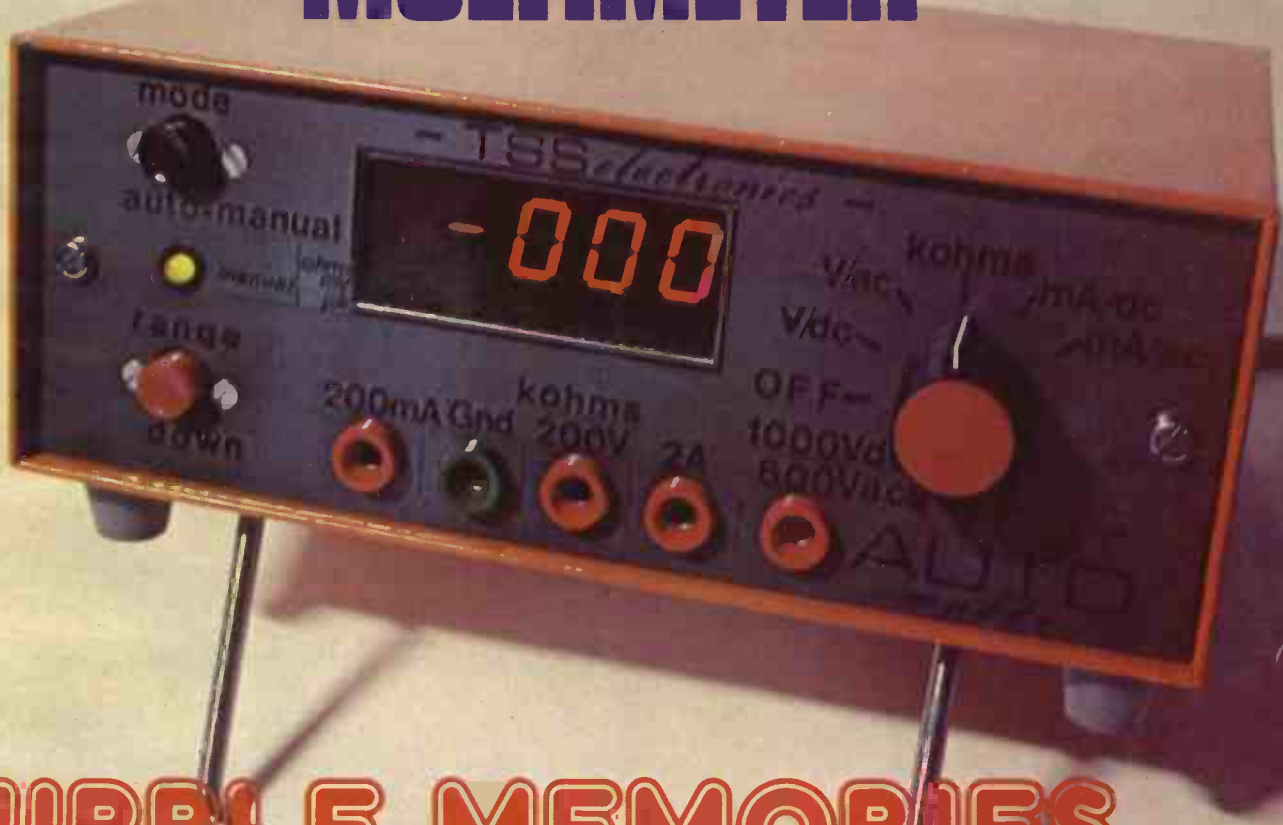
Australia 95c New Zealand 95c South Africa 90c Malaysia $2.75

PRACTICAL ELECTRONICS

APRIL 1979 50p

AUTORANGING MULTIMETER



BUBBLE MEMORIES...

Technology Update

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PET COSTS LESS AT COMP and it's a pedigree

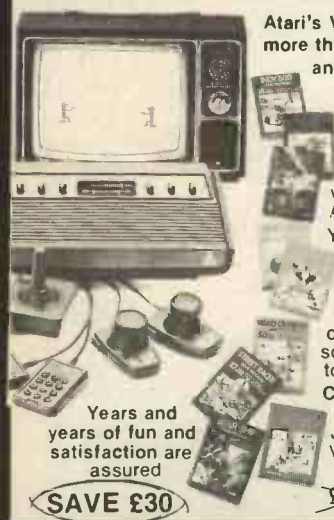
RRP £695

The No. 1 Personal Computer in the U.K.

Affordable **£590** SAVE £100

for the first time user and the professional check out the PET, the world's most popular personal computer.

THE ATARI video computer system



Atari's Video Computer System now offers more than 1300 different game variations and options in twenty great Game Program™ cartridges!

Have fun while you sharpen your mental and physical coordination. You can play rousing, challenging, sophisticated video games, the games that made Atari famous.

You'll have thrill after thrill, whether you're in the thick of a dogfight, screeching around a racetrack, or dodging asteroids in an alien galaxy. With crisp bright color (on color TV) and incredible, true-to-life sound effects. With special circuits to protect your TV.

Cartridges now available

Basic Maths, Airsea Battle, Black Jack, Breakout, Surround, Spacewar, Video Olympics, Outlaw, Basketball.

All at £13.90 each.

Years and years of fun and satisfaction are assured

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TELEPLAY have produced a product of cartridge games for you and all your family that will not go out of date. Just ADD each new cartridge as it becomes available and your colour video centre will be up to date the Teleplay way. You will save pounds in the long run. Works OK on Black and White TV

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REALISTIC SOUND EFFECTS

We offer all this to you for ONLY **£24·90** Fully Assembled ~~£35·90~~

The Teleplay consists of a Professional Finished Insect Moulded Box Joystick Hand Controls one cartridge which consists of 10 games Football Tennis Solo Squash 1 1 & 2 players! Hockey Basketball 1 1 & 2 players! Shoot etc Mains Adaptor TELEPLAY GIVES YOU TWICE THE FUN BUILDING AND PLAYING THE MOST PROFESSIONAL TV GAME KIT EVER OFFERED

SAVE £10

Main Console has 3 Facility Handicapping Switches

Every 3 months a NEW game will become available to you and those already under production include Submarines Space War Wipe Out and many more. The price of these will vary from £12 to £19 depending upon the complexity of the game

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Cartridges come complete with printed card and easy to follow instructions

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All parts fully guaranteed

THE EXIDY SORCERER.

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SORCERER COMPUTER SYSTEM

CPM NOW

The Sorcerer Computer is a completely assembled and tested computer system. Standard configuration includes 63-key typewriter-style keyboard and 16-key numeric pad, Z80 processor, dual cassette I/O with remote computer control at 300 and 1200 baud data rates, RS232 serial I/O for communications, parallel port for direct Centronics printer attachment, 4K ROM operating system, 8K ROM Microsoft BASIC in Rom Pac™ cartridge, composite video of 64 char/line 30 line/screen, 128 upper/lower case ASCII set and 128 user-defined graphic symbols, operation manual, BASIC programming manual and cassette/video cables, connection for S-100 bus expansion.

LOOK!

- 32K RAM on board
- RS232 interface
- 8K BASIC ROM
- CUTS interface
- 4K MONITOR
- KANSAS CITY interface
- S100 BUS
- User defined graphic symbols
- Z80 cpu

16K ~~£860~~ £751* 32K ~~£950~~ £850* Credit facilities available. * + VAT

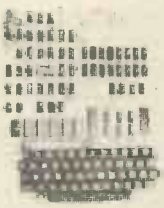
SHORT C12 CASSETTES

FOR COMPUTER PROGRAMMES

10 for £4.00

OHIO SUPERBOARD II *NEW*

For electronic buffs. Fully assembled and tested. Requires + 5V at 3 Amps and a video monitor or TV with RF converter to be up and running.



STANDARD FEATURES

Uses the ultra powerful 6502 microprocessor
8K Microsoft BASIC-in-ROM
Full feature BASIC runs faster than currently available personal computers and all 8080-based business computers.
4K static RAM on board expandable to 8K
Full 53-keyboard with upper/lower case and user programmability
Kansas City standard audio cassette interface for high reliability
Full machine code monitor and I/O utilities in ROM

Direct access video display has 1K of dedicated memory (besides 4K user memory), features upper case, lower case, graphics and gaming characters for an effective screen resolution of up to 256 by 256 points. Normal TV's with overscan display about 24 rows of 24 characters; without overscan up to 30 x 30 characters.

EXTRAS

Available expander board features 24K static RAM (additional), dual mini-floppy interface, port adapter for printer and modem and an OSI 48 line expansion interface.

Assembler/editor and extended machine code monitor available.

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ELECTRONICS

VOLUME 15 No. 4 APRIL 1979

CONSTRUCTIONAL PROJECTS

GENERAL FEATURES

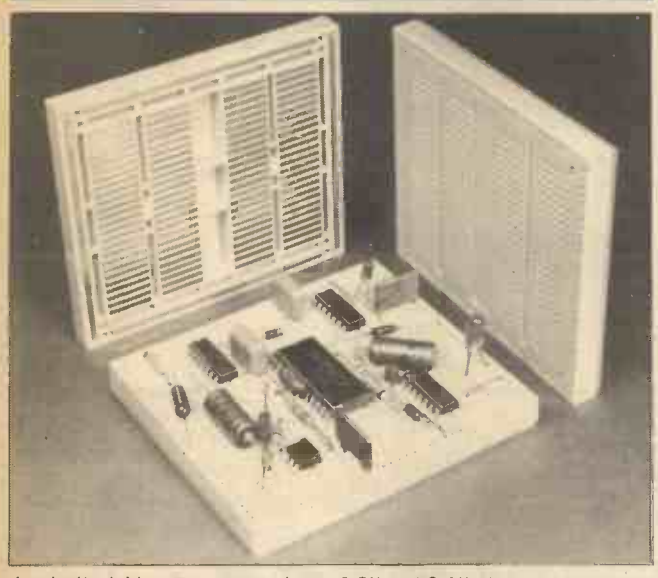
NEWS AND COMMENT

OUR MAY ISSUE WILL BE ON SALE THURSDAY, 12 APRIL 1979

(for details of contents see page 55)

ANNOUNCING

THE NEW EUROBREADBOARD



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A new development for more efficient tracking and adjustment, and more attractive appearance, the new lightweight metal head shell is perfectly interchangeable for existing SAU2, BD2 and BD103 pick up arms.

Connoisseur

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Telephone: Brighouse (0484) 712142, Telex: 517144 Sugden G
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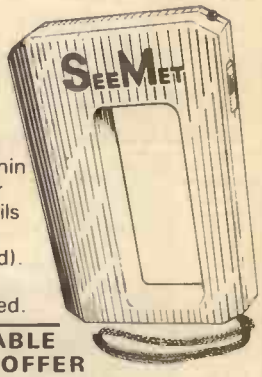
AT LAST! SEEMET

THE FAMOUS POCKETSIZE METAL DETECTOR

AVAILABLE IN KIT FORM



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Viscount IV unit in teak simulate cabinet. Silver finish rotary controls and pushbuttons with matching fascia, red mains indicator and stereo jack socket. Functions switch for mic. magnetic and crystal pickups, tape tuner and auxiliary. Rear panel features two mains outlets DIN speaker and input sockets plus fuse 20x20 watts RMS 40x40 watts peak. For use with 8 to 15 ohm speakers.

£29.90 £2.50 p&p

SPECIAL OFFER

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FREE 4 dimensional stereo sound adaptor, when purchasing the 20x20 Viscount amplifier.

30x30 WATT AMPLIFIER IN KIT FORM

For the experienced constructor complete in every detail, same facilities as Viscount IV, but with 30x30 output. 60x60 watts peak. For use with 4.15 ohms speakers.

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30x30 WATT AMPLIFIER IN KIT WITH SPEAKERS

2 Goodman compact 12" bass woofers with cropped size 14,000 Gauss magnet. 30 watt RMS handling + 3¼" approx tweeters and crossovers.

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Suitable power supply parts including mains transformer, rectifier, smoothing capacitors.

£1.00 p+p **£1.95**

Recommended set of rotary stereo controls comprising BASS, TREBLE, VOLUME and BALANCE

p+p 50p **95p**

EMI SPEAKER BARGAIN

Stereo pair 350 kit. System consists of 13" x 8" approx. woofer with rolled surround, 2½" approx. Audax tweeter, crossover components and circuit diagram. Frequency response 20 Hz to 20 KHz. Power handling 15 watts RMS. 20 watts max. 8 ohm impedance.

£14.95

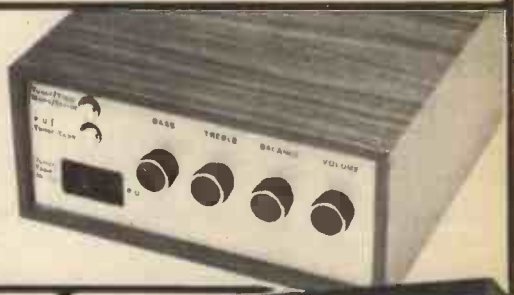
Per stereo pair
+ £3.40 p&p.

BSR P200

Belt drive chassis turntable unit semi automatic, cueing device. **£24.95** p&p £2.55

A.D.C. QLM 30 Mk III Magnetic Cartridge to suit. **£7.75**

10 + 10 AMPLIFIER KIT



An opportunity to buy a 10 watts per channel stereo amplifier kit which is suitable for use with a ceramic cartridge. The amplifier utilises proven Mullard modules and is available at a very competitive price. The amplifier kit comes complete with instructions and includes: a Mullard LP1183 stereo preamplifier module, two LP1173 power amplifiers with integral heatsinks, a power supply, Zobel networks, front and back mounting panels, a finished fascia panel, all control potentiometers (bass, treble, volume and balance), switches, input, output and headphone sockets, wire, and an easily assembled wrap around cabinet to house the finished unit.

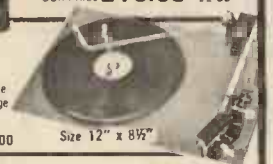
p&p £2.05 **£11.95**

BSR

Manual single play record deck with auto-return and cueing lever, fitted with stereo ceramic cartridge 2 speeds with 45 r p m spindle adaptor ideally suited from home or disco use

OUR PRICE **£10.95** p&p £2.55

GARRARD DECK MODEL CC 10A



Record changer with cueing device fitted with stereo ceramic cartridge ready to fit into your own plinth.

£7.95 p&p £2.00

Size 12" x 8½"

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MULLARD Built power supply **£1.50**

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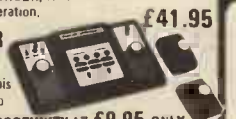
'VIDEOMASTER' Super Score TV Game with pistol mains operation **£14.95**

PORTABLE RADIO/CASSETTE RECORDER, AM/FM with clock LW, MW, SW, VHF mains/battery operation. **£41.95**

VIDEOMASTER COLOUR SHOT TV GAME



Choice of three games—Football, Tennis and Squash. Ready to play—one or two players. MAINS OPERATED.

OPPORTUNITY AT **£9.95** ONLY

50 WATT MONO DISCO AMP

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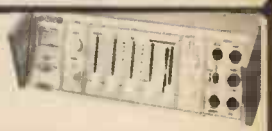
P&P £2.50

Size approx. 13⅜" x 5¼" x 6¾"

50 watts rms. 100 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

SPECIAL OFFER. The above 50 watt amp plus 4 Goodmans Type 8P, 8" speakers. Package price £45.00 + £4.00 P&P.

70 & 100 WATT MONO DISCO AMP



Size approx.
14" x 4" x 10¼".
Brushed aluminium fascia and rotary controls.
Five vertical slide controls, master volume, tape level, mic level, deck level, PLUS INTER DECK FADER for perfect graduated change from record deck No 1 to No. 2, or vice versa. Pre fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level. Output 100 watts RMS 200 watts peak.

70 watt		
140 watt peak		**£57**
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Power Output 5 watts per channel Sine at 2% THD into 15 Ohm 7 watts speech and music.

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240 Volts AC Complete with tuning dial Circuit diagram.

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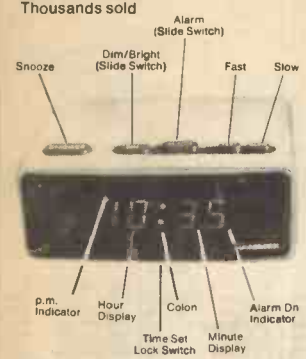

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- ★ Hour/minute display
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Weight 1.43 lbs (0.65 kg).

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11 FUNCTION SLIM CHRONO
6 digit 11 functions

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- ★ Can be switched and dimmed from many locations using TDE/K kit making 2-way switching easy.

★★ PRICE TD300K **£9.67**
TDE/K **£1.62**

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Based on the 7106 single IC 3½ digit D.V.M. the Kit contains a PCB, resistors, capacitors, presets, I.C. and 0.5" liquid crystal display. Components are also included to enable the basic D.V.M. kit to be modified to a Digital Thermometer using a single transistor as the sensor. Requires a 2mA 9V supply (PP3 battery).

ONLY £23.75

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3A	64p
6.5A with trigger	86p
8A	80p
12A	90p
16A	113p
20A	178p
25A	205p
SCR (C106D) 5A/400V	54p
Diac	23p

COMPONENTS

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Red 13p (10 for £1.08)	
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AY-5-1230	£5.23
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Standard 240V mains primary
100mA secondary

6–0–6V	92p
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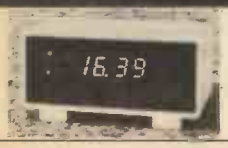
12–0–12V	102p

24HR CLOCK/APPLIANCE TIMER KIT



Switches any appliance of up to 1KW on and off at preset times once a day. KIT contains: AY–5–1230 Clock/Appliance Timer IC, 0.5" LED display, mains supply, display drivers, switches, LEDs, triac, complete with PCBs and full instructions. **£16.09**
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Ready built **£24.30**

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Ideal for the DIY enthusiast building up a complete disco system. 4/6 ch. mono, inc. LED indicators, connections via phono sockets at rear. Bargain price, including PSU

£80.46 (P & P £1.50).

PIEZO HORNS

FANTASTIC SPECIAL OFFER TO READERS OF THIS PUBLICATION

Tweeters for your disco, PA system or Hi-Fi. Frequency range 5K-20K. No X over required. They can be used in any PA system up to 100W. Why pay more?

OUR PRICE ONLY **£4.99** each (P&P 35p each)

BULGIN OCTAL PLUGS AND SOCKETS

There's always hundreds of Bulgin Octal multiway plugs and sockets in stock at Roger Squire's. Each pin rated 6A. Perfect for your Sound to Light System P552 SOCKET **£0.65** (P&P 35p) P551 PLUG **£1.84** (P&P 35p)

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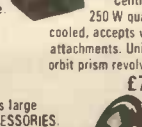
PROJECTORS SQUIRE MULTIFECT 150

— including rotator and effects wheel. A truly versatile projector which uses a powerful 150W Tungsten bulb, all effects attachments simply slot in ready for use.

A BARGAIN AT £40.50 (P&P £1.00)

STARLITE 250



An exclusive new line to Roger Squire's Disco Centres. Superb high powered 250 W quartz halogen bulb, fan cooled, accepts wide range of multifect attachments. Unique connection slot for orbit prism revolvers. Only

£70.20 (P & P £2.00) attachments extra

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All Roger Squire's shops have a service department which carries large stocks of DISCO SPARES & ACCESSORIES. For example: Fane and H. H Disco Speakers 12" and 15" BSR and Garrard decks at discount prices.

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BRISTOL: 125 Church Road, Redfield, Bristol BS5 9JR 0272 -550550
MANCHESTER: 251 Deansgate M3 4EN 061-831 7676
GLASGOW: 1 Queen Margaret Road off Queen Margaret Drive, Kelvinside, Glasgow. G20 6DP 041-946 3303

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ALL DEVICES BRAND NEW, FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/ P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS' OFFICIAL ORDERS ACCEPTED. TRADE AND EXPORT INQUIRY WELCOME. P&P ADD 30p* TO ALL ORDERS UNDER £10.00. OVERSEAS ORDERS POSTAGE AT COST. AIR/SURFACE.

SEND 50p (plus 25p p&p) FOR OUR CATALOGUE

VAT Export orders no VAT. Applicable to U.K. Customers only. Unless stated otherwise, all prices are exclusive of VAT. Please add 8% to devices marked ★. To the rest add 12½%.

We stock many more items. It pays to visit us. We are situated behind Watford Football Ground. Nearest Underground/BR Station: Watford High Street. Open Monday to Saturday 9.00 am – 6.00 pm. Ample Free Car Parking space available.

POLYESTER CAPACITORS: Axial lead type. (Values are in µF)
400V: 0.001, 0.0015, 0.0022, 0.0033 7p; 0.0047, 0.0068, 0.01, 0.015, 0.018 9p; 0.022, 0.033, 10p; 0.047, 0.068 14p; 0.10 15p; 0.15, 0.22 22p; 0.33, 0.47 39p; 0.68 45p.
160V: 0.39, 0.15, 0.22 11p; 0.33, 0.47 19p; 0.68, 1.0 22p; 1.5 29p; 2.2 32p.
DUBILIER: 1000V: 0.01, 0.015 20p; 0.022 22p; 0.047 26p; 0.1 38p; 0.47 48p.

POLYESTER RADIAL LEAD (Values are in µF) 250V:
0-01, 0-015, 0-022, 0-027 5p; 0-033, 0-047, 0-068, 0-1 7p; 0-15 11p; 0-22, 0-33 13p; 0-47 15p; 0-68 18p; 1-0 24p; 1-5 27p; 2-2 31p.

FEED THROUGH CAPACITORS
100µF 350V 8p

ELECTROLYTIC CAPACITORS: Axial lead type (Values are in µF) 500V: 10 40p; 47 68p; 250V: 100 65p; 63V: 0.47, 1.0, 1.5, 2.2, 3.3, 4.7, 6.8, 8, 10, 15, 22 8p; 47, 32, 50 11p; 63, 100 27p; 50V: 50 11p; 100, 220 25p; 470 32p; 1000 50p; 40V: 22, 33 8p; 100 12p; 2200, 3300 68p; 4700 85p; 35V: 10, 33 9p; 330, 470 32p; 1000 49p; 25V: 10, 22, 47 6p; 80, 100, 160 8p; 220, 250 13p; 470, 640 25p; 1000 27p; 1500 30p; 2200 45p; 3300 62p; 4700 68p; 16V: 10, 47, 68 7p; 100, 125 8p; 330 14p; 470 16p; 1000, 1500 20p; 2200 34p; 10V: 4, 100 6p; 640 10p; 1000 14p.
Tag-End 70V: 2000 89p; 4700 135p; 50V: 10,000 255p; 40V: 2500 65p; 3300, 4700 70p; 15,000 450p; 25V: 4700 68p; 2200 48p; 325V: 200 + 100 + 50 + 100 190p; 32 + 32 175p.

TANTALUM BEAD CAPACITORS
35V: 0.1µF, 0.22, 0.33, 0.47, 0.68, 1.0, 2.2µF, 3.3, 4.7, 6.8; 25V: 1.5, 10; 20V: 1.5; 16V: 10µF 13p each, 47, 100 40p; 10V: 22µF, 33; 6V: 47, 68, 100; 3V: 68, 100µF 20p each.

MYLAR FILM CAPACITORS
100V: 0.001, 0.002, 0.005, 0.01µF 6p
0.015, 0.02, 0.04, 0.05, 0.056µF 7p
0.01µF; 0.2 9p 50V: 0.47µF 11p

CERAMIC CAPACITORS: 50V
0.6pF to 10nF 3p each
15nF, 22nF, 33nF, 47nF 4p each
0.1µF 6p; 0.2µF 7p

POLYSTYRENE CAPACITORS
10pF to 1nF 8p; 1.5nF to 47nF 10p.

SILVER MICA (Values in pF) 3-3, 4-7, 6-8, 10, 12, 18, 22, 33, 47, 50, 68, 75, 82, 85, 100, 120, 150, 220, 250 9p ea
300, 330, 360, 390, 600, 820 18p ea
1000, 1200, 1800, 2000, 2200 20p ea.

MINIATURE TYPE TRIMMERS
2·5-6pF 3 10pF 10-40pF 22p
5 25pF 5-45pF 60pF, 88pF 30p

COMPRESSION TRIMMERS
3-40pF, 10-80pF, 25-190pF 25p
100-500pF 45p; 1250pF 60p

SOLDERCON PINS* 100 pins 50p; 1000 pins 395p

POTENTIOMETERS (AB or EGEN)
Carbon Track. ¼W Log & ⅓W Linear values
5000, 1K & 2K (lin only). Single 27p
5KΩ-2MΩ single gang 27p
5KΩ-2MΩ single gang D/P switch 60p
5KΩ-2MΩ dual gang stereo 70p

SLIDER POTENTIOMETERS
0-25W log and linear values 60mm
5KΩ-500KΩ single gang 70p
10KΩ-500KΩ dual gang 80p
Self Stick Graduated Bezels 22p

PRESET POTENTIOMETERS
Vertical & Horizontal
0·1W 500Ω—5MΩ Miniature 8p
0·25W 100Ω—3·3MΩ Horiz 10p
0·25W 200Ω—4·7MΩ Vert 10p

RESISTORS – Erie make 5% Carbon Miniature High Stability. Low noise

RANGE	VAL	1-99	100+
¼W 2·2Ω-4·7M	E24	1.5p	1p
½W 2·2Ω-4·7M	E12	2p	1.5p
1W 2·2Ω-10M	E12	5p	4p
2% Metal Film 10Ω-1MΩ		6p	4p
1% Metal Film 51Ω-1M		10p	8p

100 - price applies to Resistors of each type not mixed values.

RADIO 4 on MW
LW-MW Converter. Complete kit of parts incl. assembly instructions £4.50 only.

OPTO ELECTRONICS★
LEDs plus clip

TIL209 Red	13
TIL211 Grn	17
TIL2 12 Yellow	18
·2" Red	15
2" Yellow Green	18
Spare Clips	2
ORP12	63
2N5777	45
7 Seg Displays	
LS400	255
TIL307	675
TIL312 C An 3"	105
TIL313 C Cth 3"	105
TIL321 C An 5"	115
TIL322 C Cth 5"	115
DI704 C Cth .3"	99
DL707 C.A. .3"	99
DL747 C.A. .6"	180
FND357	120
MAN3640	175
LC0 3½ digit	875

SWITCHES★
TOGGLE 2A 250V

SPST	28p
DPDT	38p
4 pole on/off	54p

SUB-MIN TOGGLE

SP changeover	59p
SPST on/off	54p
DPDT 6 tags	70p
DPDT Centre off	79p
DPDT Biased	115p

SLIDE 250V:

1A DPDT	14p
1A DP C/off	15p
½A DPDT	13p
4 pole c/over	24p

PUSH BUTTON
Spring loaded

SPST on/off	65p
SPDT c/over	70p
DPDT 6 Tag	85p

SWITCHES ★ Miniature Non-Locking
Push to Make 15p Push to Break 25p
ROCKER (white) 10A 250V
SP changeover centre off 30p
ROCKER: (black) on/off 10A 250V 23p
ROCKER: Illuminated (white)
Lights when on: 3A 240V 52p
ROTARY: (ADJUSTABLE STOP) 1 pole/2-12 way 2p/2-6W 3p/2-4W 4p/2-3W 41p
ROTARY: Mains 250V AC, 4 Amp 45p

DIL SOCKETS ★ (Low Profile – Texas)
8 pin 10p; 14 pin 12p; 16 pin 13p; 18 pin 20p; 20 pin 27p; 24 pin 30p; 28 pin 42p; 40 pin 55p.

JACK PLUGS

	Screened chrome	Plastic body
2·5mm	13p	10p
3·5mm	15p	10p
MONO	25p	14p
STEREO	32p	18p

SOCKETS

	open metal	moulded with break contacts	in line couplers
	8p		11p
	8p		12p
	13p	20p	18p
	15p	24p	22p

DIN	PLUGS	SOCKETS	In Line
2 PIN Loudspeaker	10p	6p	20p
3, 4, 5 Pin Audio	13p	10p	20p
Co-axial (plastic)	10p	12p	12p
(metal)	18p	18p	22p
PHONO			
assorted colours	10p	6p single 8p double	15p
Metal Screened	15p	15p 4-way	20p
BANANA 4mm	11p	12p	—
2mm	10p	10p	—
1mm	8p	6p	—
WANDER 3mm	8p	6p	—

TTL 74★

7400	13	7494	78	74194	98	4056	134
7401	13	7495	65	74195	98	4057	1999
7402	14	7496	57	74196	93	4059	480
7403	14	7497	189	74197	80	4060	115
7404	14	74100	119	74198	150	4061	1425
7405	18	74105	62	75150	175	4062	999
7406	38	74107	29	75491	92	4063	110
7407	38	74109	54	75492	92	4066	58
7408	17	74110	54			4067	380
7409	17	74111	68			4068	22
7410	15	74112	125			40698E	20
7411	20	74116	198				
7412	17	74118	83				
7413	30	74119	149				
7414	51	74120	115				
7416	30	74121	25				
7417	30	74122	46				
7420	16	74123	48				
7421	29	74125	38				
7422	24	74126	57				
7423	27	74128	74				
7425	27	74132	73				
7426	36	74136	65				
7427	27	74141	56				
7428	35	74142	209				
7430	17	74143	314				
7432	25	74144	314				
7433	40	74145	65				
7437	30	74147	175				
7438	33	74148	109				
7440	17	74150	99				
7441	74	74151	64				
7442	68	74153	64				
7443	115	74154	96				
7444	112	74155	80				
7445	94	74156	67				
7446	94	74159	185				
7447	94	74160	82				
7448	92	74161	92				
7450	51	74162	92				
7451	17	74163	92				
7453	17	74164	105				
7454	17	74165	105				
7460	17	74166	140				
7470	28	74167	200				
7472	25	74170	185				
7473	32	74172	625				
7474	27	74173	120				
7475	38	74174	87				
7476	36	74175	75				
7480	48	74176	75				
7481	86	74177	78				
7482	69	74178	153				
7483	72	74180	85				
7484	95	74181	165				
7485	106	74182	88				
7486	31	74184	135				
7489	210	74185	135				
7490	33	74188	275				
7491	75	74190	95				
7492	38	74191	95				
7493	32	74192	98				
		74193	98				

CMOS★

4000	15
4001	17
4002	16
4006	92
4007	18
4008	82
4009	38
4010	38
4011	18
4012	18
4013	45
4014	80
4015	82
4016	45
4017	82
4018	87
4019	48
4020	99
4021	95
4022	85
4023	22
4024	66
4025	19
4026	180
4027	45
4028	81
4029	99
4030	58
4031	205
4032	100
4033	145
4034	116
4035	111
4036	325
4037	100
4038	108
4039	320
4040	105
4041	80
4042	75
4043	94
4044	95
4045	145
4046	128
4047	87
4048	58
4049	48
4050	48
4051	72
4052	72
4053	72
4054	110
4055	128

LINEAR IC'S

702★	75
709C 14 pin	35
710★	67
723★	45
733★	125
741C★ 8 pin	22
747C★	78
748C★	36
753★	150
810★	159
AY-1-0212	580
AY-1-1313★	315
AY-1-1320	315
AY-1-5050	180
AY-1-5051	195
AY-1-6721/6	195
AY-3-8500★	385
AY-5-1224A★	260
AY-5-1230★	450
AY-5-1315	560
AY-5-1317A	630
CA3011★	82
CA3020	170
CA3023	170
CA3028A★	80
CA3035	240
CA3036★	110
CA3043	190
CA3046★	71
CA3048	200
CA3075	175
CA3080E★	80
CA3081	190
CA3089E	210
CA3090AQ	398
CA3123E	200
CA3130★	85
CA3140★	80
ICL7106★	975
ICL7106E★	795
ICL8038★	340
ICM7205★	1150
ICM7215★	1025
ICM7217★	775
LD130★	452
LF356★	98
LM301A	30
LM304	240
LM308★	95
LM318	195
LM324★	68
LM339★	60
LM348★	90
LM379★	375
LM380	90
LM381N	145
LM382	122
LM1458★	58
LM3900★	60
LM3909N★	70
LM3911★	125
M252AA★	750
M253AA★	795

MC724★	175
MC1303	88
MC1304P	260
MC1310	149
MC1312P	195
MC1495★	390
MC1496★	92
MC1710★	79
MC3401	52
MC3403★	135
MC3340P★	120
MC3360P	120
MFC6040★	97
MK50398★	635
MK50362★	650
MM5303★	635
MM57160★	620
NE518A★	210
NE555★	29
NE556D8★	60
NE560★	325
NE561★	395
NE562★	410
NE565A★	120
NE566★	160
NE567★	170
NE570★	420
NE571★	450
RC4136D★	120
SAD1024A★	1250
SG3402	295
SN76003N	170
SN76013N	140
SN76023N	140
SN76033N	175
SN76115N	215
SN76477★	225
SN76627	115
TAA621AX1	228
TAA960	300
TAD1008★	310
TBA120S	70
T8A540Q	220
TBA641BX11	250
TBA651	180
TBA800	90
T8A810S	95
TBA820	70
TDA1004★	290
TDA1008★	290
TDA1022★	595
TDA2020	320
TL061CP★	48
TL062CP★	125
TL064CN★	199
TL071CP★	76
TL081CP★	52
TL082CP★	96
TL084CP★	130
UAA170	198
ZN414	90
ZN424	135
ZN425E★	415
ZN1034E★	195

TRANSISTORS

AC117★	35	BC170	18	8F194	12	OC35★	130
AC125★	20	BC171	11	8F196	12	OC36★	130
AC126★	20	BC172	11	8F197	14	OC41★	148
AC127★	20	BC177★	18	8F198	18	OC42★	32
AC128★	20	BC178★	16	8F200★	30	OC43★	55
AC141★	24	BC179★	18	8F224A	18	OC44★	31
AC141K★	38	BC182	9	8F244	30	OC45★	28
AC142★	24	BC182L	11	8F256★	60	OC46★	28
AC142K★	38	BC183	9	8F257★	30	OC70★	28
AC176★	20	BC183L	11	8F258★	30	OC71★	28
AC187★	20	BC184	9	8F259★	30	OC72★	30
AC188★	20	BC184L	11	8F394	27	OC74★	40
ACY17★	35	BC186	21	8F594	40	OC75★	36
ACY18★	40	BC187★	28	8F595	38	OC76★	36
ACY19★	40	BC212	10	BFR39	25	OC77★	68
ACY20★	40	BC212L	11	BFR40	28	OC79★	76
ACY21★	35	BC213	11	BFR41	28	OC81★	28
ACY22★	40	BC213L	12	8FR79	28	OC82★	40
ACY28★	40	BC214	9	BFR80	28	OC83★	48
ACY39★	78	BC214L	13	BFR81	28	OC84★	44
ACY40★	48	BC3078	20	8FX29★	28	OC122★	48
ACY44★	39	BC308	20	8FX81★	45	OC123★	48
AD140★	68	BC328	15	BFX84★	26	OC139★	110
AD149★	70	BC338	12	8FX85★	28	OC140★	110
AD161★	42	BC441★	36	BFX86★	28	OC141★	110
AD162★	42	BC461★	36	BFX87★	28	OC170★	40
AF114★	30	BC477★	25	BFX88★	28	OC171★	40
AF115★	30	BC547	12	BFY18★	28	OC201★	75
AF116★	30	BC548	12	BFY50★	20	OC202★	95
AF117★	30	BC549C	13	BFY51★	20	OC203★	85
AF118★	55	BC557	13	BFY52★	20	OC204★	85
AF121★	48	BC559C	20	BFY71★	20	TIP29A	44
AF124★	55	BCY30★	57	BSX20★	18	TIP29C	60
AF125★	35	BCY34★	75	BSY65★	30	TIP30A	50
AF127★	35	BCY39★	80	BSY95A★	18	TIP30B	64
AF139★	35	BCY40★	78	BU105	140	TIP30C	65
AF178★	70	BCY43	85	BU205★	190	TIP31A★	50
AF180★	70	BCY58★	90	BU208★	225	TIP31B★	58
AF186★	50	BCY59★	90	E113	75	TIP31C★	66
AF239★	42	BCY70★	15	E176	115	TIP32A★	55
ASY26★	40	BCY71★	20	E421	96	TIP32B★	70
ASY27★	45	BCY72★	20	MD8001★	158	TIP32C★	75
BC107★	9	BCY78★	25	ME4102	10	TIP33A★	80
BC107B★	10	BD115★	65	ME6002	10	TIP33B★	100
BC108★	9	BD121★	78	MJ400★	90	TIP33C★	110
BC108B★	10	BD123★	98	MJ491★	160	TIP34A★	85
BC108C★	12	BD124★	115	MJ2955★	120	TIP34B★	110
BC109★	9	BD131★	45	MJE340★	54	TIP34C★	110
BC109B★	12	BD132★	45	MJE370★	58	TIP35A★	195
BC109C★	12	BD133★	43	MJE371★	60	TIP35C★	245
BC113	20	BD135★	38	MJE520★	65	TIP36A★	220
BC114	20	BD136★	37	MJE521★	74	TIP36C★	295
BC115	20	BD137★	36	MJE2955★	99	TIP41A★	66
BC116	9	BD138★	50	MJE3055★	70	TIP41B★	73
BC117	20	BD139★	40	MPF102	32	TIP42A★	72
BC118	20	BD140★	36	MPF103	36	TIP42B★	82
BC119★	28	BD142★	59	MPF104	36	TIP2955★	65
BC134	20	BD145★	198	MPF105	36	TIP3055★	52
BC135	20	BD222★	75	MPF106	50	TIS43	34
BC136	18	BD695A★	65	MPF107	50	TIS44	45
BC137	20	BD696A★	65	MPSA05★	25	TIS45	45
BC140★	35	BDY17★	195	MPSA06★	25	TIS46	45
BC142★	30	BDY60★	110	MPSA12	42	TIS47	50
BC143★	30	BDY61★	165	MPSA55	25	TIS48	50
BC147	7	BF115★	34	MPSA56	25	TIS50	47
BC148	7	BF154★	25	MPSA70	34	TIS60	52
BC149	8	BF167	30	MPSU02★	58	TIS62	52
BC153	27	BF173★	25	MPSU05	50	TIS74	47
BC154	27	BF177★	24	MPSU06	56	TIS90	20
BC157	10	BF178★	25	MPSU52★	65	TIS91	24
BC158	11	BF179★	30	MPSU55★	55	ZTX107	12
BC159	11	BF180★	35	MPSU56★	60	ZTX108	12
BC160	42	BF181★	35	MPU131★	39	ZTX109	14
BC167A	11	BF182★	35	OC25★	170	ZTX300	15
BC168C	12	BF183★	35	OC26★	170	ZTX301	15
BC169C	10	BF184★	38	OC28★	105	ZTX302	20
				OC29★	160	ZTX303	25
						ZTX304	24

ZTX311	17
ZTX314	24
ZTX326	30
ZTX341	20
ZTX500	15
ZTX501	15
ZTX502	19
ZTX503	15
ZTX504	25
ZTX531	25
ZTX550	25
2N526★	58
2N696★	35
2N697★	25
2N698★	44
2N699★	54
2N706A★	19
2N707★	39
2N708★	19
2N914★	32
2N916★	27
2N918★	40
2N920★	51
2N930★	18
2N961★	61
2N1131★	22
2N1132★	22
2N1302★	35
2N1303★	50
2N1304★	50
2N1305★	28
2N1306★	35
2N1307★	50
2N1308★	46
2N1613★	23
2N1670★	150
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2N2483★	28
2N2484★	25
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2N2894★	30
2N2904A★	22
2N2905A★	22
2N2906★	22
2N2907★	22
2N2907A★	22
2N2926G	10
2N3011★	24
2N3053★	20
2N3054★	55
2N3055★	55
2N3108	32
2N3121	40
2N3133	43
2N3135	33
2N3250	30
2N3252	38
2N3302	30
2N3442★	131
2N3563	20
2N3614★	269
2N3615★	135

2N3663	26
2N3702	11
2N3703	11
2N3704	11
2N3705	11
2N3706	11
2N3707	11
2N3708	11
2N3709	11
2N3710	16
2N3711	12
2N3715★	250
2N3772★	195
2N3773★	288
2N3819	22
2N3820	45
2N3823★	65
2N3824★	70
2N3866★	90
2N3903	20
2N3904	18
2N3905	18
2N3906	17
2N4037★	52
2N4058	17
2N4061	17
2N4064★	120
2N4236★	45
2N4289	20
2N4859	65
2N5135	42
2N5136	42
2N5138	20
2N5179★	30
2N5180★	38
2N5191★	70
2N5305★	40
2N5457	32
2N5458	32
2N5459	32
2N5485	35
2N5777★	45
2N6027	40
2N6109★	50
3N128★	112
3N140★	112
40311★	50
40313★	125
40316★	85
40317★	52
40324★	85
40326★	52
40327★	62
40347★	80
40348★	105
40360★	43
40361★	45
40362★	45
40407★	52
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74LS04	14	74LS76	40	74LS158	96	74LS247	190
74LS05	23	74LS78	40	74LS160	128	74LS248	190
74LS08	22	74LS83	115	74LS161	98	74LS249	190
74LS09	22	74LS85	118	74LS162	138	74LS251	134
74LS10	20	74LS86	43	74LS163	102	74LS253	142
74LS11	22	74LS90	38	74LS164	114	74LS257	110
74LS12	23	74LS91	104	74LS165	75	74LS258	110
74LS13	38	74LS92	89	74LS166	226	74LS259	160
74LS14	75	74LS93	89	74LS169	150	74LS261	450
74LS15	30	74LS95	116	74LS170	288	74LS266	52
74LS20	20	74LS96	116	74LS173	105	74LS273	244
74LS21	22	74LS107	44	74LS174	106	74LS275	250
74LS22	22	74LS109	55	74LS175	110	74LS279	66
74LS26	48	74LS112	55	74LS181	398	74LS280	250
74LS27	28	74LS113	50	74LS183	298	74LS283	192
74LS28	48	74LS114	50	74LS189		74LS290	128
74LS30	22	74LS122	70	74LS190	140	74LS293	128
74LS32	27	74LS123	70	74LS191	140	74LS295	185
74LS33	39	74LS124	180	74LS192	132	74LS298	68
74LS37	39	74LS125	60	74LS193	130	74LS299	468
74LS38	39	74LS126	60	74LS194	166	74LS300	175
74LS40	28	74LS132	95	74LS195	136	74LS302	175
74LS42	98	74LS136	55	74LS196	100	74LS323	468
74LS47	63	74LS138	85	74LS197	140	74LS324	240
74LS48	120	74LS139	85	74LS199		74LS325	290
74LS49	120	74LS145	108	74LS200	348	74LS326	294
74LS51	24	74LS147	170	74LS202	345	74LS327	286
74LS54	28	74LS148	173	74LS221	98	74LS346	185
74LS55	30	74LS151	96	74LS240	236	74LS347	48
				74LS241	231	74LS348	186
						74LS352	228

74LS353	228	74LS393	230
74LS365	65	74LS395	218
74LS366	65	74LS396	215
74LS367	65	74LS398	276
74LS368	66	74LS399	230
74LS373	180	74LS445	150
74LS375	160	74LS447	144
74LS374		74LS490	180
74LS377	212	74LS668	182
74LS378	184	74LS669	182
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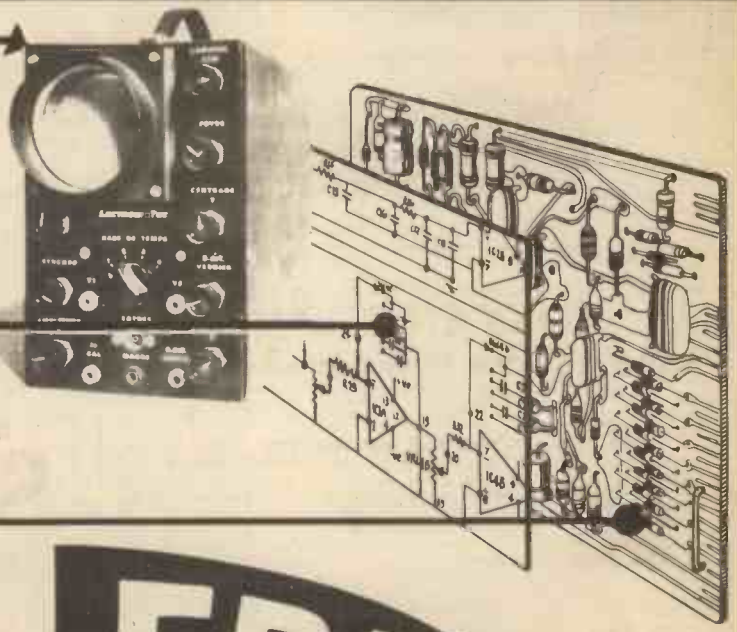

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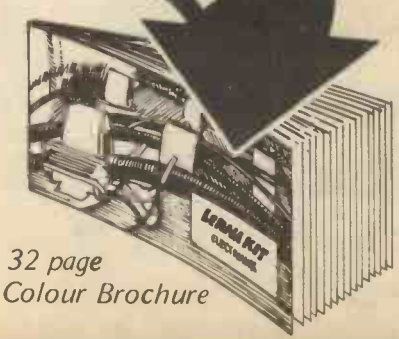

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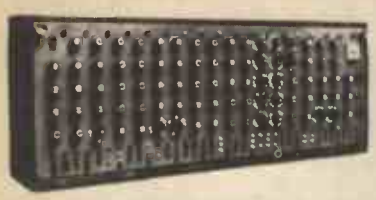

COMPONENTS SETS include all necessary resistors, capacitors, semiconductors, potentiometers and transformers. Hardware such as cases, sockets, knobs, keyboards, etc. are not included but most of these may be bought separately. Fuller details of kits, PCBs and parts are shown in our lists.

CIRCUIT AND LAYOUT DIAGRAMS are supplied free with all PCBs unless "as published".

PHOTOCOPIES of P.E. texts for most of the kits are available—prices in our lists.

PHONOSONICS

MAIL ORDER SUPPLIERS OF QUALITY PRINTED CIRCUIT BOARDS, KITS AND COMPONENTS TO A WORLD-WIDE MARKET.

P.E. MINISONIC Mk. 2 SYNTHESISER
A portable mains-operated Miniature Sound Synthesiser, with keyboard circuits. Although having slightly fewer facilities than the large P.E Synthesiser the functions offered by this design give it great scope and versatility. Consists of 2 log VCOs. VCF. 2 envelope shapers, 2 voltage controlled amps. keyboard hold and control circuits. HF oscillator and detector. ring modulator. noise generator. mixer, power supply.

Set of basic component kits (excl. KBD R's and tuning pots – see list for options available).	from £61·00
Set of printed circuit boards	£8·99

P.E. SYNTHESISER (P.E. Feb. 73 to Feb. 74)
The well acclaimed and highly versatile large-scale mains-operated Sound Synthesiser complete with keyboard circuits. Other circuits in our lists may be used with the Synthesiser to good advantage. Details in our lists.

FORMANT SYNTHESISER (Elektor 1977/78)
Very sophisticated music synthesiser for the advanced constructor who puts performance before price. Details in our lists.

128-NOTE TUNE-PROGRAMMABLE SEQUENCER (P.E. Nov/Dec 77)
Enables a voltage controlled synthesiser to automatically play pre-programmed tunes of up to 32 pitches and 128 notes long. Programs are keyboard initiated and note length and rhythmic pattern are externally variable. (Please use order codes quoted in brackets.)

Main Circuit (Nov) excl. sw's (KIT 76-1)	£18·03
Power Supply (KIT 76-3)	£4·72
Trigger Inverter and Alt. Output (KIT 76-2)	£1·15
LED Counter (KIT 76-4)	£2·10
PCB (as published) for KITS 76-1 & 3 (PCB 76A)	£2·61
PCB for KITS 76-2 & 4 (PCB 76B)	£2·54

P.E. STRING ENSEMBLE (PE Mar-July 78)
The new keyboard string-Instrument synthesiser.
Basic component sets:

Power Supply (KIT 77-1)	£8·77
Tone Generator (KIT 77-2)	£14·66
Diode Gates (KIT 77-3)	£18·81
Chorus Generator (KIT 77-4)	£19·08
Voicing System (KIT 77-5)	£7·38

Printed Circuit Boards:

Double-sided PCB for Power Supply, Tone Generator & Diode Gates with most of the Matrix wiring as printed tracking (PCB 77L/R)	£18.40
PCB for Chorus Generator (PCB 77C)	£2.65
PCB for Voicing System (PCB 77D)	£2.62

Fuller details of kits & PCBs are in our lists.

P.E. JOANNA PLUS ORGAN VOICING
The basic five octave electronic piano (P.E. May/Sept 75 and Sound Design) has switchable alternative voicings for Honky-Tonk, ordinary piano, and Harpsichord or a mixture of any of these three, together with facilities including fast and slow tremolo, loud and soft pedal switching, and sustain pedal switching. The modification retains all the circuitry associated with the piano but in addition provides an organ-voice envelope facility with 5 switchable pitches, variable attack and sustain, phasing and vibrato.

Set of components (excl switches) for PSU, Frequency generator, Pitch and Note Divider, Envelope Shapers, Voicings, and Control circuitries. (Order as KIT 71-5)	£99·25
Set of PCBs (Order as PCB SET 71-6)	£29·18

GUITAR EFFECTS PEDAL (P.E. July 75)
Modulates the attack, decay and filter characteristics of an audio signal not only from a guitar but from any audio source, producing 8 different switchable effects that can be further modified by manual controls. Possibly the most interesting of all the low-priced sound effects units in our range. Circuit does not duplicate effects from the Guitar Overdrive Unit.

Component set with special foot operated switches	£7·69
Alternative component set with panel switches	£5·05
Printed circuit board	£1·43

ELEKTOR ELECTRONIC PIANO (Elektor Sept 78)
A touch-sensitive, multiple-voicing 5 octave piano using the latest integrated-circuit techniques for the keying and envelope shaping and virtually eliminating "bee-hive" noise hitherto inherent in previous electronic pianos. Details in our lists.

DIGITAL REVERBERATION UNIT (Elektor May 78)
A very advanced unit using sophisticated i.c. techniques instead of mechanical spring-lines. The basic delay range of 24 to 90mS can be extended up to 450mS using the extension unit. Further delays can be obtained using more extensions.

Main component set (KIT 78-1)	£45·45
Extension component set (KIT 78-2)	£43·36
PCB for Kit 78-1 (PCB 78A)	£2·86
PCB for Kit 78-2 (PCB 78B)	£1·06

ANALOGUE REVERBERATION UNIT (Elektor Oct 78)
Using i.c.s instead of spring-lines, the main unit has a maximum delay of up to 100mS, and the additional set extends this up to 200mS. May be used in either mono or stereo mode.

Main component set (KIT 83-1)	£26·18
Additional Delay Set (KIT 83-2)	£18·25
PCB (as published) to hold both above kits (PCB 9973)	£4·31

RESONANCE FILTER (Elektor Oct 78)
This filter module has been designed to allow a synthesiser to produce a more realistic simulation of natural musical instruments.

Basic component set (KIT 82-1)	£15·10
PCB (as published) (PCB 9951)	£3·29

SYNTHESISER EXTERNAL INPUT INTERFACE (P.E. Oct 78)
This unit allows external inputs, such as guitars, microphones etc. to be processed by the circuits within a synthesiser.

Basic component set (Incl PCB) (KIT 81-1)	£2·94

GUITAR MULTIPROCESSOR (P.E. Dec/Feb 78)
An extremely versatile sound processing unit capable of producing, for example, Flanging, Vibrato, Reverb, Fuzz and Tremolo as well as other fascinating sounds. May be used with most electronic instruments. Details in our lists.

RHYTHM GENERATOR KITS
Several available – details in our lists.

GUITAR FREQUENCY DOUBLER (P.E. Aug. 77)
A modified and extended version of the circuit published.

Component set and PCB	£4·52

GUITAR SUSTAIN (P.E. Oct 77)
Maintains the natural attack whilst extending note duration.

Component set, PCB and foot switches	£5·13
Component set, PCB and panel switches	£3·71

WIND AND RAIN UNIT
A manually controlled unit for producing the above-named sounds.

Component set (incl. PCB)	£4·26

GUITAR OVERDRIVE UNIT (P.E. Aug. 76)
Sophisticated, versatile Fuzz unit, including variable and switchable controls affecting the fuzz quality whilst retaining the attack and decay, and also providing filtering. Does not duplicate the effects from the Guitar Effects Pedal and can be used with it and with other electronic instruments.

Component set using dual slider pot	£7·58
Component set using dual rotary pot	£6·89
Printed circuit board	£1·62

FUZZ UNIT
Simple Fuzz unit based upon P.E. "Sound Design" circuit.

Component set (incl. PCB)	£2·05

TREMOLO UNIT
Based upon P.E. "Sound Design" circuit.

Component set (incl. PCB)	£2·94

TREBLE BOOST UNIT (P.E. Apr. 76)
Gives a much shriller quality to audio signals fed through it. The depth of boost is manually adjustable.

Component set (incl. PCB)	£2·51

WAVEFORM CONVERTER
Slightly modified from a circuit published in "Elektor". Converts a saw-tooth waveform into four different waveforms: sine-wave, mark-space saw-tooth, regular triangle form, and squarewave with an externally variable mark-space ratio.

Component set (incl. PCB but excl. sw/s)	£8·40

VOLTAGE CONTROLLED FILTER (P.E. Dec. 74)
Part of the P.E. Minisonic now released as an independent kit for use with other synthesisers.

Component set (incl. PCB) (Order as Kit 65-1)	£7·17

RING MODULATOR (P.E. Jan. 75)
Part of the P.E. Minisonic now released as an independent kit for use with other synthesisers.

Component set (incl. PCB) (Order as Kit 59-1)	£5·50

NOISE GENERATOR (P.E. Jan. 75)
Part of the P.E. Minisonic now released as an independent kit for use with other synthesisers.

Component set (incl. PCB) (Order as Kit 60-1)	£3·64

ENVELOPE SHAPER WITHOUT VCA (P.E. Oct. 75)
Provides full manual control over attack, decay, sustain and release functions, and is for use with an existing voltage controlled amplifier.

Component set (incl. PCB)	£4·77

ENVELOPE SHAPER WITH VCA (P.E. Apr. 76)
This unit has its own voltage controlled amplifier and has full manual control over attack, decay, sustain and release functions.

Component set (incl. PCB)	£6·68

TRANSIENT GENERATOR (P.E. Apr. 77)
An envelope shaper, without VCA, having the usual attack, decay, sustain and release functions, and in addition it also provides a "Repeat Effect" enabling a synthesiser to be programmed to imitate such instruments as a mandolin or banjo.

Component set	£4·87
Printed circuit board	£1·82

SOPHISTICATED PHASING AND VIBRATO UNIT
A slightly modified version of the circuit published in "Elektor", December 1976, and includes manual and automatic control over the rate of phasing and vibrato.

Component set	£17·38
Printed circuit board	£2·33

PHASING UNIT (P.E. Sept. 73)
A simple but effective manually controlled unit for introducing the "phasing" sound into live or recorded music.

Component set (incl. PCB)	£3·20

PHASING CONTROL UNIT (P.E. Oct. 74)
For use with the above Phasing Unit to automatically control the rate of phasing.

Component set (incl. PCB)	£4·74

WAH-WAH UNIT (P.E. Apr. 76)
The Wah-Wah effect produced by this unit can be controlled manually or by the integral automatic controller.

Component set (incl. PCB)	£3·63

AUTOWAH UNIT (P.E. Mar. 77)
Automatically produces Wah-pedal and Swell-pedal sounds each time a new note is played.

Component set, PCB, special foot switches	£7·67
Component set and PCB, with panel switches	£4·83

VOICE OPERATED FADER (P.E. Dec. 73)
For automatically reducing music volume during "talk-over"—particularly useful for Disco work or for home-movie shows.

Component set (incl. PCB)	£3·97

10% DISCOUNT VOUCHER (PE 74)

TERMS: Goods in current adverts & lists over £50 goods value (excl P&P & VAT). Correctly costed. C.W.O., U.K. orders only. This voucher must accompany order. Valid until end of month on cover of P.E.

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AND OTHER PROJECTS

PHOTOGRAPHS in this advertisement show two of our units containing some of the P.E. projects built from our kits and PCBs. The cases were built by ourselves and are not for sale, though a small selection of other cases is available.

LIST—Send stamped addressed envelope with all U.K. requests for free list giving fuller details of PCBs, kits and other components.

OVERSEAS enquiries for list Europe—send 20p: other countries—send 50p.

KIMBER-ALLEN KEYBOARDS AND CONTACTS

Kimber-Allen Keyboards as required for many published circuits. The manufacturers claim that these are the finest moulded plastic keyboards available. All octaves are C to C, the keys are plastic, spring-loaded, fitted with actuators, and mounted on a robust aluminium frame.

3 Octave (37 notes)	£25·50
4 Octave (49 notes)	£32·25
5 Octave (61 notes)	£39·75

Contact Assemblies (gold-clad wire) for use with the above KBDS (1 for each note):

Type GJ: Single-pole change-over	each 25½p
Type GA: 1 pair of contacts, normally open	each 24p
Type GB: 2 pairs of contacts, each pair normally open	each 28½p
Type GC: 3 pairs of contacts, each pair normally open	each 37½p
Type GE: 4 pairs of contacts, each pair normally open	each 46½p
Type GH: 5 pairs of contacts, each pair normally open	each 58½p
Type 4PS: 3 pairs of contacts plus single-pole changeover	each 57p

Printed Circuit Boards for use with most contacts (thus eliminating much interwiring) are available. Details in our lists.

P.E. TUNING FORK (P.E. Nov. 75)
Produces 84 switch-selected frequency-accurate tones. A LED monitor clearly displays all beat note adjustments. Ideal for tuning acoustic or electronic musical instruments.

Main component set (incl. PCB)	£14·93
Power supply set (incl. PCB)	£6·28

SYNTHESISER TUNING INDICATOR (P.E. July 77)
A simple 4-octave frequency comparator for use with synthesisers and other instruments where the full versatility of the P.E. Tuning Fork is not required.

Component and PCB (but excl sw.)	£7·45

CONSTANT DISPLAY FREQUENCY METER (PE AUG 78)
A 5-digit frequency counter for 1Hz to 99999Hz with a 1Hz sampling rate. Readout does not count visibly or flicker due to display blanking.

Component set	£24·05*
Printed circuit board	£3·03*

*This kit & PCB are at 8% VAT (all others are 12½%)

TAPE NOISE LIMITER
Very effective circuit for reducing the hiss found in most tape recordings. All kits include PCBs

Standard tolerance set of components	£2·96
Superior tolerance set of components	£3·76
Regulated power supply (will drive 2 sets)	£4·69

DYNAMIC RANGE LIMITER (P.E. Apr. 77)
Automatically controls sound output to within a preset level.

Component set (incl. PCB)	£4·58

DISCOSTROBE (P.E. Nov. 76)
4-channel light-show controller giving a choice of sequential, random, or full strobe mode of operation.

Basic component set	£18·19
Printed circuit board	£3·45

BIOLOGICAL AMPLIFIER (P.E. Jan./Feb. 73)
Multi-function circuits that, with the use of other external equipment, can serve as lie-detector, alphaphone, cardiophone etc.

Pre-Amp Module Components set (incl. PCB)	£3·95
Basic Output Circuits—combined component set with PCBs, for alphaphone, cardiophone, frequency meter and visual feed-back lampdriver circuits.	£6·59
Audio Amplifier Module Type PC7	£7·75

SOUND BENDER (P.E. May 74)
A multi-purpose sound controller, the functions of which include envelope shaper, tremolo, voice-operated fader, automatic fader and frequency-doubler.
Details in lists.

SOPHISTICATED POWER SUPPLIES
A wide range of highly stabilised low noise power supply kits is available—details in our lists.

NEW PCB SERVICE

PCBS FOR ALL NEW P.E. & E.E. PROJECTS FOR WHICH PCB LAY-OUTS HAVE BEEN PUBLISHED AND FOR WHICH FULL COPY-RIGHT CLEARANCE IS AVAILABLE.

LIMITED QUANTITIES ONLY FOR AN EXPERI-MENTAL PERIOD.

LET US KNOW YOUR NEEDS AND WE WILL ADVISE YOU OF AVAILABILITY AND PRICES.

INTEGRATED CIRCUITS

301	8-pin DIL	48p
318	8-pin DIL	220p
320-15	---	195p
324	14-pin DIL	87p
341-15	---	87p
709	8-pin DIL	48p
723	T05	87p
723	14-pin DIL	51p
726	T05	1005p
741	8-pin DIL	24p
748	8-pin DIL	57p
4007	14-pin DIL	17½p
4011	14-pin DIL	17½p
4024	14-pin DIL	46½p
4069	14-pin DIL	18p
4136	14-pin DIL	126p
AM2833	8-pin DIL	360p
AY10212	16-pin DIL	617p
AY16721/6		188p
CA3046	14-pin DIL	71p
CA3080	8-pin DIL	63p
CA3084	14-pin DIL	209p
FX209	16-pin DIL	729p
LM323	---	562p
M252	16-pin DIL	680p
MC3340	8-pin DIL	150p
MCM6810	24-pin DIL	670p
SG3402N	14-pin DIL	262p
STK025	---	595p
TDA1022	16-pin DIL	582p
XR2207	14-pin DIL	420p
ZN425E	16-pin DIL	375p

TRANSISTORS

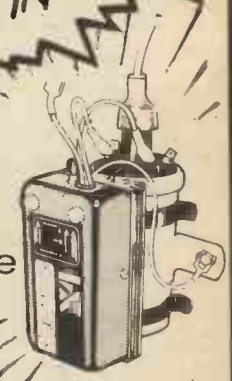
AC128	32p
AC176	28p
BC107	13p
BC108	13p
BC109	15p
BC109C	16p
BC177	18p
BC184	11p
BC187	18p
BC204	10p
BC209C	13p
BC213	11p

PRICES ARE CORRECT AT TIME OF PRESS.
E. & O. E. DELIVERY SUBJECT TO AVAILABILITY.

PHONOSONICS

The latest kit innovation! from Sparkrite

Sparkrite — was featured by Shaw Taylor in "DRIVE IN"



the quickest fitting
CLIP ON
capacitive discharge
electronic ignition
in KIT FORM

- **Smoother running**
- **Instant all-weather starting**
- **Continual peak performance**
- **Longer coil/battery/plug life**
- **Improved acceleration/top speeds**
- **Optimum fuel consumption**

Sparkrite X4 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 1/3 mins.
Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and, therefore, eliminates the possibility of blowing the transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect). The circuit incorporates a voltage regulated output for greatly improved cold starting. The circuit includes built in static timing light, systems function light, and security changeover switch. All kits fit vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED
Die pressed epoxy coated case. Ready drilled, aluminium extruded base and heat sink, coil mounting clips, and accessories. Top quality 5 year guaranteed transformer and components, cables, connectors, P.C.B., nuts, bolts and silicon grease. Full instructions to assemble kit neg. or pos. earth and fully illustrated installation instructions.
NOTE — Vehicles with current impulse tachometers (Smiths code on dial RV1) will require a tachometer pulse slave unit. Price £3.85 inc. VAT, post & packing UK only.

Electronics Design Associates, Dept. PE 10, 82 Bath Street, Walsall, WS1 3DE. Phone: Walsall 614791

Electronics Design Associates, Dept. PE 4
82 Bath Street, Walsall, WS1 3DE. Phone: (9) 614791

Name .....

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Phone your order with Access or Barclaycard

Inc. V.A.T. and P.P.	QUANTITY REQ'D.
X4 KIT £16.65	
TACHOPULSE SLAVE UNIT £3.85	

Send SAE if brochure only required.

I enclose cheque/PO's for

£ _____

Cheque No.

Please state polarity pos or neg earth.
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SEMICONDUCTORS POTS & IRONS

SOCKETS

1611	8 pin DIL	£0·11
1612	14 pin DIL	£0·12
1613	16 pin DIL	£0·13
1614	24 pin DIL	£0·25
1615	28 pin DIL	£0·30
1616	TO18 Transistor	£0·12
1617	TU3 Transistor	£0·35
16117	TO5 Transistor	£0·12

VOLTAGE REGULATORS

Positive

MVR7805 v.a. 7805 TO220	£0·70
MVR7812 v.a. 7812 TO220	£0·70
MVR7815 v.a. 7815 TO220	£0·70
MVR7824 v.a. 7824 TO220	£0·70

Negative

MVR7905 v.a. 7905 TO220	£0·80
MVR7912 v.a. 7912 TO220	£0·80
MVR7915 v.a. 7915 TO220	£0·80
MVR7924 v.a. 7924 TO220	£0·80
v.a. 723C TO99	£0·45
72723 14 pin DN	£0·45
LM309K TO3	£1·50

ZENER DIODES

400mw *(Bzy88) DO7 Glass encapsulated* range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 39v.

No. Z4 8p ea.

1w·1·5w *Plastic and metal encapsulated* Range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v

No. Z13 15p ea.

10w *Metal stud type SO10 case.* Range of voltages available, 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v.

No. Z10 35p ea.

SILICON RECTIFIERS

200mA	
IS920 50v	£0·06
IS921 100v	£0·07
IS922 150v	£0·08
IS923 200v	£0·09
IS924 300v	£0·10
1 Amp	
IN4001 50v	£0·04½
IN4002 100v	£0·05
IN4003 200v	£0·06
IN4004 400v	£0·07
IN4005 600v	£0·08
IN4006 800v	£0·09
IN4007 1000v	£0·10
1·5 Amp	
IS015 50v	£0·09
IS020 100v	£0·10
IS021 200v	£0·11
IS023 400v	£0·13
IS025 600v	£0·14
IS027 800v	£0·16
IS029 1000v	£0·20
IS031 1200v	£0·25
3 Amp	
IN5400 50v	£0·14
IN5401 100v	£0·15
IN5402 200v	£0·16
IN5404 400v	£0·17
IN5406 600v	£0·21
IN5407 800v	£0·25
IN5408 1000v	£0·30
10 Amp	
IS10/50 50v	£0·19
IS10/100 100v	£0·21
IS10/200 200v	£0·23
IS10/400 400v	£0·35
IS10/600 600v	£0·42
IS10/800 800v	£0·51
IS10/1000 1000v	£0·60
IS10/1200 1200v	£0·69
30 Amp	
IS30/50 50v	£0·56
IS30/100 100v	£0·69
IS30/200 200v	£0·93
IS30/400 400v	£1·25
IS30/600 600v	£1·76
IS30/800 800v	£1·94
IS30/1000 1000v	£2·31
IS30/1200 1200v	£2·88
60 Amp	
IS70/50 50v	£0·75
IS70/100 100v	£0·84
IS70/200 200v	£1·20
IS70/400 400v	£1·75
IS70/600 600v	£2·25
IS70/800 800v	£2·50
IS70 1000 1000v	£3·00
BYX38/300 6A 300v	£0·45
BYX38/600 6A 600v	£0·60
BYX38/300 Rev 6A 300v	£0·45
BYX38/600 Rev 6A 600v	£0·60

POTENTIOMETERS

CARBON POTS (Linear Track)

Single gang with wire end terminations, 6mm × 50mm plastic shaft 10mm bushes supplied with shake proof washer & nut. Tolerance ± 20% of resistance.

1831 1k ohms	£0·26*	1836 47kohms	£0·26*
1832 2k2ohms	£0·26*	1837 100kohms	£0·26*
1833 4k7ohms	£0·26*	1838 220kohms	£0·26*
1834 10kohms	£0·26*	1839 470kohms	£0·26*
1835 22kohms	£0·26*	1840 1Meg	£0·26*

1841 2M2 £0·26*

CARBON POTS (Log Track)

1842 4k7ohms	£0·26*	1846 100kohms	£0·26*
1843 10kohms	£0·26*	1847 220kohms	£0·26*
1844 22kohms	£0·26*	1848 470kohms	£0·26*
1845 47kohms	£0·26*	1849 1Meg	£0·26*

1850 2M2 £0·26*

DUAL CARBON POTS (Lin Track)

These high quality dual gang pots are fitted with wire end terminations and 6mm × 50mm plastic shaft 10mm, bush and supplied with shake proof washer & nut track tolerance ± 20% but matched to within 2db of each other. VC3

1851 4k7	£0·86*	1855 100kohms	£0·86*
1852 10kohms	£0·86*	1856 220kohms	£0·86*
1853 22kohms	£0·86*	1857 470kohms.	£0·86*
1854 100kohms	£0·86*	1858 1Meg	£0·86*

1859 2M2 £0·86*

DUAL CARBON POTS (Log Law)

1860 4k7ohms	£0·86*	1864 100kohms	£0·86*
1861 10kohms	£0·86*	1865 220kohms	£0·86*
1862 22kohms	£0·86*	1866 470kohms	£0·86*
1863 47kohms	£0·86*	1867 1Meg	£0·86*

1868 2M2 £0·86*

SINGLE GANG SWITCHED (Lin Law)

These potentiometers are fitted with double pole on-off switches. The switch is incorporated within the rotary action of the pot. Specification of pot is as VC1. Switch rating 1·5amps at 250v AC.

1870 4k7ohms	£0·65*	1874 100kohms	£0·65*
1871 10kohms	£0·65*	1875 220kohms	£0·65*
1872 22kohms	£0·65*	1876 470kohms	£0·65*
1873 47kohms	£0·65*	1877 1Meg	£0·65*

1878 2M2 £0·65*

SWITCHED POT (Log Track)

Specification as VC2 but track having (log) law.

1879 4k7ohms	£0·65*	1833 100kohms	£0·65*
1880 10kohms	£0·65*	1884 220kohms	£0·65*
1881 22kohms	£0·65*	1885 470kohms	£0·65*
1882 47kohms	£0·65*	1886 1Meg	£0·65*

1887 2M2 £0·65*

DUAL GANG LOG-ANTI-LOG POT

1888 Track specification as dual gang pots VC3, but tracks mounted to log-anti-log action 100kohms £0·75*

SPECIAL VOLUME CONTROLS

A miniature 16mm type replacement volume control incorporating single pole on-off switch. Resistance value 5kohms. Tolerance ± 20% 1/8watt rating.

1889 £0·27* VC8

MINIATURE ROTARY VOL CONTROL

5kohms log law with on/off switch. 20mm grooved spindle. Tag connections 17mm dia. Supplied with fixing nut. Used mainly for replacement.

1890 £0·54* VC9

WIRE WOUND POTS

A range of wire wound single gang pots with linear tracks of 1 watt rating, fitted with 10mm bush and supplied with shake-proof washer and nut.

VC6

1891 10ohms	£0·80	1895 220ohms	£0·80
1892 22ohms	£0·80	1896 470ohms	£0·80
1893 47ohms	£0·80	1897 1kohms	£0·80
1894 2·0ohms	£0·80	1898 2k2ohms	£0·80

1899 4k7ohms £0·80

PRE-SET POTS HORIZONTAL MOUNTING

Miniature type for transistor circuits. The wiper of the preset is provided with a slot for screw driver adjustment. The tags of the preset will fit printed wiring boards with a pitch of 2·54mm. All tracks are linear law.

VC7

1801 100ohms	£0·09*	1808 22kohms	£0·09*
1802 220ohms	£0·09*	1809 47kohms	£0·09*
1803 470ohms	£0·09*	1810 100kohms	£0·09*
1804 1kohms	£0·09*	1811 220kohms	£0·09*
1805 2k2ohms	£0·09*	1812 470kohms	£0·09*
1806 4k7ohms	£0·09*	1813 1Mohms	£0·09*
1807 10kohms	£0·09*	1814 2M2ohms	£0·09*

1815 4M7ohms £0·09*

PRE-SET POTS VERTICAL MOUNTING

Miniature type for transistor circuits. Wiper adjustment is made by a screw driver slot. Designed to fit 2·54mm pitch board. All tracks are linear law.

VC7

1816 100ohms	£0·09*	1823 22kohms	£0·09*
1817 220ohms	£0·09*	1824 47kohms	£0·09*
1818 470ohms	£0·09*	1825 100kohms	£0·09*
1819 1kohms	£0·09*	1826 220kohms	£0·09*
1820 2k2ohms	£0·09*	1827 470kohms	£0·09*
1821 4k7ohms	£0·09*	1828 1Megohms	£0·09
1822 10kohms	£0·09*	1829 2M2ohms	£0·09

1830 4M7ohms £0·09*

ANTEX IRONS

O/No. 1943. 15 watt high quality soldering iron totally enclosed element in a ceramic shaft fitted with 3/32" bit. £3·80

O/No. 1947. Replacement element for 1943 iron. £1·90

O/No. 1944. Iron coated bit 3/32" for 1943 iron. £0·46

O/No. 1945. Iron coated bit 1/8" for 1943 iron. £0·46

O/No. 1946. Iron coated bit 3/16" for 1943 iron. £0·46

O/No. 1948. General purpose 18 watt iron fitted with iron coated bit. £3·60

O/No. 1952. Replacement element for 1948 iron. £1·90

O/No. 1949. Iron coated bit 3/32" for 1948 iron. £0·46

O/No. 1950. Iron coated bit 1/8" for 1948 iron £0·46

O/No. 1951. Iron coated bit 3/16" for 1948 iron. £0·46

O/No. 1931. Highly popular ¥25 25 watt quality soldering iron ceramic shafts to provide near perfect insulation break-down voltage of 1500 volts AC and a leakage current of only 3-5uA and another shaft of stainless steel to ensure strength. £3·60

O/No. 1935. Replacement element for 1931 iron. £1·60

O/No. 1932. Iron coated bit 1/8" for 1931 iron. £0·50

O/No. 1933. Iron coated bit 3/16" for 1931 iron. £0·50

O/No. 1934. Iron coated bit 3/32" for 1931 iron. £0·50

O/No. 1953. SK1 soldering kit—this kit contains 15 watt soldering iron fitted with a 3/16" bit plus two spare bits, a reel of solder, heat-sink and a booklet 'how to solder'. In presentation display box. £5.55

O/No. 1939. ST3 soldering iron stand. Stand made from high grade bakelite material chromium plated strong steel spring, suitable for all models, includes accommodation for six spare bits and two sponges which serve to keep the soldering iron bits clean. £1·50

PRINTED CIRCUIT BOARD TRANSFERS

Draw your own boards with the new BI-PAK etch-resist transfers. Lay the symbols on the board, rub over with a soft pencil. The transfer will adhere to the board. Then complete the circuit with your BI-PAK etch-resist pen.

Each pack contains 11 sheets of transfers 1 of each as shown above.

Illustrations – approx. ½ size.

O/No: TR400 @ £1·50 p&p £0·10

BRIDGE RECTIFIERS

Type	Order No.	Price
SILICON 1 amp		
50V RMS	BR1/50	£0·20
100V RMS	BR1/100	£0·22
200V RMS	BR1/200	£0·25
400V RMS	BR1/400	£0·36
SILICON 2 amp		
50V RMS	BR2/50	£0·45
100V RMS	BR2/100	£0·48
200V RMS	BR2/200	£0·52
400V RMS	BR2/400	£0·58
1000V RMS	BR2/1000	£0·68

OPTOELECTRONICS

NEW INCREASED RANGE – ALL 1ST QUALITY

LED'S (diffused)

O/no.	Type	Size	Colour	Price
1501	ARL209(TIL209)	.3mm (.125)	RED	£0·10
1502	MIL3232(TIL211)	.3mm (.125)	GREEN	£0·15
1503	MIL3331 (OPL212A)	.3mm (.125)	YELLOW	£0·15
1504	ARL4850(FLV117)	.5mm (.2)	RED	£0·10
1505	MIL5251(TIL222)	.5mm (.2)	GREEN	£0·15
1506	MIL5351(MV5353)	.5mm (.2)	YELLOW	£0·15
1509	FLV111	.5mm (.2)	CLEAR (ill. Red)	£0·11

SUPER 'Hi-Brite' Type

1521	MIL32	.3mm (.125)	RED	£0·10
1522	MIL52	.5mm (.2)	RED	£0·10
1514	ORP12 Light dependent resistor			£0·55
1520	OCP71 Photo transistor			£0·35

LED CLIPS

1508/125	pack of 5	125 clips	£0·15
1508/2	pack of 5	2 clips	£0·18

ALL @ 8% V.A.T.

DISPLAYS

DL303	7 segment D.P. left (.30" height)	Common Anode	
RED	Single Digit	O/NO: 1523	£0·70
OL707	7 segment D.P. left (.0.3" height)	Common Anode	
RED	Single Digit	O/NO: 1510	£0·95
DL527	7 segment D.P. left (.50" height)	Common Anode	
RED	Two-Digit Reflector	O/NO: 1524	£1·70
DL727	7 segment D.P. right (.510" height)	Common Anode	
RED	Two-Digit Light Pipe	O/NO: 1521	£2·20
DL747	7 segment D.P. Left (.630" height)	Common Anode	
RED	Single-Digit Light Pipe	O/NO: 1511	£1·70

ALL @ 8% V.A.T.

OPTO-ISOLATORS

Isolation 100mA	Breakdown – Voltage 1500 – continuous fwd current	
CIL74	Single-Channel 6 pin DIP standard type – optically coupled pair with Infra-red LED Emitter and NPN Silicon Photo Transistor.	O/NO: 1497 £0·50
CILD74	Multi-Channel 8 pin DIP Two	Isolated Channels. O/NO: 1498 £1·00
CILQ74	Multi-Channel 16 pin DIP Four	Isolated Channels. O/NO: 1499 £2·20

ALL @ 8% V.A.T.

2nd GRADE LED PACK

A pack of 10 standard sizes and colours which fail to perform to their very rigid specification, but which are ideal for amateurs who do not require the full spec.

O/NO 107 £1·50

THYRISTORS

600ma TO 18 Case

Volts	No.	Price
10	THY600/10	£0·15
20	THY600/20	£0·16
30	THY600/30	£0·20
50	THY600/50	£0·22
100	THY600/100	£0·25
200	THY600/200	£0·38
400	THY600/400	£0·44

1 amp TO 5 Case

Volts	No.	Price
50	THY1A/50	£0·26
100	THY1A/100	£0·28
200	THY1A/200	£0·32
400	THY1A/400	£0·38
600	THY1A/600	£0·45
800	THY1A/800	£0·58

3 amp TO 66 Case

Volts	No.	Price
50	THY3A/50	£0·28
100	THY3A/100	£0·30
200	THY3A/200	£0·33
400	THY3A/400	£0·42
600	THY3A/600	£0·50
800	THY3A/800	£0·65

5 Amp TO 66 Case

Volts	No.	Price
50	THY5A/50	£0·36
100	THY5A/100	£0·45
200	THY5A/200	£0·50
400	THY5A/400	£0·57
600	THY5A/600	£0·69
800	THY5A/800	£0·81

5 Amp TO 220 Case

Volts	No.	Price
400	THY5A/400P	£0·57
800	THY5A/600P	£0·69
800	THY5A/800P	£0·81

7 Amp TO 48 Case

Volts	No.	Price
50	THY7A/50	£0·48
100	THY7A/100	£0·51
200	THY7A/200	£0·57
400	THY7A/400	£0·82
600	THY7A/600	£0·78
800	THY7A/800	£0·92

10 Amp TO 48 Case

Volts	No.	Price
50	THY10A/50	£0·51
100	THY10A/100	£0·57
200	THY10A/200	£0·82
400	THY10A/400	£0·71
600	THY10A/600	£0·99
800	THY10A/800	£1·22

16 Amp TO 48 Case

Volts	No.	Price
50	THY16A/50	£0·54
100	THY16A/100	£0·58
200	THY16A/200	£0·62
400	THY16A/400	£0·77
600	THY16A/600	£0·90
800	THY16A/800	£1·39

30 Amp TO 94 Case

Volts	No.	Price
50	THY30A/50	£1·18
100	THY30A/100	£1·43
200	THY30A/200	£1·63
400	THY30A/400	£1·79
600	THY30A/600	£3·50

No.	Price
BT101/500R	£0·80
BT102/500R	£0·80
BT106	£1·25
BT107	£0·93
BT108	£0·98
2N3228	£0·70
2N3535	£0·77
BTX30/50L	£0·33
BTX30/400L	£0·46
C106/4	£0·60

CABLES

DESCRIPTION	O/NO	PRICE/ Metre
Microphone Cable	3126	£0·10
Twin Microphone	3127	£0·20
Twin Stereo Screened Cable	3128	£0·15
Multicore Standard 4-Core Screened	3129	£0·30
4-Core Individually screened	3130	£0·22
Heavy Microphone Cable	3131	£0·18
Light 3-Core mains	3132	£0.10
Twin Oval Mains	3133	£0·09
Speaker Cable	3134	£0·07
Low Loss Co-axial Cable	3135	£0·22
15 Way Multi Coloured Ribbon Cable	3136	£0·40

SEMICONDUCTORS

TRANSISTORS

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC107	£0·22	BC119	£0·25	BD183	£0·95	BPX25	£1·45	TIP418	£0·46	2N2712	£0·22
AC113	£0·20	BC120	£0·40	BD184	£1·10	BSX19	£0·18	TIP41C	£0·48	2N2714	£0·22
AC115	£0·20	BC125	£0·17*	BD185	£0·68	BSX20	£0·18	TIP42A	£0·44	2N2904	£0·18
AC117	£0·30	BC126	£0·22*	BD186	£0·68	BSY25	£0·16	TIP42B	£0·46	2N2904A	£0·21
AC117K	£0·34	BC132	£0·18*	BD187	£0·75	BSY26	£0·16	TIP42C	£0·48	2N2905	£0·18
AC121	£0·20	BC134	£0·18*	BD188	£0·75	BSY27	£0·16	TIP2955	£0·60	2N2905A	£0·20
AC122	£0·14	BC135	£0·15*	BD189	£0·78	BSY28	£0·16	TIP3055	£0·50	2N2906	£0·16
AC125	£0·18	BC136	£0·18*	BD190	£0·78	BSY29	£0·16	TIS43	£0·22	2N2906A	£0·19
AC126	£0·18	BC137	£0·18*	BD195	£0·90	BSY38	£0·19	TIS90	£0·18*	2N2907	£0·20
AC127	£0·18	BC139	£0·32	BD196	£0·90	BSY39	£0·19			2N2907A	£0·22
AC128	£0·16	BC140	£0·30	BD197	£0·95	BSY40	£0·29			2N2923	£0·15*
AC128K	£0·26	BC141	£0·28	BD198	£0·95	BSY41	£0·29	UT46	£0·20	2N2924	£0·15*
AC132	£0·20	BC142	£0·22	BD199	£0·99	BSY51	£0·25			2N2925	£0·15*
AC134	£0·20	BC143	£0·22	BD200	£0·99	BSY95	£0·13			2N2926G	£0·09*
AC137	£0·20	BC145	£0·46	BD201	£0·80	BSY95A	£0·13	ZTX107	£0·10*	2N2926Y	£0·08*
AC141	£0·22	BC147	£0·07*	BD202	£0·80	BRY39	£0·45	ZTX108	£0·10*	2N2926O	£0·08*
AC141K	£0·30	BC148	£0·07*	BD201/202	£1·70	BU105	£1·40	ZTX109	£0·10*	2N2926R	£0·08*
AC142	£0·20	BC149	£0·07*	BD203	£0·80	BU105/02	£1·95	ZTX300	£0·12*	2N2926B	£0·08*
AC142K	£0·30	BC150	£0·20*	BD204	£0·80	BU204	£1·40	ZTX301	£0·12*	2N3010	£0·65
AC151	£0·20	BC151	£0·22*	BD203/204	£1·70	BU205	£1·40	ZTX302	£0·16*	2N3011	£0·15
AC153	£0·22	BC152	£0·20*	BD205	£0·80	BU208	£1·90	ZTX303	£0·16*	2N3053	£0·16
AC153K	£0·30	BC153	£0·25*	BD206	£0·80	BU208/02	£2·25	ZTX304	£0·20*	2N3054	£0·40
AC154	£0·20	BC154	£0·19*	BD207	£1·00			ZTX330	£0·15*	2N3055	£0·40
AC155	£0·20	BC157	£0·10	BD208	£1·00			ZTX500	£0·13*	2N3391	£0·20*
AC156	£0·20	BC158	£0·10*	BD222	£0·47	E1222	£0·38	ZTX501	£0·12*	2N3391A	£0·22*
AC157	£0·25	BC159	£0·10*	BD225	£0·47			ZTX502	£0·16*	2N3392	£0·20*
AC165	£0·20	BC160	£0·26	BD232	£0·55			ZTX503	£0·12*	2N3393	£0·20*
AC166	£0·20	BC161	£0·38	BD233	£0·48	MAT100	£0·19	ZTX504	£0·26*	2N3394	£0·20*
AC167	£0·20	BC167	£0·12*	BD234	£0·55	MAT101	£0·20	ZTX550	£0·25*	2N3395	£0·22*
AC168	£0·25	BC168	£0·12*	BD235	£0·55	MAT120	£0·19		£0·16*	2N3402	£0·21*
AC169	£0·20	BC169	£0·09*	BD236	£0·58	MAT121	£0·20			2N3403	£0·21*
AC171	£0·25	BC169C	£0·10*	BD237	£0·55	MJ480	£0·95			2N3404	£0·29*
AC176	£0·18	BC170	£0·09*	BD238	£0·66	MJ481	£1·05			2N3405	£0·42*
AC176K	£0·26	BC171	£0·09*	BDX32	£2·00	MJ490	£0·95			2N3414	£0·16*
AC178	£0·25	BC172	£0·09*	BDY11	£1·30	MJ491	£1·15	2G301	£0·22	2N3415	£0·16*
AC179	£0·25	BC173	£0·09	BDY17	£1·80	MJE340	£0·45	2G302	£0·22	2N3416	£0·29*
AC180	£0·20	BC174	£0·15*	BDY20	£0·80	MJE370	£0·55	2G303	£0·22	2N3417	£0·29*
AC180K	£0·28	BC175	£0·35*	BDX77	£0·90	MJE371	£0·60	2G304	£0·30	2N3614	£1·00
AC181	£0·20	BC177	£0·16	BF115	£0·22	MJE520	£0·45	2G306	£0·40	2N3615	£1·05
AC181K	£0·28	BC178	£0·16	BF117	£0·50	MJE521	£0·65	2G308	£0·36	2N3616	£1·05
AC187	£0·18	BC179	£0·16	BF118	£0·75	MJE2955	£0·90	2G309	£0·36	2N3646	£0·09*
AC187K	£0·28	BC180	£0·25	BF119	£0·75	MJE3055	£0·60	2G339	£0·20	2N3702	£0·08*
AC188	£0·18	BC181	£0·25*	BF121	£0·50*	MJE3440	£0·52	2G339A	£0·18	2N3703	£0·08*
AC188K	£0·28	BC182	£0·09*	BF123	£0·60*	MP8113	£0·52	2G344	£0·20	2N3704	£0·07*
ACY17	£0·35	BC182L	£0·09*	BF125	£0·50*	MPF102	£0·28	2G345	£0·18	2N3705	£0·07*
ACY18	£0·35	BC183	£0·09*	BF127	£0·60*	MPF104	£0·35	2G371	£0·18	2N3706	£0·08*
ACY19	£0·35	BC183L	£0·09*	BF152	£0·25*	MPF105	£0·35	2G371B	£0·12	2N3707	£0·08*
ACY20	£0·35	BC184	£0·09	BF153	£0·25*	MPSA05	£0·20	2G373	£0·18	2N3708	£0·07*
ACY21	£0·35	BC184L	£0·09*	BF154	£0·22*	MPSA06	£0·20*	2G374	£0·18	2N3708A	£0·07*
ACY22	£0·35	BC186	£0·22	BF155	£0·35	MPSA55	£0·20*	2G377	£0·32	2N3709	£0·07*
ACY27	£0·35	BC187	£0·22	BF156	£0·28	MPSA56	£0·20*	2G378	£0·18	2N3710	£0·07*
ACY28	£0·35	BC207	£0·11*	BF157	£0·28	ND120	£0·18	2G381	£0·18	2N3711	£0·07*
ACY29	£0·50	BC208	£0·11*	BF158	£0·28*			2G382	£0·18	2N3772	£1·60
ACY30	£0·35	BC209	£0·12*	BF159	£0·28*			2G401	£0·32	2N3773	£2·20
ACY31	£0·35	BC212	£0·09*	BF160	£0·30*			2G414	£0·32	2N3819	£0·18
ACY34	£0·35	BC212L	£0·09*	BF162	£0·30*	OC19	£0·85	2G417	£0·26	2N3820	£0·35
ACY35	£0·35	BC213	£0·09*	BF163	£0·30*	OC20	£1·85			2N3821	£0·60
ACY36	£0·50	BC213L	£0·09*	BF164	£0·50*	OC22	£1·50			2N3823	£0·60
ACY40	£0·35	BC214	£0·09*	BF165	£0·50*	OC23	£1·50	2N388	£0·36	2N3903	£0·10*
ACY41	£0·35	BC214L	£0·09*	BF167	£0·24	OC24	£1·35	2N388A	£0·56	2N3904	£0·10*
ACY44	£0·35	BC225	£0·26*	BF173	£0·20	OC25	£1·00	2N404	£0·20	2N3905	£0·10*
AD130	£0·70	BC226	£0·36*	BF176	£0·38*	OC26	£1·00	2N524	£0·40	2N3906	£0·10*
AD140	£0·60	BC227	£0·16*	BF177	£0·26	OC28	£0·80	2N527	£0·50	2N4058	£0·12*
AD142	£0·85	BC238	£0·16*	BF178	£0·28	OC29	£0·95	2N598	£0·40	2N4059	£0·14*
AD143	£0·75	BC251	£0·15*	BF179	£0·30	OC35	£0·90	2N599	£0·46	2N4060	£0·14*
AD149	£0·60	BC251A	£0·16*	BF180	£0·30	OC36	£0·90	2N696	£0·13	2N4061	£0·12*
AD161	£0·35	BC301	£0·28	BF181	£0·30	OC41	£0·20	2N697	£0·12	2N4062	£0·12*
AD162	£0·35	BC302	£0·29	BF182	£0·30	OC42	£0·22	2N698	£0·12	2N4284	£0·18*
AD161/162	£0·70	BC303	£0·28	BF183	£0·30	OC44	£0·24	2N699	£0·32	2N4285	£0·18*
ADT140	£0·55	BC304	£0·38	BF184	£0·20	OC45	£0·20	2N706	£0·10	2N4286	£0·18*
AF114	£0·25	BC327	£0·16*	BF185	£0·20	OC70	£0·24	2N706A	£0·12	2N4287	£0·18*
AF115	£0·25	BC328	£0·15*	BF186	£0·26*	OC71	£0·15	2N707	£0·48	2N4288	£0·18*
AF116	£0·25	BC337	£0·15*	BF187	£0·26	OC72	£0·24	2N708	£0·14	2N4289	£0·18*
AF117	£0·25	BC338	£0·15*	BF188	£0·40	OC74	£0·26	2N711	£0·30	2N4290	£0·18*
AF118	£0·40	BC440	£0·30	BF194	£0·10*	OC75	£0·30	2N717	£0·30	2N4291	£0·18*
AF124	£0·30	BC441	£0·30	BF195	£0·10*	OC76	£0·35	2N718	£0·25	2N4292	£0·18*
AF125	£0·30	BC460	£0·38	BF196	£0·10*	OC77	£0·50	2N718A	£0·50	2N4293	£0·18*
AF126	£0·30	BC461	£0·38	BF197	£0·12*	OC81	£0·22	2N726	£0·29	2N4921	£0·55*
AF127	£0·32	BC477	£0·20	BF198	£0·14*	OC81D	£0·24	2N727	£0·29	2N4923	£0·65*
AF139	£0·35	BC478	£0·20	BF199	£0·14*	OC82	£0·24	2N743	£0·20	2N5135	£0·10*
AF178	£0·60	BC479	£0·20	BF200	£0·30	OC82D	£0·30	2N744	£0·20	2N5136	£0·10*
AF179	£0·60	BC547	£0·10*	BF202	£0·90*	OC83	£0·26	2N914	£0·15	2N5138	£0·10*
AF180	£0·60	BC548	£0·10*	BF222	£0·90	OC84	£0·38	2N918	£0·30	2N5172	£0·14*
AF181	£0·58	BC549	£0·10*	BF224	£0·17	OC139	£0·80	2N929	£0·20	2N5194	£0·56
AF186	£0·50	BC550	£0·14*	BF240	£0·17*	OC140	£0·80	2N930	£0·18	2N5245	£0·40
AF239	£0·38	BC556	£0·14*	BF241	£0·17*	OC169	£0·35	2N946	£0·40	2N5294	£0·34
AL102	£1·20	BC557	£0·13*	BF244	£0·30*	OC170	£0·35	2N1131	£0·18	2N5296	£0·36
AL103	£1·18	BC558	£0·12*	BF257	£0·25	OC171	£0·35	2N1132	£0·18	2N5257	£0·32
ASY26	£0·38	BC559	£0·14*	BF258	£0·25	OC200	£0·38	2N1302	£0·15	2N5458	£0·32
ASY27	£0·40	BCY30	£0·55	BF259	£0·35	OC201	£0·95	2N1303	£0·18	2N5459	£0·35
ASY28	£0·38	BCY31	£0·55	BF262	£0·60*	OC202	£1·20	2N1304	£0·18	2N5551	£0·36*
ASY29	£0·38	BCY32	£0·60	BF263	£0·60*	OC203	£0·85	2N1305	£0·18	2N6027	£0·34
ASY50	£0·30	BCY33	£0·55	BF270	£0·36	OC204	£0·90	2N1306	£0·25	2N6121	£0·70
ASY51	£0·30	BCY34	£0·60	BF271	£0·31	OC205	£1·15	2N1307	£0·25	2N6122	£0·70
ASY52	£0·30	BCY70	£0·15	BF272	£0·80			2N1306	£0·30		
ASY54	£0·30	BCY71	£0·15	BF273	£0·36*			2N1309	£0·30		
ASY55	£0·30	BCY72	£0·14	BF274	£0·38*			2N1599	£0·35		
ASY56	£0·30	BCZ10	£0·60	BF324	£0·35*	P346A	£0·35	2N1613	£0·20	2S 301	£0·50
ASY57	£0·30	BCZ11	£0·60	BF336	£0·30	P397	£0·45	2N1711	£0·20	2S 302	£0·43
ASY58	£0·30	BCZ12	£0·60	BF337	£0·30*			2N1889	£0·45	2S 302A	£0·43
ASY73	£0·30	BD115	£0·50	BF338	£0·38			2N1890	£0·45	2S 303	£0·56
AU104	£1·40	BD116	£0·80	BF457	£0·37			2N1893	£0·30	2S 304	£0·71
AU110	£1·40	BD121	£0·85	BF458	£0·37	R20008B	£2·50	2N2147	£0·75	2S 305	£0·80
AU113	£1·40	BD123	£0·65	BF459	£0·38	R2010B	£2·60	2N2148	£0·70	2S 306	£0·80
		BD124	£0·70	BF594	£0·30*			2N2160	£1·00	2S 307	£0·80
		BD131	£0·35	BF596	£0·28*			2N2192	£0·38	2S 321	£0·57
BC107	£0·08	BD132	£0·35	BFR39	£0·24	ST140	£0·15	2N2193	£0·38	2S 322	£0·43
BC107A	£0·08	BD131/132	£0·80	BFR40	£0·25*	ST141	£0·20	2N2194	£0·38	2S 322A	£0·43
BC107B	£0·09	BD133	£0·40	BFR79	£0·28*			2N2217	£0·22	2S 323	£0·57
BC107C	£0·10	BD135	£0·38	BFR80	£0·28*			2N2218	£0·22	2S 324	£0·71
BC108	£0·08	BD136	£0·35	BFX29	£0·22	TIC44	£0·29	2N2218A	£0·20	2S 325	£0·71
BC108A	£0·08	BD137	£0·35	BFX30	£0·30	TIC45	£0·35*	2N2219	£0·20	2S 326	£0·71
BC108B	£0·09	BD138	£0·36	BFX84	£0·22	TIP29A	£0·40	2N2219A	£0·24	2S 327	£0·71
BC108C	£0·10	BD139	£0·36	BFX85	£0·24	TIP29B	£0·42	2N2220	£0·20		
BC109	£0·08	BD140	£0·36	BFX86	£0·25	TIP29C	£0·44	2N2221	£0·20		
BC109A	£0·08	BD139/140	£0·80	BFX87	£0·22	TIP30A	£0·40	2N2221A	£0·22		
BC109B	£0·09	BD155	£0·80	BFX88	£0·22	TIP30B	£0·42	2N2222	£0·20	40360	£0·36
BC109C	£0·10	BD175	£0·60	BFX90	£0·55*	TIP30C	£0·44	2N2222A	£0·20	40361	£0·36
BC113	£0·16*	BD176	£0·60	BFY50	£0·16	TIP31A	£0·40	2N2368	£0·18	40362	£0·38
BC114	£0·16*	BD177	£0·68	BFY51	£0·16	TIP31B	£0·42	2N2369	£0·14	40406	£0·45
BC115	£0·19*	BD178	£0·68	BFY52	£0·16	TIP31C	£0·44	2N2369A	£0·14	40407	£0·35
BC116	£0·19*	BD179	£0·75	BFY53	£0·16	TIP32A	£0·40	2N2411	£0·25	40408	£0·52
BC116A	£0·19*	BD180	£0·75	BIP19	£0·38	TIP32B	£0·42	2N2412	£0·25	40409	£0·75
BC117	£0·20*	BD181	£0·85	BIP20	£0·38	TIP32C	£0·44	2N2646	£0·47	40410	£0·75
BC118	£0·14*	BD182	£0·90	BIP19/20	£0·80	TIP41A	£0·44	2N2711	£0·22	40411	£2·70

74 SERIES TTL IC'S

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
7400	£0·09	7427	£0·24	7472	£0·20	74105	£0·38	74163	£0·62
7401	£0·11	7428	£0·26	7473	£0·25	74107	£0·24	74164	£0·68
7402	£0·11	7430	£0·11	7474	£0·25	74110	£0·36	74165	£0·68
7403	£0·11	7432	£0·22	7475	£0·29	74111	£0·58	74166	£0·78
7404	£0·11	7433	£0·30	7476	£0·25	74118	£0·80	74174	£0·65
7405	£0·11	7437	£0·21	7480	£0·44	74119	£1·18	74175	£0·62
7406	£0·22	7438	£0·21	7481	£0·85	74121	£0·24	74176	£0·58
7407	£0·22	7440	£0·12	7482	£0·68	74122	£0·39	74177	£0·58
7408	£0·13	7441	£0·50	7483	£0·58	74123	£0·40	74180	£1·50
7409	£0·13	7442	£0·40	7484	£0·88	74136	£0·52	74181	£0·58
7410	£0·11	7443	£0·70	7485	£0·68	74141	£0·55	74182	£0·70
7411	£0·17	7444	£0·70	7486	£0·22	74145	£0·55	74184	£0·70
7412	£0·15	7445	£0·85	7489	£1·70	74150	£0·68	74190	£0·68
7413	£0·24	7446	£0·80	7490	£0·32	74151	£0·48	74191	£0·62
7414	£0·50	7447	£0·48	7491	£0·64	74153	£0·48	74192	£0·60
7416	£0·23	7448	£0·56	7492	£0·35	74154	£0·82	74193	£0·58
7417	£0·23	7450	£0·11	7493	£0·30	74155	£0·50	74194	£0·62
7420	£0·11	7451	£0·11	7494	£0·75	74156	£0·50	74195	£0·60
7421	£0·20	7453	£0·11	7495	£0·50	74157	£0·50	74196	£1·05
7422	£0·16	7454	£0·11	7496	£0·50	74160	£0·58	74197	£1·05
7423	£0·21	7460	£0·11	74100	£0·85	74161	£0·62	74198	£1·85
7425	£0·19	7470	£0·25	74104	£0·39	74162	£0·62	74199	£1·85
7426	£0·23								

CMOS ICs

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
CD4000	£0·14	CD4015	£0·76	CD4026	£1·20	CD4043	£0·88	CD4070	£0·17
CD4001	£0·15	CD4016	£0·42	CD4027	£0·50	CD4044	£0·82	CD4071	£0·17
CD4002	£0·16	CD4017	£0·75	CD4028	£0·68	CD4045	£1·40	CD4072	£0·17
CD4006	£0·92	CD4018	£0·85	CD4029	£0·85	CD4046	£1·30	CD4081	£0·17
CD4007	£0·17	CD4019	£0·42	CD4030	£0·48	CD4047	£0·87	CD4082	£0·18
CD4008	£0·92	CD4020	£0·90	CD4031	£2·00	CD4049	£0·42	CD4510	£0·99
CD4009	£0·45	CD4021	£0·82	CD4035	£1·00	CD4050	£0·42	CD4511	£0·95
CD4010	£0·48	CD4022	£0·82	CD4037	£0·95	CD4054	£1·10	CD4516	£1·00
CD4011	£0·15	CD4023	£0·15	CD4040	£0·88	CD4055	£1·00	CD4518	£1·00
CD4012	£0·16	CD4024	£0·65	CD4041	£0·76	CD4056	£1·35	CD4520	£1·00
CD4013	£0·42	CD4025	£0·15	CD4042	£0·72	CD4069	£0·17	CD4014	£0·80

LINEAR ICs

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
CA3011	£0·08*	CA3031	£0·93	MC1350	£1·20*	UA710C	£0·40*	SN76115	£1·90*
CA3014	£1·35*	CA3140	£0·70	MC1352	£1·40*	72710	£0·30*	SN76660	£0·75*
CA3018	£0·65*	LM301	£0·29*	MC1469	£2·95	UA711C	£0·32*	SL414A	£1·95*
CA3020	£1·70*	LM304	£1·60	MC1496	£0·90*	72711	£0·32*	TAA550B	£0·35
CA3028	£0·80*	LM308	£1·00*	NE536	£2·66*	UA723C	£0·45	TAA621A	£2·00*
CA3035	£1·40*	LM309	£1·50	NE550	£0·95	72723	£0·45	TAA621B	£2·50*
CA3036	£1·00*	LM320-5V	£1·50	NE555	£0·24	UA741C	£0·24*	TAA661	£1·50*
CA3042	£1·50*	LM320-12V	£1·50	NE556	£0·60	72741	£0·24*	TAD100	£1·30*
CA3043	£1·85*	LM320-15V	£1·50	NE565	£1·20*	741P	£0·20*	TBA540	£2·10*
CA3046	£0·70*	LM320-24V	£1·50	NE566	£1·50*	UA747C	£0·60*	TBA810S	£0·75*
CA3052	£1·60*	LM380	£0·85*	NE567	£1·70*	72747	£0·60*	TBA810	£0·98*
CA3054	£1·10*	LM381	£1·45*	UA702C	£0·46*	UA748	£0·35*	TBA820	£0·70*
CA3075	£1·50*	LM3900	£0·58*	72702	£0·46*	72748	£0·35*	TBA9200	£2·50*
CA3081	£1·50*	MC1303L	£0·85*	UA703	£0·25*	748P	£0·35*	TCA270S	£2·00*
CA3089	£2·00*	MC1304	£1·90*	UA709	£0·25*	SN76013N	£1·75*	TBA800	£0·80*
CA3090	£3·60*	MC1310	£0·95*	72709	£0·46*	SN76023	£1·75*		
CA3123	£1·90*	MC1312	£1·90*	709P	£0·25*	SN76110	£1·50*		

DIODES

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AA119	£0.08	BAX13	£0.07	BY164	£0.51	OA5	£0.60	OA200	£0.08
AA120	£0.08	BAX16	£0.08	BY176	£0.75*	OA10	£0.35	OA202	£0.08
AA129	£0.08	BY100	£0.22	BY206	£0.30	OA47	£0.08	SD10	£0.06
AAY30	£0.09	BY101	£0.22	BYZ10	£0.45	OA70	£0.08	SD19	£0.06
AAZ13	£0.15	BY105	£0.22	BYZ11	£0.45	OA79	£0.10	IN34	£0.07
BA100	£0.10	BY114	£0.22	BYZ12	£0.45	OA81	£0.10	IN34A	£0.07
BA102	£0.32	BY124	£0.22*	BYZ13	£0.40	OA85	£0.10	IN914	£0.06
BA148	£0.15	BY126	£0.15*	BYZ16	£0.41	OA90	£0.10	IN916	£0.06
BA154	£0.12	BY127	£0.16*	BYZ17	£0.36	OA91	£0.10	IN4148	£0.06
BA155	£0.14	BY128	£0.16	BYZ18	£0.36	OA95	£0.10	IS44	£0.05
BA173	£0.15	BY130	£0.17*	BYZ19	£0.36	OA182	£0.13	IS920	£0.06
BB104	£0.15	BY133	£0.21*						

TRIACS

2 amp Volts	TO5 Case No.	Price	10 Amp Volts	TO48 Case No.	Price
100	TR12a/100	£0·31	100	TR110a/100	£0·77
200	TR12a/200	£0·51	200	TR100a/200	£0·92
400	TR12a/400	£0·71	400	TR100a/400	£1·12

6 Amp Volts	TO66 Case No.	Price	10 Amp Volts	TO220 Plastic Case No.	Price
100	TR16a/100	£0·51	400	TR110a/400p	£1·12
200	TR16a/200	£0·61		DIACS	
400	TR16a/400	£0·77	BR100	£0·20 D32	£0·20

ORDERING. Do not forget to state order number and your name and address.

V.A.T. Add 12½% to prices marked*. 8% to those unmarked. Items marked are zero rated.

P&P 35p unless otherwise shown.

SAXON ENTERTAINMENTS

THE PIONEERS OF MODULAR DISCO/P.A. EQUIPMENT NOW OFFER PACKAGE DEALS AT INCOMPARABLE PRICES

CENTAUR STEREO DISCOS

C/W LIGHT SHOW & DISPLAY, TWIN SPEAKERS & LEADS

Standard 100W

£249 + carr. £15 + VAT or Deposit **£57.12**
12 Months @ **£22.23** or 24 Manths @ **£12.73**

Super 200W

£299 + carr. £15 + VAT or Deposit **£68.12**
12 Months @ **£26.41** or 24 Months @ **£15.11**

GXL 200W (with twin 200 watt cabinets)

£389 + carr. £15 + VAT or Deposit **£87.32**
12 Months @ **£34.02** or 24 Months @ **£19.47**

COMPLETE STEREO ROADSHOWS – BUILT IN SOUND TO LIGHT/SEQUENCER & DISPLAY

TWO YEAR GUARANTEE

illustration shows GXL Centaur System

These systems feature full mixing for twa decks tape & mic with manitaring facilities – averride and are supplied camplete with sound ta light + sequencer, display, speaker leads etc.

JUST PLUG IN AND GO!

BSR Decks – 17,000 Line Laudspeakers – Rugged Aluminium Trimmed Cabinets – Cue Light And Phanes Output – Slave Output – Deck Lights/Mator Starts (GXL)

ALSO CENTAUR 'CUSTOM' 400-600W £699 – *ASK FOR DETAILS*

MINI DISCO 100 WATT MONO SYSTEM

£179.50 + carr. £15 + VAT Deposit **£42.06**
12 Months @ **£16.43** or 24 Months @ **£9.43**

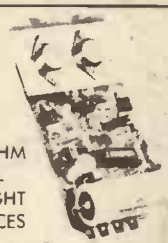
Similar in appearance ta the Centaur and complete with laudspeakers and leads.

Headphanes ta suit any system	
EM507 Electret Mic	**£15.00**
D1501 Electret Mic	**£18.50**
Baam Stand	**£15.50**
Corriage on all disco and PA systems (Included in H.P. Prices)	**£10.00**

20% Deposit Terms 12 to 24 Months – Low Interest

AMPLIFIER MODULES

- ☐ 30Hz-20kHz
- ☐ Shart/open circuit proof
- ☐ Top grade components
- ☐ Suit most mixers



NEW

240 WATT 4 OHM INDUSTRIAL MODULES EIGHT OUTPUT DEVICES

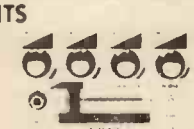
£35 SUPPLY **£24.75**

SA308 8 ohms 30W 45V	**£10.75***	Supply for 2 modules	**£11.90***
SA604 4 ohms 50V	**£14.50**	Supply for one or 2 modules	**£14.95**
SA60B 8 ohms 60W 65V	**£15.50**		
SA1204 4 ohms 120W 75V	**£17.50**	Supply for 1 module	**£14.95**
SA1208 8 ohms 120W 95V	**£21.00**	Supply for 2 modules	**£24.75**

SOUND-TO-LIGHT UNITS

3 CHANNEL – 3kW

- ☐ Operates from 1W upwards
- ☐ Bass/middle/treble/master controls



£29.50 + £1 carr complete

Module only **£19.75** Panel **£2.95**

4 CHANNEL – 4 kW SOUNDLITE SEQUENCER *(illus)*

- ☐ Dimmer on each channel
- ☐ Automatic sound light level
- ☐ Logic circuitry throughout

£39.50 Carr £1

Module only **£26.75** Panel **£2.95**

100W SPOTS

Red – Blue – Amber – Green **£1.50 ea.** Carr 50p max Free on 10+

HEAVY DUTY SPOT BANKS – MATCHES LOUDSPEAKERS

3 way 600W **£35.50** 4 way 800W **£39.50** Carr £2

SAXON KLAXON

NEW

FOUR WAY SIREN

UK Police – Destroyer – US Police – Hawaii Five-O
All the effects you need in one package **£17.50** Carr free

Individual sirens with any of the above effects **£7.50**

SAXON 'SMASH'

ALIEN VOICE SIMULATOR

Add a new dimension to your disco with this press button effect unit – just insert between mic and amplifier

£7.50 Carr free

SAXON 'SCINTILLITE'

Rope light controller with auto reverse

£24.75 Carr free

SAXON Rope Lights multicolour 25 feet long

Easy to change lamps **£35.50** Carr £1 Spare bulbs 10p ea.

FUZZ LIGHTS

Red, Blue Yellow, Green **£22.80**

DISCO MIXERS – COMPLETE OR MODULAR

MONO OR STEREO WITH AUTOFADE

Available complete and ready to plug in or as an easy to connect module with all controls except monitor switch already fitted – full instructions supplied.

MODULES

Mono module	**£27.50**
Stereo module	**£37.50**
Panel	**£3.95**
Kit of knobs/sockets etc	**£5.50**

FEATURES INCLUDE:
Twin Deck – Mic & Tape Inputs – Wide range bass & treble controls – Full headphone monitoring – Crossfade – Professional standard performance.

COMPLETE MIXERS (with case)

Mono mains	**£45.75**
Stereo mains	**£63.75**

CABINET FITTINGS

ICI Vynide 50" wide **£3.50m** Kick-res grille 50" wide **£3.50m**
Netlon kick proof 24" wide **£3.50m**
Corners/feet/recess plates **15p** ea. Recess handle **45p**
Bar handles **£2.50** Jack plugs/sockets **25p**

LOUDSPEAKER CABINETS – COMPLETE WITH LEADS

- ☐ Fitted with 100W 17,000 Gauss drivers
- ☐ Rugged cabinets with aluminium trim – black vynide etc
- ☐ Lifetime guarantee on main drive unit

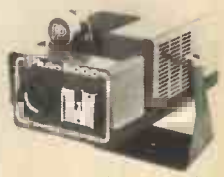
Standard 100W 1 x 12 (48 x 41 x 24)	**£39.00**	Carr £3 Deposit £9.36
Large 100W 1 x 12 (65 x 48 x 24)	**£49.50**	Carr £3 Deposit £12.70
P.A. 1 x 12 (+2 Piezos) (80 x 38 x 24)	**£66.50**	Carr £3 Deposit £15.82
P.A. 2 x 12 200W (100 x 38 x 24)	**£99.00**	Carr £3 Deposit £20.92
Disco 2 x 12 200W (80 x 63 x 24)	**£85.00**	Carr £3 Deposit £19.80
PDF reflex bin (80 x 40 x 41)	**£95.00**	Carr £3 Deposit £20.60

PDF100 Reflex Bin – Twin Horns – Integrated Slave Amplifier – Accepts mono or sterea signals

- ☐ Use with all types of mixer
- ☐ Pan and volume controls
- ☐ Send for details

£130 Carr £3 Deposit £28.40

PLUTO PROJECTORS & WHEELS



P140 150 Watt tungsten remarkable value
£37.50 Carr £1.00 Deposit £8.66

P5000 250 Watt Q.I. + fan Intachange fitting
£87.50 Carr £1.00 Deposit £20.28

Picture wheels from **£4.75** – a wide range of wheels & effects available – send for leaflet

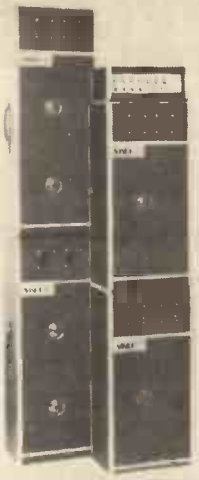
MOTOROLA PIEZO HORNS £4.50. YES!!

NOW OPEN AT

MANCHESTER PACKAGE DEAL

P.A. SYSTEMS

2 YEAR GUARANTEE



100 WATT £159.90 + Corr £15 + VAT £13.99 — **DEPOSIT £37.89**

12 mth @ £14.77 or 24 mth @ £8.48

★ AP100 4 INPUT AMPLIFIER (see below)
★ TWIN PIEZO HORN 100W COLUMNS & LEADS

200 WATT £249.00 + Corr £15 + VAT £21.12 — **DEPOSIT £57.12**

12 mth @ £22.23 or 24 mth @ £12.73

★ USES NEW AP200 SIX INPUT AMPLIFIER (below)
★ PAIR OF TWIN 200W PIEZO HORN COLUMNS

AP100 AMPLIFIER £49.50 +VAT £4.08

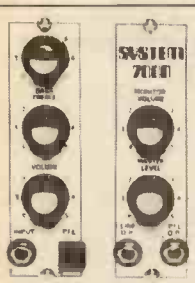
★ 4 mixing units
★ Bass, treble, moster controls
★ Twin outputs – vynide cose

+ £1.50 Carr
Deposit £10.22

AP200 NEW £89.50 +VAT £7.28

★ 6 mixing inputs
★ 3 set of boss/treble controls
★ Master & Prescence controls

+ £2.50 Carr
Deposit £20.36



D.I.Y. MODULES FOR P.A. SYSTEMS

Make your own mixer Mono/Stereo up to 20 channels accept all inputs available as PCB only or complete on front panels

MONO/STEREO

Input Modules	Mono PCB only	£6.50	Mono C/W Front panel	£9.50
	Stereo PCB only	£10.50	Stereo C/W Front panel	£13.75
Mixer/ Monitor Modules	Mono PCB only	£6.50	Mono C/W Front panel	£9.50
	Stereo PCB only	£10.50	Stereo C/W Front panel	£13.75

Power supply to suit £9.50 – send for full details of uses

PA SYSTEM ACCESSORIES

D1501 Dual Imp High O/P condenser mic	£18.50*
EM507 High output single impedance mic	£15.00*
ECM105 Low cost condenser mic	£5.00*

TWIN PIEZO HORN BOXES to match other cabinets Carr £1.50 **£27.50** Deposit £7.32

Heavy chrome mic stond – collopsible £9.90 Boom version £16.95

MELOS CASSETTE ECHO/REVERB
Twin input unit – infinitely voriable speed, depth & delay – playback feature Suits all mics & instruments
Corr £1 **£65.00**
Deposit £14.80

ADD ANY ACCESSORIES TO YOUR TOTAL CREDIT ORDER

All prices subject to 8% VAT except where asterisked (12½%)
Shop premises open Tues to Sat 9 am - 5 pm Lunch 12.30 - 1.30 pm
Mail order dept open Mon to Fri 10 am - 4 pm Ring 01-684 6385

TO ORDER

By Post Send your requirements with cheque crossed P.O. or 60p COD charge to address below or just send your Access or Barclay Card Number NOT THE CARD.

By Phone You may order COD, Access or Barclay Card.

Post & Packing 50p on all orders except where stated.

SAXON ENTERTAINMENTS

327 Whitehorse Road, Croydon, Surrey.
All Enquiries Large SAE Please Brochures on request.

MANCHESTER DISCO CENTRE, 237 DEANSGATE, MANCHESTER
CALLERS ONLY – (061) 832 8772 – COMPLETE UNITS ONLY

DIGITALLY SYNTHESIZED DOOR CHIME

24 tunes including "Rule Britannia", "Col. Bogie" etc.
Adjustable speed and tone.
In sturdy moulded case, taking internal PP3 batteries.
1 year guarantee. Special reduced price for PE readers only £14.95.

Don't Let Your Environment Dehydrate You!
Buy our Honeywell Humidity Controller.
Membrane actuated, very sensitive. ¼" shaft. 250V, 3.75A Contacts Ideal for greenhouses, centrally heated homes, offices etc. Build your own humidifiers or alarms. Fraction of original cost 50p ea. 5 for £2.

CASSETTE MOTORS
Self Regulating, will operate 6-12V Ideal for modelers, mechanical switching etc. 2000 R.P.M. approx.90p ea.

ULTRASONIC TRANSDUCERS
Transmitter and receiver. 40 kHz 14 mm.diam. £4.25 pair.

6 x 6 POLE REED RELAYS ON BOARD
12V ideal for burglar alarms, model railways etc. £2.45

100 MINIATURE REED SWITCHES
We are the cheapest! £3.30

EARPIECES
Magnetic with plug and lead 25p ea. 5 for £1
Crystal with lead 40p ea. 3 for £1

MAKE CHEAP BATTERY ELIMINATORS
Fully shrouded mini mains transformers. 240V In 6-0-6V at 100 MA out. Complete with mains lead and plug, ex new equip.90p

DE LUXE FIBRE GLASS PRINTED CIRCUIT ETCHING KITS
Includes 150 sq. ins. copper clad F/G. board, 1 lb ferric chloride, 1 dalo etch resist pen, Abrasive cleaner, Etch tray plus instructions Special Price £4.95
1 lb FE. C1. To mil. spec. £1.25
5 lb FE. C1. To mil. spec. £5.00
150 sq. in. Single sided board £2.00
150 sq. in. Double sided board £3.00

SMOKE AND GAS DETECTOR
Uses TGS 105 plug in sensor, housed in neat 3½" die cast box, led indicator, 24V, (12V by altering 3 component values). Will operate lamp or relay, with data and circuit £6.95
Relays for above £1 ea. state voltage

TRANSISTOR PACKS
100. Full spec. new and marked. Includes BC148, BC184L, MED412, BF274, BC154 etc. etc. £4.95
200 as above and Includes AC128, 2N3055, BFY50, BD131, BF200 etc. £9.95
Buy bulk and save money, these packs are worth at least double.

P/B SWITCH BANKS
These cost a fortune! Were made for various music centres. Includes independent and interdependent latching types multi pole c/o etc. Can be modified. Can't be repeated. 3 Banks for £1

BULK BARGAINS, STOCK UP FOR WINTER
300 mixed ¼ & ½ watt resistors £1.50
150 mixed 1 & 2 watt resistors £1.50
300 mixed capacitors, modern, most types £3.30
100 mixed ceramic and plate caps £1.20
25 pots and presets £1.50
25 presets, skeleton etc. £1.20
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100 Hi-wattage resistors wirewound etc. £2.20
100 electrolytics, nice values £2.20
300 printed circuit resistors £1
300 printed circuit components £1.50

100K MINIATURE THUMBWHEEL SLIDER POTS
Very neat, can be banked side by side. Ideal for v. cap tuning, graphic equalisers etc. 10 for £1

100K STEREO SLIDER POTS
Good quality. 25p ea. 5 for £1

MINIATURE LEVEL/BATT. METERS 200μA
F.S.D. as fitted to many cassette recorders. 90p

40p P & P on all above items. Cheque or P.O. with order to:

SENTINEL SUPPLY, DEPT. P.E.

149A BROOKMILL RD., DEPTFORD, LONDON, SE8

OUR RANGE OF PRODUCTS ARE NOW INDIVIDUALLY AND ATTRACTIVELY PACKAGED

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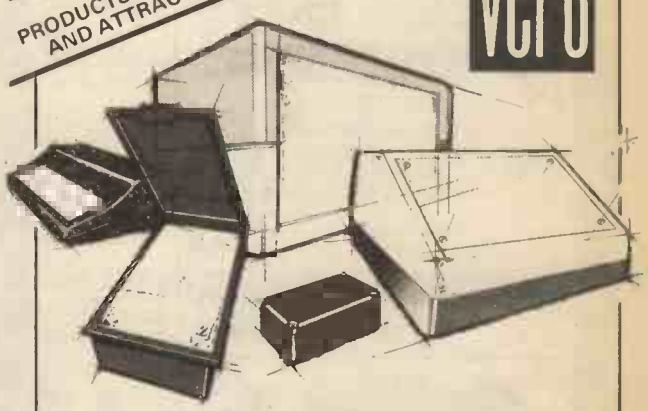

Our new catalogue lists a whole range of plastic boxes to house all your projects. And we've got circuit boards, accessories, module systems, and metal cases – everything you need to give your equipment the quality you demand. Send 25p to cover post and packing and the catalogue's yours.

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Telephone Chandlers Ford (04215) 2956

TRANSISTORS

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
AC107	0.23	BC108	0.07	BC177B	0.12
AC125	0.17	BC109	0.06	BC179	0.12
AC126	0.17	BC109B	0.07	BC182A	0.09
AC127	0.16	BC109C	0.07	BC182B	0.09
AC127K	0.23	BC113	0.12	BC183A	0.09
AC128	0.14	BC114	0.15	BC183LA	0.09
AC128K	0.25	BC116	0.13	BC183LB	0.10
AC128/176	0.42	BC117	0.15	BC184	0.08
AC142	0.18	BC118	0.12	BC184L	0.09
AC153	0.55	BC119	0.25	BC184LB	0.10
AC158	0.50	BC125	0.15	BC186	0.19
AC176	0.16	BC125B	0.16	BC187	0.19
AC187	0.50	BC126	0.15	BC204	0.08
AC187K	0.55	BC136	0.15	BC204B	0.09
AC188K	0.55	BC137	0.15	BC206	0.10
ACY20	1.02	BC138	0.30	BC206B	0.11
ACY22	1.02	BC140	0.27	BC207	0.10
AD142	0.87	BC141	0.29	BC209B	0.09
AD143	0.87	BC142	0.20	BC212A	0.10
AD149	0.65	BC147	0.06	BC213L	0.10
AD161	0.35	BC147B	0.07	BC214L	0.10
AD161/162	0.70	BC148	0.06	BC237	0.15
AD162	0.35	BC148A	0.07	BC237A	0.16
AD262	0.36	BC148B	0.07	BC237C	0.21
AD263	0.36	BC149	0.06	BC238	0.15
ADY26	4.74	BC157	0.06	BC238B	0.16
ADZ11	4.05	BC157A	0.07	BC238C	0.18
AF106	0.45	BC158	0.07	BC251A	0.15
AF109R	0.36	BC158A	0.08	BC251B	0.17
AF124	0.25	BC158V1	0.09	BC252A	0.15
AF125	0.25	BC159	0.06	BC252B	0.17
AF126	0.25	BC159A	0.07	BC252C	0.20
AF127	0.25	BC159B	0.07	BC258	0.20
AF139	0.32	BC161	0.25	BC261A	0.10
AF178	0.30	BC167	0.06	BC262	0.20
AF179	0.30	BC168	0.06	BC267A	0.21
AF200	0.36	BC169	0.06	BC267B	0.22
AF201	0.39	BC170B	0.07	BC268	0.21
ASY73	0.30	BC170C	0.07	BC304	0.25
ASZ15	0.60	BC171	0.06	BC307	0.15
ASZ16	0.60	BC171A	0.07	BC307A	0.15
ASZ17	0.60	BC171B	0.07	BC307B	0.15
AU103	0.90	B172	0.06	BC308	0.15
AU107	1.00	BC172A	0.07	BC309A	0.15
AU110	0.90	BC172B	0.07	BC317B	0.15
AU210	0.90	BC172C	0.07	B322	0.10
BC107	0.06	BC173	0.06	BC327	0.16
BC107A	0.07	BC173B	0.07	BC328	0.16
BC107B	0.07	BC174B	0.07	BC337	0.16
BC108	0.06	BC177A	0.12	BC338	0.16
BC348A	0.15	BD508	0.50	BFX43	0.70
BC350A	0.17	BD518	0.50	BFX84	0.20
BC441	0.20	BD537	1.02	BFX85	0.20
BC461	0.24	BD587	1.40	BFX88	0.20
BC546	0.10	BDX32	1.90	BFY18	0.50
BC547	0.11	BDY16	0.50	BFY19	0.50
BC547A	0.11	BDY20	0.50	BFY33	0.50
BC547B	0.11	BF115	0.35	BFY34	0.50
BC547C	0.11	BF121	0.20	BFY46	0.50
BC548A	0.11	BF123	0.20	BFY51	0.12
BC548B	0.11	BF125	0.20	BFY52	0.12
BC548C	0.11	BF127	0.20	BFY81	4.00
BC549A	0.11	BF137	0.21	BRY39	0.35
BC549B	0.11	BF152	0.15	BSX20	0.18
BC550	0.11	BF154	0.15	BSX52	0.33
BC557	0.11	BF157	0.37	BSY20	0.21
BC557A	0.11	BF158	0.15	BSY25	0.30
BC557B	0.11	BF167	0.25	BSY26	0.30
BC557C	0.11	BF173	0.20	BSY27	0.30
BC558	0.11	BF174	0.20	BSY29	0.54
BC558A	0.11	BF177	0.25	BSY39	0.15
BC558B	0.11	BF178	0.25	BSY52	0.33
BC559B	0.11	BF179	0.25	BSY54	0.39
BCY42	0.55	BF180	0.20	BSY56	0.36
BCY58	0.20	BF181	0.20	BSY60	0.36
BCY71	0.13	BF182	0.20	BSY84	0.30
BCY72	0.13	BF183	0.20	BU105	1.08
BD115	0.30	BF184	0.20	BU105-04	1.08
BD116	0.30	BF185	0.20	BU108	1.80
BD123	0.60	BF194	0.06	BU126	1.00
BD128	1.02	BF194A	0.07	BU133	1.75
BD131	0.35	BF195	0.06	BU204	1.30
BD133	0.40	BF195D	0.07	BU205	1.30
BD135	0.30	BF195G	0.07	BU208	1.50
BD136	0.30	BF196	0.06	BU208-02	1.75
BD137	0.30	BF197	0.06	BU406	3.60
BD138	0.30	BF198	0.06	BUY69A	6.75
BD139	0.30	BF224	0.18	BUY69B	2.00
BD140	0.30	BF253	0.18	BUY69C	7.00
BD144	0.30	BF254	0.18	BUY70A	5.00
BD168	0.50	BF255	0.18	BUY71	4.50
BD178	0.72	BF257	0.16	MPS6517	0.48
BD181	1.32	BF258	0.28	MPS6523	0.27
BD183	1.50	BF259	0.28	MPSA06	0.90
BD232	0.60	BF324	0.20	MV5053	0.72
BD233	0.60	BF335	0.25	NKT214	0.25
BD234	0.60	BF338	0.45	NKT224	0.25
BD235	0.40	BF457	0.60	OC22	1.40
BD236	0.40	BF523	0.22	OC26	1.40
BD237	0.40	BF594	0.10	OC29	0.85
BD238	0.40	BFR91	5.00	OC36	1.00
BD434	0.40	BFT43	0.54	OC44	0.12
BD507	0.50	BFX29	0.20	OC45	0.12
OC71	0.09	2N2188	0.20		
OC74	0.10	2N2218A	0.22		
OC75	0.10	2N2222	0.18		
OC82	0.48	2N2222A	0.20		
OC139	0.50	2N2270	0.39		
OC203	2.50	2N2368	0.10		
OC207	2.70	2N2484	0.18		
OC1072	2.50	2N2904	0.18		
OC1074	2.50	2N2906	0.18		
R2008B	2.10	2N3053	0.15		
TIP30	0.35	2N3117	1.00		
TIP31	0.45	2N3440	0.70		
TIP31A	0.45	2N3638	0.15		
TIP32	0.45	2N3638A	0.16		
TIP33	0.60	2N3643	0.24		
TIP42	0.60	2N3692	0.24		
TIP2955	0.65	2N3705	0.06		
TIS90	0.18	2N3706	0.06		
2N344B	0.30	2N3707	0.06		
2N404	0.45	2N3711	0.06		
2N524	0.48	2N3819	0.20		
2N526	0.48	2N3899	3.00		
2N527	0.48	2N3904	0.06		
2N685	3.50	2N3905	0.06		
2N705	0.10	2N3906	0.06		
2N706	0.10	2N4037	0.25		
2N706A	0.11	2N4058	0.10		
2N708	0.12	2N4222A	0.65		
2N1039	0.15	2N4348	2.00		
2N1059	0.15	2N4448	1.50		
2N1101	0.15	2N4914	3.50		
2N1102	0.15	2N5172	0.25		
2N1132	0.20	2N5245	0.30		
2N1304	0.50	2N5296	0.40		
2N1305	0.50	2N5458	0.25		
2N1307	0.50	2N5496	0.60		
2N1309	0.50	2N5670	0.65		
2N1613	0.18	2N5926	0.55		
2N1671	1.10	2N6123	0.65		
2N1671B	2.20	2S003	0.75		
2N1711	0.20	2S303	0.90		
2N1893	0.25	2S304	0.90		
2N1905	0.25	2S305	0.90		
2N1990	0.25	2S323	1.00		
2N2060	1.00	2S732	1.00		

TTL

7400	.12	7476	.13	74161	.80
7401	.12	7483	.75	74163	.80
7402	.12	7484	.90	74164	.90
7403	.12	7485	.90	74165	.90
7404	.13	7486	.26	74166	1.00
7405	.13	7489	2.00	74167	2.70
7406	.29	7490	.35	74170	1.70
7407	.29	7491	.65	74172	4.00
7408	.14	7492	.45	74173	1.20
7409	.14	7493	.36	74174	.90
7410	.13	7494	.80	74175	.70
7411	.18	7495	.55	74176	.90
7412	.21	7496	.62	74177	.90
7413	.25	7497	2.40	74178	1.20
7414	.54	74100	.95	74179	1.10
7416	.27	74105	.40	74180	.70
7417	.27	74107	.28	74181	1.95
7420	.13	74109	.45	74182	.75
7421	.28	74110	.46	74184	1.20
7423	.25	74111	.70	74185	1.20
7425	.22	74116	1.60	74186	7.20
7426	.25	74118	.82	74188	5.40
7427	.25	74119	1.30	74190	1.10
7428	.34	74120	.82	74191	1.00
7430	.13	74121	.26	74192	1.00
7432	.24	74122	.40	74193	1.10
7433	.32	74123	.55	74194	.92
7437	.24	74125	.45	74195	.85
7438	.24	74126	.46	74196	.92
7440	.13	74128	.62	74197	.92
7441	.52	74132	.70	74198	1.60
7442	.55	74141	.58	74199	1.50
7444	.90	74142	2.02		
7445	.70	74143	2.02		
7446	.70	74144	2.02		
7447	.66	74145	.65		
7448	.60	74147	1.35		
7450	.13	74148	1.20		
7451	.13	74150	1.00		
7452	.13	74151	.60		
7454	.13	74153	.60		
7460	.13	74154	1.06		
7470	.28	74155	.63		
7472	.22	74156	.63		
7473	.26	74157	.63		
7474	.20	74158	1.70		
7475	.28	74160	.80		

CMOS

4000	.15	4073	.20		
4001	.15	4075	.20		
4002	.20	4076	1.10		
4006	.95	4078	.20		
4007	.20	4081	.20		
4008	.94	4082	.20		
4009	.46	4502	.90		
4010	.50	4507	.52		
4011	.15	4508	2.30		
4012	.15	4510	1.10		
4013	.35	4511	.70		
4014	.85	4512	.95		
4015	.80	4516	.70		
4016	.45	4518	.65		
4017	.55	4520	1.10		
4018	.90				
4019	.45				
4020	.60				
4021	.85				
4022	.85				
4023	.20				
4024	.68				
4025	.20				
4026	1.35				
4027	.35				
4028	.70				
4029	.90				
4030	.50				
4033	1.40				
4035	1.10				
4040	.90				
4041	.80				
4042	.75				
4043	.85				
4044	.85				
4049	.28				
4050	.45				
4051	.88				
4052	.88				
4053	.88				
4055	1.00				
4060	1.00				
4066	.35				
4068	.20				
4069	.20				
4070	.20				
4072	.20				

DIODES

AA119	0.17	BB105G	0.35	BY201-3	0.40	ITT210	1.35	OA202	0.07
AA121	0.11	BB110G	0.45	BY201-4	0.45	ITT827	2.35	ST2	0.14
AA129	0.08	BB142	1.26	BY201-5	0.56	IT7921	0.20	1N4001	0.04
AA143	0.15	BR100	0.20	BY201-6	0.56	IT7923	0.35	1N4002	0.05
AA144	0.09	BR101	0.30	BY203-12	0.60	ITT1075	0.25	1N4003	0.05
BA102	0.30	BY100	0.20	BY203-16	0.65	ITT2001	0.25	1N4004	0.06
BA111	0.98	BY103	0.35	BY203-20	1.00	ITT2002	0.20	1N4005	0.06
BA115	0.25	BY118	1.45	BY204-4	0.45	MR502	0.75	1N4006	0.07
BA145	0.15	BY126	0.15	BY204-8	0.65	MR813	0.80	1N4007	0.08
BA148	0.12	BY127	0.10	BY204-10	0.75	MR854	1.80	1N4148	0.04
BA154	0.10	BY130	0.16	BY206	0.30	MR856	2.10	1N4150	0.45
BA155	0.12	BY133	0.10	BY210-400	0.45	MR992A	1.56	1N4448	0.25
BA156	0.12	BY134	0.45	BY210-600	0.50	MV2203	1.80	1N5401	0.12
BA157	0.46	BY142	0.45	BY210-800	0.55	MV5460	0.85	1N5402	0.15
BA158	0.65	BY164	0.50	BYX10	0.36	OA47	0.07	1N5403	0.15
BA159	0.75	BY176	3.46	BYX55-350	0.45	OA70	0.07	1N5404	0.18
BA182	0.45	BY179	0.90	BYX55-600	0.55	OA71	0.35	1N5405	0.25
BA201	0.15	BY182	1.86	BYX71-350	0.90	OA81	0.12	1N5406	0.20
BA243	0.85	BY184	0.70	BYX71-600	1.15	OA85	0.12	1N5407	0.19
BAX13	0.06	BY187	1.30	BZX61 series	0.18	OA86	0.20	1N5408	0.20
BAX16	0.07	BY198	0.75	BZY88 series	0.08	OA90	0.07	1N5450A	6.75
BAX17	0.10	BY199	0.56	DK13	0.45	OA91	0.06	1N5761	0.60
BB105B	0.35	BY201-2	0.40	ITT44	0.10	OA95	0.06		

LINEAR INTEGRATED CIRCUITS

CA3020	1.75	SC9504P	2.00	TAA300	3.75	T8A400	2.25
CA3046	0.80	SL414A	4.85	TAA310	3.15	T8A510	2.40
CA3048	2.50	SL415A	6.30	TAA320	2.60	T8A510Q	2.50
CA3065	1.58	SL9018	8.60	TAA350A	3.00	T8A520	2.50
CA3089E	7.68	SL9178	10.70	TAA435	3.40	T8A520Q	2.50
CA3090Q	4.50	SL1310	5.85	TAA550	0.50	T8A530	2.50
ETT6016	4.95	SL1327	2.75	TAA550B	0.40	T8A530Q	2.50
ETT6016	4.95	SL3046	2.60	TAA570	2.85	T8A540	2.50
MC1303L	1.50	SN76003N	2.50	TAA621	6.95	T8A540Q	2.25
MC1304P	2.00	SN76003ND	2.15	TAA630	8.56	T8A550	3.80
MC1305	5.15	SN76013N	1.80	TAA635	5.10	T8A550Q	3.80
MC1307P	2.85	SN76013ND	2.15	TAA661A	1.70	T8A560	6.46
MC1310P	1.00	SN76023N	1.80	TAA661B	1.80	T8A560C	4.50
MC1327P	2.75	SN76023ND	2.15	TAA700	3.80	T8A560Q	7.35
MC1327PQ	2.80	SN76033N	2.40	TAA840	4.50	T8A560CQ	3.00
MC1330P	1.26	SN76110N	1.80	TAD100	1.35	T8A570	2.00
MC1339P	3.85	SN76131N	2.00	TBA120A	3.05	T8A570Q	2.00
MC1349	3.35	SN76226N	3.15	TBA120AS	1.80	T8A641A12	6.20
MC1351P	1.25	SN76226ND	3.15	TBA120S	2.70	T8A641B11	6.65
MC1352P	1.45	SN76227N	2.50	TBA120SB	1.80	T8A872	5.00
MC1358PQ	3.85	SN76532N	3.15	TBA120SQ	1.80	TBA700	3.85
SAA570	4.20	SN76533N	2.70	TBA781	4.70	TBA700Q	2.25
SAA7008	10.15	SN76544N	1.80	TBA350A	3.00	TBA720	5.10
SAS560	2.75	SN76550N	1.80	TBA396	1.80	TBA720A	5.10
SAS570	2.75	SN76660N	0.80	TBA440	3.60	TBA720AQ	2.10
SBA7508	6.75	SN76666N	1.60	TBA4406	3.95	TBA750	2.40
SC9503P	2.00			TBA4800	2.50		

T8A750Q	2.50				
T8A800	0.90				
T8A800Q	2.85				
T8A810A	3.40				
T8A810S	1.10				
T8A820	0.80				
T8A915	7.35				
T8A920	3.00				
T8A920Q	3.60				
T8A950-2	5.40				
T8A950-2x	5.04				
T8A990	4.95				
T8A990Q	3.75				
TCA160	5.10				
TCA270	3.00				
TCA2708	3.60				
TCA270Q	3.60				
TCA2705	2.25				
TCA2705Q	3.40				
TCA800	5.40				
TCA800Q	12.40				
TCA830	3.10				
TDA440	6.75				
TDA1327	2.85				
TDA1327B	2.85				
TDA1330	1.60				
741	0.25				

BRIDGE RECTIFIERS

CURRENT	VOLTAGE	ORDER CODE	PRICE
1A	50V	B1/50	0.25
1A	100V	B1/100	0.28
1A	200V	B1/200	0.28
1A	400V	B1/400	0.30
1A	800V	B1/800	0.34
2A	50V	B2/50	0.40
2A	100V	B2/100	0.45
2A	200V	B2/200	0.55
2A	400V	B2/400	0.65
2A	800V	B2/800	0.70
3A	200V	B3/200	0.70
3A	600V	B3/600	0.80
4A	100V	B4/100	0.90
4A	400V	B4/400	0.95
6A	50V	B6/50	0.85
6A	200V	B6/200	1.10
6A	400V	B6/400	1.20
10A	400V	B10/400	2.50
25A	50V	B25/50	4.00
25A	200V	B25/200	4.20
25A	400V	B25/400	4.30

I. C. SOCKETS

NO. OF PINS	ORDER CODE	PRICE
8	D8	0.10
14	D14	0.11
16	D16	0.13
20	D20	0.30
22	D22	0.35
24	D24	0.40
28	D28	0.45
40	D40	0.60

PANEL METERS

Size 2" x 2" x 1⅜", requires 1¾ cut-out.

F.S.D.	ORDER CODE	PRICE
1mA	M1	5.50
500mA	M500	5.50

THYRISTORS

CURRENT	VOLTAGE	CASE	ORDER CODE	PRICE
80mA	30V	TO18	S08/30	0.22
80mA	60V	TO18	S08/60	0.24
80mA	200V	TO18	S08/200	0.26
1A	50V	TO220	S1/50	0.25
1A	100V	TO220	S1/100	0.26
1A	200V	TO220	S1/200	0.28
1A	400V	TO220	S1/400	0.35
3A	50V	TO220	S3/50	0.25
3A	100V	TO220	S3/100	0.28
3A	200V	TO220	S3/200	0.30
3A	400V	TO220	S3/400	0.40
4A	50V	TO220	S4/50	0.35
4A	100V	TO220	S4/100	0.40
4A	200V	TO220	S4/200	0.80
4A	400V	TO220	S4/400	0.86
5A	400V	TO220	S5/400	0.86
7A	50V	TO220	S7/50	0.46
7A	100V	TO220	S7/100	0.80
7A	200V	TO220	S7/200	0.86
7A	400V	TO220	S7/400	0.90
8A	400V	TO220	S8/400	0.70

TRIACS

CURRENT	VOLTAGE	CASE	ORDER CODE	PRICE
3A	100V	TO220	T3/100	0.75
3A	200V	TO220	T3/200	0.80
3A	400V	TO220	T3/400	0.85
6A	200V	TO220	T6/200	1.00
6A	400V	TO220	T6/400	1.05
8A	400V	TO220	T8/400	1.35
10A	400V	TO220	T10/400	1.40
15A	400V	TO220	T15/400	2.00

Ordering. All items offered subject to availability. Payment with order, please add 20p p & p with orders under £5 otherwise carriage free. No other charges – just send prices shown. Enquiries please send S.A.E. Government departments and educational institutions just send official order. Callers welcome. Export orders welcome.

RESISTORS

¼W Values available in E12 series from 10R to 1M. Price 0.03 each.
½W Values available in E12 series from 1R0 to 10M. Price 0.03 each.
1W Values available in E12 series from 2R2 to 10M. Price 0.06 each.
2W Values available in E12 series from 10R to 10M. Price 0.11 each.
5W Values available in E6 series from 1R0 to 6K8.
Prices 1R0 to 1K0 0.19 each.
1K5 to 3K3 0.22 each.
4K7 to 6K8 0.24 each.
7W Values available in E12 series from R47 to 22K.
Prices R47 to R82 0.26 each.
1R0 to 1K0 0.26 each.
1K2 to 12K 0.27 each.
15K to 22K 0.28 each.
11W Values available in E6 series from 1R0 to 22K.
Prices 1R0 to 1K0 0.28 each.
1K5 to 12K 0.30 each.
15K to 22K 0.36 each.
17W Values available in E6 series from 1R0 to 22K.
Prices 1R0 to 4K7 0.39 each.
6K8 to 22K 0.41 each.

¼W Single turn cermet potentiometer. Values available 100R, 200R, 500R, 1K0, 2K0, 5K0, 10K, 20K, 50K, 100K, 200K, 500K, 1M. Price 0.97 each.

½W Multiturn cermet potentiometer. Values available 20R, 50R 100R 200R, 500R, 1K0 2K0, 5K0, 10K, 20K 100K, 500K. Price 1.40 each.

1W Potentiometer with 2" spindle. Values available 10R, 25R, 50R, 100R, 250R, 500R, 1K0, 2K5, 5K0, 10K, 20K Prices 10R to 5K0 1.51 each. 10K & 20K 1.62 each.

1.5W Convergence preset potentiometer. Values available 5R0, 7R0, 10R, 15R, 20R, 100R, 500R. Price 0.50 each.

2W 10 Turn potentiometer. Values available 100R, 200R, 500R, 1K0, 2K0, 5K0, 10K, 20K, 50K, 100K. Price 7.34 each.

CAPACITORS

Tantalum Bead			25V	10uF	0.14 each
6.3V	47uF	0.32 each		22uF	0.14 each
	100uF	0.50 each		47uF	0.17 each
16V	10uF	0.24 each		100uF	0.17 each
	22uF	0.30 each		220uF	0.36 each
	47uF	0.50 each		470uF	0.47 each
25V	22uF	0.41 each		1000uF	0.72 each
35V	0.1uF	0.22 each	63V	1uF	0.14 each
	0.22uF	0.22 each		2.2uF	0.14 each
	0.47uF	0.22 each		4.7uF	0.14 each
	1.0uF	0.22 each		10uF	0.17 each
	2.2uF	0.22 each		22uF	0.17 each
	4.7uF	0.24 each		47uF	0.29 each
Disc Ceramic				100uF	0.40 each
8kV	150pF	0.27 each		220uF	0.65 each
	180pF	0.27 each		470uF	0.66 each
	200pF	0.27 each		1000uF	1.01 each
	220pF	0.27 each	100V	10uF	0.20 each
	250pF	0.40 each		22uF	0.25 each
	270pF	0.40 each		47uF	0.36 each
	300pF	0.40 each		100uF	0.61 each
Mixed Dielectric				220uF	0.68 each
600V	1uF	1.01 each	450V	1uF	0.27 each
1kV	0.01uF	0.26 each		4.7uF	0.45 each
	0.033uF	0.32 each		10uF	0.53 each
	0.047uF	0.35 each		22uF	1.07 each
	0.1uF	0.39 each		33uF	1.22 each
	0.22uF	0.58 each	Silvered Mica		
	0.47uF	0.89 each	500V	3.3pF	0.18 each
1.25kV	0.1uF	0.50 each		5pF	0.18 each
1.5kV	0.001uF	0.24 each		10pF	0.18 each
	0.0022uF	0.24 each		39pF	0.18 each
	0.0047uF	0.24 each		100pF	0.18 each
	0.22uF	0.28 each		150pF	0.18 each
Single Ended Electrolytic				180pF	0.18 each
16V	10uF	0.11 each		220pF	0.18 each
	22uF	0.11 each		330pF	0.36 each
	47uF	0.11 each		470pF	0.36 each
	100uF	0.11 each		680pF	0.36 each
	220uF	0.14 each		820pF	0.36 each
	470uF	0.28 each		1000pF	0.42 each
	1000uF	0.32 each		2200pF	0.50 each
63V	1uF	0.11 each		8200pF	1.58 each
	2.2uF	0.11 each		10000pF	1.62 each
	4.7uF	0.11 each	Multi-sectional Electrolytic		
	10uF	0.13 each	30V	2500/2500uF	1.94 each
	22uF	0.16 each	70V	2500/2500uF	2.70 each
	47uF	0.22 each	300V	150/150/100uF	2.81 each
	100uF	0.32 each	350V	200/300uF	2.46 each
	220uF	0.46 each		200/200/100/32uF	3.89 each
Double Ended Electrolytic				150/100/100/100/	
10V	22uF	0.14 each		150uF	4.75 each
	100uF	0.14 each		400/400uF	4.75 each
	220uF	0.17 each		300/300/150/100/	
	470uF	0.36 each		50uF	5.18 each
	1000uF	0.40 each			

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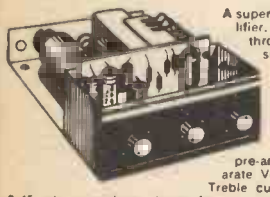

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AMPLIFIER KIT (Magnetic input components 33p extra)	£14·50 P. & P. 80p
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PE VOLUME 15 No. 4 APRIL 1979

BLOWING THE TRUMPET

IT'S NICE to know you are number one, and P.E. has over the last six months consolidated its position as the leading electronic hobby magazine published in Britain. By this we don't mean that we consider ourselves to be a better magazine, better features, better presentation, more interesting reading etc., we should not judge ourselves! We simply mean that you buy more copies per month of P.E. than any other similar magazine* and that, of course, pleases us. More copies sold is the start of a spiral, in addition to enabling us to improve the product, or at least restrict price rises, it also means that our advertisers can sell more and that helps to increase the number of adverts we carry. This in turn leads to bigger issues which, hopefully, will encourage even more people to buy and so, if we continue to "get it right", it goes on.

We hope, of course, that "more copies sold" means that you like us better than the others. It does not mean that we are perfect or that we can please all the people all the time, but we hope it shows we are going in the right direction! We will not now sit back and let the grass grow, as is so easy when things are going well, indeed we would like you to tell us how we can go on getting better—or perhaps you think we ought to *start* to improve?

We have scored some notable firsts over the last few months, our *VDU* and *Microprinter* projects for instance; we feel that the *Bubble Memories* feature this month is a significant, up to the minute, article on this "new" technology.

EXCLUSIVE

We have been able to design and manufacture a very useful tool which will be **exclusive to P.E.** and, although it is worth at least £1 (many similar tools are sold to industry for much more) we will be giving one away with each of our May issues. After that a limited quantity will be available for sale by writing to the editorial offices.

We have brought you a number of catalogues over the last year or so, and this issue carries—not a full catalogue—but at least a sample of what Maplin, the largest mail order component suppliers in this country, can offer. We are sure these catalogues are of interest to most readers and, judging by the way you respond by ordering components, they have been helpful in the search for the right part at the right price.

We have some exciting projects under development and maybe we can score some more firsts with one or two of them! We will continue to strive to improve the quality of our projects but that does not mean that they will be getting bigger to get better. There is, and will undoubtedly continue to be, a demand for the smaller well designed project.

It is not our intention to leave behind those without a pocket deep enough for the synthesiser or computer etc. However, this hobby can significantly reduce the cost of many items of equipment and we are sure that such benefits will continue for those of us that follow the hobby as constructors.

Having blown our trumpet, and thankfully you are still reading—even if you totally disagree with everything above—we will give you a chance to reply. Comments to the editor please—not too blue as it affects the nerves (and my secretary)—and hopefully we can let you have your say in *Readers' Letters* in a couple of months!

Mike Kenward

* Based on independent figures by the Audit Bureau of Circulation.

Technical Queries
We are unable to offer any advice on the use or purchase of commercial equipment or the incorporation or modification of designs published in Practical Electronics.

All letters requiring a reply should be accompanied by a stamped, self addressed envelope and each letter should relate to **one published project only.**

Components are usually available from advertisers; where we anticipate supply difficulties a source will be suggested.

Back Numbers
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Binders
Binders for PE are available from the same address as back numbers at £2·85 each to UK addresses, £3·45 overseas, including postage and packing, and VAT where appropriate. Orders should state the year and volume required.

Subscriptions
Copies of PE are available by post, inland or overseas, for £10·60 per 12 issues, from: Practical Electronics, Subscription Department, Oakfield House, Perrymount Road, Haywards Heath, West Sussex RH16 3DH.

Cheques and postal orders should be made payable to IPC Magazines Limited.

Market Place

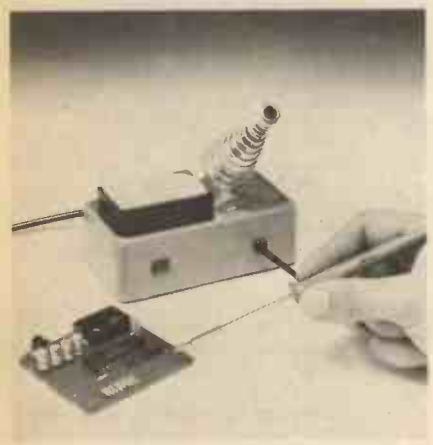
Items mentioned are usually available from electronic equipment and component retailers advertising in this magazine. However, where a full address is given, enquiries and orders should then be made direct to the firm concerned. All quoted prices are those at the time of going to press.

by Alan Turpin and David Shortland

SMALL IS BEAUTIFUL

Something really new in soldering. The Oryx PSU-6 is a complete soldering station in miniature.

Ideal for work on the latest micro-miniature circuitry, it has a fully isolated and fused transformer for safe operation, a miniature coil spring iron rest with stainless steel insert, and sponge tray for tip cleaning.



The base, which has non slip feet, measures only 120 x 65 x 50mm, has a burnproof aluminium cover which solder will not adhere to and an indicator lamp to show correct operation.

The sub-miniature 6V 6W two-wire iron has a stainless steel shaft, longlife element and a slide on nickel plated tip only 2·4mm in diameter.

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Available, ex-stock, from **Toolrange Ltd., Upton Road, Reading RG3 4JA (0734 29446).**

SALE SALE SALE SALE . . .

If you live in or around the London area and are interested in buying components at sale prices then go along to Home Radio between March 24th and 31st, shop hours are 9.00 to 5.00 and 1.00 on Wednesdays.

They are in the process of moving premises—though all mail should continue to be sent to their present address—and have decided to sell off the ex catalogue stock.

They tell us that this consists mainly of current items but also includes some valve transformers etc. It is all new and is available to callers only, during "sale week".

Once they have moved, at the end of March, they will no longer be able to serve callers and their business will then be mail order only.

Home Radio (Components) Ltd., 240 London Road, Mitcham, Surrey CR4 3HD. (01-648 8422).

ELECTRONIC BASEBALL

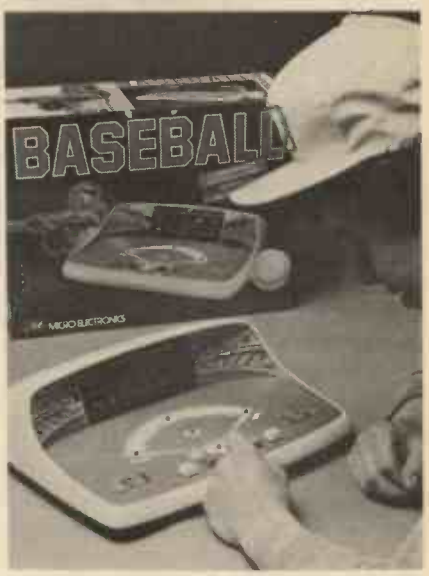
An electronic baseball game which simulates all the functions of the real game in a self-contained, battery-operated unit has been introduced by Micro Electronics Ltd.

The microprocessor-controlled game, which uses l.e.d. displays to simulate the movements of players and ball and to keep score, allows players to use their own offensive and defensive skills and strategy to influence the result.

In operation, a player chooses the desired speed of pitch (slow, normal or fast) and then presses the "pitch" button, which starts a scoreboard display cycling through all possible events at the desired speed. When the "bat" button is pressed, the cycling of events stops, and a crowd cheer (for a "hit") or a buzz (for an "out") is heard.

In addition, players can introduce offensive or defensive options in the form of "pinch hitters" or "relief pitchers", respectively. The control circuitry is designed so that the three pinch hitters have a higher "batting average" (400 against 270 for the normal team players), and the two relief pitchers, although more "powerful" to start with, are designed to "tire" to the original pitcher's effectiveness after five batters.

There are several ways in which players can use their skill: the pitcher has three choices of speeds, giving him the opportunity to analyse the batter to see whether he hits fast or slow balls, and the batter can time his pressing of the "bat" button (with practice) to obtain more and better hits.



An alphanumeric display scoreboard provides a continual display of home and visitor score, number of relief pitchers and pinch hitters remaining, event counter (showing score of present batter), inning counter, "at bat" indicator (showing which side is in), number of "outs", and indicators to show when pinch hitters or relief pitchers are introduced.

The game is mounted in a sturdy plastic case with a representation of a baseball diamond, with individual lights showing the location of the base runners. An input is provided for an external 9V d.c. supply.

Micro Electronics Limited, Consumer Products Division, 766 Finchley Road, London, NW11 7TH (01-458 8944).

INTEL TECHNICAL LIBRARY

Intel have just updated and reprinted their leaflet which lists all the technical publications available from them. These include users' and operators' manuals, brochures, application notes, reliability reports, article reprints and data sheets.

The larger manuals can be purchased from Intel and purchasers are allowed to select up to five additional publications free of charge with each order.

The Intel technical library is now extensive and covers most aspects of microcomputer and minor system design and application.

Intel Corporation (UK) Ltd., 4 Between Towns Road, Cowley, Oxford OX4 3NB (0865 771431).

SINCLAIR DMMs

To complement their two existing low cost meters, Sinclair Radionics have announced two new digital multimeters. (The DM450 and DM350). The DM450 is a 4½ digit, 5 function multimeter with a basic accuracy of 0·05 per cent of the reading and the DM350 is a 3½ digit instrument with 34 ranges and a basic accuracy of 0·1 per cent of the reading. Both units can handle currents up to 10A, and resistances to 20M, are protected against overloads and have high brightness, 8 mm l.e.d. displays.

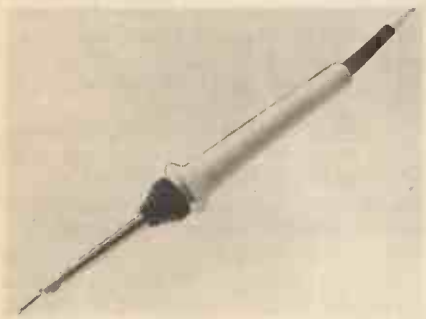
The units are powered from four C size cells and an optional a.c. adaptor is available where continuous use is required. Additional accessories include a rechargeable battery pack, 30kV high voltage probe and an "eveready" carrying case with a neck strap.

The DM450 is priced at £99 plus VAT and the DM350 is £69 plus VAT. **For further details contact Sinclair Radionics Ltd., London Road, St. Ives, Huntingdon, Cambs, PE17 4HJ. Telephone (0480 64646).**

LIGHTWEIGHT SOLDERING IRONS

Tele-Production Tools Ltd. announces the availability of the TELPRO FR range of soldering irons.

These irons operate from 220/240V but are also available for 12, 24, 48 or 110V operation, with an option of three power ratings; 18, 24 or 30W.



The standard F35 type high purity iron-clad tip is supplied with the irons; these are detachable and may be interchanged with any of twelve other iron-clad tips which are made in various shapes and sizes.

These tips reduce migration of copper molecules during soldering, thereby greatly extending the tip life and eliminating frequent re-dressing of the soldering tip.

For further information contact: **Tele-Production Tools Ltd., Stiron House, Electric Avenue, Westcliff-on-Sea, Essex SS0 9NW (0702 352719).**

MOD-1

The latest enclosures from West Hyde Developments are in three distinct series.

The MOD-1 type A series is a 19in rack mounting chassis with panel heights from 2 to 6U (3½ to 10½in).

The type C series contains cases which can be either free standing or rack mounting. Heights are from 2 to 6U and various widths and depths are available.

The type E series are 19in housings made to take "type A" racks and "type C" cases or any 19in front panels.

For full details including price contact **West Hyde Developments Ltd., Unit 9, Park Street Industrial Estate, Aylesbury, Bucks., HP20 1ET. (0296 20441).**

DISPLAY BEZEL

Newly-available from Vero Electronics is a moulded display bezel in two sizes to frame and highlight a display and at the same time cover possible tool marks around a panel cut-out.

Designed to fit into a single rectangular cut-out, the bezel is positioned in the cut-out by four removable location pegs, and firmly secured by two moulded in screwed studs which also secure the display mounting board on spacers provided.

A choice of lenses is offered—neutral, red and clear, polarised or un-polarised and a full range of compatible mounting boards for both l.e.d. and l.c.d. displays is available.

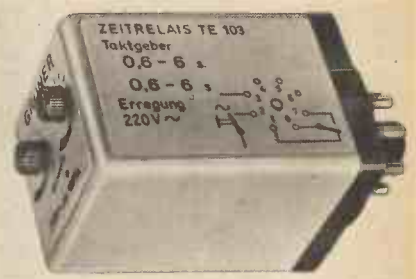
Prices range from £1·50 for a 4-digit bezel with clear lens, to £2·65 for a 6-digit with coloured lens.

Vero Electronics Limited, Industrial Estate, Chandler's Ford, Eastleigh, Hampshire, SO5 3ZR. (042-15 69911).

MINIATURE TIMERS

ELREMCO announce the introduction of a new range of miniature electronic timers.

The units are all of the plug-in module variety and are housed in the same size enclosure, which measures 36mm square × 50·5mm high, excluding plug. A full range of Delay, Interval, Delay to Off and variable On/Off cycling are available, with time ranges up to 180 seconds. All have a single change over contact rated up to 5A at 240V resistive, depending on type.



The timers are manufactured by Gruner of West Germany and ELREMCO have the sole U.K. agency.

For details contact **Electrical Remote Control Co. Ltd, P.O. Box 10, Bush Fair, Harlow, Essex CM18 6LZ (0279 24285)**

MICRO DE-SOLDERING TOOL

Less than 7in long, only ¼in diameter and weighing only 1oz, the MICRO desoldering tool is certainly small.

It has an all metal body, high suction power and easily replaceable screw in Teflon tips. It is primed and released by thumb operation, with a built in safety guard and an anti-recoil system.

Ideal for use with subminiature soldering irons on the smallest electronic circuitry, the 3mm dia. nozzle can remove solder from even the most tightly packed double sided printed circuit boards.

This MICRO costs £5·95 + VAT.

Available, ex-stock, from **Toolrange Ltd., Upton Road, Reading RG3 4JA (0734 29446).**

HAPPY TTL TESTING

Useful birthday presents generally turn out to be socks but I was more lucky with this one, an Amtron logic probe kit.

There are not many components: a 7404 i.c., a BC107B transistor, a couple of resistors, a p.c.b., two w.e.l.s (white emitting lamps), a piece of red and a piece of green celluloid, probe body, a metre of screened lead and two insulated croc clips.

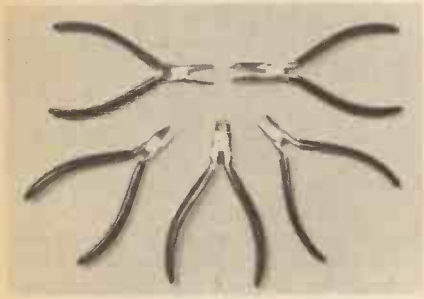
Putting the components on the board was easy, although one i.c. hole had not been drilled. Getting the assembly of board, celluloid pieces, probe body and end caps together was a bit of a struggle. One end cap had to be scraped to fit and the body and the pieces of coloured celluloid annoyingly twisted themselves out of position as the probe tip was screwed on. When the cursing was over the device proved to be a goer first time, for use on TTL only.

Our May issue will have the first part of a TTL project, a small microcomputer using the General Instrument CP1610 16 bit microprocessor.

A.T.

BELZER ELECTRONIC TOOLS

Belzer tools from West Germany are certainly not cheap but meet high standards of quality and finish. The range includes special pliers made from vanadium extra steel nickel coated, chromium plated and highly polished with spring loaded plastic handles.



Also listed are pliers, cutters and screwdrivers; tweezers, adjustable tools and complete tool kits.

A free 32 page colour catalogue and price list is available from **Toolrange Ltd., Upton Road, Reading RG3 4JA (0734 29446).**

A CAREER IN ELECTRONICS

A new careers leaflet has been issued by The Institution of Electrical and Electronics Technician Engineers (IEETE) entitled "Engineering a career in the electrical and electronics industry".

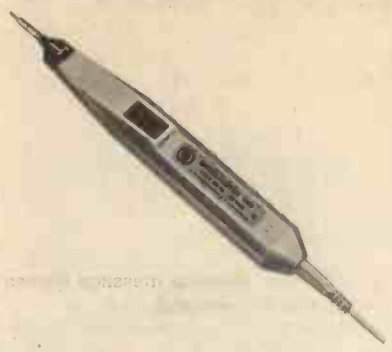
The booklet avoids excessive detail, concentrating rather on giving a general picture of the profession of electrical and electronic engineering and the qualifications required to become a Technician Engineer, a Technician or a Chartered Engineer.

The leaflet will be useful not only to young people considering their career, but also to those engaged in offering careers advice and guidance.

Copies are available on request from **The Secretary, IEETE, 2 Savoy Hill, London WC2R 0BS (01-836 3357).**

INSTANT HEAT IRON

The Engel S50 is a mains operated iron which has a 35 watt power consumption and can heat up to an operating temperature of 350°C in under 10 seconds.



The joint to be soldered is illuminated by a built-in lighting unit and an indicator lamp is fitted to show when the iron is on.

The price of the S50 is £9·50 and further information can be obtained from **Kelgray Products Limited, Kelgray House, Sandy Lane, Crawley Down, West Sussex RH10 4HS (0342 715066).**

WATFORD CATALOGUE

Watford Electronics have replaced their stock list with an illustrated catalogue which covers a wide range of components, tools, kits, test and audio equipment, and news of Watford's own business and home computer system based on the Zilog Z80μP.

The price of the catalogue, which has now been available for a few months, is 50p plus 25p for p&p.

Watford Electronics, 33/35 Cardiff Road, Watford, Herts. WD1 8ED (0923 40588).

STACKABLE l.e.d.s

The standard range of Mullard l.e.d.s has recently been extended to include a series of stackable red, green and yellow devices.

The flattened outline of these devices enables them to be mounted with a centre-to-centre distance of only 0·1in.

These new l.e.d.s have the same high brightness levels normally associated with filament type lamps (0·8mcd at 20mA) and will allow bar graphs to be easily constructed.

Type numbers for the devices are; CQX10 (red), CQX11 (green) and CQX12 (yellow).

For further information including price contact **Mullard Ltd., Mullard House, Torrington Place, London.**

DEVELOPMENT SYSTEMS

Now available, off-the-shelf, from Distronic are two microprocessor development systems for the RCA CDP1800 COSMAC microprocessor family. Costing £100 (plus VAT), the CDP18S020 evaluation kit is a complete kit of components for building an evaluation board for the CDP1802 COSMAC microprocessor, while the CDP18S021 Microterminal, which costs £70 (plus VAT), is a hand-held, non-hard-copy alternative to a teletypewriter data terminal.

The evaluation kit represents a valuable first step in the development of COSMAC programs and prototype systems, and incorporates on-board utility read-only memory for terminal control.

The Microterminal provides a convenient means of controlling a COSMAC system, reading and modifying memory, and providing hexadecimal input/output capability.

The two systems are ideally suited to combined operation.

Distronic Limited, 50-51 Burnt Mill, Elizabeth Way, Harlow, Essex (0279 32947)

ASCII ENCODED TOUCH KEYBOARD

The capacitive touch keyboard manufactured by Star Devices is a low cost terminal for use with microprocessor systems.

The standard unit includes, 7 bit parallel ASCII encoded output with positive and negative strobe edges, full ASCII character set, auto repeat, audio feedback which can be adjusted by means of a volume control and a sensitivity control which allows the touch pads to be adjusted to suit the user.

When the character is selected the seven l.e.d.s mounted above the keypad will display the ASCII code for that particular character.

The keyboard, which requires a 5V 200mA power supply, is priced at £37·50 including VAT, p&p and a comprehensive handbook.

For information contact **Star Devices Ltd., Box 21, Newbury, Berks. (0635 68020).**

Semiconductor UPDATE...

FEATURING : S 2600 S2601 2758

R.W. Coles

REMOTE CHIPS

The possibilities of electronic remote control systems have always fascinated me. I did once dabble in the subject when I became hooked on the radio control of model aircraft using a 27MHz radio link. Building the electronics was fun, but range problems and the vagaries of aerodynamics finally caused my interest to wane.

These days my only contact with the subject is a quick drool over the latest, and consequently far too expensive, quad proportional systems which appear in the window of our local model shop.

Just recently, however, a new data sheet from A.M.I. has had me thinking up all kinds of new remote control schemes for things like TV games, garage doors, model cars, and burglar alarms. The object of my new found affection is a two chip remote control set coded **S2600** and **S2601.**

The S2600 is a complete CMOS encoder intended for use with ultrasonic, I.e.d., r.f., or hardwired transmitter circuits. It can transmit any one of 31 commands under the control of a simple keyboard, and it uses a bit-synchronised encoding scheme which pulse code modulates a 40KHz carrier.

The use of sychronisation pulses transmitted with every data bit results in a link very tolerant to frequency variations between transmitter and receiver clock oscillators, and message integrity is further assured by a coded preamble message and the use of redundant transmissions so that at least two identical message frames are sent for each command.

The 40KHz carrier frequency is Ideal for the direct drive of a piezoelectric ultrasonic transducer, and the fact that the S2600 is fabricated in CMOS means that a low cost 9 volt battery can be used as a power source.

The S2601 is a PMOS decoder circuit which recognises valid commands from the S2600 and outputs a five bit binary word in response to the key pressed at the transmit end.

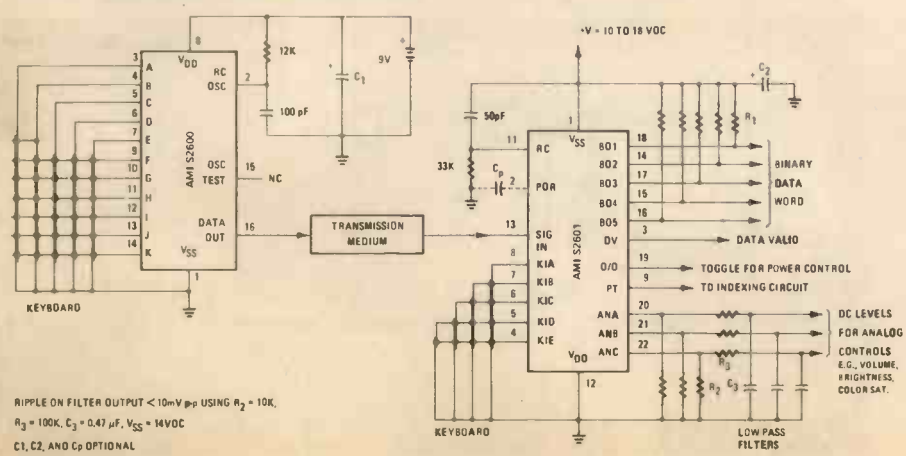
Some of the 31 codes are assigned special significance by being recognised within the S2601 and used to control additional outputs.

Five special function outputs are provided, a pulse train, or stepper, output which pulses at 2·44Hz while the appropriate button is depressed, an ON/OFF function which toggles on the receipt of its own special code, and three analogue outputs, A, B and C in the form of 10kHz pulse trains with a variable mark to space ratio.

The analogue outputs can give, after low pass filtering, 64 discrete voltage levels and they can be made to increase in response to one transmitted code and decrease in response to another.

The chips were designed in the first place for the remote control of television sets, but they can be used for any other purpose you can dream up. The S2600 is in a 16 pin d.i.l. package, and the S2601 in a 22 pin package, so they are easy to accommodate in miniature systems. Just think what you could do with a pair of these chips and one of those motorised plastic car kits!

Circuit Application **S2600/S2601**



5 VOLT EPROM

Microprocessor nuts will no doubt be familiar with the 2708 Erasable, Programmable, Read Only, Memory (EPROM), which has become something of an industry standard in the past couple of years. The 2708 is used to hold programs during software development, when the fact that it can be erased with Ultra Violet (UV) light and reprogrammed is a great asset.

Volume manufacturers go on to replace *their* 2708s with cheaper mask programmed ROMs when the software has been finalised for mass production. But for small quantity manufacture and for hobby use, the 2708 is the only form of ROM most people consider.

With a capacity of 1K 8 bit words, the 2708 is a handy size for most purposes, but unfortunately it has the drawback of needing three power supply rails, and has a data sheet restriction which forbids single word programming.

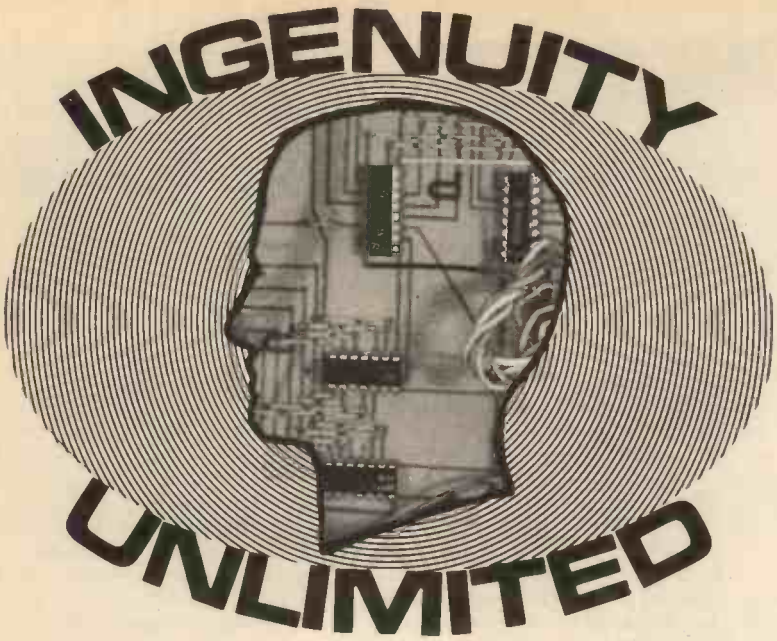
The ability to program a PROM a few words at a time can be very useful for those inevitable patches which are needed to get a program running, and having to wait for up to an hour for an erase cycle can mean that you need to have four or five PROMs in circulation for every socket on the board. An expensive overhead!

To overcome those 2708 problems, and a few more besides, Intel have introduced the **2758** which has the same capacity as the older device but which operates from a single 5 volt supply.

Single address programming is standard, and only a single 25 volt supply is needed for programming, with all inputs and outputs TTL compatible during read *and* program. With programming now so easy, it is a very simple matter to design a PROM programmer.

If you like, you can even program the PROMs in the sockets in which they will be used. All you need to do is pipe a switchable 25 volt supply to the V_{CC} pin on each PROM, set up the address and data under software control, and bang in a 50ms pulse on the PD/PGM pin. Every microprocessor system could contain its own programmer software—a nice thought. Oh, and the PD in PD/PGM stands for Power Down. The 2758 has a low power standby mode which cuts power consumption by 75 per cent when deselected by a logic high on the PD/PGM input.

Nice one, Intel!



A selection of readers' original circuit ideas. It should be emphasised that these designs have not been proven by us. They will at any rate stimulate further thought.

Why not submit *your* idea? Any idea published will be awarded payment according to its merits.

Articles submitted for publication should conform to the usual practices of this journal, e.g. with regard to abbreviations and circuit symbols. Diagrams should be on separate sheets, not inserted in the text.

Each idea submitted must be accompanied by a declaration to the effect that it is the original work of the undersigned, and that it has not been accepted for publication elsewhere.

CAR INTRUDER ALARM

THIS circuit provides protection by sensing the voltage drop in the wire to the interior courtesy light fitted to most cars.

On sensing the voltage drop, when one of the doors are opened, the alarm will trigger and 5 seconds later the horn will give an intermittent blast if the circuit is not reset.

R1 and R2 bias the inputs of the operational amplifier at approximately 10V with a 12V supply.

The inverting input however is biased at 0·7V below this (forward voltage drop of D1) which means that the output is at the positive supply rail.

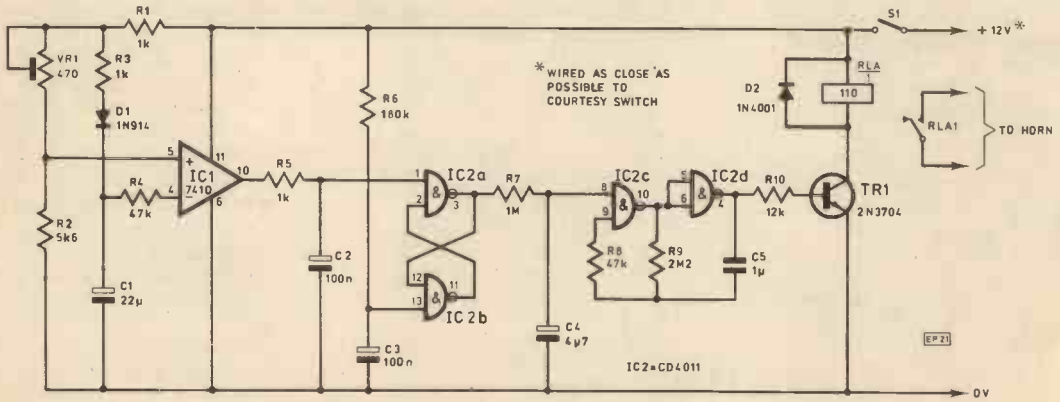
If the supply voltage should drop slightly, the non-inverting input will drop also, but the inverting input will not due to the charge on C1 and the diode D1 reverse biases preventing C1 from discharging. The output from IC1 will drop and flip the latch formed by one half of a CMOS quad two input NAND package. The output of this latch then charges up C4 in 5 seconds activating the 0·5Hz oscillator which pulses the car's horn.

R5/C2 time-constant is provided to filter any unwanted noise. R6/C3 ensure correct start up for the latch and R7, C4 give an approximate 5 second delay to allow the alarm to be deactivated on entering the car via hidden switch S1.

To arm the circuit you just open the car door and switch on the alarm. The alarm will not be activated when the door is closed as the circuit responds only to a drop in supply voltage, not a rise.

The relay should be any 12V type capable of handling the horn current. Potentiometer VR1 is provided as a sensitivity control.

C. J. Nother,
Portsmouth,
Hants.



SIGNAL INJECTOR

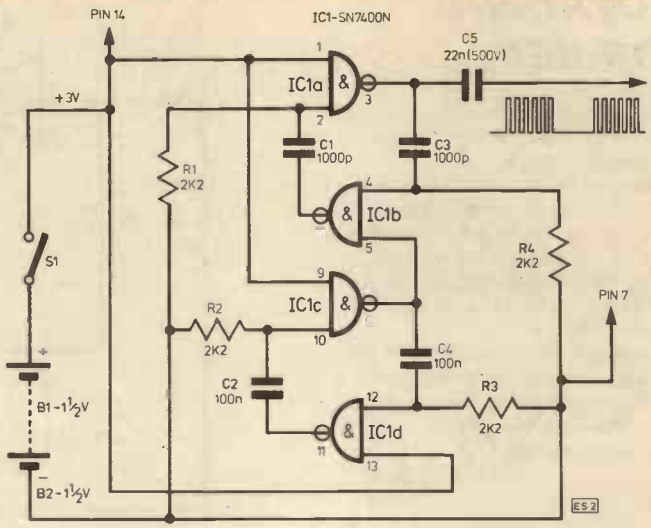
THIS design is based on the SN7400N TTL integrated circuit.

The basic oscillator runs at approximately 200kHz, and produces a square wave with fast rising edges, and hence is rich in harmonics. For this signal to be heard, it is modulated at 2kHz by another oscillator.

Each oscillator consists of two NAND gates connected as an astable multivibrator with two capacitors and two resistors. The lower frequency oscillator, IC1(c) and IC1(d), has its output fed to the spare input of IC1(b).

Thus the higher frequency oscillator is switched on and off at 2kHz. The composite signal is fed to the probe tip via a 22n isolating capacitor.

D. P. Akerman,
Coventry.



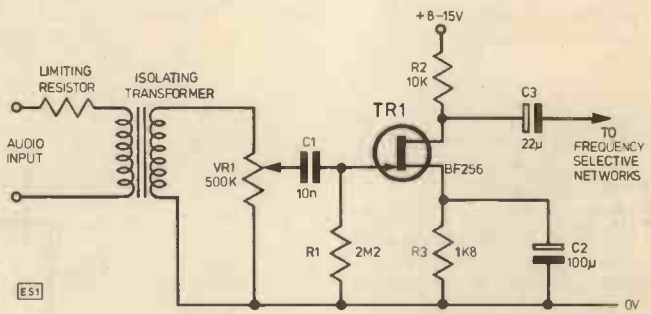
SOUND-TO-LIGHT PREAMP

WITH many circuits for sound-to-light converters using valve output transformers to isolate the audio source, the sound level has to be unacceptably high (in domestic systems certainly) to produce a reasonable display.

This can be overcome by the use of a simple field effect transistor pre-amp between the transformer and the frequency selective network. The f.e.t. is better suited to this situation than its bipolar brother as any variations of voltage appearing at the gate will be amplified irrespective of the current available.

The value of components is by no means critical in this particular circuit and virtually any *n* type f.e.t. will work. This basic configuration can, in fact, be used where ever a high input impedance and medium output impedance are required. The calculations are very simple, since, as no gate current flows, the input impedance is effectively the same value as the resistor R1, while that of the output is equal to R2.

J. Little,
Parkstone,
Dorset.



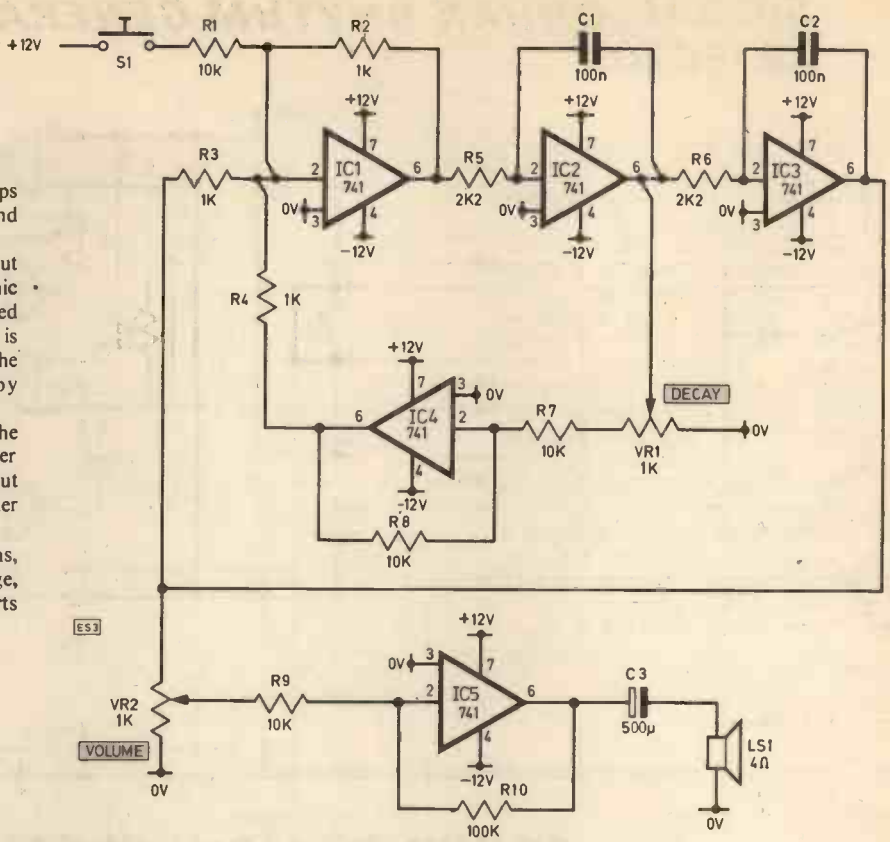
ELECTRONIC DOOR BELL

THIS door bell circuit has the op-amps IC1–IC4 arranged to form a second order differential network.

The output of the circuit to a step input is therefore damped simple harmonic motion, or the wave form from a plucked string with no harmonics. The step input is provided by the bell push button, and the ringing decay rate is adjusted by potentiometer VR1.

The output is buffered through IC5 the volume being controlled by potentiometer VR2. The speaker provides the sound but if this is not loud enough a further amplifier can be provided.

P. R. Williams,
Stevenage,
Herts



PROGRAMMABLE DIVIDER

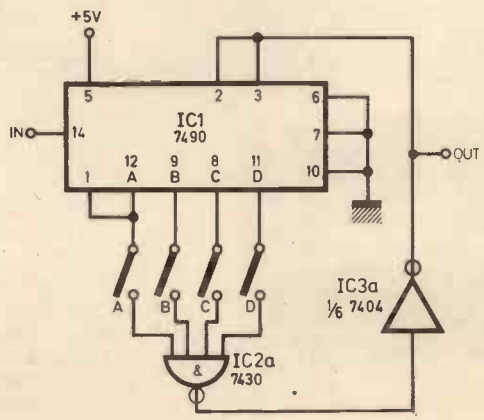
THIS circuit is extremely useful for the digital experimenter, and can divide the incoming digital signal by any whole number between two and ten.

The eight input NAND gate (four of the inputs are connected to positive via a 10 kilohm resistor or left floating) is controlled by the b.c.d. output of the 7490 via the switches.

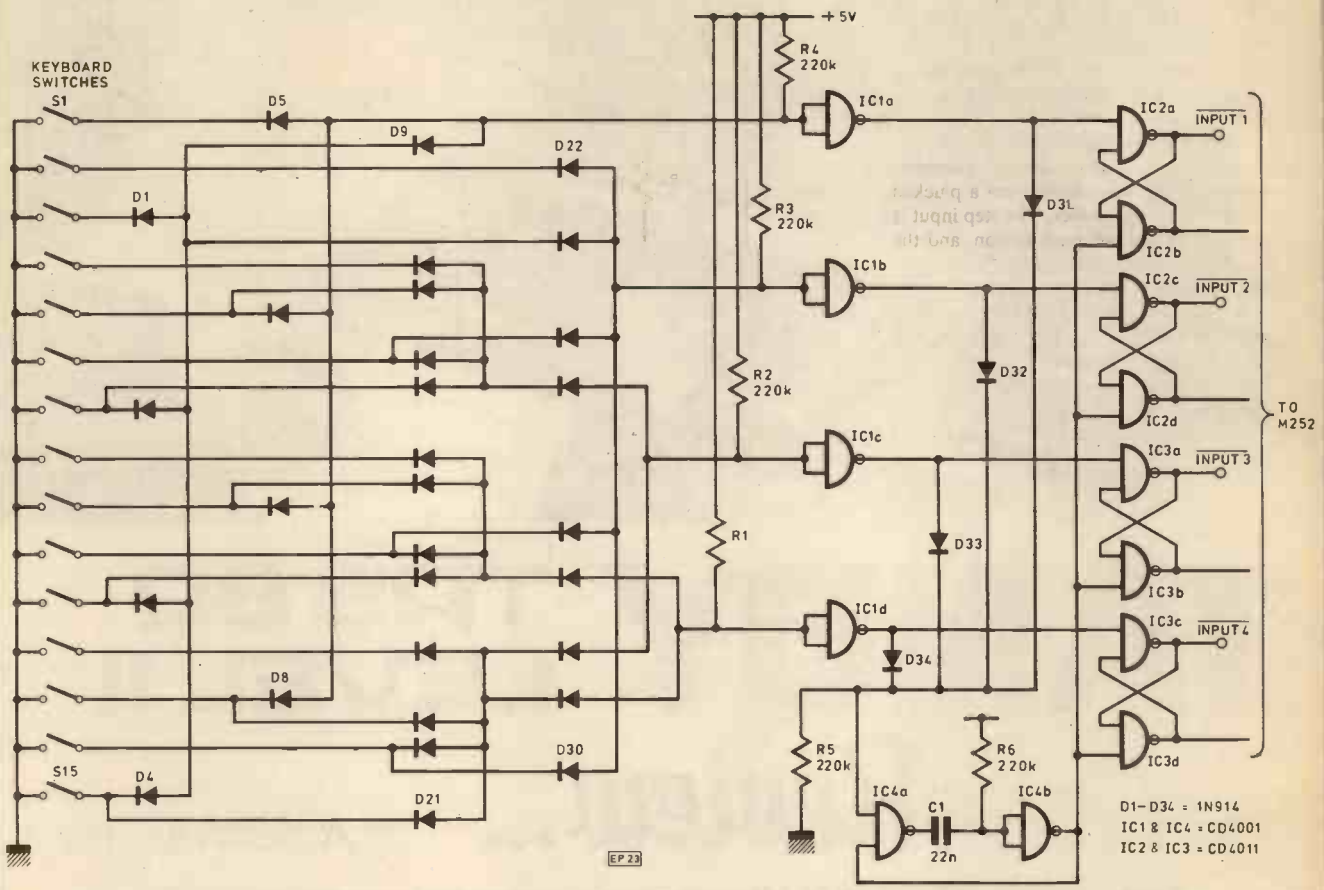
When all inputs at are a logic "1" the output becomes "0", is inverted and becomes the output pulse and resets the counter to zero.

To operate, for example if division by six is required (6 = 0110 in b.c.d.), switches B and C are closed. The A and D inputs are floating, i.e. at a logic "1", and when the B and C outputs become logic "1", the counter is reset.

J. Hogarth,
Guiseley.



ORGAN RHYTHM GENERATOR



As many readers will be aware, particular rhythms required are programmed by addressing the Signetic M252 chip with a 4-bit binary code. This may be implemented simply by using four single pole changeover switches but this involves learning the codes which represent each pattern and presents difficulties switching from one rhythm to another. An alternative solution would be to decode the outputs of a 15-way pushbutton bank into a binary code. However, these units appear to be a difficult item to procure and even when available the cost is usually prohibitive especially when one considers the low cost of the unit thus far. Owing to their availability and low price, calculator keyboards would seem to provide the obvious answer.

First of all a decoder is required which will give a 4-bit binary code from the fifteen switch contacts.

The circuit shows such a decoder, the operation of which is self evident, using the fewest number of diodes possible. The diodes may be any small signal general purpose devices. The outputs are then inverted with CMOS inverting gates IC1a–IC1d which may be CD4001, CD4011 or similar.

As the keyboard switches are push to make, release to break, it is apparent that a memory element is required.

This is implemented using eight 2-input CMOS NAND gates, IC2a–IC3d.

When one button is depressed the rest of the rhythms must be cancelled so it is necessary to reset all the latches initially. This is accomplished by deriving a logical "1" from the decoded lines, via D31–D34 and R5, when any button is depressed and using this to trigger the one-shot multivibrator made up of IC4a, IC4b, C1 and R6.

IC4a and IC4b must be CMOS NOR gates, CD4001 or similar. With the component values given the output pulse duration will be approximately 10 milliseconds which will reset the latches momentarily.

The reset pulse is made short in relation to the time which the particular keyboard switch is held down so that when the reset goes low the binary code is committed to the latches.

The code may then be input to the appropriate address pins on the M252.

P. Gladdish,
Affestree,
Derby.

TANDY TRS 80 LEVEL II

Review...

A.A.BERK B.Sc. Ph.D.

Four versions of the TRS80 Microcomputer have now been available in this country for some time. Our contributor has recently been able to put the most expensive version (£807 including VAT) through its paces.

The equipment is only available as a ready to use system, complete with 12 inch video monitor and cassette recorder.

THE TRS80, from Tandy, comes packaged in one impact protected cardboard box which splits into three separate packages containing:

(a) CPU/keyboard, plus power pack and cassette tapes, with interconnection leads (all beautifully packed in foam rubber).
(b) A *Realistic* CTR-41 cassette tape recorder.
(c) A video monitor.

Also included is a manual appropriate to the level of the machine. I shall describe the above components first and then concentrate on the complete system.

MONITOR

The video monitor is just a normal TV without the r.f. and audio side. Brightness (labelled B) and contrast (labelled C) are mounted on the front, and horizontal and vertical hold brought out to the back. The volume control (conveniently labelled V) is replaced by a plastic grommet through which passes the video lead terminated by a DIN plug for insertion into the CPU/keyboard housing. The monitor is, of course, set up to accept a 240 volt 50Hz mains supply and not 120 volt/60Hz as suggested in the manual.

Here, in my opinion, lies the most irritating aspect of the video display. The VDU frame control in the computer is based on a 60Hz frame frequency, and a frame beating effect on the screen with the 50Hz mains is constantly apparent. By wandering into various Tandy stores, I have noted this effect to some extent on every display encountered—this varies from barely noticeable to really eye-catching!

The screen brightness, on my specimen, also varied from dark to bright quite spontaneously and randomly, with or without the CPU connected—indicating a faulty component in the TV. The focusing and definition, though reasonable, is also not of the highest nature and all in all this component is the weakest of the system.

RECORDER

The cassette recorder is of the normal piano-key type with remote control and built-in condenser mic. which is left switched off by a plastic plug, supplied, for insertion into the mic. socket. One prime facility offered by this machine is its tape-counter—a truly enlightened addition making tapes usable throughout their entire length with fast access to the contents—very thoughtful, Tandy!

The comment I must make, however, concerns the wisdom of supplying tape machines apparently unchecked for head azimuth set-up. I had heard, some time previously, a criticism by a user to the effect that Tandy pre-recorded tapes were very difficult to load successfully (while his own tapes were reliable). Sure enough, I plugged the units together and tried to load the supplied "Black Jack" game—without success. I had similar trouble recording tapes myself.

In desperation, I tried listening to the tape to see if I could hear any unwanted blips, etc. The sound seemed a little muffled so I took the machine to pieces and replayed the tape while adjusting the (sealed!) head positioning screw for the clearest sound. The unit never gave another moment's trouble. Both loading and dumping is reliable, fast and easy to use, once the critical volume setting has been found ($7\frac{1}{2}$ on mine with my own recordings and $6\frac{1}{2}$ for Tandy's—tone switched to low).

The computer names each tape file dumped to tape, and can search for and load any particular file—even under program control. One could imagine a small business application running on two or three such tape systems very cheaply indeed— if very slowly!

CPU

The CPU is the most compact (and expensive) part of the system and houses the Z80 based microcomputer plus a full typewriter keyboard. There are two removable plastic covers at the back of the case. One of these houses the RESET switch and an expansion edge connector which plugs, via a ribbon cable, into the Expansion Interface, available from Tandy. This edge connector also contains almost everything the home computer man could want for expansions, etc., of his own. The second cover contains a power switch and DIN sockets for video monitor, cassette and power. The power supply unit is a small black box mostly containing iron and copper.

The system comes in several levels starting with Level I BASIC and 4K of RAM for £499. It seems generally agreed that this price is rather on the high side—but one does have a complete "front parlour" type of set-up to amaze and thrill one's friends without the usual wire-bestrewn heap of naked, loosely connected chips! At a further cost of £229 (including installation) your 4K version may be uprated to 16K.

This process is one of removing the eight 4K dynamic RAM chips (which Tandy keep!) and replacing them by the pin compatible 16K versions (with one or two small changes). For this service, £229 is, in my opinion, well overpriced and I have noticed firms springing up with offers of such conversion at considerably less. A conversion which is more than worthwhile, however, is the one to Level II BASIC for £79. In fact I would highly recommend bypassing the Level I version altogether for the difference in price. However—make sure you buy the Level I manual if you do not know anything about computers, its explanations are very full and easy to understand.

The machine used for the preparation of this article was the Level II with 16K RAM.

Level II BASIC is an extremely powerful programming language and even a small experience of Level I quickly leads the user to hanker after Level II—a fact which I suspect Tandy have realised from the design stage.

COMMAND MODE

With the four components plugged into each other via the three interconnection leads, and into the mains by three more, the complete effect is very swish—if slightly cable-bound! The video monitor may now be switched on and the CPU's power switch pressed. This causes the CPU's red l.e.d. power indicator to glow and the words MEMORY SIZE? to appear on the screen. At this time, you can reserve a block of memory in the core to be used for running machine code routines—even callable by a BASIC program.

Hitting the ENTER key (as the Americans say) then causes display of the advert:

RADIO SHACK LEVEL II BASIC

followed by:

>_

This last is an indication that the machine is now ready to accept a command—it is said to be in the "Command mode". In this mode, the keyboard may be used, for instance, to write program statements in the BASIC computer language for immediate execution.

The 16 display lines of the VDU may each contain 64 characters, and the cursor position may be shifted down, left or right by "↓", "←" or the SPACE bar. In addition, "→" allows movement of the cursor to the next "tab" position, at intervals of eight spaces; "SHIFT→" changes the screen contents to 32 double-width characters per line for greater readability; and the "CLEAR" key may be used to clear the contents of the screen and home the cursor to top left. This all allows great flexibility in the use of the machine and is very much to be commended.

While using the keyboard, one very soon discovers that the keys are not properly debounced—doubling of characters is not an uncommon occurrence—and the keys are acoustically noisy, probably because the CPU casing is acting as a large sounding board. These are very minor criticisms, and all in all, the n-key rollover and special keys built into the keyboard make it easy and pleasant to use.

An example of a BASIC program statement which may be written from the keyboard, following the characters ">_", would be:

PRINT (389*14.761) (↑8.7)*SIN(0.87)

This set of characters is displayed on the screen as shown, but is not "looked at" by the computer until the ENTER key is pressed. This allows you to correct any mistakes on the line by backspacing using the "←" key which moves a cursor ("→") back along the line obliterating the characters it meets one by one.

When you are satisfied with the statement you have built up, "ENTER" causes the computer to execute the statement. The above tells it to multiply (symbol "*") two numbers, then raise the result to the power 8·7 ("↑" symbol), and finally multiply by

The complete system, showing Level II manual and all interconnection leads.

the SINE of 0·87 (radians). The answer: "3·86502E + 32", which is 3·86502 times 10 to the power 32, appears on the next line. The machine is acting as a super calculator and will accept complex programs, with many statements—all on one line—and execute them immediately.

This is fine as long as you don't make an error near the beginning and have to backspace the full 250 characters allowed on a *program* line deleting as you go for correction. The whole line, in fact, may be deleted by "SHIFT←".

A program for execution at a later time (or for saving on tape) may be written using line numbers at the beginning of each line of program statements. This is the most usual method for program development, and allows a set of statements to be written without the computer executing them individually. New lines may be inserted between two existing ones simply by giving them line numbers between those of the old lines.

COMMANDS

In the command mode, 14 commands are available to the user. These allow: listing of all or some of the existing program lines, automatic line numbering with any increment (to allow plenty of space for insertions), cassette loading and filing, saving memory blocks for strings, line deletions, program erasure, continuation from a breakpoint, running the current BASIC program or machine code program blocks, setting or resetting trace and program line editing.

This last is particularly powerful on the TRS80. It allows insertions, deletions or amendments to any character or block of characters in a line of program text. The editor can save a tremendous amount of time in program writing and debugging, and practice with this facility in the beginning is a worthwhile investment of one's effort. In addition, most of the above commands may themselves be used as part of a program.

The full floating point package, with its 16 arithmetic functions from standard trigonometry and exponential, to Random number and integer functions may be used in a single precision (six figures and one guarding) or double precision (16 figures plus one). Conversion between integer precision (numbers between −32769 and +32768), single and double precision is easy and, in addition, any variable may be inherently defined as taking one of these precisions by the use of the DEF statement or simply by one of the special declaration characters—e.g. A% is automatically in integer form. The appendix (section F/1) conveniently gives a table of more complex trig. and hyperbolic functions derived from those available. There is a fairly obvious error in HYPERBOLIC COSINE—which I've decided to leave as an exercise for the reader!

OTHER FUNCTIONS

Many other functions exist in Level II including the INKEY function for inputting a character from the keyboard during program execution—very useful for TV type games. There are graphic and screen management functions, logical operators "AND", "OR" and "NOT" as well as a single machine code subroutine call "USR" (there are ten of these calls on the Disk version of BASIC). PEEK and POKE are also available to set any memory location as the user wishes.

Graphics on the TRS80 are adequate but simplistic, being of low resolution. The screen is divided into 128 horizontal by 48 vertical boxes—each of these graphic squares may be set to white or black by its X and Y co-ordinates. Point (0,0) is at top left (irritatingly enough). There are also 63 graphic characters which may be printed in any character slot on the screen—each of these is made up from the single graphic squares in a 3 × 2 matrix. The manual gives a small program which flashes the 63 characters down the screen too quickly to see. A better one to examine the full set is as follows.

```
10 CLS
20 FOR X = TO 191
30 PRINT X;" "; CHR$ (X),
40 IF INT (X–128)/9) = (X–128)/9 THEN PRINT: PRINT
50 NEXT
```

Each character slot on the screen is, of course, a memory location (one of 1024) and each of these has eight bits. Six of them are used to set the six squares in that slot to black (0) or white (1). Thus any graphic character may be POKED into the correct character slot. This speeds up the graphics by six times! It is in the use of graphics that one really appreciates the speed of one machine against another and it is clear that the TRS80 is slightly on the slow side.

STRING HANDLING

The string handling functions on Level II are quite sophisticated and any string may be adequately hacked about, merged, changed and compared in almost any way you can think of. There are hundreds of string variables, and numeric variables available and, with the PRINT USING statement, any screen formating or program output for commercial or any other application seems possible.

Numeric and string arrays to any practical dimension can also be used, and with the few subroutines for matrix handling given in the manual, could form the basis of complex linear programming routines.

The monitor program which controls the TRS80 is able to print one of 23 error codes plus the number of the line in which the error has occurred during execution. There is even a facility for "simulating" any specified error during execution. This is mainly for testing the "ON ERROR GOTO" statement which branches to any given line if an error occurs.

MANUAL

I found the Level II manual excellent in almost every respect—although an index would be useful. It steps in detail through the available Command and BASIC routines, and ends with a description of the Expansion Interface (£229 without extra memory). This device can handle a further cassette, a line printer, four mini disks and 48K of extra RAM. Also included, at the end of the manual, is some advice on saving time and memory on program execution—e.g., using POKE graphics.

The appendix has a summary of the whole manual; error code definitions; notes on graphics and screen management, and a full memory map of the machine (showing, for instance, the Level II BASIC ROM in 12K of memory from 0000 to 2FFF).

Three tapes are included for conversion of taped material from Level I to Level II and playing Blackjack and Backgammon. No rules are given for the games though they are decipherable to a playable level (some of the rules in Blackjack still elude me, however!). A few pieces of software are also included in the manual and though limited, give a taste of what is possible.

CONCLUSION

In conclusion, the expansions to the basic machine seem out of the general hobbyists pocket. These are more supportable by a small to medium firm who would find the "plug-in" ability and neatness of the product very attractive. The effect of the system is one of power (except perhaps the graphics) and excellent ergonomic design.

I imagine that the straight computer-cum-electronic hobbyist will be happier with a system where he can be more involved with the hardware in order to learn more and save money. It is perhaps a pity that the marketing philosophy, on the part of Tandy, does not include the sale of the CPU separately—perhaps even without case—in a form suitable for 50Hz TV. Undoubtedly, the lower cost would attract considerably higher sales. ★

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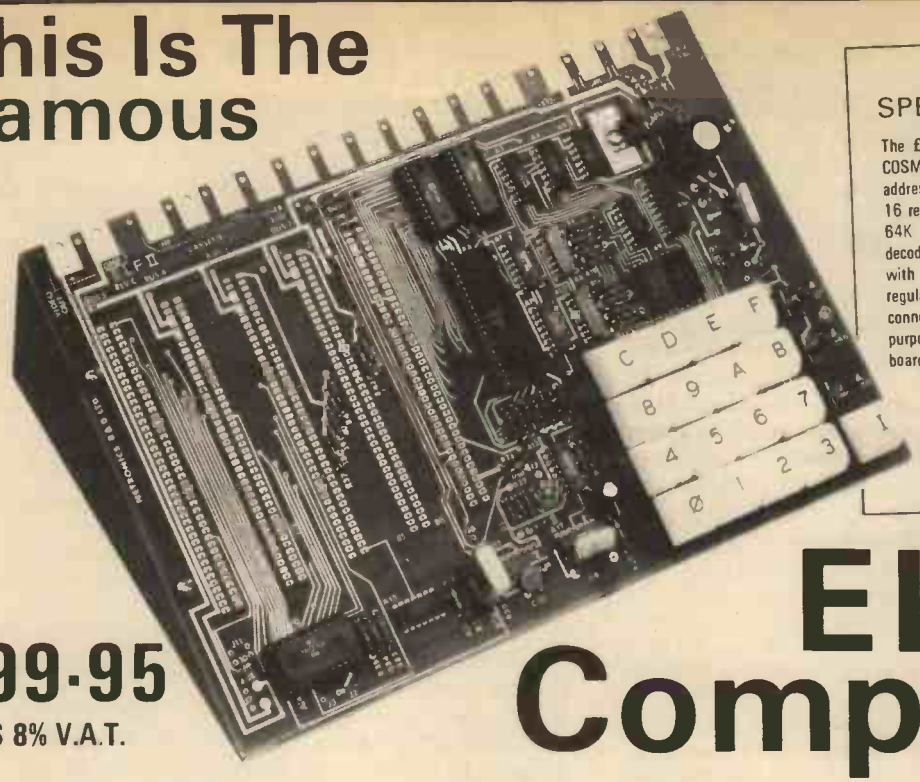

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K004 Mylar capacitors, min 100V type. 10 each all values from 1000pF to 10,000pF. Total 130 for **£3·75**
K005 Polystyrene capacitors, 10 each value from 10pF to 10,000pF. E12 series 5% 160V. Total 370 for **£12·30**
K006 Tantalum bead capacitors. 10 each of the following: 0·1, 0·15, 0·22, 0·33, 0·47, 0·68, 1, 2·2, 3·3, 4·7, 6·8, all 35V; 10/25 15/16 22/16 33/10 47/6 100/3. Total 170 tants for **£14·20**
K007 Electrolytic capacitors 25V working, small physical size. 10 each of these popular values: 1, 2·2, 4·7, 10, 22, 47, 100µF. Total 70 for **£3·50**
K008 Extended range, as above, also including 220, 470 and 1000µF. Total 100 for **£5·90**
K021 Miniature carbon film 5% resistors, CR25 or similar. 10 of each value from 10R to 1M, E12 series. Total 610 resistors, **£6·00**
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K041 Zener diodes, 400mW 5% BZY88, etc. 10 of each value from 2·7V to 36V, E24 series. Total 280 for **£15·30**.
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TRANSFORMERS

All mains primary: 12-0-12V 50mA **85p**; 100mA **95p**; 1A **£2.50**. 6-0-6V 100mA **85p**; 1½A **£2.40**. 9-0-9V 75mA **85p**; 1A **£2.10**. Multitapped type 0-12-15-20-24-30V, 1A **£3.95**; 2A **£5.35**; 3A **£6.90**. 20V 2½A **£3.90**; 25V 1½A **£2.25**; 12V 8A **£4**; 24V 5A **£7.50**; 0-22-34-41V 4A **£7.50**; 20V @ 300mA twice **£2.50**;

16 NOTE SEQUENCER

PART TWO... LYNDSAY ROBINSON

CONSTRUCTION of the sequencer on a p.c.b. is fairly straightforward and partial testing is possible before all the front panel controls are permanently wired in.

The use of i.c. sockets for the CMOS devices is recommended and these i.c.s are not placed in their sockets until that section of the circuit is to be tested. The clock is the first part of the sequencer to be tested (Figs. 7-9).

Temporarily wire in VR2 and check that pin 6 of IC1 can vary between approximately 6V and 12V. This is the control voltage for the voltage controlled clock, and ensuring that the power is off, insert IC2, IC3. By observing the clock output from pin 4 of IC2 on an oscilloscope and varying the control voltage, the correct operation of the clock can be checked.

Note that the clock waveform will not necessarily be a 50 per cent square wave and is more likely to be a pulse wave due to the varying transfer voltage of the MOSFETS.

IC4 can now be connected, together with VR4 and operation of the monostable can be checked. It may be useful to connect IC8 as well at this stage to observe the l.e.d. unless a d.c.-coupled 'scope is used or a voltmeter.

At this stage it is most convenient to wire up the remainder of the sequencer. The p.c.b. is mounted on 2in mounting pillars at the back of the front panel, previously having mounted all the panel controls. Note that D8–D23 are mounted directly on their corresponding control pot, also R18–R33 are connected directly to their l.e.d.

It is much more convenient to use ribbon cable to wire together the controls to the p.c.b., even considering the extra expense, as lacing dozens of separate wires together in a confined space would be very difficult.

Switches, S4–S5 are connected directly to the control pots behind the front panel. *Wiring of the sequencer's controls is most conveniently done from the circuit diagram than from a point to point wiring diagram because of the complexity.* For ease of fault finding, the ribbon cable is directed to the p.c.b. from one side only so that the board can be turned over easily.

OBSERVING COUNTERS

Once the sequencer has been wired up in this way, the correct operation of the counters can be observed on an oscilloscope. Check that clock pulses are reaching pin 14 of IC6-IC7 and that the counter enable pin (pin 13) is low, and that the reset (pin 15) is low.

Checking any one of the sequence output pins from the counter will show the waveform, a pulse wave that is high one period out of ten (with no reset connected); this corresponds to one count out of ten for the decade counter.

USING THE SEQUENCER

The sequential voltage output of the sequencer is usually used to control the frequency of a VCO, and short repeating melodies can be programmed into the sequencer by adjusting the tuning pots. The "Sequence Length" switch is initially switched to "1" and the initial pitch tuned up in the synthesiser and then the second note of the sequence is programmed in, etc. until the sequence is completed. The envelope shaper can now be connected and a suitable envelope shape set up. A sequence with from one to sixteen notes can be programmed in this way.

PARALLEL CHANNEL

In the parallel channel position, it is possible to construct an eight note sequential melody and use the other channel to control another of the synthesiser's voltage controlled functions such as the voltage controlled filter. In this case each note will be able to have its own individual timbre, and this is particularly useful when constructing percussive drum rhythms.

One channel can be used to control the clock frequency and the other channel to control the VCO as before. This results in each note having a different time period and adds considerable musical content to the repeating melody.

A number of jack leads can be made up for patching within the sequencer and for the use just described, the analogue output of one sequence channel is patched into the voltage control jack socket of the sequencer's clock. An interesting rhythm can be composed when one channel is programmed to produce a long and short note and controls the clock and the melody formed as before from the other channel.

LENGTHENED SEQUENCE

It is possible to produce a sequence of a form, containing up to sixty-four notes. This is achieved by allowing one counter to trigger the other. In this case a jack lead is connected from the "Pos. 1 Out" of Channel A and into the "External Clock" input of Channel B. When Channel A starts each new run it triggers Channel B along one position.

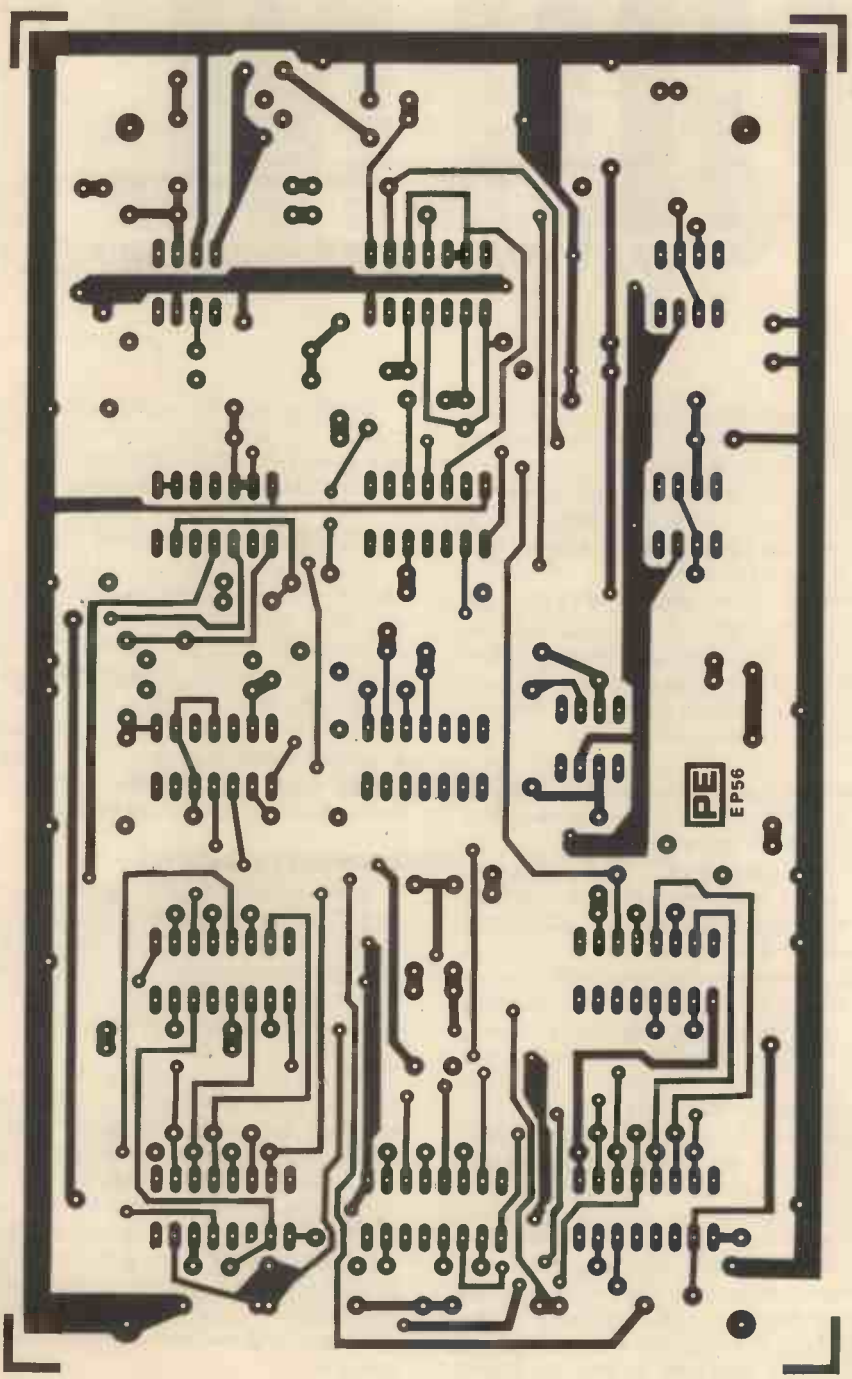


Fig. 7. Conductor side of main p.c.b. (Actual size)

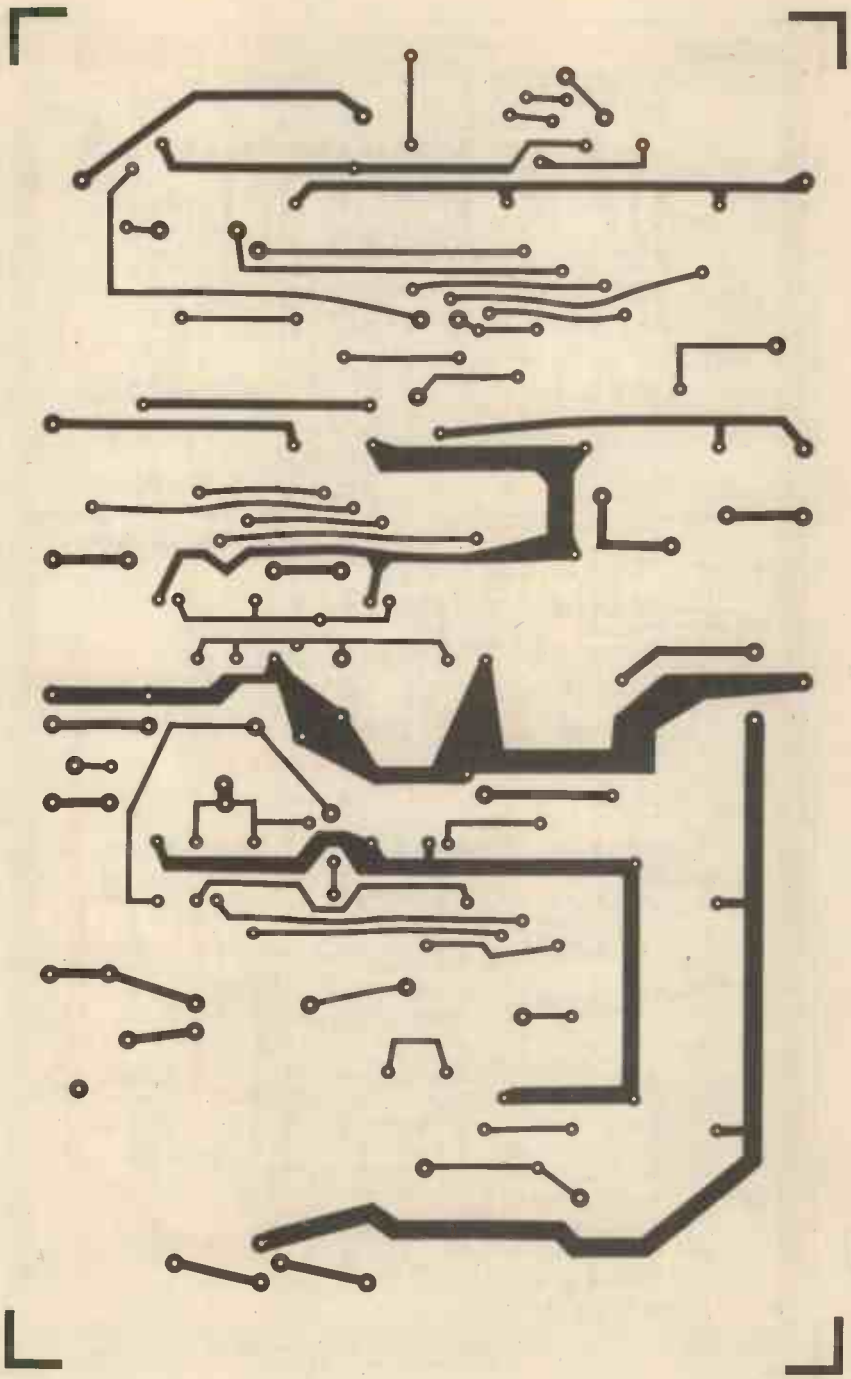


Fig. 8. Component side (Actual size)

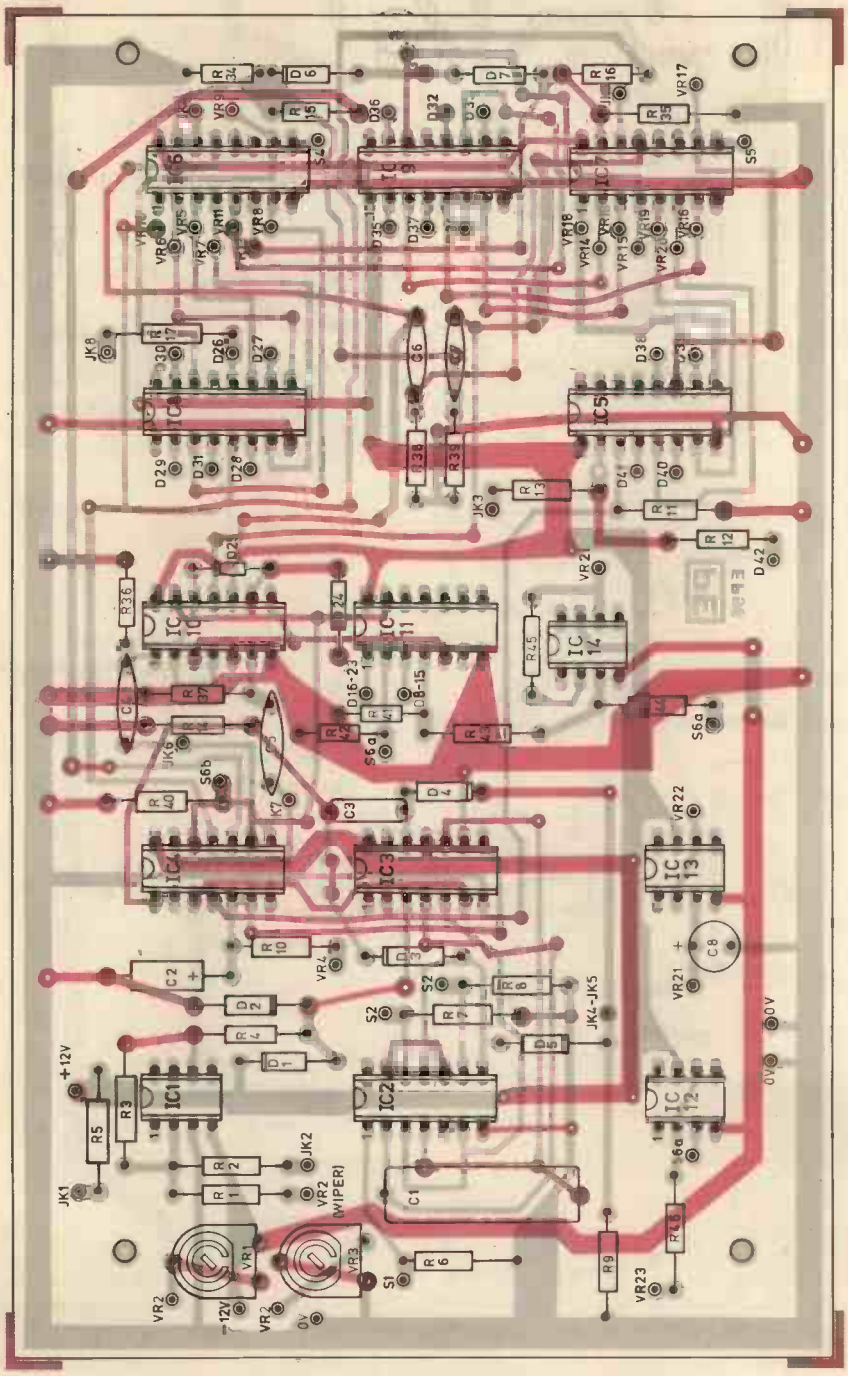


Fig. 9. Component layout on double sided board

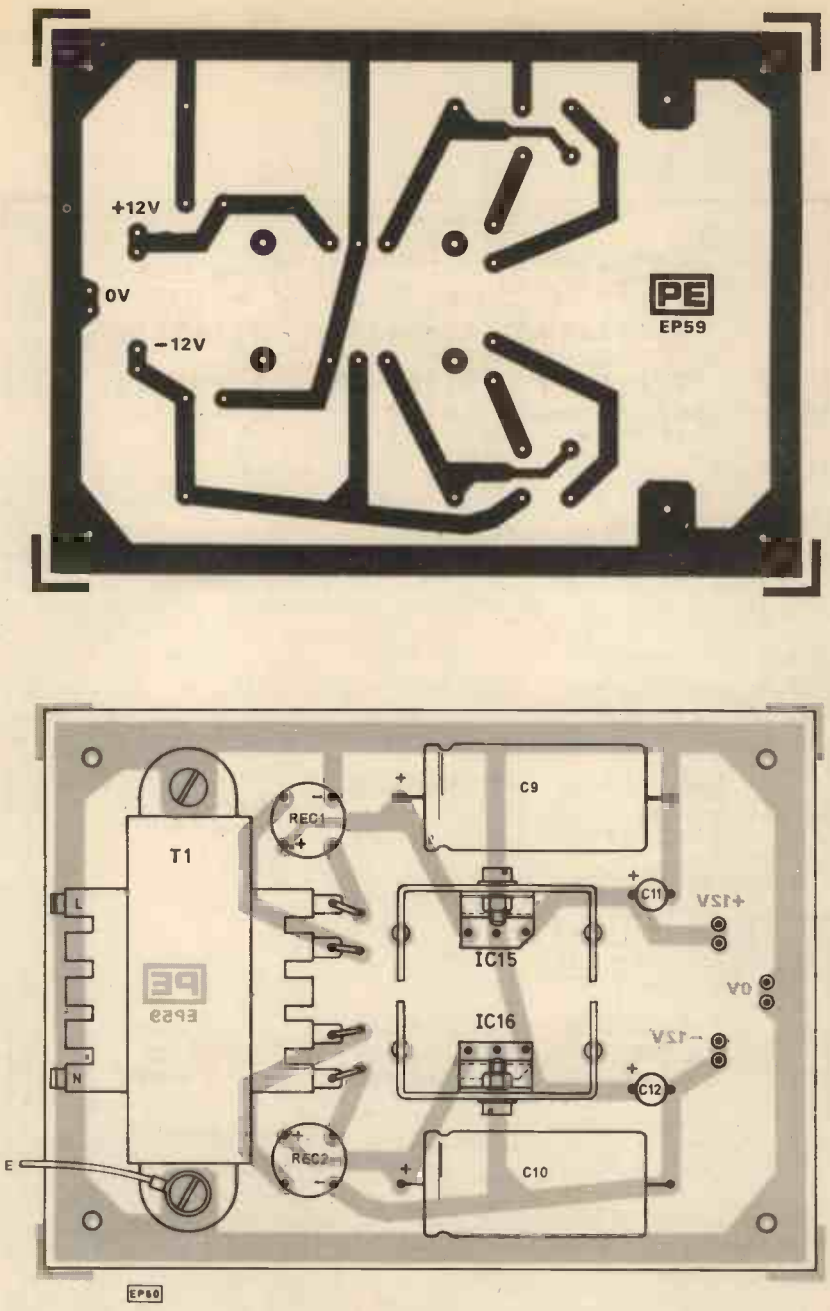


Fig. 10. P.c.b. and component layout for p.s.u.

The two voltages can now be summed if desired and the sequence programmed directed to a VCO. The sequence programmed on Channel A will change its key after each run, up to a maximum of eight times and so the sequence will run for sixty-four notes before repeating.

For normal use, the sequencer will be in the repeating mode, but it is possible to make the sequence stop after it has run through its sequence once, by connecting the "End Out" of one channel into the clock gate jack socket. On pressing the counter reset switch, the sequence will then run through its pattern again. This single run feature is of limited use but can imitate a musical doorbell that plays a pre-fixed tune on command.

BEAT INITIATION

The "Pos. 1 Out" of Channel A can be used as a trigger pulse for an additional envelope shaper that produces a tone at the beginning of the sequence. This is useful for initiating a drum beat from other synthesiser modules, at the beginning of the sequential melody.

The "Pos. 1 Out" jack socket is also used for very long sequences as previously described.

A diagram of a synthesiser's keyboard, hold and VCO circuit is shown (Fig. 13). By applying the sequential voltage in parallel with the keyboard voltage, it can be seen that the sequencer is, in fact, modulating the hold voltage. This means that the keyboard can also be used at the same time

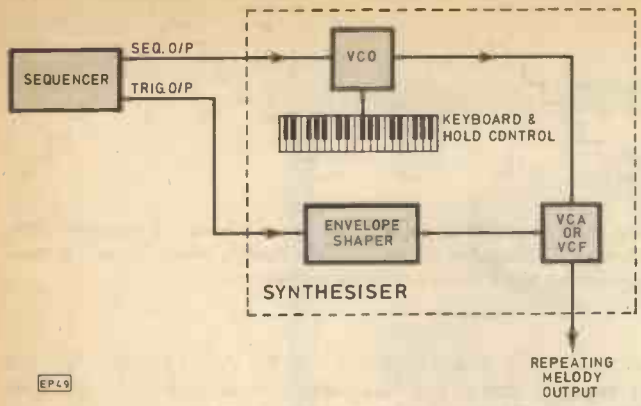


Fig. 11. Basic arrangement for using sequencer with a synthesiser

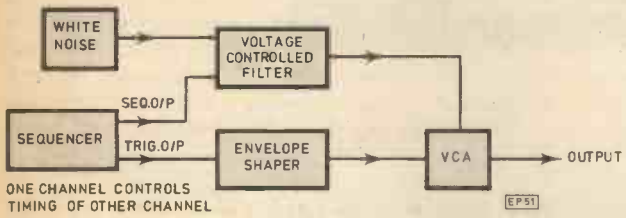


Fig. 12. Arrangement for rhythmic drum patterns

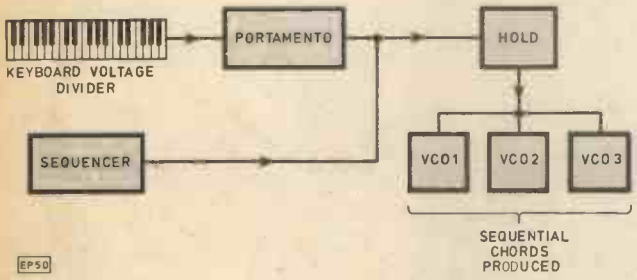


Fig. 13. Synthesiser keyboard and sequencer arranged to produce sequential chords

to vary the voltage to the VCO and this enables the composer to change the musical key of the sequence at will, adding much versatility to the sequencer's performance. Further observation of the same diagram will show that the synthesiser's portamento control is usually inserted directly before the hold circuit and the portamento will result in a slow, smooth change in pitch of the VCO when different keys are played. If the synthesiser's portamento causes this to occur when different keys are played, then with a sequential voltage, the sequential tune will slowly increase or decrease in pitch, but the individual notes of the sequence will not have any slew superimposed. Therefore the sequencer has its own portamento control with slew time up to about two seconds available; this is a factor of VR21/C8 and can be changed as desired.

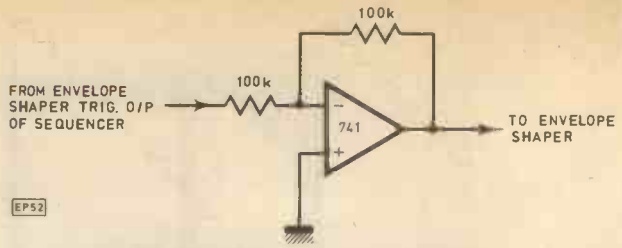


Fig. 14. Envelope trigger interface

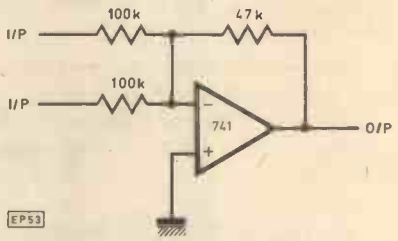


Fig. 15. Two channel mixer

ACCOMPANIMENT PATTERNS

The repeating sequential pattern produced in the various ways previously described, can be used as a bass accompaniment or background rhythm, since in conventional music these are often repeating patterns.

It is also possible to use the sequencer as a lead instrument quite effectively. For example, a fast six note sequence can be set up as a melody and then the synthesiser filter controls continually adjusted to vary the tonal quality. By various key changes and envelope time period changes, interesting musical sound patterns can be composed.

Prototype main p.c.b.

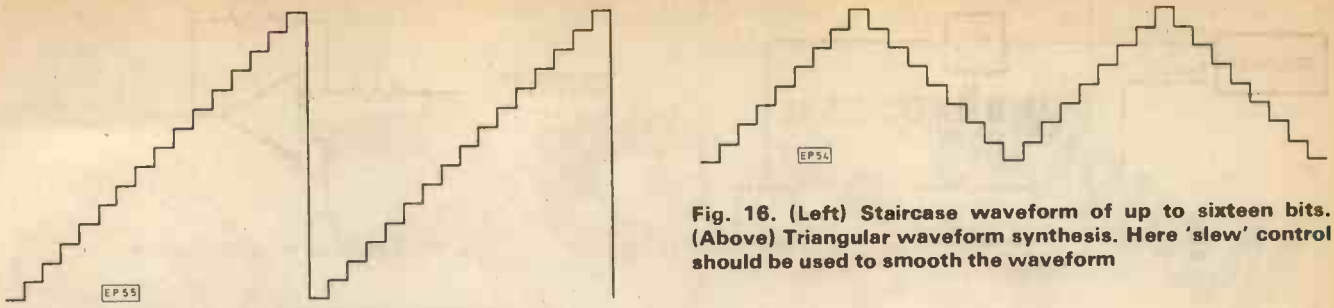


Fig. 16. (Left) Staircase waveform of up to sixteen bits. (Above) Triangular waveform synthesis. Here 'slew' control should be used to smooth the waveform

Drum patterns are also useful when controlled by the sequencer as it leaves the keyboard free for conventional playing of the synthesiser. By using the sequencer to control the voltage controlled amplifier on the synthesiser dynamic percussive patterns can be produced, with a suitable short envelope shape (Fig.12).

Other interface circuits that may be necessary for the sequencer/synthesiser union are shown in Figs. 14–15. The sequencer as it stands produces +9V as an envelope shaper trigger which may not be suitable for all synthesisers so a simple op-amp adaptor is shown. Also seen is a two channel mixer for combining the two channels of the sequencer for extended sequences (up to sixty-four notes).

By using all the oscillators on the synthesiser, it is possible to tune up sequential chords which would otherwise be difficult to play. If one channel of the sequencer controls one VCO, the other channel can control another and duets can be played.

It is possible to program breaks in the sequence, and when using the VCO with the sequencer, this is done by programming a very high pitch in the VCO (>20kHz) so that it appears that a gap has been formed. Similarly with the filter, a very low cut-off frequency is set for when the gap is required.

Further use of the sequencer is as a waveform synthesiser. The sequencer can be tuned up by referring to the sequential output on an oscilliscope and the individual steps adjusted until the required waveform has been created. By causing the clock to oscillate at a much higher frequency (by changing C1), the whole sequencer can be used as a variable waveform VCO. By adding a small amount of slew, the waveform can be smoothed off and a more realistic waveform achieved. Some diagrams are shown of digitally synthesised waveforms such as a triangular wave.

Note: The envelope shaper pulse time can be extended from 10ms—8S by changing VR4 to 2M2 and R10 to 4k7.
In Fig. 2 pin 4 of IC1 should go to −12V. ★

Showing front panel legending

Novelty BLEEPER Doorbell

D.J. FOLWELL

MANY door chimes or bells are not always audible in the home above the background noise of TV and radio, etc. whereas the bleeper circuit to be described here is easily heard and provides a novelty to the caller.

CIRCUIT DESCRIPTION

The complete circuit diagram of the doorbell is shown in Fig. 1. The basis of the circuit is a dual Schmitt trigger i.c. (SN7413) which is used to form two oscillators. Gate "a" with capacitor C2 and resistor R4 is a low frequency oscillator, and gate "b" with C3 and R5 is a higher frequency oscillator. With the values shown the frequencies are approximately 5Hz and 2kHz respectively. Oscillator "b" drives the loudspeaker via amplifier T3 but is only enabled during the positive half cycle of oscillator "a" and therefore gives a bleeping effect. The capacitors C2 and C3 can be altered to change the bleep tone as required.

The circuit only operates for a short period after the bell push has been operated: when the switch is pressed,

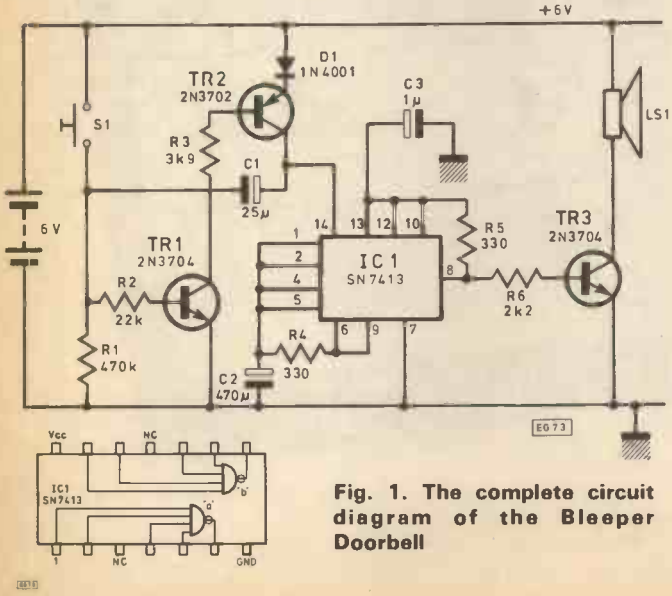


Fig. 1. The complete circuit diagram of the Bleeper Doorbell

COMPONENTS . . .

Resistors

R1	470k
R2	22k
R3	3k9
R4, R5	330 (2 off)
R6	2k2

Capacitors

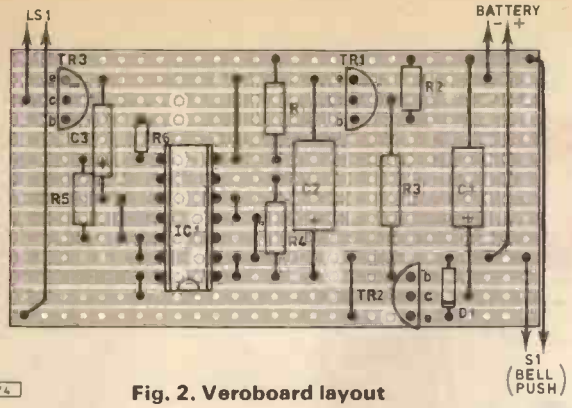
C1	25μ
C2	470μ
C3	1μ
All 10V elect.	

Semiconductors

D1	1N4001
IC1	SN7413

Miscellaneous

Battery HP11 (4 off)
Battery holder
Terminal block
Diecast box (170 x 120 x 57mm)
Speaker 80 ohms 0·25W



EG74

Fig. 2. Veroboard layout

capacitor C1 is charged up, transistors TR1 and TR2 conduct and a voltage is applied to IC1 allowing oscillation to take place. When the switch is released, C1 discharges through the base of TR1 keeping both transistors on until the current drops sufficiently for both transistors to switch off when oscillation ceases. With the value shown for C1 the circuit is active for approximately four seconds.

Diode D1 is included in the circuit to ensure a Vcc on IC1 of less than 5·5 volts.

CONSTRUCTION

The components for the doorbell were mounted on a piece of 0·1 inch Veroboard as shown in Fig. 2.

The prototype unit was fitted in a diecast box (170 x 120 x 57mm).

Holes were drilled in the lid of the box as a loudspeaker aperture and the speaker glued in the corresponding position on the back. The battery holder was then screwed to the base of the box.

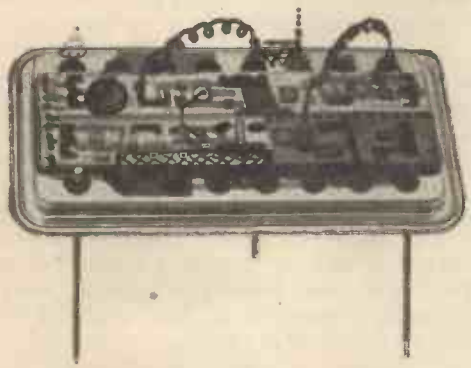
A small piece of terminal block was mounted inside the box and an adjacent slot filed through the side of the case for the external bell push connections. ★

News Briefs

by Mike Abbott

CHIP RECORDS

AN AMAZING and promising new device has been produced at the Greerson Adams and Gough research laboratories in the U.S.A. Capable of storing analogue signals of up to 36 minutes by a completely new technique, an i.c. called the "Analogue Programmable Resistance Infra-Loaded" device, stored a half hour lecture by one of the company's applications engineers, and could be the tape recorder of the future.



Photograph shows the first working Analogue Programmable Resistance Infra-Loaded device (APRIL 1)

In the recording it was explained during the first public demonstration that this "truly analogue" device does *not* use the charge coupled principle. Comprising a Hall effect semiconductor embedded in a complex microcircuit inductor which mobilises the electrons of a voltage dependent resistor, the precise nature of this hybrid package is a closely guarded secret, but the application techniques would appear to be child's play!

The i.c. has only two terminals (the third is used for programming and would be cut off after manufacture). One terminal is grounded.

To the remaining lead is applied a linear ramp, and at any given voltage the device will have a "prerecorded" resistance, hence for an optimum ramp source resistance the ramp will be modulated to the recorded signal. Simple a.c. coupling to an amplifier completes the system.

The recording time depends upon the voltage slope, but there is a trade-off between bandwidth and time. Speech recordings can be stretched to 50 minutes. At present, recording is a specialised business involving weightlessness, and hence the rental of satellite space, but in the near future we may well be buying records which look like the little capsule shown in the photograph with the lid off.

COUNTDOWN

The Harrogate International Festival of Sound, held at the Exhibition Centre and four leading hotels, will be open to the public on Saturday and Sunday, 18th and 19th August respectively, from 11.00 to 20.00 hrs.

Monday 20th and Tuesday 21st August will be for trade only, between the hours of 10.00 and 18.00.

The exhibition is organised by Stan Smith and Peter Hainsworth of Exhibition and Conference Services Ltd., Claremont House, Victoria Avenue, Harrogate, North Yorkshire.

The Great British Electronics Bazaar is coming! It is for the hobbyist and small professional buyer, and will be held at Alexandra Palace on the 28th–29th June 1979. This exhibition will incorporate teach-ins and surprises which promise to make the event a colourful one.

The bazaar is being organised by the Evan Steadman Communication Group, 34–36 High Street, Saffron Walden, Essex.

The success of Breadboard '78 had been described as overwhelming, necessitating a change of venue for **Breadboard '79.** This will be held at the Royal Horticultural Halls, Westminster, London, December 4-8.

In response to requests from last year's exhibitors and other concerns, there will also be a **Midlands Breadboard '79,** which will be held at Bingley Hall, Birmingham, on May 23-26.

Details: Trident International Exhibitions Ltd. Tel: 0822-4671.

June 19-21 for **Transducer '79** to be held at the Wembley Conference Centre. This venue will be shared with **Testmex '79,** and conferences will run concurrently. Transducer is organised by Trident International Exhibitions Ltd., Abbey Mead House, 23a Plymouth Road, Tavistock, Devon PL19 8AU.

Intel Fair—June 11, 1979. Wembley Conference Centre. Registration details to be announced.

Third International Symposium and Technical Exhibition of Electromagnetic Compatibility—May 1-3, 1979, Rotterdam. Contact: (symposium Dr. T. Dvorak (01) 326-211. (Exhibition) Mr. R. E. Gerritson (070) 906-800.

Labex International '79—March 12–16. National Exhibition Centre, Birmingham. Details: 021-705 6707.

Electronics '79—November 20–23. Olympia, London. Details: 021-705 6707.

BUBBLE Memories

TECHNOLOGY UPDATE

Dr. P.V. COOPER
Plessey Microsystems

EVER since men first began to collect and analyse information from the world around them, they have needed methods of recording that information. Although the human memory appears to have an unlimited capacity and possesses remarkable powers of associative recall, it has considerable limitations when called upon to store large amounts of similar data, such as that found in a telephone directory. Furthermore, direct access to the human memory is possible only for its owner!

Although men have recorded information in pictorial form (as in the cave paintings of Lascaux in France) since the beginning of history, the first artificial memory could be said to have appeared with the invention of writing, about five thousand years before Christ. Writing, printing, and then photography remained virtually the only methods of recording information until the invention of first mechanical and then electronic machines, capable of manipulating numbers at high speed. The existence of such machines has led to the development of methods of storing numeric information using a binary or two state code. The simplest example of this is the mechanical switch where OFF is equated to "0" and ON to "1". The number of switches will determine the range of numbers that can be stored; for example, 4 switches can store any decimal number from 0 to 15 in binary code. The number of switches, or bits, varies according to the size of number you wish to store, but 8 and 16 bits are commonly used. The 8 or 16 bit number is known collectively as a "byte". A 64K 8 bit memory can hold 2^{16} numbers between 0 and 511 and may be referred to as having a 64 kilobyte capacity.

The first electronic two state switch was the valve flip-flop circuit as used in the first computing machines constructed for code breaking towards the end of World War II. However, this type of two state store was bulky and consumed large amounts of power. The information is also lost if the power is removed. Recently, metal oxide semiconductor, or MOS technology has made this type of circuit possible with very low power consumption, using tens of thousands of integrated transistors on a single silicon chip. However, the problem of volatility of information under zero-power conditions still remains to be solved satisfactorily.

In order to realise non-volatile storage, memory designers have almost always turned to magnetism. The only real alternatives are the slow and bulky punched cards and paper tapes. For the last twenty years two types of magnetic memory have remained supreme, viz, magnetic cores, able to be switched into one of two states of magnetisation, and the moving magnetic media memories such as digital tape recorders and magnetic discs and drums. Core memories, which are written to, and read from by a matrix of sense wires, give random access to each memory bit location. The moving media memories give sequential or serial access to each memory bit location as the storage medium moves past the sensing device, which detects the state of magnetisation of the tape or disc coating as a "1" or a "0".

Until recently, magnetic memories have relied on permanent magnet materials which give a two state system by discontinuous switching of the magnetisation when it is perturbed above a certain threshold. In the last few years, however, the first real challenge to these magnetic memories has appeared in the form of magnetic bubble technology. Since they were first described in 1967 by Bell Telephone Laboratories in the USA, bubble domain memories have been one of the fastest growing areas of computer memory development, and today we see them entering commercial production with a number of companies in the USA, UK and Japan.

MAGNETIC DOMAINS

In ferromagnetic materials the quantum mechanical Pauli exclusion principle can give rise to an effective quantum mechanical exchange interaction which may make it energetically favourable for neighbouring electrons to align their spins. At sufficiently high temperatures this tendency is offset by thermal disordering but below a certain temperature (the Curie temperature) the system acquires a spontaneous magnetisation. The most familiar material to show this effect is, of course, iron. For a sample of finite size, it is energetically favourable for the magnetisation to change direction on a scale many orders of magnitude greater than the atomic spins to give a zero net magnetisation for the sample as a whole.

These areas, in which the spins are aligned, are known as magnetic domains and the region between these domains over which the spin alignment direction changes, is known as the domain wall. Materials for use in magnetic bubble memories are chosen to have a single preferred magnetisation direction. Such materials are said to have a "uniaxial magnetic anisotropy" and the magnetisation will be either "up" or "down" this direction.

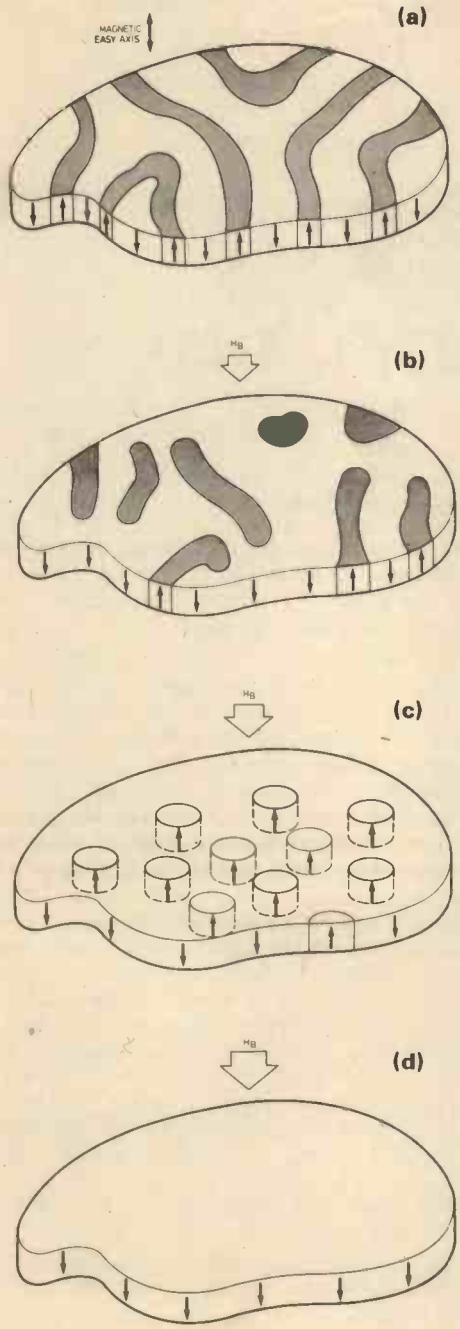


Fig. 1. (a) In zero applied field the domains have a stripe-like structure
(b) When a field H_B is applied, the antiparallel domains shrink, some forming "island" domains
(c) As H_B increases, the island domains become cylindrical—or *bubble* domains
(d) As H_B increases still further, the bubble domains shrink and eventually collapse

In the absence of any external magnetic field, the domain structure of a thin film of magnetically uniaxial material will be as shown in Fig. 1a. Here the domain structure has a stripe pattern arranged, for minimum energy, to give zero net magnetisation. If a bias field H_B, is applied perpendicular to the plane of the film it becomes energetically favourable for the antiparallel domains to shrink as shown in Fig. 1b. Some may become irregularly shaped islands of "up" magnetisation in a sea of "down" magnetisation. When the field is increased still further, as in Fig. 1c, these islands contract under *pressure* from the applied field to form cylindrical domains. These cylindrical domains are the bubbles which are used to store information.

The diameter of the bubble domains depends on the material used and on the bias field. If the field is increased still further, as shown in Fig. 1d, the bubbles will collapse leaving a magnetically saturated sample. If it is reduced much below the value of Fig. 1c, the bubbles will become unstable and "strip-out" returning to a structure similar to figure 1b. However, between the collapse and strip-out values of bias field, the bubble domains are stable and capable of storing binary data denoted simply by the presence or absence of a bubble domain. The bubble domains are very mobile and can be moved about within the film using a magnetised needle, since each one behaves like a cylindrical bar magnet. No physical movement of material is involved in bubble displacement; the apparent movement is due to the reordering of the subatomic spins. Their movement is similar to that of water waves, where the wave envelope moves horizontally while the water itself merely moves vertically with no net horizontal displacement.

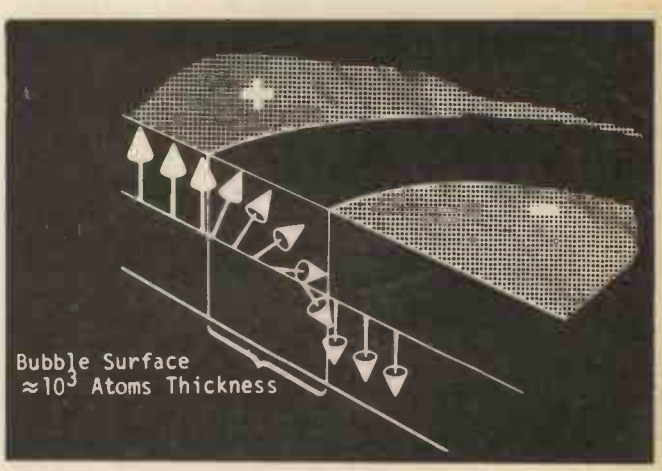


Fig. 2. Section through a bubble domain wall

A section through the bubble domain wall is shown in Fig. 2. As yet, the bubble domains have no controlled pattern as needed for information storage. The provision of this control allows the domains to be used to store information.

BUBBLE MATERIALS

Several classes of materials with strong uniaxial magnetic properties are known to support bubble domains. They range from the orthoferrites with bubble diameters of around 100μm to metallic cobalt with bubbles of about 0·01μm diameter. However, the domains are too large for efficient storage in orthoferrites, while in cobalt they are very difficult to move. The majority of present devices use a family of iron oxide materials known as the rare earth garnets as the magnetic medium. They have the general formula $X_3Fe_5O_{12}$ where X represents Yttrium or a rare earth from Samarium to Lutetium. These materials are very adaptable and a wide range of properties can be obtained by mixing various "rare earths" and by diluting the ferromagnetic iron component with non-magnetic elements.

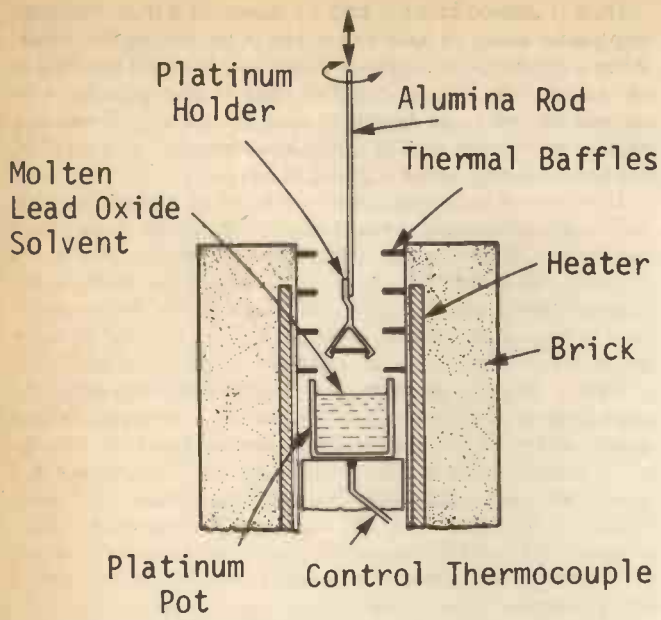


Fig. 3. Magnetic garnet film growth

These synthetic garnets can easily be tailored to give bubble domains between 1 and 5μm in diameter which are highly mobile and exhibit good temperature characteristics.

The magnetic garnet films are grown on thin substrates of single crystal non-magnetic garnet. The usual substrate material is gadolinium gallium garnet (GGG). This is chosen because it is of the same crystal class and has very similar lattice spacing and thermal co-efficient of expansion to the magnetic garnet film. It can be prepared as highly pure boules two or three inches in diameter, which can be sawn and polished into slices about 0·5mm thick.

The process of film growth is illustrated in Fig. 3. The substrates are dipped into a melt which consists of oxides of the elements required in the garnet film, dissolved in a lead oxide flux at about 1,000°C. By rotation of the substrate and careful control of the melt temperature very reproducible single crystal films can be made with extremely low defect levels (<1 defect/cm^2). Densities of around 10^6 bubbles per square inch are possible, and the energy to move a bubble domain in garnet a distance of four diameters is about 4×10^{-4} joules (more than 100 times less than the best switching transistors).

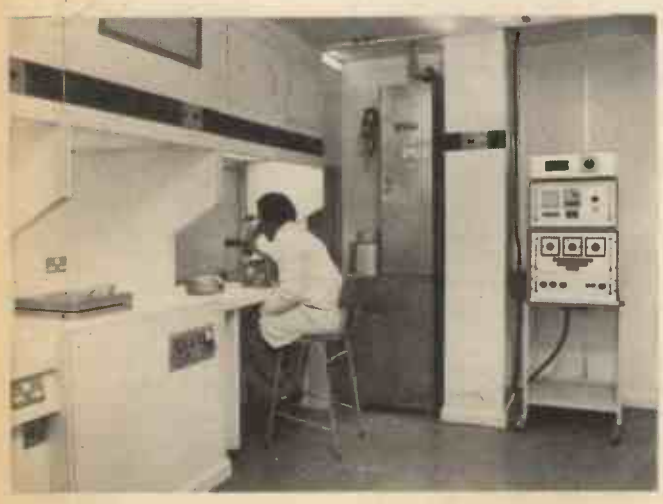
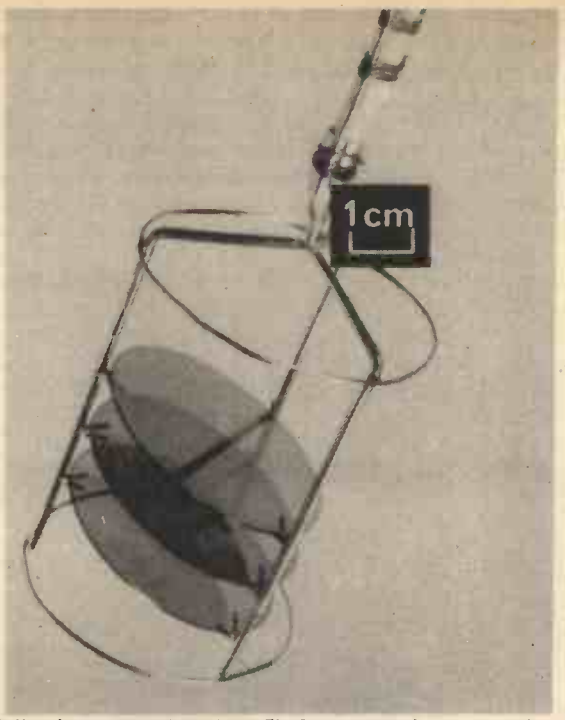


Fig. 4. Magnetic garnet film growth area



Following growth, the film's magnetic properties are measured by optical techniques which make the "up" and "down" domains visible in polarised light. Part of the garnet film growth area in the Plessey bubble memory production unit is shown in Fig. 4.

BUBBLE DEVICE STRUCTURE

To use the bubble domain for data storage, the position of the bubbles within the film needs to be controlled, and a method of entering and reading out information must be provided.

The position of the bubbles within the film is controlled by a periodic pattern of magnetically soft nickel-iron elements on the surface of the film. Various patterns are possible, but the easiest to understand is an array of T and I shaped elements as shown in Fig. 5a. In the presence of an inplane field in the direction of arrow 1, the nickel-iron elements will magnetise. Because it is much easier to magnetise a bar along its length than across its width, the top of the T elements will magnetise much more strongly than the vertical elements. If the magnetisation within

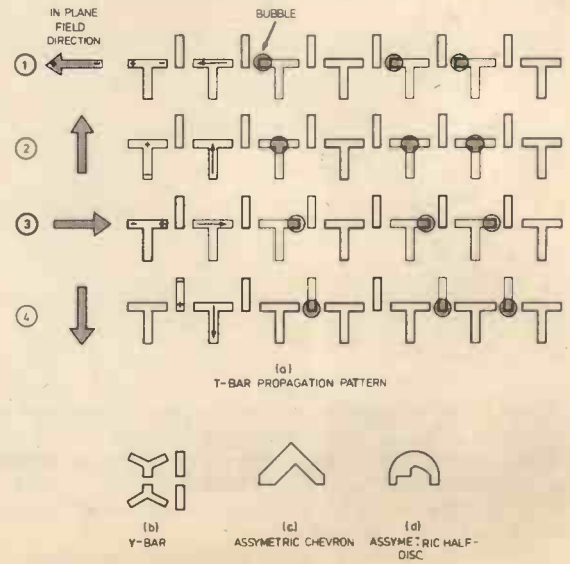
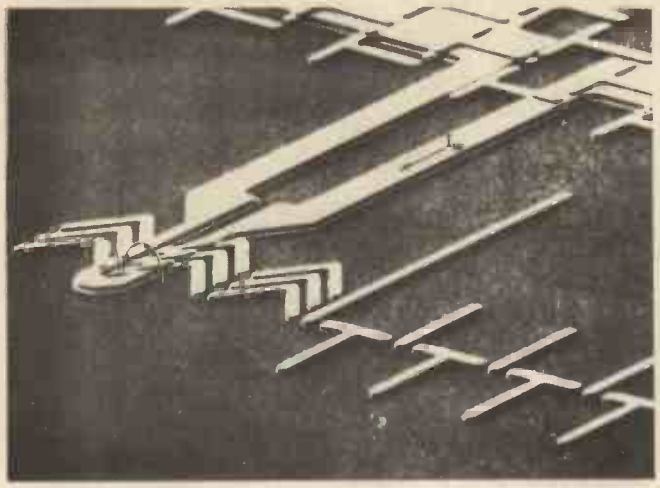


Fig. 5. Propagation elements

the cylindrical domain is such as to put a negative pole on the top surface of the cylinder the bubble will sit under the positive pole on the T element because, as every schoolboy knows, *unlike poles attract!*

If the orientation of the field now changes to position 2 the vertical elements will be the strongly magnetised ones and the bubble will move to the position shown. Hence, as the inplane field rotates through 360°, each bubble will move one period along the propagation pattern. This gives a shift register store with a capacity equal to the number of periodic cells and a clock-rate defined by the frequency of the rotating field. Fig. 5a shows the pattern 0010110 propagating from left to right. Several alternative elements to the T-bar arrangement are possible and some are shown in Figs. 5b–d. The asymmetric structures are currently favoured as they allow wider tolerances in the circuit design.



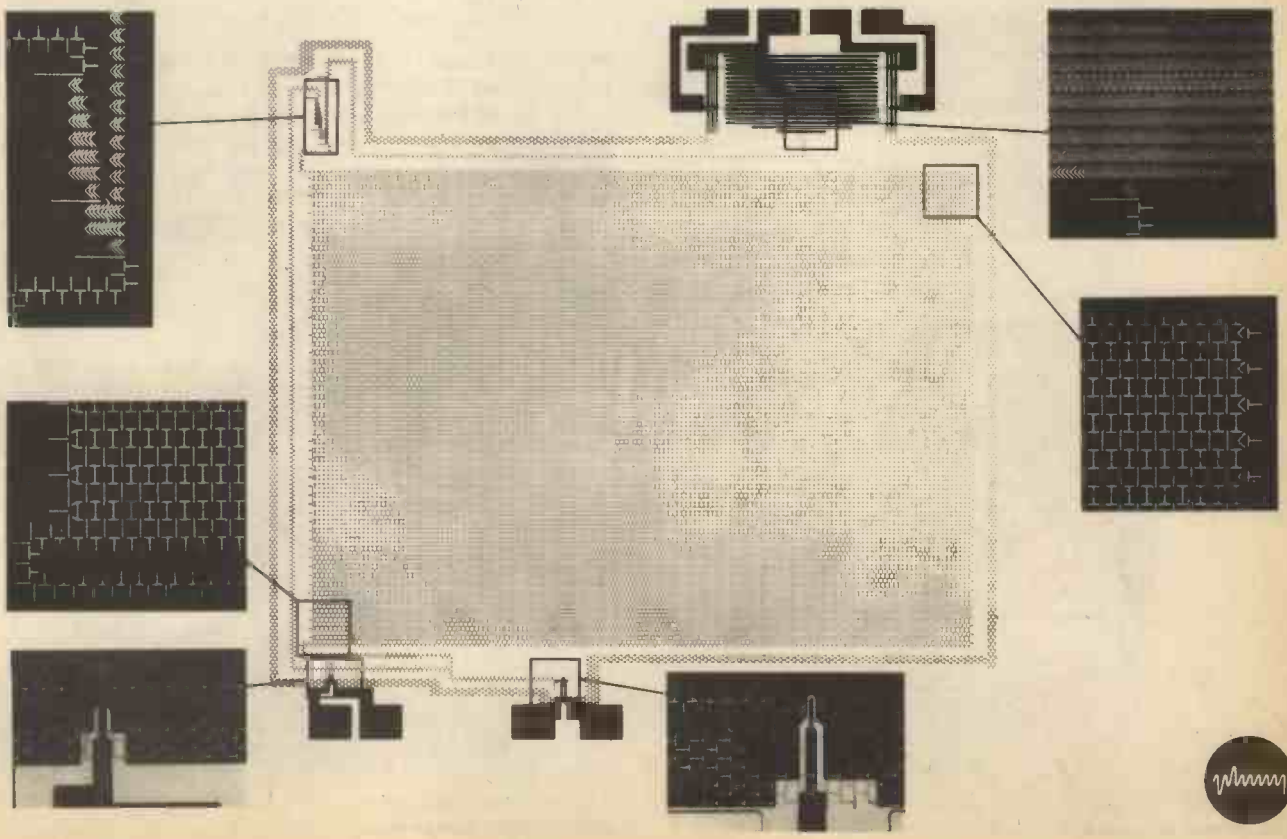
Data is entered into the chip by means of a thin conductor loop placed under an appropriate part of the propagation track. When a current pulse is applied to this loop the local bias field in the garnet film will be modified, and bubble generation or annihilation will occur depending upon the polarity. A scanning electron microscope view of a "nucleator hairpin", as it is called, in a typical bubble device is shown in Fig. 6.

Detection of bubbles has been achieved by various methods including optical and semiconductor effect, or Hall effect detectors, but currently the magnetoresistive detector is favoured. This uses the magnetoresistive effect which is the change of resistance of a conductor when exposed to a magnetic field. The bubble passes under a special section of track consisting of lines of chevron elements. These cause the bubble to form a strip domain along the chevron stack increasing the stray field of the domain many times. This expanded bubble passes under an electrically linked line of chevrons through which a current of a few milliamps is passed. The presence of a bubble will cause a resistance change which appears as a voltage change at the output terminals. The active detector is usually arranged in a bridge network with an identical dummy detector, to cancel common mode noise induced by the drive field, which usually rotates at about 100kHz.

A chip layout for a 16 kilobit single loop shift register device is shown in Fig. 7. The additional element shown is a bubble replicator to give non-destructive readout of data. This chip is an old design compared with the current 64 to 256 kilobit chips, but the comparatively large scale of the elements allows them to be photographed more easily than denser modern designs.

Fig. 6. (left) Scanning Electron Micrograph of a Nucleator Hairpin

Fig. 7. (below) 16K bit bubble memory device showing: Nucleator Hairpin, Erase Hairpin, Replicator, Detector



The single loop organisation for bubble devices can be considered as a serial shift register of very large capacity. However, the large capacity possible with bubble chips means that for single loop organisations the access time is rather slow. For example, if one considers a 64K bit chip operating at a 100kHz shift rate, the worst case access would be 640ms, if data had to circulate the whole chip to reach the required position. The average access time would be 320ms, or half the maximum value. Slow as this is, it is suitable for sequential data storage in applications such as spaceborne flight recorders. For applications requiring shorter access time the multiloop or major-minor loop organisation can be used. Both organisations are shown schematically in Fig. 8. In the multiloop organisation, the 64K bit storage in the previous example is distributed in a number of minor loops. For example, 128 minor loops, each containing 513 bits, gives the required capacity. Data is read in sequentially via the major write line, and when this is full, a control pulse is applied to the transfer-in conductor which parallel loads the data into the minor loops. At the other end of the minor loop, the data may be parallel unloaded into the major read line and propagate sequentially to the detector. The unloading into the read line may be done destructively by transferring out, leaving all zeros in the minor loops or, using a different shaped control pulse, the data can be replicated out to give non-destructive readout. The effect on access time of this change in organisation is dramatic. No storage location is now more than 512 bits away (plus the major read line length), and the average access time of 320ms for the serial 64K bit chip reduces to 2·5ms for a major-minor loop organisation of the same capacity. The improvement factor is roughly equal to the number of minor loops. This reduction in access time is, of course, achieved at the expense of supplying additional control pulses to the device to provide the transfer and replicate functions.

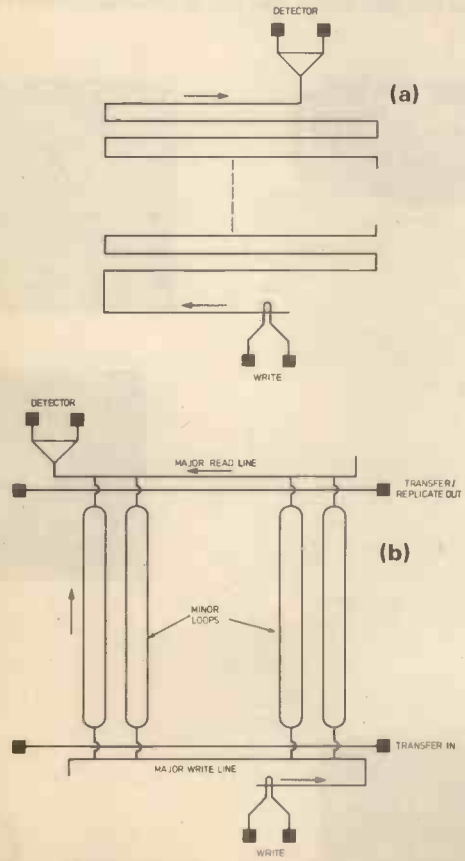


Fig. 8. (a) Single loop organisation. (b) Multiloop organisation

BUBBLE DEVICE FABRICATION

The fabrication of bubble chips on garnet films involves an ion-implantation, followed by the evaporation on sputtering of four precisely controlled layers. The process is illustrated in Fig. 9. The ion-implantation stage is necessary to avoid complex domain wall structures in the bubble which could lead to uncontrolled bubble movement. This is followed by deposition of silica (SiO_2) to act as a spacer layer between the conductor and the garnet film to avoid unwanted stress effects. On top of the silica, a layer of either aluminium-copper or gold is deposited, and the conductor pattern is defined using a photomask and photoresist exposed with ultraviolet light to obtain good resolution. The conductor pattern is produced by etching away the areas not protected by exposed photoresist, using a beam of neutralised argon ions. Fig. 10 shows slices being loaded into the ion milling equipment.

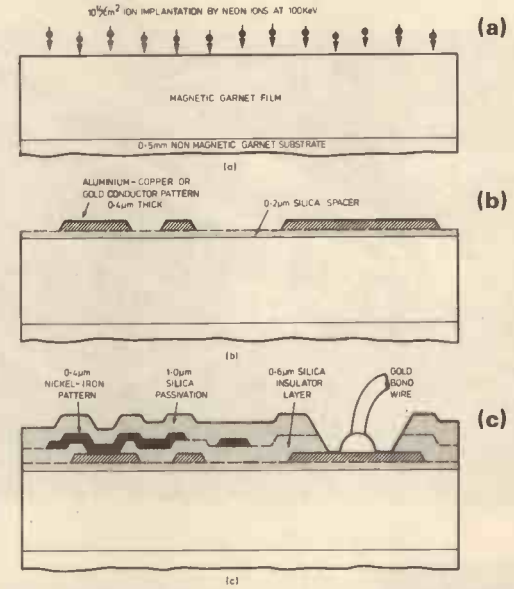


Fig. 9. (a) Magnetic film growth. (b) Conductor fabrication. (c) Shift register fabrication

Fig. 10. Ion-milling equipment used to etch conductor and propagation patterns

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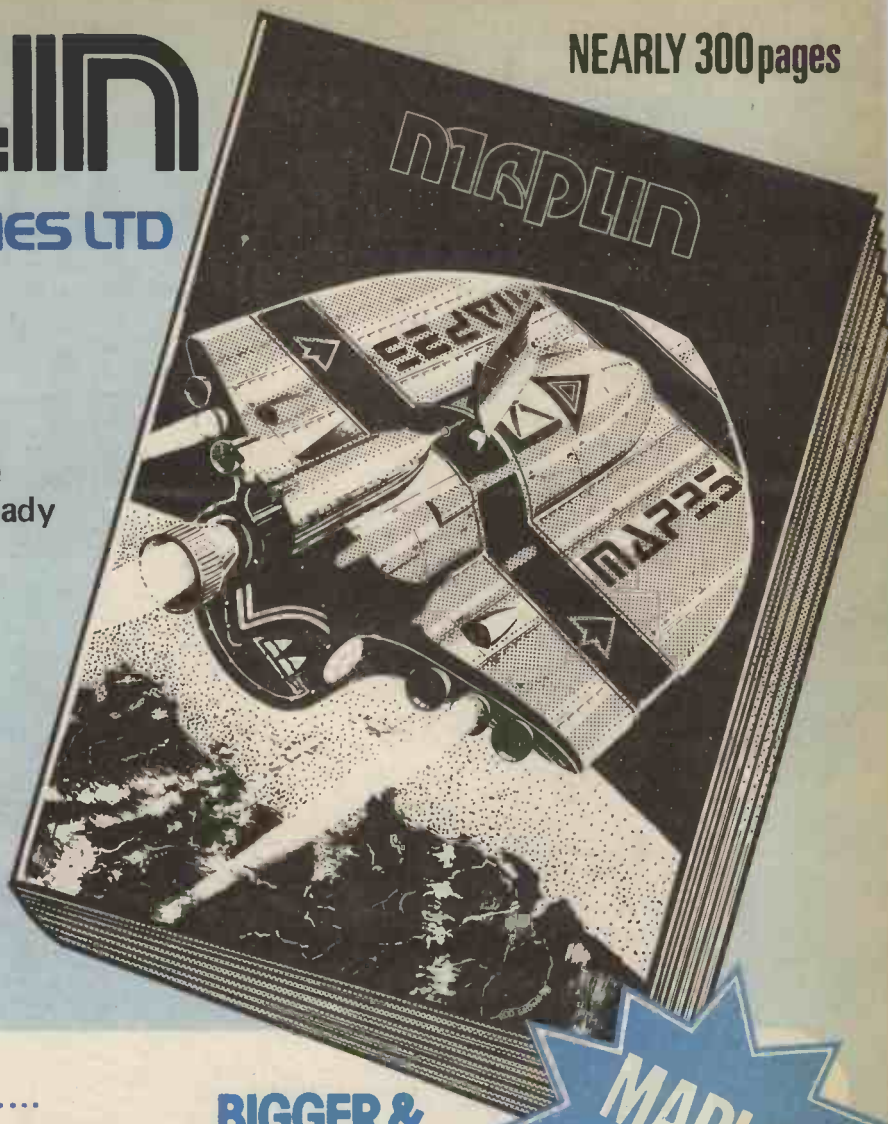

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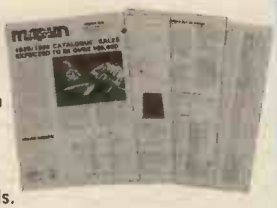

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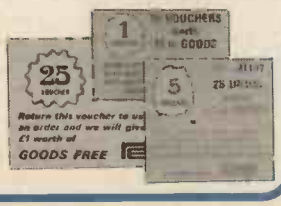

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ELECTRONIC ORGAN

A series of constructional leaflets each of which builds a complete organ which can then be expanded using all or part of the next leaflet with very little wastage. At every stage we use the very latest technology available to give you a really high quality instrument that is not only on a par with, but probably in advance of most commercially available organs.

Eventually you could be the owner of a highly sophisticated instrument and parts of it will still be using the original components you bought for the basic organ. Of course this means greatly reduced costs and wherever you stop, the organ you finish up with will have cost you only a fraction of the cost of a ready-built one — and this organ will be to your own specification!

Model 51 Basic Organ

In this leaflet MES 51 the first in the MES 50 series, we deal with the basic theory of electronic organs and go on to describe the construction of a simple polyphonic (i.e. all notes may be played simultaneously) 49-note instrument, having a single keyboard and a limited number of stops.

Specification:

Single keyboard:	49-note C to C.
Frequency range:	C_3 to C_7
Stops:	Flute and String
Output:	1Vrms (max)

When you have built this simple organ you will own the ideal instrument on which to learn to play or teach your family to play, and as your skill increases and you want more out of the organ, it can be expanded to meet your requirements as far as you want to go with hardly any wastage.

Model 52 2-Keyboard Organ

In this leaflet (MES 52) is described the extension of the organ to two keyboards each having five voices. The voicing section is considerably improved and the range of the organ is extended by a further octave.

Specification:

Two keyboard both 49-note C to C.

Frequency range: Solo C_3 to C_7.
Accompaniment C_2 to C_6

Stops: Solo manual — Flute, String, Horn, Diapason, Vox Angelica.
Accompaniment manual — Flute, String, Clarinet, Diapason, Vox Humana.

Balance control

Provision for 61-note keyboard (frequency range of both — C_2 to C_7).

Output: 1V rms (max).

Model 53 Stage One Full Scale Organ

This leaflet MES 53 marks a major step forward in the development of the organ since it introduces solid state switching

which facilitates the extension of the number of footages to seven on both keyboards with up to 38 preset stops. A novel solid state switching system is introduced which allows the organist to accurately control the attack and decay rates for any stop. A stub pedalboard is incorporated and this includes a sustain facility. In addition to the wide range of preset stops, a drawbar controlling each footage linked to the flute stops may be fitted.

Specification:

Two keyboards 49 or 61-note C to C
Pedalboard 13-note C to C.
Frequency compass of organ C_1 to C_6.
Solo manual – Stops: Flute 16', Cello 16', Tuba 16', Saxophoné 16', Flute 8', French Horn 8', Oboe 8', Trumpet 8', String 8', Clarinet 8', Diapason 8', Vox Humana 8', Flute 5⅓', Flute 4', Octave 4', String 4', Clarion 4', Flute 2⅔', Flute 2', Flute 1'.
7 drawbars on flutes, variable attack control, variable decay control, delayed tremulant.
Accompaniment manual –
Stops: Flute 16', Flute 8', String 8', Horn 8', Diapason 8', Vox Angelica 8', Dulciana 8', Salicional 8', Flute 5⅓', Flute 4', String 4', Octave 4', Salicet 4', Flute 2⅔', Flute 2', Flute 1'.
7 drawbars on flutes, variable attack control, variable decay control, delayed tremulant,
Pedal Manual – Stops: Sub Bass 16', Gedeckt 8'. Sustain.

Other facilities: Tremulant with variable rate and depth, reverberation with variable balance, solo to accompaniment variable balance, variable pedal level, foot swell pedal, variable maximum volume control.
Output: 1V rms (max).

Model 54 32-Note Pedalboard

This leaflet (MES 54) describes the construction of a full range 32-note polyphonic pedalboard that can be added to MES53 or any organ, since it is a complete unit with its own tone generation system etc. This is essential since the keyboard tones would at some times have tremulant in operation and this could not be tolerated on the pedalboard. The electronic parts of this design could be added to an existing pedalboard by the addition of one extra contact under each key to give free phase bass – the "church" sound.

Specification:

Pedalboard:	32-note C to G
Frequency range:	C_1 to G_5
Stops:	Sub-Bass 16', Diapason 16', Gedeckt 16', Mixture 16', Flute 8', Gedeckt 8', Flute 4', Reed 4'.
Output:	1V rms (max).

Model 55 Auto-Organ Rhythm Generator

This leaflet, MES 55, describes a complete rhythm generator and auto-organ which can play the whole accompaniment section providing you tell it, by depressing the appropriate key on the keyboard, which key you are playing in. Thus with one finger of the left hand and one finger of the right hand playing the tune, you can sound like a real professional. The auto-organ will add the trills to the right hand and chord and vamp the left hand in time with the rhythm generator.
The unit has eight rhythms, Waltz, Tango, Swing, Beat, Bossa Nova, Samba, Rumba and Slow Rock and drives five instruments. The rhythms can be mixed to achieve further variations and tempo control is included. There is a rhythm start/stop switch and the rhythm always starts on the downbeat. The instruments sound extremely realistic and considerable care has been taken to make them sound natural.
The chording section is turned on separately by its own on/off switch and has a standard or percussive sound which can be switched on by pressing the "harmonic attack" button. The auto-organ has its own tone generator and divider network, so that fitting the unit to any organ is very simple. The chording section has three different modes of operation: automatic, semi-automatic and manual.

Automatic
This mode is suitable for the beginner as the auto-organ plays the entire accompaniment controlled by one finger of the left hand. Simply play the tune with one or more fingers of your right hand and it sounds as though you've been playing for years. Play one note from the bottom two octaves on the keyboard and the major chord relating to that note will be generated (i.e. play 'C' and chord of 'C' will sound). Switches are fitted to change from major to minor or 6th, 7th, 5th and dim. 5th. These switches can be the black notes on the bottom octave, some of the notes on the pedalboard or front panel switches – the choice is yours when you build the unit. (The leaflet explains in more detail.)
When the note is released, chord or rhythm continue until a new note is pressed and then the chord changes. An auto-reset button is provided if you want to stop the chord sounding. The rhythm will continue and to restart the chord after the rest simply press a new note.

Semi-automatic
This mode can be used if you want to make your own chord shapes on the keyboard and this can be done on any notes in the lowest two octaves. As in the automatic mode the chord will be vamped by the rhythm unit, but in this case it will play the notes you have selected. If chord is released, the notes you had selected are memorised and carry on playing until a new chord is played or until the auto-reset button is pressed and this works in the same way as it did in the automatic mode.

Manual
This mode is the same as the semi-automatic mode except that when the chord is released, it stops playing. The rhythm however will continue as before (see auto-stop timer below).

All Modes
The following additional features are available in all modes:

Walking/Alternating Bass
This feature may be switched on at any time and generates a walking or alternating bass depending on position of switch, on its own or in addition to the chord section.

Arpeggio
This feature may be switched on at any time and will generate arpeggio runs in time with the selected rhythm and in tune with the chord being played. Three different runs are available and these are selected by a switch.

Auto-stop Delay Timer
This feature enables rhythm or chord and rhythm to be stopped after a preset time. The period is set by a variable control on the front panel and will be found very useful in all modes.

Other Features
In addition there is an overall volume control and a rhythm volume control. The auto-organ is very simple to add to any organ. It need not be electrically connected to the organ at all. All that is required is one single-pole make contact under each of the 24 lowest keys on the lowest keyboard wired to the auto-organ. These must be additional or spare contacts of course, not ones already in use. Alternatively a separate keyboard or pedalboard could be wired up. A guitarist for instance could supply himself with a complete accompaniment section with one foot on a 13-note pedalboard. The possibilities with this fascinating design are endless.

Construction Details
Full construction details are given in our leaflets:

MES51	Order As XH00A	15p
MES52	Order As XH02C	15p
MES53	Order As XH04E	35p
MES54	Order As XH31J	30p
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A range of synthesisers based around the circuitry of the 4600 synthesiser originally designed by "Electronics Today International" and now extensively redesigned and re-named the 5600S synthesiser. The 4600 synthesiser parts and its book of construction details are still available and will continue to be so for some time. The 3600 synthesiser originally designed by "Electronics Today International" has also been extensively redesigned and re-named the 3800 synthesiser. The 3600 Front Panel and 3600 Aux Board are discontinued.

INTERNATIONAL 5600S STEREO SYNTHESISER

A superb stereophonic music synthesiser with more features than virtually any other ready-made synthesiser costing up to, at the very least, more than four times the cost of the parts for this synthesiser. Its excellent styling and finished appearance make it look as good as any ready-made synthesiser. Equally at home in the studio or on the stage it is available with a teak-veneered cabinet or in a hard wearing plasticised-cloth covered cabinet with lid and carrying handle.

Just some of its outstanding features are listed below:

- ★ Fully digital keyboard which may be directly controlled by a microprocessor
- ★ Last note played always sounds regardless of number of other keys held.
- ★ Four oscillators each with five different shape outputs and one low oscillator with sine and square wave output.
- ★ Fully stereophonic output with voltage controlled panning.
- ★ 900 socket patchboard, making the output sound possibilities virtually limitless.
- ★ Voltage controlled solid state phase and reverb (not simultaneously).

Specification:

Keyboard

48-note F to E monophonic (could use a keyboard of up to 63 notes, but not in our cabinets.) Each note generates its own specific 6-bit digital code which is decoded in the keyboard controller. Thus notes may be generated directly by a microprocessor or other digital input. The code being used is displayed by six LED's.

Outputs to patchboard

Trigger:	−7V to +7V transition at each new key press. A new trigger pulse is initiated every time a new key is pressed and that key will sound whether or not any other keys are pressed.
Analogue (direct):	0 to +5V
Analogue (modulated):	0 to +12V
Output to microprocessor:	6 data lines plus strobe
Inputs:	Low oscillator Patchboard Computer
Controls:	
Glide:	Adjustable rate 0 to 10 seconds. With on/off switch.
Modulation selection:	Selects direct modulation on keyboard by low oscillator or from patchboard.
Modulation:	Allows input to modulate keyboard to a maximum of ±1 octave.
Tune:	Tunes keyboard ±2 semitones.
Pitch bend:	See Joystick.
Computer:	Switches data socket from input to output. Keyboard is operative in both positions. A microprocessor could be used directly as a sequencer giving up to 62 notes or rests of any length up to 8½ seconds based on approx. 1/60th second intervals, for each kilobit of random access memory or other digital memory. (Notes or rests use 16 bits of memory per 8½ seconds and notes or rests of any length in 1/60th second multiples can be generated). The sequence recorded in the RAM can be edited from the keyboard. A complete design for this sequencer will be available during the life of this catalogue.

Oscillators

Four voltage controlled oscillators plus one low oscillator (described separately). Overall range: 0.1Hz to >20kHz. per oscillator.

Output to mixers 1, 2 and 3.

Controls

Range:	Switchable in seven ranges from ½' to 32' plus low frequency (0.1Hz) special effects source.
Tune:	Tuning range of ±½ octave.
Free run:	Internal voltage source manually adjusts oscillator over full range. Oscillators 2, 3 and 4 can be synchronised with oscillator 1 i.e. every time

oscillator 1 starts a new cycle so does any other oscillator with free run operative. A'sync off' position is provided on oscillators 2, 3 and 4.
Shape: Varies mark/space ratio of square wave output, plus switch to enable shape to be voltage controlled from either of two control lines on patchboard or off.
Waveform: Selects sine, triangular, sawtooth, inverted sawtooth or square wave as output.
Stability: Frequency change with change in temperature: <0.015%/°C typical.
Frequency change with constant temperature over one week: <±0.05% typical.

Low Oscillator
Range: 0.2Hz to 20Hz
Outputs: Sine wave to patchboard via level control, and square wave at fixed 5V to patchboard simultaneously.

Noise
A pseudo-random noise generator with colour control to allow noise spectrum to be continuously variable between white and pink. Output to patchboard via level control.

Sample And Hold
Samples incoming waveforms and stores the voltage.
Controls:
Sample rate input: Switchable between low oscillator and external input module.
Level: Sets the range of output voltage.
Input: From patchboard
Output: To patchboard.

Mixers 1, 2 and 3
Inputs: Four (one from each oscillator) each with independent level controls.
Level: Adjusts level of output from each mixer.
Overload: LED lights to indicate overload.
Output: To patchboard.

Mixers 4 and 5
Inputs: Two each, from patchboard with level individually adjustable.
Level: Adjusts level of output from each mixer.
Overload: LED lights to indicate overload.
Output: To patchboard.

Filters 1 and 2
Two active voltage controlled filters (VCF).
Inputs: From patchboard
Cut-off rate: 24dB per octave
Control range: >2 decades
Controls Tune: Tunes filter to control source
High/Low: Selects tuning range
Resonance: Adjusts Q of filter
Level: Adjusts level of output to patchboard.

Amplifiers 1 and 2
Two voltage controlled amps (VCA) which may be AC or DC coupled.
Input signal: Via patchboard Input control: Via patchboard
Mode switch
Amp: In this position VCA is DC coupled and functions as a voltage controlled amplifier
RM: In this position VCA is AC coupled and functions as a ring modulator.
Output: To patchboard via level control.

Envelope
Input trigger: From keyboard or external input
Attack, Decay 1 and Decay 2: All adjustable from 5m sec to 5sec
Hold level: Adjustable 0 to 5 volts.
Delay: Adjustable 5msec to 5sec or duration of key contact closure as selected by switch.
Control Mode: Linear or exponential voltage controlled amplifier with a range of 60dB
Signal input: From patchboard
Signal output: To patchboard
Control output: Trapezoid output to patchboard

Transient 'A'
Trigger input: From keyboard or external input
Levels: Start, hold and final adjustable from 0 to 5V.
Delay 1, Slopes 1 and 2: Adjustable 5msec to 5sec.
Hold delay: Adjustable 5msec to 5sec or for duration of key contact closure.
Re-trigger: Allows transient to re-trigger itself at the end of each sequence, but this can be interrupted from the keyboard, then restarted again by a momentary tap on any key.
LED indicators: LED 1 lights when trigger pulse occurs and extinguishes at the end of Delay 1; LED 2 then lights and extinguishes at the end of Hold delay; then LED 3 lights and extinguishes at the end of Slope 2.
Output: To patchboard.

Transient 'B'
Identical to Transient 'A' except it has no internal re-trigger facility. However, it can be independently triggered from a push switch on the front panel.

Exponential Converter
Converts a linear input to an exponential output.
Input: From patchboard Output: To patchboard

Joystick
Gives 2-axis control of any two functions.
Range: Variable range on horizontal axis.
Switch to select patchboard or pitch bend.

External Signals
Inputs: Two inputs having a sensitivity of 50mV to 2V at 10kΩ.
Sensitivity: Input level control with high/low switch making it suitable for most signal sources.
External input 1 only, also has a trigger level control. This trigger pulse may be switched to patchboard or (in external input position) to any module switched to external.

Foot Pedal
A control voltage to patchboard may be generated by an external swell pedal. Range is controlled from front panel.

Foot Switch
Glide may be switched on and off or a trigger pulse may be generated from an external foot switch. Switched on front panel.

Echo
An external echo chamber may be connected and control on front panel adjusts balance between straight through and returned signal. Output to output channel 1.

External Control Voltage Inputs 1 and 2
Up to two control voltages from external sources (e.g. another synthesiser) may be connected and the voltages will appear separately on two patchboard lines. The inputs are protected against overload and should the voltage go more negative than OV the voltage at the patchboard will remain at OV. Similarly, if the voltage exceeds 5V the patchboard voltage will remain at 5V.

Inverter
When input is at 5V, output will be at OV and vice versa. Intermediate voltages are similarly reversed.
Input: From patchboard Output: To patchboard

Reverberation
Not available when switched to Phase
Multistage reverberation using a 3060 bit CCD solid state reverb. Level control adjusts between no reverb and full reverb, or when switched to patch, may be voltage controlled from patchboard.
Input: From patchboard Output: To patchboard

Phase
Not available when switched to Reverb.
The control angle is fully variable through 360°, and more to give a delay to the signal, the length of which depends on the frequency. This control may be used in conjunction with the voltage controlled input from the patchboard.
Input: From patchboard Output: To patchboard

Output Stages
There are two separate output channels: 1 and 2 and two separate outputs: left and right. Both channels are fed from the patchboard (or echo chamber: channel 1 only). Both left and right output can be fed from either or both output channel, or any mixture of the two. This panning facility may be controlled manually or by voltage control from Transient 'A' for right output and patchboard for left output. Note that it is the outputs that are panned between the two channels and not vice versa.
Output level: 0 to 1V rms approx.
Load impedance: 2kΩ
On/off switch provided

Phones Output
A stereo output for stereo headphones. >2W rms 8Ω

Construction Book
A book is available giving full construction details of this and the 3800 synthesiser.
Order As XF11M (5600S Stereo Synthesiser Book) £2.00

INTERNATIONAL 3800 SYNTHESISER

A low-cost version of our superb 5600S synthesiser. The 3800 is a truly remarkable small synthesiser. No ready-built synthesiser at even double the cost of the parts for the 3800 even begins to compare with this unit for versatility and excellence of specification. It is equally at home on the stage or in the studio and when mounted in its cabinet looks as good as any ready-made synthesiser.

Just some of its outstanding features are listed below:

- ★ Fully digital keyboard which may be directly controlled by a microprocessor.
- ★ Last note played always sounds regardless of number of other keys held.
- ★ Two oscillators each with five different shape outputs and one low oscillator with sine and square wave outputs.
- ★ Switchable interconnections allowing fast set-up times, making it ideal for live performance work.

Specification

Keyboard

48-note F to E monophonic. (Could use a keyboard of up to 63 notes, but not in our cabinets). Each note generates its own specific 6-bit digital code which is decoded in the keyboard controller. Thus notes may be generated directly by a microprocessor or other digital input. The code being used is displayed on the front panel.

Controls:

Tune:	Tunes keyboard ±2 semitones
Glide:	Adjustable rate 0 to 10 secs with on/off switch
Computer	Switches data socket from input to output (see 5600S for details)

Modulation

Provides a source of modulation for oscillators other than from the keyboard.

Controls

Low oscillator:	Selects low oscillator as source
Transient:	Selects transient as source
Sample and Hold:	Selects held voltage

Oscillators

Two voltage controlled oscillators plus one low oscillator (described separately). Overall range: 0.1Hz to >20kHz per oscillator.

"ELECTRONICS TODAY INTERNATIONAL" 4600 SYNTHESISER

All the parts for this synthesiser and the construction book are still available, but for new constructors it has been largely superceded by the 5600S Stereo Synthesiser. Full specification and construction details are given in the 4600 Synthesiser book.

Order As XF00A (4600 Synthesiser Book) £1.50

Controls

Input:	Selects keyboard or modulation unit as source of control. Off position provided.
Range:	Switchable in seven ranges from ½' to 32' plus low frequency (0.1 Hz) special effects source.
Tune:	Tuning range of ±½ octave.
Free run:	Internal voltage source manually adjusts oscillator over full range. Oscillator 2 can be synchronised with oscillator 1, i.e. every time oscillator 1 starts a new cycle so does oscillator 2 with free run operative. A 'sync off' position is provided on oscillator 2.

Shape: Varies mark/space ratio of square wave output plus switch to enable shape to be voltage controlled from either low oscillator or transient or off.
Waveform Selects sine, triangular, sawtooth, inverted sawtooth or square wave as output.
Output switch: Routes signal to filter, envelope, signal input of VCA or direct to output stage.
Output level: Adjusts level of output.
Stability: Frequency change with change in temperature: <0.015%/°C typical.
Frequency change with constant temperature over one week: <±0.05% typical.

Low Oscillator
Range: 0.2Hz to 20Hz Outputs: Sine wave.

Noise
A pseudo-random noise generator with colour control to allow spectrum to be continusouly variable between white and pink.
Level control adjusts level fed to VCF.

Sample And Hold
Samples incoming waveforms and stores the voltage.
Input switch: Switches between oscillator 1, oscillator 2 and noise.

Filter
An active voltage controlled filter (VCF).
Inputs: Mixed signals from oscillators, noise and external inputs.
Cut-off rate: 24dB per octave
Control range: >2 decades
Controls
Control source: Keyboard, modulation, transient, modulated keyboard or off by front panel switch
Tune: Tunes filter to control source
High/low: Selects tuning range
Resonance: Adjusts Q of filter

VCA
A voltage controlled amplifier (VCA) in addition to the envelope.
Allows ring modulation.
Controls:
Control input: From oscillator 1, oscillator 2 or transient.
Function switch: VCA or Ring modulation.
Output: Switches output between filter, envelope or output direct.

Envelope
Input trigger: See "Triggers"
Attack, Decay 1 and Decay 2: All adjustable from 5msec to 5sec.
Hold level: Adjustable 0 to 5 volts.
Delay: Adjustable 5msec to 5sec or duration of key contact closure as selected by switch.
Control mode: Linear or exponential voltage controlled amp with range of 60dB.
Signal input: From oscillator 1, oscillator 2 or VCA.
Output: Direct to output stage.

Transient
Trigger input: See "Triggers"
Levels: Start, hold and final adjustable 0 to 5 volts.
Delay 1, Slopes 1 and 2: Adjustable 5msec to 5sec.
Hold delay: Adjustable 5msec to 5sec or for duration of key contact closure.
Output: Direct to filter input switch, modulation input and VCA control input switch.

External Input
Allows external signals to be matched to the synthesiser and also generates a trigger pulse.
Sensitivity: 50mV to 2V at 10kΩ. Variable from front panel.
Trigger level: Decides at what voltage amplitude, trigger pulse occurs. Variable from front panel.

Triggers
Switches trigger pulses to envelope and transient.
Envelope: Selects trigger to control envelope from low oscillator, keyboard or external input.
Transient: Selects trigger to control transient from low oscillator, keyboard, external input or repeat.

Output Equaliser
Number of stages: Five
Centre frequencies: 60Hz, 240Hz, 1kHz, 3.4kHz and 10kHz.
Type: Active filter
Range of adjustment: >±10dB.

Reverberation
Type: Multi-spring
Output: Adjustable mix-fader from full reverb to original sound with no reverb.

Signal Output
Level control: 0 to 1V rms approx.
Load impedance: 1kΩ

Phones Output
Power output: 1W rms (mono)
Load impedance: 8Ω Output level control provided.

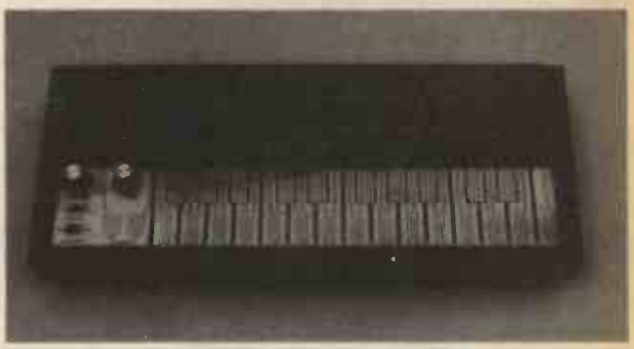
Construction Book
Full construction details of this synthesiser are to be found in the 5600S Stereo Synthesiser Book (XF11M). £2.00

'PRACTICAL ELECTRONICS' STRING ENSEMBLE

A string ensemble with brass and woodwind voices in addition. The construction details were published in "Practical Electronics" March to July 1978. Brief Specification
49-note C to C keyboard split into 16-note lower and 33-note upper section.
Range: 60Hz–2kHz (fundamental) up to 8.2kHz harmonic generation.
Transposable pitches: C, B, B*b*, E*b*.
Upper voices: String 16', String 8', Woodwind 16', Brass 16'.
Lower voices: String 16', String 8', String 4', Couple strings.
Envelope controls: Attack rate; Sustain length.
Fine tune.
Upper level balance
Output: 100mV and 1V.

Component Schedule
A component schedule is available free of charge to assist in ordering.

Order As XH17T (Leaflet MES 14)



'ELECTRONICS TODAY INTERNATIONAL' TOUCH ORGAN

A really novel project that is very easily made on one pcb, and will give endless enjoyment. No fiddly stylus to mess about with, you simply play it with your fingers, as you would an ordinary organ—but you haven't the expense of a full keyboard. Instead the 'keyboard' is printed on the printed circuit board.

The instrument has two voices and covers a full two octave range from F_3 to F_5. A variable tremolo with on/off touch pads is provided as well as a battery on/off switch and volume to miniature speaker which can be glued to the pcb.

Construction Details
Full construction details are to be found in the "Electronics Today International" publication "Top Projects No. 5".

Order As XF10L (ETI Top Project No. 5) £1.25

TOUCH-SENSITIVE ELECTRONIC PIANO

A very high quality electronic piano with highly realistic voicing and touch-sensitive keys that automatically make the notes louder, the harder you hit them. Considerable care was taken in the design to ensure that the tone of the piano was a very close approximation to the sound of an acoustic piano. In addition, there are two extra voices.

Specification
61-note C to C keyboard
Voices: Piano, Clavichord, Honky-tonk
Dynamic Range: >30dB
Volume Control: Loud and Soft Pedals

This superb design costs far less to build than almost any ready-built electronic paino let alone one with such a quality performance as this one.

Construction Details
All the construction details are given in our leaflet MES22.

Order As XH18U (Leaflet MES 22) 25p

'PRACTICAL ELECTRONICS' RADIO CONTROL SYSTEM

A really comprehensive model control system, featuring up to nine independent fully proportional channels achieved by a design using incredibly few components, thus keeping the cost to a minimum. The system operates at 27MHz and has the option of either proportional control or on/off type switched control on any channel. Full construction details are given in our booklet.

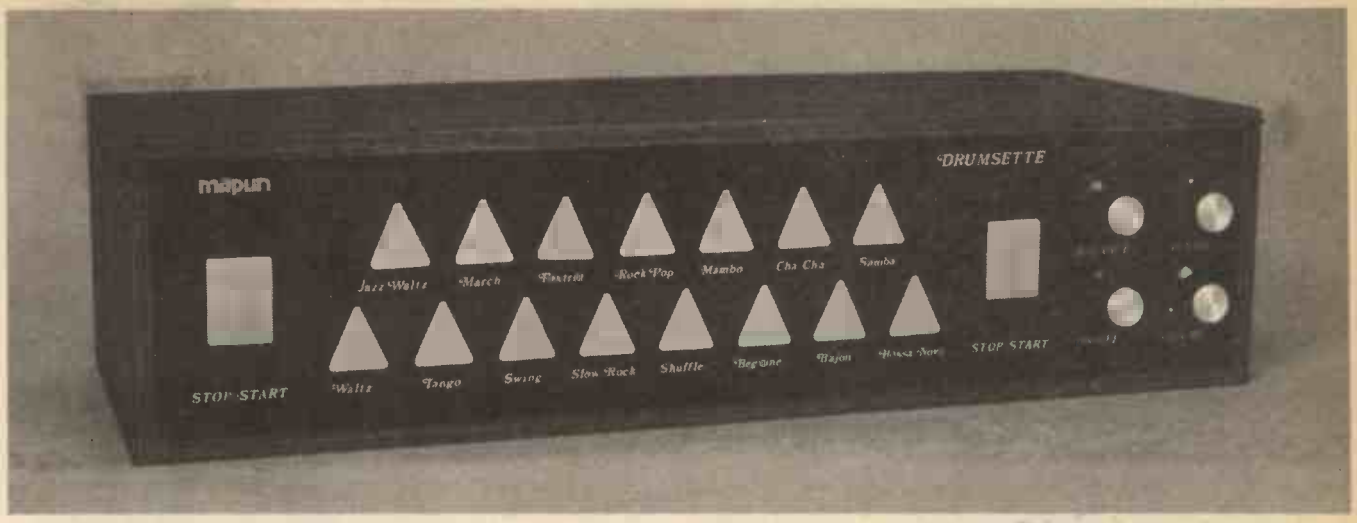
Order As XF03D ('PE' Radio Control Book) £1.20

HIGH QUALITY OPTO PRODUCTS AT LOW PRICES

LED's Sub-miniature	Red		18p	(WL32K)
	Green		22p	(WL33L)
	Orange		32p	(WL34M)
Standard	Red		15p	(WL27E)
	Green		19p	(WL28F)
	Orange		31p	(WL29G)
	Yellow		31p	(WL30H)
Rectangular			59p	(QW96E)
Seven Segment Displays	common anode			
0.6 in high 2-digits		(8.8)	£1.60	(BY66W)
		(±1.8)	£1.60	(BY67X)
	common cathode			
		(8.8)	£1.60	(BY68Y)
		(±1.8)	£1.60	(BY69A)
Liquid Crystal Display				
0.5 in high 3½ digits			£8.35	(FY89W)
Opto-Isolators				
Standard			79p	(WL35Q)
Darlington			£1.40	(WQ70M)
Photo-Darlington Transistor			36p	(HQ61R)
Fibre-Optic Light Guide			£1.34 per metre	(XR56L)

Plus much much more. See catalogue pages 258 to 262 for details.

DRUMSETTE / PEDAL UNIT



RHYTHM GENERATOR, THE "DRUMSETTE"

The Drumsette is a very high quality rhythm generator which has been designed with the musician in mind. There are no fiddly switches to complicate the instrument, the organist has only to lightly brush the sensitive touch-pads to select a rhythm. He may stop and start the rhythm during a piece simply by touching one of the large stop/start touch-pads and the rhythm will automatically re-start on the down-beat. The controls are also designed to help the musician set-up quickly for the piece he proposes to play. The balance control adjusts the volume of the brush sounds compared to the drum sounds and the tempo control is scaled so that the sheet-music may be notated with the speed you prefer to play at. It is therefore unnecessary to run the rhythm before playing a piece in order to set the speed every time you play.

The superbly finished back-screened perspex front panel and the chromed touch-pads give the unit an air of distinction and quality; a quality that extends right through the instrument with close approximations of the sounds of the actual instrument being generated.* The Drumsette will grace the finest organs, pianos or whatever you want to add a drum set to.

**When amplified through a high quality amplifier and loudspeaker.*

Specification

Output impedance: 3k†
Output voltage (max): 100mV rms
Overall size: 434x110x186mm (wxhxd)
Standard phono socket output.
Fifteen touch-selected rhythms:
Waltz; Jazz Waltz; Tango; March; Swing; Fox Trot; Slow Rock; Rock Pop; Shuffle; Mambo; Beguine; Cha Cha; Bajon; Samba; Bossa Nova.
LED indicator shows rhythm selected. Indicator LED extinguishes to indicate down-beat.
Nine instrument drum set:
Snare Drum; Bass Drum; Conga Drum; Low Bongo; High Bongo; Short Cymbal; Long Cymbal; Claves; Maracas.
Volume control.
Tempo control with scale marked on front panel.
Balance control adjusts comparative volume of brush and drum sounds.
Two linked stop/start touch pads so that rhythm may be stopped whilst playing and re-started on the same rhythm without searching through the rhythm-select pads. The rhythm always re-starts on the down-beat.
240V Mains operated.

† Thus it may be connected to any amplifier or organ, tape, radio or aux. input.

Construction Details
A leaflet is available giving full construction details and written in such a way that someone with no prior knowledge of electronics could build this project.

Order As XH19V (Leaflet MES 49) 30p

ORGAN AND BASS GUITAR PEDAL UNIT

A very high quality add on pedal unit for organs. A special feature is the bass guitar stop whose high realism is achieved by no less than four individual envelope controls which makes this pedal unit into an ideal accompaniment instrument for the solo guitarist.

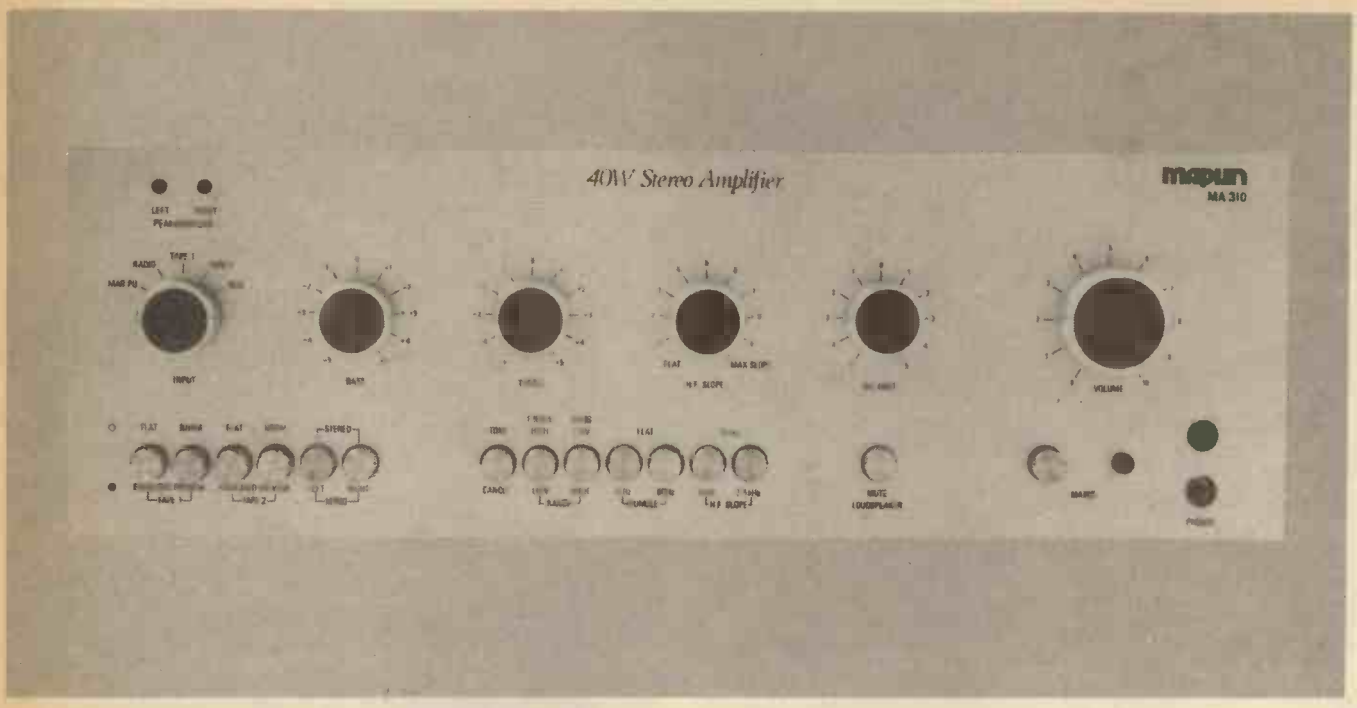
Specification:

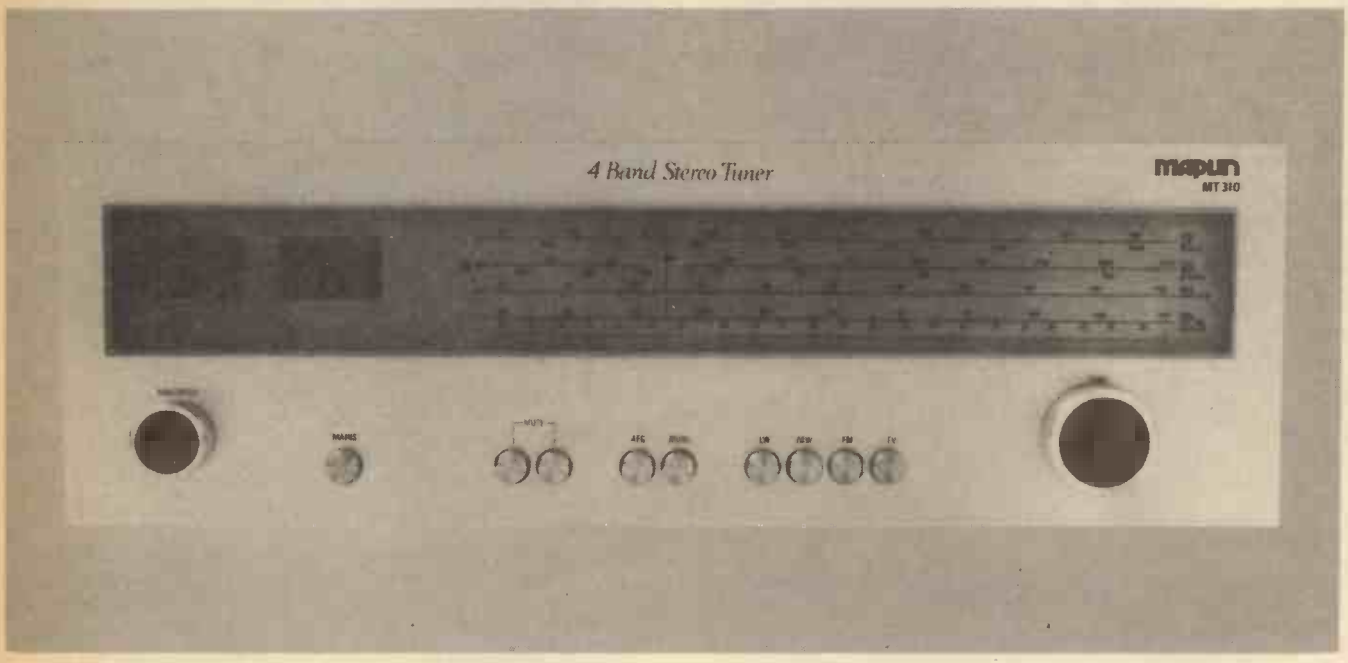
Four organ stops: Sub-Bass 16'
Diapason 16'
Gedeckt 8'
Bourdon 8'
Sustain (having an accurate exponential characteristic)
Sustain cancel (automatic)
Bass guitar stop (pitched at 8')
Mains powered (240V AC)

Output suitable for feeding directly into a power amp. (i.e. into 'line' or 'guitar' or 'tape' or 'aux' input)
13-note pedalboard C to C.
Frequency range: C_1 (≏32Hz) to C_3 (≏128Hz) (25 notes)
Whole unit tuned with one control
Highly stable, temperature compensated, voltage stabilised master oscillator.

Construction Details
A leaflet giving full construction details is available.

Order As XH20W (Leaflet MES 25) 15p



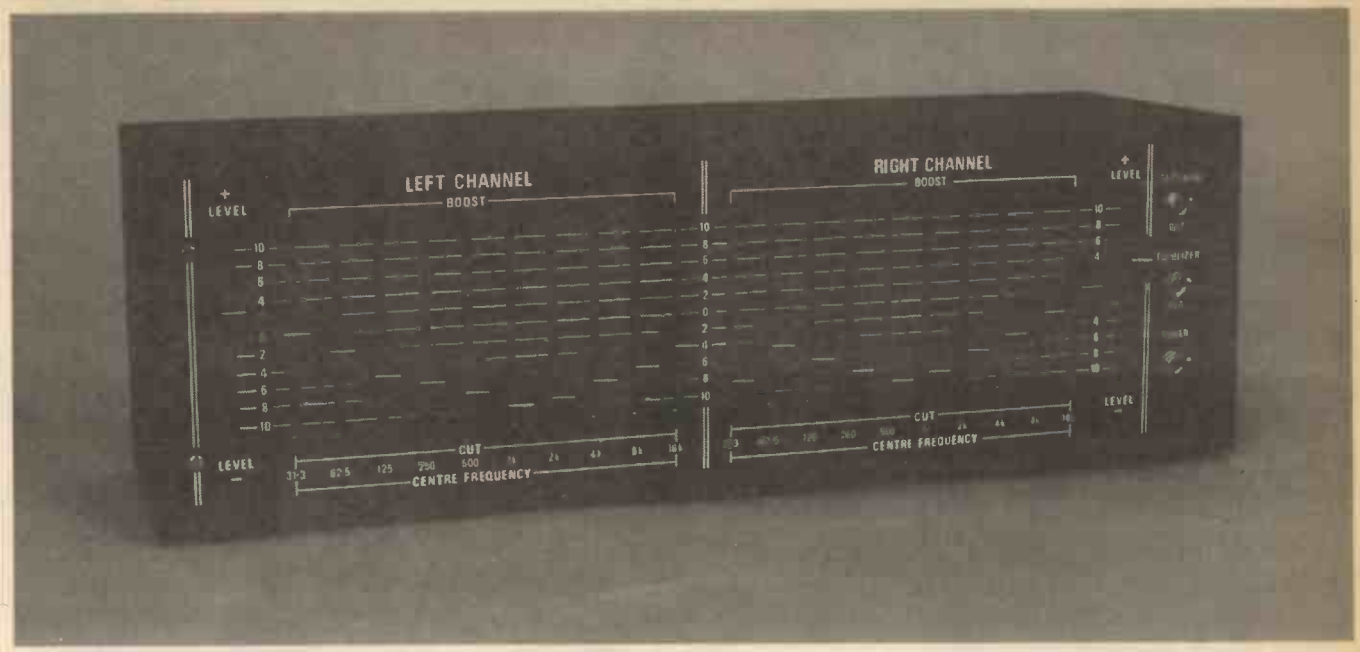


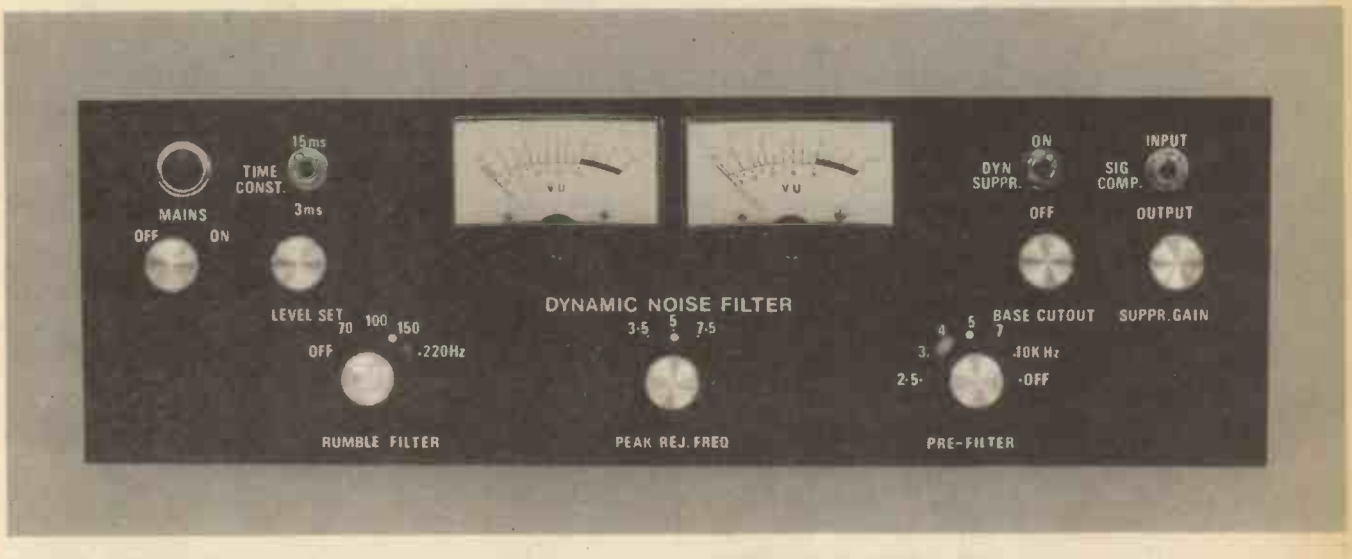
HIGH FIDELITY STEREO AMPLIFIER

A superb 40W rms per channel high fidelity stereo amplifier with a very high quality double-anodised front panel to make it look as good as it sounds. There are dozens of features including two tape inputs and outputs plus tape monitoring facilities designed so that you can tape record from any source including another tape recorder and monitor the recorded signal without interfering with the recording. There is a three position high cut filter with variable slope, and bass and treble controls with a choice of operating range; a two-position rumble filter, and lots more. For full specification and construction details turn to the project section at the back of our catalogue.

HIGH FIDELITY STEREO TUNER

A superb high fidelity stereo tuner with a very high quality double-anodised front panel designed to match the 40W hi-fi amplifier to which it makes an ideal partner. The tuner covers four wavebands: long wave, medium wave, VHF and the UHF TV band. The VHF band gives you excellent stereophonic reproduction of all BBC and local radio transmissions in your area, whilst a unique feature is the ability to receive the high quality sound, broadcast by the TV stations and usually considerably degraded by the poor quality sound reproduction systems in most TV sets. It will also give stereo sound if the TV stations ever start to broadcast in stereo. For full specification and construction details turn to the project section at the back of our catalogue.





TEN CHANNEL STEREO GRAPHIC EQUALISER

A really superior quality Graphic Equaliser with ten controls per channel making a total of twenty plus two overall volume controls. The design avoids the need for coils and also makes use of a special op-amp designed for use in audio circuits and featuring a very low noise input specification that puts this unit solidly into the top-flight hi-fi class.

Specification

Control centre frequencies:	31.3Hz, 62.5Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz
Frequency response:	(Controls flat): 10Hz to 20kHz ±½dB
Range of filter controls:	±13dB
Distortion (2V out controls flat:	0.02% typical
Signal to noise ratio:	(2V out controls flat): 82dB

Construction Details

Full construction details are given in our leaflet MES 37 complete with component schedule.

Order As XH21X (Leaflet MES37) 25p

DYNAMIC NOISE FILTER

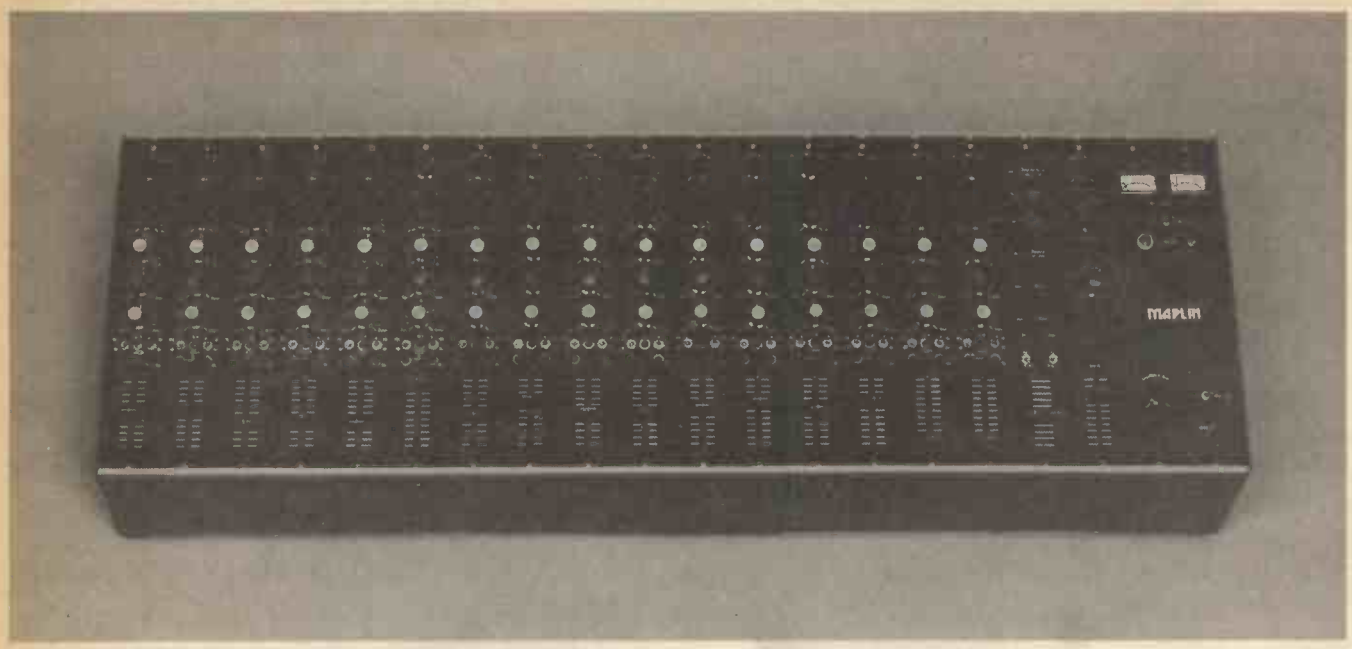
A dynamic noise filter which does not need specially encoded material to function correctly, (as does the "Dolby" noise reduction system) but will reduce the noise present in any signal.

Our six page leaflet MES 32 describes the noise limiter and how it works and shows you the full construction details, component list etc.

Construction Details

Order As XH07H (Leaflet MES 32) 20p

AUDIO MIXER



PROFESSIONAL EXTRA HIGH FIDELITY STEREO MIXER

Designed by Peter Cole

- **Fully modular for flexibility.**
- **Two separate group mixing sections both fully stereophonic and switchable to any input module.**
- **Pre-fade listen (PFL) on inputs and group mix modules.**
- **PPM or peak VU metering.**
- **Foldback (FB).**
- **Talkback.**
- **Any number up to 16 input modules (mono or stereo).**
- **Selection of input modules to cater for all types of input equipment, including professional microphones.**
- **Tone controls on all channels.**

Specification of Prototype:

Main Frame (fully assembled with PFL and FB)

Frequency response:	Better than −3dB (20Hz to 20kHz) with 16 input modules. The fall-off in the frequency response is mainly a function of the numbers and lengths of interconnecting cables and buses. The individual mixing amplifier boards have a virtually flat response over the audio spectrum.
Signal to noise ratio:	Better than 90dB
Distortion:	<0.01%
Output level:	0V to 4V (adjustable)

Input Amplifiers:

Mic. Amp.

Balanced input:	20 to 50Ω or 200 to 600Ω
Sensitivity:	12 to 20μV, 25 to 30μV, 80 to 100μV
Signal to noise ratio:	Better than 100dB
Other parameters:	Better than Main Frame

Cartridge Amp

Switchable inputs:	Magnetic Cartridge, Ceramic Cartridge, High Impedance Microphone
Sensitivities:	Magnetic Cartridge: 4mV at 50k Ceramic Cartridge: 80mV at 100k Hi-Z Mic. 10mV at 50k
Other parameters:	Better than Main Frame.

General Purpose Pre-Amp:
Sensitivity, variable from 30mV at 33k
Other parameters: Better than Main Frame

Tone Control:
Bass response: ±18dB
Treble response: ±16dB

Filter Unit:
Switch in "OUT" position: Flat
With roll-off control at minimum, the response will fall-off at 6dB/octave from the selected frequency (5,7,10 or 15kHz).
Roll-off control may be adjusted to give any roll-off between 6dB/octave and 18dB/octave.

General

The mixer to be described has been designed to meet the requirements of professional recording studios, FM radio stations, concert halls and theatres, yet is equally suited for home use. It offers a performance which matches that of the very best tape-recorders and high fidelity equipment. Considerable design and re-design work has been undertaken to achieve this remarkable performance at a fraction of the cost of comparable mixers. With the exception of the basic parts (P.S.U./main mix module, group mix module) other parts may be included or left-out as desired.

The input modules should be selected to suit the equipment that will be used with the mixer. Tone controls may be fitted to each input module as required. The block diagram Fig. 1, shows the interconnections between the boards in a module and between the modules. Each input module has a peak overload detection circuit so that immediate visual indication is given if an input signal becomes too loud. Pan pots are provided on mono channels which enable the monophonic source to be positioned on the overall stereophonic sound stage. Pre-fade listen (PFL) is provided. The operator can listen to an input which at that time is not included in the main output mix, and adjust the preset level control by switching PFL to the meters. When that input is required in the main mix the operator can simply push the channel faders fully open and that channel will enter the main mix at the preset level. The tone controls and on stereo channels the balance control may also be set in advance. The output of each input module may be switched to either group mix module as required, so that a selection of inputs e.g. all instruments may be mixed in one group, whilst another selection e.g. all vocalists may be mixed in the other group. Group mix modules may also be fitted with PFL. The outputs of the group mix modules are further mixed in the main mix module to give an overall stereo output.

Foldback is provided to allow mixed groups of signals to be fed back into an input module so that it may be remixed with other signals, and be further processed as a block of signals. It may be desirable to insert an echo effect at this point and the Echo Chamber shown on page 152 is ideal for this purpose.

Any input module except General Purpose types can also be wired with talkback facilities. This allows an input module to feed signals to the PFL line and thence to the monitor amps which may be temporarily connected to the performers' headphones. When this facility is switched on, the input module is automatically isolated so that it cannot accidentally be connected into the mix. A front panel lamp lights to give a visual indication that that module cannot be used for mixing.

Construction Details

Full construction details are given in our leaflet MES 38. (A component schedule is also available MES38B free of charge).

Order As XH22Y (Leaflet MES 38) 40p

150W STEREO DISCO

A superb fully stereophonic discothèque capable of delivering 150W rms continuous sine wave power per channel simultaneously into 4Ω loads. The unit features an automatic voice operated fader, extensive monitor facilities and the light show described below.

Specification

Output power:	continuous rms sine wave into	
	4Ω	8Ω
One channel driven	225W	146W
Both channels driven (per channel)	160W	112W
Frequency response:	±1dB (30Hz to 20kHz)	
Total harmonic distortion at 150W:	>0.1% at 1kHz.	

Construction Details

Full construction details are given in our leaflet MES 41.

Order As XF04E (Leaflet MES 41) 25p

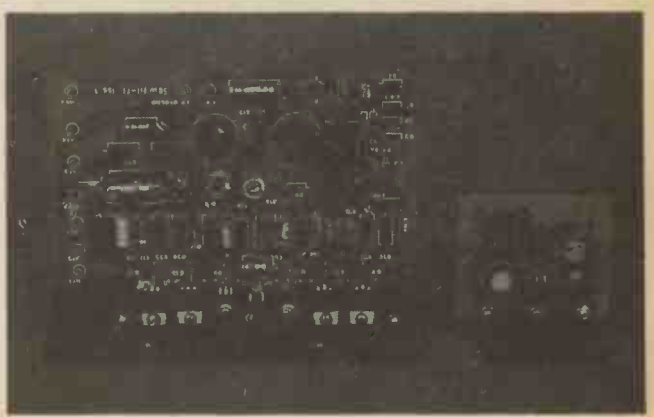
LIGHT MODULATOR

A high quality light modulator with 3 channels each capable of driving loads in excess of 1kW each. The unit has automatic gain control and very steep filters to ensure that signals proper to one channel do not operate the bulbs of another channel.

Construction Details

Full construction details are given in our leaflet MES42.

Order As XH23A (Leaflet MES42) 25p



AMPLIFIER MODULES

Turn to the project section of our catalogue for details of our high fidelity 8W, 50W,and 100W amplifier modules for you to build. Our picture shows the 8W and 50W amplifiers after construction.

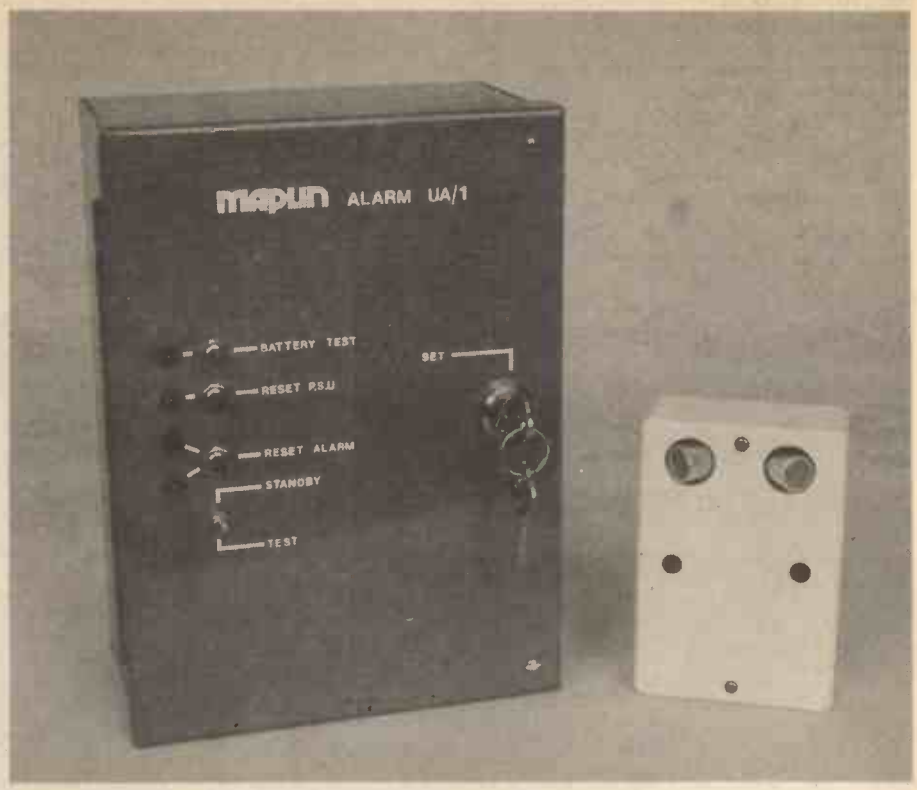
BURGLAR ALARM

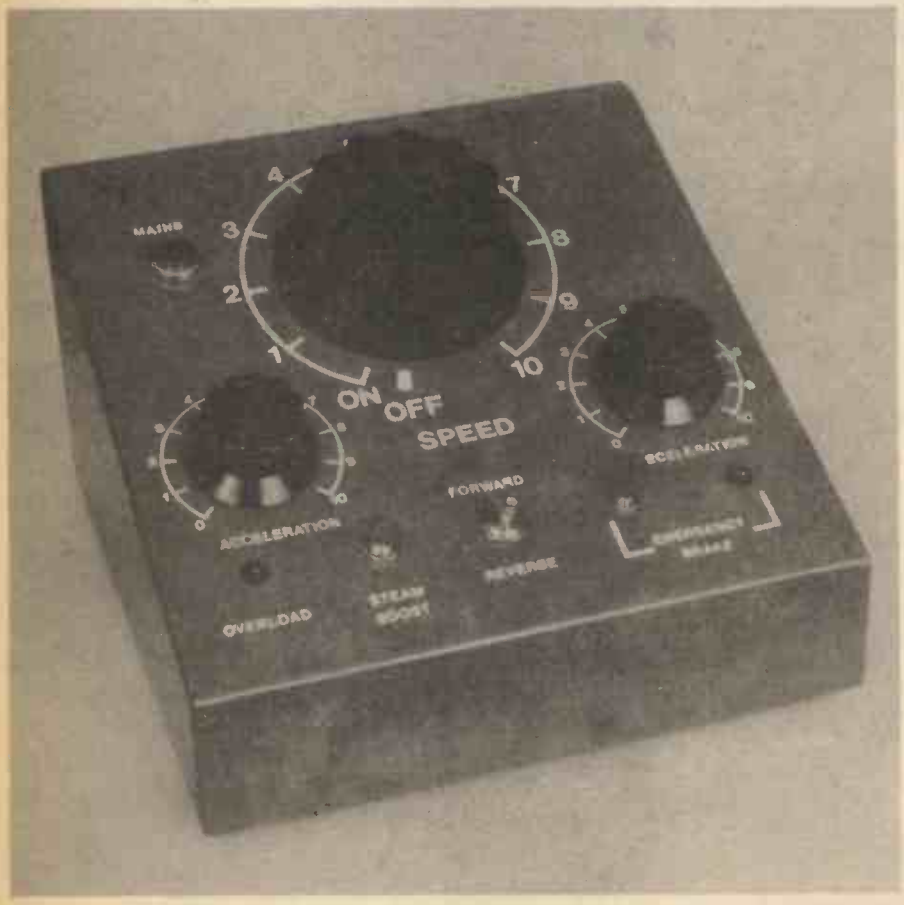
A high quality burglar alarm based on a balanced bridge system that gives the ultimate in security. As well as allowing you to use as many simple contact type detectors, pressure mats etc as you require, the design allows the use of up to four ultrasonic movement detectors as well.

The ultrasonic detector simply sticks on to a wall and guards the whole room. It produces a very high frequency sound pattern in the room, way above audio frequencies so that you can't hear it. If the sound pattern is disturbed by a movement the detector will signal to the main control box and the alarm will go off. The ultrasonic detector has a variable sensitivity control to suit room size etc. so that very small movements are not detected.

The main control box can differentiate between a contact type detector operating, an ultrasonic detector being triggered and the line to an ultrasonic detector being interfered with. In each case a different combination of lamps light on the main control box. In addition if an ultrasonic detector is the cause of the alarm going off a lamp lights on the triggered unit.

Full construction details of the main control box and the ultrasonic unit are given in the project section towards the end of our catalogue.





MODEL TRAIN CONTROLLER

A pulse width speed controller which delivers full voltage to the model train even at very slow speeds to achieve smooth train movements at all speeds. Added features are the acceleration and deceleration controls which allow smooth acceleration and braking to and from the speed set by the main speed control.

An emergency brake is provided which stops the train instantly at the press of a button, and another press button is provided to momentarily apply full power to the track to help to overcome any inertia or resistance due to dirt and dust which is stopping an engine from moving off.

The controller is fully protected against short circuits on the output and an overload lamp lights if a short circuit is present. The controller will deliver up to 1.6A at 12V DC; powerful enough to drive even the biggest locomotives.

For full construction details turn to the project section towards the end of our catalogue.

MICHRON MK II

A digital alarm clock kit complete with a beautifully finished silver and white case that will look very attractive in any room in the house. The clock features a big 0.7 in. (17.75 mm) bright red display with automatic dimming as night falls. In addition the clock has battery back-up. If the mains fails the clock will continue to function on the battery until the mains returns. Also there are all the usual functions: flashing seconds indicator, seconds display, loud audible alarm with 'set' indicator, snooze timer, sleep timer, no radio frequency interference, will switch your radio or other appliance on or off, time-set security switch to stop "little fingers" interfering with the displayed time plus all the usual features. We are offering these superb clock kits at a really low price, so turn to the project section of our catalogue, now, to see how simple it is to make one.

MONITOR TIMER

A very accurate timer that will switch mains appliances on and off again at preset times. An attractive case is available, fully punched and printed to which fits a double 13A socket so that appliances up to 1kW total (5A) may be transferred from normal mains outlets directly to the timer. Simply plug them into the timer and they will switch on and off at the times you have pre-set. In addition the timer functions as a normal 24-hour clock, with alarm on and off set indicators, flashing seconds indicator, high brightness ½ in. (12.7 mm) red display, test button to check that appliance connected will operate correctly at 'on' time, very simple 'one-finger' setting of time and on-off times with security to stop "little fingers" interfering with displayed times. For full construction details turn to the projects section in our catalogue.

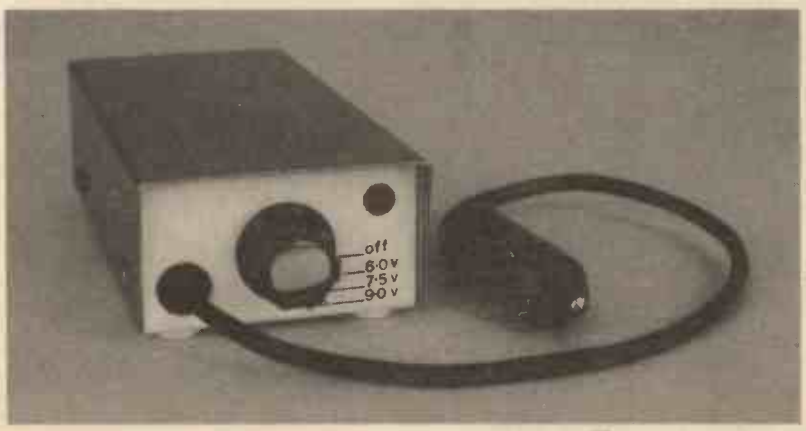
VERY LOW DISTORTION AUDIO OSCILLATOR

An audio oscillator is an essential piece of test equipment for anyone building audio equipment, hi-fi gear etc. Because of its very low distortion sine wave output this oscillator is suitable for use with even the most sophisticated hi-fi equipment.

Range: 20Hz to 26kHz in three ranges.
Distortion: Better than 0.01% (sine wave 1kHz)
Outputs: Sine or square wave variable voltage up to 1V.

Output voltage: 0 to 10mV
0 to 100mV
0 to 1V
All continuously variable
Supply voltage: 9V PP6 battery

Construction details
All the construction details are given in our leaflet MES 15.
Order As XH24B (Leaflet MES 15) 15p



CAR BATTERY/MAINS VOLTAGE CONVERTER

A voltage converter with fully stabilised outputs, short circuit protection (followed by immediate recovery), input of battery version protected against polarity reversal, and a maximum output of 400mA. Details of two versions are available, one for mains operation and output is switchable between three output voltages:

6V, 7.5V and 9V. Max ripple current with output at 9V is 150mV, at 7.5V is 80mV and at 6V is 70mV.

Construction details
All the construction details are given in our leaflet MES 17.

Order As XH25C (Leaflet MES 17) 15p

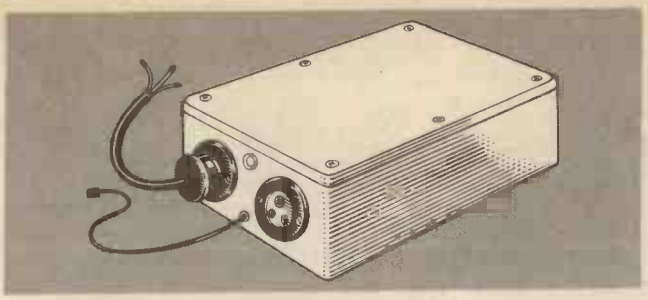
ASCII KEYBOARD AND TV DISPLAY INTERFACE

A 63-key keyboard generating an ASCII encoded output with 96 character codes and 32 control codes, 9 of which are available directly to control cursor position on the TV set. The keyboard has a repeat facility and a 2-key rollover which ensures that only one code is generated however many keys are pressed. The keyboard generates capitals and lower case characters (although the VDU only displays capitals regardless of whether capitals or lower case codes are input to it), but can be strapped to generate capitals only for microprocessors that will not recognise lower case codes.
Provision is made on the keyboard for direct connection to microprocessor and via interface boards to a standard home cassette tape-recorder and to a standard 625-line colour or monochrome television set. The VDU interface allows the TV to display 16 lines of 64 characters per line. Full cursor control is available in all four directions from the keyboard. The VDU controller will also store up to 4 pages (with extra memory boards) with automatic scrolling through the pages, and forward and backward stepping through the pages.
The cassette interface functions via a modem which can be used to transmit via telephone lines or amateur radio transmissions.
The whole unit can easily be built into our Verocase Type 502 and a front panel ready-cut to suit our keyboard is available to fit this box. The unit can be built in stages since each section is a separate pcb which simply solders on to a mother board for complete flexibility.

Construction Details

A leaflet giving full construction details is available, MES71, the first of a series describing microprocessor projects.

Order As XH26D (Leaflet MES 71) 30p



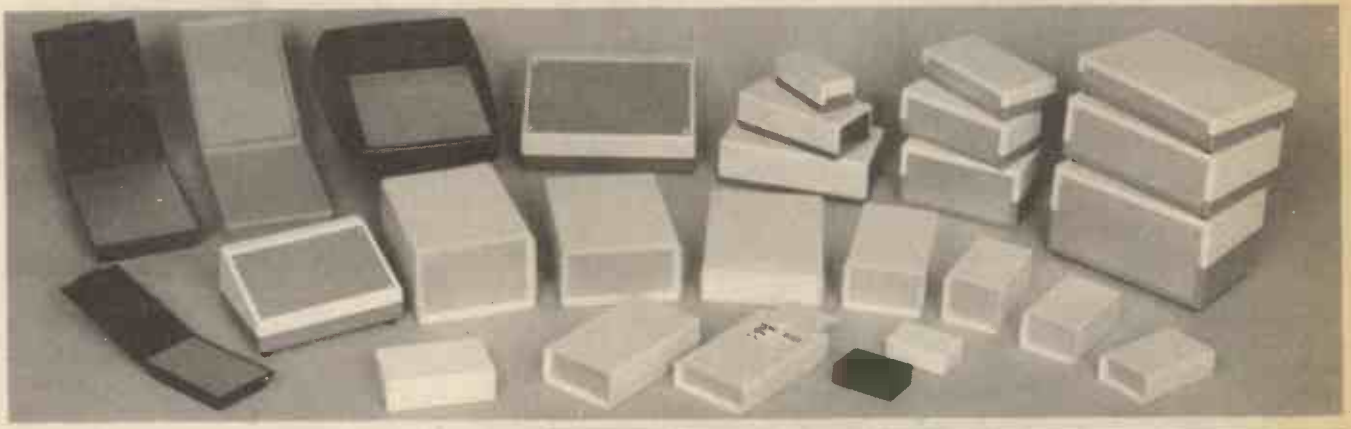
CAR ELECTRONIC IGNITION SYSTEM

A high performance electronic ignition system for negative earth cars. The unit is very easily connected and the conventional ignition system can be returned to at any time simply by transferring the input plug on the box to the second socket.
The electronic ignition system has many advantages over conventional systems, for example, fuel saving, quick starting on very low battery voltages, more power at high revs, points wear reduced.

Construction Details
Full construction details are given in our leaflet MES 16.
Order As XH27E (Leaflet MES 16) 15p

'ELECTRONICS TODAY INTERNATIONAL' INDUCTION BALANCE METAL DETECTOR

A really superior metal detector using the really sensitive induction balance system. It will detect a man's gold ring at 8 in and a 6 in. square of copper at 22 in. Full construction details are given in ETI's "Top Projects No. 5" described on page vii.
(Note: For a meter, use our Level Meter)

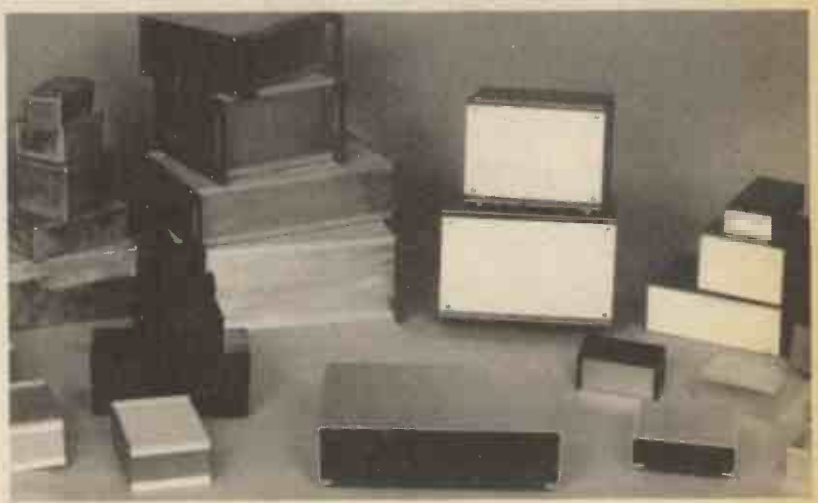


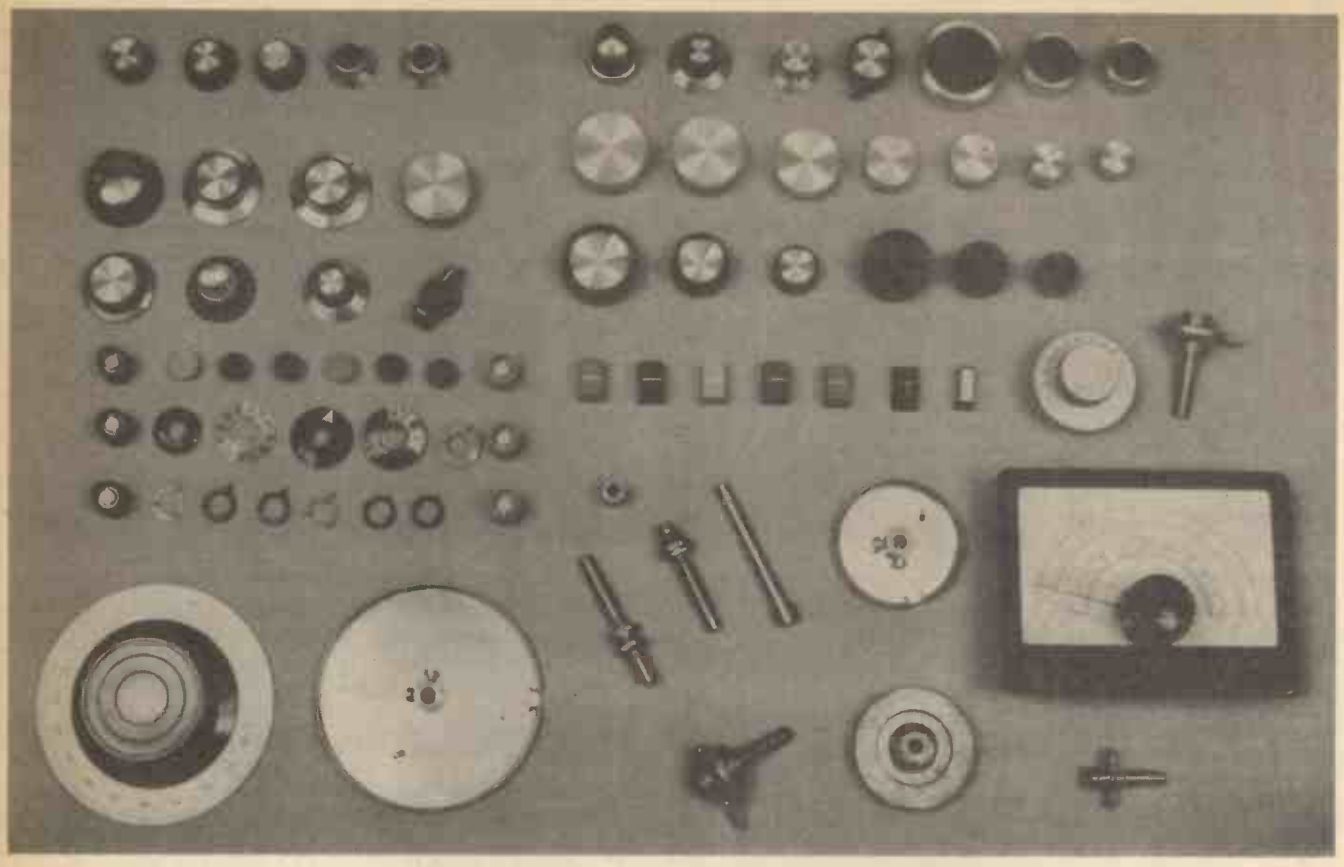
BOXES, CABINETS & CASES

A vast range of boxes, cabinets and cases to suit just about every application. From low-cost plastic (MB range) and low cost metal boxes (AB range) to the high quality Vero plastic boxes and Centurion metal boxes. We've got diecast boxes, potting boxes and even boxes with battery compartments.

There's a range of boxes in black vinyl finish and a similar range with a teak-effect finish.

There are sloping front boxes and boxes for use with foot switches. In fact well over a hundred different boxes. You'll find them all described on pages 52 to 57 of our catalogue.





KNOBS & DRIVES

Our range of highly attractive knobs gives you a really big choice to finish off your project the way you want. From the universal plastic pointer to large all shiny metal knobs we've got the lot. We also stock a range of dials, slow motion drives and cord drive parts. We've got collet knobs with different coloured caps, and slide knobs in five different colours. See pages 76 to 80 in our catalogue for full details

WIRES AND CABLES

An excellent range of wires and cables to cover many of the most common needs in electronics and home electrical work.

We also stock a range of accessories to help you when cabling such as lacing cord, tie wraps, Hiatts etc.

GENERAL COMPONENTS

We stock a very wide range indeed of all the most popular electronic components and they're all fully described in this catalogue. Resistors from precision 1% types up to 25W high power types. Capacitors from 1.8pF to 10,000µF in lots of different voltages, tolerances and dielectrics. Our transistor and IC range is very large, covering TTL, CMOS, op-amps, linears, microprocessors, memories etc. etc.

FIBRE OPTIC LAMPS

FIBRE OPTIC TABLES AND LAMPS

These beautiful lighting effects will create the centre of attraction in any room. The swirling coloured patterns of the large and small tables are fascinating to watch and the lamp with its hundreds of pin-pricks of light creates a very relaxed atmosphere. For full details turn to page 83 of our catalogue.

CHECK OUR PRICES FOR VOLTAGE REGULATORS

Positive 100mA	30p including VAT
Positive 500mA	49p including VAT
Positive 1A	62p including VAT
Positive 1.5A	95p including VAT
Negative 500mA	58p including VAT
Negative 1A at 5V, 12V and 15V	69p including VAT

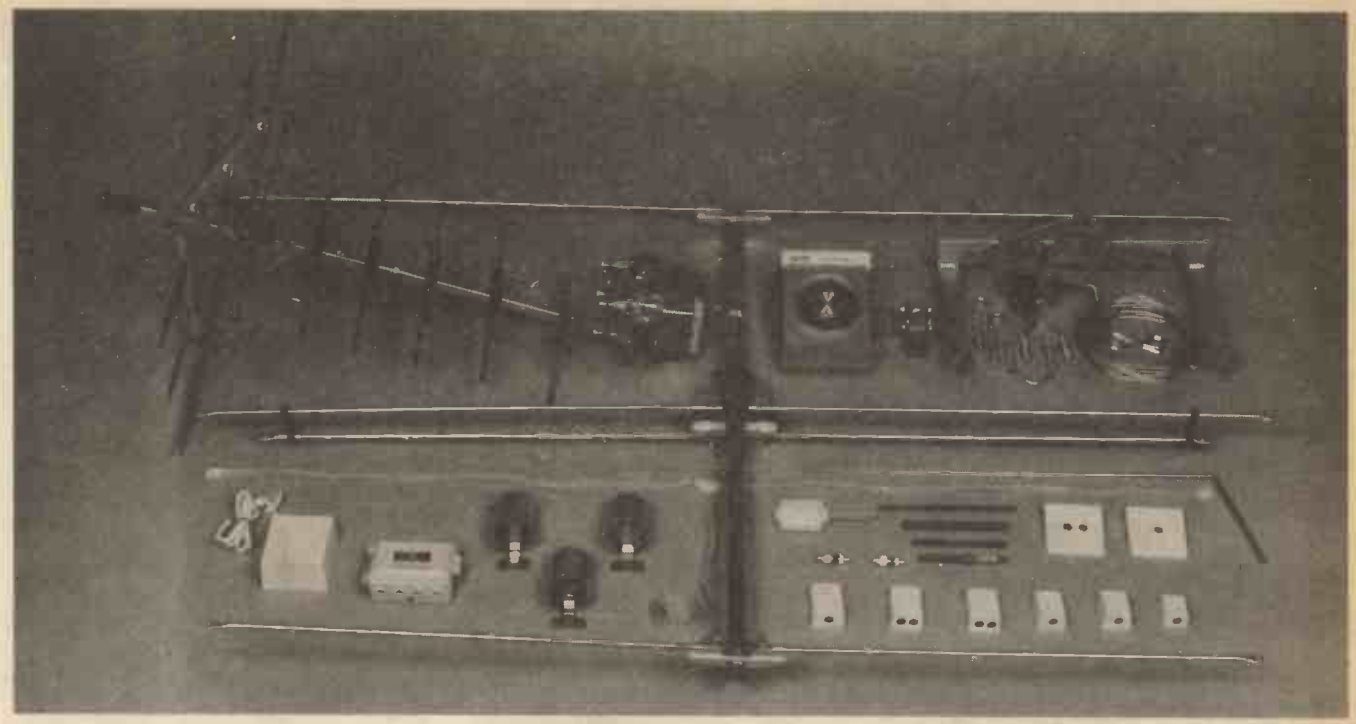
We also stock variable voltage regulators positive and negative at ½A, 1A and 5A. See μA78 and μA79. Series on catalogue page 206.

LAMPHOLDERS

A range of highly attractive lampholders to suit LES and MES bulbs. There are also some mains neons and a really unusual item, little covers that clip over LED's to give them a very neat appearance. As usual Maplin provide you with the maximum choice to help you give your projects the perfect finished look.

SWITCHES

We stock a very large range of switches and relays. Push-button, rocker, toggle, rotary and slide switches with lots of different types in each category. Our modular rotary and latch switches are excellent value for money and allow many combinations of different switch actions to be made up. See pages 84 to 89 in catalogue.



AERIALS

A completely new section in this catalogue is the section covering TV and radio aerials. Our range covers standard TV aerials and very high gain types as well as a range of FM stereo radio aerials from a simple dipole and reflector right up to the giant Mushkiller 8-element for long range reception. And they're all high quality aerials made by one of Britain's biggest and most respected names in aerials: Antiference.

We also stock their brackets and lashing kits to give long-lasting support to your aerial in even the fiercest weather conditions. In addition we stock their range of co-axial outlets, splitters and dividers and an aerial amplifier.

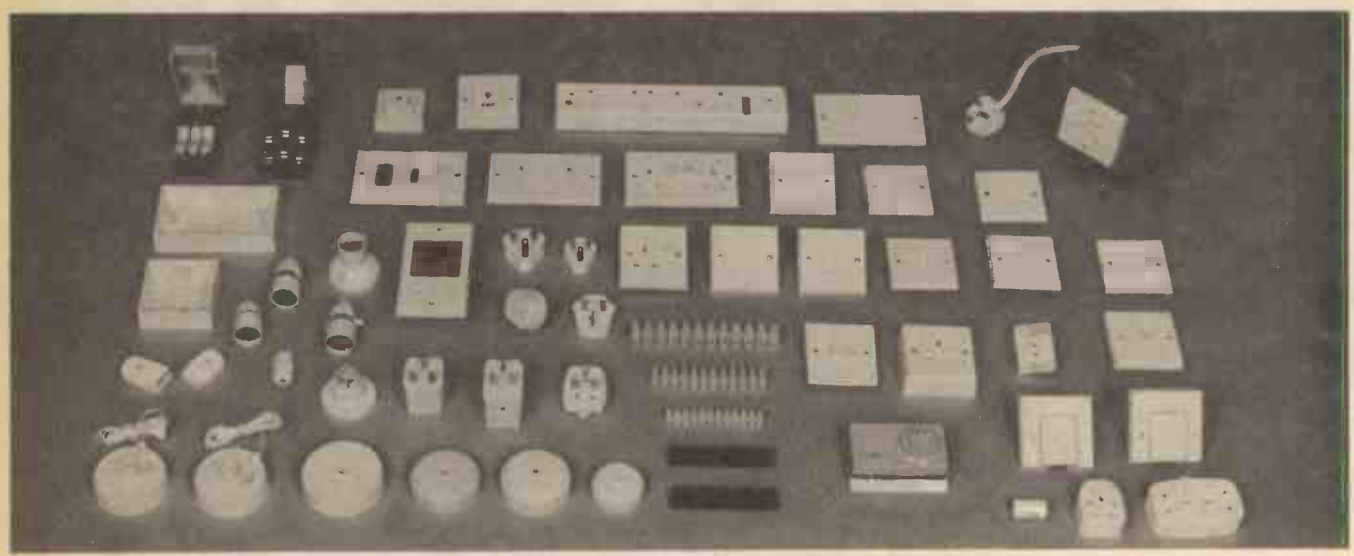
Also shown in the picture is our very high quality aerial rotator so that with a wideband TV aerial you can pull in lots of stations or with an FM aerial pick up good stereo from several local radio stations.

As usual there's a massive range to choose from and everything's at excellent prices.

MOBILE RADIO ANTENNÆ

We are major stockists of one of the finest ranges of mobile radio antennae in the world. Our range covers 66 MHz to 470 MHz with an excellent range of mounts.

Our picture shows an amateur with two of our aerials in use (the 3dB gain whip and the 5dB gain collinear) just about to pull away after visiting our busy shop in Southend. For full details of our mobile radio antennae turn to pages 105 and 106 of our catalogue.



CONNECTORS

We have a truly superb range of connectors, all at marvellous prices. There are fifteen pages in this catalogue devoted solely to connectors commencing on page 114 New this time are lockable DIN connectors, XLR "Cannon"-type connectors, some extra mains plugs and sockets, a range of 'UHF' connectors and adaptors to complement our range of mobile radio antennae, jack sockets with chromed bezels and an extended range of phono sockets. Also we've re-introduced our excellent low-cost range of edge connectors.

So if you're looking for a connector to suit your special application turn to pages 114 to 129 of our catalogue and the chances are you'll find something there that will fit the bill.

ELECTRICAL ACCESSORIES

Another completely new section in this catalogue is the section devoted to electrical accessories. Virtually everything you need for electrical jobs at home from putting in a new socket to rewiring the entire house. And if you've never done anything like it before, our books, "Home Electrics" by Geoffrey Burdett or "Practical Electrical Rewiring and Repairs" by Charles Miller explain everything you need to know in simple, practical terms. Turn to pages 43 and 44 for cables and pages 130 to 133 of our catalogue for a wide range of quality British made electrical accessories all at excellent prices. You can be completely confident about the quality and safety of your work if you follow the instructions in the books using our high quality components.

SPEAKERS

Our excellent range of speakers covers tiny miniature speakers less than two inches diameter up to the mighty McKenzie 15 inch bass speaker. In between we've got some beautiful speakers all at marvellous prices.

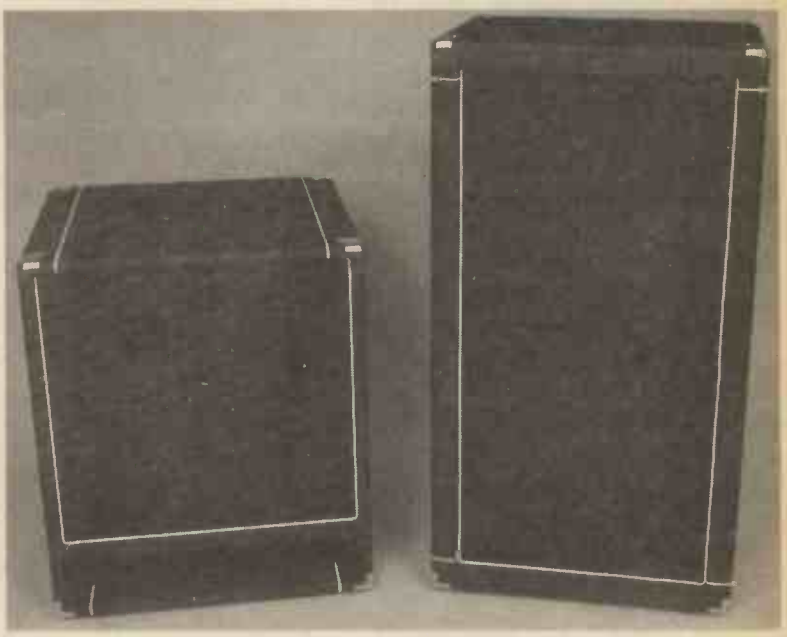
We must be the cheapest in the country for the new Piezo tweeters, and if you've never tried them, you should. They've got a sharp crystal clarity that has to be heard to be believed and at our prices they're a spectacular bargain.

For the more conventionally minded we've got a range of crossover networks, a mid-range speaker and a selection of tweeters.

For the power men we've got a good range of 12 inch speakers at 50W and 80W and the big 15 inch speaker that will deliver a massive 150W rms.

In addition we stock a portable megaphone with a dual microphone connected in antiphase to help to avoid feedback, and two types of car-top public address horns that are extremely reasonably priced. Also there are three very nice pairs of stereo headphones at prices you'll find hard to beat.

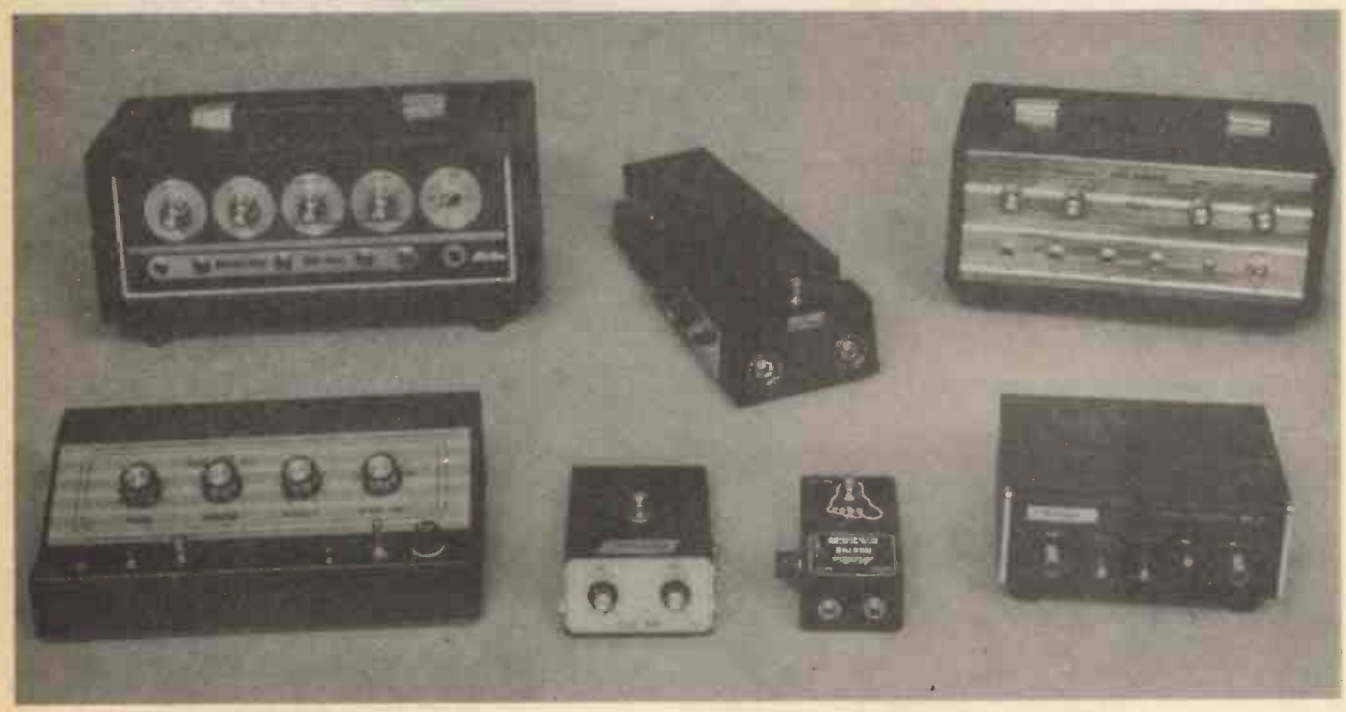
So if you're looking for speakers, tweeters, woofers, crossovers, headphones, megaphone or PA horns turn to pages 137 to 141 and pick something from our range at our low, low prices.



SPEAKER CABINETS AND ACCESSORIES

Our picture shows our two high power speaker cabinets. One to house our 15 inch McKenzie and one to house two of our 12 inch units. This latter cabinet also has cut-outs which are normally blocked off for fitting two of our 3 inch piezo tweeters.

We also stock the special acoustic wadding you will need to cover the insides of the cabinet. You will be surprised how dramatically different and improved the sound is when this is done. If you prefer to make your own cabinets we sell speaker grille material in black and brown and a hard-wearing plasticised cloth for covering the outsides of the cabinet. Coupled with our sealing strip, Velcromounts, cabinet corners and carrying handles you'll see that we've got just about everything you need (except the wood, of course) to put together your own speaker cabinets.



DISCO EFFECTS

The pages in our catalogue devoted to disco lighting effects cover projectors with a wide range of accessories , a mirror ball which rotates to create some beautiful effects, fuzz lights, strobes, and sound to light units; one with a whole range of stunning visual effects.

MUSICAL EFFECTS UNITS

These ready-built units offer a wide range of effects for professional musicians or the amateur. From simple fuzz pedals to sophisticated echo chambers, we're certain you'll be hard-pressed to beat our prices for any of these units. They all offer excellent value for money.

BOOKS

We stock over 200 titles of books on or relating to electronics. The book section in this catalogue is just like having a superb technical bookshop in your home. There are plenty of new books in this catalogue including a whole new section of superb books about microprocessors and programming, in fact even a book and tape-cassette home study course on programming.

For the absolute beginner try our superb set of "Basic Electronics" books that teach you while you experiment with the actual components. And once you've mastered that, there's an absolutely massive selection of books with projects to build in them. And don't forget that there are new titles coming on to the market all the time. You'll find details of all the best ones in our newsletters which are published about once every two months.

LEAFLETS (Prices shown under pages 35 and 36 on price list).

The following books and leaflets are published by Maplin. Those marked 'Free' are not shown on our price list and will be sent to you on request. An s.a.e. would be appreciated. However, please note that when you order any book or leaflet, its component schedule is automatically included.

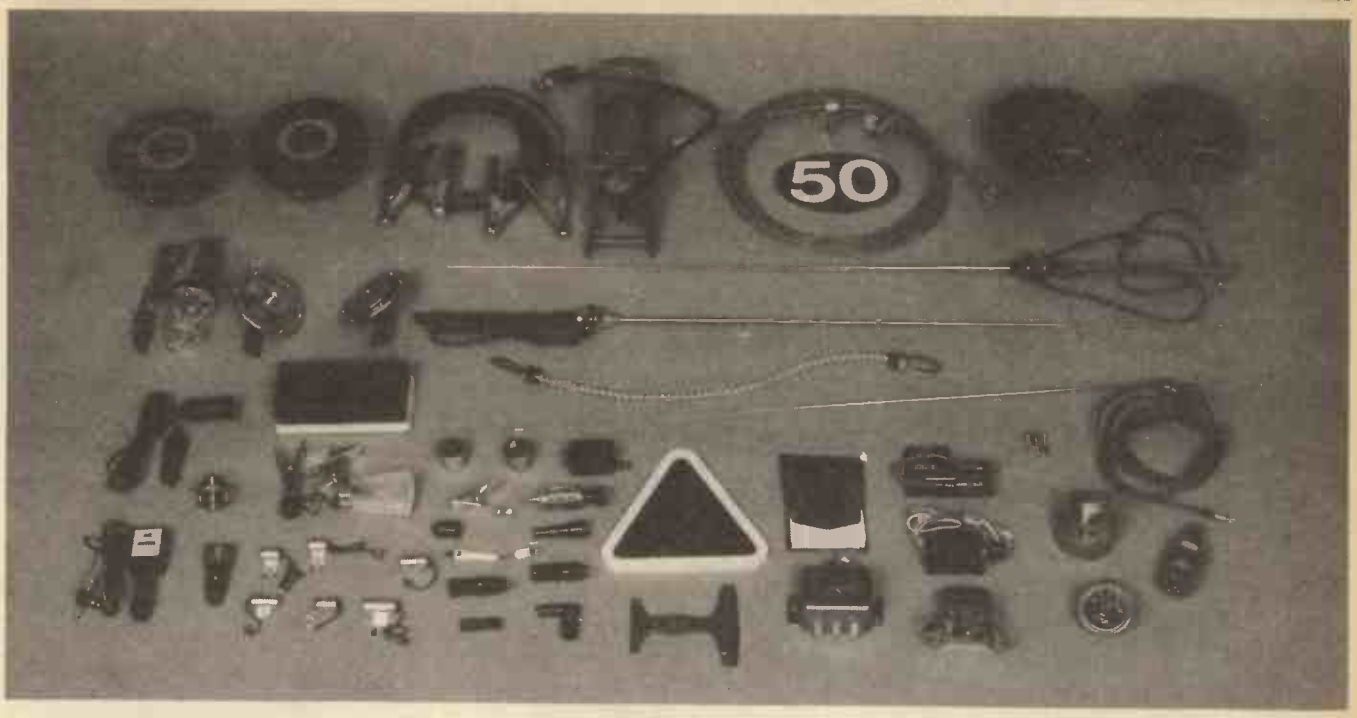
–	4600 Synthesiser Book	XF00A	
MES 11B	4600 Component Schedule	XH15R	(Free)
MES 11S	4600 Synthesiser Specification	XH09K	(Free)
MES 12	5600S/3800 Synthesiser Book	XF11M	
MES12B	5600S/3800 Component Schedule	XF13P	(Free)
MES 14	String Ensemble Component Schedule	XH17T	(Free)
MES 15	Audio Oscillator Leaflet	XH24B	
MES15B	Audio Osc. Component Schedule	XF14Q	(Free)
MES16	Car Ignition Leaflet	XH27E	
MES16B	Car Ign. Component Schedule	XF15R	(Free)
MES17	Voltage Converter Leaflet	XH25C	
MES17B	Voltage Conv. Component Schedule	XF16S	(Free)
MES18	Semiconductor Data Book Vol. 1	XF17T	
MESD19	MC1496 Data Sheet	XH11M	(Free)
MES 22	Touch-Sensitive Piano Leaflet	XH18U	
MES22B	Piano Component Schedule	XF18U	(Free)
MES24	Spring Lines and Driver Module Details	XH06G	(Free)
MES25	Bass Pedal Unit Leaflet	XH20W	
MES25B	Pedal Unit Component Schedule	XF20W	(Free)
MES26	'PE' Radio Control Book	XF03D	
MES26B	Radio Control Component Schedule	XF24B	(Free)
MES27	DM02T Data Sheet	XH13P	(Free)
MES32	Dynamic Noise Filter Leaflet	XH07H	
MES32B	Noise Filter Component Schedule	XH28F	(Free)
MES33B	40W Stereo Amp Component Schedule	XF21X	(Free)
MES34B	Stereo Tuner Component Schedule	XF22Y	(Free)
MES35B	50W Amp Component Schedule	XF25C	(Free)
MES36B	Touch Organ Component Schedule	XF27E	(Free)
MES37	10-Channel Graphic Equaliser Leaflet	XH21X	
MES37B	10-Chan G.E. Component Schedule	XF06G	(Free)
MES38	Audio Mixer Leaflet	XH22Y	
MES38B	Mixer Component Schedule	XH08J	(Free)
MES41	150W Stereo Disco Leaflet	XF04E	
MES41B	Disco Component Schedule	XF05F	(Free)
MES42	Light Modulator Leaflet	XH23A	
MES42B	Light Mod Component Schedule	XF23A	(Free)
MES46B	Train Controller Component Schedule	XF28F	(Free)
MES47B	Burglar Alarm Component Schedule	XF29G	(Free)
MES48B	ETI's Metal Detector Component Schedule	XH29G	(Free)
MES49	Drumsette Leaflet	XH19V	
MES49B	Drumsette Component Schedule	XF19V	(Free)
MES51	Basic Organ Leaflet	XH00A	
MES51B	Basic Organ Component Schedule	XH01B	(Free)
MES52	Two-Keyboard Organ Leaflet	XH02C	
MES52B	Two-Kbd Organ Component Schedule	XH03D	(Free)
MES53	Full Scale Organ Stage 1 Leaflet	XH04E	
MES53B	Stage 1 Organ Component Schedule	XH05F	(Free)
MES54	32-Note Pedalboard	XH31J	
MES54B	Pedalboard Component Schedule	XH32K	(Free)
MES55	Auto-Organ Leaflet	XH33L	
MES55B	Auto-Organ Component Schedule	XH34M	(Free)
MES56	Full Scale Organ Stage 2 Leaflet	XH35Q	
MES56B	Stage 2 Organ Component Schedule	XH36P	(Free)
MES57	String and Brass Symphoniser Leaflet	XH37S	
MES57B	Symphoniser Component Schedule	XH38R	(Free)
MES71	ASCII Keyboard and VDU Leaflet	XH26D	
MES71B	TV Display Component Schedule	XF26D	(Free)
MES92	Michron Mk II Leaflet	XF31J	(Free)
MES93B	Monitor Timer Component Schedule	XF32K	(Free)
MES98	Current Newsletter	XF08J	(Free)
MES99	Current Catalogue	XF07H	

MICROPHONES

A superb range of microphones and accessories with everything at really low prices. In particular our range of electret microphones is almost unbeatable at the price. For small projects we stock a crystal insert microphone and for the professional vocalist or musician the superb Unisound dynamic microphone. In addition we've got microphone stands, mixers and input matching transformers.

RECORD-PLAYER & TAPE ACCESSORIES

An excellent selection of hi-fi care kits for record-players and cassette and reel-to-reel tape-recorders. The range covers cleaning cloths, anti-static devices, stylus balance, tape splicers, spare cassette boxes, demagnetisers for tape heads and lots, lots more as well as a very attractive range of cassette storage cabinets.



CAR ACCESSORIES

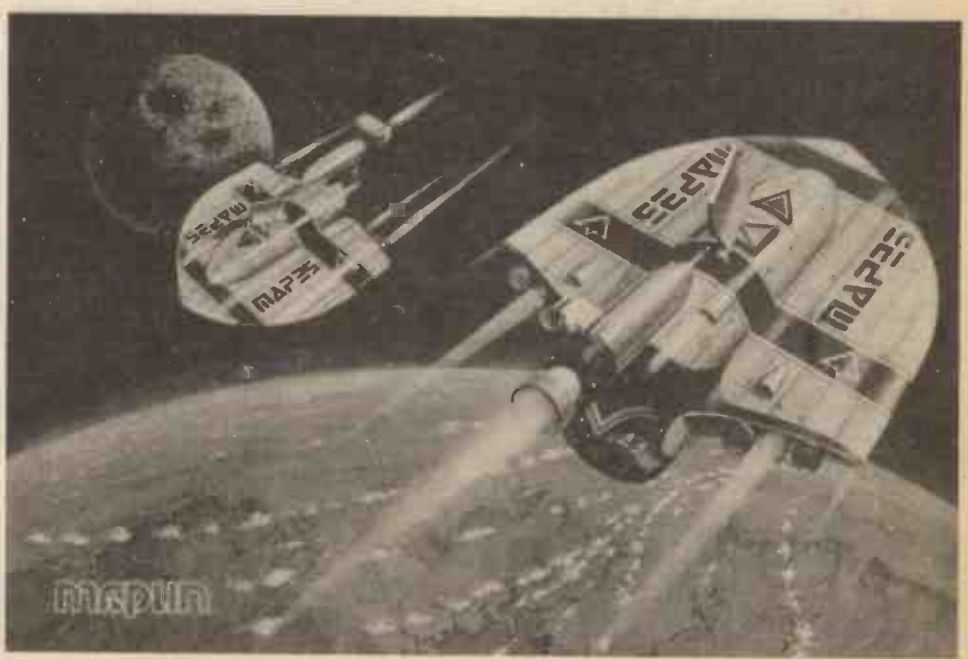
We've greatly extended our range of parts for the car owner in this catalogue. Lots of the new lines are shown in the picture above. Our telescopic car radio aerial is one of the longest of its type that we've ever come across and at our price its a bargain. Inside the car we've got three types of stereo speakers including a superb sounding 20W per channel pair.

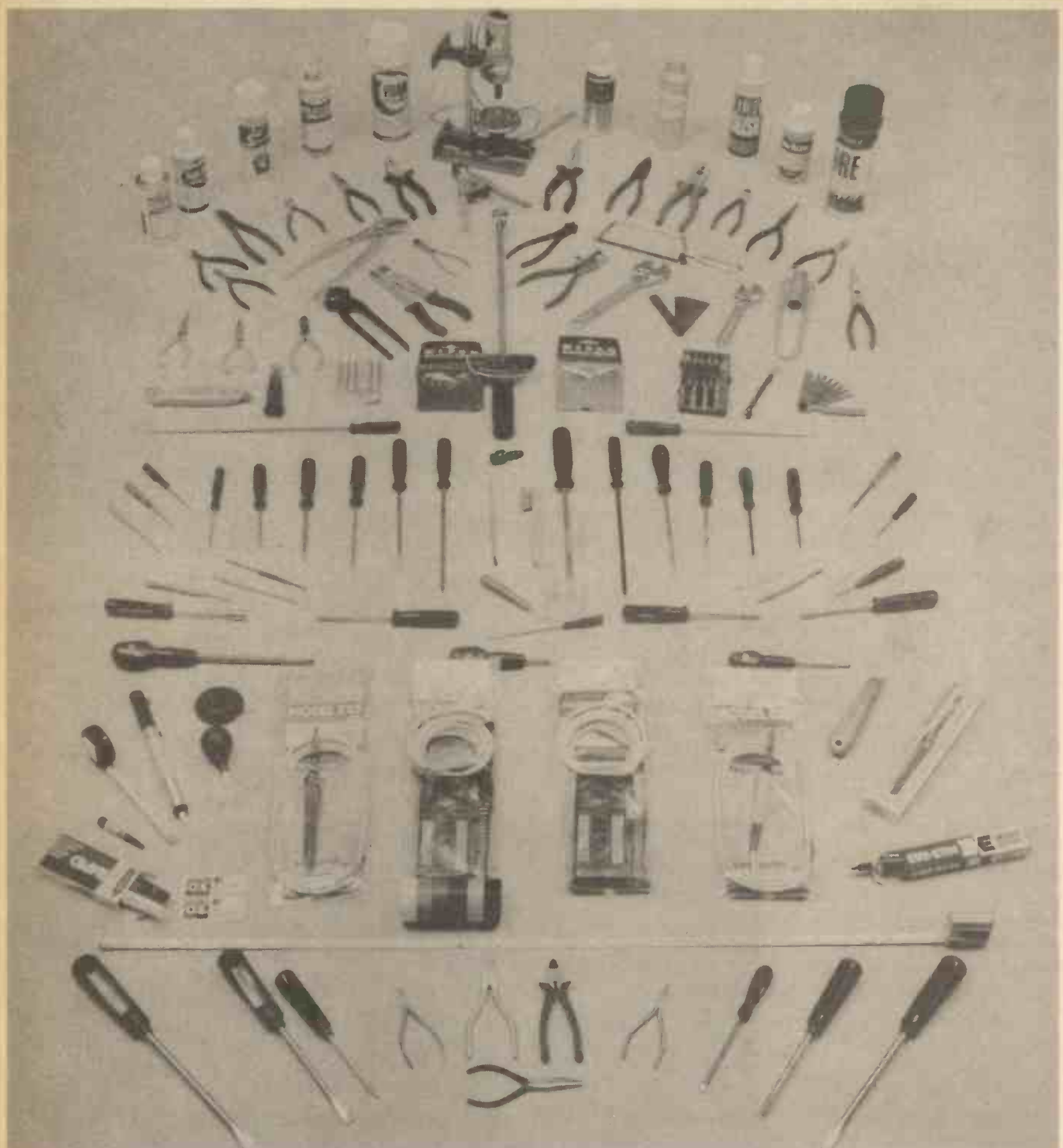
There are lots of spare parts for the electrical side of the car and we even stock a few non-electrical parts that we couldn't resist because the price we can offer them to you is so low. They include foot pumps, tow-rope, luggage elastic, even an ice scraper, and a really useful "Keep Clean Kit" that includes gauntlets, a long apron and a pre-moisturised towelette sachet, all for just a few pence, but worth its weight in gold if your car breaks down when you've got your best suit on.

MAPLIN POSTER

This beautiful colour picture, an original water-colour painting by famous artist Rod Brown was specially commissioned by Maplin Electronic Supplies. Full size reproductions of the painting are available. They measure a massive 36in x 25in., the size of the original. They have been carefully printed in full colour onto glossy art paper and are available to you for just £1 including postage and packing (or 75p in our shop). A stunning picture to hang in your office or at home. Your children will love it. Order your copy now.

Order As XF12N (Maplin Poster)





TOOLS AND SERVICE-AIDS

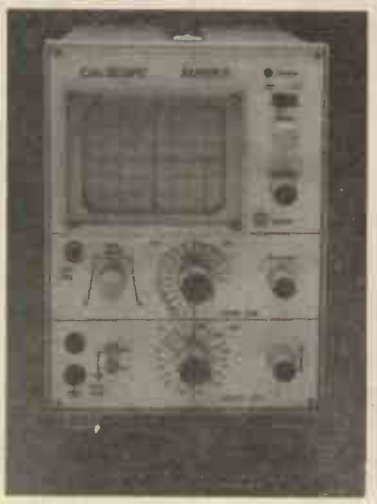
We stock a superb range of tools offering you a tremendous choice from low-cost to precision. There's a big selection of screwdrivers, wiring pliers, cutters, wire-strippers, spanners and small wrenches.

There are some beautiful little precision miniature screwdriver and spanner sets as well as miniature drills and needle files. In the heavy duty department we've got a big torque wrench at a really low price.

Our miniature electric drills are tremendous value for money and the ideal thing for making pcb's or model making. Our range of soldering irons covers almost every application and we stock exclusively the superb 'Antex' range, because we've used all types and we think 'Antex' are quite simply the best.

In addition we have a good range of service aids including spray cleaners, silicone grease etc., adhesives, conductive paint, and two types of solder to cover most requirements.

For full details turn to the tool section towards the end of our catalogue.



TEST EQUIPMENT

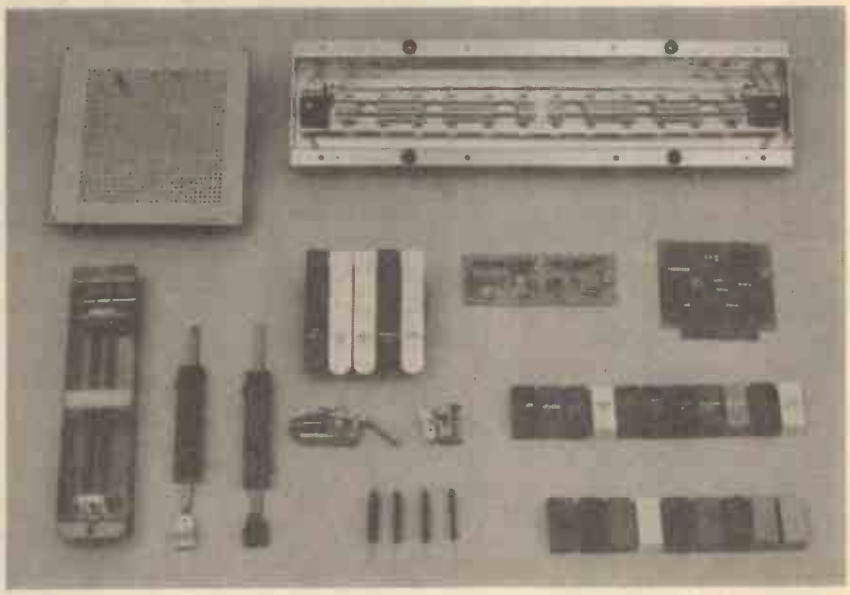
Our range of multimeters goes from our neat little Pocket Multimeter which must be just about the lowest priced multimeter you'll find anywhere, to our superb digital multimeter module that for the quality breaks new price barriers. On the way there are the three precision ICE meters with some 80 ranges on the biggest one and with accuracies as high as 1%!

In addition to multimeters we've got a very high quality frequency counter whose top-class specification is hard to believe at the price, an LCR bridge, audio oscillator, logic probe, transistor tester and two oscilloscopes designed especially for home constructors, small laboratories and service engineers. See catalogue pages 183 to 188.

Also especially for the amateur radio enthusiast we stock a grid-dip meter, SWR meter, transmitted power meter and relative field strength meter all described on page 106 of catalogue.

ELECTRONIC MUSIC COMPONENTS

Maplin are renowned for their range of components for electronic organs, synthesisers and other musical equipment. In this catalogue the range is extended even further to encompass some beautiful new marbled-effect stop tabs in several lovely colours, a new stop tab switch and a massive 32-note pedalboard in addition to all the components we've stocked before.



Like keyboards at unbeatable prices – our Moulded keyboard, for instance, is about half the price of the only other equivalent keyboard being sold by other retailers in this country, whilst our top quality keyboards are still cheaper than our competitors' Moulded keyboards. The same goes for our pedalboard, excellent quality, but at a price which is unbelievable.

Our master oscillator board the DM02T has been available for over four years now yet is still a very low cost solution to tone generation for organs, and with thousands sold you'll know you won't be wrong to join the bandwaggon. Another massive seller has been our reverberation module and the spring lines that go with it.

In addition we stock engraved and unengraved stop tabs, drawbars, contact blocks, rotating baffles for use in "Lesley" type speaker units, swell pedals, piano pedals, effects lever and even gold wire and palladium earth bar for making your own contacts. Like the rest of our catalogue the organ component section is a fascinating treasure-trove of unusual and everyday components.

HOW TO ORDER

Please use our order code to help us deal with your order quickly and efficiently. Each item has its own code number — two letters, two numbers and a letter e.g. BB23A. To order resistors use just the code letter followed by the value you require.

Payment may be made by cheque or Postal Order. These should be made payable to "Maplin Electronic Supplies Ltd." In your own interest cross all cheques or postal orders sent in the post with two straight lines across the centre. Do not send cash unless the envelope is registered at the Post Office.

DISCOUNTS

Collect our Discount Vouchers and Save Money

Every time you spend over £2* you will receive some Maplin Discount Vouchers with your order. We will give you one voucher for each full pound spent if you spend between £2 and £5.99½ in one order. If you spend £6 or more in one order, we will give you two vouchers for each full pound spent.

When you have collected 25 voucher units send them to us with an order and we will give you £1 of goods FREE.

Vouchers are not allowed against credit notes, only against the cash (P.O. or cheque) sent with the order.

The orange voucher is worth 1 unit.
The green voucher is worth 5 units.
The blue voucher is worth 25 units.

You may use any combination of vouchers to make up groups of 25 units. The vouchers do not have a pro rata exchange rate, they are only redeemable in groups of 25. The vouchers are for exchange for goods only. They do not have a cash value.

DESPATCH

We despatch all orders having a total weight of less than 750 grammes by first class letter post (except leaflets and catalogues which are despatched second class). Orders having a total weight over 750 grammes are despatched by parcel post, except as follows. Calscopes are despatched by Securicor. Items marked "Delivery by Carrier" are despatched by Roadline and the following items are also despatched by Roadline: XB77J (Disco Cabinet); XB97L (4600 Cabinet); XQ02C (5600S Cabinet); XQ04E (3800 Cabinet); XQ06G (Piano Cabinet Black); XY11M (Piano Cabinet Teak). If your order includes an item which we despatch by Roadline, we may include all or part of the rest of the order in that shipment. However, you may mark your order in large writing "Despatch all items other than carrier items by post", and we will follow your instructions.

SAME DAY SERVICE

The post arrives in our offices at 9 a.m. Here the letters are sorted for the different departments, all orders are recorded and allocated an order number in sequence. This is the number that will appear on your packing slip (and credit note where applicable).

The day's orders then start to come through to the warehouse.

Your order is collected from small bins which are constantly replenished from the main stock.

When the order is collected it is passed to the invoicing clerks who price the order and check that the money you have sent in is correct.

Finally the order passes to the packing department where it is made up into a postal packet or parcel. By 9.30 a.m. the first orders will be in the outgoing mail-sacks.

PRICE LIST

All prices shown in this list are valid from January 22nd 1979 to March 9th 1979.

Prices shown in this list are VAT inclusive prices. The second column in the ruled box shows the amount of VAT actually being charged. Overseas customers should deduct this amount from the inclusive price to arrive at the cost to them. Inland customers using our order forms should use VAT inclusive prices only.

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 20p handling charge which must be paid on all orders having a total value of under £2.00

The price list is intended for use with our 1979/80 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. Our valuable discount voucher scheme continues both on mail orders and in our shop.

Copies of manufacturers' data sheets are available for most IC's price 25p each.

Notes:
† While stocks last
NYA Not yet available

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

1979/80 Catalogue Page No.		VAT inclusive PRICE	
Page 10			
BR45Y	AS 341s	31p	2½p
BR88V	Mic/Space Adptr Kit	£2.94	22p
BB00A	Divider Board 'A'	£2.33	26p
BB01B	Divider Board 'B'	£2.10	23½p
BB02C	Tone Board 'A'	£2.19	24½p
BB03D	Tone Board 'B'	£1.80	20p
BB07H	Control Board 'A'	£3.15	35p
BB08J	Control Board 'B'	£1.40	15½p
BB09K	Sawtooth Board 'A'	£2.54	28p
BB10L	Sawtooth Board 'B'	£3.19	35½p
BB77J	Divider MO & Freq Gen	NYA	—
BB78K	Pedal PCB 'B'	NYA	—
BB79L	32-Note Pedal Voice	NYA	—
BB80B	Pedal Diode PCB	NYA	—
HQ72P	Auto Organ Gen/Clock PCB	£1.45	16p
HQ73Q	Auto-Organ Chord Coder PCB	£2.02½	22½p
HQ74R	Auto Organ Auto Stop PCB	£2.92½	32½p
HQ75S	Auto Organ Pre-Amp PSU PCB	£3.31	37p
BB11M	Gate Board	37p	4p
BB04E	Tone Board 'C'	£2.99	33p
BB05F	Tone Board 'D'	£2.98	33p
BB06G	Tone Board 'E'	£2.90	32p
BB12N	Pedal PCB 'A'	£1.99	22p
BB15R	Mother Board 'A'	£7.98	88½p
BB13P	A/B Switch Board	93p	10½p
BB14Q	MES Amp Bd 'A'	36p	4p
XH00A	MES51	15p	—
XH02C	MES52	15p	—
XH04E	MES53	35p	—
XH31J	MES54	30p	—
XH33L	MES55	30p	—
Page 13			
XF00A	4600 Synthesiser Book	£1.50	—
BB39N	Synth Keyboard Controller PCB	£4.26	31½p
BB42V	Synth Noise Controller PCB	£1.60	12p
BB46A	Synth VCF PCB	£1.41	10½p
BB57M	Synth Noise Controller Bkt	63p	4½p
BB61R	Synth VCF Mtg Mkt	54p	4p

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BB62S	Synth Output Stage Bkt	£1.03	7½p
Page 14			
HY14Q	String Ensemble 1 PCB	£2.90	32p
HY15R	String Ensemble 2 PCB	£2.54	28p
HY22Y	String Ensemble 3 PCB	£2.05	23p
HY23A	String Ensemble 4 PCB	£2.56	28½p
XH17T	Leaflet MES 14	Free	—
XB78K	4600 Front Panel	£9.80	72½p
	Carriage in UK only	£2.50	19p
XB08J	Synth Rear Panel	£1.30	9½p
XF10L	ETI Top Project No. 5	£1.25	—
BB76H	Touch Organ PCB	£4.95	55p
XB79L	4600 Cabinet	£48.44	£3.59
	Carriage in UK only	£5.00	37p
Page 15			
XH18U	Leaflet MES 22	25p	—
BY78K	Piano PSU/Voice PCB	£1.95	14½p
BY79L	Piano Top Octave PCB	£3.71	27½p
BY80B	Piano Two-Octave PCB	£4.55	33½p
XQ06G	Piano Cabinet Black	£39.90	£4.43
XY11M	Piano Cabinet Teak	NYA	—
Page 18			
XH21X	Leaflet MES37	25p	—
XX03D	10-Channel G.E. PCB	£1.67	19p
XB74R	10-Channel Equaliser Metalwork	£8.99	£1.00
XB75S	10-Channel Equaliser Woodwork	£4.90	54½p
XH07H	Leaflet MES32	20p	—
BB55K	Dyn Noise Fltr PCB	£1.49	16p
XB05F	Dyn Noise Fltr Metalwork	£8.44	94p
Page 19			
XH22Y	Leaflet MES38	40p	—
LW00A	Mixer Metalwork Kit No. 1	£19.50	£1.44

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LW06G	Mixer Mtlwk Kit No. 2	£6.48	48p
LW10L	Mixer Metalwork Kit No. 3	£8.74	64½p
LR18U	Mic Mod Front Panel	£1.26	9p
LR11M	Mono GP Front Panel	£1.26	9p
LR12N	Stereo GP Front Panel	£1.26	9p
LR17T	Cart/Hi-Z Front Panel	£1.26	9p
LR39N	Mixer Bus Mtg Plate	48p	3½p
LR32K	Mixer Bus Securer	33p	2½p
LR43W	Mixer Module Chassis	£2.98	22p
LR38R	Mixer Amp Mtg Plate	44p	3½p
LR19V	Main Mix Front Panel	£1.36	10p
LR29G	Mix Pot Bkt	33p	2½p
LR10L	Group Mix Front Panel	94p	7p
LR37S	Mixer I/P Mtg Plate	58p	4½p
LR31J	Pan Bd Bkt	33p	2½p
LR30H	Mixer Mic Tr Bkt	27p	2p
LR09K	Mixer Blank Panel	94p	7p
LR20W	Mixer Blank Underpan	45p	3½p
LR40T	Mixer Module Tab	20p	1½p
LR08J	I/P Jack Identification Tab	20p	1½p
LR13P	HQ Mixer PCB No. 2	£1.83	13p
LR14Q	HQ Mixer PCB No. 3	83p	6p
LR15R	HQ Mixer PCB No. 4	83p	6p
LR34M	HQ Mixer PCB No. 24	£1.30	9½p
LR16S	HQ Mixer PCB No. 5	72p	5p
LR35Q	HQ Mixer PCB No. 25	£1.19	9p
LR21X	HQ Mixer PCB No. 6	83p	6p
LR28F	HQ Mixer PCB No. 18	43p	3p
LR33L	HQ Mixer PCB No. 23	85p	6½p
LR36P	HQ Mixer PCB No. 26	£3.12	23p
LR41U	HQ Mixer PCB No. 27	£2.90	21½p
LR22Y	HQ Mixer PCB No. 7	£1.40	10p
LR23A	HQ Mixer PCB No. 8	£1.12	8p
LR24B	HQ Mixer PCB No. 9	£1.19	9p
LR42V	HQ Mixer PCB No. 29	£1.69	12½p
LR25C	HQ Mixer PCB No. 10	£1.40	10p
LR26D	HQ Mixer PCB No. 14	£1.36	10p
LR27E	HQ Mixer PCB No. 15	£1.38	10p
Page 20			
XH23A	Leaflet MES42	25p	—
XB37S	Sound To Light Case	£6.76	50p
Page 22			
BB72P	Sine/Square Gen PCB	£2.13	16p
BB73Q	Audio Osc Front Panel	£1.63	12p

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XH24B	Leaflet MES 15	15p	—
XH25C	Leaflet MES 17	15p	—
BB74R	Car PSU PCB	99p	7½p
Page 23			
XH26D	Leaflet MES 71	30p	—
BB82D	Keyboard PCB	£4.85	36p
BB83E	VDU Mother Board	£3.39	25p
BB84F	UART PCB	£1.23	9p
BB85G	Control PROM PCB	59p	4½p
BB86T	Clear Logic PCB	73p	5½p
BB87U	RAM Board	85p	6½p
BB88V	VDU Control Board	95p	7p
BB89W	Latch PCB	65p	5p
BB90X	Character Gen PCB	75p	5½p
BB91Y	Graphics Gen PCB	NYA	—
BB92A	Output Timing PCB	85p	6½p
BB93B	Address Switching PCB	NYA	—
BB94C	VDU Interface PCB	NYA	—
BB95D	Cassette/Modem PCB	NYA	—
BB96E	3-Page Extn Mem PCB	£1.99	14½p
BB97F	4-Page Control PCB	65p	5p
BB98G	VDU PSU PCB	£2.15	16p
BB99H	VDU Mixer PCB	59p	4½p
XY12N	VDU Front Panel	£3.20	23½p
Page 24			
XH27E	Leaflet MES 16	15p	—
BB75S	Car Ignition PCB	£1.05	8p
XF04E	Leaflet MES 41	25p	—
BB81C	Disco Pre-Amp & Tone PCB	£1.70	12½p
BB19V	Disco PSU PCB	£1.10	8p
BB20W	100W Amp Board	£1.35	10p
BB26D	Motor Switch PCB	69p	5p
BB27E	Light Mod Bd	£2.76	20½p
BB22Y	FET-Ceramic PU Bd	86p	6½p
BB24B	Disco Fader Bd	£1.26	9½p
BB25C	VUM & HP Amp Bd	£2.15	16p
BB18U	Heatsink DR2	56p	4p
XB76H	Disco Front Panel	£10.80	80p
XB77J	Disco Cabinet	£32.70	£2.42
	Carriage In UK only	£5.00	37p
XX00A	IB Metal Det PCB	£1.19	9p
XH20W	Leaflet MES 25	15p	—
BB16S	Orgn/Gtar Bass PCB	£4.95	36½p

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XF11M	5600S Ster Synth Bk	£2.00	—
BB41U	Synth Mixer PCB	£3.30	24p
BB44X	Synth VCA PCB	£1.28	9½p
BY87U	Synth Preset Mtg Bd	50p	3½p
BY88V	Synth 1979 Keyboard Controller	£4.70	35p
BY89W	Synth Binary Encoder	£5.20	33½p
BB40T	Synth Power Supply Mk. II PCB	£3.58	26½p
BY90X	Synth Sample & Noise PCB	£1.92	14p
BB43W	Synth Trns Gen 1 PCB	£1.91	14p
BB45Y	Synth Trns Gen 2 PCB	£2.31	17p
BY81C	Synth Trns Rept PCB	73p	5½p
BY82D	Synth Reverb and Phase PCB	£4.30	32p
BY83E	Synth VC Pan and Anc PCB	£4.25	31½p
BB38R	Synth Oscillator PCB	£2.49	18½p
BB48C	Synth Ext I/P's PCB	£1.38	10p
BB65V	3600 VCF PCB	£1.80	13½p
BB64U	4600 Hinge	49p	3½p
BB63T	Synth Ext I/P's Bkt	60p	4½p
BB67X	3600 VCF Mtg Bkt	69½p	5p
BB49D	Synth Oscillr Mtg Bkt	63p	4½p
BB50E	Synth Keybd Cntlr Bkt	69p	5p
BB51F	Synth Pwr Sply Hitsnk	73p	5½p
BB56L	Synth Mixer Mtg Bkt	15p	1p
BB58N	Synth Trns 1/Env Bkt	54p	4p
BB59P	Synth Trans 2 Mtg Bkt	60p	4½p
BB52G	Synth Mixer Chassis	£1.64	12p
BB60Q	Synth VCA Mtg Bkt	48p	3½p
XQ01B	5600S Front Panel Carnage in UK	£12.00 £5.00	89p 37p
BY84F	5600 Rear Panel	£2.60	19½p
XQ02C	5600S Cabinet Carriage In UK	£45.00 £5.00	£3.33½p 37p
Page 34			
XH19V	Leaflet MES 49	30p	—
XL13P	Drumsette Kit	£64.95	£6.11
XX16S	Drumsette 1 PCB	£4.95	55p
XX17T	Drumsette 2 PCB	£4.98	55p
LY01B	Drumsette Front Panel	£4.30	48p
LY02C	Drumsette Rear Panel	£1.50	11p
HY02C	Drumsette Bkt Set	£2.49	18½p
XB98G	Drumsette Cabinet	£4.90	54½p
Page 35			
XF00A	4600 Synth Book	£1.50	—
XH15R	MES 11B	Free	
XH09K	MES 11S	Free	
XF11M	MES 12	£2.00	—
XF13P	MES 12B	Free	—
XH17T	MES 14	Free	
XH24B	MES 15	15p	—
XF14Q	MES 15B	Free	
XH27E	MES 16	15p	—
XF15R	MES 16B	Free	
XH25C	MES 17	15p	—
XF16S	MES 17B	Free	
XF17T	MES 18	NYA	
XH11M	MES D19	Free	
XH18U	MES 22	25p	—
XF18U	MES 22B	Free	
XH06G	MES 24	Free	
XH20W	MES 25	15p	—
XF20W	MES 25B	Free	
XF03D	MES 26	£1.20	—
XF24B	MES 26B	NYA	
XH13P	MES 27	Free	
XH07H	MES 32	20p	—
XH28F	MES 32B	NYA	
XF21X	MES33B	Free	—
XF22Y	MES34B	Free	—
XF25C	MES 35B	Free	—
XF27E	MES 36B	Free	—
XH21X	MES 37	25p	—
XF06G	MES37B	Free	
XH22Y	MES 38	40p	—
XH08J	MES 38B	Free	
XF04E	MES 41	25p	—
XF05F	MES 41B	Free	
XH23A	MES 42	25p	—
XF23A	MES 42B	Free	
XF28F	MES 46B	Free	
XF29G	MES 47B	Free	
XH29G	MES48B	Free	
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XH19V	MES 49	30p	—
XF19V	MES 49B	Free	
XH00A	MES 51	15p	—
XH01B	MES 51B	Free	
XH02C	MES 52	15p	—
XH03D	MES 52B	Free	
XH04E	MES 53	35p	—
XH05F	MES 53B	Free	
XH31J	MES 54	NYA	
XH32K	MES 54B	Free	
XH33L	MES 55	30p	—
XH34M	MES 55B	Free	
XH35Q	MES 56	NYA	
XH36P	MES 56B	NYA	
XH37S	MES 57	NYA	
XH38R	MES 57B	NYA	
XH26D	MES 71	30p	—
XF26D	MES 71B	Free	—
XF31J	MES 92	Free	
XF32K	MES93B	Free	
XF08J	MES 98	Free	
XF07H	MES 99	75p	—
BY86T	3800 Interface PCB	NYA	
BB47B	Synth Clpt Stge PCB	£2.80	20½p
XQ03D	3800 Front Panel Carnage in UK	£9.73 £5.00	£1.08 37p
BY85G	3800 Rear Panel	£1.90	21p
XQ04E	3800 Cabinet Carriage in UK	£39.50 £5.00	£4.39 37p
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XF12N	Maplin Poster	£1.00	—
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BL77J	Wire-Wrap Black	£1.04	7½p
BL78K	Wire-Wrap Blue	£1.04	7½p
BL79L	Wire-Wrap Green	£1.04	7½p
BL80B	Wire-Wrap Natural	£1.04	7½p
BL81C	Wire-Wrap Orange	£1.04	7½p
BL82D	Wire-Wrap Red	£1.04	7½p
BL83E	Wire-Wrap White	£1.04	7½p
BL84F	Wire-Wrap Yellow	£1.04	7½p
BL85G	Bell Wire Black	23p	1½p
BL86T	Bell Wire Blue	23p	1½p
BL87U	Bell Wire Brown	23p	1½p
BL88V	Bell Wire Green	23p	1½p
BL89W	Bell Wire Grey	23p	1½p
BL90X	Bell Wire Orange	23p	1½p
BL91Y	Bell Wire Pink	23p	1½p
BL92A	Bell Wire Red	23p	1½p

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BL93B	Bell Wire Violet	23p	1½p
BL94C	Bell Wire White	23p	1½p
BL95D	Bell Wire Yellow	23p	1½p
BL46A	L/C Wire Black	59p	4½p
BL47B	L/C Wire Blue	59p	4½p
BL48C	L/C Wire Brown	59p	4½p
BL49D	L/C Wire Green	59p	4½p
BL50E	L/C Wire Grey	59p	4½p
BL51F	L/C Wire Orange	59p	4½p
BL52G	L/C Wire Pink	59p	4½p
BL53H	L/C Wire Red	59p	4½p
BL54J	L/C Wire Violet	59p	4½p
BL55K	L/C Wire White	59p	4½p
BL56L	L/C Wire Yellow	59p	4½p
BL00A	Wire 10M Black	25p	2p
BL01B	Wire 10M Blue	25p	2p
BL02C	Wire 10M Brown	25p	2p
BL03D	Wire 10M Green	25p	2p
BL04E	Wire 10M Grey	25p	2p
BL05F	Wire 10M Orange	25p	2p
BL06G	Wire 10M Pink	25p	2p
BL07H	Wire 10M Red	25p	2p
BL08J	Wire 10M Violet	25p	2p
BL09K	Wire 10M White	25p	2p
BL10L	Wire 10M Yellow	25p	2p
XL10L	Wire 11C	£2.75	20½p
XR32K	Wire 3202 Black	8p	½p
XR33L	Wire 3202 Blue	8p	½p
XR34M	Wire 3202 Brown	8p	½p
XR35Q	Wire 3202 Green	8p	½p
XR36P	Wire 3202 Red	8p	½p
XR37S	Wire 3202 White	8p	½p
XR38R	Wire 3202 Gm/Yllw	9p	½p
XR40T	Extra Flex Black	9½p	½p
XR41U	Extra Flex Blue	9½p	½p
XR43W	Extra Flex Green	9½p	½p
XR44X	Extra Flex Red	9½p	½p
XR45Y	Extra Flex Yellow	9½p	½p
Page 42			
XR22Y	EHT Wire	13p	1p
BL11M	Strappg Wire 16 swg	60p	4½p
BL12N	Strappg Wire 18 swg	64½p	5p
BL13P	Strappg Wire 20 swg	69p	5p
BL14Q	Strappg Wire 22 swg	73p	5½p
BL15R	Strappg Wire 24 swg	78p	6p
BL16S	EC Wire 14 swg	29p	2p
BL24B	EC Wire 16 swg.	64p	4½p
BL25C	EC Wire 18 swg.	58p	4½p
BL26D	EC Wire 20 swg.	60p	4½p
BL27E	EC Wire 22 swg	64p	4½p
BL28F	EC Wire 24 swg.	66p	5p
BL29G	EC Wire 26 swg.	70p	5p
BL39N	EC Wire 28 swg	74p	5½p
BL40T	EC Wire 30 swg.	77p	5½p
BL41U	EC Wire 32 swg.	79p	6p
BL42V	EC Wire 34 swg	83p	6p
BL43W	EC Wire 36 swg.	90p	6½p
BL44X	EC Wire 38 swg.	97p	7p
BL60Q	EC Wire 40 swg	£1.01	7½p
BL61R	EC Wire 42 swg.	63p	4½p
BL62S	EC Wire 44 swg.	78p	6p
BL63T	EC Wire 48 swg.	£2.12	15½p
XR47B	Twin Mains DS Black	13p	1p
XR00A	Twin Mains DS White	13p	1p
XR39N	Zip Wire	6p	½p
XR06G	Ribbon Cable 10-Way	36p	2½p
XR07H	Ribbon Cable 20-Way	72p	5½p
XR01B	Min Mains Black	14½p	1p
XR02C	Min Mains White	14½p	1p
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XR03D	6A Mains Black	26p	2p
XR04E	6A Mains White	26p	2p
XR05F	6A Mains Orange	26p	2p
XR09K	HD Mains Black	35p	2½p
XR10L	HD Mains White	35p	2½p
XR11M	HD Mains Orange	35p	2½p
XR24B	Cotton Mains	55½p	4p
BL71N	Stretchflex 1A	81p	6p
BL72P	Stretchflex 6A	£3.80	28p
XR48C	4-Core Mains	54p	4p
XR49D	1.0mm² TE Cable	13p	1p
Page 44			
XR50E	1.5mm² TE Cable	15p	1p
XR51F	2.5mm² TE Cable	25p	2p
XR52G	6mm² TE Cable	60p	6p
XR53H	1mm² Trpl & ECC Cbl	20p	1½p
XY08J	Extn Lead 5A	£8.10	60p
XY09K	Extn Lead 13A	£10.37	77p
XR15R	Min Screened	10½p	1p
XR12N	Cable Single Black	10p	½p
XR13P	Cable Single Grey	10p	½p
XR14Q	Cable Single White	10p	½p
Page 45			
XR16S	Single Mic Cable	19p	1½p
XR18U	Low Noise Scnd	22p	1½p
XR19V	Low C Cable	26½p	2p
XR20W	Lapped Pair	12p	1p
XR08J	Twin Mic Cable	33p	2½p
XR21X	Cable Twin	15p	1p
Page 46			
XR23A	Cable Quad	17p	1½p
XR25C	Multi-Core 4-Way	31p	2½p
XR26D	Multi-Core 6-Way	34p	2½p
XR27E	Multi-Core 9-Way	48p	3½p
XR28F	Multi-Core 15-Way	58p	4½p
XR46A	Multi-Core 25-Way	93p	7p
XR54J	Multi-Core 36-Way	£1.49	11p
BH30H	Scr Stretchflex Black	£1.25	9½p
BH31J	Scr Stretchflex Blue	£1.25	9½p
BH33L	Scr Stchflx Psychedlc	£1.29	9½p
BH34M	Scr Stretchflex Red	£1.25	9½p
HQ49D	Twin Stretchflex	£1.95	14½p
XR30H	Standard Co-Ax	14½p	1p
XR29G	Low Loss Co-Ax	22p	1½p
XR31J	Bal Feeder	8p	½p
Page 47			
6F86T	Heat Shrink CP16	24p	2p
6F87U	Heat Shrink CP24	26p	2p
6F88V	Heat Shrink CP32	28p	2p
6F89W	Heat Shrink CP48	30p	2p
6F90X	Heat Shrink CP64	32p	2½p
BL66W	Ht-Resist Sleeve Blk	9p	½p
BL67X	Ht-Resist Sleeve Blue	9p	½p
BL68Y	Ht-Resist Sleeve Brwn	9p	½p
BL69A	Ht-Resist Sleeve Grn	9p	½p
BL70M	Ht-Resist Sleeve Red	9p	½p
BH00A	Systoflex 1mm Black	3½p	½p
BH01B	Systoflex 1mm Blue	3½p	½p
BH02C	Systoflex 1mm Green	3½p	½p
BH03D	Systoflex 1mm Red	3½p	½p
BH04E	Systoflex 1mm White	3½p	½p
BH05F	Systoflex 1mm Yellow	3½p	½p

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BH06G	Systoflex 2mm Black	4p	½p
BH07H	Systoflex 2mm Blue	4p	½p
BH08J	Systoflex 2mm Green	4p	½p
BH09K	Systoflex 2mm Red	4p	½p
BH10L	Systoflex 2mm White	4p	½p
BH11M	Systoflex 2mm Yellow	4p	½p
BH12N	Systoflex 4mm Black	6½p	½p
BH13P	Systoflex 4mm Blue	6½p	½p
BH14Q	Systoflex 4mm Green	6½p	½p
BH15R	Systoflex 4mm Red	6½p	½p
BH16S	Systoflex 4mm White	6½p	½p
BH17T	Systoflex 4mm Yellow	6½p	½p
BH42V	Systoflex 6mm Black	7p	½p
BH43W	Systoflex 10mm Black	10p	½p
BL65V	Lacing Cord	50p	3½p
BL57M	Spirawrap ¼in.	8p	½p
BL58N	Spirawrap ⅜in.	10p	½p
BL59P	Spirawrap ½in.	18p	1½p
BF91Y	Tie-Wrap 92	2p	—
BF92A	Tie-Wrap 140	3p	—
BF93B	Tie-Wrap 186	3½p	½p
BF94C	Cable Tie Base	11p	1p
LR44X	Cable P Clip 3/16in.	2p	—
LR45Y	Cable P Clip ¼in.	2p	—
LR46A	Cable P Clip 5/16in.	2p	—
LR04E	Cable Clip ⅜in.	2p	—
BH44X	Plas Fixing	6p	½p
Page 48			
BH18U	Hiatt Rd 2¾mm	13p	1p
BH19V	Hiatt Rd 3½mm	13p	1p
BH20W	Hiatt Rd 4mm	13p	1p
BH21X	Hiatt Rd 5mm	13½p	1p
BH22Y	Hiatt Rd 6mm	14p	1p
BH23A	Hiatt Rd 7mm	15p	1p
BH24B	Hiatt Rd 8mm	16p	1p
BH36P	Hiatt Rd 9mm	20p	1½p
BH25C	Hiatt Flat 4mm	14p	1p
BH37S	Hiatt Flat 5mm	16p	1p
BH38R	Hiatt Flat 7mm	18p	1½p
BH39N	Hiatt Flat 9mm	20p	1½p
BH40T	Hiatt Flatt 10mm	20p	1½p
BH41U	Hiatt Flat 14mm	25p	2p
BH29G	Flex Tidy D2	60p	4½p
BH26D	Safix 4	4½p	½p
BH27E	Safix 8	5½p	½p
BH28F	Safix 12	6p	½p
FW59P	Grommet Small	11p	1p
FW60Q	Grommet Large	11p	1p
BL74R	Flexgrommet A	18p	1½p
BL75S	Flexigrommet B	20p	1½p
BL76H	Flexigrommet C	21p	1½p
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LR47B	SR Grommet 3P—4	6p	½p
LR48C	SR Grommet 5M-3	6½p	½p
LR49D	SR Grommet 6W—1	6½p	½p
LR50E	SR Grommet 7K—2	18p	1½p
LR51F	Sealing Grommet	1½p	—
BF00A	Bolt 2BA ½in.	30p	2p
BF01B	Bolt 2BA 1in.	46p	3½p
BF02C	Bolt 4BA ¼in.	13p	1p
BF03D	Bolt 4BA ½in.	18p	1½p
BF04E	Bolt 4BA 1in.	22p	1½p
LR52G	Bolt 4BA 1¼in.	25p	2p
BF05F	Bolt 6BA ¼in	8½p	½p
BF06G	Bolt 6BA ½in.	11p	1p
BF07H	Bolt 6BA 1in.	22p	1½p
LR53H	Bolt 6BA 1½in.	36p	2½p
BF08J	Bolt 8BA ¼in.	11p	1p
BF09K	Bolt 8BA ½in.	24p	2p
LR54J	C/S Screw 2BA ½in.	16p	1p
LR55K	C/S Screw 4BA ¼in.	11p	1p
BF10L	C/S Screw 4BA ½in.	12p	1p
BF11M	C/S Screw 4BA 1in.	14p	1p
LR56L	C/S Screw 6BA ¼in.	11p	1p
BF12N	C/S Screw 6BA ½in.	8p	½p
BF13P	C/S Screw 6BA 1in.	16p	1p
LR00A	C/S Screw 8BA ½in.	14p	1p
BF14Q	Panel Screw	1½p	—
BF16S	Nut 2BA	19p	1½p
BF17T	Nut 4BA	14p	1p
BF18U	Nut 6BA	12p	1p
BF19V	Nut 8BA	9p	½p
BF20W	Washer 2BA	11p	1p
BF21X	Washer 4BA	6p	½p
BF22Y	Washer 6BA	6p	½p
BF23A	Washer 8BA	6p	½p
BF24B	Shake 2BA	10p	½p
BF25C	Shake 4BA	7½p	½p
BF26D	Shake 6BA	7½p	½p
LR01B	Shake 8BA	7p	½p
BF27E	Tag 2BA	7p	½p
BF28F	Tag 4BA	7p	½p
BF29G	Tag 6BA	7p	½p
LR02C	Tag 8BA	5p	½p
BF30H	Pozi Screw M5 6mm	14p	1p
BF31J	Pozi Screw M5 12mm	16p	1p
BF32K	Pozi Screw M5 25mm	20p	1½p
BF33L	Pozi Screw M4 6mm	9p	½p
BF34M	Pozi Screw M4 12mm	10½p	1p
BF35Q	Pozi Screw M4 25mm	14p	1p
BF36P	Pozi Screw M3 6mm	10p	½p
LR57M	Pozi Screw M3 9mm	9p	½p
BF37S	Pozi Screw M3 12mm	10p	½p
BF38R	Pozi Screw M3 25mm	15p	1p
LR58N	Pozi Screw M3 40mm	36p	2½p
BF39N	Pozi Screw M2.5 6mm	8p	½p
BF40T	Pozi Scw M2.5 12mm	9p	½p
BF41U	Pozi Screw M2 6mm	14p	1p
BF46A	Isobolt M5 12mm	30p	2p
BF47B	Isobolt M5 25mm	46p	3½p
BF48C	Isobolt M4 6mm	16p	1p
BF49D	Isobolt M4 12mm	20p	1½p
BF50E	Isobolt M4 25mm	30p	2p
BF51F	Isobolt M3 6mm	12p	1p
BF52G	Isobolt M3 12mm	12p	1p
BF53H	Isobolt M3 25mm	17p	1½p
BF54J	Isobolt M2.5 6mm	11p	1p
BF55K	Isobolt M2.5 12mm	12p	1p
BF56L	Isonut M5	19p	1½p
BF57M	Isonut M4	15p	1p
BF58N	Isonut M3	14p	1p
BF59P	Isonut M2.5	13p	1p
LR59P	Isonut M2	9p	½p
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BF60Q	Isowasher M5	14p	1p
BF61R	Isowasher M4	19p	1½p
BF62S	Isowasher M3	8½p	½p
BF63T	Isowasher M2.5	8p	½p
LR60Q	Isowasher M2	6p	½p
BF42V	Isoshake M5	9p	½p
BF43W	Isoshake M4	8p	½p
BF44X	Isoshake M3	6½p	½p
BF45Y	Isoshake M2.5	8p	½p
LR61R	Isoshake M2	7p	½p
LR62S	Isotag M5	7p	½p
LR63T	Isotag M4	7p	½p

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LR64U	Isotag M3	7p	½p
LR65V	Isotag M2.5	7p	½p
LR66W	Isotag M2	7p	½p
BF68Y	Self-Tpr No.8 x ¾in.	22p	1½p
BF69A	Self-Tpr No.8 x ½in.	18p	1½p
LR67X	Self-Tpr No.6 x ¾in.	11p	1p
BF67X	Self-Tpr No.6 x ½in.	15p	1p
BF65V	Self-Tpr No.4 x ¾in.	11p	1p
BF66W	Self-Tpr No.4 x ½in.	13p	1p
BF64U	Slf-Tpr No.2 x 3/16in.	7p	½p
LR68Y	Self-Tpr No.2 x ¾in.	9p	½p
BF70M	Nyl 2BA ½in.	37p	2½p
BF71N	Nyl 2BA 1in.	64p	4½p
BF72P	Nyl 4BA ½in.	39p	3p
BF73Q	Nyl 4BA 1in.	55p	4p
BF74R	Nyl 4BA 1½in.	47p	3½p
BF75S	Nyl 6BA ½in.	34p	2½p
BF76H	Nyl 6BA 1in.	49p	3½p
BF77J	Nyl 8BA ½in.	43p	3p
BF78K	Nyl Nut 2BA	48p	3½p
BF79L	Nyl Nut 4BA	41p	3p
BF80B	Nyl Nut 6BA	47p	3½p
BF81C	Nyl Nut 8BA	40p	3p
BF82D	Nyl Washer 2BA	23p	1½p
BF83E	Nyl Washer 4BA	14p	1p
BF84F	Nyl Washer 6BA	19p	1½p
BF85G	Nyl Washer 8BA	29p	2p
WH18U	Nylon C/S Screw M3 x 12mm	3p	—
WH19V	Nylon Nut M3	3p	—
BF15R	Spring Clip	2p	—
FW10L	Spade 2BA	15p	1p
FW11M	Spade 4BA	15p	1p
FW12N	Spade 6BA	32p	2½p
FW13P	Studding 2BA	25p	2p
FW14Q	Studding 4BA	19p	1½p
FW15R	Studding 6BA	18p	1½p
FW30H	4BA Spacer ¼in.	16p	1p
FW31J	4BA Spacer ⅜in.	17p	1½p
FW32K	4BA Spacer ½in.	20p	1½p
FW33L	6BA Spacer ¼in.	13p	1p
FW34M	6BA Spacer ⅜in.	15p	1p
FW35Q	6BA Spacer ½in.	16p	1p
LR69A	8BA Spacer ¼in.	14p	1p
LR70M	8BA Spacer ⅜in.	14p	1p
LR71N	Thrded Spcr 4BA	20p	1½p
LR72P	Thrded Spcr 6BA	19p	1½p
FW16S	Standoff Short	3p	—
FW17T	Standoff Medium	3½p	½p
FW18U	Standoff Long	4p	½p
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LR03D	Terry Clip ¼in.	5p	½p
LR73Q	Terry Clip 1¼in.	12p	1p
FW36P	Hole Plug ¼in.	3p	—
FW37S	Hole Plug ⅜in.	3½p	½p
LH12N	Aly Sheet 18 swg	76p	5½p
LH13P	Aly Sheet 16 swg	£2.30	17p
LW21X	Mixer Trim 4	75p	5½p
LW22Y	Mixer Trim 8	89p	6½p
LW23A	Mixer Trim 12	£1.05	8p
LW24B	Mixer Trim 16	£1.25	9½p
LW17T	Mixer Mtg Tube 4	70p	5p
LW18U	Mixer Mtg Tube 8	98p	7½p
LW19V	Mixer Mtg Tube 12	£1.43	10½p
LW20W	Mixer Mtg Tube 16	£1.72	12½p
WH48C	Mains Warning Label	10p	½p
HF27E	Clips PP9	15p	1p
HF28F	PP3 Clip	10p	½p
XH39N	Transfer ¼in. Black	79p	6p
XH40T	Transfer ¼in. Red	79p	6p
XH41U	Transfer ¼in. White	79p	6p
XH42V	Transfer ¼in. Black	79p	6p
XH43W	Transfer ¼in. Red	79p	6p
XH44X	Transfer ¼in. White	79p	6p
XH45Y	Panel Transfer Black	79p	6p
XH46A	Panel Transfer Red	79p	6p
XH47B	Panel Transfer White	79p	6p
LR74R	Ni Cad AA	£1.25	9½p
HF29G	6V Batt Box	17p	1½p
HF94C	Long HP7 Batt Box	19p	1½p
HQ01B	9V Batt Holder	29p	2p
HF95D	HP11 Batt Box	30p	2p
HF96E	Long HP11 Batt Box	30p	2p
HF97F	HP2 Batt Box	30p	2p
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HQ45Y	Tilt Leg Small	99p	7½p
HQ46A	Tilt Leg Medium	£1.15	8½p
HQ47B	Tilt Leg large	£1.32	10p
LH00A	Verobox 101	£2.79	21½p
LH01B	Verobox 102	£3.20	23½p
LL00A	Verobox 103	£4.04	30p
LL01B	Verobox 104	£8.20	61p
LL02C	Verobox 105	£4.99	37p
LL03D	Verobox 106	£1.95	14½p
LL04E	Verobox 107	£2.99	22p
LL05F	Verobox 201	£3.79	28p
LL06G	Verobox 202	£4.25	31½p
LL07H	Verobox 203	£5.39	40p
LL08J	Verobox 211	£2.73	20p
LL09K	Verobox 212	£2.99	22p
LL10L	Verobox 213	£3.59	26½p
LQ07H	Verobox 214	£3.47	25½p
LQ08J	Verobox 215	£3.69	27½p
LQ09K	Verobox 216	£3.95	29½p
LL11M	Verobox 217	£4.51	33½p
LH24B	Verobox 221	£2.52	18½p
LH25C	Verobox 222	£3.18	23½p
LH26D	Verobox 223	£3.55	26½p
LL12N	Verobox 301	45p	3½p
LL13P	Verobox 302	55p	4p
LL14Q	Verobox 401	72p	5½p
XB88V	Verocase 501	£9.85	73p
XB89W	Verocase 502	£23.57	£1.75
LQ03D	Flip-Top Box 601 Blk	£2.40	18p
LQ04E	Flip-Top Box 601 Yllw	£2.40	18p
LQ05F	Flip-Top Box 602 Blk	£3.11	23p
LQ06G	Flip-Top Box 602 Yllw	£3.11	23p
LH27E	Verobox 701	£3.99	29½p
LH28F	Verobox 702	£4.20	31p
LH29G	Verobox 704	£4.98	37p
LH30H	Verobox 705	£5.30	39½p
LH31J	Verobox 707	£6.39	47½p
LH32K	Verobox 708	£6.91	51p
LH33L	Verobox 713	£4.20	31p
LH34M	Verobox 716	£4.68	34½p
LH35Q	Verobox 719	£6.50	48p
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LF00A	Plastic DC2	79p	6p
LF01B	Box PB1 White	63p	4½p
LH14Q	Box PB1 Black	60p	4½p
LF03D	Box PB301	89p	6½p
LH09K	Foot Sw Box	£2.20	16½p
LH16S	Potting Box GP05	13p	1p
LH17T	Potting Box GP1	14p	1p
LH18U	Potting Box GP2	16p	1p

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LH19V	Potting Box GP3		32p	2½p
LH15R	Hobby Box		£1.35	10p
FR22Y	Storage Drawer		49p	3½p
XQ99H	Metal Detector Shell		£16.50	£1.22
LH20W	ABS Box MB1		57p	4p
LH21X	ABS Box MB2		70p	5p
LH22Y	ABS Box MB3		80p	6p
LH23A	ABS Box MB4		£2.40	18p
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LF08J	Box	AB7	83p	6p
LF09K	Box	AB8	83p	6p
LF10L	Box	AB9	82p	6p
LF11M	Box	AB10	84p	6p
LF12N	Box	AB11	76p	5½p
LF13P	Box	AB12	73p	5½p
LF14Q	Box	AB13	£1.16	8½p
XB71N	Box	AB15	£1.99	14½p
LF15R	Box	AB23	£1.05	8p
LF16S	Box	AB24	£1.06	8p
LH10L	Box	AB28	96p	7p
XB69A	Box	AB31	£1.39	10½p
XB56L	Chassis	AC64	£1.40	10½p
XB68Y	Chassis	AC86	£1.79	13½p
LF02C	Case	WB1 Vinyl	97p	7p
LH37S	Case	WB2 Vinyl	£1.50	11p
LH38R	Case	WB3 Vinyl	£2.56	19p
LH39N	Case	WB4 Vinyl	£2.30	17p
LH40T	Case	WB5 Vinyl	£2.60	19½p
LH41U	Case	WB6 Vinyl	£2.80	20½p
LH42V	Case	WB7 Vinyl	£2.70	20p
LH43W	Case	TP1 Teak	95p	7p
LH44X	Case	TP2 Teak	£1.78	13p
LH45Y	Case	TP3 Teak	£2.46	18p
LH46A	Case	TP4 Teak	£2.60	19½p
LH47B	Case	TP5 Teak	£2.90	21½p
LH48C	Case	TP6 Teak	£3.10	23p
LH49D	Case	TP7 Teak	£3.98	29½p
LF04E	Box	DC24	£2.32	17p
LF05F	Box	DC43	£2.69	20p
LF07H	Box	DC62	£4.32	32p
LH36P	Box	DC74	£4.99	37½p
XB57M	Box	DC84	£8.15	60½p
XQ08J	G-Range	2A	£6.15	45½p
XQ09K	G-Range	3G	£8.97	66½p
XQ10L	G-Range	4B	£11.87	88p
Page 56				
XB73Q	Centurion	118	£3.74	28p
XB67X	Centurion	119	£4.22	31½p
XB70M	Centurion	121	£5.15	38p
XB55K	Centurion	221F	£6.30	46½p
XB58N	Centurion	222F	£9.19	68p
XB72P	Centurion	321F	£12.80	95p
XB61R	Centurion	Type 1	£3.27	24p
XB62S	Centurion	Type 2	£3.43	25½p
XB63T	Centurion	Type 3	£3.64	27p
XB64U	Centurion	Type 4	£4.38	32½p
XB65V	Centurion	Type 5	£4.60	34p
XB66W	Centurion	Type 6	£4.88	36p
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XQ11M	Centurion	EX1H	£8.50	63p
XQ12N	Centurion	EX2H	£8.89	66p
XQ13P	Centurion	EX3H	£4.90	36½p
XQ14Q	Centurion	EX4H	£10.95	81p
FW19V	Feet Cab		4p	½p
FW38R	Stick-on Feet		10p	½p
FW39N	HD Feet		7½p	½p
FW81C	Handle		47p	3½p
FW82D	HD Strap Handle		£1.59	12p
FX00A	Inst Handle Small		£1.39	10½p
FX01B	Inst Handle Large		£1.89	12½p
FX02C	Ferrule		19p	1½p
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FX03D	Inst Handle Plastic		33p	2½p
LH08J	Recess Handle		55p	4p
LH11M	Heavy Duty Handle		£2.59	19p
FX04E	Cab Corners		8p	½p
FX94C	Corner Two-Side		21p	1½p
FX95D	Corner Three-Side		21p	1½p
FX96E	Castors		£1.87	14p
FX05F	Castor Cup		39p	3p
FX06G	Cool Grille		24p	2p
RY00A	Black Tygan 45in		95p	7p
RY01B	Black Tygan 22½in		50p	3½p
RY02C	Brown Tygan 45in		£1.12	8½p
RY03D	Brown Tygan 22½in		60p	4½p
RY04E	Covering Cloth 50in		40p	3p
RY05F	Covering Cloth 25in		23p	1½p
RY06G	Acoustic Wadding		28p	2p
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BX05F	HV Disc 10		8p	1p
BX06G	HV Disc 47		8p	1p
BX07H	HV Disc 100		8p	1p
BX08J	HV Disc 220		8p	1p
BX09K	HV Disc 330		8p	1p
BX10L	HV Disc 470		8p	1p
BX11M	HV Disc 680		8p	1p
BX12N	HV Disc 1000		8p	1p
BX13P	HV Disc 2200		8p	1p
BX14Q	HV Disc 4700		8p	1p
BX15R	HV Disc 10,000		8p	1p
HY18U	1000V Disc 4700pF		10p	1p
BX17T	8kV Cap 10		25p	3p
BX18U	8kV Cap 22		25p	3p
BX19V	8kV Cap 47		25p	3p
BX20W	8kV Cap 100		26p	3p
BX21X	8kV Cap 220		29p	3p
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WX35Q	Ceramic	1.8	6p	½p
WX36P	Ceramic	2.2	6p	½p
WX37S	Ceramic	2.7	6p	½p
WX38R	Ceramic	3.3	6p	½p
WX39N	Ceramic	3.9	6p	½p
WX40T	Ceramic	4.7	6p	½p
WX41U	Ceramic	5.6	6p	½p
WX42V	Ceramic	6.8	6p	½p
WX43W	Ceramic	8.2	6p	½p
WX44X	Ceramic	10	6p	½p
WX45Y	Ceramic	12	6p	½p
WX46A	Ceramic	15	6p	½p
WX47B	Ceramic	18	6p	½p
WX48C	Ceramic	22	6p	½p
WX49D	Ceramic	27	6p	½p
WX50E	Ceramic	33	6p	½p
WX51F	Ceramic	39	6p	½p
WX52G	Ceramic	47	6p	½p
WX53H	Ceramic	56	6p	½p
WX54J	Ceramic	68	6p	½p
WX55K	Ceramic	82	6p	½p
WX56L	Ceramic	100	6p	½p
WX57M	Ceramic	120	6p	½p
WX58N	Ceramic	150	6p	½p
WX59P	Ceramic	180	6p	½p
WQ60Q	Ceramic	220	6p	½p
WX61R	Ceramic	270	6p	½p
WX62S	Ceramic	330	6p	½p
WX63T	Ceramic	390	6p	½p
WX64U	Ceramic	470	6p	½p
WX65V	Ceramic	560	6p	½p
WX66W	Ceramic	680	6p	½p
WX67X	Ceramic	820	6p	½p
WX68Y	Ceramic	1000	6p	½p
WX69A	Ceramic	1200	6p	½p
WF70M	Ceramic	1500	6p	½p
WX71N	Ceramic	1800	6p	½p
WX72P	Ceramic	2200	6p	½p
WX73Q	Ceramic	2700	6p	½p
WX74R	Ceramic	3300	6p	½p
WX75S	Ceramic	3900	6p	½p
WX76H	Ceramic	4700	6p	½p
WX77J	Ceramic	10,000	6p	½p
WX78K	Ceramic	22,000	6p	½p
WX00A	Mica	2.2pF	16p	1p
WX01B	Mica	3.3pF	16p	1p
WX02C	Mica	5pF	16p	1p
WX03D	Mica	10pF	16p	1p
WX04E	Mica	18pF	16p	1p
WX05F	Mica	22pF	16p	1p
WX06G	Mica	27pF	16p	1p
WX07H	Mica	33pF	16p	1p
WX08J	Mica	39pF	16p	1p
WX09K	Mica	47pF	16p	1p
WX10L	Mica	56pF	16p	1p
WX11M	Mica	68pF	16p	1p
WX12N	Mica	82pF	16p	1p
WX13P	Mica	100pF	16p	1p
WX14Q	Mica	120pF	16p	1p
WX15R	Mica	150pF	16p	1p
WX16S	Mica	180pF	16p	1p
WX17T	Mica	220pF	16p	1p
WX18U	Mica	270pF	31p	2½p
WX19V	Mica	330pF	31p	2½p
WX20W	Mica	390pF	31p	2½p
WX21X	Mica	470pF	31p	2½p
WX22Y	Mica	560pF	31p	2½p
WX23A	Mica	680pF	31p	2½p
WX24B	Mica	820pF	31p	2½p
WX25C	Mica	1000pF	36p	2½p
WX26D	Mica	1500pF	36p	2½p
WX27E	Mica	1800pF	44p	3½p
WX28F	Mica	2200pF	44p	3½p
WX29G	Mica	2700pF	57p	4½p
WX30H	Mica	3600pF	64p	5p
WX31J	Mica	4700pF	83p	6p
WX32K	Mica	6800pF	£1.11	8½p
WX33L	Mica	8200pF	£1.32	10p
WX34M	Mica	10,000pF	£1.34	10p
Page 64				
BX00A	Disc	0.01µF	8p	1p
BX01B	Disc	0.022µF	8p	1p
BX02C	Disc	0.047µF	10p	1p
BX03D	Disc	0.1µF	12p	1½p
BX04E	Disc	0.22µF	16p	2p
BX16S	Feed Thro	Cap	8p	1p
BX24B	Polystyrene	22	6p	½p
BX25C	Polystyrene	33	6p	½p
BX26D	Polystyrene	47	6p	½p
BX27E	Polystyrene	68	6p	½p
BX28F	Polystyrene	100	6p	½p
BX29G	Polystyrene	150	6p	½p
BX30H	Polystyrene	220	6p	½p
BX31J	Polystyrene	330	6p	½p
BX32K	Polystyrene	470	6p	½p
BX33L	Polystyrene	560	6p	½p
BX34M	Polystyrene	680	6p	½p
BX35Q	Polystyrene	1,000	6p	½p
BX36P	Polystyrene	1,500	6p	½p
BX37S	Polystyrene	2,200	6p	½p
BX38R	Polystyrene	3,300	6p	½p
BX39N	Polystyrene	4,700	6p	½p
BX40T	Polystyrene	5,600	7p	1p
BX41U	Polystyrene	6,800	7p	1p
BX92A	Polystyrene	10,000	6p	½p
BX93B	Polystyrene	22,000	9p	1p
BX94C	Polystyrene	47,000	10p	1p
BX95D	Polystyrene	100,000	11p	1p
BX46A	1% Polysty	100	22p	1½p
BX47B	1% Polysty	150	22p	1½p
BX49D	1% Polysty	220	22p	1½p
BX50E	1% Polysty	270	22p	1½p
BX51F	1% Polysty	330	22p	1½p
BX52G	1% Polysty	390	22p	1½p
BX53H	1% Polysty	470	22p	1½p
BX54J	1% Polysty	560	22p	1½p
BX55K	1% Polysty	750	22p	1½p
BX56L	1% Polysty	1,000	22p	1½p
BX57M	1% Polysty	1,200	22p	1½p
BX58N	1% Polysty	1,500	22p	1½p
BX59P	1% Polysty	1,800	22p	1½p
BX60Q	1% Polysty	2,200	22p	1½p
BX61R	1% Polysty	2,700	22p	1½p
BX62S	1% Polysty	3,300	22p	1½p
BX63T	1% Polysty	3,900	22p	1½p
BX64U	1% Polysty	4,700	28p	2p
BX65V	1% Polysty	5,600	28p	2p
BX66W	1% Polysty	6,800	28p	2p
BX85G	1% Polysty	8,200	28p	2p
BX86T	1% Polysty	10,000	31½p	2½p
BX87U	1% Polysty	22,000	35½p	2½p
WW15R	Mylar	0.001	5p	½p
WW16S	Mylar	0.0022	5p	½p
WW17T	Mylar	0.0047	5p	½p
WW18U	Mylar	0.01	7p	1p
WW19V	Mylar	0.022	7p	1p
WW20W	Mylar	0.047	7p	1p
WW21X	Mylar	0.1	10p	1p
WW83E	Mylar	0.22	14p	1½p
Page 65				
BX70M	Polyester	0.01µF	4½p	½p
BX71N	Polyester	0.015µF	4½p	½p
BX72P	Polyester	0.022µF	4½p	½p
BX73Q	Polyester	0.033µF	5p	½p
BX74R	Polyester	0.047µF	5p	½p
BX75S	Polyester	0.068µF	5½p	½p
BX76H	Polyester	0.1µF	6p	½p
BX77J	Polyester	0.15µF	6½p	½p
BX78K	Polyester	0.22µF	7p	1p
BX79L	Polyester	0.33µF	10½p	1p
BX80B	Polyester	0.47µF	12p	1½p
BX81C	Polyester	0.68µF	17p	2p
BX82D	Polyester	1µF	19½p	2p
BX83E	Polyester	1.5µF	33p	3½p
BX84F	Polyester	2.2µF	40p	4½p
WW22Y	Carbonate	0.001	6½p	½p
WW23A	Carbonate	0.0015	6½p	½p
WW24B	Carbonate	0.0022	6½p	½p
WW25C	Carbonate	0.0033	6½p	½p
WW26D	Carbonate	0.0047	6½p	½p
WW27E	Carbonate	0.0068	6½p	½p
WW28F	Carbonate	0.0082	6½p	½p
WW29G	Carbonate	0.01	8p	1p
WW30H	Carbonate	0.012	8p	1p
WW31J	Carbonate	0.015	8p	1p
WW32K	Carbonate	0.018	8p	1p
WW33L	Carbonate	0.022	8p	1p
WW34M	Carbonate	0.027	8p	1p
WW35Q	Carbonate	0.033	8p	1p
WW36P	Carbonate	0.039	8p	1p
WW37S	Carbonate	0.047	8p	1p
WW38R	Carbonate	0.056	8p	1p
WW39N	Carbonate	0.068	8p	1p
WW40T	Carbonate	0.082	8p	1p
WW41U	Carbonate	0.1	8p	1p
WW42V	Carbonate	0.12	8p	1p
WW43W	Carbonate	0.15	8p	1p
WW44X	Carbonate	0.18	10½p	1p
WW45Y	Carbonate	0.22	10½p	1p
WW46A	Carbonate	0.27	16p	2p
WW47B	Carbonate	0.33	16p	2p
WW48C	Carbonate	0.39	18p	2p
WW49D	Carbonate	0.47	19p	2p
WW50E	Carbonate	0.56	26p	3p
WW51F	Carbonate	0.68	26p	3p
WW52G	Carbonate	0.82	29p	3p
WW53H	Carbonate	1	29p	3p
Page 66				
FF53H	IS Cap	0.01µF	17p	1½p
FF54J	IS Cap	0.022µF	19p	1½p
FF55K	IS Cap	0.047µF	18p	1½p
FF56L	IS Cap	0.1µF	25p	2p
FF57M	IS Cap	0.22µF	33p	2½p
FF58N	IS Cap	0.47µF	62p	4½p
WW54J	Tant	0.1µF 35V	9p	1p
WW55K	Tant	0.15µF 35V	9p	1p
WW56L	Tant	0.22µF 35V	9p	1p
WW57M	Tant	0.33µF 35V	9p	1p
WW58N	Tant	0.47µF 35V	9p	1p
WW59P	Tant	0.68µF 35V	9p	1p
WW60Q	Tant	1.0µF 35V	9p	1p
WW61R	Tant	1.5µF 35V	11p	1p
WW62S	Tant	2.2µF 35V	11p	1p
WW63T	Tant	3.3µF 35V	11p	1p
WW64U	Tant	4.7µF 16V	11p	1p
WW65V	Tant	4.7µF 35V	11p	1p
WW66W	Tant	6.8µF 16V	11p	1p
WW67X	Tant	6.8µF 35V	14p	1½p
WW68Y	Tant	10µF 16V	14p	1½p
WW69A	Tant	10µF 25V	14p	1½p
WW70M	Tant	10µF 35V	18p	2p
WW71N	Tant	15µF 25V	22p	2½p
WW72P	Tant	22µF 16V	18p	2p
WW73Q	Tant	22µF 25V	22p	2½p
WW74R	Tant	33µF 10V	18p	2p
WW75S	Tant	47µF 10V	23p	2½p
WW76H	Tant	47µF 16V	36p	4p
WW77J	Tant	68µF 6.3V	23p	2½p
WW78K	Tant	100µF 3V	16p	2p
WW79L	Tant	100µF 10V	23p	2½p
BX22Y	Mix D	0.001µF 1500V	15p	1p
BX42V	Mix D	0.0047µF 1000V	23p	1½p
BX43W	Mix D	0.01 1000V	25p	2p
BX44X	Mix D	0.022µF 1000V	25p	2p
BX45Y	Mix D	0.047µF 1000V	32p	2½p
BX67X	Mix D	0.1µF 600V	35p	2½p
BX68Y	Mix D	0.1µF 1000V	39p	3p
BX69A	Mix D	0.22µF 1000V	73p	5½p
BX90X	Mix D	0.47µF 1000V	95p	7p
BX91Y	Mix D	1.0µF 600V	£1.10	8p
Page 67				
FB11M	Axial	0.47µF 250V	12p	1½p
FB12N	Axial	1µF 63V	9p	1p
FB13P	Axial	1µF 500V	23p	2½p
FB14Q	Axial	1.5µF 63V	10p	1p
FB15R	Axial	2.2µF 63V	9p	1p
FB16S	Axial	2.2µF 500V	25p	3p
FB17T	Axial	3.3µF 63V	9p	1p
FB18U	Axial	4.7µF 63V	7p	1p
FB19V	Axial	4.7µF 500V	30p	3½p
FB20W	Axial	6.8µF 40V	9p	1p
FB21X	Axial	6.8µF 63V	10p	1p
FB22Y	Axial	10µF 25V	8p	1p
FB23A	Axial	10µF 63V	11p	1p
FB24B	Axial	10µF 100V	13p	1½p
FB25C	Axial	10µF 500V	34p	4p
FB26D	Axial	15µF 16V	9p	1p
FB27E	Axial	15µF 40V	11p	1p
FB28F	Axial	15µF 63V	11½p	1½p
FB29G	Axial	22µF 10V	10p	1p
FB30H	Axial	22µF 25V	10p	1p
FB31J	Axial	22µF 63V	12p	1½p
FB32K	Axial	22µF 100V	19p	2p
FB33L	Axial	22µF 500V	41½p	4½p
FB34M	Axial	33µF 6.3V	10p	1p
FB35Q	Axial	33µF 16V	10p	1p
FB36P	Axial	33µF 40V	10p	1p
FB37S	Axial	47µF 4V	10p	1p
FB38R	Axial	47µF 10V	8p	1p
FB39N	Axial	47µF 25V	9p	1p
FB40T	Axial	47µF 40V	10½p	1p
FB41U	Axial	47µF 63V	14p	1½p
FB42V	Axial	47µF 100V	27p	3p
FB43W	Axial	47µF 500V	89p	10p
FB44X	Axial	68µF 6.3V	10p	1p
FB45Y	Axial	68µF 16V	10p	1p
FB46A	Axial	68µF 63V	39p	4½p
FB47B	Axial	100µF 4V	10½p	1p
FB48C	Axial	100µF 10V	10p	1p
FB49D	Axial	100µF 25V	9p	1p
FB50E	Axial	100µF 40V	12p	1½p
FB51F	Axial	100µF 63V	27p	3p
FB52G	Axial	100µF 100V	35p	4p
FB53H	Axial	100µF 250V	54p	7p
FB54J	Axial	150µF 6.3V	10½p	1p
FB55K	Axial	150µF 16V	12p	1p
FB56L	Axial	150µF 25V	14p	1½p
FB57M	Axial	150µF 40V	27p	3p
FB58N	Axial	150µF 63V	35p	4p
FB59P	Axial	220µF 4V	11p	1p
FB60Q	Axial	220µF 10V	10½p	1p
FB61R	Axial	220µF 16V	14p	1½p
FB62S	Axial	220µF 25V	17p	2p
FB63T	Axial	220µF 40V	27p	3p
FB64U	Axial	220µF 63V	40p	4½p
FB65V	Axial	220µF 100V	53p	6p
FB66W	Axial	330µF 4V	10½p	1p
FB67X	Axial	330µF 10V	15p	1½p
FB68Y	Axial	330µF 25V	33p	3½p
FB69A	Axial	330µF 63V	63p	7p
FB70M	Axial	470µF 6.3V	14p	1½p
FB71N	Axial	470µF 10V	18p	2p
FB72P	Axial	470µF 16V	32p	3½p
FB73Q	Axial	470µF 25V	35p	4p
FB74R	Axial	470µF 63V	36p	4p
FB75S	Axial	470µF 100V	78p	8½p
FB76H	Axial	680µF 6.3V	39p	4½p
FB77J	Axial	680µF 16V	42p	4½p
FB78K	Axial	680µF 25V	35p	4p
FB79L	Axial	680µF 40V	57p	6½p
FB80B	Axial	1000µF 6.3V	28p	3p
FB81C	Axial	1000µF 10V	29p	3p
FB82D	Axial	1000µF 16V	33p	3½p
FB83E	Axial	1000µF 25V	43p	5p
FB84F	Axial	1000µF 63V	79p	9p
FB85G	Axial	1500µF 6.3V	33p	3½p
FB86T	Axial	1500µF 10V	35p	4p
FB87U	Axial	1500µF 16V	41p	4½p
FB89W	Axial	2200µF 10V	41p	4½p
FB90X	Axial	2200µF 25V	53p	6p
FB91Y	Axial	2200µF 40V	77p	8½p
FB92A	Axial	2200µF 63V	£1.12	12½p
FB93B	Axial	3300µF 6.3V	48p	5½p
FB94C	Axial	3300µF 25V	87p	9½p
FB95D	Axial	4700µF 10V	49p	5½p
FB96E	Axial	4700µF 25V	£1.10	12p
Page 68				
FF00A	PC Elect	0.47µF 100V	10p	1p
FF01B	PC Elect	1µF 100V	10p	1p
FF02C	PC Elect	2.2µF 63V	10p	1p
FF03D	PC Elect	4.7µF 63V	10p	1p
FF04E	PC Elect	10µF 35V	10p	1p
FF05F	PC Elect	10µF 63V	11½p	1½p
FF06G	PC Elect	22µF 16V	10p	1p
FF07H	PC Elect	22µF 63V	11½p	1½p
FF08J	PC Elect	47µF 25V	11½p	1½p
FF09K	PC Elect	47µF 63V	11½p	1½p
FF10L	PC Elect	100µF 10V	11½p	1½p
FF11M	PC Elect	100µF 25V	11½p	1½p
FF12N	PC Elect	100µF 63V	22p	2½p
FF13P	PC Elect	220µF 16V	13½p	1½p
FF14Q	PC Elect	220UF 63V	31p	3½p
FF15R	PC Elect	470µF 16V	22p	2½p
FF16S	PC Elect	470µF 25V	31p	3½p
FF59P	PC Elect	470µF 63V	51p	5½p
FF17T	PC Elect	1000µF 16V	31p	3½p
FF18U	PC Elect	1000µF 25V	37p	4p
FF60Q	PC Elect	2200µF 16V	44p	5p
FB00A	Reversolytic	1.5µF	22p	2½p
FB01B	Reversolytic	2.2µF	29p	3p
FB02C	Reversolytic	3.3µF	26p	3p
FB03D	Reversolytic	4.7µF	27p	3p
FB04E	Reversolytic	6.8µF	49p	5½p
FB05F	Reversolytic	8µF	50p	5½p
FB06G	Reversolytic	10µF	60p	6½p
FB07H	Reversolytic	15µF	54p	6p
FB08J	Reversolytic	22µF	54p	6p
FB09K	Reversolytic	33µF	57p	6½p
FB10L	Reversolytic	47µF	58p	6½p
FF19V	Can	1000µF 100V	£1.55	11½p
FF20W	Can	1500µF 63V	£1.52	11p
FF21X	Can	2200µF 40V	£1.30	9½p
FF22Y	Can	2200µF 63V	£1.37	10p
FF23A	Can	2200µF 100V	£3.25	24p
FF24B	Can	3300µF 40V	£1.78	13p
FF25C	Can	3300µF 63V	£2.20	16½p
FF26D	Can	4700µF 25V	£1.55	11½p
FF27E	Can	4700µF 40V	£1.79	13p
FF28F	Can	4700µF 63V	£3.14	23p
FF29G	Can	4700µF 100V	£5.75	42½p
FF30H	Can	6800µF 40V	£2.44	18p
FF31J	Can	10,000µF 25V	£2.22	16½p
FF32K	Can	10,000µF 63V	£4.82	35½p
FF33L	Clip Can	25	11p	1p
FF34M	Clip Can	35	11p	1p
FF35Q	Clip Can	40	11p	1p
FF36P	Clip Can	50	30p	2p
FF37S	Horiz Clip	25	11p	1p
FF38R	Horiz Clip	35	11p	1p
Page 69				
WL68Y	Trimmer	5.5pF	22p	2½p
WL69A	Trimmer	10pF	22p	2½p
WL70M	Trimmer	22pF	22p	2½p
WL72P	Trimmer	65pF	29p	3p
WL71N	Trimmer	40pF	13p	1½p
WL73Q	Trimmer	500pF	24p	2½p
FF52G	Min Tuner		Not Available	
FF39N	Vari O		£3.33	37p
FF40T	DG Vari		£4.20	46½p
FF41U	Twin 00		£4.19	46½p
FF42V	Sw Trim	10pF	£2.07	23p
FF43W	Sw Trim	15pF	£2.07	23p
FF44X	Sw Trim	25pF	£2.49	27½p
FF45Y	Sw Trim	50pF	£2.69	30p
FF46A	Sw Trim	60pF	£2.59	29p
FF47B	Sw Trim	75pF	£2.59	29p
FF48C	Sw Trim	100pF	£2.63	29p
FF49D	Sw Trim	150pF	£3.70	41p
FF50E	Dilecon	300pF	£2.18	24p
FF51F	Dilecon	500pF	£2.36	26p
Page 70				
M	Min Res		1½p	—
S	Std Res		2p	—
C	1W Res		5p	½p
Page 71				
X	Oxide		6p	½p
T	1% Res		9p	1p
XL05F	Colour Wheel		10p	1p
Page 72				
W	W/W Min	.22Ω - 270Ω	12p	1p
W	W/W Min	330Ω - 22k	15p	1p
L	7W W/W		14p	1p
H	10W W/W		14½p	1p
P	25W W/W	.47 & 1Ω	£1.12	8½p
P	25W W/W	2.2Ω - 100Ω	98p	7½p
V	HV Res	1M - 33M	12p	1p
V	HV Res	47M	19p	1½p
BL64U	Constantan	28 swg	£1.30	9½p
WR52G	Hor S-Min	Preset 100Ω	7½p	1p
WR53H	Hor S-Min	Preset 220Ω	7½p	1p
WR54J	Hor S-Min	Preset 470Ω	7½p	1p
WR55K	Hor S-Min	Preset 1k	7½p	1p
WR56L	Hor S-Min	Preset 2k2	7½p	1p
WR57M	Hor S-Min	Preset 4k7	7½p	1p
WR58N	Hor S-Min	Preset 10k	7½p	1p
WR59P	Hor S-Min	Preset 22k	7½p	1p
WR60Q	Hor S-Min	Preset 47k	7½p	1p
WR61R	Hor S-Min	Preset 100k	7½p	1p
WR62S	Hor S-Min	Preset 220k	7½p	1p
WR63T	Hor S-Min	Preset 470k	7½p	1p
WR64U	Hor S-Min	Preset 1M	7½p	1p
WR65V	Vert S-Min	Prst 100Ω	8p	1p
WR66W	Vert S-Min	Prst 220Ω	8p	1p
WR67X	Vert S-Min	Prst 470Ω	8p	1p
WR68Y	Vert S-Min	Preset 1k	8p	1p
WR69A	Vert S-Min	Preset 2k2	8p	1p
WR70M	Vert S-Min	Preset 4k7	8p	1p
WR71N	Vert S-Min	Preset 10k	8p	1p
WR72P	Vert S-Min	Preset 22k	8p	1p

1979/80 Catalogue Page No.		VAT Inclusive PRICE	
WR73Q	Vert S-Min Preset 47k	8p	1p
WR74R	Vert S-Min Preset 100k	8p	1p
WR75S	Vert S-Min Preset 220k	8p	1p
WR76H	Vert S-Min Preset 470k	8p	1p
WR77J	Vert S-Min Preset 1M	8p	1p
Page 73			
WR28F	Edge Preset	22½p	2½p
WR78K	Hor Skeleton 100Ω	9½p	1p
WR79L	Hor Skeleton 220Ω	9½p	1p
WR80B	Hor Skeleton 470Ω	9½p	1p
WR81C	Hor Skeleton 1k	9½p	1p
WR82D	Hor Skeleton 2k2	9½p	1p
WR83E	Hor Skeleton 4k7	9½p	1p
WR84F	Hor Skeleton 10k	9½p	1p
WR85G	Hor Skeleton 22k	9½p	1p
WR86T	Hor Skeleton 47k	9½p	1p
WR87U	Hor Skeleton 100k	9½p	1p
WR88V	Hor Skeleton 220k	9½p	1p
WR89W	Hor Skeleton 470k	9½p	1p
WR90X	Hor Skeleton 1M	9½p	1p
WR91Y	Hor Skeleton 2M2	9½p	1p
WR92A	Hor Skeleton 4M7	9½p	1p
WW00A	Vert Skeleton 100Ω	9½p	1p
WW01B	Vert Skeleton 220Ω	9½p	1p
WW02C	Vert Skeleton 470Ω	9½p	1p
WW03C	Vert Skeleton 1k	9½p	1p
WW04E	Vert Skeleton 2k2	9½p	1p
WW05F	Vert Skeleton 4k7	9½p	1p
WW06G	Vert Skeleton 10k	9½p	1p
WW07H	Vert Skeleton 22k	9½p	1p
WW08J	Vert Skeleton 47k	9½p	1p
WW09K	Vert Skeleton 100k	9½p	1p
WW10L	Vert Skeleton 220k	9½p	1p
WW11M	Vert Skeleton 470k	9½p	1p
WW12N	Vert Skeleton 1M	9½p	1p
WW13P	Vert Skeleton 2M2	9½p	1p
WW14Q	Vert Skeleton 4M7	9½p	1p
FX41U	Japanese V/C	45p	5p
WR38R	Cermet 100Ω	76p	5½p
WR39N	Cermet 500Ω	76p	5½p
WR40T	Cermet 1k	76p	5½p
WR41U	Cermet 5k	76p	5½p
WR42V	Cermet 10k	76p	5½p
WR43W	Cermet 50k	76p	5½p
WR44X	Cermet 100k	76p	5½p
WR45Y	Cermet 1M	76p	5½p
WR46A	15-Turn Cermet 500Ω	£1.07	8p
WR47B	15-Turn Cermet 1k	£1.07	8p
WR48C	15-Turn Cermet 5k	£1.07	8p
WR49D	15-Turn Cermet 10k	£1.07	8p
WR50E	15-Turn Cermet 50k	£1.07	8p
WR51F	15-Turn Cermet 100k	£1.07	8p
BW06G	Edge Control Pot	54p	6p
BW07H	Edge Knob Small Blk	6p	½p
BW08J	Edge Knob Small Grey	6p	½p
BW09K	Edge Knob Large Blk	6p	½p
BW10L	Edge Knob Large Grey	6p	½p
FX40T	L/S Control 20Ω	57p	6½p
FX97F	L/S Control 50Ω	36p	4p
FX98G	L/S Control 100Ω	36p	4p
FX99H	L/S Control 200Ω	36p	4p
FW00A	Pot Lin 1k	23p	2½p
FW01B	Pot Lin 4k7	23p	2½p
FW02C	Pot Lin 10k	23p	2½p
FW03D	Pot Lin 22k	23p	2½p
FW04E	Pot Lin 47k	23p	2½p
FW05F	Pot Lin 100k	23p	2½p
FW06G	Pot Lin 220k	23p	2½p
FW07H	Pot Lin 470k	23p	2½p
FW08J	Pot Lin 1M	23p	2½p
FW09K	Pot Lin 2M2	23p	2½p
FW21X	Pot Log 4k7	23p	2½p
FW22Y	Pot Log 10k	23p	2½p
FW23A	Pot Log 22k	23p	2½p
FW24B	Pot Log 47k	23p	2½p
FW25C	Pot Log 100k	23p	2½p
FW26D	Pot Log 220k	23p	2½p
FW27E	Pot Log 470k	23p	2½p
FW28F	Pot Log 1M	23p	2½p
FW29G	Pot Log 2M2	23p	2½p
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FW41U	Sw Pot Lin 4k7	79p	9p
FW42V	Sw Pot Lin 10k	79p	9p
FW43W	Sw Pot Lin 22k	79p	9p
FW44X	Sw Pot Lin 47k	79p	9p
FW45Y	Sw Pot Lin 100k	79p	9p
FW46A	Sw Pot Lin 220k	79p	9p
FW47B	Sw Pot Lin 470k	79p	9p
FW48C	Sw Pot Lin 1M	79p	9p
FW49D	Sw Pot Lin 2M2	79p	9p
FW62S	Sw Pot Log 4k7	79p	9p
FW63T	Sw Pot Log 10k	79p	9p
FW64U	Sw Pot Log 22k	79p	9p
FW65V	Sw Pot Log 47k	79p	9p
FW66W	Sw Pot Log 100k	79p	9p
FW67X	Sw Pot Log 220k	79p	9p
FW68Y	Sw Pot Log 470k	79p	9p
FW69A	Sw Pot Log 1M	79p	9p
FW70M	Sw Pot Log 2M2	79p	9p
FW84F	Dual Pot Lin 4k7	98p	11p
FW85G	Dual Pot Lin 10k	98p	11p
FW86T	Dual Pot Lin 22k	98p	11p
FW87U	Dual Pot Lin 47k	98p	11p
FW88V	Dual Pot Lin 100k	98p	11p
FW89W	Dual Pot Lin 220k	98p	11p
FW90X	Dual Pot Lin 470k	98p	11p
FW91Y	Dual Pot Lin 1M	98p	11p
FW92A	Dual Pot Lin 2M2	98p	11p
FX06J	Dual Pot Log 4k7	98p	11p
FX09K	Dual Pot Log 10k	98p	11p
FX10L	Dual Pot Log 22k	98p	11p
FX11M	Dual Pot Log 47k	98p	11p
FX12N	Dual Pot Log 100k	98p	11p
FX13P	Dual Pot Log 220k	98p	11p
FX14Q	Dual Pot Log 470k	98p	11p
FX15R	Dual Pot Log 1M	98p	11p
FX16S	Dual Pot Log 2M2	98p	11p
FW50E	W/W Pot 10Ω	69p	5p
FW51F	W/W Pot 20Ω	69p	5p
FW52G	W/W Pot 50Ω	69p	5p
FW71N	W/W Pot 100Ω	69p	5p
FW72P	W/W Pot 200Ω	69p	5p
FW73Q	W/W Pot 500Ω	69p	5p
FW93B	W/W Pot 1k	69p	5p
FW96E	W/W Pot 2k	69p	5p
FW94C	W/W Pot 5k	69p	5p
FW95D	W/W Pot 10k	69p	5p
FX17T	W/W Pot 25k	£1.40	10½p
FX18U	W/W Pot 50k	£1.40	10½p
FX07H	Slide Bezel	32p	2½p
FX31J	Slide Pot Lin 1k	78p	8½p
FX32K	Slide Pot Lin 5k	78p	8½p
FX33L	Slide Pot Lin 10k	78p	8½p
FX34M	Slide Pot Lin 25k	78p	8½p
FX35Q	Slide Pot Lin 50k	78p	8½p
FX36P	Slide Pot Lin 100k	78p	8½p

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FX37S	Slide Pot Lin 250k	78p	8½p
FX38R	Slide Pot Lin 500k	78p	8½p
FX52G	Slide Pot Log 1k	81p	9p
FX53H	Slide Pot Log 5k	81p	9p
FX54J	Slide Pot Log 10k	81p	9p
FX55K	Slide Pot Log 25k	81p	9p
FX56L	Slide Pot Log 50k	81p	9p
FX57M	Slide Pot Log 100k	81p	9p
FX58N	Slide Pot Log 250k	81p	9p
FX59P	Slide Pot Log 500k	81p	9p
FX75S	Dual Slide Lin 1k	95½p	10½p
FX76H	Dual Slide Lin 5k	95½p	10½p
FX77J	Dual Slide Lin 10k	95½p	10½p
FX78K	Dual Slide Lin 25k	95½p	10½p
FX79L	Dual Slide Lin 50k	95½p	10½p
FX80B	Dual Slide Lin 100k	95½p	10½p
FX81C	Dual Slide Lin 250k	95½p	10½p
FX82D	Dual Slide Lin 500k	95½p	10½p
HB00A	Dual Slide Log 1k	£1.18	13p
HB01B	Dual Slide Log 5k	£1.18	13p
HB02C	Dual Slide Log 10k	£1.18	13p
HB03D	Dual Slide Log 25k	£1.18	13p
HB04E	Dual Slide Log 50k	£1.18	13p
HB05F	Dual Slide Log 100k	£1.18	13p
HB06G	Dual Slide Log 250k	£1.18	13p
HB07H	Dual Slide Log 500k	£1.18	13p
HQ37S	Mixer Slide Log 10k	£1.35	15p
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HQ50E	2-Axis Joystick	£2.35	17½p
XB09K	Joystick Pot	£5.99	44½p
XB06G	Joystick Mtg Plate	£1.56	11½p
FX21X	Thermistor VA 1055S	33p	3½p
FX22Y	Thermistor VA1056S	26p	3p
FX42V	Thermistor VA1066S	27p	3p
FX43W	Thermistor VA 1067S	27p	3p
FX63T	Thermistor KR047CW	33p	3½p
FX64U	Thermistor KR068CW	33p	3½p
FX65V	Thermistor KR100CW	33p	3½p
FX66W	Thermistor KR150CW	33p	3½p
FX67X	Thermistor KR330CW	33p	3½p
FX84F	Thermistor KR470CW	33p	3½p
FX85G	Thermistor KR151CW	33p	3½p
FX86T	Thermistor KR471CW	33p	3½p
FX87U	Thermistor KR152CW	33p	3½p
FX61R	Thermistor F23	£5.99	44½p
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FX62S	Thermistor R53	£3.23	24p
HB10L	LDR ORP12	£1.14	8½p
HB11M	LDR ORP60	£1.17	8½p
HB12N	LDR ORP61	£1.19	9p
HB09K	LDR RPY58A	53p	4p
WH23A	Thermistor G16	£2.30	17p
WH24B	Thermistor G23	£2.80	20½p
RW75S	Knob BK12	13p	1p
RW77J	Knob PN20	22p	1½p
RX99H	Knob RN92	17p	2p
RW87U	Knob KB4	19p	2p
RW86T	Knob KB3	31p	3½p
RX09K	Knob R78	39p	4½p
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HB19V	Knob RK401	46p	5p
HB57M	Knob RK403	95p	10½p
HB23A	Knob K1	22p	2½p
HB24B	Knob K2	28p	3p
RW88V	Knob M1	21p	2½p
RW89W	Knob M2	18p	2p
RX10L	Knob R81	34p	4p
RX11M	Knob R82	35p	4p
HB25C	Knob KCR2	N/A	
RW90X	Knob M3	20p	2p
RX00A	Knob M4	21p	2½p
RW82D	Knob F18	49p	5½p
RW78K	Knob F10	36p	4p
HB26D	Knob F11	28p	3p
RX01B	Knob NK2	34p	4p
RX02C	Knob PK2	34p	4p
HB27E	Knob KTH	26p	3p
RX04E	Knob R64	40p	4½p
HB28F	Knob R51	28p	3p
HB29G	Knob R52	29p	3p
RX07H	Knob R76	38p	4p
RX08J	Knob R77	35p	4p
HB30H	Knob R53	34p	4p
HB31J	Knob R54	42p	4½p
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HB32K	Knob K105	46p	5p
HB33L	Knob K106	£1.15	13p
HB34M	Knob K105L	66p	7½p
HB35Q	Knob K106L	£1.36	15p
HB36P	Knob K15	34p	4p
HB37S	Knob K24	48p	5½p
HB38R	Knob K30	64p	7p
HB39N	Knob K44	58p	6½p
HB40T	Knob K45	72p	8p
HB41U	Knob K46	£1.05	11½p
RX16S	Cap Knob Black	36p	2½p
RX17T	Collet Knob Grey	36p	2½p
WL45Y	15mm Collet Cap Blk	5p	½p
WL46A	15mm Collet Cap Blue	5p	½p
WL47B	15mm Collet Cap Grn	5p	½p
WL48C	15mm Collet Cap Grey	5p	½p
WL49D	15mm Collet Cap Red	5p	½p
WL50E	15mm Collet Cap Yllw	5p	½p
WL51F	15mm Collet Pntr Blk	5p	½p
WL52G	15mm Collet Pntr Blue	5p	½p
WL53H	15mm Collet Pntr Grn	5p	½p
WL54J	15mm Collet Pntr Grey	5p	½p
WL55K	15mm Collet Pntr Red	5p	½p
WL56L	15mm Collet Pntr Yllw	5p	½p
RX18U	15mm Collet Nut Cvr	11p	1p
RX19V	15mm Collet Indicator	17p	1½p
RX20W	15mm Collet Skirt	17p	1½p
RX21X	15mm Collet Stator	18p	1½p
WL43W	Collet Rd Nut ¾in.	9½p	½p
WL44X	Collet Rd Nut 10mm	11p	1p
RX12N	Knob R621 Black	18p	1½p
WL61R	Cap R622 Black	4p	½p
WL62S	Cap R622 Blue	4p	½p
WL63T	Cap R622 Brown	4p	½p
WL64U	Cap R622 Green	4p	½p
WL65V	Cap R622 Grey	4p	½p
WL66W	Cap R622 Red	4p	½p
WL67X	Cap R622 Yellow	4p	½p
RX13P	Nut Cover R624	8p	½p
RX14Q	Indicator R623A	9p	½p
RX15R	Skirt R623N	12p	1p
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RX22Y	Slide Knob A	11½p	1½p
RX23A	Slide Knob D	48p	5½p
RX24B	Slide Knob F Black	16p	2p
RX25C	Slide Knob F Blue	16p	2p
RX26D	Slide Knob F Green	16p	2p

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RX27E	Slide Knob F Grey	16p	2p
RX28F	Slide Knob F Red	16p	2p
RX29G	Spindle Coupler	26p	2p
RX30H	Ext. Spindle	34p	2½p
RX31J	Brass Bush	27p	2p
RX38R	Ebonite Rod	8p	½p
RX45Y	Cord Drive Brass	64p	4½p
RX46A	Cord Drive Steel	£1.25	9½p
BL73Q	Drive Cord	5p	½p
RX43W	Cord Drum Small	59p	4½p
RX94C	Cord Drum Large	70p	5p
RX44X	Flywheel	£2.10	15½p
RX39N	Vernier Dial Small	£1.92	14p
RX40T	Vernier Dial Medium	£2.69	20p
RX41U	Vernier Dial Large	£3.44	25½p
Page 80			
RX42V	Ball Drive	£1.60	12p
HB42V	Mini Ball Drive	98p	7½p
HB43W	DR Drive Scale	£8.47	62½p
HB44X	Round Drive Scale	£6.44	47½p
HB45Y	Aluminium Dial	£3.95	29½p
HB46A	White Pointer	24p	2p
HB47B	Ball Drive Pointer	24p	2p
HB48C	Spring Short	10p	½p
HB49D	Spring Medium	10p	½p
HB50E	Spring Long	10p	½p
RX95D	Pulley ½in	6p	½p
RX47B	F Holder 20	24p	2p
RX48C	1¼in. F Holder	48p	3½p
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RX96E	Safuseholder 20	25p	2p
RX97F	Safuseholder 1¼in	98p	7½p
WH49D	Fuse Clip	2p	—
RX49D	Chassis F/H 20mm	7½p	½p
RX50E	Chassis F/H 1¼in	13p	1p
RX51F	F/H Car	7p	½p
WR93R	Fuse 20mm 50mmA	4p	½p
WR00A	Fuse 20mm 100mA	4p	½p
WR94C	Fuse 20mm 150mA	4p	½p
WR01B	Fuse 20mm 250mA	4p	½p
WR02C	Fuse 20mm 500mA	4p	½p
WR03D	Fuse 20mm 1A	4p	½p
WR04E	Fuse 20mm 1.5A	4p	½p
WR05F	Fuse 20mm 2A	4p	½p
WR06G	Fuse 20mm 3A	4p	½p
WR07H	Fuse 20mm 5A	4p	½p
WR18U	Fuse A/S 500mA	8½p	½p
WR19V	Fuse A/S 1A	8½p	½p
WR20W	Fuse A/S 2A	8½p	½p
WR95D	Fuse 1¼ 50mA	4p	½p
WR08J	Fuse 1¼ 100mA	4p	½p
WR96E	Fuse 1¼ 150mA	4p	½p
WR09K	Fuse 1¼ 250mA	4p	½p
WR10L	Fuse 1¼ 500mA	4p	½p
WR11M	Fuse 1¼ 1A	4p	½p
WR12N	Fuse 1¼ 1.5A	4p	½p
WR13P	Fuse 1¼ 2A	4p	½p
WR14Q	Fuse 1¼ 3A	4p	½p
WR15R	Fuse 1¼ 5A	4p	½p
WR16S	Fuse 1¼ 10A	4p	½p
WR17T	Fuse 1¼ 15A	4p	½p
HQ31J	Plug Fuse 2A	5p	½p
HQ32K	Plug Fuse 3A	5p	½p
HQ33L	Plug Fuse 5A	5p	½p
HQ34M	Plug Fuse 13A	5p	½p
HB51F	Fuse Wire	28p	2p
RX85G	MES L/Hldr MST 107	27p	2p
RX86T	MES Batten Hldr	15p	1p
RX57M	Holder MES Amber	87p	6½p
RX58N	Holder MES Blue	87p	6½p
RX59P	Holder MES Clear	87p	6½p
RX60Q	Holder MES Green	87p	6½p
RX61R	Holder MES Red	87p	6½p
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RX62S	LES Clip Hldr Amber	32p	2½p
RX63T	LES Clip Hldr Blue	32p	2½p
RX64U	LES Clip Hldr Clear	32p	2½p
RX65V	LES Clip Hldr Green	32p	2½p
RX66W	LES Clip Hldr Red	32p	2½p
RX76H	Dmd LES Lhldr Blue	29p	2p
RX77J	Dmd LES Lhldr Green	29p	2p
RX78K	Dmd LES Lhldr Red	29p	2p
RX79L	Dmd LES Lhldr White	29p	2p
RX80B	Dmd LES Lhldr Yllw	29p	2p
RX67X	Fit-Tp LES Lhldr Blue	29p	2p
RX68Y	Fit-Tp LES Lhldr Grn	29p	2p
RX69A	Fit-Tp LES Lhldr Red	29p	2p
FF66W	Fluted Lhldr Amber	22p	1½p
FF67X	Fluted Lhldr Clear	22p	1½p
FF68Y	Fluted Lhldr Green	22p	1½p
FF69A	Fluted Lhldr Red	22p	1½p
RX82D	Pan Neon Amber	44p	3p
RX83E	Pan Neon Red	44p	3p
RX81C	Square Neon	45p	3½p
RX70M	Wire Neon	11p	1p
WQ13P	Wire Bulb 12V	23p	1½p
WL74R	LES Bulb 6V	19p	1½p
WL75S	LES Bulb 12V	23p	1½p
RX84F	Neon Bulb	59p	4½p
WL76H	Bulb MES 3.5V	24p	2p
WL77J	Bulb MES 6V 0.24W	27p	2p
WL78K	Bulb MES 6V 0.6W	24p	2p
WL79L	Bulb MES 6.5V	17p	1½p
WL80B	Bulb MES 12V 1.2W	15p	1p
WL81C	Bulb MES 12V 2.2W	15p	1p
WL82D	Bulb MES 24V	22p	1½p
LL15R	240V Inspection Lamp	£2.95	22p
LQ10L	Portable Lamp	£7.29	54p
LQ11M	12V Tube	£1.20	9p
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XQ15R	Bulkhead	£1.30	9½p
XQ16S	Festoon Harness Kit	£12.00	89p
XQ17T	20-Way Fest Harness	£18.23	£1.35
HB52G	Rd Bulb Blue	59p	4½p
HB53H	Rd Bulb Green	59p	4½p
HB54J	Rd Bulb Red	59p	4½p
HB55K	Rd Bulb White	59p	4½p
HB56L	Rd Bulb Yellow	59p	4½p
XQ18U	Fibre Optic Lamp	£33.92	£2.51
XQ19V	Fibre Optic Table Sml	£89.35	£6.62
XQ20W	Fibre Optic Table Lrg	£127.00	£9.41
XQ21X	M39 6V TH Lamp	£6.33	47p
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FH97F	SPST Ultra Min Toggle	64p	4½p
FH98G	SPDT Ultra Min Toggle	74p	5½p
FH99H	DPDT Ultra Min Toggle	78p	6p
FH00A	Sub-Min Toggle A	69p	5p
FF70M	Sub-Min Toggle J	99p	7½p
FH01B	Sub-Min Toggle B	79p	6p
FH02C	Sub-Min Toggle C	£1.09	8p
FH03D	Sub-Min Toggle D	£1.09	8p
FH04E	Sub-Min Toggle E	90p	6½p

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FF71N	Sub-Min Toggle K	£1.39	10½p
FH05F	Sub-Min Toggle F	99p	7½p
FH06G	Sub-Min Toggle G	£1.59	12p
FH07H	Sub-Min Toggle H	£1.58	11½p
FF72P	Sub-Min Toggle L	£1.39	10½p
FH08J	4-Pole SM Toggle	£2.05	15p
FH29G	Min SP Toggle	88p	6½p
FH39N	Toggle Sw	47p	3½p
FH10L	Std Toggle SPST	39p	3p
FH11M	Std Toggle SPDT	39p	3p
FH12N	Std Toggle DPDT	47p	3½p
FH16S	H/D Toggle Type 3	£1.07	8p
FH17T	H/D Toggle Type 4	£1.55	11½p
FH18U	H/D Toggle Type 7	87p	6½p
FH19V	H/D Toggle Type 8	£1.38	10p
FH20W	H/D Toggle Type 9	£1.49	11p
FH13P	Duck Bill Toggle	32p	2½p
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FH14Q	Long Arm Tgl Locking	50p	3½p
FH15R	Long Arm Tgl Flasher	68p	5p
FH21X	Hekla Switch Black	37p	2½p
FH22Y	Hekla Switch Blue	37p	2½p
FH23A	Hekla Switch Green	37p	2½p
FH24B	Hekla Switch Lumin	37p	2½p
FH25C	Hekla Switch Red	37p	2½p
FH26D	Hekla Switch White	37p	2½p
FH27E	Hekla Switch Yellow	37p	2½p
FH30H	SPST Rocker	39p	3p
FH31J	SPDT Rocker	42p	3p
FH32K	Rocker Neon	73p	5½p
FH33L	Rocker Sw DP	73p	5½p
FH34M	DPDT Rocker	99p	7½p
FF77J	SP Slide	8p	½p
FH35Q	Sub-Min Slide	15p	1p
FF79L	Long Chrome Slide	15p	1p
FH36P	STD Slide Sw	15p	1p
FH38R	4-Pole Slide	75p	5½p
FF73Q	Rotary Sw12B	44p	3½p
FF74R	Rotary Sw6B	44p	3½p
FF75S	Rotary Sw4B	44p	3½p
FF76H	Rotary Sw3B	44p	3½p
FH42V	Rotary Sw12	44p	3½p
FH43W	Rotary Sw6	44p	3½p
FH44X	Rotary Sw4	44p	3½p
FH45Y	Rotary Sw3	44p	3½p
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FH46A	Maka Shaft	79p	6p
FH47B	Maka Wafer 1p 12w	62p	4½p
FH48C	Maka Wafer 2p 6w	62p	4½p
FF81C	Maka Wafer 2p 9w	62p	4½p
FH49D	Maka Wafer 3p 5w	62p	4½p
FH50E	Maka Wafer 4p 3w	62p	4½p
FH51F	Maka Wafer 6p 2w	62p	4½p
FH52G	Maka Wafer 1p 12wMB	62p	4½p
FH53H	Maka Wafer 2p 6wMB	62p	4½p
FF82D	Maka Wafer 2p 9wMB	62p	4½p
FH54J	Maka Mains	49p	3½p
FH55K	Maka Screen	4p	½p
FH40T	Key Switch	£3.99	29½p
FH57M	Rotary Mains	48p	3½p
FF83E	Thumbwheel Decimal	£2.44	18p
FF84F	Thumbwheel BCD	£2.44	18p
FF85G	Thumbwheel Spacer	32p	2½p
FF86T	Thumbwheel Mtg Kit	54p	4p
FF87U	Click Switch	15p	1p
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FF88V	Click Cap Black	5p	½p
FF89W	Click Cap Blue	5p	½p
FF90X	Click Cap Green	5p	½p
FF91Y	Click Cap Grey	5p	½p
FF92A	Click Cap Ivory	5p	½p
FF93B	Click Cap Red	5p	½p
FF94C	Click Cap White	5p	½p
FF95D	Click Cap Yellow	5p	½p
FF61R	Keyboard Switch	15p	1p
FF62S	Keytop 1 Position	7p	½p
FF63T	Keytop 2 Position	16p	1p
FF64U	Keytop 3 Position	48p	3½p
FF65V	ASCII Transparency	£1.20	9p
FH59P	Push Sw	15p	1p
FF96E	Square Push Black	59p	4½p
FF97F	Square Push Green	59p	4½p
FF98G	Square Push Red	59p	4½p
FF99H	Square Push Yellow	59p	4½p
FH60Q	Break Push	22p	1½p
FH41U	Pushlock SPCO	94p	7p
FH66W	Pushlock DPCO	99p	7½p
FH94C	Pressil Sw	12½p	1p
FH91Y	Motor-Start Press	35p	2½p
FH92A	Press Toe Sw Type 1	£1.39	10½p
FH93B	Press Toe Sw Type 2	£1.89	14p
FH37S	Mains Push	55p	4p
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FH67X	Latchswitch 2-Pole	30p	2p
FH68Y	Latchswitch 4-Pole	36p	2½p
FH69A	Latchswitch 6-Pole	49p	3½p
FH70M	Latchswitch 8-Pole	67½p	5p
FH71N	Latchswitch 10-Pole	78p	6p
BW11M	Latchsoft 2-Pole	32p	2½p
BW12N	Latchsoft 4-Pole	37p	2½p
FH72P	Latchdummy	23p	1½p
FH74R	Mains Latchswitch	78p	6p
FH75S	Latchbracket Single	10p	½p
FH76H	Latchbracket 2-Way	26p	2p
FH78K	Latchbracket 4-Way	29p	2p
FH80B	Latchbracket 6-Way	33p	2½p
FH82D	Latchbracket 8-Way	40p	3p
FH84F	Latchbracket 10-Way	46p	3½p
Page 89			
FL31J	Rd Latchbutton Black	8p	½p
FL32K	Rd Latchbutton Green	8p	½p
FL33L	Rd Latchbutton Grey	8p	½p
FL34M	Rd Latchbutton Red	8p	½p
FL35Q	Rd Latchbutton White	8p	½p
FL36P	Rd Latchbutton Chrm	21p	1½p
BW13P	Sm Latchbutton Black	8p	½p
BW14Q	Sm Latchbutton Chrm	25p	2p
FH61R	Rct Latchbutton Black	8p	½p
FH62S	Rct Latchbutton Grey	8p	½p
FH63T	Rct Latchbutton Red	8p	½p
FH64U	Rct Latchbutton White	8p	½p
FH65V	Rct Latchbutton Chrm	22p	1½p
FH87U	Magiclight Btn Blue	32p	2½p
FH88V	Magiclight Btn Green	32p	2½p
FH89W	Magiclight Btn Orange	32p	2½p
FH90X	Magiclight Btn Yellow	32p	2½p
BW15R	Latchbush Blue	33p	2½p
BW16S	Latchbush Green	33p	2½p
BW17T	Latchbush Orange	33p	2½p
BW18U	Latchbush Yellow	33p	2½p
FH95D	Roller Microswitch	47p	3½p
FH96E	Microswitch	Discontinued	

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Page 90			
FX23A	Open Relay 6V	£2.21	16½p
FX24B	Open Relay 12V	£2.78	20½p
FX26D	2-Pole S-Min Rly 6V	£2.60	19½p
FX27E	2-Pole S-Min Rly 12V	£2.12	15½p
FX28F	2-Pole S-Min Rly 24V	£2.22	16½p
FX30H	4-Pole S-Min Rly 12V	£2.49	18½p
HY20W	Relay Flat 12V	£1.80	13½p
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FX44X	Plug-In Relay 6V	£2.99	22p
FX45Y	Plug-In Relay 12V	£2.99	22p
FX46A	Plug-In Relay 24V	£3.07	22½p
FX47B	Plug-In Relay 230V AC	£3.85	28½p
FX48C	Power Relay 12V	£2.69	20p
FX49D	Power Relay 230V AC	£3.78	28p
YB89W	Car Relay Single	£4.37	32½p
YB90X	Car Relay Dual	£3.40	25p
FX50E	Reed Relay 6 to 9V	91p	6½p
FX51F	Reed Relay 9 to 12V	91p	6½p
FX73Q	Reed Relay 12 to 18V	91p	6½p
FX74R	Reed Relay 18 to 30V	£1.14	8½p
Page 92			
FX88V	DIL Rd Rly 1-Pole 5V	£2.26	16½p
FX89W	DIL Rd Rly 1-Pole 12V	£2.78	20½p
FX90X	DIL Rd Rly 2-Pole 5V	£5.80	43p
FX91Y	DIL Rd Rly 2-Pole 12V	£5.80	43p
FX92A	DIL Reed Relay 1-Pole C/O 5V	£6.90	51p
FX93B	DIL Reed Relay 1-Pole C/O 12V	£8.99	66½p
FX68Y	Reed Sw Std	73p	5½p
FX69A	Reed Sw Compact	£1.33	10p
FX70M	Reed Sw Miniature	62p	4½p
FX71N	Magnet Small	24½p	2p
FX72P	Magnet Large	32p	2½p
HB13P	Sw Former Stan One	52p	4p
HB14Q	Sw Former Stan Two	52p	4p
HB15R	Sw Former Comp One	52p	4p
HB16S	Sw Former Comp Two	52p	4p
HB17T	Sw Former Min One	52p	4p
HB18U	Sw Former Min Two	52p	4p
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FL00A	SRBP 0.1in Type 1	57p	4p
FL01B	SRBP 0.1in Type 2	36p	2½p
FL02C	SRBP 0.1in Type 3	54p	4p
FL03D	SRBP 0.15in Type 1	45p	3½p
FL04E	SRBP 0.15in Type 2	Discontinued	
FL05F	SRBP 0.15in Type 3	37p	2½p
FL06G	Vero 14354	14p	1p
FL07H	Vero 10345	56p	4p
FL08J	Vero 10346	48p	3½p
FL09K	Vero 10347	64p	4½p
FL10L	Vero 10348	60p	4½p
FL53H	Vero 10401	£2.10	15½p
FL12N	Vero 53P16	13p	1p
FL13P	Vero 42P16	51p	4p
FL14Q	Vero 43P16	37p	2½p
FL15R	Vero 45P16	68p	5p
FL16S	Vero 46P16	54p	4p
FL25C	Tool 2022	89p	6½p
FL26D	Tool 2150	98p	7½p
FL27E	Tool 2151	£1.22	9p
FL17T	Verostrip 0.1in	56p	4p
FL18U	Verostrip 0.15in	53p	4p
HQ48C	Vero V-D Board	89p	6½p
FL19V	DIP Board	£2.73	20p
WQ14Q	PCB Conns 45°	4p	½p
WQ15R	PCB Conns Vertical	4p	½p
WQ16S	PCB Conns Horiz	4p	½p
FL20W	Pin 2140	42p	3p
FL21X	Pin 2141	42p	3p
FL23A	Pin 2144	40p	3p
FL24B	Pin 2145	40p	3p
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FL80B	Pin 0266 per 10	23p	1½p
FL81C	Pin 1657 per 10	28p	2p
FL82D	Track Pin	45p	3½p
†WF15R	S-Dec	£2.44	18p
FL28F	4-Way Tag	6p	½p
FL29G	Mtg Strip	13½p	1p
FL11M	Tag Board	43p	3p
†WF16S	T-Dec	£4.55	33½p
†WF21X	μ-Dec A	£4.85	36p
†LY00A	μ-Dec 'B'	£7.90	58½p
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†HX85G	DIL Holder	£1.59	12p
†HX86T	DIL Holder with Skt	£1.80	13½p
FL83E	Edge Conn 108	34p	2½p
FL84F	Edge Conn 118	63p	4½p
FL85G	Edge Conn 124	74p	5½p
FL86T	Edge Conn 132	£1.21	9p
FL87U	Edge Conn 140	£1.51	11p
FL88V	Edge Conn 156	34p	2½p
FL89W	Edge Conn 1512	48p	3½p
FL90X	Edge Conn 1516	63p	4½p
FL91Y	Edge Conn Feet G	12p	1p
FL92A	Edge Conn Feet H	12p	1p
FL93B	Edge Conn Feet L	12p	1p
FL30H	Edge Conn Silver	79p	6p
XB90X	Fixircuit	£7.95	59p
XB43W	Seno Etch System	£3.99	29½p
Page 96			
XY10L	UV Exposure Box	£38.80	£2.87
BW19V	Photo-Etch PCB	£2.20	16½p
BW20W	Photo-Etch Dirftg Pk	£1.43	10½p
XX12N	Etch Crystals	69p	5p
WF10L	Etcher Fluid	£1.05	8p
HX02C	PCB Pen	93p	7p
HX03D	Resist Remover	41p	3p
HX00A	PCB SRBP Sml Single	27p	2p
WF38R	PCB SRBP Med Single	48p	3½p
WF39N	PCB SRBP Lrg Single	74p	5½p
HX01B	PCB F Gls Sm Single	79p	6p
WF40T	PCB F Gls Med Single	£1.08	6p
WF41U	PCB F Gls Lrg Single	£1.74	13p
WF42V	PCB F Gls Med Dble	£1.12	8½p
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BW21X	Track Tape 31	48p	3½p
BW22Y	Track Tape 40	48p	3½p
BW23A	Track Tape 50	48p	3½p
BW24B	Track Tape 62	53p	4p
BW25C	Track Tape 80	53p	4p
BW26D	Track Tape 100	53p	4p
BW27E	Track Tape 125	68p	5p
BW28F	Track Tape 150	68p	5p
BW29G	Track Tape 200	68p	5p
BW30H	Pad 075	82p	6p
BW31J	Pad 100	82p	6p
BW32K	Pad 125	82p	6p
BW33L	Pad 150	82p	6p
BW34M	Pad 200	82p	6p
BW35Q	Pad 300	£1.18	8½p

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BW36P	Pad 400	£1.40	10½p
BW37S	Pad 500	£1.76	13p
BW38R	Pad 600	£2.30	17p
BW39N	IC Pads 100	£1.70	12½p
BW40T	IC Pads 200	£2.50	18½p
BW41U	Drafting Template	68p	5p
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XQ22Y	Mushkiller FM224	£7.20	80p
XQ23A	Mushkiller FM234T	£10.50	£1.17
XQ24B	Mushkiller FM235T	£10.50	£1.17
XQ25C	Mushkiller FM244T	£11.50	£1.28
XQ26D	Mushkiller FM255T	£13.50	£1.50
XQ27E	Mushkiller FM264T	£17.50	£1.94
XQ28F	Mushkiller FM284T	£22.50	£2.50
XQ29G	Trucolour TC13 Grp A	£5.80	64½p
QX30H	Trucolour TC10 Grp B	£5.80	64½p
XQ31J	Trucolour TC10 Grp C/D	£5.80	64½p
XQ32K	Trucolour TC13 Grp A	£6.90	76½p
XQ33L	Trucolour TC13 Grp B	£6.90	76½p
XQ34M	Trucolour TC13 Grp C/D	£6.90	76½p
XQ35Q	Trucolour TC18 Grp A	£8.00	89p
XQ36P	Trucolour TC18 Grp B	£8.00	89p
XQ37S	Trucolour TC18 Grp C/D	£8.00	89p
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XQ38R	Extragain XG5	£10.00	£1.11
XQ39N	Extragain XG8 Grp A	£14.50	£1.61
XQ40T	Extragain XG8 Grp B	£14.50	£1.61
XQ41U	Extragain XG8 Grp C/D	£14.50	£1.61
XQ42V	Extragain XG8 Wdbnd	£14.50	£1.61
XQ43W	Extragain XG14 Grp A	£26.00	£2.89
XQ44X	Extragain XG14 Grp B	£26.00	£2.89
XQ45Y	Extragain XG14 Grp C/D	£26.00	£2.89
XQ46A	Extragain XG14 Wdbd	£26.00	£2.89
XQ47B	Extragain XG21 Grp A	£39.00	£4.33
XQ48C	Extragain XG21 Grp B	£39.00	£4.33
XQ49D	Extragain XG21 Grp C/D	£39.00	£4.33
XQ50E	Extragain XG21 Wdbd	£39.00	£4.33
XQ51F	Super Set-Top	£5.50	61p
XQ52G	Caratenna CA7	£6.30	70p
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BW42V	Uni Clamp Type 1	95p	10½p
BW43W	Mast Bkt Type 2	£1.35	15p
XQ53H	Mast Bkt Type 3	£3.90	43½p
XQ54J	Mast Bkt Type 8	£6.30	70p
BW44X	Mast Bkt Type 14	£2.16	24p
BW45Y	Loft Bkt EM4	£2.60	29p
XQ55K	Lashing Kit Type 4	£4.30	48p
XQ56L	Lashing Kit Type 6	£8.60	96p
XQ57M	Lashing Kit Type 8	£8.50	94½p
XQ58N	Lashing Kit Type 9	£5.80	64½p
XQ59P	Mast C	£2.10	23½p
XQ60Q	Mast D	£2.10	23½p
XQ61R	Mast E	£3.90	43½p
XQ62S	Mast G	£8.90	99p
XQ63T	Mast M	£3.40	38p
XQ64U	Mast R	£5.50	61p
BW46A	Masthead Amp MA102 Group A	£13.20	£1.47
BW47B	Masthead Amp MA102 Group B	£13.20	£1.47
BW48C	Masthead Amp MA102 Group C/D	£13.20	£1.47
BW49D	Masthead Amp MA102 VHF	£13.20	£1.47
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BW50E	Power Unit PU102	£11.20	£1.24
BW51F	Diplexer UF2	£2.80	31p
BW52G	Splitter CS100	£5.95	66p
BW53H	Splitter SB2	£1.89	21p
HX88V	Aerial Splitter SB11	£1.49	16½p
HX87U	Surface Co-Ax Outlet	79p	9p
BW54J	Sface Co-Ax Dbl Outlet	£1.49	16½p
BW55K	Flush Co-Ax Outlet	£1.46	16p
BW56L	Fish Dble Co-Ax Otlt	£1.79	20p
BW57M	TV/FM Outlet	£2.59	29p
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BW58N	Aerial Switch	£2.48	27½p
LB09K	75/300 Balun	£2.45	27p
BW59P	Attenuator 6dB	£1.07	12p
BW60Q	Attenuator 12dB	£1.07	12p
BW61R	Attenuator 18dB	£1.07	12p
LB11M	FM Tape Aerial	46½p	5p
LB07H	Ferrite Rod 538	33p	3½p
LB08J	Ferrite Rod 638	42p	4½p
LB15R	Ferrite Rod 612	80p	9p
LB16S	Ferrite Rod 816	39p	4½p
LB12N	MW/LW Aerial	£1.22	13½p
LB10L	Telescopic Aerial 4ft	80p	9p
XB54J	Aerial Rotator	£59.80	£6.64
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XQ65V	Kulrod W490	£2.90	32p
XQ66W	Q Rod	£1.40	15½p
XQ67X	Collinear LMC4200	£8.90	99p
XQ68Y	Collinear LMC4500	£8.90	99p
BW62S	Mag Mount	£10.95	£1.22
BW63T	Gutter Clamp	£5.90	65½p
BW64U	Boot-Lid Clip	£5.77	64p
BW65V	Larsen L Bracket	£4.68	52p
BW66W	NLA Mount	£2.55	28½p
XQ69A	LM150 Kit	£9.95	£1.11
XQ70M	NLA150 Kit	£16.54	£1.84
BW67X	Larsen Allen Key	10p	1p
BW68Y	Larsen Grub Screw	8p	1p
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YB00A	Low-Pass RF Filter	£4.39	49p
YB01B	RF Antenna Switch	£5.48	61p
YB02C	SWR Power Meter	£17.82	£1.98
YB03D	SWR FS Meter	£10.65	£1.18
YB04E	Grid Dip Meter	£34.90	£3.88
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LB40T	9.5 Coil Former	50p	3½p
LB17T	Former 351	6½p	½p
LB18U	Former 450	6½p	½p
LB19V	Former 722/1	6½p	½p
LB20W	Former 722/2	6½p	½p
LB21X	Former 722/8	6½p	½p
LB22Y	Former 722/4	6½p	½p
LB41U	Dust Core Type 4	4½p	½p
LB42V	Dust Core Type 6	5½p	½p
LB43W	Dust Core Type 8	7½p	½p
LB44X	Former Base	6½p	½p
LB36P	Screening Can 10	6½p	½p

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LB37S	Screening Can 13	6½p	½p
LB39N	Screening Can 15	6½p	½p
LB38R	Screening Can 14	6½p	½p
LB61R	Denfix	98p	7½p
LB62S	A/P Beads	20p	1½p
HX05F	Small Pot Core	42p	3p
HX06G	Core Type 2	77p	5½p
HX07H	Bobbin Type 2	36p	2½p
HX08J	Clips Type 2	3p	—
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HX09K	Type 3 Core	89p	6½p
HX10L	Type 3 Bobbin	36p	2½p
HX11M	Type 3 Clips	4p	½p
HX12N	Large Pot Core	69p	5p
HX13P	Bobbin Type 4	8p	½p
HX14Q	Mtg System Type 4	38p	3p
HW23A	GE Coil L15	£1.63	12p
HX58N	GE Coil L9	£1.63	12p
HX57M	GE Coil L8	£1.63	12p
HW24B	GE Coil L14	£1.63	12p
HX56L	GE Coil L7	£1.63	12p
HX55K	GE Coil L6	£1.63	12p
HX54J	GE Coil L5	£1.75	13p
HW25C	GE Coil L12	£1.75	13p
HW26D	GE Coil L11	£1.75	13p
HX24B	Choke 0.5H	89p	6½p
HX25C	Choke 1H	89p	6½p
HX26D	Choke 2H	89p	6½p
HX27E	Choke 4H	89p	6½p
LR07H	Mixer Pot Core	£1.69	12½p
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HW27E	Choke 10H	£1.20	9p
HX20W	Audio Choke 0.5mH	£1.69	12½p
HX21X	Audio Choke 1mH	£1.69	12½p
WH25C	Choke 0.22μH	31p	2½p
WH26D	Choke 0.33μH	31p	2½p
WH27E	Choke 0.47μH	31p	2½p
WH28F	Choke 0.68μH	31p	2½p
WH29G	Choke 1.0μH	31p	2½p
WH30H	Choke 1.5μH	31p	2½p
WH31J	Choke 2.2μH	31p	2½p
WH32K	Choke 3.3μH	31p	2½p
WH33L	Choke 4.7μH	31p	2½p
WH34M	Choke 6.8μH	31p	2½p
WH35Q	Choke 10.0μH	31p	2½p
WH36P	Choke 15.0μH	31p	2½p
WH37S	Choke 22.0μH	31p	2½p
WH38R	Choke 33.0μH	31p	2½p
WH39N	Choke 47.0μH	31p	2½p
WH40T	Choke 68.0μH	31p	2½p
WH41U	Choke 100μH	31p	2½p
WH42V	Choke 150μH	37p	2½p
WH43W	Choke 220μH	37p	2½p
WH44X	Choke 330μH	37p	2½p
WH45Y	Choke 470μH	37p	2½p
WH46A	Choke 680μH	37p	2½p
WH47B	Choke 1mH	37p	2½p
HW28F	Choke 5μH HC	45p	3½p
HX15R	Choke 1.5mH	38p	3p
HX16S	Choke 2.5mH	38p	3p
HX17T	Choke 5mH	45p	3½p
HX18U	Choke 7.5mH	50p	3½p
HX19V	Choke 10mH	52p	4p
HX22Y	Choke RFC5	£1.13	8½p
HX23A	Choke RFC9A	£1.35	10p
HX29G	Crystal Set Coil PCC1	87p	9½p
HX42V	Toko YRCS11098	35p	4p
HX43W	Toko YHCS11100	35p	4p
HX97F	Toko ACS34342	33p	3½p
HX98G	Toko ACS34343	33p	3½p
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HX69A	Trans Coil 1T Blue	£1.29	14½p
HX70M	Trans Coil 1T Red	£1.15	13p
HX71N	Trans Coil 1T White	£1.15	13p
HX72P	Trans Coil 1T Yellow	£1.29	14½p
HX73Q	Trans Coil 2T Blue	£1.15	13p
HX74R	Trans Coil 2T Red	£1.15	13p
HX75S	Trans Coil 2T White	£1.15	13p
HX76H	Trans Coil 2T Yllw	£1.15	13p
HX77J	Trans Coil 3T Blue	£1.15	13p
HX78K	Trans Coil 3T Red	£1.15	13p
HX79L	Trans Coil 3T White	£1.15	13p
HX80B	Trans Coil 3T Yellow	£1.15	13p
HX89W	Trans Coil 4T Blue	£1.15	13p
HX90X	Trans Coil 4T Red	£1.15	13p
HX91Y	Trans Coil 4T White	£1.15	13p
HX92A	Trans Coil 4T Yellow	£1.15	13p
HX93B	Trans Coil 5T Blue	£1.15	13p
HX94C	Trans Coil 5T Red	£1.15	13p
HX95D	Trans Coil 5T White	£1.15	13p
HX96E	Trans Coil 5T Yellow	£1.15	13p
LB00A	IFT 13	89p	10p
LB01B	IFT 14	98p	11p
LB02C	IFT 15	£1.13	12½p
LB03D	IFT 16	92p	10p
LB04E	IFT 17	79p	9p
LB05F	IFT 18 465kHz	£1.23	13½p
LB06G	IFT 18 1.6MHz	£1.23	13½p
HX28F	Toc 1	92p	10p
HX99H	Ceramic Ftr 10.7MHz	54p	6p
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FY77J	FS Crystal 100kHz	£3.75	28p
HX62S	FS Crystal 1MHz	£4.95	36½p
FY78K	FS Crystal 10MHz	£2.64	19½p
FY79L	MP Crystal 1MHz	£3.74	27½p
FY80B	MP Crystal 2MHz	£1.60	12p
FY81C	MP Crystal 2.4576MHz	£2.64	19½p
FY82D	MP Crystal 4MHz	£2.64	19½p
FY83E	MP Crystal 6.144MHz	£2.64	19½p
FY84F	MP Cryst 18.432MHz	£2.75	20½p
HX30H	MCR Cryst Prs Brown	£2.89	32p
HX31J	MCR Cryst Prs Red	£2.89	32p
HX32K	MCR Cryst Prs Orange	£2.89	32p
HX33L	MCR Cryst Prs Yellow	£2.89	32p
HX34M	MCR Cryst Prs Green	£2.89	32p
HX35Q	MCR Cryst Prs Blue	£2.89	32p
FY85G	Colour TV Crystal	99p	11p
FY86T	Crystal 50Hz x 2"	£2.59	19p
FY87U	Crystal 1Hz x 2"	£2.59	19p
HX60Q	Crystal Socket 25u	10p	½p
HX61R	Crystal Socket 6u	16p	1p
HW13P	Mains Trans Supp	44p	3½p
HW04E	RF Supp Choke 1A	17p	1½p
HW05F	RF Supp Choke 2A	19p	1½p
HW06G	RF Supp Choke 3A	25½p	2p
HW07H	Delta Cap	98p	7½p
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WB00A	Sub-Min Tr 6V	£1.22	9p
WB01B	Sub-Min Tr 9V	£1.22	9p
WB02C	Sub-Min Tr 12V	£1.22	9p
WB28F	Clock Transformer	£1.75	13p
WB06G	Min Tr 6V	£1.99	14½p

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WB11M	Min Tr 9V	£2.35	17½p
WB10L	Min Tr 12V	£1.99	14½p
WB15R	Min Tr 15V	£1.99	14½p
LY03D	Tr 10VA 15V	£2.60	19p
WB16S	Min Tr 20V	£1.99	14½p
WB20W	Min Tr 24V	£1.99	14½p
WB21X	Min Tr 36V	£1.99	14½p
LW34M	15/22V Power Tran	£8.30	61½p
WB25C	Tr 12V 1A	£3.09	23p
WB26D	Tr 12V 2A	£3.98	29½p
WB03D	Tr 9V1½A	£4.10	30½p
WB12N	Tr 20V 1A	£5.76	42½p
WB17T	Tr 28V 1½A	£5.69	42p
XB38R	Tr 32032/6½A	£13.99	£1.04
HX59P	Transformer Mtg Plate	49p	3½p
Page 113			
WB07H	Tr 34V 1A	£5.69	42p
WB22Y	Tr 34V HP	£5.62	41½p
LW33L	Tr 240V isotran	£2.65	19½p
HX82D	Min Tr LT44	36½p	2½p
LB14Q	Min Tr LT700	34½p	2½p
HX81C	Pulse Transformer	£1.59	12p
HW29G	Min Motor Small	29p	2p
HW30H	Min Motor Large	35p	2½p
YB05F	Motor Pulley Set	£1.65	12p
YB06G	Motor Gear Set	£1.75	13p
Page 114			
HF25C	Croc Clips	12p	1p
HF23A	Alligator Clip Black	6p	½p
HF24B	Alligator Clip Red	6p	½p
HF26D	Charger Clip	11p	1p
BW69A	Croc Lead Kit	£1.15	8½p
HF10L	Push-On Receptacle	22½p	1½p
HF11M	Push-On Covers	21p	1½p
HF02C	Terminal Post Black	21p	1½p
HF03D	Terminal Post Blue	23p	1½p
HF04E	Terminal Post Brown	23p	1½p
HF05F	Terminal Post Green	23p	1½p
HF06G	Terminal Post Grey	23p	1½p
HF07H	Terminal Post Red	21p	1½p
HF08J	Terminal Post White	23p	1½p
HF09K	Terminal Post Yellow	23p	1½p
HF13P	Press Terminal Black	16p	1p
HF14Q	Press Terminal Blue	16p	1p
HF15R	Press Terminal Green	16p	1p
HF16S	Press Terminal Red	16p	1p
HF17T	Press Terminal White	16p	1p
HF18U	Press Terminal Yellow	16p	1p
BW70M	Qkterm Push 2-Way	NYA	
BW71N	Qkterm Push 4-Way	40p	3p
BW72P	Qkterm Lever 2-Way	52p	4p
BW73	Qkterm Lever 4-Way	NYA	
HF19V	Test Prod Black	32p	2½p
HF20W	Test Prod Red	32p	2½p
HF21X	Probe Clips	41p	3p
Page 115			
HF30H	Pistol Probe Black	64p	4½p
HF31J	Pistol Probe Red	64p	4½p
HF22Y	Lo-Cost Test Probe	69p	5p
HF32K	Moulded Test Probe	79p	6p
HF33L	4mm Test Probe	£1.29	9½p
WL57M	1mm Plug Black	6½p	½p
WL58N	1mm Plug Red	6½p	½p
WL59P	1mm Socket Black	7p	½p
WL60Q	1mm Socket Red	7p	½p
HF38R	2mm Plug Black	22p	1½p
HF39N	2mm Plug Blue	22p	1½p
HF40T	2mm Plug Green	22p	1½p
HF41U	2mm Plug Red	22p	1½p
HF42V	2mm Plug White	22p	1½p
HF43W	2mm Plug Yellow	22p	1½p
HF44X	2mm Socket Black	23p	1½p
HF45Y	2mm Socket Blue	23p	1½p
HF46A	2mm Socket Green	23p	1½p
HF47B	2mm Socket Red	23p	1½p
HF48C	2mm Socket White	23p	1½p
HF49D	2mm Socket Yellow	23p	1½p
HF50E	Wander Plug Black	7p	½p
HF51F	Wander Plug Blue	7p	½p
HF52G	Wander Plug Green	7p	½p
HF53H	Wander Plug Red	7p	½p
HF54J	Wander Plug White	7p	½p
HF55K	Wander Plug Yellow	7p	½p
HF56L	Wander Socket Black	8p	½p
HF57M	Wander Socket Blue	8p	½p
HF58N	Wander Socket Green	8p	½p
HF59P	Wander Socket Red	8p	½p
HF60Q	Wander Socket White	8p	½p
HF61R	Wander Socket Yellow	8p	½p
HF62S	4mm Plug Black	12p	1p
HF63T	4mm Plug Blue	12p	1p
HF64U	4mm Plug Brown	12p	1p
HF65V	4mm Plug Green	12p	1p
HF66W	4mm Plug Red	12p	1p
HF67X	4mm Plug White	12p	1p
HF68Y	4mm Plug Yellow	12p	1p
HF69A	4mm Socket Black	13p	1p
HF79M	4mm Socket Blue	13p	1p
HF71N	4mm Socket Brown	13p	1p
HF72P	4mm Socket Green	13p	1p
HF73Q	4mm Socket Red	13p	1p
HF74R	4mm Socket White	13p	1p
HF75S	4mm Socket Yellow	13p	1p
HF34M	4mm Patch Cord	£1.35	10p
HQ54J	Scrw-Cap Phono Blk	8½p	1p
HQ55K	Scrw-Cap Phono Blue	8½p	1p
HQ56L	Scrw-Cap Phono Grn	8½p	1p
HQ57M	Scrw-Cap Phono Grey	8½p	1p
HQ58N	Scrw-Cap Phono Red	8½p	1p
HQ59P	Scrw-Cap Phono Wht	8½p	1p
HQ60Q	Scrw-Cap Phono Yllw	8½p	1p
HH01B	Scr Phono	12½p	1½p
Page 116			
HH02C	Phono Skt Single	5½p	½p
HH03D	Phono Skt Twin	9p	1p
BW74R	Phono Skt Quad	20p	2p
BW75S	Phono Skt 5-Way	22p	2½p
BW76H	Phono Skt 6-Way	25p	3p
BW77J	Phono Skt 8-Way	34p	4p
HH04E	Line Phono	14½p	1½p
HH05F	Phono Conn	32½p	3½p
HF76H	2.5 Plug Plas	9p	½p
HF77J	2.5 Plug Scr	17p	1½p
HF78K	2.5 Jack Skt	11p	1p
HF79L	2.5 Line Skt	17p	1½p
HF80B	Plug Plas 3.5	11p	1p
HF81C	Plug Scr 3.5	18p	1½p
HF82D	Jack Skt3.5	8p	½p
HF83E	Line Skt Plas 3.5	11p	1p
HF84F	Line Skt Scr 3.5	19p	1½p
HF85G	Jack Plug Plas	16p	1p
HF86T	Side Jack Plas	43p	3p
HF87U	Jack Plug Scr	27p	2p

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HF88V	Jack Pl Sto Plas	25p	2p
HF89W	Jack Pl Sto Scr	39p	3p
HF90X	Jack Skt Brk	18p	1½p
BW78K	Chro Mono Jack Skt	26p	2p
HF91Y	Jack Skt Open	15p	1p
HF92A	Jack Skt Sto	22p	1½p
BW79L	Chro Stereo Jack Skt	26p	2p
HF93B	Stereo Open Skt	17p	1½p
BW80B	DPDT Jack Socket	N/A	
HH19V	Line Jack Plas	17p	1½p
HH20W	Scr Line Jack	35p	2½p
HH21X	Stereo Line Skt	25½p	2p
HH22Y	Scr Stereo Line Skt	49p	3½p
HH23A	Recess Plate	6p	½p
HH07H	Co-ax Plug Aly	17p	2p
HH06G	Co-ax Plug Plas	9p	1p
HH08J	Co-ax Socket Pan	16p	2p
HH09K	Co-ax Socket Flush	28p	3p
HH11M	Co-ax Conn	9p	1p
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HH13P	Skeleton Car Plug	14p	1½p
HH12N	Car Plug Plas	29p	3p
HH14Q	Chassis Car Socket	14p	1½p
HH15R	Car Line Socket	29p	3p
HH16S	FM Aerial Plug	13p	1½p
HH17T	BNC Plug 50Ω	95p	7p
HH18U	BNC Socket 50Ω	85p	6½p
BW81C	Plug PL259	39p	3p
BW82D	UHF Reducer Small	14p	1p
BW83E	UHF Reducer Large	14p	1p
BW84F	UHF Socket Round	44p	3½p
BW85G	Socket SO239	36p	2½p
BW86T	UHF Elbow Adaptor	97p	7p
BW87U	UHF Straight Adaptor	44p	3½p
BW88V	UHF T Adaptor	£1.19	9p
Page 119			
BW89W	XLR Line Plug	£1.39	10½p
BW90X	XLR Chassis Socket	£1.98	14½p
BW91Y	XLR Line Socket	£1.59	12p
BW92A	XLR Chassis Plug	£1.05	8p
BW93B	Dinlatch 3-pin Plug	65p	7p
BW94C	Dinlatch 5-pin A Plug	78p	8½p
BW95D	Dinlatch In-line 3-pin	80p	9p
BW96E	Dinlatch In-line 5-pin A	80p	9p
BW97F	Dinlatch Socket 3-pin	33p	3½p
BW98G	Dinlatch Socket 5-pin A	39p	4½p
HH24B	DIN L/S Plug	10p	1p
HH25C	DIN Plug 3-pin	10p	1p
HH26D	DIN Plug 4-pin	19p	2p
HH27E	DIN Plug 5-pin A	13½p	1½p
HH28F	DIN Plug 5-pin B	13½p	1½p
HH29G	DIN Plug 6-pin	18p	2p
HH30H	DIN Plug 7-pin	13½p	1½p
HH31J	DIN L/S Socket	7p	1p
HH32K	DIN Socket 3-pin	10p	1p
HH33L	DIN Socket 4-pin	10p	1p
HH34M	DIN Socket 5-pin A	12p	1½p
HH35Q	DIN Socket 5-pin B	12p	1½p
HH36P	DIN Socket 6-pin	12p	1½p
HH37S	DIN Socket 7-pin	10p	1p
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HH40T	DIN Line Skt 2-pin	11½p	1½p
HH41U	DIN Line Socket 3-pin	12½p	1½p
HH42V	DIN Line Socket 4-pin	13½p	1½p
HH43W	DIN Line Skt 5-pin A	16p	2p
HH44X	DIN Line Skt 5-pin B	20½p	2½p
HH45Y	DIN Line Socket 6-pin	20½p	2½p
HH46A	DIN Line Socket 7-pin	25p	3p
HH38R	Universal Plug	£1.45	10½p
HH39N	Multi-Position Plug	44p	3½p
HH47B	Multiplug 4-way	46p	3½p
HH53H	Multiplug 8-way	58p	4½p
HH54U	Multiplug 12-way	91p	6½p
HH71N	Multiplug 18-way	£1.58	11½p
HH78K	Multiplug 25-way	£1.80	13½p
HH48C	Multiskt 4-way	44p	3½p
HH54J	Multiskt 8-way	60p	4½p
HH65V	Multiskt 12-way	72p	5½p
HH72P	Multiskt 18-way	99p	7p
HH79L	Multiskt 25-way	£1.26	9½p
HH49D	Multicover 4-way	£1.32	10p
HH55K	Multicover 8-way	£1.20	9p
HH66W	Multicover 12-way	£1.29	9½p
HH73Q	Multicover 18-way	£1.29	9½p
HH80B	Multicover 25-way	£1.39	10½p
HH50E	Sidecover 4-way	£1.10	8p
HH56L	Sidecover 8-way	£1.29	9½p
HH67X	Sidecover 12-way	£1.39	10½p
HH74R	Sidecover 18-way	£1.39	10½p
HH81C	Sidecover 25-way	£1.39	10½p
HH51F	Multilatch 4-way	9p	½p
HH57M	Multilatch 8-way	9p	½p
HH68Y	Multilatch 12-way	11p	1p
HH75S	Multilatch 18-way	9p	½p
HH82D	Multilatch 25-way	19p	1½p
HH52G	Multihinge 4-way	15p	1p
HH58N	Multihinge 8-way	18p	1½p
HH69A	Multihinge 12-way	18p	1½p
HH76H	Multihinge 18-way	18p	1½p
HH83E	Multihinge 25-way	28p	2p
HH59P	Springlatch 8-way	33p	2½p
HH70M	Springlatch 12-way	34p	2½p
HH77J	Springlatch 18-way	36p	2½p
HH84F	Springlatch 25-way	29p	2p
Page 121			
HL01B	Octal Ch Plug	26p	2p
HL00A	Octal Ch Skt	26p	2p
HL02C	8-way Socket	26p	2p
HL03D	8-way Plug	21p	1½p
HF35Q	Voltage Selector Skt	29p	2p
HF37S	Voltage Selector Plug	19p	1½p
HL04E	Wafercon Plug 3-pin	8p	½p
HL05F	Wafercon Plug 4-pin	9½p	½p
HL06G	Wafercon Plug 6-pin	11p	1p
HL07H	Wafercon Plug 8-pin	14p	1p
HL08J	Wafercon Plug 12-pin	19½p	1½p
HL09K	Wafercon Skt 3-pin	7p	½p
HL10L	Wafercon Skt 4-pin	9p	½p
HL11M	Wafercon Skt 6-pin	10p	½p
HL12N	Wafercon Skt 8-pin	12p	1p
HL13P	Wafercon Skt 12-pin	19p	1½p
HL14Q	Wafercon Terminal	1p	—
Page 122			
YB07H	Patchboard Module	£18.36	£1.36
WQ00A	Mod PB Pin Black	20p	1½p
WQ01B	Mod PB Pin Blue	20p	1½p
WQ02C	Mod PB Pin Green	20p	1½p
WQ03D	Mod PB Pin Red	20p	1½p
WQ04E	Mod PB Pin White	20p	1½p
WQ05F	WPB Plug Black	55p	4p
WQ06G	WPB Plug Blue	55p	4p
WQ07H	WPB Plug Green	55p	4p
WQ08J	WPB Plug Red	55p	4p
WQ09K	WPB Plug White	55p	4p
HF00A	Patchboard	£67.85	£5.03
WL37S	Patch Plug Black	35p	2½p
WL38R	Patch Plug Blue	35p	2½p
WL39N	Patch Plug Green	35p	2½p
WL40T	Patch Plug Red	35p	2½p
WL41U	Patch Plug White	35p	2½p
WL42V	Patch Plug Yellow	35p	2½p
Page 123			
YB08J	Large Patchboard	£83.00	£6.15
WQ10L	Large Patch Plug	19p	1½p
HH60Q	Std Power Plug 2.1	11p	1p
HH61R	Long Pwr Plug 2.1	13p	1p
HH62S	Std Power Plug 2.5	11p	1p
HH63T	Long Pwr Plug 2.5	13p	1p
HH85G	Power Skt 2.1	16p	1p
HH86T	Power Skt 2.5	16p	1p
HH87U	Cassette Skt Nivico	32p	2½p
HH88V	Cassette Skt Paros	36p	2½p
HL17T	USA Mains Plug	15p	1p
HL18U	Flat Pin M/S	Discontinued	
HL19V	Flat Pin Conn	18p	1½p
HL16S	Eurosocket	74p	5½p
HL15R	Europlug	39p	3p
HL42V	Euro Facility Outlet	45p	3½p
HL43W	Euro Facility Plug	79	6p
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BW99H	Euroconn Lead	£1.30	9½p
HL20W	Mains Plug P429	34p	2½p
HL44X	Mains Socket P646	85p	6½p
HL23A	Mains Socket P430SE	59p	4½p
HL45Y	Mains Plug P649	72p	5½p
HL46A	Mains Socket P650	62p	4½p
HL47B	Mains Plug SA2403	88p	6½p
HL48C	Mains Socket SA2404	49p	3½p
HL27E	Mains Plug SA2190	32p	2½p
HL28F	Mains Socket SA1862	32p	2½p
HL49D	Mains Socket SA2111	£1.12	8½p
HL30H	Mains Plug SA2019A	80p	6p
HL31J	Mains Socket SA2020	73p	5½p
HL33L	Mains Plug SA2367	98p	7½p
HL34M	Mains Socket SA2368	54p	4p
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HL36P	Mains Plug P427	65p	5p
HL37S	Mains Socket P428	68p	5p
HL39N	Mains Plug P551	£1.78	13p
HL40T	Mains Socket P552	60p	4½p
HL50E	Sleeve 8037	6p	½p
HL51F	Boot 9455	16p	1p
HL52G	Boot 8878	20p	1½p
RW00A	Adaptor A	36p	4p
RW01B	Adaptor B	36p	4p
RW02C	Adaptor C	36p	4p
RW03D	Adaptor D	36p	4p
RW04E	Adaptor E	36p	4p
RW05F	Adaptor F	36p	4p
RW06G	Adaptor G	36p	4p
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RW07H	Adaptor H	36p	4p
RW08J	Adaptor J	36p	4p
RW09K	Adaptor K	36p	4p
RW11M	Adaptor M	36p	4p
RW12N	Adaptor N	39p	4½p
HL53H	Adaptor P	£1.34	15p
RW27E	Dinpak P	45p	5p
RW26D	Dinpak N	62p	7p
RW45Y	Dinpak 273	£1.13	12½p
RW44X	Dinpak 262	59p	6½p
RW47B	Dinpak 275	£1.26	14p
RW25C	Dinpak M	94p	10½p
RW46A	Dinpak 274	79p	9p
RW22Y	Dinpak J	58p	6½p
RW23A	Dinpak K	58p	6½p
RW24B	Dinpak L	84½p	9½p
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RW18U	Dinpak E	79p	9p
RW19V	Dinpak F	95p	10½p
RW17T	Dinpak D	£1.24	14p
RW41U	Dinpak 251	95p	10½p
RW42V	Dinpak 252	83p	9p
RW20W	Dinpak G	£1.31	14½p
RW49D	Dinpak 280	85p	9½p
RW21X	Dinpak H	£1.57	17½p
RW15R	Dinpak B	83p	9p
RW14Q	Dinpak A	84½p	9½p
RW43W	Dinpak 254	£1.20	13½p
RW40T	Dinpak 249	£1.49	16½p
RW37S	Dinpak 205	£1.18	13p
RW16S	Dinpak C	86½p	9½p
RW48C	Plugpak 279	49p	5½p
RW52G	Plugpak 289	75p	8½p
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RW54J	Plugpak 291	£1.25	14p
RW50E	Plugpak 282	89p	10p
RW51F	Plugpak 283	£2.30	25½p
RW28F	Plugpak Q	59p	6½p
RW39N	Plugpak 236	76p	8½p
RW29G	Plugpak R	£1.28	14p
RW30H	Plugpak S	£1.59	17½p
RW31J	Plugpak T	£2.39	26½p
RW32K	Plugpak V	£1.30	14½p
RW34M	Plugpak X	£1.69	19p
RW35Q	Plugpak HD Guitar	£3.17	35p
RW36P	Plugpak 200	84p	9½p
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RW56L	Cas Lead Crown	48p	5½p
RW57M	Cas Lead Hitachi	48p	5½p
RW58N	Cas Lead Nat Pan	48p	5½p
RW59P	Cas Lead Nivico	48p	5½p
RW60Q	Cas Lead Otake-Orion	48p	5½p
RW61R	Cas Lead Paros	48p	5½p
RW62S	Cas Lead Philips	48p	5½p
RW63T	Cas Lead Sanyo	48p	5½p
RW64U	Cas Lead Sharp	48p	5½p
RW65V	Cas Lead Sony	48p	5½p
RW66W	Cas Lead Teletunken	48p	5½p
HF01B	Terminal Block 5A	25p	2p
HL54J	Terminal Block 15A	69p	5p
HL55K	Terminal Block 30A	79p	6p
HL56L	Terminal Block Conn	£1.10	8p
HL57M	5 Amp Plug Nylon	44p	3½p
RW67X	13 Amp Plug Nylon	48p	3½p
HL58N	Rubber 13A Plug	67p	5p
HL59P	15A Plug Nylon	57p	4p
HL60Q	Kettle Connector	86p	6½p
HL61R	Flex Connector	68p	5p
HL62S	Mains Adaptor 2-Way	98p	7½p
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HL63T	Mains Adaptor 3-Way	£1.33	10p
HL64U	Shaver Adaptor	59p	4½p
HL65V	Junction Box Small	44p	3½p
HL66W	Junction Box Lge	49p	3½p
HL67X	Junction Box RM	63p	4½p
HL68Y	Single Skt Unswitched	90p	6½p
HL69A	Dble Skt Unswitched	£1.68	12½p
HL70M	Dble Skt Unswchd Slvr	£3.99	29½p
HL71N	Single Sw Socket	£1.15	8½p
HL72P	Double Sw Socket	£2.35	17½p
HL73Q	Trailing Skt Single	89p	6½p
HL74R	Trailing Dble Skt	£1.88	14p
RW68Y	Dis Board 4-Way	£6.20	46p
HL76H	Cooker Switch	£4.47	33p
HL77J	Neon Cooker Switch	£5.94	44p
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HL78K	Shaver Skt Isolated	£10.48	77½p
HL79L	Shaver Socket	45p	3½p
HL80B	Cooker Outlet C	98p	7½p
HL81C	Cooker Outlet T	£1.33	10p
HL82D	Flex Outlet Unswchd	£1.78	13p
HL83	Switched Flex Outlet	£1.96	14½p
HL84F	Clock Connector S	£2.15	16p
HL85G	Clock Connector B	£2.79	20½p
HL86T	Blanking Plate	34p	2½p
HL87U	20A Flatiswitch	£1.48	11p
HL88V	20A Water Htr Switch	£2.25	16½p
HL89W	Light Swch ST Single	48p	3½p
HL90X	Light Swch DT Single	59p	4½p
HL91Y	Light Swch Dual	£1.05	8p
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HL92A	Light Switch Triple	£1.56	11½p
HL93B	Light Switch Quad	£2.59	19p
FQ10L	250W Rotary Dimmer	£5.60	41½p
FQ11M	Brass Dimmer	£12.98	96p
FQ12N	250W Push Dmr Sngl	£6.98	51½p
FQ13P	250W Push Dmr Dble	£13.33	98½p
FQ14Q	630W Touch Dimmer	£9.18	68p
FQ15R	Security Dimmer	£9.73	72p
FQ16S	Auto Security Switch	£6.95	51½p
YB09K	Fl Pattress 16mm Sngl	36p	2½p
YB10L	Fl Pattress 25mm Sngl	33p	2½p
YB11M	Fl Pattress 25mm Dble	47p	3½p
YB12N	Fl Pattress 35mm Dble	55p	4p
YB13P	Steel Pattress 47mm	£1.15	8½p
YB14Q	Sur Patt 20mm Sngl	34p	2½p
YB15R	Sur Patt 29mm Sngl	38p	3p
YB16S	Sur Patt 29mm Dble	72p	5½p
YB17T	Sur Patt 47mm Dble	98p	7½p
YB18U	Conversion Pattress	£1.03	7½p
Page 133			
FQ00A	Ceiling Switch 1-Way	£1.25	9½p
FQ01B	Ceiling Switch 2-Way	£1.46	11p
FQ02C	Lampholder 702	33p	2½p
FQ03D	Lampholder 254 CG	52p	4p
FQ04E	Lampholder 252½in	54p	4p
LB63T	Bayonet L/Hldr	49p	3½p
FQ05F	Ceiling Rose	46p	3½p
FQ06G	BC Adaptor	32p	2½p
FQ07H	Starter 80W	25p	2p
YB19V	Time Switch	£12.26	91p
RW69A	1kW Power Contllr	£11.50	85p
YB20W	Room Thermostat	£16.35	£1.21
Page 134			
YB21X	Quicktest	£5.30	39½p
YB22Y	AC Adaptor 3DC	£3.05	22½p
XX09K	AC Adaptor BR300	£4.50	33½p
YB23A	AC Adaptor MVA31	£4.80	35½p
YB24B	TV Game Mains Adap	£4.85	36p
RW74R	Level Meter	£3.10	34½p
RW73Q	VU Meter V41	£2.79	31p
LB80B	Sig Strength Meter	£1.95	21½p
LB79L	Tuning Meter	£1.95	21½p
RX92A	Meter MI 15V	£4.60	34p
RX87U	Meter MI 60V	£4.90	36½p
RX88V	Meter MI 300V	£5.54	41p
RX89W	Meter MI 1A	£4.70	35p
RX90X	Meter MI 5A	£4.70	35p
RX91Y	Meter MI 15A	£4.90	36½p
RX93B	Meter MI 25A	£5.29	39p
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RW97F	2in. Pan Meter 50—0—50μA	£5.95	44p
RW98G	2in. Pan Meter 100—0—100μA	£5.95	44p
RW99H	2in. Pan Meter 500—0—500μA	£5.95	44p
RW91Y	2in. Pan Meter 50μA	£5.40	40p
RW92A	2in. Pan Meter 100μA	£5.40	40p
RW93B	2in. Pan Meter 500μA	£5.40	40p
RW94C	2in. Pan Meter 1mA	£5.40	40p
RW95D	2in. Pan Meter 5mA	£5.40	40p
RW96E	2in. Pan Meter 10mA	£5.40	40p
RX32K	2in. Pan Meter 50mA	£5.40	40p
RX33L	2in. Pan Meter 100mA	£5.40	40p
RX34M	2in. Pan Meter 500mA	£5.40	40p
RX35Q	2in. Pan Meter 1A	£5.40	40p
RX36P	2in. Pan Meter 50V	£5.40	40p
RX37S	2in. Pan Meter 300V	£5.40	40p
RX52G	2in. Pan Meter 'S'	£5.69	42p
RX53H	2in. Pan Meter 'VU'	£5.69	42p
RX55K	Illuminating Kit	86p	6½p
RX54J	Large Panel Meter	£6.69	49½p
HY00A	Touch Pads Rect	16p	1p
HY01B	Touch Pads Tri	16p	1p
YB91Y	Pressure Mat	£2.40	18p
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LQ00A	Beginners Morse Key	£1.49	11p
LQ01B	Professl Morse Key	£2.75	20½p
HY12N	Ultrasonic Transducer	£4.98	37p
FL39N	Buzzer 6V	97p	7p
FL40T	Buzzer 12V	97p	7p
FL38R	AC Bell	£1.63	12p
FL37S	Bell Xformer	£3.64	27p
FQ08J	Bell Push	53p	4p
FQ09K	Nameplate Bell Push	26p	2p
YB25C	Baby Siren	£8.56	63½p
XQ71N	Re-entrant Horn Sndr	£14.30	£1.06
Page 137			
XQ72P	Megaphone	£44.71	£3.31
XQ73Q	Car PA 5W	Discontinued	
XQ74R	Car PA 15W	£9.80	72½p
XB44X	Car Speakers Shelf	£4.90	54½p
XB42V	Car Speakers Door	£4.99	55½p
XQ75S	10W Car Stereo Spkrs	£12.20	£1.36
XQ76H	20W Air Suspen Spkrs	£17.76	£1.97
Page 138			
WF54J	Direct Rad Piezo	£4.45	33p
WF09K	PiezoHorn Flush	£4.95	36½p
WF55K	Piezo Horn Recessed	£4.95	36½p
WF56L	Wide Angle Piezo	£8.30	61½p
WB04E	L/S Lo-Z 388	99p	11p
WB05F	L/S Lo-Z 458	82p	9p
WB08J	L/S Lo-Z 508	79p	9p
WB09K	L/S Lo-Z 568	69p	7½p
WB13P	L/S Lo-Z 668	69p	7½p
WF57M	Hi-Z L/S 64Ω	90p	10p
WF58N	3 inch Tweeter	90p	10p
WF24B	Multi-Cell Tweeter	£3.95	29½p
Page 139			
WF33L	Free Stand Tweeter	£3.95	29½p
WF43W	Dome Tweeter	£3.60	26½p
WF44X	Rectangular Tweeter	£2.80	20½p
WF02C	30W Crossover 2-Way	£1.70	12½p
WF03D	30W Crossover 3-Way	£3.85	28½p
WF45Y	Escutcheon Crssvr	£4.30	32p
WF46A	Controlled Crossover	£9.78	72½p
WF47B	Low-Cost 4in Spkr	£1.30	14½p
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WB27E	Rd Spkr CM420	£1.98	22p
WF48C	Hvy Duty Car Spkr	£3.33	37p
WF49D	Low-Cost 6 x 4in Spkr	98p	11p
WF50E	Elliptical Spkr CM641	£1.87	21p
WF17T	Elliptical Spkr CM741	£2.59	29p
WF18U	Elliptical Spkr CM742	£3.29	36½p
WF23A	Elliptical Spkr CM852	£3.99	44½p
WF00A	Rd Speaker LT530	£5.25	58½p
WF51F	Rd Speaker CM610	£1.72	19p
WF52G	Rd Speaker LT610	£2.80	31p
WF01B	Rd Speaker CM620	£4.36	48½p
WF07H	Rd Speaker LT630	£4.59	51p
WF08J	Rd Speaker CM820	£3.99	44½p
WF11M	Rd Speaker LT830	£5.49	61p
WF12N	Rd Speaker LT840	£6.95	77p
WF53H	20W Squawker	£1.70	19p
XQ77J	Fane 50 4Ω	£13.99	£1.04
XB26D	Fane 50 8Ω	£13.99	£1.04
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XQ78K	Disco 80 4Ω	£19.77	£1.46
XB27E	Disco 80 8Ω	£19.77	£1.46
XQ79L	Forte 1250TC 8Ω	£16.90	£1.25
XQ80B	Forte 1250TC 16Ω	£16.90	£1.25
XQ81C	Forte C1280TC 8Ω	£22.25	£1.65
XQ82D	Forte C1280TC 16Ω	£22.25	£1.65
XQ83E	C15 Bass 8Ω	£46.66	£3.46
XQ84F	C15 Bass 16Ω	£46.66	£3.46
XB28F	Power L/S Cabinet	£32.30	£2.39
XQ05F	15 inch Power Cab	£29.70	£2.20
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WF13P	Stereophone HP110C	£4.75	53p
WF14Q	Stereophone SA5500	£7.99	89p
WF19V	Stereophone Elec 100	£18.88	£2.10
WF20W	Mag Headset	£3.20	35½p
LB13P	Headphone Adaptor	£2.99	33p
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LB23A	Mag Earpiece 2.5mm	15p	1½p
LB24B	Mag Earpiece 3.5mm	15p	1½p
LB25C	Crystal Earpiece	37p	4p
WR29G	Transkt 3-Lead TO18	12p	1p
WR30H	Transkt 4-Lead TO18	22p	1½p
WR31J	Transkt 3-Lead TO5	13p	1p
WR32K	ICSkt 8-Lead	46p	3½p
WR33L	IC Skt 10-Lead	46p	3½p
WR24B	Kit TO3	5p	½p
WR25C	Kit TO66	5p	½p
WR27E	Kit SQ55	5p	½p
WR26D	Kit TO126	5p	½p
WR23A	Kit (P) Plas	5p	½p
BL17T	DIL Socket 8-pin	11p	1p
BL18U	DIL Socket 14-pin	14p	1p
BL19V	DIL Socket 16-pin	14p	1p
HQ76H	DIL Socket 18-pin	15p	1p
HQ77J	DIL Socket 20-pin	17p	1½p
HQ78K	DIL Socket 22-pin	19p	1½p
BL20W	DIL Socket 24-pin	23p	1½p
BL21X	DIL Socket 26-pin	44p	3½p
HQ38R	DIL Socket 40-pin	45p	3½p
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XX14Q	Soldercons	65p	5p
FL56L	Transistor Cover	10p	½p
HQ79L	Heatsink 92F	10p	½p
HQ80B	Heatsink 18F	15p	1p
FL78K	Heatsink Clip-On	12p	1p
WR34M	TO5 Chassis Heatsink	79p	6p
FL59P	Vaned Heatsink TO3	29p	2p
FL58N	Vaned Htsnk Plas Pwr	28p	2p
FL57M	Vaned Heatsink IC	35p	2½p
HQ70M	Heatsink 2E	£1.10	8p
FL41U	Heatsink 4Y	79p	6p
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FL42V	Flat Heatsink	£1.50	11p
HQ69A	50W Hi-Fi Heatsink	£1.30	9½p
HQ81C	8W Hi-Fi Heatsink	£1.10	8p
FL54J	Heatsink 10DN	89p	6½p
FL55K	Heatsink 10DNDR	£1.20	9p
FL77J	Heatsink 6W—1	£2.97	22p
YB26D	Heatsink 60DN	£6.30	46½p
FL79L	Thermpath	£1.79	13½p
HQ00A	Small Thermpath	52p	4p
Page 146			
XB59P	Projector 150	£39.80	£2.95
XB60Q	Atlas A1/167	£3.88	28½p
XQ85G	Projector 500	£74.97	£5.55
XQ86T	M28 12V QI Lamp	£5.24	39p
LB26D	Pic Wheel Animal	£6.69	49½p
LB27E	Pic Wheel Comic	£5.87	43½p
LB28F	Pic Wheel Macabre	£5.87	43½p
LB29G	Pic Wheel Primitive	£5.87	43½p
LB82D	Pic Wheel Sci-Fi	£5.87	43½p
LB30H	Pic Wheel Sea	£5.87	43½p
LB31J	Pic Wheel Show	£5.87	43½p
LB32K	Pic Wheel Space	£6.80	50½p
LB33L	Pic Wheel Zodiac	£5.87	43½p
LB34M	Pic Wheel Clr Chgr	£5.90	65½p
LB81C	L 6in. Wheel Can-Can	£7.49	55½p
LB45Y	L 6in. Wheel Fairy	£7.49	55½p
LB83E	L 6in. Wheel Girlie	£7.49	55½p
LB46A	L 6in. Wheel Orgy	£7.49	55½p
Page 147			
LB84F	TR Wheel Arabesque	£6.43	47½p
LB85G	TR Wheel Demon	£6.43	47½p
LB86T	TR Wheel Pluto	£6.43	47½p
LB87U	TR Wheel Surreal	£6.43	47½p
LB59P	Cassette Motor Plate	£14.85	£1.10
LB47B	Pattern Cassette 2	£7.55	56p
LB48C	Pattern Cassette 3	£7.55	56p
LB49D	Pattern Cassette 14	£7.55	56p

1979/80 Catalogue Page No.		VAT inclusive PRICE	
LB50E	Pattern Cassette 16	£7.55	56p
LB51F	Pattern Cassette 17	£7.55	56p
LB52G	Pattern Cassette 18	£7.55	56p
LB53H	Pattern Cassette 22	£7.55	56p
LB54J	Pattern Cassette 23	£7.55	56p
LB55K	Zoomer Cassette Blue	£7.55	56p
LB56L	Zoomer Cassette Red	£7.55	56p
LB88V	PL Cass Girl's Face	£7.64	56½p
LB57M	PL Cass Go-Go Dncrs	£7.64	56½p
LB58N	PL Cassette Lovers	£7.64	56½p
XQ87U	FOL Colour Change	£18.30	£1.36
XQ88V	FOL Prism Rotator	£20.37	£1.51
XQ88W	FOL Prism Revolver	£20.37	£1.51

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XQ90X	Mini Strobe	£54.00	£4.00
XQ91Y	Maxi Strobe	£69.33	£5.14
LB89W	Xenon Tube 20W	£7.69	57p
LB90X	Xenon Tube 40W	£7.87	58½p
XQ92A	Zeromatic	£41.79	£3.10
XQ93B	Multimatic	£105.30	£7.80
XQ94C	5-Core Lead	£10.55	78p
WQ11M	Hi-Speed Fuse 5A	19p	1½p
WQ12N	Hi-Speed Fuse 15A	19p	1½p
XQ95D	Fuzzlight Blue	£23.99	£1.77½
XQ96E	Fuzzlight Amber	£23.99	£1.77½
XQ97F	Fuzzlight Green	£23.99	£1.77½
XQ98G	Fuzzlight Red	£23.99	£1.77½

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XY06G	Mirror Ball 12in	£65.00	£4.81
XY07H	Mirror Ball Stand	£15.00	£1.11
LB91Y	Flasher Unit 2-Way	£3.55	26½p
YB29G	Spot Holder	£2.25	16½p
XY00A	3-Bank Lamphoider	£8.93	66p
XB31J	BC Clip-On Hdr Sngl	£2.99	22p
XB32K	BC Clip-On Hdr Twin	£5.13	38p
WF25C	Spot Lamp Amber	£1.95	14½p
WF26D	Spot Lamp Blue	£1.95	14½p
WF27E	Spot Lamp Clear	£1.77	13p
WF28F	Spot Lamp Green	£1.95	14½p
WF29G	Spot Lamp Red	£1.95	14½p
WF30H	Spot Lamp Violet	£1.95	14½p
WF22Y	Gooseneck Lamp	£3.98	29½p

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LB64U	Foot Switch	£2.31	17p
LB65V	SP Foot Switch	£4.59	34p
LB66W	Mini-Phaser	£17.99	£1.33
YB30H	Fuzz Box	£13.25	98p
XB34M	Vibra Chorus	£49.95	£3.70
XB41U	Fuzz-Wah Pedal	£21.70	£1.61
YB88V	Mini Compressor	£18.45	£1.37

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XB33L	Echo Chamber	£66.70	£4.94
XY01B	Snd-on-Snd Echo-Pac	£94.70	£7.02
LB67X	Echo Chamber Tape	£3.34	24½p
LB92A	Phone Coil	80p	6p
LB93B	Crystal Mic Insert	49p	5½p
YB31J	Cassette Mic Jacks	£1.55	17p
YB32K	Cassette Mic DIN	£1.79	20p
YB33L	Electret Cassette Mic	£3.75	41½p
LB68Y	Lapel Mic	89p	10p

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WF04E	Desk Mic	£4.37	48½p
WF35Q	Dynamic Ball Mic	£9.83	£1.09
WF05F	Communications Mic	£4.29	47½p
LB69A	Tie-Clip Mic	£7.99	89p
YB34M	Low-Cost Elect Mic	£3.45	38½p
YB35Q	Electret Mic EM507	£9.25	£1.03
WF34M	Electret Mic Dual-Z	£16.40	£1.82

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YB36P	Unisound Mic EM82D	£18.75	£2.08
YB37S	Unisound Mic EM83D	£20.95	£2.33
YB38R	Unisnd Dyn DM1500D	£31.85	£3.54
LB94C	Screen S15	£5.60	62p
LB95D	Mic Unit U15	£5.65	63p
LB35Q	Mic Windshield	59p	6½p
WF36P	Gsneck Mic Stnd 21in	£3.25	36p
WF37S	Bkt For Gsnk Stand	£1.30	9½p
LB96E	Table-Top Mic Stand	£2.30	25½p
XB45Y	5-Fool Mic Stand	£9.73	£1.08
XB46A	Boom Arm	£9.50	£1.06

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LB70M	Mic Xformer MX5	£6.95	77p
LB71N	Mic Xformer MX6	£6.95	77p
LR05F	Mic Xformer Type 2 20—300Ω	£9.60	£1.06½
LR06G	Mic Xformer Type 2 200—600Ω	£9.60	£1.06½
XB30H	Mono Mic Mixer	£6.10	45p
XB29G	Stereo Mixer	£19.76	£1.46
LB97F	Pre-Amp EQ2S	£3.05	34p
YB39N	Pre-Amp CS5	£7.75	86p

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YB40T	Cry Guitar Pick-Up	£3.90	29p
YB41U	Nylon Mag Pick-Up	£6.85	50½p
YB42V	Steel Mag P.U.	£7.60	56½p
LB74R	Humbucker	£14.99	£1.11
LB78K	Guitar Strings Nylon	£1.18	8½p
LB60Q	Guitar Strings Steel	£1.19	9p
LB98G	Strap Button	32p	2½p
XB48C	Quodraptor	£14.99	£1.67
LB72P	Intercom 2-Station	£6.76	75p

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XQ00A	Autochanger	£14.90	£1.86
XB23A	Rim Drive Turntable	£19.75	£2.19
XB25C	Belt Drive Turntable	£24.95	£2.77

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FQ17T	Cartridge Slide MP60	£2.10	23½p
FQ18U	Cartridge Slide 710	£2.10	23½p
FQ19V	Cartridge Slide BDS95	£2.10	23½p
LB75S	Drive Wheel BSR	81p	9p
FQ20W	Spindle Auto BSR	£3.95	44p
FQ21X	Spindle Manual BSR	50p	5½p
FQ22Y	Carrier Kit SL75K	£2.75	30½p
FQ23A	Cartrdg Carrier SL95	£1.56	17½p
FQ24B	Carrier Kit SL95K	£2.40	26½p
FQ25C	Cartrdg Car Zero 100	£2.10	23½p
FQ26D	Cartrdg Car SP2511	£2.16	24p
FQ27E	Cartrdg Carrier LAB80	£1.50	16½p
FQ28F	Cartrdg Carrier SP25V	£1.40	15½p
FQ29G	Carrier Kit SP25VK	£3.20	33½p
LB76H	Dr Wheel Garrard Lrg	72p	8p
FQ30H	Dr Wheel Garrard Sm	72p	8p
FQ31J	Spindle Man Short	54p	6p
FQ32K	Spindle Man Long	46p	5p
FQ33L	Spindle Auto Short	£2.70	30p
FQ34M	Spindle Auto Long	£3.20	35½p

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YB43W	SP251V Tone Arm	£6.70	74½p
FQ35Q	CB Weight SP251V	£1.95	21½p
FQ36P	Garrard Drive Belt	£1.50	16½p
YB44X	SP25III Motor	£9.80	£1.09
YB45Y	SP25IV Motor	£11.99	£1.33

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FQ37S	Ctrdg Acos GP91-1SC	£1.99	22p
HR00A	Ctrdg Acos GP91-3SC	£2.20	24½p
HR01B	Ctrdg BSR X5M	£2.20	24½p
HR02C	Ctrdg BSR X5H	£2.20	24½p
HR03D	Ctrdg Acos GP93-1	£2.75	30½p
HR04E	Ctrdg BSR SX6M	£2.95	33p
HR05F	Ctrdg BSR SX6H	£2.95	33p
HR06G	Ctrdg Acos 104	£3.49	39p
HR09K	Ctrdg BSR SC12M	£3.33	37p
HR10L	Ctrdg BSR SC12H	£3.33	37p

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FY75S	Ctrdg Rigonda 2SB	£3.50	39p
HR11M	Ctrdg Sono 9TAHC	£3.98	44p
HR12N	Ctrdg Sono 3509	£3.85	43p
HR13P	Ctrdg Sono 3549	£3.68	41p
HR14Q	Ctrdg Sono 3559	£3.33	37p
HR17T	Ctrdg Sono V100	£5.95	66p
HR15R	Ctrdg Goldring G850	£4.69	52p
HR16S	Ctrdg Goldring G800	£6.20	69p
FQ38R	Ctrdg Goldring G800H	£5.90	65½p

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FQ39N	Ctrdg Goldring G800E	£8.83	98p
FQ40T	Ctrdg Tenorel T2001D	£3.30	36½p
FQ41U	Ctrdg Tenorel T2001ED	£9.63	£1.07
HR62S	Stylus GP91SC SS	36p	4p
HR24B	Stylus GP91SC DS	58p	6½p
HR25C	Stylus GP91SC DD	75p	8½p
HR26D	Stylus GP93 SS	39p	4½p
HR27E	Stylus GP93 DS	58p	6½p
HR28F	Stylus GP93 DD	69p	7½p
HR63T	Stylus GP95 SS	50p	5½p
HR64U	Stylus GP95 DS	76p	8½p
HR65V	Stylus GP95 DD	98p	11p
HR29G	Stylus GP104 SS	35p	4p
HR30H	Stylus GP104 DS	49p	5½p
HR31J	Stylus GP104 DD	£1.11	12½p
HR66W	Stylus Acos SM6	£3.55	39½p
HR67X	Stylus AT55-5	£3.55	39½p
HR68Y	Stylus VM8	£3.97	44p
HR38R	Stylus BSR TC8 S	12½p	1½p
HR39N	Stylus BSR TC8 D	38p	4p

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HR69A	Stylus BSR ST3	36p	4p
HR70M	Stylus BSR ST4 DS	50p	5½p
HR71N	Stylus BSR ST4 DD	72p	8p
HR40T	Stylus BSR ST8	26½p	3p
HR41U	Stylus BSR ST9	38p	4p
HR42V	Stylus BSR ST10	60p	6½p
HR43W	Stylus BSR ST12	37p	4p
HR44X	Stylus BSR ST14	49p	5½p
HR45Y	Stylus BSR ST15	71p	8p
HR72P	Stylus BSR ST16	36p	4p
HR46A	Stylus BSR ST17 DS	55p	6p
HR47B	Stylus BSR ST17 DD	71p	8p
HR73Q	Stylus BSR ST20	49p	5½p
HR74R	Stylus BSR ST21	76p	8½p
HR75S	Stylus Becca Deram	98p	11p
HR76H	Stylus D110E	£3.97	44p
HR77J	Stylus D110H	99p	11p
HR48C	Stylus D110SR	£2.91	32½p
HR49D	Stylus D120SR	£3.45	38½p
HR78K	Stylus Hitachi ST101	£3.97	44p
HR79L	Stylus Hitachi ST103	£5.25	58½p
HR80B	Stylus LV65977S	49p	5½p
HR81C	Stylus LV65977D	76p	8½p
HR82D	Stylus NP EPS19	£1.94	21½p
HR83E	Stylus NP EPS36	£1.48	16½p
HR84F	Stylus NP EPS52	£3.60	40p
HR85G	Styl Philips GP200SS	£4.77	53p
HR86T	Styl Philips GP200DS	76p	8½p
HR87U	Styl Philips GP200DD	98p	11p
HR88V	Styl Philips 22/GP204	49p	5½p
HR89W	Styl Philips 22/GP205	76p	8½p
HR90X	Styl Philips GP400	£4.00	44½p

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HR91Y	Stylus RIG-2SB SS	49p	5½p
HR92A	Stylus RIG-2SB DS	76p	8½p
HR93B	Stylus RIG-2SB DD	97p	11p
HR50E	Stylus BF40S	32p	3½p
HR51F	Stylus BF40D	86p	9½p
HR95D	Stylus Sansui SN28	£3.53	39p
HR96E	Stylus Sanyo ST28	£3.53	39p
HR97F	Stylus Sanyo 2611	£4.15	46p
HR98G	Stylus Sharp 706	£3.54	39½p
HR99H	Stylus Sharp 717	£3.54	39½p
FQ42V	Stylus 2529 DS	76p	8½p
FQ43W	Stylus 2529 DD	98p	11p
FQ44X	Stylus 2539 DS	76p	8½p
FQ45Y	Stylus 2539 DD	98p	11p
HR52G	Stylus KS40A DS	69p	7½p
HR53H	Stylus KS40A DD	71p	8p
HR54J	Stylus KS41B DS	81p	9p
HR55K	Stylus KS41B DD	£1.05	11½p
HR56L	Stylus KS41C DS	£1.09	12p
HR57M	Stylus KS41C DD	99p	11p
HR58N	Stylus 9TAHC SS	37p	4p
HR59P	Stylus 9TAHC DS	49p	5½p
HR60Q	Stylus 9TAHC DD	71p	8p
HR61R	Stylus Sonotone V100	£3.58	40p
FQ46A	Stylus Sony ND100	£3.88	43p
FQ47B	Stylus Sony ND114	£3.60	40p

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FQ48C	Stylus Sony ND128	95p	10½p
FQ49D	Stylus Sony ND133	£3.93	43½p
FQ50E	Stylus Sony ND134	£3.93	43½p
FQ51F	Styl Tenorel N2001D	£1.87	21p
FQ52G	Styl Tenorel N2001ED	£8.30	92p
FQ53H	Stylus Toshiba N-3C	£1.87	21p
FQ54J	Stylus Victor DT33	£4.20	46½p
LX00A	Popular Care Kit 59	£2.47	18½p
YB46A	Golden Disc Kit 57	£2.85	21p
LX01B	Record Care Kit 43	£3.94	29p
YB47B	Record Care Kit 107	£5.79	43p

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LX02C	Golden Care Kit 79	£6.57	48½p
YB48C	Autochanger Care Kit 81	£2.95	22p
LX03D	Musicentre Kit 105	£5.41	60p
YB49D	Hi-Fi Care Kit 89	£7.90	58½p
YB50E	Groov Kleen 50	£1.89	14p
LX06G	Groov Kleen 42	£2.52	18½p
YB51F	Groov Kleen 45	£1.59	12p
FR44X	Roller Pack GK42/S	35½p	2½p
FQ55K	Roller Pack 45/S	29p	2p
FR42V	Roller Pack 50/S	29p	2p

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FR43W	Roller Pack RC60/S	29p	2p
FQ56L	Electroscope	£1.20	9p
FR52G	Anti-Stat Fluid 69	37p	2½p
LX10L	Anti-Stat Mat 102	£2.99	22p

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LX04E	Anti-Stat Gun	£6.48	48p
YB52G	Groove-Stat 3000	£9.97	74p
FQ57M	Record Cleaner 28	86p	8½p
FR48C	Dust-Off 71	£1.25	9½p
YB53H	Groove Guard 114	£5.75	42½p
YB54J	Record Valet 110	£5.99	44½p
FR46A	Stylus Cleaner 76	42½p	3p
FQ58N	Stylus Cleaner 103	90p	6½p
FQ59P	Stylus Cleaner 112	£4.39	32½p
FR47B	Record Cloth 36A	49p	3½p
LX07H	Trntble Cleaning Kit 70	£1.02	7½p
YB55K	Cleaning Kit 64	£2.20	16½p
FQ60Q	Sprit Level 44	£2.15	16p
FR49D	Stylus Balance 32A	£1.95	14½p

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FR50E	Gram Speed Indicator	10p	½p
LX13P	Pop Cassette Kit 104	£3.33	37p
LX14Q	Cass Tape Care 26A	£3.90	43½p
LX16S	Cassette Care Kit 51	£4.99	55½p
YB56L	Cassette Care Kit 109	£4.99	55½p
YB57M	¼in Tape Care Kit 111	£3.99	44½p
YB58N	Uni Tape Care Kit 150	£4.99	55½p
RB04E	Cassette Head Clnr 62	85p	6½p
LX11M	Tape Cleaning Kit J	£1.25	9½p
YB60Q	Head Cleaning Kit 25	£2.10	15½p
RB02C	Tape Hd Maint Kit 99	£2.80	21p
FQ61R	Replmnt Felts 99A	54p	4p

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FR54J	Cassette Clnr Tape 31	86p	6½p
FR62S	Demagnetiser	£3.29	24½p
FQ62S	Cwd Probe Demag	£3.90	29p
YB61R	Uni Splicing Kit 56	£2.15	16p
YB62S	Splicing Kit 98	£2.90	21½p
YB63T	Cassette Editor	£6.30	46½p
FR57M	Cass Repair Kit 108	£2.45	18p
FR53H	Tape Splicer ¼in 20	£2.69	20p
FR56L	Cass Tape Spicer 30A	£1.57	11½p
LX17T	Splicing Tape 33	69p	5p
RB03D	Cass Case Pack 55	56p	4p
FR60Q	Cassette Index 61	39½p	3p
FR61R	Cassette Titles 83	54p	4p
RB01B	Cassette Fast Wndr 78	£1.62	12p

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FR59P	Test Cassette 53	£3.44	25½p
RB05F	Cassette Tray 52A	£1.20	9p
YB64U	Cassette Case 34	£3.50	26p
YB65V	Luxury Case 37	£5.90	43½p
RB07H	Rota-Rack 73	£4.89	36p
RB06G	Cassette Cabinet 86	£8.99	66½p
YB66W	Cassette Cabinet 87	£11.90	88p
FQ63T	GF Cassette Head	£9.79	72½p
FQ64U	Mono Cassette Head	£1.60	18p
FQ65V	Stereo Cassette Head	£3.56	39½p
FQ66W	Cassette Erase Head	£1.24	14p

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FQ67X	Tape Hd Two-Track RP	£11.75	£1.30
FQ68Y	Tape Hd Two-Trk Erase	£6.70	74½p
FQ69A	Tape Hd Four-Track RP	£9.46	£1.50
FQ70M	Tape Hd Four-Trk Erase	£11.43	£1.27
FQ71N	2-Head Bracket	£2.16	24p
FQ72P	3-Head Bracket	£2.68	30p
HW18U	Car Aerial Pull-Up	£1.89	21p
YB67X	Car Aerial Roof-Top	£3.75	41½p
HW11M	Cigar Lighter	£2.37	17½p
HW12N	Car Accessory Plug	45p	3½p
FQ73Q	Map Light	60p	4½p
YB68Y	Car Lighter Ext Lead	£2.35	17½p

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FQ74R	Car Pwr Supply 0.3A	£2.50	18½p
FQ75S	Car Pwr Supply 0.8A	£2.70	20p
HW10L	Car Spkr Control	94p	7p
HW22Y	12V Inspection Lamp	89p	6½p
FQ76H	Inspection Lamp LB6	£1.40	10½p
FQ77J	Jumper Leads	£1.98	14½p
HQ30H	Wiper Controller	£5.85	43½p
HQ35Q	Charger Ammeter	£1.20	9p
FQ78K	Car Ammeter	£1.54	11½p
HW16S	Car Flasher 4-Lamp	99p	7½p
HW17T	Car Flasher 6-Lamp	£1.13	8½p

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FQ79L	Caravan Flasher	70p	5p
YB69A	Car Horns	£8.65	64p
FQ80B	Ign Coil Straight	£4.37	32½p
FQ81C	Ign Coil Ballast	£4.37	32½p
FQ82D	Ign Cap 367	36p	2½p
FQ83E	Ign Cap 368	36p	2½p
FQ84F	Ign Cap 369	36p	2½p
FQ85G	Thermostat 82	£1.80	13½p
FQ86T	Thermostat 88	£1.80	13½p
HW01B	Supp Cap Small Lucas	35p	2½p
HW02C	Supp Cap Large Lucas	35p	2½p
HW03D	Supp Cap Spade	35p	2½p
FQ87U	Supp Cap 3µF	75p	5½p
FQ88V	Plug-Top Supp Strt	25p	2p
FQ89W	Plug-Top Supp Ang	32p	2½p
FQ90X	In-Line Plug Supp	16½p	1p
FQ91Y	Suppressor Choke	40p	3p
FQ92A	7-pin Trailer Plug	£1.70	12½p
FQ93B	7-Pin Trailer Skt	£2.20	16½p

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FQ94C	Trailer Socket Bolts	18p	1½p
XR55K	7-Core Trailer Cable	45p	3½p
YB70M	Trailer Lamp Cluster	£2.45	18p
YB71N	Trailer Reflector	68p	5p
FQ95D	Sign 50 mph	20p	1½p
FQ96E	Sign GB	20p	1½p
FQ97F	Anti-Glare Strip	45p	3½p
FQ98G	Luggage Elastic	30p	2p
FQ99H	Ice-Scaper	15p	1p
YB72P	Tow Rope	£2.12	15½p
FY00A	Keep Clean Kit	13p	1p
XY02C	Foot Pump Standard	£5.94	44p
XY03D	Foot Pump Gauge	£6.83	50½p

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YB94C	Plug Spanner	85p	6½p
FY01B	Tyre Pressure Gauge	95p	7p
FY02C	Utility Knife	99p	7½p
FY03D	Retractable Knife	£1.69	12½p
FY04E	Knife Blades	50p	3½p
FY05F	Scalpel Handle	£1.75	13p
FY06G	Scalpel Blade Type 11	38p	3p
FY07H	Min Screwdriver Set	£1.20	9p

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BR58N	Jewellers Scrdrvr Set	£2.54	19p
BR79L	Interchgbl Scrdrvr Set	£2.25	16½p
FY08J	Utility Set	£4.25	31½p
BR48C	Hex Trimmer	13p	1p
BR51F	Tnm Tool	26½p	2p
BR49D	Preset Trimmer	41p	3p
BR50E	Trim TT5	30p	2p
BR52G	Small Screwdriver	14p	1p
BR53H	Large Screwdriver	14½p	1p

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FY09K	Long Screwdriver	76p	5½p
FY10L	Driver S3	39p	3p
FY11M	Driver S4	44p	3½p
FY12N	Driver S5	52p	4p
FY13P	Driver S6	76p	5½p
FY14Q	Driver S8	£1.19	9p
FY15R	Pozidriver P1	48p	3½p
FY16S	Pozidriver P1L	48p	3½p
FY17T	Pozidriver P2	59p	4½p
FY18U	Pozidriver P2L	59p	4½p
BR57M	Philips Driver	22p	1½p
BR71N	Mains Tester	49p	3½p
FY19V	Low-Cost Min Cutters	£2.68	20p
BR75S	Ins Min Cutters	£6.35	47p
BR70M	Box-Joint Min Cutters	£4.18	31p
FY20W	Box-Joint End Cutters	£4.29	32p
FY21X	Low-Cost Cutters	£1.79	13½p
FY76H	Lrg Low-Cost Cutters	£1.98	14½p

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BR74R	Side Cutters	£3.75	28p
FY22Y	Box-JT Side Cutters	£5.23	38½p
BR72P	Side Cutters S55	£4.22	31p
FY23A	High Leverage Cutters	£4.25	31½p
FY24B	Low-Cost Min Pliers	£2.92	21½p
BR78K	Ins Min Snipe	£4.95	36½p
BR69A	Box-Joint Min Pliers	£4.25	31½p
BR77J	Bnght Pliers	£2.79	20½p
FY25C	Low-Cost Pliers	£1.78	13p
FY26D	Box Combined Pliers	£4.82	35½p
BR73Q	Long Snipe Pliers	£5.30	39½p
BR90X	Box Radio Pliers	£5.95	36½p
FY27E	Low-cost Long Pliers	£2.34	17½p
BR92A	Combination Pliers	£4.05	30p

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FY28F	Low-Cost Pliers	£1.98	14½p
FY29G	Low-Cost HD Pliers	£2.63	19½p
BR91Y	Electricians Pliers	£3.45	25½p
FY30H	Pincers	£2.57	19p
FY31J	Crimp Tool	£2.49	18½p
BR76H	End Action Strippers	£4.89	36p
BR93B	Wire Strippers 3A	£1.19	9p
BR94C	Wire Strippers 8B	£1.42	10½p
BR95D	Wire Strippers 9	£2.04	15p
BR96E	Stripmaster	£11.85	88p
BR97F	Blade L5361	£4.71	35p
XX11M	Blade L4421	£4.90	36½p

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FY32K	Hand-Wrap Tool	£2.90	21½p
HY16S	Verowire Pen	£3.20	23½p
HY17T	Verowire Spool	69p	5p
FY33L	Verowire Comb	6p	½p
FY34M	Allen Keys AF	83p	6p
FY35Q	Allen Keys Metric	83p	6p
FY36P	Min Spanner 24	£1.20	9p
FY37S	Min Spanner 68	£1.19	9p
FY38R	Ring Spanner 02	£1.30	9½p
FY39N	Ring Spanner 46	£1.30	9½p
FY40T	Box Spanner 2BA	78p	6p
FY41U	Box Spanner 4BA	78p	6p
FY42V	Box Spanner 6BA	78p	6p
FY43W	Box Spanner 8BA	78p	6p
FY44X	Quick Grips	£4.42	32½p
FY45Y	Crescent Wrench 160	£1.99	14½p
FY46A	Crescent Wrench 210	£2.39	17½p
FY47B	Adjustable Wrench	£2.38	17½p

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XY04E	Torque Wrench	£6.80	50½p
FY48C	Socket Converter	£1.60	12p
FY49D	Needle File Flat Wrdg	90p	6½p
FY50E	Needle File Hand	86p	6½p
FY51F	Needle File Halfround	94p	7p
FY52G	Needle File Round	84p	6p
BR63T	Junior Hacksaw	84p	6p
BR64U	6in Hacksaw Blades	60p	4½p
BR59P	Punch 1/8in	£2.39	17½p
BR60Q	Punch 7/16in	£2.39	17½p
BR61R	Punch 1/4in	£2.48	18½p
BR62S	Punch 9/16in	£2.45	18p
BR80B	Punch 5/8in	£2.65	19½p
BR81C	Punch 3/4in	£2.48	18½p
BR82D	Punch 7/8in	£2.95	22p
BR83E	Punch 1in	£3.74	27½p
BR98G	Punch 1 1/4in	£3.95	29½p
BR99H	Punch 13/16in	£3.95	29½p
BW00A	Punch 1 1/2in	£4.59	34p
BW01B	Punch 2½in	£14.29	£1.06
FY53H	Mini Vice	£2.30	17p
BW03D	Reliant Drill	£6.23	46p
BW02C	Titan Drill	£9.98	74p
XB12N	Drill Stand	£11.78	87½p
BR84F	Reliant Collar	43½p	3p
BW04E	Drill Power Supply	£9.72	72p
BR85G	HS Twist Drill 0.8mm	64p	4½p
BR86T	HS Twist Drill 1mm	64p	4½p
BR87U	HS Twist Drill 1.4mm	64p	4½p
BR65V	Twist Burr 0.8mm	31p	2½p
BR66W	Twist Burr 1.4mm	31p	2½p

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HQ02C	HS Drill 1/16in	13p	1p
HQ03D	HS Drill 5/64in	13½p	1p
HQ04E	HS Drill 3/32in	14p	1p
HQ05F	HS Drill 7/64in	15½p	1p
HQ06G	HS Drill 1/8in	16p	1p
HQ07H	HS Drill 9/64in	20p	1½p
HQ08J	HS Drill 5/32in	21½p	1½p
HQ09K	HS Drill 11/64in	24p	2p
HQ10L	HS Drill 3/16in	28p	2p
HQ11M	HS Drill 13/64	31½p	2½p
HQ12N	HS Drill 7/32in	33½p	2½p
HQ13P	HS Drill 15/64	38p	3p
HQ14Q	HS Drill 1/4in	41p	3p
HQ15R	HS Drill 17/64in	50½p	3½p
HQ16S	HS Drill 9/32in	53p	4p
HQ17T	HS Drill 19/64in	62½p	4½p
HQ18U	HS Drill 5/16in	63p	4½p
HQ19V	HS Drill 21/64	69p	5p
HQ20W	HS Drill 11/32in	75½p	5½p
HQ21X	HS Drill 23/64in	80p	6p
HQ22Y	HS Drill 3/8in	85½p	6½p
HQ23A	HS Drill 25/64in	90½p	6½p
HQ24B	HS Drill 13/32in	£1.06	8p

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HQ25C	HS Drill 27/64in	£1.19	9p
HQ26D	HS Drill 7/16in	£1.23	9p
HQ27E	HS Drill 29/64	£1.34	10p
HQ28F	HS Drill 15/32in	£1.42	10½p
HQ29G	HS Drill 1/2in	£1.55	11½p
FY54J	Wire Brush	29p	2p
FY55K	Wet & Dry Fine	10p	½p
FY56L	Wet & Dry Medium	10p	½p
FY57M	Wet & Dry Coarse	12p	1p
HX04E	Polish Block	92p	7p
FY58N	Round Tape Rule	NYA	
FY59P	Retractable Rule	NYA	
FY60Q	Feeler Gauge Imperial	49p	3½p
FY61R	Feeler Gauge Metric	49p	3½p
FY62S	Iron CX	£3.99	29½p
FY63T	Element CX	£1.80	13½p
FR30H	Bit 6/1106	99p	7½p
FY64U	Bit 1100	54p	4p
FY65V	Bit 1101	54p	4p
FR31J	Bit 7/1101	£1.14	8½p
FY66W	Bit 1102	54p	4p
FY67X	Bit 1103	54p	4p
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FR01B	Element Type CN	£1.65	12p
FR02C	Handle Type CN	65p	5p
FR03D	Bit 102	64p	4½p
FR04E	Bit 104	64p	4½p
FR05F	Bit 106	64p	4½p
FR06G	Bit 820	64p	4½p
FR07H	Bit 821	64p	4½p
FR08J	Bit 822	64p	4½p
FR12N	Iron X25	£3.99	29½p
FR13P	12V Iron MLX12	£4.99	37p
FR14Q	Element X25	£1.92	14p
FR15R	Element MLX12	£1.92	14p
FR16S	Bit No.50	70p	5p
FR17T	Bit No.51	70p	5p
FR18U	Bit No.52	70p	5p
FR20W	Stand ST3	£2.09	15½p
FR11M	Sponge	9p	½p
FY68Y	Kit SK3	£5.99	44½p
FY69A	Kit SK4	£5.99	44½p
FR10L	Heat Sink Tweezers	18p	1½p
FR23A	Solder Sucker	£2.06	15½p
FR24B	Sucker Tiplet	88p	6½p
FR26D	Desolder Tool	£5.90	43½p
HY13P	Desktr Nozzle Type 2	65p	5p
FR63T	Desktr Washer Type 2	22p	1½p
FR27E	Desolder Washer	20p	1½p
FR28F	Desolder Nozzle	87p	6½p
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FR29G	Solda-Mop	64p	4½p
FR21X	Solder D622	44p	3½p
FY70M	½kg Reel Solder	£6.98	51½p
FY71N	Alum Solder 1m Pk	30p	2p
LH04E	Freeze-It	£1.38	10p
LH03D	Switch Cleaner	£1.11	8p
YB77J	Servisol	£1.06	8p
LH02C	Aero-Klene	99p	7½p
YB73Q	Aero-Duster	£1.10	8p
YB74R	Silicone Grease	£1.78	13p
YB75S	Plastic Seal	94p	7p
YB76H	Foam Cleanser	£1.28	9½p
YB78K	Excel Polish	94p	7p
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YB79L	Anti-Static Spray	92p	7p
YB80B	Fire Extinguisher	£1.79	13½p
FL43W	Evostik Impact	39p	3p
FL44X	Araldite Rapid	97p	7p
FL45Y	Double Bubble Scht	13½p	1p
FL46A	Cyanoacrylate	85p	6½p
LQ02C	Potting Compound	£2.99	22p
FL47B	PVC Tape Black	29p	2p
FL48C	PVC Tape Blue	29p	2p
FL49D	PVC Tape Brown	29p	2p
FL50E	PVC Tape Green	29p	2p
FL51F	PVC Tape Red	29p	2p
FL52G	PVC Tape White	29p	2p
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FY72P	Conductive Paint	£1.99	14½p
HB22Y	Quickstick Pads	6p	½p
HB21X	Velcromounts	8p	½p
HB20W	Flexihinge	6p	½p
LQ12N	Sealing Strip	45p	3½p
LH05F	Transistor Tester HFE	£9.37	69½p
YB81C	Seesure Sig Gen	£18.20	£1.35
YB82D	LCR Bridge	£18.80	£1.39
FL60Q	Pocket Multimeter	£6.79	50½p
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YB84F	Microtest 80	£17.93	£1.33
YB85G	Supertester 680G	£26.46	£1.96
YB86T	Supertester 680R	£34.56	£2.56
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YB83E	Small Multimeter	£10.49	77½p
YB87U	100kΩ Multitester	£36.90	£2.73
YB27E	Digital Multimeter Kit	£26.90	£1.99
YB28F	DMM Module	NYA	
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XY05F	500MHz Freqncy Cntr	£99.57	£7.37
FY88V	Continuity Probe	£1.60	12p
FY73Q	Logic Probe	£12.50	92½p
FL61R	Single Injector	£4.53	33½p
FY74R	IC Test Clip	£1.69	14½p
FR25C	Insertion Tool	64p	4½p
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XB82D	Calscope Super 6	£167.96	£12.44
	Carriage in UK only	£7.00	52p
XB83E	Calscope Super 10	£229.52	£17.00
	Carriage in UK only	£7.00	52p
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BW05F	Scope Probe BNC	£15.90	£1.18
BR89W	Scope Probe 4mm	£15.90	£1.18
XL07H	Car Clk Mod MA 1003	£14.49	£1.07
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XX05F	UHF Mod No. 1	£4.50	50p
QL02C	SAM 77	£1.48	11p
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XB10L	DM02	£14.50	£1.61
XB11M	DM02T	£16.89	£1.88
XL08J	Short Spring Line	£4.49	50p
XB84F	Long Spring Line	£10.89	£1.21
XB85G	MES Driver Module	£6.00	66½p
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XB14Q	Keyboard 48-Note	£24.88	£2.76
XB15R	Keyboard 49-Note	£24.88	£2.76
XB16S	Keyboard 61-Note	£29.83	£3.31
XB13P	KB Mounting Strip	19p	1½p
XB17T	Mid Kbd 49-Note C - C	£19.50	£2.17
XB94C	Contact Block 1WG	20p	2p
XB01B	Contact Block GJ	29p	3p
XB02C	Contact Block GB2	31p	3½p
XB03D	Contact Block GC3	39½p	4½p
XB04E	Earth Bar	16p	2p
XB00A	Gold Wire	34p	4p
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XB86T	Spacesnd Mid-Range	£49.45	£3.66
XB87U	Rotating Horns Unit	£69.85	£5.17
FL66W	Stop Tab Black	73p	8p
FL67X	Stop Tab Blue	73p	8p
FL68Y	Stop Tab Green	73p	8p
FL69A	Stop Tab Grey	73p	8p
FL70M	Stop Tab Ivory	73p	8p
FL71N	Stop Tab Maroon	73p	8p
FL72P	Stop Tab Orange	73p	8p
FL73Q	Stop Tab Red	73p	8p
FL74R	Stop Tab White	73p	8p
FL75S	Stop Tab Yellow	73p	8p
BR05F	S Tab Acc Deltrem	99p	11p
BR47B	S Tab Bass Guitar	99p	11p
BR67X	S Tab Bourdon 8'	99p	11p
BR06G	S Tab Cello 16'	99p	11p
BR07H	S Tab Clarinet 8'	99p	11p
BR08J	S Tab Clarion 4'	99p	11p
BY00A	S Tab Clavichord	99p	11p
BY01B	S Tab D/B To Rotor	99p	11p
BY02C	S Tab Dly Vibrato Acc	99p	11p
BY03D	S Tab Dly Vibrato Solo	99p	11p
BR09K	S Tab Diapason 8'	99p	11p
BY04E	S Tab Diapason 16'	99p	11p
BR10L	S Tab Drawbars Acc	99p	11p
BR11M	S Tab Drawbars Solo	99p	11p
BR12N	S Tab Duiciana 8'	99p	11p
BR13P	S Tab Flute 1'	99p	11p
BR14Q	S Tab Flute 2'	99p	11p
BR15R	S Tab Flute 2⅔'	99p	11p
BR16S	S Tab Flute 4'	99p	11p
BR17T	S Tab Flute 5⅓'	99p	11p
BR18U	S Tab Flute 8	99p	11p
BR19V	S Tab Flute 16'	99p	11p
BR20W	S Tab French Horn 8'	99p	11p
BR21X	S Tab Gedeckt 8'	99p	11p
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QH24B	BZY88C27	8½p	1p
QH25C	BZY88C30	8½p	1p
QH26D	CA3046	87p	9½p
QH27E	CA3089E	£2.94	32½p
QH28F	CA313OT	99p	7½p
QH29G	CA314OT	£1.04	7½p
WQ20W	CA3189E	£2.34	26p
WQ21X	CA3240E	87p	6½p

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QH30H	C106D	87p	6½p
WQ22Y	C116D	£1.20	9p
WQ23A	C126D	£1.36	10p
WQ24B	C206D	£1.06	8p
WQ25C	C226D	£1.15	8½p
QL14Q	C246D	£1.84	13½p
WQ26D	ER1400	£13.82	£1.02
WQ27E	ER3401	£18.95	£1.40
WQ28F	HSCH1001	75p	5½p
QH32K	IR122A	£1.55	11½p
QH33L	IR122D	£2.19	16p
BH45Y	J005	£1.97	14½p
BL36P	J02	£1.99	14½p
BH46A	J04	£3.45	25½p
BH47B	K01	£2.85	21p
BH48C	K04	£3.80	28p
WQ29G	LF347	£1.72	12½p
WQ30H	LF351	40p	3p
WQ31J	LF353	74p	5½p
QH35Q	LH0042C	£3.99	29½p

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QH36P	LM301A	29p	2p
QH37S	LM308	£1.20	9p
WQ32K	LM334	97p	7p
QH38R	LM377	£2.30	25½p
QH39N	LM379S	£4.56	50½p
QH40T	LM380	£1.20	13½p
QH41U	LM381	£1.89	21p
WQ33L	LM383	£1.61	18p
WQ34M	LM384	£1.30	14½p
WQ35Q	LM387	59p	6½p
WQ36P	LM389	69p	7½p
WQ37S	LM1820	£1.39	15½p
WQ38R	LM2917	£1.77	13p
QH42V	LM3900	69p	5p
WQ39N	LM3909	86p	6½p
WQ40T	LM3911	£1.17	8½p
WQ41U	LM3914	£1.40	10½p
XL07H	MA1003	£14.49	£1.07
XL14Q	MA1023	£7.90	58½p
QH43W	MCR102	49p	5½p
QH44X	MC1303	99p	11p
QH45Y	MC1310P	£1.99	22p
QH47B	MC1496	99p	7½p
QH48C	MC3302P	£1.49	11p
QH49D	MC3340P	£1.19	9p
QH50E	MC3360P	99p	7½p
WQ42V	MCM4027 400ns	£4.75	35p
WQ43W	MC6800P	£8.45	62½p
WQ44X	MC6802P	£13.25	98p
WQ45Y	MC6810AP	£4.27	31½p
WQ46A	MC6821P	£4.66	34½p
WQ47B	MCM6830L7	£15.95	£1.18
WQ48C	MC6850P	£7.95	59p
WQ49D	MC6852P	£11.75	87p
WQ50E	MC6875L	£5.45	40½p
QH52G	MEF4220	40½p	4½p
QH53H	MEF4220MP	81p	9p
HQ61R	MEL12	36p	2½p
QH54J	MJE340	87p	6½p
WQ51F	MJE350	87p	6½p
QH55K	MJE2955	£1.64	12p
QH56L	MJE3055	£1.26	9½p
QH57M	MJ2501	£2.81	21p
BL38R	MJ2955	99p	7½p
QH58N	MJ3001	£2.29	17p
WQ52G	MM5760	£5.90	43½p
QH59P	MPF102	49p	5½p
QH60Q	MPSA14	28p	3p
QH61R	MPSA65	31p	3½p
QH62S	MPS3638	16p	2p
QH63T	MPS3638A	19p	2p
BL23A	MS4A	£1.35	10p
WQ53H	MVAM115	£1.45	16p
WH22Y	MO87	£4.89	36p
HQ71N	M251	£13.24	98p
QH64U	M252	£7.90	58½p
WH21X	M254	£6.77	50p
WQ54J	NE531	£1.49	11p
WQ55K	NE544	£1.88	14p
QH66W	NE555V	25p	2p
QH67X	NE556	80p	6p
WQ56L	NE565	£1.15	8½p
QH68Y	NE566	£1.90	14p
QH69A	NE567	£1.99	14½p
QH70M	OA47	14p	1½p
QH71N	OA90	9p	1p
QH72P	OA91	9p	1p
QH73Q	OA95	10p	1p
QH74R	OA200	8p	1p
QH75S	OA202	9p	1p
QH77J	OC28	£1.30	9½p
QH78K	OC35	£1.10	8p
QH79L	OC36	98p	7½p
QH81C	OC44	Discontinued	
QH82D	OC45	29p	2p
QH83E	OC70	36p	2½p
QH84F	OC71	29p	2p
QH85G	OC72	40p	3p
QH86T	OC75	29p	2p
QH87U	OC81	40p	3p
QH89W	OC83	21p	1½p
QH90X	OC84	32p	2½p
QH91Y	OC170	39p	3p
QH92A	OC171	43p	3p
QH93B	PN3643	19p	2p
WQ57M	PW01	83p	8p
WQ58N	PW06	£1.10	8p
WQ59P	R0-3-2513	£7.90	58½p
QL00A	R2008B	£1.97	14½p
QL01B	R2010B	£2.13	16p
QL02C	SAM77	£1.48	11p
QL05F	SC146D	£1.35	10p
WQ60Q	SFF96364	£13.25	98p
QL06G	SG1495D	£4.20	31p
QL07H	SG3402	£2.99	22p
WQ61R	SH120A	£8.70	96½p
QL08J	ST2	25p	3p
QL09K	S005	40p	3p
QL10L	S04	64p	4½p
WQ62S	TAA550	47p	5p
QL11M	TAG1/100	85p	8½p
QL12N	TAG1/600	89p	6½p
BL35Q	TBA651	£1.84	20½p
QL13P	TBA810P	99p	11p
WQ63T	TBA820M	69p	7½p
WQ64U	TCA4500A	£2.44	27p
WQ65V	TDA1008	£2.60	19½p
WH20W	TDA1022	£8.61	49p
WQ66W	TDA2006	£1.65	18½p
WQ67X	TDA2030	£1.85	20½p
WQ68Y	TIL32	NYA	
WQ69A	TIL78	NYA	
WL35Q	TIL111	79p	6p
WQ70M	TIL113	£1.40	10½p
QL15R	TIP31A	48p	3½p
QL16S	TIP32A	49p	3½p

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WQ71N	TIP33A	48p	3½p
WQ72P	TIP34A	81p	6p
QL17T	TIP41A	59p	4½p
QL18U	TIP42A	59p	4½p
WQ73Q	TIP122	80p	6p
WQ74R	TIP127	90p	6½p
QL19V	TIS43	48p	5½p
WQ75S	TL170C	39p	3p
WQ76H	TL172C	47p	3½p
QL20W	µA709C	47p	3½p
BL22Y	µA723C TO99	69p	5p
QL21X	µA723C 14-pin	49p	3½p
QL22Y	µA741C 8-pin	21p	1½p
QL23A	µA741C 14-pin	45p	3½p
QL24B	µA747C	80p	6p
QL25C	µA748C	46p	3½p
QL26D	µA78L05AWC	30p	2p
WQ77J	µA78L12AWC	30p	2p
QL27E	µA78L15AWC	30p	2p
QL28F	µA78M05UC	49p	3½p
QL29G	µA78M12UC	49p	3½p
QL30H	µA78M15UC	49p	3½p
WQ78K	µA78MGU1C	£1.55	11½p
QL31J	µA7805UC	62p	4½p
QL32K	µA7812UC	62p	4½p
QL33L	µA7815UC	62p	4½p
WQ79L	µA78GU1C	£1.85	13½p
QL34M	µA7805KC	95p	7p
QL35Q	µA7815KC	95p	7p
WQ80B	µA78H05KC	£5.35	39½p
WQ81C	µA78H12KC	£5.35	39½p
WQ82D	µA78H15KC	£5.35	39½p
WQ83E	µA78HGKC	£6.39	47½p
WQ84F	µA78P05SC	£7.43	55p
WQ85G	µA79L05AWC	98p	7½p
WQ86T	µA79L12AWC	98p	7½p
WQ87U	µA79L15AWC	98p	7½p
WQ88V	µA79M05UC	58p	4½p
WQ89W	µA79M12UC	58p	4½p
WQ90X	µA79M15UC	58p	4½p
WQ91Y	µA79MGU1C	£1.75	13p
WQ92A	µA7905UC	69p	5p
WQ93B	µA 7912UC	69p	5p
QL36P	µA7915UC	69p	5p
WQ94C	µA79GU1C	£2.10	15½p
WQ95D	µA79HGKC	£8.15	60½p
WQ96E	VN46AF	£1.19	9p
WQ97F	VN66AF	£1.19	9p
WQ98G	VN88AF	70p	5p
QL37S	W005	27p	2p
QL38R	W01	32p	2½p
QL39N	W02	39p	3p
QL40T	W04	40p	3p
QL41U	ZN414	£1.19	13p
QL42V	ZS120	26p	3p
QL43W	ZTX107	13p	1½p
QL44X	ZTX108	11p	1p
QL45Y	ZTX109	13p	1½p
QL46A	ZTX300	15p	1½p
QL47B	ZTX301	19p	2p
QL48C	ZTX302	22p	2½p
QL49D	ZTX303	26p	3p
QL50E	ZTX304	19p	2p
QL51F	ZTX312	20p	2p
QL52G	ZTX313	22p	2½p
QL53H	ZTX314	27½p	3p
QL54J	ZTX326	85p	9½p
QL55K	ZTX327	66½p	7½p
QL56L	ZTX330	24p	2½p
QL57M	ZTX331	27½p	3p
QL58N	ZTX341	26p	3p
QL59P	ZTX342	26p	3p
QL60Q	ZTX500	15p	1½p
QL51R	ZTX501	20p	2p
QL52S	ZTX502	22p	2½p
QL63T	ZTX503	24p	2½p
QL64U	ZTX504	22p	2½p
QL65V	ZTX510	18½p	2p
QL66W	ZTX530	29p	3p
QL67X	ZTX531	27½p	3p
QL68Y	ZTX541	33p	3½p
QL69A	ZTX542	33p	3½p
QL70M	Z5J	£1.99	14½p
QW00A	Z80 CPU	£10.80	80p
QW01B	Z80 CTC	£5.50	40½p
QW02C	Z80 DMA	NYA	
QW03D	Z80 PIO	£5.50	40½p
QW04E	Z80 SIO	£28.98	£2.15
QL71N	IN914	3½p	½p
QL72P	IN918	5p	½p
QL73Q	IN4001	4½p	½p
QL74R	IN4002	5p	½p
QL75S	IN4003	5½p	½p
QL76H	IN4004	5½p	½p
QL77J	IN4005	6p	½p
QL78K	IN4006	6½p	½p
QL79L	IN4007	7p	½p
QL80B	IN4148	3½p	½p
QL81C	IN5400	14p	1p
QL82D	IN5401	15p	1p
QL83E	IN5402	15½p	1p
QL84F	IN5404	16½p	1p
QL85G	IN5406	18p	1½p
QL86T	IN5407	19½p	1½p
QL87U	IN5408	20p	1½p
QL88V	IS921	10½p	1p
QH46A	1458C	56p	4p
QW05F	1702	£8.95	65p
QR00A	2N697	35p	2½p
QR01B	2N706	21p	1½p
QR03D	2N708	23½p	1½p
QR04E	2N1302	42p	3p
QR05F	2N1303	31p	2½p
QR06G	2N1304	36p	2½p
QR07H	2N1305	39p	3p
QR09K	2N1711	29p	2p
QR10L	2N1893	27p	2p
QR11M	2N2219	25p	2p
QR12N	2N2369A	18p	1½p
QR13P	2N2484	27p	2p
QR14Q	2N2646	69p	5p
QR15R	2N2647	99p	7½p
QR16S	2N2904	31p	2½p
QR17T	2N2905	26p	2p
QR18U	2N2906	25p	2p
QR19V	2N2907	25p	2p
QR20W	2N2926Or	10p	1p
QR21X	2N2926Ye	10p	1p
QR22Y	2N2926Gn	11p	1p
QR23A	2N3053	25p	2p
QR24B	2N3054	79p	6p
BL45Y	2N3055	65p	5p
QR25C	2N3525	£1.43	10½p
QR26D	2N3702	12p	1½p
QR27E	2N3703	12p	1½p
QR28F	2N3704	12p	1½p
QR29G	2N3705	12p	1½p
QR30H	2N3706	13½p	1½p

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QR31J	2N3707	12p	1½p
QR32K	2N3708	13p	1½p
QR33L	2N3710	12p	1½p
QR34M	2N3711	12p	1½p
QW06G	2N3771	£1.58	11½p
QW07H	2N3772	£1.66	12½p
QR35Q	2N3773	£2.28	17p
QR36P	2N3819	24p	2½p
QR37S	2N3823	99p	11p
QR38R	2N3866	£1.10	8p
QR39N	2N3903	17p	2p
QR40T	2N3904	11p	1p
QR41U	2N3905	13p	1½p
QR42V	2N3906	14p	1½p
QR43W	2N4058	12p	1½p
QR44X	2N4060	12p	1½p
QR45Y	2N4061	17p	2p
QR46A	2N4062	12p	1½p
QR47B	2N4871	57p	6½p
QR48C	2N5245	53p	6p
QR49D	2N5458	52p	6p
QR50E	2N5459	49p	5½p
QR51F	2N6073	£1.09	8p
QW08J	2N6609	£2.77	20½p
QW09K	2SJ50	£8.87	65½p
QW10L	2SK135	£8.87	65½p
QW11M	2102 400ns	£1.65	12p
WH17T	2112 400ns	£2.38	17½p
QW12N	2114 400ns	£10.45	77½p
QW13P	2708	£11.55	85½p
QR52G	3N140	85p	6½p
QR53H	3N141	£1.59	12p
QH51F	3403	£1.29	9½p
QX00A	4000BE	15p	1p
QX01B	4001BE	15p	1p
QL03D	4001UBE	23p	1½p
QX02C	4002BE	15p	1p
QX03D	4006BE	89p	6½p
QX04E	4007UBE	15p	1p
QW14Q	4008BE	58p	4½p
QX05F	4011BE	15p	1p
QL04E	4011UBE	25p	2p
QX06G	4012BE	15p	1p
QX07H	4013BE	39p	3p
QW15R	4014BE	58p	4½p
QW16S	4015BE	58p	4½p
QX08J	4016BE	29p	2p
QX09K	4017BE	69p	5p
QX10L	4018BE	69p	5p
QW17T	4019BE	24p	2p
QX11M	4020BE	79p	6p
QW18U	4021BE	58p	4½p
QW19V	4022BE	56p	4p

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QX12N	4023BE	15p	1p
QX13P	4024BE	47p	3½p
QX14Q	4025BE	15p	1p
QX15R	4026BE	99p	7½p
QX16S	4027BE	39p	3p
QX17T	4028BE	59p	4½p
QW20W	4029BE	58p	4½p
QW21X	4031BE	£1.60	12p
QW22Y	4032BE	58p	4½p
QW23A	4033BE	99p	7½p
QW24B	4034BE	£1.39	10½p
QW25C	4035BE	60p	4½p
QW26D	4038BE	60p	4½p
QW27E	4040BE	60p	4½p
QW28F	4041UBE	53p	4p
QX19V	4042BE	59p	4½p
QW29G	4043BE	53p	4p
QW30H	4044BE	53p	4p
QW31J	4045BE	78p	6p
QW32K	4046BE	55p	4p
QX20W	4047BE	59p	4½p
QW33L	4048BE	31p	2½p
QX21X	4049UBE	29p	2p
QX22Y	4050BE	39p	3p
QW34M	4051BE	53p	4p
QW35Q	4052BE	53p	4p
QW36P	4053BE	53p	4p
QW37S	4054BE	78p	6p
QW38R	4055BE	81p	6p
QW39N	4056BE	81p	6p
QW40T	4060BE	78p	6p
QW41U	4063BE	64p	4½p
QX23A	4066BE	39p	3p
QW42V	4067BE	£2.60	19½p
QX24B	4068BE	15p	1p
QX25C	4069UBE	15p	1p
QX26D	4070BE	15p	1p
QW43W	4071BE	16p	1p
QX27E	4072BE	15p	1p
QW44X	4073BE	16p	1p
QW45Y	4075BE	16p	1p
QW46A	4076BE	58p	4½p
QW47B	4077BE	16p	1p
QX28F	4078BE	15p	1p
QW48C	4081BE	16p	1p
QW49D	4082BE	16p	1p
QW50E	4085BE	52p	4p
QW51F	4086BE	52p	4p
QW52G	4089BE	94p	7p
QW53H	4093BE	40p	3p
QW54J	4094BE	94p	7p
QW55K	4095BE	52p	4p
QW56L	4097BE	£2.60	19½p
QX29G	4098BE	79p	6p
QW57M	4099BE	£2.16	16p
QW58N	40100BE	£1.70	12½p
QW59P	40104BE	70p	5p
QW60Q	40102BE	94p	7p
QW61R	40103BE	94p	7p
QW62S	40104BE	70p	5p
QW63T	40105BE	70p	5p
QW64U	40106BE	40p	3p
QW65V	40107BE	40p	3p
QW66W	40108BE	£3.60	26½p
QW67X	40109BE	£1.50	11p
QW68Y	40110BE	70p	5p
QW69A	40160DE	70p	5p
QW70M	40161BE	70p	5p
QW71N	40162BE	70p	5p
QW72P	40163BE	70p	5p
QW73Q	40174BE	52p	4p
QW74R	40181BE	£2.30	17p
QW75S	40182BE	70p	5p
QW76H	40192BE	70p	5p
QW77J	40193BE	70p	5p
QW78K	40194BE	70p	5p
QW79L	40257BE	64p	4½p
QX34M	40673	69p	5p
XX01B	4136	£1.58	11½p
QW80B	4151	76p	5½p
XX02C	4195	£1.50	11p
QX30H	4416BE	99p	7½p
QW81C	4502BE	52p	4p
QW82D	4508BE	50p	3½p

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QW83E	4510BE	64p	4½p
QX31J	4511BE	89p	6½p
QW84F	4512BE	£1.10	8p
QW85G	4514BE	£1.69	12½p
QW86T	4515BE	£1.69	12½p
QW87U	4516BE	64p	4½p
QX32K	4518BE	79p	6p
QX33L	4520BE	79p	6p
QW88V	4527BE	78p	6p
	4528BE	= 4098BE	
QW89W	4532BE	74p	5½p
QW90X	4555BE	52p	4p
QW91Y	4556BE	52p	4p
QX35Q	5W Zener 5V6	89p	6½p
QX36P	5W Zener 8V2	89p	6½p
QW92A	5018	£9.54	70½p
QW93B	6616 = 4116	£11.30	83½p
QW94C	7106	£11.99	89p
QW95D	7107	£11.49	85p
QX37S	7400	12p	1p
YF00A	74LS00	15p	1p
QX38R	7401	12p	1p
YF01B	74LS01	15p	1p
QX39N	7402	12p	1p
YF02C	74LS02	15p	1p
QX74R	7403	18p	1½p
YF03D	74LS03	17p	1½p
QX40T	7404	13p	1p
YF04E	74LS04	15p	1p
QX41U	7405	13p	1p
YF05F	74LS05	15p	1p
QX75S	7406	26p	2p
QX76H	7407	26p	2p
QX42V	7408	13p	1p
YF06G	74LS08	15p	1p
QX77J	7409	18p	1½p
YF07H	74LS09	17p	1½p
QX43W	7410	12p	1p
YF08J	74LS10	15p	1p
QX44X	7411	13p	1p
YF09K	74LS11	15p	1p
YF10L	74LS12	17p	1p
QX45Y	7413	22p	1½p
YF11M	74LS13	36p	2½p
QX46A	7414	39p	3p
YF12N	74LS14	48p	3½p
YF13P	74LS15	17p	1½p
QX78K	7416	30p	2p
QX79L	7417	30p	2p
QX47B	7420	17p	1½p
YF14Q	74LS20	15p	1p
QX48C	7421	19p	1½p
YF15R	74LS21	15p	1p
YF16S	74LS22	15p	1p
QX80B	7425	18p	1½p
QX81C	7426	28p	2p
YF17T	74LS26	17p	1½p
QX49D	7427	19p	1½p
YF18U	74LS27	15p	1p
YF19V	74LS28	17p	1½p
QX50E	7430	12p	1p
YF20W	74LS30	15p	1p
QX51F	7432	19p	1½p
YF21X	74LS32	15p	1p
YF22Y	74LS33	26p	2p
QX52G	7437	19p	1½p
YF23A	74LS37	24p	2p
QX82D	7438	20p	1½p
YF24B	74LS38	24p	2p
QX53H	7440	12p	1p
YF25C	74LS40	25p	2p
QX54J	7442	39p	3p
YF26D	74LS42	38p	3p
QX55K	7447A	54p	4p
QX83E	7451	22p	1½p
YF27E	74LS51	17p	1½p
QX84F	7454	18p	1½p
YF28F	74LS54	23p	1½p
YF29G	74LS55	39p	3p
QX56L	7470	25p	2p
QX57M	7472	19p	1½p
QX58N	7473	22p	1½p
YF30H	74LS73	24p	2p
QX59P	7474	22p	1½p
YF31J	74LS74	17p	1½p
QX60Q	7475	29p	2p
YF32K	74LS75	30p	2p
QX61R	7476	19p	1½p
YF33L	74LS76	24p	2p
YF34M	74LS78	40p	3p
QX62S	7481	79p	6p
QX85G	7483	60p	4½p
QX63T	7485	79p	6p
YF35Q	74LS85	48p	3½p
QX64U	7486	19p	1½p
YF36P	74LS86	24p	2p
QX65V	7489	£1.49	11p
YF37S	74LS89	NYA	
QX66W	7490	43p	3p
YF38R	74LS90	37p	2½p
QX86T	7491	96p	7p
QX67X	7492	44p	3½p
YF39N	74LS92	37p	2½p
QX68Y	7493	44p	3½p
YF40T	74LS93	37p	2½p
QX69A	7494	55p	4p
QX70M	7495	56p	4p
YF41U	74LS95	37p	2½p
QX87U	7496	50p	3½p
YF42V	74LS96	48p	3½p
QX71N	74107	19p	1½p
YF43W	74LS107	48p	3½p
QX88V	74109	40p	3p
YF44X	74LS109	26p	2p
YF45Y	74LS112	26p	2p
YF46A	74LS113	26p	2p
YF47B	74LS114	42p	3p
QX72P	74118	79p	6p
QX73Q	74121	24p	2p
WH00A	74122	35p	2½p
WH01B	74123	39p	3p
YF48C	74LS123	£1.24	9p
WH02C	74LS124	£3.49	26p
YF49D	74LS125	37p	2½p
YF50E	74LS126	38p	3p
WH03D	74132	49p	3½p
YF51F	74LS132	50p	3½p
YF52G	74LS136	26p	2p
YF53H	74LS138	52p	4p
YF54J	74LS139	52p	4p
WH05E	74141	54p	4p
WH06G	74145	64p	4½p
YF55K	74LS145	NYA	
QX89W	74150	82p	6p
WH07H	74151	45p	3½p
YF56L	74LS151	49p	3½p
YF57M	74LS153	52p	4p
WH08J	74154	84p	6p

1979/80 Catalogue Page No.		VAT inclusive PRICE	
YF58N	74LS154	60p	4½p
YF59P	74LS155	48p	3½p
YF60Q	74LS156	92p	7p
YF61R	74LS157	48p	3½p
YF62S	74LS158	77p	5½p
WH09K	74160	69p	5p
YF63T	74LS160	51p	4p
YF64U	74LS161	66p	5p
YF65V	74LS162	80p	6p
YF66W	74LS163	66p	5p
WH10L	74164	78p	6p
WF67X	74LS164	60p	4½p
YF68Y	74LS165	62p	4½p
YF69A	74LS166	NYA	
YF70M	74LS168	£1.29	9½p
YF71N	74LS169	60p	4½p
YF72P	74LS170	£1.96	14½p
YF73Q	74LS173	50p	3½p
WH11M	74174	69p	5p
YF74R	74LS174	47p	3½p
YF75S	74LS175	52p	4p
YF76H	74LS181	£2.52	18½p
YF77J	74LS189	£4.64	34½p
YF78K	74LS190	62p	4½p
YF79L	74LS191	62p	4½p
WH12N	74192	78p	6p
YF80B	74LS192	51p	4p
QX90X	74193	78p	6p
YF81C	74LS193	62p	4½p
WH13P	74194	78p	6p
YF82D	74LS194	76p	5½p
YF83E	74LS195	76p	5½p
WH14Q	74196	68p	5p
YF84F	74LS196	51p	4p
YF85G	74LS197	58p	4½p
YF86T	74LS221	98p	7½p
YF87U	74LS240	68p	5p
YF88V	74LS241	£1.40	10½p
YF89W	74LS242	68p	5p
YF90X	74LS243	£1.26	9½p
YF91Y	74LS245	£1.90	14p
YF92A	74LS251	48p	3½p
YF93B	74LS253	56p	4p
YF94C	74LS256	96p	7p
YF95D	74LS257	55p	4p
YF96E	74LS258	92p	7p
YF97F	74LS259	60p	4½p
YF98G	74LS261	£5.90	43½p
YF99H	74LS266	26p	2p
YH00A	74LS273	74p	5½p
YH01B	74LS279	68p	5p
YH02C	74LS283	53p	4p
YH03D	74LS290	70p	5p
YH04E	74LS293	74p	5½p
YH05F	74LS295	£1.46	11p
YH06G	74LS298	82p	6p
YH07H	74LS299	£3.58	26½p
YH08J	74LS323	£6.49	48p
YH09K	74LS363	NYA	
YH10L	74LS364	NYA	
YH11M	74LS365	40p	3p
YH12N	74LS366	40p	3p
YH13P	74LS367	40p	3p
YH14Q	74LS368	40p	3p
YH15R	74LS373	£1.76	13p
YH16S	74LS374	86p	6½p
YH17T	74LS375	56p	4p
YH18U	74LS377	66p	5p
YH19V	74LS378	£1.04	7½p
YH20W	74LS379	99p	7½p
YH21X	74LS390	70p	5p
YH22Y	74LS393	£1.18	8½p
YH23A	74LS395	94p	7p
YH24B	74LS398	£1.66	12½p
YH25C	74LS399	£1.54	11½p
YH26D	74LS490	£1.44	10½p
YH27E	74LS568	NYA	
YH28F	74LS569	NYA	
YH29G	74LS670	£2.16	16p
YH30H	74C917	NYA	
YH31J	74C920	£7.75	57½p
YH32K	76477	£2.25	16½p
YH33L	76489	NYA	
YH34M	8T28	£1.99	14½p
YH35Q	8T95	£2.05	15p
YH36P	8T97	£1.79	13½p
YH37S	8T98	£1.79	13½p
YH38R	8038CCPD	£3.95	29½p
YH39N	8069DCQ	£1.75	13p
YH40T	8080A	£5.45	40½p
YH41U	8085A	£15.90	£1.18
YH42V	8205	£3.20	23½p
YH43W	8211CPA	£1.65	12p
YH44X	8212	£2.66	19½p
YH45Y	8216	£2.59	19p
YH46A	8224	£3.59	26½p
YH47B	8228	£4.99	37p
YH48C	8250	£9.55	70½p
YH49D	8251	£6.95	51½p
YH50E	8255A	£5.15	38p
YH51F	8279	£11.95	88½p
YH52G	8Z5126 M1	£2.60	19p

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QH36P	LM301A	29p	2p
QH37S	LM308	£1.20	9p
WQ54J	NE531	£1.49	11p
QL20W	µA709C	47p	3½p
QL22Y	µA714C 8-pin DIL	21p	1½p
QL23A	µA741C 14-pin DIL	45p	3½p
QL24B	µA747C	80p	6p
QL25C	µA748C	46p	3½p
QH46A	1458C	56p	4p
QH51F	3403	£1.29	9½p
XX01B	4136	£1.58	11½p

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QH28F	CA3130T	99p	7½p
QH29G	CA3140T	£1.04	7½p
WQ21X	CA3240T	87p	6½p
WQ30H	LF351	40p	3p
WQ31J	LF353	74p	5½p
WQ29G	LF347	£1.72	12½p
QH35Q	LH0042C	£3.99	29½p
QH50E	MC3360P	99p	7½p

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WQ36P	LM389	69p	7½p
WQ63T	TBA820M	69p	7½p
QH38R	LM377	£2.30	25½p

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QH40T	LM380	£1.20	13½p
WQ34M	LM384	£1.30	14½p
QL13P	TBA810P	99p	11p
BR02C	5W Amp PCB	98p	11p
QH39N	LM379	£4.56	50½p

1979/80 Catalogue Page No.		VAT inclusive PRICE	
WQ33L	LM383	£1.65	18½p
WQ66W	TDA2006	£1.65	18½p
WQ67X	TDA2030	£1.85	20½p

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QH44X	MC1303	99p	11p
QH41U	LM381	£1.89	21p
BR04E	LM381 PCB	£1.23	13½p
WQ35Q	LM387	59p	6½p
QH49D	MC3340	£1.19	9p

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QH45Y	MC1310P	£1.99	22p
8R03D	Decoder PCB	98p	11p
WQ64U	TCA4500A	£2.44	27p
WQ37S	LM1820	£1.39	15½p

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BL35Q	TBA 651	£1.84	20½p
QL41U	ZN414	£1.19	13p

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QH27E	CA3089E	£2.94	32½p
WQ20W	CA3189E	£2.34	26p
WQ17T	AY-3-8115	£13.60	£1.01

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WQ62S	TAA 550	47p	5p
WQ61R	SH120A	£8.70	96½p
QB21X	AY-1-0212	£5.94	44p
QB22Y	AY-3-0215	£7.99	59p

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HQ53H	Piano IC Kit	£36.86	£3.43
HQ52G	AY-1-1320	£6.37	71p
HQ51F	AY-1-5050	£2.04	15p
WH22Y	M087	£4.89	36p
QH64U	M252	£7.90	58½p
HQ71N	M251	£13.24	98p
WH21X	M254	£6.77	50p
YH32K	76477	£2.25	16½p

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YH33L	76489	NYA	
WQ65V	TDA1008	£2.60	19½p
WH20W	TDA 1022	£6.61	49p
QB24B	AY-5-1224	£2.99	22p

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BB53H	4 Dig Clock PCB 'A'	93p	7p
QB25C	AY-5-1230	£4.95	36½p
QB26D	AY-5 4007D	£6.99	52p

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WQ52G	MM57160	£5.90	43½p
QH26D	CA3046	87p	9½p
WQ38R	LM2917	£1.77	13p
WQ39N	LM3909	86p	6½p

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WQ40T	LM3911	£1.17	8½p
WQ41U	LM3914	£1.40	10½p
QH47B	MC1496	99p	7½p
QL06G	SG1495D	£4.20	31p
QL07H	SG3402	£2.99	22p
WQ55K	NE 544	£1.88	14p
QW80B	4151	76p	5½p

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QH66W	NE 555	25p	2p
QH67X	NE 556	80p	6p
QH68Y	NE 566	£1.90	14p
WQ56L	NE 565	£1.15	8½p

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QH69A	NE 567	£1.99	14½p
WQ75S	TL170C	39p	3p
WQ76H	TL172C	47p	3½p
QH48C	MC3302	£1.49	11p
YH30H	74C917	NYA	

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YH38R	8038	£3.95	29½p
YH39N	8069	£1.75	13p
YH43W	8211	£1.65	12p
WQ32K	LM334	97p	7p
XX02C	4195	£1.50	11p
XX04E	15V Supply PCB	63p	4½p
BL227Y	µA723C T099	69p	5p
QL21X	µA723C 14-pin DIL	49p	3½p

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WQ43W	MC6800P	£8.45	62½p
WQ44X	MC6802P	£13.25	98p
WQ46A	MC6821P	£4.66	34½p
WQ48C	MC6850P	£7.95	59p
WQ49D	MC6852P	£11.75	87p
WQ50E	MC6875L	£5.45	40½p
QW00A	Z80-CPU	£10.80	80p
QW03D	Z80-PIO	£5.50	40½p
QW04E	Z80-SIO	£28.98	£2.15
QW02C	Z80-DMA	NYA	
QW01B	Z80-CTC	£5.50	40½p

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YH40T	8080A	£5.45	40½p
YH41U	8085A	£15.90	£1.18
YH46A	8224	£3.59	26½p
YH47B	8228	£4.99	37p
YH50E	8255A	£5.15	38p
YH49D	8251	£6.95	51½p
YH48C	8250	£9.55	70½p
YH51F	8279	£11.95	88½p
YH42V	8205	£3.20	23½p
YH44X	8212	£2.66	19½p

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YH45Y	8216	£2.59	19p
YH34M	8T28	£1.99	14½p
YH35Q	8T95	£2.05	15p
YH36P	8T97	£1.79	13½p
YH37S	8T98	£1.79	13½p
WQ18U	AY-5-1013A	£6.64	49p
WQ19V	AY-5-2376	£13.81	£1.02
QW92A	5018	£9.54	70½p

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QW94C	7106	£11.99	89p
QW95D	7107	£11.49	85p
BY76H	LCD 7106 PCB	85p	6p
BY77J	LCD 7107 PCB	85p	6p
WQ60Q	SFF96364	£13.25	98p
YH31J	74C920	£7.75	57½p
QW11M	2102	£1.65	12p
WH17T	2112	£2.38	17½p

1979/80 Catalogue Page No.		VAT inclusive PRICE	
WQ45Y	MC6810AP	£4.27	31½p
QW12N	2114	£10.45	77½p
WQ42V	MCM4027	£4.75	35p
QW93B	6616 = 4116	£11.30	83½p
QW05F	1702	£8.95	65p

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QW13P	2708	£11.55	85½p
WQ26D	ER1400	£13.82	£1.02
WQ27E	ER3401	£18.95	£1.40
YH52G	8Z5126M1	£2.60	19p
WQ59P	RO-3-2513	£7.90	58½p
WQ47B	MCM6830L7	£15.95	£1.18

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RQ49D	M6800 Applications	£17.42	—
RQ55K	M6800 Data	NYA	
RQ56L	M6800 Programming	£4.87	—
RQ57M	MC6850 Applications	25p	—
RQ45Y	MC6875 Applications	25p	—
RQ46A	8080 Ass Lang Manual	£7.50	—
RQ47B	8080 Systems Manual	£9.50	—
RQ48C	8085 Systems Manual	£7.50	—
RQ50E	8251 Applications	£2.50	—
RQ51F	8255 Applications	£2.50	—
RQ52G	8080 Brochure	50p	—
RQ53H	8085 Brochure	50p	—
RQ54J	Z80 Data	£1.95	—
WL32K	TIL209 Red	18p	1½p
WL33L	TIL209 Green	22p	1½p
WL34M	TIL209 Orange	32p	2½p
WL27E	LED Red	15p	1p
WL28F	LED Green	19p	1½p
WL29G	LED Orange	31p	2p
WL30H	LED Yellow	31p	2p
QW96E	Square LED Red	58p	4½p
FR36P	7-Seg Red Type 1	£1.42	10½p
FR37S	7-Seg Red Type 3	£1.42	10½p
FR38R	7-Seg Red Type 4	£1.42	10½p

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FR39N	½in. Display Type 1	£1.99	14½p
FR40T	½in. Display Type 3	£2.21	16½p
FR41U	½in. Display Type 4	£2.26	16½p
BY65V	Bargraph Display	£1.80	13½p
BY66W	DD Display Type A	£1.60	12p
BY67X	DD Display Type AF	£1.60	12p
BY68Y	DD Display Type C	£1.60	12p
BY69A	DD Display Type CF	£1.60	12p

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XX08J	4-Dig Dis Cmn Cath	£3.95	29½p
BY70M	4-Dig Dis Cmn Anode	£3.95	29½p
HQ36P	Mult Cmn Cath Display	£3.99	29½p
YH53H	Cliplite Amber	13½p	1p
YH54J	Cliplite Clear	13½p	1p
YH55K	Cliplite Green	13½p	1p
YH56L	Cliplite Red	13½p	1p
YH57M	Cliplite Yellow	13½p	1p
FY89W	Liquid Crystal Display	£8.35	82p

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WL35Q	Opto-Isolator	79p	6p
WQ70M	Darlington Isolator	£1.40	10½p
BL23A	Solar Cell MS4A	£1.35	10p
QF30H	BPX 25	£1.86	14p
HQ61R	MEL 12	36p	2½p
HQ63T	Lens	99p	7½p
HQ64U	Lensholder	45p	3½p

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XL11M	Laser Tube	£98.00	£7.26
HY19V	5kV Laser PCB	£2.69	20p
FR32K	Filter Amber	55p	4½p
FR33L	Filter Green	55p	4½p
FR34M	Filter Red	55p	4½p
FR35Q	Filter Yellow	55p	4½p
XR56L	1mm Light Guide	£1.34	10p
BY73Q	8W Amp PCB	45p	5p
LW36P	8W Amp Kit	£3.75	42p

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HQ68Y	50W Hi-Fi PCB	£1.99	14½p
LW35Q	50W Amp Kit	£12.90	96p

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XF05F	Disco Schedule	Free	
LW32K	150W Power Amp Kit	£13.99	£1.04

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HY21X	Clock Timer PCB	£1.55	11½p
LW30H	Clock Timer Case	£8.20	60½p
XF32K	Monitor Schedule	Free	
LW31J	Clock Timer Kit	£34.90	£2.58

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XL14Q	MA1023	£7.90	58½p
BY74R	Michron Mk II PCB	47p	3½p
YB92A	Michron Mk II Case	£4.30	32p
LW37S	Michron Mk II Clock Kit	£14.95	£1.11
XF31J	Michron Mk II Leaflet	Free	

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BY75S	Train Control PCB	£1.75	13p
YB93B	Train Control Case	£5.93	44p
LW49D	Train Controller Kit	£23.50	£1.74
XF28F	Train Cntrlr Schedule	Free	

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BY91Y	Ultrasonic Detector PCB	87p	6½p
BY92A	Burglar Alarm PCB	£3.57	26½p
BY93B	External Alarm PCB	45p	3½p
BY94C	Alarm Buzzer 12V	£1.43	10½p
XY13P	Burglar Alarm Box	£6.58	48½p
BY95D	Alarm Box Bracket	22p	1½p
BY96E	Extl Plug Tool	Not Required	
BY97F	External Alarm Box	£9.20	68p
LW38R	Ultrasonic Detector Kit	£10.50	78p
LW39N	Burglar Alarm Kit	£62.50	£4.63
XF29G	Burglar Alarm Sched	Free	

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LW40T	Tuner Metalwork Kit	NYA	
LW41U	Tuner PSU Module	NYA	
LW42V	Tuner Switching Mod	NYA	
LW43W	Tuner IF Module	NYA	
LW44X	Tuner Head EF5600U	£21.35	£2.37
LW45Y	TV Sound Tuner	NYA	
LW46A	AM Tuner	NYA	
LW48C	Stereo Tuner Kit	NYA	
XF22Y	Tuner Schedule	Free	

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XF21X	40W Amp Schedule	Free	

An insulator layer of silica is now added to separate the conductor and nickel-iron layers. Nickel-iron alloy follows, and in this layer the propagation pattern is defined, again using photolithography. This is the most critical step as the propagation pattern must be aligned closely with the conductor pattern. Again, high resolution pattern definition is obtained using ion milling to remove unwanted nickel-iron. The last deposition is a third silica layer which acts as a passivation protecting the chip from the outside world. Finally, the silica over the contact pads of the first conductor layer must be removed. This is done using a non-critical mask, with the unwanted silica being etched away using hydrofluoric acid. The wafer is now ready for testing by a piece of equipment called a probe-tester.

The wafer is mounted onto a stage and probe needles move from chip to chip on the wafer, making electrical contact between the chip and the test electronics. The test head contains coils to provide the rotating inplane drive field, and the static bias field perpendicular to the wafer. At this stage, chips which work over a range of bias fields greater than about 10oe are accepted. Those which do not meet this criterion are marked with an identifying inkspot and the wafer is sawn into individual chips.

Compared with semiconductor processing, the fabrication of bubble devices appears less demanding. The formation of the film overlays is a purely additive and subtractive process with no diffusion steps involved. The number of critical masking steps is only two, compared with twelve or more for semiconductors. However, much greater control of the element geometry is necessary in bubble devices with features as small as 1–2μm needing to be controllably defined over relatively large areas. This is many times more demanding than for semiconductor devices.

BUBBLE DEVICE PACKAGES

The design of packages to house bubble chips is complicated by the magnetic environment they need for correct operation. The package must provide an inplane drive field, usually 40–50oe in amplitude, which rotates at 100–300kHz in the chip plane. There are several coil configurations which can achieve this, but the most commonly used is an arrangement of orthogonal solenoid coils as shown in Fig. 11. By feeding both coils with sine-wave currents 90° out of phase with each other, a field of constant amplitude is achieved which rotates in the chip plane. This is like the circular lissajous figures obtained when quadrature sine waves are applied to the horizontal and vertical amplifiers of an oscilloscope. The bias field needed to stabilise the bubble domains is usually provided by a permanent magnet system to ensure that the data remains intact under zero power conditions. Two plates of barium ferrite ceramic permanent magnet material positioned above and below the chip are commonly used. Ferrite magnets are chosen as their temperature coefficient of magnetism matches that of the garnet

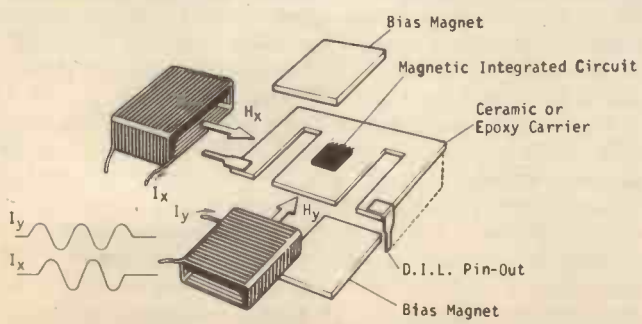


Fig. 11. Schematic of bubble package components. The coils produce the rotating magnetic field which makes the bubbles hop along the chevrons

films, allowing the bias field requirements of the bubble domains to be matched over a range of temperatures. Fig. 12 shows a package in exploded form currently in production at our company. It is designed to house chips 5mm square and is currently used for both 64K single loop (12 pin) and multiloop (14 pin) devices. The chip is glued to the E-shaped carrier board and the chip is electrically connected to the substrate tracks by 0·001 inch thick gold wire, bonded using an ultrasonic or thermocompression wirebonder, similar to those developed for silicon chips. Precisely formed self-supporting coils are slipped on and connected to the pads on the outer arms of the substrate.

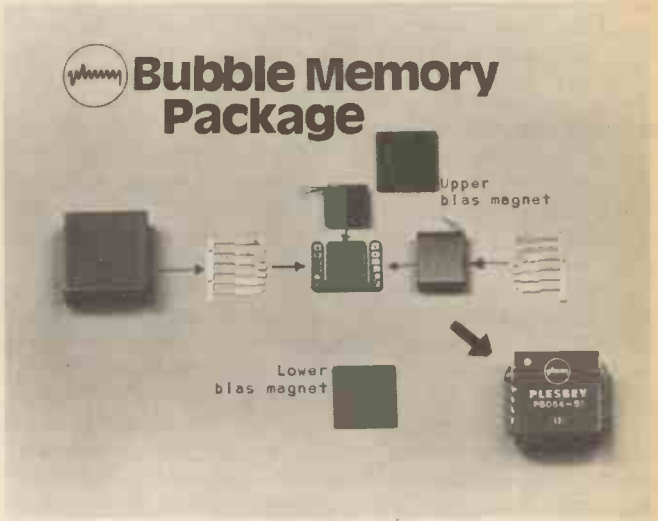


Fig. 12. Exploded view of 64K package

The lead frame is attached using a reflow solder operation, and the bias magnets are positioned above and below the outer coil. The assembly is slid inside the magnetic shield and filled with an epoxy-resin potting compound. The package legs are bent downwards to give the dual-in-line format, and the package identification is printed on the top surface.

The technology of connecting the bubble chip to the lead frame and the encapsulation of the component parts is based on that already existing within the microelectronics component industry. To produce a bubble memory package, however, the additional expertise of the coil winding, permanent magnet and magnetic shielding industries is needed.

The final stage in the device production is to set the bias magnets to the required field and to perform parametric and function tests over the operating temperature range. Each bubble chip, even from the safe wafer, will have a slightly different range of bias field over which the bubbles are stable. The magnets are first saturated by applying a field of about 12,000oe. The field level is then successively reduced by reverse field pulses of increasing amplitude until the centre of the bias field margin is reached. This is done in a computer-controlled test station which automatically monitors the performance as the bias field is reduced, and then tests the device at high and low temperature over the full range of operating conditions.

USING BUBBLE MEMORIES

Interfacing with a bubble device involves the use of some novel circuitry to produce the drive currents in the coils. Periodic currents are needed of up to two amps peak to peak into some tens of microhenries at 100–300kHz. They must be controlled to run for a defined number of complete cycles and stop and start in a *well behaved* manner without overshoot or ringing of the currents. The choice of drive circuit lies between resonant drive, giving sinusoidal currents, and direct drive which usually results in triangular currents. Resonant drive is more

difficult to use because the timing control is too complex to achieve correct waveforms at the required frequency for a number of packages on the same circuit board. A schematic of this type of drive is shown in Fig. 13a. Nowadays most systems use a triangular driver in which a voltage is simply switched across a non-resonant coil.

A simple form of this circuit is shown in Fig 13b. Currents build up during the first half of each triangular pulse through the switching transistors and decay through the diodes when the transistors are turned off.

As previously mentioned, sensing of bubble signals is usually done using the dummy and detector in a bridge circuit. The actual signal will have an I/O separation of 10—20mV for about 0·5μs. A simple circuit for bubbles sensing is shown in Fig. 13c.

WHERE WILL BUBBLES APPEAR?

The very rapid advances in bubble memory technology during the past few years have been fuelled by the attractive features offered by this device. Bubble devices fall between semiconductor RAMS and moving media memories, such as discs, in both access time and cost per bit. Compared with magnetic disc memories bubbles have higher reliability and a lower error rate since they have no moving parts. Their access time is faster than that of a disc; they consume less power, and are physically smaller. A comparison with semiconductor MOS memories is rather unfair, as their access times are two or three orders of magnitude faster than bubbles. Their interfacing is also somewhat simpler. Semiconductor RAMS will undoubtedly remain as the main memory for computers, but they may well be found transferring data in and out of a bubble memory mass storage device in the near future.

The first areas where bubbles can be expected to appear are those currently served by floppy disc or cassette stores. Bubble memories offer 100 times faster access, using multiloop devices, than a floppy disc, and because of their inherently solid state nature are more reliable. Like a disc (or its slower brother the data cassette) bubbles offer non-volatile storage and serial access at about the same cost per bit. However, bubbles, unlike discs and cassettes, are not a readily exchangeable storage medium. Since in moving media memories most of the cost is in the mechanical aspects, this may not be a serious drawback in most applications. For this type of storage, bubbles can be expected to appear fairly shortly in point of sale equipment, word processing systems, industrial process control, desk top computers and telecommunication applications. These uses will probably involve the bubble memory as a backing store to a microprocessor.

The second area where bubbles are likely to appear is that in which reliability is of prime importance. These include harsh environments encountered in military and some industrial uses. The high reliability, solid state, low power and weight characteristics of bubbles should find a ready market for such applications.

THE FUTURE

The furious pace of development throughout the micro-electronic industry makes any prediction about future progress difficult. Already, the 64 kilobit device has been passed in the laboratory by a 256 kilobit device which should enter production before 1980. In the USA chips as large as 1 Megabit have been made and operated, and chips of four times this capacity have been projected for the early 1980s. The hunt is on for better materials to support smaller bubbles and also different ways of manipulating bubbles to store information. Among ideas being actively pursued are contiguous disc devices, in which the bubble propagation is controlled by ion-implanted

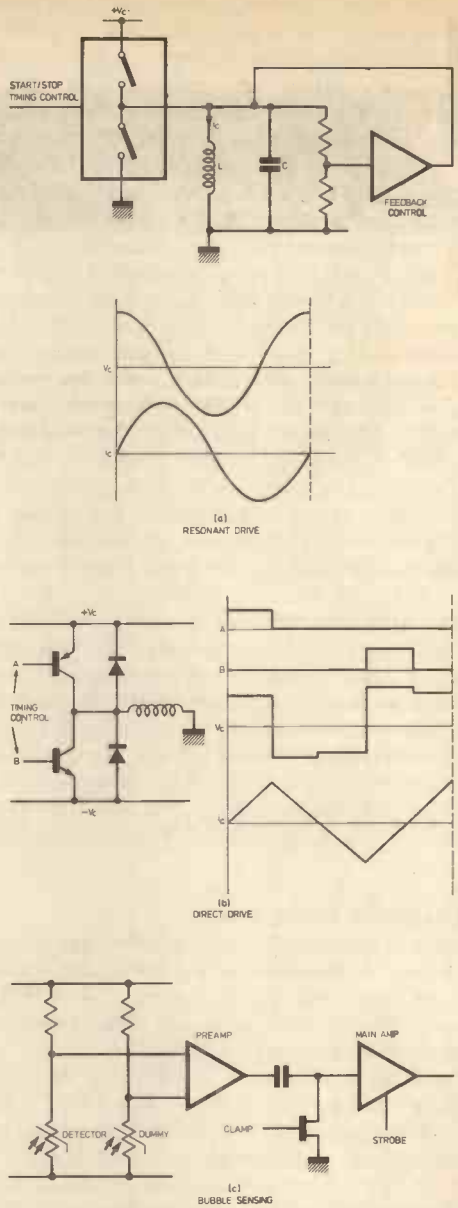


Fig. 13. Bubble device interfacing. (a) Resonant drive. (b) Direct drive. (c) Bubbles sensing

patterns in the garnet film. This pattern replaces the nickel-iron propagation patterns with ion-implanted areas which are much less critical to produce, and so can be made much smaller. Another idea, still at the development stage, is the bubble lattice file in which the binary information is stored as one of two possible spin configurations in the bubble domain wall. A close-packed array of bubbles is used here, increasing the storage density almost five times over a conventional device.

Advances in fabrication with the introduction of electron-beam techniques should also yield improvements in current designs, certainly allowing considerable increases in storage densities. New packaging techniques will give lower power, smaller devices operating at higher frequencies. Also, it is expected that families of support devices to perform the coil drive, sensing and control timing for bubble devices will be developed as soon as a measure of standardisation is arrived at between manufacturers. It is therefore hoped that over the next few years circuit designers will come to regard magnetic bubble devices as just another integrated circuit package.

MICRO-BUS

Compiled by DJD.

Appearing every two months, Micro-Bus will present ideas, applications, and programs for the most popular microprocessors; ones that you are unlikely to find in the manufacturers' data books. The most original ideas will probably come from readers working on their own microcomputer systems, and payment will be made for any contribution featured here. This is also the place to air your views, in general, on this new technology, so let's be hearing from you!

SOFTWARE ANALOGUE-TO-DIGITAL CONVERSION

THE FOLLOWING system uses a low-cost digital-to-analogue converter together with a comparator to perform A/D conversion by successive approximation. It was sent in by *Phillip L. Watson* who developed it for use with a Motorola D2 kit, and what follows is based on his description.

"The design, shown in Fig. 1, uses around £6 of external components and gives conversions to 8-bit accuracy. The successive approximation program, Fig. 2, is entered at $0000 and the first section configures the user PIA which is at $8004 to $8007 in the D2 kit. Side A lines are all outputs and bit 7 of side B is an input.

```
                *
                * SOFTWARE A/D CONVERSION USING
                *   SUCCESSIVE APPROXIMATION.
          8004  PIAA    EQU   $8004
          8005  PIACA   EQU   PIAA+1
          8006  PIAB    EQU   PIAA+2
          8007  PIACB   EQU   PIAA+3
                *
0000 86 FF    ATOD    LDA A  #$FF      CONFIGURE PIA:
0002 B7 8004          STA A  PIAA      ALL OUTPUTS
0005 4A               LSR A
0006 B7 8006          STA A  PIAB      PB7 INPUT
0009 86 3C            LDA A  #$3C      CONTROL WORD
000B B7 8005          STA A  PIACA
000E B7 8007          STA A  PIACB
                *
                * CONVERSION ROUTINE *
                *
0011 4F               CLR A
0012 C6 80            LDA B  #%10000000
0014 1B       CONVT   ABA              ADD B INTO A
0015 B7 8004          STA A  PIAA
0018 7D 8006          TST    PIAB      PB7 HIGH?
001B 2B 01            BMI    LOW       IF VOLTAGE IS TOO LOW
001D 10               SBA              RESET BIT
001E 54       LOW     LSR B            SET UP FOR NEXT BIT
001F 24 F3            BCC    CONVT     MORE TO DO?
0021 3F               SWI              STOP - RESULT IN A
                *
                      END
```

Fig. 2. Successive approximation analogue-to-digital conversion program for the M6800 micro

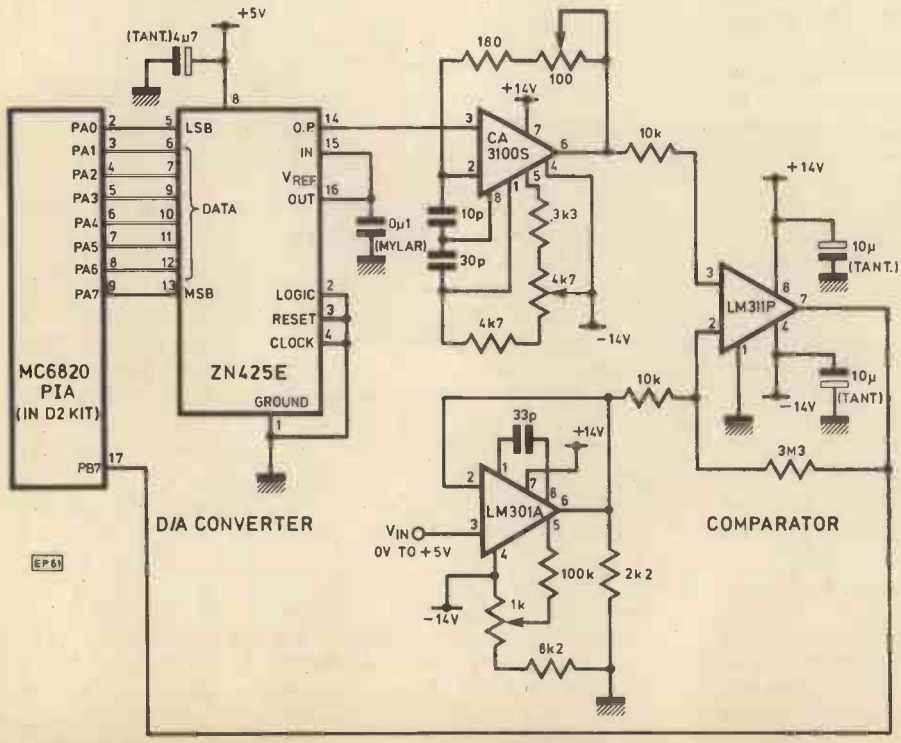


Fig. 1. Analogue-to-digital converter using a comparator and a low-cost D/A converter

The conversion routine starts at $0011 and works as follows: accumulator B bit 7 is set and this is added into A. The contents of accumulator A are then used to drive the ZN425E D/A chip through the PIA to produce a voltage determined by the value. The comparator compares this with the input voltage and, dependent on the result, conditionally resets the bit in accumulator A. The '1' in accumulator B is passed serially down all eight bits; consequently each bit of accumulator A is tried in turn. The last iteration causes the '1' to pass into the carry flag and this gives an exit from the loop. At this point the 8-bit result is in accumulator A.

"In the prototype a display routine was used to give a continuous reading of the result in hex on the display. The conversion takes about 300 microseconds with the 614·4kHz clock in the D2 kit; however the speeds of the CA3100S and LM311P are such that it could easily run on much faster systems. If the conversion rate is not fast enough, using software, for your particular application then the unit can be used in conjunction with an MC14459 successive approximation register chip; with direct clocking by Ø2 this would bring the conversion time down to a few microseconds."

In less critical applications the two op-amps could probably be omitted from Mr Watson's circuit; the ZN425E gives a direct voltage output and can therefore drive the comparator directly, giving a range of 0 to 2·56 volts.

BASIC LEARNING PROGRAM

Science of Cambridge, who market the popular MK14 microprocessor system, have kindly supplied details of an interesting computer program which could enable engineers without much experience to mend kits returned with faults. The program, a variant of the well-known "Animals" game, is a simple illustration of how computers can be made to learn how to solve tasks; a sample dialogue between the program and the engineer is shown in Fig. 3 with the engineer's entries shown underlined.

The program asks the engineer to carry out a series of tests on the kit by supplying the answer to a yes/no question. Finally, on the basis of the replies the program suggests what must be wrong. If this does not succeed in

```
>RUN

IS THERE AN MK14 TO REPAIR? YES
DOES THE DISPLAY LIGHT UP? YES
DOES THE DISPLAY SHOW 8.8.8.8.8.8.8.8.? NO
DOES THE DISPLAY FLASH ERRATICALLY? NO
IS THERE INTERFERENCE ON THE RADIO? NO
CHECK FOR A BAD SCMP. OK NOW? YES

IS THERE AN MK14 TO REPAIR? Y
DOES THE DISPLAY LIGHT UP? Y
DOES THE DISPLAY SHOW 8.8.8.8.8.8.8.8.? N
DOES THE DISPLAY FLASH ERRATICALLY? Y
CHECK FOR BAD CRYSTAL CONNECTIONS. OK NOW? N
WHAT IS WRONG? REGULATOR OVERHEATING
WHAT QUESTION DISTINGUISHES REGULATOR OVERHEATING
FROM BAD CRYSTAL CONNECTIONS? DOES TOUCHING SCMP AFFECT DISPLAY
DOES BAD CRYSTAL CONNECTIONS CAUSE THIS SYMPTOM? Y

IS THERE AN MK14 TO REPAIR? Y
DOES THE DISPLAY LIGHT UP? Y
DOES THE DISPLAY SHOW 8.8.8.8.8.8.8.8.? N
DOES THE DISPLAY FLASH ERRATICALLY? Y
DOES TOUCHING SCMP AFFECT DISPLAY? Y
CHECK FOR BAD CRYSTAL CONNECTIONS. OK NOW? Y

IS THERE AN MK14 TO REPAIR? N
GOODBYE.

>
```

Fig. 3. Example of a dialogue between the kit-repair program of Fig. 4 and an engineer

```
>LIST
50 GOTO 200
100 M=TOP: N=M: @N=#3F: $(N+1)="DOES THE DISPLAY LIGHT UP"
110 GOSUB 500: P=M: M=M+4: L=M: $L="NO POWER SUPPLY": GOSUB 500
120 K=M: $K="A BAD SCMP": GOSUB 500: @P=L/256: @(P+1)=L
130 @(P+2)=K/256: @(P+3)=K
200 N=TOP: PR "": PR "IS THERE AN MK14 TO REPAIR";: GOSUB 600
210 IF @M=0 GOTO 700
300 IF @N<>#3F GOTO 330
310 PR $(N+1);: GOSUB 600: DO: N=N+1: UNTIL @(N-1)=#0D
320 P=N+@M: N=@P*256+@(P+1): GOTO 300
330 PR "CHECK FOR ";$N;". OK NOW";: GOSUB 600: IF @M<>0 GOTO 200
340 PR "WHAT IS WRONG";: INPUT $M: L=M: GOSUB 500
350 PR "WHAT QUESTION DISTINGUISHES ";$L
355 PR "FROM ";$N;: @M=#3F
360 INPUT $(M+1): @P=M/256: @(P+1)=M: GOSUB 500: K=M
370 M=M+4: PR "DOES ";$N;" CAUSE THIS SYMPTOM";: GOSUB 600
380 @(K+@M)=N/256: @(K+1+@M)=N: @(K+2-@M)=L/256: @(K+3-@M)=L
390 M=M+4: GOTO 200
500 DO: M=M+1: UNTIL @M=#0D
510 M=M+1: RETURN
600 INPUT $M: IF @M=#59 @M=2: RETURN
610 IF @M=#4E @M=0: RETURN
620 IF @M=#51 END
630 PR "PLEASE ANSWER YES OR NO. WELL";: GOTO 600
700 PR "GOODBYE."

>
```

Fig. 4. NIBL-language program which learns how to repair faulty microprocessor kits

getting the kit working the program asks the engineer what the fault turned out to be, and requests him to type in a question that should have been asked by the program at that point. Next time a faulty kit shows the same symptoms the program will know what is wrong.

NIBL

The program, shown in Fig. 4, was written by Nick Toop of Science of Cambridge in the BASIC-like language for SC/MP, National's Industrial BASIC Language known as NIBL. This is an integer-only BASIC and although there are no arrays or string variables, these can be implemented with the operators "@" and "$". Table 1 explains these and some other non-standard features of the language, and this should enable you to convert the program into other dialects of BASIC if necessary. Note that the program listing was produced on a British teletype, and "$" appears as "£"; "PR" is used as an abbreviation of "PRINT". NIBL is available in two 2316A ROMs for £46·90 from Greenbank Electronics.

PROGRAM OPERATION

A simple way to understand the operation of the program is to consider the tree of Fig. 5 which represents the way that the strings of questions and answers might be stored in the program at an early stage in its education. The program starts at the top of the tree asking the

Table 1. Examples of statements in the NIBL language, a small BASIC interpreter for the SC/MP micro

Expressions

All expressions are 16-bit, twos-complement values.
26 variable names: A through Z.
Relational Operators <, >, =, <=, >=, <>.
Arithmetic Operations +, −, *, /.
Logical Operators AND, OR, NOT.
Decimal Constants in the range −32767 to 32767.
Hexadecimal Constants denoted by '#' followed by hex digits.
Expressions can be on individual lines or several can be inserted on the same line if they are separated with a colon (i.e., 100 PRINT "HOW MANY";: INPUT X).

Functions

RND (a, b) returns the random number in the range a through b.
MOD (a, b) returns the remainder of a/b.
STAT returns the value of the INS8060 Status Register.
PAGE returns the number of the current Page.
TOP returns the highest address of NIBL program in the current Page.

Input/Output Statements

```
INPUT X
INPUT X, Y, Z
PRINT "A STRING"
PRINT "F=", M*A
PRINT "TAKE", X, "PILLS BEFORE";
```

NOTE

The semicolon suppresses an otherwise automatic carriage return after any PRINT statement.

Assignment Statements

```
LET X=7
E=I * R
STAT=#70
PAGE=PAGE+1
LET @A=255
@ (T+36)=F
B=@(TOP+5)
```

Control Statements

```
GO TO 15 or GOTO 15
GOTO X+5
GO SUB 100 or GOSUB 100
RETURN
IF X+Y<#1A GOTO 15
IF A=B LET A=B−C
FOR I=10 TO 0 STEP −2
NEXT I
FOR K=1 TO 5
DO: X=X+1: UNTIL (X=10) OR (@X=13)
```

Indirect Operator

If the value of V is #2000, then "LET @V=100" stores 100_{10} at memory location 2000_{16} and "LET W=@V" sets W to the contents of the location specified by V.

NOTE

The values that can be stored at any one specified memory location range from 0 to 255_{10}.

String Handling

```
$T="THIS IS A STRING"
PRINT $T, $ (TOP+72)
INPUT $ (U+20)
$U=$ (TOP+2*36)
```

question at each node, then turning left or right depending on the reply. When the program reaches the end of a branch it gives the diagnosis of the fault. If this does not get the kit working another node is added to the tree at this point; the question supplied by the engineer is put at this new node, and his diagnosis is put at the end of the appropriate branch.

The tree is constructed in the computer's memory by storing two addresses after each question; these are pointers to the strings at the end of each branch. Questions are distinguished from diagnoses by being prefixed by a question-mark (3F in hex). The first time the program is run it is entered at line 100 to initialise the tree. On subsequent runs the program is entered at line 50. The variable "M" is used to point to the next free memory location for strings, and the subroutine at 500 sets it to point after a string that has been entered. The subroutine at 600 checks replies for "Y" or "N".

OTHER APPLICATIONS

The program can be used in most applications where binary decisions are used to solve problems. For example, a computer chef program might ask whether certain items are in the store-cupboard, and then suggest a recipe; if the human replies "I can't make that because I've no pepper," the computer would ask, "What can you make?" Next time the human gave the same series of replies, the computer would ask, "Have you any pepper?" and if not it would suggest the recipe previously supplied by the human.

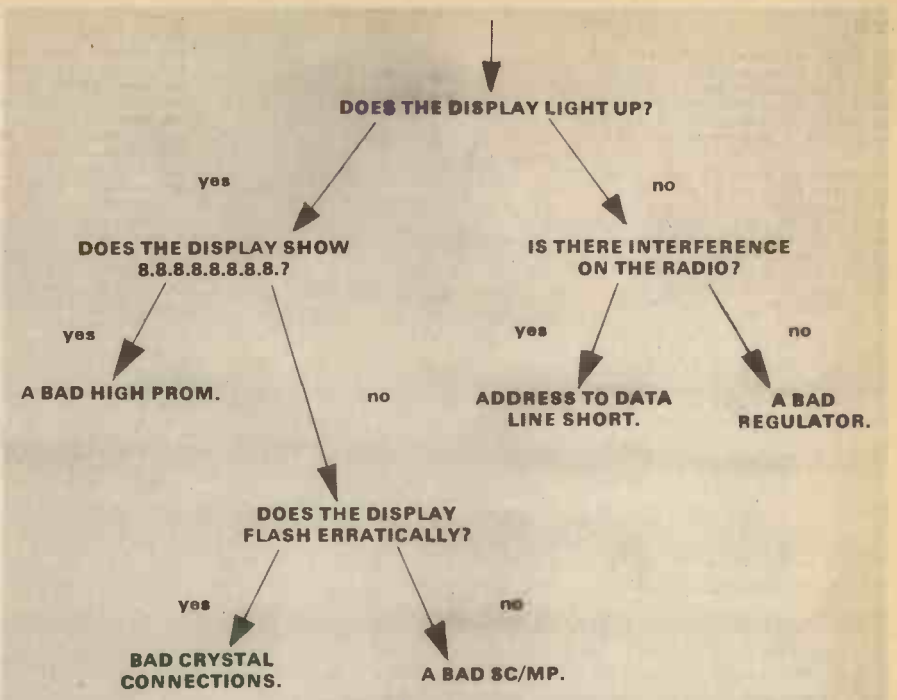


Fig. 5. Representation of the way that questions and diagnoses are built into a tree by the kit-repair program

phaser

D.S.GIBBS & I.M.SHAW C.Eng. M.I.E.E.

OF all the electronic effects used by today's guitarists there are two outstanding favourites, the sustain unit and the phaser. The phaser to be described here is to complement the sustain unit featured in the October 1977 issue of P.E. Most people will be familiar with the "science fiction" sound of a phaser, which is fortunate because it is very difficult to describe. For those who are not familiar with the sound it could be described as "atmospheric whooshing" or "skying", but it really has to be heard to be appreciated and once heard it is easily recognisable. The best effect is obtained with signals having a high harmonic content, such as a guitar after a treble booster or fuzz unit. The effect described is normally obtained with the speed control set to a slow sweep. At higher sweep speeds the effect is altogether different and is comparable to the "rotating Leslie speaker" sound used for electronic organs, or a superior tremolo.

What may not be generally realised is that the depth and intensity of the phasing effect depends on the number of stages of phase shift employed. A phaser works by shifting the phase of the input signal without altering its amplitude. The phase shifted output signal is then added to the input with the result that at certain frequencies—where the output signal is in antiphase with the input—the two signals cancel to give zero output, whilst at other frequencies where the two signals are in phase with each other the output is doubled. The frequency response thus consists of a series of peaks and troughs, the number depending on the number of stages of phase shift in the circuit. To give the effect a dynamic component the phase shift networks are voltage controlled so that the phase shift—and hence the notches—can be swept up and down the audio band by means of a low frequency sweep voltage.

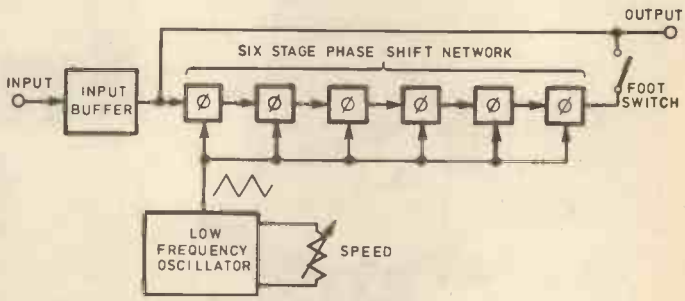
SIMPLE PHASERS

The simplest phaser would consist of two stages of phase shift and would give a single notch. There have been a number of circuits of this type and whilst it gives one a taste of what phasing is all about, it is inadequate for the serious musician. The general effect is in fact more like turning the treble and bass controls up and down than phasing.

A two notch phaser is better, but the minimum for a really convincing sound is three notches. This requires six stages of phase shift.

CIRCUIT DESCRIPTION

The full circuit diagram of the phaser is shown in Fig. 2 and at first sight it probably looks rather daunting. However, it is in fact quite simple and consists of three basic stages: the input, the sweep oscillator, and a phase shift network (Fig. 1). The latter circuit is repeated six times and it is this which gives the circuit its apparent complexity. The i.c.s. used are Texas TL062 dual FET input operational amplifiers and were chosen because of their low noise and very low power consumption. The total current drain of the unit is only about 5mA, ensuring a long life from a PP3 battery.



EG 63

Fig. 1. Block diagram of the Phaser

INPUT STAGE

IC1a acts as an input buffer. It provides a high input impedance so as not to load the guitar and a low output impedance to drive the phase shift networks. The circuit gives a gain of two, which helps to reduce the noise contribution from the phase shift networks.

SWEEP OSCILLATOR

The other half of IC1 is used to generate a low frequency triangle waveform. This is applied to the gates of the FETs to vary the phase shift, as described later. Assume that the output of IC1b has just switched from its low voltage state (about 1·5 volts on pin 7) to its high voltage state (about 7·5 volts on pin 7). Capacitor C18 starts charging up via VR2 and R45 until the voltage on pin 6 of the i.c. rises above that on pin 5 (about 6 volts). When this happens IC1b switches to its low voltage state and the voltage on pin 5 is reduced to about 3 volts. C18 now discharges through VR2 and R45 until the voltage on pin 6 drops below the voltage on pin 5.

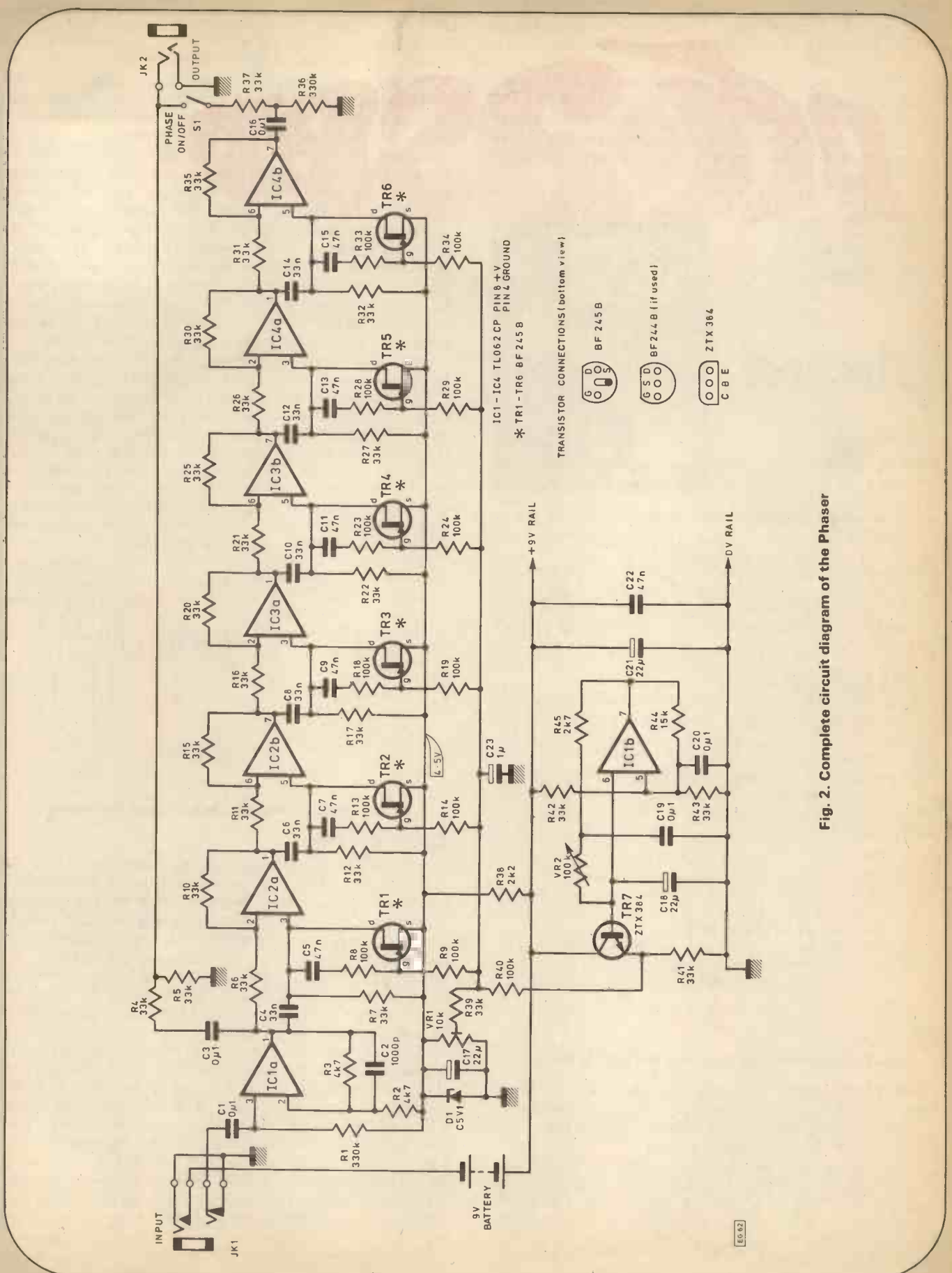
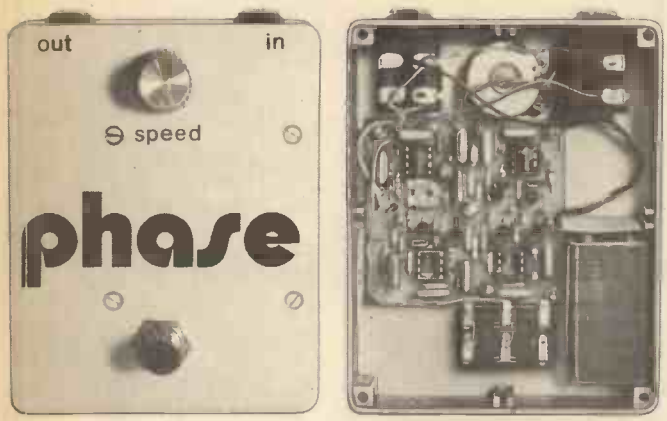


Fig. 2. Complete circuit diagram of the Phaser

When this happens IC1b switches to its high voltage state again and the cycle repeats. The circuit thus generates a triangle wave on C18 and a square wave at the output of the i.c.

The square wave output is not required, but the triangle wave is taken off via emitter follower TR7. The amount of sweep voltage applied to the FETs is governed by the ratio of R39 to R40 and the bias by the setting of VR1. VR2 controls the speed of the sweep generator and covers a range of about 1 cycle in 5 seconds to 5Hz.



Front panel annotation and internal layout of the Phaser unit

Capacitors C19 and C20 slow up the switching speed of the i.c. so that the transitions of the square wave are relatively slow. If this is not done the oscillator can generate spikes when it switches which appear as annoying clicks in the output.

PHASE SHIFT NETWORK

A simplified diagram of the phase shift network is shown in Fig. 3. At low frequencies, where the impedance of C4 is very high, the circuit becomes simply a virtual earth amplifier with a gain of −1. At high frequencies, where the reactance of C4 is negligible, the whole of the input signal is applied to the non-inverting input of the amplifier and the circuit provides a gain of +1. Between these two extremes, at the point where the reactance of C4 equals the resistance

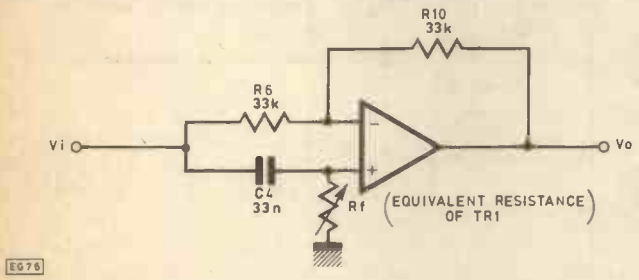


Fig. 3. Simplified diagram of a phase shift network

presented by the FET the circuit gives a phase shift of 90 degrees but the gain still remains at 1. Thus as the frequency is increased the phase shift varies from 180 degrees to zero but the gain of the circuit is always unity.

One stage by itself would not be very much use, but suppose we connect two stages in series and add the output to the input. At low frequencies both stages would give 180 degrees phase shift, i.e. 360 degrees total—which is the same as zero and thus the output adds to the input. At high frequencies both stages give zero phase shift and again the output adds to the input. At the mid point where the phase shift of each stage is 90 degrees the output is 180 degrees out of phase with the input and so the two signals cancel, producing a notch in the frequency response.

A simple single notch phaser is inadequate for the professional musician and so this design has six phase shift networks producing three notches. The total phase shift range is 0–1,080 degrees and notches are produced whenever the output is in antiphase with the input. This happens at 180, 540 and 900 degrees, corresponding to phase shifts for the individual stages of 30, 90 and 150 degrees. One could, of course, extend the chain of phase shift networks even further and produce more and more notches, but there is a snag. Every operational amplifier generates a small amount of noise and every FET generates a small amount of distortion which slowly degrade the input signal as it passes down the chain. The optimum point is a matter of opinion but we feel that a six stage circuit gives the best compromise between performance cost and complexity.

The phase shift is made voltage dependent by using FETs as voltage controlled resistors. The characteristics of these FETs are important and only the recommended type should be used as these are selected to a very narrow spread of gate voltage. The FET by itself is a rather non-linear resistor and would generate a certain amount of distortion but the performance can be greatly improved if the gate voltage is given a component at signal frequency. Best results are obtained if the signal voltage on the gate is made about half that on the drain and this is provided by the resistor and capacitor between drain and gate of each FET.

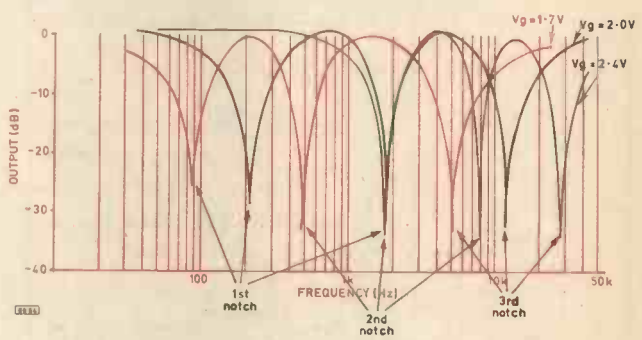


Fig. 4. Overall frequency response of the Phaser

CONSTRUCTION

The unit was constructed in an ITT diecast box (121 x 95 x 25mm) as this provides an enclosure which is sufficiently strong to withstand being dropped, stood on, and generally knocked around. The holes for the speed pot., jack sockets and footswitch should be drilled first. The components can then be temporarily fixed in place and the holes for the printed circuit board marked out on the inside of the box, using the actual p.c.b. as a template. The p.c.b. has to be mounted right up against the side of the box or there will not be sufficient room for the battery.

Most of the components are mounted on the small printed circuit board as shown in Figs. 5 and 6. There is very little room to spare and it is recommended that only the specified components are used. If desired, Texas low profile 8 lead sockets can be used for the i.c.s. but standard sockets tend to take up too much room. The use of a soldering iron with a fine bit and 22 swg solder is essential and the board should be carefully inspected for shorts between tracks, etc. Make sure that the soldering iron is earthed or damage may be caused to the FETs and the i.c. amplifiers, and take care that all the semiconductor devices and the tantalum capacitors are mounted the right way round. Lastly, clip off

all component leads as close to the board as possible or they may short against the bottom of the box.

The p.c.b. should be mounted on four screws with nuts used as spacers. Metal nuts should be used on the two screws nearest the side of the box, but nylon nuts (or a metal nut with an insulating washer on top) should be used at the other side or there may be a short between the +9 volt rail and earth.

Miniature screened lead should be used between the input jack and the p.c.b., and the leads to the speed pot.

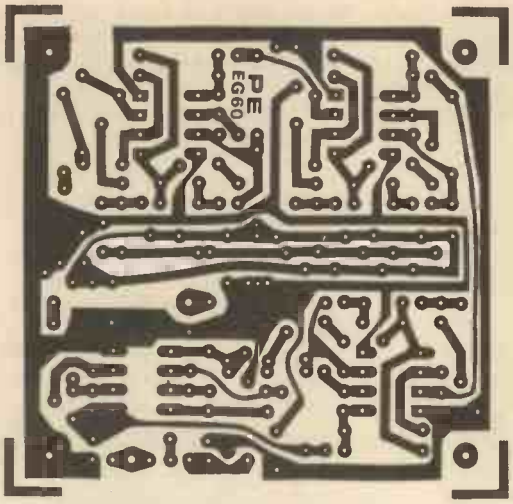


Fig. 5. Printed circuit board design

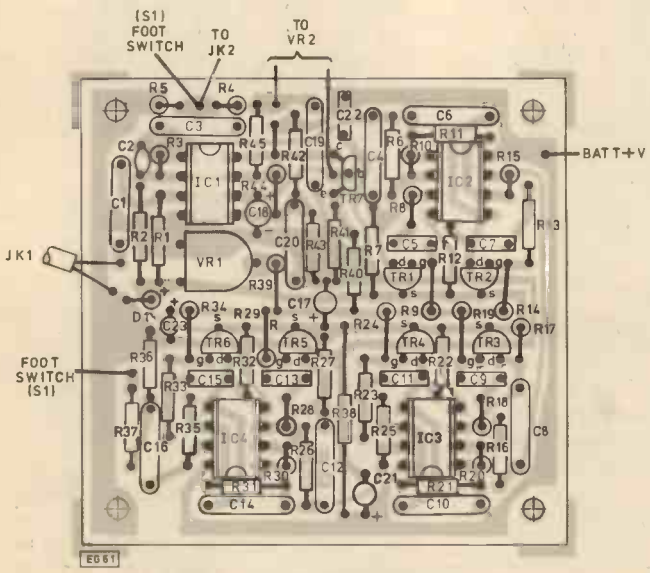


Fig. 6. Component layout

should be twisted together and kept well away from the input. The terminals of the footswitch need to be bent down flat or they may short against the lid of the box. The footswitch is a double pole type and both sides are connected together for greater reliability. The input jack is a special type which has a front contact (nearest the nut) which is normally open and a rear contact which is normally closed. The negative lead from the battery is wired to the normally open contact so that when the jack plug is inserted this contact closes and automatically switches the unit on. At the same time the shorting rear contact opens and allows the input signal to reach the circuit.

COMPONENTS . . .

Resistors

R1, R36	330k (2 off)
R2, R3	4k7 (2 off)
R4, R5, R6, R7, R10, R11, R12, R15, R16, R17, R20, R21, R22, R25, R26, R27, R30, R31, R32, R35, R37, R39, R41, R42, R43,	33k (25 off)
R8, R9, R13, R14, R18, R19, R23, R24, R28, R29, R33, R34, R40	100k (13 off)
R38	2k2
R44	15k
R45	2k7

All resistors 0·33W 5% min. carbon film

Potentiometers

VR1	10k min. skeleton preset
VR2	100k log.

Capacitors

C1, C3, C16, C19, C20	0·1µ 250V polyester (5 off)
C4, C6, C8, C10, C12, C14	33n 250V polyester (6 off)
C2	1,000p min. ceramic
C5, C7, C9, C11, C13, C15, C22	47n min. ceramic (7 off)
C17, C18, C21	22µ 16V tant (3 off)
C23	1µ 35V tant

Semiconductors

D1	5V1 400mW Zener
TR1–TR6	BF245B
TR7	ZTX 384
IC1, IC2, IC3, IC4	TL062CP

Miscellaneous

JK1 Jack socket front contact normally open rear contact normally closed.
JK2 Standard jack socket non switching
S1 D.p.d.t. push to make/push to break footswitch
Case ITT Diecast box type 46R CS00. 043. A00
Control knob, PP3 battery, battery clip, rubber feet

Constructor's Note

Only BF245B or BF244B FETs should be used. BF245A and C devices have a different spread of gate voltage and are not suitable. A complete kit of parts including the p.c.b. can be obtained from **Davian Electronics, 13 Deepdale Avenue, Royton, Oldham, Lancs, OL2 6XD. (Mail order only).**

TESTING

To test the unit connect a 9 volt PP3 battery and plug the guitar into the input jack to switch the unit on; then connect the output to the amplifier and listen to the background noise from the phaser. With the speed control set to its slowest setting you should be able to hear a "whooshing" sound as the notches generated by the phaser sweep up and down the audio band. Adjust VR1 so that the "whooshing" is continuous without any dead spots. These occur when the FETs are cut off for part of the sweep. Finally, play the guitar through the phaser and re-adjust VR1 if necessary for the most pleasing overall effect.

The judgement of a pleasing phasing effect is a matter of personal opinion and some constructors may prefer a wider or narrower sweep than is provided by this instrument. The sweep range can be increased by increasing the sweep voltage fed to the FETs. This is done by increasing R39 and reducing R40. For a smaller sweep range reduce R39 and increase R40. ★

FRANK W. HYDE

SATURN WATCH

In 1966 the Earth passed through the plane of Saturn's ring system. At this time Professor A. C. Dollfuss of the Pic du Midi Observatory discovered the tenth satellite of the planet. It is an inner moon and quite small being only 175km in diameter. It was given the name Janus (first and the last). Now the period has arrived for a similar condition of the ring system and this will extend from 1979 to 1980. Since the situations with the rings edgewise provides an excellent opportunity for the observation of possible satellites, plans are already afoot for such a search.

One such proposal has come from J. W. Fountain and S. M. Larson who are at the Lunar and Planetary Observatory, Arizona. In a paper published in *Icarus* they give details of an examination that they have carried out on existing plates of the outer ring system. They suggest that it is possible that there may be another satellite close to the outer limits of the system.

Also in the same issue of *Icarus* vol. 36 p. 107, are details of the investigation of K. Aksnes and F. A. Franklin of The Smithsonian Centre for Astrophysics, into the data which might provide some clue to new moons. They suggest that it is possible that there are two more satellites to be found in the region that lies between ring A and the second closest satellite Mimas. There clearly will be a great deal of activity from Earth based observers and perhaps a review of the probes likely to be in the vicinity of Saturn during 1979 and 1980.

THE RINGS OF URANUS

Last year the first picture of the newly discovered rings of Uranus were made by K. Matthews, G. Neugbauer and P. Nichilson using the 200 inch Mount Palomar Telescope. The team, who are from the California Institute of Technology, made extensive observations. The technique used was infrared scanning at two different frequencies.

It was found that at one frequency the rings appeared darker than when the other frequency was used. By subtracting the scans, the image of the planet itself was made to disappear. The rings were narrow in the final picture. After spectral analysis it was clear that the rings were made up of darkish material consistent with a stony composition. No ice, water or ammonia was found. This is interesting because the present thinking about the subject seemed to expect the presence of one or both conditions.

Naturally the event led to much speculation. The feature that the rings were well defined and narrow with clear sharp edges, indicates that there must be considerable constraint due to gravitational forces to hold the particles or rocks so rigidly. Two schools of thought have made public their ideas on the subject. Thomas Gold and Stan Dermott of Cornell University and Andrew Sinclair of the Royal Greenwich Observatory consider that the particles are moving on horse-shoe shaped orbits around Uranus. Details of this theory were published in the *New Scientist* vol. 80 p. 607. The second school is that of P. Goodreich of Caltech and S. Tremaine of the Institute of Astronomy, Cambridge. They suggest that the gravitational force is provided by one or perhaps two satellites. The main ring which has been given the name Epsilon could be confined by a pair of satellites. These would have a mass of 10^{13} tonnes. They would be about 500km on each side of the ring.

They think that these minor satellites could be trapped in resonance conditions with the existing satellites or Uranus. This is of course very ingenious but there still remains the problem that this theory or suggestion is strictly speaking only compatible with absolutely circular rings whereas in fact the rings are known to be elliptical. The team do not attempt to speculate on the composition of the particles or bodies composing the rings.

Once again there is a reminder that astronomy has not yet exhausted the details of the solar family nor yet disclosed why of all the planets Uranus is the oddest.

NEPTUNE AND PLUTO

Pluto the so-called outermost planet, which has been demoted to the status of a "minor planet" by reason of its size, follows its customary orbit which will bring it to perihelion in September 1989. From now until 1999 Neptune is promoted to the position of the farthest planet. There is no chance that the two bodies will be in a position of proximity. However, since Pluto was discovered by Tombaugh in 1930 it has come steadily closer to the sun. The decrease in distance will be of the order of 9–10 astronomical units. This will afford better opportunities it is hoped for a better observation of the possible satellite of Pluto. The details of this discovery were reported in *Spacewatch*.

SOLAR ACTIVITY

Data is continually being added to the already immense store of observations of the Sun. Many modifications of thinking have naturally resulted from the study and sifting of the data. Recently another view has appeared with regard to the electrical currents involved in atmospheric electricity. The existing view was what could be described as the global theory. This contended that the current flowing between the atmosphere and the surface of the Earth during thunderstorms was balanced during fine periods by very scattered weak currents from the air to Earth.

In November 1978 at the onset of a solar flare a large number of balloons were released. After a lapse of about two days it was observed that the air to ground current increased so much that the radiosondes were saturated at heights of 25–30km. The rise was later followed by a fall to what is expected as normal. It is to be supposed that the fast particles from the solar flare produced the "kick". It would seem therefore that the earlier view has to be revised and replaced with the new mechanism in which solar flares are, via thunderstorms, the energy source that controls the atmospheric current.

NORMA

Norma is an 18th magnitude star. It is blue and a candidate for a pulsed X-ray source discovered in 1967. This was established by the pulsation period measured to be 7·6809 seconds. The study by S. A. Ilovaisky, C. Chevalier and Ch. Motch of the Paris Observatory at Meudon was carried out using a microprocessor controlled EMI detector sensitive in the blue region. The telescope used was the 316 metre reflector of the European Southern Observatory in Chile.

A short period of observation was all that was needed to establish that the pulsation was real and not due to possible doppler effects in the orbital motion of a binary system. It is thought that the source may have a period of less than eight hours or its orbital plane may be perpendicular to the line of sight. Further observations now taking place will correlate the optical and the X-ray pulses and perhaps suggest a model that fits the observed data.

REMINDER — NEW COMPONENT STANDARD FOR P.E.

To illustrate this some typical component changes are given:

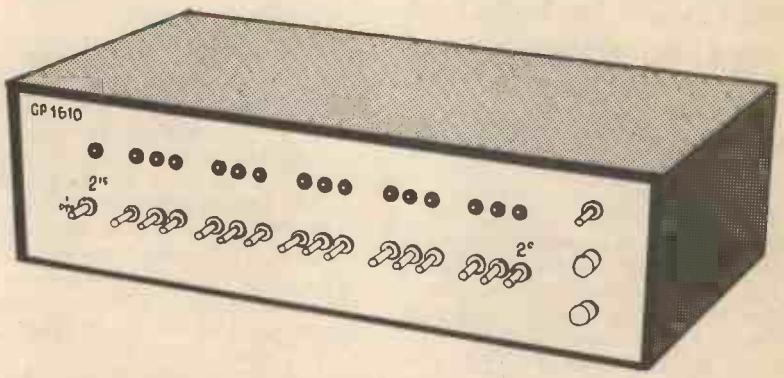
	Now	Before
Resistance	3k9	3·9kΩ
	1M5	1·5MΩ
	470	470Ω
	2Ω2	2·2Ω
Capacitance	680µ	680µF
	4µ7	4·7µF
	470n	0·47µF
	47n	0·047µF
	4p7	4·7pF
Inductance	3H4	3·4H
	800m	800mH
	2m6	2·6mH
	1m	1mH

FREE...with our MAY issue

Constructors Aid worth at least £1

MICROPROCESSOR EVALUATION SYSTEM

This unit, which is programmed via toggle switches and uses l.e.d.s for the output display, is designed around the General Instrument (CP1610) 16 bit microprocessor.



VEHICLE INSTRUMENT DISPLAYS

The car market is acknowledged to be difficult for electronic systems to penetrate. However, present technologies will make solid state displays a reality in the early 1980's. We examine the state of the art.

Also...

SOUND to LIGHT

PRACTICAL
ELECTRONICS
MAY ISSUE

AUTORANGING MULTIMETER PART 1

Dr. Mark A. Sawicki Alex. Kowalewski

THE AUTORANGING Digital Bench Multimeter presented here was designed with standard mains operated multimeter applications in mind, for both professional/amateur users. The component board and mechanical construction is quite straightforward, and all the components are easily available. Over the past few years, several digital multimeter plans have appeared in open electronic literature. This particular conception combines many of the functions of high standard professional multimeters with design features including true autoranging, auto-zero, and autopolarity, with adequate resolution level and accuracy. Also with good protection, and large l.e.d. display.

The most obvious benefit of autoranging is the fact that much less attention has to be paid to the multimeter by the user in order to get the best possible results. Automatic selection of the range will give the best resolution, and all the user has to do is to select the measurement mode required. As you will find described later on, manual multimeter operations are also possible, and auto-manual modes are indicated by a specially provided l.e.d.

Autoranging as applied to this design also makes the instrument more tolerant to most types of overloads,

even on the most sensitive multimeter ranges. This type of operational state, when the instrument is in the lowest range (mV, µA, ohms) is specially indicated by an additional warning l.e.d.

Last but certainly not least, the beauty of this autoranging instrument is also the much less expensive conventional multimeter instrument hardware, and therefore the front panel layout is extremely easy to understand and use. This project will run in two complete parts, covering the whole of the electronic design, principles of operations, p.c.b. details and constructional tips, etc.

SPECIFICATION

Five function autoranging multimeter with $3\frac{1}{2}$ digit l.e.d. display. Manual option. Meter is based on the Intersil ICL 7107 chip which features auto-zero and autopolarity.

Functions

Resistance 200Ω to 2MΩ
Current 200µA to 2A (a.c. and d.c.)
Voltage 200mV to 1,000V (d.c.); 200mV to 600V (a.c.)

Accuracy

1% of reading (determined by precision resistors used).

Resolution

±1 digit (0·05%).

Ranging

(a) **resistance.** Automatic with manual option. Manual operation uses a pushbutton to step down (one range per push).
(b) **current.** As resistance, but 2A range must be manually selected and uses a separate socket. Settles in 200µA range with no input.
(c) **voltage.** As resistance but settles in 200mV range with no input. Range indicated by decimal point. Manual option indicated by l.e.d. 1,000V range, via separate socket, manually selected.

Inputs

(a) **voltage** 10MΩ Input impedance, standard (4mm) sockets.
(b) **current** 200mV maximum voltage burden.
(c) **resistance** test current is maximum 6mA; maximum open circuit voltage 600mV.

Protection

(a) **power supply** 200mA/250V, 20mm glass type "Slo-Blo".
(b) **ICL 7107 chip** protected by 1MΩ series resistance and low leakage clamp diodes (BAV 47).
(c) **voltage** overrange on highest range causes all reed relays to drop out. Meter zeros and tries top range again.
(d) **current** as voltage, but also fuse protected (200mA/2A).
(e) **resistance** only fuse protected (1A).

Physical

Dimensions: 91 x 204 x 153mm.
Weight: Approx. 1,875 grams.

Power

Voltage 220–240V.
Frequency 50Hz.
Consumption ≏6VA.

On MANUAL the meter stays in the inactive state until DOWN is pressed, putting the meter back in top range.

BLOCK DIAGRAM

As shown in the block diagram of Fig. 1.1, the complete autoranging bench multimeter circuit can be divided as follows:

(1) Three Precision Resistor Networks
(a) voltage divider (V1—V4) with compensation capacitors.
(b) current shunts (I1—I5).
(c) reference resistors for ohms (Ω1—Ω5).

(2) Relay Board
Selects correct range, controlled by signals from the logic board "Range In" bus.
Also drives corresponding decimal points on display board via the "DP Out" bus.

(3) Display Board
Contains displays (two off LITRONIX DL 727 dual 7-segment, d.p.-right). Segments driven via 23 line "Drive Bus" from Main Board. Contains interface for under and overrange detection, "Range Sense" outputs.

(4) Logic Board
Using signals at "Range Sense" the board produces the correct output at "Range Out". Also provides "Reset" output for Main Board (used for fast overrange recovery).

(5) Main Board
Contains ICL7107 A/D converter, a.c./d.c. converter (CA 3140) op-amp, part of the divider for 1,000V input and Quad Analogue CD4016 switches (driven from AC, $\overline{AC}$, Ohm, $\overline{OHM}$) for selecting a.c. and ohms ranges.

IMPORTANT NOTE

Special grounding arrangements are necessary in order to reduce errors due to voltage drops. All boards have their own power supply connections going directly to the PSU to minimise crosstalk via the supply lines.

MAIN BOARD

The complete schematic diagram of the Main Board is shown in Fig. 1.3. The ICL7107 chip is protected by a 1M series resistance and low leakage clamp diodes.

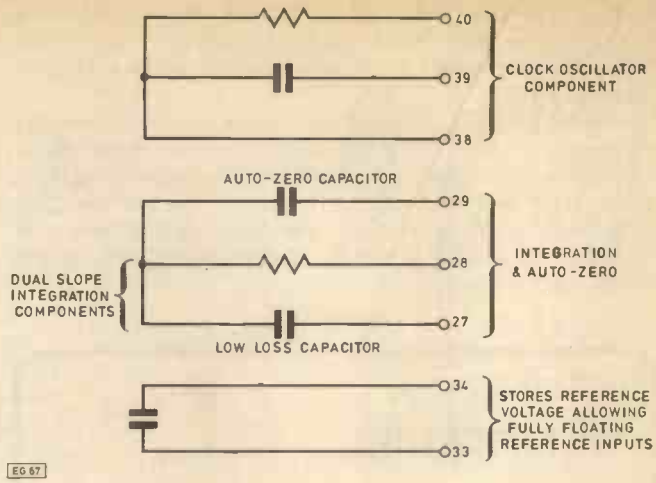
The normal range of inputs during measurement is −300mV to +400mV, so both BAV47 diodes are reverse biased. If the input is larger than ±1·2V, the diodes conduct and clamp point "*" to ±1·2V. The 1M resistor limits the current to only 1mA even for 1,000V input.

The analogue switches as shown in Fig. 1.3 marked AC are closed in a.c. ranges, and those marked $\overline{AC}$ are closed in d.c. ranges, inserting the converter into the signal path as required. For those who have not come across any of these devices, a few words about analogue switches. The CD4016 CMOS Quad Analogue Switch is a single chip monolithic silicon i.c. containing eight n channel and eight p channel enhancement mode MOS transistors, connected to form four independent bilateral signal switches. Each switch consists of both p and n channel devices with common source and drain connections. Each switch of the CD4016 device requires a single control signal and both p and n elements in a given switch are biased on or off by the mentioned control signal. The pin diagram and logic diagram for the CD4016 device is presented in Fig. 1.2.

The converter produces a partially rectified signal whose *mean* value for *sine waves* is the r.m.s. value of the signal. The factor 3·2214 must be set during a.c. calibration, which is explained in Part 2.

A.C./D.C. CONVERSION

The operational principle of the a.c./d.c. conversion is fully explained in Fig. 1.4. The fundamental element of this circuit is a MOS FET input, high performance op-amp, type 3140. The T099 metal can leads are spread to 8-pin d.i.l. form. The 3140 op-amp features reasonably high input resistance, internal frequency compensation, and also short-circuit protection. As shown, the whole circuit can be divided into two parts: (a) rectification and high impedance, and (b), smoothing. A simple method for calibration of this circuit will be described later on.



THE ICL7107

The ICL7107 A/D Converter requires some external non-active components. Basically they form the three external sections shown adjacent.

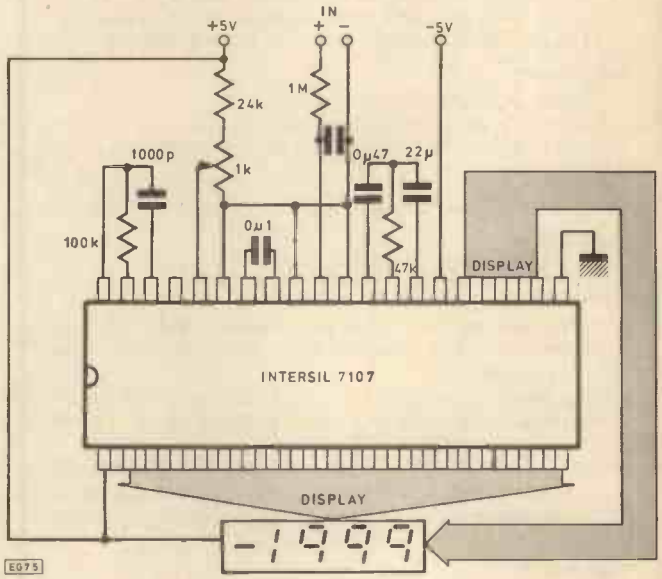
(1) Clock Oscillator components (Pins 40, 39, 38).
(2) Integration and Auto/Zero components (Pins 29, 28, 27).
(3) External capacitance (Pins 34, 33).

The 7107 chip has auto-zero, auto-polarity and fully decoded constant current drive direct to the l.e.d. segment display. Overrange is indicated by turning off all digits except the most significant one.

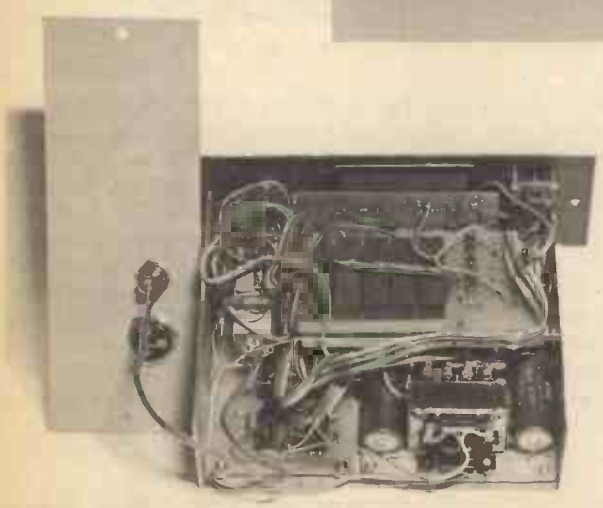
The analogue switch "RESET" shorts the inputs after an overrange to give fast recovery.

Let's now concentrate on the main inputs to the 7107 integrated circuit.

Basic arrangements of these inputs are also shown adjacent, i.e. Input High/Low (V_i). Common terminal and Reference Voltage (VRef), Ref High/Low. As you may have noticed on the Main Board schematic (see Fig. 1.3), we use the external REF –02 precision voltage reference chip by PMI (Precision Monolithics) in order to improve the overall instrument accuracy, and temperature stability, etc. The REF –02 provides a stable +5 volt output which can then be adjusted over a ±6 per cent range with minimal effect on temperature stability. PMI have designed the REF –02 specially for D/A and A/D applications in portable instruments and in high quality digital instrumentation.



A LOOK INSIDE THE MULTIMETER



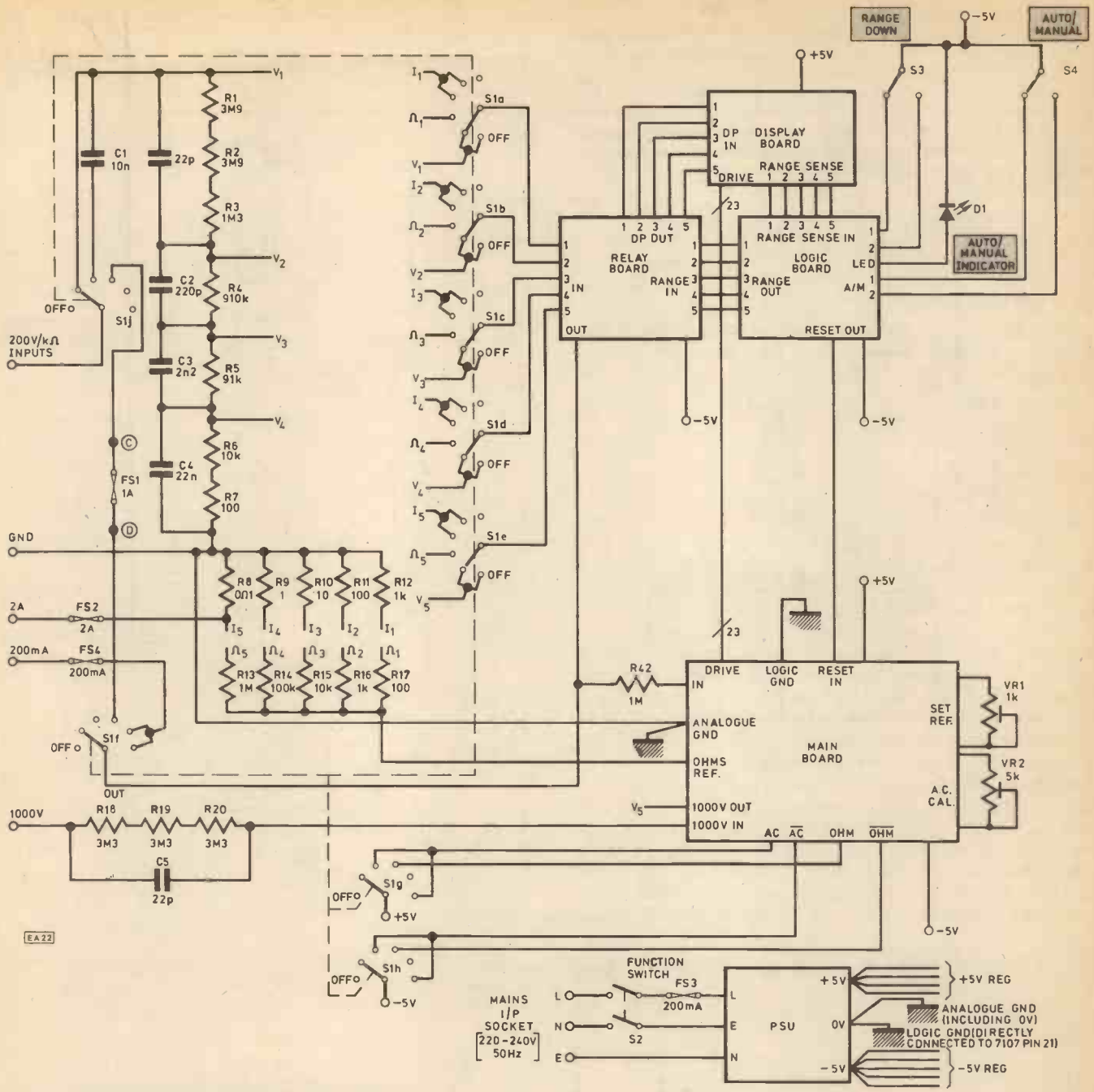


Fig. 1.1. Block diagram of Auto-Ranging DMM

SIMPLIFIED CIRCUIT FOR VOLTS/AMPS

Fig. 1.5 shows both simplified arrangements functionally valid for Volts/Amps measurements and the external reference circuit.

In order to calibrate the external reference circuit:

(1) Measure point "A" (approx. zero volts) by attaching the 200V/OHM input to point "A" in d.c. volts mode.

(2) Adjust Set Ref until the difference between the readings for points A and B is 5·00 volts.

SIMPLIFIED CIRCUIT FOR OHMS

This is selected by the closure of the "OHM" analogue switches. In order to measure the resistance, the autoranging multimeter uses a simple and accurate *ratiometric* principle, explained in Fig. 1.6.

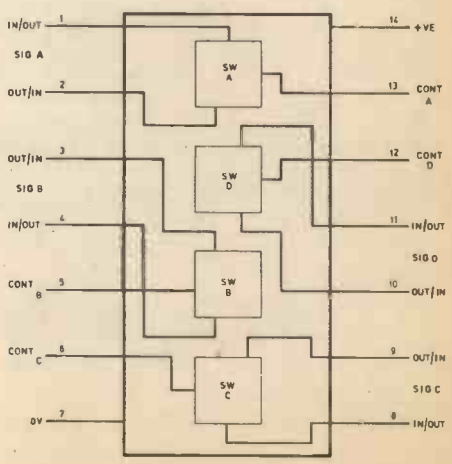


Fig. 1.2. The CD4016 Quad Analogue Switch

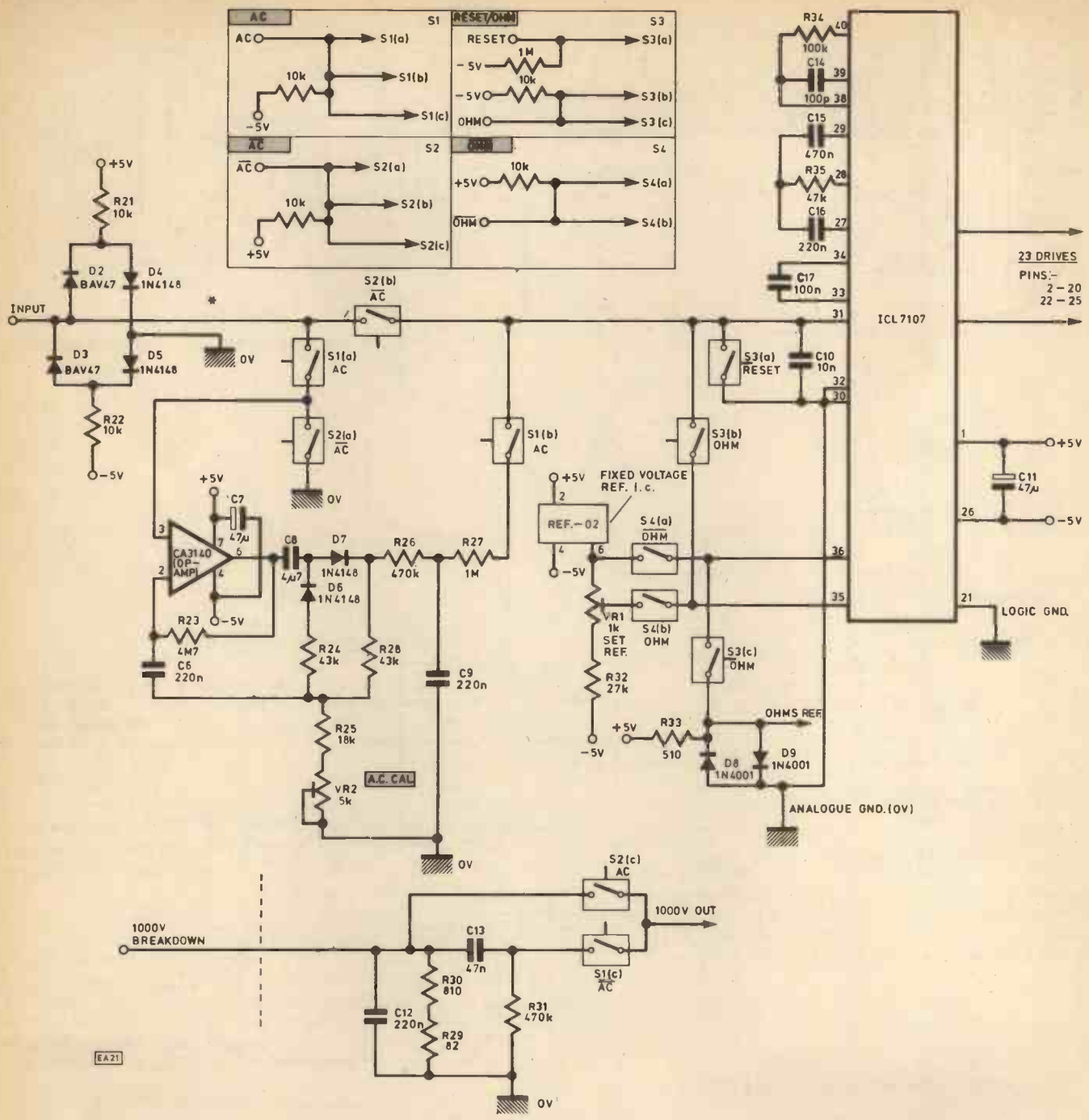


Fig. 1.3. Main Board circuit diagram

This gives true ratiometric resistance measurement since

$$1{,}000 \frac{Vi}{Vref} = \frac{Rx}{R} 1{,}000 = \text{Reading.}$$

NOTE

(1) Max Test volts (0·6V) will *not* test semiconductor junctions.

(2) A pair of diodes clamp Ref Hi to ±0·6 volts as a protection feature.

(3) Max. test current, inputs shorted, 200Ω range is 6mA.

1,000V DIVIDER SUBSYSTEM

Because of the electrical safety required, 1,000V rated input is provided via separate socket, marked on the panel as "1,000V d.c./600V a.c."

The schematic arrangement (see Fig. 1.7) shows the main high voltage dropper elements, the three 3M 3/0·5W resistors, blocked by a high voltage 22p compensatory capacitor. It is absolutely necessary to select a high quality disc ceramic capacitor for this application. In our prototype, we used the RS 22p disc ceramic (RS 124-465) rated at 8kV d.c. working. This subsystem is shown on the Main Board schematic.

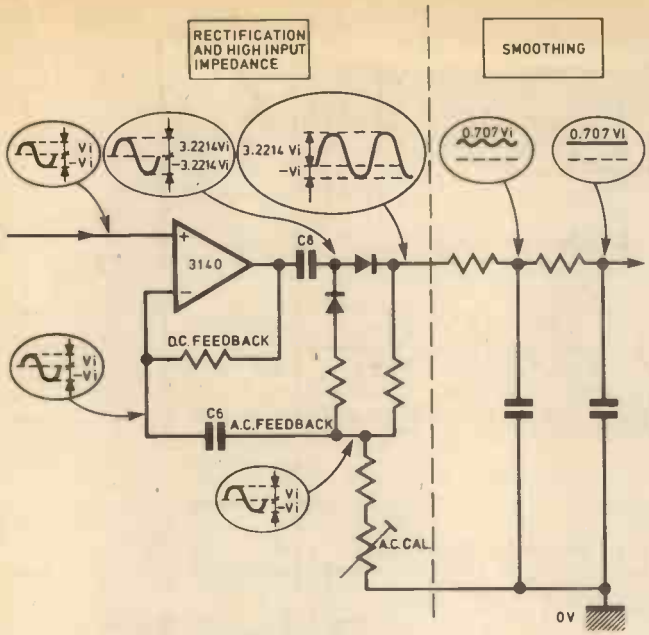


Fig. 1.4. Conversion from a.c. to d.c.

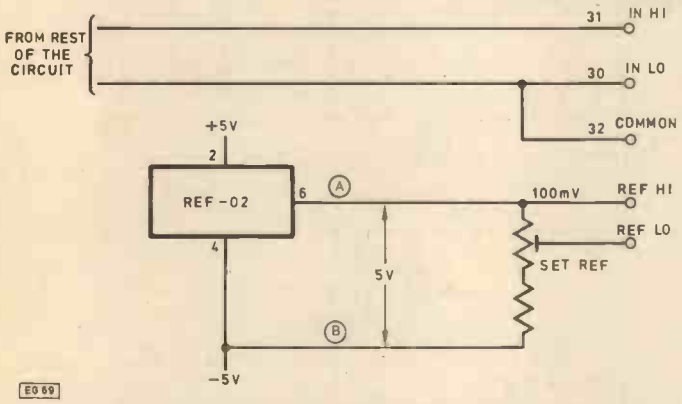


Fig. 1.5. Reference voltage circuit, selected by closure of OHM analogue switches. The REF-02 i.c. has a voltage/temperature relationship of 2·1mV/°C, can drive a 20mA load, and has infinite short circuit protection

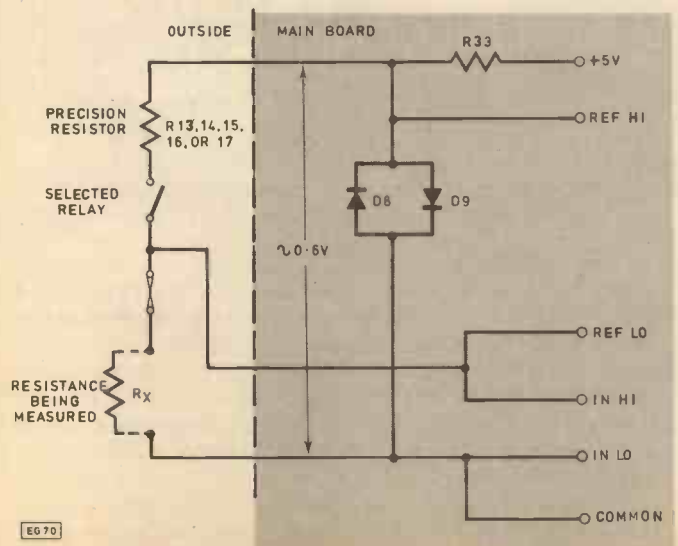


Fig. 1.6. Ratiometric resistance measurement configuration

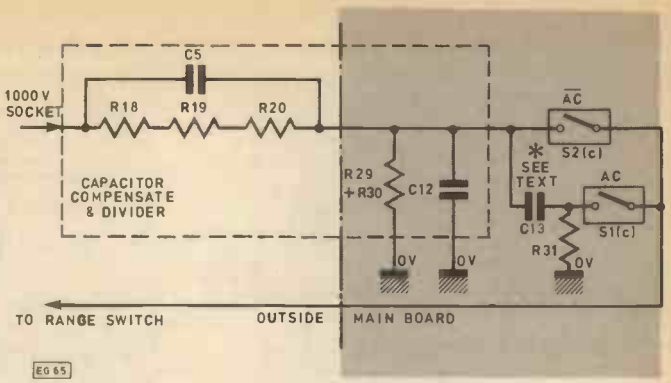


Fig. 1.7. 1,000V divider subsystem. • d.c. blocking capacitor for 1,000V a.c. range

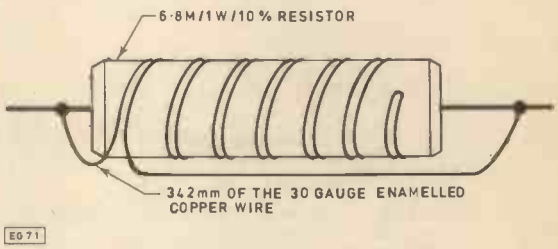


Fig. 1.8. Construction of the current shunt resistor. The enamelled copper wire should be "doubled up" before winding, in order to minimise its specific inductance. A coat of lacquer will hold the wire in place

The 0Ω1 resistor (current shunt I5) can be made by winding 342mm of 30 gauge enamelled copper wire non-inductively on a 6M 8/1W/10 per cent resistor, as shown in Fig. 1.8.

LOGIC BOARD

As described earlier the *brain* work of the instrument and the co-ordination of various logic functions is done by the logic system in the self-contained Logic Board. Nearly all active devices on this board are complementary MOS (CMOS) devices, simply because any logic function capable of being constructed with ideal switches can be implemented in CMOS technology. A major feature of the MOS devices is the very high input resistance resulting from the dielectric oxide isolation between the channel and corresponding gate. In practice, change of the polarity of the gate bias can hardly affect the input resistance. In instrumentation techniques another point is extremely important, that of temperature stability. Whether leakage current does exist (for example between gate and source) this is reasonably independent of the ambient temperature changes. The basic logic job in our instrument is done by four CMOS gates: CD4001 (Quad 2 input NOR gate), CD4011 (Quad 2 input NAND gate), CD4025 (Triple 3 input NOR gate), CD4075 (Triple 3 input OR gate).

Also one CMOS CD4022 Octal Counter/Divider is employed. The complete schematic diagram of the Logic Board is presented in Fig. 1.9.

Gates IC3(a), (b), and IC3(c), (d), as shown in Fig. 1.9 form flip-flops to debounce the Auto/Manual and Range Down

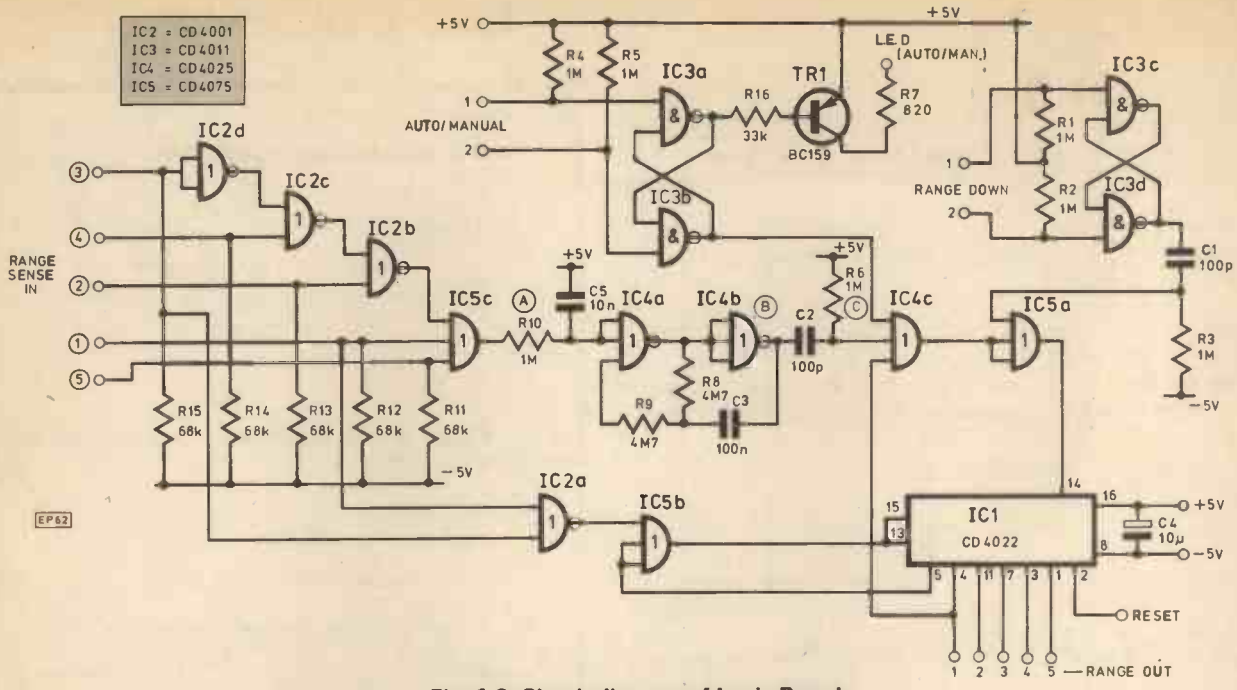


Fig. 1.9. Circuit diagram of Logic Board

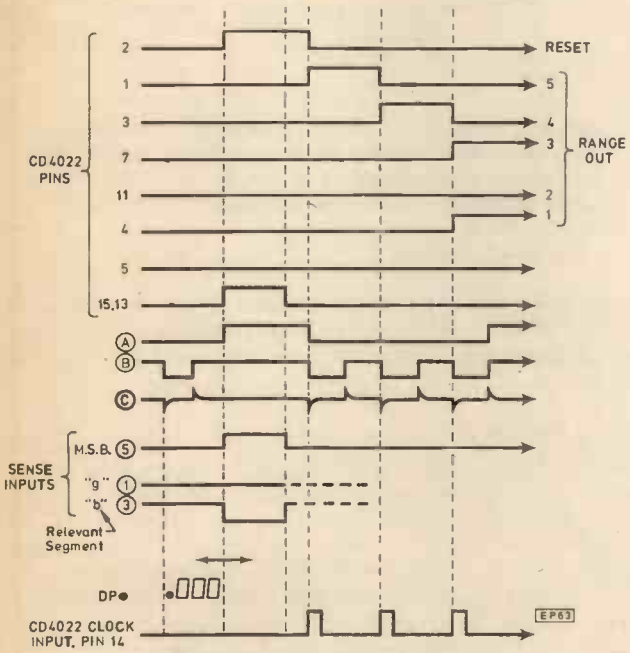


Fig. 1.10. Simple timing diagram

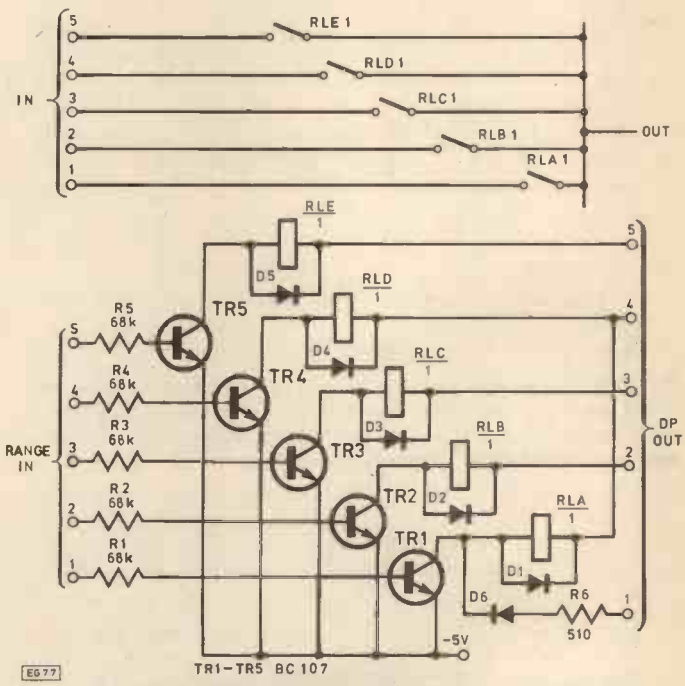


Fig. 1.11. Relay Board circuit diagram. Diodes D1 to D5 suppress back e.m.f.

pushbuttons, and transistor BC159 drives the front panel l.e.d. Auto /Manual indicator.

BASIC AUTO RANGE ACTION

Assume there is no input to the meter (or shorted inputs in Ohms range). The counter is stopped with only Range Out 1 high, since this output disables the clock via gate IC4(c). The meter is well protected in the most sensitive range since this selects the highest resistance shunt in Amps.

Now assume 6·00 volts is applied. The 7107 chip detects overrange and digit 2 blanks, Range Sense Inputs 3 and 1 go "low" and gate IC2(a) output goes high, resetting the counter via IC5(b). IC5(c) output is high, disabling the clock oscillator (IC4(a), (b)), since the meter is not in underrange.

Gates IC2(b), (c), (d) and IC5(c) decode the underrange condition using the signals from the logic interface on the display board. The counter is held with its Reset output high, so *no* relays are closed (protection) and the mainboard is reset. The 7107 chip comes out of overrange and when its display falls below 200, IC5(c) goes low enabling the clock, the counter advances to range 5 then 4, etc. Underrange ceases in range 3 with the reading 6·00, when IC5(c) goes high again.

The resistor/capacitor smoothing network between IC5(c) and IC4(a) stops false clock pulses during the 7 to 8 transitions in digit 2.

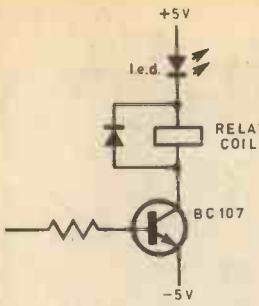


Fig. 1.12. Reed relay drivers

From the above, it is clear that with open circuit in Ohms, the meter display will continuously jump between reset and overrange. Again the meter is well protected since range 5 *only* is tested, and this has the largest reference resistor.

MANUAL

Depressing the Auto/Manual pushbutton (latching type) puts one input of IC4(c) "high" disabling the internal clock and thus the underrange sensing logic. The counter can now advance by pushing Range Down the required number of times. Pulses from IC3(c), (d), are differentiated and fed to the counter clock input via IC5(a).

When the counter tries to count above Range 1, the next decoded output feeds back to its reset input via IC5(b) since the reset pulse is so short, a spurious clock is generated on the chip and the counter skips to Range 5.

All the overrange circuitry is still effective so an overrange puts the meter in its completely protected Reset state with *no* decimal points lit. Pushing the Range Down switch returns the meter to Range 5.

Important note:

For 2A and 1,000V d.c./600V a.c. manual selection is necessary.

The simplified example of the Auto Range timing diagram is shown in Fig. 1.10.

RELAY BOARD

Amongst one of the most important sub-assemblies of our meter is the Relay Board, of which a complete schematic diagram is presented in Fig. 1.11. Five of the BC107 drivers buffer the low current output from the Logic Board.

Transistor Drivers 2–5 are arranged as shown (simplified) in Fig. 1.12.

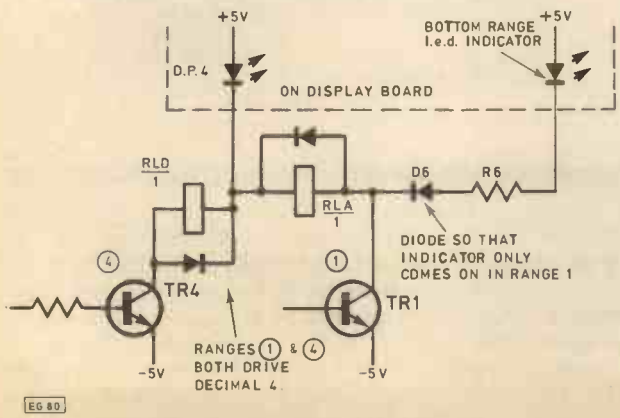


Fig. 1.13. Part of Relay Board

COMPONENTS . . .

MAIN BOARD AND GENERAL

Resistors

R1, R2	3M9 ½W 1% (2 off)
R3	1M3 ½W 1%
R4	910k ¼W 1%
R5	91k ¼W 1%
R6	10k ¼W 1%
R7, R11, R17	100 ¼W 1% (3 off)
R8	0·1 ¼W 1%
R9	1 ¼W 1%
R10	10 ¼W 1%
R12, R16	1k ¼W 1% (2 off)
R13	1M ¼W 1%
R14	100k ¼W 1%
R15	10k ¼W 1%
R18, R19, R20	3M3 ½W (3 off)
R21, R22, R36, R37, R39, R40	10k (6 off)
R23	4M7
R24	43k
R25	18k
R26, R31	470k (2 off)
R27, R38, R42	1M (3 off)
R28	43k
R29	82
R30	810
R32	27k
R33	510
R34	100k
R35	47k

All 5% ⅛W resistors except where stated.

Potentiometers

VR1	1k preset
VR2	5k preset

Capacitors

C1	10n/1250V polypropylene
C2	220p mica
C3	2n2 polyester
C4	22n polyester
C5	22p/2000V disc ceramic

Diodes

D1	l.e.d. 0·2 inch
D2, D3	BAV47 (low leakage 10pA) (2 off)
D4, D5, D6, D7	1N4148 (4 off)
D8, D9	1N4001 (2 off)

Integrated Circuits

IC1, IC2, IC3	CD4016 (3 off)
IC4	REF-02 by Precision Monolithics
IC5	CA3140
IC6	ICL7107 (Intersil)

Miscellaneous

FS1	1A fuse plus holder
FS2	2A fuse plus holder
FS3	200mA plus holder
S1	9-pole, 6-way rotary switch
S2	2-pole, 1-way
S3	1-pole, 2-way momentary push
S4	1-pole, 2-way latching push

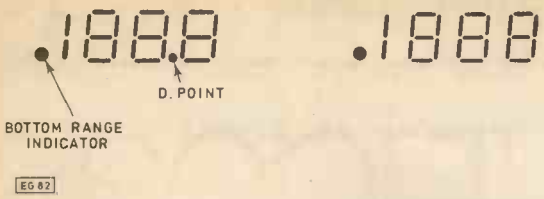


Fig. 1.14. Driver number 1 is an exception since the lowest range cannot be displayed as above left, so it is shown as above right bottom range indicator

COMPONENTS . . .

LOGIC BOARD

Resistors

R1–R6, R10	1M (7 off)
R7	820
R8, R9	4M7 (2 off)
R11–R15	68k (5 off)
R16	33k

Capacitors

C1, C2	100p polyester (2 off)
C3	100n polyester
C4	10µ/35V tant
C5	10n ceramic

Transistor

TR1	BC159

Integrated Circuits

IC1	CD4022
IC2	CD4001
IC3	CD4011
IC4	CD4025
IC5	CD4075

COMPONENTS . . .

Relay Board

Resistors

R1–R5	68k (5 off)
R6	510

Transistors and Diodes

TR1–TR5	BC107 (5 off)
D1–D6	1N4148 (6 off)

Relays

RLA–RLE	RS348 986 (5 off) reed type (or equivalent)

Note: The RS Components reed relays are 9–12V d.c. operating, with 1k coil resistance. Ace Mailtronix should be able to supply these if equivalents are unobtainable.

NEXT MONTH: Display Board, p.c.b. construction and final setting up

POINTS ARISING

STEREO MIXER *(February 1979)*

Due to a printing error the Veroboard track layout was omitted from this article. Constructors can obtain a correct copy of the layout diagram from the editorial offices at Poole.

FUEL CONSUMPTION METER *(OCTOBER 1978)*

Some corrections to Fig. 3(b) are necessary, and are as follows: IC10 output to STROBE should be pin 8, and the input, pin 9. Also on IC10, the gate marked input pin 10, output pin 9, should read: pin 11 and 10 respectively. The input pins on IC7 should read 1, 2, 4 and 5; i.e. that marked pin 10 should read pin 4.

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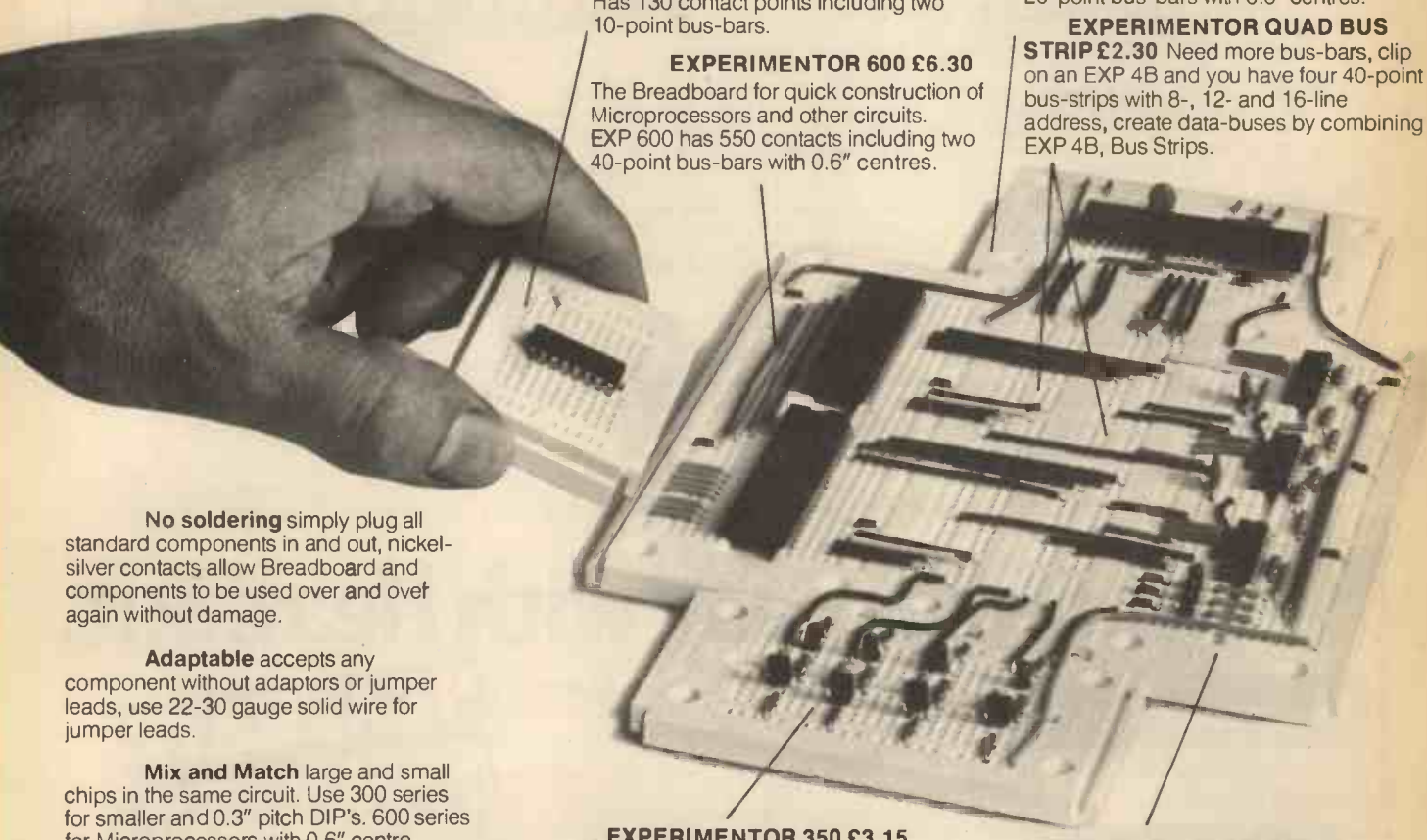

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Frequency Range: 20 Hz to 100 MHz guaranteed, (10 Hz to 130 MHz typical) – Sensitivity: 10 mV RMS, 20 Hz to 50 MHz (5 mV typical); 15 mV RMS, 50 MHz to 100 MHz (10 mV typical) – Selectable impedance: 1 MΩ/25 pF or 50Ω – Attenuation: X1, X10 or X100 – Accuracy: ± 1 Hz plus time base accuracy – Aging Rate: ± 5 ppm/yr – Temperature Stability: ± 10 ppm, 0° to 50° C – Resolution: 0.1 Hz, 1 Hz, 10 Hz selectable – Display: 8-digit LED, floating DP, overflow indicator – Overload Protection – Power Requirement: 9-15 VDC.
Optional prescaler will be available from around March 1979.

The DMM Model 2000
The model 2000 is all solid-state, incorporating a single LSI circuit and high quality components. It has five functions and a total of 28 ranges. Input overload protection, auto polarity and auto zero are provided on all ranges and a basic DCV accuracy of 0.1% ± 1 digit.

Brief specifications:
DC volts in 5 ranges: 100 μV to 1 kV – AC volts in 5 ranges: 100 μV to 1 kV – DC current in 6 ranges: 100 nA to 2A – AC current in 6 ranges: 100 nA to 2A – Resistance: 0.1Ω to 20 MΩ in 6 ranges – AC frequency response: 40 Hz to 50 kHz – Display: 0.36" (9,1 mm) 7-segment LED – Input impedance: 10 MΩ – Size: 8" W×6.5" D×3" H (203×165×76 mm) – Power requirement: 4 "C" cells (not included).

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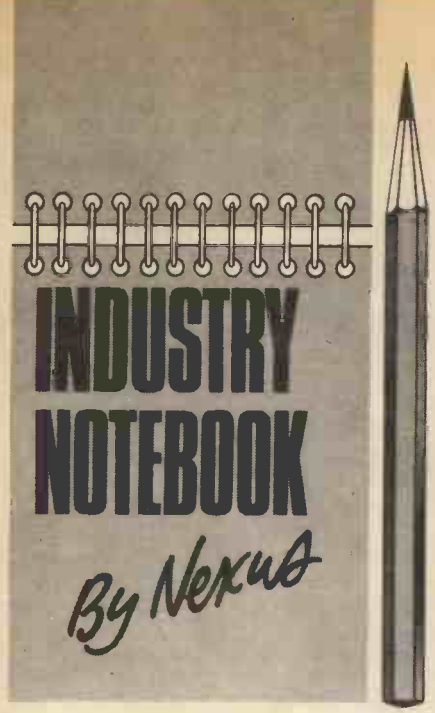


Strain

Electronic companies in all the major industrial countries are struggling with the problems posed by the new technologies now available. The new age of the microprocessor is bringing a challenge to designers and engineers as traumatic as that of the great changeover from valves to the transistor twenty years ago.

The technical problem is containable because it is in-house in each company. Older engineers can be re-trained to think "software" just as their predecessors reared on valves re-trained themselves to think "solid-state". The level of investment for re-training and R and D on the new technologies can be planned on the spot and reasonable decisions can be made.

A greater strain comes from external political and economic events beyond company control. Profitable markets, once considered secure, can virtually disappear overnight. Iran is the prime current example where trading has virtually ceased and even optimists see little or no market revival for a year or so. The great oil crisis of 1973 rocked every industry throughout the world.

It is little consolation that, elsewhere in the world, other companies are also in difficulties. For instance, the soaring price of the yen is having an effect on Japanese exports in general and the recent bonanza in CB radio sales to the USA has now slumped to the point of bankruptcy for some leading Japanese suppliers.

The great hope for the 1980's is China, a potentially enormous new market with seemingly endless possibilities. But no sooner had Britain got away to a good start with orders of £1 billion or so for starters than political lobbyists started raising objections.

For the forseeable future the world will remain in turmoil both politically and economically. While most of our interest may be focused on fascinating technical developments let us spare a thought for company market strategists struggling with forward programmes in a world environment in which the only certainty is that it will change. I recently spoke to a top professional market forecaster who sells his reports for a stiff fee. I asked him what confidence he had. He replied, "My guess is as good as anyone else's".

INMOS

I was going to give INMOS a rest this month but the enterprise is of such importance that, for the record, the struggle on siting for the technical centre has been resolved as Bristol with the proposed production units still planned for development areas with a well-known management consultancy currently canvassing regional authorities with the possibility of an announcement in the Spring of this year.

Integration

We have been so overwhelmed with publicity on VLSI in recent months that it is easy to overlook the progress that is still being made on another form of circuit integration technology, that of the thick film hybrid circuit.

Perhaps the most exciting development is a new form of substrate, the base on which the circuit is built. Traditionally this has always been a ceramic. There could now be a swing towards porcelainized steel. Two U.S. companies, Erie Ceramic Arts and Alpha Metals, are making porcelainized steel substrates, and chemical companies, Du Pont is one, are supplying appropriate resistive and conductive inks for use with them.

The big advantages claimed for porcelainized steel apart from low cost is that the substrate can be more flexible than ceramic in the sense that it can be large, of irregular form and even be shaped. The porcelainized steel could, for example, actually form part of the metal case of an equipment, saving space and doubling as a heat sink at the same time. Proponents of the steel substrate suggest that whole new possibilites of creative design are now opening up and the costs are claimed to be low enough for consumer electronic applications.

GEC's Buys

At the time of writing GEC's bid for Avery, the weighing machine giant, is still in the balance as it were, with Avery rejecting an £83 million bid. While waiting for the scales to tip one way or the other, GEC has again been looking across the Atlantic and has settled on Boonton Electronics of New Jersey as a desirable acquisition. Boonton is an instrument company with a range complementary to Marconi Instruments and with a US marketing and international sales network. Purchase price is, by GEC's standards, a modest £4·65 million. A comparable deal was made by Racal with the acquisition of the Dana Corporation to form the multinational Racal-Dana. We could be buying Marconi-Boonton instruments in the '80s.

On the joint venture front, GEC-Fairchild is to be headed by David Marriott, a British engineer who has been with Fairchild in the USA for 14 years rising to vice-president managing a plant and directing European operations. GEC-Hitachi, which officially came into being on January 1, plans to produce 300,000 colour TV's a year, double the present output at GEC's South Wales plant, over a period of five years.

Laser Gyros

The Ministry of Defence has placed development contracts with Ferranti and Sperry for the development of laser gyroscopes for the next generation of inertial navigation systems. The concept of a laser gyroscope has been around for years. It uses three light beams in a triangular formation and has the virtue of having no moving parts and therefore less in-service maintenance. It has taken a long while for people to tumble to the fact that "cost of ownership" is more important than first cost. The laser gyroscope could be a bargain, whatever the initial cost, if aircraft are still flying rather than grounded waiting maintenance. Boeing Is reported to have ordered laser gyro systems for their new generation of 757 and 767 airliners so there is every reason for the UK to press ahead in what is clearly going to be an important technological change.

Plessey Sheds ICL

Plessey has sold its share in ICL and will use its £33·6 million realised for the sale for internal development and acquisitions in data communications, office equipment and telecommunications. Plessey regards all these areas as "converging", which indeed they are. The recently introduced System 90 and Financial Transaction Terminal System are examples where the technologies are linked to provide instant banking and the cashless society, a new venture for Plessey in what is sure to be a growth area.

But Plessey Semiconductors, bravely borne by Plessey through the years still awaits a buyer. GEC is reported as interested, one of a number of possible purchasers, not excluding some of the British-based US semiconductor companies.

Comms 80

Communications 80, to be held at the National Exhibition Centre, Birmingham, next April will have no defence communications exhibits or conference papers. The restructuring, say the organisers, reflects the growing importance of data and business communications. Quite true, but equally true is that defence visitors were conspicuously thin on the ground at the last event and seem to prefer their own purely military, naval and air force events. One such is scheduled for April 79 at Brighton's Metropole conference centre with well over 100 exhibitors showing defence components and services with a strong contingent of electronics companies.

PATENTS REVIEW...

Copies of Patents can be obtained from :
the Patent Office Sales, St. Mary Cray, Orpington, Kent Price 95p each

PATENT NOTE

Under the patent laws that existed in the UK up until June 1978, all patent applications were secret throughout all their pending stages. Past patent reports in these pages have therefore been based on granted patents published several, often three or four, years after initial filing of the patent application.

Under the new patent laws, which came into force in June 1978, all this changes. Pending patent applications will now be published and thereafter reported in these pages eighteen months after first filing anywhere in the world. In some cases this will mean the publication of the "secrets" of a patent application just six months after filing in the United Kingdom! For several years there will be an overlap between the old and new laws. This will inevitably mean that some of the patents we report will be already granted under the old laws and some will still be in the pending application stage under the new laws.

We will in each case clearly identify whether a reported invention is culled from a granted patent or a pending patent application. We will also state clearly the filing date(s) on which the inventor stakes his claim.

Under the new, streamlined laws, readers can now complain direct to the Patent Office if they are able to prove that the invention covered by a new pending patent application is old hat. The object of this streamlined provision is of course to cut down on the number of new patents granted on rediscovered old ideas.

If an invention reported in these pages is identified as originating from a patent granted under the old laws there is little to be gained from complaining to the Patent Office if it appears old hat. But in the interests of wider general knowledge of the fact, readers with proof that the idea is old can write us a letter for publication.

If the invention is identified as originating from a pending patent application under the new laws, any reader with proof that the invention is old should write direct to the Comptroller of Patents, The Patent Office, 25 Southampton Buildings, London WC2A 1AY, identifying the patent application by number and enclosing whatever hard factual evidence they have to dispute the inventor's claim to originality.

No fee is payable. No form need be filled in and any member of the public inclined to object is free to do so. But note well that the Comptroller of Patents will not generally be swayed by vague personal recollections and will usually require dated proof (for instance a page from a magazine or text book) to substantiate the complaint.

By reporting pending applications on electronic inventions and thereby affording readers the opportunity to block the grant of new patents on old ideas we can perhaps help the new laws fulfil their purpose and encourage inventors and firms to research the past more carefully before making wild claims to patent monopoly on the future.

TV CODING SYSTEM

Readers have been quick to point out their belief that a previously reported patent from Indesit of Turin, Italy, claimed an old idea. It will be interesting therefore to hear readers' reactions to another recent British patent from the same source, BP 1 533 148, which was filed in mid 1975 under the old laws and covers a "reception-transmission signal for radioelectrical signals", especially colour TV.

Is the Indesit research laboratory an ivory tower cut off from the world or are their patented ideas an original approach to an old problem?

Indesit recap on existing colour television coding and decoding systems, and suggest that although the Pal and Secam systems have obvious advantages over NTSC, the European systems suffer because the receiver requires at least one changeover switch which operates at line frequency and must be phase identified.

Indesit propose a coding circuit at the transmitter as shown in Fig. 1. Colour difference signal B-Y is fed to amplitude modulator 3, and colour difference signal R-Y is fed to amplitude modulator 4. A first sub-carrier of frequency f_1 is also fed to modulator 3 and a second sub-carrier of frequency of f_2 is fed to modulator 4. Both modulators suppress the carriers so sidebands only are fed to adder 7 to provide the output chromanance signal. This is combined in conventional fashion with the luminance signal Y and the sync signals.

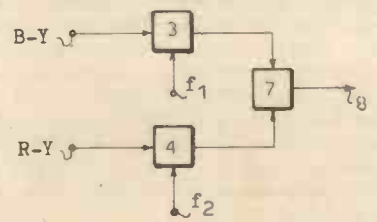


FIG. 1

Where f_1 is 4433618·75Hz (for the Pal system) f_2 is chosen to equal $f_1 \pm fH/2$ where fH is the line frequency i.e. f_2 = 4441431·25 Hz or 4425806·25 Hz.

Input 10 of a receiver decoder (Fig. 2) routes the chromanance signal to delay line 11, subtractor 12, adder 13 and colour burst gate 14 which is controlled by an input of line frequency pulses at 15.

Delay line 11 outputs to second inputs of subtractor 12 and adder 13 which in turn output to synchronous demodulators 16 and 17.

Gate 14 outputs to sub-carrier regenerators 18, 19 which are tuned respectively to frequencies f1 and f2.

Regenerator 18 (f1) is connected to a reference input of demodulator 16, and regenerator 19 (f2) is connected to a reference input of demodulator 17.

The demodulated signals B-Y and R-Y appear at decoder outputs 20, 21.

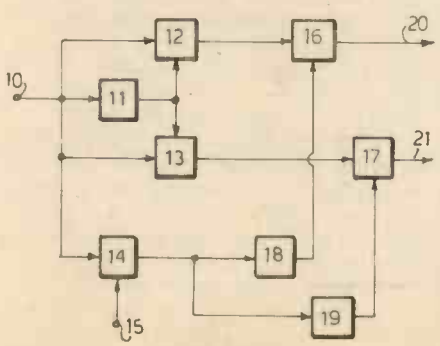


FIG. 2

According to Indesit the circuit elements 11, 12, 13 function as two complementary comb filters. The element 11 delays by one line and the chromanance components differ in frequency by half line frequency, so the number of cycles of f1 engaged by delay 11 is always a whole number plus one half cycle whereas the number of cycles of f2 is always a whole number.

(4433618·75 x 63·943 x 10^{-6} = 283·5 and 4441431·25 x 63·943 x 10^{-6} = 284). As a result the component of f1 is cancelled at 13 while the component of f2 is cancelled at 12.

Indesit claim that this system enables the design of a colour TV receiver without electronic phase changeover and obviates the need for phase identification circuitry. Indesit also suggest that their comb filter idea may be adapted to the multiple transmission of 3D images for TV. A simple formula is given for adoption of the basic idea to the transmission of more than two carriers.

Note in the context of the introductory paragraphs that this Indesit patent has already been granted under the old patent laws and is thus, along with all other patents granted under the old laws, *not* open to simple objection along the lines described above as applicable to pending applications published under the new laws.

readout

... a selection from our postbag

Readers requiring a reply to any letter must include a stamped addressed envelope.
Opinions expressed in Readout are not necessarily endorsed by the publishers of Practical Electronics.

Strictly Instrumental

Sir—Re. the most interesting article in the September issue of P.E. concerning the TDA 1008. Now this i.c. requires a Master Tone Generator to provide the top octave 8kHz–16kHz approx. to give output footages ranging from 16′ to 1′. Whilst the maximum frequencies desirable from AY-1-0212 is an octave lower using the maximum input frequency of ≏2 MHz.

I would be most interested therefore if Mr Lenton Smith could provide a design suitable for this application in the near future (I am sure other readers would agree) since this i.c. appears to offer advantages over other systems.

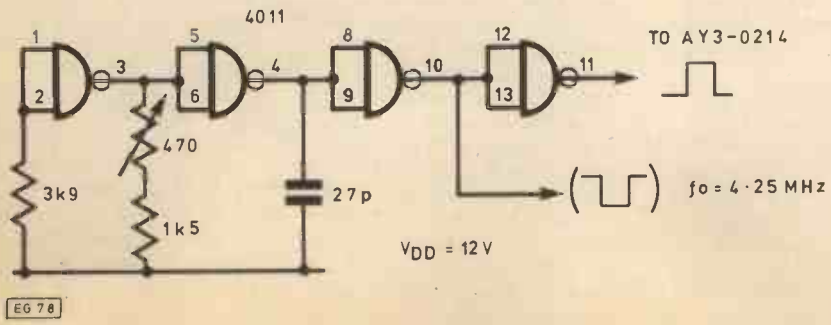
Incidentally, pin 14 was shown as N/C whereas I believe that it supplies an ungated output corresponding to the lowest ÷ 2 stage and could be used to provide pedal notes. For this purpose it should be connected to pin 13 (6V) via a 300kΩ resistor (minimum).

J. J. Fuzzard,
Chapel-en-le-Frith,
Stockport.

The Truth Table on page 988 of the September 1978 issue shows that, if 1′, 2′, 4′, 8′ and 16′ pitches are required, the top C frequency from the TOS will need to be 16,740Hz. This is a higher figure than most constructors have been used to in the past and they have usually solved the problem by "breaking back" the top octave at 1′ pitch. However, the TDA1008 ideally requires this extra octave of master frequencies but the AY-1-0212 will not provide it.

The choice must be between AY-3-0214, AY-3-0215 and AY-3-0216. All of these chips produce the required frequencies, but my choice would be AY-3-0214 on grounds of musical accuracy. Tuning errors compared with the equal temperament scale are tiny—well below 0·1 per cent—whereas the errors are larger with the other devices, including AY-1-0212A. Unfortunately, increasing the master oscillator frequency to the latter device is not the answer as its dissipation will rise and may destroy it: on the other hand, the master oscillator frequency to the AY-3 series can be reduced from approximately 4MHz to 100kHz if so desired.

Regarding the master oscillator, a Hartley followed by a Schmitt Trigger can be used. As a stabilised 12V supply is required for the set of TDA1008s, a simpler solution is to employ a 4011 4-Nand gate i.c., as shown below. This will provide a square wave signal of the correct amplitude and slew rate at the required frequency of approximately 4·25MHz.



Even though "Strictly Instrumental" was expanded last September, it was not possible to cover all the facets of the TDA1008 in that article. Pin 14 was shown as "N/C", though carries the ungated signal from the lowest divider. It is used as a factory test point, though equally the constructor could feed the keying of a 12 note pedal board from this pin. If so used, a 330k resistor should be connected between pins 14 and 13 (to draw 20μA from the 6V supply).

I am glad that you found the article concerned interesting. Signetics are updating their application notes on the TDA1008 and I would not be surprised to see developments of this device announced in the near future.

K. Lenton-Smith.

No to boxes

Sir—I feel that the mooted idea of substituting boxes for the more readily understood symbols for capacitors and resistors is without any merit whatsoever. The present symbols do suggest the function of the components, and in my opinion were well chosen in the first place.

Consider how adaptable the variations on capacitors have worked out over the years, how would one distinguish between differential, split stator, ordinary variable, varicap and maybe others yet to come, when drawing a box?

Substituting boxes is just another example of change for the hell of it. Personally I wouldn't be interested in reading a technical magazine which was deliberately less than clear.

H. Burtenshaw,
Godalming,
Surrey.

BOOK REVIEWS

A GUIDE TO AMATEUR RADIO

By Pat Hawker, G3VA
Published by Radio Society of Great Britain
35 Doughty Street, London WC1N 2AE
120 pages, 180 x 245mm. Price £1·71 post paid (UK)

GUIDANCE for the newcomer to the hobby, help in obtaining a transmitting licence, technical information, operating data; these are the aims and content of this comprehensive enthusiasts' handbook.

You can get started with a transmitter and receiver for about £40 if you build them yourself, and less if you start by just listening, which is the best way to start. Even the short waveband of a domestic receiver will enable some initial listening to be done at no outlay.

The main difference between a domestic set and a communications receiver is that the latter has a beat frequency oscillator (b.f.o.) to allow reception of single sideband (s.s.b.) and continuous wave (c.w.) telegraphy. You will have to learn a lot of new abbreviations if you are to understand amateur radio, and if you learned morse with the scouts or in the services then brush up on it as c.w. (morse) is a regular part of listening with a communications receiver.

For someone considering purchasing a second hand piece of equipment there is a comprehensive list of manufacturers' models past and present, with a brief specification on each. Alternatively, the build-it-yourselfer is given plenty of advice and for those not even familiar with receiver principles there is a good introduction to "all band" superhets, double superhets, and homodynes. Transmitters are similarly well documented, as is that most important field of aerial design and construction. There is also a section of workshop practice which should be skim reading for PE readers, and details of licence examinations.

A.T.

THE WHICH? GUIDE TO TUNER/AMPLIFIERS

Published by The Consumers' Association
Caxton Hill, Hertford SG13 7LZ
128 pages, 207 x 196mm. £3·45 on bookstalls or post free from above address

WHICH? have made this guide available to non-subscribers, and at £3·45 it could save ten times that amount; prices of sets reviewed range from £85 for the Alpha FR-5000 to £600 for the Telefunken TR 1200.

Best buy for Which? is the Pioneer SX-750, putting out 50W and costing £240. For power hungry types who listen partly with the stomach there are the "good but pricey" Rotel RX-1203, 120W, £450, and the Yamaha CR2020, 100W, £490.

Four other sets at around the £300 mark are "worth thinking about" and there are ten sets under £100 that get special mentions.

Each of the one hundred sets tested has a full page report covering—appearance and finish; specification; controls; control markings and scales; performance of the amp. and the tuner; and a listening test by professional audio consultants, student musicians, hi-fi enthusiasts, student audio technicians, etc.

Like other Which? publications there are several pages of thoughtful discussion, question and answer style, on stereo, hi-fi, combined tuner and amplifier, how much power, which wavebands, how many knobs and switches, connecting sockets and leads, aerials, tuner performance, amplifier performance.

The introduction to the summaries runs for a dozen pages and gives detailed information on probably every aspect which could affect a choice of equipment.

Should be compulsory reading for every hi-fi retailing assistant who is not familiar with RIAA equalisation. A.T.

TELEVISION INTERFERENCE MANUAL

By B. Priestley
Published by Radio Society of Great Britain
35 Doughty Street, London WC1N 2AE
78 pages, 148 x 210mm. Price £1·35 (UK)

"THERE I was struggling to maintain a fading DX on '20' with Ian in Panama when this chap from Mimosa Avenue came banging on the door insisting that I'm breaking through onto his television and ruining his viewing of Sportsnight, and if I don't do something about it immediately he'll have the Post Office shut me off the air."

That may be unlikely to happen to you but it is a fact that the Post Office can shut down an amateur transmitter if there is reason to believe it may be causing interference to a domestic receiver. What is worse is that if it turns out that the transmitter is clear but the TV has a fault the Post Office may still close the transmitter down for 30 days to allow the modification to be made to the TV.

The introduction of the interference officer of the Post Office's Radio Interference Service is obviously to be avoided if amicable testing and fault finding can be carried on between radio amateur and television viewer.

If the matter cannot be resolved in a neighbourly way there may be a local television interference group who can mediate. For many amateurs there is no such group and although the RAE covers interference, this book is intended to provide more detailed guidance, especially for the amateur new to radio.

The author states that at least 90 per cent of all television interference (TVi) is due to harmonic radiation or television overload, and although other possible causes are covered the main chapters are concerned with—TV channels, systems, spurious radiation TVi, strong signal TVi, transmitter design, and breakthrough onto audio amplifiers and tape recorders.

There is also a comprehensive data and reference section including much filter information, and finally a scenario of the general investigation taken by the Post Office if you can't patch things up with the chap from Mimosa Avenue.

A.T.

10–4, Newsletter of the Citizens' Band Association, 16 Church Road, St. Marks, Cheltenham, Glos. GL51 7AN

C.B. OR Citizens' Band is alive and well and being publicised from Cheltenham. Officially C.B. is not yet alive in Britain but hundreds of enthusiasts are campaigning for Home Office approval by writing to their MP's, newspapers, magazines; calling phone-in programmes; distributing leaflets, posters and car stickers; even publicity T-shirts are available.

Some adverse publicity from radio amateurs was experienced when C.B. started in America, mainly because 27MHz was originally an amateur band. This opposition is not general as half the founders of the Citizens' Band Association (C.B.A.) are radio amateurs and the C.B.A. has many radio amateurs in its membership.

The C.B.A. has proposed that a VHF/FM system be started up for a British C.B. and a submission has been made to the Radio Regulatory Department at the Home Office for consideration at the 1979 Geneva conference on frequency allocations. Prices of VHF/FM sets are expected to be just over £100 initially, dropping to around £65.

The above information is just part of the news from pages of C.B.A. newsletters. They have in the past published the American "Ten" code and a C.B. users' dictionary. The "Ten" code was developed to enable a number of standard messages to be sent quickly even when radio conditions are poor. 10–4 is the well known "OK" or "affirmative"; 10–9 is "please repeat"; 10–53 is "road blocked". Words which are apparently in general use include "break"—please may I interrupt (hence "breaker 14" on the record "Convoy"); "convoy"—group of vehicles travelling together linked by C.B.; "eighteen wheeler"—any large articulated vehicle; "mixing bowl"—interchange of roads.

A survey of the C.B.A. membership showed that there is some feeling against the "pop" image of C.B. and the "truckers slang" but the association organisers think the British transport system needs C.B. British lorry drivers will soon develop their own argot.

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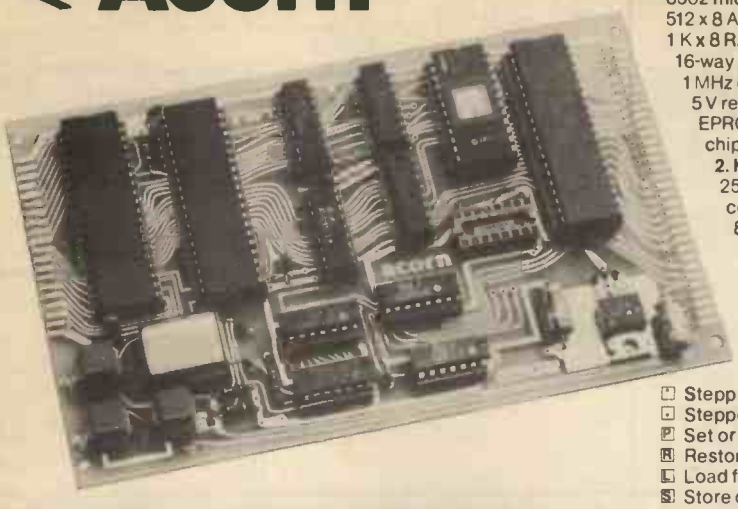
Introducing Acorn



A professional MPU card

Designed as a general purpose industrial controller based on the 6502 MPU, this card is complemented by a matching Eurocard hex keyboard and CUTS standard cassette interface, to create the new. . .

Acorn Microcomputer

This compact stand-alone micro-computer is based on standard Eurocard modules, and employs the highly popular 6502 MPU (as used in APPLE, PET, KIM, etc). Throughout, the design philosophy has been to provide full expandability, versatility and economy. Take a look at the full specification, and see how Acorn meets your requirements

Acorn technical specification

The Acorn consists of two single Eurocards:

1. MPU card
6502 microprocessor
512 x 8 ACORN monitor
1 K x 8 RAM
16-way I/O with 128 bytes of RAM
1 MHz crystal
5 V regulator, sockets for 2 K EPROM and second RAM I/O chip.

2. Keyboard card
25 click-keys (16 hex, 9 control)
8 digit, 7 segment display
CUTS standard crystal controlled tape interface circuitry

Keyboard Instructions:
M Memory Inspect/ Change (remembers last address used)
+ Stepping up through memory
- Stepping down through memory
P Set or clear break point
R Restore from break
L Load from tape
S Store on tape
G Go (recalls last address used)
RST Reset

Compact, easy to use Acorn Monitor includes the following features:

- System program
- Set of sub-routines for use in programming
- Powerful de-bugging facility displays all internal registers
- Tape load and store routines

Acorn – with real expandability!

The standard Acorn is fully expandable to 65 K of memory, and the Acorn bus is available on the 64-way edge-connector. Whether you're a beginner in the field, an ambitious home computer buff, a development engineer, a teacher or a businessman, the Acorn and its family of modules will provide a practical solution in virtually every situation.

Future expansion for Acorn includes the following software and hardware.

Software
Basic interpreter, assembler, dis-assembler, editor, TTY and disk operating system.

Hardware
Memory-mapped VDU system (with upper and lower case ascii graphics and hardware scroll) floppy disk controller for 5¼ in and 7 in disks, a memory card with 8 K bytes of static RAM (2716) and 4 K bytes of EPROM (2114), a PROM programmer (for all types of PROM usable on ACORN a full ascii keyboard, a backboard for the ACORN bus, and a Eurocard racking system.

Acorn Operating Manual

With Acorn, you'll receive an operating manual that covers computing in full, from first principles of binary arithmetic, to efficient hex programming with the 6502 instruction set. The manual also includes a listing of the monitor programs and the instruction set, and other useful tabulations; plus a selection of 12 interesting and educative program samples.

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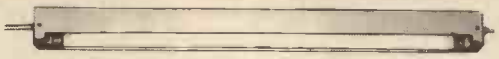
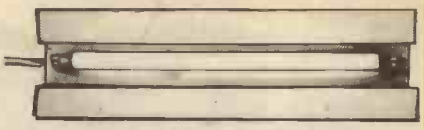
Type "B" 

Type "D" 

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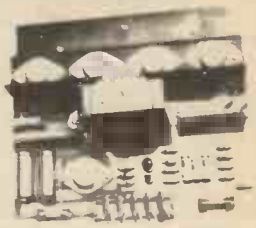
All output ratings are R.M.S. continuous sine wave output.

AMPLIFIER MODULES



SPEC. INPUT SENSITIVITY 60 mV for full output
Frequency response 20 Hz-20 KHz
HUM & NOISE – 70dB

TL30 5" x 5" x 2" • 35 watt 10 amp output transistors	£13.25
TL60 5" x 5" x 3" • 60 watt R.M.S. continuous sine wave output • 2 R.C.A. 110 watt 15 amp outpout transistors	£18.50
TL100 5" x 5" x 3" • 100 watt R.M.S. continuous sine wave output • 2 R.C.A. 150 watt 15 amp output transistors	£21.50
TP125 7" x 6½" x 3" • 125 watt R.M.S. continuous sine wave output • 4 R.C.A. 150 watt 15 amp output transistors	£27.50

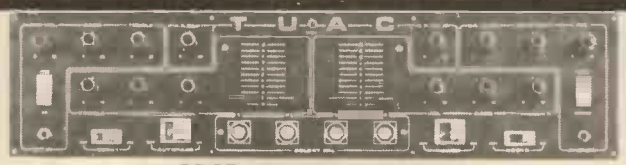
4 CHANNEL SOUND TO LIGHT SEQUENCE CHASER – 4LSMI

- Full wave control
- RCA 8A Triacs
- 1000W per channel
- Fully supressed and fused
- Switched master control for sound operation from ¼W to 125W
- Speed control for fixed rate sequence from 8 per minute to 50 per second
- Full logic integrated circuitry with optical isolation for amplifier protection

£21.50

Model 501 500W per channel as above without sound triggering

£14.00



STEREO DISCO MIXER

With touch sensitive switching and auto fade

INPUTS: Four identical stereo inputs available with any equalisation. Two magnetic and two flat supplied as standard. High quality slider control on each channel. Volume, treble and bass controls for each pair of sliders. Sensitivity mag. 3mV (R.I.A.A. comp.). Flat 50mV at 1kHz. Bass controls ± 18dB at 60Hz. Treble controls ±18dB at 15kHz.
OUTPUT: Up to 3 volts (+ 12dB) available. Attenuated output for TUAC Power Modules. Rotary master and balance controls. Band width 15Hz – 25kHz ± dB
P.F.L.: Output 250mV into 8 ohms. Rotary volume control. Monitoring facility for all 4 channels. Selection via touch sensitive illuminated switches. Switched visual cue indicator.
Miscellaneous Facilities: Two illuminated deck on/off switches. Mains illuminated on/off switches. Auto fade illuminated on/off switch. Mains powered with integral screen and back cover. Complete with full instructions
Size 25in long × 6in high × 3in deep.

Mono Disco Mixer with autofade **£49.00**

£149.00

3 CHANNEL LIGHT MODULATOR SILMB

- RCA 8A Triacs
- 1000W per channel
- Each channel fully suppressed and fused
- Master control to operate from 1W to 125W
- Full wave control

£20.75

Single Channel Version 1500 Watts

£9.75

POWER SUPPLIES

Vacuum varnish impregnated. Transformers with supply board incorporating pre-amp supply:

PS250 for supplying 2 TP125s	£30.00
PS200 for supplying to TL100s	£30.00
PS60/60 for supplying 2 TL60s	£30.00
PS125 ± 45 volts for TP125	£18.50
PS100 ± 43 volts for TL100	£17.00
PS60 ± 38 volts for TL60	£15.50
PS30 ± 25 volts for TL30	£11.75
PSU 2 for supplying disco mixer	£7.50

FRONT PANEL FOR LIGHTING EFFECT MODULES

(complete with switches, neons and knobs) as illustrated

For S1LMB. **£7.25**
Size 8" x 4½"

4LSM1 **£6.00**
Size 6½" x 4½"

S1LMB **£8.25**
Combined with 3SDM1
Size 9" x 4½"

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Red, Green, Blue, Amber. **£24.50**

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Geo Mathews, 85/87, Hurst Street, Birmingham (Tel 021-622 1941)
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Cookies Disco Centre, 126/128, West Street (Tel Crewe 4739)
Garland Bros. Ltd., Deptford Broadway, London 01-692 4412
Luton Disco Centre, 88, Wellington Street, Luton (Tel Luton 411733)
Session Music, 163, Mitcham Road, Tooting (Tel 01-672 3413)
Mon-Sat 10am to 6pm. Closed Wed.
Electra Centre, 58, Lancaster Road, Preston (Tel Preston 58488)
Electrosure Ltd., Fore Street (Tel Exeter 56687)
Salcoglen Ltd., 43, Borough Road (Tel Middlesbrough 242851)
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TRADE & EXPORT ENQUIRIES 01-672 3137

ADD SEQUENCE CHASING + DIMMING EFFECTS FOR TUAC 3 CHANNEL LIGHT MODULATOR

- Speed Control 3 per min. to 10 per sec.
- Full logic integrated circuitry
- Dimmer control to each channel

3SDMI **£15.25**

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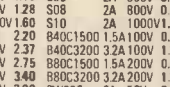
BRIDGE RECTIFIERS

Type	Rating	Price	Type	Rating	Price	Type	Rating	Price
W005/			S005	2A 50V	0.39			
T1005	1A 50V	0.28	PW01	6A 100V	0.95	S01	2A 100V	0.44
W01	1A 100V	0.30	PW02	6A 200V	0.97	S02	2A 200V	0.48
W02	1A 200V	0.32	PW04	6A 400V	1.08	S04	2A 400V	0.60
W04	1A 400V	0.40	PW06	6A 600V	1.18	S06	2A 600V	0.70
W06	1A 600V	0.50	PW08	6A 800V	1.28	S08	2A 800V	0.84
W08	1A 800V	0.60	PW10	6A 1000V	1.60	S10	2A 1000V	1.35
VM18	1A 100V	0.44	K005	25A 50V	2.20	B40C1500	1.5A 100V	0.53
VM28	1A 200V	0.48	K01	25A 100V	2.37	B40C3200	3.2A 100V	1.20
VM48	1A 400V	0.50	K02	25A 200V	2.75	B80C1500	1.5A 200V	0.82
BY164	1.4A 120V	0.75	K04	25A 400V	3.40	B80C3200	3.2A 200V	1.25
BY179	1A 800V	0.70	K06	25A 600V	3.99	PW005	6A 50V	0.90

SINGLE IN LINE PLUGS AND SOCKETS

Providing a simple and economical alternative to edge connectors for bringing cable into a pcb.
12 Way **£0.90**, 24 Way **£1.20**



New–SIEMENS TURN-SLIDE SWITCHES

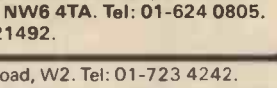
This new version of the rotary switch is especially suitable for setting programs. The rotary switch is of a 1 element no stops.
Voltage rating ≤ 60 V≂
Current rating ≤ 0.5 A≂
fixed contacts gold-plated. **£2.65**

CMOS *(see catalogue for full range)*

74C00N	0.24	74C76N	0.54	74C160N	1.11	74C221N	1.36	74C911N 7.70
74C02N	0.24	74C83N	1.30	74C161N	1.11	74C373N	1.87	74C912N 7.70
74C04N	0.24	74C85N	1.30	74C162N	1.11	74C374N	1.87	74C914N 1.41
74C08N	0.24	74C86N	0.64	74C163N	1.11	74C901N	0.54	74C915N 1.11
74C10N	0.24	74C89N	4.39	74C164N	1.04	74C902N	0.54	74C918N 1.15
74C14N	0.95	74C90N	0.85	74C165N	1.04	74C903N	0.54	74C922N 3.90
74C20N	0.24	74C93N	0.85	74C173N	0.90	74C904N	0.54	74C923N 3.74
74C30N	0.24	74C95N	1.04	74C174N	0.90	74C905N	7.28	74C925N 5.22
74C32N	0.24	74C107N	1.22	74C175N	0.90	74C906N	0.54	74C926N 5.22
74C42N	0.92	74C150N	4.14	74C192N	1.11	74C907N	0.54	74C927N 5.22
74C48N	1.38	74C151N	2.47	74C193N	1.11	74C908N	0.96	74C928N 5.22
74C73N	0.54	74C154N	3.68	74C195N	1.04	74C909N	1.63	74C932N 1.56
74C74N	0.56	74C157N	2.21	74C200N	6.70	74C910N	6.79	

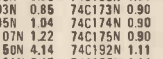
MULTI-WAY EDGE CONNECTORS

2.54mm (.1 inch)		Price
16 Way	Single	£3.00
24 Way	Single	£3.90
32 Way	Single	£5.25



3.96mm		
6 Way	Double	£2.03
10 Way	Double	£2.66
15 Way	Double	£3.08
22 Way	Double	£4.60

RESISTORS



CARBON FIXED — Price
0.25 watt ±5% Tol. Available in E12 range 10Ω to 1 meg ..... 2p each
0.5 watt ±5% Tol. Available in E12 range 10Ω to 10 meg ..... 3p each
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2.0 watt ±10% Tol. Available in E12 range 10Ω to 10 meg ..... 9p each

WIRE WOUND
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METAL OXIDE
0.5 watt ±2% Tol. E24 range 10Ω to 1 meg ..... 4p each*

**See catalogue for full list of available values.*

BRINDLEY TOOLS AND CUTTERS

GENERAL PURPOSE
100mm (4 inch)

	Price
Diagonal Cutters	£3.40
Round Nose Pliers	£3.25
Flat Nose Pliers	£3.20
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Also in stock –
BAHCO Quality Tool range.
See catalogue for full details.

TTL *(see catalogue for full range)*

SN74H05N	0.60	74LS75N	0.58	74LS194N	0.70	74LS490N	0.90	
SN74H10N	0.55	74LS76N	0.42	74LS195N	0.70	74LS670N	1.90	
SN74H11N	0.55	74LS78N	0.42	74LS196N	0.80	SN74S00N	0.77	
SN74H20N	0.55	74LS83AN	0.90	74LS197N	0.80	SN74S03N	0.77	
SN74H21N	0.55	74LS85N	0.95	74LS221N	0.80	SN74S04N	0.94	
SN74H30N	0.55	74LS86N	0.44	74LS240N	1.50	SN74S10N	0.77	
SN74H40N	0.55	74LS90N	0.64	74LS241N	1.50	SN74S20N	0.77	
SN74H51N	0.55	74LS91N	1.20	74LS242N	1.25	SN74S40N	0.77	
SN74H53N	0.55	74LS92N	0.70	74LS243N	1.25	SN74S64N	0.77	
SN74H54N	0.55	74LS93N	0.64	74LS244N	1.50	SN74S65N	0.77	
SN74H55N	0.55	74LS95AN	0.90	74LS245N	1.65	SN74S112N	1.70	
SN74H60N	0.55	74LS96N	1.35	74LS247N	1.09	SN74S114N	1.70	
SN74H62N	0.55	74LS107N	0.42	74LS248N	1.09	SN74S140N	0.77	
SN74L00N	0.55	74LS109N	0.42	74LS249N	1.09	SN74S157N	2.95	
SN74L02N	0.55	74LS112N	0.42	74LS251N	1.00	SN74S188N	2.70	
SN74L04N	0.60	74LS113N	0.42	74LS253N	1.00	SN74S189N	1.81	
SN74L47N	3.10	74LS114N	0.42	74LS257N	1.00	SN74S200N	3.50	
SN74L74N	0.90	74LS122N	0.62	74LS258N	1.00	SN74S201N	3.71	
SN74L85N	2.62	74LS123N	0.83	74LS259N	1.55	SN74S262N	12.50	
SN74L93N	2.30	74LS124N	1.70	74LS261N	3.25	SN74S287N	2.95	
74LS00N	0.26	74LS125N	0.50	74LS266N	0.44	SN74S288N	2.70	
74LS01N	0.26	74LS126N	0.50	74LS273N	1.30	SN74S289N	1.81	
74LS02N	0.26	74LS132N	0.85	74LS275N	3.20	SN74S300N	5.06	
74LS03N	0.26	74LS136N	0.42	74LS279N	0.58	SN74S301N	3.71	
74LS04N	0.29	74LS138N	0.65	74LS280N	1.65	SN74S387N	3.05	
74LS05N	0.29	74LS139N	0.65	74LS283N	1.20	SN74S470N	5.06	
74LS08N	0.26	74LS145N	1.30	74LS289N	3.74	SN74S471N	5.06	
74LS09N	0.26	74LS147N	1.65	74LS290N	1.00	SN74S472N	13.48	
74LS10N	0.26	74LS148N	1.35	74LS293N	1.00	SN74S473N	13.48	
74LS11N	0.26	74LS151N	0.58	74LS295N	1.35	SN74S474N	13.48	
74LS12N	0.26	74LS153N	0.58	74LS298N	1.35	SN74S475N	13.48	
74LS13N	0.58	74LS154N	1.45	74LS299N	2.95	SN7490AN	0.36	
74LS14N	0.75	74LS155N	0.80	74LS323N	3.50	SN7491AN	0.60	
74LS15N	0.26	74LS156N	0.80	74LS324N	1.65	SN7492N	0.36	
74LS20N	0.26	74LS157N	0.60	74LS325N	2.40	SN7493N	0.36	
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74LS22N	0.26	74LS160N	0.80	74LS327N	2.55	SN7495N	0.76	
74LS26N	0.32	74LS161N	0.85	74LS348N	1.10	SN7496N	0.54	
74LS27N	0.26	74LS162N	0.80	74LS352N	1.07	SN7497N	1.95	
74LS28N	0.29	74LS163N	0.85	74LS353N	1.07	SN74100N	1.40	
74LS30N	0.26	74LS164N	1.10	74LS365N	0.55	SN74107N	0.24	
74LS32N	0.27	74LS165N	1.15	74LS366N	0.55	SN74118N	0.95	
74LS33N	0.29	74LS166N	1.65	74LS367N	0.55	SN74119N	1.40	
74LS37N	0.32	74LS168N	1.45	74LS368N	0.55	SN74121N	0.28	
74LS38N	0.32	74LS169N	1.45	74LS373N	0.85	SN74122N	0.55	
74LS40N	0.26	74LS170N	1.90	74LS374N	0.85	SN74123N	0.55	
74LS42N	0.80	74LS173N	1.10	74LS375N	0.66	SN74124N	1.20	
74LS47N	1.09	74LS174N	0.75	74LS377N	1.30	SN74125N	0.45	
74LS48N	1.00	74LS175N	0.75	74LS378N	1.00	SN74141N	0.56	
74LS49N	1.09	74LS181N	2.75	74LS379N	1.25	SN74145N	0.85	
74LS51N	0.26	74LS183N	2.70	74LS386N	0.44	SN74148N	1.35	
74LS54N	0.26	74LS189N	3.74	74LS390N	0.90	SN74150N	0.90	
74LS55N	0.26	74LS190N	1.00	74LS393N	0.90	SN74151N	0.76	
74LS83N	1.26	74LS191N	1.00	74LS395N	1.50	SN74153N	0.65	
74LS73N	0.42	74LS192N	0.95	74LS398N	1.90	SN74154N	1.20	
74LS74N	0.42	74LS193N	0.95	74LS399N	1.45	SN74155N	0.70	

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complete with charger

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LM3.5A **£90.00** (3½ digit 0.5% Acc.)

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LM340T-5	0.88	LM1305N	1.52	MC844P	0.70	CA3065	1.10	
LM340T-12	0.88	LM1307N	1.22	MC846P	0.70	CA3068	3.80	
LM340T-15	0.88	LM1310N	2.10	MC848P	1.10	CA3070	1.90	
LM340T-24	0.88	LM1351N	1.30	MC849P	0.70	CA3071	1.90	
LM341P-5	0.56	LM1458N	0.45	MC857P	0.85	CA3072	1.90	
LM341P-12	0.56	LM1496N	0.97	MC861P	0.85	CA3075	1.70	
LM341P-15	0.56	LM1800N	1.94	MC1035P	1.90	CA3076	2.12	
LM341P-24	0.56	LM1801N	2.25	CA3000	3.30	CA3080	0.85	
LM345K	6.97	LM1808N	2.10	CA3001	4.25	CA3080A	2.10	
LM348N	0.95	LM1812N	6.20	CA3002	3.30	CA3086	0.50	
LM350K	6.50	LM1820N	1.16	CA3006	4.60	CA3088F	1.87	
LM358N	0.60	LM1828N	1.90	CA3007	4.15	CA3089E	2.90	
LM360N	3.00	LM1830N	1.90	CA3008	2.55	CA30900	4.40	
LM370N	3.30	LM1845N	1.50	CA3012	1.85	CA3130	1.06	
LM371H	2.35	LM1848N	1.98	CA3013	1.85	CA3140	1.04	
LM373N	3.35	LM1850N	1.90	CA3014	2.20	LD05T1	2.25	
LM374N	3.35	LM1889N	2.50	CA3018	0.75	LF355N	0.80	
LM377N	1.80	LM1890N	P.O.A.	CA3018A	1.10	LF356N	0.80	
LM378N	2.40	LM2907N-8	1.80	CA3020	2.20	LF357N	0.80	
LM379S	4.25	LM2917N-8	1.80	CA3020A	2.50	LF13201N	3.00	
LM380N-8	0.96	LM3301N	0.60	CA3021	2.40	LF13331N	3.00	
LM380N-14	1.08	LM3302N	0.55	CA3022	2.20	LF13741H	0.49	
LM381AN	2.70	LM3401N	0.55	CA3023	2.20	LF13741N	0.38	
LM381N	1.69	LM3900N	0.68	CA3026	0.70	LM114H	2.75	
LM382N	1.32	LM3905N	1.15	CA3028A	0.90	LM301AH	0.40	
LM384N	1.55	LM3909N	0.78	CA3028B	1.25	LM301-8	0.30	
LM386N	0.88	LM3911N	1.10	CA3029	0.75	LM304H	1.50	
LM387N	1.10	LM3913N	P.O.A.	CA3029A	0.90	LM307N	0.50	
LM388N	1.00	LM3914N	2.79	CA3030	1.50	LM308H	0.95	
LM389N	1.00	LM4250CN	1.30	CA3030A	2.20	LM308N	0.55	
LM392N	0.87	LM78L05CH	0.85	CA3033	3.70	LM309KC	1.95	
LM7018	2.99	LM78L12CH	0.85	CA3034	2.75	LM317K	3.35	
LM701C	2.99	LM78L15CH	0.85	CA3035	1.95	LM317MP	1.35	
LM702C	0.81	LM78L24CH	0.85	CA3036	1.21	LM317T	2.20	
LM703LN	1.15	LM7805KC	1.56	CA3038	2.90	LM318N	2.45	
LM709CH	0.70	LM7812KC	1.56	CA3038A	4.10	LM320T-5	1.86	
LM709-8	0.50	LM7815KC	1.56	CA3039	0.77	LM320T-12	1.86	
LM709-14	0.49	LM7824KC	1.56	CA3040	3.75	LM320T-15	1.86	
LM710CH	0.87	LM78L05CZ	0.30	CA3041	1.65	LM320T-24	1.86	
LM710-14	0.48	LM78L12CZ	0.30	CA3042	1.85	LM320MP-5	1.15	
LM711CN	0.48	LM78L15CZ	0.30	CA3043	2.20	LM320MP-12	1.15	
LM716	1.00	LM78L24CZ	0.30	CA3045	1.55	LM320MP-15	1.15	
LM723CH	0.62	MC667P	2.75	CA3046	0.77	LM320MP-24	1.15	
LM723C-14	0.45	MC671P	1.75	CA3047	2.20	LM323K	5.75	
LM741CH	0.50	MC672P	1.75	CA3047A	3.70	LM324	0.75	
LM741C-8	0.30	MC724P	2.10	CA3048	2.45	LM335	1.70	
LM741C-14	0.60	MC789P	1.80	CA3049	1.98	LM337K	3.86	
LM747CN	0.78	MC790P	3.10	CA3050	2.66	LM337MP	1.78	
LM748-8	0.50	MC798P	2.20	CA3051	1.83	LM337T	2.98	
LM748-14	0.50	MC799P	2.20	CA3052	1.78	LM338K	P.O.A.	
LM900	0.50	MC832P	0.70	CA3053	0.77	*MC1327P	1.70	
LM911	0.50	MC833P	0.70	CA3054	1.10	MC1330P	1.70	
LM921	0.50	MC836P	0.82	CA3059	2.10	*MC1352P	1.20	
LM923	0.50	MC837P	0.82	CA3060	2.50	*MC1433G	3.65	
LM1303N	1.15	MC838P	2.35	CA3062	3.75	*MC1435G	2.20	

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2N335	3.00	2N708	0.30	2N1420	0.55	2N2219	0.38	40081	1.20	AC188	0.54	BC118	0.22	BCY33A	1.10	BD140	0.43	BF157	0.48
2N388	0.80	2N718	0.30	2N1483	1.85	2N2219A	0.39	40232	0.60	AC188K	0.85	BC119	0.33	BCY34A	1.10	BD142	0.70	BF159	0.37
2N388A	0.77	2N718A	0.54	2N1485	2.20	2N2220	0.39	40233	0.70	AD136	2.75	BC122	0.61	BCY38	2.20	BDX14	1.32	BF160	0.33
2N398	0.80	2N720A	0.85	2N1507	0.35	2N2221	0.25	40235	0.65	AD142	1.45	BC123	0.65	BCY40	1.05	BDX18	1.90	BF161	0.65
2N456	2.20	2N721	1.05	2N1624	0.60	2N2221A	0.25	40237	0.45	AD143	1.45	BC125	0.22	BCY42	0.65	BDX32	2.67	BF186	0.44
2N489	4.90	2N722	0.45	2N1553	1.50	2N2222	0.25	40242	0.66	AD149	2.85	BC132	0.33	BCY43	0.76	BDY11	3.30	BF167	0.37
2N489A	5.40	2N727	0.50	2N1613	0.30	2N2222A	0.25	40251	1.15	AD150	3.10	BC134	0.22	BCY54	2.40	BDY17	3.30	BF170	0.76
2N489B	5.90	2N744	0.35	2N1637	0.72	2N2223	6.78	40254	0.66	AD161	1.00	BC135	0.22	BCY58	0.22	BDY18	3.80	BF173	0.37
2N490	4.99	2N753	0.35	2N1638	0.70	2N2223A	6.99	40264	0.95	AD162	1.00	BC136	0.21	BCY59	0.27	BDY20	1.10	TIP29C	0.65
2N490B	6.50	2N760	0.35	2N1711	0.30	2N2270	0.49	40280	3.70	AF106	0.60	BC137	0.22	BCY66	2.20	BDY23	2.45	TIP30A	0.54
2N490C	6.90	2N869	0.35	2N1889	0.30	2N2303	1.54	40309	0.60	AF109	0.82	BC138	0.44	BCY67	2.70	BDY24	2.65	TIP30C	0.70
2N491A	5.75	2N914	0.38	2N1890	0.30	2N2368	0.27	40310	0.85	AF114	0.70	BC140	0.30	BCY70	0.21	BDY25	2.85	TIP31A	0.54
2N491B	6.25	2N916	0.33	2N1893	0.30	2N2369	0.27	40311	0.55	AF115	0.70	BC141	0.32	BCY71	0.26	BDY38	1.10	TIP31C	0.72
2N491	7.50	2N917	0.38	2N1907	5.95	2N2369A	0.27	40312	0.99	AF116	0.70	BC142	0.32	BCY72	0.18	BDY54	1.55	TIP32A	0.59
2N492	6.25	2N918	0.45	2N1974	0.98	2N2405	0.66	40313	1.38	AF117	0.70	BC143	0.32	BCY77	0.70	BDY55	1.90	TIP32C	0.82
2N492A	6.75	2N929	0.37	2N1990	0.45	3N81	3.50	40315	0.60	AF118	0.70	BC152	0.38	BCY78	0.43	BDY56	2.10	TIP33A	0.86
2N492B	7.75	2N929A	0.37	2N1991	1.10	3N83	2.25	40316	0.95	AF124	0.70	BC153	0.30	BCY79	0.41	BDY57	5.90	TIP33C	1.18
2N492C	10.00	2N930	0.37	2N2060	7.00	3N128	1.35	40317	0.60	AF125	0.70	BC154	0.30	BCY87	5.35	BDY58	6.50	TIP34A	0.97
2N493A	7.99	2N930A	0.95	2N2102	0.50	3N139	1.60	40324	0.95	AF126	0.70	BC160	0.38	BCY88	3.99	BDY60	1.85	TIP34C	1.31
2N493B	8.75	2N1131	0.32	2N2147	1.55	3N140	1.10	40325	1.35	AF139	0.75	BC161	0.38	BCY89	3.80	BDY61	2.75	TIP35A	2.20
2N494	6.90	2N1132	0.35	2N2160	1.55	3N141	0.95	AC126	0.48	AF172	0.70	BC175	0.43	BD115	0.88	BDY62	2.75	TIP36A	3.00
2N494A	7.85	2N1204	1.65	2N2192	0.58	3N142	0.70	AC127	0.48	AF178	1.30	BC204	0.12	BD116	1.35	BDY92	2.75	TIP41A	0.78
2N494B	8.40	2N1302	0.80	2N2193	0.50	3N143	0.88	AC128	0.48	AF186	0.55	BC205	0.17	BD121	2.20	BF115	0.39	TIP41C	0.97
2N494C	9.35	2N1303	0.80	2N2193A	0.52	3N152	1.10	AC151	0.43	AF200	1.30	BC206	0.17	BD124	2.20	BF119	1.10	TIP42A	0.86
2N549	3.25	2N1304	0.80	2N2194	0.42	3N153	1.89	AC152	0.54	AF201	1.30	BC207	0.17	BD131	0.55	BF121	0.60	TIP42C	1.08
2N696	0.39	2N1305	0.80	2N2194A	0.45	3N154	0.99	AC153	0.59	BC113	0.22	BC208	0.17	BD132	0.75	BF123	0.60	TIP50	0.82
2N697	0.31	2N1306	1.00	2N2195	0.49	3N159	1.35	AC153K	0.59	BC114	0.22	BC209	0.17	BD135	0.40	BF134	0.60	TIP54	1.83
2N698	0.49	2N1307	1.00	2N2195A	0.49	3N187	1.80	AC176K	0.70	BC115	0.22	BCY10	1.10	BD136	0.40	BF137	0.60	TIP110	0.77
2N699	0.58	2N1308	1.10	2N2217	0.55	3N200	2.85	AC176	0.54	BC116	0.21	BCY30A	1.10	BD137	0.41	BF152	0.27	TIP112	0.93
2N706	0.30	2N1309	1.10	2N2218	0.35	3N201	1.35	AC187	0.59	BC116A	0.22	BCY31A	1.10	BD138	0.41	BF153	0.27	TIP115	0.83
2N706A	0.30	2N1370	0.55	2N2218A	0.38	40050	1.70	AC187K	0.65	BC117	0.22	BCY32A	1.10	BD139	0.43	BF154	0.27	TIP117	0.99

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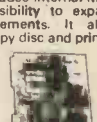

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ACY17	0·85	BD182	1·18	OA95	0·08	2G302	1·00	7433	0·36
ACY18	0·80	BD237	0·40	OA200	0·09	2G306	1·10	7437	0·32
ACY19	0·75	BD238	0·55	OA202	0·09	2N404	1·00	7438	0·32
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AFZ11	2·75	BF179	0·25	OC35	1·50	2N1307	0·50	7476	0·40
AFZ12	2·75	BF180	0·30	OC36	1·50	2N1308	0·55	7480	0·55
ASY26	0·40	BF181	0·30	OC41	0·80	2N1309	0·55	7482	0·75
ASY27	0·40	BF182	0·30	OC42	0·75	2N1613	0·25	7483	0·90
ASZ15	1·25	BF183	0·25	OC43	2·25	2N1671	1·50	7484	1·00
ASZ16	1·25	BF184	0·25	OC44	0·60	2N1893	0·25	7486	0·35
ASZ17	1·25	BF185	0·25	OC45	0·55	2N2147	1·75	7490	0·52
ASZ20	1·50	*BF194	0·09	OC71	0·55	2N2148	1·65	7491AN	0·80
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*AU110	1·70	*BF196	0·10	OC73	1·00	2N2219	0·24	7493	0·60
*AU113	1·70	*BF197	0·12	OC74	0·65	2N2220	0·18	7494	0·80
*AUY10	1·70	BF200	0·27	OC75	0·65	2N2221	0·18	7495	0·72
*BA145	0·13	*BF224	0·20	OC76	0·55	2N2222	0·18	7496	0·80
*BA148	0·13	BF244	0·28	OC77	1·20	2N2223	2·75	7497	3·00
8A154	0·09	BF257	0·24	OC81	0·65	2N2368	0·17	74100	1·50
8A155	0·10	BF258	0·26	OC81Z	1·20	2N2369A	0·21	74107	0·46
BA156	0·09	BF259	0·32	OC82	0·65	2N2484	0·20	74109	0·70
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BAX16	0·09	BF338	0·31	OC122	1·50	2N2905	0·25	74116	1·75
BC107	0·12	BFS21	3·96	OC123	1·75	2N2906	0·21	74118	1·00
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*BC114	0·13	BFW10	0·65	OC170	1·00	*2N2926	0·14	74122	0·60
*BC115	0·14	BFW11	0·65	OC171	1·00	2N3053	0·25	74123	1·00
*BC116	0·15	BFX84	0·22	OC200	1·50	2N3054	0·50	74125	0·55
*BC117	0·17	BFX85	0·23	OC201	1·75	2N3055	0·70	74126	0·55
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*BC126	0·20	BFY50	0·26	OC204	2·50	2N3442	1·10	74136	0·55
*BC135	0·14	BFY51	0·26	OC205	2·50	2N3525	0·80	74141	0·80
*BC136	0·15	BFY52	0·26	OC206	2·50	2N3614	1·50	74142	2·30
*BC137	0·15	BFY64	0·26	OC207	1·75	*2N3702	0·11	74143	2·50
*BC147	0·09	BFY90	1·25	OCP71	1·25	*2N3703	0·13	74144	2·50
BC148	0·08	BSX19	0·21	ORP12	0·75	*2N3704	0·13	74145	0·90
*BC149	0·09	BSX20	0·20	*R2008B	1·75	*2N3705	0·13	74147	2·00
*BC157	0·09	BSX21	0·20	*R2009	2·25	*2N3706	0·13	74148	1·75
*BC158	0·08	BT106	1·25	*R2010B	1·75	*2N3707	0·13	74150	1·60
*BC159	0·10	BTY79/4	3·19	T1C44	0·30	2N3708	0·10	74151	0·85
*BC167	0·12	*BU205	1·75	T1C226D	1·20	2N3709	0·13	74154	1·75
8C170	0·11	*BU206	2·25	T1L209	0·20	2N3710	0·10	74155	0·85
BC171	0·10	*BU208	2·00	*T1P29A	0·41	2N3711	0·10	74156	0·85
BC172	0·10	*BY100	0·45	*T1P30A	0·44	2N3771	1·75	74157	0·75
BC173	0·12	BY126	0·14	T1P31A	0·45	2N3772	2·00	74159	2·10
BC177	0·15	BY127	0·15	T1P32A	0·48	2N3773	3·00	74170	2·30
BC178	0·14	BZX61	0·18	T1P33A	0·69	2N3819	0·36	74172	4·40
BC179	0·16	Series		T1P34A	0·73	2N3820	0·45	74173	1·40
BC182	0·11	BZY88	0·13	T1P41A	0·63	2N3823	0·55	74174	1·50
BC183	0·10	Series		T1P42A	0·70	*2N3866	0·72	74175	0·90
BC184	0·11	CRS1/05	0·45	T1P2955	0·67	*2N3904	0·13	74176	1·10
BC212	0·13	CRS1/40	0·60	T1P3055	0·56	*2N3905	0·13	74178	1·25
BC213	0·12	CRS3/05	0·45	*T1S43	0·45	*2N3906	0·13	74179	1·28
BC214	0·15	CRS3/40	0·75	*ZS140	0·25	*2N4058	0·14	74180	1·15
BC237	0·09	CRS3/60	0·90	*ZS170	0·21	*2N4059	0·10	74190	1·50
BC238	0·12	GEX66	1·50	*ZS178	0·54	*2N4060	0·12	74191	1·50
BC301	0·25	GEX541	1·75	*ZS271	0·23	*2N4061	0·12	74192	1·35
BC303	0·24	GJ3M	0·75	*ZS278	0·57	*2N4062	0·13	74193	1·35
BC307	0·10	GJ5M	0·75	*ZTX107	0·11	*2N4124	0·15	74194	1·25
*BC308	0·10	GL7M	0·75	*ZTX108	0·10	*2N4126	0·15	74195	1·00
*BC327	0·20	GMO378A	1·75	*ZTX109	0·12	*2N4286	0·20	74196	1·20
*BC328	0·18	*KS100A	0·45	*ZTX300	0·12	*2N4288	0·22	74197	1·10
*BC337	0·18	MJE340	0·80	*ZTX301	0·13	*2N4289	0·24	74198	2·25
*BC338	0·17	MJE370	1·17	*ZTX302	0·15	*2N5457	0·35	74199	2·25
BCY30	1·00	MJE371	0·61	*ZTX303	0·17	*2N5458	0·35	*76013N	1·75
BCY31	1·00	MJE520	0·52	*ZTX304	0·19	*2N5459	0·35		
BCY32	1·00	MJE521	0·55	*ZTX311	0·12				
BCY33	0·90	MJE2955	1·25	*ZTX314	0·20	**INTEGRATED CIRCUITS**			
BCY34	0·90	MJE3055	0·75	*ZTX500	0·13				
BCY39	3·00	*MPF102	0·30	*ZTX501	0·14	7400	0·16		
BCY40	1·00	*MPF103	0·30	*ZTX502	0·16	7401	0·16		
BCY42	0·25	*MPF104	0·30	*ZTX503	0·17	7402	0·16		
BCY43	0·25	*MPF105	0·30	*ZTX504	0·20	7403	0·16		
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	7400 Series			74LS00 Series		
	1+	25+	100+	1+	25+	100+
7400	.08	.075	.07	.155	.14	.13
7401	.11	.105	.10	.155	.14	.13
7402	.11	.105	.10	.155	.14	.13
7403	.11	.105	.10	.155	.14	.13
7404	.11	.105	.10	.16	.15	.135
7405	.12	.115	.11	.16	.15	.135
7406	.22	.21	.20			
7407	.22	.21	.20			
7408	.13	.125	.12	.155	.14	.13
7409	.13	.125	.12	.16	.15	.135
7410	.11	.105	.10	.155	.14	.13
7411	.17	.16	.15	.16	.15	.135
7412	.14	.135	.13	.16	.15	.135
7413	.23	.21	.20	.28	.26	.24
7414	.46	.43	.40	.65	.57	.50
7415				.16	.15	.135
7416	.22	.20	.18			
7417	.22	.20	.18			
7420	.11	.105	.10	.155	.14	.13
7421	.22	.21	.20	.16	.15	.135
7422	.17	.165	.16	.16	.15	.135
7423	.20	.19	.18			
7425	.20	.19	.18			
7426	.21	.20	.19	.16	.15	.135
7427	.21	.20	.19	.16	.15	.135
7428				.18	.17	.16
7430	.11	.105	.10	.155	.14	.13
7432	.21	.20	.19	.23	.20	.18
7433	.30	.27	.26			
7437	.20	.19	.18	.24	.21	.185
7438	.20	.19	.18	.24	.21	.185
7440	.12	.115	.11	.18	.16	.15
7441	.48	.45	.43			
7442	.40	.36	.34	.50	.44	.40
7443	.65	.60	.57			
7444	.64	.59	.56			
7445	.53	.50	.48			
7446	.55	.52	.50			
7447	.50	.44	.40	.67	.60	.56
7448	.55	.50	.48	.82	.73	.65
7449				.67	.60	.56
7450	.12	.115	.11			
7451	.12	.115	.11	.16	.15	.135
7453	.12	.115	.11			
7454	.12	.115	.11	.155	.14	.13
7455				.16	.15	.135
7460	.12	.115	.11			
7470	.25	.23	.21			
7472	.22	.20	.18			
7473	.23	.21	.20	.26	.23	.21
7474	.23	.21	.20	.26	.23	.21
7475	.30	.28	.26	.40	.35	.32
7476	.26	.24	.23	.26	.23	.21
7478				.28	.25	.23
7480	.40	.36	.34			
7483	.52	.48	.46	.59	.55	.52
7484	.84	.80	.77			

	7400 Series			74LS00 Series		
	1+	25+	100+	1+	25+	100+
7485	.62	.58	.55	.67	.60	.56
7486	.22	.20	.19	.28	.25	.23
7489	1.35	1.25	1.18			
7490	.30	.28	.26	.42	.38	.36
7491	.60	.55	.52			
7492	.33	.30	.28			
7493	.28	.25	.23	.43	.40	.38
7494	.50	.45	.43			
7495	.50	.45	.42	.64	.58	.55
7496	.48	.42	.38			
7497	1.80	1.70	1.65			
74100	.80	.72	.68			
74104	.40	.36	.34			
74105	.37	.34	.32			
74107	.22	.20	.18	.32	.28	.28
74109	.28	.26	.24	.32	.28	.25
74110	.36	.34	.32			
74111	.55	.52	.50			
74112				.32	.28	.25
74113	.28	.26	.24	.32	.28	.25
74114				.32	.28	.25
74116	1.10	1.00	.95			
74118	.78	.75	.72			
74119	1.10	1.00	.95			
74120	.80	.76	.74			
74121	.24	.22	.20			
74122	.32	.29	.27			
74123	.38	.35	.32	.55	.50	.48
74124	1.60	1.50	1.42	1.15	1.05	.98
74125	.32	.30	.28	.38	.33	.29
74126	.32	.30	.28	.38	.33	.29
74128	.60	.55	.52			
74130	.40	.36	.32			
74132	.47	.44	.42	.62	.56	.48
74134	.32	.30	.28			
74135	.62	.58	.55			
74136	.52	.48	.46	.38	.33	.29
74137	.74	.68	.66			
74138				.52	.45	.41
74139				.52	.45	.41
74141	.52	.48	.46			
74142	1.85	1.75	1.68			
74143	2.30	2.10	2.00			
74144	2.30	2.10	2.00			
74145	.55	.50	.48			
74147	1.00	.92	.88			
74148	.84	.78	.75			
74150	.60	.55	.50			
74151	.46	.41	.38	.50	.44	.40
74153	.46	.41	.38	.48	.42	.36
74154	.78	.68	.60	1.00	.90	.82
74155	.50	.46	.44	.75	.67	.60
74156	.50	.46	.44	.75	.67	.60
74157	.45	.40	.38	.44	.40	.38
74158	.55	.52	.48	.50	.44	.40
74159	1.95	1.80	1.70			
74160	.57	.52	.48	.90	.84	.75

	7400 Series			74LS00 Series		
	1+	25+	100+	1+	25+	100+
74161	.50	.44	.40	.60	.53	.48
74162	.57	.52	.48	1.10	1.00	.92
74163	.57	.52	.48	.60	.53	.48
74164	.57	.52	.48	.82	.75	.70
74165	.57	.52	.48			
74166	.70	.64	.59			
74167	2.20	2.05	1.95			
74168				1.60	1.40	1.25
74169				1.60	1.40	1.25
74170	1.20	1.10	1.00	1.50	1.28	1.12
74172	3.80	3.55	3.40			
74173	.90	.84	.80	.85	.80	.76
74174	.64	.60	.56	.58	.52	.49
74175	.58	.54	.51	.58	.52	.49
74176	.58	.54	.51			
74177	.56	.52	.49			
74178	.90	.80	.75			
74179	1.08	1.00	.95			
74180	.80	.70	.62			
74181	1.15	.95	.80			
74182	.52	.47	.44			
74184	1.25	1.08	1.00			
74185A	1.00	.90	.86			
74186	7.20	6.90	6.70			
74188	2.60	2.40	2.25			
74189				1.98	1.75	1.60
74190	.68	.60	.55	.72	.65	.58
74191	.68	.60	.55	.70	.63	.56
74192	.62	.55	.48	.68	.62	.58
74193	.60	.50	.46	.68	.62	.58
74194	.58	.50	.46			
74195	.58	.50	.46	1.00	.92	.85
74196	.56	.50	.45	.78	.71	.65
74197	.50	.44	.40	.92	.83	.78
74198	.96	.85	.78			
74199	.98	.90	.85			
74221	1.20	1.00	.88	.94	.85	.80
74247				.90	.82	.75
74248				.90	.82	.75
74249				.90	.82	.75
74251	1.00	.82	.74	.58	.52	.48
74257				.68	.50	.56
74258				.68	.56	.50
74266				.33	.28	.25
74273	1.90	1.70	1.55	2.00	1.85	1.50
74279	1.10	.90	.82	.46	.40	.34
74283	1.50	1.30	1.20	.58	.53	.50
74284	3.50	3.20	3.00			
74289				3.75	3.45	3.28
74290				.52	.48	.45
74293	1.20	1.00	.80	.80	.72	.65
74298	1.80	1.55	1.40	.90	.82	.75
74352				.84	.75	.70

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	CMOS		
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4000	.13	.11	.10
4001	.13	.12	.11
4002	.13	.12	.11
4006	.70	.62	.58
4007	.13	.12	.11
4008	.58	.52	.48
4009	.32	.29	.27
4010	.36	.32	.30
4011	.13	.12	.11
4012	.13	.12	.11
4013	.30	.25	.22
4014	.68	.62	.56
4015	.60	.55	.52
4016	.32	.28	.26
4017	.50	.46	.44
4018	.55	.50	.47
4019	.40	.35	.32
4020	.68	.64	.60
4021	.66	.62	.58
4022	.60	.55	.52
4023	.13	.12	.11
4024	.42	.39	.36
4025	.13	.12	.11
4026	.90	.84	.78
4027	.30	.27	.25
4028	.46	.42	.40
4029	.52	.47	.44
4030	.32	.28	.26
4031	1.80	1.60	1.48
4032	.86	.80	.77
4033	1.05	.98	.92
4034	1.60	1.40	1.25
4035	.98	.90	.86
4036	2.50	2.35	2.25
4037	.82	.76	.72
4038	.84	.78	.74
4039	2.30	2.18	2.10
4040	.62	.57	.54
4041	.70	.64	.58
4042	.50	.45	.42
4043	.56	.51	.48
4044	.62	.58	.55
4045	1.05	.95	.88
4046	.90	.85	.80
4047	.84	.79	.75
4048	.42	.38	.36
4049	.28	.26	.24
4050	.28	.26	.24
4051	.54	.49	.46
4052	.54	.49	.46
4053	.58	.52	.48
4054	.92	.87	.84
4055	.92	.87	.84
4060	.92	.87	.84
4066	.36	.32	.30
4067	2.45	2.20	2.05
4068	.18	.16	.14

	CMOS		
	1+	25+	100+
4069	.14	.13	.12
4070	.14	.13	.12
4071	.14	.13	.12
4072	.14	.13	.12
4073	.14	.13	.12
4075	.14	.13	.12
4076	.82	.78	.75
4077	.38	.35	.32
4078	.14	.13	.12
4081	.14	.13	.12
4082	.14	.13	.12
4085	.58	.54	.52
4086	.58	.54	.52
4089	1.20	1.08	1.00
4093	.45	.40	.38
4094	1.38	1.25	1.15
4095	.85	.80	.77
4096	.85	.80	.77
4097	3.00	2.80	2.67
4098	.90	.84	.78
4099	1.10	.95	.88
4160	.88	.83	.80
4161	.88	.83	.80
4162	.88	.83	.80
4163	.88	.83	.80
4164	.88	.83	.80
4174	.98	.92	.87
4175	.98	.92	.87
4194	.98	.92	.87
4501	.14	.13	.12
4502	.72	.66	.63
4503	.52	.46	.43
4506	.42	.36	.34
4507	.42	.36	.34
4508	1.90	1.68	1.50
4510	.60	.54	.50
4511	.65	.58	.55
4512	.62	.56	.53
4513	1.42	1.30	1.20
4514	2.35	2.20	2.08
4515	2.35	2.20	2.08
4516	.66	.60	.56
4517	3.40	3.15	3.00
4518	.65	.58	.55
4519	.38	.36	.34
4520	.62	.56	.53
4521	1.40	1.25	1.10
4522	.80	.70	.63
4526	.80	.70	.63
4527	1.15	1.00	.90
4528	.85	.76	.70
4529	.98	.84	.75
4530	.82	.78	.74
4531	.74	.66	.60
4532	.95	.86	.80
4534	4.00	3.50	3.25
4536	2.75	2.35	2.15

	CMOS		
	1+	25+	100+
4538	1.00	.90	.82
4539	.72	.60	.54
4541	.90	.81	.70
4543	1.10	.97	.88
4549	3.00	2.50	2.25
4553	3.20	2.80	2.40
4554	.90	.78	.68
4555	.75	.62	.56
4556	.75	.62	.56
4557	3.20	2.80	2.40
4558	.90	.80	.72
4559	3.00	2.50	2.20
4560	1.45	1.20	1.05
4561	.62	.55	.50
4562	4.20	3.60	3.25
4566	.98	.86	.80
4568	1.70	1.50	1.38
4569	1.37	1.15	1.05
4580	4.20	3.65	3.40
4581	1.98	1.67	1.40
4582	.82	.74	.68
4583	.70	.60	.52
4584	.30	.27	.25
4585	.88	.78	.70
4599	1.98	1.70	1.50

LOW PROFILE DIL I.C. SOCKETS

8 pin	.10	.09	.08
14 pin	.115	.11	.105
16 pin	.125	.12	.115
18 pin	.18	.16	.15
20 pin	.20	.18	.17
22 pin	.22	.20	.19
24 pin	.24	.22	.21
28 pin	.28	.25	.23
40 pin	.40	.37	.35

LEDS

.125" 3mm

Red	.08	.07	.06
Yellow	.12	.115	.11
Green	.12	.115	.11

.2" 5mm

Red	.09	.08	.07
Yellow	.13	.125	.12
Green	.13	.125	.12

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FND107 Red 7 segment display .25" .90
TIL111 Opto isolator .75

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4 off less 10%
8 off less 20%

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*100 741-8	.16
*100 555-8	.19
*100 MC1458P	.24
*100 AD161/162 MP	50
*100 BC184	06
*100 BC214	062
*100 2N3055	.35
1000 .125" Red LED	05
1000 .2" Red LED	06
1000 IN4001	025
1000 IN4002	028
1000 IN4005	038
1000 IN4007	042
1000 IN4148	013
*1000 LESS 10%	

LINEARS

CA3045-14	30
CA3046-14	40
LM380N-14	68
LM381N-14	90
LM710N-14	26
LM711N-14	26
MC1310P-14	1.30
NE555-8	23
NE556-14	50
NE25018-14	1.25
SN75110N	40
SN76003N	1.65
SN76013N	1.25
SN76023N	1.25
SN78033N	1.65
TAA550B	30
TAA661B	1.00
TBA120S	58
TBA641A	1.60
TBA800	80
TBA810S	80
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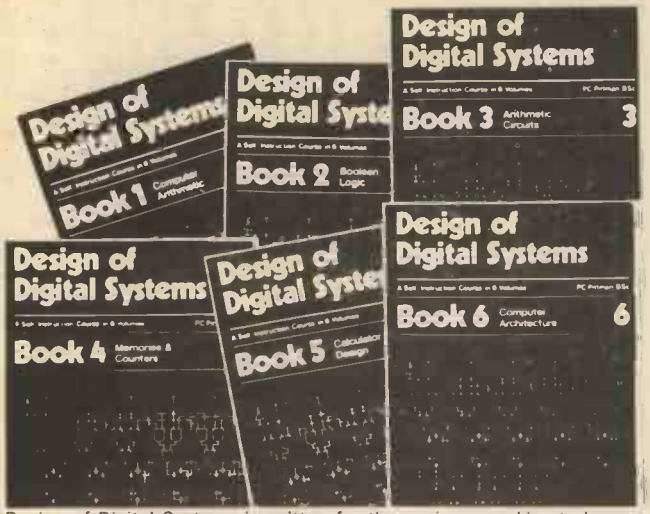

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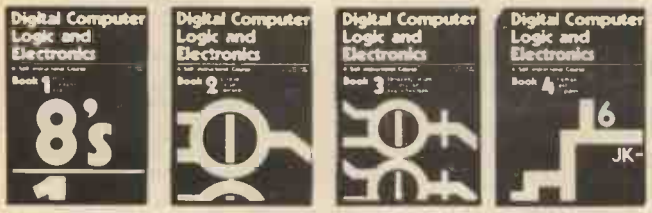

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4076	107p
4081	22p
4082	22p
4093	80p
4094	250p
4098	107p
4411	1100p
4502	120p
4503	70p
4507	55p
4510	99p
4511	150p
4514	250p
4516	110p
4518	100p
4520	100p
4528	100p
4543	180p
4553	450p
4560	250p
4583	90p
4584	90p
40014	90p
40085	200p
40097	90p
14411	1100p
14412	1100p
14433	1100p

INTERFACE ICs

MC1488	100p
MC1489	100p
75107	160p
74182	230p
75324	375p
74325	375p
75451	72p
75491/2	96p
8T26	250p
8T28	300p
8T95	160p
8T97	160p
81LS95	120p
81LS96	140p
81LS97	120p
81LS98	140p
9601	110p
9602	220p
9603	160p

93 SERIES

9301	160p
9302	175p
9308	316p
9310	275p
8311	275p
9312	160p
9314	165p
9316	225p
9321	225p
9322	150p
9334	225p
9368	200p
9370	200p
9374	200p

BUCKET BRIGADE*

SAD1024	1800p

LINEAR I.Cs

*AY1-0212	600p
*AY1-1313	668p
*AY1-1320	320p
*AY1-5050	211p
*AY5-1315	600p
*AY5-1317	636p
*CA3019	80p
*CA3046	70p
*CA3048	225p
CA3080E	72p
*CA3089E	225p
*CA3090AQ	375p
CA3130S	100p
CA3140E	70p
CA3160E	100p
FX209	750p
ICL7106	850p
ICL8038	340p
LM301A	30p
LM311	120p
LM318	200p
LM324	70p
LM339	75p
LM348	95p
*LM377	175p
*LM380	75p
*LM381AN	160p
*LM389N	140p
LM709	36p
LM710	50p
LM725	350p
LM733	100p
LM741	20p
LM747	70p
LM748	35p
LM3900	70p
LM3911	130p
LM4136	120p
*MC1310P	150p
MC1458	55p
MC1495L	350p
*MC1496	100p
*MC3340P	120p
*MC3360P	120p

VEROBOARD

0.1 0.15 (copper clad)

2½ x 3½	41p	33p
2½ x 5	49p	45p
3½ x 3½	49p	45p
3½ x 5	56p	60p
2½ x 17	152p	121p
3½ x 17	195p	163p
4½ x 17	252p	—

Pkt of 35 pins 30p
Spot face cutter 85p
Pin insertion tool 99p

VERO WIRING PEN

Plus spool 325p
Spare spool (wire) 80p
Combes 7p each

*MFC4000B	120p
MK50398	750p
NE531	110p
*NE540L	200p
NE543K	225p
NE555	25p
NE556	70p
NE561B	425p
NE562B	425p
NE565	130p
NE566	155p
NE567	175p
NE571	425p
RC4151	400p
SFF96364	1150p
*SN76003N	175p
*SN76013N	140p
*SN76013ND	120p
*SN76023N	140p
*SN76023ND	120p
*SN76033N	175p
SN76477	250p
*SP8515	750p
*TAA621	275p
*TBA641B11	225p
*TBA651	200p
*TBA800	90p
*TBA810	100p
*TBA820	90p
*TCA940	175p
*TDA1004	300p
*TDA1022	600p
*TDA2020	320p
TL084	130p
TL170	50p
XR2206	400p
XR2207	400p
XR2211	600p
*XR2216	675p
XR2240	400p
*ZN414	90p
ZN424E	135p
ZN425E	400p
ZN1034E	200p
95H90	800p

VOLTAGE REGULATORS

Fixed Plastic TO-220

	+ve		−ve	
1A				
5V	7805	90p	7905	100p
12V	7812	90p	7912	100p
15V	7815	90p	7915	100p
18V	7818	90p	7918	100p
24V	7824	90p	7924	100p
100mA	TO-92			
5V	78L05	35p	79L05	80p
12V	78L12	35p	79L12	80p
15V	78L15	35p	79L15	80p

OTHER REGULATORS

LM309K	135p	TBA6258	120p
LM317T	200p	TL430	65p
LM323K	625p	78H05KC	675p
LM723	37p	78MGT2C	135p

OPTO-ELECTRONICS

2N5777	45p	OCP71	130p
ORP12	90p	ORP60	90p
ORP61	90p	TIL78	70p

LEDS

0.125"		0.2"	
TIL32 I.R.	75p	TIL220 Red	16p
TIL209 Red	13p	TIL222 Gr	18p
TIL211 Gr	20p	TIL228 Red	22p
TIL212 Ye	25p	MV5491 TS	120p
TIL216 Red	18p	Clips	3p

DISPLAYS

3015F	200p	FND500	120p
DL704	140p	FND507	120p
DL707 Red	140p	MAN3640	175p
707 Gr	140p	TIL311	600p
DL747 Red	225p	TIL312/3	110p
747 Gr	225p	TIL321/2	130p
FND357	120p	TIL330	140p

DRIVERS

9368	200p
9370	200p

TRANSISTORS

AC126	25p
AC127/8	20p
AC176	25p
AC187/8	25p
AF116/7	30p
AD149	70p
AD161/2	45p
BC107/8	11p
BC109	11p
*BC117	20p
*BC147/8	9p
*BC149	10p
*BC157/8	10p
*BC159	11p
*BC169C	12p
*BC172	12p
BC177/8	17p
BC179	18p
*BC182/3	10p
*BC184	11p
BC187	30p
*BC212/3	11p
*BC214	12p
BC461	36p
BC477/8	30p
*BC516/7	50p
*BC547B	16p
*BC549C	18p
*BC557B	16p
*BC559C	18p
BCY70	18p
BCY71/2	22p
BD131/2	50p
BD135/6	54p
BD139	56p
BD140	60p
BD189	60p
BD242	70p
BDY56	200p
BF200	32p
*BF244B	35p
*BF256B	70p
BF257/8	32p
BF259	36p
*BFR39	30p
*BFR40	30p
*BFR41	30p
*BFR79	30p
*BFR80	30p
*BFR81	30p
BFX29	30p
BFX30	34p
BFX84/5	30p
BFX86/7	30p
BFX88	30p
BFW10	90p
BFY50	22p
BFY51/2	22p
BFY56	33p
BFY90	90p
BLY83	700p
BRY39	45p
BSX19/20	20p
BU104	225p
*BU105	190p
*BU108	250p
BU109	225p
*BU205	200p
*BU208	200p
*BU406	145p
BJ481	175p
MJ491	200p
MJ2501	225p
MJ2955	100p
MJ3001	225p
*MJE340	65p
MJE2955	100p
MJE3055	70p
*MPF102	45p
*MPF103/4	40p
*MPF105/6	30p
MPSA06	30p
*MPSA12	50p
*MPSA56	32p
*MPSU06	63p
MPSU65	78p
OC28	130p
OC35	130p
*R2008B	200p
*R20108	200p
*TIP29A	40p
*TIP29C	55p
*TIP30A	48p
*TIP30C	60p
*TIP31A	58p
TIP31C	62p
TIP32A	68p
TIP32C	82p
TIP33A	90p
TIP33C	114p
TIP34A	115p
TIP34C	160p
TIP35A	225p
TIP35C	290p
TIP36A	270p
TIP36C	340p
TIP41A	65p
TIP41C	78p
TIP42A	70p
TIP42C	82p
TIP2955	78p
TIP4055	70p
*TIS43	34p
*TIS93	30p
*ZTX108	12p
*ZTX300	13p
ZTX500	15p
*ZTX502	18p
*ZTX504	30p
2N457A	250p
2N696	35p
2N697	25p
2N698	45p
2N706A	20p
2N708A	20p
2N918	45p
2N940	18p
2N1131/2	20p
2N1613	25p
N1711	25p
2N2102	60p
2N2160	300p
2N2219A	22p
2N2222A	22p
2N2369A	18p
2N2484	30p
2N2646	50p
2N2904/5	25p
2N2906A	24p
2N2907A	30p
*2N2926	9p
2N3053	20p
2N3054	65p
2N3055	48p
2N3442	140p
2N3553	240p
*2N3565	30p
*2N3643/4	48p
*2N3663	20p
*2N3702/3	12p
*2N3704/5	12p
*2N3706/7	14p
*2N3708/9	12p
*2N3773	300p
*2N3819	25p
*2N3820	50p
2N3823	70p
2N3866	90p
*2N3903/4	18p
*2N3905/6	20p
2N4037	65p
*2N4058/9	12p
*2N4060	12p
*2N4061/2	18p
*2N4123/4	22p
*2N4125/6	22p
*2N4289	20p
*2N4401/3	27p
2N4427	90p
*2N4871	60p
*2N5087	27p
*2N5089	27p
*2N5172	27p
2N5179	90p
2N5191	83p
2N5194	90p
*2N5245	40p
*2N5296	55p
*2N5401	50p
*2N5457/8	40p
*2N5459	40p
*2N5460	40p
*2N5485	44p
*2N6027	48p
2N6247	190p
2N6254	130p
2N6290	65p
2N6292	65p
3N128	120p
3N140	100p
3N141	110p
3N201	110p
3N204	100p
40290	250p
40360	40p
40361/2	45p
40364	120p
40408	70p
40409	85p
40410	85p
40411	300p
40594	97p
40595	105p
40673	75p
40841	90p
40871/2	90p

DIODES

*BY127	12p
*OA47	9p
*OA81	15p
*OA85	15p
*OA90	9p
*OA91	9p
*OA95	9p
*OA200	9p
*OA202	10p
*1N914	4p
*1N916	7p
*1N4148	4p
1N4001/2	5p
1N4003/4	6p
1N4005	6p
1N4006/7	7p
1N5401/3	14p
1N5404/7	19p
*15920	9p

HEAT SINKS

For TO220 Voltage Regs. and Transistors 22p
For TO5 12p

BRIDGE RECTIFIERS

*1A 50V	21p
*1A 100V	22p
*1A 400V	30p
*1A 600V	35p
*2A 50V	30p
*2A 100V	35p
*2A 400V	45p
*3A 200V	60p
*3A 600V	72p
*4A 100V	95p
*4A 400V	100p
6A 50V	90p
6A 100V	100p
6A 400V	120p
10A 400V	200p
25A 400V	400p

***ZENEERS**

2.7V-33V
400mW 9p
1W 15p

TRIACS PLASTIC

3A 400V	60p
3A 500V	65p
6A 400V	70p
6A 500V	88p
8A 400V	75p
8A 500V	95p
12A 400V	85p
12A 500V	105p
16A 400V	110p
16A 500V	130p
T2800D	130p

THYRISTORS

1A 50V	40p
1A 400V	65p
1A 600V	70p
3A 400V	90p
8A 600V	140p
12A 400V	160p
16A 100V	160p
16A 400V	180p
16A 600V	220p
8T106	110p
C106D	45p
*MCR101	38p
2N5525	120p
2N4444	140p
*2N5060	34p
*2N5064	40p

LOUDSPEAKERS

Size		
2½"	64R	70p
2½"	8R	70p
2"	8R	75p
1½"	8R	75p

MEMORIES

2102	100p
2102-2	120p
2102L-4	140p
2107B	600p
2111-1	225p
2112-2	300p
2114	1000p
5101	510p
6810	350p

ROM/PROMs

74S188	225p
74S287	400p
74S387	400p
93427	400p
93436	650p
93446	650p
93448	1000p

CPUs

4040a	670p
6502	1200p
6800	900p
6801	TBA
8080A	550p

EPROMS

1702A	600p
2708	900p
2716	2500p
4702	900p

TRANSFORMERS

(prim 220-240V)

6-0-6	100mA	88p
9-0-9	75mA	92p
12-0-12	100mA	95p
0-12 0-12	500mA	280p+
0-25V (5VA)		250p
9-0-9		1A 270p*
12V		2A 350p*
0-12-15		
20-24-30		1A 340p*
15-0-15		1A 265p*

(Please add 50p p&p charge to all marked * above our normal p&p charge)

DATA BOOKS

TTLs, CMOs, Linears, Memories, etc, by Mfrs stocked.

Please send S.A.E. for details.

UART

AY-3-1015P	500p
AY-5-1013	400p
TMS6011NC	400p

CHARACTER GENERATOR

3257ADC	990p
MCM6576	750p
RO-3-2513 U.C.	600p
RO-3-2513 L.C.	550p
SN74S262AN	1360p

OTHER

3245	400p
4201	390p
4289	970p
4801	500p
6820	600p
6850	700p
8205	320p
8212	225p
8216	225p
8224	400p
8228	525p
8251	700p
8253	1200p
8255	550p
8257	1100p
8259	1400p
AY5-2376	1000p
MC14411	1100p

SUBMINIATURE SWITCHES

Toggle

SPST	51p
SPDT	53p
DPDT	55p
DPDT (Centre-off)	85p

Push to make (Red, Green, Yel., Blue) 15p
Push to break (Black only) 25p

CRYSTALS

100KHz	300p
1MHz	370p
3.276BMHz	350p
10.7MHz	350p
18MHz	300p
27.135MHz	300p

EDGEBOARD CONNECTORS

0.156" Solder Tail

2 x 10 way	85p
2 x 15 way	100p
2 x 18 way	120p
2 x 22 way	135p
2 x 25 way	160p

LOW PROFILE DIL SOCKETS BY TEXAS

8 pin	11p	18 pin	25p	24 pin	33p
14 pin	12p	20 pin	28p	28 pin	42p
16 pin	13p	22 pin	30p	40 pin	51p

WIRE WRAP SOCKETS

8 pin	30p	24 pin	80p		
14 pin	40p	28 pin	100p		
16 pin	55p	40 pin	120p		

EDGE CONNECTOR

31 Way Plug	105p
31 Way Skt.	110p
(0.1" Pitch)	

"PE" MICROPRINTER
SEND S.A.E. FOR DETAILS

***RESISTORS** High Stab Carbon Film 5% Tol E12 Series
¼W 10R-1M **1p 90p**/100 each valve
½W 10R-10M **1.5p 120p**/100 each valve

***MINIATURE PRESETS,** Horz/Vert
100R-1M **10p**

***CARBON TRACK POTENTIOMETERS**
¼W LOG or LIN
Single 5K-2M **26p**
Single with DP Switch 5K-2M **55p**
Dual 5K-2M **66p**

CAPACITORS
Low Voltage Electrolytic, Polyester, Tantalum
Disc Ceramic available

VEROBOARDS
IC BREADBOARD
(20 x 14 pin DIL ICs or 16 x 16 pin DIL ICs) 4.15" x 6.15" 270p

VQ BOARD
Specially designed for DIL ICs – No track cutting 5.82" x 2.9" 105p

ANTEX SOLDERING IRONS

Model C 15W	360p
CX 17W	360p
X25	360p
CCN	380p

Spare Bits

C/CX/CCN	46p
X25	50p

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A low-cost memory-mapped system designed to interface with all microcomputer systems.

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15-240 WATTS!

HY5
Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc.) are catered for internally, the desired function is achieved either by a multi-way switch or direct connection to the appropiate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: complete pre-amplifier in single pack, multi-function equalisation; low noise; low distortion; high overload, two simply combined for stereo.
APPLICATIONS: hi-fi; mixers; disco; guitar and organ; public address.
SPECIFICATION: Inputs-magnetic pick-up 3mV; ceramic pick-up 30mV; tuner 100mV; microphone 10mV; auxillary 3-100mV; input impedance 47kΩ at 1kHz. Outputs—tape 100mV; main output 500mV R.M.S. Active Tone Controls—treble ±12dB at 10kHz, bass ±12dB at 100Hz. Distortion—0·1% at 1kHz, signal/noise ratio 68dB. Overload—38dB on magnetic pick-up. Supply Voltage—±16-50V.

Price £6·27 + 78p VAT. P. & P. free
HY5 mounting board B.1. 48p + 6p VAT. P. & P. free

HY30
15W into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of: I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up to date technology available.

FEATURES: complete kit; low distortion; short, open and thermal protection; easy to build.
APPLICATIONS: updating audio equipment; guitar practice amplifier, test amplifier, audio oscillator.
SPECIFICATION: Output Power—15W R.M.S. into 8Ω. Distortion—0·1% at 15W. Input Sensitivity—500mV. Frequency Response—10Hz-16kHz −3dB.

Price £6·27 + 78p VAT. P. & P. free

HY50
25W into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: low distortion; integral heatsink, only five connections; 7 amp output transistors, no external components.
APPLICATIONS: medium power hi-fi systems, low power disco, guitar amplifier.
SPECIFICATION: Input Sensitivity—500mV. Output Power—25W R.M.S. into 8Ω. Load Impedance—4-16Ω. Distortion—0·04% at 25W at 1kHz. Signal/Noise Ratio—75dB. Frequency Response—10Hz-45kHz −3dB. Supply Voltage—±25V. Size—105 × 50 × 25mm.

Price £8·18 + £1·02 VAT. P. & P. free

HY120
60W into 8Ω

The HY120 is the baby of I.L.P.'s new high power range, designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: very low distortion, integral heatsink, load line protection, thermal protection, five connections, no external components.
APPLICATIONS: hi-fi; high quality disco, public address, monitor amplifier, guitar and organ.
SPECIFICATION: Input Sensitivity—500mV. Output Power—60W R.M.S. into 8Ω. Load Impedance—4-16Ω. Distortion—0·04% at 60W at 1kHz. Signal/Noise Ratio—90dB. Frequency Response—10Hz-45kHz −3dB. Supply Voltage—±35V. Size—114 × 50 × 85mm.

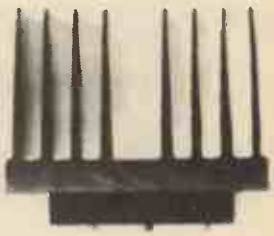
Price £19·01 + £1·52 VAT. P. & P. free

HY200
120W into 8Ω

The HY200 (now improved to give an output of 120 watts) has been designed to stand the most rugged conditions such as disco or group while still retaining true hi-fi performance.

FEATURES: thermal shutdown, very low distortion; load line protection; integral heatsink; no external components.
APPLICATIONS: hi-fi; disco, monitor, power slave, industrial, public address.
SPECIFICATION: Input Sensitivity—500mV. Output Power—120W R.M.S. into 8Ω. Load Impedance—4-16Ω. Distortion—0·05% at 100W at 1kHz. Signal Noise Ratio—96dB. Frequency Response—10Hz-45kHz −3dB. Supply Voltage—±45V. Size—114 × 50 × 85mm.

Price £27·99 + £2·24 VAT. P. & P. free

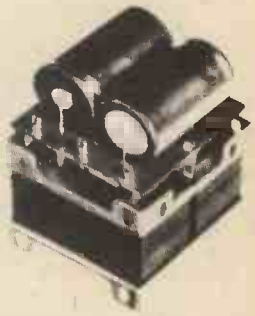


HY400
240W into 4Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco or public address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: thermal shutdown; very low distortion; load line protection; no external components.
APPLICATIONS: public address, disco, power slave; industrial
SPECIFICATION: Output Power—240W R.M.S. into 4Ω. Load Impedance—4-16Ω. Distortion—0·1% at 240W at 1kHz. Signal/Noise Ratio—94dB. Frequency Response—10Hz-45kHz −3dB. Supply Voltage—±45V. Input Sensitivity—500mV. Size—114 × 100 × 85mm.

Price £38·61 + £3·09 VAT. P. & P. free



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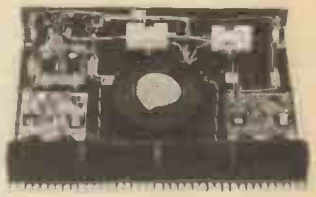

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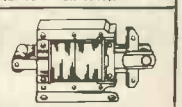

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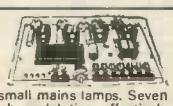

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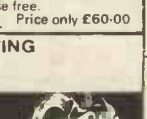

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