B)
RX93B	Meter Ml 25A	£7.95 (B)

PCB EQUIPMENT

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FL02C	SRBP 0.1in Type 3	£1.10 (D)
FL06G	Vero 14354	25p (F)
FL07H	Vero 10345	£1.20 (D)
FL08J	Vero 10346	98p (E)
FL09K	Vero 10347	£1.30 (D)
FL10L	Vero 10348	£1.20 (D)
FL53H	Vero 10401	£3.65 (C)
FL17T	Verostrip	£1.39 (D)
FL19V	DIP Board	£4.68 (C)
HQ48C	Vero V-Q Board	£2.30 (D)
FL25C	Tool 2022	£1.62 (D)
FL26D	Tool 2150	£2.32 (D)
FL27E	Tool 2151	£2.23 (D)
FL20W	Pin 2140	65p (E)
FL21X	Pin 2141	65p
FL23A	Pin 2144	65p (E)
FL24B	Pin 2145	69p

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FL80B	Pin 0266 Pk of 100	£2.65 (F)
FL81C	Pin 1657 Pk of 10	38p (F)
★RK94C	Verowire Kit	£5.60 (B)
HY16S	Verowire Pen	£4.25 (C)
★HY17T	Verowire Spool	99p (E)
FY33L	Verowire Comb	8p (H)
FL82D	Track Pin	85p (E)
FL28F	4-Way Tag	12p (G)
FL29G	Mounting Strip	32p (F)
FL11M	Tag Board	94p (E)
YL11M	Vero Plugblock	£4.92 (C)
HQ84F	Verobloc Bracket	68p (E)
BK62S	Engineer Design Sht	69p (F)
BK63T	Verobloc Kit	£5.95 (C)

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YR83E	Eurobreadboard	£6.75 (B)
YR84F	Prof Plugblock	£6.95 (B)
XX42V	MP Urobreadboard	£21.75 (A)
YR85G	Bus-Strip Plugblock	£2.95 (C)
YR86T	Plugblck Contct Strp	28p (F)
YR87U	Plugblock PCB	£1.85 (D)
XB43W	Seno Etch System	£7.96 (B)

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XY10L	UV Exposure Box	£48.20 (A)
BW19V	Photo-Etch PCB	£2.94 (C)
XX12N	Etch Crystals	£1.49 (D)
BW20W	Phot-Etch Drftg Pk	£1.95 (D)
WF10L	Etcher Fluid	£2.52 (C)
HX02C	PCB Pen	£1.35 (D)
HX03D	Resist Remover	98p (E)
HX00A	PCB SRBP Smll Single	48p (F)
WF38R	PCB SRBP Med Single	96p (E)
WF39N	PCB SRBP Lrg Single	£1.25 (D)
HX01B	PCB F.Glass Sm Sngl	85p (E)
WF40T	PCB F.Glass Med Sngl	£1.75 (D)
WF41U	PCB F.Glass Lrg Sngl	£2.75 (C)
WF42V	PCB F.Glass Med Dble	£1.39 (D)

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HX04E	Polish Block	£1.40 (D)
XB90X	Fixircuit	£9.52 (B)
XG20W	CM100 PCB Kit	£69.95 (A)
RK40T	Film FPF012	£9.95 (B)
RK41U	Etching Kit CM100E	£5.82 (C)
RK42V	PCB006 Pack	£7.95 (B)
XG21X	Chemicals Kit CM100C	£16.95 (A)
BW21X	Track Tape 31	£1.24 (E)
BW22Y	Track Tape 40	£1.24 (E)
BW23A	Track Tape 50	£1.24 (E)
BW24B	Track Tape 62	£1.39 (D)
BW25C	Track Tape 80	£1.39 (D)
BW26D	Track Tape 100	£1.39 (D)
BW27E	Track Tape 125	£1.96 (D)
BW28F	Track Tape 150	£1.96 (D)
BW29G	Track Tape 200	£1.96 (D)
BW30H	Pad 075	£1.55 (D)
BW31J	Pad 100	£1.55 (D)
BW32K	Pad 125	£1.64 (D)
BW33L	Pad 150	£1.55 (D)
BW34M	Pad 200	£1.64 (D)
BW35Q	Pad 300	£1.50 (D)
BW36P	Pad 400	£2.62 (C)
BW37S	Pad 500	£3.95 (C)
BW38R	Pad 600	£5.64 (B)

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BW40T	IC Pads 200	£5.60 (C)
BW41U	Drafting Template	94p (E)
HX45Y	Transfer Sheet 1	42p (F)
HX46A	Transfer Sheet 2	42p (F)
HX47B	Transfer Sheet 3	42p (F)
HX48C	Transfer Sheet 4	42p (F)
HX49D	Transfer Sheet 5	42p (F)
HX63T	Transfer Sheet 6	42p (F)
HX64U	Transfer Sheet 7	42p (F)
HX65V	Transfer Sheet 8	42p (F)
HX66W	Transfer Sheet 9	42p (F)
HX67X	Transfer Sheet 10	42p (F)
HX68Y	Transfer Sheet 11	42p (F)
HX83E	Transfer Sheet 12	42p (F)
HX84F	Transfer Sheet 13	42p (F)
HX44X	Transfer Kit	£3.75 (C)

PROJECTS

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BH64U	Minicon Pl 17way	46p (F)
BH67X	Rt-Angle Mncn Pl 15W	65p (E)
BX98G	Jumper Cable 17-way	£3.65 (C)
YK06G	Pedalboard Cableform	£2.98 (C)
HY31J	Steel Washer 4BA	11p (G)
$XY94C	Matinee Front Panel	£17.95 (A)
$XY95D	Matinee Mtlwk Kit	£9.50 (B)
XY96E	End Cheek Set	£6.75 (B)
YK04E	Matinee PSU Bkt	£1.60 (D)
YK05F	Pot Mntg Brkt	79p (E)
FH86T	Reset Spring	3p (H)
HB60Q	Latchbrkt 5 way	27p (F)
HY26D	Latch Brkt 16 way	72p (E)
HY27E	Reset Bar 15way	35p (F)
HY28F	Latchbrkt 9way	39p (F)
HY29G	Reset Bar 6way	16p (G)
QY15R	2716/M2	£10.50 (A)
GA18U	Matinee PSU PCB	£2.10 (C)
$XY86T	Matinee Main PCB	£50.00 (A)
XY88V	Matinee Contact pcb	£7.30 (B)
XY91Y	Matinee Organ Kit	£299.95 (A)
	Carriage with XY91Y	£15.00
XY93B	Matinee Cabinet Kit	£99.50 (A)
	Carriage with XY93B	£20.00
XG05F	Matinee Module Kit	£399.95 (A)
	Carr in UK With XG05	£15.00
XX43W	Matinee Dem Cassette	£1.99 (D)
XH55K	Matinee Book	£2.50NV (C)

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BR45Y	AS314	33p (F)
BR88V	Mk/Space Adptr Kit	£3.95 (C)
YL20W	Mstr Tuning Module	£18.20 (A)
BB00A	Divider Board 'A'	£4.64 (C)
BB01B	Divider Board 'B'	£3.28 (C)
BB02C	Tone Board 'A'	£4.45 (C)
BB03D	Tone Board 'B'	£1.98 (C)
BB07H	Control Board 'A'	£4.25 (C)
BB08J	Control Board 'B'	£2.98 (C)
BB09K	Sawtooth Board 'A'	£4.35 (C)
BB10L	Sawtooth Board 'B'	£5.49 (B)
BB77J	Divider MO & Frq Gen	£4.95 (C)
BB78K	Pedal PCB 'B'	£3.95 (C)
BB79L	32-Note Pedal Voice	£4.82 (C)
BB80B	Pedal Diode PCB	£1.65 (D)
HQ72P	Auto Ogn Gen/Clk PCB	£4.36 (C)
HQ73Q	Auto Ogn Crd Cdr PCB	£3.95 (C)
HQ74R	Auto Ogn Auto St PCB	£6.32 (B)
HQ75S	Auto Ogn PA/PSU PCB	£4.35 (C)
YL00A	Organ Mixer PCB	£3.52 (C)
YL18U	2G05 PSU PCB	£1.35 (D)
YL21X	32 Note Pdl PSU PCB	£3.42 (C)
XX38R	Downbeat Indictr PCB	£2.20 (C)

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BB11M	Gate Board	48p (F)
BB04E	Tone Board 'C'	£4.90 (C)
BB05F	Tone Board 'D'	£4.82 (C)
BB06G	Tone Board 'E'	£4.96 (C)
BB12N	Pedal PCB 'A'	£2.20 (C)
BB15R	Mother Board 'A'	£10.30 (A)
BB13P	A/B Switch Board	£1.68 (D)
BB14Q	MES Amp Board 'A'	72p (E)
XH00A	MES51	15pNV
XH02C	MES52	15pNV
XH04E	MES53	35pNV
XH31J	MES54	30pNV
XH33L	MES55	30pNV

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XF11M	Stereo Synth Book	£2.00NV (C)
BB41U	Synth Mixer PCB	£4.98 (C)
BB44X	Synth VCA PCB	£1.64 (C)
BY87U	Synth Preset Mtg Bd	68p (E)
BY88V	Synth 1979 Kybd Cont	£6.98 (B)
BY89W	Synth Binary Encoder	£8.94 (B)
BB40T	Synth PSU Mk.II PCB	£4.99 (C)
BY90X	Synth Smpl & Nse PCB	£4.20 (C)
BB43W	Synth Trns Gen 1 PCB	£3.20 (C)
BB45Y	Synth Trns Gen 2 PCB	£3.84 (C)
BY81C	Synth Trns Rept PCB	£1.38 (D)
BY82D	Synth Rvrb & Phs PCB	£3.20 (C)
BY83E	Synth VC Pn & AncPCB	£8.36 (B)
BB38R	Synth Oscillator PCB	£4.98 (C)
BB48C	Synth Ext I/P's PCB	£1.54 (D)
BB65V	3600 VCF PCB	£2.20 (C)
BB64U	4600 Hinge	75p (E)
BB63T	Synth Ext I/P's Bkt	64p (E)
BB49D	Synth Osctr Mtg Bkt	67p (E)
BB52G	Synth Mixer Chassis	£2.10 (C)
BB51F	Synth Pwr Sply Htsnk	£1.30 (D)
BB56L	Synth Mixer Mtg Bkt	16p (G)
BB61R	Synth VCF Mtg Bkt	64p (E)
BB58N	Synth Trns 1/Env Bkt	85p (E)
BB59P	Synth Trns 2 Mtg Bkt	£1.20 (D)
BB60Q	Synth VCA Mtg Bkt	52p (E)
BF95D	Joylever PCB	99p (E)
XQ01B	5600 Front Panel	£14.20 (A)
	Carr in UK with XQ01	£9.00
BY84F	5600 Rear Panel	£4.55 (C)
XQ02C	5600 Cabinet	£55.23 (A)
	Carr in UK with XQ02	£9.00
XB79L	Teak 5600 Cabinet	£63.20 (A)
	Carr In UK with XB79	£7.00
LW53H	5600S Synth Kit	£599.95 (A)
	Carr in UK with LW53	£20.00

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BY86T	3800 Interface PCB	£2.62 (C)
BB47B	Synth Otpt Stge PCB	£6.34 (B)
XQ03D	3800 Front Panel	£11.98 (B)
BB67X	3600 VCF Mtg Bkt	59p (E)
BF96E	3800 Sp.Ext.I/P.Bkt	55p (E)
BF98G	3800 VCA Bkt	55p (E)
BF99H	3800 Intface Mtg Bkt	55p (E)
BY85G	3800 Rear Panel	£4.56 (C)
XQ04E	3800 Cabinet	£49.60 (A)
	Carr in UK with XQ04	£9.00
LW54J	3800 Synth Kit	£336.75 (A)
	Carr in UK with LW54	£20.00
YQ46A	Synth Demo Tape	£4.50 (A)
XF41U	Synth Guide Book	£2.30NV (C)
XF42V	5600S Patch Chart	7pNV (H)
XF43W	3800 Patch Chart	7pNV (H)

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QY17T	2716/M3	£14.95 (A)
RK32K	Sequencer Key Print	65p (E)
GA65V	Sequencer PSU PCB	£1.35 (D)
YQ56L	Sequencer Main PCB	£5.54 (C)
YQ57M	Seq Display PCB	£1.65 (D)
YQ58N	Seq Keyboard PCB	£2.35 (C)
YQ59P	Seq Interface PCB	£2.10 (C)
LW66W	Sequencer Kit	£125.00 (A)
XH59P	Sequencer Leaflet	40pNV (F)

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XG08J	Spectrum Front Panel	£14.95 (A)
XX46A	Spectrm Joystk Panel	£2.25 (C)
XY90X	Spectrum Bus Bar Set	£2.20 (C)
GA03D	Spectrum PSU PCB	£2.40 (C)
GA09K	24-Way Contact PCB	£2.98 (C)
GA10L	25-Way Contact PCB	£2.94 (C)
GA36P	Spectrum VCO PCB	£4.75 (C)
GA53H	Spectrum LFO PCB	£2.50 (C)
GA55K	Spectrum Cntrllr PCB	£1.82 (D)
GA57M	Spectrum VCF PCB	£2.64 (C)
GA59P	Spectrum Shaper PCB	£3.26 (C)
LW60Q	Spectrum Synth Kit	£167.50 (A)
XH56L	Spectrum Synth Book	£1.42NV (D)
XH18U	MES22	25pNV
BY78K	Piano PSU/Voice PCB	£4.45 (C)
BY79L	Piano Top Oct PCB	£5.44 (C)
BY80B	Piano Two-Oct PCB	£6.72 (B)
XQ06G	Piano Cabinet Black	£49.95 (A)

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XH20W	MES25	25pNV
BB16S	Orgn/Gtar Bass PCB	£10.50 (A)
GA32K	Hexadrum Pcb	£2.60 (C)
LW85G	Hexadrum Kit	£18.95 (A)
GA05F	Syntom PCB	£1.18 (D)
BH60Q	Syntom Front Panel	£1.10 (D)
LW86T	Syntom Kit	£10.90 (A)

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GA35Q	Synwave PCB	£1.10 (D)
BX99H	Synwave Front Panel	£1.46 (D)
LW87U	Synwave Kit	£10.25 (A)
GA54J	Synclock PCB	£1.65 (D)
XX44X	Synclock Front Panel	£1.50 (D)
LW55K	Synclock Kit	£19.75 (A)
LW88V	Volume Pedal Kit	£21.45 (A)

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GA52G	Auto Swell PCB	£1.15 (D)
LW89W	Auto Swell Kit	£10.90 (A)
GA24B	Guitar Tuner PCB	£1.45 (D)
YL26D	Guitar Tuner Frt Pan	£1.10 (D)
LW90X	Guitar Tuner Kit	£10.75 (A)
GA48C	Harmony Gen PCB	£1.96 (C)
LW91Y	Harmony Gen Kit	£15.45 (A)

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GA00A	D.I.Box PCB	£1.10 (D)
GA41U	Combo Amp PCB	£5.75 (B)
XG03D	Combo Amp Frnt Panel	£4.60 (C)
LW92A	Combo-Amp Kit	£92.85 (A)

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RK25C	Stereo Amp Heatsink	£1.25 (D)
XG16S	Stereo Amp Woodwork	£6.95 (B)
XG15R	Stereo Amp Chassis	£5.95 (B)
GA71N	Stereo Amp PCB	£4.92 (C)
GA78K	Stereo Amp Sw PCB	42p (E)
LW71N	25W Stereo Amp Kit	£56.24 (A)
RK36P	Switch Panel	£1.20 (D)
GA97F	Stereo Amp IR Decodr	£2.75 (C)
GA99H	Sto Amp IR Contrller	£1.40 (D)
LW77J	Amp Remote Cntrl Kit	£28.96 (A)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.

Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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XH48C	MES33	40pNV (F)
FL94C	HiFi Amp Sel Mthr PC	£4 20 (C)
FL95D	HiFi Amp Sel PCB	£3 47 (C)
FL96E	HiFi Amp Eql Mthr PC	£3 42 (C)
FL97F	HiFi Amp Eql PCB	£2 20 (D)
FL98G	HiFi Amp Pk Det PCB	£2 46 (D)
FL99H	HiFi Amp PSU PCB	£2 15 (C)
XX32K	H/Phones Skt Brckt	59p (E)
XY21X	HiFi Amp Chassis	£24 20 (A)
XY22Y	HiFi Amp Screen	£2 42 (D)
XY23A	HiFi Amp Frt Panel	£11 98 (B)
XY24B	HiFi Amp Cover Black	£6 95 (B)
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LR13P	HQ Mixer PCB No 2	£1 96 (D)
LR14Q	HQ Mixer PCB No.3	£1 68 (D)
LR15R	HQ Mixer PCB No 4	£1 62 (D)
LR34M	HQ Mixer PCB No 24	£1 98 (D)
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LR16S	HQ Mixer PCB No 5	£1 10 (D)
LR35Q	HQ Mixer PCB No 25	£1 92 (D)
LR21X	HQ Mixer PCB No 6	£1 10 (E)
LR22Y	HQ Mixer PCB No 7	£1 75 (D)
LR23A	HQ Mixer PCB No 8	£1 60 (D)
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LR24B	HQ Mixer PCB No 9	£1 78 (D)
LR42V	HQ Mixer PCB No 29	£3 24 (C)
LR25C	HQ Mixer PCB No 10	£2 10 (D)
LR26D	HQ Mixer PCB No 14	£1 87 (D)
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GA68Y	Quadramix PCB	£1 24 (D)
YQ18U	Tone Con PCB	£1 55 (D)
YQ06G	Stereophoner PCB	£1 10 (D)
YQ19V	LM380 Amp PCB	£2 20 (D)
YQ20W	20W Amp PCB	£1 50 (D)
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HQ68Y	50W Hi Fi PCB	£3 25 (C)
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LW35Q	50W Amp Kit	£14 95 (A)
GA29G	MOSFET Amp Mtg Bkt	£1 15 (D)
GA28F	75W MOSFET Amp PCB	£1 80 (D)
LW51F	75W MOSFET Amp Kit	£11 49 (A)
BB19V	Disco PSU PCB	£1 95 (D)
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LW32K	150W Power Amp Kit	£19.62 (A)
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GA08J	Woofer PCB	£2 00 (C)
LW40T	Tuner Metalwork Kit	£43 90 (A)
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LW41U	Tuner PSU Module	£24 96 (A)
LW42V	Tuner Switching Mod	£16 20 (A)
LW45Y	TV Sound Tuner	£45 99 (A)
LW44X	Tuner Head FD811U14	£26 40 (A)
YQ00A	IF Tuner Mono Module	£9 50 (B)
YQ10L	12/30V PSU Module	£6 70 (B)
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LW43W	Tuner IF Module	£18 98 (A)
LW48C	Stereo Tuner Kit	£161 00 (A)
LW46A	AM Tuner	£17 95 (A)
XF22Y	Tuner Schedule	FREE
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XH21X	MES37	25pNV (F)
XX03D	10 Channel G.E PCB	£1 95 (D)
XB74R	10-Chl Eqlsr Mtwrk	£12 20 (A)
XB75S	10-Chl Eqlsr Wwrk	£8 50 (B)
GA30H	Compander PCB	£3 20 (C)
GA31J	Compander PSU PCB	£1 60 (D)
GA43W	Noise Gate Pcb	£1 30 (D)
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XY32K	Cassette Mechanism	£14 95 (A)
XY34M	Stereo Tape Module	£17 20 (A)
XH51F	MES30	20pNV
YQ30H	Tape Switch Board	42p
YQ33L	Tape Switch Bracket	51p
YQ31J	Tape PSU PCB	39p
XY35Q	Cassette Parts Kit	£11 90 (A)
XY36R	Cassette Recrder Kit	£39 95 (A)
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XF04E	MES41	40pNV
XB76H	Disco Front Panel	£12 50 (A)
XY26D	Heatsink Mtg Plate	£3 95 (C)
XY27E	Heatsink Cover	£6 45 (B)
BB18U	Heatsink DR2	74p (E)
XB77J	Disco Cabinet	£49 95 (A)
	Carr in UK with XB77	£8 00
BB81C	Disco Pre Amp Tn PCB	£4 45 (C)
BB19V	Disco PSU PCB	£1.95 (D)
BB20W	150W Amp Board	£2 35 (C)
BB26D	Motor Switch PCB	£1 15 (D)
BB27E	Light Mod Bd	£5 81 (B)
BB22Y	FET-Ceramic PU Bd	£1.95 (D)
BB24B	Disco Fader Bd	£2 20 (C)
BB25C	VUM & HP Amp Bd	DIS
XH23A	MES42	25pNV
XB37S	Sound To Light Case	£12 50 (A)
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GA42V	Partylite Pcb	£2 25 (C)
LW93B	Partylite Kit	£8 45 (B)
YQ21X	Snd/Light Conv PCB	£2.10 (C)
GA25C	Power Control pcb	£1 15 (D)
GA58N	The Bomb PCB	£1 55 (D)
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GA04E	Stopwatch PCB	£2 95 (C)
LW65V	Stopwatch Kit	£34 95 (A)
FY94C	Mncn Ltch Hsng 10way	18p (G)
HQ85G	Minicon Plug 10-Way	47p (F)
GA64U	Timer Front Panel	£3 85 (C)
GA61R	Timer Main PCB	£2 80 (C)
GA62S	Timer Switch Board	£3 85 (C)
GA63T	Timer Relay PCB	£1 10 (D)
LW94C	Universal Timer Kit	£39 95 (A)
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QY25C	2716/M4	£10 50 (A)
GB04E	E L C Board	£4 95 (C)
GB05F	Connect PCB	£3 80 (C)
GB06G	T/E Motherboard	£16.20 (A)
GB07H	T/E PSU PCB	£4.50 (C)
LW80B	Digi-Tel ELC Kit	£25 60 (A)
LW81C	Digi-Tel Connect Kit	£9 95 (B)
LW82D	Digi-Tel Main Kit	£68 50 (A)
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XG06G	Burglar Alarm Box	£12.50 (A)
XG07H	Ext Horn Box	£14.50 (A)
GA44X	Burglar Alrm PSU PCB	£2 80 (C)
GA45Y	Burglr Alrm Main PCB	£6 75 (B)
LW58N	Ext Horn Kit	£32.20 (A)
GA81C	Channel/PSU PCB	£1 85 (D)
GA82D	Extra Channel PCB	£1 35 (D)
LW73Q	RTX3 Doppler Kit	£39.95 (A)
LW74R	Radar Ch/PSU Module	£15 40 (A)
LW75S	Radar Extr Ch Module	£4.90 (C)
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GB00A	Ultrasonic Xvr PCB	£1 60 (D)
GB01B	Ultrasonic IF PCB	£1 60 (D)
LW83E	Usonic Xceiver Kit	£12 65 (A)
LW84F	Usonic Interface Kit	£2 50 (C)
XF44X	Magnum Booklet	59pNV (E)
YQ44X	Magnum 1 PCB	£2.95 (C)
YQ45Y	Magnum 2 PCB	£2 95 (C)
YQ72P	Magnum Mode Chng PCB	£1 65 (D)
GA79L	Multi-circuit Board	£1 35 (D)
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LW50E	Electronics For All	£14 95 (A)
XG09K	Train Control Case	£12 50 (A)
XX47B	Train Cnrl Front Pnl	£3.75 (C)
GA72P	Train Common PCB	£2 90 (C)
GA73Q	Train Control PCB	£2 20 (C)
GA74R	Train Receiver 1 PCB	£1 35 (D)
GA75S	Train Receiver 2 PCB	£1.35 (D)
LW61R	Train Common/PSU Kit	£27 50 (A)
LW62S	Train Control Kit	£6 75 (B)
LW63T	Train Rcvr1 ML926Kit	£6 90 (B)
LW64U	Train Rcvr2 ML926Kit	£6 99 (B)
LW68Y	Train Rcvr1 ML927Kit	£6.99 (B)
LW69A	Train Rcvr2 ML927Kit	£6 99 (B)
Page 242		
GA84F	Remote Data Ltch PCB	£2 10 (C)
GA85G	Data Encoder PCB	£2 49 (C)
GA86T	Data Decoder PCB	£2 45 (C)
GA87U	IR Tx PCB	£1 25 (D)
GA88V	IR Rx PCB	£1 25 (D)
GA89W	27MHz Tx PCB	98p (E)
XH26D	MES71	30pNV
BB82D	Keyboard PCB	£8 36 (B)
BB83E	VDU Logic PCB	£10 96 (A)
BB98G	VDU PSU PCB	£2 98 (C)
XY12N	VDU Front Panel	£7 95 (B)
XX05F	UHF Mod No 2	£3 49 (C)
Page 243		
XH58N	Keytop Print ZX81	25p (F)
XG17T	ZX81 Keyboard Case	£4 95 (C)
GA83E	ZX81 Ext Kyboard PCB	£2 95 (C)
LW72P	ZX81 Keyboard Kit	£21 90 (D)
XG22Y	ZX81 Keyboard	£29 95
GA90X	I/O Port PCB	£1 99 (C)
LW76H	ZX81 I/O Port Kit	£9 25 (B)
GB08J	ZX81 Extendiboard	£2 32 (C)
Page 244		
XF03D	MES26	£1 28NV
BB28F	RC Coder PCB	£1 95 (D)
BB29G	RC Xmitter PCB	£2 35 (D)
BB30H	RC Receiver PCB	£1 96 (D)
BB31J	RC Interface PCB	£1 55 (D)
BB32K	RC Decoder PCB	£1 35 (D)
BB33L	RC Relay Drive PCB	99p (E)
BB34M	RC Servo Drive PCB	82p (E)
BB35Q	RC Servo Amp PCB	92p (E)
BB36R	RC Tone Gen PCB	85p (E)
BB37S	RC Tone Decoder PCB	85p (E)
YQ03D	McM Encoder PCB	£1 82 (D)
YQ04E	McM Receiver PCB	£2 73 (D)
YQ05F	McM Rcvr Dcdr PCB	£1 94 (D)
YQ07H	McM Transmitter PCB	£2 67 (D)
YQ08J	McM Elect Ig/Cnv PCB	£1 60 (D)
XH27E	MES16	15pNV
XX40T	Ignition PCB	£1 30 (D)
XX41U	Ign Mtg Plate	£1 28 (D)
GA22Y	Strobe Main pcb	£2 20 (C)
GA23A	Strobe HT pcb	£1 20 (D)
YQ09K	McM Flasher PCB	£1 10 (D)
Page 245		
GA26D	Dig Tacho Main PCB	£1 75 (D)
GA27E	Dig Tacho Dsply PCB	£1 25 (D)
GA19V	Batt Mon PCB	£1 20 (D)
GA98G	Car Burglar Alrm PCB	£1 10 (D)
LW78K	Car Burglr Alarm Kit	£6 95 (B)
GA40T	Car Aerial Bster Pcb	£1.35 (D)
Page 246		
GA76H	MPG Meter Main PCB	£2 45 (C)
GA77J	MPG Meter Dsply PCB	£1 75 (D)
LW67X	MPG Meter Kit	£44 95 (A)
RK39N	Freq Cnt Front Panel	£1 99 (D)
GB02C	Freqency Counter PCB	£2 48 (C)
GB03D	Freq Ctr Display PCB	£1 85 (D)
LW79L	Freqency Counter Kit	£85 00 (A)
BB72P	Sine/Square Gen PCB	£3 12 (C)
BB73Q	Audio Osc Frt Panel	£2 35 (D)
XH24B	MES15	15pNV
Page 247		
XF11M	Stereo Synth Book	£2 00NV (C)
XF13P	MES12B	FREE
XF37S	MES12C	FREE
XH24B	MES15	15pNV
XF14Q	MES15B	FREE
XH27E	MES16	15pNV
XF15R	MES16B	FREE
XH18U	MES22	25pNV
XF18U	MES22B	FREE
XH06G	MES24	FREE
XH20W	MES25	25pNV
XF20W	MES25B	FREE
XF03D	MES26	£1 28NV
XH13P	MES27	FREE
XH51F	MES30	20pNV
XH48C	MES33	40pNV (F)
XF21X	40W Amp Schedule	FREE
XF22Y	Tuner Schedule	FREE
XF25C	MES35B	FREE
XH21X	MES37	25pNV (F)
XF06G	MES37B	FREE
XF04E	MES41	40pNV
XF05F	Disco Schedule	FREE
XH23A	MES42	25pNV
XF23A	MES42B	FREE
XH00A	MES51	15pNV
XH01B	MES51B	FREE
XH02C	MES52	15pNV
XH03D	MES52B	FREE
XH04E	MES53	35pNV
XH05F	MES53B	FREE
XH31J	MES54	30pNV
XH32K	MES54B	FREE
XH33L	MES55	30pNV
XH34M	MES55B	FREE
XH26D	MES71	30pNV
XF26D	MES71B	FREE
GA11M	Continuity Testr PCB	£1.32 (D)
XF46A	E&MM April 1981	£1.00NV
XF47B	E&MM May 1981	£1 00NV
XF48C	E&MM June 1981	£1.00NV
XF49D	E&MM July 1981	£1.00NV
XF50E	E&MM August 1981	£1.00NV
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XF52G	E&MM October 1981	£1.00NV
XF53H	E&MM November 1981	£1 00NV
XF54J	E&MM December 1981	£1 10NV
XF55K	E&MM January 1982	£1 10NV
XF56L	E&MM February 1982	£1 10NV
XF57M	E&MM March 1982	£1 10NV
XF58N	E&MM April 1982	£1 10NV
XF59P	E&MM May 1982	£1.10NV
XF60Q	E&MM June '82	£1 10NV
XF61R	E&MM July 1982	£1 10NV
XF62S	E&MM August 1982	£1 10NV
Page 249		
XF63T	E&MM September 1982	£1.10NV
XF64U	E&MM October 1982	£1.10NV
XH61R	E&MM Projects Vol 1	£1.00NV (D)
XA00A	Maplin Mag Subscrptn	£2 80NV
XA01B	Projects Book One	70pNV (E)
XA02C	Projects Book Two	70pNV (E)
XA03D	Projects Book Three	70pNV (E)
XA04E	Projects Book Four	70pNV (E)
PROTECTION		
Page 250		
RX96E	Safuseholder 20	45p (F)
RX97F	Safuseholder 1.1/4in	£1 96 (D)
RX49D	Chassis F/H 20mm	11p (G)
RX50E	Chassis F/H 1.1/4 in	17p (G)
WH49D	Fuse Clip	3p (H)
RX51F	F/H Car	10p (G)
WR93R	Fuse 20mm 50mA	6p (H)
WR00A	Fuse 20mm 100mA	9p (H)
WR94C	Fuse 20mm 150mA	6p (H)
WR01B	Fuse 20mm 250mA	9p (H)
WR02C	Fuse 20mm 500mA	9p (H)
WR03D	Fuse 20mm 1A	9p (H)
WR04E	Fuse 20mm 1 5A	9p (H)
WR05F	Fuse 20mm 2A	9p (H)
WR06G	Fuse 20mm 3A	9p (H)
WR07H	Fuse 20mm 5A	9p (H)
WR18U	Fuse A/S 500mA	12p (G)
WR19V	Fuse A/S 1A	12p (G)
WR20W	Fuse A/S 2A	12p (G)
WR95D	Fuse 1 1/4 50mA	5p (H)
WR08J	Fuse 1 1/4 100mA	6p (H)
WR96E	Fuse 1 1/4 150mA	8p (H)
WR09K	Fuse 1 1/4 250mA	7p (H)
WR10L	Fuse 1 1/4 500mA	6p (H)
WR11M	Fuse 1.1/4 1A	8p (H)
WR12N	Fuse 1.1/4 1.5A	8p (H)
WR13P	Fuse 1 1/4 2A	8p (H)
WR14Q	Fuse 1 1/4 3A	8p (H)
WR15R	Fuse 1 1/4 5A	9p (H)
WR16S	Fuse 1 1/4 10A	9p (H)
WR17T	Fuse 1 1/4 15A	12p (G)
HQ31J	Plug Fuse 2A	15p (G)
HQ32K	Plug Fuse 3A	14p (G)
HQ33L	Plug Fuse 5A	15p (G)
HQ34M	Plug Fuse 13A	14p (G)
BK21X	Thermal Breaker 1A	£2 35 (C)
BK22Y	Thermal Breaker 3A	£1 35 (D)
BK23A	Thermal Breaker 5A	£1 35 (D)
BK24B	Thermal Breaker 12A	£1 35 (D)
BK20W	Thermal Breaker 15A	£1 35 (D)
Page 251		
HB51F	Fuse Wire	30p (F)
HW04E	RF Supp Choke 1A	29p (F)
HW05F	RF Supp Choke 2A	32p (F)
HW06G	RF Supp Choke 3A	39p (F)
YR90X	R-C Network	£1 39 (D)
HW13P	Mains Trans Supp	65p (E)
HW07H	Delta Cap	97p (E)
*YW46A	Door Contact Reed	£1.49 (D)
YW50E	Window Foil	£1 09 (D)
YW51F	Foil Terms	65p (E)
YW49D	BA Junction Box	59p (E)
YW47B	Surface BA Reed	£1.95 (D)
YW48C	Door Loop	£2.24 (D)
YB91Y	Pressure Mat	£3 55 (C)
RECORD & VIDEO		
Page 252		
XQ00A	Autochanger	£23 60 (A)
XB23A	Rim Drive Turntable	DIS
XB25C	Belt Drive Turntable	£38 40 (A)
Page 253		
FQ17T	Cartridge Slide MP60	£2 68 (C)
FQ18U	Cartridge Slide 710	DIS
FQ19V	Crtridge Slide BDS95	DIS
LB75S	Drive Wheel BSR	£1.55 (D)
YW58N	BSR Drive Belt	£2.20 (C)
LB76H	Dr Wheel Garrard Lrg	£2 55 (C)
FQ30H	Dr Wheel Garrard Sm.	£2 85 (C)
FQ31J	Spindle Man Short	DIS
FQ32K	Spindle Man Long	DIS
†FQ33L	Spindle Auto Short	£4 50 (C)
†FQ35Q	CB Weight SP25IV	£4.60 (C)
FQ36P	Garrard Drive Belt	£2 50 (C)
XX34M	Headshell	£3.50 (C)
YX76H	Drive Belt 46mm	98p (E)
YX77J	Drive Belt 57mm	98p (E)
YX78K	Drive Belt 66mm	98p (E)
RK99H	Drive Belt 71mm	98p (D)
YX79L	Drive Belt 76mm	98p (E)
YX80B	Drive Belt 90mm	98p (E)
HR01B	Ctrdg BSR X5M.	£3.65 (C)
HR02C	Ctrdg BSR X5H	£3 65 (C)
Page 254		
HR04E	Ctrdg BSR SX6M	£4.25 (C)
HR05F	Ctrdg BSR SX6H	£4 49 (C)
HR09K	Ctrdg BSR SC12M	£3.75 (C)
HR10L	Ctrdg BSR SC12H	£3 65 (C)
YX83E	Ctridge Philps GP215	£4 99 (C)
FY75S	Ctrdg Rigonda 2SB.	£5.75 (C)
HR12N	Ctrdg Sono 3509	£4.95 (C)
HR13P	Ctrdg Sono 3549	£5.95 (B)
HR14Q	Ctrdg Sono 3559	£5.25 (B)
HR17T	Ctrdg Sono V100	£6.20 (B)
YX82D	Cartridge QLM36	£21.40 (A)
Page 255		
HR15R	Ctrdg Goldring G850	£5.70 (B)
HR16S	Ctrdg Goldring G800	£8.98 (B)
FQ38R	Ctrdg Goldring G800H	£9.49 (B)
FQ39N	Ctrdg Goldring G800E	£11.95 (A)
FQ40T	Ctrdg Tenorel T2001D	£4.85 (C)
FQ41U	Cdg Tenorel T2001ED	£11.29 (A)
RK98G	Tenorel TMC10 Cart	£39.95 (A)
BK64U	TMC10 Replacement	£19.95
Page 256		
HR25C	Stylus GP91SC DD	£1.85 (D)
BK05F	Stylus Sanyo ST26	£5.50
BK07H	Stylus ATN3400	£4.95 (C)
HR31J	Stylus GP104 DD.	£1.85 (D)
HR66W	Stylus Acos SM6	£4.95 (C)
*BK08J	Stylus ATN71	£5.50
YX06G	Stylus ADC RSQ30	£6 32 (B)
BK09K	Stylus ATN3710	£4.95
BK10L	Stylus Toshiba N501	£5 50 (B)
†YX09K	Stylus AT70	£4.95 (C)
BK19V	Stylus D5107AL	£4.95 (C)
HR68Y	Stylus VM8	£5 50 (B)
†HR39N	Stylus BSR TC8 D	£1.50 (D)
†HR71N	Stylus BSR ST4 DD	£1.85 (D)
HR42V	Stylus BSR ST10	£1 85 (D)
HR45Y	Stylus BSR ST15	£1 85 (D)
HR47B	Stylus BSR ST17 DD	£1.85 (D)
HR74R	Stylus BSR ST21	£1.85 (D)
BK11M	Stylus Hitachi E100	£5 50 (B)
BK12N	Stylus JVC DT31	£5 50 (B)
†YX12N	Stylus Garrard GA150	£10.50 (A)
HR76H	Stylus D110E	£5.50 (B)
HR77J	Stylus D110H	£2.95 (C)
HR48C	Stylus D110SR	£1 95 (D)
HR49D	Stylus D120SR	£2 45 (C)
HR78K	Stylus Hitachi ST101	£5 40 (C)
HR79L	Stylus Hitachi ST103	£6 75 (B)
†YX13P	Stylus Hitachi ST104	£4 95 (C)
YX14Q	Stylus JVC DT21S	DIS
FQ54J	Stylus JVC DT33	£4 95 (C)
BK14Q	Stylus Trio STY111	£4 95 (C)
HR81C	Stylus LV65977D	£1 50 (D)
†HR83E	Stylus NP EPS36	£2 25 (C)
HR84F	Stylus NP EPS52	£4 95 (C)
YX16S	Stylus NP EPS53	£5.50 (B)
†YX17T	Stylus Philip AG3306	£1.85 (D)
†HR87U	Sty Philips GP200DD	£1 85 (D)
†HR89W	Stylus Philips GP205	£1.25 (D)
†YX18U	Stylus Philips GP213	£1.85 (D)
HR90X	Styl Philips GP400	£5 10 (B)
YX19V	Styl Philps GP400Mk2	£4 95 (C)
YX20W	Styl Philps GP401Mk2	£6 75 (B)
BK15R	Stylus EPC207	£5 99 (B)
HR51F	Stylus BF40D	£1 85 (D)
HR96E	Stylus DM500/7	£5 72 (C)
†YX22Y	Stylus Sanyo ST10J	£4 95 (C)
HR95D	Stylus Sansui SN28	£4.95 (C)
†YX23A	Stylus Sansui SN41	£4 95 (C)
YX24B	Stylus Sanyo ST7D	£4 95 (C)
*HR97F	Stylus Sanyo 2611	£4 95 (C)
†FQ48C	Stylus Sony ND128	£2 20 (C)
†YX25C	Stylus Sharp STY101	£4 95 (C)
†HR98G	Stylus Sharp 706	£4 95 (C)
HR99H	Stylus Sharp 717	£4 95 (C)
BK16S	Stylus PN12	£5 50 (B)
HR61R	Stylus Sonotone V100	£4.95 (C)
YX26D	Stylus Sonotone V101	£5 72 (C)
FQ45Y	Stylus 2509	£1.85 (D)
HR60Q	Stylus 9TAHC DD	£1 85 (D)
HR53H	Stylus KS40A DD	£1 85 (D)
BK17T	Stylus Sony ND114	£5 50 (B)
BK18U	Stylus ND200	£6.75 (B)
YX27E	Stylus Sony XL15	£4 35 (C)
†YX28F	Stylus Sony ND126	£4 95 (C)
FQ49D	Stylus Sony ND133	£5 50 (B)
FQ50E	Stylus Sony ND134	£5.50 (B)
FQ51F	Stylus N2001D	£2 95 (C)
FQ52G	Stylus N2001ED	£7 72 (B)
†YX30H	Stylus Tetrad 51	£2 25 (C)
†FQ53H	Stylus Toshiba N3C	£2 20 (C)
YX31J	Stylus Toshiba N55	£4.95 (C)
†YX32K	Stylus Toshiba N58	£4 95 (C)
†YX21X	Stylus Toshiba N550	£4.95 (C)
Page 258		
YB47B	Record Care kt C106	£4.95 (C)
LX06G	Cleaning Arm C100	£3 25 (C)
YW81C	Cleaning Cloth C104	78p (E)
FR48C	Dust-Off C101	99p (E)
YW82D	Cleaner C92	£4 65 (C)
YX93B	Stylus Microscope	£2.45 (C)
YW83E	Stylus Brush C103	12p (G)
†FR46A	Stylus Cleaner C95	80p (E)
YB55K	Cleaning Kit C116	£2 42 (C)
FR52G	Anti-Stat Fluid 69S	49p (F)
LX10L	Anti-Stat Mat C119	£2 64 (D)
LX04E	Anti-Stat Gun	£5.25 (B)
FR49D	Stylus Balance PX1	£1.25 (C)
FR50E	Gram Speed Indicator	9p (H)
Page 259		
YW86T	Cassette Kit C115	£1.85 (D)
RK95D	Tape Head Care Kit	£2.75 (C)
YB56L	Cassette Kit C107	£4.25 (C)
*BK28F	Deluxe Head Cleaner	£3 25 (C)
†RB04E	Cass Head Clnr C118	£1.49 (D)
YW87U	Cleaning Stick C109	23p (G)
YW88V	Tape Cleaning Fluid	58p (E)
FR54J	Cassette Clnr Tape	55p (E)
YW89W	Cassette Cln & Demag	£2 25 (C)
FR62S	Straight Demagnetzer	£3.64 (C)
FQ62S	Curved Demagnetiser	£3.85 (C)
BK27E	Elec Head Demag	£8.95 (B)
YW91Y	Splicing Block	£1.85 (D)
Page 260		
YW90X	Cassette Splicer	DIS
LX17T	Splicing Tape	65p (E)
RB03D	Cassette Case	26p (G)
FR60Q	Index Cards	£1 59 (D)
RB01B	Cassette Fast Winder	£2 75 (C)
FR59P	Test Cassette 53	TEMP
YG25C	Cassette Tape C60	61p (E)
YG26D	Cassette Tape C90	65p (E)
RB07H	Rota-Rack	£2.45 (C)
LH91Y	Cassettebox	£4.65 (C)
†LH92A	Videocassettebox	£9.68 (B)
RK96E	VHS Head Cleaner	£9.75 (B)
RK97F	Betamax Head Cleaner	£10.95 (A)
Page 261		
FQ63T	GF Cassette Head	£12.80 (A)
FQ64U	Mono Cassette Head	£3.64 (C)
FQ66W	Cassette Erase Head	£2.24 (C)
FQ65V	Stereo Cassette Head	£4.48 (B)
†FQ69A	Tape hd Four-Trck RP	£16.95 (A)
FQ70M	Tpe Hd Four Trk Eras	DIS
†FQ71N	2-Head Bracket	£4.65 (C)
†FQ72P	3-Head Bracket	£5.39 (B)
Page 262		
U	Micro Res	3p (H)
B	Econ Res 1R to 8R2	2p (H)
B	Econ Res 1M2 to 10M	2p (H)
M	M1R to 8R2 (1%)	12p (H)
M	M10R to 1M (1%)	2p (H)
M	M1M2 to M10M (1%)	12p (H)
Page 263		
S	Std Res	3p (H)
C	1W Res	6p (H)
XL05F	Colour Wheel	25p (F)
X	See M	
T	See M	
W	W/W Min	19p (F)
Page 264		
L	7W W/W	29p (F)
H	10W W/W	35p (F)
P	25 W/W Res	£1.65 (D)
V	HV Res 1M-33M	12p (G)
V	HV Res 47M	25p (F)
BL64U	Constantan 28 swg.	£3.35 (C)
YY12N	Resnet 100R	85p (E)
YY13P	Resnet 220R	85p (E)
YY14Q	Resnet 470R	85p (E)
YY15R	Resnet 1k	85p (E)
YY16S	Resnet 2k2	93p (E)
YY17T	Resnet 4k7	85p (E)
YY18U	Resnet 10k	85p (E)
YY19V	Resnet 22k	85p (E)
YY20W	Resnet 47k	85p (E)
YY21X	Resnet 100k	85p (E)
WR52G	Hor S-Min Prest 100R	10p (G)
WR53H	Hor S-Min Prest 220R	10p (G)
WR54J	Hor S-Min Prest 470R	10p (G)
WR55K	Hor S-Min Prest 1k	10p (G)
WR56L	Hor S-Min Prest 2K2	10p (G)
WR57M	Hor S-Min Prest 4k7	10p (G)
WR58N	Hor S-Min Prest 10k	10p (G)
WR59P	Hor S-Min Prest 22K	10p (G)
WR60Q	Hor S-Min Prest 47k	10p (G)
WR61R	Hor S-Min 100k	10p (G)
WR62S	Hor S-Min Prest 220k	10p (G)
WR63T	Hor S-Min Prest 470k	10p (G)
WR64U	Hor S-Min Preset 1M	10p (G)
WR65V	Vrt S-Min Prest 100R	11p (G)
WR66W	Vrt S-Min Prest 220R	11p (G)
WR67X	Vrt S-Min Prest 470R	11p (G)
WR68Y	Vrt S-Min Prest 1k	11p (G)
WR69A	Vrt S-Min Prest 2k2	11p (G)
WR70M	Vrt S-Min Prest 4k7	11p (G)
WR71N	Vrt S-Min Prest 10k	11p (G)
WR72P	Vrt S-Min Prest 22k	11p (G)
WR73Q	Vrt S-Min Prest 47k	11p (G)
WR74R	Vrt S-Min Prest 100k	11p (G)
WR75S	Vrt S-Min Prest 220k	11p (G)
WR76H	Vrt S-Min Prest 470k	11p (G)
WR77J	Vert S-Min Prest 1M	11p (G)
Page 265		
WR78K	Hor Skeleton 100R	14p (G)
WR79L	Hor Skeleton 220R	14p (G)
WR80B	Hor Skeleton 470R	28p (F)
WR81C	Hor Skeleton 1k	26p (F)
WR82D	Hor Skeleton 2k2	26p (F)
WR83E	Hor Skeleton 4k7	26p (F)
WR84F	Hor Skelton 10k	26p (F)
WR85G	Hor Skeleton 22k	26p (F)
WR86T	Hor Skeleton 47k	26p (F)
WR87U	Hor Skeleton 100k	27p (F)
WR88V	Hor Skeleton 220k	26p (F)
WR89W	Hor Skeleton 470k	26p (F)
WR90X	Hor Skeleton 1M	26p (F)
WR91Y	Hor Skeleton 2M2	26p (F)
WR92A	Hor Skeleton 4M7	26p (F)
WW00A	Vrt Skeleton 100R	26p (F)
WW01B	Vrt Skeleton 220R	26p (F)
WW02C	Vert Skeleton 470R	26p (F)
WW03D	Vrt Skeleton 1k	26p (F)
WW04E	Vrt Skeleton 2k2	26p (F)
WW05F	Vrt Skeleton 4k7	26p (F)
WW06G	Vrt Skeleton 10k	26p (F)
WW07H	Vrt Skeleton 22k	29p (F)
WW08J	Vrt Skeleton 47k	26p (F)
WW09K	Vrt Skeleton 100k	26p (F)
WW10L	Vrt Skeleton 220k	26p (F)
WW11M	Vrt Skeleton 470k	24p (F)
WW12N	Vrt Skeleton 1M	28p (F)
WW13P	Vrt Skeleton 2M2	28p (F)
WW14Q	Vrt Skeleton 4M7	24p (F)
WR38R	Cermet 100R	98p (E)
WR39N	Cermet 500R	98p (E)
WR40T	Cermet 1k	98p (E)
WR41U	Cermet 5k	98p (E)
WR42V	Cermet 10k	98p (E)
WR43W	Cermet 50k	98p (E)
WR44X	Cermet 100k	98p (E)
WR45Y	Cermet 1M	98p (E)
WR46A	15-Turn Cermet 500R	£1.20 (D)
WR47B	15-Turn Cermet 1k	£1 20 (D)
WR48C	15-Turn Cermet 5k	£1.20 (D)
WR49D	15-Turn Cermet 10k	96p (D)
WR50E	15-Turn Cermet 50k	99p (D)
WR51F	15-Turn Cermet 100k	99p (D)
BW06G	Edge Control Pot	65p (E)
BW07H	Edge Knob Small Blk	8p (H)
BW08J	Edge Knob Small Grey	8p (H)
BW09K	Edge Knob Large Blk	8p (H)
BW10L	Edge Knob Large Grey	8p (H)
FW00A	Pot Lin 1k	45p (F)
FW01B	Pot Lin 4k7	45p (F)
FW02C	Pot Lin 10k	45p (F)
FW03D	Pot Lin 22k	45p (F)
FW04E	Pot Lin 47k	45p (F)
FW05F	Pot Lin 100k	45p (F)
FW06G	Pot Lin 220k	45p (F)
FW07H	Pot Lin 470k	45p (F)
FW08J	Pot Lin 1M	45p (F)
FW09K	Pot Lin 2M2	45p (F)
FW21X	Pot Log 4k7	45p (F)
FW22Y	Pot Log 10k	45p (F)
FW23A	Pot Log 22k	45p (F)
FW24B	Pot Log 47k	45p (F)
FW25C	Pot Log 100k	45p (F)
FW26D	Pot Log 220k	45p (F)
FW27E	Pot Log 470k	45p (F)
FW28F	Pot Log 1M	45p (F)
FW29G	Pot Log 2M2	45p (F)
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FW41U	Sw Pot Lin 4k7	£1.12 (D)
FW42V	Sw Pot Lin 10k	£1.12 (D)
FW43W	Sw Pot Lin 22k	£1.12 (D)
FW44X	Sw Pot Lin 47k	£1.12 (D)
FW45Y	Sw Pot Lin 100k	£1.12 (D)
FW46A	Sw Pot Lin 220k	£1.12 (D)
FW47B	Sw Pot Lin 470k	£1.12 (D)
FW48C	Sw Pot Lin 1M	£1.12 (D)
FW49D	Sw Pot Lin 2M2	£1.12 (D)
FW62S	Sw Pot Log 4k7.	£1.12 (D)
FW63T	Sw Pot Log 10k	£1.12 (D)
FW64U	Sw Pot Log 22k	£1.12 (D)
FW65V	Sw Pot Log 47k	£1.12 (D)
FW66W	Sw Pot Log 100k	£1.12 (D)
FW67X	Sw Pot Log 220k	£1.12 (D)
FW68Y	Sw Pot Log 470k	£1.12 (D)
FW69A	Sw Pot Log 1M	£1.12 (D)
FW70M	Sw Pot Log 2M2	£1.12 (D)
FW50E	W/W Pot 10R	£2.15 (C)
FW51F	W/W Pot 25R	£2.24 (D)
FW52G	W/W Pot 50R	£2.24 (D)
FW71N	W/W Pot 100R	£2.55 (C)
FW72P	W/W Pot 250R	£1.98 (D)
FW73Q	W/W Pot 500R	£1.98 (D)
FW93B	W/W Pot 1k	£1.98 (D)
FW96E	W/W Pot 2K5	DIS
FW94C	W/W Pot 5k	99p (E)
FW95D	W/W Pot 10k	£2.29 (C)
FX18U	W/W Pot 50k	£2.96 (C)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.
Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

1983 Catalogue Page No.		VAT inclusive PRICE
FW84F	Dual Pot Lin 4k7	£1.24 (D)
FW85G	Dual Pot Lin 10k	£1.24 (D)
FW86T	Dual Pot Lin 22k	£1.24 (D)
FW87U	Dual Pot Lin 47k	£1.24 (D)
FW88V	Dual Pot Lin 100k	£1.24 (D)
FW89W	Dual Pot Lin 220k	£1.24 (D)
FW90X	Dual Pot Lin 470k	£1.24 (D)
FW91Y	Dual Pot Lin 1M	£1.24 (D)
FW92A	Dual Pot Lin 2M2	£1.24 (D)
FX08J	Dual Pot Log 4k7	£1.24 (D)
FX09K	Dual Pot Log 10k	£1.24 (D)
FX10L	Dual Pot Log 22k	£1.24 (D)
FX11M	Dual Pot Log 47k	£1.24 (D)
FX12N	Dual Pot Log 100k	£1.24 (D)
FX13P	Dual Pot Log 220k	£1.24 (D)
FX14Q	Dual Pot Log 470k	£1.24 (D)
FX15R	Dual Pot Log 1M	£1.24 (D)
FX16S	Dual Pot Log 2M2	£1.24 (D)
FX40T	L/S Control 20R	55p (E)
FX97F	L/S Control 50R	55p (E)
FX98G	L/S Control 100R	55p (E)
FX99H	L/S Control 200R	55p (E)
YG04E	Rheostat 50R	£4.90 (C)
YG05F	Rheostat 100R	£4.90 (C)
YG06G	Rheostat 150R	£4.90 (C)
YG07H	Rheostat 200R	£4.90 (C)

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FX32K	Slide Pot Lin 5k	79p (E)
FX33L	Slide Pot Lin 10k	79p (E)
FX34M	Slide Pot Lin 25k	79p (E)
FX35Q	Slide Pot Lin 50k	79p (E)
FX36P	Slide Pot Lin 100k	79p (E)
FX37S	Slide Pot Lin 250k	79p (E)
FX38R	Slide Pot Lin 500k	79p (E)
FX53H	Slide Pot Log 5k	79p (E)
FX54J	Slide Pot Log 10k	79p (E)
FX55K	Slide Pot Log 25k	79p (E)
FX56L	Slide Pot Log 50k	79p (E)
FX57M	Slide Pot Log 100k	79p (E)
FX58N	Slide Pot Log 250k	79p (E)
FX59P	Slide Pot Log 500k	79p (E)
FX76H	Dual Slide Lin 5k	£1.25 (D)
FX77J	Dual Slide Lin 10k	£1.25 (D)
FX80B	Dual Slide Lin 100k	£1.25 (D)
HB02C	Dual Slide Log 10k	£1.25 (D)
HB04E	Dual Slide Log 50k	£1.25 (D)
HB05F	Dual Slide Log 100k	£1.25 (D)
HB07H	Dual Slide Log 500k	£1.25 (D)
FX07H	Slide Bezel	49p (F)
XB09K	Joystick Pot	£6.38 (B)
HQ50E	2-Axis Joystick	£3.25 (C)
XB06G	Joystick Mtg Plate	£1.66 (D)

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FX87U	Thermistor KR152CW	79p (E)
FX21X	Thermistor VA1055S	51p (E)
FX22Y	Thermistor VA1056S	49p (F)
FX42V	Thermistor VA1066S	41p (F)
FX43W	Thermistor VA1067S	39p (F)
FX62S	Thermistor R53	£5.95 (B)
WH23A	Thermistor G16	£5.40 (B)
WH24B	Thermistor G23	£5.35 (B)
HB10L	LDR ORP12	£1.35 (D)
†HB11M	LDR ORP60	£1.72 (D)
HB09K	LDR RPY58A	£1.18 (D)

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QB00A	AA119	11p (G)
QB01B	AC126	36p (F)
QB02C	AC127	38p (F)
QB03D	AC128	38p (F)
QB04E	AC141	39p (F)
QB05F	AC142	42p (F)
QB06G	AC176	34p (F)
QB07H	AC187	35p (F)
QB08J	AC188	37p (F)
QB10L	ACY19	77p (E)
QB11M	ACY20	DIS
BL30H	AD140	£1.55 (D)
BL31J	AD149	£1.35 (D)
BL32K	AD161	61p (E)
BL33L	AD161/2MP	£1.22 (D)
BL34M	AD162	61p (E)
QQ00A	ADC0804LCN	£4.45 (C)
QB19V	AF139	65p (E)
QB20W	AF239	88p (E)
BR45Y	AS314	33p (F)
QB21X	AY-1-0212	DIS
HQ52G	AY-1-1320	£4.99 (C)
HQ51F	AY-1-5050	£1.99 (D)
YY98G	AY-3-1270	£8.30 (B)
YY89W	AY-3-1350	£5.95 (B)
WQ18U	AY-3-1015D	£5.98 (B)
WQ19V	AY-5-2376	£13.99 (B)
QB27E	BA102B	29p (F)
QQ12N	BA243	DIS
QQ13P	BAR28	15p (G)
QB28F	BAX13	12p (H)
QB29G	BAX16	7p (H)
QB31J	BC107B	16p (G)
QB32K	BC108C	16p (G)
QB33L	BC109C	16p (G)
QB34M	BC117	24p (F)
QB35Q	BC119	39p (F)
QB36P	BC139	40p (F)
QB37S	BC140	34p (F)
QB38R	BC141	37p (F)
QB39N	BC142	35p (F)
QB40T	BC143	34p (F)
QB44X	BC154	27p (F)
QB48C	BC160	43p (F)

SEMICONDUCTORS

QB49D	BC161	36p (F)
QB50E	BC168C	11p (G)
QB51F	BC169C	11p (G)
QB52G	BC177	20p (G)
QB53H	BC178	20p (G)
QB54J	BC179	20p (G)
QB55K	BC182L	11p (G)
QB56L	BC183L	11p (G)
QB57M	BC184L	11p (G)
QB58N	BC204	15p (G)
QB59P	BC209C	14p (G)
QB60Q	BC212L	11p (G)
QB61R	BC213L	11p (G)
QB62S	BC214L	10p (G)
QB63T	BC301/5	40p (F)
*QB64U	BC301/5/303/5MP	89p (E)
*QB65V	BC303/5	36p (F)

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QB66W	BC327	15p (G)
QB67X	BC328	15p (G)
QB68Y	BC337	15p (G)
QB69A	BC338	15p (G)
QB70M	BC441	38p (F)
QB71N	BC441/461MP	79p (E)
QB72P	BC461	43p (F)
QQ14Q	BC547	11p (G)
QB73Q	BC548	14p (G)
QQ15R	BC549	12p (G)
QQ16S	BC557	11p (G)
QQ17T	BC558	11p (G)
QQ18U	BC559	11p (G)
QB74R	BC650	29p (F)
QF00A	BCY70	18p (G)
QF01B	BCY71	18p (G)
QF03D	BD131	49p (F)
QF04E	BD131/2MP	£1.19 (D)
QF05F	BD132	50p (E)
QF06G	BD135	36p (F)
QF75S	BD136	33p (F)
QF07H	BD139	40p (F)
QF08J	BD140	40p (F)
WH15R	BD711	68p (E)
WH16S	BD712	68p (E)
QF09K	BF115	38p (F)
QF10L	BF167	38p (F)
QF11M	BF180	48p (F)
QF15R	BF200	32p (F)
QF16S	BF244	32p (F)
QF17T	BF258	33p (F)
QF18U	BF259	39p (F)
QF19V	BF337	40p (F)
QQ19V	BF494	25p (F)
QQ20W	BF495	25p (F)
QF20W	BFW10	£1.43 (D)
QF21X	BFX29	33p (F)
QF22Y	BFX30	35p (F)
QF23A	BFX84	34p (F)
QF24B	BFX85	31p (F)
QF25C	BFX87	32p (F)
QF26D	BFX88	36p (F)
QF27E	BFY50	30p (F)
QF28F	BFY51	29p (F)
QF29G	BFY52	31p (F)
QF31J	BRY39	48p (F)
QF32K	BSX20	26p (F)
QF33L	BSX21	29p (F)
QF35Q	BT109	£1.49 (D)
QF37S	BU205	£1.95 (D)
QF39N	BU208	£2.99 (C)
QF41U	BY126	21p (G)
QF42V	BY127	16p (G)
QF43W	BY164	76p (E)
QF44X	BY206	25p (F)
QF45Y	BZX61C4V7	16p (G)
QF46A	BZX61C5V1	16p (G)
QF47B	BZX61C5V6	16p (G)
QF48C	BZX61C6V2	16p (G)
QF49D	BZX61C6V8	16p (G)
QF50E	BZX61C7V5	16p (G)
QF51F	BZX61C8V2	16p (G)
QF52G	BZX61C9V1	16p (G)
QF53H	BZX61C10	16p (G)
QF54J	BZX61C11	16p (G)
QF55K	BZX61C12	16p (G)
QF56L	BZX61C13	16p (G)
QF57M	BZX61C15	16p (G)
QF58N	BZX61C16	16p (G)
QF59P	BZX61C18	16p (G)
QF60Q	BZX61C20	16p (G)
QF61R	BZX61C22	16p (G)
QF62S	BZX61C24	16p (G)
QF63T	BZX61C27	16p (G)
QF64U	BZX61C30	16p (G)
QF65V	BZX61C33	16p (G)
QF66W	BZX61C36	16p (G)
QF67X	BZX61C39	16p (G)
QF68Y	BZX61C43	16p (G)
QF69A	BZX61C47	16p (G)
QF70M	BZX61C51	16p (G)
QF71N	BZX61C56	16p (G)
QF72P	BZX61C62	16p (G)
QF73Q	BZX61C68	16p (G)
QF74R	BZX61C75	16p (G)
QH00A	BZY88C2V7	9p (H)
QH01B	BZY88C3V0	9p (H)
QH02C	BZY88C3V3	9p (H)
QH03D	BZY88C3V6	9p (H)
QH04E	BZY88C3V9	9p (H)
QH05F	BZY88C4V3	9p (H)
QH06G	BZY88C4V7	9p (H)
QH07H	BZY88C5V1	9p (H)
QH08J	BZY88C5V6	9p (H)
QH09K	BZY88C6V2	9p (H)
QH10L	BZY88C6V8	9p (H)
QH11M	BZY88C7V5	8p (H)
QH12N	BZY88C8V2	9p (H)
QH13P	BZY88C9V1	9p (H)
QH14Q	BZY88C10	9p (H)
QH15R	BZY88C11	9p (H)
QH16S	BZY88C12	9p (H)
QH17T	BZY88C13	9p (H)
QH18U	BZY88C15	9p (H)
QH19V	BZY88C16	9p (H)
QH20W	BZY88C18	9p (H)
QH21X	BZY88C20	9p (H)
QH22Y	BZY88C22	9p (H)
QH23A	BZY88C24	9p (H)
QH24B	BZY88C27	8p (H)
QH25C	BZY88C30	9p (H)
QH26D	CA3046	72p (E)
YH58N	CA3080E	87p (E)
QH27E	CA3089E	£2.70 (C)
QH28F	CA3130T	£1.26 (D)
QH29G	CA3140T	99p (E)
WQ20W	CA3189E	£1.95 (D)
WQ21X	CA3240E	£1.38 (D)
YG37S	CL8960	£31.26 (A)
QH30H	C106D	42p (F)
WQ22Y	C116D	99p (E)
WQ23A	C126D	£1.63 (D)
WQ24B	C206D	£1.40 (E)
WQ25C	C226D	64p (E)
QL14Q	C246D	£1.24 (D)
QQ01B	DAC0801LCN	£2.45 (C)
QQ21X	DV1202W	£8.35 (B)
QQ22Y	DV1205W	TEMP
QQ23A	DV1210W	£13.63 (A)
QQ24B	DV1220W	£16.88 (A)
QQ25C	DV1230W	£21.30 (A)
QQ26D	DV1240W	TEMP
WQ28F	HSCH1001	55p (E)
YH59P	ICL7109	£19.98 (A)
YY75S	ICL7660CPA	£3.24 (C)
YY93B	ICM7045IPI	£14.20 (A)
YY94C	ICM7216DIPI	£19.95 (A)
†YY95D	ICM7226BIPI	£21.90 (A)
YH63T	ICM 7555	£1.32 (D)
QH33L	1R122D	£2.79 (C)
BH45Y	J005	£1.75 (D)
BL36P	J02	£1.80 (D)

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BH46A	J04	£1.95 (D)
BH47B	K01	£3.15 (C)
BH48C	K04	£4.25 (C)
YY74R	L200	£2.69 (C)
WQ29G	LF347	£1.94 (C)
WQ30H	LF351	56p (E)
WQ31J	LF353	99p (E)
QY26D	LF400CN	NYA
QY27E	LF411CN	82p (E)
QY28F	LF412CN	£1.38 (D)
QY29G	LF441CN	72p (E)
QY30H	LF442CN	£1.42 (D)
QY31J	LF444CN	£1.98 (D)
YY69A	LF13741	55p (E)
QH35Q	LH0042C	£4.46 (C)
QH36P	LM301A	27p (F)
QH37S	LM308	72p (E)
QY09K	LM311N	68p (E)
WQ32K	LM334	£1.10 (D)
YY73Q	LM335Z	£1.42 (D)
QH38R	LM377	£2.25 (C)
QH39N	LM379S	£5.52 (B)
QH40T	LM380	75p (E)
QH41U	LM381	£1.89 (D)
YY84F	LM382	£1.45 (D)
WQ33L	LM383	£1.61 (D)
WQ34M	LM384	£1.99 (D)
WQ35Q	LM387	£1.25 (D)
WQ36P	LM389	£1.49 (D)
QY19V	LM1035	£4.50 (C)
QY33L	LM1037N	£2.72 (C)
QY34M	LM1038N	£2.85 (C)
YY85G	LM1818	£1.95 (D)
YY99H	LM1830	£2.65 (C)
QY36P	LM1851N	£1.46 (D)
YY71N	LM1871	£5.60 (B)
YY72P	LM1872	£5.90 (B)
WQ38R	LM2917	£2.45 (C)
WQ37S	LM1820	£2.24 (D)
QH42V	LM3900	86p (E)
WQ39N	LM3909	98p (E)
WQ40T	LM3911	£1.31 (D)
WQ41U	LM3914	£3.51 (C)
YY96E	LM3915	£3.24 (C)
YY97F	LM3916	£3.46 (C)
YH64U	LM13700N	£1.39 (D)
YY81C	M083	£4.75 (C)
WH22Y	M087	DIS
YY90X	M108	£18.25 (A)
YY91Y	M147	£6.51 (B)
HQ71N	M251	£12.20 (A)
WH21X	M254	£7.49 (B)
QH43W	MCR102	59p (E)

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QH45Y	MC1310P	£2.30 (C)
QH47B	MC1496	89p (E)
QH48C	MC3302P	80p (E)
QH49D	MC3340P	£2.25 (D)
WQ42V	MCM4027 250ns	£2.40 (D)
WQ43W	MC6800P	£5.10 (B)
WQ44X	MC6802P	£4.72 (C)
WQ45Y	MC6810AP 450ns	£1.86 (D)
WQ46A	MC6821P	£1.99 (D)
QQ03D	MC6845	£7.95 (A)
WQ48C	MC6850P	£2.20 (C)
WQ49D	MC6852P	£2.95 (C)
WQ50E	MC6875L	£6.32 (B)
QY23A	MC10116P	96p (E)
QY35Q	MF10CN	£4.96 (C)
QH54J	MJE340	75p (E)
WQ51F	MJE350	96p (D)
QH55K	MJE2955=TIP2955	99p (E)
QH56L	MJE3055=TIP3055	81p (E)
QH57M	MJ2501	£2.98 (C)
BL38R	MJ2955	£1.10 (D)
QH58N	MJ3001	£2.40 (C)
YY92A	MK50395	£10.50 (A)
YH67X	ML922	£5.25 (B)
QR57M	ML926	£2.45 (C)
QR58N	ML927	£2.45 (C)
YH68Y	ML928	£2.40 (C)
YH69A	ML929	£2.40 (C)
QH59P	MPF102	52p (E)
QH60Q	MPSA14	36p (F)
QH61R	MPSA65	45p (F)
QH62S	MPS3638	21p (G)
QH63T	MPS3638A	18p (G)
WQ53H	MVAM115	£2.62 (C)
WQ54J	NE531	£1.52 (D)
WQ55K	NE 544	£2.18 (C)
QH66W	NE 555	21p (G)
QH67X	NE 556	62p (E)
WQ56L	NE 565	£1.64 (D)
QH68Y	NE 566	£1.72 (D)
QH69A	NE 567	£1.30 (D)
QY10L	NE570	£4.28 (C)
YY87U	NE571	£3.36 (C)
YY68Y	NE5534A	£2.26 (C)
YY67X	NE5539	£7.85 (B)
QH70M	OA47	12p (G)
QH71N	OA90	9p (H)
QH72P	OA91	8p (H)
QH73Q	OA95	8p (H)
QH74R	OA200	9p (H)
QH75S	OA202	13p (G)
QH82D	OC45	47p (F)
QH84F	OC71	31p (F)
QH85G	OC72	42p (F)
QH87U	OC81	42p (F)
QH89W	OC83	45p (F)
QH91Y	OC170	95p (E)
QH92A	OC171	95p (E)
QY37S	Satronics PC1R	£3.62 (C)
QY38R	Satronics PC12R	£6.94 (B)
QH93B	PN3643	30p (F)
WQ57M	PW01	95p (E)
WQ58N	PW06	£1.10 (D)
WQ59P	RO-3-2513	£8.95 (B)
QL00A	R2008B	£2.25 (C)
QL02C	SAM77	£1.20 (D)
QL05F	SC146D	£1.62 (D)
WQ60Q	SFF96364	£9.45 (B)
QL06G	SG1495D	£3.95 (C)
QL07H	SG3402	£4.56 (C)
WQ61R	SH120A	£6.65 (B)
YH66W	SL490	£3.35 (C)
QY18U	SP8680B	£12.40 (A)
QL08J	ST2	25p (F)
QL09K	S005	47p (F)
QL10L	S04	52p (E)
WQ62S	TAA 550	35p (F)
QL11M	TAG1/100	£1.45 (D)
QL12N	TAG1/600	£1.20 (D)
BL35Q	TBA 651	£2.25 (C)
QL13P	TBA810P	95p (E)
WQ63T	TBA820M	70p (E)
YY79L	TCA350Z	£3.95 (C)
WQ64U	TCA4500A	£3.35 (C)

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WH20W	TDA1022	£6.75 (B)
YY76H	TDA1024	£1.49 (D)
QY32K	TDA 1102SP	£3.24 (C)
YY70M	TDA2005M	£8.25 (B)
WQ66W	TDA2006	£1.65 (D)
WQ67X	TDA2030	£1.95 (D)
YY86T	TDA3410	£1.90 (D)
QL15R	TIP31A	39p (F)
QL16S	TIP32A	39p (F)
WQ71N	TIP33A	68p (E)
WQ72P	TIP34A	99p (E)
QL17T	TIP41A	49p (F)
QL18U	TIP42A	45p (F)
WQ73Q	TIP122	99p (E)
WQ74R	TIP127	75p (E)
QL19V	TIS43	55p (E)
WQ75S	TL170C	55p (E)
WQ76H	TL172C	76p (E)
YY77J	TL430C	99p (E)
YY78K	TL497A	£1.65 (D)
YY88V	TMS1121	£8.90 (B)
QY14Q	UAA170L	£2.50 (C)
QL20W	uA709C	75p (E)
BL22Y	uA723C TO99	85p (E)
QL21X	uA723C 14-pin DIL	55p (E)
QL22Y	uA741C 8-pin DIL	23p (G)
QL23A	uA741C 14-pin DIL	78p (E)
QL24B	uA747C	75p (E)
QL25C	uA748C	59p (E)
QL26D	uA78L05AWC	45p (F)
WQ77J	uA78L12AWC	45p (F)
QL27E	uA78L15AWC	45p (F)
QL28F	uA78M05UC	79p (E)
QL29G	uA78M12UC	79p (E)
QL30H	uA78M15UC	79p (E)
WQ78K	uA78MGU1C	£1.25 (D)
QL31J	uA7805UC	78p (E)
QL32K	uA7812UC	78p (E)
QL33L	uA7815UC	78p (E)
WQ79L	uA78GU1C	£1.25 (D)
QL34M	uA7805KC	£1.65 (D)
QL35Q	uA7815KC	£1.65 (D)
WQ80B	uA78H05KC	£5.55 (B)
WQ81C	uA78H12KC	£6.49 (B)
WQ83E	uA78HGKC	£6.25 (B)
WQ84F	uA78P05SC	£8.25 (B)
WQ85G	uA79L05AWC	62p (E)
WQ86T	uA79L12AWC	68p (E)
WQ87U	uA79L15AWC	75p (E)
WQ88V	uA79M05UC	89p (E)
WQ89W	uA79M12UC	64p (E)
WQ90X	uA79M15UC	89p (E)
WQ91Y	uA79MGU1C	£1.20 (D)
WQ92A	uA7905UC	£1.38 (D)
WQ93B	uA7912UC	95p (E)
QL36P	uA7915UC	82p (E)
WQ94C	uA79GU1C	£1.25 (D)
WQ95D	uA79HGKC	£8.59 (B)
QQ27E	VK10KM	83p (E)
QQ28F	VK1010	£1.48 (D)
QQ29G	VK1011	£1.35 (D)
WQ96E	VN46AF	£1.10 (D)
WQ97F	VN66AF	£1.55 (D)
WQ98G	VN88AF	£1.76 (D)
QQ11M	VQ1000CJ	£4.30 (C)
QL37S	W005	28p (F)
QL38R	W01	34p (F)
QL39N	W02	38p (F)
QL40T	W04	39p (F)
QL41U	ZN414	£1.25 (D)
QL42V	ZS120	44p (F)
QL43W	ZTX107	22p (G)
QL44X	ZTX108	15p (G)
QL45Y	ZTX109	24p (G)
QL46A	ZTX300	21p (G)
QL47B	ZTX301	20p (G)
QL48C	ZTX302	22p (G)
QL50E	ZTX304	24p (F)
QL54J	ZTX326	98p (E)
QL56L	ZTX330	29p (F)
QL57M	ZTX331	28p (F)
QL60Q	ZTX500	21p (G)
QL62S	ZTX502	19p (G)
QL64U	ZTX504	34p (F)
QL66W	ZTX530	42p (F)
QL67X	ZTX531	33p (F)
QL68Y	ZTX541	31p (F)
QL69A	ZTX542	33p (F)
QL70M	Z5J	£2.84 (C)
QW00A	Z80-CPU	£7.95 (B)
QW01B	Z80 CTC	£4.50 (C)
QW03D	Z80-PID	£3.99 (C)
QL71N	1N914	4p (H)
QL72P	1N916	5p (H)
QL73Q	1N4001	5p (H)
QL74R	1N4002	4p (H)
QL75S	1N4003	6p (H)
QL76H	1N4004	6p (H)
QL77J	1N4005	6p (H)
QL78K	1N4006	6p (H)
QL79L	1N4007	7p (H)
QL80B	1N4148	4p (H)
QL81C	1N5400	15p (G)
QL82D	1N5401	12p (G)
QL83E	1N5402	16p (G)
QL84F	1N5404	19p (G)
QL85G	1N5406	20p (G)
QL86T	1N5407	21p (G)
QL87U	1N5408	19p (G)
QL88V	1S921	9p (H)
QH46A	1458C	45p (F)
QR00A	2N697	49p (F)
QR01B	2N706	26p (F)
QR03D	2N708	35p (F)
QR09K	2N1711	39p (F)
QR10L	2N1893	32p (F)
QR11M	2N2219	31p (F)
QR12N	2N2369A	22p (G)
QR13P	2N2484	38p (F)
QR14Q	2N2646	62p (E)
QR15R	2N2647	95p (E)
QR16S	2N2904	31p (F)
QR17T	2N2905	31p (F)
QR18U	2N2906	26p (F)
QR19V	2N2907	26p (F)
QR20W	2N2926Or	12p (G)
QR21X	2N2926Ye	12p (G)
QR22Y	2N2926Gn	12p (G)
QR23A	2N3053	32p (F)
QR24B	2N3054	68p (E)
BL45Y	2N3055	75p (E)
QR25C	2N3525	£1.85 (D)
QR26D	2N3702	11p (G)
QR27E	2N3703	11p (G)
QR28F	2N3704	10p (G)
QR29G	2N3705	12p (G)
QR30H	2N3706	14p (G)
QR31J	2N3707	12p (G)
QR32K	2N3708	11p (G)
QR34M	2N3711	11p (G)
QW07H	2N3772	£1.95 (D)

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QR35Q	2N3773	£2.94 (C)
QR36P	2N3819	32p (F)
*QR37S	2N3823	65p (E)
QR38R	2N3866	£1.10 (D)
QR39N	2N3903	17p (G)
QR40T	2N3904	17p (G)
QR41U	2N3905	15p (G)
QR42V	2N3906	14p (G)
QR43W	2N4058	14p (G)
QR44X	2N4060	12p (G)
QR45Y	2N4061	17p (G)
QR46A	2N4062	12p (G)
QR47B	2N4871	69p (E)
QR49D	2N5458	42p (F)
QR50E	2N5459	36p (F)
QR51F	2N6073	£1.20 (D)
QW08J	2N6609	£3.55 (C)
QR56L	2SA715	45p (F)
QQ30H	2SA872	39p (F)
QY12N	2SA1085E	34p (F)
QQ31J	2SB716	30p (F)
QR59P	2SC1162	45p (F)
QQ32K	2SC1307	£2.54 (C)
QY11M	2SC2547E	38p (F)
QQ33L	2SD756	30p (F)
QQ34M	2SJ48	£3.82 (C)
QQ35Q	2SJ49	£3.95 (C)
QW09K	2SJ50	£4.54 (C)
QQ36P	2SK133	£3.60 (C)
QQ37S	2SK134	£4.18 (C)
QW10L	2SK135	£4.30 (C)
QW11M	2102 450ns	£1.98 (D)
QW12N	2114 450ns	£1.30 (D)
QW13P	2708 450ns	£3.85 (C)
QQ07H	2716 450ns	£3.65 (C)
*QQ08J	2732 450ns	£5.19 (B)
QQ09K	2764 450ns	£9.64 (A)
QR52G	3N140	£1.62 (D)
QR53H	3N141	DIS
QH51F	3403	72p (E)
QX00A	4000BE	24p (F)
QX01B	4001BE	15p (G)
QL03D	4001UBE	17p (G)
QX02C	4002BE	15p (G)
QX03D	4006BE	52p (E)
QX04E	4007UBE	15p (G)
QW14Q	4008BE	42p (E)
QX05F	4011BE	15p (G)
QL04E	4011UBE	16p (F)
QX06G	4012BE	15p (G)
QX07H	4013BE	35p (F)
QW15R	4014BE	46p (E)
QW16S	4015BE	43p (E)
QX08J	4016BE	22p (F)
QX09K	4017BE	42p (F)
QX10L	4018BE	47p (F)
QW17T	4019BE	42p (F)
QX11M	4020BE	46p (E)
QW18U	4021BE	59p (F)
QW19V	4022BE	43p (E)
QX12N	4023BE	15p (G)
QX13P	4024BE	37p (F)
QX14Q	4025BE	15p (G)
QX15R	4026BE	80p (E)
QX16S	4027BE	21p (F)
QX17T	4028BE	40p (E)
QW20W	4029BE	54p (E)
QW21X	4031BE	98p (D)
QW22Y	4032BE	75p (E)
QW23A	4033BE	94p (E)
QW24B	4034BE	£2.45 (C)
QW25C	4035BE	48p (E)
QW26D	4038BE	85p (E)
QW27E	4040BE	44p (E)
QW28F	4041UBE	44p (E)
QX19V	4042BE	41p (F)
QW29G	4043BE	52p (E)
QW30H	4044BE	43p (E)
QW31J	4045BE	99p (D)
QW32K	4046BE	49p (E)
QX20W	4047BE	75p (E)
QW33L	4048BE	38p (E)
QX21X	4049UBE	25p (F)
QX22Y	4050BE	26p (F)
QW34M	4051BE	45p (E)
QW35Q	4052BE	60p (E)
QW36P	4053BE	50p (E)
QW37S	4054BE	95p (E)
QW38R	4055BE	85p (E)
QW39N	4056BE	£1.20 (D)

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QW40T	4060BE	60p (D)
QW41U	4063BE	85p (D)
QX23A	4066BE	25p (F)
QW42V	4067BE	£2.99 (C)
QX24B	4068BE	16p (G)
QX25C	4069UBE	18p (F)
QX26D	4070BE	16p (G)
QW43W	4071BE	16p (G)
QX27E	4072BE	16p (G)
QW44X	4073BE	16p (G)
QW45Y	4075BE	16p (G)
QW46A	4076BE	52p (E)
QW47B	4077BE	16p (G)
QX28F	4078BE	16p (G)
QW48C	4081BE	15p (F)
QW49D	4082BE	16p (G)
QW50E	4085BE	65p (E)
QW51F	4086BE	65p (E)
QW52G	4089BE	£1.40 (D)
QW53H	4093BE	22p (F)
QW54J	4094BE	£1.20 (D)
QW55K	4095BE	75p (E)
QW56L	4097BE	£3.20 (C)
QX29G	4098BE	79p (E)
QW57M	4099BE	79p (E)
QW58N	40100BE	£1.96 (D)
QW59P	40101BE	90p (E)
QW60Q	40102BE	£1.50 (D)
QW61R	40103BE	£1.20 (E)
QW62S	40104BE	85p (E)
QW63T	40105BE	£1.20 (E)
QW64U	40106BE	60p (E)
QW65V	40107BE	60p (E)
QW66W	40108BE	£4.30 (C)
QW67X	40109BE	95p (E)
QW68Y	40110BE	£1.10 (D)
QW69A	40160BE	£1.25 (D)
QW70M	40161BE	92p (E)
QW71N	40162BE	85p (E)
QW72P	40163BE	£1.60 (D)
QW73Q	40174BE	68p (E)
QQ38R	40175BE	75p (D)
QW74R	40181BE	£2.45 (D)
QW75S	40182BE	85p (E)
QW76H	40192BE	£1.25 (D)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.

Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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QW77J	40193BE	67p (E)
QW78K	40194BE	85p (E)
QW79L	40257BE	£1.10 (D)
QX34M	40673	£1.62 (D)
QW93B	4116 250ns	£1.45 (D)
QQ05F	4118 250ns	£4.78 (C)
XX01B	4136	75p (E)
QW80B	4151	89p (E)
QQ06G	4164 250ns	£4.90 (B)
XX02C	4195	£1.45 (D)
QX30H	4416BE	£1.92 (D)
QW81C	4502BE	62p (D)
QQ41U	4503BE	42p (E)
QW82D	4508BE	£2.10 (C)
QW83E	4510BE	68p (E)
QX31J	4511BE	52p (E)
QW84F	4512BE	£1.49 (D)
QW85G	4514BE	£1.20 (D)
QW86T	4515BE	£1.20 (D)
QW87U	4516BE	49p (F)
QX32K	4518BE	43p (E)
QX33L	4520BE	52p (E)
QQ42V	4521BE	£3.36 (C)
QQ43W	4522BE	88p (E)
QQ44X	4526BE	58p (E)
QW88Y	4527BE	£1.15 (D)
QQ45Y	4529BE	£1.42 (D)
QW89W	4532BE	55p (E)
QW90X	4555BE	50p (E)
QW91Y	4556BE	58p (E)
QQ49D	4568BE	£3.15 (C)
QQ51F	45100BE	£2.62 (C)
QX35Q	5W Zener 5V6	£1.27 (D)
QX36P	5W Zener 8V2	£1.27 (D)
YH31J	5101-L1	£3.48 (C)
QR55K	634SS2	£4.95 (C)
QQ04E	6402	£6.99 (B)
QQ02C	6502	£6.36 (B)
QW94C	7106	£8.15 (B)
QW95D	7107	£7.95 (B)
QX37S	7400	17p (G)
YF00A	74LS00	20p (G)
QX38R	7401	17p (G)
YF01B	74LS01	17p (G)
QX39N	7402	22p (G)
YF02C	74LS02	21p (G)
QX74R	7403	20p (G)
YF03D	74LS03	21p (G)
QY24B	74S03	30p (E)
QX40T	7404	21p (G)
YF04E	74LS04	20p (G)
QX41U	7405	21p (G)
YF05F	74LS05	20p (G)
QX75S	7406	29p (F)
QX76H	7407	29p (F)
QX42V	7408	21p (G)
YF06G	74LS08	22p (G)
QX77J	7409	22p (G)
YF07H	74LS09	22p (G)
QX43W	7410	17p (G)
YF08J	74LS10	24p (G)
QX44X	7411	24p (G)
YF09K	74LS11	20p (G)
YF10L	74LS12	17p (G)
QX45Y	7413	38p (F)
YF11M	74LS13	31p (F)
QX46A	7414	42p (F)
YF12N	74LS14	44p (F)
YF13P	74LS15	21p (G)
QX78K	7416	31p (F)
QX79L	7417	30p (F)
QX47B	7420	23p (G)
YF14Q	74LS20	23p (G)
QX48C	7421	40p (F)
YF15R	74LS21	20p (G)
YF16S	74LS22	23p (G)
QX80B	7425	28p (F)
QX81C	7426	22p (G)
YF17T	74LS26	22p (G)
QX49D	7427	29p (F)
YF18U	74LS27	29p (F)
YF19V	74LS28	29p (F)
QX50E	7430	21p (G)
YF20W	74LS30	21p (G)
QX51F	7432	36p (F)
YF21X	74LS32	21p (G)
YF22Y	74LS33	40p (F)
YF23A	74LS37	21p (G)
QX82D	7438	32p (F)
YF24B	74LS38	22p (G)
QX53H	7440	24p (F)
YF25C	74LS40	40p (F)
QX54J	7441	58p (F)
YF26D	74LS42	33p (F)
QX55K	7447A	55p (E)
QQ52G	74LS47	65p (E)
QQ53H	74LS48	46p (E)
QX83E	7451	22p (G)
YF27E	74LS51	21p (G)
YF28F	74LS54	30p (F)
QX56L	7470	36p (F)
QX57M	7472	35p (F)
QX58N	7473	32p (F)
YF30H	74LS73	28p (F)
QX59P	7474	32p (F)
YY83E	74ALS74	90p (E)
YF31J	74LS74	26p (F)
QX60Q	7475	45p (F)
YF32K	74LS75	33p (F)
QX61R	7476	32p (F)
YF33L	74LS76	23p (F)
QX62S	7481	£1.75 (D)
QX85G	7483	50p (E)
QX63T	7485	77p (E)
YF35Q	74LS85	70p (E)
QX64U	7486	28p (F)
YF36P	74LS86	36p (F)
QX65V	7489	£3.10 (C)
QX66W	7490	32p (F)
YF38R	74LS90	36p (F)
QX86T	7491	£1.20 (D)
QX67X	7492	32p (F)
YF39N	74LS92	36p (F)
QX68Y	7493	35p (F)
YF40T	74LS93	36p (F)
QX69A	7494	39p (F)
QX70M	7495	48p (F)
YF41U	74LS95	£1.20 (E)
QX87U	7496	50p (E)
QX71N	74107	26p (F)
YF43W	74LS107	41p (F)
QX88V	74109	53p (E)
YF44X	74LS109	34p (F)
YF45Y	74LS112	64p (E)
YF46A	74LS113	40p (F)
QX72P	74118	£2.30 (C)
QX73Q	74121	33p (F)
WH00A	74122	48p (E)
QQ54J	74LS122	62p (E)
WH01B	74123	42p (F)

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YF48C	74LS123	62p (E)
YF49D	74LS125	33p (F)
YF50E	74LS126	33p (F)
WH03D	74132	68p (E)
YF51F	74LS132	45p (F)
YF52G	74LS136	49p (F)
YF53H	74LS138	38p (F)
YF54J	74LS139	44p (F)
WH05E	74141	78p (E)
WH06G	74145	67p (E)
YF55K	74LS145	£1.65 (D)
QX89W	74150	80p (E)
WH07H	74151	65p (E)
YF56L	74LS151	43p (F)
YF57M	74LS153	49p (F)
WH08J	74154	78p (E)
YF58N	74LS154	98p (E)
YF59P	74LS155	37p (F)
YF60Q	74LS156	57p (E)
YF61R	74LS157	35p (F)
YF62S	74LS158	33p (E)
WH09K	74160	67p (E)
YF63T	74LS160	49p (F)
YF64U	74LS161	49p (F)
YF65V	74LS162	53p (E)
YF66W	74LS163	49p (F)
WH10L	74164	79p (E)
YF67X	74LS164	55p (E)
YF68Y	74LS165	£1.10 (D)
YF69A	74LS166	£1.25 (D)
YF70M	74LS168	£1.20 (D)
YF71N	74LS169	99p (E)
YF72P	74LS170	£2.99 (C)
YF73Q	74LS173	65p (E)
WH11M	74174	96p (E)
YF74R	74LS174	62p (E)
YF75S	74LS175	58p (E)
YF76H	74LS181	£2.95 (C)
YF78K	74LS190	58p (E)
YF79L	74LS191	68p (E)
WH12N	74192	70p (E)
YF80B	74LS192	56p (E)
QX90X	74193	£1.75 (D)
YF81C	74LS193	65p (E)
WH13P	74194	55p (E)
YF82D	74LS194	65p (E)
YF83E	74LS195	45p (F)
WH14Q	74196	46p (F)
YF84F	74LS196	59p (E)
YF85G	74LS197	£1.45 (E)
YF86T	74LS221	63p (E)
YF87U	74LS240	79p (E)
YF88V	74LS241	99p (E)
YF89W	74LS242	£1.62 (D)
YF90X	74LS243	89p (E)
QQ56L	74LS244	87p (E)
YF91Y	74LS245	£2.23 (C)
YF92A	74LS251	69p (E)
YF93B	74LS253	98p (E)
YF95D	74LS257	52p (E)
YF96E	74LS258	55p (E)
YF97F	74LS259	89p (E)
YF98G	74LS261	£2.25 (C)
YF99H	74LS266	32p (F)
YH00A	74LS273	£1.32 (D)
YH01B	74LS279	44p (F)
YH02C	74LS283	69p (E)
YH03D	74LS290	£1.30 (D)
QY39N	74LS292	£11.20 (A)
YH04E	74LS293	96p (E)
QY40T	74LS297	£11.20 (A)
YH06G	74LS298	£1.75 (D)
YH07H	74LS299	£4.25 (C)
YH08J	74LS323	£6.75 (B)
YH09K	74LS363	£2.36 (C)
YH11M	74LS365	39p (F)
YH12N	74LS366	45p (F)
YH13P	74LS367	62p (E)
YH14Q	74LS368	43p (F)
YH15R	74LS373	74p (D)
YH16S	74LS374	99p (D)
YH18U	74LS377	£1.82 (D)
YH19V	74LS378	£1.40 (D)
YH20W	74LS379	£2.40 (D)
YH21X	74LS390	£1.45 (D)
YH22Y	74LS393	£1.40 (D)
YH23A	74LS395	£1.35 (D)
YH24B	74LS398	£1.99 (D)
YH25C	74LS399	£2.50 (C)
QQ59P	74LS600	NYA
QY41U	74LS601	£11.72 (A)
QY42V	74LS604	£4.56 (C)
QQ61R	74LS608	NYA
QQ62S	74LS610	NYA
WH02C	74LS629•74LS124	£1.94 (D)
YH29G	74LS670	£3.96 (C)
QQ63T	74LS684	£4.75 (C)
YH30H	74C917	£8.95 (B)
QY08J	74C925	£5.95 (B)
YH32K	76477	£5.20 (B)
YH33L	76489	£5.64 (B)
YH34M	8T28	£1.99 (C)
YH35Q	8T95	£2.55 (C)
YH38R	8038 CCPD	£4.80 (C)
YH39N	8069 DCQ	£2.95 (C)
YH40T	8080A	£4.95 (C)
YH41U	8085A	£5.99 (B)
YH43W	8211 CPA	£3.25 (C)
YH44X	8212	£1.95 (D)
YH45Y	8216	£1.95 (D)
YH46A	8224	£2.68 (C)
YH47B	8228	£4.94 (C)
YH48C	8250	£9.95 (B)
YH49D	8251	£3.98 (C)
YH50E	8255A	£4.40 (C)
YH51F	8279	£6.46 (B)
YH52G	82S126M1	£2.51 (C)

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QH36P	LM301A	27p (F)
QH37S	LM308	72p (E)
WQ54J	NE531	£1.52 (D)
YY68Y	NE5534A	£2.26 (C)
YY67X	NE5539	£7.85 (B)
QL20W	uA709C	75p (E)
QL22Y	uA741C 8-pin DIL	23p (G)
QL24B	uA747C	59p (E)
QL25C	uA748C	59p (E)
QH46A	1458C	45p (F)
QH51F	3403	72p (E)
XX01B	4136	75p (E)

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QH28F	CA3130T	£1.26 (D)
QH29G	CA3140T	99p (E)
WQ21X	CA3240E	£1.38 (D)
QH35Q	LH0042C	£4.46 (C)

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WQ30H	LF351	56p (E)
WQ31J	LF353	99p (E)
WQ29G	LF347	£1.94 (C)
QY26D	LF400CN	NYA
QY27E	LF411CN	82p (E)
QY28F	LF412CN	£1.38 (D)
QY29G	LF441CN	72p (E)
QY30H	LF442CN	£1.42 (D)
QY31J	LF444CN	£1.98 (D)
YY69A	LF13741	55p (E)

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YH58N	CA3080E	87p (E)
YH64U	LM13700N	£1.39 (D)
QY09K	LM311N	68p (E)
QH48C	MC3302P	80p (E)

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WQ36P	LM389	£1.49 (D)
QH38R	LM377	£2.25 (C)

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QH40T	LM380	75p (E)
WQ34M	LM384	£1.99 (D)
QL13P	TBA810P	95p (E)
BR02C	5W Amp PCB	£1.62 (D)

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WQ33L	LM383	£1.61 (D)
BY73Q	8W Amp PCB	62p (E)
LW36P	8W Amp Kit	£4.45 (C)
YY70M	TDA2005M	£8.25 (B)
WQ66W	TDA2006	£1.65 (D)

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WQ67X	TDA2030	£1.95 (D)
YQ43W	15W Amp Kit	£6.45 (B)
YQ35Q	15W Amp PCB	£1.25 (D)
YQ36P	15W Amp Bracket	65p (E)
YQ38R	30/2 PSU PCB	£1.40 (D)
YQ37S	15W Amp Module	£6.49 (B)

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QY32K	TDA 1102SP	£3.24 (C)
QH41U	LM381	£1.89 (D)
BR04E	LM381 PCB	£2.15 (C)

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YY84F	LM382	£1.45 (D)
QY10L	NE570	£4.28 (C)
YY87U	NE571	£3.36 (C)
YY86T	TDA3410	£1.90 (D)
WQ35Q	LM387	£1.25 (D)

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QY19V	LM1035	£4.50 (C)
QY33L	LM1037N	£2.72 (C)
QY34M	LM1038N	£2.85 (C)

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QH49D	MC3340P	£2.25 (D)
YY85G	LM1818	£1.95 (D)
QY35Q	MF10CN	£4.96 (C)
YY81C	M083	£4.75 (C)
WH22Y	M087	DIS

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QB21X	AY-1-0212	DIS
HQ53H	Piano IC Kit	£38.44 (A)
HQ52G	AY-1-1320	£4.99 (C)
HQ51F	AY-1-5050	£1.99 (D)
HQ71N	M251	£12.20 (A)
WH21X	M254	£7.49 (B)
YY90X	M108	£18.25 (A)

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YY91Y	M147	£6.51 (B)
YY89W	AY-3-1350	£5.95 (B)
WH20W	TDA1022	£6.75 (B)
YH33L	76489	£5.64 (B)

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YY79L	TCA350Z	£3.95 (C)
YH32K	76477	£5.20 (B)
YQ42V	Sound Effects PCB	£1.10 (D)

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WQ61R	SH120A	£6.65 (B)
QH27E	CA3089E	£2.70 (C)
WQ20W	CA3189E	£1.95 (D)

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WQ37S	LM1820	£2.24 (D)
BL35Q	TBA 651	£2.25 (C)
WQ64U	TCA4500A	£3.35 (C)
QH45Y	MC1310P	£2.30 (C)
BR03D	Decoder PCB	£1.84 (D)

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QL41U	ZN414	£1.25 (D)
QY23A	MC10116P	96p (E)

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QH47B	MC1496	89p (E)
QL06G	SG1495D	£3.95 (C)
QL07H	SG3402	£4.56 (C)
QH26D	CA3046	72p (E)
QQ11M	VQ1000CJ	£4.30 (C)
YH66W	SL490	£3.35 (C)

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YH67X	ML922	£5.25 (B)
QR57M	ML926	£2.45 (C)
QR58N	ML927	£2.45 (C)

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YH68Y	ML928	£2.40 (C)
YH69A	ML929	£2.40 (C)
YG37S	CL8960	£31.26 (A)
YY71N	LM1871	£5.60 (B)
YQ69A	LM1871 Xmitter PCB	98p (E)
BX11M	HV Disc 680	9p (H)

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YY72P	LM1872	£5.90 (B)
YQ70M	LM1872 Receiver PCB	95p (E)
WQ55K	NE 544	£2.18 (C)
YQ71N	Servo Driver PCB	85p (E)
WQ76H	TL172C	76p (E)

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WQ75S	TL170C	55p (E)
QR55K	634SS2	£4.95 (C)
YY99H	LM1830	£2.65 (C)
YY73Q	LM335Z	£1.42 (D)
WQ40T	LM3911	£1.31 (D)

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YY98G	AY-3-1270	£8.30 (B)
WQ41U	LM3914	£3.51 (C)
YY96E	LM3915	£3.24 (C)
YY97F	LM3916	£3.46 (C)
YQ66W	LM3914 PCB	85p (E)

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QY14Q	UAA170L	£2.50 (C)
YH30H	74C917	£8.95 (B)
FY90X	Crystal 6.5536MHz	£2.98 (C)
YY93B	ICM7045IPI	£14.20 (A)

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YY88V	TMS1121	£8.90 (B)
QY08J	74C925	£5.95 (B)
YY92A	MK50395	£10.50 (A)

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YY94C	ICM7216DIPI	£19.95 (A)
QY18U	SP8680B	£12.40 (A)
†YY95D	ICM7226BIPI	£21.90 (A)
QH67X	NE 556	62p (E)
QH66W	NE 555	21p (G)

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YH63T	ICM 7555	£1.32 (D)
QH68Y	NE 566	£1.72 (D)
WQ56L	NE 565	£1.64 (D)

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QH69A	NE 567	£1.30 (D)
WQ39N	LM3909	98p (E)
YY76H	TDA1024	£1.49 (D)
QY36P	LM1851N	£1.46 (D)
YH43W	8211 CPA	£3.25 (C)
YH39N	8069 DCQ	£2.95 (C)

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WQ32K	LM334	£1.10 (D)
YY78K	TL497A	£1.65 (D)
YY77J	TL430C	99p (E)
WQ62S	TAA 550	35p (F)
YY75S	ICL7660CPA	£3.24 (C)
XX02C	4195	£1.45 (D)

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XX04E	15V Supply PCB	75p (E)
YY74R	L200	£2.69 (C)
BL22Y	uA723C TO99	85p (E)
QL21X	uA723C 14-pin DIL	55p (E)

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YQ39N	0.1A Reg PSU PCB	£1.24 (D)
YQ40T	0.5/1A Reg +V PS PCB	85p (E)
YQ41U	0.5/1A Reg -V PS PCB	85p (E)
YQ54J	0.5/1A Vareg Pos PCB	85p (E)
YQ55K	0.5/1A Vareg Neg PCB	85p (E)

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QY37S	Satronics PC1R	£3.62 (C)
QY38R	Satronics PC12R	£6.94 (B)

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QQ02C	6502	£6.36 (B)
WQ43W	MC6800P	£5.10 (B)
WQ44X	MC6802P	£4.72 (C)
WQ46A	MC6821P	£1.99 (D)
WQ48C	MC6850P	£2.20 (C)
WQ49D	•MC6852P	£2.95 (C)
WQ50E	MC6875L	£6.32 (B)
QW00A	Z80-CPU	£7.95 (B)
QW03D	Z80-PIO	£3.99 (C)
QW01B	Z80-CTC	£4.50 (C)
YH40T	8080A	£4.95 (C)
YH41U	8085A	£5.99 (B)

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YH46A	8224	£2.68 (C)
YH47B	8228	£4.94 (C)
YH50E	8255A	£4.40 (C)
YH49D	8251	£3.98 (C)
YH48C	8250	£9.95 (B)
YH51F	8279	£6.46 (B)
YH44X	8212	£1.95 (D)
YH45Y	8216	£1.95 (D)
YH34M	8T28	£1.99 (C)
YH35Q	8T95	£2.55 (C)
WQ19V	AY-5-2376	£13.99 (B)
WQ18U	AY-3-1015D	£5.98 (B)
QQ04E	6402	£6.99 (B)

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WQ60Q	SFF96364	£9.45 (B)
QQ03D	MC6845	£7.95 (A)
YH31J	5101-L1	£3.48 (C)
QW11M	2102 450ns	£1.98 (D)
WQ45Y	MC6810AP 450ns	£1.86 (D)
QW12N	2114 450ns	£1.30 (D)
QQ05F	4118 250ns	£4.78 (C)
WQ42V	MCM4027 250ns	£2.40 (D)
QW93B	4116 250ns	£1.45 (D)

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QQ06G	4164 250ns	£4.90 (B)
QW13P	2708 450ns	£3.85 (C)
QQ07H	2716 450ns	£3.65 (C)
*QQ08J	2732 450ns	£5.19 (B)
QQ09K	2764 450ns	£9.64 (A)

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XY84F	Softy 2 System	£169.00 (A)
XY83E	EPROM Eraser	£42.95 (A)
YH52G	82S126M1	£2.51 (C)
WQ59P	RO-3-2513	£8.95 (B)
YH38R	8038 CCPD	£4.80 (C)

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YQ65V	8038 PCB	85p (E)
QW80B	4151	89p (E)
QQ01B	DAC0801LCN	£2.45 (C)

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QQ00A	ADC0804LCN	£4.45 (C)
YH59P	ICL7109	£19.98 (A)
WQ38R	LM2917	£2.45 (C)
YQ67X	LM2917 PCB	85p (E)
QW94C	7106	£8.15 (B)
QW95D	7107	£7.95 (B)

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BY76H	7106/7 PCB	£1.45 (D)
WR29G	Transkt 3-Lead TO18	16p (G)
WR30H	Transkt 4-Lead TO18	35p (F)
WR31J	Transkt 3-Lead TO5	19p (G)
WR32K	IC Skt 8-Lead	55p (E)
WR33L	IC Skt 10-Lead	69p (E)
QY44X	Insulator TO3	18p (G)
QY45Y	Insulator P	14p (G)
WR24B	Kit TO3	11p (H)
WR25C	Kit TO66	9p (H)
WR27E	Kit SO55	9p (H)
WR26D	Kit TO126	5p (H)
WR23A	Kit (P) Plas	6p (H)
XX14Q	Soldercons	90p

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BL17T	DIL Socket 8-pin	9p (H)
BL18U	DIL Socket 14-Pin	11p (G)
BL19V	DIL Socket 16-pin	12p (G)
HQ76H	DIL Socket 18-pin	16p (G)
HQ77J	DIL Socket 20-pin	17p (G)
HQ78K	DIL Socket 22-pin	20p (G)
BL20W	DIL Socket 24-pin	19p (G)
BL21X	DIL Socket 28-pin	24p (F)
HQ38R	DIL Socket 40-pin	35p (F)
FR25C	Insertion Tool	80p (E)
YG27E	Header 14-pin	54p (E)
YG28F	Header 16-pin	75p (E)
YG29G	Header 24-pin	£1.10 (D)
YX50E	ZIF Socket 24-Way	£4.42 (C)
FL56L	Transistor Cover	10p (G)
HQ79L	Heatsink 92F	19p (G)
HQ80B	Heatsink 18F	24p (F)
FL78K	Heatsink Clip-On	16p (G)
WR34M	TO5 Chassis Heatsink	89p (E)

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FL59P	Vaned Heatsink TO3	46p (F)
FL58N	Vaned Htsnk Plas Pwr	34p (F)
FL57M	Vaned Heatsink IC	72p (E)
HQ70M	Heatsink 2E	£2.96 (C)
FL41U	Heatsink 4Y	£1.96 (D)
HQ69A	50W Hi-Fi Heatsink	£1.95 (D)
HQ81C	8W Hi-Fi Heatsink	£1.17 (D)
FL42V	Flat Heatsink	£3.71 (C)
FL54J	Heatsink 10DN	£2.15 (C)
FL55K	Heatsink 10DNOR	£2.60 (C)
FL77J	Heatsink 6W-1	£6.62 (B)

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YB26D	Heatsink 60DN	£13.95 (A)
FL79L	Thermpath	£3.60 (C)
HQ00A	Silicone Grease Tube	84p (E)
WY08J	Standard Fan	£15.50 (A)

SPEAKERS

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HY12N	Ultrasonic Transducr	£6.20 (B)
QY13P	Piezo Transducer27mm	30p (F)
QY16S	Rubber Disc 27mm	5p (H)
FL39N	Buzzer 6V	88p (E)
FL40T	Buzzer 12V	88p (E)
FL38R	AC Bell	£1.90 (D)
FL37S	Bell Xformer	£5.60 (C)
FQ08J	Bell Push	£1.10 (D)
FQ09K	Nameplate Bell Push	55p (E)

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YB25C	Baby Siren	£9.25 (B)
LH96E	Plastic Siren	£5.95 (B)
LH98G	Hawaii Five-O Siren	£24.95 (A)
XG14Q	Electronic Siren	£19.95 (A)
XQ71N	Re-entrant Horn Sndr	£26.50 (A)
YW52G	2in Piezo Tweeter	£2.49 (C)

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WF54J	Direct Radiant Piezo	£3.95 (C)
WF09K	Piezo Horn Flush	£5.96 (B)
WF55K	Piezo Horn Recessed	£6.56 (B)
WF56L	Wide Angle Piezo	£8.64 (B)
LB23A	Mag Earpiece 2.5mm	25p (F)
LB24B	Mag Earpiece 3.5mm	25p (F)
LB25C	Crystal Earpiece	55p (E)
YW57M	Stethoscope	75p (E)
*WF20W	Mag Headset	£4.85 (C)
LH81C	Education Headphone	£5.75 (B)
LH82D	Boom Mic Headphone	£13.90 (A)
LH83E	Stereophone OH150P	£4.25 (C)

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WF13P	Stereophone HP110C	£5.40 (B)
WF14Q	Stereophone DH207	£7.99 (B)
LH84F	Stereophone M110B	£8.60 (B)
LH85G	Stophone SH590/HS310	£13.40 (A)
YK56L	Persnl Stereo Phones	£4.95 (C)
LB13P	Headphone Adaptor	£3.95 (C)
WB04E	L/S Lo-Z 388	85p (E)
WB05F	L/S Lo-Z 458	89p (E)
WB08J	L/S Lo-Z 508	89p (E)
WB09K	L/S Lo-Z 568	89p (E)
WB13P	L/S Lo-Z 668	89p (E)
WF57M	Hi-Z L/S 64R	99p (E)
YW53H	L/S Lo-Z 768	99p (E)
WF58N	3 inch Tweeter	£1.64 (D)
YW54J	15W Cone Tweeter	£2.85 (C)

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WF24B	Multi-Cell Tweeter	£5.95 (B)
WF33L	Free Stand Tweeter	£5.95 (B)
WF43W	Dome Tweeter	£5.45 (B)
WF44X	Rectangular Tweeter	£5.45 (B)
WF02C	Crossover 2-Way	£4.20 (C)
WF03D	Crossover 3-Way	£5.20 (B)
WF46A	Controlled Crossover	£10.69 (A)
WF47B	Low-Cost 4in Spkr	£2.94 (C)
BK30H	Spkr Fixing Clamp	25p (F)
YW55K	Plastic Car Grille	£1.10 (E)

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WF48C	Hvy Duty Car Spkr	£6.45 (B)
WF50E	Elliptcal Spkr CM641	£3.35 (C)
WF18U	Elliptcal Spkr CM742	£4.45 (C)
WF23A	Elliptcal Spkr CM852	£5.20 (B)
WY13P	Elliptcal Spkr LT853	£6.45 (B)
WF00A	Rd Speaker LT530	£8.20 (B)
WF52G	Rd Speaker LT610	£5.75 (B)
WF08J	Rd Speaker CM820	£5.95 (B)
WF11M	Rd Speaker LT830	£7.30 (B)
WF12N	Rd Speaker LT840	£11.45 (A)

TRADE QUANTITIES

The letter in brackets after the price indicates the minimum quantity of that item you can buy and qualify for a trade price. See table at start of price list. If you buy less than the quantity shown then the price is that shown. If you want to buy the quantity shown or more of that item, then please contact us for a trade price. If no trade quantity is shown, then the price shown is the best price we can offer regardless of the quantity.
Trade quantities shown for wires or cables of any type is in metres, not reels or parts of metres. Trade quantities for nuts, bolts, washers, Hiatts etc. refers to the number of packs, i.e. to qualify for a trade price on Tag 2BA for example (trade quantity 500), you will need to order 500 packs which is equal to 5000 tags.

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WF53H	20W Squawker	£3.25 (C)
WY15R	40W Squawker	£5.45 (B)
XG02C	Loudspeaker 12in 35W	£19.75 (A)
XQ77J	Fane 50 4R	£19.95 (A)
XB26D	Fane 50 8R	£21.45 (A)

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XQ78K	Disco 80 4R	£29.45 (A)
XB27E	Disco 80 8R	£29.45 (A)
XQ79L	Forte 1250TC 8R	£21.75 (A)
XQ80B	Forte 1250TC 16R	£21.75 (A)
XQ81C	Forte C1285TC 8R	£29.64 (A)
XQ82D	Forte C1285TC 16R	£28.45 (A)
XQ83E	C15 Bass 8R	£59.60 (A)
†XQ84F	C15 Bass 16R	£57.80 (A)
XB28F	Power L/S Cabinet	£49.00 (A)

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AF33L	Mini Speaker System	£45.50 (A)
AF34M	5W Spkr in Cab	DIS
AF35Q	15W Spkr Pair	£33.50 (A)
†AF31J	20W Spkr Pair	£63.00 (A)
AF32K	PA Spkr in Cab	£21.99 (A)
XY79L	Ceiling Speaker	£11.75 (A)
YL15R	Bracket Minor 5	£6.50 (B)
YL16S	Bracket Bek 100	£14.95 (A)
YK54J	Wallclamps Duo 220	£15.95 (A)

SWITCHES RELAYS

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FH97F	SPST Ultra Min Tggle	66p (E)
FH98G	SPDT Ultra Min Tggle	69p (E)
FH99H	DPDT Ultra Min Tggle	75p (E)
FH00A	Sub-Min Toggle A	70p (E)
FF70M	Sub-Min Toggle J	80p (E)
FH01B	Sub-Min Toggle B	89p (E)
FH03D	Sub-Min Toggle D	£1.06 (D)
FH04E	Sub-Min Toggle E	99p (E)
FF71N	Sub-Min Toggle K	£2.35 (C)
FH05F	Sub-Min Toggle F	£1.29 (D)
FH07H	Sub-Min Toggle H	£1.25 (D)
FF72P	Sub-Min Toggle L	£2.15 (C)
FH08J	4-Pole SM Toggle	£2.35 (C)
FH39N	Toggle Sw	62p (E)
YL01B	Toggle Switch Cover	47p (F)
FH10L	Std Toggle SPST	50p (E)
FH11M	Std Toggle SPDT	57p (E)
FH12N	Std Toggle DPDT	77p (E)
BK32K	10A SPST Toggle	95p (E)
BK33L	10A SPDT Toggle	£1.15 (D)
FH17T	H/D Toggle Type 4	£2.98 (C)
FH18U	H/D Toggle Type 7	£1.95 (D)
FH19V	H/D Toggle Type 8	£4.40 (C)
FH20W	H/D Toggle Type 9	£3.20 (C)

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FH13P	Duck Bill Toggle	55p (E)
XY56L	Chrome Bar Toggle	85p (E)
XY64U	Min Rocker SPST	69p (E)
XY65V	Min Rocker DPDT	£1.15 (D)
FH30H	SPST Rocker	39p (F)
FH31J	SPDT Rocker	49p (F)
YR68Y	Rocker Neon	79p (E)
YR69A	Rocker Sw DP	69p (E)
FH34M	DPDT Rocker	98p (E)
YR70M	Dual Rocker Neon	98p (D)
BH58N	Co-ax Switch SO239	£6.99 (B)
BH59P	Co-ax Switch PL259	£6.99 (B)
XX26D	DIL Switch SPST Dual	99p (D)
XX27E	DIL Switch SPST Octl	£1.65 (D)
XX28F	DIL Switch SPDT Sgl	95p (E)
XX29G	DIL Switch SPDT Quad	£2.95 (C)
FF73Q	Rotary SW12B	74p (E)
FF74R	Rotary SW6B	70p (E)
FF75S	Rotary SW4B	79p (E)
FF76H	Rotary SW3B	70p (E)
FH42V	Rotary SW12	85p (E)
FH43W	Rotary SW6	85p (E)
FH44X	Rotary SW4	85p (E)
FH45Y	Rotary SW3	89p (E)
XX45Y	Switchpot 1p 12w	85p (E)

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FF83E	Thumbwheel Decimal	£3.32 (C)
FF84F	Thumbwheel BCD	£3.32 (C)
BK49D	End Cheeks	78p (F)
BK50E	Dial Stops	35p (F)
YR77J	Push Wheel BCD	£5.45 (B)
YR79L	Push Whl End Cheeks	99p (E)
FH40T	Key Switch	£3.60 (C)
FH57M	Rotary Mains	75p (E)
FH95D	Roller Microswitch	£1.15 (D)
FH46A	Maka Shaft	£1.10 (D)

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FH47B	Maka Wafer 1p 12w	£1.06 (D)
FH48C	Maka Wafer 2p 6w	£1.06 (D)
FF81C	Maka Wafer 2p 9w	£1.25 (D)
FH50E	Maka Wafer 4p 3w	£1.10 (D)
FH51F	Maka Wafer 6p 2w	£1.17 (D)
FH52G	Maka Wafer 1p 12w MB	75p (E)
FH53H	Maka Wafer 2p 6w MB	£1.05 (D)
FF82D	Maka Wafer 2p 9w MB	29p (F)
FH55K	Maka Screen	5p (H)
FF87U	Click Switch	30p (F)
FF88V	Click Cap Black	18p (G)
FF89W	Click Cap Blue	18p (G)
FF90X	Click Cap Green	18p (G)
FF91Y	Click Cap Grey	18p (G)
FF92A	Click Cap Ivory	18p (G)
FF93B	Click Cap Red	18p (G)
FF94C	Click Cap White	18p (G)
FF95D	Click Cap Yellow	18p (G)
HY34M	Click Key Black	24p (F)
FF61R	Keyboard Switch	23p (G)
FF62S	Keytop 1 Position	18p (G)
FF63T	Keytop 2 Position	29p (F)
FF64U	Keytop 3 Position	56p (E)
FF65V	ASCII Transparency	£1.35 (D)
YR71N	Switch Contact Sheet	£1.49 (D)

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FF77J	SP Slide	12p (G)
FH35Q	Sub-Min Slide	15p (G)
FF79L	Long Chrome Slide	22p (G)
FH36P	Std Slide Switch	15p (G)
FH38R	4-Pole Slide	69p (E)
FH59P	Push Switch	17p (G)
YR67X	HQ Push Switch	39p (F)
FH60Q	Break Push	23p (G)
FH91Y	Motor-Start Press	43p (F)
RK82D	Lge Red Push Button	69p (E)
FF96E	Square Push Black	77p (E)
FF97F	Square Push Green	77p (E)
FF98G	Square Push Red	77p (E)
FF99H	Square Push Yellow	77p (E)
YW41U	Square Psh Lck Black	75p (E)
YW43W	Square Psh Lck Red	75p (E)
YW44X	Square Psh Lck Yllow	75p (E)

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FH41U	Pushlock SPCO	£1.20 (D)
FH66W	Pushlock DPCO	£1.45 (D)
FH94C	Pressl Switch	28p (F)
FH92A	Press Toe Sw Type 1	£1.20 (D)
BK31J	Press Toe SPST 2	£1.39 (D)
FH93B	Press Toe Sw Type 2	£1.95 (D)
LB64U	Foot Switch	£4.25 (C)
FH37S	Mains Push	£1.10 (D)
LB91Y	Flasher Unit 2 Way	£7.89 (B)
LQ00A	Beginners Morse Key	£1.90 (D)
LQ01B	Professl Morse Key	£5.86 (B)
HY00A	Touch Pads Rect	26p (G)
HY01B	Touch Pads Tri	27p (F)
YR88V	Solenoid 12V	£5.64 (C)
YR89W	Solenoid 240V AC	£5.98 (C)

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FH67X	Latchswitch 2 pole	46p (F)
FH68Y	Latchswitch 4-pole	59p (E)
FH69A	Latchswitch 6-pole	99p (E)
FH70M	Latchswitch 8-pole	£1.45 (D)
FH71N	Latchswitch 10-pole	£1.25 (D)
BW11M	Latchsoft 2 pole	60p (E)
BW12N	Latchsoft 4-pole	£1.20 (D)
FH72P	Latchdummy	32p (F)
FH74R	Mains Latchswitch	£1.59 (D)
FH75S	Latchbracket Single	16p (G)
FH76H	Latchbracket 2-way	38p (F)
FH78K	Latchbracket 4-way	45p (F)
FH80B	Latchbracket 6-way	64p (E)
FH82D	Latchbracket 8-way	64p (E)
FH84F	Latchbracket 10-way	69p (E)

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FL31J	Rd Latchbutton Black	14p (G)
FL32K	Rd Latchbutton Green	14p (G)
FL33L	Rd Latchbutton Grey	14p (G)
FL34M	Rd Latchbutton Red	14p (G)
FL36P	Rd Latchbutton Chrm	22p (G)
BW13P	Sm Latchbutton Black	11p (G)
BW14Q	Sm Latchbutton Chrm	33p (F)
FH61R	Rct Latchbutton Blk	14p (G)
FH62S	Rct Latchbutton Grey	14p (G)
FH63T	Rct Latchbutton Red	14p (G)
FH64U	Rct Latchbutton White	14p (G)
FH87U	Magiclight Bttn Blu	49p (E)
FH89W	Magiclight Bttn Orng	49p (F)
FH90X	Magiclight Bttn Yllw	49p (F)
BW15R	Latchbush Blue	39p (F)
BW16S	Latchbush Green	45p (F)
BW17T	Latchbush Orange	45p (F)
BW18U	Latchbush Yellow	39p (F)

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BK47B	Micro-Min Relay	60p (E)
YX94C	Ult-Min Rlay 12V SPDT	96p (E)
YX95D	Ult-Min Rlay 12V DPDT	£1.49 (D)
BK48C	Ult-Min Rlay 6V DPDT	£1.10 (E)
YX96E	3A Min Relay	99p (E)
YX97F	10A Mains Relay	£1.65 (D)

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YX98G	5A Mains Relay	£1.95 (C)
YX99H	12V 30A Relay	£2.15 (C)
FX23A	Open Relay 6V	£3.25 (C)
FX24B	Open Relay 12V	£3.88 (C)
FX26D	2p Sub Min Relay 6V	£3.45 (C)
FX27E	2p Sub Min Relay 12V	£3.45 (C)
FX30H	4p Sub-Min Relay 12V	£3.99 (C)

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FX48C	Power Relay 12V	£3.95 (C)
FX49D	Power Relay 230V AC	£4.25 (C)
HY20W	Relay Flat 12V	£1.98 (C)
FX50E	Reed Relay 6 to 9V	£1.98 (D)
FX51F	Reed Relay 9 to 12V	£2.15 (C)
FX88V	Dil Reed Relay 1p 5V	£1.95 (D)
FX89W	Dil Reed Relay 1p12V	£1.70 (C)
FX90X	Dil Reed Relay 2p 5V	£3.99 (C)
FX91Y	Dil Reed Relay 2p12V	£3.85 (C)
FX93B	Dil Rd Rly 1p C/O12V	£7.60 (B)

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FX68Y	Reed SW Standard	89p (E)
FX69A	Reed SW Compact	£1.75 (D)
FX70M	Reed SW Miniature	79p (E)
FX71N	Magnet Small	38p (F)
FX72P	Magnet Large	88p (E)

TEST GEAR

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HF19V	Test Prod Black	45p (F)
HF20W	Test Prod Red	45p (F)
HF21X	Probe Clips	98p (E)
YX57M	Min Probe Black	42p (F)
†YX58N	Min Probe Blue	38p (F)
YX59P	Min Probe Green	42p (F)
YX60Q	Min Probe Red	42p (F)
†YX61R	Min Probe Yellow	42p (F)
HF30H	Pistol Probe Black	£1.24 (E)
HF31J	Pistol Probe Red	£1.24 (E)
HF22Y	Lo-Cost Test Probe	74p (E)
HF32K	Moulded Test Probe	79p (E)
HF33L	4mm Test Probe	89p (E)
YR93B	Test Lead Kit	£2.99 (C)
FY73Q	Logic Probe	£9.50 (B)
FY88V	Continuity Probe	75p (E)

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FL61R	Signal Injector	£3.99 (B)
FY74R	IC Test Clip	£2.35 (C)
YB21X	Safebloc	£7.50 (B)
BW05F	Scope Probe BNC	£13.85 (A)
YR95D	Lo-Cost Scope Probe	£3.75 (C)
XB82D	Crotech 3030	£167.90 (A)
	Carr in UK with XB82	£8.45

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XB83E	Crotech 3131	£286.00 (A)
	Carr in UK with XB83	£9.45 (B)
YK38R	Low-Cost Counter	£49.90
LH05F	Transistor Testr HFE	£15.20 (A)
YB82D	LCR Bridge	£25.95 (A)

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YB81C	Seesure Sig Gen	£28.64 (A)
YK40T	Seesure CMOS Tester	£34.95 (A)
YW93B	Low Cost Multimeter	£4.85 (C)
FL60Q	Pocket Multimeter	£7.50 (B)
YB83E	Small Multimeter	£15.95 (A)

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YK35Q	Multimeter 2050	£11.95 (A)
YK37S	Range Dblr Multimetr	£19.95 (A)
YW68Y	Multimeter Type 320	£16.25 (A)
LH93B	Taut-Band Multimeter	£27.95 (A)
YB87U	100K Multitester	£44.00 (A)

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YB84F	Microtest 80	£24.00
YB85G	Supertester 680G	£33.30
YB86T	Supertester 680R	£39.50

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LH80B	Clamp Meter	£31.50 (A)
YK36P	Low Cost DMM	£29.95 (A)
YK32K	Multimeter DD601	£42.50 (A)

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YK34M	Auto Range Meter	£54.50 (A)
LH95D	DMM 100	£88.61 (A)
YK01B	RF Frequency Meter	£69.95 (A)
YB04E	Grid Dip Meter	£46.50 (A)

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†XY75S	Ham Multimeter	£31.95 (A)
†WY18U	SWR Meter 310	£10.75 (A)
WY19V	SWR Meter 110	£14.75 (A)
WY21X	SWR Meter 178	£24.95 (A)

TOOLS

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LH15R	Hobby Box	£3.45 (C)
FR22Y	Storage Drawer	99p (E)
BR48C	Hex Trimmer	24p (F)
BR51F	Trim Tool	45p (F)
BR49D	Preset Trimmer	72p (E)
BR50E	Trim TT5	60p (E)
BK34M	Trim Tool Set	£1.25 (D)
FY07H	Min Screwdriver Set	85p (E)
BR58N	Jewellers Scrwdvr Set	£2.30 (C)
BK44X	11 Pce S/Driver Set	£6.45 (B)

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BR79L	Intrchgbl Scdrvr Set	£1.69 (D)
†YW60Q	Min Tool Set	£2.10 (C)
FY08J	Utility Set	£4.49 (C)
YX74R	Min Screwdriver	10p (G)
BR52G	Small Screwdriver	34p (F)
BR53H	Large Screwdriver	36p
FY10L	Driver S3	36p (F)
FY12N	Driver S5	64p (E)
†FY13P	Driver S6	63p (E)
BK35Q	Driver S7	£1.25 (D)
BK36P	Driver S8	£2.25 (C)
FY15R	Pozidriver P1	£1.52 (D)
FY17T	Pozidriver P2	£1.60 (E)
BK37S	Pozidriver 3	£1.26 (D)
BK38R	Pozidriver 4	£2.25 (C)
BR71N	Mains Tester	60p (E)

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LH75S	Spiraldriver	£4.25 (C)
YW92A	Ratchet Socket Set	£5.99 (B)
WY04E	Cushiongrip Drvr Set	£5.84 (B)
FY19V	Low Cost Min Cutters	£4.25 (C)
BR75S	Ins Min Cutters	£6.93 (B)
BK42V	Slant Edge Cutters	£6.75 (B)
FY20W	Box-JT End Cutter	£6.95 (B)
FY21X	Low-Cost Cutters	£2.25 (C)
†FY76H	Large Low Cost Cutts	£3.75 (C)
BR74R	Side Cutters	£5.95 (B)
FY22Y	Box JT Side Cutters	£7.60 (B)
BR72P	Side Cutters S55	£5.95 (C)
YW67X	Tweezers	26p (G)

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BK43W	Pearl Catcher	£1.75 (D)
FY24B	Low Cost Min Pliers	£3.90 (C)
BR78K	Ins Min Snipe	£5.72 (B)
BR41U	Hooked Pliers	£6.75 (B)
BR77J	Bright Pliers	£4.99 (C)
FY25C	Low-Cost Pliers	£1.95 (D)
FY26D	Box Combined Pliers	£3.99 (C)
BR73Q	Long Snipe Pliers	£7.49 (B)
BR90X	Box Radio Pliers	£6.52 (B)
FY27E	Low Cost Long Pliers	£3.99 (C)
BR92A	Combination Pliers	£4.95 (B)
†FY28F	Low-Cost Elec Pliers	£2.25 (C)
FY29G	Low-Cost HD Pliers	£2.95 (C)

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BR91Y	Electricians Pliers	£4.90 (C)
†FY30H	Pincers	£3.85 (C)
FY31J	Crimp Tool	£2.15 (C)
BR76H	End Action Strippers	£5.99 (B)
BR93B	Wire Strippers 3A	£2.35 (C)
BR94C	Wire Strippers 8B	£1.49 (D)
BR95D	Wire Strippers 9	£3.96 (C)
BR96E	Stripmaster	£16.25 (A)
XX11M	Blade L4421	£6.25 (B)
BR97F	Blade L5361	£6.20 (B)
FY32K	Hand Wrap Tool	£6.48 (B)
YX52G	Helping Hands	£5.95 (B)
YX53H	Helping Hands † Mag	£9.20 (B)
FY34M	Allen Keys AF	£1.64 (D)
FY35Q	Allen Keys Metric	£1.64 (D)

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†YR82D	Min Spanner Set	£2.10 (C)
YW61R	Box Spanner Set	£2.15 (C)
FY36P	Min Spanner 24	£1.15 (D)
FY37S	Min Spanner 68	£1.15 (D)
FY38R	Ring Spanner 02	£1.99 (D)
FY39N	Ring Spanner 46	£1.69 (D)
FY45Y	Crescent Wrench 160	£3.35 (C)
FY46A	Crescent Wrench 210	£4.38 (C)
FY40T	Box Spanner 2BA	£1.25 (D)
FY41U	Box Spanner 4BA	£1.25 (D)
FY42V	Box Spanner 6BA	£1.25 (D)
FY43W	Box Spanner 8BA	£1.25 (D)
†FY47B	Adjustable Wrench	£3.20 (C)
YW63T	Needle File Set	£7.45 (B)
FY49D	Needle File Flat Wrd	£1.75 (D)
FY50E	Needle File Hand	£1.75 (D)
FY51F	Needle File Halfrnd	£1.96 (D)
FY52G	Needle File Round	£2.27 (C)
BR63T	Junior Hacksaw	99p (E)
BR64U	6in Hacksaw Blades	98p (E)
FY54J	Wire Brush	DIS
FY55K	Wet & Dry Fine	20p (G)
FY56L	Wet & Dry Med	20p (G)
FY57M	Wet & Dry Course	28p (F)

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*FY02C	Utility Knife	£1.60 (D)
FY03D	Retractable Knife	TEMP
FY04E	Knife Blades	99p (E)
YW64U	Snap-Off Blade Knife	99p (E)
FY05F	Scalpel Handle	£1.75 (D)
FY06G	Scalpel Bld Type II	58p
BR59P	Punch 3/8in	£4.38 (C)
BR60Q	Punch 7/16in	£4.49 (C)
BR61R	Punch 1/2in	£4.64 (C)
BR62S	Punch 9/16in	£4.86 (C)
BR80B	Punch 5/8in	£4.92 (C)
BR81C	Punch 3/4in	£4.99 (C)
BR83E	Punch 1in	£5.20 (B)
BW00A	Punch 1 1/2in	£6.04 (B)
YX27E	Chassis Punch Set	£13.45 (A)
FY53H	Mini Vice	£3.85 (C)
LH79L	Reliant Kit	£22.50 (A)
BW03D	Reliant Drill	£6.94 (B)
BW02C	Titan Drill	£11.25 (A)

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YW65V	Mini Mains Drill	£14.25 (A)
XB12N	Drill Stand	£14.95 (A)
BR84F	Reliant Collar	75p (E)
BW04E	Drill Power Supply	£13.99 (A)
BR65V	Twist Burr 0.8mm	43p (F)
BR66W	Twist Burr 1.4mm	43p (F)
BR85G	HS Twist Drill 0.8mm	75p (E)
BR86T	HS Twist Drill 1mm	75p (E)
BR87U	HS Twist Drill 1.4mm	75p (E)
YY28F	Long-Life Drill 1mm	£1.20 (D)
LH77J	20-Piece Tool Kit	£8.25 (B)
LH78K	40-Piece Tool Kit	£15.46 (A)
LH76H	Wishbone Sharpener	£6.85 (B)
YW66W	Pin Drill	£4.95 (C)
HQ02C	HS Drill 1/16in	19p (G)
HQ03D	HS Drill 5/64in	23p (G)
HQ04E	HS Drill 3/32in	29p (F)
HQ05F	HS Drill 7/64in	32p (F)
HQ06G	HS Drill 1/8in	36p (F)
HQ07H	HS Drill 9/64in	39p (F)
HQ08J	HS Drill 5/32in	43p (F)
†HQ09K	HS Drill 11/64in	49p (F)
HQ10L	HS Drill 3/16in	53p (E)
†HQ11M	HS Drill 13/64in	56p (E)
HQ12N	HS Drill 7/32in	65p (E)
†HQ13P	HS Drill 15/64in	72p (E)
HQ14Q	HS Drill 1/4in	75p (E)
†HQ15R	HS Drill 17/64in	95p (E)
HQ16S	HS Drill 9/32in	98p (E)
†HQ17T	HS Drill 19/64in	£1.12 (D)
HQ18U	HS Drill 5/16in	£1.19 (D)
†HQ19V	HS Drill 21/64in	£1.26 (D)
HQ20W	HS Drill 11/32in	£1.36 (D)
†HQ21X	HS Drill 23/64in	£1.54 (D)
HQ22Y	HS Drill 3/8in	£1.54 (D)
†HQ23A	HS Drill 25/64in	£1.75 (D)
HQ24B	HS Drill 13/32in	DIS
†HQ25C	HS Drill 27/64in	£2.18 (C)
HQ26D	HS Drill 7/16in	£2.32 (C)
HQ27E	HS Drill 29/64in	DIS
HQ28F	HS Drill 15/32in	DIS
HQ29G	HS Drill 1/2in	£2.99 (C)

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FY59P	Retractable Rule	£2.75 (C)
FY60Q	Feeler Gauge Imp	96p (E)
FY61R	Feeler Gauge Metric	96p (E)
FY62S	Iron CX	£6.59 (B)
FY63T	Element CX	£2.80 (C)
FR30H	Bit 6/1106	89p (E)
FY64U	Bit 1100	84p (E)
FY65V	Bit 1101	92p (E)
FR31J	Bit 7/1101	£1.19 (D)
FY66W	Bit 1102	93p (E)
FY67X	Bit 1103	92p (E)
FR01B	Element Type CN	£2.65 (C)
FR02C	Handle Type CN	99p (E)
FR03D	Bit 102	84p (E)
FR04E	Bit 104	88p (E)
FR05F	Bit 106	84p (E)
FR06G	Bit 820	89p (E)
FR07H	Bit 821	84p (E)
FR08J	Bit 822	84p (E)
FR12N	Iron X25	£6.32 (B)
FR13P	12V Iron MLX12	£7.48 (B)
FR14Q	Element X25	£2.65 (C)
FR15R	Element MLX12	£2.49 (C)
FR16S	Bit No 50	89p (E)
FR17T	Bit No 51	92p (E)
FR18U	Bit No. 52	89p (E)

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FR20W	Stand ST4	£2.46 (C)
FR11M	Sponge ST3	11p (G)
RK33L	Sponge ST4	32p (F)
FY68Y	Kit SK3	£8.92 (B)
FY69A	Kit SK4	£8.99 (B)
WY05F	Rechargeable Iron	£32.50 (A)
YX68Y	B50 Bit Angled	£3.62 (C)
YX69A	B50 Bit Flattened	£3.65 (C)
YX70M	B50 Lamp	85p (E)
YX71N	B50 Holder	68p (E)
YX72P	B50 Sponge	29p (F)
FR10L	Heat Sink Tweezers	19p (G)
FR23A	Solder Sucker	£4.50 (C)
FR24B	Sucker Tiplet	£1.55 (D)
FR26D	Desolder Tool	£7.25 (B)
BK39N	Desolder nozzle 3	85p (E)
BK40T	Replacement O rings	55p (E)
FR63T	Desldr Washer Type 2	24p (F)
HY13P	Desldr Nozzle Type 2	89p (E)
FR28F	Desolder Nozzle	£1.55 (D)
FR29G	Solda-Mop	68p (E)

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FR21X	Solder D622	75p (E)
FY70M	1/2kg Reel Solder	£10.50 (A)
FY71N	Aluminium Solder	43p (F)
FY72P	Conductive Paint	£5.35 (B)
LH04E	Freeze-it	£1.94 (D)
LH03D	Switch Cleaner	£1.94 (D)
YB77J	Servisol	£1.96 (D)
LH02C	Aero-Klene	£1.65 (D)
YB73Q	Aero-Duster	£1.75 (D)
YB74R	Silicone Grease	£2.24 (D)
YB75S	Plastic Seal	£1.55 (D)
YB76H	Foam Cleanser	£2.35 (C)
YB78K	Excel Polish	£1.78 (D)
YB79L	Anti-Static Spray	£1.72 (D)

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YB80B	Fire Extinguisher	£5.45 (C)
FL43W	Evostik Impact	99p (E)
FL46A	Cyanoacrylate	82p (D)
LQ02C	Potting Compound	£3.75 (C)
FL44X	Araldite Rapid	£2.25 (C)
FL45Y	Double Bubble Sachet	28p (F)
FL47B	PVC Tape Black	35p (F)
FL48C	PVC Tape Blue	35p (F)
†FL49D	PVC Tape Brown	35p (F)
FL50E	PVC Tape Green	35p (F)
FL51F	PVC Tape Red	35p (F)
FL52G	PVC Tape White	35p (F)
YR99H	PVC Tape Yellow	35p (F)

WOUND COMPONENTS

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LB40T	9.5 Coil Former	60p (E)
LB17T	Former 351	24p (F)
LB18U	Former 450	16p (G)
LB19V	Former 722/1	16p (G)
LB20W	Former 722/2	18p (G)
LB21X	Former 722/8	21p (G)
LB22Y	Former 722/4	18p (G)
LB41U	Dust Core Type 4	10p (G)
LB42V	Dust Core Type 6	11p (G)
LB43W	Dust Core Type 8	17p (G)
LB44X	Former Base	12p (G)
LB36P	Screening Can 10	10p (G)
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HX05F	Small Pot Core	£1.30 (D)
HX06G	Core Type 2	£1.55 (D)

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HX07H	Bobbin Type 2	96p (E)
HX08J	Clips Type 2	5p (H)
HX09K	Type 3 Core	£1.85 (D)
HX10L	Type 3 Bobbin	65p (E)
HX11M	Type 3 Clips	6p (H)
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HX24B	Choke 0.5H	£1.15 (D)
HX25C	Choke 1H	£1.15 (D)
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HX27E	Choke 4H	£1.15 (D)
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HX15R	Choke 1.5mH	58p (E)
HX16S	Choke 2.5mH	59p (E)
HX17T	Choke 5mH	66p (E)
HX19V	Choke 10mH	29p (F)
WH25C	Choke 0.22uH	52p (E)
WH27E	Choke 0.47uH	53p (E)
WH29G	Choke 1.0uH	45p (F)
WH30H	Choke 1.5uH	49p (E)
WH31J	Choke 2.2uH	45p (F)
WH32K	Choke 3.3uH	45p (F)
WH33L	Choke 4.7uH	49p (F)
WH34M	Choke 6.8uH	55p (E)
WH35Q	Choke 10.0uH	45p (F)
WH36P	Choke 15.0uH	61p (E)
WH37S	Choke 22.0uH	48p (F)
WH38R	Choke 33.0uH	48p (F)
WH39N	Choke 47.0uH	48p (F)
WH41U	Choke 100uH	54p (E)
WH45Y	Choke 470uH	55p (E)
WH47B	Choke 1mH	75p (E)

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HX42V	Toko YRCS 11098	51p (E)
YG30H	Toko YRCS12374	61p (E)
HX43W	Toko YHCS 11100	52p (E)
YG31J	Toko CSK3464	53p (E)
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CMOS Crystal Calibrator

- ★ **Enables calibration of receivers.**
- ★ **Checks the position of the edges of amateur band allocations.**
- ★ **Produces markers at switchable intervals of 1MHz, 100kHz, 12.5kHz, or 10kHz.**

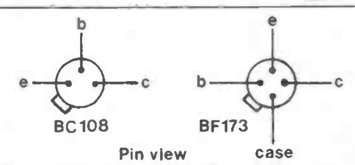
by A. J. Bell, BSc, GW4JJW

Introduction

This article describes a crystal calibrator designed around CMOS logic IC's, which produces markers switchable at intervals of 1MHz, 100kHz, 12.5kHz or 10kHz. When the calibrator was tested using a spectrum analyser, the markers were found to be complete to 300MHz - beyond this frequency they approached the spectrum analyser noise level. The markers can be amplitude modulated with a 1kHz tone, a facility which produces markers at 1kHz intervals. The current consumption of the crystal calibrator is less than 3mA at 9V (27mW) - less power than would be consumed by a single 74-series TTL integrated circuit.

Operation

The circuit diagram of the crystal calibrator is shown in figure 1, and the various semiconductor pinouts and logical functions in figure 2. A stabilised voltage supply, comprising TR2 and D2, supplies power to all the CMOS logic. In order to reduce power consumption the zener diode is run at a lower current than normal. Three different zener



ADDRESS INPUTS			CONTROL INPUTS		OUTPUT
C	B	A	INHIBIT	$\overline{OE}$	Z
0	0	0	0	0	x 0
0	0	1	0	0	x 1
0	1	0	0	0	x 2
0	1	1	0	0	x 3
1	0	0	0	0	x 4
1	0	1	0	0	x 5
1	1	0	0	0	x 6
1	1	1	0	0	x 7
-	-	-	1	0	0
-	-	-	-	1	Hi Z

- = Dont care. Hi Z = Tristate condition

Figure 2. Semiconductor pinouts and logic function chart.

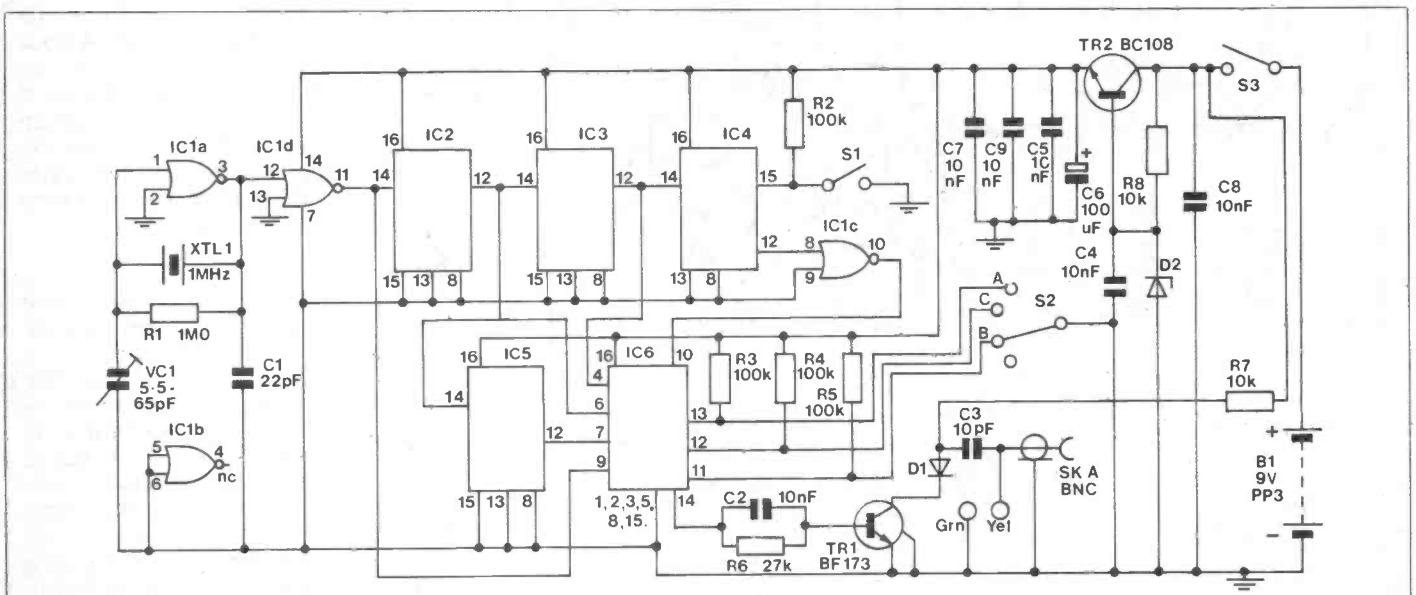


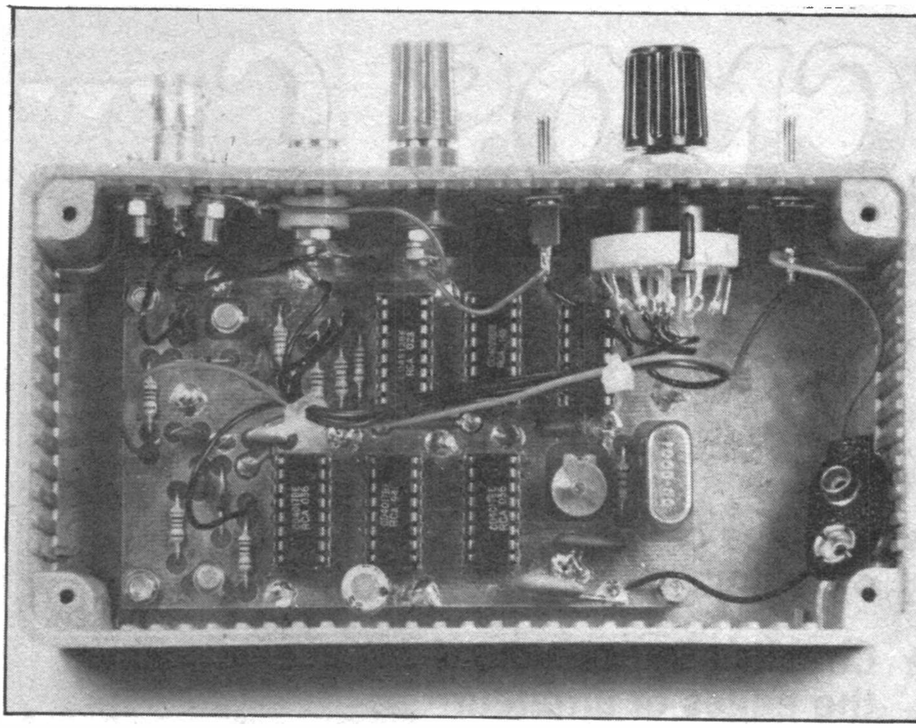
Figure 1. Circuit diagram.

diodes were tried under these conditions and all functioned satisfactorily. A single CMOS NOR gate(IC1a) is used as a 1MHz crystal oscillator, whose frequency may be trimmed using VC1. The output from the oscillator is buffered by another section of the NOR gate(IC1d) and then fed into a chain of dividers which produce frequencies of 100kHz, 12.5kHz and 10kHz. These, together with the original 1MHz, are fed into the data selector(IC6).

A "data selector" is a type of logic IC that selects only one of many inputs. The selection is performed according to the value set on its address line inputs. Figure 2 shows the logical functions of the data selector, type 4512, used in the crystal calibrator. It can be seen that if all address lines are high, data line "X7" will be selected. For the crystal calibrator, inputs X7, X6, X5 and X3 are used for the 1MHz, 12.5KHz, 100KHz and 10kHz signals respectively. These particular input lines were chosen because they can be selected by making none or any one of the address lines logical zero - this is the function of the interval switch SW2.

The use of a data selector allows the marker interval to be chosen by switching DC signal levels, instead of the standard method of switching the RF signals directly. This keeps the lengths of the wire carrying RF to a minimum, thereby reducing radiation or pickup.

When SW1 is closed, IC4 is freed from its reset state and produces a 1kHz signal which is inverted by IC1c and fed to the inhibit of IC6. This amplitude modulates its output which is fed to the base of TR1 via a 27k ohm resistor and a parallel ceramic capacitor. TR1 is a UHF transistor with a very high ft. In its collector is a 1N914 diode, a non-linear load, which generates harmonics. Finally the RF output is taken via 10pF ceramic capacitor, C3, to both a BNC connector and a terminal post, thereby offering a choice of connection.



Construction

The calibrator was constructed on double-sided, copper clad glass fibre epoxy board, size 100mm x 60mm. The top surface of the PCB was used as a ground plane and the underside for interconnections. The artwork for the PCB and the component layout are given in figures 3 and 4. If you drill the PCB, copper surrounding the holes on the component side should be removed by countersinking with a 3/16 inch drill. The author used IC sockets throughout, but there is no reason why the IC's could not be soldered directly on to the PCB provided a low leakage soldering iron is used and normal CMOS precautions are observed. The two capacitors, C2 and C3 must be low inductance type, such as disc ceramic, so as to obtain a good high frequency response from the calibrator. Although IC1 is specified as a quad NOR gate, it is used throughout as an inverter - one input of each of the three gates used being grounded.

The crystal calibrator described is possibly more comprehensive than will be required in some instances. Various functions can easily be removed from the circuit if required. For example, if IC5 is omitted then the 12.5KHz option will be unavailable. If IC4 is omitted and pin-12 of its socket is connected to Vdd via 100K ohm resistor, then the tone facility will be unavailable.

Alignment

The calibrator is best aligned when it has been installed in its working position (box or rig). The station RX is switched to AM and tuned to one of the standard frequency services, such as MSF on 5MHz. The calibrator is switched on and loosely connected to the RX antenna socket in parallel with the antenna used to receive MSF. If the RX uses "UHF" type connectors, unscrew the outer skirt and pull the plug half way out of the socket. Take a length of wire, strip both ends, connect one end to the terminal post and loop the

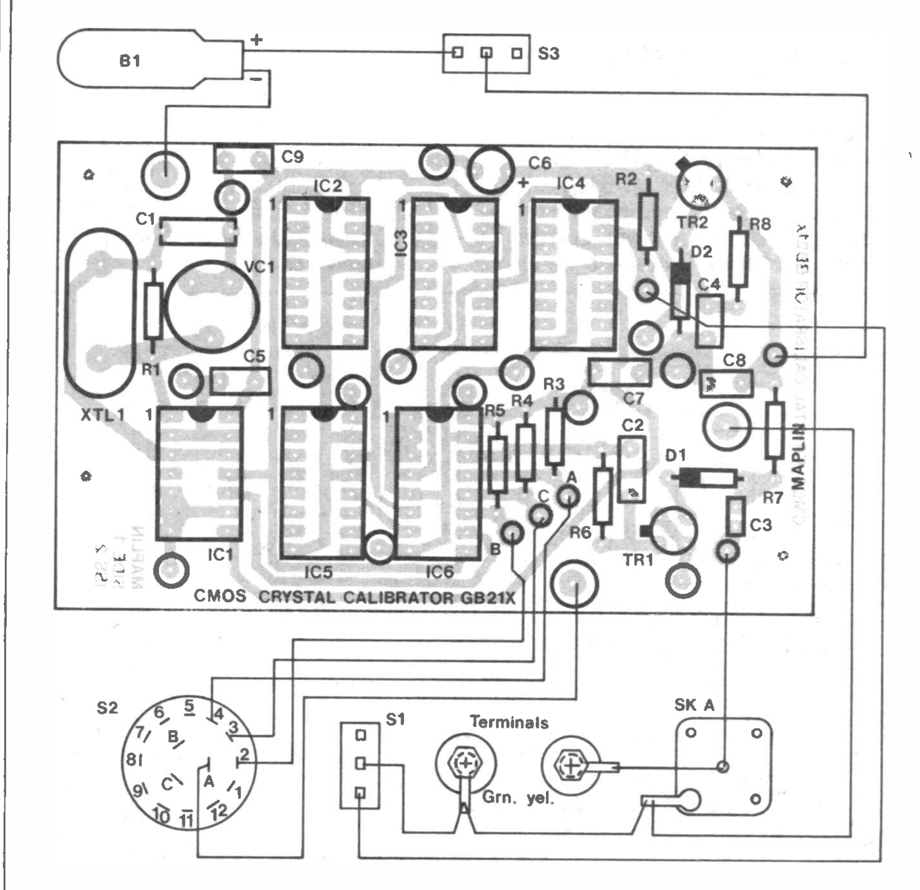


Figure 3. PCB layout and wiring diagram.

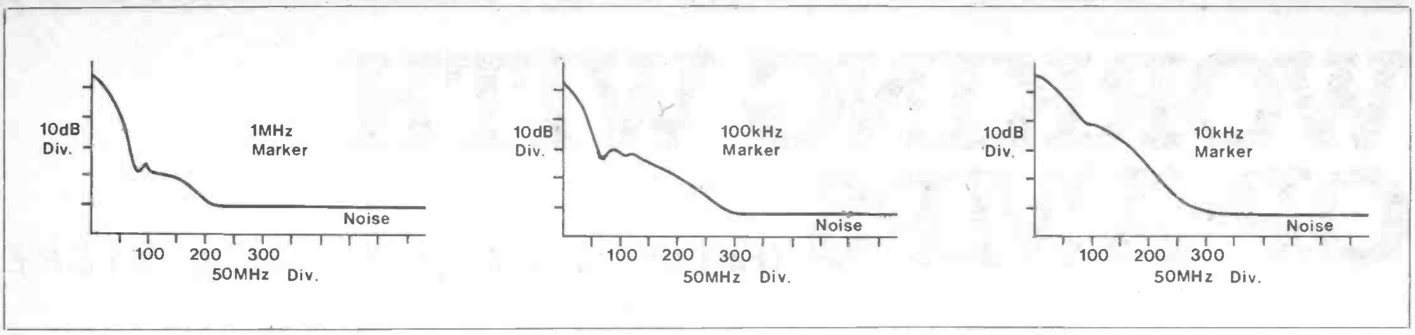
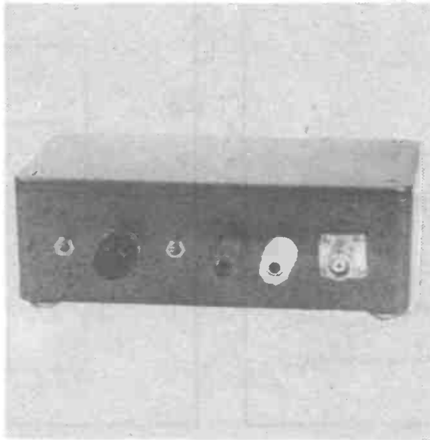


Figure 5. Test Graph.

other end over the exposed inner section of the plug. A beat note generated by the mixing of the standard service and the calibrator should be heard from the RX. To align the calibrator, trimmer capacitor VC1 should be adjusted to zero beat the two signals. An oscilloscope connected to the AF output from the RX is useful for monitoring the beat note frequency down to a few Hz. Zero beat is the position at which the beat note disappears after the note becomes progressively lower in frequency. Very low frequency beats, less than 1Hz, manifest themselves as a cyclic slow rise and fall in background noise level. The higher the frequency of the standard service used, the sharper, and hence more precise, will be the zero beat position. Note that an error of 10Hz at 5MHz will multiplied to an error of 1kHz at 500MHz.

Applications

A crystal calibrator is used to check the calibration of receivers, and in the amateur sphere is particularly useful in checking the position of the edges of the amateur band allocations. To do this, the RX is tuned as close as possible to the required band edge. The calibrator is then loosely connected to the antenna socket of the RX. If the band edge is on a 1MHz boundary (28.0MHz) then 1MHz markers should be selected. Alternatively if the band edge is on a 100KHz boundary (3.5MHz-3.8MHz)



then select 100KHz. Failing this, 12.5KHz and 10KHz intervals are available for use. Receivers are usually calibrated according to the type of emission to be received.

For AM tune the RX for a peak S-Meter reading from the calibrator signal. If no S-Meter is available switch on the tone facility and tune for loudest tone. Using the tone facility, however, is of limited value as markers at 1KHz intervals tend to be generated but are lower in amplitude than the 100KHz and 1MHz signals. For SSB reception the RX should be set to receive the appropriate side-band and tuned so as to zero beat the calibrator signal. For CW, the situation is a little more difficult, as the RX is usually tuned about 800Hz lower in frequency than the incoming signal - this produces the audible tone. Usually, however, receivers are calibrated such that SSB and CW give identical readouts, and therefore the RX should be set to receive CW and then tuned to zero beat the calibrator signal. It may not be possible to hear low frequency beat notes when using narrow CW filters. Note that a station transmitting on the same frequency as the calibrator would be inaudible, being zero beat, and the RX would normally be tuned about 800Hz away from the zero beat position in order to copy CW transmissions. It is important to remember that if the TX carrier is positioned close to a band edge care must be taken to ensure that no sidebands are radiated outside the authorised frequency band.

Acknowledgements

The author wishes to thank G3GIH, G3VMW, G3XAQ and GW4JJV for their comments and suggestions during the course of this project.

Bibliography

CMOS Data Book. National Semiconductor Corporation, 1981.
Evans DS & Jessop GR.
100kHZ VHF Crystal Marker. In VHF-UHF Manual 3rd edition. RSGB, 1976. p10.34.
Hawker P.
Amateur Radio Techniques. 7th edition. RSGB, 1980. pp39-40.
Radio Amateur's Handbook. 58th edition. ARRL, 1981. pp 16.12-16.16.

PARTS LIST FOR CRYSTAL CALIBRATOR

Resistors - All 0.4W 1% metal film unless specified.			
R1	1M0		(M1M0)
R2-5	100k	4 off	(M100K)
R6	27k		(M27K)
R7,8	10k	2 off	(M10K)
Capacitors			
C1	22pF Mica		(WX05F)
C2,4,5,7-9	10nF Disc	6 off	(BX00A)
C3	10pF Ceramic		(WX44X)
C6	100uf PC elect.		(FF11M)
VC1	65pF Trimmer		(WL72P)
Semiconductors			
D1	IN914		(QL71N)
ZD1	BZY88C8V2		(QH12N)
TR1	BF173		(QY53H)
TR2	EC108		(QB32K)
IC1	4001BE		(QX01B)
IC2-4	4017BE	3 off	(QX09K)
IC5	4022BE		(QW19V)
IC6	4512BE		(QW84F)

Miscellaneous			
S1,3	SPST ultra min. toggle	2 off	(FH97F)
S2	Rotary SW4B		(FF75S)
SKA	BNC square skt.		(YW00A)
	Terminal post green		(HF05F)
	Terminal post yellow		(HF09K)
	DIL socket 14 pin		(BL18U)
	DIL socket 16 pin	5 off	(BL19V)
	PP3 Clip		(HF28F)
	PP3 Battery		
	1MHz FS crystal		(HX62S)
	Crystal Socket 6u		(HX61R)
	PC Board		(GB21X)
	Box DCM5005		(LH73Q)
	Collet knob black		(RX16S)
	15mm collet cap black		(WL45Y)
	15mm collet nut cover		(RX18U)
	Stick-on feet	1 pkt	(FW38R)
	Bolt 6BA ½in.	1 pkt	(BF06G)
	Washer 6BA	1 pkt	(BF22Y)
	Shake 6BA	1 pkt	(BF26D)
	Nut 6BA	1 pkt	(BF18U)
	Tag 6BA	1 pkt	(BF29G)
	Wire black	1 metre	(BL00A)
	Veropins type 2141	1 pkt	(FL21X)
	Track pins	1 pkt	(FL82D)

A complete kit of all parts, excluding the case, is available.
Order As LK10L (X'tal Calibrator Kit). Price £15.95

WORKING WITH OP~AMPS

(Part six) *by Graham Dixey C.Eng., M.I.E.R.E.*

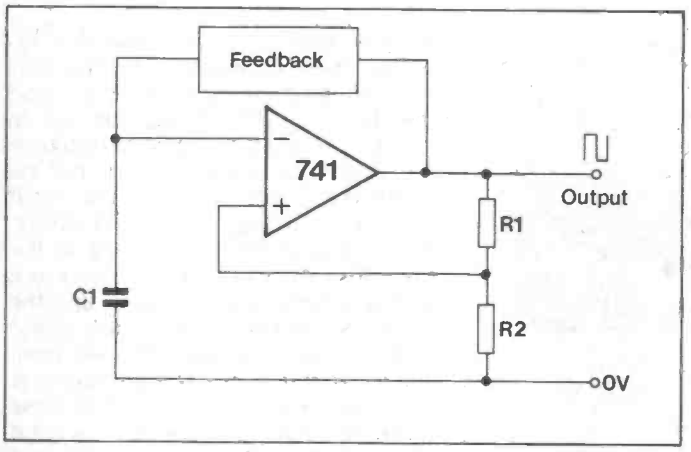


Figure 1. Basic astable waveform generator.

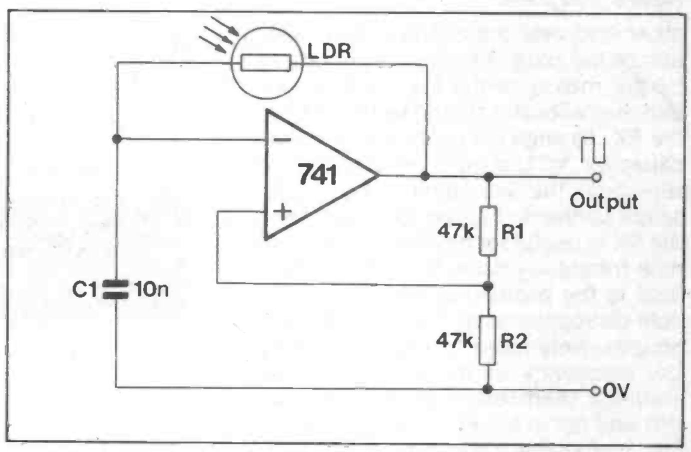


Figure 2. A 'light-to-sound' converter.

This, the final part in this series, deals with circuits that, in one way or another are concerned with sound - either its generation or control. In previous parts, the role of the op-amp. as a linear amplifier, as a waveform generator and as an active filter have been discussed. Applications of these ideas in practical situations will now be shown. A 'generator of sound' circuit implies ultimate connection to a loudspeaker and, hence, the need for some form of power amplifier. The exact nature of such an output stage depends upon the nature of the application - consequently such details are left t the individual experimenter. The exception to this is the 'frost alarm' which, being intended for automobile use, includes a 12V output stage suitable for this specific application.

Sound Generators and Alarms

Figure 1 shows the basic square-wave generator, first introduced in Part 2 of this series as the 'astable multivibrator'. The non-inverting input is 'tied' to a fixed potential by R1/R2 and the circuit changes state every time that C1 charges to a value just in excess of this value. The rate at which the charging occurs is determined by the values of C1 and the feedback component. This latter is often a resistor in the basic astable circuit but it may be replaced by an alternative component to give more interesting results.

In Figure 2 the feedback component is a photocell or L.D.R. (Light Dependent Resistor). This has the property that, 'in the dark', its resistance is extremely high but falls dramatically when illuminated. The actual resistance in the extreme cases depends upon the photocell type. Some idea of values can be gained from the characteristics of Figure 3 for a typical small photocell. If the resistance of the cell is high enough, the frequency will be too low to be audible. For example, if C = 100nF and the cell resistance is 1MΩ, then the frequency will be a mere 4.55Hz, well below audibility. But, when the cell resistance falls to 10kΩ, the frequency is 455Hz.

This leads to the idea of using the circuit as the basis of an 'alarm system', using the word alarm in the broadest sense of the word, to mean an audible indication of some event having occurred. Thus, in general, the presence or absence of light may be indicated; such a circuit may be called a 'light-to-sound' converter.

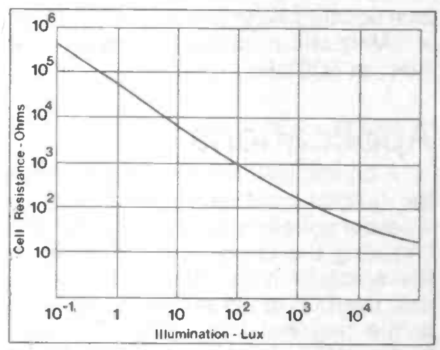


Figure 3. Characteristic of typical small photoconductive cell (LDR).

As an alternative to the photocell, a thermistor could be used. In this device a change of temperature causes a change of reistance, either an increase - positive temperature coefficient (p.t.c.) or a decrease - negative temperature coefficient (n.t.c.). Figure 4 shows a thermistor used as the feedback component in a circuit that could now be described as a 'heat-to-sound' converter. Normal temperature variations may not produce such dramatic shifts of frequency as the light-to-sound converter, but they are nonetheless significant.

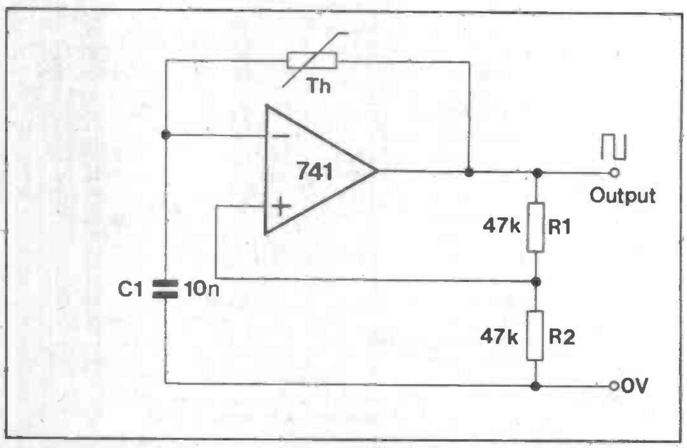


Figure 4. A 'heat-so-sound' converter.

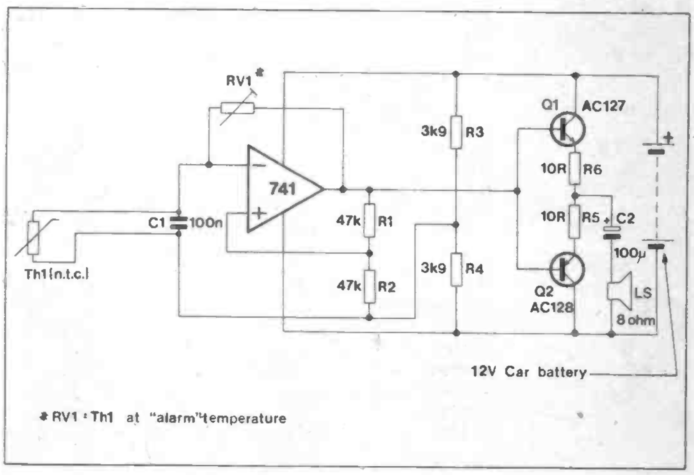


Figure 5. A 'frost alarm' for a car.

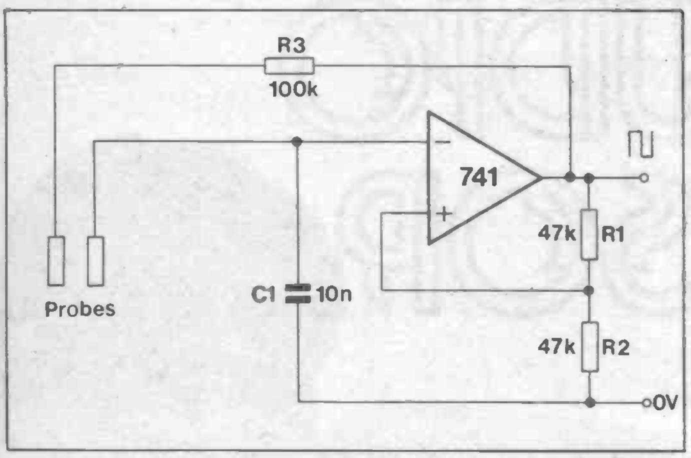


Figure 6. Circuit to detect presence of water.

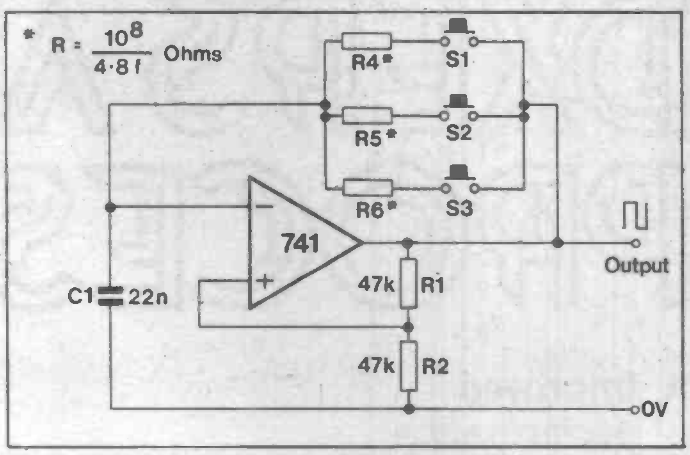


Figure 7. A door calling system.

Still on the subject of sensing temperature changes, Figure 5 shows a variation on the theme put to practical use in a car. The circuit is of a 'frost alarm', intended to warn the driver by an audible signal of the imminence of freezing conditions. The sensor is an n.t.c. thermistor mounted low down at the front of the vehicle. However, this time the thermistor is wired in parallel with the capacitor C1 and the feedback path is a preset potentiometer RV1. The idea behind this arrangement is that if the value of Th's resistance is less than that of RV1 (such as will apply above freezing point), then the charge on C1 leaks away too quickly for the switch-on point to be reached; result - no oscillations, no audible output. But at freezing point the thermistor resistance has increased enough to allow oscillations to take place, giving an audible warning. RV1 is adjusted to set the precise point at which the circuit burst into oscillation. Try the domestic ice-box as a means of testing it! Because it is intended for automobile use, the power supply is organised to use the car's 12V battery and a simple complementary-symmetry output stage is included. Alternatively, an IC power amplifier could be used.

Figure 6 shows a very simple on/off alarm to detect the presence of water or some other conducting liquid between the 'probes'. These are closely spaced so as to be easily bridged by the moisture droplets; two adjacent tracks on a P.C.B. would serve. The liquid closes the otherwise open feedback path and the circuit oscillates. Possible applications include its use as a rain alarm or as a sensor of liquid level in some container.

Figure 7 likewise is extremely simple. Operation of any of the push-button switches, S1-S3 (or as many others as you like) causes the circuit to oscillate, each switch having its own unique frequency because of the resistor value that it selects. Thus, in a door-calling system, each door is identified by its own distinctive tone. Details of tone frequencies appear on the figure.

These are just a few of the ways in which the op-amp astable circuit can be put to good use. As a change from this 'switching' mode, consider now two examples of its use as a linear device in the field of audio.

The first of these is shown in Figure 8 and is an automatic level control circuit as used, for example, in a tape recorder. It is used in conjunction with a field effect transistor, the well-known 2N3819. This FET is employed as a 'voltage variable reistor', making use of the pre-pinch-off region of the drain characteristics. Together with R4, a 330kΩ resistor, it forms a potential divider across the output of the op-amp. The proportion of output voltage developed across the drain-source path is fed back through R2 to control the gain of the op-amp. Thus, op-amp gain is controlled by the value of the FET's drain-source resistance. This, in turn, is controlled by the bias on the gate of the FET, and this is derived from the output signal itself by a simple rectifier circuit (D1; R5; R6; C1). Thus, the level of the output signal controls the op-amp gain which, in turn, controls the output level - a closed loop of dependence. All being well, the output maintains itself fairly constant over a wide range of input signal amplitude. For a small input signal, the op-amp gain rises in an attempt to hold the output constant. With a large input signal, the op-amp gain is turned down, giving the same result.

Finally, Figure 9 shows an op-amp used to give equalisation to the signals from a magnetic pick-up for disc reproduction. These magnetic pick-ups produce an output voltage which depends upon stylus velocity; since the latter rises with signal frequency, so does the output voltage. What is required, of course, is a level response at all audio frequencies, the only 'tailoring' of the response being carried out by the tone controls.

This level response is achieved by using a pre-amplifier with a falling response that more or less balances the rising response of the pick-up. This is called 'equalisation' and produces the R.I.A.A. characteristic, also shown in Figure 10. (R.I.A.A. = Radio Industry Association of America). The feedback components shown as parallel pairs together with the gain of the op-amp produce an active filter with the required characteristic. Resistor R1 presents the required load to the magnetic pick-up.

This series has explored a variety of circuits involving op-amps. Even so, it has only scratched the surface of the possibilities. Nonetheless, it is hoped that it has been both instructive and inspirational to all those who now find themselves 'working with op-amps.'

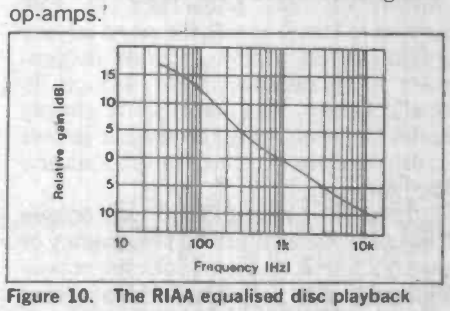


Figure 10. The RIAA equalised disc playback curve.

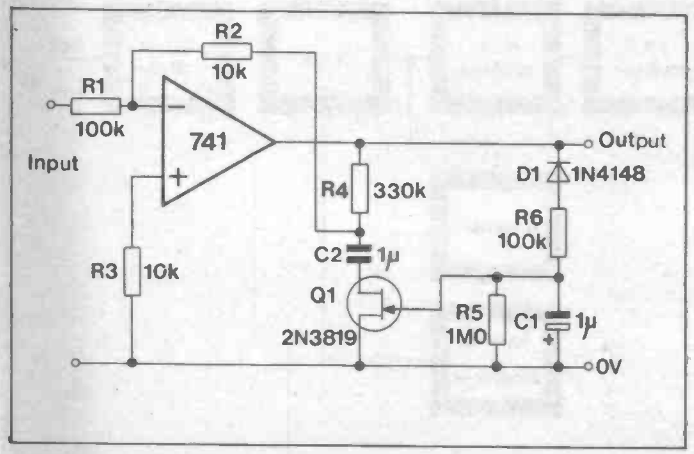


Figure 8. Automatic sound level circuit.

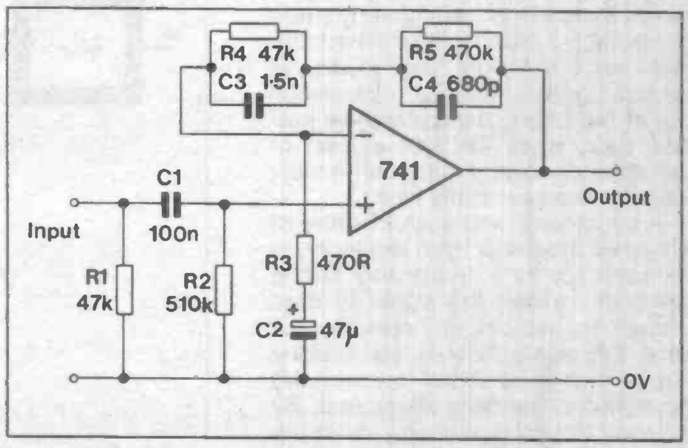


Figure 9. RIAA equalised pre-amplifier for disc reproduction.

DXER'S AUDIO PROCESSOR

- ★ **Improved performance**
- ★ **Needs no modifications to receiver**
- ★ **High filter attenuation rate**
- ★ **Easy to build**

by Robert Penfold

The performance of many communications receivers is not all that one would desire, and probably the most common failing is a lack of really good I.F. filtering which results in an excessive amount of adjacent channel interference. A simple way of obtaining improved performance is to use an audio filter to process the audio output of the receiver, and although this does not give a level of improvement equal to that produced by adding high quality I.F. filters to the receiver, it nevertheless gives a substantial improvement. An advantage of this system is that it avoids the need for any modifications to the receiver (which, even if successful, could reduce its resale value), and the filter is simply wired between an audio output socket of the receiver and the headphones or a loudspeaker.

This filter has a 36dB per octave lowpass filter with a cutoff frequency of about 2.5kHZ, and an 18dB per octave highpass filter with a cutoff frequency at about 150HZ. This very restricted audio bandwidth helps to greatly attenuate adjacent channel interference but does not impair the intelligibility of speech signals. The high attenuation rate of the filters, particularly the lowpass type, gives the unit a level of performance which is superior to most audio processors of this type.

An additional and useful feature of this audio processor is an expander. In the presence of a reasonably strong signal this allows the signal to pass through to the output normally, but when the signal level is low (during pauses in a voice signal for example) the signal is severely attenuated. By reducing the noise during gaps in the wanted signal it is often easier to copy the signal, especially where it is necessary to copy the signal for some time. Under some circumstances the use of the expander can produce an apparent boost in the signal to noise ratio of the processed signal, and it can make a worthwhile reduction in general background noise as well as adjacent channel interference.

Just how well or otherwise the unit performs depends almost entirely on the receiver with which it is used and on reception conditions. There is obviously more scope for the processor to produce an improvement if it is used with a wide bandwidth receiver under poor conditions than if it is used with one that has good I.F. filtering and under good reception conditions. However, the prototype has been tried over a period of a few months with a short wave receiver which has 7kHZ mechanical I.F. filters, and a comparison of the processed and unprocessed signals almost invariably revealed a substantial improvement with the processor in use, especially for S.S.B. reception. The unit has also been tried with an F.M. C.B. transceiver with similar results.

Block Diagram

Figure 1 shows the block diagram for the processor, and as will be apparent from this, the filtering is used before the expander stages. This is important as it helps to prevent unwanted signals from operating the expander, and it does so simply because the filtering prevents some of these unwanted signals from reaching the expander. A buffer stage is used at the input to ensure that the lowpass filter is fed from a suitably low source impedance, and the lowpass filter is actually two 18dB per octave filters in series rather than a single filter block.

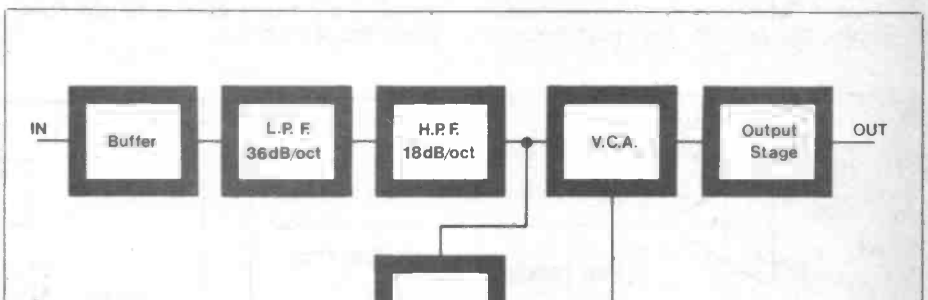


Figure 1. Block diagram.

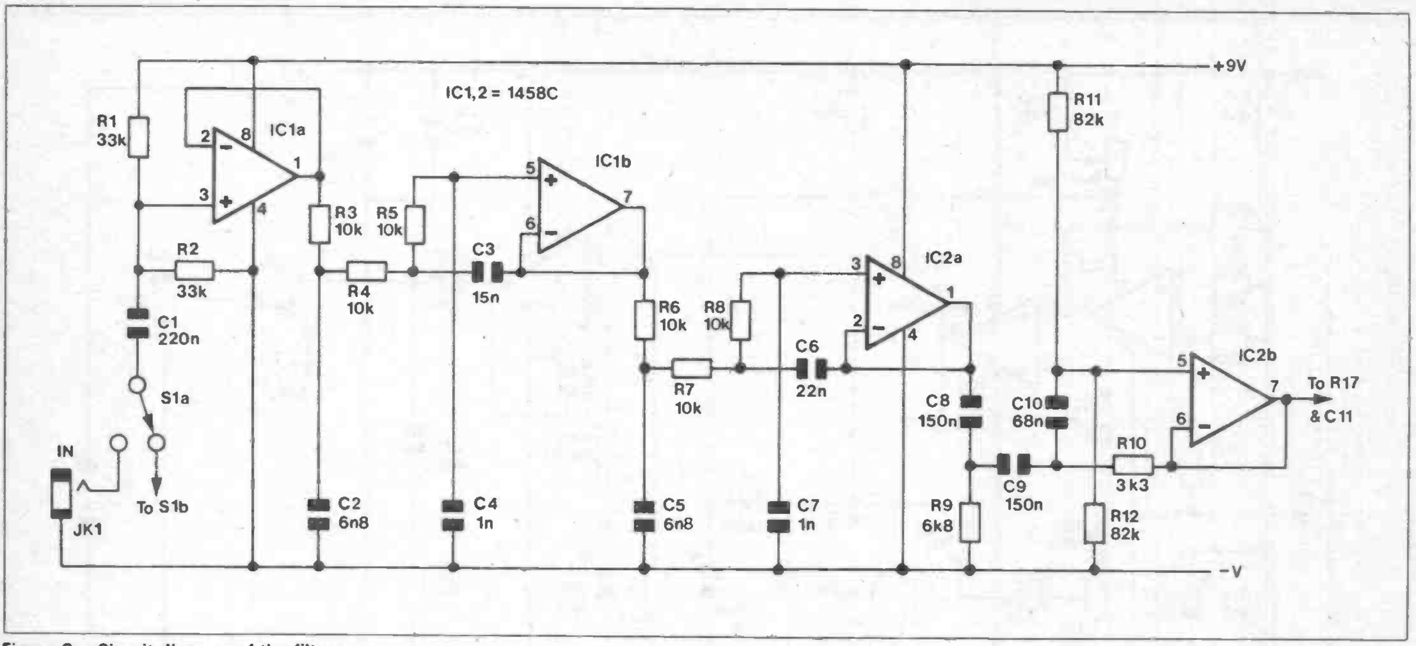


Figure 2. Circuit diagram of the filters.

After passing through the highpass filter the signal is fed through a voltage controlled amplifier (V.C.A.) which has only a small control voltage under quiescent conditions. It consequently attenuates the input signal. Some of the output of the highpass filter is fed to an amplifier, and then the amplified signal is rectified and smoothed to produce a D.C. signal which is roughly proportional to the amplitude of the input signal. This D.C. signal is fed to the control input of the V.C.A. and provides an increase in gain if the input signal is sufficiently strong. Thus the required action is obtained with low level signals being attenuated while high levels signals are through the V.C.A. unattenuated.

The output stage will drive any normal type of headphones, and will also drive an 8 ohm impedance loudspeaker with an output power of up to about 500mW R.M.S.

The Circuit

Figure 2 shows the circuit diagram for the input buffer and filter stages of the unit. IC1a is the buffer stage and is a straightforward non-inverting unity voltage gain circuit which is biased by R1 and R2.

IC1b is used as the basis of the first section of the lowpass filter, and this uses a standard configuration. R3, R4, R5, C3 and C4 effectively form a second order active filter, but due to the high value of C3 a pronounced peak in the response is produced just below the cutoff frequency. R3 and C2 form a passive low pass filter which removes this peak and gives an excellent overall response with an abrupt introduction of the full 18dB per octave attenuation rate. The second lowpass filter stage is based on IC2a and is virtually identical to the first stage. The only difference is that C6 has a slightly higher value than its equivalent in the first filter section (C3), and this gives a slight improvement to the combined responses of the two filters.

The highpass filter uses IC2b, and the configuration used is essentially the same as that employed in each section of the lowpass circuit, but the resistive and capacitive filter elements are transposed to give a highpass and not a lowpass action. The final resistive element of the filter is formed by the parallel resistance of R11 and R12, and as there is no D.C. path through C8 to C10 to bias the non-inverting input of IC2b these are used to provide a suitable bias voltage.

Figure 3 shows the combined frequency response of all three filter sections.

Expander

The circuit diagram of the expander and output stages of the processor are shown in Figure 4. The V.C.A. is built around IC3 which is an operational transconductance amplifier and IC4 which is merely used as a buffer amplifier. R17 and R19 form a negative feedback network which set the voltage gain of the V.C.A. at unity, but this assumes that the bias current fed to the amplifier bias input of IC3 (pin 5) is sufficient to produce unity voltage gain. With RV1 at minimum resistance this will indeed be the case and the expander action of the circuit is eliminated. However, with RV1 at maximum value the quiescent bias current is greatly reduced and there is a substantial amount of attenuation through the V.C.A. Intermediate settings of RV1 give a corresponding degree of attenuation through the V.C.A.

Some of the output from the final filter stage is taken via sensitivity con-

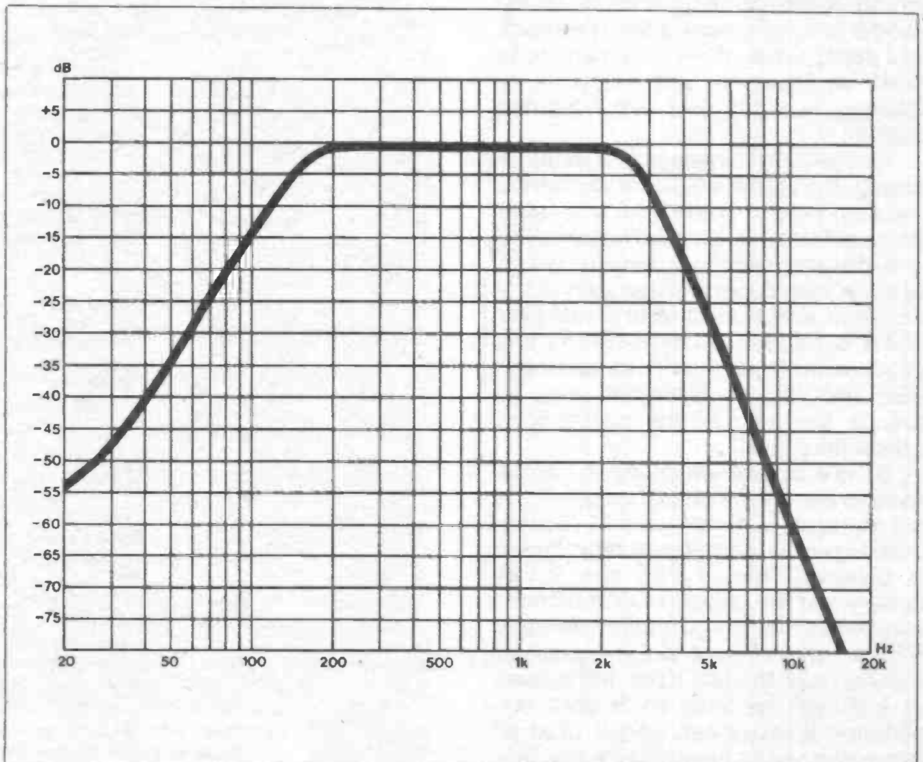


Figure 3. Frequency response of the unit.

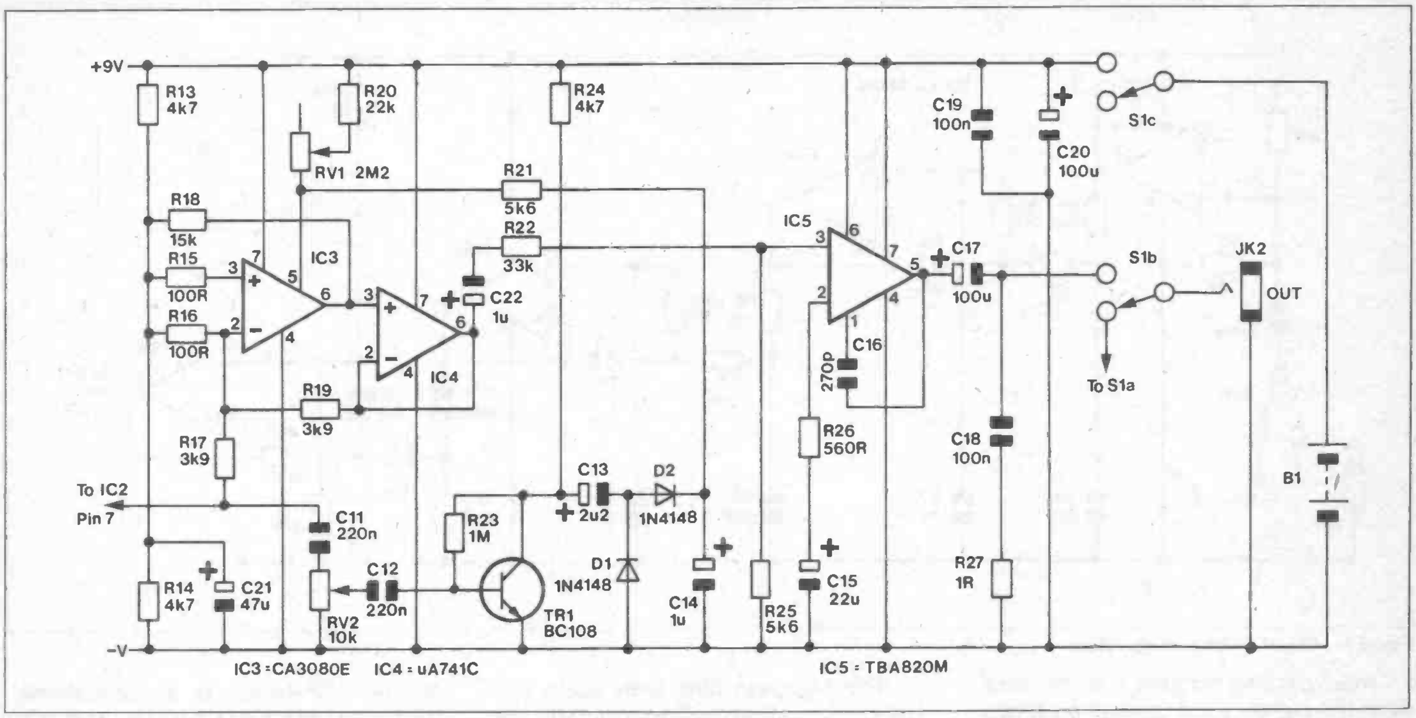


Figure 4. Circuit of the expander and output stages.

trol RV1 to a high gain common emitter amplifier which uses TR1. The output of TR1 is rectified by D1 and D2, and smoothed by C14. The resultant positive voltage is fed to the V.C.A. by way of R21, and in the presence of a strong input signal boosts the gain of the V.C.A. to unity regardless of the setting of RV1. RV2 is adjusted so that the wanted signal operates the expander circuit but the background noise does not. In practice the circuit tends to operate for the majority of the time at full gain or the lower gain level set using RV1, and it therefore operates virtually as a noise gate. However, as the V.C.A. is not switched between two levels of gain and it can have intermediate levels of gain, strictly speaking the circuit is an expander and not a noise gate. The attack and decay times of the circuit are quite short so that the unit responds to changes in input level with adequate rapidity.

A TBA820M integrated circuit is used in the output stage and this device gives an output power which is more than sufficient for this application. R26 is a discrete feedback resistor which sets the closed loop voltage gain of the amplifier at a modest level of just over 20dB, but this is still excessive for this application. An attenuator consisting of R22 and R25 is therefore used to reduce the gain of the circuit to a satisfactory level.

S1 is a bypass switch which can be used to cut out the processor when it is not required, and one pole of S1 (S1c) is used to provide on/off switching. Power is obtained from a PP6 size 9 volt battery and the quiescent current consumption of the circuit is approximately 8.5mA. The current drain increases substantially, though, if the unit is used at high volume with an 8 ohm impedance loudspeaker, and if used in this way it would be advisable to use a larger battery, such as a PP9 size.

PARTS LIST FOR DXer's AUDIO PROCESSOR

Resistors — all 0.4W 1% metal film unless specified.			
R1,2,22	33k	3 off	(M33K)
R3-R8	10k	6 off	(M10K)
R9	6k8		(M6K8)
R10	3k3		(M3K3)
R11,12	82k	2 off	(M82K)
R13,14,24	4k7	3 off	(M4K7)
R15,16	100R	2 off	(M100R)
R17,19	3k9	2 off	(M3K9)
R18	15k		(M15K)
R20	22k		(M22K)
R21,25	5k6	2 off	(M5K6)
R23	1M		(M1M0)
R26	560R		(M560R)
R27	1R (½W 5% carbon)		(B1R0)
RV1	2M2 lin pot		(FW09K)
RV2	10k lin pot		(FW02C)
Capacitors			
C1,11,12	220nF carbonate	3 off	(WW45Y)
C2,5	6n8 polycarb.	2 off	(WW27E)
C3	15nF polyester		(BX71N)
C4,7	1nF mylar	2 off	(WW15R)
C6	22nF polyester		(BX72P)
C8,9	150nF polyester	2 off	(BX77J)
C10	68nF polyester		(BX75S)
C13	2u2 63V elect		(FB15R)
C14,22	1uF 63V elect	2 off	(FB12N)
C15	22uF 25V elect		(FB30H)
C16	270pF ceramic plate		(WX61R)
C17,20	100uF 10V elect	2 off	(FB48C)
C18,19	100nF polyester	2 off	(BX76H)
C21	47uF 10V elect		(FB38R)
Semiconductors			
IC1,2	1458C	2 off	(QH46A)
IC3	CA3080E		(YH58N)
IC4	741C 8 pin DIL		(QL22Y)
IC5	TBA820M		(WQ63T)
TR1	BC108		(QB32K)
D1,2	1N4148	2 off	(QL80B)
Miscellaneous			
S1	4 way 3 pole rotary		(FF76H)
JK1,2	Standard ¼in. jack	2 off	(HF90X)
B1	9V PP6 size		
	Case		(XY45Y)
	Battery connector		(HF28F)
	Control knobs	3 off	(HB26D)
	Printed circuit board		(GB19V)
	6BA ½in. bolts	1 pkt	(BF06G)
	6BA nuts	1 pkt	(BF18U)
	6BA ¼in. spacers	1 pkt	(FW34M)
	Veropins type 2145	1 pkt	(FL24B)
	Wire	(as req.)	(BL00A)

A complete kit of all parts, excluding the case and knobs, is available.
Order As LK05F (D'Xers Audio Processor kit). Price £14.95.

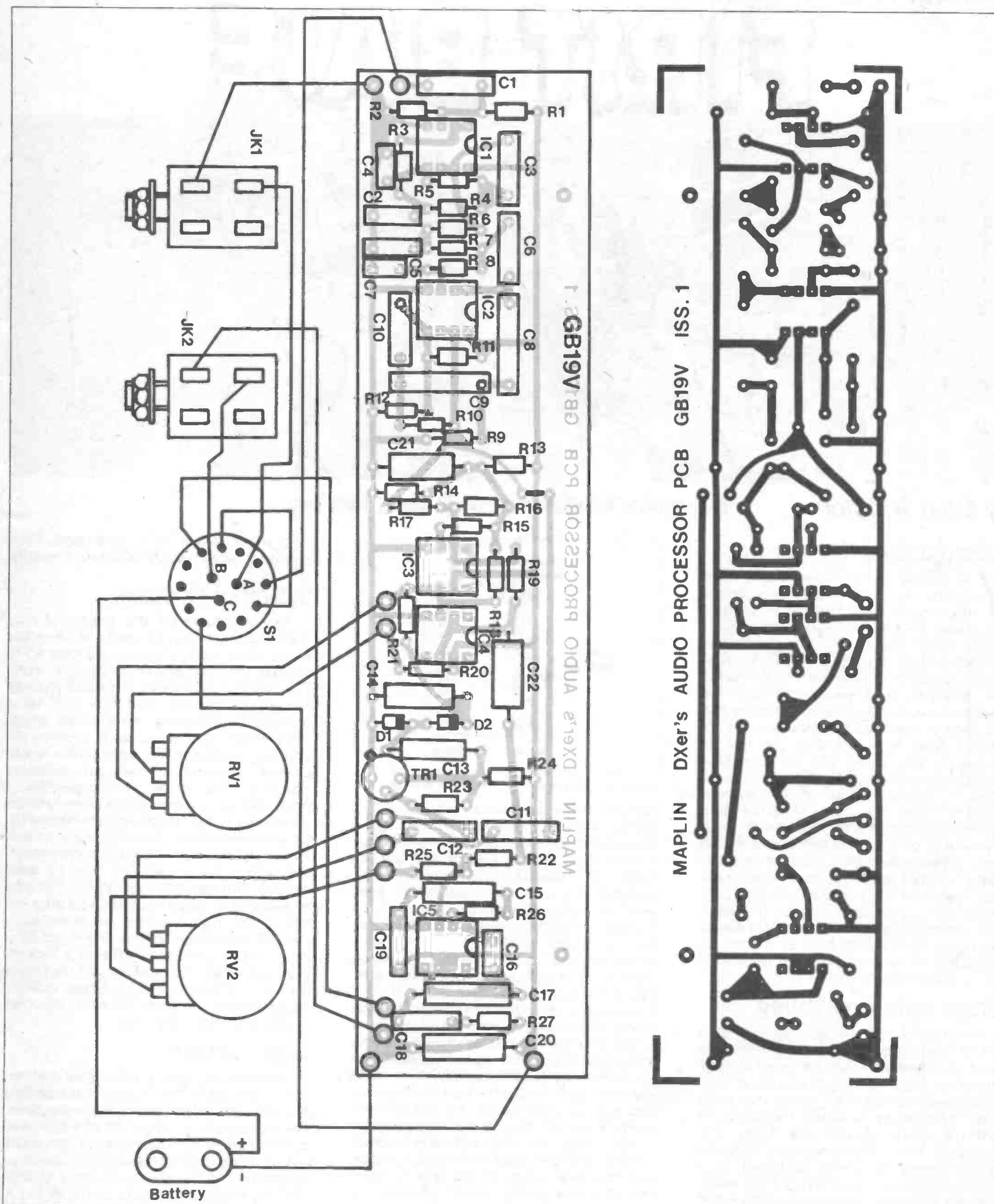


Figure 5. PCB layout and wiring.

Construction

Refer to Figure 5 for details of the printed circuit boar and wiring of the unit. Veropins are used at points on the printed circuit board where connections to off-board components will be made. Be careful to fit the semiconductor devices onto the board with the correct orientation, especially the integrated circuits which would be difficult to remove from the board once soldered into place. Note that there is a single link wire on the board (near to R13 and R16).

An instrument case having approximate outside dimensions of 200 by 125 by 75mm makes a good housing for this project, and a suitable front panel layout can be seen by referring to the photographs. S1 is a 4 way 3 pole rotary type having an adjustable end stop, and the latter is set for 2 way operation. The recommended case has an aluminium chassis and the completed printed circuit board is mounted on this using ½ inch 6BA bolts plus ¼ inch 6BA spacers to hold the underside of the board well clear of the chassis. Mount the board towards the front of the chassis so that there is sufficient space for the battery to the rear of the board. The unit is then finished by wiring in the controls, battery connector, and sockets.

continued on page 62

FIRST BASE

by Mike Wharton

A Beginner's Guide to Logic Design Part Two

Introduction

You should by now have built, or have access to, a DC supply providing a regulated 5 volts. This will be used as the power supply for the various experiments which will mainly use Transistor-Transistor Logic devices, or TTL for short. If such a supply is not available it is possible to use batteries at a pinch, although the commonly available voltages are either just too high or too low. For example, a 4.5V battery may be used with no risk of damaging any chips, but as its output voltage falls with use, it may become insufficient to operate some of the devices properly. This can lead to some very misleading problems for the unwary. A 6V dry battery, on the other hand, is really too high, although with care it can be reduced with a suitable series resistor. Possibly the best source in this line would be four 1.2V NiCad cells connected in series; this gives 4.8V which will remain fairly constant during discharge. These cells may, of course, be recharged — which brings us back to a mains power supply again!

Chips with everything

A feature of modern electronic apparatus is that often somewhere lurking inside the most mundane item will be found at least one 'chip'. A glance through any electronics component catalogue will reveal that there must by now be umpteen thousands of different types, shapes and sizes. The electronic 'chip' is distinguished from the potato variety by being packaged in a rectangular black (usually), box from which protrude two rows (usually) of sharp metal pins or legs. Its type will be indicated by a code number printed on the top side, and pin number '1' identified in one of several ways, as shown in Figure 1.

All the wide variety of chips produced by modern technology may be divided into two categories, Analogue and Digital. We shall only be concerned at this stage with the digital variety; the analogue types (or analog, if you speak American) consist of all manner of specialist devices intended for particular applications.

Before we start any cookery with these chips it is essential that we all know and can identify the devices which are going to be

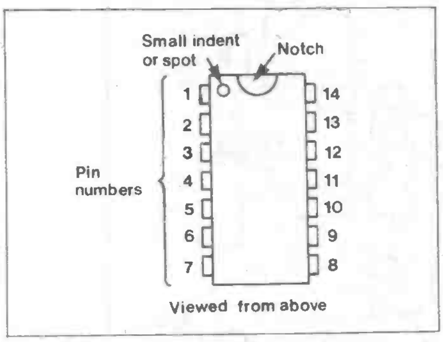


Figure 1. 14-pin dual-in-line (DIL) package.

needed; there are several 'grades' of TTL device, and the one of interest to us is the 7400 series. Each device in this series has a specific part number, starting with the two figures '74'. Thus the first in the series, 7400, is listed as a quad two-input NAND gate, which at first glance may seem to be a bit of a mouthful. What this means will be clear later, but first there are some more numbers which you will find on the package which need to be explained to avoid confusion. Figure 2 shows a typical chip of this type; in this case the part number is pre-fixed by the letters SN, which originally stood for Semiconductor Network, and is still used by some manufacturers. Other manufacturers may use other letters, such as DM, whilst some use none at all. Finally, the type number may end with a single letter, the commonest being 'N', which indicates a plastic package.

Very often the chip will have another number stamped close to the type number, and may look similar to the type number. This is a date stamp, which indicates the week and year of manufacture. For example, the number 7933 would mean that the chip was made during week 33 of 1979; some confusion may arise if you come across old

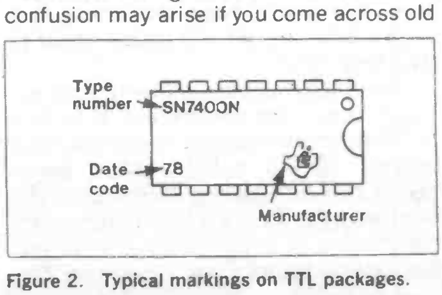


Figure 2. Typical markings on TTL packages.

chips made during 1974, so beware if you buy some 'bargain packs' of suspect devices.

Schottky Devices

Before moving off the subject of chip identification, it may be useful to say a few words about some of the more modern TTL devices. One of the few drawbacks to using TTL devices is that they use a relatively large amount of current, and this can be a problem if designing commercial equipment which uses many such devices. An improvement which has led to a reduction in current consumption without seriously affecting some of the other properties of these devices has produced a range of chips commonly called Low power Schottky, or 'LS' for short. Generally, these are made as pin-for-pin replacements for the standard types, and with a few exceptions may be used instead. The method of identifying this type of device is to insert the letters LS after the '74' of the type number; for example, a 74LS00 would be the Low power Schottky version of the standard 7400 device. Indeed, there are other letters which you may have noticed in this sort of type number, indicating yet further variations, but we'll cross that bridge when we come to it.

Logic Levels

Since we are dealing with digital devices, it is important at the start to make certain that what this entails is properly understood. The segregation of chips into analogue and digital varieties was mentioned above, and it is true to say that one deals with analogue quantities and the other with digital quantities. An analogue quantity is one which is continuously variable, and although this may be a voltage it could equally well be the amount of liquid flowing down a pipe, the speed of the wind or the intensity of light from the sun. All of these quantities can be converted into a proportional voltage by suitable means. A digital quantity, on the other hand, is one which changes by fixed amounts, with no fractional parts in between. Thus the number of people in a group is a digital amount, you cannot sensibly have three-and-two-thirds people. Likewise, in digital electronics, we are concerned with voltage signals which have just two levels, and ideally nothing in between. Using TTL devices these levels are +5 volts and 0 volts, with the +5 volt level being assigned the logic value of '1' and 0 volts a logic value of '0'. Again, there are other systems, but we shall not concern ourselves with them.

The great advantage of this system is that it actually makes the representation of numbers a lot easier than any analogue system; for instance, suppose you wanted to show a value of '5' using a range of voltages between 0V and 10V. Easy, you say, that would be given by 5 volts, but now imagine you need to show a value of 255 on the same voltage range. One solution would be to make the 10V equal to a value of 1000, so that 255 would be given by a voltage of 2.55 volts. This would then mean that only 0.01 volt represents a value of 1, and this is such a small voltage that any practical system would be hopelessly inaccurate. By adopting

VALUE	
+5Volts	0 Volts
Logic 1	Logic 0
True	False
Valid	Invalid
High	Low

Figure 3. The positive true logic notation system.

a digital system any value can be created with perfect accuracy. This is the basis of the modern digital computer, but more of that later, as we are getting ahead of ourselves. At this stage it is sufficient to appreciate that the presence of 5 volts, or a voltage very close to it, represents logic 1, and 0 volts, or again a value very close to that, is logic 0. These logic values do not necessarily stand for the numerical values of 1 and 0, but might equally well mean True and False, or Valid and Invalid in terms of logical arguments, and Figure 3 summarises these ideas.

Truth Tables

The introduction of the idea of logic brings us next to the subject of Truth Tables; these have been adapted from the subject of Boolean Algebra as a convenient method of describing the performance of a particular logic chip. Mention of such things as Boolean Algebra may have caused some of you to wonder what you might have let yourselves in for. If so, then rest assured that this series will stick to the practical path, and although it is difficult to ignore it completely, those readers wishing to delve more deeply into this fascinating subject will have to look elsewhere.

If you have studied the subject of electronics previously, then it is quite possible that you have come across the so-called characteristic curves for active devices such as transistors. These are used to describe in a graphical form how such things react when voltages are applied to them, and can be used to make sure that the transistor is operated under the correct conditions. Fortunately, as far as TTL chips are concerned, we can treat them as what they are — little black boxes! Although they may contain several hundred individual transistors, provided some simple rules are adhered to it is possible to ignore this when connecting together a number of different devices. This makes it possible to make up quite complex logic designs with the ability to predict the manner in which the final circuit will behave, something which would be extremely difficult using any other system with separate transistors.

Truth Table

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

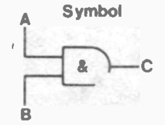


Figure 4. Two input AND gate.

Figure 4 shows the Truth Table for a two-input AND gate alongside the commonly used symbol for this gate in circuit diagrams. It may as well be said at this stage that although this is not a British Standard symbol, it is the one which is most likely to be found in published circuit diagrams, and there seems little point in swimming against the tide!

The explanation of the Truth Table given is quite straightforward; the two inputs to the logic device or 'gate' are labelled A and B, whilst the output is C. The Truth Table simply summarises the various outputs which would be obtained for all possible combinations of input. Thus, if both inputs are connected to logic 0, or 0 volts, then the output will be 0 volts. Only if both inputs are connected to logic 1, or +5 volts, will an output of logic 1 be obtained. This shows why the gate is called an AND gate, since both input A AND input B must be 'high' for the output to be 'high', all other combinations

Truth Table

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

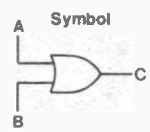


Figure 5. Two input OR gate.

Truth Table

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

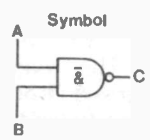


Figure 6. Two input NAND gate.

Truth Table

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

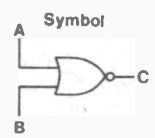


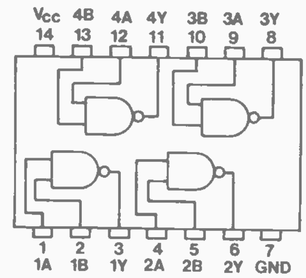
Figure 7. Two input NOR gate.

giving a 'low' output. Figures 5, 6 and 7 show the corresponding Truth Tables and symbol for three more common logic gates; figure 5 is for a two-input OR gate, figure 6 a two-input NAND gate and figure 7 a two-input NOR gate. The last two gates deserve a little more mention, as they are the opposites of the first two. That is, if you look at their Truth Tables, you will see that similar inputs produce opposite outputs, so that logically a NAND gate is a Not AND gate and a NOR gate is a Not OR gate.

Practical Devices

If you have a copy of the Maplin catalogue (if not, why not!) and turn to page 282, you will see the pin-outs of a number of TTL chips. You will also see that only rarely does a package contain a single device. For those without this valuable reference aid, the pin-out of a 7400 is given in figure 8. This is where we come back to that mouthful of a name used to describe such packages. Thus a 7400, which contains four identical two-input NAND gates, is listed as a Quad 2-input NAND gate, whilst the 7420 is a Dual 4-input NAND gate, ie two NAND gates each having four inputs.

Two other pins identified in figure 8 are labelled Vcc and GND; these are the pins to which the necessary power supply for the whole package is connected, with Vcc being connected to +5 volts and GND, or Ground, to 0 volts. Usually, Vcc is pin 14 and GND pin 7 on a 14-pin DIL package, but there are



Pinout of 7400

Figure 8. Quad two input NAND gate.

some important exceptions, and it is wise to check the pin-out when making up circuits. If you examine published diagrams these connections are often left out for the sake of clarity, but of course the circuit will not work without them!

Watch Your Combinations

The connecting together of various logic gates, such as NAND gates and NOR gates, to produce designs with predictable output states, is called Combinational Logic. To take a very simple example to start with; suppose that both inputs of a 2-input NAND gate are connected together, the Truth Table will

Truth Table

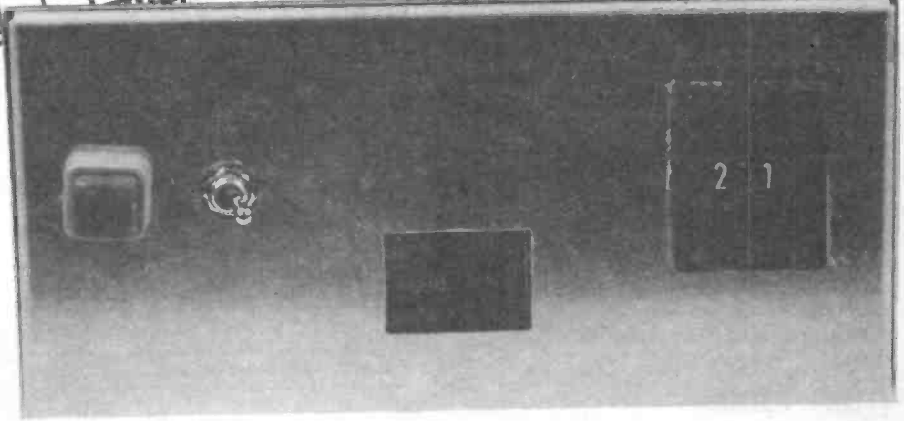
A	B
0	1
1	0

Figure 9. NAND to NOT conversion.

become as given in figure 9 as there is now effectively only one input. The result is a NOT gate, or inverter, since the output is the inverse of the input. This is also true for the NOR gate, and this is often a convenient way of producing an inverter from spare gates within a package.

It is true to say that the NAND gate is the most versatile of all those available, since the others can be made up by a suitable combination of NAND gates. For example, figure 10 shows how a 2-input NOR gate may be made up by this method. You can check out the Truth Table for this logic array by first giving the two inputs, A and B, the value 0. Then by following the Truth Table for the

DIGITAL ENLARGER TIMER/CONTROLLER



by David J. Silvester

Reversal colour printing does not permit the use of a safelight, whilst the safelight for negative colour work is so dim as to make exposure timing with a clock almost impossible. The only enlarger timers for sale were of a mechanical type and it was felt that using CMOS logic a suitable timer could be made at a cost below that of the 'off the shelf' item.

Given that the timer must be operated by feel alone the controls were reduced to a thumbwheel 'time set' switch and two control switches. This introduces two possible methods of operation. The timer may either count the elapsed time up or down, and it was felt that the up counting system which allows the time display to show the exposure time before operation would prevent the author from making too many exposure errors. The disadvantage is that when the timer is switched on or the thumb-wheel switches are altered the enlarger lamp will turn on until the display shows the same figures as the thumbwheel switch. Normally, however, more time is taken in preparing the darkroom or setting up the next print, so that in practice no time is actually lost.

Circuit Description

The main timing of the unit is derived from the 50Hz mains frequency via the transformer T1. Diodes D1, D2, capacitors C1, C2 and voltage regulator REG1 provide the 12 volt power supply, which is applied to all the IC's. The +12V is attached to the highest numbered pin of the IC's (14 or 16) and the 0V to the diagonally opposite pin (7 or 8). In all cases unused inputs must be connected to either high or low supply to ensure correct operation or freedom from oscillation.

The timing pulses are derived from the 15V/50Hz output of T1, ie. approximately 21V peak to peak. The zener diode D3, fed via R1, clips this voltage to +12V when the input is positive and to -0.6V when the input is negative. This clipped sine wave is then applied to a schmitt trigger IC1a, which provides a square wave at 50Hz with short rise and fall times on the logic transitions. This 50Hz square wave is fed to IC2a connected with IC3c and IC3d to act as a divide by 5 counter. IC2 has outputs in BCD (binary coded decimal) which will normally count from 0 to 9 (0000 to 1001) but at a count of 5 (0101) IC3 resets the counter immediately to 0. In this way after every 5 input cycles the output of IC3c connected to the reset pin of IC2a, gives a single short pulse every 0.1 seconds.

The connections for the operating switches S1 and S2 pass through IC1b and IC1d to provide the logic levels required for the operation of the counter reset and output logic stages.

The 10 pulses per second from IC3c pass through a count inhibit circuit IC10a and then to IC2b which produces 1 pulse per second when input 1 of IC10a is high. IC4 acts as a 00 to 99 counter with BCD output lines. This BCD data is used to drive a 7 segment double digit display, via display drivers IC5 and IC6. It should be noted that the ballast resistors used with the display are of unusually high values (R4-17) so that the display will show only a dull glow in the darkroom.

IC's 7, 8 and 9 provide a system which checks whether the BCD data on the output of IC4 and from the BCD thumbwheel switches S3 and S4 are the same. IC7 and IC8 are quad exclusive NOR gates which act as comparators for each of the BCD data line pairs.

- ★ Accurate to 0.1 seconds
- ★ Timing range of 1 to 99 seconds
- ★ Cost below that of mechanical timers
- ★ Switching capability of 6 amps at 240V 50Hz

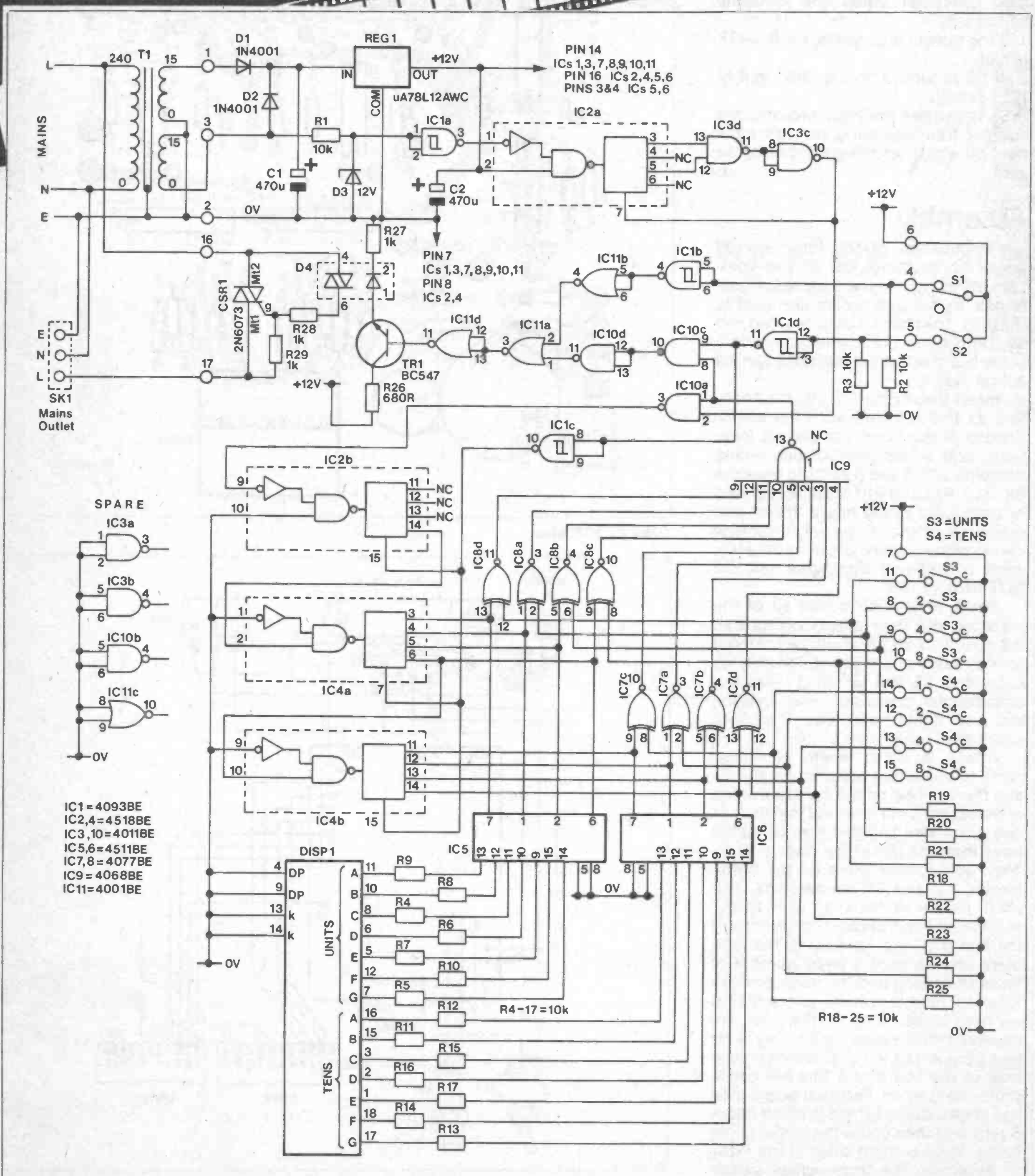


Figure 1. Circuit diagram.

When the values of BCD input are the same the output is high. IC9 is an 8 input NAND gate giving low output on pin 13 only when all of the 8 BCD input pairs are the same. It is this output which controls the counting and also the output circuitry when S1 and S2 are in their off positions. The output of IC9 is over-ridden by the logic levels derived from S1 or S2 when either switch is used.

The output logic circuit consists of IC11d, IC11a, IC11b, IC1b, IC10c, IC10d, IC1d, and TR1 which cause the opto-couplers diode to turn the output triac CSR1 on under the following conditions:—

1. If the system is counting, i.e. if pin 13 is high
2. If S2 is turned on, i.e. the input to IC1b is high.

If S1 is pushed the logic prevents the counter from operating and holds the triac off whilst resetting the counter to zero.

Assembly

Construction of the timer should cause no problems as all the components except for the switches, transformer and output socket are fixed to the PCB. The board is double sided and all components are mounted on side 2 of the board with most soldering carried out on side 1.

Insert the vertisocket into the board first as this will help with the identification of the other component locations, and solder into position noting that pins 1, 3, 6 and 8 going to resistors R8, R10, R11 and R13 must be soldered to both sides of the board. Insert and solder all of the IC sockets checking carefully the position of pin 1 as the IC's point in different directions, but DO NOT INSERT IC's.

Bend, insert and solder all of the resistors into their places noting that R8, R10, R11 and R13 will be soldered to both sides of the board, followed by capacitors C1 and C2. Next insert the opto-coupler, transistor, triac, regulator, and diodes and after checking orientation solder into place.

Attach a 30cm length of ribbon cable to the output holes for S3 and S4 and the 12V line on the right hand side of the board. It will be found that there is one spare wire and this may be pulled away from the rest of the ribbon cable. Then add further wires for the transformer, S1 and S2 connections, and short pieces of hook up wire to the mains input and output connections. If the board is now held up to the light there can be seen a large number of holes remaining and the track pins are inserted into these holes and soldered on both sides. If all of the pins are inserted before soldering it is very likely that a pin will be left unsoldered on one side of the board and this will cause problems later on. Personal experience has shown that it is best to insert about 6 pins and then count the solder joints being made on both sides of the PCB.

Assemble the thumbwheel switch from the component parts and identify

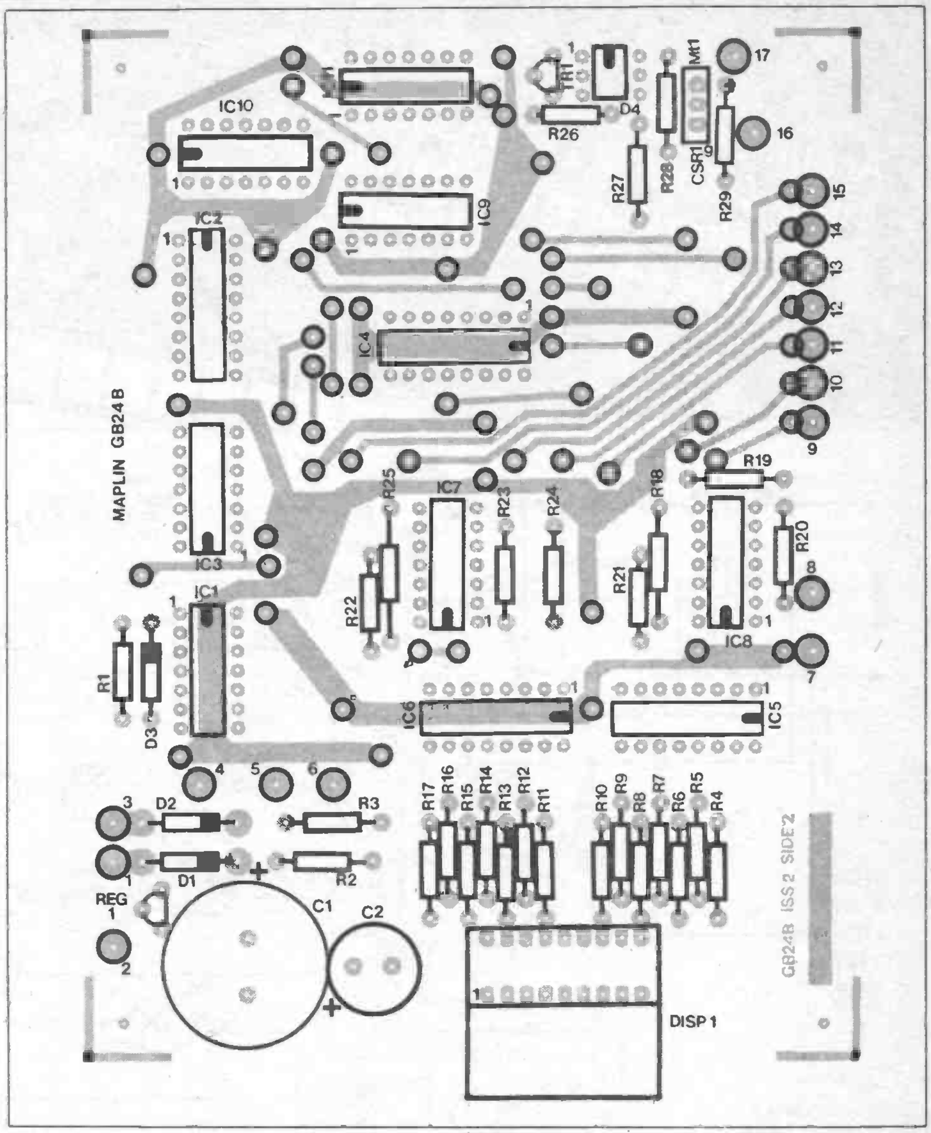


Figure 2. PCB layout.

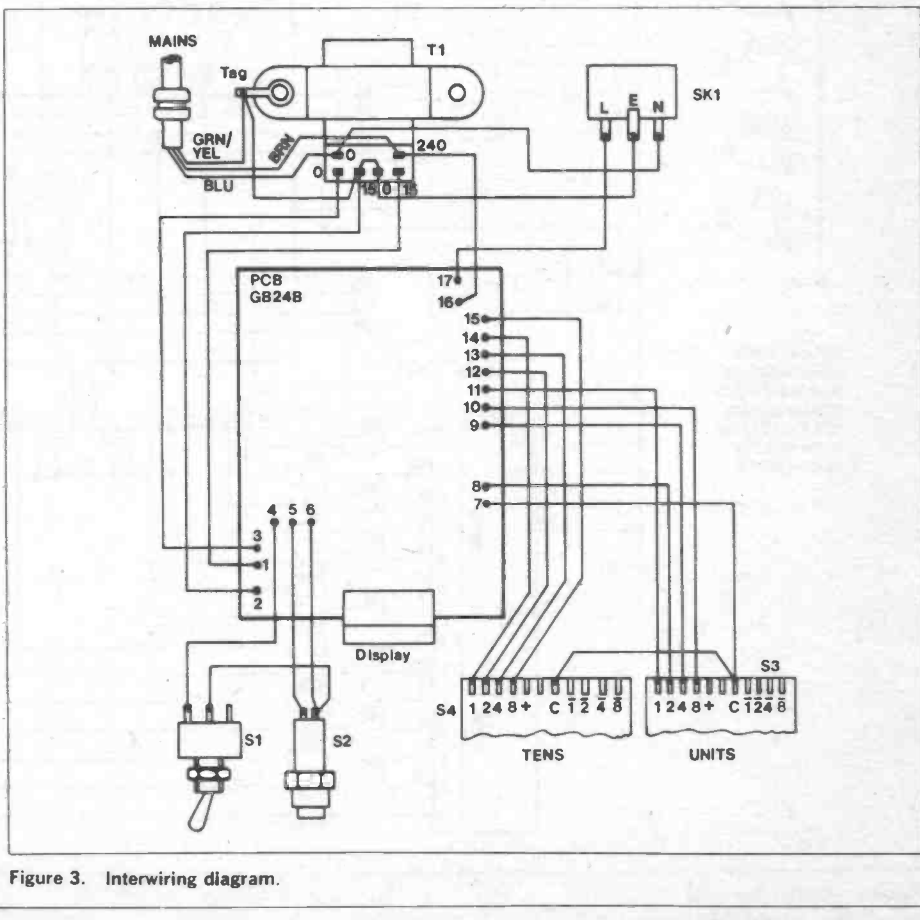


Figure 3. Interwiring diagram.

the 8, 4, 2 and 1 switch contacts as well as the common line C.

A suitable case should be chosen and drilled or cut to take the PCB with cut-out for the display, thumbwheel switch, Euro outlet, transformer, mains input grommet, and switches S1 and S2.

After mounting all of the components in the case connect these as shown in the wiring diagram Figure 3. The mains input earth MUST be connected securely to the metal case and to the Euro socket as failure to do this will make the timer dangerous to use in the wet atmosphere of the darkroom.

Circuit Testing

Insert a 3A fuse into the mains input plug. The constructor should remember that the large PCB carries mains voltages so extreme care should be taken whilst testing the circuits. First, and before inserting the IC's check that the 12V power supply is operating correctly by checking the voltage across pins 7 and 14 of IC1 socket.

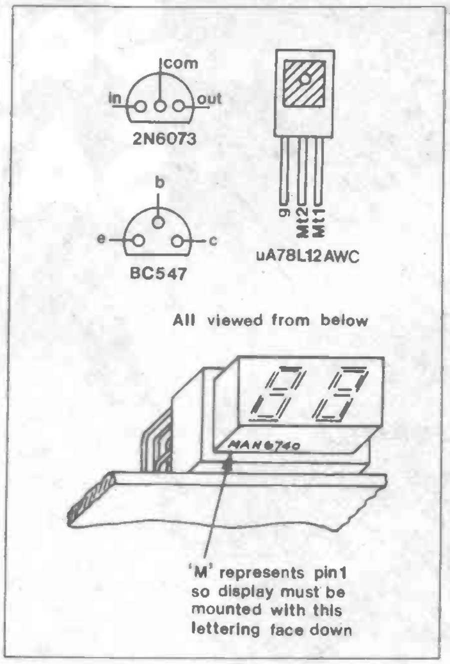


Figure 4. Pin configurations.

Switch off and remove the mains plug. Insert all of the IC's and turn on again. The LED display should light (note the intensity of the lamps is low), count up to the number set on the thumbwheel switch at one count per second, and then stop. Also check that the thumbwheel switch has been connected correctly by making the counter stop at 0, 1, 2 to 9 and 10, 20 to 90 seconds. Finally pull out the mains plug and check that none of the components has become hot. Now connect a 100W/240V bulb across the output socket and repeat the above. During counting the lamp should light and go off when the count stops. Set S2 to the on position, the lamp should light but the display remain at the same setting. Press S1 and the display should reset to zero but the lamp remain off. Releasing the switch will allow the lamp to light for the required time.

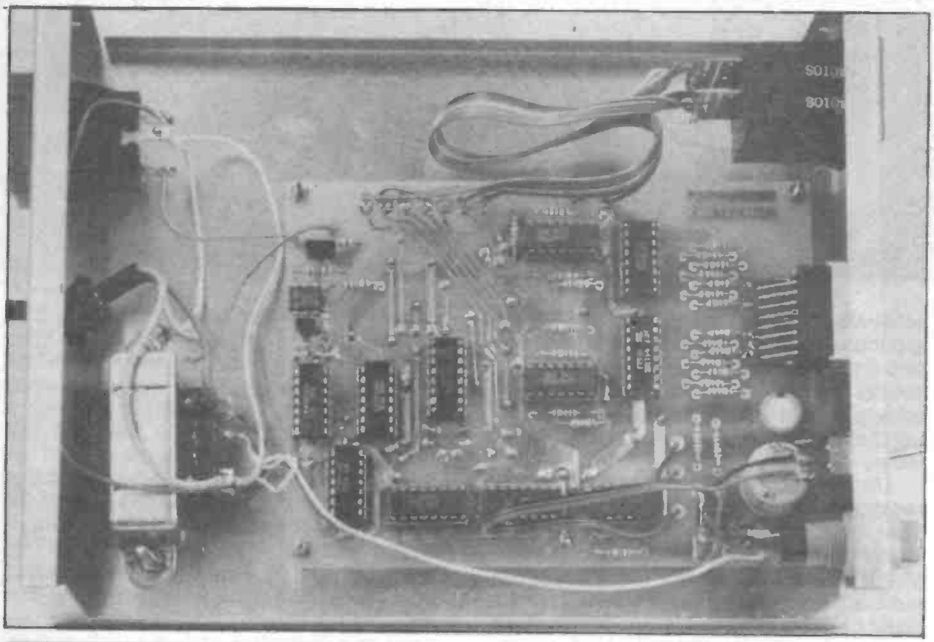
Using the Timer

If all tests have proved satisfactory connect the timer to the enlarger, and set up the darkroom. Set the thumbwheel switch to the desired exposure time and switch S2 on, to prevent the lamp turning off whilst trying to set up the negative and baseboard. When you are ready, switch S2 on, place photographic paper in the baseboard, then press S1 and release to make the exposure.

Modifications Outside Great Britain

In countries with a mains frequency of 50Hz only T1 will need to be changed to a transformer having an input winding suitable for the local voltage.

In countries with 60Hz mains frequency the constructor must break the connection between IC2 pin 3 and IC3 pin 13. A new connection must be made between IC2 pin 4 and IC3 pin 13.



ENLARGER TIMER PARTS LIST

Resistors — All 0.4W 1% metal film.			
R1-25 inc	10k	25 off	(M10K)
R26	680R		(M680R)
R27,28,29	1k	3 off	(M1K)
Capacitors			
C1	470uF 63V PC electrolytic		(FF59P)
C2	470uF 16V PC electrolytic		(FF15R)
Semiconductors			
D1,2	1N4001	2 off	(QL73Q)
D3	BZY88C12V		(QH16S)
D4	Opto-triac-isolator		(QQ10L)
CSR1	2N6073		(QR51F)
REG1	uA78L12AWC		(WQ77J)
TR1	BC547		(QQ14Q)
IC1	4093BE		(QW53H)
IC2,4	4518BE	2 off	(QX32K)
IC3,10	4011BE	2 off	(QX05F)
IC5,6	4511BE	2 off	(QX31J)
IC7,8	4077BE	2 off	(QW47B)
IC9	4068BE		(QX24B)
IC11	4001BE		(QX01B)
Miscellaneous			
DISP1	DD Display Type C		(BY68Y)
	Vertisocket Type 2		(BK04E)

	14 Pin DIL Skt	7 off	(BL18U)
	16 Pin DIL Skt	4 off	(BL19V)
	Veropin 2141	1 pkt	(FL21X)
	Track Pin	2 pkts	(FL82D)
T1	Transformer 15V		(WB15R)
S1	Sub-Min Toggle A		(FH00A)
S2	Square Push Red		(FF98G)
S3,4	Thumbwheel BCD	2 off	(FF84F)
	Thumbwheel End Cheeks		(BK49D)
	Grommet		(FW59P)
SK1	Euro Facility outlet		(HL42V)
	Euro Facility plug		(HL43W)
	10-way Ribbon cable	1 metre	(XR06G)
	Min Mains Black	2 metres	(XR01B)
	Hook up wire	1 pkt	(BL00A)
	Case AB15		(XB71N)
	PCB		(GB24B)
	Screws 6BA x 1 inch	1 pkt	(BF07H)
	Nuts 6BA	1 pkt	(BF18U)
	Spacer 6BA x ½ inch	1 pkt	(FW35Q)
	Screws 4BA x ¼ inch	1 pkt	(BF02C)
	Nuts 4BA	1 pkt	(BF17T)
	Tag 4BA	1 pkt	(BF28F)
	Stick-on-feet		(FW38R)

A complete kit of all parts, excluding the case, is available.
Order As LK07H (Enlarger Timer kit). Price £27.50.

Say it with SATELLITES

Part 4
by Mike Wharton

Giotto Spacecraft

Since this is the last in the present series of articles, we will finish off by taking a look at some of the current events on the space scene. The use of satellites is only one aspect of a much wider field, that of the exploration of space. After an initial impetus during the late 1960's, which culminated in the American Moon landings, the exploration of space has become more the exploitation of space. During the last ten years there have been steady advances in the science and technology involved, and it may well be that manned exploration will eventually follow where the Pioneer and Voyager space-craft have led the way towards this 'final frontier'.

Ups and Downs

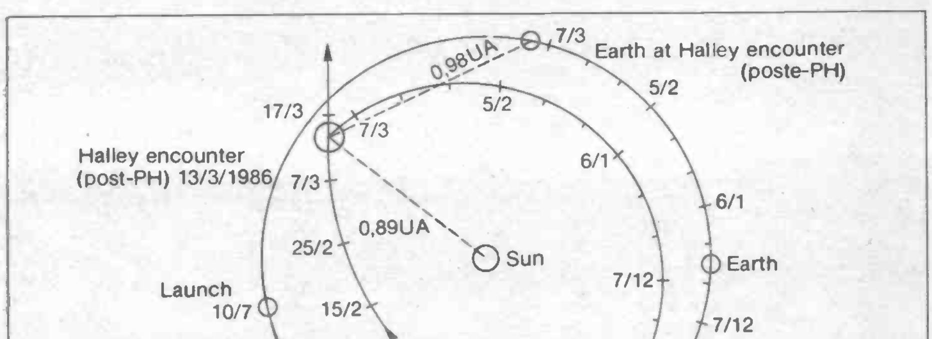
Despite the complexity and marvellous technology in this area of human endeavour, it still manages to prove the truth of that old saying 'what goes up must come down'; well, at least they come down quite often! Perhaps one of the more important 'downs' in the recent past was that of COSMOS 1402. This was a Soviet low-altitude surveillance satellite, and its demise proved to be newsworthy because of the descent of the radio-active portion of the space-craft.

The radio-activity is produced by special nuclear 'batteries', powered by a radio-thermal source in part of the satellite. This is kept as far away from the rest of the instrumentation and other sensitive areas of the satellite since radiation can play havoc with some of the electronic equipment on board. Also, the amount of shielding is kept to a minimum, since it is not expected that anyone will come into contact with the satellite once it is in space, and any effective shielding would only represent a dead weight in the pay-load.

The reason why such sources are used, in addition to the usual solar arrays and conventional batteries, is to provide the large amounts of power needed to operate the ground searching radars. These are used in this type of 'spying' operation since purely optical methods can be rendered completely ineffective by even the lightest covering of cloud, which, of course, does not affect radar.

Usually, this type of satellite containing a radio-active source would be manoeuvred from its normal orbital path into a much higher parking orbit at the end of its useful life. It would then be left there while the radio-activity decayed to safer levels; then it could be either left there, virtually forever, or brought down to an altitude where atmospheric drag would take an effect, and it would then burn up during re-entry through the atmosphere.

It seems that in the case of COSMOS 1402 control of the satellite was lost, and proved impossible to push it out into its parking orbit. This meant that it started to re-enter the Earth's atmosphere before the radio-active source had been given a chance to decay. This should not have been a problem, since this was its intended fate anyway, but since control of it had been lost it was impossible to put it into an orbit that would ensure complete vaporisation of the dense radio-active source. In the event, it seems that the villain of the peace fell into the South Atlantic, even if it did remain intact on re-entry. The point is worth making that even if such sources are 'burned up' on re-entry, this does not destroy the radio-activity present, for once formed it is not possible to destroy an isotope by such physical methods as burning. However, by vaporising it in the upper atmosphere, the radio-activity is dispersed to such an extent that harmful levels



Giotto reference transfer orbit with a launch on 10 July 1985 and a Halley encounter on 13 March 1986.

of radiation should not be experienced by anyone on the ground.

Many of these surveillance satellites, put into orbit by both the USA and the USSR, contain such radio-active sources and this was not the first to cause concern; it may be remembered that a piece of similar Soviet space debris fell on northern Canada some three years previously. It seems a safe bet that sooner or later the same thing will happen again.

A Satellite for Sport

The satellite's vantage point from its orbit some 900 km. out in space provides the basis for one of its most useful roles, that of satellite navigation. There are several systems which make use of this facility, such as the Marecs satellites operated by Inmarsat. These satellite provide a means by which commercial shipping can obtain a much more accurate fix of their position at sea than ever was possible by dead reckoning. One disadvantage of this type of system to the average yachtsman is its fairly high cost for the receivers and associated computing equipment.

A system presently operated by the US Navy, and soon to be updated, is based on satellite navigation by their so-called Transit satellites, and known by many yachtsmen as SATNAV. The development of modern microprocessor based computing devices has ensured that this method is reasonably cheap to install. Like many other such navigation aids, it uses the Doppler shift between two signals to provide data for the calculation of latitude and longitude at sea. For greater positional accuracy, it may be interfaced with the compass and ship's log, the latter being the device which gives the ship's speed. At the present time there are five satellites, with one more to be launched shortly, so there are still some gaps in the system. The satellites used for this method occupy a polar orbit, with a period of about 100 minutes. Each satellite transmits beacon signals on 150 MHz and 400 MHz which are picked up by the receiver on board the yacht. The transmitted signals are compared with a very stable signal generated by the equipment. Since the satellite is moving very rapidly, its signal will appear to rise and then fall in frequency as it passes by on its orbit, just like the old example of the whistle on a steam train - this is Doppler shift. The satellite always knows where it is above the surface of the Earth, and by making some computations based on the magnitude of the Doppler shift, the position of the yacht may be found relative to the satellite.

If the yacht is moving, then this factor can also be taken into account, and the final result should have an accuracy of about 300 metres, although it is theoretically possible to obtain your position to within 100 metres.

This system is to be superseded shortly by a new Global Positioning System, or GPS, called NAVSTAR, which will give a new meaning to the old nautical phrase, "a star to steer by".

International Rescue Takes Off

The method of using Doppler shift to calculate the position of an object on the surface of the Earth can also be used in the opposite sense, that is, for the satellite to determine the position of a fixed beacon. This is the basis of a project which Britain has recently joined, and which will use satellites to locate crashed aircraft or shipwrecked mariners. The other countries involved are the US, Canada and France, who will join up their SARSAT system with the Soviet COSPAS system. SARSAT, or Search And Rescue Satellite Aided Tracking is a method which uses satellites to pick up the transmissions from distress beacons on the ground or in the sea. COSPAS-1 was launched in the middle of last year, and an American satellite, to be operated by NOAA, should follow it up on March 28th this year. These satellites will pick up transmissions from emergency beacons which are automatically turned on in the event of an accident. Those carried on board an aircraft should operate due to the jolt of the crash, whilst those on a ship operate when immersed in water.

These beacons have to be carried by law, but it is by no means an easy task to locate their position from ground based receiving stations or even over-flying aircraft. This is where the satellite's superior vantage point comes into its own. The beacons transmit on the international distress frequencies of 121.5 MHz and 243 MHz for at least two days; aircraft flying over the sea are obliged to monitor these frequencies, but not whilst they are flying over land. A satellite in a polar orbit can monitor the whole surface of the globe, again having a period of around 100 minutes, so that any transmitting beacon will be located in a relatively short time. The signal from a beacon is recorded as the satellite passes close by, and then the Doppler shift compared to a reference signal is used to work out its position relative to the satellite. This information is 'dumped' via telemetry when the satellite comes in range of a ground station, and the position of the distress beacon calculated. This gives a very precise location for the rescue craft to home in on and hence remove much of the uncertainty and guesswork often involved in trying to locate the position of a craft in distress, particularly at sea and in bad weather conditions. A development of the system will use beacons which operate on a higher frequency of 406 MHz, in a less cluttered part of the radio spectrum, and has a potential accuracy of some 2 to 5 km, rather than the 20 to 50 km. with the presently envisaged system.

I-R Astronomers over the Moon

So far, all the various satellite systems considered have had their attention directed towards the surface of the Earth. This need not necessarily always be the case, for there are a number of satellites whose attention is very clearly on outer space. Amongst these are the special telescopes which have been carried aloft within a satellite in order to obtain a better view of the Universe. The reason for doing this is usually to place the telescope above the Earth's atmosphere so that it cannot interfere with the incredibly weak signals which the astronomers are looking for. Indeed, the atmosphere and the dust and water vapour contained in it can completely obscure some parts of the electro-magnetic spectrum which are of interest.

This is especially true of a wide range of infra-red (I-R) wavelengths, which are absorbed by water vapour in the air. To overcome this problem, a satellite has recently been launched called IRAS, or Infra-Red Astronomical Satellite. This carries on board a set of special sensors which will be used to study the emission of infra-red by certain parts of the galaxy. Infra-red, of course, is heat energy, and to make the sensors as sensitive as possible they are cooled down to a very low temperature. On IRAS this has been achieved by the use of liquid helium, contained in a special vacuum flask, and which is able to cool the sensors down to within a few degrees of absolute zero. The telescope will only be able to operate whilst the supply of liquid helium lasts, and the astronomers in charge of the project are pleased because it seems that the helium may last for up to 300 days, rather than the 200 days originally calculated.

Because of the extreme sensitivity of the infra-red sensors, one glance at anything as bright as the Sun would destroy them immediately. For this reason the satellite has been put into a special orbit, called sun-synchronous. This is a polar orbit, but the orbital increment is so arranged that the satellite always faces away from the Sun. To protect the sensors during launch, a cover was placed over them; the first signals received from the satellite when it was put into operation was the minute infra-red trace from these covers as they were jettisoned and drifted away into space. At the time of writing the telescope has only just begun its operational life, but it is reported that one minute of observation has revealed more than was previously known about this part of the spectrum from all Earth bound observations.

On Track for Halley's Comet

Many reader will no doubt be aware that Halley's comet is due to reappear during the next few years. This is one of the more spectacular of these heavenly bodies, although it is not expected to be such a sight in the night sky as on its last appearance 75 years ago. There is a great deal of speculation amongst astronomers as to what the composition of a comet actually is. It is generally agreed that the head consists of frozen water or gases, along with some rock and that the tail is a very thin stream of this material evaporated by heat from the Sun and flowing out in the solar wind, so that it always points away from the Sun. One way which could provide a lot more information

continued on page 62

With sales of the Commodore 64 steadily rising there must be a vast number of users becoming increasingly frustrated in the knowledge that they are the proud owners of a powerful and yet undocumented machine.

The users manual which accompanies the 64 is extremely basic, and continually makes reference to the Programmers Reference Guide for more information on the concepts of advanced operation. Where is this Oracle? No doubt it will materialise in time, but for all you Commodore 64 owners here are some routines to whet your appetites.

Joysticks

The 64 has two control ports which are controlled by one of two CIA chips. these are 6526's and control the I/O and interrupts etc. CIA 1 handles IRQ whilst CIA 2 handles NMI. To read the joystick switches use the following

JY = NOT PEEK(56320) AND 15

this will yield 1 for UP, 2 for DOWN, 4 for LEFT, 8 for RIGHT, and the appropriate combinations for the diagonals. To read the fire button use

FB = NOT PEEK(56320) AND 16

(I have used Port B. Replace address with 56321 for Port A.)

High Resolution Graphics

Another feature of the Commodore 64 is its high resolution graphics facility. This is not even hinted at in the manual - so here it is. The screen has its Pixels arranged in a 320 by 200 matrix. In normal operation the screen requires 1000 bytes of RAM to hold the code for each of the 1000 possible character positions. In Bit Map Mode every Pixel on the screen needs to be addressable - 64000 bits are needed and one byte contains 8 bits - so 8000 bytes will be required in RAM to enable high resolution graphics. Program 1 is written in basic to demonstrate this facility.

You will notice that in this mode the screen memory starts at 24K, and the colour memory starts at 16K. The screen will be completely blank, but due to the slow nature of BASIC it adequately demonstrates how the screen is mapped. Program 2 executes the same function in machine code (somewhat faster), and then allows the screen to be used as a doodle pad with a joystick in control Port B.

by Nigel Fawcett

USING THE COMMODORE 64

```
100 V1=56576:V2=53248:          REM POINTERS TO CIA AND VIDEO CHIPS
140 POKE V1,PEEK(V1) AND 254:   REM SET UP CIA CHIP
150 POKE V2+24,8:               REM RECONFIGURE SCREEN MEMORY MATRIX
160 POKE V2+17,PEEK(V2+17) OR 32: REM ENABLE BIT MAP MODE
170 FOR X=0 TO 8191:            REM 8K FOR SCREEN MEMORY MAP
180 POKE 24576+X,0:             REM CLEAR MEMORY
190 NEXT X
200 FOR X=0 TO 1023:            REM 1K FOR COLOUR MEMORY
210 POKE 16384+X,1:             REM SET COLOUR TO WHITE - CHANGE THIS
215 REM:                        REM FOR ANY COLOUR CODE 0-15
220 NEXT X
300 GOTO 300:                   REM RUN/STOP & RESTORE TO BREAK OUT!
32767 END
```

Program 1

```
100 V1=56576:V2=53248
105 RESTORE
110 FOR I=0 TO 42
120 READ A:POKE 832+I,A
130 NEXT I
140 POKE V1,PEEK(V1) AND 254
150 POKE V2+24,8
160 POKE V2+17,PEEK(V2+17) OR 32
170 SYS 832
1000 C1%=0:C2%=0:B1%=0:B2%=0
1010 JY=NOT PEEK(56320) AND 15
1020 IF JY AND 1 THEN GOSUB 11000
1030 IF JY AND 2 THEN GOSUB 12000
1040 IF JY AND 4 THEN GOSUB 13000
1050 IF JY AND 8 THEN GOSUB 14000
1060 IF NOTPEEK(56320) AND 16 THEN 105
1070 GOTO 1010
2000 GOTO 2000
3000 DATA 162,32,160,0,169,0,141,0,96,238,71,3,136,208,245,238,72,3,202,208
3010 DATA 239,162,4,160,0,169,2,141,0,64,238,92,3,136,208,245,238,93,3,202
3020 DATA 208,239,96
10999 RETURN
11000 B1%=B1%-1:IF SGN(B1%)<>-1 THEN 11100
11010 B1%=7:C1%=C1%-1
11020 IF C1%<0 THEN C1%=24
11100 CH=C1%*320+C2%*8+B1%+24576
11110 POKE CH,PEEK(CH) OR (2↑B2%)
11999 RETURN
12000 B1%=B1%+1:IF B1%<8 THEN 12100
12010 B1%=0:C1%=C1%+1
12020 IF C1%>24 THEN C1%=0
12100 CH=C1%*320+C2%*8+B1%+24576
12110 POKE CH,PEEK(CH) OR (2↑B2%)
12999 RETURN
13000 B2%=B2%+1:IF B2%<8 THEN 13100
13010 B2%=0:C2%=C2%-1
13020 IF C2%<0 THEN C2%=39
13100 CH=C1%*320+C2%*8+B1%+24576
13110 POKE CH,PEEK(CH) OR (2↑B2%)
13999 RETURN
14000 B2%=B2%-1:IF SGN(B2%)<>-1 THEN 14100
14010 B2%=7:C2%=C2%+1
14020 IF C2%>39 THEN C2%=0
14100 CH=C1%*320+C2%*8+B1%+24576
14110 POKE CH,PEEK(CH) OR (2↑B2%)
14999 RETURN
32767 END
```

Program 2

COMPUTER NEWS

Returning by popular demand for a second year, the Computer Fair at Earls Court reflects just how important the micro is becoming. The Fair is being held from the 16th to the 19th of June, and the doors will be open from 1 p.m. to 6 p.m. on the 16th, 10 a.m. to 6 p.m. on the 17th and 18th, and 10 a.m. to 5 p.m. on the 19th. Admission prices will be £3 for adults, children under sixteen and OAPs £2, and special reduced price vouchers will be printed in the magazines sponsoring the event. There are also reductions for group advance bookings. Further details can be obtained by ringing 01-643 8040 ext. 4859.

British Rail are also offering reduced price inclusive return tickets, e.g. a return rail ticket and admission to the Fair will cost you only £5.80 if you live in Essex. For more details contact the Travel Centre at Kings Cross Station, or phone 01-278 2477.

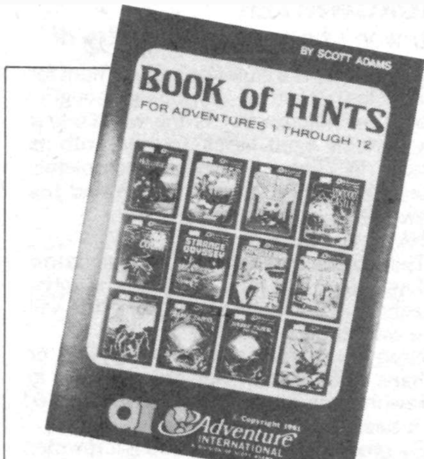
Amongst the items on offer from the organisers of the Fair are a Sinclair Village, a Club Avenue, and a Micro Mouse contest. Indeed the Fair will be bigger than last year, held in a larger area, and open for longer.

The Maplin stand will be showing our extensive range of computers and software, all of which will be available for purchase, PLUS a demonstration of the abilities of the new M5 computer from Sord, providing it is here on time. There will also be a whole host of books and literature for you to choose from, and free leaflets on hardware and software will be placed about the stand.

Our technical staff will be at hand to provide you with help and advice should you require it, and there will be a representative of the U.K. Atari User Group present, to talk to those of you have already bought, or are seriously thinking of investing in one of the Atari range of computers and peripherals.

THE Computer Fair
Personal computers
Home computing
Small business systems

June 16th
to 19th 1983



Book of Hints
by Scott Adams

Never let it be said that Scott Adams doesn't provide at least some help for the perplexed Adventurer! His hint book contains additional clues to help you out of some of the sticky spots you have got into, while still letting you solve the Adventure yourself - all without giving away any of the clues until you really want them! So if you really can't seem to get out of the bog or locate the Pharaoh's heart, then this is the right place for help. This expanded edition includes hints for all twelve Adventures, and a special section on the making of Adventure maps. Relief at last! 1982. 14 pages. 190 x 133mm.

Order As WK25C (Book of Hints)
Price £4.99 *NV*

```
1000 POKE 56334,PEEK(56334) AND 254:      REM SET UP CIA CHIP
1010 POKE 1,PEEK(1) AND 251:              REM SET UP I/O DIRECTION
1020 FOR I=0 TO 2047
1030 POKE 12288+I,PEEK(53248+I):          REM COPY THE CURSOR UP MODE CHARACTER
1035 REM:                                 SET INTO RAM STARTING AT 12K
1040 NEXT I
1100 POKE 1,PEEK(1) OR 4:                 REM RESET THE I/O DIRECTION
1110 POKE 56334,PEEK(56334) OR 1:         REM RESET THE CIA CHIP
1200 FOR I=13312 TO 13327:                REM ALTER THE CHARACTERS WHICH NORMALLY
1210 READ C:                              REM HAVE SCREEN CODES 128 & 129
1220 POKE I,C:                            REM (NORMALLY REVERSE @ AND REVERSE A)
1230 NEXT I
1300 POKE 53272,(PEEK(53272) AND 240)+12
1305 REM:                                 REM TELL THE VIDEO CHIP WHERE THE NEW
1306 REM:                                 REM CHARACTER SET IS
2000 PRINT "♥":                           REM CLEAR SCREEN
2010 PRINT "■@@@@@AAAAA■ !!!!":        REM INVERSE @ AND INVERSE A !!!!
3000 DATA 0,0,0,0,3,12,48,192,3,12,48,192,0,0,0,0
```

Program 3

```
1000 POKE 52,48:POKE 56,48:CLR
1010 FOR I=832 TO 860
1020 READ A
1030 POKE I,A
1040 NEXT I
1050 POKE 56334,PEEK(56334) AND 254
1060 POKE 1,PEEK(1) AND 251
1070 SYS 832
1080 POKE 1,PEEK(1) OR 4
1090 POKE 56334,PEEK(56334) OR 1
1100 FOR I=13312 TO 13327
1110 READ C
1120 POKE I,C
1130 NEXT I
1140 POKE 53272,(PEEK(53272) AND 240)+12
30000 DATA 162,8,160,0,173,0,208,141,0,48,238,69,3,238,72,3,136,208,241,238
30010 DATA 70,3,238,73,3,202,208,232,96
31000 DATA 0,0,0,0,3,12,48,192,3,12,48,192,0,0,0,0
```

Program 4

Redefining the character set

The 4K of memory required to generate the 512 characters available resides in ROM starting at memory location 53248. This may come as a surprise to those who are already aware that the video chip controlling the sprites starts at the same address. Reading the character ROM can only be achieved when the I/O chips are correctly configured, as program 3 will show.

For those who were again disappointed by the slowness of BASIC, Program 4 performs the same function using machine code.

These demonstration programs do not by any means explain the full power or capabilities of the Commodore 64. There are many other places in RAM at which the character set can be set up and redefined. This is not the only method of creating a bit mapped screen - multicolour modes have not been shown nor has the ability to fine scroll or mix Hi-res graphics with text - this is just meant as an insight into the possibilities that exist when programming on this machine. Full details will be found in the Programmers Reference Guide and more programs and ideas will be given in future editions of Electronics. Good programming.

MICROWRITER

You won't believe it till you try it!

Microwriter is a superior replacement for every known method of putting thoughts onto paper. Microwriter is the world's first fully portable word processor and, with its unique five-finger keyboard, completely supersedes handwriting, dictation and the typewriter.

"WHAT'S IT FOR?"

Think of the amount of writing you do in a working day - letters, memos, reports, speeches, notes, etc. A Micro-writer will cope with the lot.

Normally you'd originate text by hand, or perhaps by dictation. Then you wait for it to be rewritten on a typewriter, possibly sending it back for correction.

By producing that copy on a Microwriter you'll eliminate the duplication of effort and the frustration of redrafting.

And because it's portable it's just as invaluable at home or out in the field.

"WHAT DOES IT DO?"

Although it's no bigger than an average paperback book, don't be misled. The Microwriter is a remarkably powerful machine.

Quite simply, its six keys have the capabilities of the entire typewriter keyboard.

It will produce both upper and lower case alphabets, numerals, the full range of punctuation, as well as an additional range of technical symbols.

As you produce your copy it's stored on a 1600 word memory - that's about five pages of A4. Once there it can be recalled on the moving display at any time, allowing you to make corrections or insertions. The entire

memory can be saved to cassette in about 3 minutes and kept for use later.

Plug the Microwriter into a printer or electronic typewriter and your copy is immediately transformed into neatly typed text.

You're not limited in your choice of formats. The Microwriter easily copes with standard and variable formats on any size or type of paper, including automatic carriage returns, indented paragraphs, headings, underlining and complex tabulations.

All this the Microwriter will do with just the help of a printer. A television monitor can be used to increase the display.

"BUT ISN'T IT HARD TO LEARN?"

"No, quite the contrary. Thousands of users have proved that Microwriting can be learned in an hour or less, and that you can be producing work within a day. In a few days of practice you can reach handwriting speed. With regular use you'll be Microwriting more than twice as fast as you can handle a pen.

Compared to the months it takes to train a typist, it's easier than falling off a log.

"HOW FRIENDLY IS THE MICROWRITER TO OTHER EQUIPMENT?"

The Microwriter's compatability with other equipment gives you a powerful means of access to systems in use everywhere.

It's compatible with most standard RS232C equipment, capable of both transmitting and receiving data. It can also be used as an alternative keyboard on most KSR and RO printers using this standard.

It can be used as an input device to your existing microprocessor.

HOW DO I BUY ONE?

Microwriter is available by mail-order or from our Westcliff shop only, and comes complete with mains charger, soft case with carrying handle, cassette lead, User's Guide, Systems Manual and set of crib cards.

Order As AF62S Microwriter £557.75
AF66W TV/Monitor Interface £189.75
AF67X RS232C Cable male to male £28.75
AF68Y RS232C Cable male to female £28.75

MICROPROFESSOR MPF-II

Runs most existing Apple II Software

Microprofessor II is one of the new breed of home computers containing a full 64K of RAM when supplied. This extremely powerful colour home computer also contains an excellent 12K BASIC which is Applesoft compatible and a 4K monitor in ROM. However, both these can be switched out and all 64K of RAM utilised if desired.

Microprofessor II is a powerful learning tool that will help any student. Because of its compact size, it slips easily into a briefcase or bag and can even travel comfortably if you're on the road a lot.

Peripherals available include a separate full-size keyboard for heavy-duty input, floppy disk interface and drive, Centronics-type parallel interface for a printer, a matching 40-column thermal printer (which plugs in directly) and a joystick.

The computer itself comes complete with power supply, cassette cable, TV interface and four handbooks. These include a comprehensive 250 page Introduction to BASIC Programming for beginners, a 130 page User's Manual, an Installation Manual and a Self-Diagnosis Manual. There are also keyboard overlays for the graphics symbols and another for the single key BASIC commands.

Microprofessor II can be used with most standard cassette recorders and a lead is included for mono recorders. The computer has its own internal speaker and a speech synthesiser module will be available later this year. A 50-pin edge connector for plug-in cartridges can also be used to gain direct access to the busses and CPU interrupts etc.

Specification

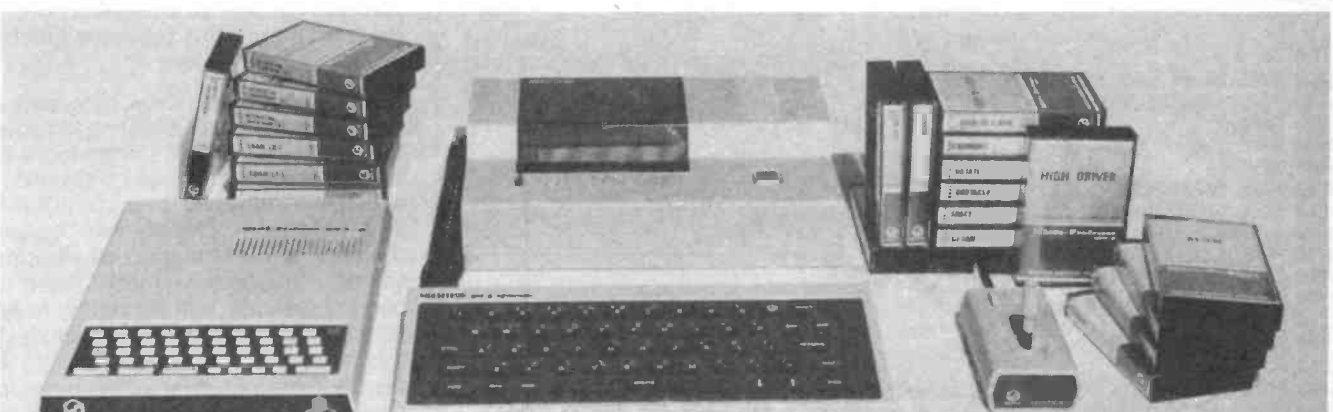
6502 Microprocessor
16K of ROM including 12K BASIC
64K of RAM

Keyboards

Built-in calculator style 49-key keyboard.
Detachable full-size 55-key keyboard (optional extra).
Both keyboards include single-key BASIC commands.

Peripherals

Sockets for disk drive, tape cassette, video monitor, TV printer and joystick.
Floppy disk drive (optional extra).
Centronics type parallel interface (optional extra).
Thermal printer (does not require the



interface) (optional extra).
Joystick (optional extra).
Speech synthesiser board (optional extra).
Built-in 8 ohm, 2.25 inch, 0.25W speaker.

Languages
Applesoft compatible 12K BASIC.
Optional extras: Assembly, Pascal, Forth, Logo, Pilot.

Video Display
Memory mapped into system RAM.
Mixable text, low, and high resolution modes.
960 characters, 40 columns, 24 lines in text mode.
1920 dots in 40 x 48 array in low-res graphics mode.
53,760 dots in 280 x 192 array in high-res graphics mode.
Six colours.

The following items are available now. fuller details in our next issue.

Order As

AF69A	Microprofessor II	Price £268.95
AF70M	Full-size Keyboard	Price £36.25
AF71N	MPF II Printer	Price £185.75
AF72P	Printer Interface Kit	Price £28.25
AF73Q	Disk Drive	Price £296.85
AF74R	Disk Interface Kit	Price £41.49
AF75S	Joystick	Price £14.95
AF76H	Thermal Paper (pack of 3 rolls)	Price £5.24

Software on Cassette
Order As

KT00A	Gobbler	Price £6.99
KT01B	Panic	Price £6.99
KT02C	Blitz	Price £6.99
KT03D	Rain	Price £6.99
KT04E	High Driver	Price £6.99
KT05F	Fighter Docking	Price £6.99
KT06G	Beetle	Price £6.99
KT07H	Sabotage	Price £6.99
KT08J	Boaga 2	Price £6.99
KT09K	Obstacle	Price £6.99
KT10L	Alien	Price £6.99
KT11M	Space	Price £6.99
KT12N	Snake	Price £6.99
KT13P	Head-on	Price £6.99
KT14Q	Auto Barn	Price £6.99
KT15R	Gomoku	Price £6.99
KT16S	O-X Games	Price £6.99
KT17T	Four In A Row	Price £6.99
KT18U	Groan	Price £6.99
KT19V	Rotate	Price £6.99
KT20W	Master Bagles	Price £6.99
KT21X	Graphics	Price £6.99

SORD M5 AVAILABLE IN JUNE

The superb new Sord M5 computer which we described in detail in our last issue will be availale in early June. A low priced micro-floppy disk drive will be available in September. There will be a 32K RAM expansion box also to be released in September and a printer will be available in December. In addition at least 70 or 80 pieces of software are due to be released by October with much more to come after that.

The following list of products is scheduled to be released in June (or July if marked†).

AF64U	**Sord M5 Computer**	**£189.95**
AF65V	**Sord Joypads**	**£24.95 per pair**
KS00A	**Falc Cartridge (Visicalc-type spreadsheet program)**	**£34.95**
KS01B	**BASIC G (An BASIC with extended and very powerful graphics commands)**	**£34.95**
†KS02C	**BASIC F (A very powerful floating point BASIC)**	**£34.95**

Games Cartridges

KS03D	**Tank Battalion**	**£23.95**
KS04E	**Step Up**	**£23.95**
KS05F	**Word Maze**	**£23.95**
KS06G	**Super Baseball**	**£23.95**
†KS07H	**Boxing**	**£23.95**
†KS08J	**Skiing**	**£23.95**
†KS09K	**Tennis**	**£23.95**

Games Cassettes

KS10L	**Smokey & Barrier Attack**	**£8.95**
KS11M	**Jogging & Sidewinder**	**£8.95**
KS12N	**Solitaire & Tower of Hanoi**	**£8.95**
KS13P	**Three Circles & Number Search**	**Price £8.95**
KS14Q	**Black Jack & Slot Machine**	**£8.95**
KS15R	**Last Day of The Earth & Mini Star Trek**	**Price £8.95**
KS16S	**Congenial Biorhythm & Music Tone**	**Price £8.95**
KS17T	**Cowboy & Barricade**	**Price £8.95**

We will have more details of this and much more new software for the Sord M5 in our next issue.

CBBS - North East

CBBS North-East is a computerised bulletin board system, which is available FREE to all, except for the price of a phone call. It has advantages over a normal bulletin board in that the number of notices stored is much larger, any of the information can be transferred at a rate of 30 characters/sec (you can read that fast, but without full retention) to your own system, and if you have a means of storing it, peruse it at your leisure.

Computer programs in any language or format can be sent or collected from the system. The operators will also make available programs, news, and items of interest relevant to micros. Essential equipment is as follows:

1. ANY computer or terminal.
2. A telephone and line adjacent to the computer.
3. If a computer, then a program which makes it act as a dumb terminal, sending and receiving characters in standard ASCII code. CBBS North-East is programmed for the international standard of 8 bits per character, no parity, 1 stop bit.
4. A modem.

The service is available on 0207 43555 and 0207 32447 daily from 19.00 to 08.00 and all day Sunday. From 00.00 to 08.00 32447 will only respond to Bell 103 U.S.A. tones. If you want to access them, you should follow these instructions:

1. Load terminal program into computer.
2. Modem switched on, originate/call mode selected (if there is a choice, as some modems are originate only), phone latch switch (who knows what it is called on your modem, it may even be incorporated in the on/off) set to release.
3. Dial number.
4. CBBS NORTH-EAST will answer with a high pitched, 1850Hz tone.
5. Turn phone latch to hold (or switch on)
6. Replace receiver, or place on modem if it is the audio-coupled type.
7. CBBS NORTH-EAST will then handle everything automatically. If your modem is not sending out the correct tone of 1050Hz, it will disconnect within 30 seconds of the connection being made. If all is in order, all you have to do is respond to its questions. For reference, a list of its major commands is enclosed. Many more subtle facilities are available which you will discover as you become familiar with the system.
8. When you are finished, and have logged off properly using the "G" (for goodbye) command, put your modem back to release (or switch off) and replace the receiver.
9. If you have "got lost" and you or your equipment fails to give CBBS NORTH-EAST any instructions for 5 minutes, a warning is issued, then after a further 1 minute with no instructions it will disconnect you.

Major Functions

(E)nter message
(G)ood bye
(H)ELP = =
(R)etrieve msg
(Q)uick summary
(S)ummarize msgs

Minor Functions

£ Print caller £ etc
(B)ulletin reprint
(C)ase upper/lower
(D)uplex: echo off
(P)rompt bell off
(K)ill message
(N)ulls: How many?
(O)ne line summary
(T)ime/date/E.T.
(U)ser update (password, etc)
(V)ideo backspace
(W)elcome reprint
e(X)pert user mode

For details, type H, press return, then type the command letter. HELP New user help; (vs H: keyword based help)
CHAT See if operator is available to talk via keyboard

New Books

Understanding Telephone Electronics
by John L. Fike and George E. Friend
This takes the reader step-by-step from the simplest explanation of telephonic principles through to an intermediate level of telecoms learning. It covers the technologies involved in dialling, ringing, transmission, signalling, switching, digital techniques, modems, and cordless telephones. At the end of each chapter is a summary quiz, making the book ideal for self-paced individual learning.
1983. 288 pages. 209 x 133mm.
Order As WK45Y (Phone Electronics) Price £5.10*NV*

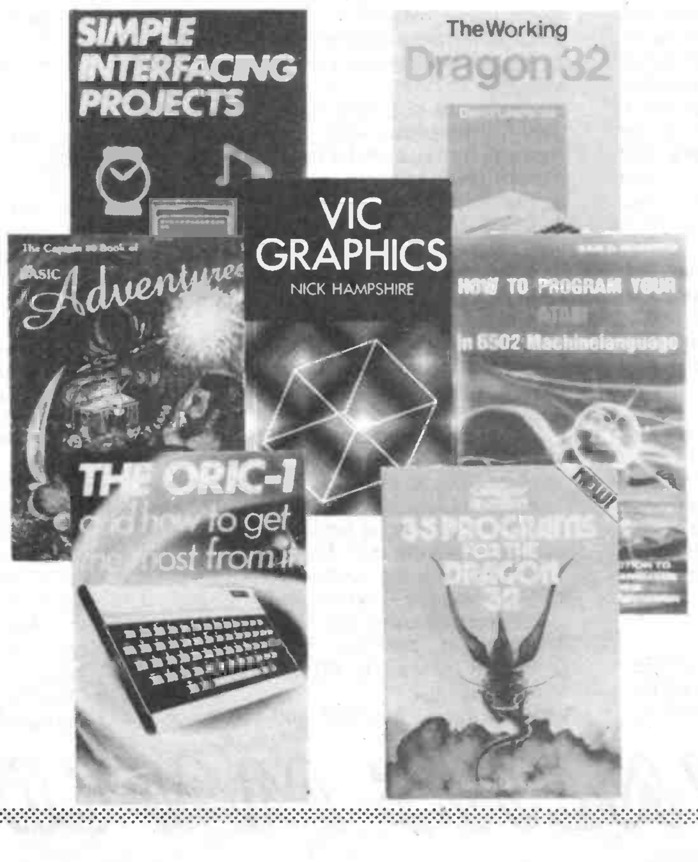
The Working Commodore 64
by David Lawrence
This is based on a collection of solid, sophisticated programs in areas such as data storage, finance, graphics, household management, education and games of skill. The programs have been designed to make the most of the CBM 64's special features. Some of the programs are a word processor and text editor, a music and sound synthesiser, a sprite editor, and one which allows the user to enter hi-res graphics mode. This is not available in the standard BASIC.
1983. 158 pages. 234 x 156mm.
Order As WK46A (Working CBM 64) Price £7.20*NV*

Commodore 64 Computing
by Ian Sinclair
This is an introductory guide and reference book for all CBM 64 users, and is essential for getting the best out of this new machine. It covers the setting up and operation of the micro and its many facilities in detail. BASIC syntax is comprehensively summarised with examples, and the book sets out and fully explains the features which make this computer such remarkable value for both business and domestic users - such as graphics, sprites, programmable function keys, colour commands, programming for sound, using the 64K option, CP/M and running programs written for PET machines.
1983. 134 pages. 232 x 155mm.
Order As WK47B (CBM 64 Computing) Price £6.60*NV*

Programming the 6809
by Rodnay Zaks and William Labiak
This book covers the 6809 inside and out. You will learn how signals are handled within the chip itself and how to get them to control all essential I/O functions. Whether you are a first time or experienced programmer, this book will make it possible for you to use the 6809 to its fullest capacity.
1983. 362 pages. 227 x 151mm.
Order As WK30H (Programming the 6809) Price £13.75*NV*

Mastering the VIC 20
by A. J. Jones, E. A. Coley, D. G. J. Cole
This book offers a comprehensive study of BASIC and VIC 20 structure, and covers machine code programming using the VICMON assembler. It offers a wealth of interesting programs, including MINISYN (setting up the VIC as a two-octave keyboard instrument with sustain and colour display), PONTOON, and STARSHIP. Hi-res graphics in BASIC and machine code are explained in detail, and routines for saving a hi-res screen to disk or tape are given.
1983. 178 pages. 253 x 170mm.
Order As WK31J (Mastering the VIC 20) Price £7.35*NV*

Simple Interfacing Projects
by Owen Bishop
This book contains a variety of interfacing projects, ranging from the relatively simple which a beginner can build, to those requiring more experience of construction. It includes a voice-operated controller, a sound processor, a real-time clock, music generator, and digitiser projects. Full constructional details, hints on testing and troubleshooting, programming notes, component listings, and a circuit or logic diagram are given.
1983. 168 pages. 234 x 156mm.
Order As WK29G (Simple Interface Project Book) Price £7.75*NW*



The Working Dragon 32
by David Lawrence
This book is based on a collection of solid, sophisticated programs in areas such as data storage, finance, graphics, household management, education and games of skill. Each of the programs is explained in detail, line by line. And each of the programs is built up out of general purpose sub-routines and modules which, once understood, can form the basis of any other programs you need to write.
1983. 158 pages. 234 x 156mm.
Order As WK32K (Working Dragon 32) Price £7.20*NV*

The Captain 80 Book of BASIC Adventures
This is the world's first anthology of BASIC adventures from some of the best-known writers of micro-computer software. All of these programs were originally written for the TRS-80 Model I, Level II, 16K computer, but should be easily converted to other machines and other BASICS. There are eighteen Adventures for you to type in to your computer. American book.
1981. 252 pages. 276 x 210mm.
Order As WK23A (BASIC Adventures) Price £14.50*NV*

How to Program Your ATARI in 6502 Machinelanguage
This is an introduction to machine code on the Atari for the programmer at present using BASIC. The book includes comparisons of equivalent BASIC and machine code programs, and describes how to call machine code subroutines from BASIC.
1982. 106 pages. 206 x 130mm.
Order As WK33L (Atari 6502 Book) Price £6.95*NV*

VIC Graphics
by Nick Hampshire
This book provides the reader with an introduction to programming techniques used to generate graphic displays on a VIC. Topics include using colour, two dimensional shape plotting, shape plotting, scaling, stretching, movement and rotation, plotting using matrix manipulation, and 3-D shape plotting.
1983. 186 pages. 214 x 132mm.
Order As WA48C (VIC Graphics) Price £6.95*NV*

The ORIC-1 - and how to get the most from it
by Ian Sinclair
This book introduces Microsoft BASIC, thoroughly explains the ORIC's graphics, colour and sound systems, and also sets out the data processing capabilities to open up the full range of the ORIC's facilities to the beginner. Many examples of useful programs are included, and the book aims to be a convenient reference source.
1983. 134 pages. 234 x 155mm.
Order As WK34M (ORIC-1 Book) Price £6.65*NV*

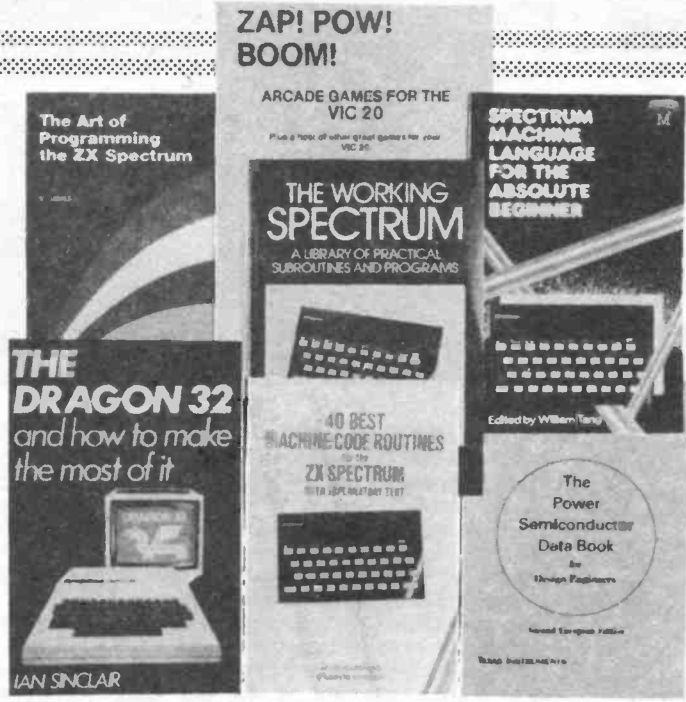
35 Programs for the Dragon 32
by Dr Tim Langdell
This is an exciting collection of games and home applications for the Dragon. The programs are simple to use and will make full use of the colour facilities on the Dragon. Programs included are a metric converter, home accounts, and various games and routines.
1983. 62 pages. 208 x 147mm.
Order As WK35Q (35 Dragon Programs) Price £5.65*NV*

The Art of Programming the ZX Spectrum
by M. James
A book that should enable you to program the ZX Spectrum effectively. Amongst the topics covered are Low and High res graphics, Sound, PEEK and POKE, Strings and Words, and Moving and Advanced Graphics, along with all the details that will make your programs on the Spectrum look and sound more professional.
1983. 138 pages. 179 x 110mm
Order As WK27E (Book BP119) Price £2.50*NV*

The Dragon 32
by Ian Sinclair
This book is aimed at the beginner, and starts with setting up the machine, guiding you step-by-step until you become sufficiently expert to write your own programs and create your own special effects. It should set you on a sure course to mastering and enjoying to the full the range of facilities that the Dragon offers.
1983. 158 pages. 234 x 155mm.
Order As WK26D (Book GP1149) Price £6.95*NV*

The Power Semiconductor Data Book
Contains information on the recently introduced Advanced Planar Power series of transistors and darlingtons, plus full details of TI's standard range of transistors, darlingtons, thyristors and triacs and many recently added pro-electron, jedec and limited source types. Gives all electrical and mechanical data, and power application notes and information.
1983. 888 pages. 210 x 147mm.
Order As WK28F (Power Semicon Data Book) Price £11.35*NW*

The Working Spectrum, Vol. 1
by David Lawrence
This book is based on a collection of solid sophisticated programs in areas such as data storage, finance, calculation, graphics, household management, and education. Each of the programs is explained in detail, line by line. And each of the programs is built up out of general purpose sub-routines and modules which, once understood, can form the basis of any other programs you need to write.
Order As WK38R (Working Spectrum Vol 1) Price £7.25*NV*



40 Best Machine Code Routines for the ZX Spectrum
by John Hardman and Andrew Hewson
Section A of this book explains what you need to know about Z80 machine code on the Spectrum - how memory is organised, the registers, the stack, the display. Section B contains 40 routines, including scroll-up, down, side-to-side by pixel or by character, search and replace, token swap, string search. Rotate character, invert character - horizontally and vertically. Line renumber - including GOSUBs, GOTOs, RUNs, etc. Plus many more.
1983. 144 pages. 209 x 147mm.
Order As WK39N (40 M/C Spectrum Routines) Price £6.35*NV*

Spectrum Machine Language for the Absolute Beginner
Edited by William Tang
If you are frustrated by the limitations of BASIC and want to write faster, more powerful, space-saving programs, then this is the book for you. Even with no previous experience of computer languages you will be able to discover the ease and power of the Spectrum's own language. Each chapter includes specific examples which can be used on your Spectrum, as well as a self-test questionnaire. At the end of the book this is all brought together into an entire machine language program - from design right through to the complete listing of an exciting, original arcade game.
1983. 244 pages. 210 x 139mm.
Order As WK40T (Spectrum Beginners M/C) Price £6.95*NV*

ZAP! POW! BOOM!
by Mark Ramshaw
This book contains listings for the following thirty games for the VIC20: Maze Man, Asteroids, Swarm, Gunfight, Astro-Wars, Scramble, Space Invaders, Airplane, Marathon, Star Trek, Wizard, Tail Gunner, 3-D Maze, Brands Hatch, Lightning-Bolt, Space Eggs, Xyloid, Adventure, Gomoku, Lunar Lander, Missile Command, Nightmare Castle, One-Armed-Bandit, Draughts, Dambuster, Breakout, Dogfight, Night Raid, Tank Battle, Death Star.
1983. 52 pages. 295 x 210mm.
Order As WK36P (Zap Pow Boom) Price £7.95*NV*

The VIC20 for Children
by Tony Noble
This book is aimed at the younger user, perhaps working with their parents to explore what computing is all about. it covers everything from switching on, through simple BASIC programming to exciting games and puzzles. It also provides a new fun way of learning arithmetic and other subjects.
1983. 154 pages. 190 x 260mm.
Order As WK37S (VIC20 for Children) Price £7.30*NV*

Games BBC Computers Play
by Tim Hartnell, S. M. Gee, Mike James
This book contains full program listings for 41 games, including Zombie Island, Singing and Interplanetary Miner Blues, Le Mans, Wall Street, Enchanted Forest, and dozens more.
1983. 114 pages. 234 x 156mm.
Order As WK41U (Games BBC Computers Play) Price £7.75*NV*

Load and Go With Your Dragon
by John Phipps and Trevor Toms
This book contains listings for 25 programs, and also sections on debugging, hints and tips, and graphics. All the programs have been thoroughly tested, and the authors undertake to help anyone who cannot get them to run.
1983. 128 pages. 209 x 144mm.
Order As WK42V (Load And Go) Price £6.40*NV*

Creative Graphics on the BBC Micro
by John Cownie
Starting with first principles this book describes how to exploit the excellent graphics facilities provided by the BBC micro. It proceeds to explore more advanced routines, explaining in detail the individual procedures that go to make up whole programs. There are 36 listings that will run on either the A or B Model to produce a dazzling range of pictures and patterns in full colour, including animated pictures, recursively-defined curves, and rotating 3-D shapes. Colour illustrations.
1983. 110 pages. 205 x 153mm.
Order As WK43W (BBC Creative Graphics) Price £9.80*NV*

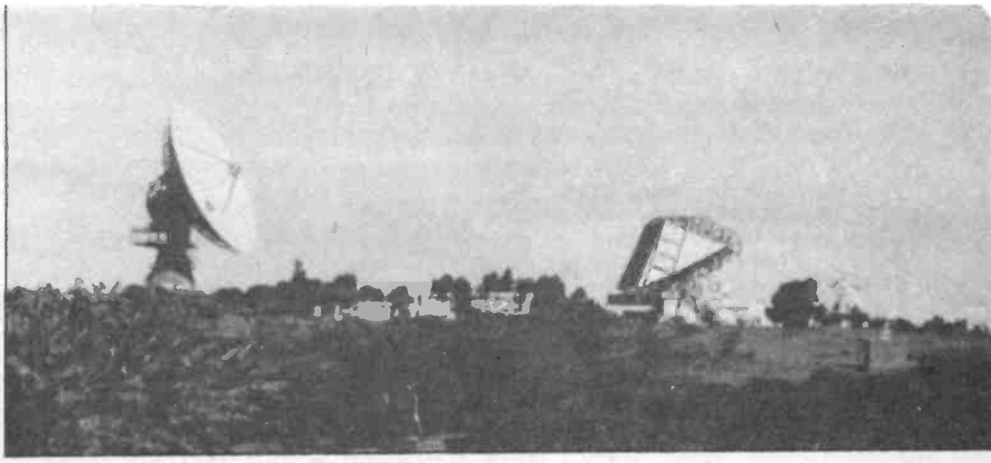
BASIC Exercises for the Atari
by J. P. Lamoitier
This is a practical and entertaining way to learn programming with Atari BASIC. Through progressive examples you will learn the fine points of the language and learn how to write your own programs.
It will enable you to use your Atari to compute taxes, forecast sales, calculate rate of growth, find the average of a sequence of measurements, calculate mean, variance, and standard deviation, and play games. All of the exercises will run on 400, 800 and 1200XL models.
1983. 252 pages. 228 x 177mm.
Order As WK44X (Atari BASIC Exercise) Price £11.80*NV*

SAY IT WITH SATELLITES

continued from page 55

on the subject is if it were possible to obtain samples from such a comet, and carry out an analysis. Until recently this would have been an astronomers pipe-dream, but with the advent of satellites it has now become a real possibility.

The European Space Agency and British Aerospace have designed a £34 million contract for the Giotto space craft. This will be Europe's first deep space probe, although as such it may seem to be stretching the label of 'satellite' a long way. It is due to be launched during July 1985, and to intercept the comet about eight months later. Giotto will carry some of the most advanced instrumentation available and pass closer to the comet than either the Russian or Japanese probes which are also to be sent in its direction. It is hoped to carry out a chemical analysis of the comet and take colour photographs of the nucleus and also take measurements of surrounding magnetic fields.



Finally, back to the Box

The Box referred to is, of course, our old friend the TV. Developments in Direct Broadcast by Satellite, DBS, seems to be three steps forward and two steps back, and it is getting difficult to predict just when the average 'consumer' may expect to enjoy the delights of such a scheme. The background technology involved was outlined in a previous article in this series, and the present state of play appears to have the BBC and IBA knocking the ball backwards and forwards between them. With such a wide ranging system it is vital that common standards of transmission are used, and this is where one of the present problems lies. The IBA have proposed a transmission system called MAC (for multiplexed analogue component), whilst the BBC are pushing an improved version of the commonly used PAL method, known as Enhanced PAL. There is actually a third contender which is a hybrid digital/analogue system, but it seems very likely that it will turn out to be an 'also ran', since it is only just at the early stages of development and there is reckoned to be insufficient time for it to be brought up to the same standard as the two main systems in the race. This is despite the acknowledgement by the Part Committee, the Government body who have the responsibility for deciding these matters, that it is an elegant and ingenious method. It could well be that there is some professional jealousy involved, since it appears highly probably that the IBA's MAC system will be the one recommended by the Committee and eventually put into service.

The reasons for having several systems to choose between is because although DBS has many advantages over terrestrial broadcasting, it is not all plain sailing, and as usual there are some trade-offs to be considered.

E-PAL is attractive because it is compatible with existing decoders, all that would be needed to receive pictures from a satellite transmission is an antenna and a down-converter. On the other hand, the MAC system will require the use of a more elaborate decoder which produces separate RGB (red, green, blue), outputs to give a better picture. Thus to receive these TV transmissions, one will need a MAC-to-PAL converter and an r.f. modulator to drive the antenna input of a standard television. Future sets would contain their own decoders, but this would make them more expensive.

The third contender, mentioned above, uses a digital encoding technique, very similar to methods which have already proved themselves in other satellite systems. Only time will tell how this situation will be resolved, but it looks as though it is going to be a few years before it is possible to watch the Muppets in half a dozen different languages!

There are always new developments in the application of electronics to the field of satellites and in future these will be published as an occasional "Space News" feature.

D'XERS AUDIO PROCESSORS

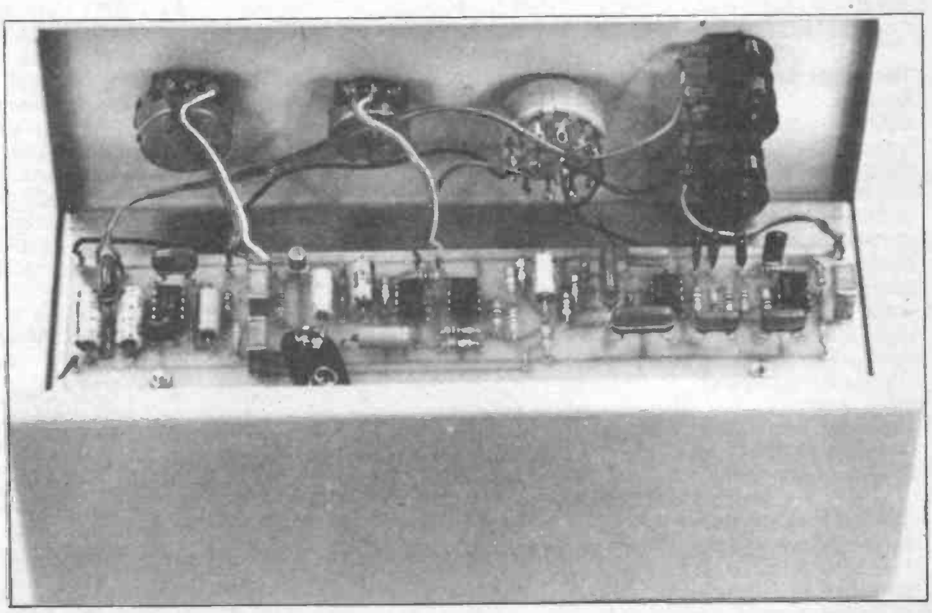
continued from page 47

In Use

Satisfactory results will probably be obtained if the unit is fed from either a loudspeaker socket or a headphone output of the receiver. If fed from an output intended for low impedance headphones the unit may provide inadequate output for use with a loudspeaker or high impedance headphones. This is not likely to happen in practice, but if necessary R22 could be replaced with a link wire to provide an increase in gain.

The processor will drive any normal type of headphones, but with some low impedance types the output of the unit may be excessive. This can be overcome by adding a resistor of about 100 ohms in value in series with one of the leads to JK2. An 8 ohm impedance loudspeaker can be driven at good volume, and higher impedance loudspeakers are also suitable, but the maximum output power decreases roughly in proportion to any increase in loudspeaker impedance. The use of a speaker impedance of less than 8 ohms is not recommended.

When the expander is not required RV1 is set in a fully anticlockwise direction. It is not advisable to always use the expander section of the processor since it will be of little or no benefit if the wanted signal is badly affected by noise or interference, and under these conditions the expander may be unable to function at all. It is not advisable to use the expander when trying to receive a station which is fading badly since the expansion will simply make the fading worse.



If reception conditions are not very poor and the expander is to be used, RV1 is advanced in a clockwise direction to give the desired degree of expansion (a roughly mid-point setting should be satisfactory). VR2 is then adjusted so that the wanted signal readily operates the expander and is reproduced at full volume, but during pauses in the wanted signal the background noise or interference does not and is consequently attenuated. After a little experimentation there should be no difficulty in setting these controls for optimum results.

CLASSIFIED

HI-FI FOR SALE

TANDON 8" DSDD dual disk drives, slim line, cased with p.s.u., £250 ono. May deliver (may exchange for good micro, BBC etc.), 12" ex Juke Box speakers, £2 each. 01-690 3131.
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SHURE V15 III boxed cartridge, used one week, with guarantee, £25. Maplin 150W amp, built, £10 and psu, £15 as page 228 Maplin catalogue. Tel. Dave 051-426 5742.

COMPUTERS FOR SALE

VIC20 TALKING backgammon for computers with Maplin Talkback and 8K expansion cassette £6.50 + £1 p&p. Mr. Hoare, 10, Snell Hatch, West Green, Crawley, SSX. Tel. 542823.
ATARI 825 + Atari word p.d., £350 ono. 825 4 months warranty left. All in perfect condition. Tel. 948-6654.
ACORN ATOM 12k ROM, 12k RAM, PSU, over £60 worth of books and cassettes. Absolutely perfect condition. Worth over £300, great bargain, at £150. Can answer anywhere. 0616812875.

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FOR SALE, Everyday Electronics Magazines, Volumes 1 to 8 inclusive, in binders. Offers. 24, Greenhill Rise, Carlton, Nottingham. 0602-611173.
OSCILLOSCOPE for sale, Gould Advance OS245A. Dual trace 10MHz with probes and accessories, as new, £180. Reason? I'm getting out of electronics. Phone Sheffield 396995.
DUAL BEAM oscilloscope for sale, working order, but needs little attention, old model, size 21 x 14 x 8 inches. Price £25 ono. Tel. 01-644 3833.
TRANSFORMERS, valves, three circuit diagrams, sae. for further particulars H. Heather, 375, Rayleigh Road, Thundesley, Benfleet SS7 35T.

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MAPLIN 5600S for sale, just over half completed, £350. Five circuit boards with some components not mounted in yet included. Write to D. Blomfield, 57, Silver Street, Norwich NR3 4TT.
MAPLIN 5600S synth complete and working but needs setting up. No time due to career commitments, so no reasonable offer refused. Phone Mark on Guyhirn (094 575) 360.
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5600S SYNTHESISER, only requires £50 of components to complete. All made PCBs working although not set up. Further details, offers to Karl Simpson, 5, Verbena Way, Worle, Weston Super Mare.

WANTED

WANTED CHANNEL "F" Videocart cartridges for use with Fairchild video entertainment system. Tel. Oxford 53483.
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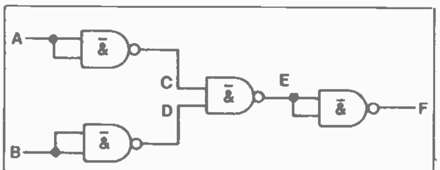
HORIZON RADIO control equipment, T. Beckett, The Poplars, Harringworth Road, Seaton, Oakham LE15 9HZ. Morcott 876.
WANTING two used five oct. keyboard with contacts, offer best price. A. K. Banerjee, Sebast Kneipp G 4/3/10, A1020 Vienna/Austria/Europe.
WANTED: 4600 synthesiser patchboard. Tel. David 01-385 0182.
PHILIP TYPE EL3514/15 tape recorder, manual or circuit, required. Box No 4.

FIRST BASE continued from page 49



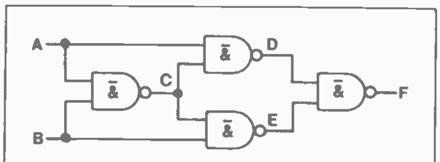
Truth Table

A	B	C	D	E	F
0	0	1	1	0	1
0	1	1	0	1	0
1	0	0	1	1	0
1	1	0	0	1	0

Figure 10.
Two input NOR gate using four NAND gates.

NAND gate you can find the value of the inputs to the third gate, C and D. Continuing this process gives the input to the fourth gate, E, and finally the output F. Repeating this procedure for the other combinations of logical inputs will give the rest of the Truth Table.

Figure 11 shows another logic array using NAND gates, but it is left to you to work out the relevant Truth Table. You should obtain that for an important logic gate which has not been mentioned yet, and which can be obtained in a single package, and the solution will be given in the next article.



Derive the Truth Table for this array of NAND gates.

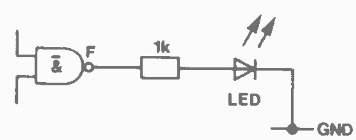
Figure 11. NAND gate array.

A Practical Solution

No doubt some of you are thinking that this is a rather theoretical approach to the problem, and would prefer a practical solution which actually involves using chips. This is the next stage in our progression along the way.

Those who are unfamiliar with making up circuits using these types of component may welcome a few guide-lines. First and foremost you will need something on which you can mount the integrated circuit package and make connections to the various pins. It is possible to solder fine wires directly to the pins, but the chips are not going to last very long this way and it is definitely not to be recommended. The most suitable method is to use one of specially made 'breadboards', such as those shown on page 200 and 201 of the Maplin catalogue. These may seem rather expensive just for messing about with a couple of chips, but if you intend studying this aspect of the subject further then they are a very good investment for the future. As a practical exercise try making up the circuit shown in figure 11; first copy out the diagram and add the pin numbers, taken from the illustration of the 7400 in figure 8. Next make the connections between inputs and outputs using fine wire, solid core bell wire of 0.6mm diameter is ideal for this. Don't forget the connections to +5V for Vcc and 0V for GND. The inputs A and B in the diagram can be connected to +5V for logic 1, or 0V for logic 0; if you leave them 'floating', that is not connected to either logic 1 or 0, the inputs of these devices will tend to float high, ie assume a value of logic 1. To find out what the logic level of the output F is for the various combinations of input there are several methods which may be used. If you possess a simple voltmeter capable of indicating around five volts or slightly more, then use that, remembering that +5V represents logic 1. Alternatively, a small Light Emitting Diode, LED is very useful, and these will be used in some of the later circuits. To indicate a logic 1 when lit, the LED should be connected to the output as shown in figure 12; a value of 1k is given for the resistor to limit the current taken to a safe level. The LED may seem rather dim, especially if viewed in bright light, but the temptation to reduce the value of the resistor to make the LED brighter should be avoided. For the same reason, low voltage bulbs should not be used as these take more current than the chip can safely supply, and you may find that you have cooked your chips!

Next time we will have a look at further combinational logic circuits and how they are used in practical situations.



The series resistor is used to limit the current through the LED

Figure 12. LED connection.

AMENDMENTS TO CATALOGUE

Please amend your 1983 catalogue as follows:

Page 25
The Aerial Rotator (XB54J) is not supplied with cable. Use 4-core mains (XR48C). Make no connections to terminal 2 of the controller. The wire from terminal 3 of the controller must be connected to terminals 2 and 3 at the rotator.

Page 66
The Snap-Together Plastic Boxes (YK48C, YK49D, YK50E, YK51F) dimensions stated are all internal.

Page 67
The foot-operated switch box (LH09K) is no longer supplied with any cut-outs, and the aluminium cover does not have a hole punched into it.

Page 74
Laminate Aluminium large (XY20W) size is now 482 x 190mm (19 x 7½in).

Page 89
The sub-miniature single-ended electrolytic capacitor YY35Q is now only 35V working, not 40V as stated.

Page 91
The 4700uF 63V can-type electrolytic (FF28F) max. ripple current should be 5A.
The 4700uF 100V can-type electrolytic (FF29G) max. ripple current should be 6.4A.
The 6800uF 40V can-type electrolytic (FF30H) max. ripple current should be 6.8A.
The 10,000uF 25V can-type electrolytic (FF31J) max. ripple current should be 7.2A.
The 10,000uF 63V can-type electrolytic (FF32K) max. ripple current should be 8.4A.

Page 99
The picture of the 2m Rubber Duck (YG15R) shows a UHF plug, but the item is supplied with a BNC plug as stated in the text.

Page 104
The Atari 400 (AF36P and AF37S) sound generators can only be 'piped' to a TV speaker. There is no DIN socket available for connection to an amplifier.

Page 122
BC44X (Computavoice) is a cassette, and BC36P (Cave Hunter) and BC38R (Starship Chameleon) are both cartridges.

Page 200
The Verowire contained in the kit RK94C and sold separately as HY17T is 30swg, not 38swg as stated.

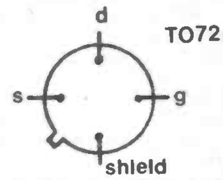
Page 251
The door contact reed relay switch (YW46A) is now a slightly smaller size. Flange dimensions are 12mm dia. x 0.75mm thick, and main body dimensions are 27.5mm x 8mm dia. This switch is no longer supplied with fixing pins.

Page 257
The Sharp stylus STY117 is the same as our stylus HR97F (Stylus Sanyo 2611), not BK08J as shown in our stylus guide.

Page 259
The High Quality Cassette Head Cleaner (BK28F) is now being supplied with a tape head cleaning stick and a 30cc bottle of tape head and capstan cleaning fluid.

Page 269
QB65V is now supplied as a BC303/5, not a BC302/5. The matched pair of transistors QB64U are now supplied as one BC301/5 and one BC303/5.

Page 278
The pin-out shown for transistor case type TO72g is incorrect. Drain and source are reversed in the catalogue diagram. Shown below is the correct pin-out. This affects the FET 2N3823 (QR37S).



Page 286
The IC 74LS244 (QQ56L) pinout is shown incorrectly. Pin 19 should be shown as inverted.

Page 331
The 2732 EPROM (QQ08J) programming is achieved by applying +25V to pin 20 and +5V to pin 18, not pins 20 and 21 as stated.

Page 341
The mono headset (WF20W) is now terminated in a mono ¼in jack plug, not a 3.5mm jack plug as stated.

Page 374
The utility knife (FY02C) is shown incorrectly in the picture. This knife is NOT retractable.

Page 384
The overall size of the sub-miniature mains transformers (WB00A, WB01B and WB02C) is now 30 x 27 x 35mm, and fixing centres are 46mm.

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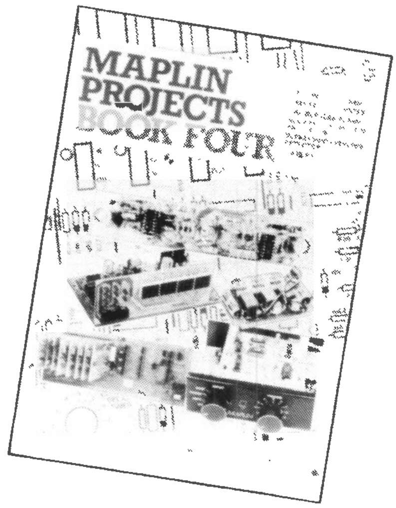
DID YOU MISS THESE ISSUES?

Copies of issue 4 are now sold out, but a reprint of the projects from issue 4 is available and contains:



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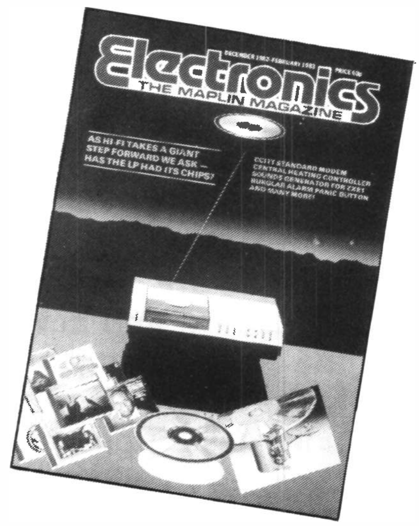

Modem. With this low-cost, high quality modem, transmission speeds of 300 baud are obtainable over ordinary telephone lines. Send data to your friends anywhere in Europe, or talk to our computer.

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