

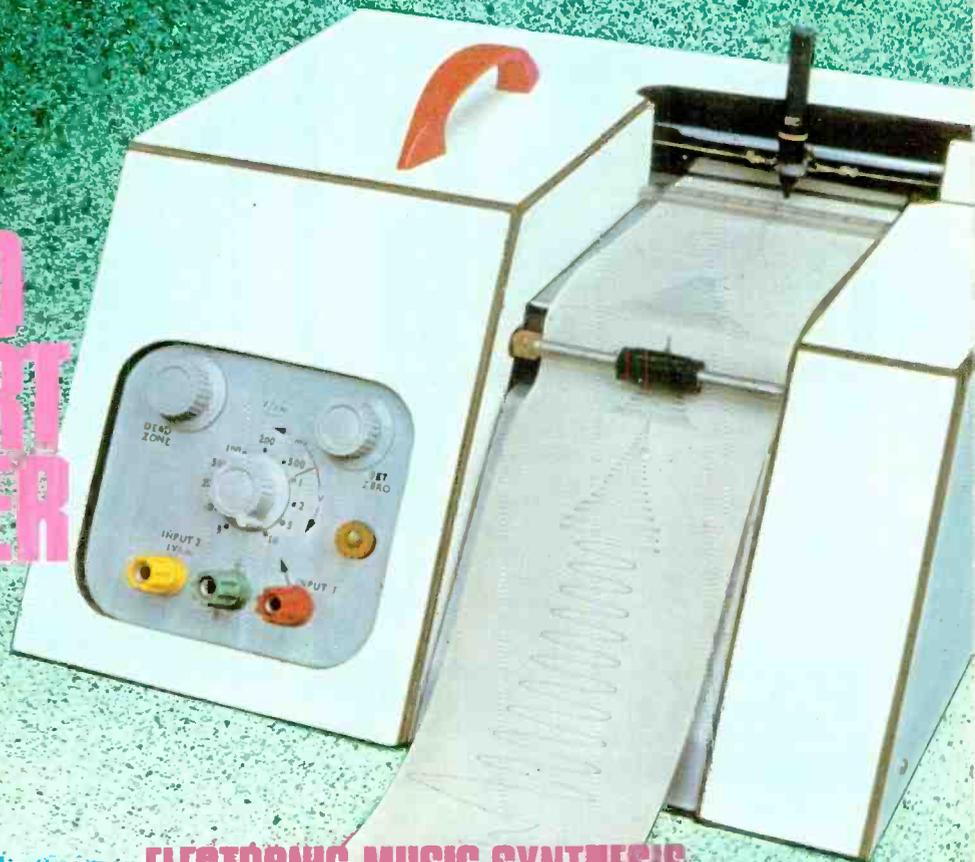
PRACTICAL

ELECTRONICS

OCTOBER 1971

20p

SERVO CHART RECORDER



Special Feature: ELECTRONIC MUSIC SYNTHESIS

ADCOLA Soldering Instruments add to your efficiency

THE NEW 'INVADER'

ADCOLA L.646

for Factory Bench Line Assembly

A precision instrument—supplied with standard 3/16" (4.75 mm) diameter, detachable copper chisel-face bit*.

Standard temp. 360°c at 23 watts.

Special temps. from 250°c—410°c.

*Additional Stock Bits

(illustrated) available

COPPER



B 38 — 3.2 mm CHISEL FACE



B 14 — 2.4 mm CHISEL FACE



B 24 — 4.75 mm SCREWDRIVER FACE

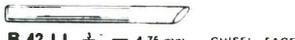


B 12 — 4.75 mm EYELET BIT



B 58 — 6.34 mm CHISEL FACE

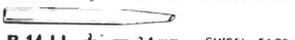
LONG LIFE



B 42 LL — 4.75 mm CHISEL FACE



B 38 LL — 3.2 mm CHISEL FACE



B 14 LL — 2.4 mm CHISEL FACE



B 44 LL — 4.75 mm SCREWDRIVER FACE

PRICE
£1.85



Don't take chances. We don't. All our ADCOLA Soldering Instruments are of impeccable quality. You can depend on ADCOLA day after day. That's why they're so popular. You get consistent good service... reliability... from our famous thermally controlled ADCOLA Element and the tough steel construction of this ideal production tool.

* Write for price list and catalogue

ADCOLA

Regd Trade Mark

ADCOLA PRODUCTS LTD.,

(Dept. L), ADCOLA HOUSE, GAUDEN RD., LONDON, S.W.4.

Telephone: 01-622 0291/3 • Telegrams: Soljoint London Telex • Telex: Adcola London 21851

JERMYN 50p BARGAIN PACKS

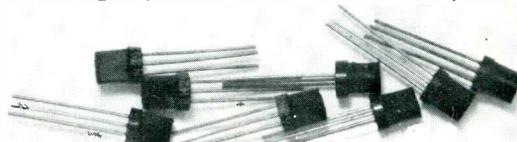
All fully coded, all from well-known manufacturers and now available, while stocks last, at better than bulk-buyer's prices! Cash with order only.

THIS MONTH:

| | | |
|------------------------|--|------------|
| 1N4148 (=1N914) | Signal Diode | 18 for 50p |
| 1N5060 (=A14D) | 1 Amp Rectifier 400V avalanche protected | 7 for 50p |
| 2N2926 (Red) | NPN Silicon Transistor hfe 55 - 110 | 8 for 50p |
| 2N2923 | NPN Silicon Transistor hfe 90 - 180 | 7 for 50p |
| 2N2646 | Versatile Unijunction | 3 for 100p |

Post and packing 10p for 1 or 2 packs; 3 packs or more post free.

Order and quantity, till sold (but we regret packs cannot be subdivided).



P.O. or Cheque payable Jermyn Industries, Vestry Estate, Sevenoaks, Kent.

PRINTED CIRCUIT KIT

BUILD 50 INTERESTING PROJECTS on a PRINTED CIRCUIT CHASSIS with PARTS and TRANSISTORS from your SPARES BOX

CONTENTS: (1) 2 Copper Laminate Boards 4 1/2in x 2 1/2in. (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet *Printed Circuits for Amateurs*. (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit: (10) Essential Design Data, Circuits, Chassis Plans, etc. for 50 TRANSISTORISED PROJECTS. A very comprehensive selection of circuits to suit everyone's requirements and constructional ability. Many recently developed very efficient designs published for the first time, including 10 new circuits.

EXPERIMENTER'S
PRINTED CIRCUIT KIT
50p

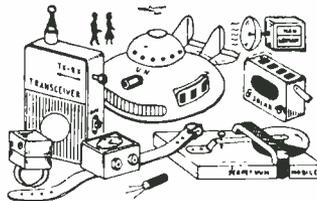
Postage & Pack. 10p (UK)

Commonwealth:

SURFACE MAIL 15p

AIR MAIL 60p

Australia, New Zealand,
South Africa, Canada



(1) Crystal Set with biased Detector. (2) Crystal Set with voltage-quadrupler detector. (3) Crystal Set with Dynamic Loudspeaker. (4) Crystal Tuner with Audio Amplifier. (5) Carrier Power Conversion Receiver. (6) Split-Load Neutralised Double Reflex. (7) Matchbox or Photo-cell Radio. (8) "TRI-FLEXON" Triple Reflex with self-adjusting regeneration (Patent Pending). (9) Solar Battery Loudspeaker Radio. The smallest 3 designs yet offered to the Home Constructor anywhere in the World. (10) 3 Subminiature Radio Receivers based on the "Triflexon" circuit. Let us know if you know of a smaller design published anywhere. (11) Postage Stamp Radio. Size only 1-62in x 0-95in x 0-25in. (12) Wristwatch Radio 1-15in x 0-80in x 0-55in. (13) Ring Radio 0-70in x 0-70in x 0-55in. (14) Bacteria-powered Radio. Runs on sugar or bread. (15) Transistor P/P Amplifier. (16) Intercom. (17) 1-valve Amplifier. (18) Reliable Burglar Alarm. (19) Light-Seeking Animal. (20) "Photophone". (21) Light-Beam Transmitter. (22) Silent TV Sound Adaptor. (23) Human Body Radiation Detector. (24) Man/Woman Discriminator. (25) Signal Injector. (26) Pocket Transceiver (Licence required). (27) Constant Volume intercom. (28) Remote Control of Models by Induction. (29) Inductive-Loop Transmitter. (30) Pocket Triple Reflex Radio. (31) Wristwatch Transmitter/Wire-less Microphone. (32) Rain Alarm. (33) Ultrasonic Switch/Alarm. (34) Stereo Pre-amplifier. (35) Quality Stereo Push-Pull Amplifier. (36) Light-Beam Telephone. (37) "Photophone". (38) Light-Beam Transmitter. (39) Silent TV Sound Adaptor. (40) Ultrasonic Transmitter. (41) Thyristor Drill Speed Controller. Plus 10 Photoelectric Circuits, Simple Alarms, Long Range Alarms, Projector Modulators, etc.

YORK ELECTRICS, Mail Order Dept.

335 BATTERSEA PARK ROAD, LONDON, S.W.11

Send a S.A.E. for full details and a brief description of all kits and Projects.

BUDGET HIGH-FIDELITY STEREO SYSTEMS



PREMIER STEREO SYSTEM "ONE" consists of an all transistor stereo amplifier, Garrard 2025 T/C auto manual record player unit fitted stereo mono ceramic cartridge with diamond stylus and mounted in teak finish plinth with perspex cover and two matching teak finish loud-speaker systems. Absolutely complete and supplied ready to plug in and play. 2500 amplifier has an output of 2 watts per channel with inputs for pick-up, tape and tuner, also tape output socket. Controls: Bass, Treble, Volume, Balance, Selector. Power on/off. Solid teak cabinet with aluminium front panel. Size: 12 1/2 in x 4 1/2 in x 3 1/2 in high. Amplifier available separately if required **£14.95**. Carr. 40p.

ONLY £40-95
carr. £1.75

ONLY £57-75
carr. £1.75

PREMIER STEREO SYSTEM "TWO", as above but with Garrard SP25 Mk III—**ONLY £47**. Carr. **£1.75**.

PREMIER STEREO SYSTEM "THREE". This consists of Klinger KC903 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and ceramic pick-up, tuner, tape in and out, Stereo headphone socket. Garrard SP25 Mk III in teak finish plinth with cover and fitted Sontonec 9TAIHC diamond stereo cartridge. A pair of I.M.F. Speakers size: 16 1/2 in x 10 1/2 in x 9 in and fitted EMI units complete the matching system.

ALL SYSTEMS SUPPLIED WITH FREE LEADS AND PLUGS

PREMIER HI-FI OFFERS!

Rogers Ravensbrook II Stereo Amplifier in teak case (List £52.50) £40

Rogers Ravensbourne Stereo Amplifier in teak case (List £64) **£50**

Metresound ST20 Stereo Amplifier in teak case (List £36) **£27.50**

Garrard SP25 III less cartridge **£11.90**

Garrard SL65 B less cartridge **£15.90**

Garrard 2025 T/C with Sontonec 9TAHC Diamond Cartridge **£8.97**

SPECIAL BARGAIN!
Garrard 2025 T/C with Sontonec 9TAHC Diamond Cartridge ready wired in teak plinth with cover **£14**

Carrriage and Insurance 50p extra any item.

VERITAS V-49 MIXER

Battery operated 4-channel audio mixer providing four separate inputs. Size 6 x 3 x 2 1/2 in suitable for crystal microphone, low impedance microphone with transformer, radio, tape, etc. Max. input 1.5V, max. output 2.5V, gain 6dB. Standard jack plug socket inputs, phono-plugs output. Attractive teak wood grain finish case.



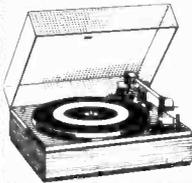
Mono Model **£3** Stereo Model **£3.47** P. & P. 12p



MULTIMETER 20,000 O.P.V. MULTIMETER

Features large easy-to-read meter, wide choice of ranges. With test leads, batteries and manual. Size: 4 1/2 in x 3 1/2 in x 1 in. Ranges: D.C. voltages: 0.5-25-50-250-500-2,500v. A.C. voltages: 0-10-50-100-200-1,000v. D.C. current: 0-50µA-2.5mA-250mA. Resistance: 0-5,000 ohms-0-5 meg ohms (300 ohms and 30 Kohms at centre scale) Capacity: 10 µf to .001µf, .001µf to .01µf. Decibels: -20 to +22dB. **£4.80**. P. & P. 17p.

SP25 Mk III SPECIAL!



Garrard SP25 Mk. III Single Record Player. Fitted Goldring G850 or AT86 Magnetic Stereo Cartridge as available Complete in Teak Plinth with Rigid Perspex Cover.

Total list Price over £29. **PREMIER PRICE £19.90** P. & P. 50p



HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2 1/2 in speaker units with soft padded ear muffs. Adjustable headband. 8 ohm impedance. Complete with 6ft lead and stereo jack plug. **£2.47** P. & P. 25p

STEREO STETHOSCOPE SET Low imp. **£1.25**. P. & P. 10p
MONO STETHOSCOPE SET Low imp. **52p**. P. & P. 10p

E.M.I. 13x8in. HI-FI SPEAKERS



Fitted two 2 1/2 in tweeters and crossover network. Available with 8 or 15 ohm impedance. Handling capacity 10W. Brand new. **£3.47** P. & P. 40p

PREMIER QUALITY MICROPHONES

Precision made, beautifully designed and offering reliability at a reasonable price.



FANON MKO47 MINIATURE DYNAMIC

Frequency response 60-13,000Hz. Impedance 50kΩ (-20dB). Can be used with stand, hand held or around neck. Die cast body satin chrome finish. Features removable windscreen. Complete with 8ft cable, stand adaptor and Lavalier cord. **PREMIER PRICE £5.97**. P. & P. 20p.

FANON MKO45 3-WAY DYNAMIC

Frequency response 60-12,000Hz. High impedance. Complete with 8ft cable, table stand and Lavalier cord. **PREMIER PRICE £2.87**. P. & P. 20p.

FANON MKC54 DYNAMIC

Frequency response 60-12,000Hz. Impedance 50kΩ (-80dB) and 150 ohms (-71dB). On/off switch. Complete with 20ft cable and stand adaptor. **PREMIER PRICE £8.97**. P. & P. 20p.

TAPE CASSETTES

C60 (60 min.) 37p 3 for **£1.05**

C90 (90 min.) 62p 3 for **£1.80**

C120 (120 min.) 87p 3 for **£2.55**

P. & P. 5p



FREE Cassette Head Cleaner with every 10 cassettes purchased
All cassettes can be supplied with library cases at 3p extra each.

"VERITONE" RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED.

TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped—attractively boxed.

| | | | | | | | |
|---------|-------|-----------|-----|---------|-------|-----------|-------|
| LP3 3' | 250' | P.V.C. | 28p | DT6 51' | 1800' | POLYESTER | £1.12 |
| TT3 3' | 450' | POLYESTER | 37p | TT8 51' | 2400' | POLYESTER | £1.87 |
| DT3 31' | 600' | POLYESTER | 57p | SP7 7' | 1200' | P.V.C. | 62p |
| SP5 5' | 600' | P.V.C. | 42p | LP7 7' | 1800' | ACETATE | 75p |
| LP5 5' | 900' | P.V.C. | 50p | DT7 7' | 2400' | POLYESTER | £1.25 |
| DT5 5' | 1200' | POLYESTER | 75p | TT7 7' | 3600' | POLYESTER | £2.50 |

TAPE SPOOLS 3" 5p, 5", 5 1/2", 7" 9p.
Post and Packing 3" 5p, 5", 5 1/2" 8p, 7" 10p. (3 reels and over Post Free.)



PREMIER RADIO

10 & 23, TOTTENHAM COURT ROAD, LONDON, W.1 TEL: 01-636 3451/2639
HEAD OFFICE & MAIL ORDER DEPT. 23, TOTTENHAM CT. RD. TEL: 01-636 3451



JUST BEGINNING?

Then try out **8-Watt, 10-Transistor Stereo Amplifier R.137**

ROC price
£10.50

Separate tone and volume controls for each channel, inputs for turntable (ceramic cartridge), tuner and tape. Attractive black crackle finish with brushed aluminium front. Frequency response: 70-20,000 Hz \pm 3dB. Output: 4 watts per channel ω 8 ohms. Inputs: Phono 80mV; tuner/aux 80mV.

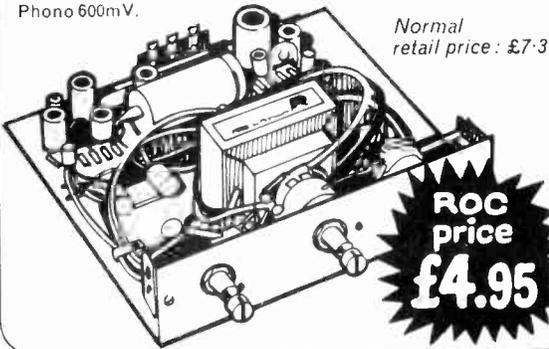
Normal retail price: £14.70

FIRST STEP TO STEREO!

5-Watt Transistor Stereo Amplifier Chassis R.123

Completely self-contained, fully transistorised, mains-powered (240v AC) amplifier, needing only cabinet and knobs. Ideal for adapting mono players to stereo. Frequency response: 40-17,000 Hz \pm 3dB. Output: 2.5 watts per channel ω 8 ohms. Input: Phono 600mV.

Normal retail price: £7.30



ROC price
£4.95

SOUNDS SENSATIONAL

AM/FM/MPX Stereo Tuner Amplifier R.124

A top quality amplifier with facility for receiving stereo broadcasts. Separate bass and treble controls, automatic frequency response, stereo headphone socket, output power: 8 watts. FM frequency range 88-108 MHz; AM frequency range 535-1605 KHz. Inputs for turntable (ceramic cartridge) and tape. Frequency response: 50-10,000 Hz \pm 3dB. Output: 4 watts per channel ω 8 ohms. Inputs: Phono 200mV, tape 100mV. FM: Sensitivity 20 μ V, stereo separation 26dB, image rejection 55dB. AM: Sensitivity 300 μ V.

Normal retail price: £42.00

ROC price: £29.95



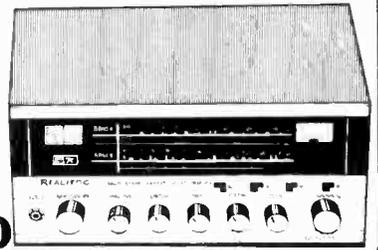
World wide reception

Professional Solid-state, Four-band Communications Receiver R.135

Fully transistorised with continuous coverage from 555K Hz to 30 MHz in four bands (with illuminated bandspread for 160-10 metres). Incorporates internal speaker, automatic noise limiter, SSB/AM/CW switch, AVC switch, S Meter, Receive and Standby switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. Runs off 240 v AC, batteries or any 12 v DC negative ground source. Frequency ranges (in MHz): Band A, 535-1.6; B, 1.55-4.5; C, 4.5-13; D, 13-30. Sensitivity: 0.5 μ V @ 30mHz. Bandspread: 10-160 metres.

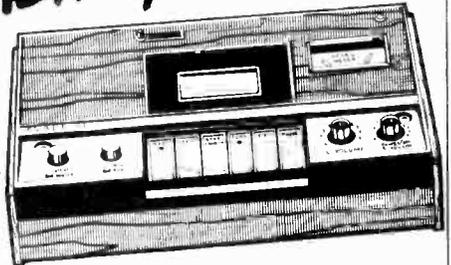
Normal retail price: £65.00

ROC price: £45.00



AMAZING OFFER!

Stereo Cassette Tape Unit R.142



Complete stereo record and playback unit with line and microphone inputs. Fitted with tape counter, separate pause control, recording level metres for each channel, pop-up cassette ejection. Supplied complete with two pencil microphones. Wow & flutter better than 0.3%, frequency response 100-10,000 Hz. Tape speed: 1 1/2 IPS, 4.75 CMS. Rewind time: Better than 60 sec (C.60 cassette).

Normal retail price: £65.00

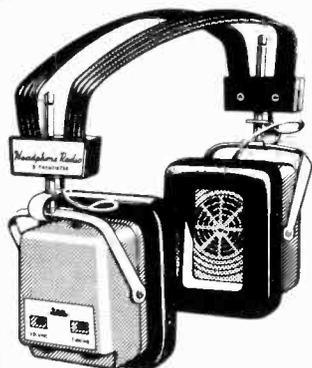
ROC Price
£49.50

We don't want you to

Every piece of electronic or audio equipment we sell is built to our specifications. It comes complete with a Guarantee. And it's tested before it leaves us.

We bend over backwards in our advertising to make sure everything we say is factually accurate. But, buying mail-order, even though you're buying from us, we accept you could still end up with a piece of equipment that's not exactly what you wanted. And we think that's unfair.

FANTASTIC BARGAIN



Headphone Radio R.143

For completely private listening without the distortion of the ordinary earphone adaptor. Battery operated; PP3. Fully transistorised. Frequency range: 535-1600 K Hz, Medium Wave Band. Maximum output: 300mW.

ROC price
£6.90

Normal retail price: £9.40

STEREO headphones

only
£2.40

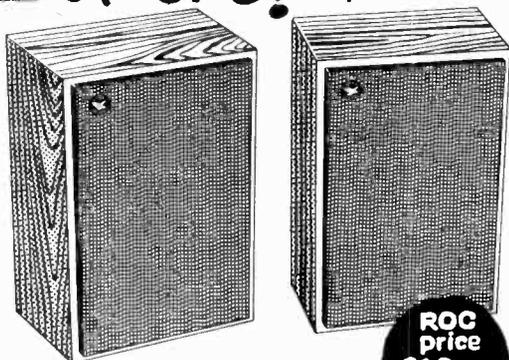


Stereo Headphones R.328

Light and comfortable, with a frequency response of 30-15,000 Hz for real listening pleasure. Complete with jack plug. Impedance 8-16 ohms.
Normal retail price: £2.95

2 for the price of one!

Matched Stereo Speakers R.446



Heavily lagged teak finish cabinets each with large dual cone base unit and separate tweeter. Power handling: 10 watts peak; frequency range: 40-18,000 Hz, impedance: 8 ohms. Size: 14 x 8½ x 6½.

ROC price
£16.40

Normal retail price: £19.60

pay for your mistakes

So we've got a proposition for you. If you buy a piece of Roc equipment, and it's not quite what you expected, send it back within seven days, and as long as it's as good as new we'll give you your money back. O.K.?

Return of post mail-order service; orders over £10 post free, (U.K. only) add 25p for p & p to orders under £10. HP terms available.

ROC ELECTRONICS LIMITED

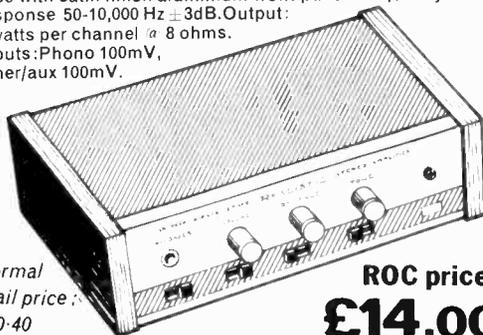
193 Edgware Road, London W2 1ET. Phone: 01-723 6211.

Callers at Shop welcome 9-6 Mon to Sat (Thurs 1pm)

Don't read this!

10-watt Transistor Stereo Amplifier R.136

Ganged volume, balance and tone controls. Inputs for turntable (ceramic cartridge), tuner (see R.134) or tape. Oiled walnut case with satin finish aluminium front panel. Frequency response 50-10,000 Hz \pm 3dB. Output: 5 watts per channel @ 8 ohms. Inputs: Phono 100mV, tuner/aux 100mV.



Normal retail price: £20.40

ROC price:
£14.00

The Perfect match!

AM/FM/MPX Stereo Tuner R.134



Matching unit to the R.136 amplifier. Covers AM and FM tuning bands with automatic stereo signal light. FM frequency range: 88-108MHz; AM frequency range: 535-1605kHz. FM: Sensitivity 5µV, stereo separation 25dB @ 1kHz, image rejection 50dB. AM: Sensitivity 250µV.

Normal retail price: £28.60

ROC price
£22

Out now! The 1971/2 Mullard data book.

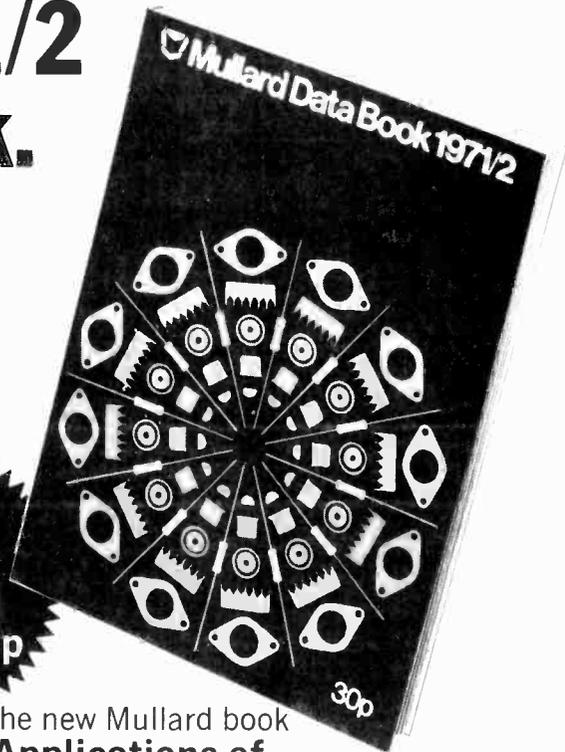
An easy reference guide to the Mullard consumer electronics range of semiconductors, valves, television picture tubes and passive components.

Pocket size and colour coded for handy reference.

All components concisely listed in alpha-numeric sequence with Mullard equivalents, comparables and replacements.

Concise data on component types.

All this for just **30p**



How to get your copy:

available from your local bookseller or cash with order plus 5p for p & p from Selray Book Co., 60 Hayes Hill, Bromley, Kent.

The new Mullard book 'Applications of Infrared Detectors' also now available.

CED 137

S-DeC BREADBOARD
British Made

Solderless breadboard panels, for fast reliable component connections. Single DeCs. One S-DeC with Control Panel, with booklet "Projects on S-DeC" giving construction details for a variety of circuits. £1 P. & P. 17½p.

4-DeC KIT. Four S-DeCs with two Control Panels, and the booklet "Projects on S-DeC" all contained in a strong attractive plastic case. Ideal for the professional user. £3.95 P. & P. 17½p.

T-DeC KIT £2.50 P. & P. 17½p.

S-DeC STOR £2.50 P. & P. 17½p.

VHF AIRCRAFT BAND CONVERTER

When placed within 1in of a MW band radio full coverage of VHF Aircraft Band 110-135MHz can be obtained. All transistor, 9V battery operation. Fully tunable 18½in X 7 section telescopic aerial. Size 4in X 2½in X 1½in. OUR PRICE £3.60 P. & P. 20p.

GARRARD TURNTABLES

SP25 Mk. III £11.75
2025T/C..... £9.87

Base and cover for above £5.98
AP70..... £19.50
SL73B £24.97½
SL75B £28.35
SL95B..... £39.45

Base and cover for above..... £3.87½
401..... £31.50

P. & P. Decks, 82½p; Base and cover, 50p; Deck Base/Cover, 87½p.

THIS MONTH'S SPECIAL OFFERS!

SP25 Mk. III with base..... £13.98 P. & P. 70p
SP25 Mk. III with Sonotone 9TAHCD cartridge and base £16.75 P. & P. 70p

LIND-AIR AUDIO
(Dept. PE10), 53 Tottenham Court Road London, W.1. Tel. 01-637 1601

Vary the strength of your lighting with a DIMMASWITCH



The DIMMASWITCH is an attractive and efficient dimmer unit which fits in place of the normal light switch and is connected up in exactly the same way. The ivory mounting plate of the DIMMASWITCH matches modern electric fittings. Two models are available, with the bright chrome knob controlling up to 300 w or 600 w of all lights except fluorescents at mains voltages from 200-250 v, 50Hz. The DIMMASWITCH has built-in radio interference suppression:

600 w — £3.20. Kit Form £2.70
300 w — £2.70. Kit Form £2.20

All plus 10p post and packing.
Please send C.W.O. to:

DEXTER & COMPANY
1 ULVER HOUSE, 19 KING STREET
CHESTER CH1 2AH Tel. 0244-25883
As supplied to H.M. Government Departments

INTER-LOCKING PLASTIC STORAGE DRAWERS

NEAT! HANDY! TIDY!

DISCOUNT PRICES

5 SIZES ALL INTERLOCK

Newest, nearest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots/removable space dividers. Build up any size cabinet for wall, bench or table top.

BUY AT TRADE PRICES!

SINGLE UNITS (1D) (5ins 2½ins 2½ins) £1.35 DOZEN.

DOUBLE UNITS (2D) (5ins 4½ins 2½ins) £2.25 DOZEN.

TREBLE (3D) £2.35 for 8.

DOUBLE TREBLE 2 draws, in one outer case (6D2), £3.65 for 8, **EXTRA LARGE SIZE (6D1)** £3.30 for 8.

PLUS QUANTITY DISCOUNTS!

Orders £5 and over DEDUCT 5% in the £. Orders £10 and over DEDUCT 7½% in the £. Orders £20 and over DEDUCT 10% in the £. PACKING/POSTAGE/CARRIAGE: Add 35p to all orders under £5. Orders £5 and over, packing/postage/carriage free.

QUOTATIONS FOR LARGER QUANTITIES ALL PRICES TAX PAID

IVORYET LIMITED (Dept. PE10) 124 Cricklewood Broadway, London, N.W.2 Tel. 01-450 4844

MAIL ORDER DIVISION

distrionic LTD

THE POWER HOUSE

28 BURNT MILL
ELIZABETH WAY
HARLOW ESSEX
HARLOW 32947

**Why wait weeks? — ALL OUR ORDERS
DISPATCHED BY RETURN OF POST!**
Transistors, Diodes and Integrated Circuits

A) DIODES & RECTIFIERS

| | | | | | | |
|--------|-----|------------------|--------|-----|-------|-----|
| IN4001 | 7p | AC187K } Matched | BC109 | 11p | BFX86 | 30p |
| IN4002 | 8p | AC188K } pr. 50p | BC113 | 20p | BFX87 | 30p |
| IN4003 | 9p | AC191 | BC114 | 20p | BFX88 | 25p |
| IN4004 | 10p | AC192 | BC115 | 25p | BFY34 | 30p |
| IN4005 | 12p | AC193 | BC116A | 30p | | |
| IN4006 | 14p | AC194K } Matched | BC117 | 30p | | |
| IN4007 | 20p | AC194K } pr. 60p | BC125 | 20p | | |
| | | AC194 | BC126 | 30p | | |
| | | AD143 | BC132 | 20p | | |
| | | AD262 } Matched | BC134 | 20p | | |
| | | BD162 } pr. 90p | BC137 | 30p | | |
| | | AD262 | BC142 | 35p | | |
| | | AD263 | BC143 | 40p | | |
| | | AF106 | BC144 | 35p | | |
| | | AF109 | BC145 | 30p | | |
| | | AF139 | BC147 | 15p | | |
| | | AF166 | BC148 | 11p | | |
| | | AF170 | | | | |
| | | AF172 | | | | |
| | | AF200 | | | | |
| | | AF201 | | | | |
| | | AF239 | | | | |
| | | AF239S | | | | |
| | | AL102 | | | | |
| | | AL103 | | | | |
| | | AU103 | | | | |

Compare our prices

| | |
|------|-----|
| WOOS | 40p |
| WO1 | 45p |
| WO4 | 48p |
| WO6 | 50p |

B) TRANSISTORS

| | | | | | |
|---------|-------|--------|-----|--------|-----|
| 2N696 | 15p | AU106 | 95p | BCY70 | 26p |
| 2N930 | 25p | AU107 | 70p | BCY71 | 26p |
| 2N930A | 30p | AU108 | 65p | BCY72 | 26p |
| 2N1613 | 22p | AU110 | £1 | BF152 | 25p |
| 2N1711 | 25p | AU111 | 70p | BF153 | 25p |
| 2N2369 | 20p | AUY21A | 60p | BF158 | 25p |
| 2N2484 | 34p | AUY22A | 70p | BF159 | 35p |
| 2N2605 | 45p | AUY35 | 45p | BF160 | 28p |
| 2N2904 | 36p | AUY37 | 60p | BF177 | 25p |
| 2N2904A | 41p | BC107 | 11p | BF178 | 35p |
| 2N2905 | 46p | BC108 | 11p | BF179C | 40p |
| 2N2905A | 60p | | | | |
| 2N3053 | 22p | | | | |
| 2N3055 | 70p | | | | |
| 2N3442 | £2 | | | | |
| 2N3638 | 25p | | | | |
| 2N3866 | £1.50 | | | | |
| 2N4347 | £1.50 | | | | |
| 2N4356 | 35p | | | | |
| 40411 | £2.50 | | | | |
| AC138 | 15p | | | | |
| AC141 | 20p | | | | |
| AC141H | 25p | | | | |
| AC142 | 15p | | | | |

Send 10p for price list or free with order

**Component Discounts
10% on orders over £5**

11p BFX86 30p
20p BFX87 30p
20p BFX88 25p
25p BFY34 30p

Please note minimum order 50p

BFY50 22p
BFY51 20p
BFY52 20p
ME0404-1 12p
ME0404-2 13p
ME1001 10p
ME1002 11p
ME2001 10p
ME2002 11p
ME3001 20p
ME3002 25p
ME4001 10p
ME4002 11p
ME6001 15p
ME6002 18p
ME8001 20p
ME8002 30p
ME8003 30p
ME9001 15p
ME9002 15p
MEL11 40p
MEL12 50p
MEU21 40p
MEU22 50p
OC25 37p

C) INTEGRATED CIRCUITS
709C (TO-99) 95p
709C (DIP) 95p
741C (TO-99) 25p
741C (DIP) £1.25

| | |
|-------------------------------|-------|
| 2N3055 | 70p |
| 115 Watt 15 Amp | |
| 2N3053 | 22p |
| 1 Amp TO-5 | |
| BC107 | 11p |
| Also BC108 and BC109 | |
| AF239 | 40p |
| UHF: 5 DB at 800 MHz | |
| WO1 | 45p |
| 1 Amp, 100 V Bridge Rectifier | |
| AD262 } PNP Matched | 90p |
| BD162 } NPN pair | |
| 10 Watts, AUDIO OUTPUT PAIR | |
| ADI42 | 50p |
| 80 Volts, 10 Amp TO-3 | |
| AU103 | £1 |
| 155 Volts, 10 Amp TO-3 | |
| AU106 | 95p |
| 320 Volts, 10 Amps | |
| BC147/8/9 | 15p |
| High gain LOCKFIT | |
| ME1001 | 10p |
| 45 Volt high gain | |
| 40411 | £2.50 |
| 30 Amp, 150 Volts | |
| IN4001 | 7p |
| 1 Amp, 100 Volts | |
| BF179C | 40p |
| 250 Volts TO-5 | |
| BFY51/2 | 20p |
| 2N3866 | £1.50 |
| 1 Watt output at 400MHz | |
| BC114 | 20p |
| High gain: 200 at 1mA | |
| 741C | £1.25 |
| DIP or TO-99 | |
| High gain operational amp. | |
| S/C proof | |

POSTAGE & PACKING PLEASE ADD 10p TO YOUR ORDER

**SEND FOR
BONUS VOUCHER*
FREE WITH EVERY
£1 ORDER**

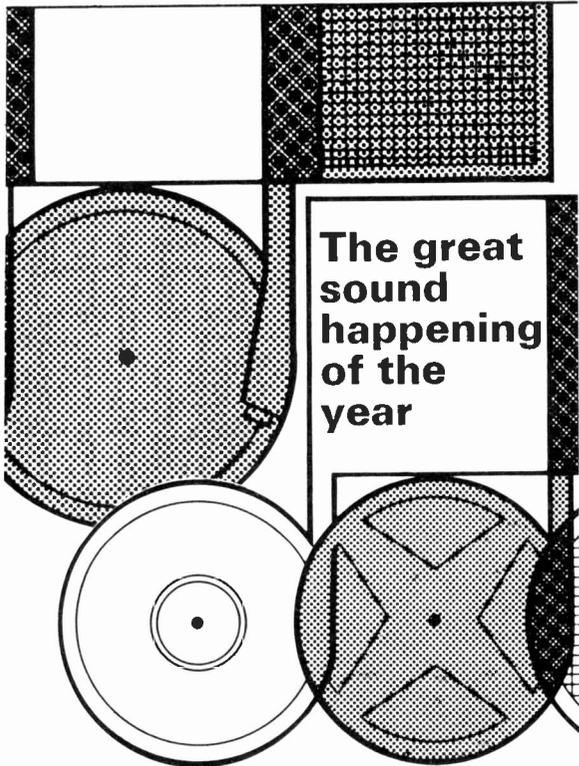
*Redeemable upon receipt of subsequent order value £5 or more, received before Dec. 31, 1971
Practical Electronics October 1971

BONUS VOUCHER

Send this voucher with your next order to receive a complimentary...


distrionic LTD

28 BURNT MILL, ELIZABETH WAY, HARLOW, ESSEX



The great
sound
happening
of the
year

THE 1971 INTERNATIONAL AUDIO FESTIVAL AND FAIR October 26-30

You must see and hear the most comprehensive demonstration of Hi-Fi ever staged in Europe. Come to Olympia and see the big names of the Sound Industry displaying the latest reproduction equipment. Tape recorders, Cassette Players and Cassettes, Loudspeakers and Earphones, VHF radios, Stereo Multiplier Receivers, Tapes and Discs — you can hear them all in action in 100 specially constructed Audio Studios.

And you can relax in the comfortable Hi-Fi Theatre with daily presentations, lectures and discussions by the industry's top names.

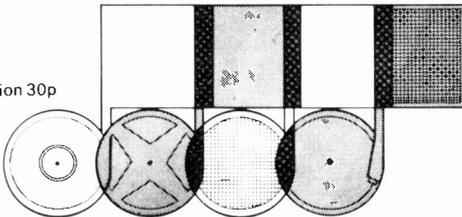
Everyone interested in Hi-Fi must come. This is the greatest event in the history of sound techniques.

OLYMPIA

Tuesday to Saturday 10 - 9 daily

LONDON

Admission 30p

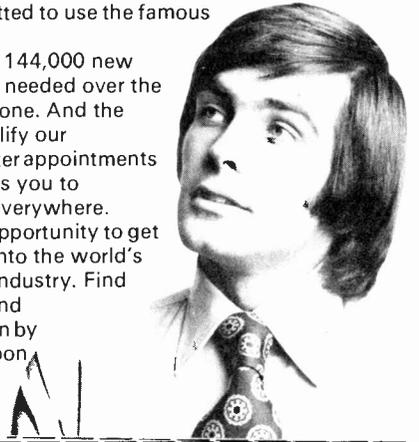


High Salary
A Dream House
A New Car
And A Secure Future
Get into the Computer
Industry the fast and
easy way.

Now for the first time, anybody (no special qualifications are needed) can train outside the computer industry for an exciting career as a **computer operator in only 4 weeks** — and can earn £2,000 ++ p.a.

How? We are the only commercial training organisation in the U.K. permitted to use the famous 'Eduputer'.

JOBS GALORE! 144,000 new operators will be needed over the next five years alone. And the moment you qualify our exclusive computer appointments bureau introduces you to computer users everywhere. This is your big opportunity to get out of a rut and into the world's fastest growing industry. Find out more **FREE** and without obligation by posting this coupon **TO-DAY**.



London Computer Operators Training Centre

C26 Oxford House, 9/15 Oxford Street, London, W.1
Telephone 01-734 2874
127/131 The Piazza, Dept. C26, Piccadilly Plaza,
Manchester 1. Telephone 061-236 2935.

Please send me your **FREE** illustrated brochure on exclusive Eduputer 'hands on' training for computer operating.

Name

Address

Tel

SEW PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.
 ● LOW COST ● QUICK DELIVERY ● OVER 200 RANGES IN STOCK ● OTHER RANGES TO ORDER

NEW "SEW" DESIGNS!

CLEAR PLASTIC METERS

| TYPE SW. 100 100 x 80 mm | | TYPE S-80 80 mm square fronts | |
|-----------------------------|-------|----------------------------------|-------|
| 500μA | £3.12 | 50μA | £3.12 |
| 1mA | £2.97 | 50-0-50μA | £2.97 |
| 20V d.c. | £2.97 | 100μA | £2.97 |
| 50V d.c. | £2.97 | 100-0-100μA | £2.97 |
| 300V d.c. | £2.97 | 500μA | £2.97 |
| 50μA | £3.47 | 1A d.c. | £2.47 |
| 50-0-50μA | £3.37 | 5A d.c. | £2.47 |
| 100μA | £3.37 | 300V a.c. | £2.92 |
| 100-0-100μA | £3.25 | AT Meter | £3.75 |

"SEW" CLEAR PLASTIC METERS

| Type MR.85P. 4 1/2 in 4 1/2 in fronts. | | Type MR.38P. 1 21/32 in square fronts. | |
|--|-------|--|-------|
| 50μA | £3.60 | 150mA | £1.37 |
| 50-0-50μA | £3.10 | 300mA | £1.37 |
| 100μA | £3.10 | 500mA | £1.37 |
| 100-0-100μA | £3.10 | 750mA | £1.37 |
| 200μA | £2.87 | 1A | £1.37 |
| 500μA | £2.75 | 2A | £1.37 |
| 500-0-500μA | £2.60 | 5A | £1.37 |
| 1mA | £2.60 | 10A | £1.37 |
| 1-0-1mA | £2.60 | 10V d.c. | £1.37 |
| 5mA | £2.60 | 20V d.c. | £1.37 |
| 10mA | £2.60 | 50V d.c. | £1.37 |

| Type MR.52P. 2 1/2 in square fronts. | | Type MR.45P. 2 1/2 in square fronts. | |
|--------------------------------------|-------|--------------------------------------|-------|
| 50μA | £3.10 | 50μA | £2.25 |
| 50-0-50μA | £2.60 | 50-0-50μA | £2.10 |
| 100μA | £2.60 | 100μA | £2.10 |
| 100-0-100μA | £2.37 | 100-0-100μA | £1.87 |
| 500μA | £2.25 | 200μA | £1.87 |
| 1mA | £2.00 | 500μA | £1.80 |
| 5mA | £2.00 | 1mA | £1.87 |
| 10mA | £2.00 | 5mA | £1.87 |
| 10V d.c. | £2.00 | 10mA | £1.87 |

"SEW" BAKELITE PANEL METERS

| Type MR.65P. 3 1/2 in 3 1/2 in fronts. | | Type MR.65 3 1/2 in square fronts. | |
|--|-------|------------------------------------|-------|
| 50μA | £3.37 | 500μA | £1.75 |
| 50-0-50μA | £2.75 | 1A | £1.75 |
| 100μA | £2.75 | 5A | £1.75 |
| 100-0-100μA | £2.60 | 10A | £1.75 |
| 200μA | £2.60 | 30A | £1.75 |
| 500μA | £2.37 | 50A | £1.75 |
| 500-0-500μA | £2.10 | 5V d.c. | £1.75 |
| 1mA | £2.10 | 10V d.c. | £1.75 |
| 5mA | £2.10 | 20V d.c. | £1.75 |
| 10mA | £2.10 | 50V d.c. | £1.75 |
| 50mA | £2.10 | 150V d.c. | £1.75 |
| 1A | £2.10 | 300V d.c. | £1.75 |
| 5A | £2.10 | 30V a.c.* | £1.75 |
| 10A | £2.10 | 50V a.c.* | £1.75 |
| 50A | £2.10 | 150V a.c.* | £1.75 |
| 5V d.c. | £2.10 | 300V a.c.* | £1.75 |
| 10V d.c. | £2.10 | 500μA | £1.75 |

* MOVING IRON — ALL OTHERS MOVING COIL

Please add postage

"SEW" EDUCATIONAL METERS

Type ED.107. Size overall 100mm x 90mm x 108mm.

A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The easily accessible to demonstrate internal working. Available in the following ranges:

| | | | |
|-----------|-------|---------------|-------|
| 50μA | £4.50 | 20V d.c. | £3.97 |
| 100μA | £4.25 | 50V d.c. | £3.97 |
| 1mA | £3.97 | 300V d.c. | £3.97 |
| 50-0-50μA | £4.25 | Dual range | |
| 1-0-1mA | £3.97 | 500mA/5A d.c. | £4.25 |
| 1A d.c. | £3.97 | 5V/50V d.c. | £4.25 |
| 5A d.c. | £3.97 | | |
| 10V d.c. | £3.97 | | |

EDGWISE METERS

PE.70 3 1/2 3 1/2 in 1 15/32 in 2 1/2 in deep.

| | | | |
|-------------|-------|-----------|-------|
| 50μA | £3.00 | 500μA | £2.80 |
| 50-0-50μA | £2.87 | 1mA | £2.37 |
| 100μA | £2.87 | 5mA | £2.37 |
| 100-0-100μA | £2.75 | 300V a.c. | £2.37 |
| 200μA | £2.75 | VU meter | £3.25 |

MULTIMETERS for EVERY purpose!



TECH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V a.c. and d.c. 0/1/100/500mA. d.c. 0/100K. £1-97. P. & P. 121p.



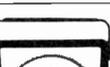
MODEL TE-200. 20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000V d.c. 0/10/50/250/1,000V a.c. 0/50μA/260MA. 0/60K/6 meg. -20 to +62dB. £3.75. P. & P. 15p.



MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200V d.c. 0/6/30/120/600/1,200V a.c. 0/30μA/300/300MA. 0/16K/160K/1.6M/16 meg. £3-50. P. & P. 15p.



MODEL TE12. 20,000 O.P.V. 0/0-6/30/120/600. 1,200 / 3,000 / 6,000V d.c. 1/6/30/120/600/1,200V a.c. 0 / 60μA / 6 / 60 / 600MA / 0 / 6K / 60K / 6 meg. / 60. Megohm 50PF. 2 MFD £3-97. P. & P. 17jp.



MODEL PL436. 20K / Volt d.c. 8K / Volt a.c. Mirror scale. 0-6/3/12/30/120/600V d.c. 0-6/3/30/120/600V a.c. 50/600μA/600/600MA. 10/100K/1 Meg/10 meg Ohm. -20 to +46dB. £3-97. P. & P. 121p.



MODEL 500. 30,000 O.P.V. with overload protection, mirror scale. 0/5/12/5/10/25/100/250/500/1,000V d.c. 0/2-5/10/25/100/250/500/1,000V a.c. 0/50μA/5/50/500MA. 12 amp. d.c. 0/60K/6 Meg./60 Meg/Ω. £3-87. Post paid.



TMK LAB TESTER. 100,000 O.P.V. 6 1/2 in scale buzzer short circuit check. Sensitivity: 100,000 OPV d.c. 5/Volt a.c. D.c. volts: 0-5, 2-5, 10, 50, 250, 1,000V. D.c. currents: 0-0.05, 0.5, 5, 50, 500mA. Resistance: 0-5K, 50K, 0-500K, 5 meg. Decibels: -20 to +62dB. £11.50. P. & P. 17jp.



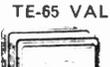
TMK LAB TESTER. 100,000 O.P.V. 6 1/2 in scale buzzer short circuit check. Sensitivity: 100,000 OPV d.c. 5/Volt a.c. D.c. volts: 0-5, 2-5, 10, 50, 250, 1,000V. D.c. currents: 0-0.05, 0.5, 5, 50, 500mA. Resistance: 0-5K, 50K, 0-500K, 5 meg. Decibels: -20 to +62dB. £18-90. P. & P. 23p.



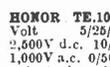
270° WIDE ANGLE 1mA METERS
 MW1-6 60mm square £3-97. MW1-8 80mm square £4-97. P. & P. extra.



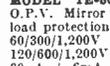
T.E.40 HIGH SENSITIVITY A.C. VOLT METER
 10 meg. input 10 ranges: 0/1 / .003 / .1 / 1 / 3 / 10 / 30 / 100 / 300V. R.M.S. d.c. 468-1.500V. Decibels -40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V a.c. £17-50. Carr. 25p.



TE-65 VALVE VOLTMETER
 High quality instrument with 28 ranges. D.c. volts 1-5-1,500V. A.c. volts 1-5-1,500V. Resistance up to 1,000 megohms, 220/240V a.c. operation. Complete with probe and instructions. £17-50. P. & P. 30p. Additional Probes available: R.F. £2.124, H.V. £2-50.



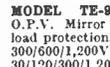
HONOR TE.10A. 20K / Volt 5/25/50/250/500/2,500V d.c. 10/50/100/500/1,000V a.c. 0/50μA/2-5mA 250mA 0/6K/6 meg. ohm. -20 to +22dB. 10-0, 100 mfd. 0-100-0-1 mfd. £3-47. P. & P. 15p.



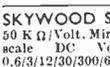
MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection 0/0-6/3/16/60/300/1,200V d.c. 0/6/30/120/600/1,200V a.c. 0/30μA / 6mA / 60mA / 300MA/600MA. 0/8K/80K/800K/8 meg. -20 to +63dB. £3-97. P. & P. 15p.



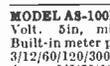
TMK MODEL MD.120. Mirror scale. 20K / Volt d.c. 10K / Volt a.c. 30/60/300/600/3,000V d.c. 6/120/1,200V a.c. Current 0-60μA/0-12-0-300mA. 0-60K/0-6-6M Ω. -20 to +63dB. £7-50. P. & P. 15p.



MODEL TE-90. 50,000 O.P.V. Mirror scale, overload protection. 0/0.3/13/60/300/600/1,200V d.c. 0/6/30/120/300/1,200V a.c. 0-0.3/6/60/600MA. d.c. 15K/150K/1.5M meg. -20 to +63dB. £7-50. P. & P. 15p.



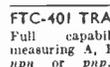
SKYWOOD SW-500
 50 K Ω/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. AC Volts 3/30/300/600. DC Current 200A/600/600MA. Resistance 10K/100K/1Meg/10Meg. Decibels -20 to +57dB. £7-50. P. & P. 15p.



MODEL AS-100D. 100K Ω / Volt 5 in, mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200V d.c. 0/6/30/120/300/600V a.c. 0/10μA/6/60/300MA/12A. 0/2K/20K/2M/20M. -20 to +17dB. £12-50. P. & P. 17jp.



TE-900 20,000 Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6 in full view meter. 2 colour scale. 0/2-5/10/25/100/250/500/1,000V a.c. 0/25/125/50/250/1,000/5,000V d.c. 0/50μA/110/100/500MA/10A d.c. 0/2K/20K/20 meg. ohm. £15. P. & P. 25p.



FTC-401 TRANSISTOR TESTER
 Full capabilities for measuring A, B and ICO, *npn* or *ppn*. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. £6-97. P. & P. 13p.



HONEYWELL DIGITAL VOLTMETER VT.100
 Can be panel or bench mounted. Basic meter measures 1 volt d.c. but can be used to measure a wide range of a.c. and d.c. volt, current and ohms with optional plug-in cards. Specification: Accuracy: ± 0.2% 1 digit. Resolution: 1mV. No. of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1999) Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100V d.c. Input: Fully floating (3 poles). Input power: 110-230V a.c. 50/60 cycles. Overall size: 5 1/2 in. x 2 1/2 in. x 8 3/16 in. AVAILABLE BRAND NEW AND FULLY GUARANTEED AT APPROX. HALF PRICE £49-97; Carr. 50p

G. W. SMITH & CO (RADIO) LTD.
 Also see next two pages

SEMI-CONDUCTORS/VALVES

ALL DEVICES BRAND NEW AND FULLY GUARANTEED

| Transistors | | 2N3415 | | 2N3438 | | BC114 | | BFW90 | | NKT219 | | 80p | |
|-------------|-----|--------|------|--------|-----|-------|-----|-------|-----|--------|-----|-----|--|
| 2G301 | 20p | 2N3417 | 27p | 2N3439 | 48p | BC115 | 15p | BFW91 | 20p | NKT223 | 27p | | |
| 2G302 | 10p | 2N3439 | 130p | 2N3440 | 25p | BC116 | 15p | BFX12 | 25p | NKT225 | 27p | | |
| 2G303 | 20p | 2N3440 | 97p | 2N3441 | 25p | BC117 | 15p | BFX13 | 25p | NKT229 | 30p | | |
| 2G304 | 30p | 2N3441 | 17p | 2N3442 | 47p | BC118 | 15p | BFX14 | 25p | NKT237 | 35p | | |
| 2G305 | 30p | 2N3442 | 17p | 2N3443 | 47p | BC119 | 15p | BFX15 | 25p | NKT238 | 35p | | |
| 2G306 | 30p | 2N3443 | 17p | 2N3444 | 47p | BC120 | 15p | BFX16 | 25p | NKT241 | 20p | | |
| 2G307 | 30p | 2N3444 | 17p | 2N3445 | 47p | BC121 | 15p | BFX17 | 25p | NKT242 | 20p | | |
| 2G308 | 30p | 2N3445 | 17p | 2N3446 | 47p | BC122 | 15p | BFX18 | 25p | NKT243 | 62p | | |
| 2G309 | 30p | 2N3446 | 17p | 2N3447 | 47p | BC123 | 15p | BFX19 | 25p | NKT244 | 17p | | |
| 2G310 | 30p | 2N3447 | 17p | 2N3448 | 47p | BC124 | 15p | BFX20 | 25p | NKT245 | 62p | | |
| 2G311 | 15p | 2N3448 | 25p | 2N3449 | 72p | BC125 | 15p | BFX21 | 25p | NKT246 | 17p | | |
| 2G312 | 15p | 2N3449 | 25p | 2N3450 | 72p | BC126 | 15p | BFX22 | 25p | NKT247 | 17p | | |
| 2G313 | 15p | 2N3450 | 25p | 2N3451 | 72p | BC127 | 15p | BFX23 | 25p | NKT248 | 17p | | |
| 2G314 | 15p | 2N3451 | 25p | 2N3452 | 72p | BC128 | 15p | BFX24 | 25p | NKT249 | 17p | | |
| 2G315 | 15p | 2N3452 | 25p | 2N3453 | 72p | BC129 | 15p | BFX25 | 25p | NKT250 | 17p | | |
| 2G316 | 15p | 2N3453 | 25p | 2N3454 | 72p | BC130 | 15p | BFX26 | 25p | NKT251 | 17p | | |
| 2G317 | 15p | 2N3454 | 25p | 2N3455 | 72p | BC131 | 15p | BFX27 | 25p | NKT252 | 17p | | |
| 2G318 | 15p | 2N3455 | 25p | 2N3456 | 72p | BC132 | 15p | BFX28 | 25p | NKT253 | 17p | | |
| 2G319 | 15p | 2N3456 | 25p | 2N3457 | 72p | BC133 | 15p | BFX29 | 25p | NKT254 | 17p | | |
| 2G320 | 15p | 2N3457 | 25p | 2N3458 | 72p | BC134 | 15p | BFX30 | 25p | NKT255 | 17p | | |
| 2G321 | 15p | 2N3458 | 25p | 2N3459 | 72p | BC135 | 15p | BFX31 | 25p | NKT256 | 17p | | |
| 2G322 | 15p | 2N3459 | 25p | 2N3460 | 72p | BC136 | 15p | BFX32 | 25p | NKT257 | 17p | | |
| 2G323 | 15p | 2N3460 | 25p | 2N3461 | 72p | BC137 | 15p | BFX33 | 25p | NKT258 | 17p | | |
| 2G324 | 15p | 2N3461 | 25p | 2N3462 | 72p | BC138 | 15p | BFX34 | 25p | NKT259 | 17p | | |
| 2G325 | 15p | 2N3462 | 25p | 2N3463 | 72p | BC139 | 15p | BFX35 | 25p | NKT260 | 17p | | |
| 2G326 | 15p | 2N3463 | 25p | 2N3464 | 72p | BC140 | 15p | BFX36 | 25p | NKT261 | 17p | | |
| 2G327 | 15p | 2N3464 | 25p | 2N3465 | 72p | BC141 | 15p | BFX37 | 25p | NKT262 | 17p | | |
| 2G328 | 15p | 2N3465 | 25p | 2N3466 | 72p | BC142 | 15p | BFX38 | 25p | NKT263 | 17p | | |
| 2G329 | 15p | 2N3466 | 25p | 2N3467 | 72p | BC143 | 15p | BFX39 | 25p | NKT264 | 17p | | |
| 2G330 | 15p | 2N3467 | 25p | 2N3468 | 72p | BC144 | 15p | BFX40 | 25p | NKT265 | 17p | | |
| 2G331 | 15p | 2N3468 | 25p | 2N3469 | 72p | BC145 | 15p | BFX41 | 25p | NKT266 | 17p | | |
| 2G332 | 15p | 2N3469 | 25p | 2N3470 | 72p | BC146 | 15p | BFX42 | 25p | NKT267 | 17p | | |
| 2G333 | 15p | 2N3470 | 25p | 2N3471 | 72p | BC147 | 15p | BFX43 | 25p | NKT268 | 17p | | |
| 2G334 | 15p | 2N3471 | 25p | 2N3472 | 72p | BC148 | 15p | BFX44 | 25p | NKT269 | 17p | | |
| 2G335 | 15p | 2N3472 | 25p | 2N3473 | 72p | BC149 | 15p | BFX45 | 25p | NKT270 | 17p | | |
| 2G336 | 15p | 2N3473 | 25p | 2N3474 | 72p | BC150 | 15p | BFX46 | 25p | NKT271 | 17p | | |
| 2G337 | 15p | 2N3474 | 25p | 2N3475 | 72p | BC151 | 15p | BFX47 | 25p | NKT272 | 17p | | |
| 2G338 | 15p | 2N3475 | 25p | 2N3476 | 72p | BC152 | 15p | BFX48 | 25p | NKT273 | 17p | | |
| 2G339 | 15p | 2N3476 | 25p | 2N3477 | 72p | BC153 | 15p | BFX49 | 25p | NKT274 | 17p | | |
| 2G340 | 15p | 2N3477 | 25p | 2N3478 | 72p | BC154 | 15p | BFX50 | 25p | NKT275 | 17p | | |
| 2G341 | 15p | 2N3478 | 25p | 2N3479 | 72p | BC155 | 15p | BFX51 | 25p | NKT276 | 17p | | |
| 2G342 | 15p | 2N3479 | 25p | 2N3480 | 72p | BC156 | 15p | BFX52 | 25p | NKT277 | 17p | | |
| 2G343 | 15p | 2N3480 | 25p | 2N3481 | 72p | BC157 | 15p | BFX53 | 25p | NKT278 | 17p | | |
| 2G344 | 15p | 2N3481 | 25p | 2N3482 | 72p | BC158 | 15p | BFX54 | 25p | NKT279 | 17p | | |
| 2G345 | 15p | 2N3482 | 25p | 2N3483 | 72p | BC159 | 15p | BFX55 | 25p | NKT280 | 17p | | |
| 2G346 | 15p | 2N3483 | 25p | 2N3484 | 72p | BC160 | 15p | BFX56 | 25p | NKT281 | 17p | | |
| 2G347 | 15p | 2N3484 | 25p | 2N3485 | 72p | BC161 | 15p | BFX57 | 25p | NKT282 | 17p | | |
| 2G348 | 15p | 2N3485 | 25p | 2N3486 | 72p | BC162 | 15p | BFX58 | 25p | NKT283 | 17p | | |
| 2G349 | 15p | 2N3486 | 25p | 2N3487 | 72p | BC163 | 15p | BFX59 | 25p | NKT284 | 17p | | |
| 2G350 | 15p | 2N3487 | 25p | 2N3488 | 72p | BC164 | 15p | BFX60 | 25p | NKT285 | 17p | | |
| 2G351 | 15p | 2N3488 | 25p | 2N3489 | 72p | BC165 | 15p | BFX61 | 25p | NKT286 | 17p | | |
| 2G352 | 15p | 2N3489 | 25p | 2N3490 | 72p | BC166 | 15p | BFX62 | 25p | NKT287 | 17p | | |
| 2G353 | 15p | 2N3490 | 25p | 2N3491 | 72p | BC167 | 15p | BFX63 | 25p | NKT288 | 17p | | |
| 2G354 | 15p | 2N3491 | 25p | 2N3492 | 72p | BC168 | 15p | BFX64 | 25p | NKT289 | 17p | | |
| 2G355 | 15p | 2N3492 | 25p | 2N3493 | 72p | BC169 | 15p | BFX65 | 25p | NKT290 | 17p | | |
| 2G356 | 15p | 2N3493 | 25p | 2N3494 | 72p | BC170 | 15p | BFX66 | 25p | NKT291 | 17p | | |
| 2G357 | 15p | 2N3494 | 25p | 2N3495 | 72p | BC171 | 15p | BFX67 | 25p | NKT292 | 17p | | |
| 2G358 | 15p | 2N3495 | 25p | 2N3496 | 72p | BC172 | 15p | BFX68 | 25p | NKT293 | 17p | | |
| 2G359 | 15p | 2N3496 | 25p | 2N3497 | 72p | BC173 | 15p | BFX69 | 25p | NKT294 | 17p | | |
| 2G360 | 15p | 2N3497 | 25p | 2N3498 | 72p | BC174 | 15p | BFX70 | 25p | NKT295 | 17p | | |
| 2G361 | 15p | 2N3498 | 25p | 2N3499 | 72p | BC175 | 15p | BFX71 | 25p | NKT296 | 17p | | |
| 2G362 | 15p | 2N3499 | 25p | 2N3500 | 72p | BC176 | 15p | BFX72 | 25p | NKT297 | 17p | | |
| 2G363 | 15p | 2N3500 | 25p | 2N3501 | 72p | BC177 | 15p | BFX73 | 25p | NKT298 | 17p | | |
| 2G364 | 15p | 2N3501 | 25p | 2N3502 | 72p | BC178 | 15p | BFX74 | 25p | NKT299 | 17p | | |
| 2G365 | 15p | 2N3502 | 25p | 2N3503 | 72p | BC179 | 15p | BFX75 | 25p | NKT300 | 17p | | |
| 2G366 | 15p | 2N3503 | 25p | 2N3504 | 72p | BC180 | 15p | BFX76 | 25p | NKT301 | 17p | | |
| 2G367 | 15p | 2N3504 | 25p | 2N3505 | 72p | BC181 | 15p | BFX77 | 25p | NKT302 | 17p | | |
| 2G368 | 15p | 2N3505 | 25p | 2N3506 | 72p | BC182 | 15p | BFX78 | 25p | NKT303 | 17p | | |
| 2G369 | 15p | 2N3506 | 25p | 2N3507 | 72p | BC183 | 15p | BFX79 | 25p | NKT304 | 17p | | |
| 2G370 | 15p | 2N3507 | 25p | 2N3508 | 72p | BC184 | 15p | BFX80 | 25p | NKT305 | 17p | | |
| 2G371 | 15p | 2N3508 | 25p | 2N3509 | 72p | BC185 | 15p | BFX81 | 25p | NKT306 | 17p | | |
| 2G372 | 15p | 2N3509 | 25p | 2N3510 | 72p | BC186 | 15p | BFX82 | 25p | NKT307 | 17p | | |
| 2G373 | 15p | 2N3510 | 25p | 2N3511 | 72p | BC187 | 15p | BFX83 | 25p | NKT308 | 17p | | |
| 2G374 | 15p | 2N3511 | 25p | 2N3512 | 72p | BC188 | 15p | BFX84 | 25p | NKT309 | 17p | | |
| 2G375 | 15p | 2N3512 | 25p | 2N3513 | 72p | BC189 | 15p | BFX85 | 25p | NKT310 | 17p | | |
| 2G376 | 15p | 2N3513 | 25p | 2N3514 | 72p | BC190 | 15p | BFX86 | 25p | NKT311 | 17p | | |
| 2G377 | 15p | 2N3514 | 25p | 2N3515 | 72p | BC191 | 15p | BFX87 | 25p | NKT312 | 17p | | |
| 2G378 | 15p | 2N3515 | 25p | 2N3516 | 72p | BC192 | 15p | BFX88 | 25p | NKT313 | 17p | | |
| 2G379 | 15p | 2N3516 | 25p | 2N3517 | 72p | BC193 | 15p | BFX89 | 25p | NKT314 | 17p | | |
| 2G380 | 15p | 2N3517 | 25p | 2N3518 | 72p | BC194 | 15p | BFX90 | 25p | NKT315 | 17p | | |
| 2G381 | 15p | 2N3518 | 25p | 2N3519 | 72p | BC195 | 15p | BFX91 | 25p | NKT316 | 17p | | |
| 2G382 | 15p | 2N3519 | 25p | 2N3520 | 72p | BC196 | 15p | BFX92 | 25p | NKT317 | 17p | | |
| 2G383 | 15p | 2N3520 | 25p | 2N3521 | 72p | BC197 | 15p | BFX93 | 25p | NKT318 | 17p | | |
| 2G384 | 15p | 2N3521 | 25p | 2N3522 | 72p | BC198 | 15p | BFX94 | 25p | NKT319 | 17p | | |
| 2G385 | 15p | 2N3522 | 25p | 2N3523 | 72p | BC199 | 15p | BFX95 | 25p | NKT320 | 17p | | |
| 2G386 | 15p | 2N3523 | 25p | 2N3524 | 72p | BC200 | 15p | BFX96 | 25p | NKT321 | 17p | | |
| 2G387 | 15p | 2N3524 | 25p | 2N3525 | 72p | BC201 | 15p | BFX97 | 25p | NKT322 | 17p | | |
| 2G388 | 15p | 2N3525 | 25p | 2N3526 | 72p | BC202 | 15p | BFX98 | 25p | NKT323 | 17p | | |
| 2G389 | 15p | 2N3526 | 25p | 2N3527 | 72p | BC203 | 15p | BFX99 | 25p | NKT324 | 17p | | |
| 2G390 | 15p | 2N3527 | 2 | | | | | | | | | | |

HI-FI EQUIPMENT

SAVE UP TO
33 1/3% OR MORE
SEND S.A.E. FOR
DISCOUNT PRICE LISTS
AND PACKAGE OFFERS!

RECORD DECKS

| | | | |
|-----------------|---------|--|--|
| B.B.R. | | | |
| Mini Mono | \$4.97 | | |
| CL29* | \$6.70 | | |
| MP60 | \$11.30 | | |
| 810 | \$15.15 | | |
| 510 | \$12.47 | | |
| 310 | \$10.55 | | |
| MP60 T.P.D.1. | \$18.75 | | |
| MP60 T.P.D.2 | \$17.65 | | |
| 610 T.P.D.1. | \$22.12 | | |
| 610 T.P.D.1. | \$20.19 | | |
| 210 Package* | \$11.30 | | |
| H.T.70 | \$16.60 | | |
| H.T. 70 Package | \$24.00 | | |



| | | | |
|-----------|---------|--|--|
| GARRARD | | | |
| A40 II* | \$8.40 | | |
| 2925 T/C* | \$9.50 | | |
| 3500* | \$9.75 | | |
| HP25 III | \$10.95 | | |
| A70 II | \$11.97 | | |
| AP76 | \$14.40 | | |
| AP76 | \$18.95 | | |
| 8L72B | \$25.00 | | |
| 8L75B | \$27.50 | | |
| 8L95B | \$37.00 | | |
| 401 | \$28.40 | | |

| | | | |
|------------|---------|--|--|
| TEORENS | | | |
| TD 125 | \$59.65 | | |
| TD125AB | \$94.25 | | |
| TX25 | \$57.70 | | |
| TD150A II | \$34.60 | | |
| TD150AB II | \$41.35 | | |
| TX11 | \$37.77 | | |

GOLDRING
CL89/2 \$21.25
CL89/2 \$23.50
GL75 \$29.97
GL75P \$38.50
LD169/75 \$3.40
G199 \$21.97

PIONEER
FL12AC \$36.50

!Mono *Stereo Cartridge
All other models less Cartridge
Carriage 50p extra any model.

RECORD DECK PACKAGES

Decks supplied ready wired in plinth and cover fitted with cartridge.

Garrard 2025 T/C with Sonotone 9TAHCD **\$13.95**

Garrard SP25 III with Goldring G800 **\$18.95**

Garrard AP76 with Goldring G800 **\$29.95**

B.S.R. MP60 with Audio Technica AT-65 **\$21.00**

Goldring GL69/2 with Goldring G800 **\$37.50**

Goldring GL75 with Goldring G800 **\$42.50**

Goldring GL76 with Goldring G800 **\$46.65**

Carriage 50p extra any model.



TE-1035 STEREO HEADPHONES

Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable headband. 8 ohm impedance. 25-18,000Hz. With lead and stereo jack plug.

ONLY **\$1.97**. P. & P. 12jp.



SINCLAIR EQUIPMENT



Project 60. Package offers. 2 x Z30 amplifier, stereo 60 pre-amp. PZ5 power supply. **\$18.85**. Carr. 37jp. Or with PZ6 power supply. **\$18.85**. Carr. 37jp. 2 x Z50 amplifier, stereo 60 pre-amp, PZ6 power supply. **\$20.25**. Carr. 37jp. Transformer for PZ6, **\$2.97** extra. Add to any of the above **\$4.87** for active filter unit and **\$18** for a pair of Q16 speakers. Project 60 FM Tuner **\$20.25**. Carr. 37jp.

All Sinclair products in stock. IC10/IC12 **\$2.50**. 2,000 amplifier, **\$24.50**. Carr. 37jp. 3000 Amplifier **\$31.50**. Carr. 37jp. Neoteric amplifier **\$45.97**. Carr. 37jp.

LATEST CATALOGUE



SEND NOW—
STILL ONLY
37 1/2p
P. & P.
10p

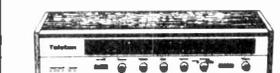
Our new 8th edition gives full details of a comprehensive range of HI-FI EQUIPMENT COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT. FREE DISCOUNT COUPONS VALUE 50p. 272 pages, fully illustrated and detailing thousands of items at bargain prices.



TELETON SAQ-206 STEREO AMPLIFIER

Latest exciting release. Beautifully styled with walnut case. 6 + 6 watts r.m.s. Switched inputs for Mag, Xtal, aux, tape. Incorporates volume, bass, treble, sliding balance, scratch filter and loudness controls. Rec. List **£32.50**. Our price **£18.50**. Carr. 37p.

TELETON F.2000 AM/FM STEREO TUNER AMPLIFIER



Probably the most popular budget Tuner/Amp. and now offered at a ridiculous low price. 5 watts r.m.s. per channel. Tape/Car inputs. 3 PC Built-in MPX. List **£31**. OUR PRICE **£32.50**. Carr. 30p.

SUGGESTED SYSTEM
F.2000, Garrard 2025T/C Changer fitted stereo cartridge, with plinth and cover and pair of G.W.S. 3 way Speakers. Total Rec. Price **£97.73**. OUR PRICE **£56.40**. Carr. £1.

★ TRANSISTORISED FM TUNER ★

6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6.4 x 2 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88-108 MHz. Ready built ready for use. Fantastic value for money. **£8.37**. P. & P. 12jp. Stereo multiplex adaptors **£4.97**.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPES
5MHz Pass Band. Separate Y1, Y2 amplifier. Calibrated triggered sweep from 0.2µsec to 100msec/cm. Supplied complete with all accessories and instructions. **£87**. Carr. paid.

BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR
New high quality portable instrument. Single Hz to 100kHz. Square 20Hz to 20kHz. Output max. +10dB (10kΩ). Operation 220/240V a.c. Size 215mm 160mm 120mm. Price **£27.50**. Carr. 25p.

TE-20RF SIGNAL GENERATOR
Accurate wide range signal generator covering 120 kHz to 250 Mc/s on 6 bands. Directly calibrated variable R.F. attenuator. Operation 200/240V a.c. Brand new with instructions. **£15**. P. & P. 37jp. S.A.E. for details.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR
Sine 15-200,000Hz; Square 18-50,000Hz. Output max +10dB (10kΩ). Operation internal batteries. Attractive two-tone case 7 1/2 in x 5 in 2 1/2 in. Price **£17.50**. Carr. 17jp.



TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-11.1 megΩ. 6 Ranges ±1%. L.I. µH - 11.1 HENRY'S 6 Ranges -2%. C. 10pF +111.10mF d.c. Ranges ±2%. TURNS RATIO 1:1/1000-1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2 1/2 in. **£20**. P. & P. 25p.

TE-16A Transistorised Signal Generator, 6 ranges 400 kHz-30 MHz. An inexpensive instrument for the handyman. Operates on 9V battery. Wide, easy to read scale. 800 kHz modulation. 5j x 5j x 3 1/2 in. Complete with instructions and leads. **£7.97**. P. & P. 20p.

LAFAYETTE TE46 RESISTANCE CAPACITY ANALYSER
2pF-2,000 mfd 2 ohms-200 megohms. Also checks impedance, turns ratio, insulation. 200/250V a.c. Brand New **£17.50**. Carr. 37p.

RUSSIAN 22 RANGE MULTIMETER
Model U437 20,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2.5/10/50/250/500/1000V d.c.; 2.5/10/50/250/500/1000V a.c. D.C. current 100 nA/1/10/100mA/1A. Resistance 300 ohms/3/30/300kΩ/3MΩ. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE **£5.97**. P. & P. 25p.

TE111 DECADE RESISTANCE ATTENUATOR
Variable range 0-111dB. Connections: Unbalanced T and Bridge T. Impedance 600Ω range (0.1B x 10) + (10B x 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200kHz. Accuracy: 0.05dB. +indication dB ±0.01. Maximum input less than 4W (50V). Built in 500Ω load resistance with internal/external switch. Brand new **£27.50**. P. & P. 25p.

ROUND SCALE TYPE PENCIL TESTER MODEL TS.68
Completely portable, simple to use pocket sized tester. Ranges 0.3/30/300V a.c. and d.c. at 2,000 o.p.v. Resistance 0-20kΩ. ONLY **£1.97**. P. & P. 13p.

POWER RHEOSTATS
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiring. Continuous rating. Wide range ext-stock Single hole fixing, lin. dia. shafts. Bulk quantities available.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS
Excellent quality - Low price - Immediate delivery

| S-260 General Purpose Bench Mounting | | S-260B Panel Mounting | |
|--------------------------------------|--------|-----------------------|-------|
| 1A | £5.50 | 1A | £6.50 |
| 2.5A | £6.75 | 2.5A | £6.69 |
| 5A | £9.75 | | |
| 8A | £14.50 | | |
| 10A | £15.50 | | |
| 12A | £21.00 | | |
| 20A | £37.00 | | |

ALL MODELS INPUT 230 VOLTS 50/60 CYCLES. OUTPUT VARIABLE 0-250 VOLTS. Special discounts for quantity.



UR-1A SOLID STATE COMMUNICATION RECEIVER
4 Bands covering 550KHz-30MHz. FET, 8 Meter, Variable BFO for 8SB. Built in Speaker, Bandread, Sensitivity Control. 220/240V a.c. or 12V d.c. 12 1/2 in x 4 1/2 in x 7 in. Brand new with instructions. **£25**. Carr. 37jp.



UNR-30 RECEIVER
4 Bands covering 550KHz-30MHz. B.F.O. Built in Speaker 220/240V a.c. Brand new with instructions. **£15.75**. Carr. 37jp.



LAFAYETTE HA-600 RECEIVER
General coverage 150-400KHz, 550KHz-30MHz. FET front end, 2 mech. filters, product detector, variable B.F.O., noise limiter, 8 Meter, Bandread, RF Gain. 16in x 9 1/2 in x 8 1/2 in. 220/240V a.c. or 12V d.c. Brand new with instructions **£45**. Carr. 50p.

CRYSTAL CALIBRATORS No. 10
Small portable crystal controlled calibrator for wavemeter. Size 7" x 7" x 4". Frequency range 600 Kc/s. 10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300 V.D.C. 15mA and 12 V.D.C. 0.5A. Excellent condition. **£3.47**. Carr. 37jp.

B.C. 221 FREQUENCY METERS
latest release 12kHz to 20MHz. Excellent condition. Fully tested and checked and complete with calibration charts. **£27.50** each. Carr. 50p.

SOLID STATE VARIABLE A.C. VOLTAGE REGULATORS
Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances, etc. Input 230/240V a.c. Output continuously variable from 20V to 230V. Model MR2305 5A 68 x 46 x 43mm, **£8.37**. Model MR2310 10A 90 x 68 x 60mm, **£11.97**. Postage 12jp.

AUTO TRANSFORMERS
0/115/230V. Step up or step down. Fully shrouded.

| | | |
|--------|--------|---------------|
| 150W | £2.37 | P. & P. 17jp. |
| 300W | £3.25 | P. & P. 22jp. |
| 500W | £4.97 | P. & P. 32jp. |
| 1,000W | £7.25 | P. & P. 37jp. |
| 1,500W | £8.97 | P. & P. 42jp. |
| 5,000W | £38.00 | P. & P. £1. |

G.W.SMITH & CO.(RADIO) LTD

27 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-636 3715
3 Lisle Street, London, W.C.2 Tel: 01-437 8204
34 Lisle Street, London, W.C.2 Tel: 01-437 9155
311 EDGWARE ROAD, LONDON, W.2 Tel: 01-262 0387

OPEN 9-5 MONDAY TO SATURDAY

All Mail Orders to—
11-12, Paddington Green,
London, W.2
Tel: 01-262 8562
(Trade supplied)



AMPEX 7.5v. D.C. MOTOR. This is an ultra-precision tape motor designed for use in the AMPEX model AG20 portable recorder. Torque 450GM/CM. Stall load at 500ma. Draws 60 ma on run. 600rpm \pm 5% speed adjustment, internal AFRR suppression $\frac{1}{2}$ " dia. 1" spindle, motor 3" dia. 1 $\frac{1}{2}$ ". Original cost £16.50. Our price £4.25. P. & P. 25p. Mu-metal enclosure available 75p each.

SYNCHRONOUS MOTORS. 220/380 v. 50/60 Hz. 250-300 rpm. 75p each.
MYCALEX MAINS. Shaded pole, 1425 rpm, $\frac{3}{8}$ " spindle. 2 for £1.25. Carriage Paid.
MAINS INDUCTION MOTOR. Open frame, $\frac{3}{8}$ " spindle, weight 2 lb. Powerful. 88p each. P. & P. 12p.

GEARED MOTORS
ELECTRO CONTROL (CHICAGO). Shaded pole 240v. 50 Hz. 200 rpm. 10lb. in. £2.50. P. & P. 25p.
MYCALEX. Open frame, shaded pole motors, 240v, 50 Hz. 7 rpm. 28 lb. in. 80 rpm. 12 lb. in. £2.25 each. P. & P. 25p.

"CROUZET" TYPE 965. 115/240v. 50 Hz. 47/68 watts. 50 rpm. Stoutly constructed. Size: 2 $\frac{1}{2}$ " x $\frac{3}{4}$ " dia. x $\frac{3}{4}$ " long plus spindle 1" x $\frac{1}{2}$ " dia. Anti-clock. £2.75. P. & P. 25p.

TYPE 955. Same as above, but 3 rpm. £3.00. P. & P. 25p.

"MALLORY" LONG LIFE BATTERIES. Type A. RM12 cell 1.35v. 3,600 ma/H. CAP. 250/300 ma cont. current. Size: 2 $\frac{1}{2}$ " x $\frac{3}{4}$ " x $\frac{1}{2}$ ". 5 for £1.00 or £2.00 per doz. Carr. Paid. Type B. Comprises 8 x RM 625 cells. Nom. volts. 1.35 each 10.5v. Overall, 350ma/H CAP. 20/25 ma cont. current. Size: 2 $\frac{1}{2}$ " x $\frac{3}{4}$ " x $\frac{1}{2}$ ". 3 for £1.00 or £3.00 per doz. Carr. Paid.

A.C./D.C. M/IRON AMMETERS. 0-5 amps or 0-8 amps (suitable battery chargers, etc.). Perspex front. Size: 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ ". Any 2 for £1.10. Carr. Paid.

ERNEST TURNER 800µA METER. 160Ω movement, 2" case elliptic, plastic front, Green-Red-Green uncalibrated scale £1.50 each. Carriage paid.

PAINTON BOURNS TRIMPOTS. 1k, 2k, 2.5k, 5k, 10k, 20k, 50k, 500k. Other Trimmer pots in stock. R10k. MORGANITE 1k. MEC 200 Ω (tubular) 50Ω. Any 3 for £1.10 carr. paid.

PROGRAMME TIMER BY HONEYWELL

A bank of 15 micro-switches are each independently operated by 15 pairs of cams which in turn are individually adjustable to give switching periods of zero to 12 seconds with infinitely variable combinations. A mains synchronous motor drives the cam shaft at 1 rev. per 12 seconds (S.P.M.). Originally cost £15.00 plus. Many applications such as lighting effects etc. New in original makers cartons. First class value at £5.75 plus 25p. P. & P.



PRECISION FAN CO. (SMITHS INDUSTRIES) DOUBLE ENTRY CENTRIFUGAL FAN/ BLOWER. This is a beautifully balanced particularly quiet running unit giving approx. 90 cubic ft./min. The motor is a 2 pole shaded pole Mycalex, drawing only 240ma on run. Weight 2 $\frac{1}{2}$ lbs. Sizes: case dia. 3-1 ins. width (case only) 3-125 ins. Width overall (inc. 5.25 ins. Aperture 3-125 ins x 1.85 ins. Offered well below makers price at £2-95. P. & P. 25p.

Brand New "DISCUS" Centrifugal Blower by Watkins & Watson. 240v. 50 Hz. Powered by A.E.I. continuous rating 2850 rpm motor. Cowl diameter 10". Outlet flange 2" I.D. Coupling flange supplied. These superb precision units are ideally suited for Organ construction. Offered at approx. half makers price £12.50. Carriage £1.50.

PLUNGER SWITCHES. Spring return 3 P.D.T. 1 amp. Single action. Size: 1 $\frac{1}{2}$ " x $\frac{1}{2}$ " plus plunger. £1.50 per doz. Carr. Paid
"HONEYWELL" TYPE 23AC-NE.—15 amp. change-over micro switch is fitted on angled metal mount with spring-loaded plastic rod operating cam. 50p. each.

VINKOR POT CORE ASS. TYPE LA. 2103 (core Lx 2100). Normal price £1.48. Our price 75p each. Special quote for quantity.

UNISELECTORS. 8 Bank 25-way, 24 volt Double sweep. Brand new in maker's boxes £5.25 P. & P. 25p.

Special offer of AMPEX professional tape heads. mu-metal shrouded. (Designed for model AG20). Full track record, or playback, £3.00. Erase head £2.00. Set of 3 with mounting bracket and cover £7.50. Half track record only £3.00 each. Carriage paid.



"BENSON BROS." 12v. D.C. HEAVY DUTY SOLENOID. Size: 3" overall x 1 $\frac{1}{4}$ " x 1". Very powerful, with secondary low current hold coil. Cont. rated £1.00 each. P. & P. 15p.

"DECCO" MAINS SOLENOID. Compact and very powerful. 16 lb. pull. $\frac{1}{2}$ " travel which can be increased to 1" by removing captive-end-plate. Overall size 2" x 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " high. £1.50. P. & P. 25p.

"MAGNETIC DEVICES" Mains Solenoid.—2" x 1 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ " approx. 2lb. pull. Plunger Travel $\frac{1}{2}$ ". New in makers boxes; offered at half original cost. 75p. P. & P. 25p.

"FIBRE GLASS" COPPER CLAD. Top grade. One size only. 7 $\frac{1}{2}$ " x 4 $\frac{1}{2}$ " x $\frac{1}{2}$ ". 3 panels £1.00. 12 panels £3.50. P. & P. 15p.

"SRBP" COPPER CLAD. Sizes: 7 $\frac{1}{2}$ " x 4 $\frac{1}{2}$ " x $\frac{1}{2}$ " 16 for £1.00. 14 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " x $\frac{1}{2}$ " 8 for £1.00. 19 $\frac{1}{2}$ " x 7 $\frac{1}{2}$ " x $\frac{1}{2}$ " 4 for £1.00.

SLIDER SWITCHES. 3 amp. type D.P.D.T. 1" x $\frac{1}{2}$ " x $\frac{1}{2}$ " deep. 1 amp. type 3 P.D.T. 1 $\frac{1}{2}$ " x $\frac{1}{2}$ " x $\frac{1}{2}$ " deep. £1.25 per doz. Either type or mixed as required Carr. Paid.

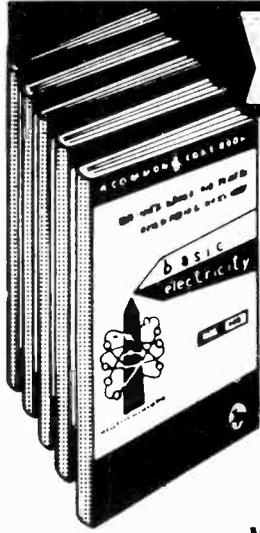
L.T. TRANSFORMERS. Prim. 0-110-240v. Sec. 4.5-0-4.5v. at 1 amp. Size: 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ ". 60p. P. & P. 15p
 Prim. 220/240 v. Sec. 0-5-10-15-20 v. at 2 amps. £1.25. P. & P. 15p

Prim. 200/240v Sec. 0-1-56-58-60 at 3.5 amps plus 0-90 at 100 ma. Wax impregnated with screw term. blocks. Weight 10 lbs £3.60 plus 40p P. & P.

CURRENT FLOW INDICATOR. Ideal for all types of battery operated equipment (portable machines, tape recorders etc.). Four white segments appear when current flows. Coil is 600Ω 6/12v. Drawing only 8 ma on function. Neat in appearance. Size: dia. $\frac{1}{2}$ " x $\frac{1}{2}$ " deep. Fixing centres $\frac{1}{4}$ ". £1.25 each. Carr. Paid.

ELECTRO-TECH SALES

BUSINESS HOURS: 264 PENTONVILLE ROAD, LONDON, N.1
 9.30-6 (1 p.m. Sat.) P.W.10 (ONE MIN. FROM KINGS X STATION) Tel. 01-837 74012



YOURS FREE FOR 7 DAYS

The 'New Picture-Book' way of learning BASIC ELECTRICITY (5 vols.) BASIC ELECTRONICS (6 vols.)

You'll find it easy to learn with this outstandingly successful NEW PICTORIAL METHOD—the essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate, cartoon-type drawing. The books are based on the latest research into simplified learning techniques. This has proved that the PICTORIAL APPROACH to learning is the quickest and soundest way of gaining mastery over these subjects.

TO TRY IT, IS TO PROVE IT

The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

WHAT READERS SAY

"BEST I HAVE EVER SET EYES ON."
 "shall definitely recommend to friends."
 F.C., Fife.

"WHAT A CONTRAST TO OTHER MANUALS."
 "Delighted, what a contrast to other Manuals I have grappled with."
 W.A.F., Durham.

"EASILY PRESENTED."
 "I didn't know this subject could be so easily presented."
 J.K., Earlsfield.

A TECH-PRESS PUBLICATION

POST NOW FOR THIS OFFER !!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT BR2 7HP
 Please send me WITHOUT OBLIGATION TO PURCHASE, one of the above sets on 7 DAYS FREE TRIAL, I will either return set, carriage paid, in good condition within 7 days or send the following amounts. BASIC ELECTRICITY £4.50. Cash Price on Down Payment of £1 followed by 4 fortnightly payments of £1 each (Total £5). BASIC ELECTRONICS £5.40. Cash Price or Down Payment of £1 followed by 5 fortnightly payments of £1 each (Total £6). This offer applies to UNITED KINGDOM ONLY. Overseas customers cash with order, prices as above.

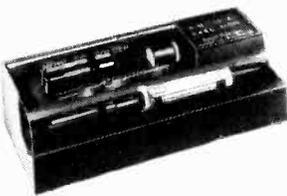
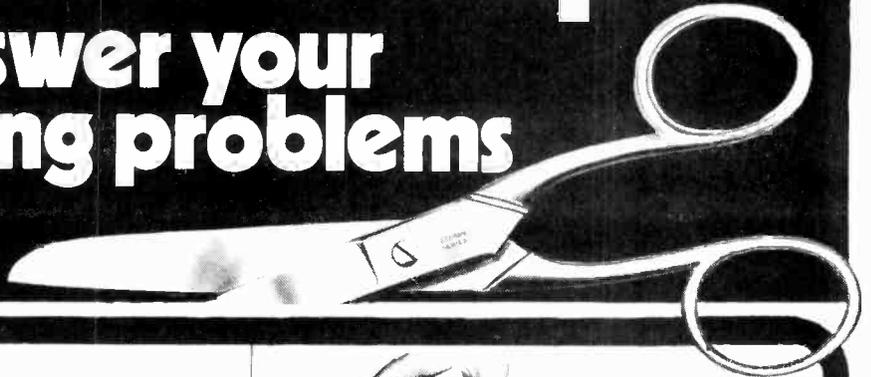
Tick Set required (Only one set allowed on free trial)

BASIC ELECTRICITY BASIC ELECTRONICS
 Prices include Postage and Packing.

Signature _____
 (If under 18 signature required of parent or guardian)

NAME _____
 BLOCK LETTERS
 FULL POSTAL ADDRESS _____

cut out this coupon and answer your soldering problems



SK1 SOLDERING KIT

In rigid plastic "tool box" containing Model CN - 15 watts - 240 volts miniature iron fitted $\frac{3}{16}$ " bit. Spare bits $\frac{5}{32}$ " and $\frac{3}{32}$ ". Reel of resin-cored solder, heat sink, cleaning pad, stand and booklet "How to Solder".

£2.75



SK2 SOLDERING KIT

In polystyrene pack, containing 15 watt miniature soldering iron, 240 volts fitted with $\frac{3}{16}$ " bit, 2 spare bits $\frac{5}{32}$ " and $\frac{3}{32}$ ". Coil of resin-cored solder, heat sink, 1A fuse and booklet "How to Solder".

£2.40

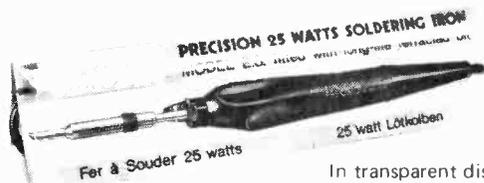


Model CN 240/2

- 15 watts
- 240 volts

Fitted with nickel plated $\frac{3}{32}$ " bit and packed in handy transparent box.

£1.70



ES240 D 25 watt
soldering iron

In transparent display pack, fitted with long life iron-coated bit $\frac{1}{8}$ " diam. Interchangeable spare bits $\frac{3}{32}$ ", $\frac{1}{16}$ ", $\frac{1}{4}$ " (extra) available. Improved design to ensure strong and reliable high speed iron. Heats up in 2 minutes.

£1.83



M.E.S. Battery-operated 12 volt soldering iron

Complete with 15 ft (4.50m) lead, 2 heavy gauge clips for instant

connection to car battery and a guide 'How to Solder'.

Packed in strong plastic wallet.

£1.95



from electrical and radio shops or by Free Post (No stamp required) from ANTEX Ltd. FREE POST. PLYMOUTH, PL1 1BR
Tel: (0752) 67377/8

- Please send the ANTEX colour catalogue.
- Please send the following:

I enclose cheque / P.O. / Cash (Giro No. 2581001)

NAME

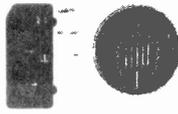
ADDRESS

PE 10

“many a mickle makes a muckle”

(small gains mount up)

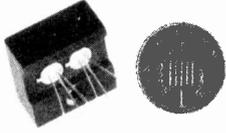
BRIDGE RECTIFIERS




Four silicon rectifiers interconnected as single-phase full-wave bridge in one four-terminal package. Current handling from 1 to 5A dc. and voltage ratings from 100 to 420V dc. First code number reflects dc. current and last three dc. voltage ratings—D1100-1A, 100V.

Send for Information Bulletin VB

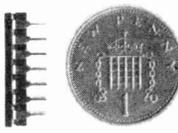
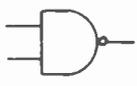
DIFF. AMP. PAIRS




Transistors, f.e.t.s. or diodes available in closely matched pairs, loose or in special heat sinks. Available as standards (such as the BCY55 h_{FE}/V_{BE} matched pair) or with special close-tolerance matching of other parameters such as V_F , V_P , I_{OSS} , I_{CBO} or I_{GSS} .

Send for Information Bulletin VH

DIGITAL I.C.'s

A range of gates, flip flops, etc. in both "DTL 930", and TTL "74" series. Normally in dual-in-line packages, but T05 or flat pack available. NKT codings enable immediate identification with corresponding "930" or "74" series; e.g. NKT DIC 936=DTL 936 and NKT DIC 7400=SN 7400.

Send for Information Bulletin VG

DIODES




Germanium and Silicon diodes for most switching and small signal purposes including such standards as 1N914, 1N4148, OA91, and OA47. Germanium junction high-current diodes also available. Special selections for V_F , C_D , I_A , etc. on request. Thermal biasing diodes a speciality.

Send for Information Bulletin VR

DUAL TRANSISTORS




Two isolated high-gain, low-leakage, low-noise transistor chips mounted in close physical and thermal proximity in an industry standard 6-lead T05 package, and closely matched for V_{BE} and h_{FE} provide best low-drift front end for instrumentation differential amplifiers.

Send for Information Bulletin VD

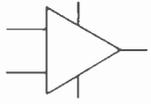
FET's




NKT markets a range of N-channel, junction-gate f.e.t.s. (field effect transistors) covering dc, a.f., r.f. and switching applications. The NKT 80420 series are in four-lead T072 metal cans and the PN 3819 in plastic T018 style. Special selections of V_P and I_{OSS} can be provided.

Send for Information Bulletin VF

LINEAR IC'S

NKT has an expanding range of industrial linear I.C.'s, such as the LIC 709C (=uA709C), LIC 723C (=uA723C), and LIC 741C (=uA741C). Packages are normally 14-lead dual-in-line (indicated by "/14") after type number, but T05 ("5") and 8-lead dual-in-line ("8") are available.

Send for Information Bulletin VA

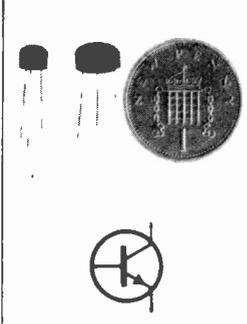
OPTOELECTRONICS




The NKT 7000 range contains infra-red emitting diodes (LED'S), visible light diodes (VLED'S), photo-transistors, photo-scr's, photo-resistors, photo-voltaic cells and optical couplers. Both plastic and hermetic glass-metal-seal packages are available.

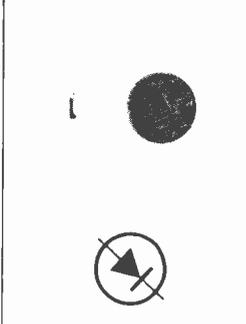
Send for Information Bulletin VO

non-transistors from Newmarket Transistors



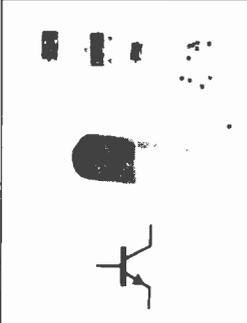
PLASTIC TRANSISTORS

A wide range of plastic transistors with code numbers identifiable with the related metal-can industrial types e.g. PN70/71/72 (=BCY 70/71/72) PN 107/8/9 (=BC 107/8/9), PN 918 (=2N 918), PN 1613/1711 (=2N 1613/1711), PN 2904-7 (=2N 2904-7), PN 3054 (3A NPN "tab" power). Send for Information Bulletin VP



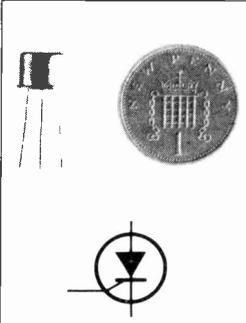
RECTIFIERS

Small flying lead rectifiers with $\frac{1}{2}$ and 1A current ratings at voltages from 100 to 1000V in industry standard package. Apart from such standards as the 1N4001-4007 series, NKT provides special selections on characteristics such as leakage or forward voltage drop. Send for Information Bulletin VR



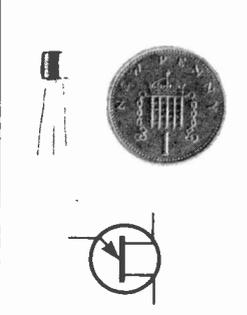
MICRO DEVICES

As manufacturers of thick film hybrid circuits, NKT specialises in the supply of microminiature semiconductor active devices for attachment to film circuits—the range includes unencapsulated chips, leadless inverted devices (LID's), microtab and flexible lead types. Send for Information Bulletin VS



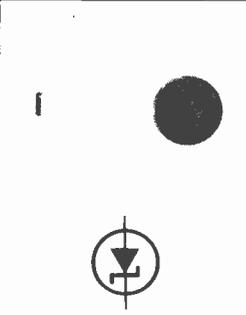
THYRISTORS

NKT specialises in the area of low current (up to 1A) thyristors in industrial metal can and economical plastic packages. The range stretches from the plastic NTS 311 (30V, 0.6A) to the T05 metal can NTS 1500 (500V, 1A) via the T018 NTS 0660 (60V, 0.6A). Send for Information Bulletin VT



UNIUNCTIONS

In unijunctions, NKT has available the well tried industry-standard metal-can 2N 2646/7 and 2N 1671B, as well as economical plastic devices for less onerous applications where cost is the overriding factor. Send for Information Bulletin VU



ZENER DIODES

Completing the array of standard non-transistor devices, NKT provides a useful range of zener diodes. As well as the industry standard 400mW "work horse" (BZY 88/3.3-30V), the range features an economical 1W zener range, the NKT 10C-V-(11-30V). Send for Information Bulletin VZ

Distributors

For further details contact one of the distributors listed below. (In the case of large scale requirements you can save time by referring direct to Newmarket).

Eastern Aero Electrical Services Ltd.,
Building 202,
Enfield Road, London
(Heathrow) Airport,
Hounslow, Middlesex.
Tel: 01-759 1314

S.D.S. (Portsmouth) Ltd.,
Hilsea Industrial Estate,
Portsmouth PO3 5JW Hampshire.
Tel: 0715/65311
Telex: 86114

I.T.T. Electronic Services Ltd.,
Edinburgh Way,
Harlow,
Essex.
Tel: 02796-26777
Telex: 81146

L.S.T. Electronic Components Ltd.,
7 Coptfold Road,
Brentwood,
Essex.
Tel: Brentwood 226470
Telex: 99443

G.S.P.K. (Sales) Ltd.,
Hookstone Park,
Harrogate,
Yorkshire.
Tel: Harrogate 86258
Telex: 57962

Hird-Brown Electronics Ltd.,
Lever Street,
Bolton BL3 6BJ
Lancashire
Tel: Bolton 27311
Telex: 63478

Coventry Factors Ltd.,
Coronet House,
Upper Well Street,
Coventry VC1 4AF
Warwickshire,
Tel: 0203-21051/5
Telex: 311243

NKT

NEWMARKET TRANSISTORS LTD.,
EXNING ROAD, NEWMARKET, SUFFOLK
Tel: 0638-3381 Telex 81358

ONLY FROM US! FIRST SHIPMENT JUST ARRIVED!

BRAND NEW 1971 Model!

RUSSIAN WORLD BEATER!

6 WAVEBAND 10 TRANSISTOR PORTABLE RADIO

WORLD WIDE RECEPTION

£9.97

THOUSANDS OF TRANSMISSIONS AND STATIONS THE WORLD OVER!

BOX POST ETC. 43p

NOT JUST A RADIO—BUT TECHNOLOGICAL MAGIC!

WE COULDN'T EVEN MAKE THEM FOR THIS PRICE!



THE LATEST 1971 MODEL, SUPERSEDING ALL PREVIOUS MODELS.—FANTASTIC BRAND NEW RUSSIAN 6 WAVEBAND PORTABLE RADIO—DESIGNED FOR WORLD WIDE RECEPTION. Only put into production after incorporation of every conceivable possible up-to-date technological improvement had been carefully considered and thoroughly examined. So advanced it will probably make your present radio seem like a "crystal set"! It's far better than any 6-wave radio even they have produced! Finest value we've ever offered! We're almost giving them away at £9.97—a mere fraction of even today's Russian miracle price! We challenge you to compare performance and value with that of £34 radios! ★ Instant refund if you are not astounded! Purer and sweeter tone than ever! Much wider band spread than hitherto for "pin-point" station selection. Once again the Russians have proved their fantastic ability in electronics—brilliantly reflecting their advanced micro-circuitry techniques in the field of spaceship and satellite communications. **YOU GET THIS AMAZING SET FROM US AT A PRICE THAT BEARS NO RELATION TO TRUE VALUE!** Yes, 6 separate wavebands, including Standard, Long, Medium and Short Waves to cover world! Unique side control waveband selection unit gives incredible ease of station tuning! Thousands of different transmissions and stations at your fingertips 24 hours a day, even ships at sea and messages from all over the world—nothing is secret! The radio enthusiast has the world in his hand! Superb, sweet tone—controlled from a whisper to a roar. Push-pull output! Separate ON/OFF volume and Treble/Bass tone controls! Take it anywhere—runs economically on standard batteries. Internal ferrite rod aerial plus built-in telescopic aerial extending to full 33in length. It's also a fabulous **CAR RADIO**—any speed, requires no additional aerial. **UNIQUE!** Elegant Black, White and Chrome finish case. **SIZE 10in x 8in x 3in** overall approx. Magnetically designed, made to give years of perfect service. With **WRITTEN GUARANTEE**, manual with simple operating instructions and circuit diagram. **ONLY £9.97, POST ETC. 43p.** Standard batteries 25p extra. Can also be used through extension amplifier, tape recorder or public address. Shopertunities for bargains. Send quickly or call.

***COMPARE ITS PERFORMANCE with £34 RADIOS!**

SAVE £13.98 NOW!

FIRST CLASS MAKER'S

BRAND NEW Cassette TAPE RECORDER and PLAYER

fabulous 1971 model

RECOMMENDED LIST PRICE £26.97

OUR PRICE £12.99

POST ETC. 30p

WITH REMOTE CONTROL, MICROPHONE



MAKE NO MISTAKE—this is the **EXPENSIVE** model with "PIANO KEYBOARD" CONTROL PANEL and "MAGIC EYE" AUTOMATIC LEVEL! **SAVE £13.98!** Due to price we cannot mention famous maker's name—but rest assured you're getting one of the BEST! 1971 cassette model—no fiddling with awkward tape and reels, just "slap-in" a cassette and off you go! (takes 30, 60 or 90 minute standard Philips cassette tapes obtainable everywhere). Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Separate volume control! Rapid rewind! Beautiful tone from a whisper to a roar! Completely self-contained—record anywhere. Separate jacks for remote control microphone, etc. Size 9in x 4½in x 2½in overall approx. Case design can vary slightly. **WRITTEN GUARANTEE** and instructions. **Only £12.99** post 30p. Refund guarantee. **BONUS** one per customer: Cassette tape, set of standard batteries AND microphone stand all for 51p extra if required. Refund if not delighted.

WHY PAY £40 OR MORE?

ADVANCED COMPLETE HIGH FIDELITY COMMUNICATIONS & RADIO RECEIVER

VHF—WITH SPECIAL AIRCRAFT WAVEBAND

AND AC/DC MAINS and BATTERY

BUILT-IN MAINS BATTERY BOOSTER!

MIRACULOUS PRICE — REDUCED TO

£9.99 POST ETC. 30p



Yes—advance 1972 model—NOW! Our introductory price is miraculous! Control to AIRCRAFT, SHIPS, POP PIRATES, TAXIS, AMBULANCES, LOCAL STATIONS, CONTINENTAL STATIONS, ALL B.B.C., V.H.F. AND MANY MORE, including public service transmissions we are not allowed to mention! Far more than an ordinary radio! Frequency range: MW 540-1600 KHz. FM 88-108MHz. Air 108-145 MHz. Intermediate Frequency: AM 455KHz. FM 10.7MHz. Air 10.7MHz. 18 SEMI-CONDUCTORS—Transistors 11. Diodes 6+Thermister! Automatic frequency control "locks-in" eliminating drift. Pinpoint station selection! Built-in 8-section 36in Telescopic aerial. Leather grained finish case with carry handle. 10½in 6½in x 4in overall approx. **Written guarantee. Only £9.99, post etc., 30p.** Runs off mains—**a.c. 230-250 volts**, or off standard batteries! But that's not all! It's got a built-in Battery Booster too! Just plug in to mains whenever you wish! *** Compare it with sets costing £40 or more. Refund guaranteed. BONUS TO EVERY PURCHASER!** Shoulder Strap earphone for personal listening and dry batteries, all for 31p extra, if required.

SHOPERTUNITIES LTD. SL Dept. PE/9, 164 UXBRIDGE RD. London, W12 8AQ (Thurs. 1, Fri. 7), (facing Shepherd's Bush Green). Also 37 High Holborn, London, WC1. (Thursday 7 p.m.). Both open Mon. to Sat. from 9 to 6.

TV's

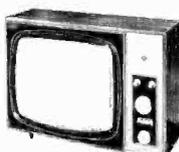
19" NOW £11.95

TWO YEARS GUARANTEE ALL MODELS

405/625: 19" £29.95; 23" £39.95

FREE CATALOGUE

DAILY DEMONSTRATIONS FOR PERSONAL SHOPPERS



COMPONENTS MUST BE CLEARED

Transistor Radio Cases: 25p each. Size 9½" x 6½" x 3½". Post 15p.
Speakers: 15p. 2½" 8Ω. Brand new. Post 15p.
VHF/FM Tuners: 95p. 88-108 mcs. takes EEC85 valve (extra). Post 15p.
BSR R/P Motors: 95p. £1.95 new. 200/250V. Post 20p.
Precision Tape Motors: Brand new. 200/250V. Famous German manufacturer. Post 20p.
Transistor Gang Condensers: 20p. Miniature AM. Post free.
Modern Gang Condensers: 30p. AM/FM or AM only 20p. Post 10p.
Transistors 15p each. Post free. AC126, AC128, AF14, AF17, OC45, OC71, OC81, OC81D. Valve ELL80 50p. Only stock in the country.
Pots: 25p each. Post 5p. D SW 500/500 KΩ. D SW 500/100 KΩ. D SW 1 meg/100 KΩ. S SW 500/500 KΩ. S SW 500/1 meg. 625 UHF Aerial: £1.95. 10 Element fitting. Post 20p.

Knobs: 100,000 to clear. Brand New. 100 assorted radio and tv knobs. 50p. Post 25p.
Radios £3.95 8 Transistor LW/MW. Free Case, Battery. Post 15p.
Personal 6 Transistor MW. £2.95. Post 15p.

TV TUBES REBUILT GUARANTEED 2 YEARS



14" £3.95; 17" & 19" £5.95; 21" & 23" £6.45

Exchange Bowls carr. 55p.

TEAK HI-FI STEREO CABINETS £14.95

Brand new 44" wide x 16" deep x 18" high with legs. A superb piece of furniture. Carriage £1. WHILE STOCKS LAST.

DUKE & CO. (LONDON) LTD.

621/3 ROMFORD ROAD, MANOR PARK, E.12

Phone 01-478 6001-2-3 Stamp for Free List

AMAZING MINI-DRILL

Indispensable for precision drilling, grinding, polishing, etching, gouging, shaping. Precision power for the enthusiast. Shockproof. Completely portable power from 4½ volt external battery. So much more scope with MINI-DRILL. Super Kit (extra power, interchangeable chuck) £4.50 p.p. 13p.
De Luxe Professional Kit with 17 tools £7 p.p. 23p.
Money Ref. Guarantee.

FOR PRECISION MODEL WORK

ABRASIVE
SPEAR DRILL
BURR
NIP
BRUSH

+ 6 TOOLS

ONLY £2 P. & P. 10p

MERLIN SUPPLY CO.

Dept. PE10D, Nailsea, Bristol BS19 2LP



YUKAN SELF-SPRAY

SO PROFESSIONAL THE YUKAN AEROSOL WAY—

Get these air drying **GREY HAMMER** or **BLACK WRINKLE** (CRACKLE) finishes

Yukan Aerosol spraykit contains 453g fine quality, durable easy instant spray. No stove baking required. Hammers available in grey and blue. 90p can. pd. Modern Eggshell Black Wrinkle (Crackle) producing a 3D textured finish. 90p can. pd. all at 85p per push-button self-spray can at our counter. Also durable, heat and water resistant Black Matt finish (339g self-spray cans only) 75p can. pd.

SPECIAL OFFER: One can plus optional transferable snap-on trigger handle (value 25p) for 96p can. pd. Choice of 13 self-spray plain colours and primer (motor car quality) also available.

Please enclose cheque or crossed P.O. for total amount direct to

DEPT: K9 YUKAN, 307A EDGWARE ROAD, LONDON W2 1BN

We supply many Government Departments, Municipal Authorities, Institutes and Leading Industrial Organisations—We can supply you too. *Now British even better.*

Other Yukan Air Drying Aerosols 453g at 90p can. pd. include: Zinc Chromate Clear Lacquer, Metallics Grey, Blue.



TRANSISTORS

NEW LIST—NEW PRICES
SEND FOR FREE COPY TODAY
Brand New Fully Guaranteed

| | | | | | |
|---------|-------|---------|-----|---------|-------|
| 2N404 | 20p | BC107 | 12p | BY213 | 25p |
| 2N696 | 15p | BC108 | 12p | BY2184 | 00 |
| 2N697 | 15p | BC112 | 12p | GE1800 | 37p |
| 2N706 | 10p | BC113 | 12p | MAF100 | 25p |
| 2N708A | 12p | BC114 | 25p | MAT101 | 30p |
| 2N930 | 25p | BC115 | 20p | MAT120 | 25p |
| 2N1131 | 25p | BC116 | 20p | MAT121 | 30p |
| 2N1132 | 25p | BC116A | 30p | MJ2801 | £1.37 |
| 2N1302 | 20p | BC118 | 25p | MJ2901 | £2.25 |
| 2N1303 | 20p | BC119 | 25p | MJ2370 | 97p |
| 2N1304 | 25p | BC124 | 25p | MJ2620 | 87p |
| 2N1305 | 25p | BC135 | 20p | MJ2955 | |
| 2N1306 | 25p | BC136 | 22p | | £1.37 |
| 2N1307 | 25p | BC137 | 25p | MJE3055 | 87p |
| 2N1308 | 25p | BC138 | 25p | MPF102 | 42p |
| 2N1309 | 25p | BC147 | 17p | MPF103 | 35p |
| 2N1613 | 22p | BC148 | 12p | MP104 | 37p |
| 2N1711 | 25p | BC149 | 20p | MP105 | 40p |
| 2N2147 | 75p | BC154 | 87p | NK7217 | 40p |
| 2N2160 | 60p | BC157 | 20p | NKT277 | 20p |
| 2N2218 | 20p | BC165 | 17p | NKT403 | 75p |
| 2N2219 | 20p | BC169 | 20p | NKT404 | 62p |
| 2N2220 | 20p | BC169C | 15p | OAS | 20p |
| 2N2222 | 25p | BC177 | 25p | OA9 | 10p |
| 2N2269 | 20p | BC178 | 25p | OA10 | 25p |
| 2N2484 | 35p | BC179 | 27p | OA47 | 10p |
| 2N2646 | 50p | BC182L | 12p | OA70 | 10p |
| 2N2904 | 20p | BC183L | 12p | OA73 | 10p |
| 2N2904A | 25p | BC184L | 15p | OA79 | 10p |
| 2N2905 | 25p | BC212 | 12p | OA81 | 10p |
| 2N2906 | 20p | BCY30 | 25p | OA85 | 12p |
| 2N2906A | 25p | BCY31 | 25p | OA91 | 7p |
| 2N2907 | 25p | BCY32 | 50p | OA91 | 7p |
| 2N2926 | 10p | BCY33 | 50p | OA95 | 7p |
| 2N3011 | 25p | BCY34 | 30p | OA200 | 7p |
| 2N3053 | 20p | BCY38 | 40p | OA202 | 10p |
| 2N3054 | 50p | BCY39 | 85p | OC18 | 50p |
| 2N3055 | 75p | BCY40 | 50p | OC20 | 97p |
| 2N3525 | | BCY45 | 25p | OC22 | 45p |
| | £1.10 | BCY39 | 25p | OC23 | 60p |
| 2N3702 | 10p | BCY70 | 15p | OC24 | 60p |
| 2N3703 | 10p | BCY71 | 20p | OC25 | 37p |
| 2N3704 | 15p | BCY72 | 15p | OC26 | 25p |
| 2N3705 | 15p | BCY78 | 30p | OC28 | 60p |
| 2N3707 | 15p | BCY79 | 30p | OC29 | 60p |
| 2N3709 | 10p | BCZ10 | 35p | OC30 | 60p |
| 2N3710 | 10p | BD111 | 45p | OC36 | 60p |
| 2N3819 | 35p | BD112 | 50p | OC41 | 25p |
| 2N3820 | 60p | BD121 | 65p | OC42 | 30p |
| 2N4058 | 15p | BD123 | 60p | OC43 | 40p |
| 2N4061 | 15p | BD124 | 75p | OC44 | 17p |
| 2N4347 | 35p | BD125 | 50p | OC45 | 15p |
| 2N4548 | 37p | BD131 | 75p | OC49 | 12p |
| 2N4549 | 50p | BD132 | 45p | OC71 | 15p |
| 2S301 | 50p | BD153 | 82p | OC72 | 25p |
| 2S302 | 50p | BD156 | 57p | OC73 | 30p |
| 2S303 | 60p | BDY1081 | 25p | OC74 | 30p |
| 2S304 | 75p | BDY1161 | 62p | OC75 | 25p |
| 40250 | 50p | BDY1721 | 50p | OC76 | 25p |
| 40361 | 50p | BDY1821 | 75p | OC77 | 25p |
| 40362 | 55p | BDY1921 | 97p | OC81 | 25p |
| AA530 | 10p | BDY6121 | 25p | OC82 | 25p |
| AA542 | 15p | BDY6221 | 00p | OC83 | 25p |
| AAZ13 | 12p | BF115 | 25p | OC84 | 25p |
| AAZ17 | 10p | BF152 | 30p | OC139 | 25p |
| AC107 | 37p | BF184 | 40p | OC140 | 37p |
| AC116 | 25p | BF158 | 30p | OC141 | 62p |
| AC127 | 25p | BF162 | 25p | OC170 | 25p |
| AC128 | 25p | BF167 | 25p | OC171 | 30p |
| AC176 | 25p | BF170 | 35p | OC200 | 40p |
| AC187 | 30p | BF173 | 30p | OC201 | 70p |
| AC188 | 30p | BF177 | 40p | OC202 | 80p |
| AC197 | 30p | BF178 | 25p | OC203 | 40p |
| ACY18 | 25p | BF179 | 45p | OC204 | 40p |
| ACY19 | 25p | BF180 | 35p | OC205 | 75p |
| ACY20 | 20p | BF181 | 35p | OC206 | 90p |
| ACY21 | 20p | BF182 | 30p | OC207 | 80p |
| ACY22 | 10p | BF184 | 20p | OC271 | 97p |
| ACY39 | 50p | BF185 | 20p | ORP12 | 50p |
| AD140 | 15p | BF194 | 17p | ORP13 | 40p |
| AD149 | 50p | BF195 | 45p | ORP61 | 42p |
| AD149 | 50p | BF196 | 15p | TIP29A | 50p |
| AD161 | 37p | BF197 | 15p | TIP30A | 60p |
| AD162 | 37p | BF200 | 37p | TIP31A | 62p |
| AF114 | 25p | BF274 | 37p | TIP32A | 75p |
| AF115 | 25p | BFX13 | 25p | TIP33A | |
| AF116 | 25p | BFX30 | 25p | | £1.00 |
| AF117 | 25p | BFX30 | 25p | | £2.00 |
| AF118 | 62p | BFX37 | 32p | TI843 | 40p |
| AF124 | 25p | BFX84 | 25p | TI860 | 22p |
| AF125 | 20p | BFX85 | 35p | TI861 | 25p |
| AF126 | 17p | BFX86 | 25p | TI862 | 27p |
| AF127 | 17p | BFX87 | 25p | ZTX107 | 15p |
| AF139 | 30p | BF198 | 45p | ZTX108 | 15p |
| AF178 | 47p | BFY18 | 30p | ZTX301 | 12p |
| AF179 | 65p | BFY50 | 22p | ZTX302 | 20p |
| AF180 | 52p | BFY51 | 20p | ZTX303 | 25p |
| AF181 | 42p | BFY52 | 22p | ZTX304 | 25p |
| AF186 | 40p | BFY53 | 17p | ZTX500 | 20p |
| AF239 | 40p | BSX20 | 65p | ZTX501 | 25p |
| ASY26 | 25p | BSX29 | 20p | ZTX502 | 25p |
| ASY27 | 32p | BSX21 | 20p | ZTX503 | 25p |
| ASY28 | 25p | BSX76 | 15p | ZTX504 | 40p |
| ASY29 | 30p | BSY95 | 15p | ZTX531 | 30p |
| ASY67 | 47p | BSY95A | 15p | | |
| AS221 | 42p | BY100 | 15p | | |
| BA115 | 7p | BY126 | 15p | | |
| BA194 | 7p | BY127 | 20p | | |
| BAX13 | 6p | BY182 | 85p | | |
| BAX16 | 7p | BY210 | 40p | | |
| BAY31 | 7p | BYZ11 | 35p | | |
| BAY38 | 17p | BYZ12 | 30p | | |

HENRY'S LOW COST INTEGRATED CIRCUITS

WE OFFER FROM STOCK AN EXCLUSIVE RANGE OF BRAND NEW CERAMIC FULL SPECIFICATION LOW COST TTL 7400 RANGE BY I.T.T., TEXAS, FAIRCHILD

| Part No. | Ceramic | Description | Price and Qty. |
|----------|---------|--|-------------------------|
| 7400 | | Quadrate 2-input NAND Gate | 1 24 25 89 10 250 + |
| 7401 | | Quadrate 2-input Positive NAND Gate (with open collector output) | 20p 18p 15p 13p |
| 7402 | | Quadrate 2-input Positive NOR Gates | 20p 18p 15p 13p |
| 7403 | | Quadrate 2-input Positive NAND Gates (with reset collector output) | 20p 18p 15p 13p |
| 7404 | | Hex Inverter | 20p 18p 15p 13p |
| 7405 | | Hex Inverter with open collector | 20p 18p 15p 13p |
| 7410 | | Triple 3-input Positive NAND Gates | 20p 18p 15p 13p |
| 7413 | | Dual 4-input Schmitt Trigger | 35p 32p 29p 25p |
| 7420 | | Dual 4-input Positive NAND Gates | 20p 18p 15p 13p |
| 7430 | | 8-input Positive NAND Gates | 20p 18p 15p 13p |
| 7440 | | Dual 4-input Positive NAND Buffers | 20p 18p 15p 13p |
| 7441 | | BCD to decimal mixer driver | 87p 77p 66p 60p |
| 7442 | | BCD to decimal decoder (4-10 lines, 1 of 10) | 87p 77p 66p 60p |
| 7447 | | BCD-Seven-Segment Decoder/Drivers (15-V Outputs) | £1.40 £1.30 £1.20 £1.05 |
| 7450 | | Expandable dual 2-input AND-OR-INVERT | 20p 18p 15p 13p |
| 7451 | | Dual 2-wide 2-input AND-OR-INVERT GATES | 20p 18p 15p 13p |
| 7453 | | Dual 2-input Expandable AND-OR-INVERT | 20p 18p 15p 13p |
| 7454 | | 4-wide 2-input AND-OR-INVERT Gates | 20p 18p 15p 13p |
| 7460 | | Dual 4-input Expander | 35p 32p 29p 25p |
| 7470 | | Single-stage J-K Flip-Flop | 35p 32p 29p 25p |
| 7472 | | Master-slave J-K Flip-Flop | 43p 40p 37p 33p |
| 7473 | | Dual Master-slave J-K Flip-Flop | 43p 40p 37p 33p |
| 7474 | | Dual 0-type Flip-Flop | 43p 40p 37p 33p |
| 7475 | | Quad latch | 47p 45p 43p 40p |
| 7476 | | Dual J-K with pre-set and clear | 47p 45p 43p 40p |
| 7480 | | Gated Full Adders | £1.30 £1.25 £1.15 £1.00 |
| 7481 | | 16-bit read/write memory | £1.30 £1.20 £1.00 85p |
| 7482 | | 2-bit Binary Full Adders | 87p 77p 67p 60p |
| 7483 | | Quad Full Adder | 80p 70p 60p 50p |
| 7486 | | Quad 2-input Exclusive OR Gates | 87p 77p 67p 60p |
| 7489 | | BCD decade counter | £1.91 £1.10 87p 75p |
| 7492 | | 8-bit Shift Registers | 87p 77p 67p 60p |
| 7493 | | 4-bit Binary Counters | 87p 77p 67p 60p |
| 7494 | | Dual entry 4-bit shift register | 87p 77p 67p 60p |
| 7495 | | 4-bit up-down shift register | 87p 77p 67p 60p |
| 7498 | | 5-bit Parallel in parallel out Shift Register | 87p 77p 67p 60p |
| 74100 | | 8-bit Bistable Latches | £1.75 £1.65 £1.65 £1.35 |
| 74118 | | Hex Set-Reset Multiplexers | £1.30 £1.20 £1.00 85p |
| 74121 | | Monostable Multivibrators | 87p 77p 67p 60p |
| 74141 | | BCD-to-Decimal Decoder/Driver | 87p 77p 67p 60p |
| 74145 | | BCD-to-Decimal Decoder/Drivers | £1.80 £1.70 £1.60 £1.50 |
| 74151 | | 8-bit Data Selectors (with Strobes) | £1.40 £1.30 £1.20 £1.05 |
| 74153 | | Dual 4-Line-to-1-Line Data Selectors/Multiplexers | £1.40 £1.30 £1.20 £1.05 |
| 74191 | | Binary Counter reversible | £2.50 £2.25 £2.00 £1.50 |

Devices may be mixed to qualify for quantity price. Data available for above series in booklet form, price 10p. (Ref No. 30). Larger quantity prices Extn. 4. Dual in-line 14 Pin Socket 30p each 16 Pin 35p each.

SEMI-CONDUCTORS

LOOK AT THESE PRICES FOR QUANTITIES FROM STOCK

| | | | |
|-------------------|------------------------------------|------------------------------|--|
| AF114 Mullard 25p | 25 + 20p 100 + 17p 500 + 15p | AF115 Mullard 25p | 25 + 20p 100 + 17p 500 + 15p |
| AF116 Mullard 25p | 25 + 20p 100 + 17p 500 + 15p | AF117 Mullard 25p | 25 + 20p 100 + 17p 500 + 15p |
| 2N3055 75p | Mullard 115watt Silicon Power | 2N3819 Texas 35p | Motorola Unijunction |
| BFY90 65p | 1000 MC/S | 2N2646 40p | 25 + 30p 100 + 25p 500 + 20p 1000 + 18p |
| AF139 30p | Siemens V.H.F. | AF186 40p | Motorola V.H.F. |
| OC170 Mullard 25p | 25 + 21p 100 + 17p 500 + 15p | BY127 Mullard 20p | 25 + 35p 100 + 30p 500 + 25p |
| OC171 Mullard 30p | 25 + 27p 100 + 22p | BC107, BC108, BC109 12p each | I.T.T. Planars |
| BY127 Mullard 20p | 1000V 1 amp Plastic | OC717 97p | Mullard Power |
| BC113 SGS 15p | 25 + 13p 100 + 11p 500 + 9p | OA202 10p | SILICON Diodes |
| OC28 62p | 25 + 45p 100 + 42p 500 + 42p | OC42 Mullard 30p | 25 + 12p 100 + 10p 500 + 8p |
| OC71 Mullard 15p | 25 + 12p 100 + 10p 500 + 8p | OC45 Mullard 15p | 25 + 13p 100 + 12p 500 + 10p |
| ORP12 Mullard 50p | 25 + 45p 100 + 42p 500 + 42p | OC75 Mullard 25p | 25 + 21p 100 + 17p 500 + 15p |
| OC20 97p | Mullard 100V | OC81 Mullard 25p | 25 + 20p 100 + 17p 500 + 15p |
| OC83 25p | 25 + 20p 100 + 17p 500 + 15p | AF239 42p | 25 + 35p 100 + 30p 500 + 25p 1000 + 20p |

SILICON RECTIFIERS

| | |
|---|--|
| 1 AMP MINIATURE WIRE ENDED PLASTIC RECTIFIERS | Type P.I.V. 1-49 50 + 100 + 500 + 1000 + |
| IN4001 50 8p | 7p 6p 5p 4p |
| IN4002 100 9p | 8p 7p 5p 4p |
| IN4003 200 10p | 9p 7p 6p 5p |
| IN4004 400 10p | 9p 8p 7p 6p |
| IN4005 600 12p | 10p 9p 7p 7p |
| IN4006 800 15p | 14p 12p 11p 9p |
| IN4007 1000 20p | 16p 13p 12p 10p |
| 1.5 AMP MINIATURE WIRE ENDED PLASTIC RECTIFIERS | Type P.I.V. 1-49 50 + 100 + 500 + 1000 + |
| PL4001 50 10p | 9p 8p 7p 6p |
| PL4002 100 11p | 10p 9p 8p 7p |
| PL4003 200 12p | 11p 10p 9p 8p |
| PL4004 400 12p | 11p 10p 9p 8p |
| PL4005 600 15p | 13p 11p 10p 9p |
| PL4006 800 17p | 15p 13p 12p 10p |
| PL4007 1000 20p | 17p 15p 13p 11p |
| 3 AMP PLASTIC WIRE ENDED RECTIFIERS | Type P.I.V. 1-49 50 + 100 + 500 + 1000 + |
| PL7001 50 20p | 18p 17p 16p 14p |
| PL7002 100 20p | 18p 18p 17p 15p |
| PL7003 200 22p | 20p 19p 18p 16p |
| PL7004 400 25p | 23p 21p 20p 18p |
| PL7005 600 28p | 24p 23p 22p 20p |
| PL7006 800 27p | 25p 24p 23p 21p |
| PL7007 1000 30p | 28p 26p 24p 22p |

| | |
|--|-----------------------|
| POTTED BRIDGE RECTIFIERS (SILICON) SIZE $x \times x \times x$ ins. | Cur. |
| Type P.I.V. 1-49 50 + 100 + 500 + | |
| 2002 200 2 amps | 70p 65p 60p 55p |
| 4002 400 2 amps | 80p 75p 70p 65p |
| 1004 100 4 amps | 70p 60p 55p 50p |
| 2004 200 4 amps | 75p 70p 65p 60p |
| 4004 400 4 amps | 80p 75p 70p 65p |
| 6002 600 2 amps | 90p 80p 75p 70p |
| 8002 800 2 amps | 90p 80p 75p 70p |
| 10002 1000 6 amps | 75p 70p 65p 60p |
| 20006 200 6 amps | 80p 75p 70p 65p |
| 40006 400 6 amps | £1.10 £1.00 80p 80p |
| 60006 600 6 amps | £1.25 £1.10 £1.00 90p |

INTEGRATED CIRCUITS

| | |
|-----------|------------|
| MCFC4000P | LA709C 85p |
| I.C. 12 | £1.12 |
| PA246 | £2.45 |
| TA2463 | 75p</ |

28watts, r.m.s. 40Hz to 40kHz \pm 3dB



Viscount III Audio Suite complete £49

There are two stereo amplifiers—the R100 for ceramic cartridges, the R101 for magnetic. Both incorporate FETs (FIELD EFFECT TRANSISTORS), just like top-priced units. FETs give you more of the signal you want, and almost none of the background hiss you don't. Both units have a jack socket to plug in headphones and there's a separate output for tape recorder. Filters (an unusual feature in this price range) and tone controls give a wide range of bass and treble adjustment which compensate for input deficiencies and domestic acoustic conditions.



PRICES SYSTEM 1

| | | |
|--|-------------|-------|
| Viscount III R101 amplifier | £22 + 90p | P.&P. |
| 2 x Duo Type II speakers | £14 + £2 | P.&P. |
| Garrard SP25 Mk. III with MAG. cartridge, plinth and cover | £23 + £1.50 | P.&P. |
| Total | £59 | |

Available complete for only **£52 - £3.50**

P.&P.

SYSTEM 2

| | | |
|--|-------------|-------|
| Viscount III R101 amplifier | £22 + 90p | P.&P. |
| 2 x Duo Type III speakers | £32 + £3 | P.&P. |
| Garrard SP25 Mk. III with MAG. cartridge, plinth and cover | £23 + £1.50 | P.&P. |
| Total | £77 | |

Available complete for **£69 + £4** P.&P.

SYSTEM 3

| | | |
|--|-------------|-------|
| Viscount III R100 Amplifier | £17 + 90p | P.&P. |
| 2 x Duo Type II speakers | £14 + £2 | P.&P. |
| Garrard SP25 Mk. III with CER. diamond cartridge, plinth and cover | £21 + £1.50 | P.&P. |
| Total | £52 | |

Available complete for only **£49 + £3.50**

P.&P.

SPEAKERS Duo Type II

Size 17in x 10 $\frac{1}{2}$ in x 6 $\frac{1}{2}$ in. Drive unit 13in x 8in with parasitic tweeter. Max. power 10W, 3 ohms. Simulated Teak cabinet. **£14 pair + £2 P. & P.**

Duo Type III Size 23 $\frac{1}{2}$ in x 11 $\frac{1}{2}$ in x 9 $\frac{1}{2}$ in. Drive unit 13 $\frac{1}{2}$ in x 8 $\frac{1}{2}$ in with H.F. speaker. Max. power 20W at 3 ohms. Frequency range 20Hz to 20kHz. Teak veneer cabinet. **£32 pair + £3 P. & P.**

SPECIFICATION R100/101

14 watts per channel into 3 to 4 ohms. Total distortion @ 10W @ 1kHz 0.1%. P.U.1 (for ceramic cartridges) 150mV into 3 Meg. P.U.2 (for magnetic cartridges) 4mV @ 1kHz into 47K equalised within \pm 1dB R.I.A.A. Radio 150mV into 220K. (Sensitivities given at full power.) Tape out facilities; headphone socket, power out 250mW per channel. *Tone controls and filter characteristics.* Bass: +12dB to -17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to -12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio:* (all controls at max.) R101—P.U.1. and radio—65dB. P.U.2—58dB. R100 same as R101 but P.U.2 (for crystal cartridges) 450mV into 3 Meg. *Cross talk* better than -35dB on all inputs. *Overload characteristics* better than 26dB on all inputs. Size 13 $\frac{1}{2}$ x 9in x 3 $\frac{1}{2}$ in.

R+TV

Radio and TV Components (Acton) Ltd. 21d High Street, Acton, London, W36NG
323 Edgware Road, London, W.2. Mail orders to Acton. Terms C.W.O. All enquiries S.A.E.

Goods not dispatched outside U.K.

Give us six months, and we'll turn your hobby into a career.

You have a hobby for a very good reason. It gives you a lot of pleasure.

So if you can find a job that involves your hobby, chances are you'll enjoy your work more, and you'll do better work.

Now CDI can help you find such a job. A job where you'll be responsible for the maintenance of a computer installation. A job that pays well too. If you're interested in mechanics or electronics (without necessarily being a

mathematical genius), have a clear, logical mind and a will to work, then we can train you to be a Computer Engineer inside six months.

So give us a call. CDI. We're the Education Division of one of the world's largest computer manufacturers. And we have the experience to know if you can make it. A ten minute talk with us, and you could be on the way to spending the rest of your life with your hobby.

Ring
01-637 2171

between 9 a.m. and 9 p.m. and ask for Mr Peters

It's quicker and easier to phone, but if you prefer, send this coupon to: Control Data Institute, Wells House, 77 Wells Street, London, W.1.

Please give me further information.

Name

Address

Age

Phone

4J1

**CONTROL DATA
INSTITUTE**

**CONTROL DATA
LIMITED**

The Education Division of one of the world's largest Computer manufacturers.

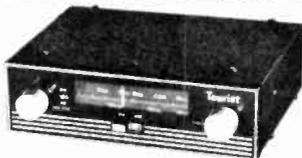
TOURIST

MARK 3 CAR RADIO

ALL TRANSISTOR

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts. Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4 1/2in deep.

Circuit diagram 13p, free with parts Speaker, baffle and fixing kit
£1.25 extra plus P. & P. 25p



SET OF PARTS

£6.30 Plus P. & P. 50p

Speaker postage free when ordered with parts

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



Output Power: 45 watts R.M.S. (Sine wave drive).
Frequency response: -3dB points 30Hz at 18KHz. Total distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB.
Speaker Impedance: 3, 8 or 15 ohms. Bass Control Range: ±13dB at 60Hz.
Treble Control Range: ±12dB at 10KHz.
Inputs: 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K.

To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.

SPEAKERS! Size 20in x 20in x 10in incorporating 12in heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

COMPLETE SYSTEM

£50 Plus £6 P. & P.

or available separately
Amplifier: **£28.50** plus £1.50 P. & P.
Speaker: **£12.50** each plus £2.25 P. & P.



RELIANT MK. IV

The Reliant Mk. IV provides a high standard of sound reproduction, with full mixing facilities. It's versatility makes it suitable for: Discotheque, P.A., Home Entertainment Applications, etc.

- ★ Five Electronically Mixed Inputs
- ★ Three Individual Mixing Controls
- ★ Separate bass and treble controls common to all five inputs
- ★ Mixer employing F.E.T. (Field Effect Transistor)
- ★ Solid State Circuitry
- ★ Attractive Styling

PRICE
£9.50

Plus P. & P. 60p

SPECIFICATIONS

1. Crystal Mic. or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV. Inputs 3, 4 and 5 are suitable for a wide range of medium output equipment (Gram, Tuner, Monitor, Organ, etc.). All 250mV sensitivity.
CONTROLS: 3 Volume controls. Bass control range ±13dB @ 60 Hz. Treble control range ±12dB @ 15KHz. Separate ON/OFF Switch. Neon Indicator.

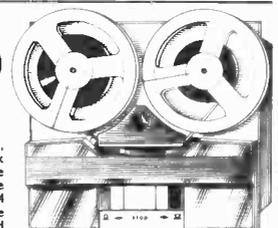
POWER OUTPUT: 12 Watts R.M.S. into 3 to 4 ohms speaker.

SIGNAL/NOISE: Better than -60dB on inputs 3, 4 and 5 and -50dB on 1 and 2.

SUPPLY: 220 to 250V A.C. Mains.

SIZE: 12 1/2in x 6in x 3 1/2in.

CONTINENTAL 4-TRACK, 3-SPEED TAPE DECK



R.C. 74 tape deck. Three speeds—7 1/2, 3 1/2 and 1 1/2 i.p.s. 4-track record/playback head. Plus 4-track erase head. Positive pressure pad system. Takes any tape spool up to and including 7in. The R.C. 74 is driven by a powerful 200/250V 50-cycle a.c. motor. A heavy, accurately balanced flywheel brings wow and flutter levels down to approx. 0.3% total at 3 1/2 and 7 1/2 i.p.s. Fast rewind in both directions. Controls couldn't be simpler! Just five push buttons that interlock to cut out accidental tape damage. Efficient servo-action type braking. Easy drop-in tape loading.

The R.C. 74 comes with an attractive moulded deck cover, which has positions for tone and volume controls. The unit is built into a rigid die-cast frame, and overall size of the whole unit is 12 1/2 x 11 1/2 x 6in. Every single deck fully tested before dispatch. Spools not supplied. Price complete £15. Plus 75p P. & P.

R+TV RADIO & TV COMPONENTS
(ACTON) LIMITED

See opposite page for addresses

The largest selection

NEW LOW PRICE TESTED S.C.R.'s

| PIV | 1A TO-5 | 3A TO-66 | 7A TO-66 | 10A TO-48 | 16A TO-48 | 30A TO-48 |
|-----|---------|----------|----------|-----------|-----------|-----------|
| 50 | 0-23 | 0-25 | 0-47 | 0-50 | 0-53 | 1-16 |
| 100 | 0-25 | 0-23 | 0-53 | 0-58 | 0-63 | 1-40 |
| 200 | 0-35 | 0-37 | 0-57 | 0-61 | 0-75 | 1-60 |
| 400 | 0-43 | 0-47 | 0-67 | 0-75 | 0-83 | 1-75 |
| 600 | 0-53 | 0-57 | 0-77 | 0-87 | 1-25 | — |
| 800 | 0-58 | 0-70 | 0-90 | 1-20 | 1-50 | 4-00 |

SIL. RECTS. TESTED

| PIV | 300mA | 750mA | 1A | 1.5A | 3A | 10A | 30A |
|------|-------|-------|------|------|------|------|------|
| 50 | 0-04 | 0-05 | 0-05 | 0-07 | 0-14 | 0-21 | 0-47 |
| 100 | 0-04 | 0-06 | 0-05 | 0-13 | 0-18 | 0-23 | 0-75 |
| 200 | 0-05 | 0-09 | 0-06 | 0-14 | 0-23 | 0-24 | 1-00 |
| 400 | 0-06 | 0-13 | 0-07 | 0-20 | 0-27 | 0-37 | 1-25 |
| 600 | 0-07 | 0-16 | 0-10 | 0-23 | 0-34 | 0-45 | 1-85 |
| 800 | 0-10 | 0-17 | 0-13 | 0-25 | 0-37 | 0-55 | 2-00 |
| 1000 | 0-11 | 0-25 | 0-15 | 0-30 | 0-46 | 0-63 | 2-50 |
| 1200 | — | 0-33 | — | 0-33 | 0-57 | 0-75 | — |

TRIACS

| VBO | 2A | 6A | 10A |
|-----|------|------|------|
| 100 | 0-50 | 0-83 | 1-00 |
| 200 | 0-70 | 0-90 | 1-25 |
| 400 | 0-90 | 1-00 | 1-60 |

SILICON HIGH VOLT-AGE RECTIFIERS

10-Amp 3-K.V. (3000 P.I.V.) Stud Type with Flying Leads, 80p each.

DIACS

FOR USE WITH TRIACS

BR100 37p each

2A POTTED BRIDGE RECTIFIERS 200V 50p

UNIUNION

UT46. Eqt. 2N2646, Eqt. T1843, BEN3000 27p each. 25-99 25p 100 UP 20p.

NPN SILICON PLANAR

BC107/8/9, 10p each; 50-99, 8p; 100 up, 8p each; 1,000 off, 7p each. Fully tested and coded TO-18 case.

FREE

One 50p Pak of your own choice free with orders valued \$4 or over.

AF239 PNP GERM. SIEMENS VHF TRANSISTORS. RF MIXER & OSC. UP TO 900 MHZ. USE AS REPLACEMENT FOR AF139-AF186 & 100's OF OTHER USES IN VHF. OUR SPECIAL LOW PRICE:—1-2437p each, 25-99 34p each 100 + 30p each.

FET'S

2N 3819 35p
2N 3820 35p
MPP103 40p

CADMIUM CELLS

ORP12 43p
ORP60, ORP61 40p each

PHOTO TRANS.

OCF71 Type. 43p

SIL. G.P. DIODES 5p

300mV 30 0-50
40PIV (Min.) 100 1-50
Sub-Min. 500 5-00
Full Tested, 1,000 9-00
Ideal for Organ Builders.

D13D1 Silicon Unilateral switch 50p each.

A Silicon Planar, monolithic integrated circuit having thyristor electrical characteristics, but with an anode gate and a built-in "Zener" diode between gate and cathode. Full data and application circuits available on request.

EX-EQUIPMENT MULLARD

AF117 transistors. Large can 4 leads type. Leads cut short but still usable, real value at 15 for 50p.

KING OF THE PAKS Unequalled Value and Quality

SUPER PAKS NEW BI-PAK UNTESTED SEMICONDUCTORS

Satisfaction GUARANTEED in Every Pak, or money back.

| Pak No. | Description | Price |
|---------|---|-------|
| U1 | 120 Glass sub-min. general purpose germanium diodes | 50p |
| U2 | 60 Mixed germanium transistors AF/RF | 0-50 |
| U3 | 75 Germanium gold bonded diodes sim. OA5, OA47 | 0-50 |
| U4 | 40 Germanium transistors like OC81, AC128 | 0-50 |
| U5 | 60 200mA sub-min. Sil. diodes | 0-50 |
| U6 | 30 Silicon planar transistors NPN sim. B8Y95A, 2N706 | 0-50 |
| U7 | 16 Silicon rectifiers Top-Hat 750mA up to 1,000V | 0-50 |
| U8 | 50 Sil. planar diodes 250mA, OA/200/202 | 0-50 |
| U9 | 20 Mixed volts 1 watt Zener diodes | 0-50 |
| U10 | 30 PNP silicon planar transistors TO-5 sim. 2N1132 | 0-50 |
| U11 | 30 PNP-NPN sil. transistors OC200 & 2S104 | 0-50 |
| U14 | 150 Mixed silicon and germanium diodes | 0-50 |
| U15 | 25 NPN Silicon planar transistors TO-5 sim. 2N897 | 0-50 |
| U16 | 10 3-Amp silicon rectifiers stud type up to 1000 PIV | 0-50 |
| U17 | 10 Germanium PNP AF transistors TO-5 like ACY 17-22 | 0-60 |
| U18 | 8 6-Amp silicon rectifiers BYZ13 type up to 600 PIV | 0-50 |
| U19 | 25 Silicon NPN transistors like BC108 | 0-50 |
| U20 | 12 1.5-Amp silicon rectifiers Top-Hat up to 1,000 PIV | 0-50 |
| U21 | 30 A.F. germanium alloy transistors 2G300 series & OC71 | 0-50 |
| U23 | 30 Mat's like MAT series PNP transistors | 0-50 |
| U24 | 20 Germanium 1-Amp rectifiers GJM up to 300 PIV | 0-50 |
| U25 | 25 300Mc/s NPN silicon transistors 2N708, B8Y27 | 0-50 |
| U26 | 30 Fast switching silicon diodes like IN914 micro-min | 0-50 |
| U28 | Experimenters' assortment of integrated circuits, untested. Gates, flip-flops, registers, etc., 8 assorted pieces | 1-00 |
| U29 | 10 1-Amp SCR's TO-5 can up to 600 PIV CR1125-600 | 1-00 |
| U31 | 20 Sil. Planar NPN trans. low noise amp 2N3707 | 0-50 |
| U32 | 25 Zener diodes 400W D07 case mixed volts, 3-18 | 0-50 |
| U33 | 15 Plastic case 1 amp silicon rectifiers IN4000 series | 0-50 |
| U34 | 30 Sil. PNP alloy trans. TO-5 BCY26, 28302/4 | 0-50 |
| U35 | 25 Sil. planar trans. PNP TO-18 2N2906 | 0-50 |
| U36 | 25 Sil. planar NPN trans. TO-5 BFY50/51/52 | 0-50 |
| U37 | 30 Sil. alloy trans. SO-2 PNP, OC200 28322 | 0-50 |
| U38 | 20 Fast switching sil. trans. NPN, 400Mc/s 2N3011 | 0-60 |
| U39 | 30 RF germ. PNP trans. 2N1303/5 TO-5 | 0-50 |
| U40 | 10 Dual trans. 6 lead TO-5 2N2060 | 0-50 |
| U41 | 25 RF germ. trans. TO-1 OC45 NKT72 | 0-50 |
| U42 | 10 VHF germ. PNP trans. TO-1 NKT1567 AF117 | 0-50 |

Code Nos. mentioned above are given as a guide to the type of device in the Pak. The devices themselves are normally unmarked.

NEW QUALITY TESTED PAKS

| Pak | Description | Price |
|-----|---|-------|
| Q1 | 20 Red spot trans. PNP AF | 0-60 |
| Q2 | 16 White spot R.F. trans. PNP | 0-60 |
| Q3 | 4 OC77 type trans. | 0-60 |
| Q4 | 6 Matched trans. OC44/45/61/81D | 0-60 |
| Q5 | 4 OC75 transistors | 0-50 |
| Q6 | 4 OC72 transistors | 0-50 |
| Q7 | 4 AC128 trans. PNP high gain | 0-50 |
| Q8 | 4 AC126 trans. PNP | 0-50 |
| Q9 | 7 OC81 type trans. | 0-50 |
| Q10 | 7 OC71 type trans. | 0-50 |
| Q11 | 2 AC127/128 comp. pairs PNP/NPN | 0-50 |
| Q12 | 3 AF116 type trans. | 0-50 |
| Q13 | 3 AF117 type trans. | 0-50 |
| Q14 | 3 OC171 H.F. type trans. | 0-50 |
| Q15 | 5 2N2926 sil. epoxy trans. | 0-60 |
| Q16 | 2 GBT880 low noise germ. trans. | 0-60 |
| Q17 | 3 NPN 1 ST141 & 2 ST140 | 0-50 |
| Q18 | 4 Matched 2 MAT 100 & 2 MAT 120 | 0-50 |
| Q19 | 3 Mat's 2 MAT 101 & 1 MAT 121 | 0-50 |
| Q20 | 4 OC44 germ. trans. A.F. | 0-50 |
| Q21 | 3 AC127 NPN germ. trans. | 0-50 |
| Q22 | 20 NKT trans. A.F. R.F. coded | 0-50 |
| Q23 | 10 OA202 sil. diodes sub-min. | 0-50 |
| Q24 | 8 OA81 diodes | 0-50 |
| Q25 | 6 IN914 sil. diodes 75 PIV 75mA | 0-50 |
| Q26 | 8 OA95 germ. diodes sub-min. IN69 | 0-50 |
| Q27 | 2 10A 600PIV sil. rect. 1845R | 0-50 |
| Q28 | 2 Sil. power rect. BYZ13 | 0-60 |
| Q29 | 4 Sil. trans. 2 x 2N696, 1 x 2N697, 1 x 2N698 | 0-50 |
| Q30 | 7 Sil. switch trans. 2N706 NPN | 0-50 |
| Q31 | 6 Sil. switch trans. 2N708 NPN | 0-50 |
| Q32 | 3 PNP sil. trans. 2 x 2N1131, 1 x 2N1132 | 0-60 |
| Q33 | 3 Sil. NPN trans. 2N1711 | 0-60 |
| Q34 | 7 Sil. NPN trans. 2N2909, 300MHZ. | 0-50 |
| C35 | 3 Sil. PNP TO-5 2 x 2N2904, 1 x 2905 | 0-50 |
| C36 | 7 2N3646 TO-18 plastic 300MHZ | 0-50 |
| Q37 | 3 2N3053 NPN sil. trans. | 0-50 |
| Q38 | 7 PNP trans. 4 x 2N3703, 3 x 2N3702 | 0-50 |
| Q39 | 7 NPN trans. 4 x 2N3704, 3 x 2N3705 | 0-50 |
| Q40 | 7 NPN amp. 4 x 2N3707, 3 x 2N3708 | 0-50 |
| Q41 | 3 Plastic NPN TO-18 2N3904 | 0-50 |
| Q42 | 6 NPN trans. 2N5173 | 0-50 |
| Q43 | 7 BC107 NPN sil. trans. | 0-60 |
| Q44 | 7 NPN trans. 4 x BC108, 3 x BC109 | 0-60 |
| Q45 | 3 BC113 NPN TO-18 trans. | 0-60 |
| Q46 | 3 BC115 NPN TO-5 trans. | 0-60 |
| Q47 | 6 NPN high gain 3 x BC167, 3 x BC168 | 0-50 |
| Q48 | 4 BCY70 NPN trans. TO-18 | 0-50 |
| Q49 | 4 NPN trans. 2 x BFY41, 2 x BFY52 | 0-50 |
| Q50 | 7 B8Y28 NPN switch TO-18 | 0-60 |
| Q51 | 7 B8Y95A NPN trans. 300MHZ. | 0-50 |
| Q52 | 8 BY100 type sil. rect. | 1-00 |
| Q53 | 25 Sil. & germ. trans. mixed all marked new | 1-50 |

PRINTED CIRCUITS—EX-COMPUTER

Packed with semiconductor and components, 10 boards give a guaranteed 30 trans and 30 diodes. Our price. 10 boards, 50p. Plus 10p P. & P. 100 Boards \$3. P. & P. 30p.

GENERAL PURPOSE GERM. PNP POWER TRANSISTORS

Coded GP100. BRAND NEW TO-3 CASE. POSS. REPLACEMENTS FOR.—OC25-28-29-30-35-36. NKT 401-403-404-405-406-430-451-452-453. T13027-3028, 2N250A, 2N456A-457A-458A, 2N511 A & B. 2G220-222, ETC.

SPECIFICATION

V_{CEO} 80V V_{CE0} 30V IC 10A PT. 30 WATTS Hfe 30-170.

PRICE

1-24 25-99 100 up
43p each 40p each 36p each

GENERAL PURPOSE SILICON PNP POWER TRANSISTORS

Coded GP300. BRAND NEW TO-3 CASE. POSSIBLE REPLACEMENT FOR.—2N3055, BDY20, BDY11.

SPECIFICATION

V_{CEO} 100V, V_{CE0} 60V, IC 15AMP, PT. 115 WATTS. Hfe 20-100. FTI MHZ

PRICE

1-24 25-99 100 up
55p each 50p each 47p each

GENERAL PURPOSE NPN SILICON SWITCHING TRANS. TO-18 SIM. TO 2N706/8, B8Y27/28/95A. All usable devices no open or short circuits. ALSO AVAILABLE in PNP Sim. to 2N2906, BCY70. When ordering please state preference NPN or PNP.

20 For 0-50 100 For 1-75
50 For 1-00 1000 For 7-50 13-00

JUMBO COMPONENT PAKS

MIXED ELECTRONIC COMPONENTS

Exceptionally good value (no rubbish)

Resistors, capacitors, pots, electrolytics and coils plus many other useful items. Approximately 30+ in weight. Price incl. P. & P

£1.50 only

Plus our satisfaction or money back guarantee.

NEW EDITION 1971

TRANSISTOR EQUIVALENTS BOOK. A complete cross reference and equivalents book for European, American and Japanese Transistors. Exclusive to BI-PAK 90p each.

GERM. POWER TRANS.

| Type | Price each | Type | Price each |
|------|------------|-------|------------|
| OC20 | 50p | OC29 | 40p |
| OC22 | 30p | OC33 | 33p |
| OC23 | 33p | OC35 | 40p |
| OC25 | 25p | AD140 | 40p |
| OC26 | 25p | AD142 | 40p |
| OC28 | 40p | AD149 | 45p |

OUR STOCKS of individual devices are now too numerous to mention in this Advertisement. Send S.A.E. for our listing of over 1,000 Semiconductors. All available Ex-Stock at very competitive prices.

SILICON PHOTO TRANSISTOR. TO-18 Lens end. NPN Sim. to BP x25 and P21. BRAND NEW. Full data available. Fully guaranteed.

Qty. 1-24 25-99 100 up

Price each 45p 40p 35p

RTL MICROLOGIC CIRCUITS

| | Price each |
|--------------------------------------|-------------------|
| Epoxy TO-5 case | 1-24 25-99 100 up |
| u1800 Buffer | 35p 33p 27p |
| u1914 Dual 2/p gate | 55p 33p 27p |
| u1923 J-K flip-flop | 50p 47p 45p |
| Data and Circuits Booklet for I.C.'s | Price 7p. |

Dual-in-Line Low Profile Sockets

14 and 16 Lead Sockets for use with Dual-in-Line Integrated Circuits

| Order No. | 1-24 | 25-99 | 100 up |
|-----------------|------|-------|--------|
| T80 14 pin type | 30p | 27p | 25p |
| T80 16 pin type | 35p | 32p | 30p |

-the lowest prices!

74 series T.T.L. I.C.'s DOWN AGAIN IN PRICE

Check our 74 Series List before you buy any I.C.'s. Our prices are the lowest possible. All devices ex-stock. Full spec. guaranteed.

| BI-PAK Order No. | Similar Types to:—Description | Price and qty. prices | | |
|------------------|---|-----------------------|-----------|------------|
| | | 1-24 \$p | 25-99 \$p | 100 up \$p |
| BP00 = 7400 | Quad 2-input NAND gate | 0-15 | 0-14 | 0-12 |
| BP01 = 7401 | Quad 2-input pos. NAND gate (with open collector output) | 0-15 | 0-14 | 0-12 |
| BP02 = 7402 | Quad 2-input pos. NOR gates | 0-15 | 0-14 | 0-12 |
| BP03 = 7403 | Quad 2-input pos. NAND gates (with open collector output) | 0-15 | 0-14 | 0-12 |
| BP04 = 7404 | Hex Inverters | 0-15 | 0-14 | 0-12 |
| BP05 = 7405 | Hex Inverter (with open-collector output) | 0-15 | 0-14 | 0-12 |
| BP10 = 7410 | Triple 3-input pos. NAND gates | 0-15 | 0-14 | 0-12 |
| BP13 = 7413 | Dual 4-input Schmitt trigger | 0-29 | 0-28 | 0-24 |
| BP20 = 7420 | Dual 4-input NAND gates | 0-15 | 0-14 | 0-12 |
| BP30 = 7430 | 8-input pos. NAND gates | 0-15 | 0-14 | 0-12 |
| BP40 = 7440 | Dual 4-input pos. NAND buffers | 0-15 | 0-14 | 0-12 |
| BP41 = 7441 | BCD to decimal nixie driver | 0-67 | 0-64 | 0-58 |
| BP42 = 7442 | BCD to decimal decoder (4-10 lines, 1 of 10) | 0-67 | 0-64 | 0-58 |
| BP46 = 7446 | BCD-to-seven-segment decoder/driver | 2-00 | 1-75 | 1-50 |
| BP47 = 7447 | BCD-seven-segment decoder/drivers (15V outputs) | 0-97 | 0-94 | 0-88 |
| BP48 = 7448 | BCD-to-seven-segment decoder/driver | 0-97 | 0-94 | 0-88 |
| BP50 = 7450 | Expandable dual 2-input and-or-invert | 0-15 | 0-14 | 0-12 |
| BP51 = 7451 | Dual 2-wide 2-input and-or-invert gate | 0-15 | 0-14 | 0-12 |
| BP53 = 7453 | Dual 2-input expandable and-or-invert | 0-15 | 0-14 | 0-12 |
| BP64 = 7464 | 4-wide 2-input and-or-invert gates | 0-15 | 0-14 | 0-12 |
| BP60 = 7460 | Dual 4-input expander | 0-15 | 0-14 | 0-12 |
| BP70 = 7470 | Single-phase J-K flip-flop | 0-29 | 0-28 | 0-24 |
| BP72 = 7472 | Master slave J-K flip-flop | 0-29 | 0-28 | 0-24 |
| BP73 = 7473 | Dual Master slave J-K flip-flop | 0-37 | 0-35 | 0-32 |
| BP74 = 7474 | Dual D type flip-flop | 0-37 | 0-35 | 0-32 |
| BP75 = 7475 | Quad latch | 0-47 | 0-45 | 0-42 |
| BP76 = 7476 | Dual J-K with pre-set and clear | 0-43 | 0-40 | 0-38 |
| BP80 = 7480 | Gated full adders | 0-67 | 0-64 | 0-58 |
| BP81 = 7481 | 16-bit read/write memory | 0-97 | 0-94 | 0-88 |
| BP82 = 7482 | 2-bit binary full adders | 0-97 | 0-94 | 0-88 |
| BP83 = 7483 | Quad full adder | 1-10 | 1-05 | 0-95 |
| BP86 = 7486 | Quad 2-input exclusive NOR gates | 0-32 | 0-30 | 0-28 |
| BP90 = 7490 | BCD decade counter | 0-67 | 0-64 | 0-58 |
| BP91 = 7491 | 8-bit shift registers | 0-87 | 0-84 | 0-78 |
| BP92 = 7492 | Divide-by-twelve counters | 0-67 | 0-64 | 0-58 |
| BP93 = 7493 | 4-bit binary counters | 0-67 | 0-64 | 0-58 |
| BP94 = 7494 | Dual entry 4-bit shift register | 0-77 | 0-74 | 0-68 |
| BP95 = 7495 | 4-bit up-down shift register | 0-77 | 0-74 | 0-68 |
| BP96 = 7496 | 3-bit parallel in parallel out shift register | 0-77 | 0-74 | 0-68 |
| BP100 = 74100 | 8-bit bistable latches | 1-75 | 1-65 | 1-55 |
| BP104 = 74104 | Single J-K flip-flop equivalent 9000 series | 0-97 | 9-94 | 0-88 |
| BP105 = 74105 | Single J-K flip-flop equivalent 9001 series | 0-97 | 9-94 | 0-88 |
| BP107 = 74107 | Dual Master slave flip-flops | 0-40 | 0-38 | 0-36 |
| BP110 = 74110 | Gates master-slave flip-flops | 0-55 | 0-53 | 0-50 |
| BP111 = 74111 | Dual data lock-out flip-flop | 1-25 | 1-15 | 1-00 |
| BP118 = 74118 | Hex set-reset latches | 1-00 | 0-95 | 0-90 |
| BP119 = 74119 | Hex set-reset latches—24-pin | 1-35 | 1-25 | 1-10 |
| BP121 = 74121 | Monostable multivibrators | 0-67 | 0-64 | 0-58 |
| BP141 = 74141 | BCD-to-decimal decoder/driver | 0-67 | 0-64 | 0-58 |
| BP145 = 74145 | BCD-to-decimal decoder/driver O/C | 1-50 | 1-40 | 1-30 |
| BP150 = 74150 | 16-bit data selector | 1-80 | 1-70 | 1-60 |
| BP151 = 74151 | 8-bit data selectors (with strobe) | 1-00 | 0-95 | 0-90 |
| BP153 = 74153 | Dual 4-line-to-1-line data | 1-20 | 1-10 | 0-95 |
| BP154 = 74154 | 4-to-16-line decoder | 1-80 | 1-70 | 1-60 |
| BP155 = 74155 | Dual 2- to 4-line decoder | 1-30 | 1-20 | 1-10 |
| BP156 = 74156 | Dual 2- to 4-line decoder O/C | 1-40 | 1-30 | 1-20 |
| BP160 = 74160 | Sync. decade counter | 1-80 | 1-70 | 1-60 |
| BP161 = 74161 | Sync. 4-bit binary counter | 1-80 | 1-70 | 1-60 |
| BP190 = 74190 | Sync. up-down BCD counter | 3-50 | 3-25 | 3-00 |
| BP191 = 74191 | Sync. binary up-down counter (single clock line) | 3-50 | 3-25 | 3-00 |
| BP192 = 74192 | Sync. up-down decade counter | 2-10 | 1-95 | 1-75 |
| BP193 = 74193 | Sync. binary up-down counter (two clock lines) | 2-10 | 1-95 | 1-75 |
| BP196 = 74196 | Pre-settable 50MHz decade counter | 1-80 | 1-70 | 1-60 |
| BP197 = 74197 | Pre-settable 50MHz binary counter | 1-80 | 1-70 | 1-60 |
| BP198 = 74198 | 8-bit parallel L-R shift register | 5-50 | 5-00 | 4-00 |
| BP199 = 74199 | 8-bit parallel access shift register | 5-50 | 5-00 | 4-00 |

Devices may be mixed to qualify for quantity price. Larger quantity prices on application (TTL 74 Series only). Data is available for the above series of I.C.'s in booklet form. Price 13p.

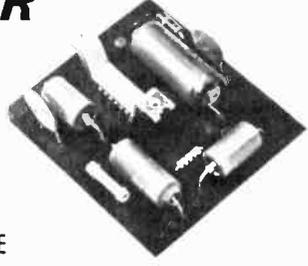
TTL INTEGRATED CIRCUITS

Manufacturers' "Fall outs"—out of spec. devices including functional units and part function but classed as out of spec. from the manufacturers' very rigid specifications. Ideal for learning about I.C.'s and experimental work.

| PAK No. | PAK No. | PAK No. |
|--------------------|--------------------|-------------------|
| UIC00 = 12 x 7400N | UIC42 = 5 x 7450N | UIC80 = 5 x 7480N |
| UIC01 = 12 x 7401N | UIC50 = 12 x 7450N | UIC82 = 5 x 7482N |
| UIC02 = 12 x 7402N | UIC51 = 12 x 7451N | UIC83 = 5 x 7483N |
| UIC03 = 12 x 7403N | UIC60 = 12 x 7460N | UIC86 = 5 x 7486N |
| UIC04 = 12 x 7404N | UIC70 = 8 x 7470N | UIC90 = 5 x 7490N |
| UIC05 = 12 x 7405N | UIC72 = 8 x 7472N | UIC92 = 5 x 7492N |
| UIC10 = 12 x 7410N | UIC73 = 8 x 7473N | UIC93 = 5 x 7493N |
| UIC20 = 12 x 7420N | UIC74 = 8 x 7474N | UIC94 = 5 x 7494N |
| UIC40 = 12 x 7440N | UIC75 = 8 x 7475N | UIC95 = 5 x 7495N |
| UIC41 = 5 x 7441AN | UIC76 = 8 x 7476N | UIC96 = 5 x 7496N |

Paks cannot be split but 20 assorted pieces (our mix) is available as PAK UICX1 Every PAK carries out BI-PAK Satisfaction or money back GUARANTEE.

ANOTHER BI-PAK FIRST!



THE NEW S.G.S.
EA 1000 AUDIO
AMPLIFIER MODULE

*GUARANTEED NOT LESS THAN 3 WATTS RMS

Especially designed by S.G.S. incorporating their proven Linear I.C. Audio Amp TA/621 providing unlimited applications for the enthusiast in the construction of radios, record players, Audio and Stereo units. Also ideal for intercom systems, monitoring applications and phone answering machines. OTHER USES: portable applications where supply rails as low as 9V are of prime importance.

- Sensitivity 40 mV for 1 watt VOLTAGE GAIN 40dB but can be varied up to 73dB for some applications.
- Overall Size 2" x 3" x 1".
- Typical Total Harmonic distortion at 1 watt less than 1%.
- Signal to Noise Ratio 86dB.
- Supply voltage (Vs) = 24V 15ohm load.
- Frequency response better than 50 Hz to 25 KHz for -3dB.
- Normal supply Voltage 9-24V.
- Suitable for 8-16 OHM Loads.

Module Tested and Guaranteed

Quantity 1-9 10-25
Price each £2-63 £2-28

Larger quantities quoted on request

Full hook-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

ROCK BOTTOM PRICES—CAN'T BE BEATEN!

| LOGIC Type No. | DTL 930 SERIES Function | IC's Price |
|----------------|---|-------------------|
| BP930 | Expandable dual 4-input NAND | 1-24 25-99 100 up |
| BP932 | Expandable dual 4-input NAND buffer | 13p 11p 10p |
| BP933 | Dual 4-input expander | 13p 12p 11p |
| BP935 | Expandable Hex Inverter | 13p 12p 11p |
| BP936 | Hex Inverter | 13p 12p 11p |
| BP944 | Dual 4-input NAND expandable buffer without pull-up | 13p 12p 11p |
| BP945 | Master-slave JK or RS | 25p 24p 22p |
| BP946 | Quad, 2-input NAND | 12p 11p 10p |
| BP948 | Master-slave JK or RS | 25p 24p 22p |
| BP951 | Monostable | 65p 60p 55p |
| BP962 | Triple 3-input NAND | 12p 11p 10p |
| BP963 | Dual Master-slave JK with separate clock | 40p 38p 35p |
| BP9094 | Dual Master-slave JK with separate clock | 40p 38p 35p |
| BP9097 | Dual Master-slave JK with Common Clock | 40p 38p 35p |
| BP9099 | Dual Master-slave JK Common Clock | 40p 38p 35p |

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

BRAND NEW LINEAR I.C.'s—FULL SPEC.

| Type No. | Case | Leads | Description | Price |
|----------------|--------|-------|------------------------------|-------------------|
| BP 201C—BL201C | TO-5 | 8 | G.P. Amp | 1-24 25-99 100 up |
| BP 701C—BL701C | TO-5 | 8 | OP Amp | 63p 50p 45p |
| BP 702C—BL702C | TO-5 | 8 | OP Amp Direct OP | 63p 50p 45p |
| BP 702—72702 | D.I.L. | 14 | G.P. OP Amp (Wide Band) | 53p 45p 40p |
| BP 709—72709 | D.I.L. | 14 | High OP Amp | 53p 45p 40p |
| BP 709P—μA709C | TO-5 | 8 | High Gain OP Amp | 53p 45p 40p |
| BP 711—μA711 | TO-5 | 10 | Dual comparator | 58p 50p 45p |
| BP 741—μA741 | D.I.L. | 14 | High Gain OP Amp (Protected) | 75p 60p 50p |
| μA 703C—μA703C | TO-5 | 6 | R.F.—I.F. Amp | 45p 35p 27p |
| TAA 263— | TO-72 | 4 | A.F. Amp | 70p 60p 55p |
| TAA 293— | TO-74 | 10 | G.P. Amp | 90p 75p 70p |

All prices quoted in new pence Giro No. 388-7006

Please send all orders direct to warehouse and despatch department

BI-PAK

P.O. BOX 6, WARE · HERTS

Postage and packing add 7p. Overseas add extra for airmail. Minimum order 50p. Cash with order please.

Guaranteed Satisfaction or Money Back



of obtaining components quickly & easily

HOME RADIO (Components) Ltd.
Dept. PE, 234-240 London Road,
Mitcham CR4 3HD. 01-648 8422

1

CALL AT No. 240 London Rd., Mitcham

If you live within easy reach of Mitcham or are in the area at any time do call on us. We are almost opposite Mitcham Baths. We open 9 a.m. every weekday. On Wednesdays we close 1 p.m. and all other days, including Saturdays, 5.30 p.m. On Saturdays we have extra staff to deal with queries. We carry a vast stock of components, and 999 times out of a 1,000 we can immediately lay our hands on the particular item required.

2

JOIN OUR CREDIT ACCOUNT SERVICE

We began our Credit Account Service about 18 months ago and it has proved extremely popular. Little wonder! Our customers find it a very simple and convenient way of purchasing all their radio and electronic needs. We supply pre-paid envelopes and order forms and no matter how many orders you send us you make only one payment per month. There are several other advantages with our Credit Account Service. Please write or phone for details.

The price of 70p applies only to catalogues purchased by customers in the U.K. and to BFPO addresses.

3

and ORDER BY MAIL OR TELEPHONE

Although we are kept busy selling "over the counter" we supply even more by Mail Order. You can telephone any time of day or night, Sundays included. If you ring out of office hours a recording machine takes your message for us to deal with as soon as we open shop again. Our number is 01-648 8422. If you wish to order by post our address is in the panel at the top of the page. We deal with all orders promptly.

WHICHEVER WAY YOU CHOOSE you need the Home Radio Catalogue

In its 315 pages are listed over 8,000 components, over 1,500 of them illustrated. Each copy contains 10 vouchers, each worth 5p when used as instructed. Free Supplements are supplied regularly to keep you up-to-date. The Catalogue costs 50p over the counter, or 70p including postage and packing.



Post this Coupon with
Cheque or P.O. for 70p

Please write your Name and Address in block capitals

Name.....

Address.....



HOME RADIO (Components) LTD.
Dept. PE, 234-240 London Road, Mitcham CR4 3HD

Editor F. E. BENNETT Assistant Editor M. A. COLWELL Editorial Assistants D. BARRINGTON G. GODBOLD M. KENWARD
Art Editor J. D. POUNTNEY Technical Illustrators J. A. HADLEY P. A. LOATES
Advertisement Manager D. W. B. TILLEARD

NON-PERMISSIVE

EVEN in this permissive age editors have certain censorial duties to perform in the interests of their readers. One of these is to apply the blue pencil and expunge from the printed page any words having dubious meanings or likely to encourage the adoption of undesirable practices.

In respect of the latter hazard, this magazine has a particularly onerous responsibility; in matters appertaining to circuit design and construction, we mean. It follows that we should have our little list of disfavoured words and expressions; although some of them may be frequently used in the vernacular without so much as an eyebrow being raised.

Yet, as we have implied, there are lines to be drawn, and altogether in our readers' own interest. Not to keep anyone in suspense any longer, let us reveal one of these disfavoured terms. It is "junk box". As alert readers will have already surmised, it is our normal policy to remove any reference to this peculiar, though fascinating, source of supply from contributors' manuscripts before they are presented to the public eye.

We recognise the partiality of many amateur designers for a dip into this traditional repository for temporarily abandoned components. But the advantages the junk box offers are strictly personal and local. The contents of some boxes would defy identification, let alone duplication, anywhere. That's for sure.

Obviously we cannot allow component oddities procured in this way to remain in the specification of any project offered to constructors at large. A suitable substitute, currently available, has to be found, and the design modified where necessary. (All would-be contributors kindly note.)

Checking with our little list again, there is the somewhat allied expression "cannibalisation". This goes hand in glove with those deliberate wrecking operations known variously as "breaking up" (or "down") and "stripping down". The fruits of these labours often go to swell the contents of the junk box and to make the collection even more varied and mysterious.

Not that we are opposed to the junk box as such. Every constructor will accumulate one in the fullness of time. Actually there's nothing you can do about it; it just grows, and grows. And what strange practices are perpetrated in private workshops is not our business. But the supply of designs for other constructors to execute is.

So have no fear about our "censorship". We wield our blue pencil solely in the cause of good, sound design, and this is in the best interests of all who construct.

F.E.B.

THIS MONTH

CONSTRUCTIONAL PROJECTS

| | |
|-------------------------------|-----|
| ENGINE TEMPERATURE CONTROLLER | 798 |
| WAR GAMES COMPUTER | 810 |
| RAIN AND WATER LEVEL ALARM | 820 |
| SERVO CHART RECORDER | 822 |

SPECIAL SERIES

| | |
|------------------------------|-----|
| RADIO ASTRONOMY TECHNIQUES—5 | 830 |
|------------------------------|-----|

GENERAL FEATURES

| | |
|----------------------------|-----|
| ELECTRONIC MUSIC SYNTHESIS | 802 |
| INGENUITY UNLIMITED | 843 |

NEWS AND COMMENT

| | |
|--------------|-----|
| EDITORIAL | 797 |
| SPACEWATCH | 819 |
| MARKET PLACE | 840 |
| READOUT | 847 |

Our November issue will be published on Friday, October 15

© IPC Magazines Limited 1971. Copyright in all drawings, photographs and articles published in PRACTICAL ELECTRONICS is fully protected, and reproduction or imitations in whole or part are expressly forbidden. All reasonable precautions are taken by PRACTICAL ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press. Subscription Rates including postage for one year, to any part of the world, £2.65 (£2 13s. 0d).
Practical Electronics, Fleetway House, Farringdon St., London, E.C.4. Phone: Editorial 01-634 4452; Advertisements 01-634 4202.

Engine Temperature CONTROLLER

By M. A. HARRIS

Thermostatically controlled fan for your car

MOST internal combustion engines in cars are overcooled, the manufacturers having to take into account all types of driving conditions that might be encountered. For the majority of the time, engines tend to run on the cool side, and the belt-driven fan on the water pump boss can be removed but, of course, it is inconvenient to do so en route.

With the mechanical fan removed permanently some auxiliary form of controlled cooling is necessary for those occasions when the forward motion of the vehicle does not force enough air through the radiator, for example, in traffic jams or when climbing a steep hill.

There are on the market various devices to increase the air flow; some fans "feather" according to temperature and/or engine speed. The one disadvantage these have is that they tend to be somewhat on the expensive side and are still wasteful of engine power. The controlled electric fan to be described, on the other hand, is inexpensive, only operates according to engine temperature, and takes no power from the engine.

AUXILIARY FANS

The two fans in use on the author's vehicle were mounted on a metal plate in front of the radiator and behind the radiator grill, so that they draw air through the grill and push it through the radiator. Initially, they were wired up to a pair of relay contacts controlled by a switch on the dashboard—in the final version this became the manual override to an electronic switch. See Fig. 1. The fans must obviously be mounted the right way round to force air through the radiator, or to suck it out through the radiator in the case of transverse engine cars.

The circuit is basically very similar in either polarity version. Fig. 2 shows the negative earth version. For positive earth operation, all that is needed is to change the transistors from *pnp* types to equivalent *npn* and reverse C2.

LONG-TAILED PAIR

The control circuit is a "long-tailed pair", the base of TR3 being fixed while the emitter determines how the temperature sensor (thermistor TH1) is

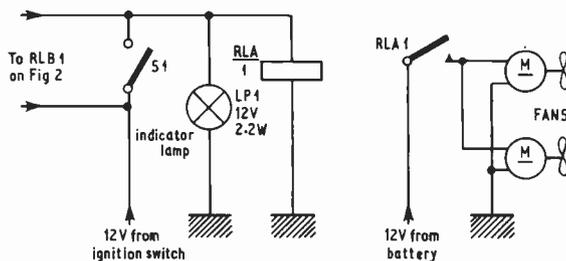


Fig. 1. The two auxiliary fans controlled by a 12V relay (RLA), switched on by RLB or S1. LP1 provides visual indication of motor operation and should be fitted to the dash panel

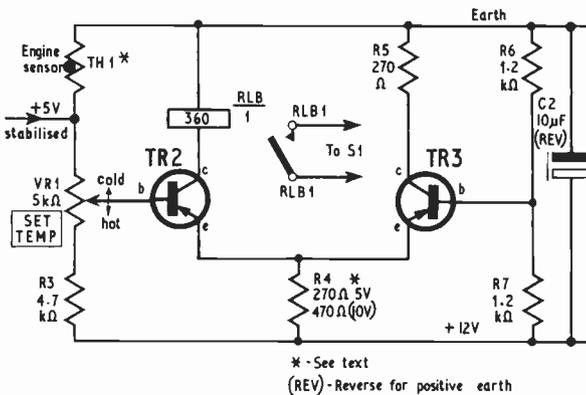
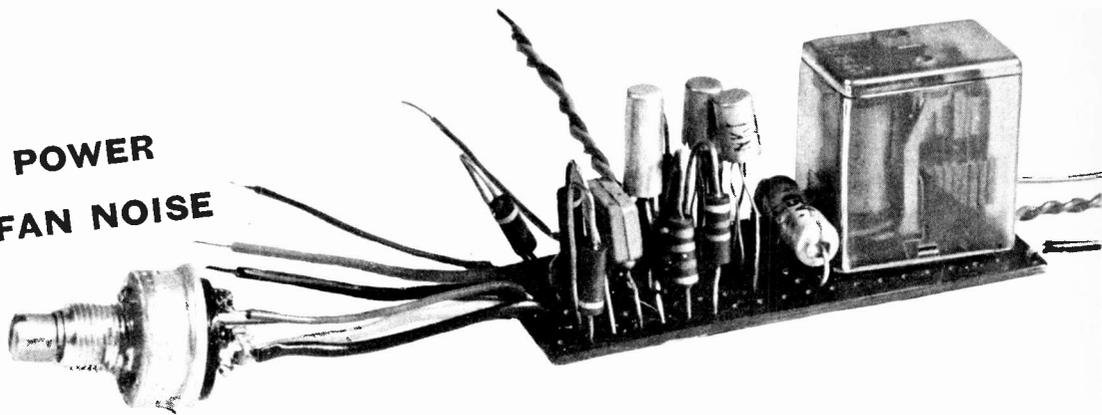


Fig. 2. Negative earth version of the electronic control circuit. For positive earth cars, change the transistors and reverse the connections of C2

★ MORE POWER
★ LESS FAN NOISE



★ BETTER HEATER EFFICIENCY ★ QUICKER WARM UP

COMPONENTS...

Resistors

| | | | |
|---------------------------------------|--|----|---------------|
| R1 | 1k Ω (560 Ω for 10V system) | R5 | 270 Ω |
| R2 | 220 Ω | R6 | 1.2k Ω |
| R3 | 4.7k Ω | R7 | 1.2k Ω |
| R4 | 270 Ω (470 Ω for 10V system) | | |
| All $\frac{1}{4}$ W $\pm 10\%$ carbon | | | |

Potentiometer

VRI 5k Ω carbon linear

Capacitors

C1 0.1 μ F 600V
C2 10 μ F elect. 25V

Transistors

| | POSITIVE EARTH | NEGATIVE EARTH |
|-----|-------------------|-------------------|
| TR1 | OC35 or OC22 | 2N3055 or BD124 |
| TR2 | AC127 or NKT713 | AC128 or OC81 |
| TR3 | AC127 or NKT713 | AC128 or OC81 |

Zener Diode

D1 Approximately 6.3V 250mW selected from tests (see text)

Relays

RLA 12V with single pole normally open heavy duty contacts (see text)
RLB 6V approximately 350 ohms with single pole normally open contacts (see text)

Miscellaneous

LPI 12V 2.2W indicator lamp and holder
S1 Single pole on/off toggle switch
Veroboard 0.15 inch matrix 3in \times 1 $\frac{1}{2}$ in
Fan (see text)
Diecast box 4 $\frac{1}{2}$ in \times 2 $\frac{1}{2}$ in \times 1in
Sheet steel for fan mounting $\frac{1}{8}$ in painted or p.v.c. coated
Metal brackets (see text)
Clips to hold fan motors
Grommets, wire and bolts

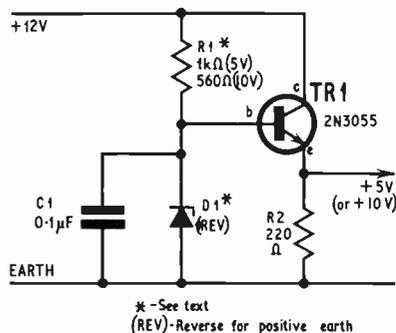


Fig. 3. Circuit of the stabilised 5V supply for cars with 12V negative earth. For positive earth, change TR1 and reverse D1

going to operate relay RLB via TR2. The thermistor is the variable element, whose resistance changes inversely with temperature. It is usually fitted into the engine block and wired up to the temperature gauge on the dashboard.

The relay RLB in the collector circuit is a small one, capable of switching a heavy duty relay to turn on the cooling fans. The relay contacts RLB1 are wired across the manual override switch S1 in Fig. 1.

In the prototype there were two changeover contacts, and two make contacts. To reduce the mechanical load of all these contacts on the relay armature, the two changeover contacts were removed. This way the relay would operate at around 4V.

STABILISED LINE

It was originally intended that the stabilised 5V line was derived from the car's instrument circuit. But on investigation the stabilised 5V was found to be a pulsed 12V, the average value of which was 5V. Hence a stabiliser (Fig. 3) was constructed to replace the original unit. For positive earth the stabiliser transistor is changed and the polarity of D1 reversed.

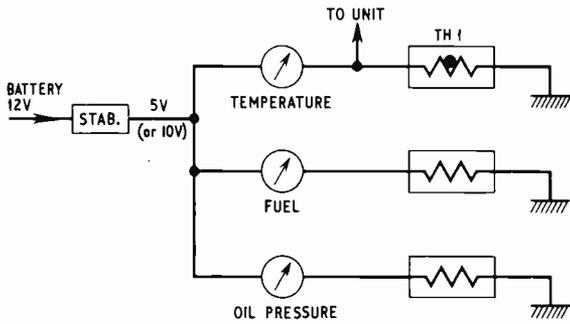


Fig. 4. Connection of the electronic stabiliser (Fig. 3) into the car instrument system (5V or 10V positive or negative earth). Also shown is the connection for the controller unit.

This system can be used for 5V (Ford) or 10V (BLMC and others) instrument systems, by alteration of R4 (Fig. 2) and R1 (Fig. 3). The power transistor TR1 has been chosen to be able to supply the current for up to three gauges as shown in Fig. 4.

If an electric temperature gauge is not fitted, or the instruments are not stabilised but fed directly from the 12V line then it is possible to construct the unit using a temperature gauge thermistor screwed into the block or a VA 1026 thermistor mounted, by epoxy resin, to the outside of the radiator just above the core and near the top hose. This thermistor then becomes TH1 in the circuit and the stabiliser output is connected directly to the junction of TH1 and VR1. The VA 1026 thermistor must not be placed in water for calibration purposes unless it has been covered in epoxy resin.

The power transistor (TR1 in Fig. 3) is required, in the worst case of full fuel tank, boiling engine, and high oil pressure, to carry approximately 0.75 A. So the maximum dissipation could be 0.75(14-5) watts, which is approximately 7 watts.

SUPPRESSION

Due to the tasks expected of a car electrical system, the occurrence of high voltage "spikes" from the ignition and charging circuit are bound to effect the supply to the controller and the Zener diode and transistors must be protected from such "spikes". The 10 μ F capacitor C2 across the supply line suppresses voltage spikes so preventing damage to the semiconductors. Which way round it is connected depends on the earth polarity as mentioned earlier. A 0.1 μ F capacitor C1 is likewise connected across the Zener diode.

THERMISTOR

If the resistance of the thermistor is not known at extreme temperatures it can be found by adopting the following course. Release the pressure of the coolant by slowly unscrewing the radiator cap and then replace the cap. Remove the sensor unit from the engine block, and plug the hole with a cork, or rag. Place the sensor in a pan of warm water and heat it up gently to boiling point. Leave the water boiling for a few minutes to allow the sensor to reach the same temperature.

Now measure the resistance of the sensor (in the prototype this was 22 ohms) and the temperature of

the water, which will be around 212 degrees F (or 100 degrees C). The sensor is now replaced in the block and allowed to cool. It is quite a good idea to leave it out until the following day. The reasoning behind this is that when cold, the sensor has a resistance of approximately 450 ohms, and to give the temperature gauge the impression of a hot engine, all that is needed is to bridge the sensor with a 22 ohm resistor.

If this is done, and the temperature gauge observed, the Zener diode voltage can be chosen to give the required voltage from the stabiliser and the appropriate water temperature reference on the meter scale. In the prototype, a 6.3V Zener was used, but different cars may require different types. Some experimentation might be necessary.

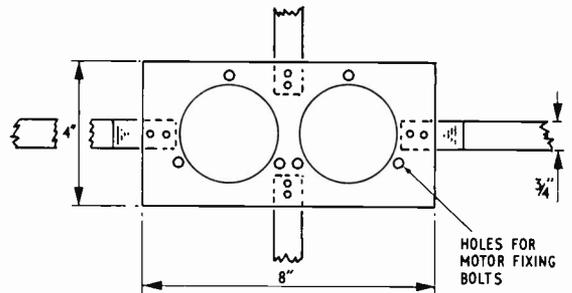


Fig. 5. The fans are mounted on a protected steel plate

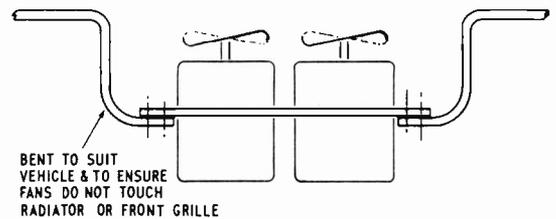


Fig. 6. Side view of the fan plate showing brackets

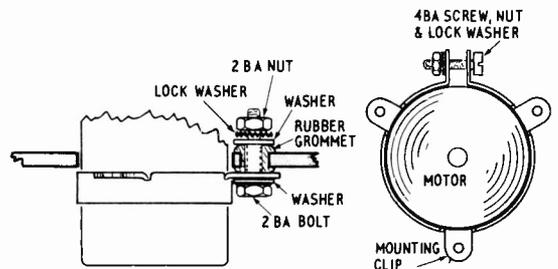


Fig. 7. Detail of mounting the motor with vibration absorbers

RELAYS

For TR1, any appropriate polarity transistor would do, provided that (a) it can carry at least 600mA collector current (that is for cars with two gauges). For vehicles with an electric oil pressure gauge as well as fuel and temperature gauges, 1A collector current should be allowed. (b) it can dissipate 10 watts or more (assuming the worst case).

The main relay RLA that switches the fans on is driven from the 12V supply. It can be a common car 12 V relay as used elsewhere in car wiring, or any other 12V relay provided that the contacts are heavy duty types and are rated at 5A continuous at 12V. Do not wire this relay directly into the transistor circuit in place of RLB or transistor damage may result.

FANS

The fans suitable for this particular application can be obtained from surplus equipment suppliers. They would be 12V 1.5A motors with 3inch or 5inch radius fan blades to fit on the shaft. Alternatively, an old car heater motor can be obtained from a breaker's yard. The centrifugal type is the most powerful.

A 5inch blade was tried on one fan, but it did not give as much air flow as the 3inch due to the motor running a lot slower, trying to push a greater volume of air. Also, the current rose to something in the order of 2.5A. Consequently, two 3inch fans were used in order to get a reasonable airflow through the radiator. These motors were circular with multi-bladed fans, the motor body diameter was 2½inches and the overall depth was 3inches excluding the fan blades.

They were mounted on a piece of ¼inch steel sheet approximately 8inches by 4inches (Fig. 5). Two holes were cut to take the motors and the sheet painted and attached to the car with brackets. (Sheet steel already coated with p.v.c. is excellent for this job and does not need painting.) These brackets will differ in length, and how they are bent, depending on the vehicle to which they are fitted (Fig. 6).

The fans were attached to the plate with circular metal straps or clips fitted to the steel sheet. Rubber mountings are recommended to absorb vibrations. See Fig. 7 for details. It will be noted that the fans can slide in their mounting. This helps a great deal in positioning them clear of the radiator. Further details on fitting electric fans can be found in the July and August 1971 issues of *Practical Motorist*.

COMPONENT BOX

The electronic circuit is built into a diecast box of approximate dimensions 4½in × 2½in × 1in. This box can be bolted to the underside of the dashboard housing or in a glove compartment.

Although the box is robust it is not a good idea to mount it where damp and heat can get at it (such as under the bonnet) unless suitable protection is given to it. In these circumstances the box should be well painted and the joint of the lid waterproofed. A matt black finish is ideal, since this will aid any heat dissipation from TR1. Silicon grease smeared on both sides of the mica washer of TR1 will also protect from damp as well as assisting with insulation and heat transference. Similar treatment can be given to the cable entry hole when finished.

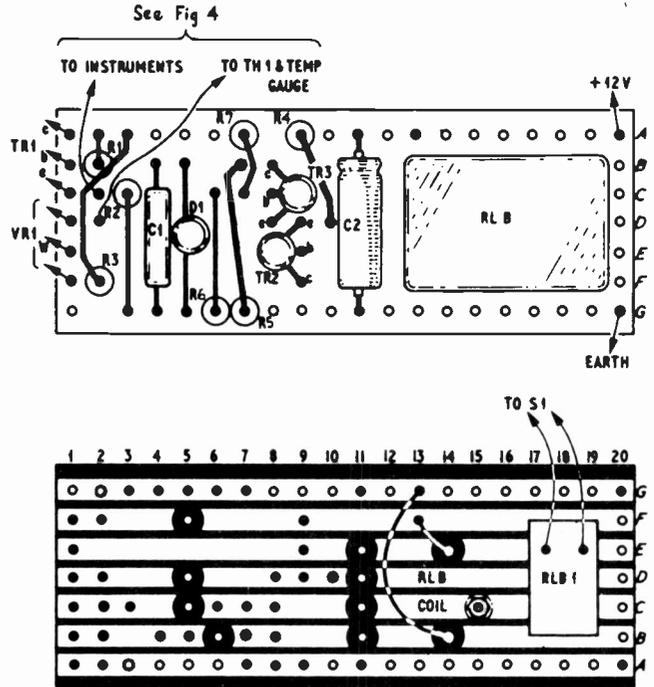


Fig. 8a. Layout of components on Veroboard

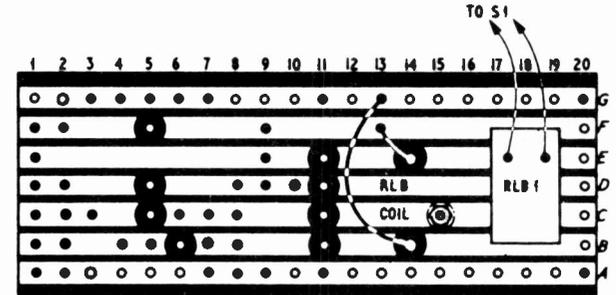


Fig. 8b. Underside view of board showing the cut out for the relay and cuts in the copper strips

The circuit board is shown in Fig. 8. Most of the components are mounted on this board, the exceptions being the thermistor TH1, transistor TR1, VR1 and RLA. The copper strips on the underside need to be cut as shown in Fig. 8b.

The components board was mounted on spacers and fitted to the box with screws, leaving sufficient space to mount the power transistor TR1 on the lid beside the potentiometer VR1. A mica washer must be fitted between the lid and TR1 to ensure insulation, as the case of TR1 will be connected to the collector. A smear of silicon grease is recommended on both sides of the washer. Nylon fixing screws or insulation bushes must also be used. A soldering tag should be fitted under the head of one of these screws to facilitate connection to the collector.

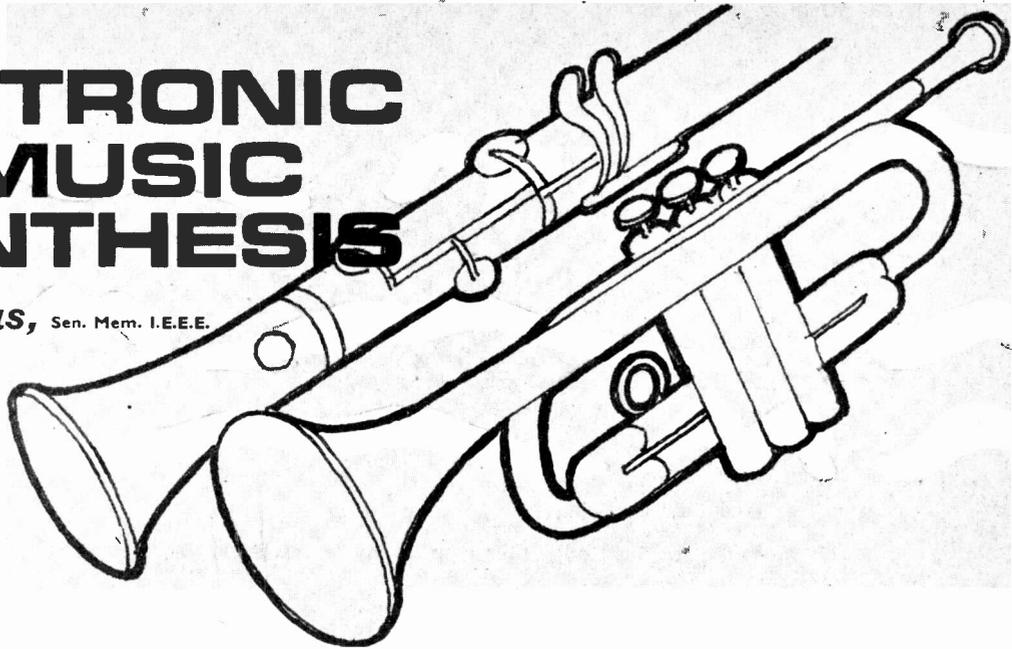
WIRING AND SETTING UP

When finished, the board, potentiometer and transistor TR1 are all mounted in the box and connected up. The wiring to RLA, the manual override switch S1 and indicator lamp LP1 is carried out as in Fig. 1. The feed labelled on the diagram as "12V from battery" can conveniently be taken from the starter solenoid, one ammeter terminal, or the fusebox, whichever seems to be the most convenient point.

Potentiometer VR1 can now be adjusted so that the fans just come on and finally, the resistor across TH1 removed and the thermistor replaced in the engine. A few trial runs in the car will soon show any alterations necessary in the setting of VR1. Keep a watchful eye on the temperature gauge and indicator lamp during these trial runs and try leaving the car ticking over for 10 minutes when it is hot.★

ELECTRONIC MUSIC SYNTHESIS

By A. Douglas, Sen. Mem. I.E.E.E.



A survey of the development of electronic synthesisers which provide new dimensions in tonal colouration

MUSIC is basically dependent on three factors only: pitch or frequency; loudness or intensity; and duration or time. However, other attributes are required to complete a satisfying musical sound. Firstly we must distinguish between music and noise.

Noise is a transient system having a high degree of randomness and usually consists of groups of frequencies unrelated as to pitch and power. As these transients increase in periodicity and become more symmetrical, the elements of a tone are formed. If the shape of the waveform assumes a regular character and lies within prescribed loudness and frequency limits, we have a sound which we call musical.

THE TONE DEFINED

But to establish pitch alone creates no interest; the sound must have character. It obtains this from two important attributes, the harmonic content and the shape of the wave envelope. Other desirable components appear in complex sounds, so to form a complete musical tone we require:

1. A pitch or frequency,
2. A rate at which the sound starts,
3. A length of time for which it persists,
4. A rate at which it decays,
5. A loudness level, not necessarily fixed,
6. Harmonics or partials,
7. Probably noise due to the mechanics of producing the sound,
8. Possibly vibrato or other modulation.

If any of these components is removed, the sound will be unreal, although it may be agreeable. For example, a flute or diapason-like sound on an electronic organ will probably have no "wind" noise but it can be very pleasant. However, take the corresponding organ pipe and blow it, and the synthesis is at once apparent. All of these things we, as listeners, take for granted, because we have always been brought up with them. But consider the composer for a moment.

He is in a unique position, for he requires the mental ability to create melody, harmony and rhythm (to somewhat simplify matters); yet he must thoroughly understand the capabilities of the instruments on which this music will be performed. So the music is in the end dependent on two factors; the composition, and the means to interpret that composition.

INSTRUMENT LIMITATIONS

Now instruments of the orchestra have not changed for many years. If we look at these, two things are at once apparent; some have fixed wind valves, like the oboe, clarinet, saxophone, etc; some have fixed keys, like the organ, piano, celeste, etc. But some have infinite gradations of frequency, like the string family (violin, viola, cello, base viol) and the slide trombone. These differences in construction mean that the composer of Western music is tied to the semitone scale, because this is the smallest frequency interval between successive notes which is possible with keyed instruments.

Further, consider the pitch and power range. Few orchestral instruments cover more than three octaves. Extensions up or down require additional instruments, for instance, the bassoon has to be extended downwards by the contra bassoon; the flute upwards by the piccolo. The whole range of notes required cannot be incorporated in one instrument. It is just the same with the violin, viola, etc.

As to power, well this is extremely limited for all instruments; even the trombone will only deliver just over half a watt of acoustic power. So, for more power we need more instruments. All these foregoing factors are limitations on the composer.

It is true that we have rubbed along for several hundred years with the existing conditions, but this is not to say that composers were satisfied. Far from it, nearly 70 years ago Busoni attempted to introduce another musical form, followed by Webern and others.

In those days when communications were limited and there was no general dissemination of concerts,

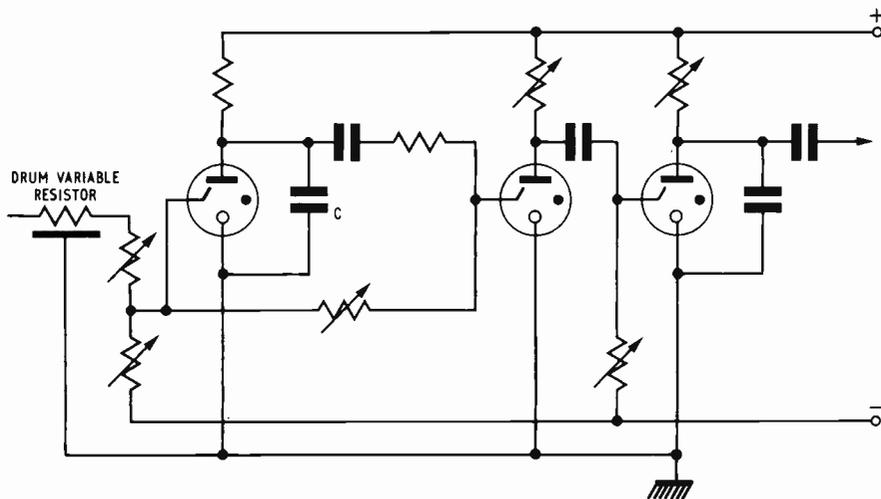


Fig. 1(a). Circuit of Trautonium with frequency divider; (b) the manual drum resistor is in a flexible form, so proportioned that the frequency of oscillation is proportional to the strip in use. Playing the "keyboard" consists of pressing the tubular cover enclosing the resistance contact strip at the point required to produce the correct pitch note

convention outlawed such revolutionary ideas. And of course at that time, all sound patterns had to be produced acoustically, there being no transducers, amplifiers or loudspeakers. Such limitations defeat the boldest spirits.

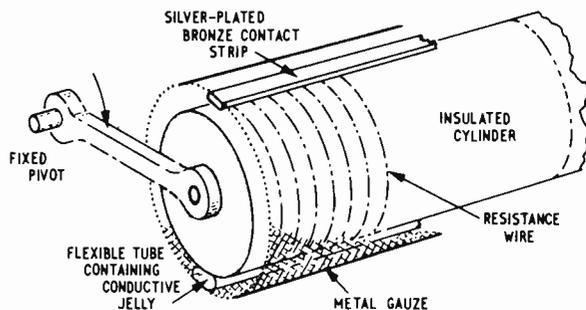
CHANGES AND THE FIRST SYNTHESISER

Most musical performances in those days were sponsored by a patron, who usually financed the composer. As times changed, especially with the introduction of gramophone records and broadcasting, the role of the patron diminished and the financial arrangements altered. Clearly this produced an atmosphere which discouraged serious composition, for the decline in status of the composer increased as the public tastes changed owing to the ease of communication. But, as always, there comes a time when old threads are picked up again in a new guise, this time by organisations instead of individuals.

The use of the valve had become commonplace after the 1914 war, but stability was unheard of and it was not until gas tubes became highly developed in Germany that successful synthetic musical instruments were produced; for it became clear that electrical methods would have to be used to overcome the limitations of all existing physical instruments.

THE TRAUTONIUM

Professor Friederich Trautwein designed the first, and still one of the most useful, synthesising devices, the Trautonium, in 1928. With this two keyboard instrument, instead of the conventional 12 notes to the octave, it is possible to obtain 1,200! Strangely enough, the Trautonium was for some years regarded as a device for examining the tonal spectrum of existing instruments, and for use as a solo instrument with orchestra—as Oskar Sala uses it. Its powers as a composing device were not really recognised until the North West German broadcasting authority set up a school of electronic music research into musical tone, form and composition.



By this time, tape recorders were readily available, as were good quality microphones and reverberation systems. It was the tape recorder which set the seal on the ability to construct music from the basic parameters mentioned, and without which electronic music is not possible, unless it be very elementary in form.

The circuit of the Trautonium is shown in Fig. 1a as an early example of voltage control, so often hailed as a new development. But in fact, voltage to frequency converters, variable gain circuits, vibrato and envelope shaping circuits all depending on voltage control are very old. Note the ingenious way of getting small increments of grid bias control by means of a variable resistance drum, Fig. 1b.

Dummy rubber keys were in fact mounted over the top "keyboard" to give an approximate indication of note positions.

This important instrument was extensively used all over Germany until the coming of the semiconductor. Of course, Helmholtz, Hermann Smith, Dayton Miller and especially Maurice Martenot had devised synthesisers, some purely mechanical, before this.

MACHINE COMPOSITION ADVANTAGES

But now we must revert to more recent problems, and there are several; but most have the composer,

rather than the performer, in mind, although all composing machines can play back the composition.

In the past, a composer could put pen to paper and draft a piece of music for, say, ten players. But how could he make sure he was getting the best intended effect without employing ten musicians to play his score? This is both costly and inconvenient, and calls for a suitable acoustic environment. How much better if he could convey the musical information to a device which could play it for him. He could then listen to it in private and make any corrections thought desirable.

This was the idea behind the RCA and Oramic sound systems. Both of these enable a musician to prepare the "score" with his own hands and play it at once—no matter how long it is. The information imparted to the system can be called back and re-played again and again, and alterations made. This can only be done for very short periods of time with synthesisers of the Moog or EMS types unless they incorporate a computer and even then, the playing time per realisation is quite short—perhaps 30 seconds.

THE RCA SYNTHESISER

Let us then have a quick look at the RCA machine. This is a complete studio, and not intended to be portable, a typical installation being in a college of music or a university. No matter what the system, it must be capable of providing the eight basic parameters mentioned earlier, as a minimum. Of course, there may be extensions and there is great flexibility for each of these.

The apparatus is contained in ten standard racks, each 6ft high, see Fig. 2. It comprises a range of tuning fork oscillators, frequency multipliers and dividers, means for producing any overtone or harmonic structure, duration or decay characteristic, vibrato and "glide" circuits, loudness or level controls, relay trees for operating the foregoing from the information source, and other devices to produce deviations from the above for special effects.

All the above circuitry is duplicated so that two simultaneous channels are available. The whole of this is controlled from the keyboard perforator.

PERFORATED ROLLS

Most readers remember the perforated paper roll used in player pianos. The information required to operate the correct notes took the form of perforations in the paper. As this was unwound from its reel by a motor, the roll passed over a perforated metal bar—there being as many apertures as there were notes on the piano.

A vacuum was created in a bellows system, and when a perforation in the roll coincided with an aperture in the tracker bar, as the perforated rod was called, air would be sucked in to the appropriate hole and this energised a small pneumatic device which actuated the correct hammer.

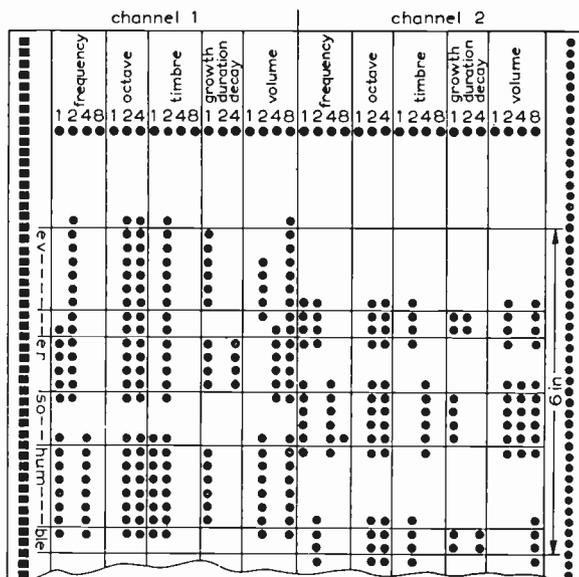


Fig. 3. Part of RCA punched roll

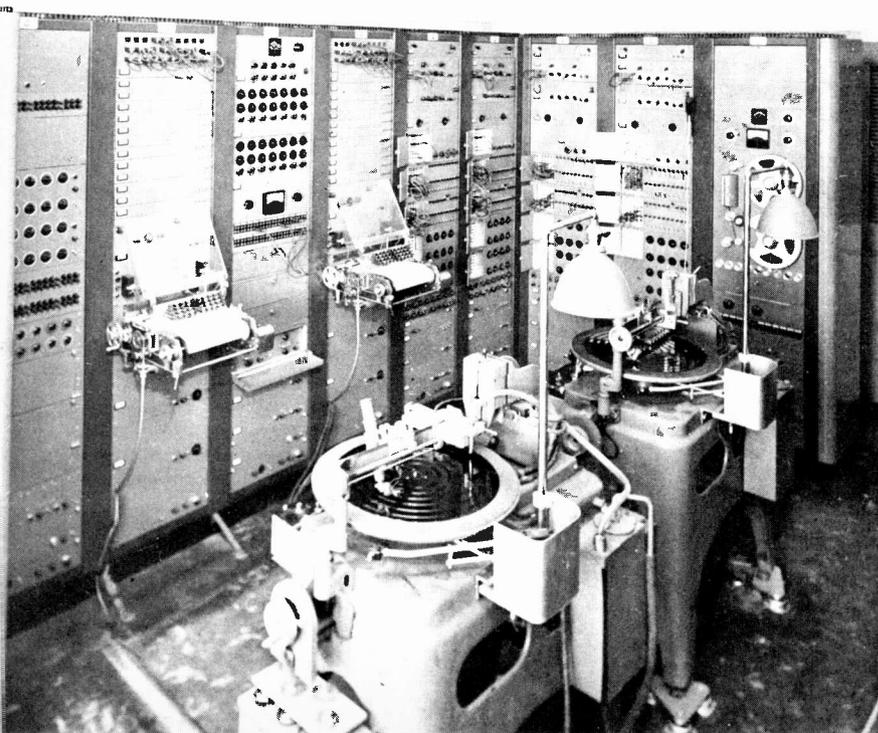
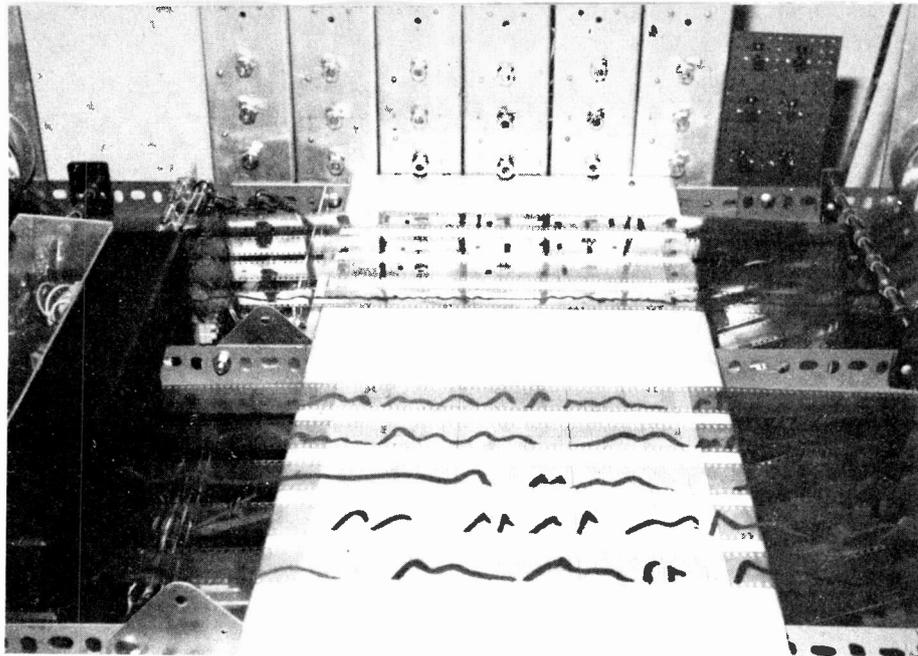


Fig. 2. RCA Synthesiser at Columbia University

Fig. 4. Digital and analogue information on film for the Oramic Sound System



To produce a sustained note, a slot was cut in the roll, thus the hammer did not return until the end of the slot arrived, and the damper was so kept off the strings.

The same idea is used by RCA to convey the information, but as the paper roll is wider, slots make it liable to stretch and therefore a series of closely spaced holes is used for a sustained note. The little microswitches which "feel" a hole are so arranged that they will not close again if two holes immediately follow one another; in this way, sustained notes are possible.

An alternative method is to paint dots or bars for the duration of the required parameter, and then scan them photoelectrically. By this means excessive perforations in the paper are avoided. An example of the prepared roll is given in Fig. 3.

DISC AND TAPE LINKS

The two perforators are mechanically linked to either disc or tape recorders, so that after the completion of a composition, the substance can be recorded and either played back or stored.

Although only two channels are provided, re-recording is resorted to, and with modern materials quite elaborate compositions can be realised and performed. But one of the prime objects is to help the composer; he can come along with a theme, punch out the parts with quite arbitrary tone colours, listen to his harmonies at once, and correct anything which he does not like. Armed with the final information, he can write out the score in completed form—and all without employing a single live musician!

It is often thought that gliding tones, percussion sounds, "wah-wah", etc. are recent ideas. This is not at all true; all of these effects have been known and used for over 40 years; it is just that until the coming of the semiconductor, the apparatus to produce the effects was too bulky to be convenient.

Today, it is hard to realise that the free cone moving coil loudspeaker is nearly 50 years old and the rigid diaphragm moving coil speaker is nearly 80 years old.

Now it is clear that the RCA system closely approaches a stepless method, for by having many perforations and restricting the frequency or other coverage per paper section, one can produce intervals smaller than a semitone and these can be bridged by the portamento (or gliding) system. Nevertheless, the fact that the holes are discrete and represent time intervals does limit the synthesiser in some ways. When all the parameters are on the one roll, it is not possible to separate them or, for example, to change their relative positions or phase relationships.

THE ORAMIC SOUND SYSTEM

To have complete control over all the factors involved, a system such as the Oramics graphic device offers unlimited flexibility. The essential part, which provides the information, is shown in Fig. 4.

Basically, the idea of drawing a waveshape or control element is far from new; it has been extensively tried in Canada, Germany, France and this country for electronic organ generators, for example, as well as for motion picture film. But all these investigators tried to produce the fully-finished and complete complex waveform at one time, just as if it were a photographic sound film track. For composing or musical synthesis, this would be useless; no variation is possible once the track is drawn.

The Oramic system builds up a sound picture from its basic elements, related to each other only in time. Observe that there are a number of independent tracks, each consisting of a length of transparent 35mm motion picture film. These are contained on spools and are drawn up by sprockets keyed to a common shaft. Thus, however many sprockets there are, all must rotate in synchronism. Now the film passes over a large metal plate, which is the writing table and is again picked up by similar sprockets on another shaft; this is coupled by a chain to the first shaft, so they must turn together and cannot slip.

INFORMATION TRACKS

Information is imparted to the film tracks in the manner shown in Fig. 5. For example, the top four

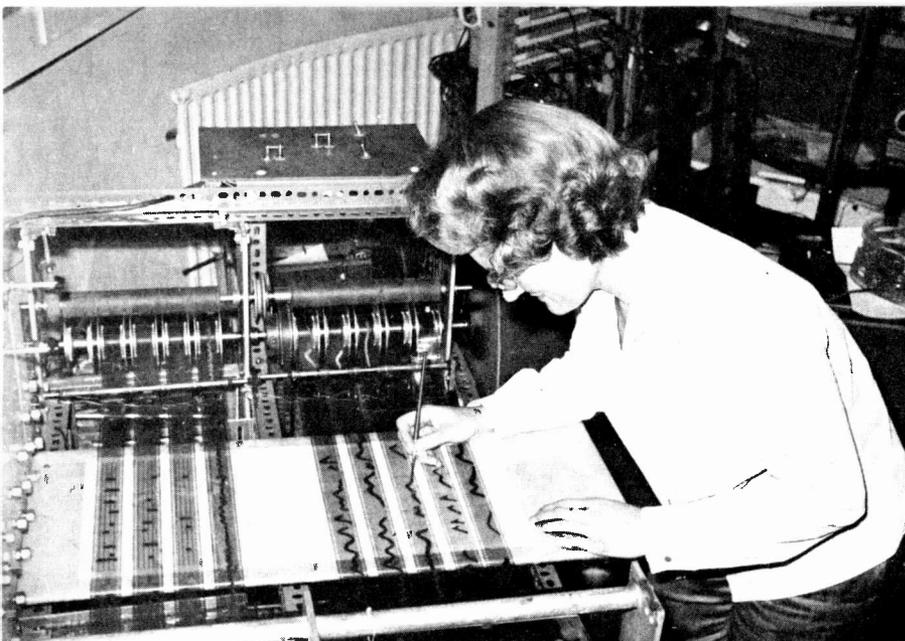


Fig. 5. Printing information on film tracks

tracks could be frequency tracks, the fifth could be noise: then the sixth could be a gating track, to initiate the signal, the seventh could be envelope control (rise time, duration, decay) and the eighth track could be vibrato. Of course, there is no limit to the number of tracks possible.

The information is painted or drawn in opaque ink, or it could be strips of adhesive tape cut to shape and stuck on (easier to alter). When the shafts are rotated, the films pass from right to left over photoscanners with suitable exciter lamps. These scanners control the different sections of the synthesiser, in much the same way as do the microswitches of RCA, but of course in a smoother and much more accurate way. Additional harmonic control is imparted by drawn masks scanned by a cathode ray tube, and these are instantly changeable. Much more complex harmonic patterns can thus be produced than by any switching system.

The tracks are ferried back and forth until the composer is satisfied that he has the effect he wants. Then the next "bars" can be worked on and so on, because in this system there is virtually no limit to the length of the composition.

An electric motor drives the sprocket assemblies at a constant speed when the hand control is not being used, and of course the composition is recorded on tape. Even so, this need not be the end of the process; if each signal track is recorded separately on a multi-track machine, further after-treatment is possible before combining the tracks in final form.

This machine, by the way, is an excellent teaching device, since the effect of altering each parameter can not only be seen, but heard. The real meaning of a musical waveform is thus clearly brought home to the student.

SOLID STATE VERSATILITY

We might again stress that however simple or however complex the apparatus, it must have the basic facilities mentioned at the outset and it need have no more; but it can have elaboration of each channel and more channels. Today then we find that because of the compactness and light weight of solid state circuits, there are portable or semi-portable synthesisers of formidable capabilities. The purpose of all

these devices is the same, but some have facilities for taking in existing sounds (e.g. a microphone) and processing this in some special way.

The versatility of the transistor synthesiser is largely due to the use of voltage control. As already pointed out, this is far from new, but it is more readily applicable to semiconductors. Broadly it confers the advantage of noiseless gain control, the ability to use very long signal leads, and abolition of difficulties associated with impedance matching.

R. A. Moog appears to have been the first to apply these techniques commercially and in order to draw attention to the method, he made the well-known "Switched on Bach" record. This is indeed a combination of the old and the new, and one feels that Dr Moog was very wise not to rely on any modern composition for processing. Systems like this have no storage time, therefore only a small amount of synthesis is possible without resetting. Consequently such recordings take a long time to complete—it may run into months.

THE SYNTHI-100

These devices contain the facilities required to form any kind of musical or non-musical sound. Later developments have abolished the cumbersome patch cord, which gets in the way and is easily broken, so we show in Fig. 6 an example of the most up-to-date studio in existence, that of the Synthi-100 made by Electronic Music Studios of London.

Readers will of course have seen the advertisements for the VCS-3 in this journal, and the author has one of these, with keyboard. But the Synthi-100 is something far in advance of anything else, not only because of its facilities and long-term stability (which has always been poor with solid state synthesisers) but because for the first time it includes a small special purpose digital computer, complete with converters from analogue to digital and vice versa.

The storage capacity of this device is 10,240 bits, and the start of each event can be controlled to an accuracy of 1 part in 1,024; thus, if the clock is set to a rate of, say, 100 pulses per second, each event



...LISTLESS?

DIFFICULT
STARTER?

DR. P.E.
HAS THE
CURE....
NEXT MONTH !!



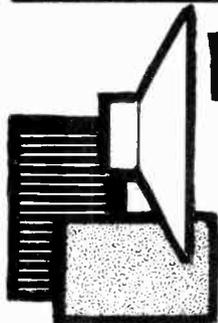
After prolonged and searching road tests performed under all normal (plus some abnormal) conditions in a variety of different types of popular cars—Practical Electronics now presents and commends to its readers (and indeed the whole motoring public) this excellent IGNITION SYSTEM with unique circuit features.

For zip and peak performance, you owe it to yourself and your car to build P.E. Scorpio.

Simple, uncomplicated installation in most vehicles.

WITH P.E.
'SCORPIO'...
**THERE'S A
STING IN
IT'S TAIL !!**

IT'S SOUND SENSE !



LOUDSPEAKER SYSTEMS

DRIVE UNITS . . . ENCLOSURES

A SPECIAL AUDIO FEATURE . . . an objective discussion on all important aspects relating to the vital final component of any audio system

**ALL IN THE NOVEMBER ISSUE
OF PRACTICAL ELECTRONICS
ON SALE OCT. 15**

Heavy demand is expected, so advisable to place order with your newsagent or supplier NOW to avoid possible disappointment. Sorry, but we can no longer supply back numbers.

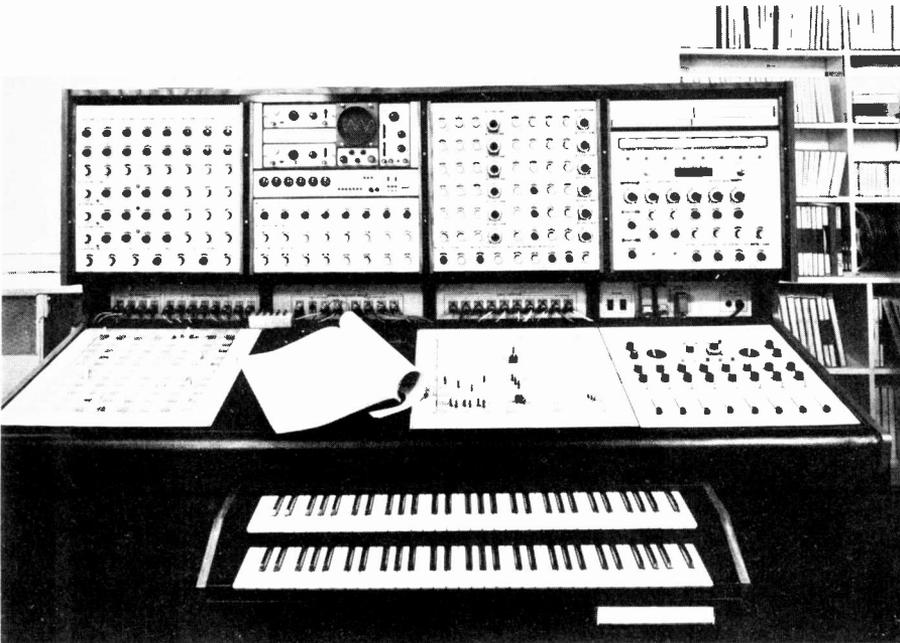


Fig. 6. EMS Synthi-100 studio

may be adjusted backwards or forwards in increments of one hundredth of a second. The total sequence length would be 10 seconds.

The many signal and processing circuits can be controlled from two 5 octave dynamically proportional keyboards. These operate the studio in real time, on six tracks, with the sequencer (the computer) remembering what is played.

This performance can be played backwards or forwards, at any speed, and edited to any degree of precision, prior to recording on magnetic tape. It is as if an infinite number of pianola rolls could be made instantly, but for any parameter.

SIGNAL AND PROCESS CIRCUITS

Briefly, this ingenious device contains voltage controlled slew limiters, a frequency to voltage converter and a two-output random staircase generator with controllable time and amplitude variations. Twelve drift-free oscillators, from 20kHz to 40 seconds per cycle; eight dynamic filters and three transformerless ring modulators, which in fact can be cascaded to give double or even triple modulation—a fearsome thought!

Also there are eight voltage controlled output channels, eight input amplifiers, two joystick controllers, three envelope shapers and followers, a noise generator and reverberation units. All of these, and many other functions, are controlled by two cordless 60 by 60 way patchboards, a total of 7,200 pin locations.

It is not surprising that the BBC bought this unit in preference to all others, although it has VCS-3's as well.

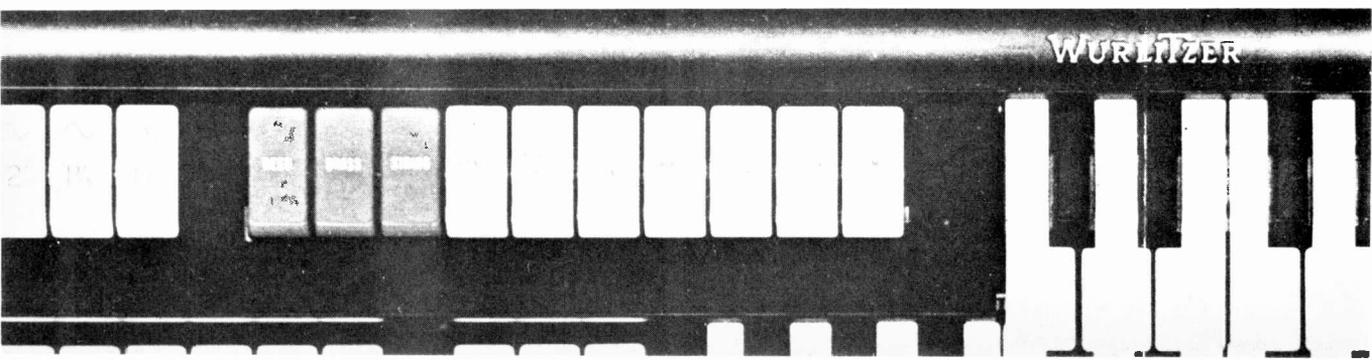
We cannot, of course, give any examples of sounds created by such systems, because a sound cannot be written down and even if this were possible, it would mean different things to different people. But we can say that it can produce musical effects of surpassing beauty, and at the other extreme, noises of an alarming nature. One could never exhaust the versatility of the Synthi-100.

And so to computers. Of course, any system feeding in digital information—like the RCA roll—is a kind of computer. But the description implies a logic device. It further suggests ownership of a computer, and this limits the field to those so equipped and with the time to spare. Consequently it is not surprising that most of the work along these lines has been carried out by the Bell Telephone Laboratories. Nevertheless, one of the most modern computer studios in the world is in London.

SYNTHESIS BY COMPUTER

Frequency and any function which can be specified numerically requires digital treatment; duration, envelope control and other factors involving time need analogue circuitry; but various compromises are necessary because of the enormous amount of detail required.

Fig. 7. Showing the short manual of the new Wurlitzer 4037 organ. This controls the Orbit III Synthesiser which adds a new realism to conventional stops. The controls to the right provide a whole new repertoire of totally new sounds for the performer. This means that the scope of the total instrument is almost limitless



Numbers stored in a computer represent the desired sound waves to be generated. These numbers are converted to pulses of constant width but of amplitudes corresponding to numbers; for example, twelve is twice as "loud" as six. These pulses are then smoothed to produce a sound. Frequencies from 0Hz to nHz can be generated by 2n pulses per second, so we require 10,000 per second to obtain 5kHz at the loudspeaker.

But this is far too tedious a process for any length of time, so simplifications have been made by grouping frequency bands and other parameters into blocks or "instruments" as they are called, so that the number of operations to release or call up a complex event is reduced. Modifying parameters are introduced by the composer, and the computer reads a line from the instrument signals and inserts the chosen modifiers at the correct time, thus activating the instrument with generated numbers equivalent to the duration of the note.

This process can also be made self-repetitive in a random manner, so that the same effect is never repeated twice; it is then rather like throwing a number of dice into a bowl and then shaking them out, in the hope that a certain total number will appear!

THE HUMAN ELEMENT

All in all, and from such recorded computer music as is available, it is irrefutable that if one wants music agreeable to our ears at this time, it is impossible to dispense with the human composer, although it is true that some sort of form can emerge from a process based on an order of probability.

Work has been done on the songs of Stephen Foster, so well known to all. All Foster's works have some resemblance to each other, so that it is possible to analyse them and establish an order of recurrence for all the notes used. If suitable deductions are made from these figures, and the result fed into a computer, sounds will emerge which, in their fundamental structure, bear a resemblance to Foster's compositions but do not sound like any of them. However, here we have a simple case, involving not more than 12 notes in all, because these are folk tunes.

PERFORMANCE DEFICIENCIES

A disadvantage of the conventional computer is that the composer is unlikely to be able to re-cast his thinking into suitable "language" acceptable to the computer; hence he may have to work through a programmer, and this may very well upset his musical judgement and certainly any spontaneity.

There are some simplifications of the computer system, notably the serial structure method, but there is no doubt that when the machine takes charge, the warmth of character and the nuances of expression disappear completely, however "clever" the result may appear to be.

Therefore we can assume that no machine is likely to supplant the human brain, any more than an electronic synthesiser is likely to take the place of a member of the orchestra. But certainly it can augment and extend his facilities and of course, can produce special effects as we all know. This would seem to be a likely exploitation of musical electronics in the future.

LINKING ORGAN AND SYNTHESISER

Readers have no doubt grasped that time is required to set up effects on any synthesiser, but if this range is limited, or complex mixing is not required, some of the facilities can be made available very quickly. We therefore see, in the new Wurlitzer 4037 organ, a simple Orbit III synthesiser built into the console and playable from a short compass third manual.

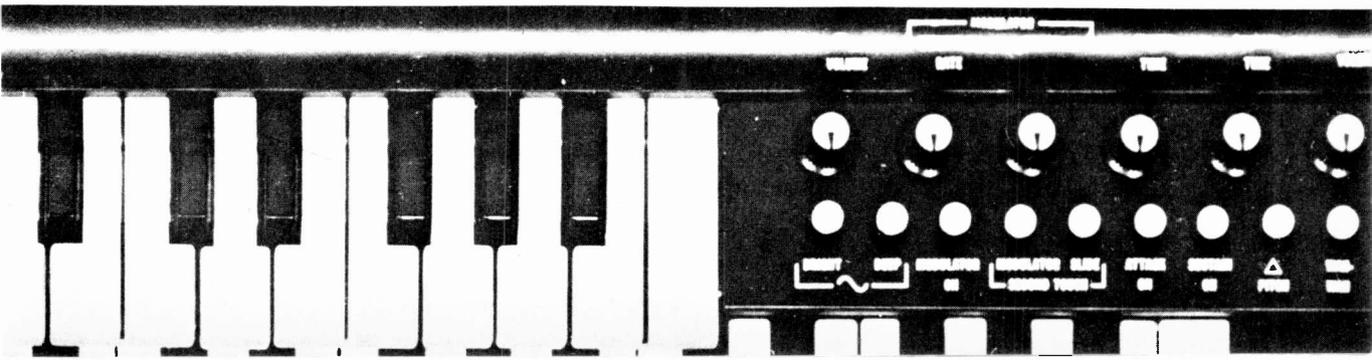
A vast number of extra effects came from this circuit, which has double touch keys so that yet further circuits can be brought into action. Because of the variable pitch characteristics of the Orbit III section, it must be on a keyboard separate from the main organ. Fig. 7 shows the lay-out.

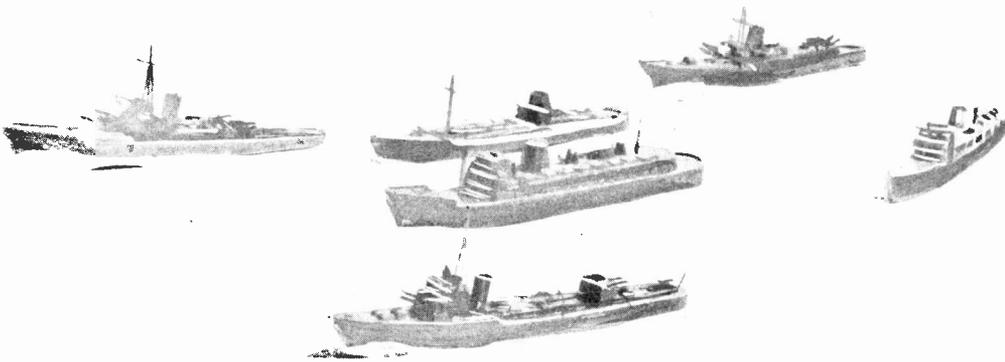
TRENDS FOR THE FUTURE

Finally, one must appreciate that the performer-audience relationship might change so far as the concert hall is concerned. Since the advent of multi-track recording for cinema films, loudspeakers have been used above and behind an audience as well as behind the screen. The listener can be immersed in the sound field, and this produces strong psychological reactions in many people and is a powerful factor in estimating the effect of sound.

Because of the increasing use of magnetic tapes and the excellence of reproduction now obtainable, recorded sound can be as realistic as the original except for the dynamic or loudness range. It is therefore altogether possible that some synthetic music, alone or combined with recorded conventional music, may be played before audiences in halls designed acoustically so as to favour the loudspeaker and no other kind of sound source.

This could already be so in the cinema, were it not required to be so heavily damped because of the speaking voice. We await the developments of the next few years with great interest. ★





WAR GAMES COMPUTER

PART THREE By D. R. Daines

THE basic concept of the War Games Computer has been described together with the constructional information required to build up to the Third Stage (Fig. 3). The remaining stages convert the computer for fair assessment of any "damage" sustained during battle. Additionally this next stage will provide various types of target.

STAGE FOUR — PANEL 'B'

Panel B (Figs. 12 and 13) and switch S11 begin to open up the real potential of the computer, for this panel adds up the energy of the incoming pulses and gives us an indication when a preset amount has been received, or when a ship is sunk (Fig. 12).

Incoming pulses of various amplitudes are amplified by TR10. This is not to say that the previous stage has been a wasted effort, for all pulses are amplified—the strong and the weak. Capacitor C2 blocks d.c. and leaves only pulses swinging about zero volts, which any high impedance voltmeter or oscilloscope will show. In order to charge the storage capacitor C12, however, only negative-going pulses are required and this is achieved by the diode clamp D9 and R77. The exact value of R77 will depend on the characteristics of the particular diode used. Adjust this until the positive swing of the pulses is exactly zero volts.

SCHMITT TRIGGER

The Schmitt trigger formed by TR11 and TR12 will fire briefly when the voltage at the base of TR11 reaches 2 volts, which it does when C12 is charged through R78. Switch 59a is a cancel switch to discharge C12 completely; C13 is an anti-surge capacitor to prevent the Schmitt from firing when the switch is snapped open.

The brief outgoing pulse passes through diode D10 and a flying lead (k) to (j) on D11 routes it to switch S11. Resistor R85 provides a convenient method of

adjusting the energy available to the much larger storage capacitors C14 to C23, while diodes D10 and D11 prevent leakage of charge already on the selected capacitor. If constructors have no intention of going beyond this stage of construction, one of the Schmitt triggers (Trigger 1) can be omitted, the output from R78 going direct to D11 via points (h) and (j) on Fig. 12.

The storage capacitors C14 to C23 can be of any desired capacitance; those shown in the components list are for guidance only.

No accurate work has been done on the exponential curve comparing with size of ship, but the above component values have worked very well in dozens of games. (N.C. is no connection.)

EXTERNAL STORAGE CAPACITORS

Switch S11 is a single-pole twelve-way wafer switch fitted with a skirted knob, which has the figures 0-10 on the skirt plus a blank space. In the 0 position no capacitor (n.c.) at all is fixed, which is a useful facility when checking the correct functioning of the circuit, while in the blank position a single wire leads to a socket which also has a chassis contact. In this way external storage capacitors C14a to C23a may be switched in. Such external additions might be temporary, or favourite values permanently soldered to the tags of a switch and housed in a little box. Notice that the positive side of all capacitors must be returned to computer chassis.

From point (l) two wires are taken off—one to S10a and one back to panel B at TR13 base. (Fire bistable line is mentioned later). When the charge across the capacitor selected by S11 reaches two volts, Schmitt trigger 2 fires. The resulting brief pulse passes through C25 to Bistable 2 which switches to its second stable condition with TR15 hard on and TR16 fully off. The voltage TR16 collector rises, switching on TR17 and TR18, which are arranged in a super-alpha pair.

Since R100 carries considerable current it generates some heat. For this reason it is better to keep it away from where the increase in temperature may affect the working characteristics of transistors or even destroy them. It is used for final adjustment of lamp voltage for LP2, after some 20 V has been dropped across R16 in the power supply.

The lamp itself is mounted behind a plastic lens and marked "Magazine", the return wire being connected to chassis (Fig. 10b).

Switch S10 is a double pole on/off which discharges the capacitors on switch S11 (S10a) and also earths the base of TR15, thereby switching it off (S10b) and extinguishing the lamp. Resistor R101 is a low value discharge load for the capacitors on

S11; the value should be found to be sufficiently low not to interfere with the circuit operation (about 22 ohms). Although not shown in the wiring diagram (Fig. 10b) R101 can be inserted between S10a and Trigger 2 input (l).

USE OF STAGE FOUR

The knob-skirt numbers correspond to numbers assigned to ships and as long as players remember to turn to the correct target number each time, they may happily bang away at each other confident in the knowledge that the lamp will glow when any ship has been at the receiving end of sufficient computed damage. Fuller details will be given later.

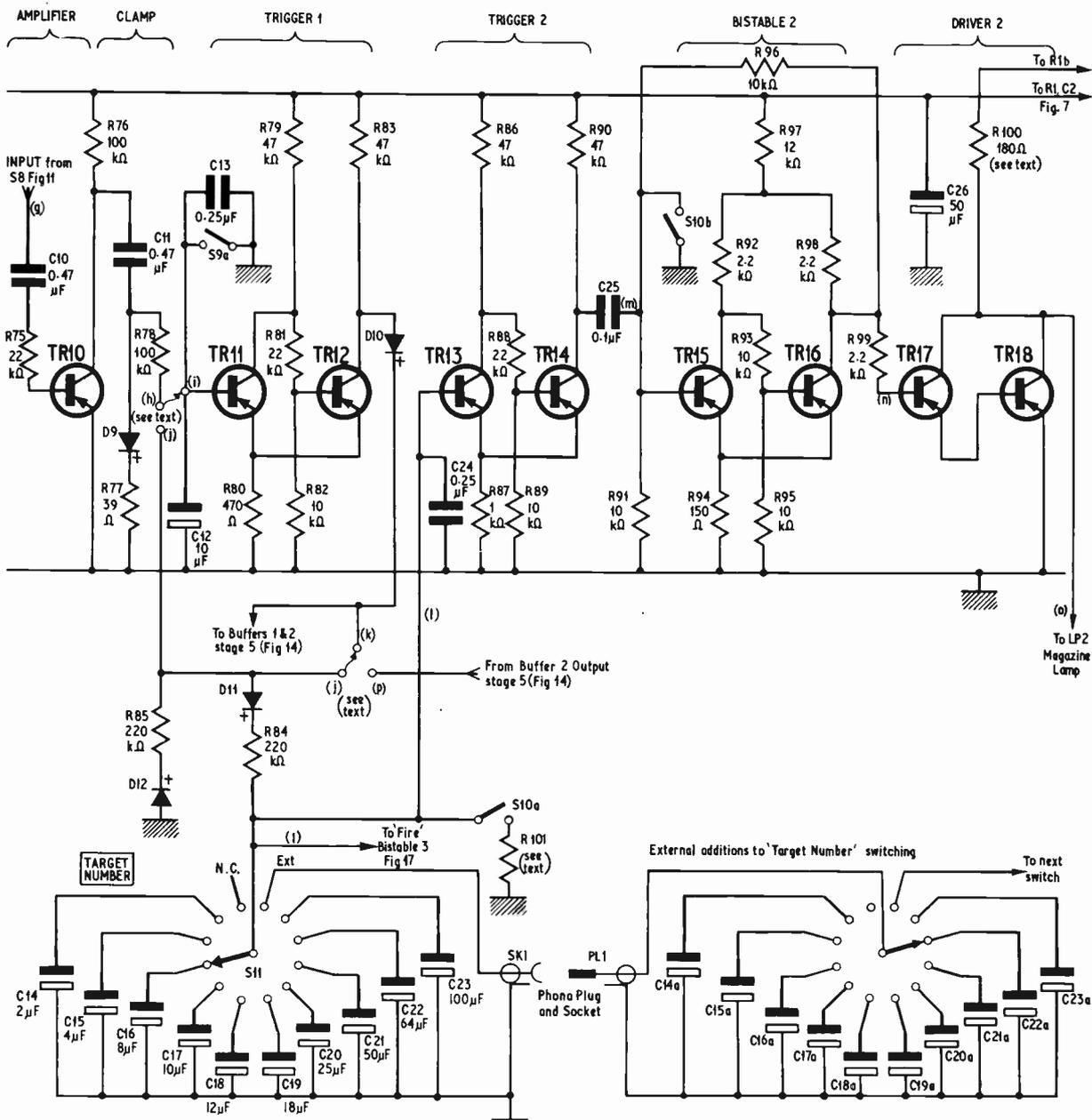


Fig. 12. Circuit diagram of Panel B (stage four). Incoming pulses are passed to the selected storage capacitor (C14-C23); trigger 2 fires when this capacitor is fully charged, bistable 2 operates, and driver 2 switches on LP2

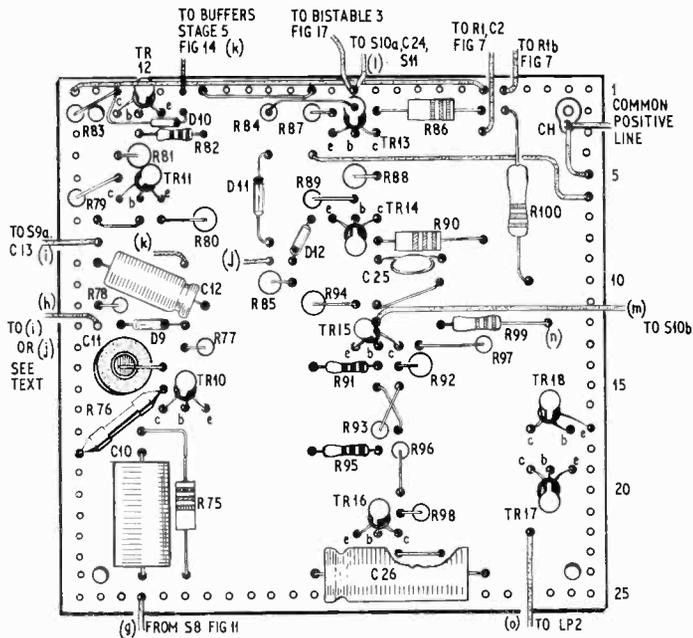


Fig. 13a. Layout of components on Panel B with underside view showing the breaks in the copper strip

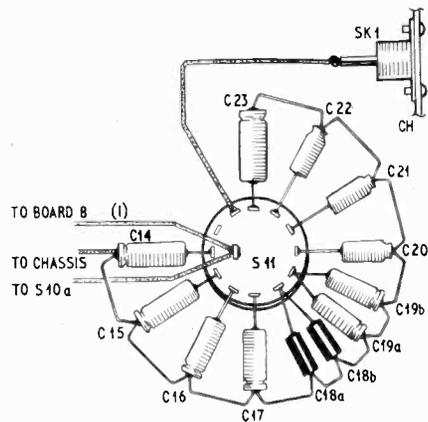


Fig. 13b. Wiring details for target number switch S11 and the storage capacitors

Components . . .

STAGE FOUR (Panel B Figs. 12 and 13)

Resistors

| | | | | | |
|-----|---------------|-----|---------------|------|-----------------|
| R75 | 22k Ω | R84 | 220k Ω | R93 | 10k Ω |
| R76 | 100k Ω | R85 | 220k Ω | R94 | 150 Ω |
| R77 | 39 Ω | R86 | 47k Ω | R95 | 10k Ω |
| R78 | 100k Ω | R87 | 1k Ω | R96 | 10k Ω |
| R79 | 47k Ω | R88 | 22k Ω | R97 | 12k Ω |
| R80 | 470 Ω | R89 | 10k Ω | R98 | 2.2k Ω |
| R81 | 22k Ω | R90 | 47k Ω | R99 | 2.2k Ω |
| R82 | 10k Ω | R91 | 10k Ω | R100 | 180 Ω 1W |
| R83 | 47k Ω | R92 | 2.2k Ω | R101 | 22 Ω 1W |

(see text)

All $\pm 10\%$ $\frac{1}{4}$ W carbon except where shown

Capacitors

| | |
|-------------------------|---|
| C10 | 0.47 μ F polyester 125V (or 0.5 μ F) |
| C11 | 0.47 μ F polyester 125V (or 0.5 μ F) |
| C12 | 10 μ F elect. 50V |
| C13 | 0.22 μ F polyester 125V (or 0.25 μ F) |
| C14 | 2 μ F elect. 15V |
| C15 | 4 μ F elect. 15V |
| C16 | 8 μ F elect. 15V |
| C17 | 10 μ F elect. 15V |
| C18a | 8 μ F |
| C18b | 4 μ F |
| } 12 μ F elect. 15V | |
| C19a | 8 μ F elect. 15V |
| C19b | 10 μ F elect. 15V |
| C20 | 25 μ F elect. 15V |
| C21 | 50 μ F elect. 15V |
| C22 | 64 μ F elect. 10V |
| C23 | 100 μ F elect. 15V |
| C24 | 0.22 μ F polyester 125V (or 0.25 μ F) |
| C25 | 0.1 μ F polyester 125V |
| C26 | 50 μ F elect. 50V |

Transistors and Diodes

TR10 to TR18 OC71 or similar pnp germanium type
D9 to D12 OA91 or similar germanium type

Switches

S9 Double-pole, on/off or changeover toggle
S10 Double-pole, on off or changeover toggle
S11 Single-bank, single-pole, 12-way wafer

Miscellaneous

LP2 6V 0.06A m.e.s. lamp and holder SK1, PL1
Phono or coaxial socket and plug Veroboard
0.15in in matrix $3\frac{1}{2} \times 3\frac{1}{2}$ in with copper strips.

DISCOUNTS UP TO 60% ON BRANDED GOODS

ALL BRAND NEW in manufacturer's sealed cartons. GUARANTEED 12 MONTHS.

SONY · LEAK · SINCLAIR · TELETON · ARMSTRONG · THORENS · PHILIPS · K.E.F. · TEAC · ROGERS · PIONEER

SPECIAL OFFER

Garrard SP25 Mk.III
Goldring G800H

Teak plinth and tinted cover. Ready wired for immediate use.

£18.50

Please add £1.15 for post and packing

TURNTABLES

Please add 50p for post and packing

| | |
|-------------------------------------|--------|
| *Garrard SP25 Mk. III | £10.75 |
| *Garrard 2025TC with stereo cart. | £8.00 |
| *Garrard 2025TC with Sonotone 9TAHC | £8.95 |
| *Garrard 3000 with Sonotone 9TAHC | £10.25 |
| *Garrard SL65B | £13.25 |
| *Garrard AP76 | £18.75 |
| *Garrard SL72B | £24.00 |
| *Garrard SL75B | £26.00 |
| *Garrard SL95B | £35.50 |
| Garrard 401 | £27.00 |
| *B.S.R. MP60 | £11.00 |
| Pioneer PL12AC | £39.00 |
| Thorens TD125 | £62.50 |
| Thorens TD125AB | £98.50 |
| Thorens 150AB11 | £42.50 |
| Goldring GL69/2 | £21.50 |
| Goldring GL69P2 | £29.50 |

* Items marked can be mounted in plinth and cover, ready wired for £4.50 extra plus 25p for post and packing

AMPLIFIERS

Please add 50p for post and packing

| | |
|-----------------------------------|--------|
| Armstrong 521 (cased) | £41.95 |
| Amstrad 8000 | £17.70 |
| Dulci 207 | £15.95 |
| Dulci 207M | £21.00 |
| Europhon 10 + 10 | £14.50 |
| H.L. Audio 707 | £17.75 |
| MetroSound ST20E | £29.00 |
| Philips R580 | £20.50 |
| Pioneer SA500 | £41.50 |
| Pioneer SA700 | £68.00 |
| Pioneer SA900 | £94.50 |
| Rogers Ravensbrook Chassis | £36.00 |
| Rogers Ravensbrook Cased | £41.00 |
| Rogers Ravensbourne Chassis | £45.00 |
| Rogers Ravensbourne Cased | £48.50 |
| Sinclair 2000 Mk. I | £21.00 |
| Sinclair 2000 Mk. II | £22.25 |
| Sinclair 3000 | £32.50 |
| Sinclair PRO60/2 × Z30/PZ5 | £15.75 |
| Sinclair PRO60/2 × Z30/PZ6 | £18.00 |
| Sinclair PRO60/2 × Z50/PZ8/Trans. | £22.95 |
| Teleton SAQ206 | £18.00 |

TUNERS

Please add 50p for post and packing

| | |
|-----------------------------------|--------|
| Armstrong 523 AM/FM | £40.00 |
| Armstrong 524 FM | £31.00 |
| Dulci FMT7 | £19.50 |
| Dulci FMT7 Stereo | £27.00 |
| Teleton GT101 MPLX | £30.50 |
| Rogers Ravensbourne FET 2 Chassis | £45.50 |
| Rogers Ravensbourne FET 2 Cased | £49.00 |
| Rogers Ravensbrook FET 4 Chassis | £37.50 |
| Rogers Ravensbrook FET 4 Cased | £38.00 |

PICK-UP ARMS

Please add 35p for post and packing

| | |
|-----------------------|--------|
| SME 3009/S2 | £23.95 |
| SME 3012/S2 | £25.75 |
| Goldring L75 | £9.50 |
| Goldring L69 | £7.50 |
| Audio-Technica AT1005 | £14.95 |

TUNER AMPLIFIERS

Please add 75p for post and packing

| | |
|-----------------------------|---------|
| Armstrong 525 FM | £68.75 |
| Armstrong 526 AM/FM | £78.75 |
| Teleton CR10T with speakers | £26.25 |
| Teleton F2300 (new product) | £38.50 |
| Teleton CR55 | £87.00 |
| Teleton TSF50 | £51.75 |
| Teleton F2000 | £31.00 |
| Wharfedale 100-1 | £103.00 |
| Teleton TF550LA | £60.00 |
| Teleton 2100 | £34.00 |

SPEAKERS

Please add £1.25 for post and packing

(PRICE PER PAIR)

| | |
|----------------------|---------|
| Wharfedale Denton | £29.75 |
| Wharfedale Melton | £49.90 |
| Wharfedale Triton | £45.75 |
| Wharfedale S/Linton | £40.75 |
| Keletron KN500 | £15.00 |
| Keletron KN700 | £18.00 |
| Keletron KN123/3 | £31.50 |
| Keletron KN1000 | £27.50 |
| Keletron KN1500 | £37.00 |
| Keletron KN2000 | £41.50 |
| K.E.F. by letter | £35.50 |
| Celestion Ditton 120 | £49.50 |
| Celestion Ditton 15 | £101.00 |
| Celestion Ditton 25 | £67.50 |
| Celestion Ditton 10 | £34.00 |
| Ste-Ma 400 | £48.50 |
| Ste-Ma Hi-Fi 4 | £78.00 |
| Ste-Ma Hi-Fi 115 | £17.50 |
| Ste-Ma Hi-Fi 3 | £63.50 |

GLOBAL CONTRACT SERIES

| | |
|---------------------------------|--------|
| Contract 8 3-way 7 watts R.M.S. | £16.00 |
| Contract 6 3-way 5 watts R.M.S. | £10.75 |

SPEAKER KITS

| | |
|-------------------|--------|
| Wharfedale Unit 3 | £20.50 |
| Wharfedale Unit 4 | £27.00 |
| Wharfedale Unit 5 | £39.00 |

CARTRIDGES

Please add 10p for post and packing

| | |
|------------------------|--------|
| Goldring G850 | £3.75 |
| Goldring G800H | £5.50 |
| Goldring G800 | £6.75 |
| Goldring G800E | £10.50 |
| Goldring G800SE | £15.25 |
| Sonotone 9TAHC Diamond | £1.75 |
| Shure M3DM | £4.75 |
| Shure M445/7/C | £7.00 |
| Shure M55 | £9.00 |
| Shure M75E | £14.00 |
| Shure V15 Type 2 | £28.00 |
| Shure M44E | £8.00 |
| Shure M31E | £8.50 |
| Shure M32E | £8.00 |
| Audio-Technica AT66 | £4.95 |
| Audio-Technica AT35 | £14.25 |
| SMC 101 | £2.79 |
| MC15 | £4.50 |

TAPE DECKS & RECORDERS

Please add 75p for post and packing

| | |
|------------------|--------|
| Teleton FXB 510D | £44.75 |
| Teleton TCRI30 | £22.90 |

PERSONAL CALLERS VERY WELCOME!

Come and browse through our multi 1,000 foot warehouse/showroom. NO PARKING PROBLEM

PURCHASE TAX CUT!

—we pass these reductions to you.

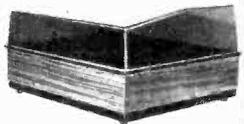
The following branded names are not allowed to be advertised at Discount Rates—SONY, SANYO, BANG & OLUFSEN, TRIO, RADFORD, SONAB, NIKKO, CHILTON, FERROGRAPH, LUXOR, CELESTION, AKAI, TANNoy, TONDBERG, TEAC, CAMBRIDGE, ARENA, ROTEL. Send a stamped addressed envelope for a GUARANTEED DISCOUNT PRICE.

PLINTHS & COVERS

(as illustrated)

£3.20

plus 35p post and packing



Finished in real teak veneer with tinted dustcover. Ready to use (fully assembled). Suitable for Garrard SP25, 2025TC, 3000, AT60, 2000, 2500, 3500, 5100, 1025, SL65B.

Also for B.S.R. McDONALD MP60 and others

Plinths and Covers for AP76, AP75, SL72B, SL75B, SL95B. £4.20 plus 35p post and packing.

Also finished in walnut to match Japanese equipment—no extra charge.

GLOBAL TRANSEUROPEAN COMBO

Made by world famous European manufacturer

COMPLETE HI-FI STEREO SYSTEM

VHF/MEDIUM/LONG WAVE Tuner Amplifier 4 watt per channel, separate tone and balance controls. Two neat speakers with wooden slatted front. Single play deck in plinth and cover. Finished in teak. Fully guaranteed 12 months. On constant demonstration.

£37.50

plus £1.25 carriage



GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept. (PE2) 174 Pentonville Road, London, N1. Telephone 01-278 1769

Open Monday to Saturday 9.30 a.m. to 6 p.m. LATE NIGHT FRIDAY 7 p.m.

2 minutes from KING'S CROSS, EUSTON & ST. PANCRAS on main road leading to the East and West Country

MAIL ORDERS. Order with confidence. Send Postal Order, Cheque, Money Order, Bank Draft, Giro or Cash by Registered Mail. CALLERS: Please note that cheques can only be accepted together with cheque cards (not Barclay Card).

YATES ELECTRONICS

(FLITWICK) LTD.

RESISTORS

1/4W Iskra high stability carbon film—very low noise—capless construction.
1/4W Mullard CR25 carbon film—very small body size 7.5 x 2.5mm. 4W Erie wire wound.

| Power watts | Tolerance | Range | Values available | Price |
|-------------|-----------|------------|------------------|-----------|
| 1/4 | 5% | 4.7Ω-2.2MΩ | E24 | 1-99 100+ |
| 1/4 | 10% | 3.3MΩ-10MΩ | E12 | 1-0p 0.8p |
| 1/4 | 10% | 1Ω-3.9Ω | E12 | 1-0p 0.8p |
| 1/4 | 5% | 4.7Ω-1MΩ | E12 | 1-0p 0.8p |
| 1/4 | 10% | 1Ω-10Ω | E12 | 1-0p 0.8p |

Quantity price applies for any selection. Ignore fractions on total order.

DEVELOPMENT PACK

0.5 watt 5% Iskra resistors 5 off each value 4.7Ω to 1MΩ.
E12 pack 325 resistors £2.40. E24 pack 650 resistors £4.70.

POTENTIOMETERS

Carbon track 5kΩ to 2MΩ, log or linear (log 1/4W, lin 1/2W).
Single, 12p. Dual gang (stereo), 37p.

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C. mounting (0-1 matrix).
Sub-miniature 0.1W, 5p each. Miniature 0.25W, 6p each.

SEMICONDUCTORS

| | | | | | | | |
|-------|-----|-------|-----|--------|-----|--------|---------|
| AC126 | 12p | BFY52 | 22p | OC81 | 12p | 2N3055 | 72p |
| AC127 | 12p | BSY56 | 30p | OC82 | 12p | 2N3702 | 15p |
| AC128 | 12p | BSX21 | 25p | ORP12 | 48p | 2N3703 | 14p |
| AD140 | 40p | BY124 | 71p | IN4001 | 71p | 2N3704 | 17 1/2p |
| AF115 | 20p | BYZ10 | 20p | IN4002 | 10p | 2N3705 | 15p |
| AF117 | 20p | BYZ13 | 20p | IN4003 | 11p | 2N3706 | 12p |
| BC107 | 10p | OA85 | 7p | IN4004 | 12p | 2N3707 | 18 1/2p |
| BC108 | 10p | OA91 | 5p | IN4005 | 13p | 2N3708 | 10p |
| BC109 | 10p | OA202 | 7p | IN4006 | 13p | 2N3709 | 11p |
| BFY50 | 22p | OC71 | 12p | 2N4007 | 13p | 2N3710 | 12p |
| BFY51 | 22p | OC72 | 12p | 1N2926 | 11p | 2N3711 | 14p |

ZENER DIODES

400mW 5% 3.3V to 30V, 15p.

ROTARY SWITCHES

2P2W, 1P12W, 2P6W, 3P4W, 4P3W, 22p.

BRUSHED ALUMINIUM PANELS

12in x 6in = 25p; 12in x 2 1/2in = 10p; 9in x 2in = 7p.

ELSTOW STORAGE DEPOT,
KEMPSTON HARDWICK,
BEDFORD

C.W.O. PLEASE. POST AND PACKING,
PLEASE ADD 10p TO ORDERS UNDER £2.
Catalogue which contains data sheets for most of the
components listed will be sent free on request.
5p stamp appreciated.

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0.001μF, 0.0015μF, 0.0022μF, 0.0033μF, 0.0047μF, 2 1/2p. 0.0068μF, 0.01μF,
0.015μF, 0.022μF, 0.033μF, 3p. 0.047μF, 0.068μF, 0.1μF, 4p. 0.15μF, 6p. 0.22μF, 7 1/2p.
0.33μF, 11p. 0.47μF, 13p.
160V: 0.01μF, 0.015μF, 0.022μF, 0.033μF, 0.047μF, 0.068μF, 3p. 0.1μF 3 1/2p. 0.15μF 4 1/2p.
0.22μF, 5p. 0.33μF, 6p. 0.47μF, 7 1/2p. 0.68μF, 11p. 1.0μF, 13p.

MULLARD POLYESTER CAPACITORS C283 SERIES

250V P.C. mounting: 0.01μF, 0.015μF, 0.022μF, 3p. 0.033μF, 0.047μF, 0.068μF, 4p.
3 1/2p. 0.1μF, 4p. 0.15μF, 0.22μF, 5p. 0.33μF, 6 1/2p. 0.47μF, 8 1/2p. 0.68μF, 11p. 1.0μF, 13p.
1.5μF, 20p. 2.2μF, 24p.

MYLAR FILM CAPACITORS 100V

0.001μF, 0.002μF, 0.005μF, 0.01μF, 0.02μF, 3p.
0.04μF, 0.05μF, 0.068μF, 0.1μF, 3 1/2p.

CERAMIC DISC CAPACITORS

100pF to 10,000pF, 2p each.

CAPACITOR DEVELOPMENT PACK

Selection of 100 ceramic and polyester capacitors, 100pF to 1.0μF, £2.90.

ELECTROLYTIC CAPACITORS—MULLARD C426 SERIES

(μF/V): 10/2.5, 40/2.5, 80/2.5, 160/2.5, 320/2.5, 500/2.5, 80/4, 32/4, 64/4, 125/4, 250/4,
400/4, 6.4/6.4, 25/6.4, 50/6.4, 100/6.4, 200/6.4, 320/6.4, 10, 16/10, 32/10, 64/10, 125/10,
200/10, 2.5/16, 10/16, 20/16, 40/16, 80/16, 125/16, 1.6/25, 6.4/25, 12.5/25, 25/25, 50/25,
80/25, 1/40, 4/40, 8/40, 16/40, 32/40, 50/40, 0.64/64, 2.5/64, 5/64, 10/64, 20/64, 32/64.

ELECTROLYTIC CAPACITORS Miniature P.C. mounting

(μF/V): 10/12, 50/12, 100/12, 200/12, 5/25, 10/25, 25/25, 100/25.

5p each.

VEROBOARD

| | |
|--------------------|---------|
| 0-1 | 0-15 |
| 2 1/2 x 3 1/2 | 22p |
| 2 1/2 x 5 | 24p |
| 3 1/2 x 3 1/2 | 24p |
| 3 1/2 x 5 | 27p |
| 17 x 2 1/2 | 75p |
| 17 x 3 1/2 | 100p |
| 17 x 5 (plain) | 75p |
| 17 x 3 1/2 (plain) | 52 1/2p |
| 17 x 2 1/2 (plain) | 37 1/2p |
| 2 1/2 x 5 (plain) | 17 1/2p |
| Pin insertion tool | 47 1/2p |
| Spot face cutter | 37 1/2p |
| Pkt. 50 pins | 20p |

PLUGS AND SOCKETS

| | | | |
|--------------------|-----|-----------------|-----|
| Standard screened | 18p | 2.5mm insulated | 8p |
| Standard insulated | 12p | 3.5mm insulated | 8p |
| Stereo screened | 35p | 2.5mm screened | 13p |
| Standard socket | 15p | 2.5mm socket | 8p |
| Stereo socket | 18p | 3.5mm socket | 8p |

D.I.N. PLUGS AND SOCKETS

2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
Plug 12p. Socket 8p.

BATTERY ELIMINATOR

£1 50
9V mains power supply. Same size as PP9 battery.

4-STATION INTERCOM



£6.75

Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs) in de-luxe plastic cabinets for desk or wall mounting. Call talk listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 40p.

MAINS INTERCOM

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On/off switch and volume control with lock system. Price £13.95. P. & P. 50p extra.

INTERCOM/BABY ALARM



£3.35

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire. Battery 13p. P. & P. 25p.

Transistor TELEPHONE AMPLIFIER



£2.98

Why not boost business efficiency with this incredible De-Luxe Telephone Amplifier. Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume control. Battery 13p extra. P. & P. 20p. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (P. & P.)
189 KENSINGTON HIGH STREET, LONDON, W.8

COLOUR TELEVISION PICTURE FAULTS

There are over 120 illustrations, including 88 colour photographs by K. J. Bohlman. £2.50. Postage 10p.

TRANSISTOR SUBSTITUTION HANDBOOK No. 10, by Foulsham-Sams £1. Postage 7p.

ELECTRONIC ORGAN SERVICING GUIDE, R. G. Middleton. £2.25. Postage 10p.

BEGINNER'S GUIDE TO PRACTICAL ELECTRONICS, by R. H. Warring. £1.25. Postage 7p.

TV TECHNICIAN'S BENCH MANUAL, by G. R. Wilding. £2.50. Postage 7p.

SERVICING WITH THE OSCILLOSCOPE, by Gordon J. King. £1.80. Postage 7p.

TRANSISTOR POCKET BOOK, by R. G. Hibberd. £1.40. Postage 7p.

110 SEMICONDUCTOR PROJECTS FOR THE HOME CONSTRUCTOR, by R. M. Marston. £1.20. Postage 5p.

Q & A ON RADIO & TELEVISION by H. W. Hellyer. 60p. Postage 5p.

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKIST of British and American Technical Books

19-21 PRAED STREET LONDON W2 1NP

Phone: PADdington 4185
Closed Saturday 1 p.m.

OSMABET LTD.

We make transformers amongst other things

MAINS TRANSFORMERS

Prim. 200/240V a.c. TX6, 425-0 425V, 500 mA, 6.3V 6A CT, 0-5-6.3V, 3A, £12.75; TX1, 425-0-425V, 250mA, 6.3V 4A CT, 0-5-6-3V, 3A, £27.50; TX2, 250-0-250V, 150mA, 6.3V 4A CT, 0-5-6-3V, 3A, £44.05; TX3, 300-0-300V, 120mA, 6.3V 2A CT, 0-6-3V, 2A, 6.3V, 1A, £4.05; TX8, 250-0-250V, 65mA, 6.3V, 1.5A, £2.10; MT1, 200V, 30mA, 6.3V, 1A, £1.20; MT2, 230V, 45mA, 6.3V, 1.5A, £1.50; MT3A, 250V, 60mA, 6.3V, 2A, £1.95; MT3B Prim. 110/240V, Sec. 250V, 100mA, 6.3V, 2A, £2.25

AUTO TRANSFORMERS

30 to 4000 watt ex stock, up to 1100 watt to order.
MULTIVOLT TRANSFORMERS
Prim. 200/240V a.c. OMT4/L, One tapped sec. 5-20-30-40-60V giving 5-10-15-20-25-30-40-45-55-60, 10-0-10, 20-0-20; 30-0-30V a.c., 1A, £2.25 OMT4 2 ditto, 2A, £3.45 OMT5/L one tapped sec. 40-50-60-80-90-100-110V a.c., 1A, £3.45. Dm. 12V 4A 12V 4A £3.60; Dm. 0-10-20-25V 2A-0-10-20-25V 2A £3.60.

LOW VOLTAGE TRANSFORMERS

Prim. 200/240V a.c., 6.3V, 1.5A, 85p; 3A, £1.13; 6A CT, £1.80; 12V, 1.5A, £1.13; 3A CT, £1.80; 6A CT, £2.70; 12V, 1.5A CT, £1.80; 24V, 1.5A CT, £1.80; 3A CT, £2.70; 5A, £3.75; 8A, £6.15A, £9.40V, 3A CT, £3.45.
For FW rest, size 1 1/2 x 2 1/4in. Prim. 200/240V a.c. output, PPT1 9-0-9V, 0.3A, PPT2 12-0-12V, 0.25A, PPT3 20-0-20V, 0.15A, £1.20 each; ditto, size 2 x 2 1/4 x 1 1/4in. MTV1 9-0-9V, 1A, 85p; MTV2 12-0-12V, 1A, MTV3 20-0-20V, 0.75A, £1.20 each.

O.P. TRANSFORMERS FOR POWER AMPLIFIERS

Power, 0.01/2KVA, 12 1/2p; 0-22/200V a.c. 25p; 40/150V 25p; 4/500V, 25p. Electrolytics, 6000 15V, 10p.
12V LT FLUORESCENT LIGHTING
Complete 8 watt 12 in fitting with tube, £3.75; 12V inverter for 20 watt tube, £5.75.

PRINTED CIRCUIT ETCHING KITS

Comprehensive factory pack, with all solutions, and equipment to make your own P.C. boards, instructions, £1.25.
Carriage extra all orders.
S.A.E. INQUIRIES-LISTS, MAIL ORDER ONLY
46 Kenilworth Road, Edgware, Middx. HA8 8YG
Tel. 01-958 9314

STAGE FIVE—PANEL 'C'

One criticism of the computer to date is that ships blaze away at each other unabated until the sudden moment of oblivion. This is hardly realistic. A much more interesting and exciting game results when damage occurs bit by bit, affecting the fighting qualities in various ways. Panel C does that.

First, the lead (k) is disconnected from point (j) (Figures 12 and 13) and instead the damage pulses are passed equally from (k) to two buffers TR19 and TR20 (Fig. 14). These are arranged in emitter follower mode, and are designed so that the two halves of the readout section do not interfere with each other. From TR19 the output is taken through C27 and then reconnected to point (j) via (p) as in Fig. 12. The output from TR20 is taken through

R108 and C30 to switch over the bistable formed by TR21 and TR22 and so drive lamp LP3 in the now familiar way through TR5 and TR6 and point (s).

TESTING AND USING

Lamp LP3 will now glow every time there is a pulse from Trigger 1 and may be extinguished by the use of S9. The number of times that this may be done before lamp LP2 glows depends entirely upon the size of storage capacitor selected by S11.

In use a dice may be rolled each time a unit of damage occurs, in order to see where it is. A six for instance might indicate the captain killed and the conning tower in flames; a one might indicate an aircraft catapult destroyed. Further examples will be given later.

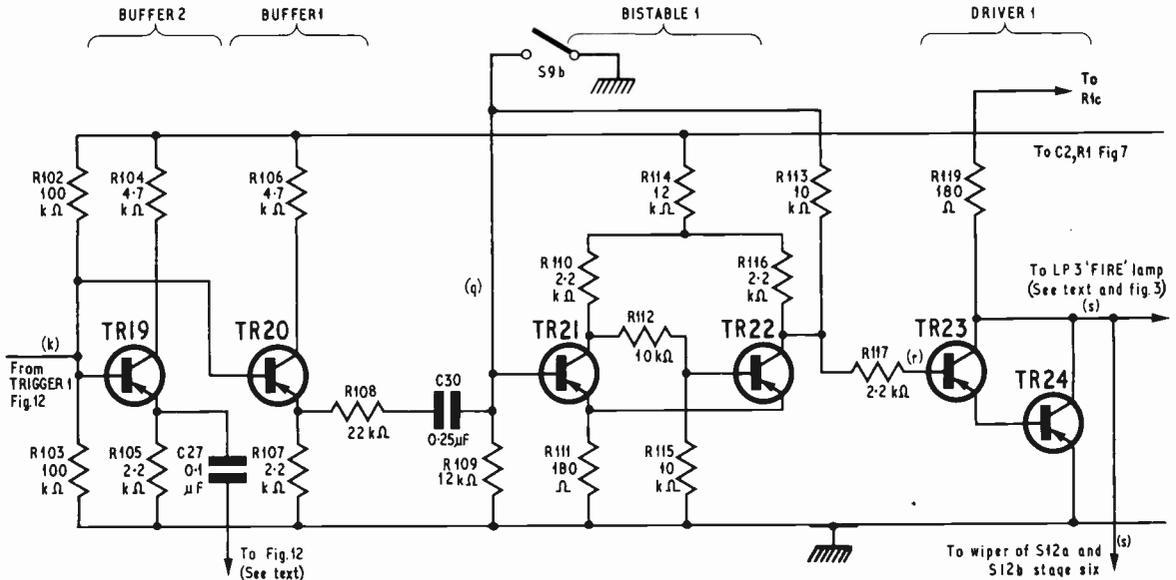


Fig. 14a. Circuit diagram for Panel C (stage five). This adds a further hazard in the form of "fire" (lamp LP3)

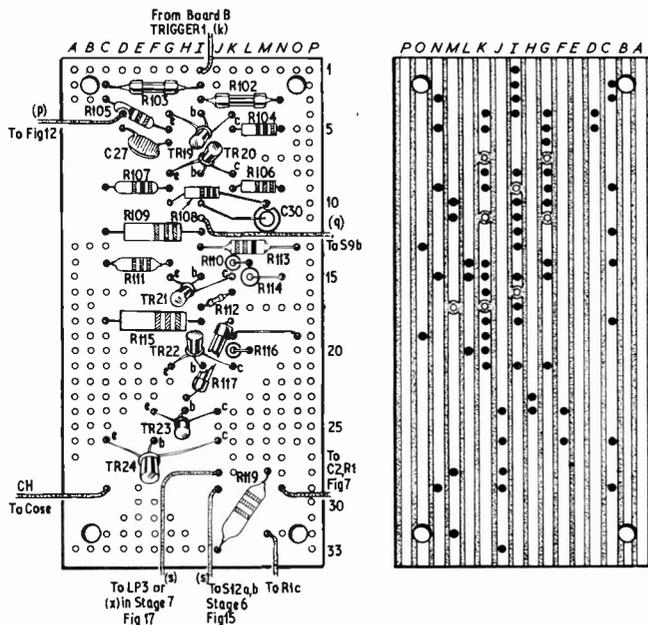


Fig. 14b. Layout of components on Panel C with underside view showing the breaks in the copper strips

Components . . .

STAGE FIVE (Panel C Fig. 14)

Resistors

| | | | |
|------|---------------|------|-----------------|
| R102 | 100k Ω | R111 | 180 Ω |
| R103 | 100k Ω | R112 | 10k Ω |
| R104 | 4.7k Ω | R113 | 10k Ω |
| R105 | 2.2k Ω | R114 | 12k Ω |
| R106 | 4.7k Ω | R115 | 10k Ω |
| R107 | 2.2k Ω | R116 | 2.2k Ω |
| R108 | 22k Ω | R117 | 2.2k Ω |
| R109 | 12k Ω | R119 | 180 Ω 1W |
| R110 | 2.7k Ω | | |

All $\pm 10\%$ $\frac{1}{4}$ W carbon except where shown

Capacitors

| | |
|-----|-----------------------------|
| C27 | 0.1 μ F polyester 125V |
| C30 | 0.25 μ F polyester 125V |

Transistors

TR19 to TR24 OC71 or similar germanium pnp type

Miscellaneous

LP3 6V 0.06A m.e.s. lamp and lampholder
Veroboard 0.15in matrix
5in \times 2 $\frac{1}{2}$ in with copper strips

STAGE SIX—AUTOMATIC INDICATION

Actually attempting to compute just where damage should occur would be impossible and quite beyond the needs of a game. What is required is a random selection, with some types of damage occurring more often than others. One method of doing this would be by a twisted-ring counter in conjunction with gates—a method rather lavish in its use of semi-conductors. Another more simple method would be to spin a twelve-way switch with the click-stop mechanism removed. No doubt other methods will occur to readers. The system used in the prototype was to move a Ledex motor-driven rotary switch of the double-pole twelve-way type or a uniselector switch one space each time the dial was operated. The wiring of the wafers will be seen in Fig. 15. The output of the driver is thus routed to any one of eight lamps, with four having twice the chances of the other four created by S12b. It should be noticed that one of the second wafer tags covers the n.c. condition of the first wafer.) The lamps are labelled as follows:

Single chance

- Lamp 4 Conning tower
- Lamp 5 Hull
- Lamp 6 Aircraft or torpedo tubes
- Lamp 7 $\frac{1}{2}$ sub. armament

Double chance

- Lamp 8 Engine room
- Lamp 9 Rear turret
- Lamp 10 Forward turret
- Lamp 11 Rudder

The lamps may be arranged in any order for viewing, but it is difficult in the excitement of a game to keep track of what the next indication will be, particularly as threequarters of diallings will produce no visible effect. Moreover, no player could do anything to affect the outcome, even if he did remember the sequence.

DRIVING THE LEDEX

The Ledex coil requires 48 volts (24 volt versions are available) and draws a heavy current. It was required to keep everything as automatic as possible and so the telephone dial was used again. There is a pair of contacts that makes when the dial is drawn back, and remain closed until the dial is again at rest. Fig. 16 shows how this contact is used.

Resistor R118 passes insufficient current to pull the armature when the dial contacts are closed. However, C28 is very large and the surge of current charging it plus the small amount going through R118 is enough to activate the coil. It is only momentary; C28 is soon charged and the current passing through R118 is insufficient to hold the coil. The armature drops back and now the current used by the circuit is limited to the tiny amount through R118. Capacitor C29 is a surge suppressor to prevent supply line variations triggering Schmitts.

When dialling is completed, the dial trigger contact opens and C28 slowly discharges through R118. This takes about three seconds and if dialling is attempted before C28 completely discharges, the Ledex coil may not operate satisfactorily. In game conditions this is of no moment.

Next Month: Stage seven "fire" switching from Ledex. Further notes regarding how to get the best out of the computer.

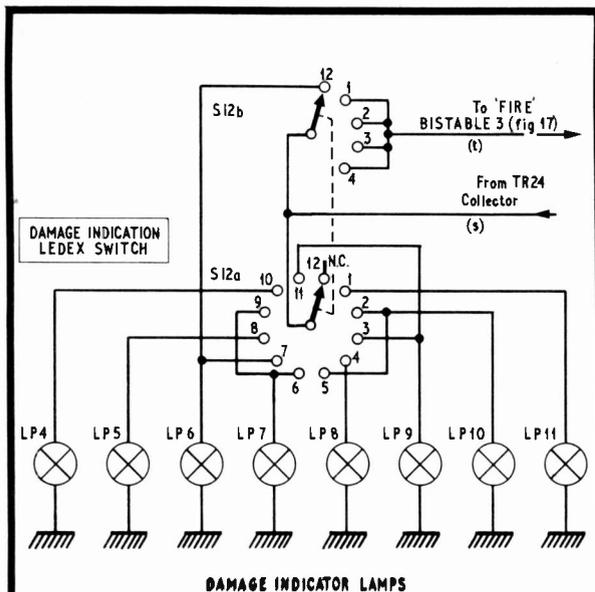


Fig. 15. "Random damage" selection circuit (stage six) using a Ledex switch

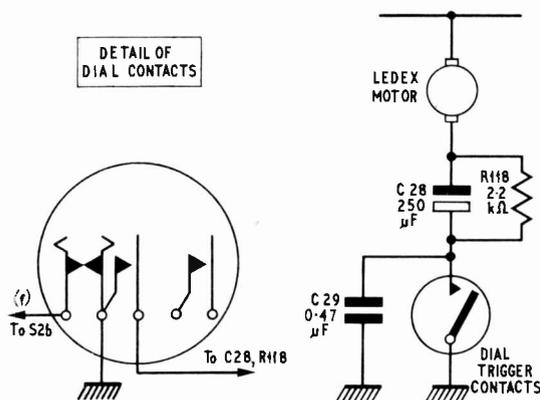


Fig. 16. Circuit details of the Ledex motor

Components . . .

STAGE SIX (Ledex switching Figs. 15 and 16)

Resistor

R118 2.2k Ω 10% $\frac{1}{2}$ W carbon

Capacitors

C28 250 μ F elect. 64V

C29 0.47 μ F polyester 125V

Switch and motor

S12a Single-pole, 12-way wafer

S12b Single-pole, 5-way wafer

Both wafers assembled on a miniature Ledex rotor and ratchet mechanism available from suppliers of surplus Post Office equipment and components. (Manufacturer is N.S.F.) Alternative suggestions see text.

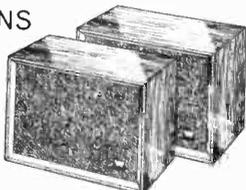
Lamps

LP4 to LP11 6V 0.06A m.e.s. lamps and lampholders

SUPER SPEAKER BARGAINS

WHARFEDALE DENTONS

A compact system sold in matched pairs for a perfectly balanced stereo system. Each Denton contains an 8in bass unit with 3in pressure unit, coupled by a Wharfedale crossover network. Rated input: 15 watts maximum. Frequency response: 65-17,000Hz. Impedance: 4/8 ohms. Cabinet 9 1/2in x 14in x 8 1/2in. These most attractive units are available in oiled teak finish and are small enough to blend in with most surroundings.

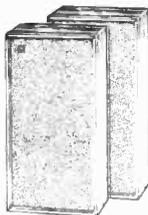


Post 75p

LIST PRICE £39.90 **LASKY'S PRICE £28.00**

WHARFEDALE TRITONS

A new and exciting addition to the Wharfedale range, this three-speaker system will satisfy the most ardent Hi-Fi enthusiast. Shelf or floor standing—hand finished in oiled teak. Frequency response: 55-22,000Hz. C.A.B. Dome pressure unit. Bass unit 8in. Mid-range unit 5in. Treble unit 2in. Impedance: 8 ohms. Size: 2 1/2in x 9 1/2in x 9in.



Post 75p

LIST PRICE £59.90 **LASKY'S PRICE £36.00**

EXCLUSIVE TM-1

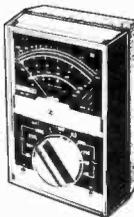
MODEL TM-1 MINI-TESTER

The first of Lasky's new-look top value meters, the TM-1 is a really tiny pocket multimeter providing "big" meter accuracy and performance. Precision movement calibrated to 3in of full scale. Click stop range selection switch. Beautifully designed and made impact resistant black case with white and metallic red/green figuring. Ohms zero adjustment.

Size Only

- DC/V: 0-10-50-250-1,000 at 1k OPV
- AC/V: 0-10-50-250-1,000 at 1k OPV
- DC CURRENT: 0-1mA, 100mA

- Resistance: 0-150k
- Decibels: -10dB to +22dB
- Complete with test leads, battery and instructions



LASKY'S PRICE £1.95

POST 13p

TM-5 5K ohms/V POCKET MULTIMETER

Another new look pocket multimeter from Lasky's providing top quality and value. The "slimline" impact resistant case, size 4 1/2in x 2 1/2in x 1 1/2in, fitted with extra large 2 1/2in square meter. Readability is superior on all low ranges; making this an excellent instrument for servicing transistorised equipment. Recessed click stop selection switch. Ohms zero adjustment. Buff finish with crystal clear meter cover.

- DC/V: 3-15-150-300-1,200 at 5k OPV
- AC/V: 6-30-300-600 at 2.5k OPV
- DC Current 0-300µA, 0-300mA
- Resistance: 0-10k/ohms, 0-1M/ohm
- Decibels: -10dB to +16dB
- Complete with test leads, battery and instructions.

LASKY'S PRICE £2.95

POST 13p

LASKY'S NEW "LOW NOISE" CASSETTES FROM the U.S.A.

| Model | Singles | 5 | 10 | 20 |
|-------|---------|-------|-------|--------|
| C.60 | 41p | £1.82 | £3.41 | £6.55 |
| C.90 | 63p | £3.04 | £5.78 | £10.89 |
| C.120 | 96p | £4.13 | £7.43 | £13.41 |

Post Each 5p. 5-20p. 10-25p. 20-50p.

TRIO KA.2002 PACKAGE DEAL TOP VALUE

TRIO KA.2002 £39.50
 Pair Wharfedale Dentons .. £39.90
 BSR MP60 £15.20
 LASKY BASE & COVER £4.75
 AD76K CARTRIDGE £4.35

Total list price **£103.70**

PACKAGE PRICE £82.50

Carriage in U.K. £2.00

ADD £9 if Wharfedale TRITONS are preferred to Dentons

TMK MODEL 200 METER KIT

TMK offer the unique opportunity of building a really first-class precision multimeter at a worthwhile saving in cost. The cabinets are supplied with the meter scale and movement mounted in position. The highest quality components and 1% tolerance resistors are used throughout. Supplied complete with full constructional circuit and operating instructions.

Specification

20,000 P.O.V. Multimeter. Features 24 measurement ranges with mirror scale accuracy. DC/V and current: 2%. A.c.:V: 3%. Resistance 3%. Special 0-6V DC range for transistor circuit measurements.

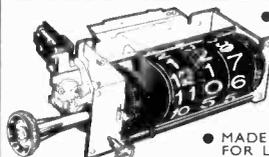


ONLY

LASKY'S PRICE £4.60

POST 13p

DIGITAL CLOCK SCOOP



- SHOCK AND VIBRATION PROOF
- 12-HOUR ALARM AUTO "SLEEP" SWITCH
- HOURS, MINUTES AND SECONDS READ-OFF
- FORWARD AND BACKWARD TIME ADJUSTMENT
- SILENT OPERATION SYNCHRONOUS MOTOR
- BUILT-IN ALARM BUZZER
- MADE ESPECIALLY FOR LASKY'S BY FAMOUS MAKER
- MAINS OPERATION

EXCLUSIVELY FROM LASKY'S in chassis form for you to mount in any housing. The clock measures 4 1/2W x 1 1/4 x 3 1/8D (overall from front of drum to back of switch). SPEC.: 210/240V AC, 50Hz operation; switch rating 250V, 3A. Complete with instructions.

HUNDREDS OF APPLICATIONS. COMPLETE WITH KNOBS

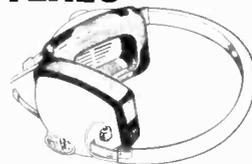
LASKY'S PRICE £6.95

POST 18p

SPECIAL QUOTATIONS FOR QUANTITIES

TRIO HS.1 HS.2. STEREO HEADPHONE BARGAINS

Models HS.1 and HS.2. Both these sets by TRIO offer really superb stereo reproduction in a lightweight, fully adjustable headset designed for optimum comfort. Listening fatigue is unknown with TRIO headphones. Brief spec. both models: Input imp. 8 nominal (matching 4 to 8); max. input 0.5W; frequency response 20-19k Hz; output sensitivity at 1mW input; HS.1 118dB, HS.2 111dB; weight 0.66lbs. Identical in appearance—both models are finished in ivory with contrasting foam-filled ear pads and head band.



List Price £8.40.

Lasky's Price £5.20

HS.2.

List Price £6.75.

Lasky's Price £4.15

Post 18p

Lasky's Radio Limited

Branches

207 EDGWARE ROAD, LONDON, W.2 Tel: 01-723 3271

33 TOTTENHAM CT. RD., LONDON, W.1 Tel: 01-636 2605

Open all day, 9 a.m. - 6 p.m. Monday to Saturday

152/3 FLEET STREET, LONDON, E.C.4 Tel: 01-353 2833

Open all day Thursday, early closing 1 p.m. Saturday

The Home of High Fidelity

42-45 TOTTENHAM CT. RD., LONDON, W.1 Tel: 01-580 2573

Open all day, 9 a.m. - 6 p.m. Monday to Saturday

NEW CITY BRANCH NOW OPEN

109 FLEET STREET, LONDON, E.C.4 Tel: 01-353 5812

Open all day Thursday, early closing 1 p.m. Saturday

ALL MAIL ORDERS AND CORRESPONDENCE TO: 3-15 CAVELL ST. TOWER HAMLETS, LONDON, E.1 Tel.: 01-790 4821



Great new OFFER from **DIOTRAN**

TRANSISTORS

BRAND NEW FULLY GUARANTEED DEVICES

| | | | | | | | | | | | | | | | | | | | |
|----------|-------|-------|-----|--------|-----|-------|-----|-------|-------|--------|-----|--------|-----|--------|-----|-----------|--------|--------|-------|
| AC107 | 15p | AF115 | 17p | BC140 | 35p | BCY31 | 22p | BF272 | 80p | EC403 | 15p | ORP60 | 40p | 2N918 | 30p | 2N2714 | 25p | 2N3704 | 15p |
| AC113 | 20p | AF116 | 17p | BC141 | 35p | BCY32 | 25p | BF273 | 80p | GET880 | 27p | ORP61 | 40p | 2N929 | 22p | 2N2904 | 25p | 2N3705 | 12p |
| AC115 | 23p | AF117 | 17p | BC142 | 45p | BCY33 | 17p | BF274 | 30p | MAT100 | 15p | ST140 | 12p | 2N1131 | 20p | 2N2905 | 25p | 2N3706 | 13p |
| AC125 | 17p | AF118 | 30p | BC143 | 40p | BCY34 | 17p | BF308 | 35p | MAT101 | 17p | ST141 | 17p | 2N1132 | 22p | 2N2905A | 30p | 2N3708 | 8p |
| AC126 | 17p | AF124 | 21p | BC145 | 45p | BCY70 | 17p | BF309 | 37p | MAT120 | 15p | TI543 | 40p | 2N1303 | 17p | 2N2906A | 25p | 2N3710 | 10p |
| AC127 | 17p | AF125 | 20p | BC147 | 17p | BCY71 | 30p | BF316 | 75p | MAT121 | 17p | UT446 | 27p | 2N1304 | 20p | 2N2907 | 25p | 2N3711 | 10p |
| AC128 | 17p | AF126 | 20p | BC148 | 17p | BCY72 | 15p | BFV10 | 55p | MPF102 | 43p | V405A | 25p | 2N1305 | 20p | 2N2907A | 30p | 2N3819 | 40p |
| AC141K | 17p | AF127 | 20p | BC149 | 17p | BCZ11 | 20p | BFX29 | 27p | MPF105 | 43p | V410A | 45p | 2N1306 | 22p | 2N2923 | 13p | 2N3820 | £1 |
| AC142K | 17p | AF139 | 33p | BC150 | 17p | BD121 | 85p | BFX84 | 20p | OC19 | 30p | 2G301 | 19p | 2N1307 | 22p | 2N2924 | 13p | 2N3903 | 25p |
| AC151 | 15p | AF178 | 50p | BC151 | 20p | BD123 | 85p | BFX85 | 27p | OC20 | 50p | 2G302 | 19p | 2N1308 | 27p | 2N2925 | 13p | 2N3904 | 27p |
| AC154 | 15p | AF179 | 50p | BC152 | 20p | BD124 | 75p | BFX86 | 22p | OC22 | 33p | 2G303 | 19p | 2N1309 | 27p | 2N2926 | 13p | 2N3905 | 25p |
| AC155 | 17p | AF180 | 50p | BC153 | 27p | BD131 | 80p | BFX87 | 25p | OC23 | 33p | 2G304 | 20p | 2N1613 | 17p | (G) | 12p | 2N3906 | 27p |
| AC156 | 17p | AF191 | 50p | BC154 | 30p | BD132 | 80p | BFX88 | 22p | OC24 | 45p | 2G306 | 35p | 2N1711 | 20p | 2N2926(Y) | 11p | 2N4058 | 15p |
| AC157 | 17p | AF186 | 45p | BC157 | 20p | BDY20 | £1 | BFY50 | 20p | OC25 | 25p | 2G308 | 35p | 2N1889 | 35p | 2N2926 | 2N4059 | 10p | |
| AC165 | 17p | AF239 | 37p | BC158 | 17p | BF115 | 22p | BFY51 | 20p | OC26 | 25p | 2G309 | 35p | 2N1890 | 45p | (O) | 10p | 2N4060 | 12p |
| AC166 | 17p | AF211 | 37p | BC159 | 20p | BF117 | 45p | BFY52 | 20p | OC28 | 40p | 2G339 | 17p | 2N1893 | 37p | 2N3010 | 80p | 2N4061 | 12p |
| AC167 | 20p | AF212 | 45p | BC167 | 13p | BF118 | 60p | BFY53 | 17p | OC29 | 17p | 2G339A | 15p | 2N2160 | 60p | 2N3011 | 20p | 2N4062 | 12p |
| AC168 | 20p | AL102 | 85p | BC168 | 13p | BF119 | 70p | BSX19 | 15p | OC35 | 33p | 2G344 | 15p | 2N2147 | 75p | 2N3053 | 20p | 2N5172 | 12p |
| AC169 | 14p | AL103 | 85p | BC169 | 13p | BF152 | 35p | BSX20 | 15p | OC36 | 40p | 2G345 | 15p | 2N2148 | 60p | 2N3054 | 50p | 2N5459 | 43p |
| AC176 | 23p | ASV26 | 25p | BC170 | 12p | BF153 | 35p | BSY25 | 15p | OC41 | 20p | 2G371 | 13p | 2N2192 | 30p | 2N3055 | 63p | 2S034 | 75p |
| AC177 | 20p | ASV27 | 30p | BC171 | 13p | BF154 | 35p | BSY26 | 15p | OC42 | 22p | 2G371B | 10p | 2N2193 | 30p | 2N3391 | 17p | 2S031 | 50p |
| AC187 | 30p | ASV28 | 25p | BC172 | 13p | BF157 | 45p | BSY27 | 15p | OC44 | 15p | 2G374 | 17p | 2N2194 | 27p | 2N3391A | 20p | 2S032A | 45p |
| AC188 | 30p | ASV29 | 25p | BC173 | 13p | BF158 | 25p | BSY28 | 15p | OC45 | 12p | 2G377 | 12p | 2N2217 | 20p | 2N3392 | 17p | 2S032 | 45p |
| AC189 | 30p | ASV30 | 25p | BC174 | 13p | BF159 | 30p | BSY29 | 15p | OC70 | 15p | 2G378 | 15p | 2N2218 | 25p | 2N3393 | 15p | 2S033 | 60p |
| AC189 | 30p | ASV31 | 25p | BC175 | 13p | BF160 | 30p | BSY38 | 15p | OC71 | 9p | 2G382 | 10p | 2N2219 | 27p | 2N3394 | 15p | 2S034 | £1.10 |
| AC191 | 22p | ASV32 | 25p | BC177 | 13p | BF162 | 30p | BSY39 | 15p | OC72 | 15p | 2G401 | 30p | 2N2220 | 22p | 2N3395 | 20p | 2S035 | £1 |
| AC192 | 20p | ASV34 | 25p | BC178 | 17p | BF163 | 35p | BSY40 | 30p | OC74 | 12p | 2G414 | 30p | 2N2221 | 22p | 2N3402 | 22p | 2S036 | £1.10 |
| AC192 | 20p | ASV35 | 25p | BC179 | 17p | BF164 | 35p | BSY41 | 35p | OC75 | 15p | 2G417 | 25p | 2N2222 | 27p | 2N3403 | 22p | 2S037 | £1.10 |
| AC192 | 20p | ASV36 | 25p | BC180 | 20p | BF165 | 35p | BSY95 | 12p | OC76 | 15p | 2N388 | 30p | 2N2368 | 17p | 2N3404 | 32p | 2S21 | 60p |
| AC192 | 20p | ASV37 | 25p | BC181 | 22p | BF167 | 22p | BU105 | £3.90 | OC81 | 15p | 2N404 | 50p | 2N2369 | 15p | 2N3405 | 45p | 2S22 | 50p |
| AC192 | 20p | ASV38 | 25p | BC182 | 10p | BF173 | 22p | C111E | 60p | OC81D | 15p | 2N404A | 30p | 2N2411 | 50p | 2N3415 | 20p | 2S23 | 60p |
| AC192 | 20p | ASV39 | 25p | BC183 | 10p | BF177 | 35p | C408 | 30p | OC82 | 15p | 2N524 | 55p | 2N2412 | 50p | 2N3417 | 37p | 2S24 | £1.20 |
| AC192 | 20p | ASV40 | 25p | BC184 | 10p | BF178 | 45p | C407 | 25p | OC82D | 15p | 2N527 | 60p | 2N2646 | 55p | 2N3525 | 74p | 2S25 | £1.20 |
| AC192 | 20p | ASV41 | 25p | BC185 | 13p | BF179 | 50p | C424 | 17p | OC83 | 20p | 2N696 | 12p | 2N2711 | 22p | 2N3702 | 12p | 2S26 | £1.20 |
| AC192 | 20p | ASV42 | 25p | BC186 | 13p | BF180 | 30p | C425 | 40p | OC84 | 20p | 2N697 | 15p | 2N2712 | 22p | 2N3703 | 12p | 2S27 | £1.20 |
| AC192 | 20p | ASV43 | 25p | BC187 | 27p | BF181 | 30p | C426 | 30p | OC139 | 15p | 2N698 | 24p | | | | | | |
| AC192 | 20p | ASV44 | 25p | BC188 | 27p | BF182 | 30p | C428 | 20p | OC140 | 17p | 2N699 | 55p | | | | | | |
| AC192 | 20p | ASV45 | 25p | BC189 | 11p | BF183 | 30p | C441 | 27p | OC170 | 15p | 2N706 | 7p | | | | | | |
| AC192 | 20p | ASV46 | 25p | BC190 | 11p | BF184 | 25p | C442 | 35p | OC171 | 15p | 2N706A | 8p | AA119 | 8p | BYZ11 | 32p | OA81 | 7p |
| AD140 | 40p | BC117 | 35p | BC209 | 11p | BF185 | 30p | C444 | 37p | OC200 | 25p | 2N708 | 12p | AA120 | 8p | BYZ12 | 30p | OA85 | 7p |
| AD142 | 40p | BC118 | 25p | BC212L | 11p | BF188 | 30p | C450 | 27p | OC201 | 27p | IN709 | 45p | BA116 | 22p | BYZ13 | 25p | OA90 | 6p |
| AD149 | 43p | BC119 | 45p | BC213L | 11p | BF194 | 23p | C720 | 12p | OC202 | 27p | 2N711 | 40p | BA126 | 15p | BYZ16 | 35p | OA91 | 7p |
| AD161 | 35p | BC125 | 35p | BC213L | 11p | BF195 | 24p | C722 | 20p | OC203 | 25p | 2N717 | 42p | BY100 | 22p | BYZ17 | 35p | OA95 | 7p |
| AD162 | 35p | BC126 | 35p | BC214L | 12p | BF196 | 30p | C740 | 25p | OC204 | 25p | 2N718 | 24p | BY101 | 12p | BYZ18 | 30p | OA200 | 6p |
| AD161(P) | 63p | BC132 | 25p | BC225 | 25p | BF197 | 35p | C742 | 17p | OC205 | 35p | 2N718A | 50p | BY105 | 15p | BYZ19 | 25p | OA202 | 7p |
| ADT140 | 50p | BC135 | 30p | BC226 | 35p | BF200 | 45p | C744 | 22p | OC309 | 35p | 2N726 | 27p | BY114 | 12p | OA5 | 17p | SO10 | 4p |
| ADZ11 | £2 | BC136 | 30p | BC317 | 12p | BF222 | 80p | C760 | 17p | P346A | 17p | 2N727 | 27p | BY126 | 15p | OA10 | 22p | SO19 | 4p |
| ADZ11 | £2 | BC137 | 30p | BC318 | 12p | BF257 | 35p | C762 | 17p | P397 | 45p | 2N743 | 17p | BY127 | 17p | OA47 | 7p | IN914 | 6p |
| ADZ12 | £2.10 | BC139 | 35p | BC319 | 12p | BF270 | 25p | C764 | 60p | ORP71 | 43p | 2N744 | 17p | BY130 | 15p | OA70 | 7p | IN916 | 6p |
| AF114 | 17p | BC137 | 45p | BCY30 | 20p | BF271 | 17p | EC401 | 15p | ORP12 | 43p | 2N914 | 17p | BYZ10 | 35p | OA79 | 8p | IN914B | 6p |

DIODES & RECTIFIERS

| | | | | | |
|--------|-----|-----------|--------|--------|-------|
| 2N918 | 30p | 2N2714 | 25p | 2N3704 | 15p |
| 2N929 | 22p | 2N2904 | 25p | 2N3705 | 12p |
| 2N930 | 25p | 2N2904A | 30p | 2N3706 | 13p |
| 2N1131 | 20p | 2N2905 | 25p | 2N3707 | 12p |
| 2N1132 | 22p | 2N2905A | 30p | 2N3708 | 8p |
| 2N1303 | 17p | 2N2906 | 25p | 2N3709 | 8p |
| 2N1304 | 20p | 2N2907 | 25p | 2N3710 | 10p |
| 2N1305 | 20p | 2N2907A | 30p | 2N3711 | 10p |
| 2N1306 | 22p | 2N2923 | 13p | 2N3820 | £1 |
| 2N1307 | 22p | 2N2924 | 13p | 2N3903 | 25p |
| 2N1308 | 27p | 2N2925 | 13p | 2N3904 | 27p |
| 2N1309 | 27p | 2N2926 | 13p | 2N3905 | 25p |
| 2N1613 | 17p | (G) | 12p | 2N3906 | 27p |
| 2N1711 | 20p | 2N2926(Y) | 11p | 2N4058 | 15p |
| 2N1889 | 35p | 2N2926 | 2N4059 | 10p | |
| 2N1890 | 45p | (O) | 10p | 2N4060 | 12p |
| 2N1893 | 37p | 2N3010 | 80p | 2N4061 | 12p |
| 2N2160 | 60p | 2N3011 | 20p | 2N4062 | 12p |
| 2N2147 | 75p | 2N3053 | 20p | 2N5172 | 12p |
| 2N2148 | 60p | 2N3054 | 50p | 2N5459 | 43p |
| 2N2192 | 30p | 2N3055 | 63p | 2S034 | 75p |
| 2N2193 | 30p | 2N3391 | 17p | 2S031 | 50p |
| 2N2194 | 27p | 2N3391A | 20p | 2S032A | 45p |
| 2N2217 | 20p | 2N3392 | 17p | 2S032 | 45p |
| 2N2218 | 25p | 2N3393 | 15p | 2S033 | 60p |
| 2N2219 | 27p | 2N3394 | 15p | 2S034 | £1.10 |
| 2N2220 | 22p | 2N3395 | 20p | 2S035 | £1 |
| 2N2221 | 22p | 2N3402 | 22p | 2S036 | £1.10 |
| 2N2222 | 27p | 2N3403 | 22p | 2S037 | £1.10 |
| 2N2368 | 17p | 2N3404 | 32p | 2S21 | 60p |
| 2N2369 | 15p | 2N3405 | 45p | 2S22 | 50p |
| 2N2411 | 50p | 2N3415 | 20p | 2S23 | 60p |
| 2N2412 | 50p | 2N3417 | 37p | 2S24 | £1.20 |
| 2N2646 | 55p | 2N3525 | 74p | 2S25 | £1.20 |
| 2N2711 | 22p | 2N3702 | 12p | 2S26 | £1.20 |
| 2N2712 | 22p | 2N3703 | 12p | 2S27 | £1.20 |

1,000,000 SILICON PLANAR TRANSISTORS

Clearance of manufacturers' seconds, selected in types and guaranteed no open or short circuit units. Ideal cheap transistors for radio enthusiasts, manufacturers, schools and colleges.

TYPE STN18. Silicon Planar Transistors npn TO-18 Metal Can. Types similar to: 2N706, 2N2220, BSY27-95A, BSX44-76-77.

Price: 500 £9, 1,000 £15

TYPE STP18. Silicon Planar Transistors npn TO-18 Metal Can. Types similar to: BCY70-72, 2N2906-7, 2N2411 and BC186-7. Also used as complementary to the above npn type device type STN18.

Price: 500 £9, 1,000 £15

TYPE STNL. Silicon Plastic Epitaxial Planar Transistors TO-92 case. I.C. 200mA, 300mV medium to high gain, available in npn or pnp and types similar to: NPN2N2926-2N2711-2N3391-2N3707-2N3711-BC167-8-9.

Price: 500 £7.50, 1,000 £13

TYPE STPL. As above but in pnp and similar to types 2N5354-56, 2N4058-2N4061 and 2N3702-3. Also used as complementary to the above npn devices type STNL.

Price: 500 £7.50, 1,000 £13

TYPE STNK. Silicon Planar Plastic Transistor npn with TO-18 pin circular lead configuration, I.C. 20mA, 300mV and similar to BC107-8-9, BC170, BC173, BC182-184, BC237-8-9 and BC337-8.

Price: 50



RADIATION FROM JUPITER

New light on the variations of the radiation from Jupiter has been offered by a team from Meudon Observatory. Recent observations carried out by Messrs. L. Consiel, Y. Leblanc, G. Antonini and D. Quemada has led them to the conclusion that Jupiter has a plasmasphere similar to that of the earth. It must also be concluded that this plasmasphere is very strongly affected by the solar wind, even though Jupiter is some five times as far away from the sun as the earth.

The difference between the earth's plasmasphere and Jupiter's plasmasphere is the size. The magnetosphere (the boundary across which the solar wind cannot go) is determined by the magnetic field. It is not regular in shape and in fact can be and is very much distorted by the pressure of the solar wind and its interaction at the boundary. In the case of the earth it is pushed back on the sunward side and causes the whole boundary to swell up in size as it were on the lee side, see Fig. 1.

The normal radius of the magnetosphere of Jupiter is some 50 times that of the planet. This boundary is determined by the electrical effects in the plasma around Jupiter. The co-rotating plasma has an upper limit which depends on the interaction between the rotating electric field and the solar wind. This limit in the case of Jupiter is only about eight times the radius of Jupiter.

EFFECTS OF SATELLITE IO

This fact has led the Meudon observers to suggest that the effects known to be made on the Jupiter radiations by this planet's No. 1

satellite named IO, is the direct result of changes of level in the plasmasphere.

The effects of IO, first suggested by Bigg in 1964 were observed before this by the writer and the team led by C. H. Barrow under a NASA contract with Florida State University.

There are other considerations to be taken into account, for example, the effect of the next two satellites. Although the effect of these was slight it was detectable. As the writer predicted in 1966, Amalthea the innermost satellite was also a factor in modifying radiations as was confirmed a few years later. Still another effect has to be remembered, and that is that not all the radiation that has been observed in the decametre region is effected by IO. Some remains continuous whatever the position of IO.

THE PLASMAPAUSE

Basically the theory put forward by the French observers does add an important viewpoint. The mechanism they are suggesting works as follows. The solar wind velocity was compared with the radiation activity time and the position of IO. The results were then correlated. It seems clear that the radiation received did occur when IO crossed the upper boundary of the plasmasphere. This boundary is called the plasmopause.

During the quiet sun it would appear that the plasmasphere is able to extend outwards from its normal position, but when the sun is active it is forced downwards to a much lower level. This places the boundary within the orbit of IO, and the bursts of radiation appear when the satellite crosses the boundary.

This is of course valuable additional data but there are still a number of anomalies. Moreover in the first study undertaken by the writer in co-operation with the team previously mentioned a direct correlation between solar activity and Jupiter activity could not be found, as was reported in "Nature". However, it was always considered that the sun was a cause as the writer has always held. This new work confirms the validity of the supposition and it is now only necessary to pursue the French work further to find a satisfactory answer.

There are two prime questions which are not satisfied as yet. The first is, why is there so much difference in the level of the radiation in the northern and southern hemispheres and why is the radiation frequency selective at different stations?

This last question is a very important one since it is quite often the case that two or three stations working on the same frequency do not simultaneously receive the radiations and where the stations are

working on say three frequencies, station 'A' may receive radiation at say 18MHz, station 'B' at 20MHz, and station 'C' at 22MHz at a particular time, but in each case the other operating frequencies show no results.

JUPITER'S ATMOSPHERE

Attempts to measure the depths or even the existence of atmosphere on planets and satellites use observation in the visual spectrum as well as the radio spectrum. The usual visual method is the observation of an occultation. In the case of Jupiter which is one of the brightest objects in the sky it eclipsed the bright star Beta Scorpii. This is the first time this century that this has happened.

Naturally full advantage was taken of this by astronomers. A team from the University of Texas led by Prof. David Evans and Dr. William Hubbard observed the occultation from observatories in India, Australia, South Africa and the Virgin Islands. Specially designed scanning photometers were used since it was necessary to make very quick determinations of the star's light curves.

New information as to the temperature of the planets reveals that instead of the previous figure of 100 degrees K for the outer atmosphere the observers all agree on a figure between 150 degrees and 200 degrees K. The atmospheric gradient also turned out to be less steep than had been thought.

A bonus on this observation was the fortuitous occultation of the star by IO, which proved that the satellite was larger than the earth's moon with a negligible atmosphere. The observations have enabled a more precise position for Jupiter's orbit to be determined and new information on the weight of the gases in its atmosphere.

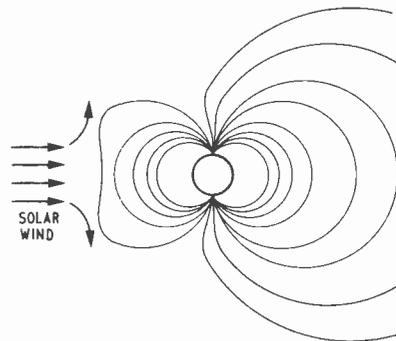


Fig. 1. A section through the magnetosphere at noon. The solar wind has pushed the sunward side of the magnetic field away to form a tail which at times is so long that a tadpole shape appears

RAIN



WATER LEVEL

ALARM

By H. MOORSHEAD

THE unit to be described will act as a tireless sentry, sounding off as soon as water level rises or, perhaps more practically for most of us, will give you early warning of rain or snow so that washing left in the garden can be quickly brought in.

The unit can be left switched on for months on end as the quiescent current is in the order of nanoamps. Assuming that the alarm is not left on for hours on end, the battery will decay of old age rather than run down and for the specified type the life is at least a year.

CIRCUIT ACTION

To understand the circuit consider the block diagram in Fig. 1. The unijunction relaxation oscillator TR2 has a highly sensitive electronic switch, triggered by water or damp, in its positive supply—TR1 acts as the switch.

The output of the oscillator is insufficient for a practical alarm system so it is coupled to TR3 which switches on and off in sympathy with TR2 and passes the alarm signal to the loudspeaker.

Referring to the actual circuit in Fig. 2 it will be seen that in the "on" state (assuming the sensors are inoperative) the only current drawn will be the leakage of TR1 and TR3 since the base of TR1 is

floating and the base of TR3 is held at negative potential.

When the sensors are shorted out, R1 applies bias to TR1 turning it on and although there is a volts drop across it, this is small and not enough to affect the operation of TR2.

The resistor R2 charges up C1 when TR1 allows current to pass; this raises the potential at the emitter of TR2 and because of the mode of operation of the unijunction transistor, when a certain level has been reached the device passes current which discharges C1 and this turns TR2 off. The oscillatory cycle then starts all over again.

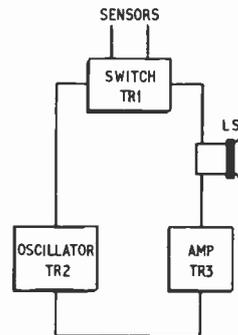


Fig. 1. Block diagram of alarm

COMPONENTS . . .

Resistors

R1 100k Ω
R2 2.7k Ω
R3 330 Ω
All 10% $\frac{1}{4}$ watt carbon

Capacitors

C1 0.5 μ F Polyester

Transistors

TR1, TR3 2N2926 (G) 2 off
TR2 2N2646

Loudspeaker

LS1 8 ohm 2 $\frac{1}{2}$ in dia.

Miscellaneous

Tagstrip, 5in \times 4in \times 2 $\frac{1}{2}$ in aluminium chassis, S1—2 pole, 3 way rotary switch, 9V battery (PP9).

LOUDSPEAKER DRIVER

When TR2 is on, a potential is developed across R3 and this switches on TR3. What we get in effect is most of the battery potential being applied across the loudspeaker in a series of rapid pulses which together form a note.

The pitch of the alarm note is controlled by the ratio of R2/C1 and it can be changed by altering either. Greater effective output can be achieved by selecting the note so that it corresponds to the resonant frequency of the speaker which, with miniature types, is quite high.

The frequency will alter very slightly depending

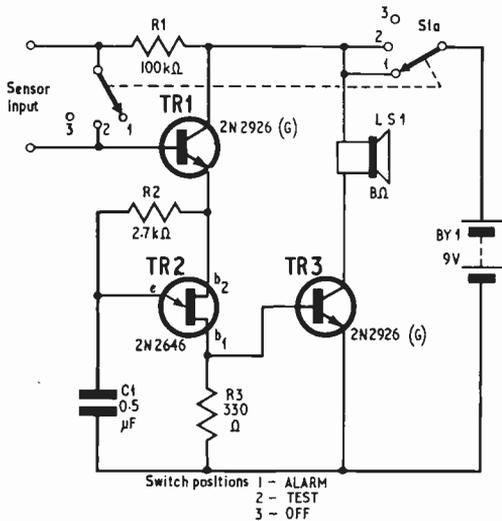


Fig. 2. Circuit diagram of alarm

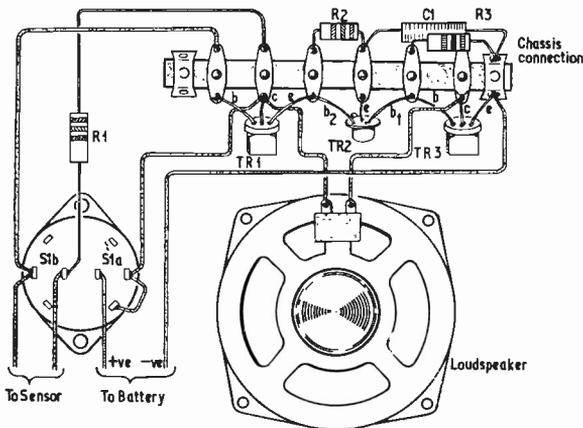
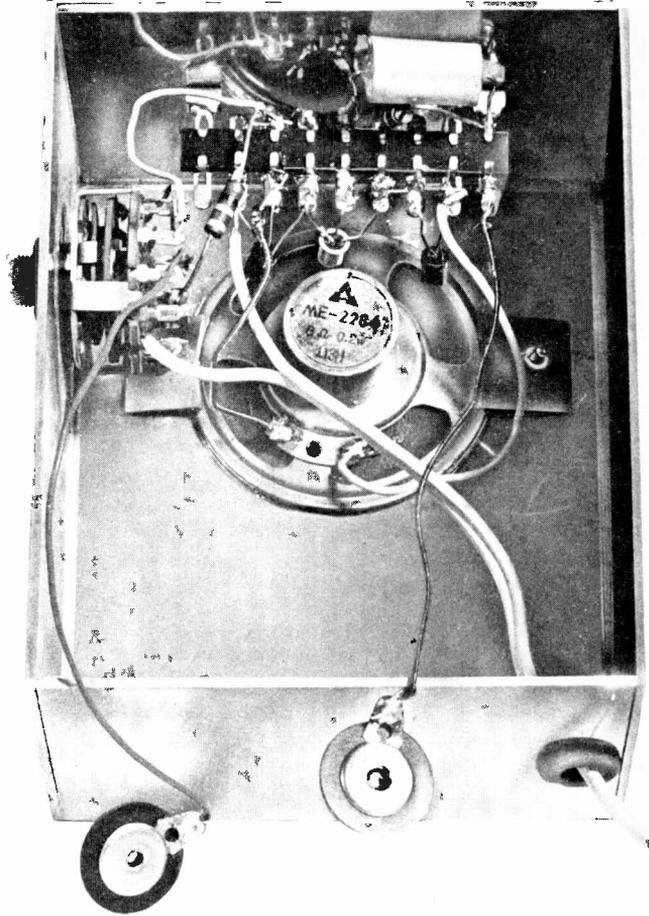


Fig. 3. Interwiring details for alarm components



on the resistance between the sensors. In operation the alarm will sound if any resistance between zero and five megohms is connected between the sensors.

SWITCH POSITIONS

Three positions can be selected by the switch. In position "1" the unit is on standby. In position "2" the sensors are shorted out setting the alarm in operation for testing. This is necessary because after about a year the battery will eventually run down and if it has not been operated, some check is needed on the battery condition.

Position "3" is used once the alarm has been noted and is no longer required. If a mains power supply is used instead of batteries this could be wired to a bulb whose other connection runs to chassis giving a visual indication that the alarm is not set. A warning bulb can of course be used with battery operation but battery life will be greatly reduced.

CONSTRUCTION

All components, except of course the sensors are mounted into an aluminium chassis 5 in × 4 in × 2½ in; this makes for a neat wall mounted unit.

A series of holes should be drilled for the loudspeaker vents and others for the switch spindle, the sensor wires and the tag-strip screws.

The three transistors are fixed to an 8-way tag-strip, the two extreme tags being chassis connections. Both this, the loudspeaker and the switch are wired up as shown in Fig. 3.

continued on page 829

SERVO CHART RECORDER

By D. BOLLEN

SPECIFICATION

| | |
|--------------------|---|
| Pen span | 10.5 cm |
| Slewing rate | Approx. 15cm per second |
| Input resistance | 20k Ω per full span volt + 6k Ω |
| Dead zone | Less than 0.5mm (0.5%) |
| Accuracy | Typically $\pm 2\%$ |
| Set zero | Anywhere on paper |
| Inputs (1) | Eleven attenuator settings covering 5mV/cm-10V/cm |
| (2) | 1V/cm for timing pulses |
| Frequency response | D.C.-1Hz at 5cm peak to peak |

THE rate of change of some electrical signals is too slow for convenient measurement with ordinary test instruments. Examples of such signals are; the charge-discharge characteristics of large batteries and capacitors, long-term drift voltages in electronic circuits, outputs from light, pressure and temperature sensors, biological impulses and waveforms, long period earthquake waves, and radio astronomy reception.

Recorders for handling very slow electrical events are expensive to buy, and some will consume hundreds of feet of specially sensitised film or paper each week when running continuously. The recorder design offered here can be built for as little as £15-£20 and draws a linear ink trace on cheap rolls of adding and accounting machine paper. Rolls cut from decorator's lining paper can also be used.

It is a simple matter to take measurements from unruled paper with the aid of a transparent graticule, similar to that employed with oscilloscope screens, and the instrument is conveniently calibrated in terms of volts per centimetre of pen deflection.

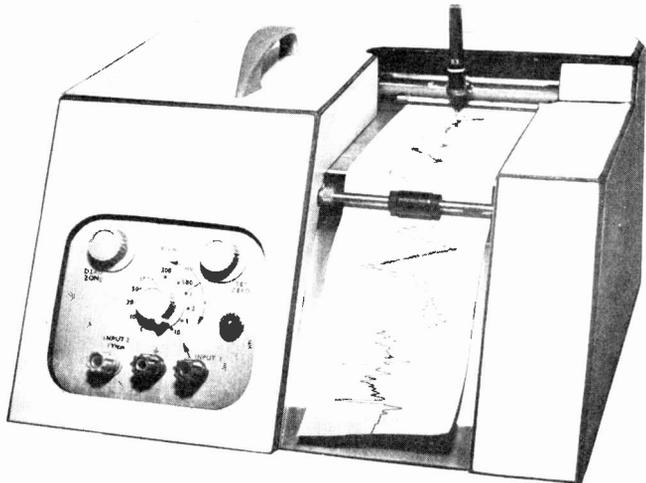
Although no attempt was made to exploit the high accuracy possible with a servo recorder, the accuracy achieved with standard components is equal to, or better than, that offered by most quality testmeters. The recorder pen mechanism is made up from radio dial cord drive parts, and a model boat motor supplies the necessary motivating force.

DESIGN CONSIDERATIONS

A simple, uncorrected servo system would drive the recorder pen in a most erratic manner. The pen could oscillate, overshoot the mark, undershoot, or take a long time to traverse the paper. As with audio amplifier testing, servo faults really come to light when the system is subjected to a step or square wave input, see Fig. 1a.

Of course, we are concerned here with a very low frequency square wave test signal, say 0.01Hz, as there is a limit to how fast a heavy pen can be made to respond. Most servo recorders have a frequency response extending to not more than a few Hertz at most.

Yet another fault, as shown in Fig. 1b, is where the pen moves in a series of jerks or steps when the input signal varies very slowly.



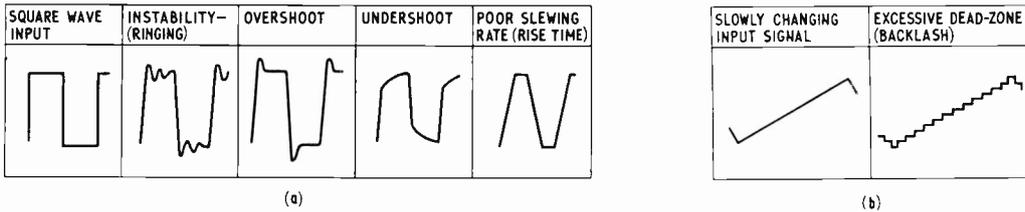


Fig. 1 (a) Oscillograms indicating various faulty recorder responses for a test square wave input. (b) ramp distortion oscillogram, the result of a jerky pen action.

BASIC CIRCUIT

The basic circuit of the chart recorder is given in Fig. 2. A high gain operational amplifier, IC1 is arranged to compare two voltages at its inverting input, one via R1 from the slider of VR1, and the other an output voltage via R2. VR1 is mechanically linked to the pen drive, and has a reference voltage V_B across its track.

Because of its very high gain, IC1 can be thought of as a switch which is off when both inputs are equal and of opposite polarity. If one input is slightly different to the other, the output will switch hard on in a positive or negative direction, depending on the relative polarities of the inputs.

With the servo motor at rest, there is zero volts relative to earth at the operational amplifier output, and the voltage from VR1 exactly cancels the input voltage, assuming that R1 equals R2.

Suppose now that the input increases by positive 30 millivolts; this small change of input is amplified and causes the output to switch hard on and place something like negative 6 volts across the motor brushes. The motor now rotates in a direction dictated by output polarity and moves VR1 slider to a new position where the slider output has increased by a negative 30 millivolts, thus cancelling the change of input voltage, and reducing the voltage across the motor to zero again.

The distance travelled by VR1 slider during the above operation is equivalent to the positive 30 millivolt input change.

When R1 equals R2, the full pen deflection, or span, will represent an input voltage equal to V_B , and if R2 is halved in value the span will be equivalent to half V_B . All that is necessary, therefore, to provide a choice of calibrated inputs, is single switched values of R2.

OVERCOMING INSTABILITY

The servo system shown in Fig. 2 would be unstable if the dotted components C1 and R_f were omitted. There are two forms of instability at work here, the first caused by too much amplifier gain, and the second by the delaying action of the servo motor, or electro-mechanical integrator effect. The inclusion of a feedback resistor R_f serves to reduce amplifier gain to a manageable level, but if it is made too small in value there will be a large unwanted dead zone, giving a result similar to Fig. 1b.

The function of C1 is to supply a differentiating action which almost exactly cancels servo motor integration. Without it there would be instability and overshoot resulting from a sudden change of input voltage.

If, however, C1 is too large in value, over correction leading to undershoot will be the result. It

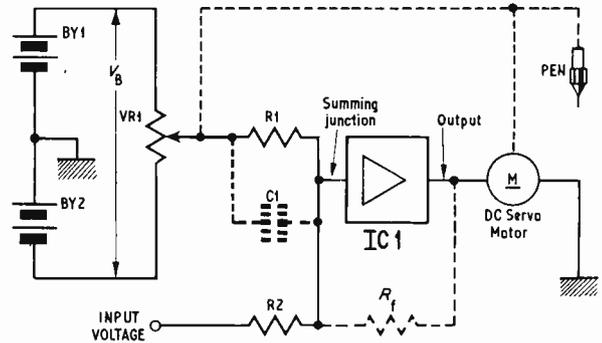


Fig. 2. Basic chart recorder circuit

follows that C1 and R_f should be made adjustable to cater for individual variations of motor speed and amplifier gain.

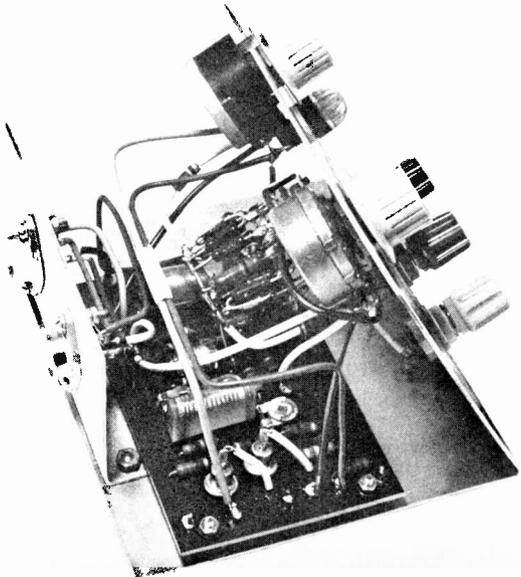
The remaining factor of a poor slewing rate is largely determined by the power of the motor and gear reduction used.

PAPER FEED PROBLEMS

A few problems can occur with the chart paper feed. Usual faults are short-term speed discrepancies, and lateral shifting, or wobble of the paper.

The former is quite difficult to cure, even when the paper has sprocket holes, and is due to paper imperfections, etc. A timing pulse fed to the pen at regular intervals will, however, serve to calibrate paper speed. Lateral shift can be prevented by correct design of the paper feed mechanism.

Controls are mounted on a single piece of aluminium which also forms a chassis for the amplifier panel. Note the heat sink for the output transistors



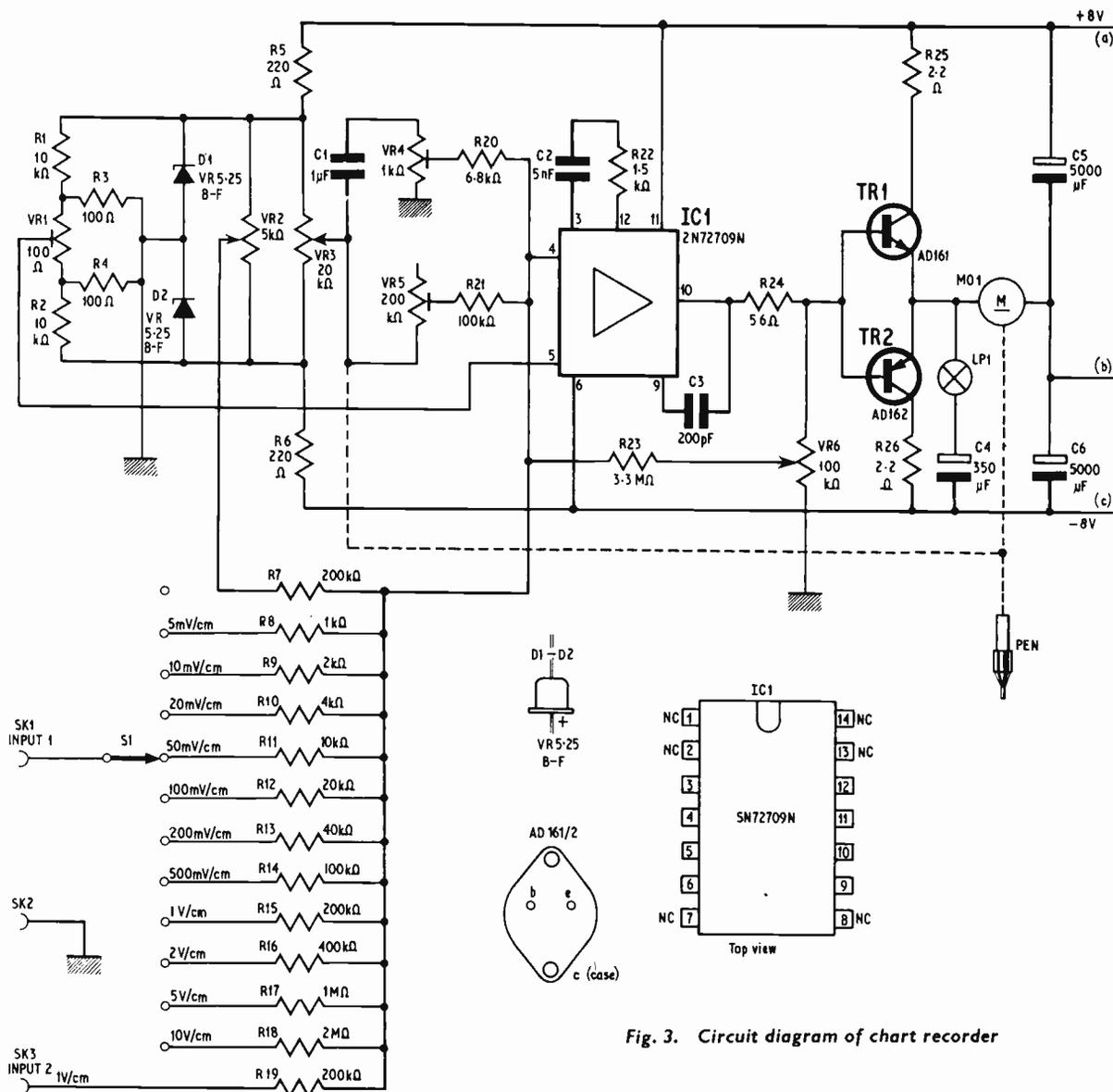


Fig. 3. Circuit diagram of chart recorder

CHART RECORDER CIRCUIT

The complete circuit of the chart recorder is given in Fig. 3. A brief comparison with the circuit of Fig. 2 will help to identify the main component functions.

VR3 in Fig. 3 is the mechanically driven potentiometer equivalent to VR1 in Fig. 2. VR5 and R21 are equivalent to R1, pin 4 of the i.c. package is the inverting input, inputs R8 to R18 are switched values for R2, diodes D1 and D2 provide the reference voltage VRB, VR4 gives a variable output from differentiating capacitor C1, and VR6 acts as an adjustable dead zone or R_f value.

Now looking at Fig. 3 in more detail, VR1 ensures that the chart recorder will maintain its zero setting with the input terminal open or short circuited, by supplying a small offset compensating voltage to the amplifier non-inverting input, pin 5. VR2 allows the pen to be set anywhere on the chart paper (centre zero, or zero either side) by injecting a large offset voltage to the summing junction via R7.

VR5 is for initial calibration of the instrument.

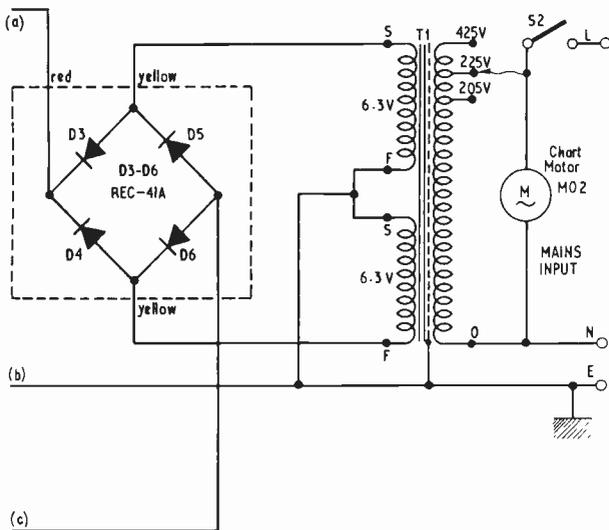
Attenuator steps (resistors R8 to R18) are in a 1, 2, 5 sequence, from 5mV/cm up to 10V/cm, plus an additional input for timing pulse calibration of chart speed.

The motor specified for use with the recorder has a stall current of 500mA at 6V d.c., far in excess of the output capability of an i.c. operational amplifier.

Complementary emitter followers TR1 and TR2 serve to boost the amplifier output current to a maximum of 1A, thus allowing other motors of heavier consumption to be substituted.

HUM INDICATOR

If mains hum or other higher frequencies are present at the recorder input they could be amplified and fed to the motor as a.c. power, thus causing it to overheat. There is no visible response from the servo to input frequencies above about 15Hz, so some method of indicating these unwanted inputs must be devised.



COMPONENTS . . .

Resistors

| | | |
|-------------------|----------------------|----------------------|
| R1 10k Ω | R10 4k Ω 1% | R19 200k Ω 2% |
| R2 10k Ω | R11 10k Ω 1% | R20 6.8k Ω |
| R3 100 Ω | R12 20k Ω 1% | R21 100k Ω |
| R4 100 Ω | R13 40k Ω 1% | R22 1.5k Ω |
| R5 220 Ω | R14 100k Ω 1% | R23 3.3M Ω |
| R6 220 Ω | R15 200k Ω 1% | R24 56 Ω |
| R7 200k Ω | R16 400k Ω 1% | R25 2.2 Ω 1W |
| R8 1k Ω 1% | R17 1M Ω 1% | R26 2.2 Ω 1W |
| R9 2k Ω 1% | R18 2M Ω 1% | |

All $\pm 10\%$, $\frac{1}{2}$ watt carbon except where stated.

Potentiometers

| |
|--|
| VR1 100 Ω miniature horizontal mounting pre-set |
| VR2 5k Ω linear carbon |
| VR3 20k Ω wirewound or linear carbon (see text) |
| VR4 1k Ω miniature horizontal pre-set |
| VR5 200k Ω miniature horizontal pre-set |
| VR6 100k Ω linear carbon potentiometer |

Capacitors

| | |
|------------------------|-----------------------------|
| C1 1 μ F polyester | C4 350 μ F elect. 15V |
| C2 5nF polystyrene | C5 5,000 μ F elect. 12V |
| C3 200pF polystyrene | C6 5,000 μ F elect. 12V |

Integrated Circuit

IC1 SN 72709N, BP 709 or 709 OPA

Transistors

TR1 AD161 TR2 AD162

Diodes

D1, D2 VR5-25B-F 5.25V 2W Zener (2 off)

Rectifier

D3-D6 Rec-41A

Transformer

T1 Filament transformer, secondaries 6.3V 1.8A; 6.3V 1.8A (Radiospares "Hygrade")

Switches

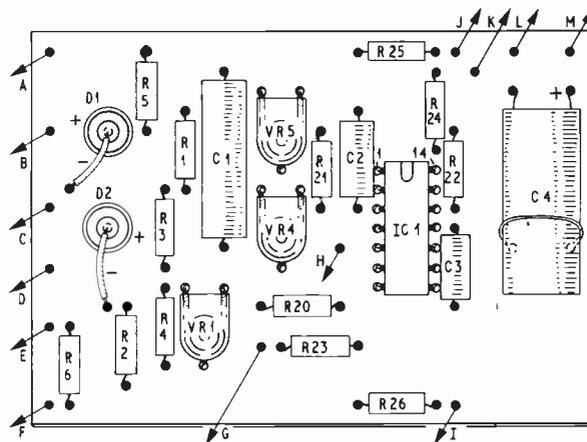
S1 Single pole 12 way wafer
S2 Single pole mains on/off

Lamp

LPI 6V 0.36W

Miscellaneous

$4\frac{1}{2}$ in \times $2\frac{1}{2}$ in 0.1in matrix s.r.b.p. or copper laminate board, 16 s.w.g. sheet aluminium, knobs, terminals, lampholder, TO-66 mica washers with insulating bushes. For mechanical components see text. SK1-SK3 Miniature sockets with plugs. M01, M02 (see text).



TERMINAL PINS - ●
CONNECTIONS TO UNDERSIDE - ○

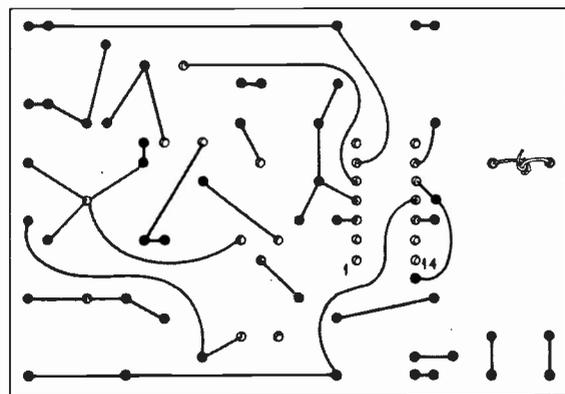


Fig. 4. Component assembly and wiring details of amplifier panel

It might be thought a simple matter to just filter out all frequencies above 15Hz, but this could upset the servo compensation and cause undershoot and instability. Instead, a lamp LPI and capacitor C4 are included to give a visual warning of hum.

Recorder accuracy is mainly determined by the track linearity of VR3 and the tolerance of input resistors R8-R18.

GENERAL CONSTRUCTION

The layout of individual chart recorders may differ from the prototype, to suit individual preferences and mechanical components to hand. Some readers may wish, for example, to increase the pen span and paper width to, say, 10 inches, or merely tailor the instrument to fit an existing box.

To facilitate custom building, the recorder is broken down into the following sub-units: amplifier panel, power pack, TR1 and TR2 heat sink, control panel, pen drive, and chart drive. The chassis frame to which the pen drive and chart drive are mounted can be fashioned from brass or alloy angle, sheet aluminium, or Meccano parts.

AMPLIFIER PANEL CONSTRUCTION

Fig. 4 shows the amplifier panel layout. As there are no wiring crossovers, components can either be assembled on a 0.1 inch matrix, punched s.r.b.p. board or a printed circuit. In the latter case it is

advisable to use a 14 way dual-in-line socket for the i.c. package owing to the difficulty of desoldering in the event of a failure.

Panel leads are labelled A to M for quick identification during final wiring of the chart recorder.

POWER PACK CONSTRUCTION

With only four components, the power pack can be quickly assembled on a suitable piece of aluminium sheet, with clips for the capacitors. The sheet acts as a heat sink for the rectifier bridge assembly.

Yellow rectifier pins are wired to the transformer output, and the connection to C5 is the red pin. Finally, ensure that the finish of one transformer 6.3V winding is connected to the start of the other winding when forming the centre tap. See Fig. 5.

HEAT SINK AND CONTROL PANEL CONSTRUCTION

TR1 and TR2 should be provided with a heat sink equivalent to at least 16 square inches of 16 s.w.g. aluminium sheet. If the control panel is bent to form a chassis for the amplifier panel, this will act as an auxiliary heat sink. The power transistors must be mounted with insulating washers, and it is advisable to check this insulation with a testmeter during construction.

PEN DRIVE UNIT

Details of the pen drive are given in Fig. 6. The pen boom can be made of a section of chromed tubing taken from an old portable radio or television telescopic aerial, or just plain brass tubing.

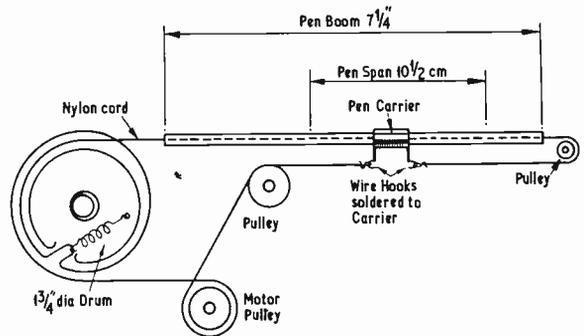


Fig. 6. Details of the pen drive assembly

The short piece of brass tubing which acts as a pen carrier should be a snug sliding fit on the boom. A compass attachment is securely glued to the carrier with epoxy resin to accept a range of tubular nib drawing pens of the Variant type.

VR3 is an ordinary wirewound or linear carbon one to three watt potentiometer, which is easy to obtain and cheap to replace when worn out. If the user wishes to extract the best possible slewing rate from his recorder, it should be specially selected or treated for minimum spindle torque.

It is possible to lighten the action of many wirewound pots by taking the back off and removing any thick protective grease with switch cleaner.

If the component used for VR3 is later found to have a linearity error of more than 1 per cent, this can often be improved by wiring a 1 Megohm preset resistor between the slider and one end of the track. The linearity error of general purpose potentiometers is seldom quoted by manufacturers, but those with values above 10 kilohms can be surprisingly good. If in any doubt, a precision potentiometer with low torque and a linearity error of less than 0.5 per cent can be purchased.

D.C. MOTOR

The d.c. motor (M01) employed for the recorder must have carbon brushes, a stall current of less than 1A, and be fitted with a gear reduction in the region of 16 : 1.

A motor with a multi-speed gearbox is preferable as it allows the reduction ratio to be adjusted to suit the frictional loading of the cord drive for optimum slewing rate.

The motor pulley is a brass or plastics bush mounted on the gearbox spindle with a tight fit p.v.c. grommet. Rubber grommets are useless in this application and will wear out quickly. Conventional brass or plastics pulleys, on the other hand, are prone to slipping. It is advisable to support the free end of the gearbox spindle with some form of bush bearing.

After assembly, check the pen drive for smooth action by connecting a 1½-3V battery to the motor. It may be necessary to alter the tension of the drum spring and remove high spots from the boom tube with glasspaper.

If a longer pen span is required, this can be achieved by fitting an extended boom tube and a larger diameter drum. The diameter of drum needed for a given span is equal to the span in centimetres divided by 5.97, assuming that VR3 has a 270 degree effective rotation.

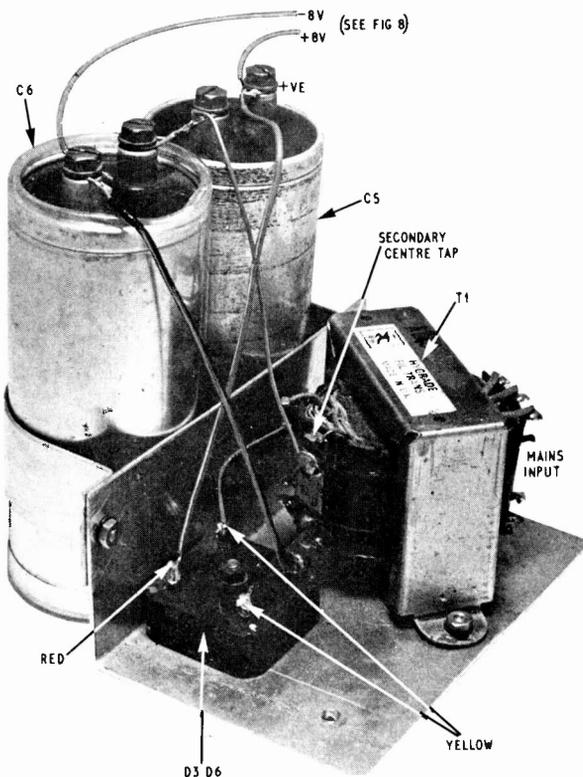


Fig. 5. Modular assembly of power pack on aluminium sheet

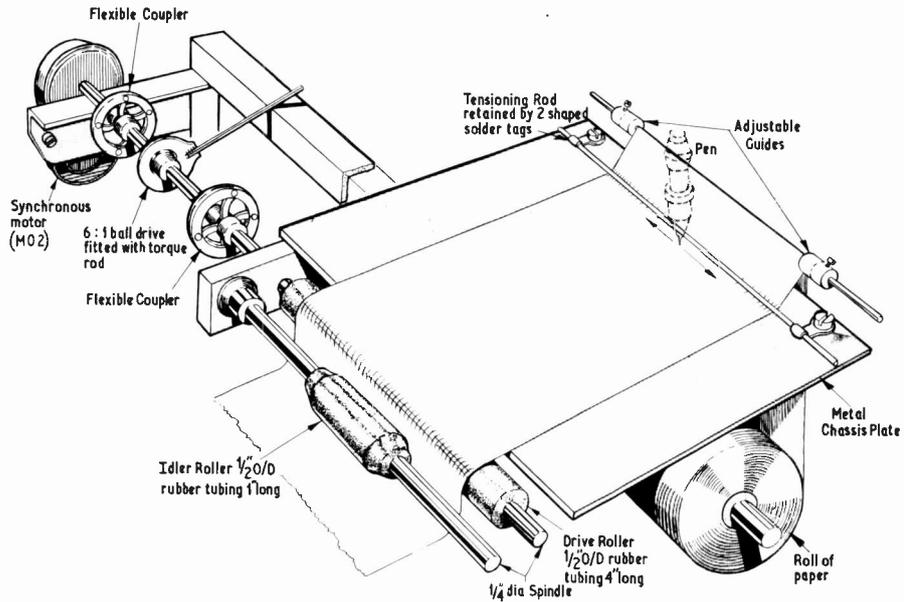


Fig. 7. Details of the chart drive unit

CHART DRIVE UNIT

The drive mechanism shown in Fig. 7 accepts any width of paper, up to the full pen span, without lateral shifting. The paper moves from the roll, through adjustable guides, and under a tensioning rod; this rod, in conjunction with the short idler roller, maintains a stable feed. Smooth, seam free rubber tubing is glued to the drive spindles to form the rollers.

Ball reduction drives are used to give a selection of speeds from one chart motor. For example, a one r.p.m. motor with three cascaded 6 : 1 ball drives gives the following speeds with a $\frac{1}{2}$ inch diameter drive roller: 4cm/min, 40cm/hr, 6.6cm/hr, and 1.1cm/hr.

When a reduction drive is not needed it can be replaced by a flexible coupler or short length of $\frac{1}{4}$ inch spindle.

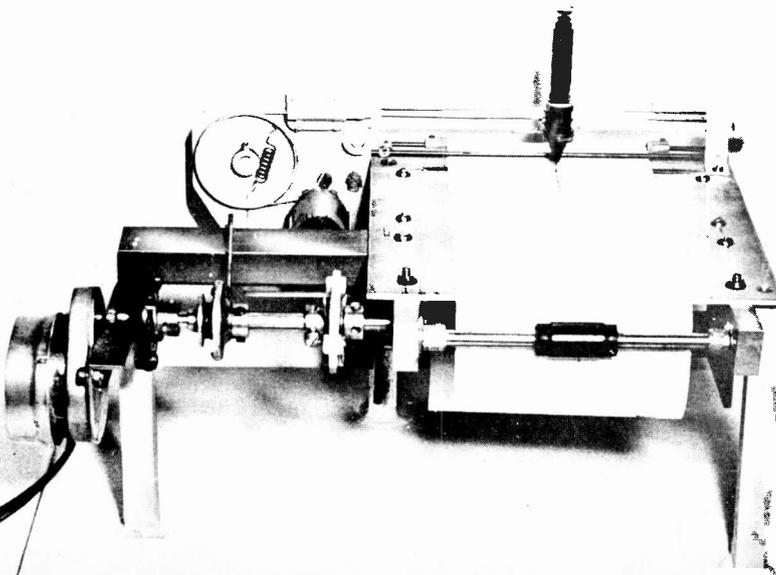
The prototype chart drive employed roller spindles mounted in thick brass bearers, but this was later

found to be too robust and difficult to adjust. A much simpler form of construction would be with spindles revolving in bearings made from old potentiometer bushes, which are bolted to angle or sheet aluminium.

MECHANICAL COMPONENTS

A Mini-Richard motor with six speed gearbox can be ordered from most model shops and is imported by Ripmax, 80 Highgate Road, London, N.W.5. A Variant pen with 0.2mm nib, and a compass attachment is available from large stationers. Electronic Brokers Ltd., of 49-53 Pancras Road, London, N.W.1, can supply MA23 chart motors with fixed speeds ranging from 20 r.p.m. to 1/240th r.p.m.

Silver steel $\frac{1}{4}$ inch diameter spindles are stocked by ironmongers, and the dial drum, flexible couplers, and reduction drives by the usual electronic component suppliers.



Chassis frame with pen and chart drive unit

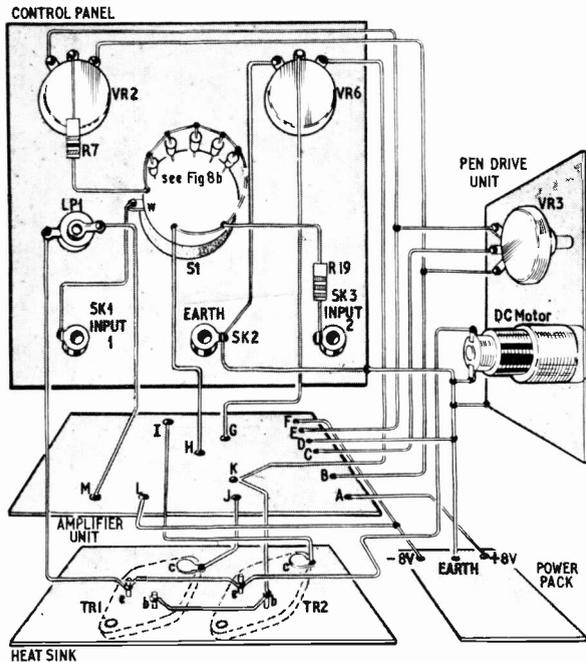


Fig. 8a. Interwiring diagram of chart recorder sub-assemblies

FINAL ASSEMBLY AND SETTING UP

Chart recorder sub-units are wired together as shown in Figs. 8a, b. The following points should be borne in mind before testing the recorder, and during final assembly.

Connections to the track of VR3 may need to be reversed to give the desired direction of pen travel for a positive input voltage. If the leads to the d.c. motor are out of "sense" with VR3 rotation the pen will move hard over to one side of the paper

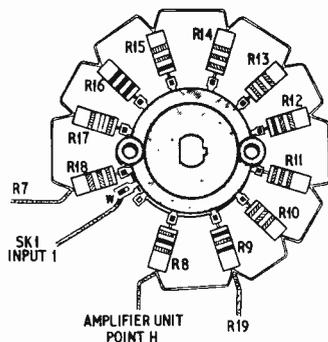


Fig. 8b. Wiring of switch S1

and will not respond to an input signal. A peculiarity of the Mini-Richard gearbox is that it changes its direction of rotation for each step change of gear ratio, thus necessitating reversal of motor leads when changing gear.

To set up and calibrate the recorder, all pre-sets and VR2 and VR6 should first be placed in the mid-track position. Stick a 0-10cm scale (cut from an exercise book or a thin plastics ruler) under the pen and switch the recorder on. The pen should move to somewhere near the 5cm mark and stop. If the pen oscillates, increase the VR6 dead zone setting. Position the pen at exactly 5cm with VR2.

If the input attenuator is set to 5mV/cm, and input 1 is shorted to earth, the pen will be seen to shift to a new position. Bring the pen back to the 5cm mark with VR1 while the input is still shorted. There should be no movement of the pen when the input is open or short circuited. Now set the attenuator to 1V/cm and inject a known d.c. voltage into input 1. Calibrate the pen deflection by adjustment of VR5.

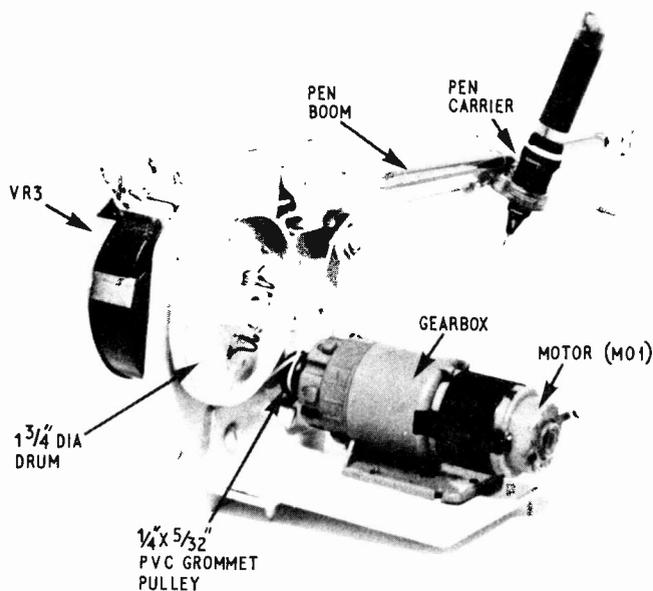
To check for over or undershoot, have the chart paper moving at maximum speed and switch a fixed input voltage on and off, this should trace a rough square wave. Adjust VR4 and VR6 for best square wave response, with reference to Fig. 1a.

As a final test for smooth pen travel in response to a slowly changing signal (Fig. 1b), charge a 1,000µF capacitor to about 10V and connect it across input 1 and earth with the attenuator set to 2V/cm. The pen will trace the discharge curve of the capacitor and if it moves in a series of jerks or steps, try increasing the gearbox reduction ratio or use a smaller dead zone. The recorder should now be ready for use.

USING THE RECORDER

Normal precautions should be taken to avoid input hum when connecting the recorder to other equipment, in some cases it will be necessary to increase the dead zone setting to extinguish LPI. If desired, limit switches can be fitted, to open circuit trace, try another brand of ink, or water down the ink.

Ensure that the servo motor does not remain stalled for long periods with the pen at span limits. If desired, limit switches can be fitted, to open circuit the collector of TR1 or TR2. Alternatively, the pen drive cord tension can be carefully adjusted so that the motor pulley slips when the pen reaches the end of its travel.



Pen drive unit

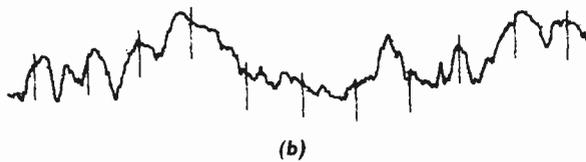
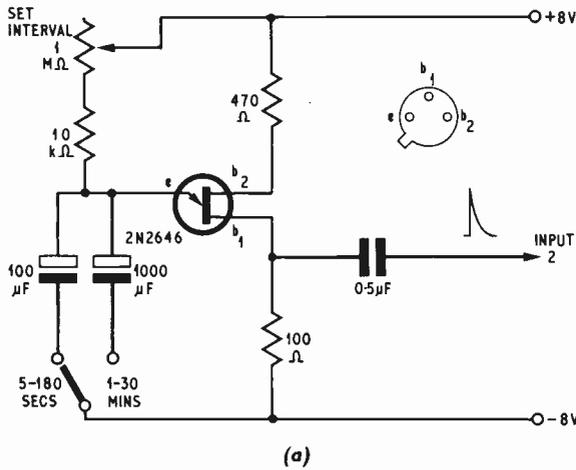


Fig. 9(a). Simple u.j.t. oscillator circuit that can be built for calibrating chart speeds. (b) Showing timing pulses superimposed on trace

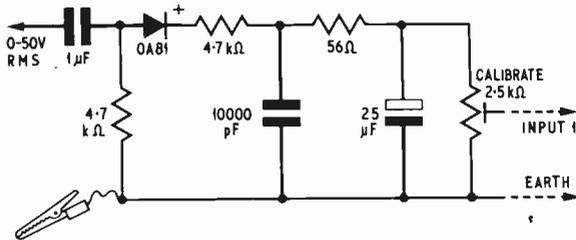


Fig. 10. Circuit diagram for a divide by ten probe. This extends the measurement capability of the recorder to higher frequencies

The circuit of Fig. 9 shows a simple pulse generator for calibrating chart speeds. A pulse output is obtained at intervals ranging from 5 seconds to 30 minutes by switch selection of two capacitors and adjustment of a 1 megohm potentiometer. An example of timing pulses superimposed on a trace is given in Fig. 9b.

As it stands, the recorder will display an undistorted sine wave of 1Hz at more than 5 cm peak to peak, and 5Hz at 1cm peak to peak. It is possible to measure and record the average level of higher frequencies by using a radio frequency probe, such as that shown in Fig. 10.

The probe has a frequency response extending from 100Hz to tens of megahertz, and with its division ratio of ten will offer 0-10V r.m.s. when the recorder attenuator is set to 100mV/cm, 0-20V r.m.s. at 200mV/cm, and 0-50V r.m.s. at 500mV/cm. If the probe is used with attenuator settings below 100mV/cm it will need to be recalibrated because of resistive loading, and linearity will be poor.

The servo chart recorder is well suited for use with the Seismograph described last month, and with Radio Astronomy receivers. ★

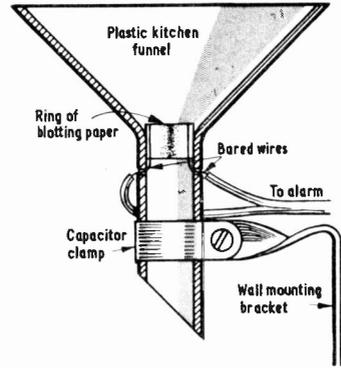


Fig. 4. Funnel arranged as a sensor for rain or snow

SENSORS

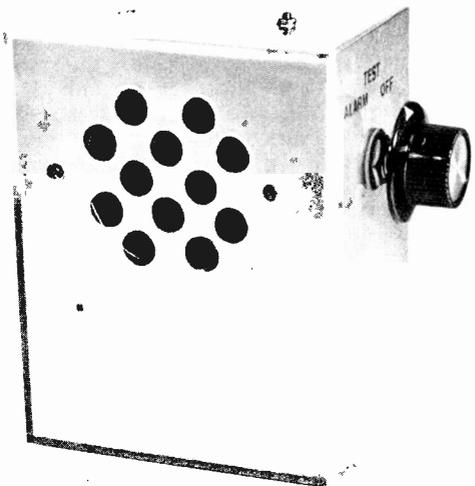
The sensors can take two forms. For water level warning two brass rods should be spaced about an inch apart and positioned above the water surface at the required level.

For rain or snow a plastic kitchen funnel can be used as seen in Fig. 4. Here two copper wires are fitted through small drilled holes at the top of the neck and a circle of blotting paper is slipped in so that it touches both. By using this arrangement snow, which may not soak into the blotting paper, will also build up until it bridges the sensors. Very light rain will tend to stick to the sides of the funnel and run down, soaking into the paper. A simple bracket should grasp the neck of the funnel for mounting to an outside wall or post.

Very long lengths of wire can be run between the sensors and the alarm because of the sensitivity of the unit.

LDR CUT-OUT

A simple refinement to the circuit can make sure that you are not disturbed by the alarm at night—after all if used as a rain alarm you usually couldn't care less if it pours after dark. Simply insert a light dependent resistor such as the ORP 12, in the collector supply to TRI. The resistance will stop operation of the whole unit except during daylight. Obviously this l.d.r. will have to be mounted outside. ★





The North American Nebula (N.G.C. 7,000). The shape of this nebula shows how it became so named. It is about 3 degrees east of α Cygni.

RADIO ASTRONOMY TECHNIQUES

BY F.W.HYDE
PART 5

THE previous article dealt with the setting up of the aerial system and the construction of a suitable corner reflector. This article deals with the pre-amplifier, the converter, the receiver, and the recording system.

PRE-AMPLIFIER

Although a general specification has been laid down for the pre-amplifier, some latitude is permissible provided that certain of the important parameters are kept in mind. For example, the desired gain has been stated as not less than 16dB. There is no reason why this should not be greater, provided that the unit is stable and the noise level at a reasonable figure.

More than one unit could be used up to a maximum overall gain of 100dB. Again, it is the stability and noise factor which will be important. If the noise level is too high the latter stages of the amplifiers may be overloaded, not forgetting the receiver. The result in such a case would be useless. The pre-amplifier gain must be consistent with low noise and real amplification of signal.

It is preferable to have a pre-amplifier at the aerial itself, and if two units or more are available then the first can be mounted on the aerial and the others located nearer the receiver. It will be clear that the screening and earthing of high gain units will need care. The interconnecting coaxial leads will have to be routed and be cut so that nodes do not appear on the screening. This is best accomplished by avoiding multiples of one-half wavelength when cutting to size.

POWER SUPPLY ARRANGEMENTS

The pre-amplifier can be a standard commercial type, built round either valves or transistors. Where the aerial is at the observation position the power supply offers no problem whether valve units or transistor units are employed. However where the aerial is some distance away there can be problems.

If valve units are decided upon, and provided the distance is not excessive, mains leads may be run. If this is the case it is recommended that they are laid in the ground, since this will generally avoid any local interference being picked up and conveyed to the amplifier.

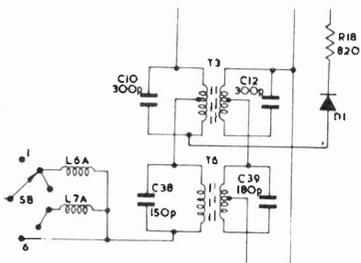
An alternative arrangement is to use low voltage transmission by means of a step-down, step-up system at the ends. Since this will require rather larger cable it could be more costly than the simple system.

If the units are transistorised then the power can be taken via the aerial lead with suitable filter networks at each end. Alternatively the power pack may be an integral part of the unit, and normal mains leads taken to the point of use.

It is not recommended that dry batteries be used. Wet (secondary) batteries are a possibility if they happen to be available. On the whole it is perhaps best to use the mains feed for this will provide a point for appliances that may be used when working on or modifying the aerial or ancillary systems.

A watertight case or box should be provided to house the unit since exposure to the weather will cause serious problems. It is also a wise precaution to tape up the coaxial connection points.

electronics mastered!*



by our highly practical
BUILD, SEE & LEARN system

Step by step we take you through the apparent intricacies of electronics and show you how easily you can master the subject. Write for the brochure which shows, in full detail, how you can do it.

1

We provide a full range of components and sub-assemblies, with details of what they do, so that you learn to recognise all the 'bits and pieces'. Using some of these you are instructed in how to build this oscilloscope, simply and quickly.

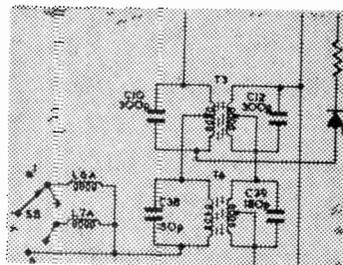
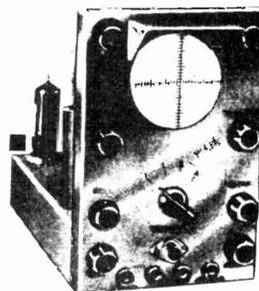
2

You are shown how to read and understand circuit diagrams so that you can later build more advanced equipment or draw your own diagrams.

3

You can construct over 40 kits, including:—

- Valve experiments
- Transistor experiments
- Amplifiers
- Oscillators
- Signal tracer
- Photo electric circuit
- Computer circuit
- Basic radio receiver
- Electronic switch
- Simple transmitter
- a.c. experiments
- d.c. experiments
- Simple counter
- Time delay circuit
- Servicing procedures



This course has been designed to help even those who are complete newcomers to electronics. **No Maths needed!**

POST NOW
FOR
FREE BROCHURE
BLOCK CAPITALS PLEASE

To: **British National Radio School, Reading, Berks.**
Please send your free Brochure, without obligation, to:

NAME

ADDRESS

P.E.10

FREE

SPECIAL ELECTRONIC GIFT
to all our Students **POST COUPON NOW!**

VARIABLE VOLTAGE TRANSFORMERS

BODINE TYPE N.C.I. GEARED MOTOR

(Type 1) 71 r.p.m. Torque 10lb. inch. Reversible. 1/70th h.p. 50 cycle, 0.38 amp. (Type 2) 28 r.p.m. Torque 20lb. inch. Reversible. 1/80th h.p. 50 cycle, 0.28 amp. 115V a.c. Input voltage of motor. Supplied complete with transformer for 230/240V a.c. input. Price, either type £3.15 plus 35p P. & P. or less transformer £2.13 plus 27p P. & P.

12 VOLT DC MOTOR

Powerful 1 amp. REVERSIBLE motor Speed 3,750 RPM complete with external gear train (removable) giving final speed of 125 RPM. Size: 4 1/2" dia. Price 95p inc. post.

230V/240V COMPACT SYNCHRONOUS GEARED MOTORS

Manufactured by either Sangamo, Haydon or Smith. Built-in gearbox. 1 rev. per hour. Clockwise rotation. 1 rev. per hour. Anti-clockwise rotation. 2 revs. per hour. Clockwise rotation. 3 revs. per hour. Anti-clockwise rotation. 60 revs. per hour. Clockwise rotation. Fraction of makers' price. All at 75p incl. P. & P.

ALARM BELL

Mfg. by GENTS. 6 inch bell, 3/6 volt D.C. operation. As NEW. Only £1.50 plus 45p P. & P.

200-250V A.C.

NEON INDICATOR

Available in red or amber at 20p each. Or in green at 32p each. Minimum order 3 units. P. & P. 5p.



ELECTRONIC ORGAN KIT

Easy to build. Solid State. Two full octave (less sharps and flats). Fitted hardwood case. Powered by two penlite 1 1/2V batteries. Complete set of parts including speaker, etc., together with full instructions and 10 tunes. Price £3.00. P. & P. 22p.

50 in 1 ELECTRONIC PROJECT KIT

50 easy to build Projects. No soldering, no special tools required. The kit includes: Speaker, Meter, Relay, Transformer, plus a host of other components and a 56-page instruction leaflet. Some examples of the 50 possible Projects are: Sound Level Meter, 2 Transistor Radio, Amplifier, etc. Price £7.75. P. & P. 30p.

CRYSTAL RADIO KIT

Complete set of parts, including: Crystal Diode, Ferrite Aerial, Drilled Chassis, and Personal Ear Piece. No soldering, easy to build, full step by step instructions. £1.75 inc. post.

230v AC SOLENOID

Extremely powerful with approx. 14lb. pull, 1" travel. Fitted with mounting feet. Size: 4" long, 2 1/2" wide, 3" high. £2.00 incl. P. & P.

230-250V SOLENOID

Mfg. by Westco, approx. 1 1/2lb pull (similar in appearance to above illustration). Size of feet 1 1/2" x 1 1/2". Price 85p incl. Post.

YENNER Electric Time Switch

200/250V Ex. G.P.O. Tested. Manually set 2 on, 2 off every 24h. Override switch: 10A £2.75, 15A £3.25, 20A £3.75. P. & P. 20p. Also available with solar dial ON dusk, OFF dawn. Price as above.

INPUT 230/240V a.c. 50/60 OUTPUT VARIABLE 0-260V.

All Types (and Spares) from 1/2 to 50 amp from stock. SHROUDED TYPE 1 amp, £5.50. 2.5 amp, £6.75. 5 amp, £9.75. 8 amp, £14.50. 10 amp, £18.50. 12 amp, £21.00. 15 amp, £25.00. 20 amp, £37.00. 37.5 amp, £72.00. 50 amp, £92.00. Carr. extra. 2.5 AMP OPEN TYPE (Panel Mounting) 1 amp, £3.93. 1 amp, £5.50. 2 1/2 amp, £6.63. Carr. 40p on open types.



Superior Quality Precision Made NEW POWER RHEOSTATS

100 WATT. 1 ohm, 10A; 5 ohm, 4.7A; 10 ohm, 3A; 25 ohm, 2A; 50 ohm, 1.4A; 100 ohm, 1A; 250 ohm, 0.7A; 500 ohm, 0.45A; 1 kΩ, 280 mA; 1.5 kΩ, 230 mA; 2.5 kΩ, 2A; 5kΩ, 140 mA. Diameter 3 1/2 in. Shaft length 3 in. dia. 3/8 in. All at 35p each. P. & P. 5p. 50 WATT. 1/5/10/25/50/100/250/500/1/1.5/2/5/5kΩ. All at £1.12 each. P. & P. 11p. 25 WATT. 10/25/50/100/250/500/1/1.5/2/5/3/5/5kΩ. All at 78p each. P. & P. 15p.



STROBE! STROBE! STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/250V a.c. operation.

EXPERIMENTERS' ECONOMY KIT Speed adjustable 1 to 36 Flash per sec. All electronic components including Veri-board, S.C.R., Unijunction Xenon Tube and instructions £6.30 plus 25p P. & P.

NEW INDUSTRIAL KIT Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor. Speed adjustable 1-80 f.p.s. Price £10.50. P. & P. 50p.

HY-LIGHT STROBE MK III This strobe has been designed and produced for use in large rooms, halls and the photographic field, and utilizes a silica plug-in tube for longer life expectancy, printed circuit for easy assembly, also a special trigger coil and output capacitor. Speed adjustable 0-30 f.p.s. Light output approx. 4 joules. £12.00. P. & P. 50p. Suitable metal case and reflector £4.00 extra.

AND NOW! THE 'SUPER' HY-LIGHT KIT

Approx. four times the light output of our well proven Hy-Light strobe. Incorporating: ● Heavy duty power supply ● Variable speed from 1-25 flash per sec. ● Fantastic Octal based tube with massive electrodes. ● Reactor control circuit producing an intense white light. The brilliant light output of the "SUPER" HY-LIGHT gives fabulous effects with colour filters. Never before a Strobe Kit with so HIGH an output as to LOW a price. ONLY £20 plus 75p P. & P. Suitable metal case & reflector £7.00 plus 45p P. & P. extra 7-inch POLISHED REFLECTOR Ideally suited for above Strobe kits. Price 53p. P. & P. 13p or post paid with kits.

RELAYS SIEMENS, PLESSEY, Etc.

| MINIATURE RELAYS - COMPETITIVE PRICES | | | |
|---------------------------------------|--------|----------|------|
| 1 | 2 | 3 | 4 |
| 45 | 6-9 | 2 HD M | 50p |
| 185 | 6-12 | 4 c/o | 73p* |
| 230 | 9-12 | 4 c/o | 78p* |
| 280 | 9-12 | 2 c/o | 73p* |
| 600 | 18-32 | 4 c/o | 78p* |
| 700 | 16-24 | 4M 2B | 63p* |
| 700 | 16-24 | 4 c/o | 78p* |
| 700 | 12-24 | 2 c/o | 63p* |
| 700 | 15-35 | 2 c/o HD | 73p* |
| 700 | 16-24 | 6M | 63p* |
| 700 | 24-36 | 4 c/o | 63p* |
| 700 | 36-45 | 6M | 50p |
| 700 | 30-48 | 4 c/o | 63p* |
| 700 | 40-70 | 4 c/o | 50p* |
| 700 | 40-70 | 2 c/o | 50p* |
| 700 | 85-110 | 6M | 50p* |

(1) Coil ohms; (2) Working d.c. volts; (3) Contacts; (4) Price (HD) Heavy Duty. All Post Paid. *Including Base.

MAINS RELAY

230V a.c. coil 3 c/o. 10 amp a.c. contacts, 50p plus 8p P. & P.

MOTOROLA MAC III/6 PLASTIC TRIAC 400 PIV. 8 AMP

Now available EX STOCK. Supplied with full data and applications sheet. Price £1.05, P. & P. 7p. Suitable DIAC (RCA 40583) 30p each.

BLACK LIGHT KIT



This kit consists of a high-pressure mercury discharge lamp enclosed in a deep blue-violet outer bulb. This absorbs all visible light given by the discharge but transmits the long-wave ultra-violet rays. The unit performs in a similar fashion to the fluorescent tube type units in use in some discotheques but instead uses a 3-pin B.C. lamp fitted into a high intensity spot-fitting with fully adjustable swivel bearing. The reflector is also fully adjustable and the unit may be mounted in any position and focused as desired. White shirts and dresses glow "Whiter than white". Paint scenes on walls, etc., with our special fluorescent paint, focus the black-light from across the room and switch-on. The pictures glow brilliantly as if by magic! Full kit includes lamp, reflector, control-gear, generous samples of five different colours of fluorescent paint and full instructions. Price £25 carr. paid. S.A.E. with all inquiries.

PSYCHEDELIC LIGHTING

UNIT Mk. 3



This unit represents a natural progression from our phenomenally successful Mk. 1 and 2 Units. As before the drive voltage is derived directly from the amplifier output or across the speakers. The unit converts the audio frequency signals into a three-coloured light display; the colour depending on the frequency of the signal and the intensity on the loudness of the audio source. The unit is constructed on professional fibre-glass printed-circuit board material and uses latest full-wave triac circuitry. There is a master-level control, together with independent sensitivity controls for each channel. The original minimum ambient light level controls have been redesigned permitting their use as faders; allowing dimming from max. to zero at the turn of a knob. R.F.I. suppression is now incorporated as standard as well as provision for D.J. "Pulse-Flash" controls. The choice of two inputs enables operation from both high and low amplifiers. Max. power 15kW per channel at 240V a.c. Complete assembly built and tested. Size 9in x 7in x 3in. Price £25 carr. paid. S.A.E. with all inquiries.

AUDIO MIXER MODULES



A range of Audio Pre-amplifier Modules is now available enabling the construction of custom-built audio mixers for studio, P.A. and discotheque installations; at reasonable cost and with many facilities usually available only on expensive systems. The modules, constructed on fibre-glass printed-circuit boards are complete with anodised aluminium black fascia plates and four control knobs. A comprehensive range of input modules is available, together with mixer/line amplifier and V.U. meter, power unit and 100W slave amp. See Aug. and Sept. Practical Electronics for further details or send 25p for manual showing mixing arrangements, connection data, etc. Trade inquiries welcome.

DABAR ELECTRONIC PRODUCTS

98a LICHFIELD STREET
WALSALL, STAFFS WS1 1UZ
WALSALL 34365
MAIL-ORDER ONLY

SERVICE TRADING CO

All Mail Orders—Also Callers—Ample Parking Space
Dept. P.E. 57 BRIDGMAN ROAD, LONDON W4 5BB
Phone 01-995 1560 SHOWROOM NOW OPEN MON.-FRI.
Personal callers only. Open Sat.
9 LITTLE NEWPORT ST.
LONDON WC2H 7JL 01-437 0576

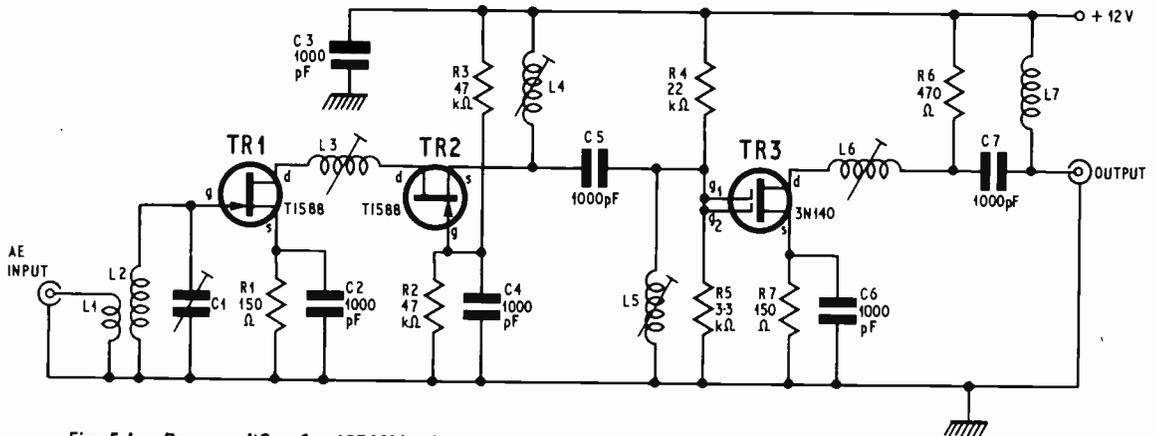


Fig. 5.1. Pre-amplifier for 137MHz, basic circuit using field effect transistors

PRE-AMPLIFIER CIRCUITS

The choice of pre-amplifier circuitry is a wide one, and some examples for the home constructor are given in Figs. 5.1 and 5.2.

Commercial units can be purchased from a number of suppliers. Among these commercial units will be found some specially designed for the 144MHz amateur band. It should be a simple matter to modify these for the chosen frequency of 137MHz. This can be done in such a way that the pre-amplifier may be used for both purposes.

THE CONVERTER

Considering the converter, it is better in some ways to use a commercial product since all the "bugs" will have been dealt with in the course of development. However, if the urge to start from scratch is strong, then there are commercial units that can be modified or entirely new units may be designed and made up.

To cover this aspect two circuits have been drawn as a guide and are shown in Figs. 5.3 and 5.4. Commercial television converters can be modified for the purpose and both valve and transistor types are available. Alternatively, local radio service dealers may have suitable turrets available from obsolete television sets.

One particular example which the writer used was a turret from a Murphy Television receiver which was manufactured as a unit by Sidney Bird Ltd. Some of these are likely to be still around. The coils on these units were easily accessible and gave no difficulty when it came to modification.

As in the case of the pre-amplifier, there are some commercial converter units built for the exact frequency band required and others that are available for the amateur band of 144MHz. Generally, these latter are easily modified, but if crystal controlled the latitude on such units as regards tuning coverage would be too narrow. In such cases, the crystal will need to be deleted and the necessary circuit modifications made.

Another point to bear in mind is that some of the converters that may be available on the surplus market have an intermediate frequency which is above 30MHz. Here, unless the communication receiver to be used has a range above 30MHz, additional modification would be required.

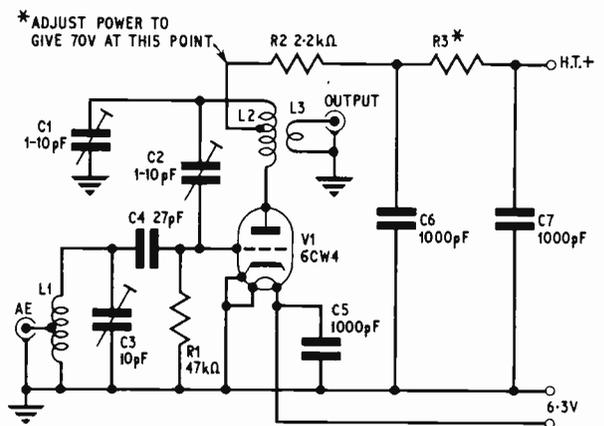


Fig. 5.2. Pre-amplifier for 137MHz, basic circuit using triode valve

A final point that must be emphasised is that the converter must be adequately bonded to the receiver. The i.f. output of the converter will come to the aerial terminal of the receiver, but it will not be sufficient to rely on the earthing provided by the coaxial lead. The chassis of the converter and the chassis of the receiver must be properly electrically bonded together.

THE COMMUNICATIONS RECEIVER

In the case of the receiver, if there is the need to acquire one, there are two groups to choose from: the current range of commercial receivers, and those which appear on the surplus market.

There are many well known brand names that come to mind, and some of these receivers may already be in the possession of readers who propose to attempt this radio astronomy project. Some of the "surplus" types have increased in price over the last year or so. This usually means that they are almost in mint condition. The most important point to be made in regard to the older types of communications receivers is the availability of spare valves.

**RADIO
ASTRONOMY
continued**

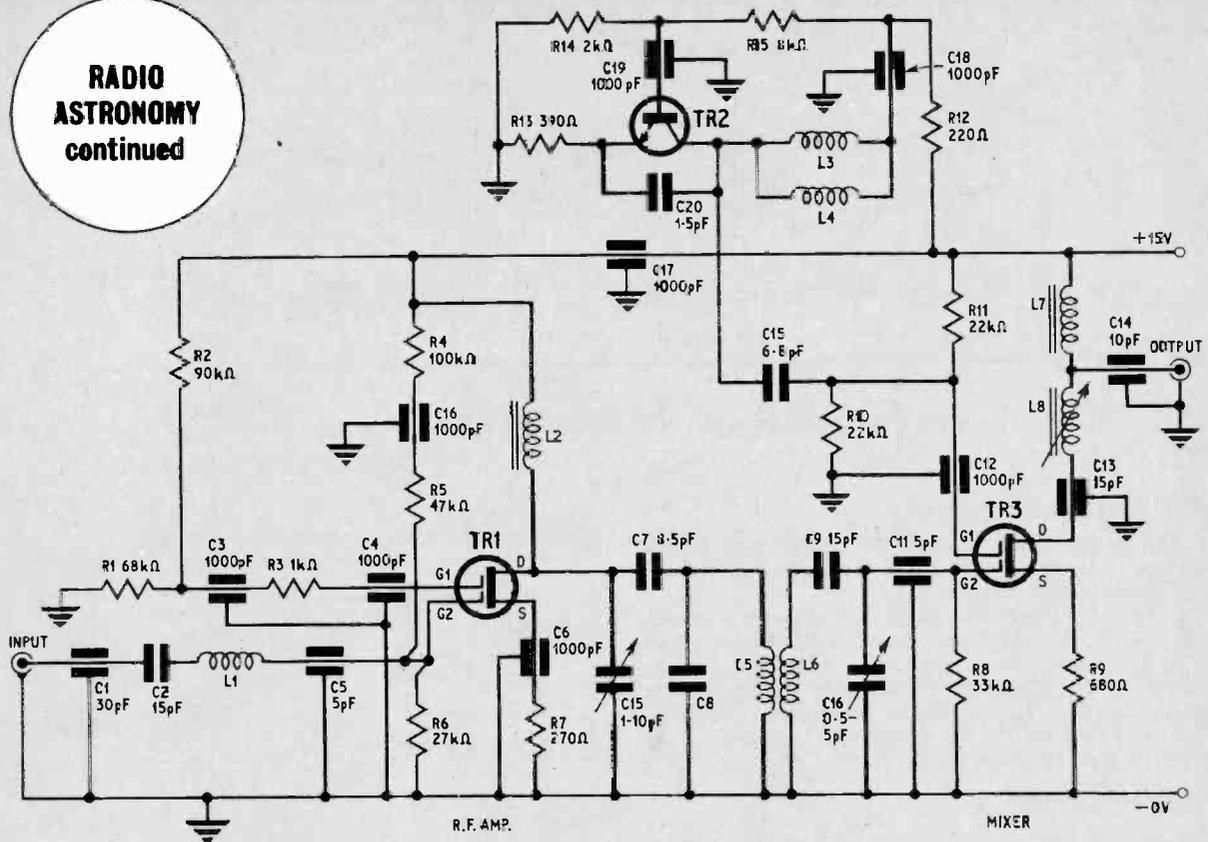


Fig. 5.3. Converter circuit, using field effect transistors

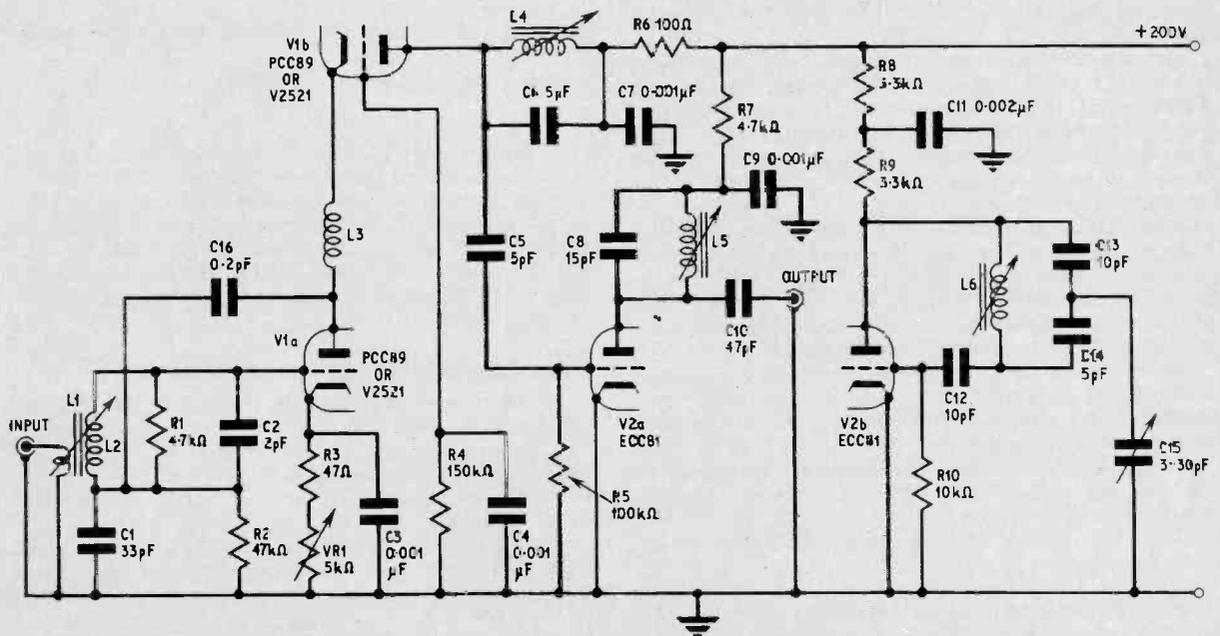


Fig. 5.4. Converter circuit, using valves

NEW 1971 CATALOGUE
NOW READY—OUR BEST YET
 64 pages and cover—thousands of
 well classified items—pages of
 valuable information—post free,
 10p.

ELECTROVALUE

Electronic Component Specialists

EVERYTHING BRAND NEW TO SPEC • LARGE STOCKS • NO SURPLUS

BARGAINS IN NEW SEMI-CONDUCTORS

MANY AT NEW REDUCED PRICES • ALL POWER TYPES WITH FREE INSULATING SETS

| | | | | | | | | | |
|---------|-----|---------|-----|--------|-----|--------|-----|---------|-----|
| 40361 | 55p | 2N2905 | 44p | 2N4291 | 15p | BC148 | 9p | BFX87 | 29p |
| 40362 | 68p | 2N2905A | 47p | 2N4292 | 15p | BC149 | 10p | BFX88 | 26p |
| 2N696 | 17p | 2N2924 | 20p | AC107 | 46p | BC153 | 19p | BFY50 | 23p |
| 2N697 | 18p | 2N2925 | 22p | AC126 | 20p | BC154 | 20p | BFY51 | 23p |
| 2N706 | 12p | 2N2926 | 11p | AC127 | 20p | BC157 | 12p | BFY52 | 23p |
| 2N930 | 29p | 2N3053 | 27p | AC128 | 20p | BC158 | 11p | BXS20 | 16p |
| 2N1131 | 29p | 2N3055 | 60p | AC153K | 22p | BC159 | 12p | C407 | 17p |
| 2N1132 | 29p | 2N3702 | 13p | AC176 | 16p | BC167 | 11p | MCI40 | 25p |
| 2N1302 | 19p | 2N3703 | 13p | ACY20 | 20p | BC168 | 10p | MPS6531 | 35p |
| 2N1303 | 19p | 2N3704 | 13p | AC172 | 16p | BC169 | 11p | MPS6534 | 30p |
| 2N1304 | 26p | 2N3705 | 13p | AD140 | 63p | BC177 | 14p | NKT211 | 25p |
| 2N1305 | 26p | 2N3706 | 13p | AD142 | 50p | BC178 | 13p | NKT212 | 25p |
| 2N1306 | 33p | 2N3707 | 13p | AD149 | 58p | BC179 | 14p | NKT214 | 23p |
| 2N1307 | 33p | 2N3708 | 10p | AD161 | 33p | BC182L | 11p | NKT274 | 18p |
| 2N1308 | 36p | 2N3709 | 11p | AD162 | 36p | BC183L | 10p | NKT403 | 65p |
| 2N1309 | 36p | 2N3710 | 13p | AF114 | 24p | BC184L | 11p | NKT405 | 79p |
| 2N1613 | 23p | 2N3711 | 13p | AF115 | 24p | BC212L | 16p | OC71 | 38p |
| 2N1711 | 26p | 2N3719 | 24p | AF117 | 24p | BC213L | 16p | OC81 | 25p |
| 2N1893 | 54p | 2N3904 | 35p | AF124 | 24p | BC214L | 16p | OC81D | 25p |
| 2N2147 | 95p | 2N3906 | 35p | AF127 | 22p | BCY70 | 18p | ZTX300 | 14p |
| 2N2218 | 34p | 2N4058 | 13p | AF139 | 33p | BCY71 | 33p | ZTX301 | 16p |
| 2N2218A | 44p | 2N4059 | 10p | AF239 | 36p | BCY72 | 15p | ZTX302 | 22p |
| 2N2219 | 38p | 2N4060 | 11p | ASy26 | 27p | BF115 | 23p | ZTX303 | 22p |
| 2N2219A | 53p | 2N4061 | 11p | ASy28 | 27p | BF167 | 18p | ZTX304 | 27p |
| 2N2270 | 38p | 2N4062 | 11p | AG107 | 24p | BF177 | 18p | ZTX500 | 18p |
| 2N2369A | 19p | 2N4124 | 18p | BC108 | 11p | BF194 | 14p | ZTX501 | 21p |
| 2N2483 | 35p | 2N4126 | 27p | BC109 | 12p | BF195 | 15p | ZTX502 | 25p |
| 2N2484 | 42p | 2N4284 | 15p | BC125 | 15p | BFX29 | 31p | ZTX503 | 22p |
| 2N2646 | 47p | 2N4286 | 15p | BC126 | 22p | BFX84 | 25p | ZTX504 | 52p |
| 2N2904A | 42p | 2N4289 | 15p | BC147 | 10p | BFX85 | 52p | | |

Appointed distributors for
SIEMENS (U.K.) LTD.

Appointed stockists
NEWMARKET TRANSISTORS
RADIOHM POTENTIOMETERS

SAVE £6.25 ON THE NEW ENGLEFIELD 840 AMPLIFIER

This latest Peak Sound high fidelity amplifier incorporates many strikingly original features including facility for adding in stereo FM tuner. Superb performance characteristics and luxurious styling. Electrovalue choice of simulated soft leather covering in black, blue, red or dark green. As now advertised at £49.50. Our price, nett **£38.75**

MAINLINE AMPLIFIER KITS
 70W. power amplifier, £12.60 nett.

30 WATT BAILEY AMPLIFIER PARTS

Transistors and PCB for one channel £6.46
 Capacitors, resistors (metal oxide), and transistors, one channel. £8.41.
 Complete unregulated power supply pack, £4.75
 Suitable heatsink 10DN 400C, 55p

RESISTORS

| Code | Power | Tolerance | Range | Values available | 1 to 9 | 10 to 99 | 100 up |
|------|-------|-------------|------------|------------------|--------|----------|--------|
| C | 1/20W | 5% | 82Ω-220KΩ | E12 | 9 | 8 | 7 |
| C | 1/8W | 5% | 47Ω-470KΩ | E24 | 1 | 0.8 | 0.7 |
| C | 1/4W | 10% | 47Ω-10MΩ | E12 | 1 | 0.8 | 0.7 |
| C | 1/2W | 5% | 47Ω-10MΩ | E24 | 1.2 | 1 | 0.9 |
| CO | 1W | 10% | 47Ω-10MΩ | E12 | 2.5 | 2 | 1.9 |
| MO | 1/2W | 2% | 10Ω-1MΩ | E24 | 4 | 3.5 | 3 |
| WW | 1W | 10% ± 1/20Ω | 0.22Ω-3.9Ω | E12 | 7 | 7 | 6 |
| WW | 3W | 5% | 12Ω-10KΩ | E12 | 7 | 7 | 6 |
| WW | 7W | 5% | 12Ω-10KΩ | E12 | 9 | 9 | 8 |

Codes: C=carbon film, high stability, low noise.
 MO=metal oxide, Electrofilm TR5, ultra low noise.
 WW=wire wound, Pleseley.

Values:
 E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
 E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

ZENER DIODES 5% full range E24 values:
 400mW: 2.7V to 30V, 15p each; 1W: 6.8V to 82V, 27p each; 1.5W: 4.7V to 75V, 60p each.
 Clip to increase 1.5W rating to 3 watts (type 266F), 4p.

CARBON TRACK POTENTIOMETERS, long spindles. Double wiper ensures minimum noise level.
 Single gang linear 100Ω to 2.2MΩ, 12p; Single gang log 47KΩ to 2.2MΩ, 12p; Dual gang linear 4.7KΩ to 2.2MΩ, 42p; Dual gang log, 4.7KΩ to 2.2MΩ, 42p; Log/antilog, 10K, 47K, 1MΩ, only 42p; Dual antilog, 10K only, 42p. Any type with 1/2 A.D.P. mains switch, 12p extra.
 Only decades of 10, 22 and 47 available in ranges quoted.

CARBON SKELETON PRE-SETS
 Small high quality, type PR, linear only: 100Ω, 220Ω, 470Ω, 1K, 2K, 4K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M, 4M, 10MΩ. Vertical or horizontal mounting, 5p each.

COLVERN 3 watt Wire-wound Potentiometers, 10Ω, 15Ω, 25Ω, 50Ω, 100Ω, 150Ω, 250Ω, 500Ω, 1K, 1.5K, 2.5K, 5K, 10K, 15K, 25K, 50K, 32p each.

Handbook of transistor equivalent and substitutes, 40p. (Postage 3p if ordered alone).

Prices are in pence each for quantities of the same ohmic value and power rating. NOT mixed values. (Ignore fractions on total value of resistor order.)

MULLARD polyester C280 series
 250V 20%; 0.01, 0.022, 0.033, 0.047 3p each; 0.068, 0.1, 4p each; 0.15, 4p; 0.22, 5p; 0.33, 7p; 0.47, 8p; 0.68, 11p; 1μF, 14p; 1.5μF, 21p; 2.2μF, 24p.

MULLARD SUB-MIN. ELECTROLYTICS
 C246 range, axial lead 6p each
 Values (μF): 0.64/64; 1/40; 1.6/25; 2.5/16; 2.5/64; 4/10; 4/40; 5/64; 6.4/64; 6.4/25; 8/4; 8/40; 10/25; 10/16; 10/64; 12.5/25; 16/40; 20/16; 20/64; 25/64; 25/25; 32/4; 32/10; 32/40; 32/64; 40/16; 40/25; 50/64; 50/25; 50/40; 64/4; 64/10; 80/2.5; 80/16; 80/25; 100/64; 125/4; 125/10; 125/16; 160/2.5; 200/64; 200/10; 250/4; 320/2.5; 320/64; 400/4; 500/2.5.

LARGE CAPACITORS
 High ripple current types: 1000/25, 28p; 1000/50, 41p; 1000/100, 82p; 2000/25, 37p; 2000/50, 57p; 2000/100, £1.44; 2500/64, 77p; 2500/70, 98p; 5000/25, 62p; 5000/50, £1.10; 5000/100, £2.91; 10000/50, £2.40.

● ● ● COMPONENT DISCOUNTS
 10% on orders for components for £5 or more.
 15% on orders for components for £15 or more.
 (No discount on nett items.)

POSTAGE AND PACKING
 Free on orders over £2. Please add 10p if orders under £2.

Overseas orders welcome: carriage and insurance charged at cost. Prices subject to alteration without notice.

U.S.A. CUSTOMERS
 U.S.A. orders charged at special prices as advertised by ELECTROVALUE AMERICA, P.O. Box 27, Swarthmore, PA 19081.

SIEMENS TTL INTEGRATED CIRCUITS

We stock a large range of all Siemens types for a very wide range of applications. For details, see our latest catalogue.

S-DeC RANGE
 S-DeC, £1.44; DeCSTOR, £2.88; 5 DeC 4-pack, £5.10; T-DeC, £2.88; μDeC A, £3.18; μDeC B, £5.94; 6V 0.04A clear type L55C/C-6V, 30p; 6V 0.04A green type L55C/G-6V, 30p; 12V 0.04A L55C/R-12V, 34p; 34V 0.04A L55C/R-28V, 45p.

INDICATOR LAMPS
NEON chrome bezel, round red NR/R, 24p; chrome bezel, round amber NR/A, 24p; chrome bezel, round clear NR/C, 24p. Neon, square red type L55C/R, 18p; amber type L55C/A, 18p; clear type L55C/C, 18p. All above are for 240V mains operation. Filament types: 6V, 0.04A square red type L55C/R-6V, 30p; 6V, 0.04A amber type L55C/A-6V, 30p; 6V 0.04A clear type L55C/C-6V, 30p; 6V 0.04A green type L55C/G-6V, 30p; 12V 0.04A L55C/R-12V, 34p; 34V 0.04A L55C/R-28V, 45p.

SIEMENS 5% TOLERANCE POLYCARBONATE CAPACITORS

250V up to 0.1mF; 100V 0.1mF and above
 0.01, 0.012, 0.015, 0.018, 0.022, 0.027 5p
 0.033, 0.039, 0.047, 0.056, 0.068, 0.082, 0.1, 0.12, 0.15, 0.18, 0.22 6p
 0.27, 7p; 0.33, 9p; 0.39, 9p; 0.47, 10p; 0.56, 13p; 0.68, 15p.

DIN CONNECTORS

| | | plug | socket |
|-------------|----|----------------|---------|
| Loudspeaker | .. | 2-pole | 12p 10p |
| Audio | .. | 3-pole | 13p 10p |
| Audio | .. | 4-pole | 14p 12p |
| Audio | .. | 5-pole 180deg. | 15p 12p |
| Audio | .. | 5-pole 240deg. | 15p 12p |
| Audio | .. | 6-pole | 15p 13p |

HAD YOUR COPY YET? ELECTROVALUE 1971 CATALOGUE

64 pages, plus covers. Thousands of items plus classified information and illustrations.
 Post free 10p

ELECTROVALUE DEPT. P.E.1071, 28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY
 Hours: 9-5.30, 1.0 p.m. Saturdays. Phone: Egham 5533 (STD 0784-3) Telex 264475

Now! A FAST EASY WAY TO LEARN BASIC RADIO & ELECTRONICS



Build as you learn with the exciting new **TECHNATRON** Outfit! No mathematics. No soldering—you learn the practical way.

Learn basic Radio and Electronics at home—the fast, modern way. Give yourself essential technical “know-how”—like reading circuits, assembling standard components, experimenting, building—quickly and without effort, and enjoy every moment. B.I.E.T.’s Simplified Study Method and the remarkable **TECHNATRON** Self-Built Outfit take the mystery out of the subject, making learning easy and interesting.

Even if you don’t know the first thing about Radio now, you’ll build your own Radio set within a month or so!

... and what’s more, you will understand exactly what you are doing. The **TECHNATRON** Outfit contains everything you need, from tools to transistors—even a versatile Multimeter which we teach you to use. All you need give is a little of your spare time and the surprisingly low fee, payable monthly if you wish. And the equipment remains yours, so you can use it again and again.

You LEARN—but it’s as fascinating as a hobby.

Among many other interesting experiments, the Radio set you build—and it’s a good one—is really a bonus. This is first and last a teaching course, but the training is as fascinating as any hobby and it could be the springboard for a career in Radio and Electronics.

A 14-year-old could understand and benefit from this Course—but it teaches the real thing. The easy to understand, practical projects—from a burglar-alarm to a sophisticated Radio set—help you master basic Radio and Electronics—even if you are a “non-technical” type. And, if you want to make it a career, B.I.E.T. has a fine range of Courses up to City and Guilds standards.

New Specialist Booklet

If you wish to make a career in Electronics, send for your FREE copy of “OPPORTUNITIES IN TELECOMMUNICATIONS/TV AND RADIO”. This brand new booklet—just out—tells you all about **TECHNATRON** and B.I.E.T.’s full range of courses.

FREE



Opportunities in Telecommunications TV and Radio



BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Dept. B12, ALDERMASTON COURT, READING RG7 4PF

POST THIS COUPON FOR FREE BOOK

To B.I.E.T. Dept. B12, Aldermaston Court, Reading RG7 4PF
Please send books and full information — free and without obligation.



NAME AGE
BLOCK CAPITALS PLEASE

ADDRESS.....

OCCUPATION.....

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

VALVES

**SAME DAY SERVICE
NEW! TESTED! GUARANTEED!**

SETS 1R5, 1R5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94.
Set of 4 for £1.02. DAF96, DF96, DK96, DL96, 4 for £1.48.

| | | | | | | | | | | | |
|--------|-------|--------|-----|--------|-----|---------|-----|--------|-------|------------|-------|
| 1R5 | -28 | 25F4GT | -57 | DY86 | -28 | EL300 | -62 | PC182 | -33 | UACB80 | -33 |
| 1R5 | -22 | 30C1 | -29 | DY87 | -26 | EM90 | -41 | PC183 | -59 | UCF42 | -51 |
| 1T4 | -16 | 30C15 | -63 | DY802 | -40 | EM81 | -41 | PC184 | -35 | UBC41 | -52 |
| 3S4 | -28 | 30C17 | -80 | EAB80 | -32 | EM84 | -32 | PC185 | -42 | UBF80 | -34 |
| 3V4 | -37 | 30C18 | -63 | EAF42 | -50 | EM87 | -36 | PC186 | -40 | UBF89 | -38 |
| 5T4G | -26 | 30F5 | -70 | EB41 | -40 | EY31 | -38 | PC188 | -72 | UCB84 | -33 |
| 5T4G | -35 | 30F11 | -63 | EB91 | -11 | EY86 | -81 | PC1800 | -77 | UCB85 | -86 |
| 5Y3GT | -28 | 30FL12 | -70 | EB33 | -40 | EZ40 | -48 | PEN 34 | -77 | UCF80 | -34 |
| 5Z4G | -35 | 30FL14 | -70 | EB31 | -54 | EZ41 | -43 | PEN36 | -70 | UCI42 | -82 |
| 6J901E | -58 | 30L1 | -30 | EB30 | -22 | EZ80 | -22 | PFL200 | -53 | UCI81 | -32 |
| 6AL5 | -11 | 30L15 | -59 | EBF80 | -32 | EZ81 | -23 | PL36 | -49 | UCL82 | -34 |
| 6AM6 | -13 | 30L17 | -71 | EBF89 | -31 | EZ30 | -35 | PL81 | -56 | UCL83 | -55 |
| 6AQ5 | -26 | 30P4 | -65 | ECC81 | -17 | EZ32 | -42 | PL81A | -49 | UF41 | -56 |
| 6AT6 | -22 | 30P12 | -77 | ECC82 | -20 | EZ34 | -50 | PL82 | -31 | UF89 | -31 |
| 6AU6 | -21 | 30P19 | -65 | ECC83 | -35 | KT41 | -77 | PL83 | -35 | UL41 | -60 |
| 6BA6 | -21 | 30P11 | -63 | ECC85 | -28 | K761 | -35 | PL84 | -30 | UL44 | £1.00 |
| 6BE6 | -22 | 30P113 | -78 | ECC804 | -57 | K766 | -81 | PL500 | -64 | UL84 | -33 |
| 6BJ6 | -41 | 30P114 | -67 | ECCF80 | -30 | LN319 | -68 | PL504 | -64 | UM84 | -22 |
| 6BW7 | -55 | 30P115 | -80 | ECCF82 | -28 | LN329 | -72 | PM84 | -35 | UY41 | -40 |
| 6CD6G | £1.07 | 35L6GT | -45 | ECH35 | -30 | LN339 | -68 | PX25 | £1.00 | UY85 | -28 |
| 6F14 | -42 | 35W4 | -25 | ECH42 | -61 | N78 | -87 | PY32 | -55 | VP48 | -77 |
| 6P23 | -70 | 35Z4GT | -25 | ECH91 | -29 | P61 | -45 | PY33 | -55 | Z77 | -22 |
| 6P25 | -60 | 80P1 | -62 | ECH93 | -40 | PA1BC30 | -34 | PY81 | -27 | Transistor | 1 |
| 6K7G | -12 | 6093 | -62 | ECH84 | -36 | PC67 | -48 | PY82 | -25 | AC107 | -17 |
| 6K8G | -17 | AC/VP2 | -77 | ECL80 | -32 | PC68 | -48 | PY83 | -28 | AC127 | -18 |
| 6Q7G | -28 | B349 | -65 | ECL82 | -31 | PC69 | -42 | PY88 | -33 | AD140 | -37 |
| 6SN7GT | -30 | B729 | -82 | ECL86 | -36 | PC97 | -40 | PY800 | -34 | AF115 | -20 |
| 6V6G | -23 | CCH35 | -67 | EF39 | -38 | PC900 | -33 | PY801 | -34 | AF116 | -20 |
| 6V6GT | -31 | CV31 | -32 | EF41 | -60 | PC934 | -30 | R19 | -30 | AF117 | -20 |
| 6X4 | -22 | DAF91 | -62 | EP80 | -23 | PC985 | -27 | R29 | -59 | AF118 | -48 |
| 6X5GT | -28 | DAF96 | -38 | EP85 | -28 | PC988 | -42 | E25 | -65 | AF125 | -17 |
| 7B7 | -33 | DF33 | -38 | EP86 | -31 | PC989 | -46 | E26 | -59 | AF127 | -17 |
| 10P13 | -58 | DF91 | -18 | EP89 | -28 | PCC189 | -48 | U47 | -65 | OC26 | -25 |
| 12AH8 | £2.25 | DF96 | -38 | EP91 | -13 | PCC905 | -59 | U49 | -59 | OC44 | -12 |
| 12AT7 | -17 | DH77 | -22 | EF183 | -28 | PCF80 | -28 | U50 | -39 | OC45 | -12 |
| 12AU6 | -29 | DH92 | -37 | EF184 | -31 | PCF82 | -31 | U52 | -31 | OC71 | -12 |
| 12AU7 | -30 | DK91 | -28 | EH90 | -37 | PCF86 | -45 | U78 | -24 | OC72 | -12 |
| 12AX7 | -23 | DK92 | -42 | EL33 | -55 | PCF800 | -67 | U91 | -60 | OC75 | -12 |
| 19B6GG | -87 | DK96 | -38 | EL34 | -45 | PCF801 | -61 | U93 | -42 | OC81 | -12 |
| 20F2 | -67 | DL35 | -40 | EL41 | -54 | PCF802 | -44 | U231 | -86 | OC81D | -12 |
| 20P3 | -80 | DL92 | -26 | EL84 | -23 | PCF803 | -63 | U301 | -43 | OC82 | -12 |
| 20P4 | -82 | DL94 | -37 | EL90 | -26 | PCF806 | -58 | U329 | -66 | OC82D | -12 |
| 25L6GT | -20 | DL96 | -38 | EL95 | -33 | PCF808 | -70 | U801 | -98 | OC70 | -22 |

READERS RADIO

85 TORQUAY GARDENS, REDBRIDGE, ILFORD, ESSEX.

Tel. 01-550 7441.

Postage on 1 valve 5p, on 2 or more valves 3p per valve extra.
Any parcel insured against damage in transit 3p extra.

AMPLIFIER & PREAMP PRINTED CIRCUIT BOARDS FOR MULLARD CIRCUITS

High quality Printed Circuit Boards for the following circuits shown in the Mullard publication **Transistor Audio and Radio Circuits**.

- 10 W high quality audio amplifier (p.102) **66p**
- 25 W high quality audio amplifier (p.106) **70p**
- 10/25 W high quality audio preamplifier (p.108) **73p**

Price each including postage and packing. Cash with order.

All boards are tinned to prevent oxidation and to aid soldering and have the component identification printed on the reverse.

BRIBOND PRINTED CIRCUITS LTD
Terminus Road, Chichester, Sussex

IN 15 MINUTES YOU COULD HAVE CAPACITIVE DISCHARGE ELECTRONIC IGNITION FITTED TO YOUR CAR

Capacitive Discharge Ignition is recognised as being the most efficient ignition system and will give you:

- CONTINUAL PEAK PERFORMANCE
- UP TO 20% REDUCED FUEL CONSUMPTION
- EASIER ALL-WEATHER STARTING
- INCREASED ACCELERATION & TOP SPEED
- LONGER SPARK PLUG LIFE
- INCREASED BATTERY LIFE
- CONTACT BURN ELIMINATED
- PURER EXHAUST GAS EMISSION
- RADIO INTERFERENCE SUPPRESSED



For all petrol engines—cars, boats, etc. Guaranteed for 5 yrs.

Complete Installation Kit for 12-volt vehicles £12.95 + 35p P. & P. State earth polarity of vehicle POSITIVE or NEGATIVE earth. Unit Construction Kit also available for the radio electronics constructor £9.95 + 35p P. & P. The construction kit includes instructions and all components for wiring as positive or negative earth, and is complete with the stove enamelled steel case and aluminium base. All components are available separately.

ELECTRONIC DESIGN ASSOCIATES

82 BATH STREET, WALSALL WS1 3DE

Of the many newer types of communications receivers available there are reconditioned models and some commercial firms specialise in such equipment.

ESSENTIAL FEATURES

There are one or two points that need emphasising in regard to the receiver specification. An r.f. gain control is desirable. It would be an advantage if the a.g.c. can be switched. It would be useful if a noise limiter is fitted. Last but not least is the importance of stability of the power supply; on cheaper types of receiver this is unlikely to be good enough, so to the price of the receiver must be added something for the provision of stabilisation.

In spite of what has been said above, it need not prevent any one "having a go". Even if the results are not all that is to be desired the thrill of getting some results will be the greatest urge to improve the equipment.

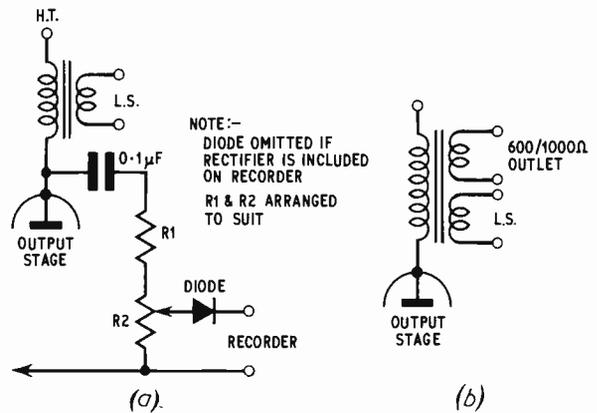


Fig. 5.5 a, b. Alternative arrangements for connecting recorder to receiver output stage

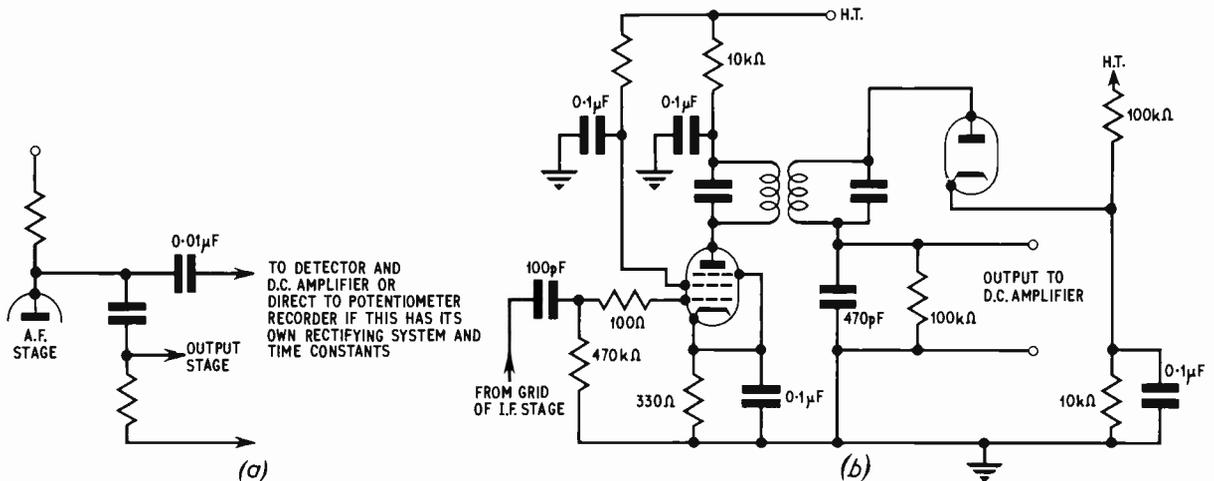


Fig. 5.6 a, b. Arrangements for connecting recorder to receiver via d.c. amplifier

RECORDING UNITS

The most basic recording system will be the pen recorder connected to the output of the receiver. If the recorder is of the low resistance coil type it can be connected directly to the output transformer at the speaker terminals via a diode or metal rectifier. Some recorders are fitted with the alternative terminal board arrangements for a.c. or d.c. operation. Where the coil is of high resistance then the output can be taken off the anode of the output section via a suitable network. Alternative systems are shown in the diagrams in Fig. 5.5 a, b.

There are other alternatives for the connection of the recorder when the coil resistance is high or the recorder is of the potentiometer type. A modification has to be made to the receiver circuitry in this case. The actual modification detail will naturally depend on the type of receiver in use, however the basic requirements for this modification are indicated in the examples of circuitry given in Fig. 5.6 a, b.

TYPES OF RECORDER

At this point it will be useful to describe the various types of recorder and the principles of operation. The simplest form is the moving coil system

which is a "giant" version of the ordinary moving coil meter as used for measuring current and voltage. It consists of a magnet within which a coil is suspended between bearings. There is an arm attached to the coil which is a capillary tube type of pen, one end submerged in an ink reservoir and the other in the form of tube resting on the paper. The pen moves across the paper leaving an ink trace. The paper itself is driven by a clock of high precision or a synchronous motor. Provision is made for the speed to be changed by the use of gears.

Another type of recorder is generally known as the "potentiometer" form. This consists basically of an amplifier into which the signal is fed and the output drives a motor system which carries the pen across the paper. There are a number of forms of this but the basic principle is the same. The main difference between this type and the pen motor type is that the potentiometer version has a system of mechanical or electrical means of "chopping" the input signal so that it can be amplified sufficiently to drive the motor to which the pen is attached.

There are also a number of variations in the way the paper is marked. The ink method has been mentioned so far, but there are other ways such as hot stylus on a waxed paper, a current conveyed through

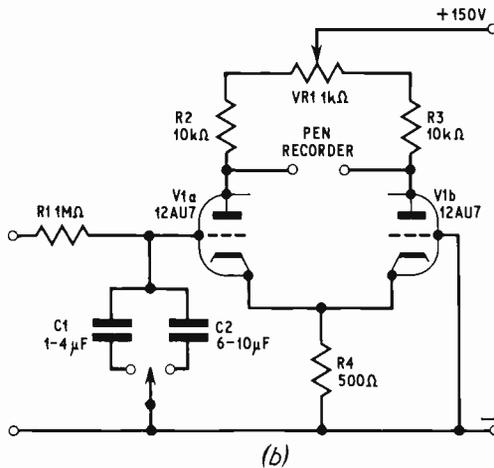
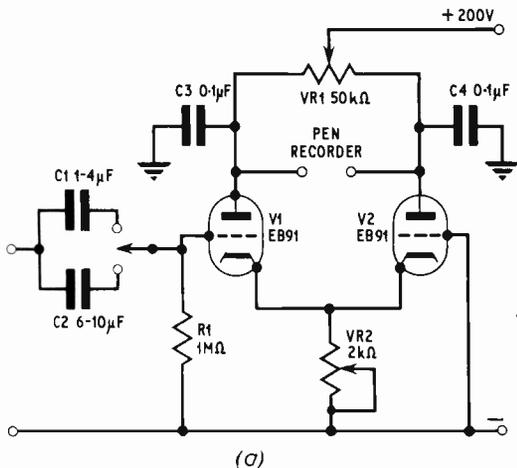


Fig. 5.7 a, b. D.C. amplifier circuits

a sensitive paper which in effect colours the paper, or maybe a system where the pen is pulled down on to the paper and the result is a series of dots. Whatever the system used the end result is a visible trace on some form of paper.

(A potentiometer recorder which will be ideal for this project appears in this month's issue.)

D.C. AMPLIFIERS

Two examples of d.c. amplifiers for recorders are shown in Fig. 5.7 a, b. Each has time constant circuits incorporated, these are necessary to record a clearer trace. If the normal time constant in the receiver were used then all the random noise received will obscure the solar noise proper. The length of the time constant is made variable so that there is a choice when looking for special effects.

For example, certain solar bursts are short in duration and therefore the best results will be obtained with a short time constant. Other phenomena is slow acting and this is better detected when using a longer time constant.

TAPE RECORDING

It is very useful to keep a tape recording of all observations since this provides an additional catalogue of events even when a pen recorder is used. For those who are unable to use a pen recorder at the beginning it may be possible for them to arrange for the tape recording to be transferred to paper at a later date.

When using the tape recorder for the observations the time of the observation must be recorded accurately, preferably on the tape as well as in the log. It would be an advantage to have a timing device that could superimpose a "time tick" on the track, but for this particular project it is not essential.

SOLAR PHENOMENA

The project being described is directed primarily to the study of certain solar phenomena. A brief survey of this phenomena will now be made so that when all the equipment is ready for operation, some idea of what the recordings will mean is understood by the observer.

The sun is one of a hundred million similar stars in the Galaxy. It is a yellow star classified as a

"G" type. Though it is quite insignificant as a star in the Galaxy, it is nevertheless the most important unit in the solar system since the earth and its people could not exist without it. It is the source of energy necessary to life.

The sun has a peculiarity so far as astronomers are concerned, and that is that it is a variable star. Because this is so a great deal can be learned about processes which cannot be reproduced on earth but which enable important deductions to be made about some of the fundamental principles of the universe.

The sun is a vast sphere of highly compressed gas some 864,000 miles in diameter. It is visible as a bright disc which is called the photosphere. It has a well defined edge because there is a sharp boundary where the temperature of the main body and the chromosphere and corona suddenly changes.

The actual temperature of the photosphere is of the order of 6,000 degrees K (degrees Kelvin = degrees Centigrade + 273 degrees). Temperature measured in degrees Kelvin is known as the Absolute Temperature. From the size and the mass of the sun it can be deduced that the temperature at the centre must be of the order of 15 million to 20 million degrees. About half the mass of the sun is hydrogen and a large part of the remainder helium.

This mass of gas can be likened to a vast reactor where the energy is radiated from the centre outwards from the central core to the surface of the photosphere. From the surface it then escapes in various forms over the whole of the electromagnetic spectrum. The sun consumes some 4,000 tons of its own mass each second.

THE CHROMOSPHERE

The chromosphere, or coloursphere, is so named because of its pinkish appearance. The chromosphere is about 12,000 miles thick. It has certain special characteristics one of which is the "reversing layer" which exists at the lower levels and is about 600 miles deep. This area contains many ionised atoms, that is atoms which have lost one electron.

Under such conditions visible light can be absorbed by these atoms. Such is the activity in this area that electrons are continually jumping from one level to another. In the process intense ultraviolet radiation is produced. This extends toward the earth and causes the ionosphere layer round the earth.

TABLE 5.1
TYPES OF SOLAR EMISSION

| TYPE | DURATION | POLARISATION | MECHANISM | TEMP K ² |
|--|-------------------------------|---|-------------|----------------------|
| Quiet Sun | Constant Days or months | Random | Thermal | 10 ⁶ |
| Slowly varying component | | Generally random but circular at cm wavelength | Thermal | <2 × 10 ⁶ |
| Rapidly varying components (after flare) | | | | |
| <i>Initial phase</i> | | | | |
| Type III | Seconds | Random | Plasma | >10 ¹¹ |
| Type V | Minutes | Usually random | Synchrotron | 10 ¹¹ |
| <i>Second phase</i> | | | | |
| Type II | Minutes | Random | Plasma | <10 ¹¹ |
| Type IV | Hours | Varies random to circular | Synchrotron | 10 ¹¹ |
| Type I | Hours | Random to circular | ? | 10 ⁹ |

THE CORONA

The corona is an extension of a more tenuous part of the sun and is normally seen only at the time of an eclipse. It extends out in an irregular manner dependent upon the magnetic field of the sun.

Over a period of about 11.2 years there is a variation of the coronal activity which depends upon the number of sun spots that occur during this period. This cycle, which is regular in its rhythm but varies in maximum intensity, has many effects on the solar system.

OTHER SOLAR ACTIVITIES

In addition to the sunspots themselves there is considerable other activity. When the photosphere is examined closely it is found to be granular in appearance. These granules are of various sizes varying between 150 and 800 miles in length. There is a slightly different temperature between the darker granules and photosphere proper. This difference is something of the order of 200 degrees.

The surface is however constantly changing and great spouts of gas are thrown off to enormous

heights, areas flare up and there is a constant stream of plasma which is radiated into space and known as the solar wind. Each of these activities have certain effects and these will be dealt with in more detail when the work on the project begins. In the meanwhile a list is given in Table 5.1 which summarises the various types of activity and their effects on the earth's environment.

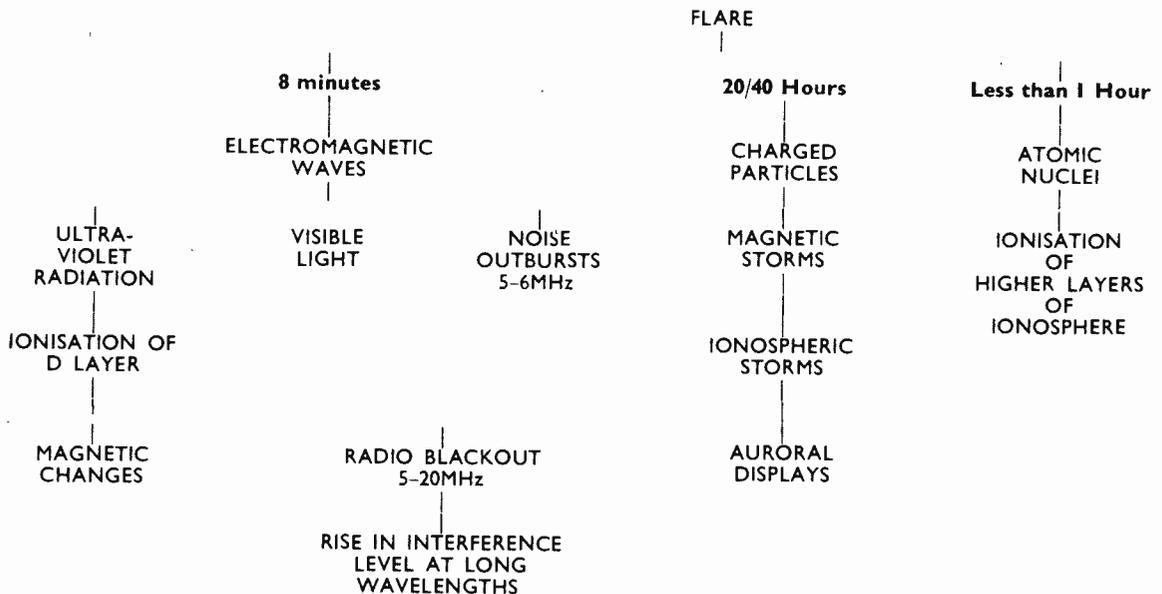
THE RADIO SUN

The radio sun is very much greater in extent than the visible corona would suggest. The radio sun is invisible and extends to something like an ellipse which is 80 solar radii in one direction and 110 solar radii in the other. This was established during the period of activity that existed in 1960 by O. B. Slee in Sydney, Australia. More will be said about this again in another project using the interferometer.

The effects of a flare are shown in Table 5.2.

The next article will describe the setting up and testing of the telescope units and the commencement of the first observations.

TABLE 5.2
THE RESULTING EFFECTS OF A SOLAR FLARE



MARKET PLACE

Items mentioned in this feature 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.

AUDIOPHILE

It is not often that **Ferrograph** find it desirable to make technical changes to their professional quality tape recorders, but when they do it is usually carefully noted by other manufacturers.

The latest modification to their Series 7 range of recorders is claimed to make them the only hi fi. domestic use, tape recorders incorporating the Dolby "B" noise reduction system on the market at the moment.

The type "B" system for use in the home recorder is based upon, and works on the same principles as, the Dolby "A" type professional noise reduction system. The "B" system eliminates the background noise once considered inevitable when recording wide-frequency-range sounds at the low speeds generally associated with domestic tape recorders. At low speeds tape hiss is usually the primary barrier to satisfactory quality, and this system was designed to reduce such hiss.

The high quality of the **Ferrograph** tape transport, heads, and electronics are such that when any inherent noise resulting from low recording speeds is reduced (a claimed 10dB) through use of the Dolby system; the overall quality of recordings made at $1\frac{1}{2}$ in/sec is claimed to be comparable to that produced at $7\frac{1}{2}$ in/sec without this system.

Available direct from **Ferrograph Co. Ltd.** at The Hyde, Edgware Road, London, N.W.9, or through selected dealers, the **Ferrograph** recorders with the Dolby system start at £187 for a monaural recorder, and go to £263 for a high speed, high performance stereo recorder. Purchase tax is not included.

COMPACT STEREO

Since manufacturers realised that people wanted a good performance amplifier incorporated in the compact type record player/amplifier units, they are now generally accepted and gaining increasing popularity.

Now most manufacturers produce excellent amplifiers for these units

and the **Permic 6-6** stereo amplifier/player is one such unit.

The amplifier has a claimed output of 6 watts r.m.s. per channel, measured at 1kHz continuous sine wave into 8 ohm loads. Distortion is in the order of 0.3 per cent. The frequency response at 1 watt r.m.s. with tone circuits flat is 20Hz to 20kHz ± 2 dB.

Inputs are provided for record, tape and radio and the input sensitivity is claimed to be better than 100mV into 3 megohm for a rated output at 1kHz.

An output socket on the front panel is provided for low impedance stereo headphone listening.

The price of the **Permic 6-6** is £39, which does not include the price of speakers. All models are fitted with a Garrard turntable, and a Sonotone 9, TAHC or KS41C cartridge with a diamond stylus.

Full details of the **Permic 6-6** stereo amplifier and other models can be obtained from **Permic Ltd.** 17 Upland Road, Bexleyheath, Kent.

Permic also run a special customer service for those who wish to have the amplifiers installed in their own favourite piece of furniture.

HEADPHONE LISTENING

For those who prefer to listen to their favourite programme or piece of music without any outside distractions, then the new **Ravensbrook** senior professional stereo headphones from **Rogers Developments Ltd.**, 4-14 Barmeston Road, London, SE6 3BN, should be most popular.

The headphones, although intended primarily for their own

amplifiers, are compatible with other high quality amplifiers. Particular features include a twin moving coil system, individual volume controls integral with each earpiece and excellent bass response, claimed to be above average.

The recommended U.K. retail price for the **Ravensbrook Stereo Headphones** is £18.50.

BENCH LIGHT

Designed primarily to aid operators and inspectors engaged on assembly or inspection work of an intricate nature, the **Allen A90 4** and **6 tube bench floodlights** would be a handy luxury to have in the workshop.

Costing from £24 to £55 there are two models available with either four or six 8 watt 12 inch (300mm) fluorescent tubes providing illumination levels of 11,000 and 16,000 Lux respectively 4 inches (100mm) distant from the lamps. Precise positioning is provided by a spring-balanced support arm and ball-joint mechanism.

It is claimed that the large area light source obviates distracting shadows from tools or hands, even when located very close to the work area. The maximum reach of the arm is 26 inches (640mm).

In addition to the screwdown base for bench mounting, two other alternative mountings are available: a bench clamp and a wall bracket.

Applications advice, and an illustrated leaflet is available from the manufacturers, **P. W. Allen & Co.**, 253 Liverpool Road, London, N1 1NA.

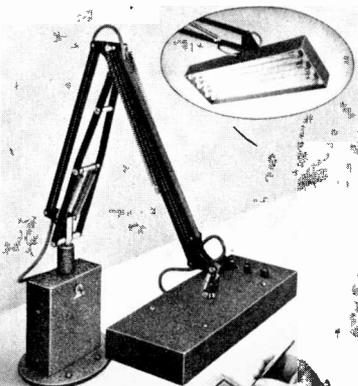


**Ferrograph
Dolby "B"
Recorder**



**Rogers Ravensbrook
stereo headphones**

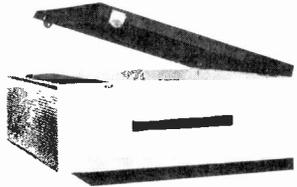
Allen A90 benchlight



Permic stereo 6-6 amplifier/player



PHILIPS PORTABLE PLAYER CABINET



Size 18 x 15 1/2 7 1/2 in. Cut for BSR UA12/14/15/16/25 deck. Amplifier space 14 x 5 3/4 in. Satin aluminium front grille. Really smart appearance. £4 25p
Reliability with 12 months' guarantee. AC 200/250v. Chrome fittings.

BSR C.109 SUPERSLIM STEREO & MONO CHANGER

Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v. Size 18 1/2 x 11 1/2 in. Above motor board 3 1/2 in. below motor board 2 1/2 in.



with STEREO and MONO XTAL £7-75 Post 25p.

GARRARD PLAYERS with Sonotone 9TA Cartridges. Stereo Diamond and Mono Sapphire. SP25 Mk II 215. Model 3500 Stereo and Mono Autochanger 214. Post 25p.

RECORD PLAYER PORTABLE CABINET £3-75
Space for amplifier and autochanger. Post 25p.

RC8 DE-LUXE 3 WATT AMPLIFIER. Ready made tested. 2-stage with triode pentode valve, 3 watts output. Tone and volume controls. Isolated mains transformer. Knobs, loudspeaker, valves ECL82, E230. Response 50-12,000 cps. Sensitivity 200mV. Post 25p.

RC3 2 WATT AMPLIFIER with loudspeaker and valves UCL82 and UY85. Post 25p. £3

R.C.S. TEAKWOOD BASE. Ready cut out for mounting (state player make and model). £2-75

R.C.S. PLASTIC COVERS FOR ABOVE BASE. £2-75
Durable tinted plastic, attractive appearance.

EMI PICK-UP ARM. With mono xtal and stylus £1.25.
HI-FI PICK UP CARTRIDGES. Diamond Stereo/Mono 9TA £2.90; GP84 £2.75; GP83 £2.25; Mono GP91 £1.50; GC8 21-25; ACOS L.P. only 50p.

All standard fixing complete with stylus.

PHILIPS TRANSISTOR FM STEREO MULTIPLEX DECODER. As used in LEAK Troughline Tuner. Brand New. Pre-aligned with 8 semiconductor. 24v. D.C. at 6mA. Complete with circuit and connection details. Size 3 1/2 x 1 1/2 in. £4 POST FREE

WEYRAD P50 - TRANSISTOR COILS

| | | | |
|---------------------------------|-----|----------------------------|-----|
| RA2W Ferrite Aerial..... | 65p | Spare Cores..... | 30p |
| AC. P50/1AC..... | 30p | Driver Trans. LFDT4..... | 50p |
| I.F. P50/2C 470 kc..... | 33p | Printed Circuit, PCA1..... | 50p |
| 3rd I.F. P50/3C..... | 33p | J.B. Tuning Gang..... | 65p |
| PS11 or P51/2..... | 33p | Weyrad Booklet..... | 10p |
| P50/3V..... | 33p | OPT..... | 50p |
| Mullard Ferrite Rod 8 x 1/2 in. | 20p | 6 x 1/2 in. 25p. | |

VOLUME CONTROLS

200 Ohm Coax 4p yd. Long spindles. Midget Size 2 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. FRINGE LOW LOSS 10p. Edge 6K. S.P. Transistor 25p. Ideal 625 and colour yd

WIRE-WOUND 3-WATT POTS. WIRE-WOUND 3-WATT Small type with small knob. STANDARD SIZE POTS. Values 10Ω to 30 K. 25p | 10 OHMS to 100 K. 40p

VEROBOARD 015 MATRIX 2 1/2 x 5 in. 19p. 2 1/2 x 3 1/2 in. 18p. 3 1/2 x 3 1/2 in. 19p. 3 1/2 x 5 in. 26p. EDGE CONNECTORS 16 way 25p; 24 way 38p. PINS 36 per packet 17p. FACE CUTTERS 38p.

S.R.B.P. Board 015 MATRIX 2 1/2 in. wide 3p per lin., 3 1/2 in. wide 4p per lin.; 5 in. wide 5p per lin. (up to 17 in.). S.R.B.P. undrilled 1/4 in. Board 10 x 8 in. 15p.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2 in. sides 7 x 4 in. 45p; 9 x 7 in. 50p; 11 x 7 in. 70p; 13 x 8 in. 75p; 14 x 11 in. 80p; 15 x 14 in. 85p; 11 x 8 in. 60p.

ALUMINIUM PANELS 18 s.w.g. 8 x 4 in. 8p; 8 x 6 in. 15p; 10 x 7 in. 17p; 12 x 8 in. 23p; 14 x 8 in. 27p; 12 x 12 in. 32p.

1 1/2 inch DIAMETER WAVECHARGE SWITCHES. 25p. 2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way 25p each. 1 p. 1 2-way, or 4 p. 2-way, or 4 p. 3-way 25p. 1 inch DIAMETER Wavecharge "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way, 1 water 60p. 2 water 95p. Extra valves up to sixp each. TOGGLE SWITCHES, sp. 14p; dp. 18p; dp. dt. 25p.

ALL PURPOSE HEADPHONES H.R. HEADPHONES 2000 ohms Super Sensitive. £1-75
10W RESISTANCE HEADPHONES 3-5 ohms. £2
DE LUXE STEREO HEADPHONES 8 ohms. £3-25

"THE INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER £2-35
200/250 v. A.C. Leaflet S.A.E. Post 15p

Minimum Post and Packing 15p. RETURN OF POST DESPATCH. HI-FI STOCKISTS. CUSTOMERS FREE CAR PARK. CALLERS WELCOME

RADIO COMPONENT SPECIALISTS 337 WHITEHORN CROFT, CROYDON
Open 9-6 p.m. (Wednesdays 9-1 p.m., Saturdays 9-5 p.m.)
List 5p. Written guarantee with every purchase. (Export: Remit cash and extra postage.) Buses 133, 68 pass door. S.R. Stn. Selhurst. Tel. 01-684-1666

GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

for Mike, Tape, P.U. Guitar, etc. Battery 9-12v. or H.T. line 200-300v. D.C. operation. Size 1 1/2 x 1 1/2 x 4". Response 25 c.p.s. to 25 Kc/s, 26 db gain. For use with valve or transistor equipment. Full instructions supplied. Brand new. Guaranteed. Details S.A.E. 90p Post 10p

| NEW TUBULAR ELECTROLYTICS | CAN TYPES |
|---------------------------|-----------------|
| 2/350V .. 14p | 250/25V .. 14p |
| 4/350V .. 14p | 500/25V .. 20p |
| 8/450V .. 14p | 1000/25V .. 35p |
| 16/450V .. 15p | 1000/50V .. 47p |
| 32/450V .. 20p | 2-8/450V .. 15p |
| 25/25V .. 10p | 8-16/450V 20p |
| 50/50V .. 10p | 16-16/450V 25p |
| 100/25V .. 10p | 32-32/350V 25p |

SUB-MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p; 500, 1000mF 12V 18p; 2000mF 25V 35p. CERAMIC. 1pF to 0.01mF, 4p. Silver Mica 2 to 5000pF, 4p. PAPER 350V-0.1 4p, 0.5 13p; 1mF 15p; 2mF 150V 15p. 500V-0.01 0.05 4p, 0.1 5p; 0.1 8p; 0.47 25p. 1.000V-0.001, 0.0022, 0.0047, 8p; 0.01, 0.02, 12p; 0.047, 0.1, 16p.

SILVER MICA. Close tolerance P. 1. 2-500pF 8p; 560-2,200pF 10p; 2,700-5,600pF 20p; 6,800pF-0.01, mfd 30p each. TWIN GANG. "0-0" 208pF+175pF. 65p; Slow motion drive 365pF+365pF with 25pF+25pF, 50p; 500pF slow motion standard 45p; 450pF+50pF 500pF £1.10. SHORT WAVE SINGLE. 25pF, 60pF, 55p.

CHROME TELESCOPIC AERIALS 23 in. Swivel base 20p. TUNING. Solid dielectric. 100pF, 500pF, 35p each. TRIMMERS. Compression 30, 50, 70pF, 5p; 100pF, 150pF, 35p; 250pF, 100p; 600pF, 750pF, 10p; 1250pF, 10p. RECTIFIERS CONTACT COOLED half wave 60mA 38p; 80mA 48p; SILICON 30p; 2V, 8V, 15V, 30V; BV127 30p. Full wave Bridge Rectifiers 75mA 50p; 150mA 95p. EX-GOVT. RECTIFIERS 250V 200mA 30p. NEON PANEL INDICATORS 250V AC/DC Red or Amber 20p. RESISTORS. 1 w., 1 w., 2 w., 20°C, 1p; 2 w. 5p. HIGH STABILITY. 1 w., 2 w., 10 ohms to 1 meg., 10p. DHT 50. Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS. 500Ω, 10 watt, 15 watt, 10 ohms to 100K 10p each; 2 1/2 watt, 1 ohm to 8-2 ohms 10p.

Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key. 1/2 in. 83p. 1/4 in. 88p. 1/8 in. 95p. 1/16 in. £1.20 2 1/2 in. £2.21. 1/2 in. 83p. 1/4 in. 88p. 1/8 in. £1.03. 1/16 in. £1.45. 2 1/2 in. £2.86. 1/2 in. 84p. 1/4 in. 88p. 1/8 in. £1.08. 2 in. £1.99. 1 in. sq. £1.83

AM - FM/VHF TUNING GANG



Super quality small size 1 1/2 x 1 1/2 x 1 1/2 in. plus spindle 1 1/2 in. 365+365 pF with 25+25 pF. British made. Geared slow motion drive 6:1. Plastic dust cover. 6BA tapped front fixing. Cast aluminium frame. 50p POST FREE

MAINS TRANSFORMERS

| | | |
|--|-------------------|-------|
| 250-0-250 80 mA. 6.3 v. 4 amp. | All post 25p each | £1.40 |
| 250-0-250 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a. or 5 v. 2 a. | | £2 |
| 350-0-350 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a. or 5 v. 2 a. | | £2 |
| 330-0-330 200 mA., 6.3 v. 2 a. 6.3 v. 2 a. 6.3 v. 3 a. | | £4 |
| 300-0-300 v. 120 mA., 6.3 v. 4 a. C.T.; 6.3 v. 2 a. £2.50 | | |
| MINIATURE 200 v. 20 mA., 6.3 v. 1 a. 2 1/2 x 2 1/2 in. 75p | | |
| MIDGET 220 v. 45 mA. 3 1/2 x 2 1/2 in. £1.20 | | 90p |
| P.E. AURORA TRANS. 12-12v., 500mA | | £1.50 |
| MINI-MAINS 20v. 100mA. 1 1/2 x 1 1/2 in. | | 50p |
| HEATER TRANS. 0.3 v. 3a. | | 70p |
| Dial tapped sec. 1.4 v., 2.3, 4, 5, 6.3 v. 1 1/2 amp. | | 80p |

GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 5 amp, 3, 4, 5, 6, 8, 10, 12, 15, 18, 24 and 30 v. £2. 1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £2. 2 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £3. AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. Input/Output. 150w. £2; 500w. £5; 1000w. £12

CHARGER TRANSFORMERS. Input 200/250v. For 6 or 12 v. 1 amp., 2 amp. £1.50; 4 amp. £2

FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1 amp. 40p; 2 amp. 55p; 4 amp. 85p. All Transformers Postage 25p each

E.M.I. 13 1/2 x 8 in. LOUDSPEAKERS

With flared tweeter cone and ceramic magnet. 10 watt. £2-25
Has res. 45-60 ohms. Flux 10,000 gauss. State 3 or 8 or 15 ohm. Post 15p

And with twin tweeters. And crossover. 10 watt. State 3 or 8 or 15 ohm. Post 15p As illustrated. £4

Recommended Teak Cabinet Size 16 x 10 in. Post 25p. £5

10W MINI-MODULE 43-25 LOUDSPEAKER KIT

Triple speaker system combining on ready cut baffle. 1 in. chipboard 15 in. x 8 in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5 in. Bass Woofer unit has a low resonance cone. The Mid-Range unit is specially designed to add drive to the middle register and the tweeter recreates the top end of the musical spectrum. Total response 20-15,000 cps. Full instructions for 5 or 15 ohm. TEAK VENEERED BOOKSHELF ENCLOSURE. 18 1/2 x 10 1/2 x 6 in. Modern design, dark grey Tylan covered baffle. £5 Post 25p

ALL MODELS "BAKER SPEAKERS" IN STOCK

BAKER 12in MAJOR £9



30-14,800 c.p.s., 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwell. Bass resonance 40 c.p.s. Rated 20 watts. State 3 or 8 or 15 ohm. State Free.

Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. £11-50

BAKER "BIG-SOUND" SPEAKERS

| Group 25' | Group 35' | Group 50' |
|------------------|------------------|-----------------|
| 12 inch 25 watt | 12 inch 35 watt | 15 inch 50 watt |
| 3 or 8 or 15 ohm | 3 or 8 or 15 ohm | 8 or 15 ohm |

TEAK HI-FI SPEAKER CABINETS. Fluted wood front. For 12in. round Loudspeaker £9 Post 25p. For 13 x 8in. Loudspeaker £5 Post 25p. For 10 x 6in. Loudspeaker £4 Post 25p. LOUDSPEAKER CABINET WADDING 18in. wide, 15p if

THIS ELACON TWEETER IS THE VERY LATEST DESIGN AND GIVES A HIGHER STANDARD OF PERFORMANCE THAN MORE EXPENSIVE UNITS



The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3 1/2 x 3 1/2 in. deep. Rating 10 watt. 3 ohm or 15 ohm models. £1-90 Post 10p

TWO-WAY XOVER NETWORK 3000 c/s.

With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5 1/2 in. 4 in. with control knob, tweeter and woofer leads and £1-90 Post input terminals. Suitable for 3 to 8 ohm imp.

GOODMANS HI-FIDELITY 6in. WOOFER

8 ohm, 10 watt. Large ceramic magnet. 30-12,000 cps. £4 Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc.

Horn Tweeters 2-18Kc/s, 10W 8 ohm or 15 ohm £1-50. De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm 43. TWO-WAY 3,000 c.p.s. CROSSOVERS 3 or 8 or 15 ohm 95p. SPECIAL OFFER! 80 ohm. 2 in. dia.; 35 ohm, 3 in. 25 ohm, 3 in. dia.; 6 in. 8 in. £1 EACH

15 ohm, 3 in. dia.; 7 in. 8 in. 3 ohm, 2 1/2 in. 8 in. 5 in. 5 in. 8 in. LOUDSPEAKERS P.M. 3 OHMS. 6 in. £1.10; 8 x 6 in. £1.25; 8 x 2 1/2 in. 8 in. £1.75; 10 x 6 in. £1.90. Sin. WOOFER. 8 w. max. 20-10,000 cps. 8 or 15 ohm £1.80. ELAC 8 in. De Luxe Ceramic 3 ohm or 15 ohm £2.50. RICHARD ALLAN TWIN CONE LOUDSPEAKERS 8 in. dia. 4 watt; 10 in. dia. 5 watt; 12 in. dia. 8 watt; 3 or 8 or 15 ohm models £1.95 each. Post 15p. OUTPUT TRANS. EL84, etc. 25p. MIKE TRANS. 50 1/2 25p. SPEAKER COVERING MATERIALS. Samples Large S.A.E. GOODMANS OUTPUT TRANSFORMER 5 watt push pull for valves EL84, etc., 3, 8 and 15 ohms 85p. Post 20p.

100 WATT ALL PURPOSE POWER AMPLIFIER 4 input speech and music. Response 10-30,000 cps. Matches all loudspeakers. A.C. 200/250V. Treble £36 Post and Bass controls. Guaranteed. Details S.A.E. £36 Free

ALL EAGLE PRODUCTS

SUPPLIED AT LOWEST PRICES. ILLUSTRATED EAGLE CATALOGUE 20p. Post free

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. £4

BARGAIN 4 CHANNEL TRANSISTOR MIXER. Add musical highlights and sound effects to recordings. Will mix microphone, records, tape and tuner with separate controls into single output. 9 volt. £3

BARGAIN FM TUNER 88-108 Mc/s Six Transistor. 9 volt. Printed Circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 x 5 1/4 inch BARGAIN FM TUNER as above. Chassis only, less cabinet. £7-50

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. £3-50

COAXIAL PLUG 6p. PANEL SOCKETS 6p. LINE 18p. OUTLET BOXES. SURFACE OR FLUSH 25p. BALANCED TWIN FEEDERS 5p yd. 80 ohms or 300 ohms. JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plug 5p. Phono Socket 5p. JACK PLUGS Std. Chrome 15p; 3 mm Chrome 14p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS, 5p; CERAMIC 9p; CAMS 5p.

E.M.I. TAPE MOTORS. 120v. or 240v. AC. 1,200 r.p.m. 4 pole 135mA Spindle 0.187 x 0.75 in. Size 3 1/2 x 2 1/2 in. (illustrated). Post 15p. £1-25

BALFOUR GRAM. MOTORS. 120v. or 240v. AC. 1,200 r.p.m. 4 pole 50mA. Spindle 3/8 x 3/20. Size. 2 1/2 x 2 1/2 x 1 1/2 in. Post 15p. £1-85p

Minimum Post and Packing 15p. RETURN OF POST DESPATCH. HI-FI STOCKISTS. CUSTOMERS FREE CAR PARK. CALLERS WELCOME

RADIO COMPONENT SPECIALISTS 337 WHITEHORN CROFT, CROYDON
Open 9-6 p.m. (Wednesdays 9-1 p.m., Saturdays 9-5 p.m.)
List 5p. Written guarantee with every purchase. (Export: Remit cash and extra postage.) Buses 133, 68 pass door. S.R. Stn. Selhurst. Tel. 01-684-1666

TECHNICAL TRAINING

in radio television and electronics

Whether you are a newcomer to radio and electronics, or are engaged in the industry and wish to prepare for a recognized examination, ICS can further your technical knowledge and provide the specialized training so essential to success. ICS have helped thousands of ambitious men to move up into higher paid jobs—they can help you too! Why not fill in the coupon below and find out how?

Many diploma and examination courses available, including expert coaching for:

- C. & G. Telecommunication Techns'. Certs.
 - Radio Amateurs' Examination
 - Radio Operators' Certs.
 - General Certificate of Education, etc.
- Now available, Colour T.V. Servicing

Examination Students coached until successful

NEW SELF-BUILD RADIO COURSES

Learn as you build. You can learn both the theory and practice of valve and transistor circuits, and servicing work while building your own 5-valve receiver, transistor portable, and high-grade test instruments, all under expert tuition. Transistor Portable available as separate course.

POST THIS COUPON TODAY

for full details of ICS courses in Radio, T.V. and Electronics



INTERNATIONAL CORRESPONDENCE SCHOOLS

EST. 1891

Dept. 151, Intertext House, Stewarts Rd., London SW8 4UJ

Please send me the ICS prospectus—free and without obligation.
(state Subject or Exam.)

NAME AGE
(Block Capitals Please)

ADDRESS

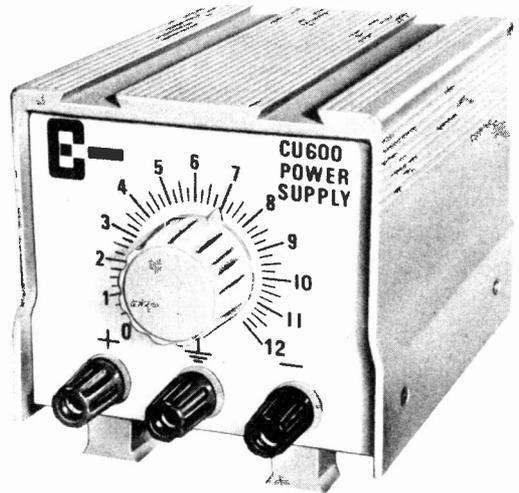
10/71

INTERNATIONAL CORRESPONDENCE SCHOOLS

Looking for the best deal in

Low cost power supplies?

YOU'VE FOUND IT!



CU600A

OUTPUT 0-12 volts
Max. Current 0.5 A

PRICE £12.45

Incl. Post & Packing

This is it—the latest from the power supply experts. CU600 is an advanced specification supply unit at an astonishingly low price. Check this brief specification. **Output impedance less than 0.05 ohm. All silicon semiconductors. IC stabilized. Short circuit protection. Use in series or parallel. Compact design, rugged construction. Slide-in stacking.**

Complete the coupon and mail with remittance to **CIRCUIT INTEGRATION LTD.**, Canal Street, RUNCORN, Cheshire.

To: CIRCUIT INTEGRATION LTD., Canal St., RUNCORN, Cheshire.

Please supply.....CU600A Power Supply Units for which I enclose

P.O./Cheque for £.....

NAME

ADDRESS.....

Please print clearly.

Allow 3 weeks delivery.



A selection of readers' suggested circuits. It should be emphasised that these designs have not been proven by us. They will at any rate stimulate further thought. This is YOUR page and any idea published will be awarded payment according to its merit.

ORGAN DIVIDER CIRCUIT

ONE generators of frequency divider type electronic organs are usually either driven by bistable multivibrators or synchronised blocking oscillators.

Substantial cost saving can be accomplished by using a multivibrator chain with each multivibrator cycling at one-quarter (normally half) of the frequency of the previous, and each multivibrator providing two outputs, one being twice the frequency of the other. The blocking oscillator transformers are dispensed with and only half the number of multivibrators are required.

The circuit diagram in Fig. 1 shows a circuit that has been tested and works well. Fig. 2a and 2b show the waveforms on the bases of TR1 and TR2. By combining the two, the waveform in Fig. 2c results. This is one of the outputs and has a frequency twice that of the multivibrator.

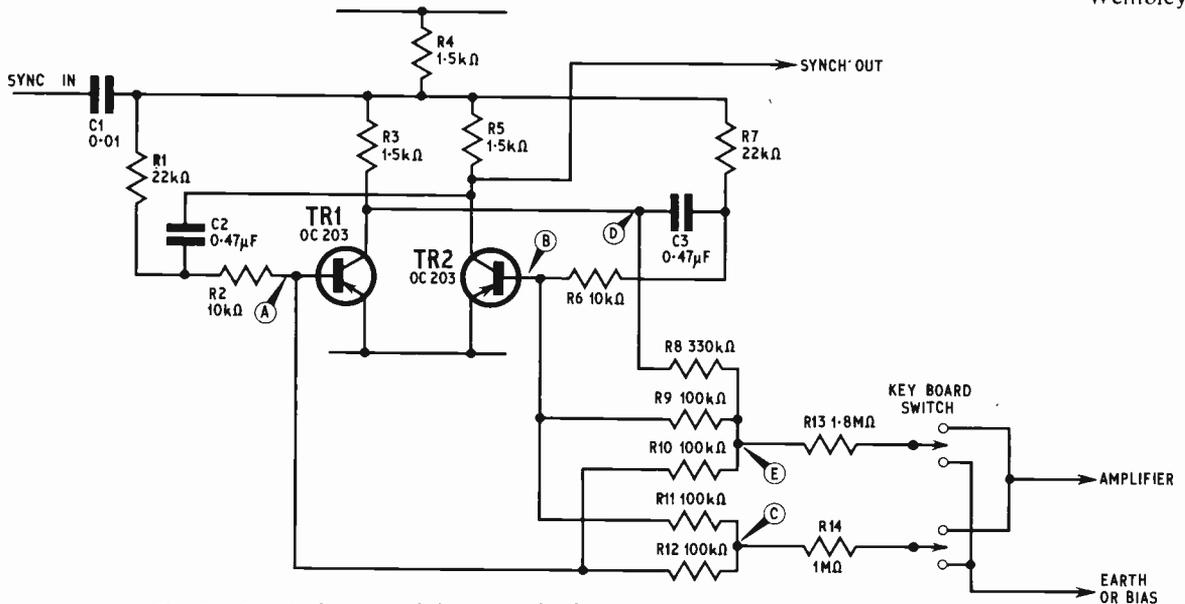


Fig. 1. Circuit diagram of the organ divider

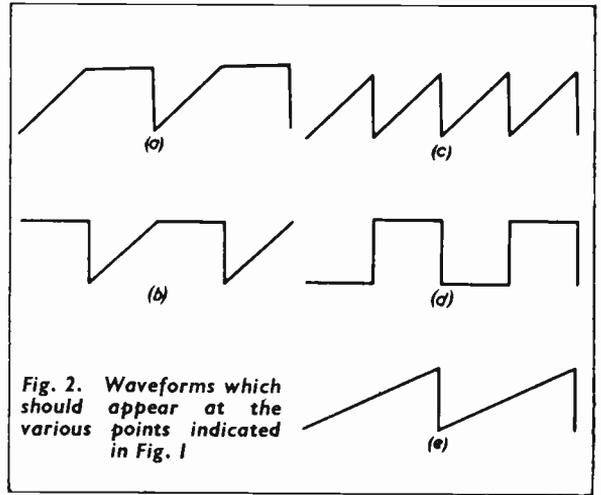


Fig. 2. Waveforms which should appear at the various points indicated in Fig. 1

The waveform in Fig. 2d is taken from the collector of TR1. When combined with the waveform of 2c and reduced to half the magnitude the resultant effect is shown in Fig. 2e. This has the same frequency as the multivibrator and is the second output.

The values of the capacitors have, of course, to be scaled proportionately to the frequency of each multivibrator.

The synchronising output to the next multivibrator contains some of the input synchronising pulse. If desired, to make the synchronising easier an r.c. filter may be introduced between each stage to reduce this unwanted signal.

Each output is connected to the switching resistors for the various footages.

The amplifier following the keyboard switching should be biased so that the d.c. potential of the input is the same as the d.c. potential of the earth side of the keyboard switches.

J. H. Asbery,
Wembley.

TIME SWITCH

SOME of your readers might be interested in the circuit shown in Fig. 1 that I have designed. Basically it is a monostable with a high power output and a very long time delay, approximately 10 minutes.

I am using the circuit to ring a bell for 10 minutes after a light beam is broken, but there are obviously many other ingenious applications that readers could experiment with.

An input pulse turns the thyristor SCR1 "on" and rings the bell. The resistor R1 passes more than the required holding current, while diode D1 kills any back e.m.f. The capacitor C2 charges via R3 and capacitor C4 charges via R4, D2, and SCR1. After 10 minutes TR1 fires and capacitor C4 discharges via R6 and D3. A pulse across R6 fires SCR2 via capacitor C3 and capacitor C2 switches SCR1 "off", stopping the bell ringing.

Capacitor C4 and resistor R4 determine the delay time and may be altered over a wide range, remembering that R4 should be greater than 3 kilohms. If C4 is larger than specified the value of R6 should be increased. Capacitor C5 smooths out any spikes on the supply rail, which could upset the operation of the thyristors. Resistors R2 and R5 stop any misfiring.

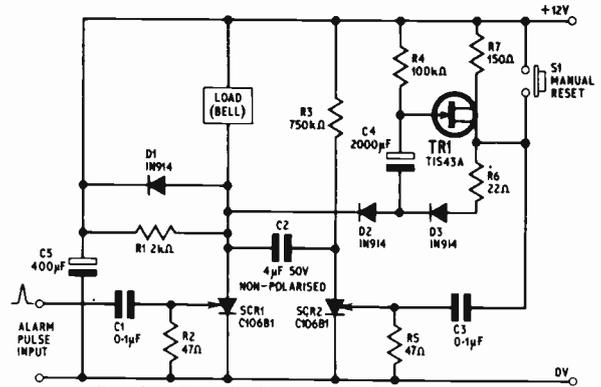


Fig. 1. Circuit diagram of the time switch

Thyristor SCR1 can handle 1A easily (12 watts load); for larger loads the thyristor must be uprated and C2 and R3 changed to ensure reliable turn-off of the SCR.

This circuit has been built and works perfectly. However, would-be constructors should note that if different thyristors are used then resistor R3 should be chosen to pass less holding current, but be low enough to charge C2 in approximately five minutes.

L. Cook,
Prescot, Lancashire.

CRYSTAL OSCILLATOR FOR CLOCK

THE "Digi-Clock" published in the December 1970 to March 1971 issues of P.E. relies for its accuracy on the stability of the mains voltage frequency used to power the clock. This may be accurate enough for most people but for high accuracy, a crystal oscillator unit is the answer.

The frequency of the mains supply varies slightly during the day, and it can cause a clock to be 8 seconds slow in any one day. It is true that at sometime after midnight this error is eliminated by increasing the frequency of the mains supply to cancel any error. Also, at times during the winter months, just prior to voltage reductions, the frequency is reduced by a few per cent.

For readers who require an accurate clock, instead of one with an alarm, the enclosed circuit could be included in the original design using approximately the same number of components and occupy the same amount of area as the alarm.

The circuit of the crystal oscillator is shown in Fig. 1. The 100kHz crystal operates in the parallel mode and the 60pF trimming capacitor in series with the crystal is adjusted to give exactly 100kHz. A convenient frequency standard for this adjustment is the B.B.C. Radio 2 carrier frequency of 200kHz.

An oscilloscope is triggered from the 100kHz crystal oscillator and the 200kHz waveform is displayed on the screen. The 60pF trimmer is then adjusted for minimum horizontal shift of the waveform.

The oscillator is followed by seven divider stages where the frequency of pulses is reduced to one every minute, see Fig. 2. The first six of these dividers are decade counters in the form of integrated circuits and the seventh stage is a divide by 6 integrated circuit.

For setting the clock to exactly the correct time,

the Greenwich time signal can be used. On the last of the six "pips" the clock can be switched on and adjusted to read the correct time. If a clock with seconds indication has been constructed, then the output from IC5, which has a frequency of 1Hz, can be fed to the input neglecting IC6 and 7.

The actual accuracy obtained with the prototype was the loss of only 1 second per week. After running for a month in a room in which the ambient temperature varied by about 10°C, the clock was found to be only 4 seconds fast.

J. A. Wise,
Watford.

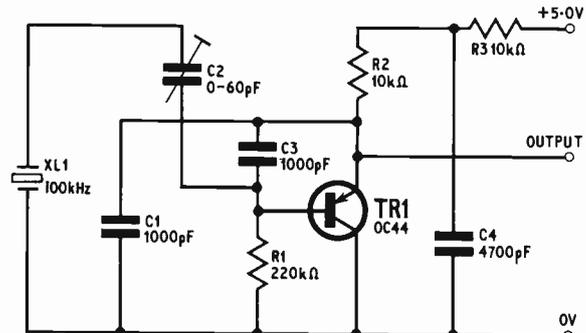


Fig. 1. Circuit diagram of the crystal oscillator

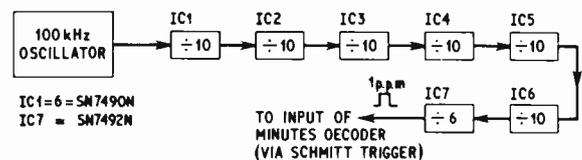


Fig. 2. Block diagram showing arrangement of oscillator and divider stages

IC1-6 = SN7490M
IC7 = SN7492N

BI-PRE-PAK LIMITED

FULLY TESTED AND MARKED

| Part No. | Price | Part No. | Price |
|---------------|-------|--------------------------|-------|
| AC107 | 0.15 | OC170 | 0.23 |
| AC126 | 0.13 | OC171 | 0.23 |
| AC127 | 0.17 | OC200 | 0.25 |
| AC128 | 0.13 | OC201 | 0.25 |
| AC176 | 0.25 | 2G301 | 0.13 |
| AC177 | 0.15 | 2G303 | 0.13 |
| AF239 | 0.37 | BC113 | 0.10 |
| AF186 | 0.50 | 2N1302-3 | 0.20 |
| AF139 | 0.37 | 2N1304-5 | 0.25 |
| BC154 | 0.25 | 2N1306-7 | 0.30 |
| BC171 = BC107 | 0.13 | 2N1308-9 | 0.35 |
| BC172 = BC108 | 0.13 | 2N3819FET | 0.45 |
| BF194 | 0.15 | | |
| BF274 | 0.15 | Power Transistors | |
| BFY50 | 0.20 | OC20 | 0.50 |
| BSY25 | 0.57 | OC23 | 0.30 |
| BSY26 | 0.13 | OC25 | 0.25 |
| BSY27 | 0.13 | OC26 | 0.25 |
| BSY28 | 0.13 | OC28 | 0.30 |
| BSY29 | 0.13 | OC35 | 0.25 |
| BSY95A | 0.15 | OC36 | 0.37 |
| OC41 | 0.13 | AD149 | 0.30 |
| OC44 | 0.13 | AUY10 | 1.25 |
| OC45 | 0.13 | 25034 | 0.25 |
| OC71 | 0.13 | 2N3055 | 0.63 |
| OC72 | 0.13 | | |
| OC73 | 0.17 | Diodes | |
| OC81 | 0.13 | AAY42 | 0.10 |
| OC81D | 0.13 | OA95 | 0.10 |
| OC83 | 0.20 | OA79 | 0.09 |
| OC139 | 0.13 | OA81 | 0.09 |
| OC140 | 0.17 | IN914 | 0.07 |

FREE!

PACKS OF YOUR OWN CHOICE UP TO THE VALUE OF 50p WITH ORDERS OVER £4

OUR VERY POPULAR 3p TRANSISTORS

FULLY TESTED & GUARANTEED

- TYPE "A" PNP Silicon alloy, metal TO-5 can. 2S300 type, direct replacement for the OC200/203 range.
- TYPE "B" PNP Silicon, plastic encapsulation, low voltage but good gain, these are of the 2N3702/3 and 2N4059/62 range.
- TYPE "E" PNP Germanium AF or RF—please state on order. Fully marked and tested.
- TYPE "F" NPN Silicon plastic encapsulation, low noise amplifier of the 2N3708, 9, 10, 11.

BULK BUYING CORNER

NPN/PNP Silicon Planar Transistors, mixed, untested, similar to 2N706/6A/8, BSY26-29, BSY95A, BCY70, etc. £4-25 per 500, £8 per 1,000.

Silicon Planar NPN Plastic Transistors, untested, similar to 2N3707-11, etc., £4-25 per 500; £8 per 1,000.

Silicon Planar Diodes, DO-7 Glass, similar to OA200/202, BAY31-36, £4-50 per 1,000.

NPN/PNP Silicon Planar Transistors, Plastic TO-18, similar to BC113/4, BC153/4, BF153/160, etc., £4-25 per 500; £8 per 1,000.

OC44, OCS5 Transistors fully marked and tested, 500+ at 8p each; 1,000+ at 6p each.

OC71 Transistors, fully marked and tested, 500+ at 6p each; 1,000+ at 5p each.

3823E Field effect Transistors. This is the 2N3823 in Plastic Case, 500+ 13p each; 1,000+ 10p each.

1 amp Miniature Plastic Diodes:
 IN4001, 500+ 3p each; 1,000+ 3p each.
 IN4004, 500+ at 5p each; 1,000+ at 4p each.
 IN4006, 500+ at 6p each; 1,000+ at 5p each.
 IN4007, 500+ at 8p each; 1,000+ at 7p each.

CLEARANCE LINES

- | Part No. | 1-10 | 10-50 | 50+ |
|---|------|-------|-------|
| SL403D Audio amp. | £2 | £1.95 | £1.80 |
| 1C 709C Linear Opp. amp | 50p | 40p | 35p |
| A.E.I. fully marked and tested gates | 25p | 22p | 20p |
| A.E.I. fully marked and tested flip-flops | 50p | 40p | 30p |
| OC71/72 fully tested unmarked | 5p | 5p | 4p |
| Matched sets 1-OC44, 2-OC45 per set | 25p | 20p | 15p |
| Matched sets OC45's 1st and 2nd IF per set | 15p | 12p | 10p |
| TIC 45 Thyristors—6 amp 60V Texas | 15p | 15p | 12p |
| OA47 gold bonded diodes | 3p | 3p | 2p |
| IW Zener diodes 6.8, 7.5, 24, 27, 30 and 43V | 5p | 4p | 3p |
| IOW Zener diodes 7.5, 11, 13, 20 and 100V | 20p | 17p | 15p |
| Micro switches, S/P, C/O | 25p | 20p | 15p |
| 1 amp bridge rec. 25V | 25p | 22p | 20p |
| 1 amp plastic rectifiers. These are voltage, reversed polarity and other rejects from the BY127 range. Ideal for low voltage power units etc. Price £1 per 100. | | | |

COLOUR T.V. LINE OUTPUT TRANSFORMERS

Designed to give 25kV when used with PL509 and PY500 valves. As removed from colour receivers at the factory. **ONLY £1 each** post and packing 23p.

BUMPER BUNDLES

These parcels contain all types of surplus electronic components, printed panels, switches, potentiometers, transistors and diodes, etc.

2 LBS IN WEIGHT FOR £1

Post and packing 25p.

NEW TESTED AND GUARANTEED PAKS

- | | | | |
|-----|-----|--|-----|
| B2 | 4 | Photo Cells, Sun Batteries. 0.3 to 0.5V, 0.5 to 2mA. | 50p |
| B79 | 4 | IN4007 Sil. Rec. diodes, 1,000 PIV lamp plastic | 50p |
| B81 | 10 | Reed Switches, mixed types large and small | 50p |
| B99 | 200 | Mixed Capacitors. Postage 13p. Approx. quantity, counted by weight | 50p |
| H4 | 250 | Mixed Resistors. Postage 10p. Approx. quantity, counted by weight | 50p |
| H7 | 40 | Wirewound Resistors. Mixed types and values. Postage 8p | 50p |
| H8 | 4 | BY127 Sil. Recs. 1000 PIV. 1 amp plastic | 50p |
| H9 | 2 | OC71 Light Sensitive Photo Transistor | 50p |
| H12 | 20 | NKT155/259 Germ. diodes, brand new stock clearance | 50p |
| H18 | 10 | OC71/75 uncodded black glass type PNP Germ. | 50p |
| H19 | 10 | OC81/81D uncodded white glass type PNP Germ. | 50p |
| H28 | 20 | OC200/1/2/3 PNP Silicon uncodded TO-5 can | 50p |
| H29 | 20 | OA47 gold bonded diodes coded MCS2 | 50p |

F.E.T. PRICE BREAKTHROUGH!!!

This field effect transistor is the 2N3823 in a plastic encapsulation, coded as 3823E. It is also an excellent replacement for the 2N3819.

Data sheet supplied with device.

1-10 30p each, 10-50 25p each, 50+ 20p each.

Make a Rev. Counter for your Car. The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car. **£1 each**

FREE CATALOGUE AND LISTS FOR:—

ZENER DIODES TRANSISTORS, RECTIFIERS FULL PRE-PAK LISTS & SUBSTITUTION CHART

MINIMUM ORDER 50p CASH WITH ORDER PLEASE. Add 10p post and packing per order. OVERSEAS ADD EXTRA FOR AIRMAIL.

P.O. RELAYS 8 FOR £1
 Various Contacts and Coil Resistances. No individual selection. Post & Packing 25p

NEW UNMARKED UNTESTED PAKS

- | | | | |
|-----|-----|--|-----|
| B66 | 150 | Germanium Diodes Min. glass type | 50p |
| B83 | 200 | Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ. | 50p |
| B84 | 100 | Silicon Diodes DO-7 glass equiv. to OA200, OA202 | 50p |
| B86 | 50 | Sil. Diodes sub. min. IN914 and IN916 types | 50p |
| B88 | 50 | Sil. Trans. NPN, PNP, equiv. to OC200/1, 2N706A, BSY95A, etc. | 50p |
| B60 | 10 | 7 Watt Zener Diodes Mixed Voltages | 50p |
| H6 | 40 | 250mW. Zener Diodes DO-7 Min. Glass Type | 50p |
| H10 | 25 | Mixed volts, 1½ watt Zeners. Top hat type | 50p |
| H11 | 30 | MAT Series " alloy " pnp Transistors | 50p |
| H15 | 30 | Top Hat Silicon Rectifiers, 750mA. Mixed volts | 50p |
| H16 | 8 | Experimenters' Pak of Integrated Circuits. Data supplied | 50p |
| H20 | 20 | BY126/7 Type Silicon Rectifiers, 1 amp plastic. Mixed volts. | 50p |

FREE! A WRITTEN GUARANTEE WITH ALL OUR TESTED SEMICONDUCTORS

BI-PRE-PAK LTD

DEPT. A, 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX
 TELEPHONE: SOUTHEND (0702) 46344

HEARING AID AMPLIFIERS

(Ex behind ear deaf aids) 3 transistors on tiny P.C. board with volume control—whole thing only about half as big as Oxo cube. £1.75 or with sub-miniature microphone and L.S. attached, £3.50.



MAINS OPERATED SOLENOIDS

Model 772—small but powerful 3in. pull—approx. size 1 1/2" x 1/2" x 1/2". 60p.

Model 400/1 1in. pull. Size 2 1/2" x 1 1/2" x 1 1/2". 75p.
Model TT10 1 1/2in. pull. Size 3 x 2 1/2 x 2 1/2in. £1.80 plus 20p post. and insurance.

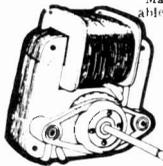
SERVO CHART RECORDER

as described in this issue.
Send S.A.E. for parts list.

DRILL CONTROLLER NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1.50 plus 13p post and insurance. Made up model also available. £2.25 plus 13p post & p.

CONTROL DRILL SPEEDS



MAINS MOTOR

Precision made — as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 50p. Postage 15p for first one then 5p for each one ordered.

NEED A SPECIAL SWITCH?

Double Lead Contact. Very slight pressure closes both contacts. 6p each, 60p doz. Plastic push-rod suitable for operating, 5p each, 45p doz.



MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 18p each. £1.80 dozen, your assortment.

SEE LAST MONTH for prices of STANDARD WAFER SWITCHES

MICRO SWITCH

5 amp, changeover contacts, 9p each, 21 doz. 15 amp, On/off 10p, each, 15 amp, changeover 15p each, 10 for £1.35.



MAINS OPERATED CONTACTOR

220/240V. 30 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10A. Extremely well made by a German Electrical Company. Overall size 2 1/2" x 2" x 2in. £1 each.



PAPST MOTORS

Est. 1/40th h.p. Made for 110-120V working, but two of these work ideally together off our standard 240V mains. A really beautiful motor, extremely quiet running and reversible. £1.50 each. Postage one 25p, two 35p.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, etc., it's so quiet it can hardly be heard. Compact, 3 1/2" casing with 5 1/2" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets. £2 plus 30p post and ins.

MAINS TRANSISTOR POWER PACK

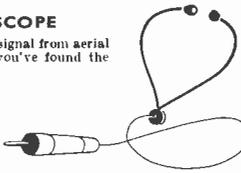
Designed to operate transistor sets and amplifiers. Adjustable output 6V, 9V, 12V for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only 88p, plus 18p postage.

COMPONENT BARGAINS

100 Eerie 1/2 watt resistors, 50 different values up to 10 meg. 50p.
50 assorted capacitors, 25 different values up to 5,000 p.f. 60p.
Both parcels £1 post paid.

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. £2—twin stethoscope instead of crystal earpiece. £3 extra—post and ins. 20p.



BATTERY CONDITION TESTER

Made by Mallory but suitable for all batteries made by Ever Ready and others, most of which are zinc carbon types but also mercury manganese—nickel—silver oxide and alkaline batteries may be tested. The tester puts a dummy load on the battery and the meter scale indicates the condition depending upon which section the pointer rests. The section reads "replace", "weak" or "good". The tester is complete in its case, size 3 1/2" x 6 1/2" x 2 1/2" with leads and prods. Price £1.75 plus 20p postage.

1 HOUR MINUTE TIMER

Made by famous Smiths company, these have a large clear dial, size 4 1/2" x 3 1/2", which can be set in minutes up to 1 hour. After preset period the bell rings. Ideal for processing, a memory jogger or, by adding simple lever, would operate micro-switch £1.15.



THIS MONTH'S SNIP

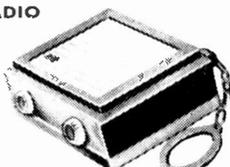
CENTRIFUGAL FAN



Mains operated, turbo-blower type. Pressed steel housing contains motor and aluminium impeller. Motor is 1/10th h.p. giving considerable air flow but virtually no noise. Approx. dimensions 10 1/2in wide x 12 1/2in dia. Outlet into trunking 10 1/2in x 4 1/2in. £4.95 + £1.

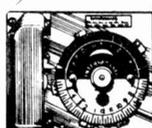
MICROSONIC KEYCHAIN RADIO

7 transistor Keychain Radio in very pretty case, size 2 1/2" x 2 1/2" x 1 1/2in.—complete with soft leather zipped bag. 7 transistor, ferrite rod. Loudspeaker. In transit from the East these sets suffered corrosion as the batteries were left in them but when this corrosion is cleared away they should work—offered without guarantee except that they are new. Price only £1.25 less batteries, plus 13p post, 6 for £7.27 free. Pair of rechargeable batteries and charger 85p.



24-HOUR TIME SWITCH

Made by Smiths, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours. 5 amp changeover contacts will switch circuit on or off during these periods. £2.50 post and ins. 25p. Additional time contacts 50p pair.



PE GEMINI

Dual purpose twin 30 watt stereo amplifier for exceptional performance. Complete kit of parts £45. Reprint of data and parts list 25p.

THE FULL-FI STEREO SIX

The amplifier sensation of the year



You will be amazed at the fullness of reproduction and at the added qualities your records or tuner will reproduce. Built into metal cabinet elegantly styled in simulated teak finished to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts R.M.S. split over the two channels. The amplifier is ideal for use with normal pick-ups and tuners, it has a double wound mains transformer and ganged volume and tone controls—also switching for Mono to Stereo, tuner or pick-up. Other controls include "treble lift and cut", "balance" and separate mains/on/off switch. UNREPEATABLE PRICE is £29 plus 38p post and insurance.

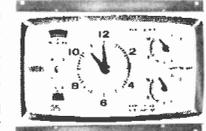
DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work, £2 less plug £2.25 with fitted 13 amp plug; £2.40 with fitted 15 amp plug, plus 23p P. & I.



ELECTRIC CLOCK WITH 20 AMP. SWITCH

Made by Smiths these units are as fitted to many top quality cookers to control the oven. The clock is mains driven and frequency controlled so it is extremely accurate. The two small dials enable switch on and off times to be accurately set—also on the left is another time or alarm—this may be set in minutes up to 1 hour. At the end of the period a bell will sound. Offered at only a fraction of the regular price—£2.50, less than the value of the clock alone—post and ins. 13p.



CAPACITOR DISCHARGE CAR IGNITION

ELECTRONIC IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the Wireless World for a year ago. We can supply kit of parts for improved and even more efficient version (PW June), price £4.95. When ordering please state whether for positive or negative systems. Plus 30p post.

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, starter holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled Kit A—15-20 w. £1. Kit B—30-40 w. £1. Kit C—80 w. £1.20. Kit E—65 w. £1.20. Kit F for 8ft 125 w. tube £1.75. Kit MF1 is for 6in, 9in and 12in miniature tubes £1. Kit MF2 for 21in 13 w. miniature tube £1. Postage on Kits A and B 23p for one or two kits then 23p for each two kits ordered. Kits C, D and E 23p on first kit then 18p for each kit ordered. Kit F 33p then 23p for each kit ordered. Kit MF1 18p on first kit then 15p on each two kits ordered.

THYRISTOR LIGHT DIMMER

For any lamp up to 200 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interferences. Price £1.99 plus 20p post and insurance.



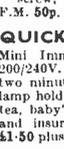
TREASURE TRACER

Complete Kit (except wooden battens) to make the metal detector as described editorially in Practical Wireless August issue. £2.50 plus 20p post and insurance.



TELESCOPIC AERIAL

for portable, car radio or transmitter. Chrome plated—six sections, extends from 7 1/2 to 47in. Hole in bottom for 6BA screw. 38p. KNUCKLED MODEL FOR F.W.M. 50p.



QUICK CUPPA

Mini Immersion Heater, 350W, 200/240V. Boils full cup in about two minutes. Use any socket or lamp holder. Have at bedside for tea, baby's food, etc. £1.25, post and insurance 14p. Jug heater £1.50 plus 14p P. & P.



WATER LEVEL RAIN ALARM

as described in this issue.
Send S.A.E. for parts list.



12 VOLT 1/2 AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mfd/50 smoothing. Price £1.50 plus 20p P. & P.



REED SWITCHES

Glass encased, switches operated by external magnet—gold welded contacts. We can now offer 3 types:
Miniature. 1in long x approximately 3/16in diameter. Will make and break up to 1A up to 300 volts. Price 13p each. £1.20 dozen.
Standard. 2in. long x 3/16in. diameter. This will break currents of up to 1A, voltages up to 250 volts. Price 10p each. 90p per dozen.
Flat. Flat type, 2in. long, just over 1/16in. thick approximately 3/16in. wide. The Standard Type flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1 amp 200 volts. Price 30p each. £3 per dozen.
Small ceramic magnets to operate these reed switches 8p each. 90p per dozen.

METER BOX

Designed to take 3in flush mounting meter. This has a 2 1/2in diameter hole with 3 meter fixing holes. Overall size of box 4in x 4in x 2 1/2in deep, hinged to a metal base 2 1/2in x 4 1/2in x 3/4in deep. Price 50p.

PILOT BULBS

6-8 Volts 15 amp tubular MES British made good quality. 1 dozen in a box. 25p per box.

5 AMP CONNECTOR STRIPS

This is the normal type of connector strip. 12 connectors with grub screws mounted in a line and moulded in polythene. 15p each £1.50 per dozen.

J. BULL (ELECTRICAL) LTD.
Dept. P.E. 7, Park Street, Croydon CRO 1YD

Readout —

A SELECTION FROM OUR POSTBAG

Correspondents wishing to have a reply must enclose a stamped addressed envelope. We regret we are unable to guarantee a reply on matters not relating to articles published in the magazine. Technical queries cannot be dealt with on the telephone.

Build or bust!

Sir—Of date I have read with interest letters from the readers of your esteemed magazine in the *Readout* section, concerning the state of "chaos" brought about by the unavailability of special components for some of the projects that are published in your magazine.

It surprises me very much that your readers "at home" (the U.K.) like the Old Mariner, keep wailing "water, water everywhere but not a drop to drink." What would some of these gentlemen do if they had to hunt for i-c's or special components in this country?

A group of us interested in such projects have evolved a way around this problem by forming a Club and when we see that we have an order to make it "well worth the while" of the various mail-order houses that advertise with your magazine, I send off an order for the required parts.

Sometimes however, we do come across a special relay or switch that cannot be supplied or is out of stock, or by writing to the manufacturer we cannot get a "one-off" job. It is here that we cannibalise parts from old equipment which have been junked, to the extent of rebuilding some of the switches to suit our needs.

It seems that your modern readers want things laid out on the table for them to go ahead and build some piece of equipment that takes their fancy. Why not improvise? If a particular transistor is not available or is obsolete, why not find an alternative? After all, we are in this hobby to enjoy ourselves, not to make a profit like the component dealers (who, must, if they want to keep their business from running into the red). What greater satisfaction in making a piece of equipment that requires something special through improvisation rather than frowning that "that damned thing isn't going to work without that thingamajig"?

Now before some keen reader bops me for saying that, I would suggest that should your magazine wish to co-operate, and I am sure

it has done all it can for its readers these past many years, is to have a Swap-Box column whereby readers could exchange parts with each other (without asking for monetary remunerations) and thus solve some of their problems if not all of them.

Supplying home experimenters is big business in the U.S.A. and why dealers in the U.K. do not try to capture this large source of revenue is something very surprising!! Of course, dealers that do extend certain services to experimenters beyond the call of service will note that they have a *customer who chooses to deal with no one else in the long run*. I hope that some enterprising mail-order house in the U.K. finds a practical solution to this tangled problem.

Keep on publishing your specialised designs. "WE SHALL BUILD THEM OR BUST".

S. M. Sharifi,
Teheran,
Iran.

American way

Sir—The amateur is very well catered for in this country. Early this year I received the latest catalogues FREE from the mail-order component houses I buy parts from on occasion.

Newark's catalogue for 1971 runs to 736 pages; Allied Radio Shack's to 460; Lafayettes to 467. It is impossible to detail their offerings which run the whole gamut from individual components of every conceivable kind through brand name kits to commercial equipment, hi-fi systems and so on, and on. I would almost say that there is no component available to the professional engineer which the amateur cannot purchase by mail. He must be prepared to pay for it though!

In Cincinnati there is also a branch of a local Ohio concern, Hughes Peters, and they have an across the counter service daily and Saturday mornings. Parts not immediately available here are ordered from their suppliers and the

customer is advised by phone when they arrive. There is no extra charge for this service.

Mail orders from the other firms are processed in about fourteen days. A sign of the times, however, has been an increase in the minimum value of a mail order that these firms will handle.

Some of the firms also run their own hire-purchase plans, which cover components as well as kits and ready to use equipment.

Firms offer quantity discounts, these vary with quantity and the kind of item. Generally it pays to buy as large a number as possible, as for small items savings can be substantial.

There are also firms specialising in selling complete ready-to-assemble kits for the more sophisticated projects published in the popular magazines, and also special components that may be called for.

I expect that the hobbist here has more to splurge on bits than his UK counterpart and his potential business attractive to the component suppliers. Having the cash and an American philosophy he will tend to do the job right and not save pennies adapting old junk if the correct part can be purchased.

L. Huggard,
Cincinnati,
U.S.A.

New hobby

Sir—At the moment, (having just completed the first part of the "War Games Computer" successfully), I am rather keen on constructing similar projects, such as the "Operation Seasearch."

I am hoping you can give me the date of the magazines in which it appeared and where I might obtain them? Also any similar projects which might have been shown in your magazine?

I must confess that this month's is the first of your magazines I have bought, for although very interested in electronics, I have up until now mostly constructed radios.

Needless to say, from now on I shall place a regular order for PRACTICAL ELECTRONICS, which has given me a "start" on a wonderful new hobby.

Hope to hear from you soon.

N. Early,
Langport,
Somerset.

"Operation Seasearch" appeared in the December '70 issue; "Submarine Chaser" in February this year.

We regret that all back numbers of our magazine are no longer available. We can only suggest you try your local technical or reference library.

CRESCENT RADIO LTD

11 & 40 MAYES ROAD, LONDON N22 6TL 888 3206

MAIL ORDER
DEPT.
No. 11
MAYES RD.
LONDON
N22
6TL

COMPONENTS AND HI FI FOR THE HOME CONSTRUCTOR

OUR SHOPS ARE OPEN ALL DAY
FROM 9 A.M. TO 6 P.M. 6.30 P.M. ON FRIDAY
(WE CLOSE ALL DAY THURSDAY)
13 SOUTH MALL, EDMONTON, N 9 803 1685



"CRESCENT" D.J. PARTY AMPLIFIER "P100"

A completely new style 100W Amplifier especially designed for the D.J. who expects his equipment to look and sound really good, and still keep a moderate price.
10-30,000Hz response.
All loudspeaker systems suitable.
Full output into 4 ohm.

All silicon transistors. F.E.T. at front end. Real value at £42 plus £1 P. & P. and insurance.

★ £2 DISCOUNT ★

If purchased at the same time as the Psychedelic Light Control Unit. If you require more information please send a S.A.E.

STEREO HEADSET

8 ohm impedance, complete with plug and 5ft lead. A very comfortable phone set. Listen to stereo without noise interrupting the pleasure. Wonderful value. £2.50 plus 10p P. & P.



MINI LOUDSPEAKERS

2 1/2in 8 ohm = 35p | 2 1/2in 25 ohm = 38p
3in 8 ohm = 40p | 2 1/2in 75 ohm = 38p
Plus 3p P. & P. on each Speaker

MIDGOT FLEX CONNECTOR

Approx. 2amp rating. Two-pin non-reversible midgot flex connector. Approx. size: 2in x 1/4in. Ideal for loudspeaker connections, etc. 8p plus 2p P. & P.

MAINS TRANSFORMER

Fused Primary 240V. Secondary 220V @ 60M/A. 6.3V @ 1A. This transformer is made to a very high standard and is a small size: 2in x 2 1/2in x 2 1/2in. 88p plus 15p P. & P.



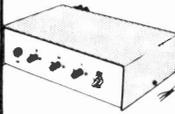
BARGAIN BOARDS

Components galore for the experimenter. Ex computer boards with: Resistors, Capacitors and useful Transistors—at least 4 transistors per board.



BARGAIN PRICE 30p per board
5 BOARDS £1.20 P. & P. Free on this item.

PSYCHEDELIC LIGHT CONTROL UNIT



Three Channel: Bass—Middle—Treble. Each channel has its own sensitivity control. Just connect the input of this unit to the loudspeaker terminals of an amplifier, and connect three 250V up to 500W lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed) £18.50 plus 38p P. & P.

If you require more information please send S.A.E.



CRESCENT CASSETTES

Top quality cassettes at unbeatable prices (complete with standard storage case): C60 38p, C90 68p, C120 88p plus 5p P. & P.

S. G. BROWN HEADPHONES

Used! But in good working condition. These Type "F" phones are 4,000Ω imp. and a bargain at



50p Plus 10p. P. & P. per pair

CHROME TV STAND

28in x 8 1/2in x 16in high. This modern design TV stand would make an ideal base for a coffee table and is a bargain at:



£1.63 plus 25p P. & P.

EA1000 3 WATT AUDIO AMPLIFIER MODULE

An Audio Amplifier designed around the TAAG21 Linear I.C.:
Supply Voltage 9-24V
Speaker Imp. 8-16 ohm
Frequency 50Hz-25kHz
Overall Size 2in x 3in x 1/4in
Ideal Amplifier for radios, record players, stereo units, etc.
Full technical data and diagrams with each module. All guaranteed and a bargain at



BRIGHTNESS CONTROL

Full control over 300 watts of incandescent lighting. Thyristor light dimmer mounted on a standard switch block ready to fit into a MK. Box. Enjoy the pleasure of having the precise amount of light you require at any time. Our Price £2.75 plus 8p P. & P. each.



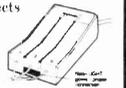
BATTERY ELIMINATOR

Plug your Transistor Radio, Amplifier, Cassette, etc., into the a.c. mains through this compact eliminator. 2 1/2in x 2 1/2in x 3in approx. £1.50, £1.50, 6V £1.50, 9V £1.50, 7 1/2V complete with cable and plug for Philips Cassette. £2 plus 8p P. & P. each.



MAINS KEYNECTOR

Keynector connects any Electrical Equipment to the mains supply in seconds. Ideal for bench, garage, demonstrations, etc. Multi connections can be made (max. load 13A fused). ONLY £2.75 P. & P. 6p.



£2.63 + 5p P. & P

G. F. MILWARD 369 Alum Rock Road, Birmingham B8 3DR. Tel. 021-327 2339

VEROBOARD

2 1/2in x 1in x 0.15in 6p | 5in x 3 1/2in 0.15in 28p | 3 1/2in x 3 1/2in 0.1in 24p
3 1/2in x 2 1/2in 0.15in 16p | 17in x 2 1/2in 0.15in 55p | 5in x 2 1/2in 0.1in 23p
3 1/2in x 3 1/2in 0.15in 20p | 17in x 3 1/2in 0.15in 74p | 5in x 3 1/2in 0.1in 28p
5in x 2 1/2in 0.15in 20p | 3 1/2in x 2 1/2in 0.1in 21p
Spot Face Cutter 38p. Pin Insert Tool 48p. Terminal Pins (0.1 or 0.15) 36 for 18p. Special Offer Pack consisting of 5 2 1/2in x 1in boards and a Spot Face Cutter—50p.

RECORD PLAYER CARTRIDGES. Well below normal prices!

G90 Magnetic Stereo Cartridges, Diamond Needle, 6mV output, £4. ACOS GP 67/2 (Mono, Crystal) 75p. ACOS GP 91/3 (Compatible, Crystal) £1. ACOS GP 93/1 (Stereo, Crystal, Sapphire) £1.25. ACOS GP 93/1D (Stereo, Crystal, Diamond) £1.63. ACOS GP 94/1 (Stereo, Ceramic, Sapphire) £1.50. ACOS GP 94/1D (Stereo, Ceramic, Diamond) £1.88. ACOS GP 95/1 (Stereo, Crystal with two L.P./Stereo needles) £1.25.

TRANSFORMERISED FLUORESCENT LIGHTS, 12 volt. All with reversed polarity protection. 8 watt type with reflector suitable for tents, etc. £3. Postage/Packing 25p. 15 watt type, better fitting for caravans £4. Postage/Packing 25p. 13 watt type, better with switch. 2 1/2in x 2 1/2in. £5. Postage/Packing 25p. THESE CAN BE SENT ON APPROVAL AGAINST FULL PAYMENT.

MULLARD POLYESTER CONDENSERS

1,000pF, 1,200pF, 1,500pF, 1,800pF, 2,200pF, 15p per dozen (all 400V working). 0.15µF, 0.22µF, 0.27µF, 30p per dozen (all 160V working). 25% discount for lots of 100 of any one type.

RESISTORS

1/2 and 1/4 watt. Most values in stock. 50p per 100. 10p per dozen of any one value. WIRE WOUND MAINS DROPPERS. Hundreds of values from 0.7 ohm upwards. 1 watt to 50 watts. A large percentage of these are multi-tapped droppers for radio/television. Owing to the huge variety these can only be offered "assorted" at 50p per dozen.

SILVER MICA/CERAMIC/POLYSTYRENE CONDENSERS

Large range in stock, 75p per 100 of any one value. 15p per dozen. RECORDING TAPE BARGAIN! The very best British Made low-noise high-quality Tape! 5in Standard 38p. Long-play 45p. 5 1/2in Standard 45p. Long-play 60p. 7in Standard 60p. Long-play 82p. We are getting a fantastic number of repeat orders for this tape. Might we suggest that you order now whilst we still have a good stock at these low prices?

STOCKTAKING CLEARANCE! IMPOSSIBLE TO REPEAT!

We have huge numbers of components in quantities too small to advertise individually. In order to "clear the decks" we have made up parcels containing a mixture of carbon and wire-wound resistors, electrolytic and paper condensers, controls, transistors, diodes etc., for a tiny fraction of normal price. It is emphasised that these are mixed parcels only—contents cannot be stipulated! Sold only by weight.

Gross weight 2 lb. £1 (postage 20p)
Gross weight 5 lb. £2 (postage 30p)

G. F. MILWARD, Drayton Bassett, Tamworth, Staffs. Postage (minimum) per order 15p.

Unrepeatable Offer ! ! ! !

Surplus VEROBOARDS, 3 1/2" x 2 1/2" x .15"
Only 10p each or £1.00 per dozen

TANTALUM CAPACITORS. COMPARE THE PRICE—ONLY 10p EACH ! ! ! !

| Sub-miniature types | Miniature types | 5-6 µF | 35 volts |
|---------------------|------------------|----------|-----------|
| 0.047µF 50 volts | 0.022µF 20 volts | 8.2 µF | 10 volts |
| 0.056µF 50 volts | 0.033µF 20 volts | 15 µF | 35 volts |
| 0.07 µF 20 volts | 0.047µF 20 volts | 18 µF | 35 volts |
| 0.1 µF 20 volts | 0.068µF 35 volts | 22 µF | 15 volts |
| 0.1 µF 50 volts | 0.12 µF 35 volts | 27 µF | 120 volts |
| 0.18 µF 20 volts | 0.15 µF 35 volts | 56 µF | 15 volts |
| 0.33 µF 35 volts | 0.22 µF 50 volts | 56 µF | 20 volts |
| 0.47 µF 35 volts | 0.47 µF 50 volts | 150 µF | 6 volts |
| 0.68 µF 20 volts | 0.68 µF 35 volts | Standard | |
| 1.0 µF 15 volts | 1.0 µF 35 volts | 6.8 µF | 50 volts |
| 2.2 µF 3 volts | 1.0 µF 75 volts | 7.5 µF | 20 volts |
| 2.7 µF 15 volts | 1.8 µF 20 volts | 8.2 µF | 150 volts |
| 2.7 µF 35 volts | 2.2 µF 20 volts | 12 µF | 35 volts |
| 3.0 µF 12 volts | 2.7 µF 50 volts | 12 µF | 50 volts |
| 10.0 µF 1.5 volts | 3 µF 12 volts | 12 µF | 20 volts |
| | 3.3 µF 15 volts | 39 µF | 20 volts |
| | 4 µF 20 volts | 82 µF | 20 volts |
| | 4.7 µF 35 volts | 150 µF | 15 volts |
| | 5.6 µF 6 volts | 270 µF | 6 volts |

NEW! NEW! NEW! NEW!

An aerosol spray providing a convenient means of producing any number of copies of a printed circuit both simply and quickly.

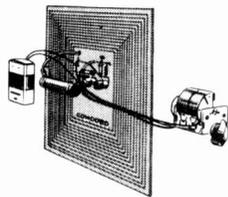
Method: Spray copper laminate board with light-sensitive spray. Cover with transparent film upon which circuit has been drawn. Expose to light. (No need to use ultra-violet.) Spray with developer, rinse and etch in normal manner.

Light sensitive aerosol spray £1
Developer spray 50p

FIND BURIED TREASURE WITH THIS
READY BUILT & TESTED

Treasure Locator Module

Only
£4.95
(99/-)



BRAND NEW FULLY TRANSISTORISED PRINTED CIRCUIT METAL DETECTOR MODULE. Ready built and tested—just plug in a PP3 battery and 'phones and it's working. Put it in a case, screw a handle on and YOU HAVE A PORTABLE TREASURE LOCATOR EASILY WORTH ABOUT £20! Extremely sensitive—penetrates through earth, sand, rock, wood, dirt, water, etc.—EASILY LOCATES COINS, GOLD, SILVER, WATCHES, JEWELLERY, NUGGETS, METALLIC ORE, HISTORICAL RELICS, BURIED PIPES, KEYS, NAIL-IN-TREES, ETC. ETC. Signals exact location by "beep" pitch increasing as you near buried metallic objects. PRINTED CIRCUIT SEARCH COIL so stable and sensitive it will detect certain objects buried SEVERAL FEET BELOW GROUND! GIVES CLEAR SIGNAL ON ONE COIN! You could even pay for your holidays with two or three days electronic beachcombing—it's almost like having a license to print money! Unclaimed treasure now exceeds the combined wealth of all nations. ORDER NOW WHILE PRESENT STOCKS LAST—TREMENDOUS DEMAND EXPECTED AT THIS REMARKABLY LOW PRICE. DEMONSTRATIONS DAILY. ORDERS DESPATCHED IN STRICT ROTATION. SEND NOW £4.95 + 30p carr. (99/- + 6/-) etc. (High quality Danish Stethoscope headphones £2.75 (55/-) extra if required).

SOOTHE YOUR NERVES, RELAX WITH THIS AMAZING RELAXATRON



ONLY
£2.37 Plus P & P. 23p
(47/6)

CUTS OUT NOISE POLLUTION—SOOTHS YOUR NERVES! Don't underestimate the uses of this fantastic new design—the RELAXATRON is basically a pink noise generator based on avalanche operated transistors. Besides being able to mask out extraneous unwanted sounds, it has other very interesting properties. For instance, many people find a rainstorm mysteriously relaxing, a large part of this feeling of well-being can be directly traced to the sound of falling raindrops—a well known type of pink noise. A group of Dentists have experimented on patients with this pink noise—NO ANESTHETICS WERE USED! The noise ostensibly created a most definite reaction on these patients' nervous systems with the results that their pain systems were blocked. IF YOU WORK IN NOISY OR DISTRACTING SURROUNDINGS, IF YOU HAVE TROUBLE CONCENTRATING, IF YOU FEEL TENSED, UNABLE TO RELAX—then build this fantastic Relaxatron. Once used you will never want to be without it—use this amazing pink noise generator whenever you feel you can't relax or wish to concentrate. TAKE IT ANYWHERE, pocket sized. Uses standard PP3 batteries (current used so small that battery life is almost shelf-life) CAN BE EASILY BUILT BY ANYONE OVER 12 YEARS OF AGE using our unique, step-by-step, fully illustrated plans. No soldering necessary. All parts including case, a pair of crystal phones, Components, Nuts, Screws, Wire, etc. etc. no soldering. Send only £2.25 + 25p (45/- + 5/-) p. & p. parts available separately.)

GET A GOOD NIGHT'S SLEEP—EVERY NIGHT! INGENIOUS ELECTRONIC SLEEP INDUCER



only
£2.75
(55/-)

CAN'T SLEEP AT NIGHTS? DO YOU WAKE UP IN THE NIGHT AND CAN'T GET OFF TO SLEEP AGAIN? WOULD YOU LIKE TO BE GENTLY SOOTHED OFF TO SATISFYING SLEEP EVERY NIGHT? Then build this ingenious electronic soothing audio-frequency sounds, continuously repeated—but as time goes on the sounds gradually become less and less—until they eventually cease altogether, the effect it has on people is amazingly very similar to hypnosis. A control is provided for adjusting the length of times etc. all transistor, can be built by anyone over 12 years of age in about two hours. No knowledge of electronics or radio needed. Extremely simple, easy-to-follow, step-by-step, fully illustrated instructions included. No soldering necessary. Works off standard batteries—extremely economical. Size only 3" x 4 1/2" x 1 1/2"—take it anywhere. All parts including case, loudspeaker, components, nuts, wire, screws, etc. etc. THERE WILL BE A GREAT DEMAND FOR THIS UNIQUE NEW DESIGN—SEND NOW £2.75 + 25p (55/- + 5/-) p. & p. (parts available separately).

REAL WORKING ELECTRONIC ORGAN



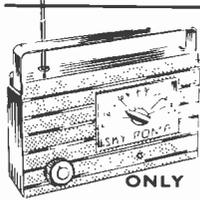
ONLY
£2.75
(55/-)

Don't confuse with ordinary electric organs that simply blow air over mouth-organ type reeds etc. Eight months were spent in creating and testing this superb, revolutionary electronic organ. Fully transistorized—no valves. Proper self-contained loudspeaker. Fifteen separate keys spans two full octaves—play the "Yellow Rose of Texas", play "Silent Night", play "Auld Lang Syne", play lots and lots of similar tunes on this real working electronic organ. Although it's no theatre organ it's certainly no tiny thing, it measures 13 1/2 x 10 x 2 1/2". You have the thrill and excitement of building it together with the pleasure of playing a real, live, throbbing electronic organ. Take it anywhere—play it anywhere. NO PREVIOUS KNOWLEDGE OF ELECTRONICS NEEDED—NONE WHATSOEVER. No soldering necessary, it really is as simple as a.b.c. to make.

Anyone from nine years upwards can build it easily in one short evening following the fully illustrated, step-by-step, simply worded instructions. BIG DEMAND ANTICIPATED FOR THIS UNIQUE INSTRUMENT at our low, low building price. ONLY £2.75 (55/-) + 23p (4/6) p. & p. for all parts, including case, loudspeaker, transistors, condensers, resistors, knobs, transformer, volume control, wire, nuts, screws, simple (but full) instructions, etc. etc. Uses standard battery (parts available separately). Have all the pleasure of making it yourself, finish with an exciting gift for someone.

SHORTWAVE TRANSISTOR RADIO

Can be built in one evening



ONLY
£2.25
(45/-)

At last! After trying countless circuits searching for easy build, work first-time world-waver. Giving advanced world-wide performance, we chose this "Sky Roma". Anyone from 9 years up can follow the step-by-step, easy-as-ABC, fully illustrated instructions. (We built ten prototypes and every one worked first time) no soldering necessary. 76 stations logged on rod aerial in 30 mins.—Russia, Africa, USA, Switzerland, etc. Experience thrills of world wide news, sport, music, etc. Eavesdrop on unusual broadcasts. Uses PP3 battery. Transistorised (no valves). Size only 3" x 4 1/2" x 1 1/2". As tremendous demand anticipated price held to only £2.25 (45/-) + 17p (3/6) p. & p. for all parts incl. Cabinet, screws, instructions etc. (Part available separately).

EAVESDROP ON THE EXCITING WORLD OF AIRCRAFT COMMUNICATIONS—JUST OUT V.H.F. AIRCRAFT BAND CONVERTER



ONLY
£2.37 Plus P & P. 23p
(47/6)

Many thousands of v.h.f. Aircraft Band Converters now selling in U.S.A. Listen in to AIRLINES, PRIVATE PLANES, JETPLANES. Eavesdrop on exciting crosstalk between pilots, ground approach control, airport tower. Hear for yourself the disciplined voices hiding tenacious on talk downs. Be with them when they have to take nerve rippling decisions in emergencies—Tune into the international distress frequency. Covers the aircraft frequency band including HEATHROW, GATWICK, LUTON, RINGWAY, PRESTWICK ETC., ETC. CLEAR AS A BELL. This fantastic fully transistorised instrument can be built by anyone nine to ninety in under two hours. (Our design team built four—everyone worked first time). No knowledge of radio or electronics required. No soldering necessary. Fully illustrated simply worded instructions take you step-by-step. Uses standard PP3 battery. Size only 4 1/2" x 3" x 1 1/2". All you do is extend rod aerial, place close to any ordinary medium-wave radio—(even tiny portables) NO CONNECTIONS WHATSOEVER NEEDED. Use indoors or outdoors. THERE WILL BE ENORMOUS DEMAND FOR THIS NEW DESIGN. SEND NOW, ONLY £2.37 (47/6) + 23p (4/6) p. & p. for all parts, including case, nuts, screws, wire, etc., etc. (parts available separately)

BUILD 5 RADIO AND ELECTRONIC PROJECTS



TOTAL BUILDING PRICE
£1.97
(39/6)

Amazing Radio Construction set! Become a radio expert for £1.97 (39/6). A complete Home Radio Course. No experience needed. Parts including simple instructions for each Step-by-step—plans, all Transistors, loudspeaker, personal phone, knobs, screws, etc., all you need. Presentation Box 37p (7/6) extra as illus. (if required) (extra parts available separately) no soldering necessary. Send only £1.97 (39/6) + 23p (4/6) p. & p.

FIND BURIED TREASURE! TREASURE LOCATOR TRANSISTORISED

NOW IT'S HERE AT LAST, after experimenting for four and a half months with a multitude of different circuits, our design team have come up with this real winner. This fully portable transistorised metal locator detects and tracks down buried metal objects—signals exact location with low audible sound (no phones used)—uses



ONLY
£2.37
(47/6)

any transistor radio which fits its side—no connections needed. FINDS GOLD, SILVER, LOST COINS, JEWELLERY, KEYS, WAR SOUVENIRS, ARCHAEOLOGICAL PIECES, METALLIC ORE, NUGGETS ETC. ETC. OUTDOORS or indoors. Extremely sensitive, will signal presence of certain objects buried several feet below ground! No knowledge of radio or electronics required. Can be built with ease in one short evening by anybody from nine years of age upwards, with the wonderfully clear, easy to follow, step-by-step, fully illustrated instructions—it really is as easy as A.B.C. transistorized—no valves. Uses standard PP3 battery. No soldering necessary. Size of detector head 13 1/2" x 10" x 2 1/2". Great demand expected at this remarkably low price—ORDER WHILE PRESENT STOCKS LAST. All parts including detector head case, nuts, screws, wire, simple instructions etc. etc. ONLY £2.37 (47/6) + 27p (5/6) p. & p. (Sectional handle as illustrated 75p (15/-) extra). Parts available separately. Made up looks worth £15!

EXAMINE AT HOME FOR 7 DAYS. YOUR MONEY REFUNDED IN FULL IF NOT 100% DELIGHTED.

CONCORD ELECTRONICS LTD (Dept. PE22)
(STAFF WANTED FOR ALL DEPARTMENTS)

8 Westbourne Grove, London W.2.
(Nr Bayswater & Queensway Tubes. 1 minute ABC Cinema)
Callers Welcome 9 a.m.-6 p.m. inc. Saturday

OSCILLOSCOPES

| | | |
|---|---|-----|
| E.M.I. WM18. Complete with Dual Trace Plug-in Amp/Differential Plug-in Amp | £ | 175 |
| Solartron CD1220. With Wide Band Unit | £ | 190 |
| Solartron CD1220. With Dual Trace Unit | £ | 220 |
| Solartron CD1220. With Differential Amp Unit | £ | 240 |
| Solartron CD71182. Double Beam | £ | 80 |
| Cawwell Remscope S01. Storage Oscilloscope | £ | 200 |
| E.M.I. WM8. Complete with Amplifier Type 8 | £ | 55 |

TEST GEAR

| | | |
|---|---|-----|
| Wayne Kerr. Universal Bridge Type B221 | £ | 65 |
| Marconi. Q Meter Type TF2904 | £ | 45 |
| Marconi. Video Oscillator Type TP885A 25Hz-5MHz. | £ | 45 |
| Marconi. Vacuum Tube Voltmeter TF1041A | £ | 80 |
| Marconi. FM/AM Signal Generator TF995A/4 | £ | 175 |
| Power Unit. 240V a.c. 1/P.DC Output 400V 170mA/6.3V 3A | £ | 10 |
| R.F. Generator. 200MHz. 275W | £ | 25 |
| R.F. Generator. 25W | £ | 15 |
| Servorex Controls Ltd. Motor Controller Type MC47 complete with motor | £ | 65 |

TV CAMERA LENSES

| | | | |
|--|------|----|----|
| Rank Taylor Hobson Vidial Lenses. Standard "C" Mounts. Focal lengths 2cm, 6cm, 8cm | Each | £ | 25 |
| R.C.A. AR88. Receiver | £ | 40 | |

MINIATURE GEARED MOTORS

| | | | |
|--|------|------|------|
| 1 r.p.m. Hayden 240V a.c. clockwise rotation | Each | £ | 0.80 |
| 1/5 r.p.m. Crouzet. 240V a.c. anticlockwise rotation | £ | 0.80 | |
| 2 r.p.m. Crouzet. 20V a.c./12V d.c. anticlockwise rotation | £ | 0.80 | |

RELAYS

| | |
|--|--|
| Siemens/Varley Plug-in. Complete with transparent dust cover 2-pole C/o 35p each; 4-pole C/o 50p each. | |
| S.T.C. Miniature sealed relays, 6V, 12V, 24V, 48V. 2-pole C/o 50p each. | |
| G.P.O. Relays. 2000Ω, 2-pole C/o 50p; 4-pole C/o 80p each. | |
| Heavy Duty. Relays 5A and 10A contacts 12V, 24V, d.c. 110V, 240V a.c., 2-pole C/o 80p each. | |
| Latching Relays. B. & R. Type H02/TF98 2-pole C/o 98p each. | |

SOLENOIDS

| | | | |
|---------------------------------|------|---|------|
| 12V d.c. 2 1/2in x 1 1/4in dia. | Each | £ | 0.50 |
|---------------------------------|------|---|------|

WIRE WOUND POTENTIOMETERS

| | | |
|---|---|------|
| Colvern. Reliance. All values from 1Ω-100KΩ. Brand new | £ | 0.19 |
| 360° Wire Wound Pots. COLVERN CLR/6305/418 10KΩ CLR/6605/18 100KΩ | £ | 1.50 |
| Bourns. 10 Turn Pots. 10KΩ + 5% LIN 0-25% | £ | 1.98 |

ILLUMINATED PUSH BUTTON SWITCHES

| | | |
|------------------------------|---|------|
| Non-Locking Only. 2-pole C/o | £ | 0.35 |
|------------------------------|---|------|

PUSH BUTTON SWITCHES

| | |
|--|-----------------|
| Multibank push button switch assemblies now in stock. Any combination, latching non-latching, push-push, push to change over, push to hold, etc. | |
| 2-pole C/o | 20p per button. |
| 4-pole C/o | 30p per button. |
| 6-pole C/o | 40p per button. |

MULTIPLUG PLUGS AND SOCKETS

| | |
|--|--|
| Painton/Jones 2/4/6/8/12/18/24/33 way. | |
| P.E.T., B.N.C., AMPHENOL, CANNON, D.I.N., plus complete audio range. | |

TRANSFORMERS

| | | | | |
|-------------------------|---|------|------|------|
| D.C. Tibbles & Co. | Pri. 0-100-110-220-240V; | Each | £ | 6.50 |
| | Sec. 12V 20A | | | |
| Miniature Transformers | Pri. 240V; Sec. 12V 100mA | | | |
| 2in x 1 1/2in x 1 1/2in | Pri. 240V; Sec. 0, 20V, 30V 100mA | | | |
| | Pri. 240V; Sec. 0, 18, 36, 0, 18, 36 100mA. | | | |
| | All Types 60p each | | | |
| Shrouded Transformers | Pri. 0-120-240V; Sec. 24V 1A | £ | 1.25 | |
| | Pri. 0-240V; Sec. 28V 1A | £ | 1.60 | |
| C-Core Transformers | Pri. 240V; Sec. 0, 7.5, 15V 1A | £ | 1.20 | |
| Heater Transformers | Pri. 0-110-200-220-240V; Sec. 6-3V 3A | £ | 1.00 | |

ALARM BELLS

| | | |
|---|---|------|
| Suitable for burglar alarms. AGRO Type 4145 200/250V a.c. | £ | 3.50 |
|---|---|------|

PANEL METERS

| | | | | |
|--------------------|------------------------------------|------|------|------|
| Sifam Moving coil | 1mA size 4 1/2 x 4in | Each | £ | 3.25 |
| Sifam Moving coil | 100µA size 3 1/2 x 3in | £ | 3.00 | |
| Taylor Moving Coil | 50-0-50µA edgewise 2 1/2in scale | £ | 4.25 | |
| Ernest Turner | 270° Movement/Centre zero circular | | | |
| | 0-5-0-5mA 2 1/2in dia. | £ | 3.00 | |
| Ernest Turner | 270° Movement/Centre zero Circular | | | |
| | 1-0-1mA 2 1/2in dia. | £ | 4.25 | |
| Sangamo-Weston | 500µA F.S.D. 4 1/2 x 3 1/2in | £ | 3.80 | |
| Illuminated Meter | | | | |
| Sangamo Weston | 50µA F.S.D. 4 1/2 x 3 1/2in | £ | 4.75 | |

We also have a large number of assorted meters of different shapes/sizes/movements in stock.

SOUND-TO-LIGHT MODULES SUITABLE FOR DISCOTHEQUES, ETC.

| | | | |
|---|------|-------|------|
| Single Channel 750W model | Each | £ | 6.00 |
| Three Channel Model | £ | 18.00 | |
| 150W Liquid Oil Wheel Projectors, complete with wheel | £ | 35.00 | |
| Extra Wheels 6in dia. | £ | 6.00 | |

COMPONENTS

| | |
|---------------------------------|---|
| Metal Oxide Resistors | 2% T.R.S. Complete range always in stock. 1 off 5p each, 100 off 31p each. |
| Mullard Electrolytic Capacitors | Complete range always in stock. |
| Mullard Polyester Capacitors | Complete range always in stock. |
| Lenoco Silver Mica Capacitors | Complete range always in stock. |
| Polystyrene Capacitors | Complete range always in stock. |
| Wirewound Resistors | 1W, 3W, 6W, 12W, 15W, 30W. Complete range always in stock. |
| Semiconductors | Transistors, Diodes, Rectifier Blocks, Thyristors, U.J.T.'s, Diacs, Triacs, P.E.T.'s, Zeners, Photo-cells, etc. |

10% DISCOUNT On any cash sale for customers presenting this advertisement. 10% DISCOUNT

C.T. ELECTRONICS

267 ACTON LANE, LONDON, W.4 01-994 6275

Nearest Underground—Chiswick Park (District Line). Acton Town (Piccadilly Line).

Bus Routes E3, 88, 207, 15, 7, 260. (Please note: As yet we do not have a catalogue available. Any queries please phone or call at the above address).

Business Hours: Mon-Sat. 9-30 a.m. to 6 p.m. Wed. 9.30 a.m. to 1 p.m.

WANTED. SURPLUS OR REDUNDANT COMPONENTS AND TEST EQUIPMENT

LST FOR SIEMENS, NEWMARKET, IR, RCA MULLARD, TEXAS, FERRANTI, GE

| | | | | | | | |
|--------|-------|---------|-------|---------------|-----|---------------------|-------|
| AC107 | 37p | BY100 | 20p | NKT10339 | 25p | IN4005 | 12p |
| AC126 | 25p | BYX10 | 15p | NKT10419 | 19p | IN4006 | 15p |
| AC127 | 25p | BYZ10 | 40p | NKT10439 | 27p | IN4007 | 20p |
| AC128 | 20p | BYZ12 | 30p | NKT10519 | 22p | IN4148 | 7p |
| AC151 | 12p | BYZ13 | 20p | NKT20329/0013 | | 2G302 | 19p |
| AC176 | 25p | BZY88 | 15p | | 31p | 2G371 | 15p |
| AC187 | 30p | C3V3 | 15p | NKT80111 | 83p | 2G374 | 25p |
| AC188 | 30p | C3V6 | 15p | NKT80112 | 83p | 2N174 | 80p |
| AC177 | 29p | C3V9 | 15p | NKT80113 | 81p | 2N174 | 25p |
| AC187 | 20p | C4V3 | 15p | NKT80114 | 75p | 2N385A/2388A | 75p |
| AC192 | 20p | C4V7 | 15p | NKT80115 | 75p | 2N385A | 25p |
| AC200 | 19p | C5V1 | 15p | NKT80212 | 75p | 2N404 | 25p |
| AC211 | 19p | C5V6 | 15p | NKT80213 | 75p | 2N696 | 15p |
| AC222 | 19p | C6V2 | 15p | NKT80214 | 75p | 2N697 | 17p |
| AC240 | 15p | C6V8 | 15p | NKT80215 | 75p | 2N698 | 30p |
| AC241 | 15p | C7V5 | 15p | NKT80216 | 75p | 2N706 | 10p |
| AD140 | 55p | C8V2 | 15p | OA5 | 20p | 2N706A | 12p |
| AD149 | 57p | C9V1 | 15p | OA10 | 25p | 2N708 | 16p |
| AD161 | 37p | C10 | 15p | OA17 | 8p | 2N711 | 37p |
| AD162 | 37p | C11 | 15p | OA73 | 8p | 2N711A | 37p |
| AF106 | 24p | C12 | 15p | OA79 | 8p | 2N911 | 50p |
| AF14 | 25p | C13 | 15p | OA81 | 8p | 2N914 | 20p |
| AF115 | 25p | C15 | 15p | OA85 | 8p | 2N918 | 42p |
| AF116 | 25p | C16 | 15p | OA90 | 8p | 2N1090 | 30p |
| AF117 | 25p | C18 | 15p | OA91 | 8p | 2N1091 | 33p |
| AF118 | 44p | C20 | 15p | OA95 | 8p | 2N1131 | 30p |
| AF124 | 25p | C22 | 15p | OA200 | 10p | 2N1132 | 30p |
| AF126 | 17p | C24 | 15p | OC202 | 10p | 2N1302 | 20p |
| AF19 | 37p | C27 | 15p | OC19 | 20p | 2N1303 | 20p |
| AF186 | 40p | C30 | 15p | OC20 | 97p | 2N1304 | 25p |
| AF239 | 37p | D13T1 | 45p | OC22 | 47p | 2N1305 | 25p |
| AS526 | 25p | MJES20 | 75p | OC23 | 60p | 2N1306 | 30p |
| AS527 | 30p | MJ480 | 97p | OC24 | 60p | 2N1307 | 30p |
| AS528 | 22p | MJ481 | £1.25 | OC25 | 37p | 2N1308 | 34p |
| AS529 | 30p | MJ490 | £1.00 | OC26 | 33p | 2N1309 | 31p |
| ASZ21 | 37p | MJ491 | £1.35 | OC28 | 60p | 2N1507 | 23p |
| AU10 | £1.50 | MPF102 | 43p | OC29 | 75p | 2N1613 | 25p |
| BA115 | 8p | MPF103 | 37p | OC35 | 50p | 2N1711 | 25p |
| BC107 | 12p | MPF104 | 37p | OC36 | 63p | 2N2147 | 82p |
| BC108 | 12p | MPF105 | 40p | OC41 | 25p | 2N2148 | 62p |
| BC109 | 12p | NKT124 | 30p | OC42 | 30p | 2N2160 | 63p |
| BC147 | 15p | NKT125 | 40p | OC45 | 15p | 2N2368 | 17p |
| BC148 | 15p | NKT126 | 37p | OC45 | 15p | 2N2369 | 17p |
| BC149 | 15p | NKT128 | 25p | OC71 | 15p | 2N2369A | 20p |
| BC158 | 17p | NKT135 | 26p | OC72 | 23p | 2N2646 | 50p |
| BC167 | 11p | NKT137 | 32p | OC75 | 23p | 2N2904 | 44p |
| BC168 | 11p | NKT210 | 25p | OC76 | 25p | 2N2904A | 49p |
| BC169 | 11p | NKT211 | 25p | OC77 | 40p | 2N2905 | 65p |
| BC182 | 12p | NKT212 | 25p | OC81 | 23p | 2N2905A | 75p |
| BC182L | 12p | NKT213 | 25p | OC81D | 20p | 2N2906 | 44p |
| BC182L | 10p | NKT214 | 23p | OC81Z | 55p | 2N2906A | 54p |
| BC183 | 9p | NKT215 | 21p | OC82 | 25p | 2N2926 all colours: | 10p |
| BC183L | 9p | NKT216 | 46p | OC82D | 15p | 2N3053 | 25p |
| BC184 | 15p | NKT217 | 50p | OC83 | 23p | 2N3054 | 63p |
| BC184L | 15p | NKT218 | 25p | OC84 | 25p | 2N3055 | 75p |
| BC212 | 17p | NKT219 | 25p | OC39 | 25p | 2N3056 | 11p |
| BC212L | 12p | NKT223 | 27p | OC140 | 35p | 2N3703 | 10p |
| BCY30 | 25p | NKT224 | 25p | OC170 | 25p | 2N3704 | 11p |
| BCY31 | 48p | NKT225 | 21p | OC171 | 30p | 2N3705 | 10p |
| BCY32 | 50p | NKT229 | 29p | OC200 | 37p | 2N3706 | 9p |
| BCY33 | 20p | NKT237 | 31p | OC201 | 47p | 2N3707 | 11p |
| BCY34 | 25p | NKT238 | 19p | OC202 | 65p | 2N3708 | 37p |
| BCY38 | 30p | NKT239 | 23p | OC203 | 37p | 2N3709 | 9p |
| BCY70 | 19p | NKT240 | 20p | OC204 | 40p | 2N3710 | 9p |
| BCY71 | 37p | NKT241 | 21p | OC205 | 65p | 2N3711 | 9p |
| BCY72 | 16p | NKT242 | 15p | OC206 | 75p | 2N3711 | 9p |
| BD121 | £1.10 | NKT243 | 56p | OC207 | 75p | 2N3819 | 35p |
| BD123 | £1.10 | NKT244 | 17p | OCP71/M | 47p | 2N3820 | 60p |
| BD124 | £1.03 | NKT245 | 17p | OCR12 | 50p | 2N3821 | 30p |
| BDY20 | £1.05 | NKT261 | 21p | ORP60 | 60p | 2N4058 | 17p |
| BF115 | 25p | NKT262 | 19p | ORP61 | 40p | 2N4060 | 20p |
| BF163 | 40p | NKT264 | 21p | P346A | 19p | 2N4062 | 20p |
| BF167 | 25p | NKT271 | 18p | ST140 | 15p | 2N4062 | 20p |
| BF173 | 30p | NKT272 | 17p | ST141 | 20p | 2N4284 | 15p |
| BF177 | 25p | NKT274 | 18p | TD716 | 60p | 2N4287 | 15p |
| BF178 | 57p | NKT275 | 25p | TIP31A | 65p | 2N4289 | 15p |
| BF180 | 37p | NKT279A | 12p | TIP32A | 74p | 2N4871 | 40p |
| BF181 | 37p | NKT281 | 29p | TS88A | 45p | 2N5254 | 45p |
| BF184 | 25p | NKT302 | 87p | V405A | 46p | 3N184 | £1.30 |
| BF185 | 25p | NKT304 | 79p | ZTX108 | 11p | 3N188 | 69p |
| BF194 | 17p | NKT351 | 75p | ZTX300 | 13p | 3N140 | 76p |
| BF195 | 15p | NKT351 | 75p | ZTX302 | 18p | 3N141 | 73p |
| BF196 | 15p | NKT402 | 77p | ZTX303 | 18p | 3N152 | 86p |
| BF200 | 35p | NKT403 | 65p | ZTX304 | 27p | 40250 | 55p |

BEST BUY IN TTL!!

SIEMENS QUALITY PLUS BARGAIN PRICES PLUS LST SERVICE

A full design range of high quality TTL available from LST your Officially Appointed Siemens Distributors

| Part No. | Description | Equal 1-24 25-99 100 up to | Part No. | Description | Equal 1-24 25-99 100 up to | Part No. | Description | Equal 1-24 25-99 100 up to |
|----------|--|----------------------------|----------|--|----------------------------|----------|---|----------------------------|
| FLH 101 | Quadruple 2-input NAND gate | 7400 20p 16p 14p | FLH 271 | Hex inverter with open collector output | 7405 25p 21p 18p | FLJ 141 | Dual D-type edge triggered flip-flop | 7474 46p 38p 33p |
| 111 | Triple 3-input NAND gate | 7410 20p 16p 14p | 281 | BCD to decimal decoder TTL output | 7442 £1.16 94p 81p | 151 | Quad bistable latch | 7475 45p 40p 37p |
| 121 | Dual 4-input NAND gate | 7420 20p 16p 14p | 291 | Quadruple 2-input NAND gate with open collector output | 7403 20p 16p 14p | 161 | Decade counter | 7490 80p 67p 57p |
| 131 | 8-input NAND gate | 7430 20p 16p 14p | 341 | Quadruple 2-input exclusive-OR element | 7486 33p 27p 23p | 171 | Divide-by-12 counter | 7492 85p 71p 61p |
| 141 | Dual 4-input NAND buffer | 7440 24p 20p 17p | 351 | Schmitt Trigger | 7413 35p 29p 25p | 181 | 4-bit binary counter | 7493 80p 67p 57p |
| 151 | Expandable dual 2-wide 2-input AND-OR-INVERT gate | 7450 20p 16p 14p | 361 | Excess 3 to decimal decoder | 7443 £1.45 £1.20 £1.08 | 191 | 4-bit shift register | 7495 87p 72p 62p |
| 161 | Dual 2-wide 2-input AND-OR-INVERT gate | 7451 20p 16p 14p | 371 | Excess 3 gray to decimal decoder | 7444 £1.45 £1.20 £1.08 | 201 | Synchronous up down 4-bit decade counter with one line mode control | 74190 £1.80 £1.48 £1.27 |
| 171 | Expandable 4-wide 2-input AND-OR-INVERT gate | 7453 20p 16p 14p | 381 | Quad 2-input positive AND gate Totem pole output | 7408 25p 21p 18p | 211 | Synchronous up down 4-bit binary counter with one line mode control | 74191 £1.80 £1.48 £1.27 |
| 181 | 4-wide 2-input AND-OR-INVERT gate | 7454 20p 16p 14p | 391 | Quad 2-input positive AND gate open collector | 7409 25p 21p 18p | 221 | 8-bit shift register | 7491A £1.28 £1.07 92p |
| 191 | Quadruple 2-input NOR gate | 7402 20p 16p 14p | FLY 101 | Dual 4-input expander | 7460 20p 16p 14p | 231 | 4-bit shift register | 7494 £1.13 94p 81p |
| 201 | Quadruple 2-input NAND gate with open collector output | 7401 20p 16p 14p | FLJ 101 | J-K flip flop | 7470 45p 37p 32p | 241 | Synchronous up down 4-bit decade counter | 74192 £1.74 £1.45 £1.25 |
| 211 | Hex inverter | 7404 25p 21p 18p | 111 | J-K master-slave flip-flop | 7472 32p 27p 23p | 251 | As above—binary counter | 74193 £1.74 £1.45 £1.25 |
| 221 | Gated full adder | 7480 67p 56p 48p | 121 | Dual J-K master-slave flip-flop | 7473 45p 40p 35p | 261 | 5-bit shift register | 7496 £1.48 £1.22 £1.05 |
| 231 | 2-bit binary full-adder | 7482 87p 73p 62p | 131 | Dual J-K master-slave flip-flop with preset and clear | 7476 45p 40p 36p | 271 | Dual J-K master-slave flip-flop with preset and clear | 74107 52p 43p 36p |
| 241 | Four-bit binary full adder | 7483 £1.32 £1.16 £1.00 | | | | 301 | Dual quadruple bistable latch | 74100 £1.64 £1.37 £1.17 |

TYPES MAY BE MIXED TO QUALIFY FOR PRICE BREAKS

CONTRACT ORDER PRICES AND BULK QUANTITY PRICES QUOTED ON REQUEST

ALL STOCKS ADVERTISED LAST MONTH STILL AVAILABLE

NO GIMMICKS!!
Our catalogue is Free postage appreciated (5p)

NEW PRODUCT!!

(Siemens Tantalum Bead Capacitors)

| Mfd. | Voltage | Mfd. | Voltage |
|------|---------|------|---------|
| 1 | 35 | 2.2 | 16 |
| 22 | 35 | 4.7 | 16 |
| 47 | 35 | 10 | 16 |
| 1 | 35 | 15 | 16 |
| 2.2 | 35 | 22 | 16 |
| 4.7 | 35 | 33 | 10 |
| 6.8 | 25 | 10 | 6.3 |
| 10 | 25 | 22 | 6.3 |
| 15 | 20 | 47 | 6.3 |
| | | 100 | 3 |

Epoxy encapsulated miniature sinter Tantalum Electrolytics—polarized
Size example: 10mfd 16v 4.5 x 7.5 mm.
All one price: 12p each; 25 pieces 1 type 10p each.

BZY88 SERIES ZENERS 400mW

| All voltages available 3.3 to 33 Volt | |
|---------------------------------------|-----------|
| 25 + 12p | 100 + 10p |
| 500 + 9p | 1000 + 8p |

SPECIAL OFFER IN 4000 SERIES 1 AMP RECTIFIERS

| p.i.v. | 50 + | 100 + |
|--------|--------------|-------|
| IN4001 | 50 070 060 | 050 |
| IN4002 | 100 070 065 | 060 |
| IN4003 | 200 090 085 | 070 |
| IN4004 | 400 100 090 | 080 |
| IN4005 | 600 120 100 | 090 |
| IN4006 | 800 140 130 | 110 |
| IN4007 | 1000 190 150 | 120 |

Should any item be out of stock we reserve the right to supply at higher voltage rated item at no extra charge.

TERMS: Cash with order please. Postage: 10p inland, 25p Europe, 60p elsewhere.
All goods carry manufacturers' warranty.
Counter Sales—Same Address.

Mullard Metallised Polyester C280 series

| Mfd. | Voltage | Mfd. | Voltage |
|-------|---------|------|---------|
| 0.01 | 16 | 3p | |
| 0.015 | 16 | 3p | |
| 0.022 | 16 | 3p | |
| 0.033 | 16 | 3p | |
| 0.047 | 16 | 4p | |
| 0.068 | 16 | 4p | |
| 0.1 | 16 | 4p | |
| 0.15 | 16 | 5p | |
| 0.22 | 16 | 5p | |
| 0.33 | 16 | 7p | |
| 0.47 | 16 | 8p | |
| 0.68 | 16 | 11p | |
| 1.0 | 16 | 14p | |
| 1.5 | 16 | 20p | |
| 2.2 | 16 | 24p | |

Mullard Electrolytic C437 series

| Mfd. | Voltage | Mfd. | Voltage |
|-------|---------|------|---------|
| 250 | 16 | 9p | |
| 400 | 16 | 12p | |
| 640 | 16 | 15p | |
| 1,000 | 16 | 18p | |
| 1,600 | 25 | 9p | |
| 250 | 25 | 12p | |
| 400 | 25 | 15p | |
| 640 | 25 | 18p | |
| 100 | 40 | 9p | |
| 160 | 40 | 12p | |
| 250 | 40 | 15p | |
| 400 | 40 | 18p | |

Mullard Sub-Miniature Ceramic Plate C333 series

63 volt working. Range 1.8pf to 220pf (usual pref. values).
Packs of 6 (any values) 15p

CAPACITORS—Mullard Miniature Electrolytic C426 series

| Mfd. | Voltage | Mfd. | Voltage |
|------|---------|------|---------|
| 2.5 | 16 | 8p | |
| 10 | 16 | 6p | |
| 20 | 16 | 6p | |
| 40 | 16 | 6p | |
| 80 | 16 | 6p | |
| 1.6 | 25 | 6p | |
| 6.4 | 25 | 6p | |
| 12.5 | 25 | 6p | |
| 25 | 25 | 6p | |
| 50 | 25 | 6p | |
| 80 | 25 | 6p | |
| 1 | 40 | 6p | |
| 4 | 40 | 6p | |
| 8 | 40 | 6p | |
| 16 | 40 | 6p | |
| 32 | 40 | 6p | |
| 50 | 40 | 6p | |

ENCAPSULATED BRIDGES

Type No. Current Rms. Volts.
W005 1 Amp 50 50p
W006 1 Amp 600 60p

R.C.A.

| | |
|---------|-------|
| CA3004 | £1.80 |
| CA3005 | £1.20 |
| CA3011 | 75p |
| CA3013 | £1.05 |
| CA3014 | £1.25 |
| CA3018 | 85p |
| CA3020 | £1.30 |
| CA3028A | 75p |
| CA3035 | 7p |
| CA3043 | £1.40 |
| CA3044 | £1.20 |
| CA3046 | 75p |
| CA3047 | £1.40 |
| CA3048 | £2.05 |
| CA3049 | £1.60 |
| CA3052 | £1.65 |
| CA3090Q | £3.46 |

OP-AMPS!!

| | |
|---------|-----|
| LM709C | 60p |
| LM741CN | 95p |

THYRISTORS

| | | |
|----------|--------------------------|-------|
| CR1/051C | 1 Amp 50 PIV TO-5 | 40p |
| CR1/401C | 1 Amp 400 PIV TO-5 | 50p |
| 2N3525 | 5 Amp 400 PIV TO-66 | £1.09 |
| 40739 | 10 Amp 400 PIV Stud Mtg. | £1.65 |

LINEAR AND DIGITAL ICs

| | | |
|----------------|-------|---------|
| Fairchild 1-11 | 12-24 | 25+ |
| µL900 | 40p | 35p 32p |
| µL914 | 40p | 35p 32p |
| µL923 | 53p | 50p 47p |

Devices may be mixed to qualify for quantity price.

MISCELLANEOUS

| | | |
|-------|------------------|-------|
| PA230 | Pre-amp | £1.10 |
| PA234 | 1 watt Amp | £1.00 |
| PA237 | 2 watt Amp | £1.87 |
| PA246 | 5 watt Amp | £2.63 |
| PA424 | Zero Volt Switch | £2.45 |

PHASE LOCKED LOOP £9.98

LST break the price barrier on this fantastic device. M565 Phase locked loop IC now ex stock—data 10p.

ULTRASONIC TRANSDUCERS

Operate at 40 kc/s. Can be used for remote control systems without cables or electronic links. Type 1404 transducers can transmit and receive.
FREE: With each pair our complete transmitter and receiver circuit.
PRICE (Sold only in pairs) £5.90

LST ELECTRONIC LTD

Mail Order Dept.: (PE) 7 Coptford Road, Brentwood, Essex
Industrial Sales Dept.: Tel.: Brentwood 226470/1 Telex 99443

SPECIAL PURCHASE !

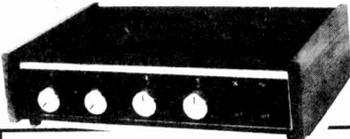
BRAND NEW FM MULTIPLEX STEREO DECODER UNITS. Manufactured by PHILIPS. Size 7" x 3 1/2" x 1 1/2". All transistor 24V. at 6mA. Supplied pre-aligned with full circuit diagram and connection details. 24 each. Post free.

FEW ONLY—LEAK MK I TRANSCRIPTION PICK-UP ARMS. Using the world famous gimbal pivot system. Complete but less pick-up head. £2-50. P. & P. 20p.

INPUT MATCHING TRANSFORMER. Beautifully made in heavy Mu-metal cylindrical case for minimum hum pick-up. Size 1 1/2" high x 1 1/2" dia. Ratio 150:1 approx. Especially suitable for matching dynamic or ribbon mikes or pick-up from low to high impedance or vice versa. 75p each. Post Free.

BLACK ANODISED 16g. ALUMINIUM HEAT SINKS. For TO3, complete with mica's and bushes. Size 2 1/2" x 3" approx. 25p pair. P. & P. 5p.

HARVERSON SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED PRINTED CIRCUIT BOARD FOR EASY CONSTRUCTION

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output 14W r.m.s. per channel into 8 ohms. Frequency response ±3dB 12-30,000Hz. Sensitivity better than 80mV into 1MΩ. Fullpower bandwidth ±3dB 12-15,000Hz. Bass boost approx. to -12dB. Treble cut approx. to -16dB. Negative feedback 18dB over main amp. Power requirements 25V at 1-0 amp. Overall size—12" wide, 8" deep, 2 1/2" high. Fully detailed 7-page construction manual and parts list free with kit or send 18p plus large S.A.E.

PRICES AMPLIFIER KIT. £10-50 P. & P. 15p. POWER PACK KIT. £3 P. & P. 30p. CABINET. 25 P. & P. 30p.

Post Free if all units purchased at same time. Full after sales service. Also available ready built and tested, £20-50. Post Free.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mixer, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.

SPECIAL PURCHASE OF MANUFACTURER'S SURPLUS! All Transistor F.M. tuner head with twin A.M. Gang incorporated. Beautifully engineered with precision gear reduction drive. F.M. R.F. Transistor, oscillator/Mixer and first I.P. stage (10.7 Mc/s output) with optional AFC connection. Built on printed circuit panel and fully screened. Extremely stable over range 88-108 Mc/s. Brand new and pre-aligned. Size 2 1/2in H. x 1 1/2in W. x 2 1/2in D. For 6V D.C. at 2.8mA. A.M. Gang fitted with trimmers which can be connected to standard A.M. aerial and oscillator circuits if required. **LIMITED NUMBER. Only £2-25 post free.** Connection details supplied.

HIGH GRADE COPPER LAMINATE BOARDS 8x6x 1/4in. FIVE for 50p. P. & P. 13p.

TELESCOPIC AERIALS WITH SWIVEL JOINT. Can be angled and rotated in any direction. 6 section Laquerred Brass. Extends from 6in. to approx. 22 1/2in. Maximum diameter 1/4in. 25p each. P. & P. 5p.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240V. Secondary combinations: 0-5-10-15-20-25-30-35-40-60V half wave at 1 amp or 10-0-10, 20-0-20, 30-0-30V, at 2 amps full wave. Size 3inL x 3 1/2inW x 3inD. Price £1-75. P. & P. 30p.

MAINS TRANSFORMER. For transistor power supplies. Pri. 200/240V. Sec. 9-0-9 at 500mA. 70p. P. & P. 13p. Pri. 200/240V. Sec. 12-0-12 at 1 amp. 85p. P. & P. 13p. Pri. 200/240V. Sec. 10-0-10 at 2 amp. £1-38. P. & P. 30p. Tapped Primary 200-220-240V. Sec. 21-5V at 500mA. 65p. P. & P. 13p.

Open 9-5.30 Monday to Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station

SPECIAL OFFER!! HI-FI LOUSPEAKER SYSTEM

Beautifully made teak finish enclosure with most attractive Tygan-Vynair front. Size 16 1/2in high x 10 1/2in wide x 5 1/2" deep. Fitted with E.M.I. Ceramic Magnet 13in x 8in bass unit, two H.F. tweeter units and crossover. Power handling 10W. Available 3, 8 or 15 ohm impedance.

Our Price £8-40 Carr. 65p.
CABINET AVAILABLE SEPARATELY £4-50. Carr. 60p.

Also available in 8 ohm with EMI 13in x 8in. bass speaker with parasitic tweeter. £8-50. Carr. 65p.

LOUSPEAKER BARGAINS

3in 4 ohm 50p. P. & P. 13p. 5in 3 ohm 80p. P. & P. 15p. 7 x 4in 3 ohm £1-05. P. & P. 20p. 10 x 6in 3 or 15 ohm £1-90. P. & P. 30p. E.M.I. 8 x 5in 3 ohm with high flux magnet £1-62. P. & P. 20p. E.M.I. 13 x 8in 3 ohm with high flux ceramic magnet £2-10 (15 ohm £2-25). P. & P. 30p. E.M.I. 13 x 8in, 3 or 8 or 15 ohm with two inbuilt tweeters and crossover network £4-20. P. & P. 30p. E.M.I. 13 x 8 in twin cone (parasitic tweeter) 8 ohm £2-25. P. & P. 30p.

BRAND NEW. 12in 15W HiD Speakers, 3 or 15 ohm. Current production by well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly £2-50. Guitar models: 25W £2-60. 35W £2-50. P. & P. 38p each.

E.M.I. 3in HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3, 8 or 15 ohm 88p each. P. & P. 13p.

12in "RA" TWIN CONE LOUSPEAKER 10 watts peak handling, 3 or 15 ohm, £2-20. P. & P. 30p. 35 ohm SPEAKERS 3". ONLY 83p. P. & P. 13p.

VYNAIR & BEXINE SPEAKERS & CABINET FABRICS app. 64 in. wide. Usually £1-75 yd., our price 75p yd. length. P. & P. 15p (min. 1 yd.). S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam ear-muffs. Wired and fitted with standard stereo 3in jack plug. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. PRICE £2-95. P. & P. 15p.

SINGLE HEADPHONE. With aluminium headband. Approx. 200 ohm. 95p. P. & P. 8p.

CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity. 83p. P. & P. 8p.

HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE £1-05. P. & P. 8p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER. For P.U. Tape, Mike, Guitar, etc., and suitable for use with valve or transistor equipment. 0-18V. Battery or from H.T. line 200/300V. Frequency response 15Hz-25KHz. Gain 26dB. Solid encapsulation size 1 1/2 x 1 1/2 in. Brand new — complete with instructions. Price 88p. P. & P. 13p.

BRAND NEW E.M.I. LIGHTWEIGHT PICK-UP ARM WITH ARM REST. Fitted mono T/O stylus and cartridge for LP/78. ONLY £1. P. & P. 8p.

QUALITY RECORD PLAYER AMPLIFIER MK II A top-quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7 1/2in x 9 1/2in x 6 1/2in. Ready built and tested. PRICE £3-75. P. & P. 40p. ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit cabinet below. PRICE £4-88. P. & P. 50p.

DE LUXE QUALITY PORTABLE R/P CABINET MK II 1/2 cut motor board size 14 1/2 x 12in., clearance 2in. below, 5 1/2in. above. Will take above amplifier and any B.S.R. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 x 15 x 6in. PRICE £3-98. P. & P. 50p.

10/14 WATT HI-FI AMPLIFIER KIT

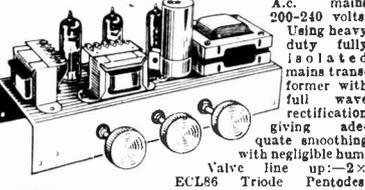
A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate bass and treble inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and E280 rectifier. Simple instruction booklet 13p (Free with parts). All parts sold separately. ONLY £7-87. P. & P. 55p. Also available ready built and tested complete with std. input sockets, £8-97. P. & P. 55p.

BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched pair) 75p; V15/10p, 50p; OC71 25p; OC76 30p; AF117 18p; 2G339 (NPN) 15p. Set of Mullard 6 transistors OC44, 2-OC45, AC128D, matched pair AC128; ORP21 Cadmium Sulphide Cell 53p. All post free.

SPECIAL PURCHASE ! SPEAKER CABINET FROM FAMOUS MAKER !

Beautifully made all-wooden construction cabinet with medium walnut finish front, gold anodised expanded aluminium grille and dark sides. Approx. size overall 11 1/2" high x 5" deep x 13 1/2" wide at base. Easily removable baffle cut out for 8" speaker. Fibre board back. Could accommodate amplifier or radio together with speaker. An expensively made cabinet at a give-away price.
LIMITED NUMBER ONLY £1-38 Post Free.

DE LUXE STEREO AMPLIFIER



A.c. mains 200-240 volts. Using heavy duty fully plated heavy gauge metal chassis, size 7 1/2in W. x 4in. D. x 4 1/2in H. Incorporates ECC83, EL84, E280 valves. Heavy duty double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and tone with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 43 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £4-75. P. & P. 35p.

4-SPEED RECORD PLAYER BARGAINS Mains models. All brand new in maker's packing. LATEST B.S.R. C109/A21 4-SPEED AUTOCHANGER. With latest mono compatible cartridge £6-97. Carr. 50p. With stereo cartridge £7-97. Carr. 50p.

SUITABLE PLINTH UNIT FOR ABOVE with rigid plastic cover. £5-75 complete. P. & P. 50p.

LATEST GARRARD MODELS. All types available 1025, 2025, SP25, 3000, AT80, etc. S.A.E. for Latest Prices! PLINTH UNITS cut out for Garrard Models 1025, 2025, 2000, 3000, 3500, etc. With rigid transparent plastic cover. Special design enables above models to be used with cover in position. Also suitable for housing AT60 and SP25. OUR PRICE £5-75 complete. P. & P. 50p.

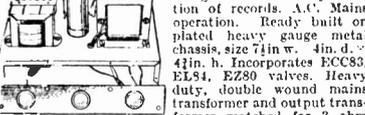
LATEST ACOS GP91/18C Mono Compatible Cartridge with T/O stylus for LP/EP/78. Universal mounting bracket. £1-50. P. & P. 8p.

SONOTONE 97AHC COMPATIBLE STEREO CARTRIDGE T/O stylus. Diamond Stereo LP and Sapphire 78. ONLY £2-50. P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3. P. & P. 10p.

LATEST RONETTE T/O Stereo Compatible Cartridge for EP/LP/Stereo/78. £1-63. P. & P. 10p.

LATEST RONETTE T/O Mono Compatible Cartridge for EP/LP/78 mono or stereo records on mono equipment. £1-50. P. & P. 10p.

3-VALVE AUDIO AMPLIFIER HA34 MK II



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2in W. x 4in. D. x 4 1/2in H. Incorporates ECC83, EL84, E280 valves. Heavy duty double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and tone with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 43 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £4-75. P. & P. 35p.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £3-98. P. & P. 40p.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. AC mains 200/240V. Supplied absolutely Brand New, completely wired and tested with good quality output transformer. FEW ONLY.

OUR ROCK BOTTOM BARGAIN PRICE £2-75 P. & P. 35p

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES

A must for servicemen and home constructors. 1971 edition including many 1000's of British, U.S.A., European and Japanese transistors. ONLY 40p. Post 5p.

HARVERSON SURPLUS CO. LTD.

170 HIGH ST., MERTON, LONDON, S.W.19 Tel. 01-540 3985

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

Build yourself a TRANSISTOR RADIO

NEW! ROAMER 10 WITH VHF INCLUDING AIRCRAFT

10 TRANSISTORS. 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER BAND, VHF AND AIRCRAFT BAND.

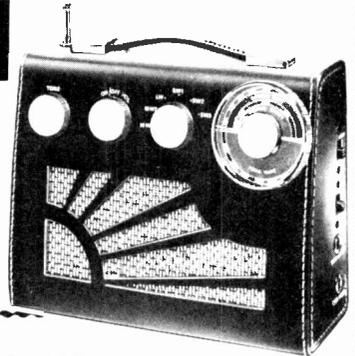
Built-in ferrite rod aerial for MW/LW. Retractable, chrome plated 7 section telescopic aerial, can be angled and rotated for peak short wave and VHF listening. Push-pull output using 600mW transistors. Car Aerial and tape record sockets. Switched earpiece socket complete with earpiece. 10 transistors plus 3 diodes. 7in x 4in speaker. Air spaced ganged tuning condenser with VHF section. Volume/on/off, wave change and tone controls. Attractive case in black with silver blocking. Size 9in x 7in x 4in.

Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts).

TOTAL BUILDING COSTS

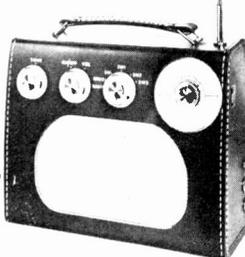
£8.50

P.P. & INS. 50p
(OVERSEAS P. & P. £1)



ROAMER EIGHT Mk. I

NOW WITH SWITCHED TONE CONTROL



7 TUNABLE WAVEBANDS: MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND. Built-in ferrite rod aerial for MW and LW. Retractable chrome plated telescopic aerial for short waves. Push-pull output using 600mW transistors. Car aerial and tape record sockets. Selectivity switch. Switched earpiece socket complete with earpiece. 8 transistors plus 3 diodes. 7in x 4in speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9in x 7in x 4in approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 25p (FREE with parts).

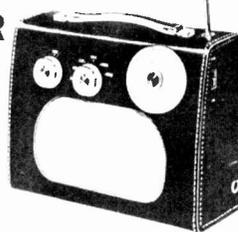
TOTAL BUILDING COSTS **£6.98** P. P. & INS. 41p (OVERSEAS P. & P. £1)

ROAMER SEVEN Mk. IV

7 TUNABLE WAVEBANDS: MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND.

Extra medium waveband provides easier tuning of Radio Luxembourg, etc. Built-in ferrite rod aerial for MW and LW. Retractable 4 section 24in chrome plated telescopic aerial for SW. Socket for car aerial. Powerful push-pull output. 7 transistors and 2 diodes, including micro-alloy R.F. transistors. 7in x 4in P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle. Size 9in x 7in x 4in approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 10p (FREE with parts). Earpiece with plug and switched socket for private listening. 30p extra.

TOTAL BUILDING COSTS **£5.98** P. P. & INS. 41p (OVERSEAS P. & P. £1)

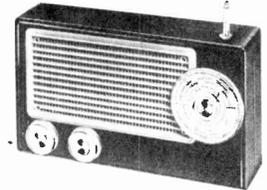


ROAMER SIX

6 TUNABLE WAVEBANDS: MW, LW, SW1, SW2, TRAWLER BAND PLUS AN EXTRA MW BAND FOR EASIER TUNING OF LUXEMBOURG, ETC.

Sensitive ferrite rod aerial and telescopic aerial for short waves. 3in speaker. 8 stages—6 transistors and 2 diodes including micro-alloy R.F. transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9in x 5 1/2in x 2 1/2in approx. Easy build plans and parts price list 15p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

TOTAL BUILDING COSTS **£3.98** P. P. & INS. 26p (OVERSEAS P. & P. £1)

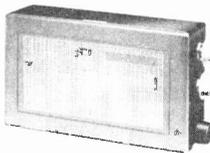


POCKET FIVE

3 TUNABLE WAVEBANDS: MW, LW, TRAWLER BAND WITH EXTENDED MW BAND FOR EASIER TUNING OF LUXEMBOURG, ETC.

7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5 1/2in x 1 1/2in x 3 1/2in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

TOTAL BUILDING COSTS **£2.23** P. P. & INS. 21p (OVERSEAS P. & P. 63p)

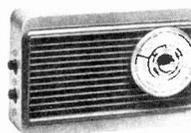


TRANSONA FIVE

NOW WITH 3in SPEAKER

3 TUNABLE WAVEBANDS: MW, LW AND TRAWLER BAND. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone 3in moving coil speaker. Attractive case with red speaker grille. Size 6 1/2in x 4 1/2in x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

TOTAL BUILDING COSTS **£2.50** P. P. & INS. 22p (OVERSEAS P. & P. 63p)

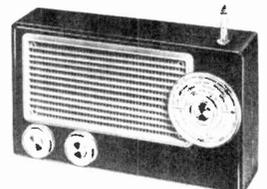


TRANS EIGHT

6 TUNABLE WAVEBANDS: MW, LW, SW1, SW2, SW3 AND TRAWLER BAND.

Sensitive ferrite rod aerial for MW and LW. Telescopic aerial for short waves. 3in speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9in x 5 1/2in x 2 1/2in approx. Push-pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 20p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

TOTAL BUILDING COSTS **£4.48** P. P. & INS. 31p (OVERSEAS P. & P. £1)

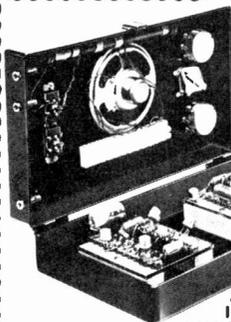


NEW! "EDU-KIT"

BUILD RADIOS, AMPLIFIERS, ETC., FROM EASY STAGE DIAGRAMS. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT. Components include: Tuning Condenser; 2 Volume Controls; 2 Slider Switches; 4 x 2 1/2" Speaker; Terminal Strip; Ferrite Rod Aerial; 3 Plugs and Sockets; Battery Clips; 4 Tag Boards; Balanced Armature Unit; 10 Transistors; 4 Diodes; Resistors; Capacitors; Three 4in Knobs.

Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.

ALL PARTS INCLUDING CASE AND PLANS **£5.50** P. P. & INS. 31p (OVERSEAS P. & P. £1)



RADIO EXCHANGE LTD

61 HIGH STREET, BEDFORD.

Tel. 0234 52367

I enclose £..... please send items marked

- | | | | |
|---------------|--------------------------|--------------|--------------------------|
| ROAMER TEN | <input type="checkbox"/> | ROAMER SEVEN | <input type="checkbox"/> |
| ROAMER EIGHT | <input type="checkbox"/> | TRANS EIGHT | <input type="checkbox"/> |
| TRANSONA FIVE | <input type="checkbox"/> | ROAMER SIX | <input type="checkbox"/> |
| POCKET FIVE | <input type="checkbox"/> | EDU-KIT | <input type="checkbox"/> |

Parts price list and plans for.....

Name

Address

P.E. 34

FULL AFTER SALES SERVICE

- ★ Callers side entrance Barratts Shoe Shop
- ★ Open 10-1, 2.30-4.30 Monday-Friday, 9-12 Saturday

LARGEST STOCKS WIDEST RANGE SEMICONDUCTORS & COMPONENTS BRAND NEW GUARANTEED

TRANSISTORS

| | | | | | | | | | |
|-----------|-------|---------|-------|--------|-------|--------|--------|---------|--------|
| 2G301 | 20p | 2N3400 | 45p | 4031 | 35p | BC172 | 15p | BSW70 | 27p |
| 2G302 | 20p | 2N3414 | 22p | 40312 | 47p | BC175 | 27p | BX19 | 17p |
| 2G303 | 20p | 2N3415 | 22p | 40314 | 37p | BC182 | 10p | BX20 | 17p |
| 2G306 | 42p | 2N3416 | 22p | 40319 | 47p | BC184 | 11p | BX21 | 17p |
| 2G308 | 30p | 2N3417 | 37p | 40323 | 30p | BC184 | 11p | BX22 | 17p |
| 2G309 | 30p | 2N3570 | 11-25 | 40324 | 37p | BC212L | 13p | BX26 | 45p |
| 2G371 | 15p | 2N3572 | 97p | 40326 | 37p | BCY30 | 27p | BX27 | 47p |
| 2G374 | 20p | 2N3605 | 27p | 40329 | 30p | BCY31 | 30p | BX28 | 30p |
| 2G381 | 22p | 2N3606 | 27p | 40344 | 27p | BCY32 | 50p | BX29 | 30p |
| 2N404 | 22p | 2N3607 | 22p | 40347 | 57p | BCY33 | 25p | BX30 | 22p |
| 2N696 | 20p | 2N3702 | 11p | 40348 | 52p | BCY34 | 30p | BX31 | 22p |
| 2N697 | 20p | 2N3703 | 11p | 40348 | 52p | BCY34 | 30p | BX32 | 22p |
| 2N698 | 25p | 2N3704 | 11p | 40380 | 42p | BCY39 | 60p | BX37 | 27p |
| 2N706 | 12p | 2N3705 | 10p | 40382 | 57p | BCY40 | 50p | BX78 | 27p |
| 2N706A | 12p | 2N3706 | 9p | 40370 | 32p | BCY42 | 15p | BX79 | 27p |
| 2N708 | 15p | 2N3707 | 11p | 40406 | 57p | BCY43 | 15p | BXV11 | 27p |
| 2N709 | 62p | 2N3708 | 7p | 40407 | 57p | BCY44 | 35p | BXV12 | 27p |
| 2N718 | 20p | 2N3709 | 9p | 40407 | 57p | BCY45 | 22p | BXV25 | 15p |
| 2N726 | 20p | 2N3710 | 9p | 40408 | 52p | BCY59 | 22p | BXV26 | 17p |
| 2N727 | 20p | 2N3711 | 11p | 40410 | 62p | BCY60 | 97p | BXV27 | 17p |
| 2N914 | 17p | 2N3715 | 11-28 | 40487A | 57p | BCY70 | 20p | BXV28 | 17p |
| 2N916 | 17p | 2N3716 | 11-30 | 40488A | 35p | BCV71 | 25p | BXV29 | 27p |
| 2N918 | 30p | 2N3791 | 28-06 | 40673 | 57p | BCV72 | 17p | BXV32 | 25p |
| 2N929 | 22p | 2N3817 | 35p | 40673 | 57p | BCV73 | 22p | BXV36 | 22p |
| 2N930 | 22p | 2N3823 | 37p | AC107 | 30p | BCZ11 | 42p | BXV36 | 22p |
| 2N1090 | 22p | 2N3854 | 27p | AC126 | 20p | BD116 | 21-121 | BXV37 | 25p |
| 2N1091 | 22p | 2N3854A | 27p | AC127 | 25p | BD121 | 65p | BXV39 | 22p |
| 2N1131 | 25p | 2N3855 | 27p | AC128 | 20p | BD123 | 82p | BXV40 | 22p |
| 2N1132 | 25p | 2N3856A | 30p | AC154 | 22p | BD124 | 60p | BXV41 | 22p |
| 2N1302 | 17p | 2N3856 | 30p | AC176 | 26p | BD131 | 75p | BXV42 | 32p |
| 2N1303 | 17p | 2N3858A | 35p | AC187 | 62p | BD132 | 35p | BXV43 | 37p |
| 2N1304 | 22p | 2N3859 | 25p | AC188 | 37p | BDY10 | 21-371 | BXV53 | 37p |
| 2N1305 | 22p | 2N3858A | 30p | ACV17 | 27p | BDY11 | 21-621 | BXV54 | 40p |
| 2N1306 | 25p | 2N3859 | 27p | ACV18 | 25p | BDY12 | 21-65 | BXV56 | 90p |
| 2N1307 | 25p | 2N3859A | 32p | ACV19 | 25p | BDY18 | 21-75 | BXV78 | 47p |
| 2N1308 | 30p | 2N3860 | 30p | ACV20 | 25p | BDY19 | 21-97 | BXV79 | 45p |
| 2N1309 | 30p | 2N3866 | 21-60 | ACV21 | 25p | BDY20 | 21-121 | BXV82 | 52p |
| 2N1507 | 17p | 2N3877 | 40p | ACV22 | 20p | BDY21 | 21-121 | BXV90 | 57p |
| 2N1613 | 25p | 2N3877A | 40p | ACV28 | 20p | BDY60 | 21-25 | BXV95A | 12p |
| 2N1631 | 35p | 2N3900 | 37p | ACV41 | 20p | BDY61 | 21-25 | C111 | 75p |
| 2N1632 | 30p | 2N3900A | 40p | ACV41 | 20p | BDY62 | 21 | C424 | 27p |
| 2N1637 | 30p | 2N3901 | 97p | ACV44 | 40p | BF115 | 25p | C425 | 55p |
| 2N1638 | 27p | 2N3903 | 35p | AD140 | 52p | BF117 | 47p | C426 | 40p |
| 2N1671B | 27p | 2N3904 | 35p | AD149 | 57p | BF163 | 37p | C428 | 37p |
| 2N1711 | 82p | 2N3905 | 37p | AD150 | 62p | BF173 | 18p | C430 | 30p |
| 2N1889 | 32p | 2N3906 | 37p | AD150 | 62p | BF173 | 18p | C430 | 30p |
| 2N1893 | 37p | 2N4058 | 17p | AD161 | 37p | BF177 | 30p | D13T1 | 62p |
| 2N2147 | 82p | 2N4059 | 10p | AD162 | 37p | BF178 | 30p | D13T2 | 62p |
| 2N2148 | 57p | 2N4060 | 12p | AF106 | 42p | BF179 | 30p | D13T3 | 62p |
| 2N2160 | 57p | 2N4061 | 12p | AF114 | 25p | BF180 | 35p | D16P1 | 40p |
| 2N2193 | 42p | 2N4062 | 12p | AF115 | 25p | BF181 | 35p | D16P2 | 40p |
| 2N2193A | 42p | 2N4244 | 47p | AF118 | 25p | BF184 | 35p | D16P3 | 40p |
| 2N2194A | 30p | 2N4285 | 17p | AF117 | 25p | BF185 | 42p | GET102 | 30p |
| 2N2217 | 27p | 2N4286 | 17p | AF118 | 62p | BF194 | 17p | GET113 | 20p |
| 2N2218 | 32p | 2N4287 | 17p | AF119 | 20p | BF195 | 15p | GET114 | 20p |
| 2N2219 | 32p | 2N4288 | 17p | AF124 | 22p | BF196 | 15p | GET118 | 20p |
| 2N2220 | 25p | 2N4289 | 17p | AF125 | 20p | BF197 | 42p | GET119 | 20p |
| 2N2221 | 25p | 2N4290 | 17p | AF126 | 20p | BF198 | 42p | GET120 | 57p |
| 2N2222 | 30p | 2N4291 | 17p | AF127 | 17p | BF200 | 52p | GET733 | 12p |
| 2N2287 | 11-07 | 2N4292 | 12p | AF127 | 17p | BF224 | 14p | GET880 | 30p |
| 2N2297 | 30p | 2N4303 | 47p | AF130 | 37p | BF225 | 19p | GET887 | 20p |
| 2N2308 | 17p | 2N5027 | 52p | AF179 | 72p | BF237 | 23p | GET889 | 22p |
| 2N2309 | 17p | 2N5028 | 57p | AF180 | 52p | BF238 | 23p | GET890 | 22p |
| 2N2369A | 42p | 2N5029 | 47p | AF181 | 42p | BF245 | 25p | GET896 | 22p |
| 2N2410 | 42p | 2N5030 | 47p | AF181 | 42p | BFW58 | 27p | GET897 | 22p |
| 2N2483 | 27p | 2N5172 | 12p | AF239 | 42p | BFW59 | 25p | GET898 | 22p |
| 2N2484 | 32p | 2N5174 | 52p | AF279 | 47p | BFW60 | 25p | GET979 | 22p |
| 2N2539 | 22p | 2N5175 | 52p | AF280 | 62p | BFW61 | 47p | MJ400 | 21-071 |
| 2N2540 | 22p | 2N5176 | 40p | AF211 | 32p | BFX12 | 22p | MJ420 | 21-12 |
| 2N2543 | 35p | 2N5232A | 30p | AF245 | 32p | BFX13 | 22p | MJ421 | 21-12 |
| 2N2614 | 30p | 2N5233 | 40p | ASV27 | 37p | BFX14 | 22p | MJ440 | 65p |
| 2N2646 | 52p | 2N5246 | 42p | ASV28 | 27p | BFX30 | 30p | MJ480 | 97p |
| 2N2696 | 32p | 2N5249 | 67p | ASV29 | 27p | BFX43 | 37p | MJ481 | 21-05 |
| 2N2711 | 25p | 2N5265 | 23-25 | ASV36 | 25p | BFX44 | 37p | MJ490 | 21-05 |
| 2N2712 | 25p | 2N5266 | 22-75 | ASV50 | 25p | BFX68 | 67p | MJ491 | 21-371 |
| 2N2713 | 27p | 2N5267 | 22-82 | ASV51 | 32p | BFX84 | 25p | MJ1800 | 22-171 |
| 2N2714 | 62p | 2N5306 | 37p | ASV54 | 32p | BFX85 | 25p | MJE340 | 62p |
| 2N2863 | 62p | 2N5306 | 40p | ASV55 | 25p | BFX86 | 25p | MJE320 | 60p |
| 2N2904 | 30p | 2N5307 | 37p | ASV86 | 32p | BFX87 | 27p | MJE321 | 73p |
| 2N2904A | 32p | 2N5308 | 37p | ASZ21 | 42p | BFX88 | 25p | MJE2955 | 57p |
| 2N2905 | 37p | 2N5309 | 62p | AU103 | 21-25 | BFX89 | 62p | MJE3055 | 57p |
| 2N2906A | 40p | 2N5310 | 42p | BC107 | 10p | BFX93A | 70p | MPF102 | 42p |
| 2N2906 | 25p | 2N5354 | 27p | BC108 | 10p | BFY10 | 32p | MPF103 | 37p |
| 2N2907 | 30p | 2N5355 | 27p | BC109 | 10p | BFY11 | 42p | MPF104 | 37p |
| 2N2923 | 15p | 2N5356 | 47p | BC113 | 15p | BFY18 | 32p | MPS8638 | 32p |
| 2N2924 | 15p | 2N5366 | 32p | BC115 | 15p | BFY19 | 32p | NKT0013 | 47p |
| 2N2925 | 15p | 2N5367 | 57p | BC116A | 15p | BFY20 | 21-80 | NKT0113 | 47p |
| 2N2926 | 15p | 2N5377 | 47p | BC118 | 10p | BFY21 | 42p | NKT1211 | 47p |
| .. Green | 14p | 2N6086 | 75p | BC121 | 20p | BFY24 | 45p | NKT1212 | 47p |
| .. Yellow | 12p | 2N6202 | 82p | BC122 | 20p | BFY25 | 25p | NKT1213 | 47p |
| .. Orange | 12p | 2N6202 | 50p | BC125 | 20p | BFY26 | 20p | NKT1216 | 27p |
| 2N3011 | 30p | 2N6103 | 25p | BC126 | 20p | BFY29 | 50p | NKT1217 | 27p |
| 2N3014 | 32p | 2N6104 | 25p | BC140 | 37p | BFY30 | 50p | NKT1218 | 27p |
| 2N3053 | 15p | 2N5501 | 32p | BC147 | 10p | BFY41 | 50p | NKT135 | 32p |
| 2N3054 | 42p | 2N5502 | 37p | BC148 | 10p | BFY43 | 62p | NKT136 | 32p |
| 2N3055 | 62p | 2N5503 | 27p | BC149 | 10p | BFY50 | 23p | NKT137 | 32p |
| 2N3133 | 30p | 2N128 | 70p | BC152 | 17p | BFY51 | 20p | NKT138 | 32p |
| 2N3134 | 30p | 2N139 | 11-27 | BC157 | 22p | BFY52 | 23p | NKT139 | 30p |
| 2N3135 | 25p | 2N140 | 77p | BC158 | 17p | BFY53 | 17p | NKT140 | 22p |
| 2N3136 | 25p | 2N141 | 77p | BC159 | 12p | BFY54 | 17p | NKT141 | 22p |
| 2N3390 | 25p | 2N142 | 55p | BC160 | 62p | BFY55 | 57p | NKT142 | 22p |
| 2N3391 | 20p | 2N143 | 67p | BC160 | 62p | BFY76 | 42p | NKT143 | 22p |
| 2N3391A | 30p | 2N152 | 87p | BC167 | 11p | BFY77 | 57p | NKT144 | 22p |
| 2N3392 | 17p | R.C.A.— | — | BC168B | 10p | BFY90 | 67p | NKT145 | 22p |
| 2N3393 | 15p | 40050 | 55p | BC168C | 11p | BFX25 | 21-85 | NKT146 | 22p |
| 2N3394 | 15p | 40244 | 22p | BC169B | 11p | BFX29 | 21-80 | NKT147 | 22p |
| 2N3402 | 25p | 40251 | 87p | BC169C | 12p | BFY10 | 41-45 | NKT148 | 22p |
| 2N3403 | 22p | 40309 | 32p | BC170 | 12p | BFY39 | 47p | NKT149 | 22p |
| 2N3404 | 32p | 40310 | 45p | BC171 | 15p | BSW41 | 42p | NKT150 | 22p |

D.C. PANEL METERS

MR38 SERIES—FACE SIZE 42 x 42mm. ALL PRICES FOR 1-9 PIECES.

| |
|--|
| 50μA, 22-00; 100μA, 21-871; 200μA, 21-76; 500μA, 21-50; 50-0-50μA, 21-872; 100-0-100μA, 21-75; 500-0-500μA, 21-871; 1mA, 21-371; 5mA, 20-371; 10mA, 21-371; 50mA, 21-871; 100mA, 21-371; 500mA, 21-371; 1A, 21-371; 5A, 21-371; 10V, 21-371; 20V, 21-371; 50V, 21-371; 300V, 21-371; 500V, 21-371. |
|--|

SILICON RECTIFIERS

| | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|--------|
| PIV | 50 | 100 | 200 | 400 | 600 | 800 | 1000 | 1200 |
| 1A | 10p | 12p | 15p | 18p | 17p | 19p | 20p | — |
| 3A | 15p | — | — | 22p | — | 30p | — | — |
| 6A | — | — | 25p | 30p | 32p | 35p | 50p | — |
| 10A | — | 52p | 57p | 65p | 77p | 87p | 97p | 11-25 |
| 17A | — | 57p | 62p | 77p | 90p | 97p | 11-20 | 11-571 |

1A and 3A are plastic encapsulation.

DIODES & RECTIFIERS

| | | | | | | | |
|--------|--------|-------|-----|-------|-----|-------|-----|
| IN914 | 7p | 18940 | 7p | BAX13 | 12p | BYZ13 | 25p |
| IN916 | 7p | AA119 | 10p | BAX16 | 12p | OA5 | 17p |
| IN4007 | 22p | AA129 | 10p | BAX18 | 17p | OA8 | 10p |
| IN4148 | 7p | AAZ13 | 10p | BAX31 | 7p | OA10 | 22p |
| IN5145 | 22-371 | AAZ15 | 12p | BAX38 | 25p | OA47 | 7p |
| 1844 | 10p | AAZ17 | 12p | BY100 | 17p | OA70 | 7p |
| 18113 | 15p | BA100 | 15p | BY103 | 22p | OA73 | 10p |
| 18120 | 15p | BA102 | 22p | BY122 | 37p | OA79 | 9p |
| 18121 | 17p | BA110 | 32p | BY126 | 15p | OA81 | 7p |
| 18130 | 12p | BA115 | 7p | BY127 | 17p | OA85 | 7p |
| 18131 | 12p | BA141 | 32p | BY164 | 52p | OA90 | 7p |
| 18132 | 15p | BA142 | 32p | BYX10 | 22p | OA91 | 7p |
| 18920 | 7p | BA144 | 12p | BYX | | | |

**LOW COST ELECTRONIC AND SCIENTIFIC
EQUIPMENT AND COMPONENTS**

RELAYS

Omron Midget Power Relay Mk. 1

Coil 230V a.c. 50Hz. Contacts SPDT 5A. Faulty plating on frame—electrically good. 5 for £1.50 post free.

Sangamo Type S115 Miniature Moving Coil Relay

New in original packing. Coil resistance 315 ohm. Current 310uA d.c. Contacts: single pole polarised. Max load 1 watt. Highly sensitive relay for use in d.c. circuits. New Price £4.50. Our Price £1.15 each post free.

Leach Power Relay

Coil 24-28V d.c. Contacts 3PDT 10A £1.50 each post free.

FANS—PLANAIR MINIATURE FANS

2 1/2in Fan driven by a 240V a.c. 50Hz shaded pole motor at 3,000 r.p.m. Originally designed for cooling electronic equipment. £2.75 each post free.

GRELCO TERMINAL BLOCKS 12-way

6 for £1.20 post free.

PUSH BUTTON SWITCHES—CRABTREE

5 for £1 post free.

YAXLEY WAFER SWITCHES—2-bank

3 for £1 post free.

KEY SWITCHES

2-pole change over. 3 for £1 post free.

TELESCOPIC CABINET LID STAYS



Lift lid once stays open. Lift twice catch releases and allows lid to close. Closed length 7 1/2in, open length 10 1/2in. Finished dull plating brand new. 4 for £1. Post free.

SLIDING CABINET LID STAYS



Similar principle to above closed length 1 1/2in, open length 5 1/2in. Finished dull plating brand new. 5 for £1. Post free.

NEW MICROSWITCHES—HONEYWELL

1 PL 900 6 contacts. 15 Amp. 125/250 volts. Single pole. ON/OFF. Plunger operated. L 1 7/8", W. 5/8", H. 3/4". Price 5 for £1.25. Post free.

RAPID HEAT SOURCE



from brand new Infra Red Tubular Quartz Lamps. Ideally suited as heat source for Drying Ovens, Egg Hatching, Incubators, etc., 240V, 1,440V, 20,000 Angstroms. Length 12in x 3in dia. Price 75p. P. & P. 25p.

TELEPHONE DIALS

Clear Perspex, very good condition. No markings. 75p each. P. & P. 25p.

**Electronic Brokers Ltd. (Dept. P.E.) 49-53 Pancras Road
London NW1 Tel. 01-837 7781 Telex 267307**

Open Mon.-Fri. 9-6 p.m.

OVERHAULED AVOMETERS

Models 40, 47A, 48A. (Models 47A and 48A are Admiralty pattern.)
D.C. volts: 0.12, 1.2, 12, 120, 480, 1,200.
Amps: 0-0.12, 0-12, 1-2, 12, 120, 480, 1,200.
A.C. volts: 12, 120, 480, 1,200.
Amps: 0-0.12, 0-12, 1-2, 12.
Ohms: 1,000, 10,000, 1,000,000 (external voltage source).
Sensitivity: 166.6 Ohms/Volt. 333.3 Ohms/Volt when divided by two button is pressed on both a.c. and d.c. ranges.
£16. P. & P. 75p.
Complete with voltage multiplier for 480V and 5,600V. Current shunts for 120A and 480A. A.C. current transformer for 20A and 60A. In special wooden box. £18.50. P. & P. £1.



Due to demand it may not always be possible to supply a particular model, and a different type to that ordered may be dispatched. These models are electrically identical.

DELAY LINE LEXOR MDN 2484D

Miniature resin encapsulated module. Total delay 60nsec to 10nsec. Tapped at 10% intervals. Impedance 75 ohms to 10 kΩ. 30V w/g. Attenuation 0.5 dB/nsec. Also available MDN 2484C 3 micro-sec 600 ohm impedance. 2 1/2in x 1 1/2in x 1 1/2in. £1.50. Post free.

MOTORS

BRAND NEW CAPACITOR REVERSIBLE SINGLE PHASE PARVALUX MOTORS

230/250V, 50Hz, 2,800 r.p.m., 130 h.p. cont. rated; 3/8in dia. shaft; 3 1/2in long foot mounting; wt. 6lb. C/W capacitor. £28.50. Post free.



NEW ENICRON SHADED POLE MOTORS

240/250V, 50Hz, 2,500 r.p.m. (no load). Shaft 1/2in dia. x 1 1/2in long. Suitable record player, blower motor, etc. 65p. Post free.



NEW FRACTIONAL H.P. CAPACITOR MAINS MOTORS

230V, 50Hz, 0.65A, 1/20 h.p., 2,850 r.p.m. Cont. rated. Shaft 1/2in dia. x 1 1/2in long. Circular clamp mounting. £23.50. Post free.

NUMICATOR PRICE LIST

| End Reading | Quantity | Price each (less base) |
|-----------------------------|------------|------------------------|
| 0-100M/Ω (Clear) | 1-3 | £1.40 |
| | 4-10 | £1.35 |
| | 11-25 | £1.30 |
| | 26-100 | £1.20 |
| Price Base. Bases 20p each. | | |
| Size Reading | Price each | |
| XN3/FA 38m/m Lead (Amber) | £1.15 each | |
| XN3/F 38m/m Lead (Red) | £1.10 each | |
| XN3A/F 6m/m Lead (Red) | £1.05 each | |
| XN3A 6m/m Lead (Clear) | 85p each | |
| XN11/F 38m/m Lead (Red) | | |
| XN23/FA 38m/m Lead (Amber) | | |
| 1-3 | £1.15 each | |
| 4-10 | £1.10 each | |
| 11-25 | £1.05 each | |
| 26-100 | 85p each | |

All Post Free

GOOD QUALITY INSTRUMENTS TAKEN IN PART EXCHANGE OR PURCHASED FOR CASH

BRUNEL TECHNICAL COLLEGE BRISTOL

DEPARTMENT OF MARINE AND AERO-ELECTRONICS

MARINE RADIO OFFICERS

The Department offers the following courses for prospective Radio Officers in the Merchant Navy—2 years' full-time course leading to the Ministry of Posts and Telecommunications General Certificate in Radiocommunications. 1 term full-time course leading to the Department of Trade and Industry Radar Maintenance Certificate. Conversion Course from 1st or 2nd class MPT R/T Licences (Full and Restricted). Marine Electronics Diploma. Advanced Marine Electronics Diploma.

LICENSED AIRCRAFT RADIO ENGINEERS (Civil Aviation)

A full-time course of two years' duration commences in September of each year. This leads to the award of the Aircraft Maintenance Engineers Category R Licence issued by the Air Registration Board.

All instruction and practice is carried out with modern equipment and test instruments, in well-equipped laboratories and workshops at the College and on the Department's own aircraft at Bristol Airport.

The Department also offers a course for the Board of Trade Civil Aero-nautical RT Licence.

For further information apply to — Head of Department of Marine and Aero-Electronics,

**Brunel Technical College, Ashley Down
BRISTOL BS7 9BU**

FETS N CHANNEL FETS FULLY TESTED AND MARKED

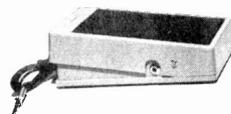
| Type | BV _{gss} (Min.) | I _{gss} (Max.) | V _p (Max.) | I _{Dss} (Max.) | R on (Max.) | Case |
|------|--------------------------|-------------------------|-----------------------|-------------------------|-------------|------|
| GP25 | 20V | 1nA | 10V | 20mA | — | TO72 |
| GP71 | 20V | 1nA | 12V | 150mA | 190Ω | TO18 |

ANY 6 — 60p

PACKING AND POSTAGE FREE
NO STAMP NEEDED ON ORDER
SEND TO:

DURHAM ELECTRONICS
FREE POST • PETERLEE • CO. DURHAM
BUSINESS ENQUIRIES WELCOME • MINIMUM ORDER VALUE 60p
TERMS STRICTLY CASH WITH ORDER

BUILD THIS WAH-WAH PEDAL KIT



AND SAVE
£££'s

The Wilsic Wah-Wah pedal comprises a SELECTIVE AMPLIFIER MODULE KIT, containing all the components to build a two transistor circuit module, which may be used by the constructor for his own design or fitted to the FOOT VOLUME CONTROL PEDAL (as photo) converting it to Wah-Wah operation. This pedal is in strong fawn plastic and fitted with output lead and screened plug.

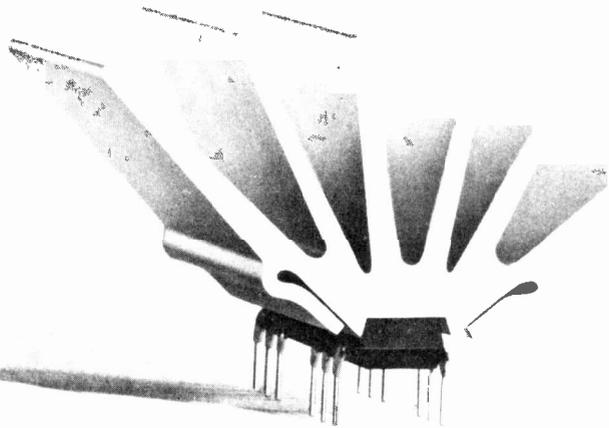
Please send me
Selective amplifier module £1.75
Foot Volume control pedal £5.13
COMPLETE KIT £6.50
add 38p for assembly of module
Send 15p for latest catalogue

Name
Address

*Tick as required
WILSIC ELECTRONICS LTD.
6 COPLEY RD., DONCASTER, YORKS.

new

Super IC-12



High fidelity Monolithic Integrated Circuit Amplifier

Two years ago Sinclair Radionics announced the World's first monolithic integrated circuit Hi-Fi amplifier, the IC.10. Now we are delighted to be able to introduce its successor, the Super IC.12. This 22 transistor unit has all the virtues of the original IC.10 plus the following advantages:

1. Higher power.
2. Fewer external components.
3. Lower quiescent consumption.
4. Compatible with Project 60 modules.
5. Specially designed built-in heat sink. No other heat sink needed.
6. Full output into 3, 4, 5 or 8 ohms.
7. Works on any voltage from 6 to 28 volts without adjustment.
8. NEW 22 transistor circuit.

Output power 6 watts RMS continuous (12 watts peak).

Frequency Response 5 Hz to 100KHz \pm 1 dB.

Total Harmonic Distortion Less than 1% (Typical 0.1%) at all output powers and all frequencies in the audio band.

Load Impedance 3 to 15 ohms.

Power Gain 90dB (1,000,000,000 times) after feedback.

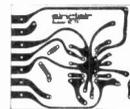
Supply Voltage 6 to 28 volts (Sinclair PZ-5 or PZ-6 power supplies ideal).

Size 22 x 45 x 28 mm including pins and heat sink.

Input Impedance 250 Kohms nominal.

Quiescent current 8mA at 28 volts

With the addition of only a very few external resistors and capacitors the Super IC.12 makes a complete high fidelity audio amplifier suitable for use with pick-up, F.M. tuner etc. Alternatively, for more elaborate systems, modules in the Project-60 range such as the Stereo 60 and A.F.U. may be added. The comprehensive manual supplied with each unit gives full circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include car radios, oscillators etc. The very low quiescent consumption makes the Super IC.12 ideal for battery operation.



Price, inc. FREE printed circuit board for mounting.

£2.98 Post free

Sinclair Radionics Ltd, London Rd, St. Ives Huntingdonshire PE17 4HJ
Telephone St Ives (048 06) 4311

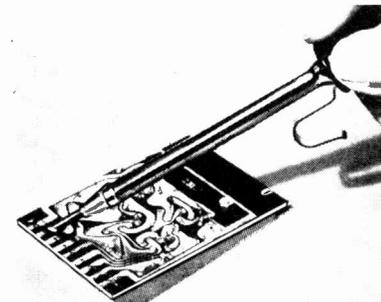
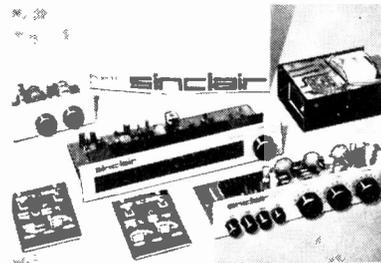
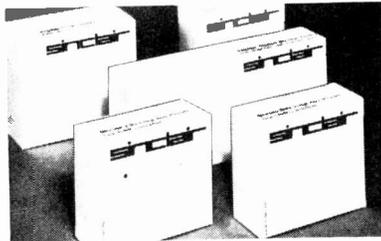
sinclair

SINCLAIR GENERAL GUARANTEE

Should you not be completely satisfied with your purchase when you receive it from us, return the goods without delay and your money will be refunded in full, including cost of return postage, at once and without question. Full service facilities are available to all Sinclair customers.

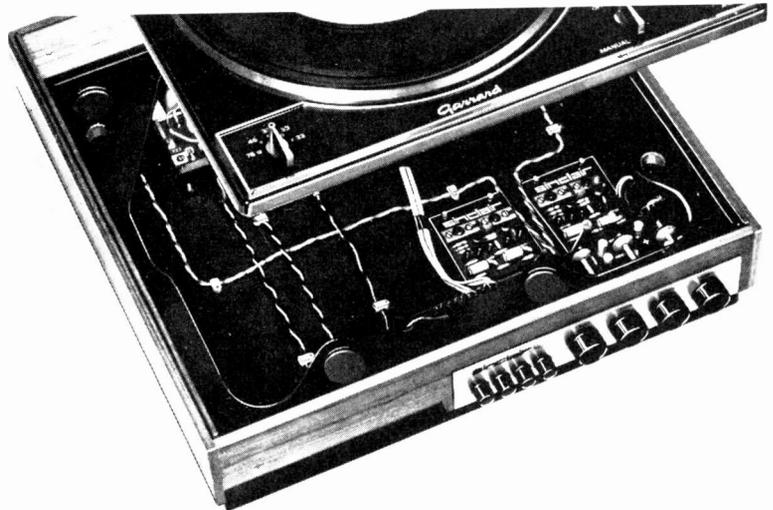
Sinclair Project 60

The World's leading range of high fidelity modules



Sinclair Radionics Limited, London Road,
St. Ives, Huntingdonshire PE17 4HJ.
Tel. St. Ives (048 06) 4311

sinclair



Project 60 offers more advantage to the constructor and user of high fidelity equipment than any other system in the world.

Performance characteristics are so good they hold their own with any other available system irrespective of price or size.

Project 60 modules are more versatile – using them you can have anything from a simple record player or car radio amplifier to a sophisticated and powerful stereo tuner-amplifier. Either power amplifier can be used in a wide variety of applications as well as high fidelity. The Stereo 60 pre-amplifier control unit may also be used with any other power amplifier system, as can the AFU filter unit. The stereo FM tuner operates on the unique phase lock loop principle to provide the best ever standards of sensitivity and audio quality. Project 60 modules are very easily connected together by following the 48 page manual supplied free with all Project 60 equipment. The modules are great space savers too and are sold individually boxed in distinctive white and black cartons. With all these wonderful advantages, there remains the most attractive of all – price. When you choose Project 60 you know you are going to get the best high fidelity in the world, yet thanks to Sinclair's vast manufacturing resources (the largest in Europe) prices are fantastically low and everything you buy is covered by the famous Sinclair guarantee of reliability and satisfaction.

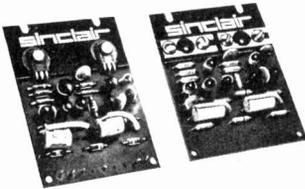
Typical Project 60 applications

| System | The Units to use | together with | Cost of Units |
|---|---|---|---------------|
| Simple battery record player | Z.30 | Crystal P.U., 12V battery volume control | £4.48 |
| Mains powered record player | Z.30, PZ.5 | Crystal or ceramic P.U. volume control etc | £9.45 |
| 20 + 20 W. stereo amplifier for most needs | 2 x Z.30s, Stereo 60, PZ.5 | Crystal, ceramic or mag P.U., F.M. Tuner, etc | £23.90 |
| 20 + 20 W. stereo amplifier with high performance spkrs | 2 x Z.30s, Stereo 60, PZ.6 | High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc | £26.90 |
| 40 + 40 W. R.M.S. de-luxe stereo amplifier | 2 x Z.50s, Stereo 60 PZ.8, mains trnsfrmr | As above | £34.88 |
| Indoor P.A. | Z.50, PZ.8, mains transformer | Mic., guitar, speakers, etc., controls | £19.43 |

F.M. Stereo Tuner (£25) & A.F.U. Filter Unit (£5.98) may be added as required.

from a simple amplifier to a complete stereo tuner amplifier with Project 60 modules

Z.30 & Z.50 power amplifiers



The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and may be used with other units in the Project 60 range equally well.

SPECIFICATIONS (Z.50 units are interchangeable with Z.30s in all applications).

Power Outputs

Z.30 15 watts R.M.S. into 8 ohms using 35 volts; 20 watts R.M.S. into 3 ohms using 30 volts.

Z.50 40 watts R.M.S. into 3 ohms using 40 volts; 30 watts R.M.S. into 8 ohms using 50 volts.

Frequency response: 30 to 300,000Hz 1dB.

Distortion: 0.02% into 8 ohms

Signal to noise ratio: better than 70dB unweighted.

Input sensitivity: 250mV into 100 Kohms

For speakers from 3 to 15 ohms impedance.

Size: 14 x 80 x 57 mm

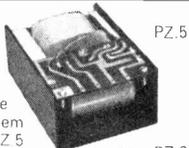
Z.30

Built, tested and guaranteed with circuits and instructions manual. **£4.48**

Z.50

Built, tested and guaranteed with circuits and instructions manual. **£5.48**

Power Supply Units



Designed special for use with the Project 60 system of your choice. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.

PZ.5 30 volts un stabilised **£4.98**

PZ.6 35 volts stabilised **£7.98**

PZ.7 45 volts stabilised

(less mains transformer) **£7.98**

PZ.8 mains transformer **£5.98**

Project 60 Stereo F.M. Tuner



First in the world to use the phase lock loop principle

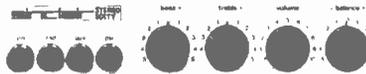
The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other original features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and squelch circuit for silent tuning between stations. Good reception is possible in difficult areas, and often a few inches of wire are enough for an aerial. In terms of a high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with any other high fidelity system.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108 MHz. **Capture ratio:** 1.5dB. **Sensitivity:** 2µV for 30dB quieting 7µV for full limiting. **Squelch level:** 20µV. **A.F.C. range:** ±200 KHz. **Signal to noise ratio:** > 65dB. **Audio frequency response:** 10 Hz – 15 KHz (±1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2µV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. **Operating voltage:** 25-30 VDC. **Indicators:** Mains on; Stereo on; tuning. **Size:** 93 x 40 x 207 mm.

Built and tested Post free.

£25

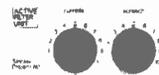
Stereo 60 Pre-amp/control unit



Designed for Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalisation is provided for all the usual inputs.

SPECIFICATIONS—Input sensitivities: Radio—up to 3mV Mag p.u. 3mV correct to R.I.A.A. curve ±1dB 20 to 25,000 Hz. Ceramic p.u—up to 3mV. Aux—up to 3mV. **Output:** 250mV. **Signal to noise ratio:** better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE – 15 to –15dB at 10 KHz. BASS + 15 to –15dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm. **£9.98**

A.F.U. High & Low Pass Filter Unit



For use between Stereo 60 unit and two Z.30s or Z.50s, and is easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less

loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The A.F.U. is suitable for use with any other amplifier system. Two filter stages—rumble (high pass) and scratch (low pass). Supply voltage—15 to 35V. Current—3mA H.F. cut-off (–3dB) variable from 28KHz to 5KHz. L.F. cut-off (–3dB) variable from 25Hz to 100Hz. Distortion at 1 KHz (35V supply) 0.02% at rated output. **Size:** 66 x 40 x 90 mm. **£5.98**

Built tested and guaranteed.

The Sinclair Guarantee

If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost.

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send _____ Name _____
 _____ Address _____

 I enclose cash/cheque/money order _____

PE10/71

Practical Electronics Classified Advertisements

RATES: 7½p per word (minimum 12 words). Box No. 7½p extra. Advertisements must be prepaid and addressed to Classified Advertisement Manager, "Practical Electronics" IPC MAGAZINES LTD., Fleetway House, Farringdon Street, London EC4A 4AD

MISCELLANEOUS

LIGHT WEIGHT TREASURE-PROBE

Look for BURIED COINS, silver, gold and metal relics PROFESSIONALLY with the BOFFIN solid-state TREASURE-PROBE. An extremely EASY-TO-BUILD kit that REALLY DOES WORK! SIMPLE-TO-FOLLOW INSTRUCTIONS. It comes to your doorstep with maximum copper PRINTED-CIRCUIT BOARD plus ALL ELECTRONIC COMPONENTS including search-coil and earphone. Think of the fun you'll have BEACH-COMBING with the sensitive TREASURE-PROBE, and the expectancy of hearing its LOUD "BEEP" tell you "YOU'RE ON TO SOMETHING".

GET YOUR TREASURE-PROBE!
SEND £6.95 NOW!

BOFFIN PROJECTS

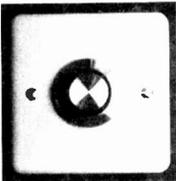
4 CUNLIFFE ROAD, STONELEIGH
EWELL, SURREY
Designed by GERRY BROWN and JOHN SALMON and presented on TV

RADIO SKY. Journal of the Society for Amateur Radio Astronomers. Further details from Hon. Sec., 17 St. Thomas' Square, Newport, I.O.W.

AARVAK ELECTRONICS. 3-channel sound-light converters, £17. Strobes, £16. Rainbow Strobes, £96. 74 Bedford Avenue, Barnet, Herts. 01-449 1268.

HARDWARE FOR CONSTRUCTORS. Screws, nuts, brackets, spacers, etc. S.A.E. list. R. A. MARSH, 29 Shelbourne Road, Stratford-on-Avon, Warwick.

BUILD IT in a DEWBOX quality cabinet 2in x 2½in x any length. DEW LTD., Ringwood Road, Ferndown, Dorset. S.A.E. for leaflet. Write now—right now.



THE

Dimmerswitch

Will dim up to 400 watts of incandescent lighting from zero to full brilliance. This unit simply replaces the normal light switch, and is fitted in a matter of minutes. An MK mounting frame is supplied, for use when more depth is required.

| | |
|--------------------|-------|
| Price—complete kit | £2.80 |
| built and tested | £3.20 |

as supplied to Industry, Schools, Hospitals
Government Depts. etc.

Diathane Ltd.

111, Sheffield Road, Wymondham, NORFOLK.

£0.10 postage & packing

REGORD T.V. SOUND using our loudspeaker isolating transformer. Provides safe connection to recorder. Instructions included. 70p + 10p P. & P. CROWBOROUGH ELECTRONICS (P.E.), Eridge Road, Crowborough, Sussex.

MISCELLANEOUS (continued)

TOP TRANSISTORS

Brand New and Individually Tested Transistors supplied unmarked, but packed separately for identification and guaranteed to be within their correct specification or money refunded. All at 9p. each or

Any 25 transistors for only £1.90

| | | | |
|-------|-------|--------|--------|
| ACY22 | BFY51 | OC72 | 2N3702 |
| BC108 | BFY52 | OC202 | 2N3703 |
| BC109 | BSY27 | ZTX300 | 2N3705 |
| BC168 | OC45 | 2N706 | 2N3706 |
| BC169 | OC71 | 2N2926 | 2N3708 |

Money back guarantee. P. & P. 10p.

J. M. KING (N)

17 Buckridge, Portpool Lane, London, E.C.1

TOP MANUFACTURERS' PRODUCTS AT TRADE PRICES!!!

ADCOLA SOLDERING IRONS AND ACCESSORIES: 60/40 SOLDER

ELECTROSIL RESISTORS: TR4, TR5, TR6, TR8, C5

T.M.C. RELAYS, PUSH BUTTON KEYS AND LEVER KEYS

B.I.C.C. P.V.C. EQUIPMENT WIRE—ALL COLOURS

Send large s.a.e. for price lists

SPEDDY COMPONENTS SUPPLY LTD.

High Street · Handcross
Haywards Heath · Sussex RH17 6BW
Handcross 671/2

CALLERS WELCOME

CLEARING LABORATORY, scopes, V.T.V.M.'s, V.O.M.'s, H.S. recorders, transcription turntables, electronic testmeters, calibration units, P.S.U.'s, pulse generators, D.C. null-potentiometers, bridges, spectrum analysers, voltage regulators, sig-gens, M/C relays, components, etc. Lower Beeding 236.

JOHN SAYS...

RING MODULATOR by Dewtron is professional, transformerless, 5-transistor, has adjustable F1/F2 rejection. Module £7. Unit £8.90. WAA-WAA Pedal kit of all parts, including all mechanics and instructions ONLY £2.45. **AUTO RHYTHM** from Dewtron modules. Simple unit for waltz, fox-trot, etc. Costs £16.55 in modules. **SYNTHESIZER MODULES** and other miracles! Send 15p for illustrated list. D.E.W. LTD., 254 Ringwood Road, Ferndown, Dorset

PSYCHEDELIC LUMINOPHORS

Or is this just another way of referring to FANTASY? Either way, our Projects 24 and 104 probably come within this category—THINK OF THE FUN YOU WOULD HAVE WITH SOMETHING LIKE THIS AT A PARTY! There are MANY OTHER UNUSUAL PROJECTS TOO—how about an ELECTRONIC STETHOSCOPE for LISTENING THROUGH WALLS, etc., or a TRANSMITTER/RECEIVER that doesn't use RF, SO LICENCE WORRIES ARE OVER! Then there's another project for a "LEARNING" MACHINE—imagine one of these in YOUR BACKROOM; YOUR FRIENDS WOULD BE AMAZED! If REALLY UNUSUAL projects interest you, then WE'VE GOT WHAT YOU WANT. In a few days from now YOU COULD BE IN THE "SCIENCE-FICTION" WORLD OF "BOFFIN"!

DON'T PUT IT OFF! SEND 15p for your list—NOW

BOFFIN PROJECTS

4 CUNLIFFE RD., STONELEIGH, EWELL, SURREY
Designs by GERRY BROWN and JOHN SALMON and presented on TV

MISCELLANEOUS (continued)

NO NEED TO WORRY ABOUT A TRANSMITTING LICENCE

because this GPO approved transmitter/receiver kit does not use R.F. and you can get one easily. Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get all the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—has obvious applications for HOUSE-TO-HOUSE USE, SCHOOL PROJECTS, LANGUAGE LABORATORIES, SCOUT CAMPS, etc.

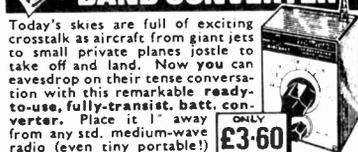
GET YOURS! SEND £5.20 NOW

TO: 'BOFFIN PROJECTS'

DEPT. KE2010
4 CUNLIFFE ROAD
STONELEIGH, EWELL, SURREY

HEAR PILOTS AND CONTROLLERS
TALK THEIR AIRCRAFT DOWN!

VHF AIRCRAFT BAND CONVERTER



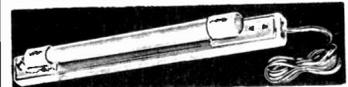
Today's skies are full of exciting crosstalk as aircraft from giant jets to small private planes jostle to take off and land. Now you can eavesdrop on their tense conversation with this remarkable ready-to-use, fully-transist. batt. converter. Place it 1' away from any std. medium-wave radio (even tiny portable!) for crystal-clear reception on aircraft communications. Money back guarantee.

MARKTYME
(MAIL ORDER) LTD

Dept. PE3
Willasden Lane
London, N.W.6
01-624 4633

FASCIA PANELS, hi-fi equipment, etc., etched aluminium to individual specifications, S.A.E. details. R. MARSH, 29 Shelbourne Road, Stratford on Avon, Warwick.

12 VOLT FLUORESCENT LIGHTS



Beat Power Cuts, 12 ins 8 watt Tube, ideal for Caravan, Tent, Emergency Lighting, etc. Fully Transistorised, Low Battery Drain. With ON/OFF Switch and 12V Socket to run other Lights or 12V Equipment.

Unbeatable at **£3.30**
or in kit form **£2.90** post paid

SALOP ELECTRONICS Callers welcome
23 Wyle Cop Shrewsbury, Shropshire S.A.E. for lists

PROFESSIONAL CONTROL PANELS

with **FASCIA KIT**

MAKE YOUR OWN PANELS IN PERMANENT, ANODISED, SELF-ADHESIVE ALUMINIUM. NO SPECIAL EQUIPMENT NEEDED. EASY TO FOLLOW INSTRUCTIONS. CHOICE OF SILVER OR BLACK, RED, BLUE, GREEN.

TRIAL KIT (Approx. 50 sq. in.) 98p + p.p. 30p
No. 2 KIT (Approx. 100 sq. in.) £1.58 + p.p. 30p
M.P.E. Ltd., BRIDGE ST., CLAY CROSS, DERBYS.

SYNTHESISER MODULES

Send S.A.E. for details of voltage-controlled modules for synthesiser construction to:

D.E.W. Ltd.

254 Ringwood Road, Ferndown, Dorset

LOUDSPEAKERS for P.E. intercom. 15Ω. 3in. Two for £1, post free. CROWBOROUGH ELECTRONICS, Eridge Road, Crowborough, Sussex.

WANTED

CASH PAID for New Valves. Payment by return. WILLOW VALE ELECTRONICS, 4 The Broadway, Hanwell, London, W.7. 01-567 5400/2971.

HIGHEST POSSIBLE CASH prices for Akai, B. & O., Brenell, Ferrograph, Revox, Sanyo, Sony, Tandberg, Uher, Vortexion, etc. 9.30-5.00. 01-242 7401.

WE PAY THE HIGHEST PRICES for new valves. Cash sent by return. A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

TOP PRICES PAID

for new valves and components

Popular T.V. and Radio types

KENSINGTON SUPPLIES

(B) 367 Kensington Street
Bradford 8, Yorks.

COURSES

BOURNEMOUTH COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

B.Sc. (Eng.) HONOURS DEGREE

in Electrical and Electronic Engineering

Entrance Requirements G.C.E. O or A Levels, O.N.D., O.N.C. or H.N.C.

DIPLOMA IN COMPUTER TECHNOLOGY

Two year full-time course of O.N.D. standard. Entrance requirements G.C.E. O or C.S.E.

For details and application forms write to T. A. Goodchild, Head of Department of Electrical and Electronic Engineering, Room E3, College of Technology, Lansdowne, Bournemouth BH1 3JJ.

SERVICE SHEETS

RADIO, TELEVISION AND TAPE RECORDERS. 50 mixed odd sheets 50p. Also large stock of obsolete and current valves. JOHN GILBERT TELEVISION, 1b Shepherds Bush Road, London, W.6 (01-743 8441). S.A.E. enquiries.

SERVICE SHEETS. Radio, TV, etc., 8,000 models. List 10p. S.A.E. enquiries. TELRAY, 11 Maudland Bank, Preston.

SERVICE SHEETS (1925-1971) for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., by return post, with free Fault-Finding Guide. Prices from 5p. Over 8,000 models available. Catalogue 13p. Please send S.A.E. with all orders/enquiries. HAMILTON RADIO, 54 London Road, Bexhill, Sussex. Telephone, Bexhill 7097.

EDUCATIONAL

GET INTO ELECTRONICS—big opportunities for trained men. Learn the practical way with low-cost Postal Training, complete with equipment. R.T.E.B., City & Guilds, Radio, TV, Telecons, etc. For free informative Guide, write CHAMBERS COLLEGE (Dept. 856K), Aldermaston Court, Reading, RG7 4PF.

ENGINEERS—get a technical certificate. Exam and Certificate Postal Courses in all branches of Engineering, Electronics, Radio and TV, Computers, Draughts., Building, etc. Write for helpful Free Book—BIET (Dept. H.4), Aldermaston Court, Reading, RG7 4PF.

SITUATIONS VACANT

EAGLE INTERNATIONAL require Audio Engineers. Excellent prospects. Must be fully conversant with Stereo Amplifiers, Tuners, Multiplex, etc. Contact MR. MORROW 01-903 0144.

FOR SALE

SEEN MY CAT? 5,000 items. Mechanical and Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PE, New Mills, Stockport.

CATALOGUE NO. 18. Electronic and Mechanical Components, new and manufacturers' surplus. Credit vouchers value 50p. Price 23p, including post. ARTHUR SALLIS RADIO CONTROL LTD., 28 Gardner Street, Brighton, Sussex.

PRACTICAL ELECTRONICS Journals, November 1964 to February 1971, with enclosures. Welwyn Garden 22975.

MORSE MADE EASY, complete course, never used, £3. 25 Launceston Close, Walsall WS5 3EG.

MORSE MADE !! EASY

FACT NOT FICTION. If you start RIGHT you will be reading amateur and commercial Morse within a month (normal progress to be expected).

Using scientifically prepared 3-speed records you automatically learn to recognise the code RHYTHM without translating. You can't help it, it's as easy as learning a tune. 18 W.P.M. in 4 weeks guaranteed.

For details and course C.O.D. ring S.T.D. 01-660 2896 or send 4p stamp for explanatory booklet to:

GHSC (Box 19), 45 GREEN LANE, PURLEY, SURREY

LADDERS

VARNISHED TIMBER LADDERS from manufacturer, LOWEST PRICES anywhere: 15ft ext., £6-20; 17ft extd., £6-50; 20ft extd., £7; 21ft extd., £7-75; 24ft extd., £8-90; 29ft extd., £10-25; 31ft triple extd., £12-25; 36ft. triple extd., £16. Carr. 80p. Free Lists. Also Aluminium Ext. and Loft Ladders. Callers welcome. Dept. PEE, HOME SALES, Baldwin Road, Stourport, Wores. Phone: 02-993 2574. Placing order on C.O.D.



Established 1891

TECHNICAL TRAINING IN RADIO, TELEVISION AND ELECTRONIC ENGINEERING

First-class opportunities in Radio and Electronics await the ICS trained man. Let ICS train YOU for a well-paid post in this expanding field.

ICS courses offer the keen, ambitious man the opportunity to acquire, quickly and easily, the specialized training so essential to success. Diploma courses in Radio/TV Engineering and Servicing, Colour TV Servicing, also Electronics, Computers, etc.

Expert coaching for:

- * C. & G. TELECOMMUNICATION TECHNICIANS' CERTIFICATES.
- * RADIO AMATEURS' EXAMINATION.
- * RADIO OPERATOR CERTIFICATES.

Examination Students coached until successful.

NEW SELF-BUILD RADIO AND ELECTRONIC COURSES

Build your own 5-valve receiver, transistor portable, signal generator and multi-meter. All under expert guidance.

POST THIS COUPON TODAY and find out how ICS can help YOU in your career. Full details of ICS courses in Radio, Television and Electronics will be sent to you by return mail.

MEMBER OF THE ASSOCIATION OF BRITISH CORRESPONDENCE COLLEGES

INTERNATIONAL CORRESPONDENCE SCHOOLS

A WHOLE WORLD OF KNOWLEDGE AWAITS YOU!

International Correspondence Schools
(Dept. 152), Intertext House, Stewarts Road,
London SW8 4UJ

NAME.....
Block Capitals Please

ADDRESS.....

AGE..... OCCUPATION..... 10/71

RECEIVERS AND COMPONENTS

BRAND NEW COMPONENTS BY RETURN. Electrolytics 15 or 25 volts, 1, 2, 5, 10 mfd. 3p; 25, 50, 4p; 100, 5p. Mylar Film 100V 0.001, 0.002, 0.005, 0.01, 0.02, 2p; 0.04, 0.05, 0.1, 2.5p. Mullard miniature carbon film resistors, third watt E.12 series, 1Ω-10MΩ, 8 for 5p. Postage 5p. THE C.R. SUPPLY CO., 127, Chesterfield Road, Sheffield, S8 0RN.

P. E. AURORA. Complete sets of electronic components for assembly on Vero board. We also have specially designed printed circuit cards for a combined controller/filter system readily available. (S.A.E. for lists).

OPTELMEC LTD.
1, 2 & 3 Nelson Works
Back Road, SIDCUP, Kent

PRINTED CIRCUIT BOARDS FOR P.E. PROJECTS
All boards drilled and roller tinned complete with layout drawing.

EXAMPLES
Marine Tachometer (May 1970) 25p ea. Musical Stave (May 1970) 40p ea.
Waa-Vaa pedal Vol. 4 No. 7 14p ea. Audio Sig. Gen. (Sine and Square on one board) Vol. 5 No. 10 42p ea.
S.A.E. for List. Now available from:- HENRY'S RADIO LTD., Edgware Road, London, W.2
P.H. ELECTRONICS, Industrial Estate, Sandwich, Kent. Tel. 2517

I.C. STEREO AMPLIFIER
3W per channel, internal overvoltage, short circuit and polarity protection. Minimum impedance required per channel, 8 ohms for 3W output. Distortion at max. output 0.5%. Controls, volume, bass, treble and balance. Supply, 18V @ 1A d.c. Size 7in x 8in x 1 1/2in, will fit into the lower part of most plinths. Built and tested complete with instructions, £14.75. P. & P. 25p.

POWER SUPPLY for I.C. Stereo Amplifier. Smoothed, unregulated. Input 230/250V a.c. Insulated case size 4in x 4in x 3in. Built and tested, £4.75. P. & P. 25p.
Amplifier and power supply on one order P. & P. 25p only.

HEATSINKS
5DN Plain undrilled 4in x 4in x 1/2in finned one side only, 25p each.
5DN Plain drilled 2 x TO-3 (OC28), 35p each.
10DN Plain undrilled 4in x 4in x 1in finned both sides, 35p each.
10DN Plain drilled 2 x TO-3 (OC28), 35p each.
Accessory kits TO-3 (OC28), 1 set 5p; 2 or more sets 4p each.
80-55 (AD161) 1 set 5p; 2 or more sets 4p each.
P. & P. on Heatsinks and Accessory kits 10p under £1.

SEPTON ELECTRONICS
P.O. Box 15, Aldershot, Hants
Mail order only please.

NEW, TESTED, UNMARKED: 2N3708 5p, AC128 8p, BCY30 10p, 2N3055 50p. P. & P. 5p. P.E. 1 Empire Road, Salisbury.

RECEIVERS AND COMPONENTS (continued)

Microcircuits
SN76013 (like IC12) £1.50; 709 36p; 741 36p; PA230 97p; PA234 87p; PA237 £1.55; SL402A £1.75; SL702C 40p; TTL GATES 19p; Flip-Flops 42p.

Transistors
2N3055 54p; BC107B 9p; BC108C 9p; BC109C 9p; BCY70 16p; BF866 15p; ME0402 21p; ME0411 20p; ME0412 20p; ME0413 15p; ME1002 12p; ME4101 11p; ME4102 12p; ME6101 15p; ME6102 19p; ME8001 17p; MP8111 35p; MP8112 45p.

1 Amp Rectifiers
50V 3p; 100V 4p; 200V 5p; 400V 6p.
Bridges: 50V 30p; 100V 31p; 400V 33p.
Printed Circuit Resist Pad 80p.
AW Miniature Resistors 41p.

JEF ELECTRONICS (P.E.10)
York House, 12 York Drive, Grappenhall, Warrington. Mail Order Only.
C.W.O. P. & P. 7p per order. Overseas 50p.
Money back if not satisfied.
List free on application.

PE GEMINI STEREO AMPLIFIER

(Dual purpose, 30W per channel)

All the components to build this high quality amplifier, as featured in "Practical Electronics," Nov. 1970—Feb. 1971, are now available from one source.

ALL PARTS CAN BE PURCHASED SEPARATELY.

Please send foolscap size S.A.E. for free complete lists. Return post service.

MAIL ORDER ONLY

ELECTROSPARES

21 BROOKSIDE BAR
CHESTERFIELD, DERBYSHIRE
QUALITY • VALUE • SERVICE

DRY REED INSERTS

Overall length 1.85" (Body length 1.1"). Diameter 0.14" to switch up to 500 mA at up to 250V D.C. Gold clad contacts. 62p per doz.; £3.75 per 100; £27.50 per 1,000; £250 per 10,000. All carriage paid.
G.V.M. RADIO LTD.
40/42 Portland Road, Worthing, Sussex BN90 34897

MINI MAINS PACK KIT. Safe double-wound transformer, 81 rectrs., 1,000µF and instructions for 9V, 120mA eliminator. Can be built to size of PP6 battery. U.K. post paid 95p. S.A.E. list. AMATRONIX LTD., 396 Seladon Road, S. Croydon, Surrey, CR2 0DE.

CHROMASONIC electronics

supply only brand new guaranteed goods

LOW NOISE HI-STABS

1 watt 5%, all E24 values for 3 2p plus p. & p. up to 50 resistors + 1p for each additional 60.

CAPACITORS

Mullard C280-01µF, .015µF, .022µF, .033µF, .047µF 5p each. .068µF 3p. .1µF, .15µF 4p. .22µF 5p. .33µF 6p. .47µF 8p. .68µF 11p. 1µF 15p. 1.5µF 20p. 2.2µF 24p.
C420 series now all 6p. Also in stock C333, C431 and C487 series, plus polystyrene and 8. mica's.

FM Stereo I.F. Strip £3.50
FM Front End £5.00
FM Stereo Decoder £5.25
+ p. & p. 25p each

INTEGRATED CIRCUITS

MC1303L £1.55 PA234 87p TAA320 65p
MC1304P £2.50 PA237 £1.57 TAD100 £1.05
MC1305P £2.50 PA246 £1.60 µA709C 50p
MFC4000P 70p TAA283 70p µA710C 50p
MFC4010P 75p TAA681B £1.90 µA747C 75p

TRANSISTORS

BC107 12p 2N3055 70p OA81/09/91 7p
BC108 11p AC128 17p 1N914 7p
BC109 12p AD161/162 65p BB104 37p
BC168 15p 2N2484 53p BB106G 20p
BC261 30p 2N2926O/Y 15p BZY88 series
BFY61 21p 2N3707 15p Zeners 15p
2N3053 25p 2N4058 17p T1843 30p
2N3054 50p 2N5458 49p 1N4004 10p

FREE CATALOGUE p. & p. 3p

p. & p. on all orders other than resistors 6p
56 Fortis Green Road, London N10 8HN

COMPUTER PANELS 5-BC108, Diodes, 15p, post 5p; 4-50p, post 10p. Small Panels with 3 U.H.F. Silicon Transistors, diodes 5p, 3p each; 6-35p, post paid. Panels with 10 x B8 x 26, (500 MEG silicon pnp) 10 x 1,000 pf caps, 18 diodes, 35p, post 5p.

AMERICAN PANELS, total at least 30 transistors, first grade components, details provided, 3-35p, post 10p. LIST OF PANELS AVAILABLE, send S.A.E. for copy.

MIXED TRANSISTORS ON PANELS (at least 4) 50-65p, post 10p. ASSORTED I.C.s. Fall outs, 5-10p, post 3p. Type and pin connections given.
NEW COIL PACK. L.M.S.W. Piano key, no dope, 20p, post 15p each. ORP12 on panel ex-queue, 35p c.p. FERRITE ROD 7in x 1/2in, 12p, post 8p each. LAZ POT CORES 20 in all box with 20 1% caps, £1.50, post 27p. Singles 15p c.p. **COMPUTER RELAYS.** D.P.D.T. 700 ohm coil, weigh 1oz, 55p, with base 65p c.p. Same—weigh 1oz carry 2 amps, also 5,000 ohm coil, weigh 1 1/2oz carry 2 amps. Both 60p c.p.

SMALL SYNCHRONOUS MOTORS with train of gears 200-250V, 30p c.p. COPPER CLAD PAKOLIN, single sided, 13 x 1 1/2, 30p, post 8p each.
ASSORTED COMPONENTS 7lb £1.25 c.p.

J.W.B. RADIO
75 HAYFIELD ROAD, SALFORD 6, LANCs.
MAIL ORDER ONLY

NEW SILICON TRANSISTORS

Texas markings. NOT seconds, etc., or rejects. Both are for general-purpose, low-level, high-gain applications. Both have hfe 45-800 and max dissipation 250 mw.
2N3708 7p each. (N-P-N, coll-emitter 30v max, coll current 30ma max).
2N4059 9p each. (P-N-P, coll-emitter -30v max, coll current -30ma max).
Ratings at 25°C free-air temp. Data sheets 2p ea. Mail order only. Post, etc. 6p per order.
K. M. GRAPHIC (Components Dept.) Ref. D1
8 Gower Street, Derby DE1 1SB

FERRANTI

SEMICONDUCTORS AT LOWEST PRICES

| | | | | | | | |
|--------|-----|---------|--------|---------|-----|--------|-----|
| ZTX107 | 10p | ZTX301 | 11p | ZS142 | 30p | K8036A | 17p |
| ZTX108 | 9p | ZTX302 | 15p | ZS170 | 9p | K8039A | 17p |
| ZTX109 | 10p | ZTX303 | 12p | ZS171 | 11p | K8043A | 17p |
| ZTX300 | 10p | ZTX304 | 39p | ZS172 | 14p | K8047A | 17p |
| ZTX301 | 11p | ZTX510 | 15p | ZS174 | 15p | K8051A | 17p |
| ZTX302 | 15p | ZTX530 | 19p | ZS176 | 21p | K8066A | 17p |
| ZTX303 | 12p | ZTX531 | 20p | ZS178 | 34p | K8082A | 17p |
| ZTX304 | 19p | BF859 | 18p | ZS270 | 10p | K8088A | 17p |
| ZTX310 | 7p | BF860 | 19p | ZS271 | 14p | K8075A | 17p |
| ZTX311 | 9p | BF861 | 19p | ZS272 | 16p | K8082A | 17p |
| ZTX312 | 9p | BF886 | 16p | ZS274 | 17p | K8091A | 17p |
| ZTX313 | 10p | BF897 | 21p | ZS276 | 25p | K8100A | 17p |
| ZTX314 | 11p | BF898 | 21p | ZS278 | 35p | K8110A | 17p |
| ZTX320 | 28p | MJE2955 | £1.65 | MJE3055 | 85p | K8120A | 17p |
| ZTX330 | 13p | Diodes | Zenera | | | K8130A | 17p |
| ZTX331 | 14p | ZS140 | 22p | K8030A | 17p | K8130A | 17p |
| ZTX500 | 10p | ZS141 | 39p | K8033A | 17p | K8150A | 17p |

Postage and Packing 10p. Free above £2. Send S.A.E. for data.

DAVIAN ELECTRONICS
P.O. Box 38, Oldham, Lancs.

COMPUTER BOARDS

Minimum 10 silicon trans., mostly similar 2N706, diodes, resistors, capacitors, etc. 1 board 17p, 5 boards (50 transistors) 70p, 25 boards (250 transistors) £2.50, 100 boards (1,000 transistors) £8.10.

Logic ICs, dual inlines and flat-packs. 10 assorted on boards, 60p.

Mixed small components, some damaged. Transistors, resistors, capacitors, diodes, a few ICs. Bargain price 65p per lb.

IC memories, 16 bit similar to SN7481N. 8 on board with further 12 ICs (total 20) £6.

Post paid on above items. All components are marked and data available. Refund if not satisfied. S.A.E. for list and data.

Heavy transformers including constant voltage; paper capacitors 3-10µF, 220-660V, a.c. State requirements, S.A.E. please.

PAWSON

114 South Street • Armadale • West Lothian

EX COMPUTER PRINTED CIRCUIT PANELS
21in x 4in packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price 10 boards 50p. P. & P. 7p. With a guaranteed minimum of 35 transistors. Data on transistors included.

SPECIAL BARGAIN PACK. 25 boards for £1. P. & P. 18p. With a guaranteed minimum of 55 transistors. Data on transistors included.

PANELS with 2 power transistors similar to OC28 on each board—components 2 boards (4: OC28) 50p. P. & P. 6p.

9 OA5, 3 OA10, 3 Pot Cores, 26 Resistors, 14 Capacitors, 3 GET 872, 3 (GET 872B), 1 GET 876. All long leaded on panels 13in x 4in. 4 for £1. P. & P. 25p.

LARGE CAPACITY ELECTROLYTICS
10,000MFD 30V } 40p each. P. & P. 6p.
16,000MFD 12V }
or £3.50 per doz. Carr. 50p.

250 MIXED RESISTORS 62p
½ & ¼ watt.

150 MIXED HI STABS 62p
½, ¼ & 1 watt 5% & better.

QUARTZ HALOGEN BULBS
With long leads. 12V 56W for car spot lights, projectors, etc. 50p each. P. & P. 5p.

DIODES EX EGYPT. SILICON
1 Amp 1,000 PIV 4 for 50p
20 Amp 150 PIV 4 for £1.
P. & P. 5p.

BARGAIN RELAY OFFER
Single pole change over silver contacts 25V to 50V, 2.5kΩ coil. 8 for 50p. P. & P. 5p.

KEYTRONICS mail order only
44 EARLS COURT ROAD
LONDON, W.8 01-478 8499

COMPONENTS. Carbon film resistors (E24), range 0.5W 5%, at 1½p each. P.P. plus 10%, minimum 5p. FREEMANTLE, 18 Pennine Road, Southampton.

If you have difficulty
in obtaining

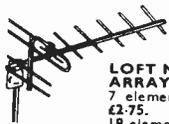
PRACTICAL ELECTRONICS

Please place a regular
order with your news-
agent or send 1 year's
subscription (£2.65) to

IPC MAGAZINES LTD.
Subscription Department
Practical Electronics
Tower House
Southampton Street
London WC2E 9QX

U.H.F. TV AERIALS

SUITABLE FOR COLOUR & MONO-
CHROME RECEPTION



All U.H.F. aerials
now fitted with
tilting bracket and 4
element reflector.

LOFT MOUNTING ARRAYS

7 element £2.25. 11 element
£2.75. 14 element £3.25.
18 element £3.75.

**WALL MOUNTING c/w WALL ARM
AND BRACKET.** 7 element £3.25. 11 element
£3.75. 14 element £4.25. 18 element £4.75.

**CHIMNEY MOUNTING ARRAYS c/w
MAST AND LASHING KIT.** 7 element £4.
11 element £4.50. 14 element £4.75. 18
element £5.25.

MAST MOUNTING arrays only 7 element
£2.25. 11 element £2.75. 14 element £3.25.
18 element £3.75. Complete assembly in-
structions with every aerial. LOW LOSS
coaxial cable 9p yd.

KING TELEBOOSTERS from £3.75. LABGEAR
all band V.H.F.—U.H.F.—F.M. radio mains
operated pre-amps £7.50. State clearly channel
number required on all orders. P. & P. on all
aerials 50p accs. 15p. C.W.O. min. C.O.D.
charge 25p.

BBC-ITV-FM AERIALS

BBC (band 1) Wall S/D £2. **LOFT inverted**
"T" £1.25. **EXTERNAL "H" array** only £3.
ITV (band 3) 5 element loft array £2.50.
7 element £3. **COMBINED BBC-ITV** loft
1+5 £2.75. 1+7 £3.50. **WALL AND
CHIMNEY UNITS ALSO AVAILABLE.**
Pre-amps from £3.75.

COMBINED U.H.F.-V.H.F. aerials 1+5+9 £4.
1+5+14 £4.50. 1+7+14 £5. **F.M. RADIO**
loft S/D £1. 3 element £3.25. 4 element £3.50.
Standard coaxial plugs 9p. Coaxial cable 5p yd.
Outlet box 30p. P. & P. all aerials 50p. accs. 30p.
C.W.O. min. C.O.D. charge 25p. Send 5p for
fully illustrated lists.

**CALLERS WELCOMED
OPEN ALL DAY SATURDAY**

K.V.A. ELECTRONICS

40-41 Monarch Parade, London Rd.
Mitcham, Surrey
Telephone 01-648 4884

BATTERY ELIMINATORS

The ideal way of running your **TRANSISTOR
RADIO, RECORD PLAYER, TAPE RECORDER,
AMPLIFIER**, etc. Types available: 6v, 9v, 12v,
18v (single output) £2 each. P. & P. 15p.
9v + 9v; 6v + 6v; or 4½v + 4½v (two separate
outputs) £2.50 each. P. & P. 15p. Please state
output required. All the above units are
completely isolated from mains by double
wound transformer ensuring 100% safety.

R.C.S. PRODUCTS (RADIO) LTD.
(Dept. P.E.), 31 Oliver Road, London, E.17



MICROJET WELDER
A TINY FLAME UP TO
5000°F!
WELDS-BRAZES
SOLDS
INC.3
£9.99
FLAME TIPS

A precision tool using a com-
bination of butane and com-
pressed oxygen. U.S.A. manu-
factured. Gives two sizes of flame
of pencil lead thickness. Adjustable temperatures up
to 5,000°F. Lights instantly, no priming. Cuts
metals, welds, brazes and solders, etc., gold and
silver. Ideal for jewellers, clockmakers, silversmiths.
Up to 40 minutes' operation using fuel supplied.
Replacement set of 2 oxygen and 1 butane cylinders
£1.50 inc. post. Complete with instructions. List
price £14.50. Our price £9.99 + 31p p. & p. Send
£10.30.

JOHN DUDLEY & CO. LTD. Dept. P.E.1
301 Cricklewood Lane, Child's Hill, London, N.W.2.
Tel. 01-458 5917. Callers welcome.

TELERRADIO SPECIAL PRODUCTS

How to build a Digital radio control System.
2-5 Channels 75p 2 Channel 50p
How to build a Digital Clock 65p
How to build a Mullard Stereo Pre-Amplifier 50p
How to build a W/World (Linsley-Hood) Hi-Fi
Amp. 75p Also Texas & Bailey Hi-Fi amplifiers
LISTS FREE SEND S.A.E.

TELERRADIO ELECTRONICS
325-7 Lower Fore Street, Edmonton
London, N.9 01-807 3719

Understanding the Semiconductor

C. N. G. Matthews

The book starts with an intro-
duction to conduction and semi-
conduction, in which the physics
is kept very simple, and it goes
on to deal with the *pn* junction
and its action in diodes and
transistors. The latter part of
the book comprises an intro-
duction to transistor circuitry,
describing in detail the action of
the three fundamental con-
figurations and laying the
foundations for an approach to
stable circuit design.

0 408 00049 X 128 pages illustrated
1971 £1.00

Questions and Answers on Radio and Television

— 3rd Edition

H. W. Hellyer

Beginning with the funda-
mentals of electricity and sound
and radio waves, this manual
takes the reader step by step in
question and answer form to a
thorough grasp of the principles
of radio and television recep-
tion, and transmission with
emphasis on the techniques and
operations employed in day to
day practical work. It will be of
great interest to radio and
television service engineers,
craft apprentices and the
amateur enthusiast.

0 408 00054 6 128 pages illustrated
1971 60p

Information about other
Butterworth Electronics Books
is available from the
Publishers on request

Available from leading
booksellers or

**The Butterworth
Group**
88 Kingsway London
WC2B 6AB

Showrooms and Trade Counter
4-5 Bell Yard London WC2

RST

VALVE MAIL ORDER CO. BLACKWOOD HALL 16a WELLFIELD ROAD, LONDON SW16 2BS SPECIAL EXPRESS MAIL ORDER SERVICE

Express postage 1p per transistor, over ten post free

| | | | | | | | | | |
|---------|------|--------|------|------------|------|---------|------|---------|------|
| 1N91 | 0.25 | AC127 | 0.25 | BF179 | 0.30 | GJ4M | 0.38 | OC43 | 0.40 |
| 1N83 | 0.20 | AC128 | 0.25 | BF181 | 0.38 | GJ5M | 0.25 | OC44 | 0.18 |
| 1N85 | 0.88 | AC187 | 0.30 | BF184 | 0.25 | GJ7M | 0.38 | OC44M | 0.18 |
| 1N253 | 0.50 | AC188 | 0.30 | BF185 | 0.25 | HG1005 | 0.50 | OC45 | 0.18 |
| 1N256 | 0.50 | AC177 | 0.30 | BF194 | 0.18 | HS100A | 0.20 | OC45M | 0.15 |
| 1N645 | 0.25 | AC178 | 0.25 | BF195 | 0.15 | MAT100 | 0.25 | OC46 | 0.28 |
| 1N725A | 0.20 | AC179 | 0.25 | BF196 | 0.28 | MAT101 | 0.30 | OC57 | 0.60 |
| 1N914 | 0.08 | AC120 | 0.25 | BF197 | 0.28 | MAT120 | 0.25 | OC58 | 0.60 |
| 1N4007 | 0.25 | AC121 | 0.25 | BF861 | 0.28 | MAT121 | 0.30 | OC59 | 0.65 |
| 1R021 | 0.20 | AC122 | 0.18 | BF898 | 0.28 | MJE250 | 0.88 | OC66 | 0.50 |
| 1R113 | 0.15 | AC127 | 0.25 | BFX12 | 0.28 | MJE255 | 1.75 | OC70 | 0.15 |
| 1R130 | 0.13 | AC128 | 0.18 | BFX13 | 0.25 | MJE3055 | 0.93 | OC71 | 0.13 |
| 1R131 | 0.13 | AC139 | 0.55 | BFX29 | 0.30 | NKT128 | 0.35 | OC72 | 0.25 |
| 1R202 | 0.23 | AC140 | 0.15 | BFX30 | 0.33 | NKT129 | 0.30 | OC73 | 0.30 |
| 2G240 | 1.98 | AC141 | 0.25 | BFX35 | 0.98 | NKT211 | 0.25 | OC74 | 0.30 |
| 2G301 | 0.20 | AC144 | 0.38 | BFX63 | 0.50 | NKT213 | 0.25 | OC75 | 0.25 |
| 2G302 | 0.23 | AD140 | 0.30 | BFX84 | 0.30 | NKT214 | 0.15 | OC76 | 0.25 |
| 2G306 | 0.30 | AD149 | 0.50 | BFX85 | 0.40 | NKT216 | 0.38 | OC77 | 0.40 |
| 2G371 | 0.23 | AD161 | 0.38 | BFX86 | 0.33 | NKT217 | 0.40 | OC78 | 0.20 |
| 2G381 | 0.25 | AD162 | 0.38 | BFX87 | 0.33 | NKT218 | 0.40 | OC79 | 0.23 |
| 2G414 | 0.20 | AF106 | 0.30 | BFX88 | 0.25 | NKT219 | 0.33 | OC81 | 0.25 |
| 2G417 | 0.20 | AF114 | 0.25 | BFY10 | 0.50 | NKT222 | 0.28 | OC81D | 0.20 |
| 2N214 | 0.43 | AF115 | 0.30 | BFY11 | 1.25 | NKT224 | 0.23 | OC81M | 0.20 |
| 2N247 | 0.25 | AF116 | 0.33 | BFY17 | 0.25 | NKT251 | 0.24 | OC81DM | 0.18 |
| 2N250 | 0.50 | AF117 | 0.25 | BFY18 | 0.25 | NKT271 | 0.25 | OC81Z | 0.25 |
| 2N404 | 0.23 | AF118 | 0.63 | BFY19 | 0.25 | NKT272 | 0.25 | OC82 | 0.25 |
| 2N697 | 0.18 | AF119 | 0.20 | BFY24 | 0.45 | NKT273 | 0.20 | OC82D | 0.15 |
| 2N699 | 0.43 | AF124 | 0.63 | BFY24 | 1.00 | NKT274 | 0.20 | OC83 | 0.20 |
| 2N706 | 0.10 | AF125 | 0.20 | BFY30 | 0.23 | NKT275 | 0.25 | OC84 | 0.25 |
| 2N708A | 0.12 | AF126 | 0.18 | BFY51 | 0.20 | NKT277 | 0.20 | OC114 | 0.38 |
| 2N708 | 0.15 | AF127 | 0.18 | BFY52 | 0.23 | NKT278 | 0.25 | OC122 | 0.30 |
| 2N709 | 0.63 | AF139 | 0.30 | BFY53 | 0.18 | NKT301 | 0.40 | OC123 | 0.20 |
| 2N711 | 0.38 | AF178 | 0.48 | BFY64 | 0.43 | NKT304 | 0.50 | OC139 | 0.25 |
| 2N987 | 0.53 | AF179 | 0.48 | BFY90 | 0.68 | NKT403 | 0.75 | OC140 | 0.38 |
| 2N1090 | 0.30 | AF180 | 0.33 | BSY27 | 0.50 | NKT404 | 0.83 | OC141 | 0.63 |
| 2N1091 | 0.33 | AF181 | 0.43 | BSX60 | 0.93 | NKT678 | 0.30 | OC169 | 0.20 |
| 2N1131 | 0.30 | AF186 | 0.40 | BSX76 | 0.15 | NKT713 | 0.25 | OC170 | 0.25 |
| 2N1132 | 0.30 | AFY19 | 1.13 | BSY26 | 0.18 | NKT773 | 0.25 | OC171 | 0.30 |
| 2N1302 | 0.20 | AFZ11 | 0.83 | BSY27 | 0.20 | NKT777 | 0.38 | OC200 | 0.40 |
| 2N1303 | 0.23 | AFZ12 | 0.75 | BSY51 | 0.20 | 078B | 0.38 | OC201 | 0.60 |
| 2N1304 | 0.25 | ASV26 | 0.25 | BSY52A | 0.15 | 0A5 | 0.20 | OC202 | 0.75 |
| 2N1305 | 0.25 | ASV27 | 0.33 | BSY53 | 0.15 | 0A6 | 0.13 | OC203 | 0.40 |
| 2N1306 | 0.25 | ASV28 | 0.25 | BT102/500R | | 0A7 | 0.10 | OC204 | 0.40 |
| 2N1307 | 0.25 | ASV29 | 0.30 | | | 0A70 | 0.10 | OC205 | 0.75 |
| 2N1308 | 0.30 | ASV36 | 0.25 | BTY42 | 0.75 | 0A71 | 0.10 | OC206 | 0.90 |
| 2N1309 | 0.25 | ASV50 | 0.18 | BTY79/100R | | 0A73 | 0.10 | OC207 | 0.90 |
| 2N1320 | 0.28 | ASV51 | 0.40 | | 0.75 | 0A74 | 0.10 | OC460 | 0.30 |
| 2N1507 | 0.28 | ASV53 | 0.20 | BTY79/400R | | 0A79 | 0.10 | OC470 | 0.30 |
| 2N1526 | 0.38 | ASV55 | 0.20 | | 1.75 | 0A81 | 0.10 | OCP71 | 0.98 |
| 2N1909 | 0.25 | ASV62 | 0.25 | BY100 | 0.18 | 0A85 | 0.13 | ORP12 | 0.88 |
| 2N2147 | 0.75 | ASV86 | 0.33 | BY126 | 0.15 | 0A86 | 0.15 | ORP69 | 0.40 |
| 2N2148 | 0.60 | ASZ21 | 0.43 | BY127 | 0.20 | 0A90 | 0.10 | ORP61 | 0.43 |
| 2N2160 | 0.63 | ASZ23 | 0.75 | BY182 | 0.85 | 0A91 | 0.08 | 819T | 0.30 |
| 2N2218 | 0.40 | ASV10 | 0.88 | BY213 | 0.25 | 0A95 | 0.08 | 8A40 | 0.25 |
| 2N2219 | 0.33 | AU100 | 1.50 | BY213 | 0.85 | 0A200 | 0.08 | SFT308 | 0.38 |
| 2N2287 | 1.03 | BC107 | 0.13 | BYZ10 | 0.40 | 0A202 | 0.10 | ST722 | 0.38 |
| 2N2297 | 0.30 | BC108 | 0.13 | BYZ11 | 0.35 | 0A210 | 0.25 | ST7231 | 0.63 |
| 2N2369A | 0.20 | BC109 | 0.13 | BYZ12 | 0.30 | 0A211 | 0.38 | 8X68 | 0.20 |
| 2N2613 | 0.28 | BC113 | 0.25 | BYZ13 | 0.25 | 0AZ209 | 0.55 | 8X631 | 0.20 |
| 2N2646 | 0.53 | BC115 | 0.33 | BYZ15 | 1.00 | 0AZ201 | 0.50 | 8X635 | 0.20 |
| 2N2712 | 0.25 | BC116 | 0.40 | BYZ15 | 1.00 | 0AZ202 | 0.43 | 8X640 | 0.50 |
| 2N2784 | 0.50 | BC116A | 0.45 | BYZ16 | 0.63 | 0AZ203 | 0.43 | 8X641 | 0.55 |
| 2N2846 | 0.25 | BC118 | 0.38 | BYZ88C33 | | 0AZ204 | 0.43 | 8X642 | 0.60 |
| 2N2848 | 0.48 | BC121 | 0.20 | | 0.18 | 0AZ205 | 0.43 | 8X644 | 0.75 |
| 2N2904 | 0.30 | BC122 | 0.20 | CI11 | 0.65 | 0AZ206 | 0.43 | 8X645 | 0.75 |
| 2N2904A | 0.33 | BC125 | 0.68 | CR81/65 | 0.25 | 0AZ207 | 0.48 | V1530P | 0.50 |
| 2N2906 | 0.30 | BC126 | 0.65 | CR81/40 | 0.48 | 0AZ208 | 0.33 | V30930P | 0.38 |
| 2N2907 | 0.38 | BC140 | 0.55 | CS4B | 2.50 | 0AZ209 | 0.33 | V60201 | 0.50 |
| 2N2924 | 0.23 | BC147 | 0.18 | CS10B | 3.13 | 0AZ210 | 0.33 | V60201P | 0.38 |
| 2N2925 | 0.18 | BC148A | 0.13 | DD000 | 0.15 | 0AZ211 | 0.33 | XA101 | 0.10 |
| 2N2926 | 0.13 | BC149 | 0.20 | DD003 | 0.15 | 0AZ222 | 0.40 | XA102 | 0.18 |
| 2N3034 | 0.50 | BC157 | 0.20 | DD006 | 0.18 | 0AZ223 | 0.40 | XA151 | 0.15 |
| 2N3055 | 0.75 | BC158 | 0.20 | DD007 | 0.40 | 0AZ224 | 0.38 | XA152 | 0.18 |
| 2N3702 | 0.13 | BC158 | 0.20 | DD008 | 0.38 | 0AZ241 | 0.23 | XA161 | 0.25 |
| 2N3705 | 0.15 | BC160 | 0.63 | DD3 | 0.33 | 0AZ242 | 0.23 | XA162 | 0.25 |
| 2N3706 | 0.23 | BC169 | 0.13 | DD4 | 0.05 | 0AZ244 | 0.23 | XA162 | 0.25 |
| 2N3707 | 0.15 | BCY31 | 0.30 | DD5 | 0.33 | 0AZ246 | 0.23 | XB101 | 0.43 |
| 2N3709 | 0.13 | BCY32 | 0.50 | DD8 | 0.25 | 0AZ290 | 0.38 | XB102 | 0.10 |
| 2N3710 | 0.13 | BCY33 | 0.25 | ED12 | 0.05 | 0C16 | 0.50 | XB103 | 0.25 |
| 2N3711 | 0.13 | BCY33 | 0.25 | GET102 | 0.30 | 0C16T | 0.38 | XB113 | 0.12 |
| 2N3819 | 0.35 | BCY34 | 0.30 | GET103 | 0.23 | 0C19 | 0.38 | XB121 | 0.43 |
| 2N3820 | 0.88 | BCY38 | 0.40 | GET113 | 0.20 | 0C20 | 0.98 | ZR24 | 0.63 |
| 2N3823 | 0.75 | BCY39 | 0.60 | GET114 | 0.15 | 0C22 | 0.50 | Z8170 | 0.10 |
| 2N5027 | 0.53 | BCY40 | 0.50 | GET115 | 0.45 | 0C23 | 0.60 | Z8271 | 0.18 |
| 2N5088 | 0.38 | BCY42 | 0.15 | GET116 | 0.60 | 0C24 | 0.60 | ZT21 | 0.25 |
| 2N8003 | 1.00 | BCY43 | 0.30 | GET120 | 0.25 | 0C25 | 0.38 | ZT21 | 0.25 |
| 2N801 | 0.50 | BCY71 | 0.30 | GET872 | 0.30 | 0C26 | 0.25 | ZT43 | 0.25 |
| 2N804 | 0.75 | BCZ10 | 0.35 | GET875 | 0.25 | 0C28 | 0.63 | ZTX107 | 0.15 |
| 2N801 | 0.38 | BCZ11 | 0.40 | GET880 | 0.38 | 0C29 | 0.63 | ZTX108 | 0.15 |
| 2N803 | 0.63 | BD121 | 0.65 | GET881 | 0.25 | 0C30 | 0.40 | ZTX300 | 0.13 |
| AA129 | 0.20 | BD123 | 0.83 | GET882 | 0.25 | 0C35 | 0.50 | ZTX304 | 0.28 |
| AAZ12 | 0.30 | BD124 | 0.80 | GET885 | 0.25 | 0C36 | 0.63 | ZTX500 | 0.20 |
| AAZ13 | 0.13 | BF115 | 0.25 | GEX45.1 | 0.08 | 0C41 | 0.25 | ZTX503 | 0.20 |
| AC107 | 0.38 | BF117 | 0.50 | GEX941 | 0.15 | 0C42 | 0.30 | ZTX531 | 0.30 |
| ACT26 | 0.25 | BF167 | 0.25 | GJ3M | 0.25 | | | | |

SEMI-CONDUCTOR SET FOR P. E. GEMINI AMPLIFIER £12.95

SEND S.A.E. FOR LIST OF 3,000 TYPES
VALVES, TUBES AND TRANSISTORS

Open daily to callers: Mon.-Sat. 9 a.m.-5 p.m.
Closed Sat. 1.30 p.m.-2.30 p.m.

Terms C.W.O. only | Tel. 01-769 0199/1649

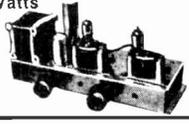
MW/LW TRANSISTOR RADIO



Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-555m+1070-1870m. 9 volt 6 transistor superhet using 3 AF117 in RF and IF stages powered by a two stage AF amplifier using OC81D, 2 x OC81. Output approx. 500MW. Transistors 3 x AF117, OC81D + 2 OC81. Also works off car-aerial. Full instruction book 12p free with parts. Red only, ply case, rexine covered. Requires PP7 battery, price £22p extra. 3 1/2 high-quality speaker. Price £26 plus 40p P. & P.

STEREO AMPLIFIER Type SHV—2 x 3 Watts

Fully built. Separate vol., base and treble controls each channel; 12 x 4 1/2 x 6in high. EZ80 and 2 x ECL86 valves. O.P. trans. for 3-ohm speakers. Double wound mains trans. Suitable for crystal magn. cartridge, tuner, etc. with mono-stereo switch. 200-250V a.c. mains. £7.25, 50p P. & P.



1 1/2 W MAINS GRAMOPHONE AMPLIFIER

EZ80, ECL82, O.P. Transformer (3 ohm). Vol./On-off and Tone Control. Double wound mains transformer; 2 1/2 x 2 1/2 x 2 1/2in high but wired to chassis, 4 x 2 1/2 x 4 1/2in over valves. £3.37 1/2 including 5in speaker (£2.75 less speaker). (Post paid.) (Two less 10%.)

MAINS TRANSFORMERS (240-250V input)

Postage in brackets
6.3V at 2A, 40p (15p).
250V at 50mA and 6.3V at 1 1/2A, 50p (20p).
22V at 1A, 6.3V at 2A and 250V at 50mA, 75p (25p).
90V at 20mA and 1.4V at 250mA, 50p (15p).
Deduct 10 per cent from total bill for more than one transformer.

Complete set of parts with wiring diagram for battery eliminator to give 90V. H.T. at 20-30mA and 1.4V at 125 or 200mA (adjustable). With undrilled aluminium box approx. 6 x 3 x 3in. trans., choke, two rectifiers, condensers.
Price £2.75 plus 25p P. & P.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants
(2 mins. from Station and Buses). FULL GUARANTEE. Aldershot 22240
CLOSED WEDNESDAY. S.A.E. for enquiries please.

ODEON RADIO

TEL. 01-427 5778

146 COLLEGE ROAD

HARROW

- RADIOSPARES LTD.
- BULGIN
- BELLING-LEE
- MULLARD
- EAGLE
- REPANCO
- WEYMOUTH
- J BEAM AERIALS
- ETC., ETC.

Veroboard, Chassis, Multimeters, Inst. Cases, Thermistors, Capacitors, Resistors, Plugs, Sockets, Audio Packs, Semiconductors, T/Recorder Drive Belts, Cartridges, Terminals, Microphones, Headphones, Etc. Most Components for Home Constructors.

BAKER 15in. AUDITORIUM

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home.

- Maximum Power 35 watts
- Bass Resonance 35 c.p.s.
- Flux Density 15,000 gauss
- Voice coil impedance 8 or 15 ohms models
- Useful response 20-14,000 c.p.s.
- Nett weight 15 lbs.

£19

POST FREE

GUITAR MODEL "GROUP 50" 50 watt £19

Latest catalogue 5p with enclosure plans

Baker Reproducers Ltd

Bensham Manor Road Passage, Thornton Heath, Surrey. 01-684-1665



In just 2 minutes, find out how you can qualify for promotion or a better job in Engineering...

That's how long it will take you to fill in the coupon below. Mail it to B.I.E.T. and we'll send you full details and a free book. B.I.E.T. has successfully trained *thousands* of men at home - equipped them for higher pay and better, more interesting jobs. We can do as much for YOU. A low-cost B.I.E.T. Home Study Course gets results fast - makes learning easier and something you look forward to. There are no books to buy and you can pay-as-you-learn on 'SATISFACTION - OR REFUND OF FEE' terms. If you'd like to know how just a few hours a week of your spare time, doing something constructive and enjoyable, could put you out in front, post the coupon today. No obligation.

WHICH SUBJECT WOULD INTEREST YOU?

Mechanical
A.M.S.E. (Mech.)
Inst. of Engineers
Mechanical Eng.
Maintenance Eng.
Welding
General Diesel Eng.
Sheet Metal Work
Eng. Inspection
Eng. Metallurgy
C. & G. Eng. Crafts
C. & G. Fabrication

Draughtsmanship
A.M.I.E.D.
Gen. Draughtsmanship
Die & Press Tools
Elec. Draughtsmanship
Jig & Tool Design
Design of Elec. Machines
Technical Drawing
Building

Electrical & Electronic
A.M.S.E. (Elec.)
C. & G. Elec. Eng.
General Elec. Eng.
Installations & Wiring
Electrical Maths.
Electrical Science
Computer Electronics
Electronic Eng.

Radio & Telecomms.
C. & G. Telecomms.
C. & G. Radio Servicing
Radio Amateurs' Exam.
Radio Operators' Cert.
Radio & TV Engineering
Radio Servicing
Practical Television
TV Servicing
Colour TV
Practical Radio & Electronics (with kit)

Auto & Aero
A.M.I.M.I.
MAA/IMI Diploma
C. & G. Auto Eng.
General Auto Eng.
Motor Mechanics
A.R.B. Certs.
Gen. Aero Eng.

Management & Production
Computer Programming
Inst. of Marketing
A.C.W.A.
Works Management
Work Study
Production Eng.
Storekeeping
Estimating
Personnel Management
Quality Control
Electronic Data Processing
Numerical Control
Planning Engineering
Materials Handling
Operational Research
Metrication

Constructional
A.M.S.E. (Civ.)
C. & G. Structural
Road Engineering
Civil Engineering
Building
Air Conditioning
Heating & Ventilating
Carpentry & Joinery
Clerk of Works
Building Drawing
Surveying
Painting and Decorating.
Architecture
Builders' Quantities

General
C.E.I.
Petroleum Tech.
Practical Maths.
Refrigerator Servicing.
Rubber Technology
Sales Engineer
Timber Trade
Farm Science
Agricultural Eng.
General Plastics

General Certificate of Education
Choose from 42 'O' and 'A' Level subjects including:
English
Chemistry
General Science
Geology
Physics
Mathematics
Technical Drawing
French
German
Russian
Spanish
Biology
B.I.E.T. and its associated schools have recorded well over 10,000 G.C.E. successes at 'O' and 'A' level.
WE COVER A WIDE RANGE OF TECHNICAL AND PROFESSIONAL EXAMINATIONS.

Over 3,000 of our Students have obtained City & Guilds Certificates. Thousands of other exam successes.

THEY DID IT— SO COULD YOU

"My income has almost trebled... my life is fuller and happier." - Case History G/321.

"In addition to having my salary doubled, my future is assured." - Case History H/493.

"Completing your Course meant going from a job I detested to a job I love." - Case History B/461.

FIND OUT FOR YOURSELF

These letters - and there are many more on file at Aldermaston Court - speak of the rewards that come to the man who has given himself the specialised know-how employers seek. There's no surer way of getting ahead or of opening up new opportunities for yourself. It will cost you a stamp to find out how we can help you.

Free!

Why not do the thing that really interests you? Without losing a day's pay, you could quietly turn yourself into something of an expert. Complete the coupon (or write if you prefer not to cut the page). We'll send you full details and a FREE illustrated book. No obligation and nobody will call on you... but it could be the best thing you ever did.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Dept B4, Aldermaston Court, Reading RG7 4PF.

(Write if you prefer not to cut this page)



POST THIS COUPON TODAY

To: B.I.E.T., Dept B4, Aldermaston Court, Reading RG7 4PF
Please send me book and details of your Courses in
BLOCK CAPITALS PLEASE

Name..... Age.....

Address.....

..... Occupation.....

B.I.E.T. - IN ASSOCIATION WITH THE SCHOOL OF CAREERS - ALDERMASTON COURT, BERKSHIRE

Published approximately on the 15th of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand - Gordon & Gotch (Asia) Ltd.; South Africa - Central News Agency Ltd.; Rhodesia and Zambia - Kingstons Ltd.; East Africa - Stationery and Office Supplies Ltd. Subscription Rate (including postage): For one year to any part of the world £2.65 (£2.13.0). Practical Electronics is sold subject to the following conditions, namely, that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

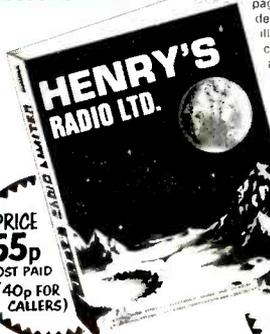
HENRY'S RADIO LIMITED



ENGLAND'S LEADING ELECTRONIC CENTRES

HI-FI · COMPONENTS · TEST · PA · DISCOTHEQUE · ELECTRONIC ORGANS · MAIL ORDER

COMPLETELY NEW
10th EDITION
CATALOGUE



350

pages fully detailed and illustrated covering every aspect of Electronics — plus data and information

PRICE 55p
POST PAID
(40p FOR CALLERS)

10,000

Stock lines at Special Low Prices and Fully Guaranteed

PLUS! FIVE 10p VOUCHERS FOR USE WITH PURCHASES

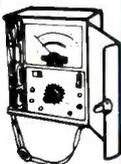
Send to this address: **HENRY'S RADIO LTD. (DEPT. PE), 3 ALBEMARLE WAY, LONDON, E.C.1.** For catalogue only. (All other mail to "303" as below).

A NEW HENRY'S CATALOGUE IS A MUST FOR ELECTRONICS TODAY!

TEST EQUIPMENT FOR EVERY PURPOSE



AF105 50kV multimeter (illus.). Price £8.50, p.p. 20p. Leather case £11.42.
200M 20kV. Price £3.87, p.p. 20p. Case 62p.
500 30kV multimeter. Price £8.87, p.p. 20p. Leather case £11.50.
FH133 2kV. Price £4.12, p.p. 15p. Leather case £1.15.
TE65 Valve voltmeter (illus.). Price £17.50, p.p. 40p.
SE250B Pocket pencil signal injector £1.75, p.p. 15p.
SE500 Pocket pencil signal tracer £1.50, p.p. 15p.
TE20D RF generator. Price £15, p.p. 40p.
TE22D Matching audio generator. Price £17, p.p. 40p.
TE15 Grid dip meter. Price £12.50, p.p. 40p.
TO3 Scope 3in tube. Price £37.50, p.p. 50p.
TE22 Audio Generator. Price £17, p.p. 40p.
CI-5 Pulse Scope. Price £39, p.p. 50p.



PANEL METERS

Complete range in stock. 38, 65 and 85 types plus large range Edge types also 240°-250° types. (Get a copy of our latest catalogue for full specifications and further ranges.)

MORE OF EVERYTHING AT LOW PRICES ALWAYS FROM HENRY'S

★ COMPONENTS IN STOCK FOR ALMOST ALL PUBLISHED DESIGNS. YOUR ENQUIRIES INVITED. SEND LARGE SAE (with list) FOR PARTS QUOTE FOR ALL CIRCUITS.

See our advertisement inside this magazine for the largest range of transistors and I.C.'s, etc. available in U.K. Free list No. 36 on request.

HENRY'S SUPPLY ALL YOUR AUDIO-ELECTRONIC NEEDS!

TRANSISTOR AMPLIFIERS



(Leaflets Ref. Nos. 6 and 8).

Post, etc. 20p.
4-300 4TR 9V 300mW £1.75 PA7 6TR 16V 7W £3.62
104 4TR 9V 1W £2.12 608 6TR 24V 10W £4.12
304 4TR 9V 3W £2.47 410 4TR 28V 10W £4.97
555 6TR 12V 3W £2.75 MPA12/3 6TR 18V 12W £4.50
MPA12/15 6TR 36V 12W £5.25

OPTIONAL POWER SUPPLIES Post, etc., 20p
P500 (1 or 2) for 104, 304 £2.62
P520 (1 or 2) for PA7 £3.47
MU24/40 (1 or 2) for MPA12/3 or MPA12/15 £4.50
P11 for 608 £2.87 P15 for 410 £2.62

SINCLAIR PROJECT 60

PACKAGE DEALS—SAVE POUNDS!



2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply, £16.75. Carr. 40p. Or with PZ6 power supply £18.25. Carr. 40p. 2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply, £20.25. Carr. 40p. Transformer for PZ8 £2.45 extra. Any of the above with Active Filter unit add £4.75 or with pair Q16 speakers add £16. Also new FM Tuner £21. 2000 Amplifier £34.50. P/P 50p. 3000 Amplifier £31.50. P/P 50p. Also IC12 £2.50

LOW COST HI-FI SPEAKERS

E.M.I. Size 13 1/2in x 8 1/2in
TYPE 150 6 watt, 3, 8 or 15 ohms. £2.12. Post 22p.



TYPE 150TC Twin cone version. £2.75. Post 22p.
TYPE 450 10 watt with twin tweeters and crossover. 3, 8 or 15 ohms. £3.50. Post 25p.
TYPE 350 20 watt with tweeter and crossover. 8 and 15 ohms. £7.50. Post 28p.



POLISHED CABINETS For 150, 150TC and 450 £4.50. Post 30p.
TERRIFIC RANGE OF SPEAKERS, KITS AND CABINETS IN STOCK. CATALOGUE OR YOUR ENQUIRIES INVITED.

MONO, STEREO AND MIXING EQUIPMENT. HIGH QUALITY WITH LOW PRICES



SELF-POWERED SILICON —FET CONTROL UNITS/ PREAMPLIFIERS
FET 9/4 Mono or single channel. Adjustable levels. All facilities plus microphone. Mixing. £12.50.
FET 154 Stereo with all facilities, magnetic cart. input, etc. £16.50.
SILICON POWER AMPLIFIERS FOR USE WITH ABOVE
PA25 25 watts into 8 ohms £7.50.
PA50 50 watts into 4 ohms £9.50.
MU442 Power Supply for 1 or 2. PA25's or 1 only PA50 £6. Post 20p.
Free Brochure No. 25 on request. No soldering—all units interconnecting. On demonstration at "356".

NIXIE TUBES

XN3 or XN13 0-9 side view with data sheet. 85p each.
GN4 end view 0-9 with socket and data. £1.75. All I.C.'s for Digital Clocks in stock. HENRY'S CLOCK CIRCUIT No. 29, 10p

20 WATT I.C. AMPLIFIER

Toshiba 20 watt Power Amplifier. £4.57. Toshiba Pre-Amplifier I.C. £1.50. Data and suggested circuits No. 42, 10p.

HI-FI TO SUIT EVERY POCKET



TELETON "206". Garrard SP25 Mk III Goldring G800 Series. Carr. 20p. Plinth/Cover, 10 watt 3 way bookshelf Speaker Systems, all leads, etc. (Rec. price £81).

SAVE **£59.45** Carr. £21.55

(OR WITH U.K. MADE HLSA707 (same performance) £56.95).

PLUS FREE PAIR STEREO HEADPHONES

TELETON F2000 Med. Wave, Stereo FM Tuner Amplifier, Garrard 2025 T.C. 9TAMC Diam. Plinth/Cover, 10 watt Speaker Systems as above, all leads, etc. (Rec. Price £91).

SAVE **£64.50** Carr. £26.50

PLUS FREE PAIR STEREO HEADPHONES

THE TWO MOST POPULAR SYSTEMS EVER— PLUS FULL 12 MONTHS' GUARANTEE AS WITH ALL "HENRY'S" OFFERS!

FREE 12-page Audio — Hi-Fi Stock and Stereo Systems discounts lists. — save up to 40%! — demonstrations and credit terms (to callers). Plus 12 months' guarantee.

BUILD THIS VHF FM TUNER

5 MULLARD TRANSISTORS 300kc/s BANDWIDTH. PRINTED CIRCUIT. HIGH FIDELITY REPRODUCTION. MONO AND STEREO. A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately.
Free Leaflet Nos. 3 and 7.
TOTAL £6.97, p.p. 20p. Cabinet £1. Decoder Kit £5.97. Tuning meter £1.75. Mains unit (optional) Model PS900 £2.47. Mains unit for Tuner and Decoder PS1200 £2.62.



NEW "BANDSPREAD" PORTABLE TO BUILD

Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bandspread for extra selectivity. Also slow motion geared tuning. 600mW push-pull output, fibre glass PVC covered cabinet, car aerial socket. Attractive appearance and performance.
TOTAL COST TO BUILD £7.98, p.p. 32p (Battery 22p). All parts sold separately—Leaflet No. 2.
77 PORTABLE (as previously advertised), £6.98, p.p. 35p from stock. (Leaflet No. 1.)



FREE BROCHURES

* P.A. DISCO, LIGHTING No. 18
* ELECTRONIC ORGANS IN KIT FORM No. 9
* HIGH FIDELITY No. 16/17
* TRANSISTORS, I.C.'s No. 36
All details also in latest catalogue—see above

Electronic Components, Audio and Test Gear Centre
356 EDGWARE ROAD, LONDON, W.2.
Tel: 01-402 4736

High Fidelity Sales & Demonstrations Centre
354 EDGWARE ROAD, LONDON, W.2.
Tel: 01-402 5854

Electronic Organs, P.A. & Discotheque Centre
309 EDGWARE ROAD, LONDON, W.2.
Tel: 01-723 6963

Mail Orders, Special Bargain Shop, Industrial Sales
303 EDGWARE ROAD, LONDON, W.2.
Tel: 01-723 1008/9

"354" & "356" OPEN SIX FULL DAYS A WEEK 9 am to 6 pm MONDAY TO SATURDAY