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AUGUST 1976

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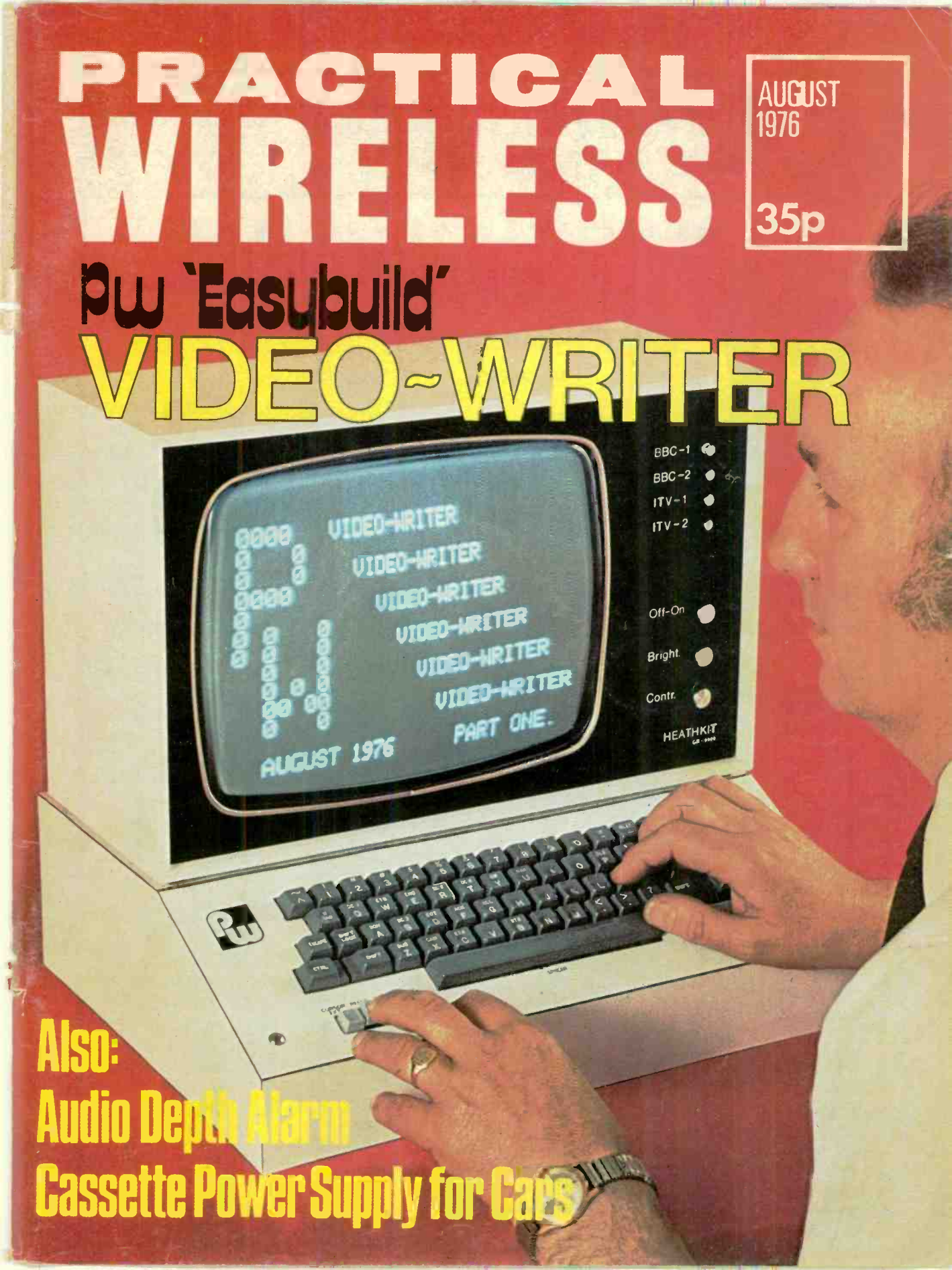

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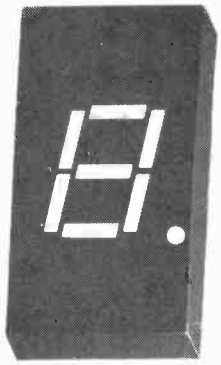

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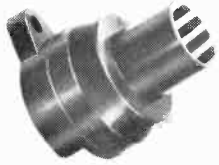

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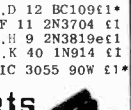

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VOL. 52 NO. 4
ISSUE 834
AUGUST 1976

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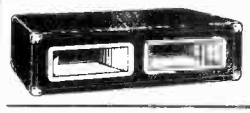

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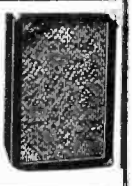

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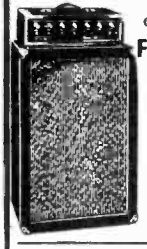

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Sparkrite mk2

Capacitive discharge electronic ignition kit

VOTED BEST OF 8 SYSTEMS TESTED BY 'POPULAR MOTORING' MAGAZINE

- Smoother running
- Instant all-weather starting
- Continual peak performance
- Longer coil/battery/plug life
- Improved acceleration/top speeds
- Up to 20% better fuel consumption

Sparkrite Mk. 2 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 15/30 mins.

Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and, therefore, eliminates the possibility of blowing the transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect). All kits fit vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED

Ready drilled pressed steel case coated in matt black epoxy resin, ready drilled base and heat-sink, top quality 5 year guaranteed transformer and components, cables, coil connectors, printed circuit board, nuts, bolts, silicon grease, full instructions to make the kit negative or positive earth, and 10 page installation instructions.

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Richard Allan Triple 8	each	£20·25
Richard Allan Triple 12	each	£25·16
Richard Allan Super Triple	each	£29·25
Richard Allan RA8 Kit	pair	£37·80
Richard Allan RA82 Kit	pair	£59·40
Richard Allan RA82L Kit	pair	£65·70
Fane Mode One Mk2	each	£10·35
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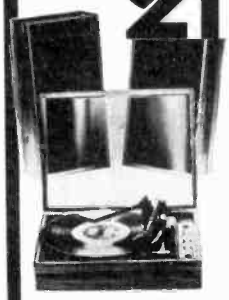
RTVC

Now the VISCOUNT IV 30 x 30 Stereo Amp IN KIT FORM

For the experienced constructor the Viscount IV amplifier comes complete with teak finished cabinet, front trim panel, knobs and all necessary metalwork. The specification for the NEW 30 x 30 is similar to the complete system offered below, but of course with the bigger output.

£24.75 +£1.50 p&p

STEREO 21



COMPLETE ONLY

£23.00 + p&p £4.00

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Garrard 3 speed Deck automatic, manual facilities together with stereo cartridge and cueing device.

Stereo 21, easy to assemble audio system kit. No soldering required. The unit is finished in SimiTeak and the acrylic top presents an unusually interesting variation on the modern deck plinth.
Includes – **3 speed deck**, automatic manual facilities together with stereo cartridge and cueing device.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications – For the technically minded.
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8-15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs – radio, tape, etc., and outputs for taping discs.
Overall Dimensions. Speakers approx 12"x 9"x 5". Complete deck and cover in closed position approx. 15½" x12" x 6".
Extras if required. Optional Diamond Styli **£1.50**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance **£5.25**

BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS

MP 60 Type *(illustrated)* Less Cartridge	**£14.40** p&p £2·00
C141 *(not illustrated)* Auto. with Cue Fitted Stereo Cartridge	**£10.80** p&p £1·50

All plinths finished in matching Teak veneer.

EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" x 8" woofer, 3¼" tweeter and matching crossover.
Easily put together with just a few basic tools.
Specification (each speaker): Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20-20,000 Hz. Size 20"x11"x 9½" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.

£19.80 pair complete + £5.20 p&p

Complete with crossover Components and circuit diagram.

EASYBUILD SPEAKER KIT THE NEW 'COMPACT'

A compact bookshelf speaker system giving a high electro accoustic efficiency for the low powered amplifier.
The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, and fix together with masking tape till glue dries.
The cabinet measures 12" x 9" x 5" deep approx. finished in simulated teak, incorporating a quality 8" speaker, maximum power handling 7 watts, impedance 8 ohms nominal, magnet size 2⅜" approx., with 1½" parasitic tweeter.

£7.50 PAIR INCLUSIVE + p&p £1.70

EMI 350 KIT

£6.55 + £1.20 p & p.

Complete with crossover Components and circuit diagram

System consists of a 13" x 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

VISCOUNT IV STEREO AMP

COMPLETE 20 x 20 SYSTEMS

SYSTEM 1b £65.00

The new 20 + 20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.
The VISCOUNT IV has a comprehensive range of controls – volume, bass, treble, balance mono/stereo, mode selector, and scratch filter.
Front panel socket for stereo headphones. And a host of sockets at the rear – for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.
SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion at 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. – 3 millivolts at 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. – 50 millivolts at 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. – 140 millivolts at 50 K ohms (flat frequency response); 5. Microphone – 3 millivolts at 50 K ohms (flat frequency response).
CONTROLS: Push button ON/OFF, stereo/mono, scratch filter. 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. **Frequency response:** 25 Hz to 25 kHz at full rated output. **Signal to noise ratio:** better than –50 dB on all inputs. **Tone control range:** Bass ±15 dB at 50 Hz; Treble ±12 dB at 10 KHz. **Power requirements:** 250V A.C. mains at 60 watts.
Approx size: 15¼" x 3" x10." **MP60 type deck** with magnetic cartridge, de luxe plinth and cover. **Two Duo Type IIB matched speakers**—Enclosure size 18½"×13½"×7¼" approx. in veneer teak. Drive unit 10" with 2½" tweeter. 12 watts handling 24 watts peak.

Complete System with these speakers

£65.00 + £6.50 p&p.

SYSTEM 2 £80.00

Viscount IV amplifier (As System 1a)
MP60 type deck (As System 1a)
Two Duo Type III matched speakers – Enclosure size approx. 27" × 13" × 11½". Finished in teak simulate. Drive units 13" × 8" bass driver, and two 3" (approx.) tweeters. 20 watts RMS, 8 ohms frequency range – 20 Hz to 18,000 Hz.
Complete System with these speakers **£80.00** + £7.60 p & p.

PRICES: SYSTEM 1a

Viscount IV amplifier	£24.75 + £1.90 p & p.
2 Duo Type IIb speakers	£27.00 + £6.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£19.80 + £3.30 p & p.
Total if purchased separately:	**£71.55**
Available complete for only:	**£65.00** + £6.50 p & p.

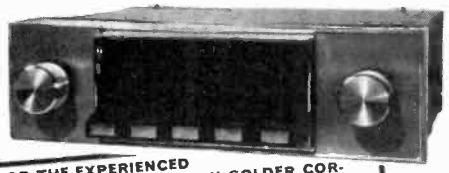
PRICES: SYSTEM 2

Viscount IV amplifier	£24.75 + £1.90 p & p.
2 Duo Type III speakers	£41.40 + £7.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£19.80 + £3.30 p & p.
Total if purchased separately:	**£85.95**
Available complete for only	**£80.00** + £7.80 p & p.

Scotland P & P Surcharge System 1a £1.75 System 2 £3.50

Note: 30 x 30 kit available only as a separate item.

PUSH BUTTON CAR RADIO KIT—THE TOURIST



FOR THE EXPERIENCED CONSTRUCTOR WHO CAN SOLDER CORRECTLY ON A PRINTED CIRCUIT BOARD YOU CAN BUILD THIS KIT CORRECTLY

NOW YOU CAN BUILD YOUR OWN PUSH BUTTON CAR RADIO!

This construction kit comprises a fully built and aligned R.F.I.F. module; Printed circuit board, with ready mounted integrated circuit output stage and all other components. The push button tuning mechanism is fully built and tested ready to mate with the printed circuit board. (once it is assembled). **NOTE:** No test equipment is required for alignment, but remember you must have the ability to solder on a printed circuit board.

TECHNICAL SPECIFICATION
(1) Output 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) Integrated circuit output stage, pre-built three stage IF Module. Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide, 2" high and 4¾" deep approx. Speaker including baffle and fixing strip £1.80+45p. p&p. **Car Aerial Recommended** – fully retractable £1.45+40p. p&p.

£7.40 +£1.05 p&p.

STEREO CASSETTE TAPE DECK KIT

Kit comprises of ready built cassette tape transport mechanism. Featuring pause control, solenoid assisted auto-stop, 3 digit tape counter, belt-driven balanced fly wheel. DC motor with electronic speed control, ready built and mounted record/replay PC board, and two VU meters, power supply, PC board, mains transformer. Input and output sockets and two level controls. Specification power source 240 AC 50Hz. Output more than 0.5v imput mike −65dB 10KΩ. DIN −47dB. 100KΩ. Track system 2 channel stereo record play-back. Tape speed. 4.8CM/SEC. Frequency response 50-12,000 Hz signal to noise ratio −42dB. Recording system AC Bias. Erasing system AC erase. Bias frequency 57KHz. Size of mechanism 8" x 5" x 3½" approx: unit easy to mount into your cabinet 3" required to clear base of mechanism approx.

* This is an advanced kit not suitable for those without electrical knowledge and those unable to solder.

£29.25 + p&p £1.50 or send SAE for complete details.

NEW PRODUCT
DISCO 35 MONO AMPLIFIER

An ideal general purpose 35 watt mono amplifier with full mixing facilities. Suitable for DISCO, PUBLIC ADDRESS & GUITAR/MUSICAL INSTRUMENTS. Unit housed in an attractively styled teak veneered cabinet. 4 Inputs: DISC 1 & DISC 2 (BOTH FOR CERAMIC CARTRIDGES), tape and microphone. CONTROLS: All level mixing controls are fitted with integral switches, push button type. DISC 1 & DISC 2: Volume combined treble filter. TAPE: Volume combined bass booster switch. MASTER: Volume control combined on/off. MIC: Volume combined bass booster switch. INDEPENDENT BASS AND TREBLE CONTROLS.

TECHNICAL SPECIFICATION
Power output: 35RMS into 4 ohms. **Speaker:** (Suitable for 4 to 15 ohms speakers). **Sensitivities: DISC 1 & DISC 2:** 30 mv (into 120k RIAA). **Treble Filter Switch:** 12 db@ 10 KHz. **Tape:** 100 mv (into 120k Flat). **Bass Booster Switch**+18 db@ 60 Hz. **Mic:** 2 mv (equilised for dynamic). **Bass Booster Switch**+20 db@ 60 Hz. **Bass Control:** ±15 db@ 60 Hz. **Treble Control:** ±12 db@ 10 KHz.

£25.00 +£1.40 p&p

8 TRACK HOME CARTRIDGE PLAYER

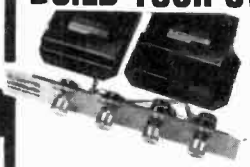
Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input. 240V. Output sensitivity 125mV.

Yours for only **£12.60** +£1.70 p & p.

SPECIAL OFFER

As above but complete with build yourself Unisound Amplifier Kit (see opposite panel) + 2 'Compact' easy to build speaker kits (see opposite page) **£24.50** + p & p £2·00

BUILD YOUR OWN STEREO AMPLIFIER

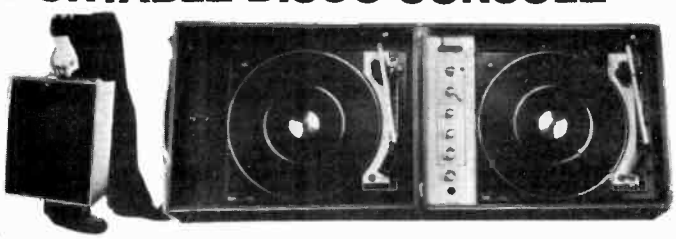


For the man who wants to design his own stereo – here's your chance to start, with Unisound – pre-amp, power amplifier and control panel. – Just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum. 240V. AC only.

£8.00 £1.05 p & p.

Also available with the 'Compact' (see opposite page) easy build speaker kit £14.50 + £2 p & p

PORTABLE DISCO CONSOLE



INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables. Two B.S.R. MP60 type single play professional series decks, fitted with crystal cartridges.

TECHNICAL SPECIFICATION:
Pre-amp – Output – 200mV. Auxiliary inputs – 200mV and 750mV into 1 meg. Mic input – 6mV into 100K. 240 volt operation. **Turntables capacity** – 7", 10" or 12" records. **Rumble, wow and flutter** Rumble Better than −35dB. Wow Better than 0.2% Flutter Better than 0.06% (Gaumont kalee meter). **Finish** – Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size –
Unit Closed – 17¾" × 13¾" × 8¾" (app.)
Unit Open – 35¾" × 13¾" × 4¾" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only
£51.00 +£6.50 p & p.

All prices include VAT at current rates

Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.

All items subject to availability. Prices correct at 1st June 1976 and subject to change without notice.

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323 EDGWARE ROAD, LONDON W2
Personal Shoppers **EDGWARE RD:** 9 a.m.–5.30p.m. Half day Thurs
ACTON: 9.30a.m.–5p.m. Closed all day Wed.

15—240 Watts!

HY5
Preamplifier

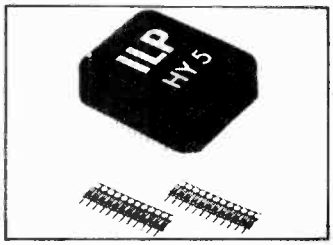
The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc) are catered for internally. The desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: Complete pre-amplifier in single pack—Multi-function equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.

APPLICATIONS: Hi-Fi—Mixers—Disco—Guitar and Organ—Public address

SPECIFICATIONS:
INPUTS. Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; Input impedance 47kΩ at 1kHz.
OUTPUTS. Tape 100mV; Main output 500mV R.M.S.
ACTIVE TONE CONTROLS. Treble ± 12dB at 10kHz; Bass ± at 100Hz.
DISTORTION. 0·1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD. 38dB on Magnetic Pick-up. SUPPLY VOLTAGE ± 16-50V.

Price £4·75 + £1·19 VAT P&P free.



HY30
15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.

FEATURES: Complete Kit—Low Distortion—Short, Open and Thermal Protection—Easy to Build.

APPLICATIONS: Updating audio equipment—Guitar practice amplifier—Test amplifier—audio oscillator.

SPECIFICATIONS:
OUTPUT POWER 15W R.M.S. into 8Ω; DISTORTION 0·1% at 1·5W.
INPUT SENSITIVITY 500mV. FREQUENCY RESPONSE 10Hz-16kHz—3dB.
SUPPLY VOLTAGE ± 18V.

Price £4·75 + £1·19 VAT P&P free.

Available June '76

HY50
25 Watts into 8Ω

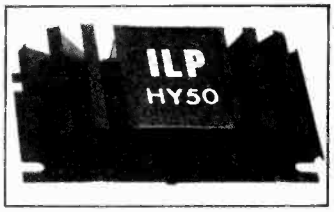
The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components

APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier

SPECIFICATIONS: INPUT SENSITIVITY 500mV
OUTPUT POWER 25W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 25W at 1kHz
SIGNAL/NOISE RATIO 75dB FREQUENCY RESPONSE 10Hz-45kHz—3dB.
SUPPLY VOLTAGE ±25V SIZE 105 50 25mm

Price £6.20+£1.55 VAT P&P free.



HY120
60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components

APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ

SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 60W at 1kHz
SIGNAL/NOISE RATIO 90dB FREQUENCY RESPONSE 10Hz-45kHz —3dB SUPPLY VOLTAGE ±35V
SIZE 114 50 85mm

Price £14.40+£1.16 VAT P&P free.

HY200
120 Watts into 8Ω

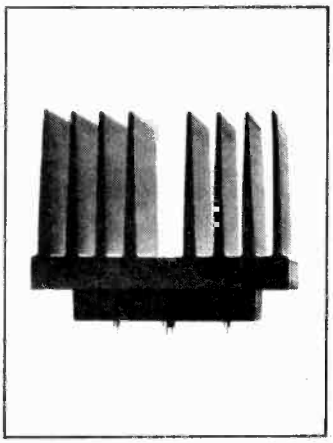
The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address

SPECIFICATIONS
INPUT SENSITIVITY 500mV
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96 dB FREQUENCY RESPONSE 10Hz-45kHz—3dB SUPPLY VOLTAGE ±45V
SIZE 114 100 85mm

Price £21.20+£1.70 VAT P&P free.



HY400
240 Watts into 4Ω

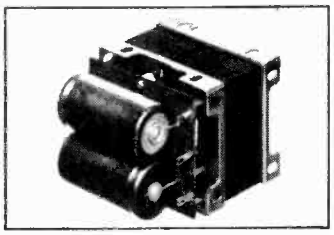
The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components.

APPLICATIONS: Public address—Disco—Power slave—Industrial

SPECIFICATIONS
OUTPUT POWER 240W RMS into 4Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·1% at 240W at 1kHz
SIGNAL NOISE RATIO 94dB FREQUENCY RESPONSE 10Hz-45kHz —3dB SUPPLY VOLTAGE ±45V
INPUT SENSITIVITY 500mV SIZE 114 x 100 x 85mm

Price £29.25+£2.34 VAT P&P free.



POWER SUPPLIES

PSU36 suitable for two HY30's **£4.75** plus **£1.19** VAT. P/P free.
PSU50 suitable for two HY50's **£6.20** plus **£1.55** VAT. P/P free
PSU70 suitable for two HY120's **£12.50** plus £1.00 VAT. P/P free.
PSU90 suitable for one HY200 **£11.50** plus £0·92 VAT. P/P free.

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TECHNOLOGICAL PRECISION PRODUCTS

CBM

SR7919D ● 8-digit or 5-digit+2 Exp. ● Full trig and log functions ● Sq. root ● Reciprocals Y^x, X^3, π ● Register exchange ● Memory plus ● Store recall ● Sign change ● Algebraic logic.
£12·50*

4148R—10-digits, 2 exponents, Full log and trig functions. X^3, Reciprocal, π, X root of Y. Polar rectangular co-ordinates. 2-store memory. Rechargeable. Mean and Standard deviation.
(R) £30·22

SR4190R. 10-digit, 2 Exp. 90 function pre-programmed, metric conversions. Extra functions to the 4148R:—Perms and combinations. Gamma. Poisson and Binomial distributions, factorial, complex numbers, hyperbolic functions, linear regression and integration of $Y = f(x)$.
(R) £43·95

SR1800—Similar to the 4148R. Green display. Battery operated. **£22·68***

799D—8-digits, % and store. **£6·27***

997R—Rechargeable % and full memory.
(R) £11·58

SINCLAIR

NEW SCIENTIFIC
Only ¼" x 2" x 4¼". Yet has 8-digits or 8 + 2 exponents. Using the NEW chip, it has full algebraic logic and many more functions. Algebraic logic is constant on all four arithmetic functions.

FUNCTIONS:
C & CE key ● sin ● cos ● tan ● arccos and tan ● reciprocal ● E to the X ● natural log ● antilog ● memory+ ● memory— ● memory exchange ● memory cancel ● EE exponent ● change notation ● PLUS a degree radian switch.
ONLY £13·58

OXFORD 300—Larger version of above. **£16·25***

CAMBRIDGE— **£7·45***

CAMBRIDGE MEMORY— **£9·99***

OXFORD 150— **£8·32**

DECIMO

VATMAN—SCIENTIFIC
Large green display, 8-digits, 2 exponents, 4 trig log functions 10^{-99}. Radian degrees. Exchange, Memory, π, Reciprocal, X^3 etc. Single Function keyboard. 20 hr battery life. **£25·50**

MINI-VATMAN—Similar to above but slimmer. Green display 8-digits. % key. $\sqrt{\ }$. **£8·84**

MINI-VATMAN M—As above but with % and full-function memory. **£10·70**

VATMAN—8 digit % key. Green display. **£8·84**

SUPER-VATMAN—Similar to above but with full-function memory, X^2 Reciprical. π. $\sqrt{\ }$. **£11·58**

55p p&p

ROCKWELL

44RD. 9-digit or 5-digit & 2 Exp. Green display. Store. Similar to the 63R less factorial
£17·55*

64RD. 12-digit or 8-digit+2 Exp. Additional to 44RD: Polar rec., co-ordinates, log, rad or grad.
£22·20*

63R—8-digit, 2 exponent, 10^{-99}. Memory. 2-level parenthisis. All trig and log functions. Degree radian. Factorial. Reciprocal. π. $\sqrt{\ }$ etc. Rechargeable.
(R) £23·95
Including recharger.

61R—Green display. 8-digits. All trig and log functions. **(R) £20·42**

8R—Special purchase. 8-digits. % key. Only **£8·11***

20R—Special purchase. 8-digits. % key. Full-function memory.
£10·15*

31R—Special purchase. $\sqrt{\ }$, Memory. Memory exchange. Reciprocal. X^2. Rechargeable.
(R) £14·65
Including recharger.

24RD—Green display. 8-digit. **£12·75***

24K—Stainless-steel Slimline. Green display. Beautiful leatherette wallet to hold pen, note-pad and credit cards (all included). Full memory. $\sqrt{\ }$. Click-buttons. Rechargeable. Including recharger

(R) £20·35

CASIO

FX-20—Full trig and log functions. 8-digit mantissa or 6-digit mantissa and 2-digit exponents. 10^{99} to 10^{-99}. Bright green display. Full sin, cos, tan, Inverse sin, Inverse cos, Inverse tan. Log X and Inx, e^x, x^y, $\sqrt{\ }$, Reciprocal Degree Radian conversion. Memory and exponent key. ONLY
£15·65*

FX-15—As above but larger and including a larger display. x^2 key. π key. Reciprocal key. ONLY **£19·35***

FX-101—De Luxe model with similar functions to the FX-15 but 8-digits + 2 exponent 10^{-99} to 10^{99}.
OUR PRICE **£23·95***

8R—Memory. % key. **£8·32***

POCKET 88—% key. **£7·39***

POCKET MINI-MEMORY—% key. Bright green display. **£9·25***

ALL ITEMS CARRY A FULL YEARS GUARANTEE

*=Free B.S.I. approved adaptor.
(R)=Free recharger.
ADD 8% VAT TO ALL PRICES

NOVUS

4525—8-digit, 2 Exp. 100 step programmable. R.P.N. Full log, & trig functions. X Y Exchange, exponent key, change sign, memory, 4 roll stack, skip, delete, accesable additional programmes within the 100 step.
(R) £42·55

4520—Non-programmable version of the 4525.
(R) £21·20

4510—8-digits. 3 level stack. All trig and log functions. $\sqrt{\ }$. π. Reciprocal. Memory etc. **£13·80***

4515—100-step programmable version.
(R) £35·10

6010—Metric **£17·80***

6020—Financier. **£16·65***

6025—Rechargeable. Financier 100-step programmable. **(R) £42·50**

6030—Statistician. **£16·50***

6035—100-step programmable Statistician. Rechargeable. **(R) £42·50**

THE THINNEST L.E.D. ELECTRONIC WATCH IN THE WORLD!

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10 functions:
● Hours ● Mins ● Secs ● Date In letters ● Month & Date In letters ● Day of Week ● 4-Yr calendar ● A.M./P.M. SET/ indicate. Incl S/Steel bracelet. 1 Yr Guar.
£34·40 P & P 55p.

pulstronic KL1

3 functions: Shows hours, mins & secs. Single button operation. With matching S/Steel bracelet. Limited supplies at this low, low price.
ONLY £15·69
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SR50A—10-digit. 2 exponent. Rechargeable. All trig and log functions. Hyperbolic. X to the root of Y. Radian and degree. Factorial. Memory etc.
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Including recharger

SR51A—As above but with 3 independent memories. Linear regression. Mean. Variance. Standard deviation. Permutation. Random number generation + 20 basic conversions and their inverse. Rechargeable. **(R) £46·26**
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5-FUNCTION
digital watch in S/steel finish with matching bracelet. Shows Hrs. Mins, Secs, Date PLUS a.m. Indicator, Hold & Fade-out.
ONLY **£20·25**
Gold finish £22·10 P&P 55p

DECIMO DIGITAL CLOCK/RADIO

£32·95 *OUR PRICE* Incl. VAT *plus £1 p&p*

LARGE DIGITAL READOUT

This is the most unique clock/radio in the country today having a soft 1½" high orange-glow digital readout which is completely silent and non-pulsating. In a beautiful teak style cabinet with up-to-date VHF/MW radio. You can awake to soft music or alarm—and if you want up to 10 minutes more—just press the 'Drowse' button. Automatic 80 minute 'sleep' button in case you drop off while the radio's on.

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Centre tap with screen

Ref.	VA (Watts)	£
07*	20	3·97
149	60	5·84
150	100	6·67
151	200	10·43
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153	350	14·99
154	500	17·21
155	750	23·69†
156	1000	33·01†
157	1500	37·68†
158	2000	42·03†
159	3000	66·40†

*115V or 240V Sec. only.

30 VOLT RANGE

Prim. 200-240V
Sec. 0-12-15-20-24-30V

Ref.	Amps	£
112	0·5	2·58
79	1·0	3·38
3	2·0	4·85
20	3·0	5·99
21	4·0	6·92
51	5·0	8·32
117	6·0	9·33
88	8·0	12·38
89	10·0	12·71

60 VOLT RANGE

Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref	Amps	£
124	0·5	3·46
126	1·0	4·75
127	2·0	6·67
125	3·0	9·58
123	4·0	11·45
40	5·0	12·41
120	6·0	14·56
121	8·0	17·01†
122	10·0	20·95†
189	12·0	21·87†

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PRIMARY 240-250 VOLTS

Ref.	Amps 12v	Amps 24v	£
111	0·5	0·25	1·97
213	1·0	0·5	2·64
71	2	1	3·23
68	3	–	4·60
18	4	2	3·98
85	5	–	4·91
70	6	3	5·56
108	8	4	6·41
72	10	5	6·86
116	12	6	7·42
17	16	8	9·13
115	20	10	13·52
187	30	15	16·86
226	60	30	19·08†

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Mains Isolating

Prim. 200/220 or 400/440
Sec. 100/120 or 200/240

VA	Ref.	£ P & P
60	243	5·77
350	247	13·33
1000	250	28·41†
2000	252	47·65†

AUTO TRANSFORMERS

Ref	VA (Watts)	Auto Taps	£
113	20	0-115-210-240	2·44
64	75	" "	4·07
4	150	0-115-200-220-240	5·45
66	300	" "	7·51
67	500	" "	11·46
84	1000	" "	17·25
93	1500	" "	20·54†
95	2000	" "	27·44†
73	3000	" "	39·46†

CASED AUTO TRANSFORMERS

240V mains lead input & USA 2 pin outlets.

20VA	£4·33	Ref 113W
150VA	£7·80	Ref 4W
500VA	£13·37	Ref 67W
1000VA	£19·86†	Ref 84W
2000VA	£31·01†	Ref 95W

POWER UNIT

Plugs direct into 13A 3pin socket 6-7·5-9V 300mA with multi-plug **£3·59.**

50 VOLT RANGE

Prim. 200-240V
Sec. 0-19-25-33-40-50V

Ref. No.	Amps	£
102	0·5	3·46
103	1·0	4·61
104	2·0	6·26
105	3·0	7·63
106	4·0	9·83
107	6·0	15·08
118	8·0	16·46
119	10·0	19·17†

SCREENED MINIATURES

Ref	mA	Volts	£
238	200	3-0-3	1·98
212	1A, 1A	0-6, 0-6	2·71
13	100	9-0-9	1·96
235	330, 330	0-9, 0-9	2·04
207	500, 500	0-8-9, 0-8-9	2·73
208	1A, 1A	0-8-9, 0-8-9	3·94
236	200, 200	0-15, 0-15	1·95
214	300, 300	0-20, 0-20	2·82
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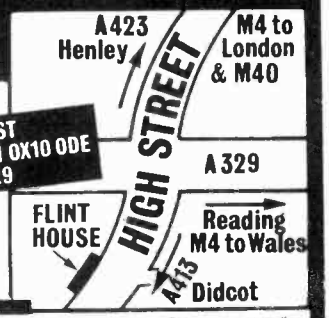

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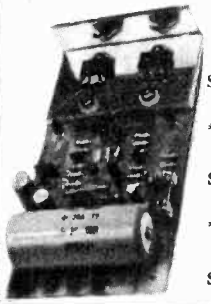

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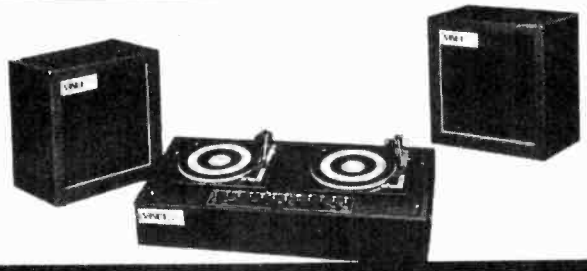

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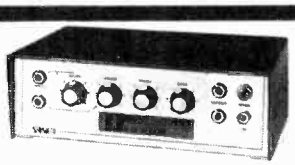

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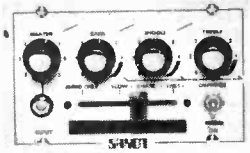

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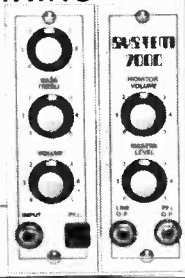

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TP16 20 OC200/1/2/3 transistors, PNP silicon TO-5, unmarked.

TP17 20 1 watt zener diodes, mixed voltages, 6·8 to 43 volts.

TP18 20 2N3707/8/9/10 transistors, NPN silicon plastic, unmarked.

TP19 100 Diodes, mixture of germanium, gold bonded, silicon, etc., a useful selection of many types, marked and unmarked.

TP20 10 Mullard OC45 transistors, I.F. amp. PNP germanium.

TP23 20 BFY50/1/2, 2N696/7, 2N1613, etc. NPN silicon TO-5 uncoded. COMPLEMENTARY TO PAK TP24.

TP24 20 BFY64, 2N2904/5, etc., PNP silicon TO-5 uncoded COMPLEMENTARY to PAK TP23.

TP30 20 NPN silicon planar transistors, TO-18 similar to BC108 etc. uncoded.

TP31 20 PNP silicon planar transistors. TO-18 similar to BC178 etc. uncoded.

TP32 20 2N2926 silicon plastic transistors, uncoded and ungraded for colours.

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UT2 150 Germanium diodes, miniature glass type.

UT5 40 Zener diodes, 250 mW OAZ240 range, average 50% good.

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2N4416 **20p**

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40P1	15	20	3	20p*
40N2	40	40	4	30p*
40P2	40	40	4	30p*
90N1	15	45	4	25p*
90P1	15	45	4	25p*
90N2	40	90	8	35p*
90P2	40	90	8	35p*

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MM5314 Dual in line clock chip **£3***
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SST12/1	12v 1amp	**£2·05***
SST18/1	18v 1amp	**£2·50***
SST25/2	25v 2amp	**£3·00***
SST30/2	30v 2amp	**£4·25***
SST35/4	35v 4amp	**£5·50***

PC EDGE CONNECTORS

Type	Sizes	Pitch	
SSEC 6 way	1⅛"	·156"	**32p**
SSEC 10 ,,	1⅞"	·156"	**50p**
SSEC 12 ,,	2"	·156"	**60p**
SSEC 16 ,,	2½"	·156"	**75p**
SSEC 18 ,,	3"	·156"	**85p**
SSEC 22 ,,	3½"	·156"	**1·00**

Other untested packs **60p ea.**
UT10 15 power transistors, PNP germanium and NPN silicon, mostly TO-3 but some plastic and some marked.

UT13 15 Integrated circuits, experimenters pak, dual in line, TO-5, TTL, DTL, marked and unmarked, some definitely good but old types,
For full ranges—See Catalogue

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Hear Hear?

A FEW years ago, the professional electronics industry was plagued by a ridiculous war which served no useful purpose and made life extremely difficult for both the manufacturer and customer alike. It was called the "Specsmanship War". The idea was that in order to sell more of your equipment (or whatever) you continually tried to offer better specifications (specs) than any of your rivals. This led to the continual upgrading of equipment and specifications were commonly offered which were far in excess of those required. Designers lived in a world of seeking ever better performance while the customer (who was busy demanding even better specs) ended up by getting what he asked for and paying heavily for the privilege. Equipment became obsolete before it arrived in the sales literature and prices rose. Imagine, for example, using an oscilloscope with a 100MHz bandwidth for making simple audio measurements.

That's the story from the professional industrial sector. What about the Amateur and hobbiest front? Have we learnt anything from our industrial brothers; or are we plodding on blindly following their footsteps without seeking to learn anything from their mistakes?

What of the audio enthusiast who absolutely must have that flat response from zero to 100kHz? The fact that his ears cannot detect sound above 20kHz at best makes no difference; the amplifier *must* be flat to 100kHz.

After the expense of (often) hundreds of pounds, what does our tyro end up with? He has an amplifier which will faithfully reproduce sound at frequencies which he cannot hear (and never will), and beautiful loudspeakers which will not respond to 100kHz anyway.

Throughout the pages of *Practical Wireless* there are many advertisements for audio amplifiers which are either in kit form or completely assembled into modules. Response is good and many are eminently suitable for all but the most exacting audio work. What power is needed? There are those who just have to have huge wattages—prestige specsmanship! The "I need 50 Watts" brigade. Anyone who has ever sat in an average size living room and turned a 50W amplifier up to maximum will readily verify (if they have recovered their sanity) that even 15 Watts is quite a volume of sound in a small room.

Again, rolling one's own offers a chance to have a bespoke system which can be built into existing spaces or specially designed enclosures. For the real enthusiast, numerous designs have appeared for constructors in the pages of this journal.

This leader does not seek to dissuade the would-be audio enthusiast from saving up and buying good equipment. What it does ask is that one should examine not just the specs for specs sake. Surely a more sensible approach is to decide on an overall system and then seek to achieve it at a reasonable price.

As an example of this, one well known advertiser in this journal offers a complete stereo amplifier kit giving 20 Watts rms output per channel into an 8Ω load with total distortion better than 0·2% at 10 Watts. Response is from 25Hz to 25kHz at full rated output and the price is £26·25—and that includes VAT and post and packing charges.

Perhaps before you reach for your cheque book to buy equipment you should first reach for a copy of *Practical Wireless*, it could save you pounds. And on that reckoning, a regular subscription could save you thousands!

LIONEL E. HOWES—*Editor*

NEWS...

Open University

A ONE-YEAR course—Telecommunications Systems — is being offered by the Open University. The course, which is part of the University's Post-experience programme for 1977 looks at the basic engineering principles of telecoms. systems. It deals mainly with the way in which various elements of telecoms. systems are selected and combined; the functions they serve; the way they interact and the effects which inherent imperfections have on the overall performance of a system. Students will study in detail the telephone (including data transmission) and television. The rest of the course comprises case studies and includes an examination from the control and planning angle, of an experimental telephone exchange.

Students wishing to take this course should be familiar with elementary electronics including AC circuit theory; complex numbers; principles of amplification and feedback and simple transistor/diode circuits.

With these courses, students study at home in their own time from correspondence texts backed up by radio and TV broadcasts. There are 21 subjects to choose from in the 1977 syllabus. Anyone wishing to apply for the above-mentioned course (applications up to October 15th.) or receive further information on the Post-experience programme should write to: *Post-Experience Student Office, Open University, P.O. Box 76, Milton Keynes, MK7 6AA.*

Components Shops

AFTER a trial run to test the viability of selling components side-by-side with audio and Hi-Fi equipment, Henry's-Lindair now have four shops offering this facility: Edgware Road, Tottenham Court Road, Nottingham and Croydon. These shops, which offer counter and self-service selections are stocked, staffed and controlled by Henry's Radio.

NEWS... NEWS... NEWS...

Eddystone order

EDDYSTONE Radio Limited has won an order to supply 300 of its general purpose receivers type 1830/1 for use in Saudi Arabia.

Under the terms of the contract the receivers are to be supplied to the Saudi Arabian Posts, Telegraphs and Telecommunications Authority. They will then be deployed throughout the country and used by the authority for general monitoring purposes.

For those readers who don't know, the 1830/1 covers 120kHz to 31MHz in nine ranges with double-conversion and incremental tuning facility above 1·5MHz. (CW, MCW, AM-d.s.b., s.s.b.,—selective u.s.b./l.s.b.). Sensitivity is said to be 3μV for 15dB s/n (A.M. mode with 3kHz b/w). 1μV for 15dB s/n (CW, s.s.b. mode).—*Eddystone Radio Limited, GEC-Marconi Electronics, Marconi House, Chelmsford, CM1 1PL.*

A Collector's Book

IN the June issue we showed a picture of M. G. Scroggie being presented with a specially-bound copy of his book "Foundations of Wireless and Electronics."

Readers may be interested to know that a second copy in this special leather binding was produced. This is being offered in a simple competition to purchasers of the ninth edition of the book. Particulars are included in all copies of the book currently on sale in bookshops.

New Solar Cells

A SOLAR battery announced by Mullard features increased efficiency and higher power ratings. Designated type BPX 47A, it consists of thirty-four 40mm diameter disc-shaped cells. Power output is typically 10·7W in sunlight conditions.

Improved cell efficiency (resulting from lower cell temperatures) is achieved because the panel transparency allows sunlight to pass through 'unused' areas of the panel with low heat absorbtion.

Callsign note

THE callsign for the Tyneside Amateur Radio Society is G3ZQM and not G3ZQN as previously stated in this magazine.

EMI balloon

AN 80ft high hot-air balloon nicknamed "Sounds Great" is to play an important role in the promotional plans of EMI Tape Limited, of Hayes, Middx.

The company is hoping to fly its 65,000 cu. ft balloon at special events throughout Britain and abroad.

BBC Cardigan Bay

RADIO 1 transmissions from a new MW transmitter at Tywyn started recently. This brings transmissions on 1214kHz (247 metres) to over 50,000 people in Aberystwyth and an area around Cardigan Bay extending from the Lleyn peninsula to Fishguard.

Aerial Brochure

THE Aerial Manufacturers' Association Ltd. are giving away a very useful little booklet entitled "Aerial Sense is Good Sense"—The Enthusiasts Guide to FM Radio Reception. It's for anyone interested at all in getting a good signal into their FM receiver—and that's nearly all of us!

For your free copy, send a stamped, addressed envelope to: *The Aerial Manufacturers' Association Ltd., 343/345 High Street, Cheltenham, Gloucestershire.*

Quad 405 wins

AT a recent press conference the Design Council announced its Consumer and Contracts awards for good design. The Quad 405 was one of the nine products selected from over 5000 entries.

This is the second Design Council award for Quad. The Quad 33/303/FM3 were selected in 1969.

A particular source of pride is that on each occasion the products were designed entirely by Quad's design team.

BBC cassette

LATEST release from the BBC stable on compact cassette is:

"Out of This World"—the BBC Radiophonic Workshop (Rec 225 Stereo). A unique sound-effects album from the Radiophonic Workshop, this features noises unearthly and supernatural — everything in fact the amateur movie-maker or drama group could possibly need to produce a futuristic, sci-fi, suspense or fantasy atmosphere.

The very detailed 'sleeve' notes offer plenty of practical advice on how these effects can be put to the best use, and while the album is split into four sections entitled (a) Outer Space, (b) Magic & Fantasy, (c) Suspense & The Supernatural, and (d) The Elements, the versatility of the synthesised effects is such that they can often be interpreted in accordance with what the audience imagines is happening or by what action is taking place.

A VERSATILE TRANSISTOR TESTER

Part 2

Ian HICKMAN

CALIBRATION

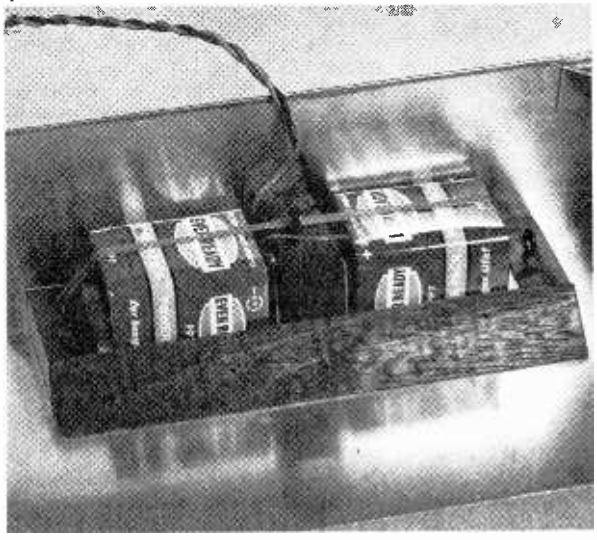
On completion of assembly but before calibration can commence the stabilised supply must be set. The required voltage is 12·0V and this should be maintained over an input range of 12·5V to 19·0V. The most convenient way of providing this variation of input is to use a laboratory type power supply.

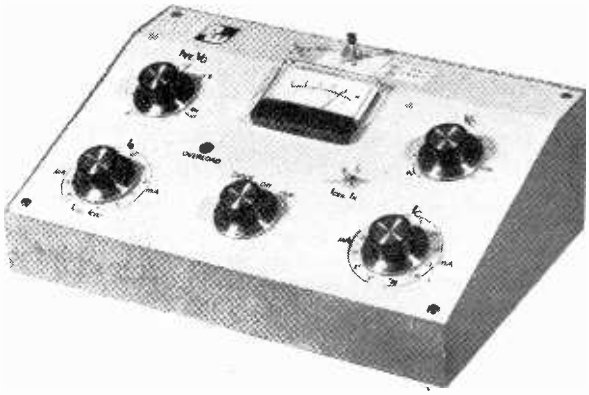
Connect the output of the power supply to the battery leads, with the battery disconnected, set it to about 13V and switch on. Adjust VR4 to give 12·0V across C3. Swing the input over the range 12·5V to 19V to check that the reading across C3 remains constant.

To check the current limiting circuit apply a short circuit across C3 via a 100mA meter. The current should be between 50mA and 60mA. The Light Emitting Diode D5 should glow. If the current indicated is outside the limits given it can be adjusted by varying R41.

The next stage is to calibrate the base current circuit. No direct current measurements are made since a common voltage is used on all ranges and variations in the actual value of the resistors R1 to R12 will affect the currents flowing. As mentioned earlier the voltage applied to the resistor chain and the base-emitter junction is 10·5V. This voltage is measured across R3 and is adjusted by VR1.

Photograph of the inside of the case showing the authors method of mounting the two PP7 batteries.





To effect the measurement, switch S4 to NPN, connect a voltmeter across R3 (negative lead to the end of R3 nearest the edge of the board), and adjust VR1 to give 10·5V on the meter. This is the h_{FE} X1 position. Similarly, settings at 7·2V, 5·5V and 3·8V are required to give the X1·5, X2 and X3 positions. These settings, by reducing the voltage across the resistor chain, reduce the current flowing in the base-emitter junction by an equivalent factor and therefore act as multipliers. If each of the readings is reduced by 0·5V to allow for the junction voltage the ratios become obvious.

Resistor VR1 also sets the gate voltages for testing FETs and it is convenient to set and mark the unit in one volt steps from 1V up to 11V at this time.

To calibrate the collector voltage control VR3, connect the voltmeter across R30 (negative lead to the junction of R29 and R30) and adjust VR3 to give 1 volt increments. Mark the front panel at each voltage. The collector voltage should not be measured at the T.U.T. terminals because of the voltage drop across the meter (100mV at fsd).

To calibrate the meter circuit, set VR3 (V_C) to 5V, S1 to position 1 (I_B=0·1μA), VR1 (h_{FE}) to X3, S3 to position 9 (I_C=1mA), connect the emitter and base leads of an NPN transistor to the relevant T.U.T. terminals and the transistor collector to its terminal via a 1mA meter. Increase the base current until the meters indicate between 0·4mA and full scale. By using the h_{FE} multiplier increase the current in the external meter to read full scale. Check that the reading of the instrument meter is the same. If there are significant differences closer agreement can be reached by changing the value of R30. Should it be necessary to change R30 it will

be necessary to recheck the settings of V_C since measurements were made across it.

The final item is the LED. This should just glow at 10mA and reach full brightness at 30mA. To confirm its action, connect the NPN transistor fully to the T.U.T. terminals and increase I_B and I_C to give transistor collector currents in the range 10mA to 30mA.

TESTING NPN TRANSISTORS

If an NPN small signal transistor is to be tested, it should be connected to the instrument before switching on. Next select a suitable collector current range (eg 0-3mA) and the desired collector voltage. Select a suitable base current. For example, if an h_{FE} in the range 30 to 100 is expected, set I_B to 0·03mA. Check that the h_{FE} multiplier is at X1. Switch to NPN and the collector current will be shown on the meter. Since the 3mA range was selected the 0 to 3 scale will apply. However, as 0·03mA I_B was selected, a full scale reading implies an h_{FE} of 100, so that the 0 to 10 scale (X10) reads the current gain directly. Similarly, because both the BASE CURRENT and COLLECTOR CURRENT ranges advanced in $\sqrt{10}$ steps, if I_C were changed to 1mA and I_B remained at 0·03mA, the instrument would read h_{FE} over the range 0 to 30 on the 0 to 3 scale.

At positions 1 and 12 of I_B the I_{CES} and I_{CEO} of the transistor can be read using a suitably sensitive I_C range. For most silicon transistors except power types I_{CEO} should be barely detectable, even on the 0·1μA range, and I_{CES} will be even smaller.

It will be found that the gain of most transistors falls steadily as the collector current is reduced. For germanium types, however, the "gain" will apparently rise at very low currents. This is because a certain amount of collector current, I_{CEO}, will flow without any base current.

To measure the current gain at a particular collector current, h_{FE} may be adjusted, after increasing I_B if necessary, to obtain the required collector current. The h_{FE} is then as read by the meter, but multiplied by the h_{FE} MULTIPLIER factor. Note that the h_{FE} multiplier settings are not linear. Always return the multiplier to X1 after use to avoid misleading readings later on.

If the overload warning lamp lights, switch off and check the transistor connections and control settings. If in doubt, set I_B to I_{CES}, V_C to 5V and I_C to 30mA. If the lamp still lights and the meter reads more than full scale the transistor has a collector to emitter short circuit. Other faults are also easily deduced. For example, if the collector current is less than the base current, either the device has an open circuit emitter (with or without a collector to base short) or the h_{FE} is less than unity. Either way, its not much use as a transistor.

N CHANNEL FET's

N channel enhancement MOSFETS can be measured by connecting source, gate and drain leads to emitter, base and collector terminals respectively. I_B should be set to I_{CEO}. The drain current at any drain voltage set by V_C can be measured as a function of the gate voltage indicated by V_G. Setting I_B to 0·1μA should result in no change in drain current; if it does there is appreciable gate

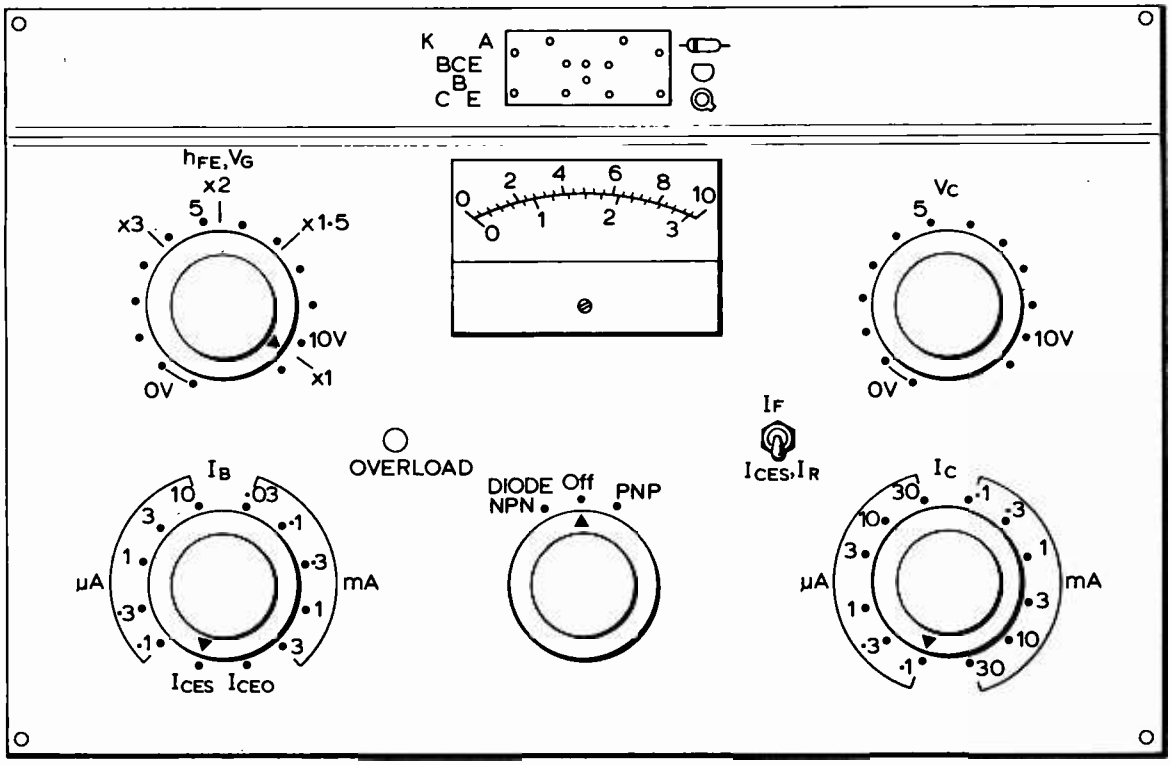


Fig. 6. Front panel marking and control identification to suit the drilling details given in Part 1, Fig. 3. See also the photograph used in the heading.

leakage current. For example, if it were necessary to change the V_G setting by half a volt to restore the gate current to the previous value, the gate leakage under those conditions would be 0·5V/100MΩ=5nA.

N channel junction FETs and N channel depletion MOSFETS can be measured by connecting source, gate and drain leads to base, emitter and collector terminals respectively. With I_B set to I_{CES}, the drain saturation current I_{DSS} can be measured, whilst with I_B set to 3mA the gate cut off voltage, defined as the gate/source voltage required to reduce the drain current to, say, 1μA, can be read from the setting of V_G. Note that if V_G is set to 10V, and the cut off voltage is measured as 4V, the actual drain to source voltage across the FET is 6V only. Gate voltages corresponding to drain currents between I_{DSS} and cut off cannot conveniently be measured.

PNP transistors and P channel FETs are tested as described above for NPN and N channel types but with the PNP mode selected.

DIODES

To check small signal diodes, switch to DIODE, set I_C to 0·1mA and V_C to 10V. Hold I_F/I_R switch to I_F, apply a temporary short circuit to the D.U.T. terminals A and K and adjust V_C to give full scale deflection. Release switch and remove short on A to K. Diodes can now be tested for reverse leakage at 10V by connecting to the terminals A and K. Conduction in the forward direction is checked at position I_F of the I_R/I_F switch. Germanium diodes will read approx two-thirds full scale, whilst, due to their higher forward voltage, silicon diodes will read approx half full scale.

LEDs

Light emitting diodes tend to have low reverse voltage ratings, so the following procedure should be adopted. Set V_C to 3V and I_B to I_{CES}. Check the leakage. It may be appreciable but this is normally of no significance as circuits should be designed not to reverse bias the device. Check in the forward direction with the I_R/I_F switch at I_F and I_C set to 30mA. The lamp should glow brightly. The test current will be 8mA approx.

ZENER DIODES

Set V_C to OV, I_B to I_{CES} and select a suitable current range on I_C. Zener diodes are typically specified at 5mA test current. Connect the zener to the DUT terminals and increase V_C until the test current is reached. The zener voltage can now be read on V_C.

POWER TRANSISTORS

The tester can be used to match power transistors for use in Class B output stages, as a current gain match at 10-30mA is important to minimise cross-over distortion. With PNP and NPN types which are listed as complementary, the variation of gain with current will have a similar form for both types, so the match will also hold at high currents. This is obviously even more so when matching pairs of NPN devices for a "quasi-complementary" design. Indeed, where using two power transistors of the same type, matching at 30mA generally prove satisfactory even for Class A amplifier applications.

CONCLUSION

The broad scope of this instrument will ensure that suspect semiconductor faults can be confirmed or eliminated. It will also ensure that the devices taken from your scrap box, jacket pocket or earlier projects are ready and able to perform the functions you require of them.

ADDITIONAL INFORMATION AND CORRECTIONS TO PART 1.

Transistor type BC213 is available with a range of pin configurations. Types coded BC213L, LA, LB all have the collector as centre pin. Types coded BC213K, KA, KB all have the base as centre pin. Devices by National Semiconductors coded BC213K, KA or KB are now supplied preformed with the base offset as standard. It is, therefore, essential to confirm the pin connections on purchase and insert accordingly.

An error has been made on the circuit diagram whereby the junction of D1 and D3 is shown connected to C2 as well as to the junction of R29 and R30. The correct connections are D1 and D3 junction to R29 and R30 junction (i.e. bridging the line from C2 to R33). The PCB artwork and layout is correct.

A second error is shown on the circuit diagram in the numbering of switch S1. Only 11 positions are shown. The correct numbering is: Present pin 2 should be pin 3, present pin 1 should be pin 2, a new position, pin 1 I_{CES}, to be added going to switch $S2_a$ only.

PW

KINDLY NOTE!

Digital Frequency Meter, June/July 1976

Due to demand, the printed circuit boards for the 7-segment filament tubes, previously obtainable from Doram Electronics (code no. 433-905) are no longer available.

Steps have been taken to include this board in the PW pcb Service, and prospective constructors should look out for an announcement in next month's issue.

Wobbulator, April 1976

On the PCB Fig. 5 page 1053, the collector and emitter of Tr2 are shown connected to the wrong pads. It is therefore advisable to sleeve the two leads and connect the collector to the OV rail and the emitter to pin 5 IC1.

THE TWENTY-SECOND INTERNATIONAL VHF CONVENTION

APPROACHING 1000 people from the four corners of the globe attended the 22nd International VHF Convention on the 8th and 9th May, held this year for the first time at Brunel University, Uxbridge. Facilities on the campus were first-class and comfortable accommodation was enjoyed by over 100 visitors who stayed overnight.

Trade display

Another feature of the new location, was the greater space for traders, who took full advantage of this. In general, the traders reported very good sales, particularly on the Saturday. One best seller was the new edition of the RSGB VHF/UHF Manual, and shortly after the Convention reopened on the Sunday morning the last of the 260 copies had passed over the counter. The President, G3FKM, volunteered to rush to HQ to fetch further supplies!

Opening addresses

The idea of relaying the opening addresses from one of the three lecture theatres to the other two by closed-circuit TV ran into a slight problem, and although all were able to see the proceedings, not all heard what was being said.

The first speaker was RSGB President Dr. John Allaway, G3FKM, who discussed the role of the RSGB in promoting the general advancement of the science and practice of amateur radio. He pointed out that the Society was run mainly by volunteers, and that members of committees receive no payment for the considerable amount of time they devote to their duties. He went on to list some of the achievements of the Society in recent years, particularly those arising out of their relationship with the licencing authority. He mentioned the granting of the Class B licence concession, the extension of the microwave allocation and the permission to establish and use repeaters.

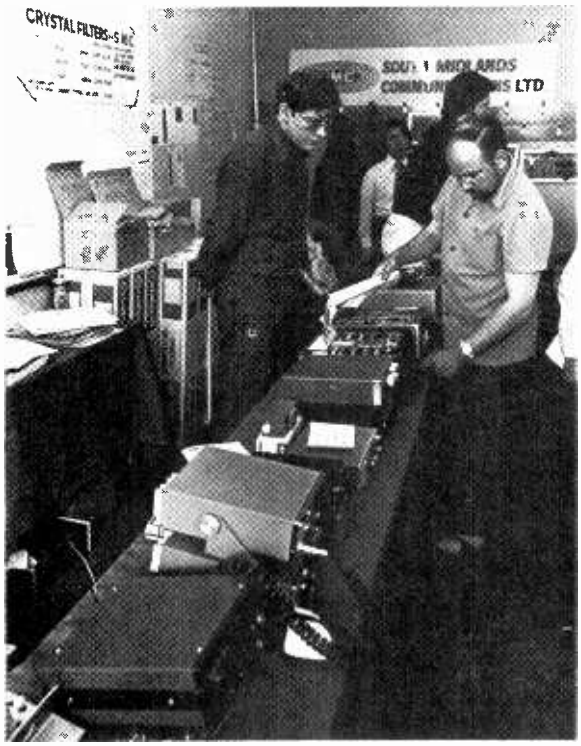
In other areas, the President referred to the range and quality of publications produced by the Society, equalled only by ARRL. He added that research into microwave propagation was being led by the RSGB, and that our beacon network was part of an international project which was the brainchild of the Society.

In conclusion Dr. Allaway referred to the 1979 World Administrative Radio Conference, and warned that bad behaviour on the air, whether it be through repeaters or otherwise, could contribute to us all finding ourselves off the air by the early 1980s.

The next speaker, Roy Stevens, G2BVN, RSGB telecoms liaison, continued the theme of WARC, outlining the work the Society is doing to prepare for this conference. A major brief is being prepared to justify the occupancy of our bands, and then efforts will be made to reach agreement with other users of the radio spectrum. This is so that the UK authorities can present a composite plan in 1979.

One country, one vote

G2BVN made it clear that the RSGB had no vote at the WARC, and all that the Society could do was impress upon the authorities the value of amateur radio. He explained that of the 148 member states, 58 were African and 26 south-east Asian or similar, and that each country, however small, had one vote. It was, therefore, the aim of IARU to convince administrative authorities of the virtues of amateur radio, particularly in those countries where it is held in poor esteem. IARU represents all but about 3000 of the world's radio amateurs, even those who are not members of their national



One of the exhibitors, South Midlands Communications Ltd., showing one of its products to a prospective customer. The firm also specialises in crystal filters, Communication antennas as well as mobile equipment.

society. Roy Stevens concluded by saying that whatever the results of the votes in the WARC in 1970, it will not be possible to say that the amateur radio service has not done its homework.

The lectures

With the end of the opening addresses, the three lecture streams got under way. The scope and variety of lectures (14 sessions in two days) meant that there was something for everyone. The only problem as far as the writer was concerned was that it was not possible to be in three places at the same time. Regretfully, the OSCAR sessions in stream B, and the microwave stream C had to be left out in favour of the stream A lectures. Particularly interesting was the amount of thought devoted to the psychology of operating, and the way that the knowledge gained had been built into the Hampshire repeater. This sometimes gave GB3SN the appearance of almost human behaviour and judgement, justifying the nickname 'Susan'.

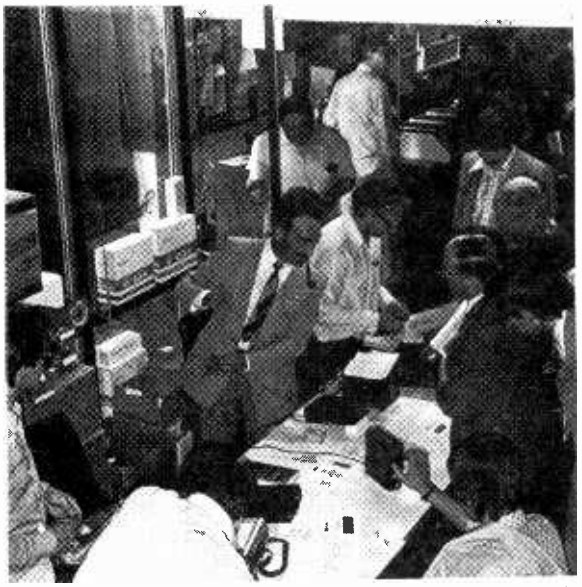
Peter Blair, G3LTF, then gave an informed and fascinating talk on the technique and technicalities of moonbounce operation. The intriguing aspect to G3LTF of this mode is the fact that the path is just, and only just, possible using equipment that amateurs can reasonably be expected to obtain or construct. He demonstrated the calculations necessary to ascertain whether a given system was capable of being successfully used in e-m-e experiments, showing that the problems increase with the reduction of frequency. He discussed the various problems of background noise, libration fading, Faraday fading and Doppler shift, and gave his views on the various aerial systems used. As a final tip, he suggested a method of checking whether a system was really good enough for serious moonbounce work: incredibly enough (to the writer anyway) a good system will "see" the star Cygnus some $1\frac{1}{2}$dB above noise!

Sounds peculiar

Moving on to the Sunday lectures, the morning session in stream A started with Angus McKenzie, G3OSS, discussing audio distortion in transmitters and receivers. His experiments showed the improved readability of signals in noise with proper clipping and limiting, further demonstrating that it was possible to copy speech solidly up to 4dB below the noise level. He went on to describe some of the elementary design faults in imported commercial equipment, and the effects of these in terms of the hash and spurii transmitted by certain 144MHz "black-boxes".

Open forum

Ranged in the firing line for this free-for-all last session were members of the VHF Committee and VHF Contests Committee. A lively discussion developed with no shortage of questions from the floor. The first salvo came from those questioning the wisdom of the mixed "DX" and "local" contest on 144MHz, and the VHF contest Committee were quick to confess that the experiment had not worked in practice. However, there was general agreement that the idea had been sound, even if the application had not, and the feeling was that there was room for separate contests for the "DX" modes and "local" modes. In reply to another question, G3SEK, VHF Contests Committee chairman, made it clear that although the possibility of an alternative scoring method based on QTH locator squares had been investigated, there was no intention of introducing such a system at present.



As can be seen from the above photograph, things got a bit hectic during the convention with enthusiasts eager for information. The firm shown here is Thanet Electronics Ltd.

In response to questions concerning the movement of the VHF NFD date from September to July, G3SEK explained that publicity had been given to this suggestion well before the rules had been written and no significant adverse comment had been received. One of the reasons for the change was that the September IARU event with which Field Day coincided is now 144MHz only, and there is likely to be little Continental activity on the other bands. Another contest query concerned the recent 1·3GHz and 432MHz open events, held this year on consecutive week-ends. The committee were asked to consider the possibility of combining the two events in future.

On the thorny problem of whether it is necessary in contests to record QTH as well as QRA locator, G3SEK confessed that the committee were divided on this issue, but with the licence conditions as they stand it is not sufficient for a portable station to transmit QRA only; the full QTH must be given, so the rules stay as they are for the present.

Several questions were then aimed at the VHF Committee, and there was discussion on the way that the WARC was likely to affect the VHF/UHF spectrum. Richard Baker, VHF Committee Chairman, explained that no more than speculation was possible, and that although some bands appeared less vulnerable than others, there was bound to be pressure on all four frequencies. Another questioner raised the possibility of the use of CW on a limited basis by Class B licensees, and it was explained that the present policy was that the use of CW should be preceded by a test, acting as a form of incentive licensing.

The Saturday evening dinner and dance raised only one minor criticism; the after dinner dancing (and drinking) time seemed all too short! Guest of honour, Dr Saxton proposed the toast "the RSGB", congratulating those responsible for organising this most successful convention. He went on to stress the need for a strong RSGB, and ended by paying tribute to Roy Stevens, G2BVN, for the hard work he does as the Society's telecoms representative.

Replying to the toast, the President of the Society, Dr. John Allaway, confessed that he had never yet operated on VHF, but hoped that he might rectify this omission some day. He continued by saying that he had had the honour recently of attending the world-wide IARU conference in Miami, when, for the first time, all three IARU regions had met together to prepare a concerted policy for the 1979 World Administrative Radio Conference. Continuing, he said that he had been surprised by the lack of interest in VHF in the New World, with the exception of the States. In the USA, he noted the phenomenal growth of the Citizen's Band, with all the dangers of the media confusing CB users with radio amateurs. The President concluded by saying that it was up to us to ensure that we radiated clean signals and clean conversation to give ourselves the best possible chance in 1979.

The awards

The formalities ended with the presentation of the awards and trophies by the President. The John Rouse Memorial Trophy was awarded to G8DLZ for his excellent 144 to 1296MHz low-level mixer. The Surrey Trophy went to the March Group for their success in VHF NFD 1975, and the Mitchell Milling Trophy was awarded to the Bangor University team, GW3UCB, for winning the 144MHz Open Contest. The Golden Valley Contest Group took the VHF Manager's Trophy for the 1975 70MHz Open, and this year's J. Frazer Shepherd award was won by G3WJG for the technical excellence and boldness of approach of his experimental 10GHz transmitter.

Acknowledgements to Russell Whitworth, G4CTP for the photographs in this article.

CQ! CQ! CQ! CQ!

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..BA or M/C W.D. headphones.—E. S. Symonds, 5 John Street, City Road, Cambridge.

..a Leak TL10 or two Leak Point One amplifiers.—B. C. Godbold, 'Crabapple Cottage', Aldringham, Nr. Leiston, Suffolk, IP16 4QJ.

..pair of X81 valves for Commander communication receiver. —T. Younger, 11a The Avenue, Canvey Island, Essex.

INFORMATION WANTED

..Sea Cadet unit seeks article (?PW) on fitting mains power supply unit to R1155 receiver.—J. Dow, 45 Gourlaybank, Haddington, East Lothian, Scotland.

..information on a 'Constable' burglar alarm (ultrasonic). Comprises 2 units connected to mains. I have pair but one coil damaged by capacitor explosion.—W. H. Rees, 'Brendon', Carlton Road, South Godstone, Surrey, RH9 8LD.

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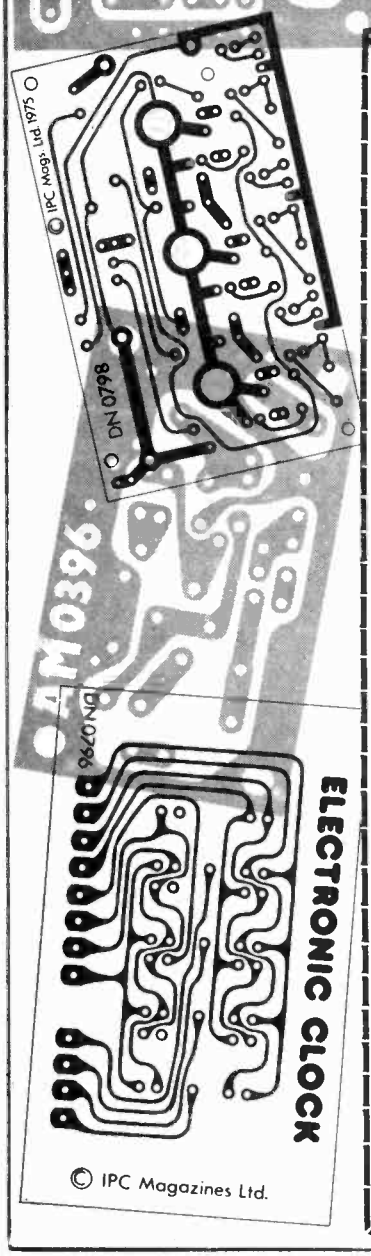

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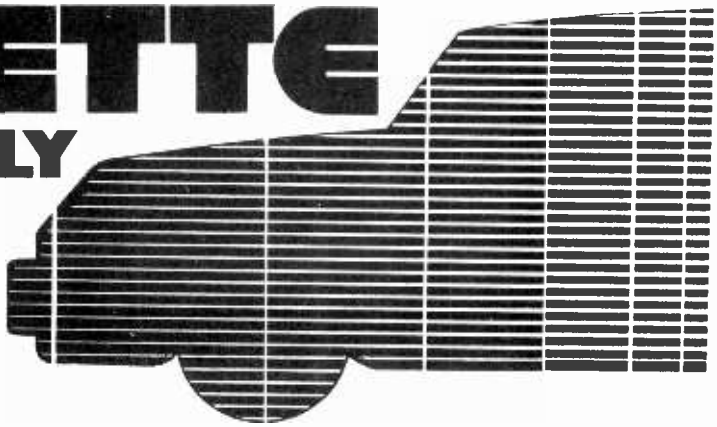


Steven DAVIES

MANY people like to use a portable cassette player or radio in their car, and it is often convenient (and much cheaper) to run it from the car battery. The unit described here will provide a well regulated supply of 6, 7·5 or 9V, is short-circuit proof, and can be connected to the supply the wrong way without damage.

The Circuit

The circuit is given in Fig. 1 and is in essence a series-pass voltage regulator with current limiting. Tr1 and Tr2 form the series-pass pair, with base current supplied by R2. R1 and C2 bias and smooth the reference voltage source D2, maintaining the

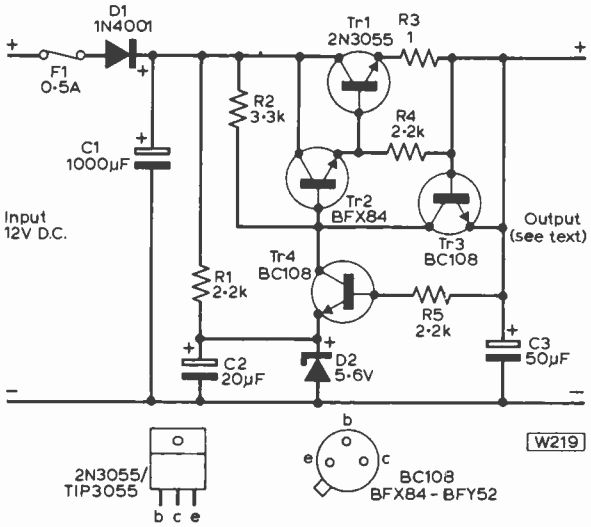
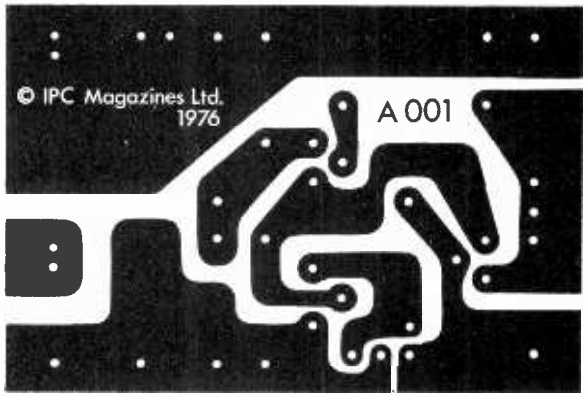


Fig. 1: Complete circuit diagram of the unit, which is basically a series-pass voltage regulator. The output in this case is 6V, although 7·5V and 9V are obtainable by the alteration of D2, R1 and R2.

emitter of Tr4 at a constant voltage. Tr4 is the control element, maintaining the output voltage at approximately 0·6V above the reference voltage by removing base current from Tr2. Current limiting is provided by Tr3 and R3. Once the voltage across R3 exceeds 0·6V, Tr3 turns on, removing the base drive from Tr2. This limits the maximum output current to about 0·6A. Noise on the supply rails is removed by C1 and C3, while D1 protects the circuit against incorrect supply polarity.



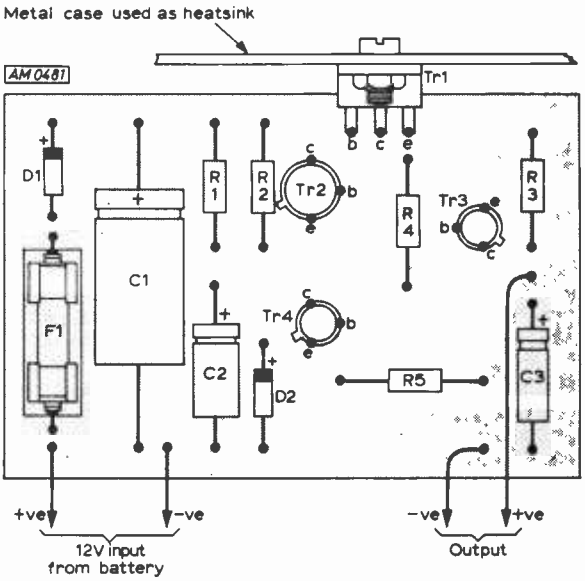
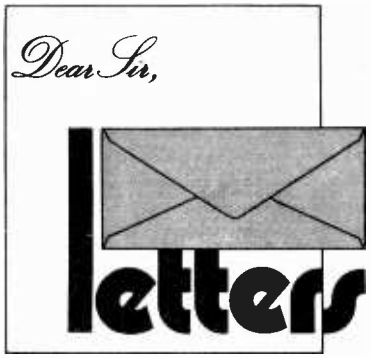


Fig. 2: Actual size printed circuit board showing foil side above and component overlay below.



Info-on-Fax?

After hearing of the decision of the Home Office to allow the use of Facsimile transmission (Fax) on 3·5, 7, 14, 21, 28 and 144 MHz bands using modes A4 and F4 with a maximum bandwidth of not more than 6kHz, my curiosity was naturally aroused. However, I am having much difficulty in obtaining information about this mode of transmission, so I would like to hear from any other Amateurs who are interested in using "Fax", or who have any further information.

It is my intention to gather as much information as possible with a view to passing it on to other readers. Therefore, if any of your readers can help me, or have an interest in this type of transmission, I would like to hear from them in writing, or by telephone at Mansfield (STD code 0623) 861545.—**A. W. Brown G4CCB** (Notts)

Boring Letter

Thank you for the many interesting articles in *Practical Wireless* which I have taken regularly for a number of years since *Practical Mechanics* was discontinued.

I have a tip which may be useful to other readers who make their own printed circuit boards, the drilling of which can present problems due to breakage of the very small diameter drill, necessary to make the holes for mounting components.

I overcame this problem by using a centre drill of the type normally used on a lathe. This type of drill has the very small diameter tip required to make the hole, but has the advantage of a larger diameter shank which eliminates the problem of breakage even when used in a power drill.

I find that by mounting the power drill in a vertical stand it is possible to drill a complete printed circuit board in a matter of minutes as one hand is always free to position the board, and the adjustable stop can be set to prevent the drill penetrating too deeply. A size 'E' drill is suitable for most jobs.

After the components have been soldered in place a pair of ordinary nail clippers makes a neat job of trimming the unwanted ends.—**C J Addington** (Lincoln).

Digitals rule—OK

Having asked similar questions about the recent revolution albeit "Stationary Revolution" in watches I offer the following. Most people read an analogue time-piece after they have ceased to see it and yet can read it to a better than 5 min accuracy if necessary. The best example being a work study engineer reading 3-7 second periods on a "Snap Back" stop watch.

Most watch readers are either going to write down the time, pass it on verbally or compare it with an already written or quoted time. Therefore the conversion from analogue to digital takes place anyway so the digital readout will be marginally quicker. Ask any sailor which is quicker to use, the digital readout on a Decca Navigator or the analogue Decometer on the same set.

All the juggling with time takes place in a part of the brain having nothing to do with the actual seeing process, and which has been brought up on "Digits" anyway. The only possible delay in reading a Digital display is in the activation of the device. Most wrist watches are inside our sleeves so there is usually a hand movement to uncover it which can be modified to activate an electronic watch, but there is a fractional delay, least if there is no "button" to locate. Any good accounts clerk will be slowed down by using a calculator for simple arithmetic. However, the biggest advantage of an electronic time-piece is mainly ignored by the "Digitals" and this is its 24 hour capability. International business, in general and most forms of transport and communications home and abroad already use the 24 hour clock and yet even Sinclair only offer a 12 hour readout.

Advantage number 2 is night reading, even the best luminous analogue is not good enough and has a short life.

Advantage number 3 an accuracy requiring correction three or four times a year rather than weekly as in mechanicals costing more.

Advantage number 4 moisture resistance, perhaps not yet proven but it will obviously be easier to seal an electronic than a mechanical system.

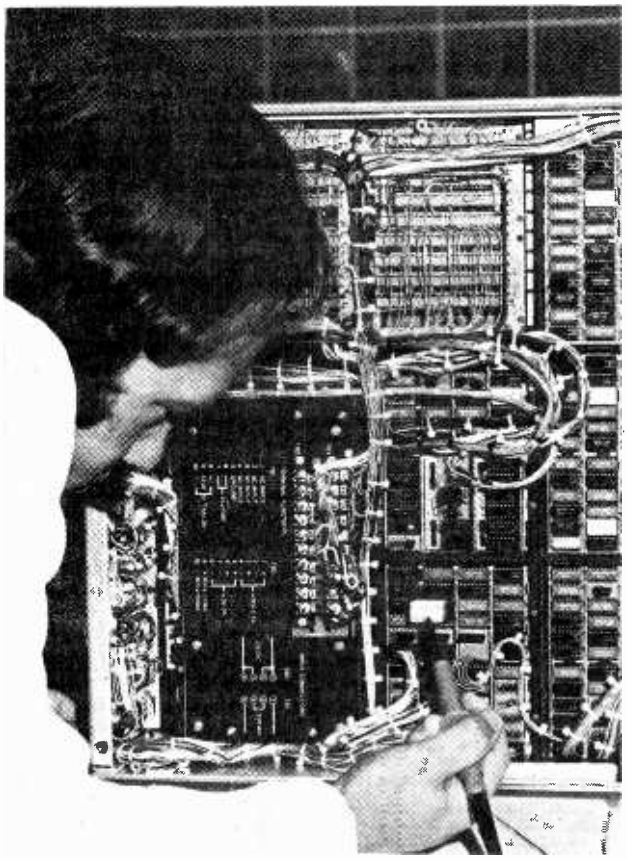
The last revolution in time-pieces was about the 1880s when the Waterbury and later Ingersoll brought watches to the working man. Waterbury made the Ingersoll anyway and in 1896 one US dollar bought a "good enough" watch. The market was huge (1,000,000 Ingersolls in 1898) mainly because the working man had to get to work on time or lose money, also train services began to need accurate time-keeping for safety reasons.

If electronic digitals are kept simple they will do as well, they are already cheaper than the one dollar Ingersoll was in 1896 and will be as cheap as the cheapest mechanical digital is now, within 1-2 years.

What a con

We keep seeing "Manufacturer's recommended price" on goods in shops. Is it really fair though, to let people think they're getting fantastic discounts on goods just because the manufacturers have set their "suggested" retail price so high? Much imported equipment is sold like this. If one were to see, for example, a British stereo amp. with a "MRP" of £200 offered at £150 next to an imported amp. with a MRP of £250 offered at £150 (identical specs.) one would probably buy the imported one.

When will British consumers get wise to this selling method? After all, it's the consumer who keeps the wheels of British industry turning. — **A. J. Fuller** (Essex).



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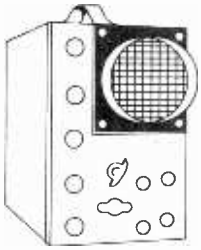
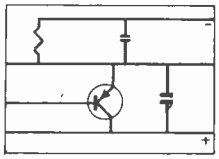


Build an oscilloscope.

As the first stage of your training, you actually build your own Cathode ray oscilloscope! This is no toy, but a test instrument that you will need not only for the course's practical experiments, but also later if you decide to develop your knowledge and enter the profession. It remains your property and represents a very large saving over buying a similar piece of essential equipment.

2



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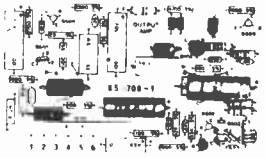

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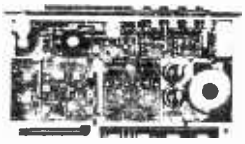

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Equals less than 1p sq.in.
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24v 2c/o with base, **50p** ea.

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HOTLINES

ON RECENT DEVELOPMENTS

FENCES HAVE EARS!

A tip for when you talk about something confidential—don't stand too close to a fence, some of them have ears! It's a system designed by an Austrian company and it forms an ingenious security alarm. The fence itself can take the form of a simple wire link type with the familiar criss cross pattern. However, in one of the fence posts is a detector which reports directly to a computer located elsewhere. Inside the detector is a sensitive sensor which can sense the stress on the fence. If someone were to lean a ladder against the mesh, then the tension would change and the sensor would detect this. Again, if any of the links in the fence were cut, the overall fence tension would change and again the sensor would detect it.

In the computer memory are sets of standard conditions or non-alarm conditions. The computer continually monitors the sensor comparing its output signals against those in its memory. If anything differs, the computer will actuate an alarm. Would-be saboteurs can forget any bold ideas of rendering the system inactive. The sensor also monitors itself. Any interference with it will trigger the alarm. Also, the cable connecting the sensor with the computer is monitored. It is sensitive to any electromagnetic or electrical interference, too.

Sound waves impinging on the fence are also detected and the system is so sensitive and yet selective that it can differentiate between sound waves from a human voice and disturbances set up in the fence by weather, such as wind, rain, etc. Next time you're lonely, do what burglars do—chat up a fence !

BANG! BANG!

So there you are in your tank. You are going to fire a shell at someone you don't like. First, the range is estimated accurately. Then, the fuze in the shell of the air-burst missile (you've got all the latest ammo.) has the range set on its fuze. Then you load the shell and finally you fire. It sounds fairly straightforward, but the American military has decided that it could be simpler—even if it's more complicated to achieve, if you see what I mean?

In the latest air-burst shells, the fuze is set electronically while the missile is actually in flight on its way to do the nasty. This makes it simpler, and very much quicker to fire, but it's more complex electronically. Our new shell has two useful allies—the tank's laser range-finder plus the services of an onboard ballistic computer. With this set up, you can now drive round happily in your tank with the shell already in the breech and ready to fire—no wasting time loading the thing.

Deep inside the new shell is the fuzing device which consists of a tiny antenna, a complete radio receiver and some rather complex timing electronics. When the laser rangefinder and computer have determined that the shell is in the best position to inflict maximum nasties, the fuzing data instructs it to explode.

An interesting but not so obvious fact is the absence of a battery inside the missile. The electronics gets its power from a rather clever application of a principle which dates back many years. A tiny coil of wire inside the shell has a moveable magnetic core inside it. When the shell is fired, the movement of the missile causes the magnet inside the coil to move. As it does so, its lines of force (i.e. the magnetic field) "cut" the wire of the coil inducing a current in it and thus a voltage across it. This voltage is used to charge up a tantalum capacitor which acts as a power store and thus as a battery from which the electronics draws the necessary operating power.

THE HEAT'S ON

I was interested to see that one American company is marketing foil heaters. These are flexible heaters only 2thou. thick and include a resistive temperature detector. The main application would probably be to wrap the foil around a crystal thereby eliminating the need for a more bulky crystal oven. I wonder if one will see this type of foil stitched into clothes for wearing in winter? I understand that control to within one degree is common for this type of heating element and sensor. Perhaps other applications might be in photography where solutions must be kept at a fairly constant temperature?

ON FILM

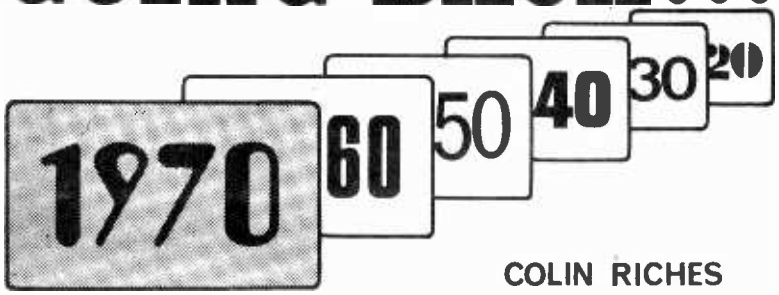
It has often been remarked that the hobbies of electronics and photography seem to attract the same people i.e. electronics enthusiasts are commonly keen amateur photographers. It seems that the same principle has been established in the professional electronics industry. Companies are now using 35mm film as a production line aid to manufacture complex circuitry. One French company, for example, punches holes in each frame of a reel of standard 35mm film. Into these holes go subtrates held in position with adhesive tape which has a fairly high resistance to heat.

The reel is then fitted into a machine and the film fed to a take-up reel at the far end of the equipment. As the film slowly transfers from one reel to the other, the individually mounted subtrates have various minute components mounted on and bonded to them. The last stage in this particular process is to pass the tape over an acute angle of metal. This has the effect of separating the subtrates from the 35mm film.

The final act of the machine (prior to separation of the completely wired subtrates from the reel of film) is the descent of a number of small needles which position themselves in exactly the right test places. These tiny needles form probes, and various voltages and currents are monitored in the substrate so that the good circuits can be separated from the bad ones when the film passes over the acutely angled metal. Imagine the saving. Once the reel of film has been fitted and the take up spool connected, the complete wiring and testing of these tiny circuits is completely automatic.

Ginsberg

GOING BACK...



COLIN RICHES

The W.W. 'Everyman's Four Valve'

IN the July 28th issue of Wireless World, there appeared a design for the well-known Everyman-Four.' It had one RF stage neutralised with a DE5B valve with two tuned circuits. Three-inch diameter coils were employed. They were $3\frac{1}{2}$in. long and had 74 turns of 27/42 Litz wire. Over the medium wave band, the RF gain was 36·5 to 46.

The detector was of the anode-bend type employing a Cosmos SP18 blue spot valve RC coupled to a DE5B. This was in turn coupled to a DE5 output valve. Power consumption of the Everyman-Four was 10mA at 150V.

This wireless became famous because its performance was far superior to its competitors at the time, its success being largely dependent on the RF coil development and the development of neutralising.

The original title of the W.W. article was 'Everyman's Four-Valve' and a prototype is kept in the science museum.

A tip from 1924

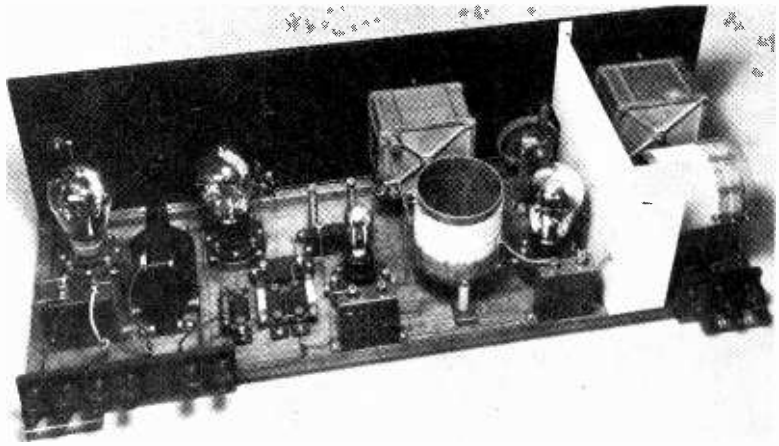
CRYSTAL detectors always need delicate adjustment to give the best results, and this is particularly the case when they are used in reflex circuits. The shadow cast by components mounted above the panel may shield the catswhisker from view. If so, arrange a small mirror behind the valve (not a dull emitter of course) for this will give sufficient light to facilitate the finding of sensitive spots.

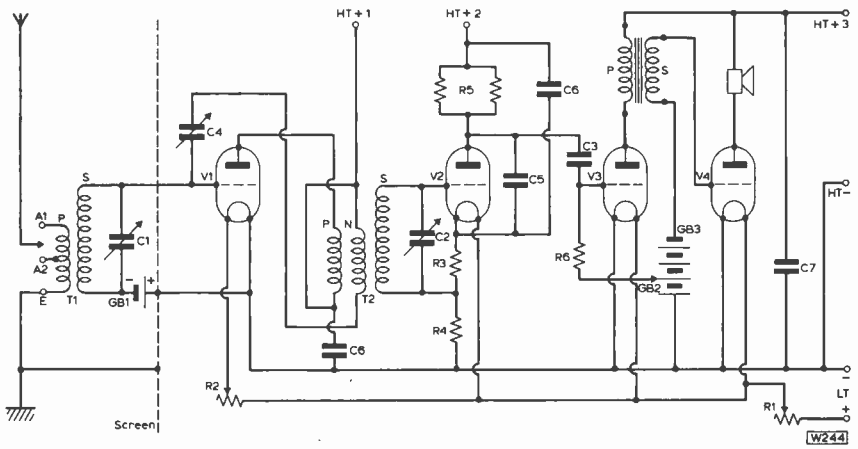
Vintage spares

MR. **Chas E. Miller** (who writes for our sister mag. "Television" from time to time) recently dropped me a line and said, "It has occurred to me that there may be many readers in need not only of complete sets but also of spares for vintage radios. I have literally thousands of bits and pieces in my store rooms (he's a radio and TV engineer) because I am one of those persons who never throws anything away. So, if anyone is stuck for valves, components or sets in general, they are welcome to write to me (s.a.e. please) or phone if they can afford it nowadays!"

Chas also says that he can undertake to recondition old radios, and where IF alignment is required, it will be done with vintage equipment i.e. Cossor Wobbulator of 1938 vintage and converted radar display unit c1944.

Chas can be contacted at 31 Hockley Road, Uttoxeter, Staffs. Telephone: Uttoxeter 2122.





Above—a photograph of the receiver at the Science Museum

Circuit of the 'Everyman 4' T1 is the aerial grid transformer, T2 the HF valve transformer and T3 a Ferranti 3·5 : 1 LF type. C1, C2 (0·00027μF) square law tuner. C3 (0·01μF) C4 (balancing condenser) C5 (0·0005μF) C6 (1·0μF) C7 (2μF). R1 (2Ω rheostat) R2 (30Ω rheostat) R3 (15Ω) R4 (7·5Ω) R5 (1MΩ) R6 (3MΩ).

Thanks to Wireless World for allowing us to use the Everyman 4 information.

—continued on page 334

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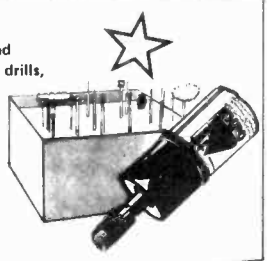

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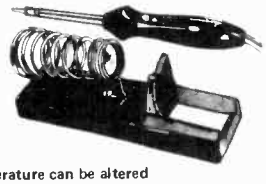

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Spare nozzle 60p ea. + s
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HP7	0·5Ah	50	£1.10 s
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Neg. earth or pos. earth

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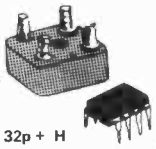

IN 4001 - 5p ea.)
IN 4002 - 6p ea.) + s
IN 4003 - 6p ea.)

1·0A bridge	(400V)	-	32p + H
1·6A "	(200V)	-	48p + H
1·6A "	(800V)	-	70p + H
2·0A "	(200V)	-	72p + H
2·0A "	(600V)	-	90p + H

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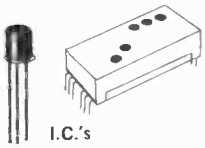

TRANSISTORS

BC 107	- 12p	s	
BC 108	- 11p	s	
BC 109	- 12p	s	
BFY 50	- 20p	s	
BFY 51	- 19p	s	
BFY 52	- 20p	s	
2N 3055	- 80p	s	
2N 2646	- 94p	s	
TIP 2955	£1.14	s	
TIP 3055	- 61p	s	
BC 237B	- 11p	H	
BC 238C	- 10p	H	
BC 239C	- 12p	H	
ZTX 107	- 10p	H	
ZTX 108	- 9p	H	
ZTX 109	- 12p	H	
ZTX 300	- 13p	H	
ZTX 500	- 14p	H	
MJE 340	- 62p	H	
TIP 31A	- 36p	H	
TIP 32A	- 40p	H	
2N 3819	- 32p	H	
3N 141	- 65p	s	
CS 715 (Similar to 2N 3819)	- 18p	H	
BF 180	- 40p	s	
BRY39	- 72p	s	

I.C.'s

T05 Reg	- £1.10	s	
MVR 5	- £1.55	s	
MVR 12	- £1.55	s	
MVR 15	- £1.55	s	
LM 309K	- £2.10	s	
7805	- £1.55	s	
7812	- £1.55	s	
7815	- £1.55	s	
7824	- £1.55	s	
±15V D.I.L.	- £2.82	s	
TBA 231	- £1.75	H	
TBA 800	£1.20	H	
TBA 810S	- £1.31	H	
TBA 820	- £1.00	H	
ZN 414	- £1.30	H	
ZN 424	- £1.25	H	
741 Op-amp	- 36p	s	
747 Op-amp (Dual 741)	- 95p	s	
748 Op-amp	- 48p	s	
555 TIMER	- 56p	s	
556 (dual 555)	- £1.10	H	
HA 1156 (similar to MC1310P)	- £1.60	H	
ORP12	- 72p	s	
8A Triac	- £1.18	s	
ZN 1034E	- £4.70	s	

BOOKS (z)

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P.C.B. assembly (Newnes)	£1.80 ea.
Electronic diagrams (Newnes)	£1.80 ea.

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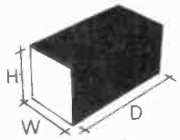
Low-cost blue cover and white base PVC steel cases



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S3	150W x 50H x 100D	£1.31 +	s
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SATELLITE COMMUNICATIONS

PART 1

Brian DANCE M.Sc

IT is only a hundred years since Alexander Graham Bell, a Scotsman, sent the first telephone message, in Philadelphia, on March 10, 1876, yet in this age of Concorde there is an unprecedented demand for instant intercontinental communications by telephone, telex, etc. In the decade since the first telecommunications satellite became operational, intercontinental telephone traffic has increased by a factor of 17. In addition, live television programmes from other continents are regularly brought into our homes. Satellite communications are virtually essential for this latter service which has enabled us to see epoch-making live events such as men walking on the moon.

Although a single telephone conversation requires a relatively narrow bandwidth, about 3·4kHz, the bandwidth required to carry the thousands of simultaneous telephone conversations taking place at any moment between, say, the UK and the USA, is quite large. One also requires a wide bandwidth to carry a high-quality television programme.

Short wave radio signals can be reflected around the earth as they bounce between the ionised layers in the upper atmosphere and the surface of the earth or sea. Relatively low radio frequencies can be used to carry a single speech channel, but for a wide bandwidth signal, one must employ ultra-high frequencies or microwave frequencies. In addition, the use of such UHFs enables a greatly improved signal-to-noise ratio to be obtained with reliability. However, UHF and microwave frequencies are not reflected back to earth by the ionosphere but penetrate it and are lost into space.

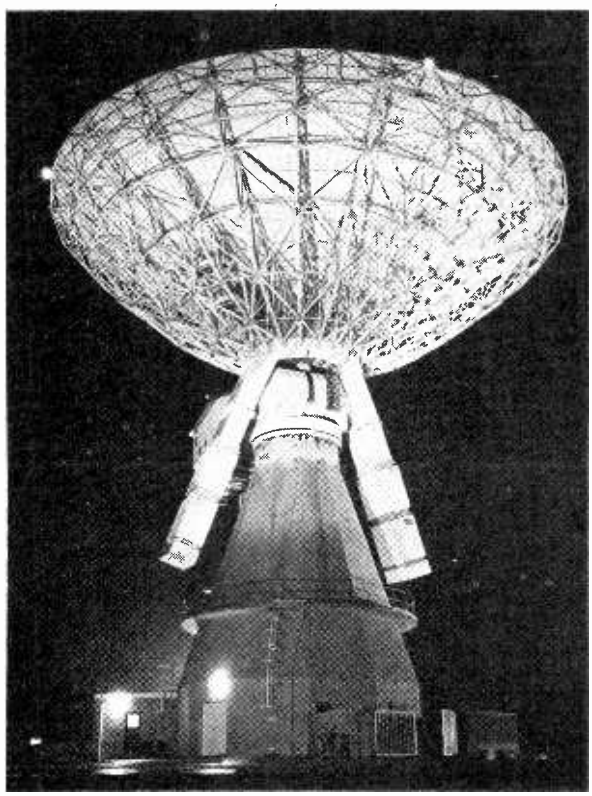
As UHFs are not reflected around the earth, they cannot generally be used for signalling unless the transmitting and receiving aerials are almost in a line-of-sight. The Post Office use microwave aerials in reflecting dishes on their towers to carry many telephone conversations. The beam can travel some tens of miles between the towers, but as the distance increases, the height of the towers must be increased to maintain the line-of-sight condition. In theory one could convey a signal across the Atlantic by using a large number of such towers floating on the ocean and spaced at distances of a few tens of miles from one another. Even more impossible would be the task of constructing a single tower at the centre of the Atlantic which is high enough to be visible from both the USA and the UK. Such a tower would be nearly 500 miles in height!

The practical answer to a "communications switchboard in the sky" involves the use of a satellite which receives a signal, amplifies it and sends it to another point on earth. This type of link offers a very effective alternative to a sub-oceanic telephone cable. Although satellites are used for special communication purposes, such as the Moscow-New York 'hot line', about 85 per cent of their use is for ordinary intercontinental telephone work involving business men and private people.

HISTORY

A telephone service with France was opened as long ago as 1896 using a copper conductor rather than a coaxial system, but it was not until January 1927 that the trans-Atlantic telephone service was inaugurated using the Rugby 60kHz radio transmitter GBT. The service was extended to India, Rhodesia and Turkey in 1933 and Japan in 1935. The first coaxial submarine cables were brought into operation in 1937 on short runs.

The first trans-Atlantic cable was brought into



A very impressive night shot of the Aerial No. 3 at Goonhilly Earth Station in its vertical (non-operational) position. (Courtesy: Post Office).

TABLE 1

Launch Date	*Operational Region*	*Status and Position*
Intelsat 1 (Early Bird) April 1965	Atlantic	Placed in service over Atlantic at 325° E No longer in service.
Intelsat 11 (F-1) October 1966	—	Failed to achieve synchronous orbit due to malfunction of apogee motor. Used briefly as non-synchronous satellite.
Intelsat II (F-2) January 1967	Pacific	No longer in service.
Intelsat II (F-3) March 1967	Atlantic	No longer in service.
Intelsat II (F-4) September 1967	Pacific	No longer in service.
Intelsat III (F-1) September 1968	—	Failed to achieve orbit due launch vehicle malfunction.
Intelsat III (F-2) December 1968	Atlantic	Stalled aerial—not considered serviceable.
Intelsat III (F-3) February 1969	Pacific	Placed in service over the Pacific at 174° E. Repositioned over Indian Ocean—now in reserve at 60°E.
Intelsat III (F-4) May 1969	Pacific	Removed from service upon availability of IV (F-4)
Intelsat III (F-5) July 1969	—	Failed to achieve proper transfer orbit due launch vehicle malfunction.
Intelsat III (F-6) January 1970	Atlantic	Relocated to Indian Ocean as emergency backup—relocated from Indian to Pacific at 177°E. Presently serving as Pacific spare.
Intelsat III (F-7) April 1970	Atlantic	Satellite failure.
Intelsat III (F-8) July 1970	—	Failed to achieve synchronous orbit due malfunction during apogee motor firing.
Intelsat IV (F-2) January 1971	Atlantic	Placed in service over the Atlantic at 335·5°E. Now is reserve as Atlantic spare at 340·5°E.
Intelsat IV (F-3) December 1971	Atlantic	Placed in service over the Atlantic at 340·5° E. Now at 335·5° E—serving presently as the Primary satellite.
Intelsat IV (F-4) January 1972	Pacific	Placed in service over the Pacific at 174° E. Now at 177° E.
Intelsat IV (F-5) June 1972	Indian Ocean	Placed in service over the Indian Ocean at 61·4° E. Now at 60° E.
Intelsat IV (F-7) August 1973	Atlantic	Placed in service over the Atlantic at 330° E. Now at 330·5° E—serving as Major Path satellite.
Intelsat IV (F-8) November 1974	Pacific	Placed in service over the Pacific at 174° E.
Intelsat IV (F-6) February 1975	—	Failed to achieve orbit due to launch vehicle malfunction.
Intelsat IV (F-1) May 1975	Indian Ocean	Placed in service over the Indian Ocean at 63° E.
Intelsat IVA September 1975	Atlantic	New Atlantic Primary Satellite 335° E.

service in 1956 with 48 speech circuits and gave much better quality and reliability than the earlier radio links. The first trans-Pacific cable was laid in 1963 and sub-oceanic cables have since built up into an international network which is still expanding even in this space age. The TAT-6 trans-Atlantic cable scheduled for completion in 1976 will provide 4,000 speech circuits.

ECHO SATELLITES

The era of space communication dawned with the launching of the Echo-1 satellite from Cape Canaveral, Florida on August 12th, 1960, inside a 66 cm magnesium sphere in the nose of a Delta rocket. About 1000 miles above the earth an explosive charge split open the container and allowed the chemicals inside Echo-1 to vaporise and to inflate this balloon type satellite to a diameter of 100 feet. The aluminised mylar plastic skin reflected both light and radio waves extremely well so that it could be seen by enormous numbers of people as a bright moving object in the sky, even brighter than the Pole star. It may well have been seen by more people than any other man-made object.

Echo-1 circled the earth every two hours, but served only as a passive reflector of the radio waves directed at it. It did not contain any transmitter. It was used to relay the first transcontinental telephone call by satellite made by President Eisenhower from New Jersey to California, and to relay various signals across the USA and to Europe. Although it was expected to remain in orbit for a year, it actually completed eight years before it entered the atmosphere off South America and burnt up. A larger passive reflector, Echo-2, followed on January 25th, 1964.

TELSTAR

Before Echo-2 was launched, however, the American Telephone and Telegraph Company's Telstar-1, the first privately owned satellite, was placed in orbit on July 10, 1962. This 170lb satellite had an array of solar cells which converted the energy of the sun into electricity so that Telstar could receive signals, amplify them and re-transmit them. Thus it was a great improvement on the passive satellites.

Telstar-1 provided the first intercontinental television transmissions between the USA and Europe. The more powerful Relay-1 followed on December 13th, 1962, Telstar-2 on May 7th, 1963 and Relay-2 on January 21st, 1964. The main disadvantage of all of these satellites was that their period of use was limited to the time that they were above the horizon at both ground stations.

GEOSYNCHRONOUS ORBIT

Modern communications satellites are launched by powerful rockets which place them at an altitude of 22,300 miles (35,680km). At this particular distance from the earth, a satellite can be made to rotate round the earth once per day at exactly the same rate as that at which the earth rotates beneath it. The satellite therefore remains stationary over a chosen part of the earth's surface remaining in constant radio contact with the appropriate ground stations. Any such satellite can communicate with ground stations over about one-third of the earth's surface.

Satellites which appear stationary at a point above the earth are said to be in "geosynchronous orbit". The first experimental satellites placed in such an orbit were known as the "Syncoms", but it is the Intelsat (International Telecommunications Satellite Organisation) satellites which have provided commercial intercontinental communications.

INTELSAT

The Intelsat organisation was formed in Washington in 1964 and it aims to provide commercial networks for high reliability international public telecommunications by satellite to all areas of the world on a non-discriminatory basis to all users. There were 14 founder nations, but Intelsat now has 91 member nations. The UK is second only to the USA as a shareholder with 11% of shares. Intelsat owns its own satellites, but the ground stations communicating with these satellites are normally owned by the appropriate authority of the country in which they are situated.

The satellites are launched by the US National Aeronautics and Space Administration (NASA) on a cost re-imbursable basis. The Communications Satellite Corporation (COMSAT) of Washington manages the satellite operations over the whole global area on a cost-plus-fee basis and also operates its own satellites for maritime communications and for operation across the USA. It also represents the USA in Intelsat.

THE SATELLITES

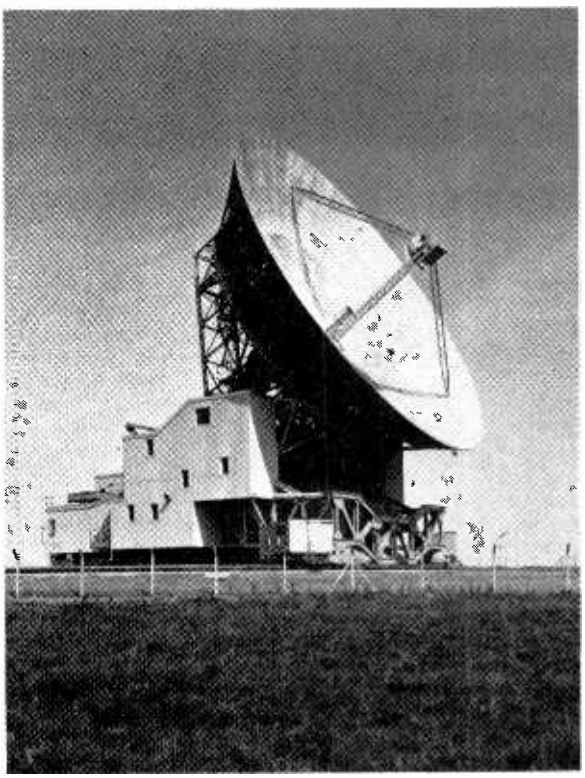
The Intelsat satellites launched up to the time of writing are shown in Table 1. The first was known as Intelsat-1 (or "Early Bird") and came into commercial operation on June 28th, 1965, taking telephone calls across the Atlantic from the Post Office Goonhilly Earth Station in Cornwall. It increased the trans-Atlantic telecommunications capacity by about 50%, although it could handle only 240 calls simultaneously and could communicate with only two ground stations at any time. A "squinted" aerial was used which confined the beam to the heavy traffic area between Europe and N. America.

Early Bird was followed by four Intelsat-II satellites in 1966 and 1967. As shown in Table 2, they were larger than Early Bird and had the important advantage of "multiple access capability", that is, they could communicate with several ground stations simultaneously. In addition, they provided a much wider coverage, offering service to both the northern and southern hemispheres.

Eight Intelsat-III satellites followed in the period 1968 to 1970. Each could carry 1200 telephone signals or 4 television channels or a combination of both simultaneously. They could also carry telex, data and facsimile signals. The aerials of the Intelsat-II satellites are mechanically "despun" on a shelf, which provides maximum stability by allowing the body of the satellite to spin, but keeping the aerials pointing in the required direction at all times. This system is used in all later satellites.

Between 1971 and 1975 eight of the still more advanced Intelsat-IV satellites were launched. Each can relay 4000 telephone calls or twelve television signals at any time. Two global aerials for transmitting and two for receiving are employed for covering a wide area. In addition, steerable spot beam aerials are used. The most advanced satellites of this type are the Intelsat-IVA series, the first of which was launched in September 1975 from Cape Canaveral. It now serves over 40 earth stations in the Atlantic region, being used by nearly all countries in this area. It is known as the "Primary" satellite, the other "Major Path" satellite being used mainly by the large user countries which have two or more aerials for this region.

The IVA satellites resemble the IV series, but the capacity has been greatly increased by frequency re-use. An east beam is sent to Europe and Africa with a 320MHz bandwidth, whilst the same 320MHz band is beamed West to North and South America; eight transponders are used for each of these beams. In addition, there are four global transponders which cover all ground stations in the Atlantic area, such as Atlantic islands not in the east or west beams. The 53in transmitter and 35in receiver aerial reflectors are constructed from metallic mesh on an open frame to minimise the torque experienced from the particles emitted by the sun. They are all supported on a single tubular mast with the telemetry omnidirectional bicone aerial on the mast tip.

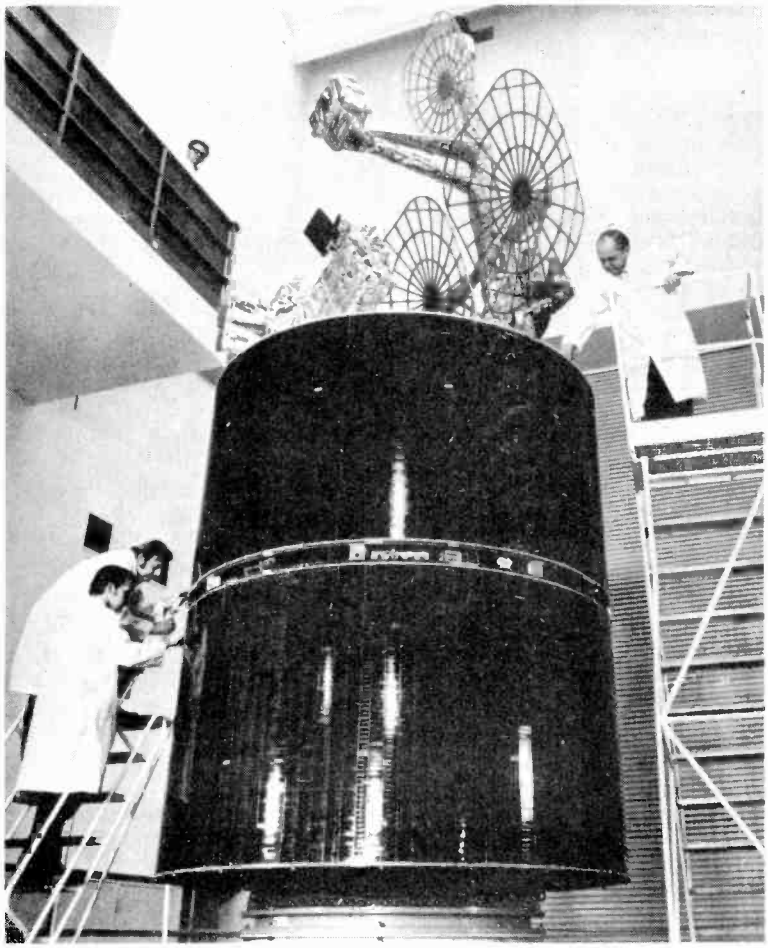


Aerial No. 2 at Goonhilly which, with Aerial No. 3, operates with the Atlantic satellite in maintaining contact with many countries across the Atlantic. (Courtesy: Post Office).

Another five Intelsat-IVA's have been ordered from Hughes Aircraft Co., California, and these are expected to provide a sufficient capacity for the remainder of the decade. One will be used for the Pacific area, one for the Indian Ocean region and another three for the Atlantic. The total cost will be about £136 million, namely about £11·5 million per satellite and £11·2 million for each of the Atlas-Centaur launch vehicles.

TABLE 2

Intelsat Series number	Height (inches)	Diameter (inches)	Orbital weight (lb)	Launch weight (lb)	Design Life (yr)	Power (W)	Repeaters	Bandwidth of each repeater (MHz)	Channels	Remarks
I (Early Bird)	23	28	85	150	1·5	31	2	25	240 or 1 TV.	Squinted aerial confining service to heavy traffic N. Atlantic area. No multiple access.
II	26	56	190	357	3	85	2	126	240 or 1 TV.	Wide coverage (N and S hemispheres) Multiple access.
III	41	56	334	647	5	127	2	226	1200 and 1 TV.	Mechanically despun aerials. TV, telephone, telegraphy, facsimile, high speed data capability.
IV	208 (Solar panel III)	94	1610	3120	7	500	12	36	4000 and 2 TV.	Steerable spot beam aerial and global aerial.
IVA	275 (Solar panel III)	94	1820	3280	7	700 (600 after 7 yrs)	20	36	6250 and 2 TV.	Twin 53″ dish transmit aerials. Two sets of reed horns in conjunction with third dish reflector.



An Intelsat IVA satellite during pre-flight testing. Note the great area of solar cells and the reflectors at the top for the various aerials. (Courtesy: Intelsat Washington).

All satellites orbit near the equator. All obtain power from solar cells, the IVA series each having 17,000 solar cells on a cylindrical drum. It is essential to have unbroken communications, so each satellite contains two nickel-cadmium storage cells for use during the times when the satellite is eclipsed by the earth. These cells are a major factor in limiting the life of the satellites, but COMSAT is developing nickel-hydrogen cells with three times the storage capacity and five times the life of nickel-cadmium.

Interruptions of the service provided by an Intelsat IV in the Atlantic region occurred in 1964, apparently because solar storms affected the aerials directional control system. However, all satellites launched after November 1974 have been modified to alleviate this problem. The satellites transmit in the 4GHz (3·7 to 4·2GHz) band, but receive signals from ground stations in the 6GHz (5·925 to 6·425GHz) band so that transmission and reception can take place simultaneously. Travelling wave tubes are used in the satellite transmitters.

A series of Intelsat-V satellites is planned for about 1979. Each will have about 12,000 telephone circuits and they will probably use the 11-14GHz band in addition to the 4-6GHz band. The Post Office is currently making propagation measurements at up to 30GHz to ascertain how signals from satellites at such frequencies will be affected by rain, etc.

PART 2 OF SATELLITE COMMUNICATIONS WILL BE PUBLISHED NEXT MONTH

I.C. OF THE MONTH

by BRIAN DANCE

Number 60 — Ferranti ZN424 GATED OP-AMPLIFIER

THE Ferranti ZN424 device is a low noise, low distortion operational amplifier which is very suitable for both audio use and as a general purpose operational amplifier. It incorporates an internal gate which enables the output to be isolated from the input.

The ZN424 is available in three types of package. The ZN424P employs an 8-pin dual-in-line package, whilst the ZN424E is an electrically equivalent device in a 14-pin dual-in-line package. The connections to both of these types are shown in Fig. 1.

A circular metal package is employed for the ZN424T, but readers will normally find the dual-in-line devices more convenient to use, especially when one wishes to use a socket. Any of these devices may be used in the circuits to be described.

BASIC CIRCUIT

The basic circuit in which a ZN424 device can be used is shown in Fig. 2, the feedback connections, etc. being omitted for simplicity. Balanced positive and negative power supply lines are shown, the recommended voltage range being ±12V to ±18V. However, it is wise to regard the upper limit as being about ±16V so as to allow a small margin of safety and prevent possible damage to the device. The supply current required is about 5mA when ±12V supplies are used. Output voltage swings of about ±11V can be obtained with ±12V supplies.

A resistor R2 and a capacitor C1 are required between the positive line and the "balance/shaping" pin to provide frequency compensation without which oscillation may occur. The bandwidth is typically 20kHz at −3dB down without feedback, whilst the frequency at which the gain falls to unity is about 4MHz with the recommended value of C1. The slew rates are about 100V/μs (rising edge) and 20V/μs (falling edge).

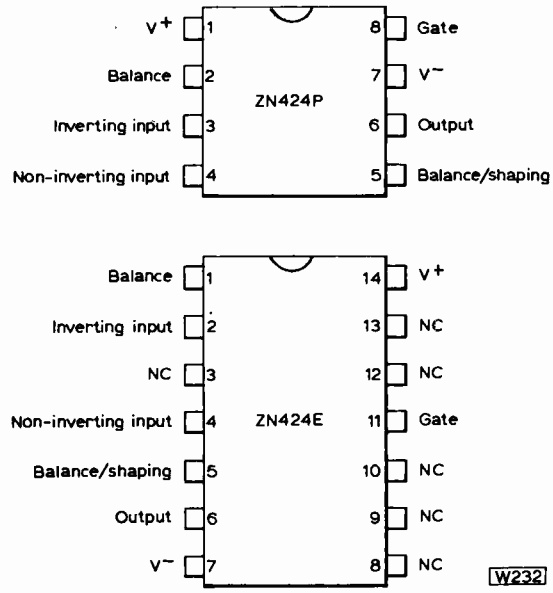


Fig. 1: The pin connections for the two types of ZN424 package likely to be encountered.

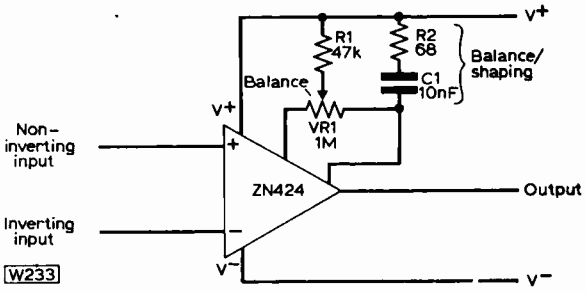


Fig. 2: The basic circuit utilising the ZN424 gated amplifier.

The potentiometer VR1 may be adjusted so that the output voltage has a mean value equal to the mean potential. This balances out the offset voltage of the device. If this facility is not required, VR1 and R1 may be omitted.

The gain of the ZN424 is typically 86dB without feedback, this being a voltage gain of 20,000 times with a minimum value for any ZN424 device of 10,000. As in all practical operational amplifier circuits, this gain is greatly reduced by negative feedback.

The voltage difference between the two inputs should not exceed 5V in any circuit. The input resistance is about 200kΩ and the output resistance about 4kΩ.

AMPLIFIER CIRCUIT

The ZN424 can be used as an audio pre-amplifier in the type of circuit shown in Fig. 3. In order that a single positive power supply line may be used

without any negative supply, the non-inverting (+) input is returned through R3 to the junction of two equal resistors, R1 and R2; this keeps the input of the ZN424 at a quiescent potential mid-way between that of the positive and negative supply lines.

Negative feedback is taken from the output to the potential dividing resistors R7 and R6. A fraction of the output voltage equal to R6/(R6+R7) is fed back to the inverting (−) input and this fraction determines the audio gain. However, the presence of C3 ensures that the full output voltage is fed back at zero frequency and this helps to keep the mean output voltage at V+/2.

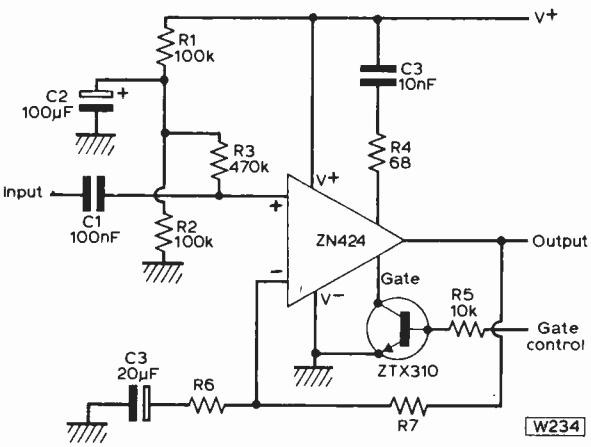


Fig. 3: The ZN424 in an audio amplifier circuit using the gating facility.

The gain of this circuit is equal to (1+R7/R6). Thus R7 may be 100kΩ, R6 2·2kΩ, in which case the gain will be about 46 (or about 33dB). If R7, R6 and C3 are omitted and the output is connected directly to the inverting (−) input, the gain will be unity and the output voltage will follow that of the input. The optimum value of C3 varies with the resistor values, so the value shown is intended only as a guide.

GATING

If the gating facility is not required, the ZTX310 transistor and R5 may be omitted and the gate pin of the ZN424 left unconnected. The output may be isolated from the input merely by connecting the gate pin of the ZN424 to earth. However, it is normally required to use an electrical signal for gating. In the circuit shown any positive signal of 2V or more fed to R5 will cause the ZTX310 transistor to conduct and this effectively connects the gate pin to earth. The output signal from a TTL device is suitable for feeding to R5.

The type of transistor employed is not at all critical and any NPN small-signal transistor will prove suitable. The output leakage current of the ZN424 when the device is gated off is about 5nA with a maximum value of 30nA.

The gate connection has an entirely different use when the device is operated from a low supply voltage and one wishes to preserve the 3mA maximum output current. An external resistor should then be connected between the gate pin and the positive supply line; the value of this resistor (in parallel with an internal 23kΩ resistor) is about (V+)−1·4) kΩ for 3mA output current. The gating facility also enables the ZN424 to be used in multiplex switching applications when several signals are sent sequentially along a single line.

AUDIO PRE-AMPLIFIER

An audio pre-amplifier for use with a magnetic pick-up is shown in Fig. 4. The network used in the feedback circuit between the output and the inverting input (C4, C5, R6 and R7) is designed to provide the required RIAA frequency response.

If more gain is required than the 34dB provided, R8 may be reduced, but C6 should then be increased in proportion to preserve the bass response. Actually C6 and R8 limit the response in the extreme bass region and constitute a filter which helps to remove any turntable rumble.

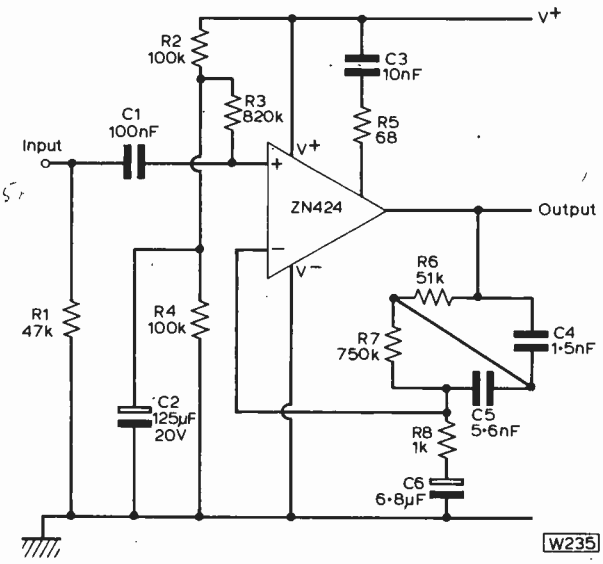


Fig. 4: This circuit shows the ZN424 as a pre-amplifier for use with a magnetic cartridge.

If no feedback is employed in a ZN424 circuit, the total harmonic distortion added by the device is normally less than 1·5% for a 2V peak-to-peak swing at the output. The circuit of Fig. 4 employs feedback to reduce the gain of the circuit from about 86dB to about 34dB, a difference of 52dB or about 400 times. Thus the distortion is reduced to the utterly negligible level of 1·5/400% or about 0·004%!

The signal-to-noise ratio is better than 70dB below a level of 5mV at the input. The circuit layout is not at all critical.

CONCLUSIONS

The Ferranti ZN424 devices offer lower noise and less distortion than other IC pre-amplifiers available at the present time. The circuits of Figs. 4 and 5 have been designed by Ferranti Ltd. especially for the ZN424 and are reproduced with their permission.

All ZN424 devices are readily available from Ferranti distributors. The ZN424E is available from Radnage Radio and Electronics, 2 Bottom Road, Radnage, High Wycombe, Bucks. and from Doram Electronics Ltd., P.O. Box TR8, Leeds LS12 2UF, the price being of the order of £1·50. PW

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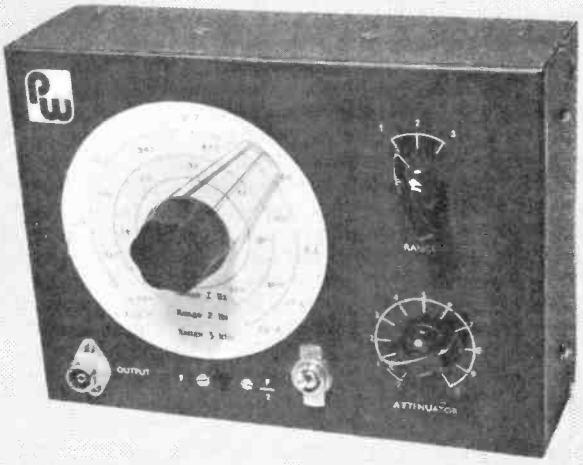

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AUDIO OSCILLATOR

ALSO:-

A 'Jingle' Machine

ACTIVE ROTATING AERIAL

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The unit resembles a conventional typewriter but it displays its text directly on the screen of a domestic television set or a video monitor. In the former instance connection is made via the aerial socket.

A page of text, which is alpha-numeric with a wide range of punctuation, comprises 16 lines of 32 characters. While one page of text is being displayed a second can be held in memory and this memory capacity can be readily expanded to store extra pages if required. The desired page can be recovered from memory and displayed by manual or electronic switching while the previously displayed page is transferred to memory for later recall.

APPLICATIONS

In its present form:—

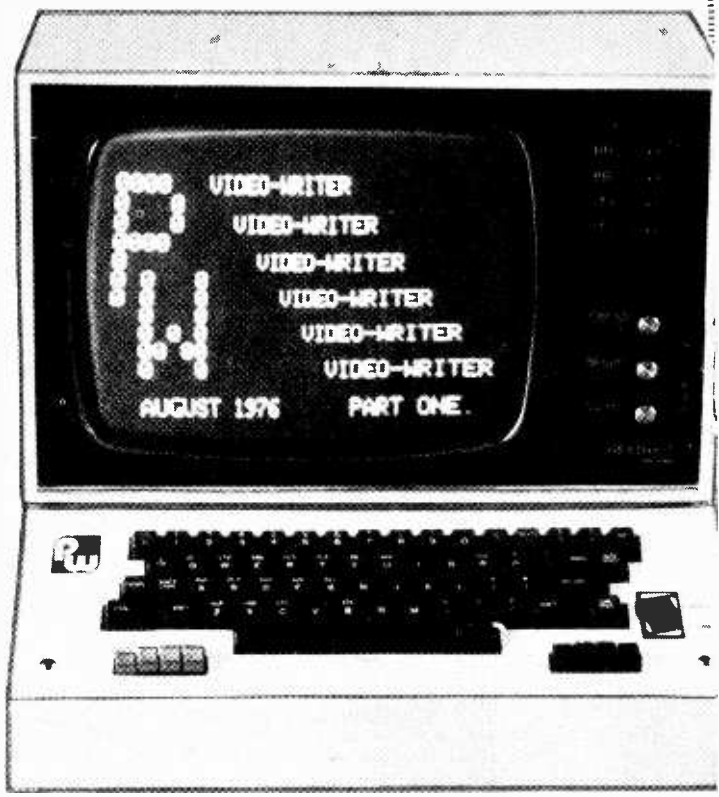
1. Displaying information in public areas
2. Shop window advertising
3. Cafe menus and price lists
4. Display of indoor sports scores (darts, bowling, etc.)
5. Silent paging in clubs, hotels, libraries etc.
6. Communications for the deaf and dumb
7. Games—electronic "Scrabble", etc.
8. Captioning closed circuit TV programmes

With certain modifications:—

1. Long distance text communication (via telephone or radio)
2. Interfacing with a micro-processor (for home computer)
3. Home terminal for communicating with Tele-Text system

NOVEL FEATURES

1. Can be assembled at home
2. Constructional cost less than £150
3. Relies, for its economy, on the latest microcircuits
4. Simple animated displays can be presented



THE project to be described is an electronic typewriter which presents its alpha-numeric display on the screen of any British standard 625 line black and white or colour television set. It also produces a standard video level signal which can be fed into an existing closed circuit television system for titling or sub-titling programmes. As the unit incorporates a CCIR standard interlaced sync generator it could be used as the central source of sync pulses for a CCTV system. Reference to the necessary sync drive signals will be made later.

Although the project incorporates sophisticated logic in places, there is nothing which cannot be understood by the amateur with some basic knowledge of logic theory or application.

Construction is very straightforward (most is on printed circuit boards) even though over 50 integrated circuits are used. Apart from the memory circuits, readily available TTL integrated circuits are used throughout. All the semiconductors can be obtained through advertisers in *Practical Wireless* but in the case of the Random Access Memories and the Read Only Memory it might be better to go direct to the distribution.

The only component which might present a problem is the keyboard. These are sometimes advertised by companies dealing in computer surplus and it is worth browsing through advertisements in this and other magazines if you don't want to use the one given in the parts list. There are, also, a couple of alternative approaches which will be described later. In order to simplify the description it will be assumed that the keyboard specified will be used.

STORAGE FACILITY

The unit will display a page of data comprising 16 lines each of 32 characters and, at the same time,

PW "Easybuild" VIDEO-WRITER

PART 1

M.J.HUGHES M.A., C.Eng. MIERE

will store a second page in its memory. The displayed page can be interchanged with the stored page at the push of a button and this operation can be carried out under electronic control thus allowing sequential display of the two pages. This allows simple animations to be presented for advertising purposes.

AUXILIARY OPERATIONS

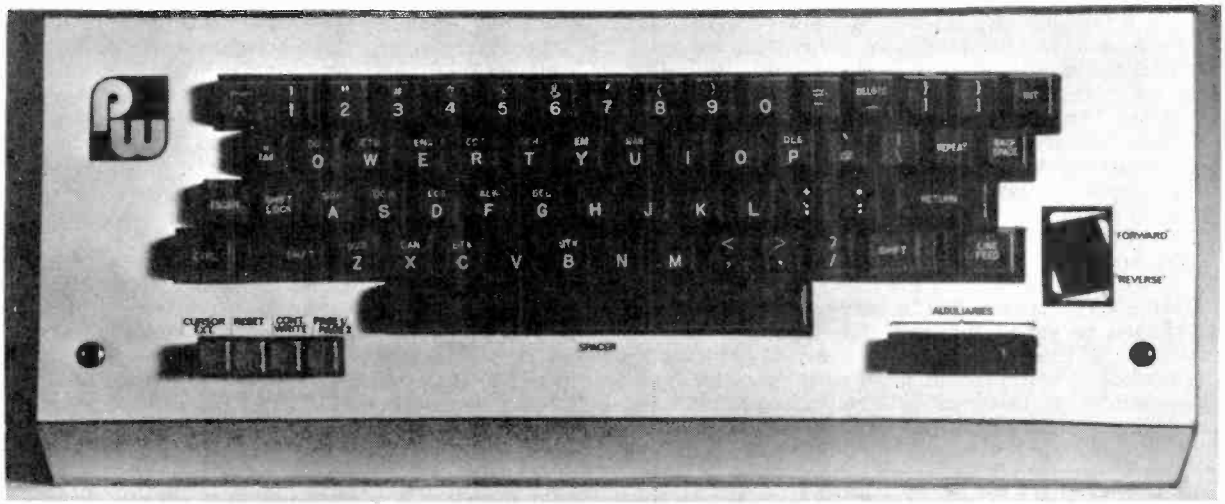
Before attempting to describe the operating principles it might be best to start with a detailed description of how the machine is used. Firstly the output is connected via a coaxial lead to the aerial input socket of a domestic television set and the set tuned to a spare channel, a practice now common for television games. On switch-on the screen is filled with a random selection of letters, numbers and punctuation. To clear the screen it is necessary to depress the spacer bar and while it is held down the auxiliary button marked "Continuous Write" is depressed. This has the effect of writing a "Space" into every memory location for that page thus giving a blank screen. The "Continuous Write" button must be released before the "Spacer Bar" to keep the screen clear. The button marked "Page 1/Page 2" should then be depressed to display the page which had been in store. Again a random selection of letters, etc, will be displayed and this should be cleared in the same manner. Depressing the "Page 1/Page 2" button once more brings us back to displaying page 1, which is still blank. The only mark on the screen will be the chequered marker we call a "CURSOR". The cursor is used to show where the next symbol will be printed when we depress the typewriter keys. It can be switched off by depressing the "Cursor Extinguish" button if its presence spoils the appearance of the final display.

Normally one would start to type from the top left hand corner of the screen so provision is made to reset the position of the cursor to this point by a single depression of the button marked "Reset". The four "action" buttons mentioned so far (Continuous Write, Page 1/page 2, Cursor Extinguisher and Reset) are grouped in a bank at the bottom left of the panel.

KEYBOARD FUNCTIONS

All other machine functions are initiated by depressing the keyboard buttons. On the keyboard listed, the result of pressing one of the keys is to produce a unique 7-bit binary code on the seven parallel lines feeding from the keyboard to the rest of the equipment.

The codes are standard ASCII, which comprises 7 data bits but, in practice, we shall only use the 6 least significant bits to generate the alpha-numeric characters. The seventh bit serves a purpose in de-



Photograph of authors keyboard and front panel showing the auxiliary function buttons and the Forward/Reverse indicators.

tecting "Non Writing" key functions, i.e. Carriage Return, Cursor Step, Line Feed and Forward/Reverse. When the carriage return key is pressed the cursor jumps back to the extreme left hand side of the screen ready to start a new line of type and the line feed key steps the cursor down to the next line.

One feature of this machine is not found on a conventional typewriter. It is possible to type from left to right or from right to left. This is not because there are Chinese applications in mind but because it is sometimes necessary to back space along a line or step UP several lines to effect a correction. To do this we have built in a Forward/Reverse function which is actuated by depressing the "Tab" button.

A single depression of the button will change the direction of typing and this is displayed on one of the two LEDs, located at the right of the front panel and labelled with arrows indicating "Top to Bottom and Left to Right" or "Bottom to Top and Right to Left". When the former is lit conventional typing can be carried out. Depressing the TAB button will cause the latter to light. Now the Line Feed button will step the cursor UP the screen and depressing the keys will cause the cursor to move from right to left. Depressing the Tab button 'a second time will put the unit back to normal operation.

It should be understood that use of the spacer bar is not an inert operation, i.e. when it is depressed the cursor will move from left to right (or right to left if in reverse mode) and on a blank screen will not produce any characters but if stepped over the top of any characters that are already present on a line it will erase them by writing a "Space" into memory at that point. In order to step backwards and forwards along a line to position the cursor in readiness for a correction we need a "Non Writing" horizontal step mechanism and for this we use the code generated by the "Back Space" key. To avoid confusion we shall call this key "Cursor Step"

Carriage Return is NOT affected by the Forward/Reverse mode and will always return the cursor to the left hand side of the screen. As said previously the selection of these non-writing instructions is done by detecting the seventh bit of the ASCII code. The remaining 6 bits give 64 permutations of binary coding to describe the 26 letters of the alphabet, the 10 numerals from 0 to 9, a writing "Space" and a host of punctuation and special symbols, asterisk, mathematical signs and, because we are using components produced in America, a "dollar" sign!

Because of self-imposed price restrictions we have limited the display to "Upper Case" only (capitals), but with the keyboard listed it is not necessary to have the "Shift Lock" key depressed. Numerals are already in lower case as on a conventional keyboard and punctuation is sometimes upper and sometimes lower, again as normal. With alternative keyboards it may be necessary to depress the Shift Lock key to type letters. (The complete character fount is shown in Fig. 4).

Apart from the special Forward/Reverse function and the fact that one has to carry out a TWO stage operation to get to the next line (Carriage Return followed by Line Feed) typing is carried out exactly as normal. When a line is filled with characters surplus letters or numbers will be "Overprinted" on top of each other in the extreme right hand position, each erasing the previous symbol, hence the operator has to be careful not to overfill a line! Likewise when the bottom of the screen is reached (line 16) an unwary operator could overprint the line. No warnings have been built in to guard against these possibilities. Such alarms are possible but in view of the additional expense and circuitry involved it was not felt necessary to incorporate them.

Provision was made in the prototype for four other auxiliary functions hence the bank of four push-buttons to the bottom right of the keyboard. These are not used in the basic unit.

CHARACTER GENERATION

Now that the reader has a basic grasp of what we are to expect from the machine it will be easier to describe its operation. Refer to Fig. 1 which shows how a character is generated within the television raster. A television picture is made up of two interlacing fields each containing $312\frac{1}{2}$ lines giving a total of 625 lines. Each line scans from the left to the right of the screen in 64μS and it takes 20mS to generate the $312\frac{1}{2}$ successive lines to complete a field. In practice the second field of an interlaced pair has its set of lines positioned between the lines drawn by the first field. Odd and even fields are repeated sequentialy. In some displays of this type it is not considered necessary to bother about interlaced scanning because it does not make a great difference to the resolution. For the comparatively little extra cost, it was felt useful to incorporate the special synchronisation signals to facilitate interlacing for the benefit of those who might want to use the unit to caption normal television productions. Because there is basically no difference between the signals that define the characters on an interlaced or non-interlaced system we shall describe how the characters are generated in a single field (whether odd or even).

Each character is made by brightening up the screen at specific "Picture Points" as the raster lines are generated. A symbol is defined by 5 picture points horizontally and 7 vertically as shown on the matrix describing the letter "E" in Fig. 1. Note that we have built into the basic 5×7 matrix an extra row above the letter, this will form the gap between one line of letters and the next. There is also an extra column to the left of the letter; this will give a blank gap between one letter and its neighbour on the same line. It also allows a bit of time for switching to occur when the memories are accessed before the character is displayed. The complete character, including the "inter-row gap" and the "inter-character gap" thus occupies a cell comprising a matrix of 6×8 picture points. With 32 such cells along a line of text, plus a gap at either end for left and right hand margins, 16 rows of them give the page of text. Again, we shall need a margin at the top and bottom of the screen.

TIME DETERMINATION

If we now consider a single line scan of the TV raster it will be seen that we need $32\times6=192$ picture points plus the margins to occur within the 64μS of the scan period. It is convenient to define the horizontal width of a single picture point in terms of Time along the raster line and if this is 250μS we can see that 48μS of the 64μS line period will be taken up defining the horizontal dimensions of the 32 characters. This allows 16μS for the horizontal sync pulse, approx 4·7μS, and the left and right margins. It is fortunate that such a choice of picture point width gives rise to easy numbers. The

width of a character cell is thus 1·5μS.

For the vertical disposition of the lines we need 16×8=128 picture points to describe the 16 vertical cells. Because there are $312\frac{1}{2}$ lines to play with it is convenient to allocate 2 raster lines to each picture point. This uses up 256 of the possible $312\frac{1}{2}$ lines leaving sufficient for the field sync pulse train and top and bottom margins.

By judicious use of dividing circuitry we start by generating a master frequency signal of 4MHz, each complete phase of which will produce a picture point and then, by counting down from this frequency, generate line sync pulses, field sync trains, left and right margins, and top and bottom margins. Details of how these dividing circuits work will be given later.

SIGNAL ROUTING

Before going any deeper into how the characters are generated it might be best, now, to consider the overall system as shown, in abbreviated form, in Fig. 2. The heart of the system is the 4MHz oscillator already mentioned. This feeds a set of dividers which produce the line sync pulses, the width of each being 19 picture points at 0·25μS giving a line sync width of 4·75μS as opposed to the standard 4·70μS. The error in line sync width is not significant and is probably well within normal tolerances. The same dividing system produces the complex waveforms required for the interlaced field sync train (Broad pulses, Equalisation pulses etc). The mixed line and field sync are fed straight from the sync generator to the Sync Mixer near the output of the unit for later recombination with the video signal. The sync generator also produces Line Drive and Field Drive signals which are fed to the Address Counter These drive signals could be extracted and used as a sync source for a complete closed circuit television system!

ADDRESS INFORMATION

The Address Counter produces three main sets of signals and a number of control signals. The three most important sets of signals are called ADDRESSES and are used to define specific points and areas on the television screen within the time of a raster.

It might be convenient to refer back to Fig. 1 showing the dispositions of the character cells on the screen. There are 32 columns of cells numbered sequentially from 0 to 31 inclusive. Similarly there are 16 rows numbered from 0 to 15. The cell that is ringed is thus in column 3 and row 2. These two numbers coordinate the cell and are called its Column and Row Addresses respectively. The Address Counter generates Column Addresses by waiting a discrete number of picture points after the line sync pulse has finished, to allow for a left hand margin, and then counts every six picture points starting off at zero (shown as the binary state 00000 —a five bit word— on the output of its counter). After the first group of six picture points (describing the column 0) the Address counter increments by 1 to give the binary number 00001 which is the address for column 1. The counter continues incrementing for every set of six picture points until it reaches the binary number -11111 which corres-

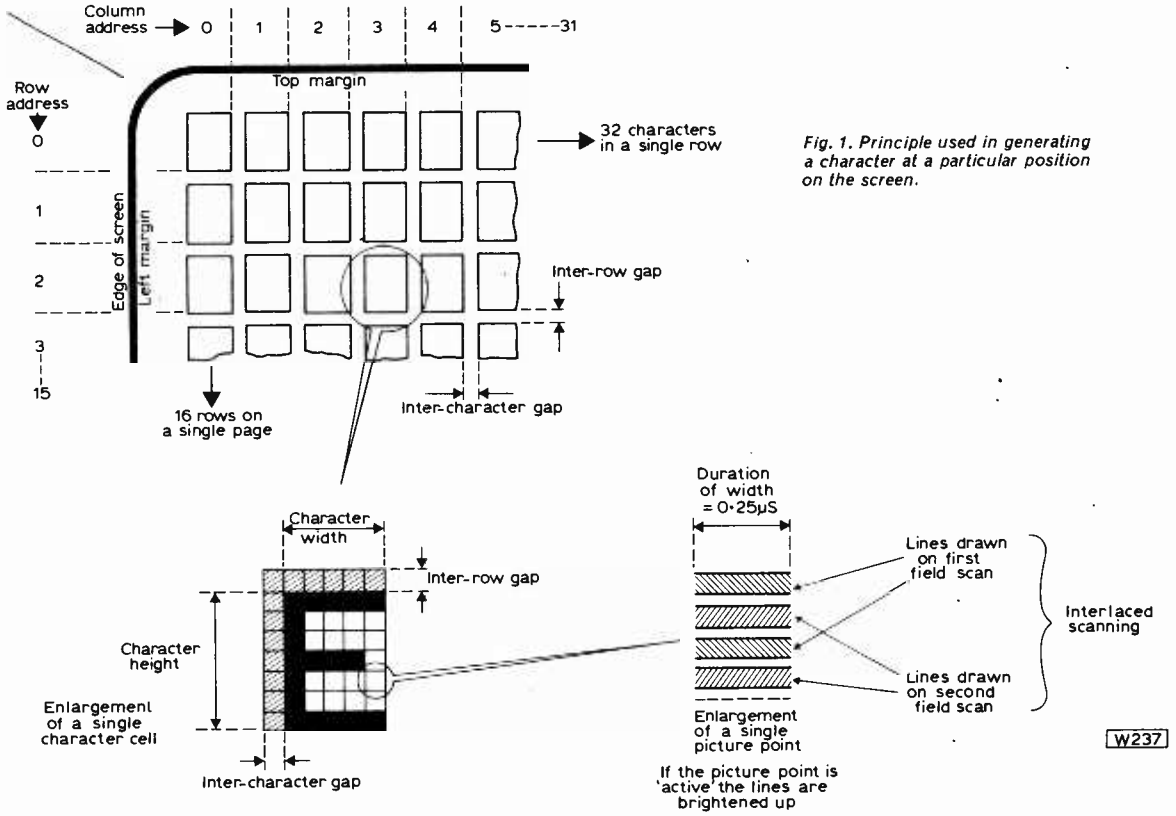


Fig. 1. Principle used in generating a character at a particular position on the screen.

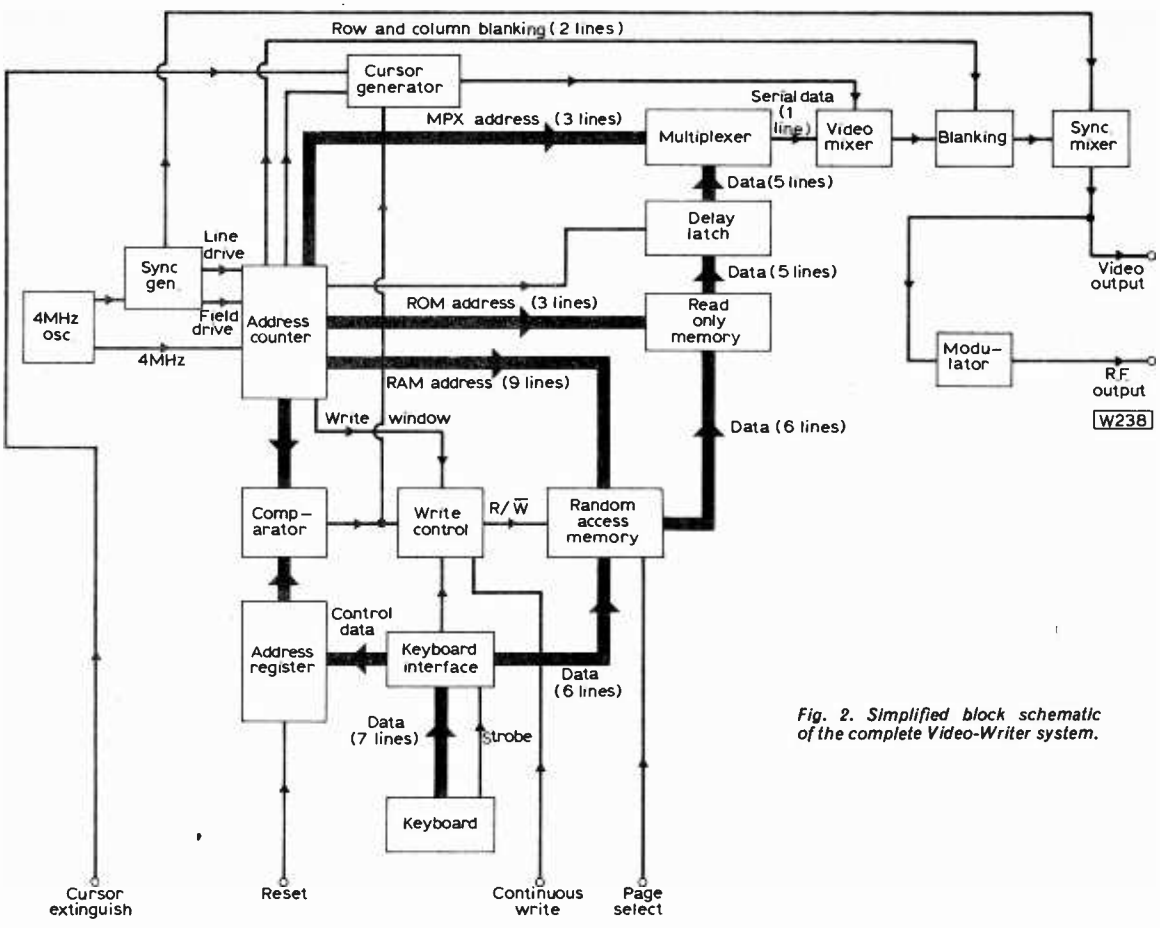


Fig. 2. Simplified block schematic of the complete Video-Writer system.

ponds to the ADDRESS for column 31. Fig. 3. The five wires that carry the 32 codes are fed to the Random Access Memory (RAM) and tell it to give out the codes for the characters that occur in that column. There will, of course, be 16 possible codes depending on which line of text (Row) we are considering and this is where the idea of matrixing comes in.

The Address Counter has a second counter within it which waits a discrete number of lines after the field drive pulse (for the top margin) and then counts up in groups of 16 lines starting with a binary code 0000 (four bits) to describe row address 0. It then increments by one to give the code 0001 which is the address for row 1 and so on up to 1111 (the Address for row 15) Fig. 3. The four wires that carry the 16 possible row addresses are also fed to the RAM and tell it which of the 16 possible characters in the column it should select from its memory. We shall describe later how the codes got into the memory. When the Address Counter reaches the limiting values of its addresses, i.e. 31 for the columns and 15 for the rows, another two signals come into play. These are Row Blanking and Column Blanking. These are used to blank the video signal to prevent unwanted characters appearing in the margins.

Because the Address Counter is precisely referenced to the line and field drive pulses the RAM knows exactly where on the display television screen the raster spot is and can thus give out the right code to generate the desired character in the cell which the spot is entering at the time.

RANDOM ACCESS AND READ ONLY MEMORIES

The two other main signals emanating from the Address Counter will be described presently. Firstly we must consider what happens to the code that the RAM disgorges when it is addressed for a certain position on the screen. Let us say it has received the address for the position shown ringed in Fig. 1 (Column 3 Row 2). Six separate flip-flop memory elements in the RAM will be interrogated and if the letter "E" was originally intended to appear at this point on the screen the RAM will produce the ASCII code for "E" on its 6 output data lines. This will be the binary code 000101 (only the 6 least significant bits of the full code are used).

This code is fed direct to another type of memory called a Read Only Memory (ROM) which is nothing more than a very complicatad set of gates inside an integrated circuit which changes codes (similar in many respects to the principle used in BCD to Seven Segment encoding). Fortunately the constructor does not have to worry about the gate configuration because the unit used in this project is specially programmed by the manufacturer to give out codes that will generate the picture points of the character

★ Collated components list

Resistors
1 off 100Ω ¼W 10%
6 off 330Ω ¼W 10%
4 off 470Ω ¼W 10%
3 off 1kΩ ¼W 10%
1 off 470kΩ ¼W 10%

Capacitors
1 off 310 pF Compression Trimmer
1 off 1,000pF Polystyrene
1 off 10μF 12V
1 off 47μF 12V
1 off 1,000μF 50V
1 off 4,700μF 25V

Transistors
3 off BC108

Integrated Circuits
Standard TTL
6 off 7400
4 off 7404
3 off 7410
1 off 7414
2 off 7420
10 off 7430
2 off 7474
3 off 7485
4 off 7490
4 off 7493
1 off 74151
1 off 74174
4 off 74177
3 off 74191
Random Access Memories
6 off 2102-2 (650nS access time) Intel or TMS 4034 Texas Instruments
Read Only Memory
1 off RO-3-2513 Character Generator, General Instrument Microelectronics
Voltage Regulators
2 off 7805 in TO-3 package

Diodes
5 off 1N4148
1 off Bridge, 100V 3A, RS Components type REC 43 or equiv.
1 off 12V 400mW Zener
2 off LEDs type MV5025 or similar

Dil Sockets
40 off 14 pin
14 off 16 pin
1 off 24 pin

Coil
1 off Denco Aerial Coil type 3T (Blue)

Transformers
1 off Miniature 12V 50mA (or 6-6V with centre tap ignored)
1 off 9V 2A, Douglas MT-3-AT using 15V and 24V tappings

Switches
1 off Mains Rated 2 pole toggle
2 off Single pole "push-to-make" RS Components type 338-434
2 off Single pole "push-to-make, push-to-break" RS Components type 338-434
4 off Buttons to suit
1 off Bracket to suit

Keyboard
1 off Clare Pendar Keyboard with ASCII encoding ROM and Strobe (see text)

Miscellaneous
3 off PCBs, Readers PCB Service
2 off heatsinks, Home Radio type TR89 or equiv.
1 off UHF Modulator, Crofton Electronics
Board pins, SRBP, Aluminium, Plugs, Sockets, etc.
NOTE.—Details of individual component content and identification will be given as the relevant section is issued.

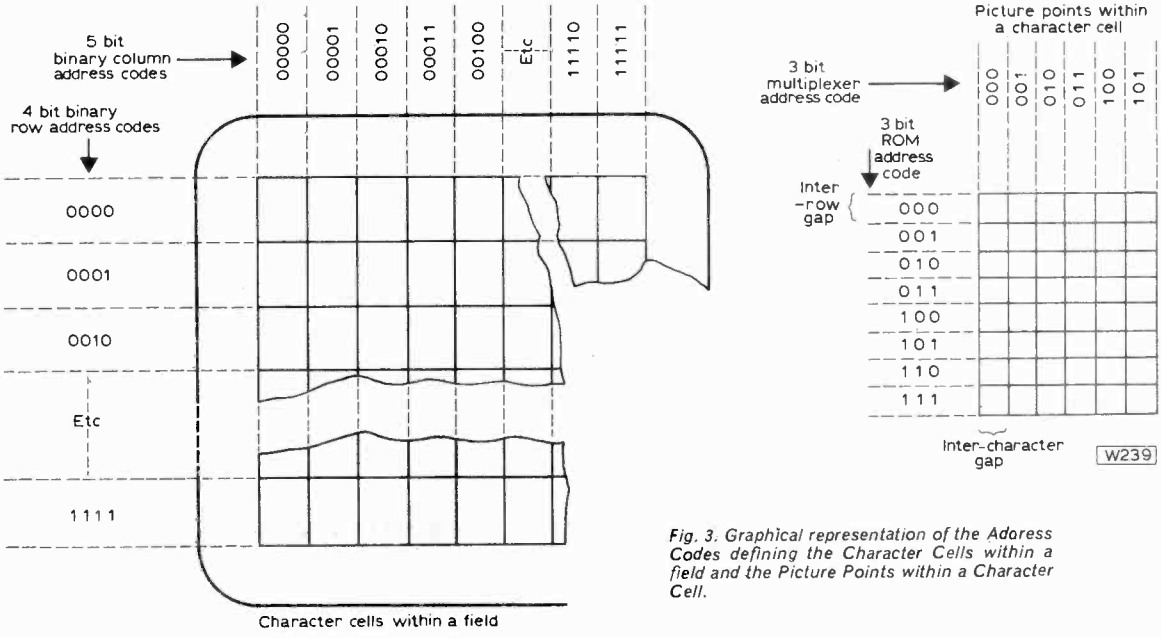


Fig. 3. Graphical representation of the Address Codes defining the Character Cells within a field and the Picture Points within a Character Cell.

that is described by the ASCII code we feed into it. There are 5 lines coming out of the ROM each of which corresponds to a vertical column of picture points within the character we want to describe.

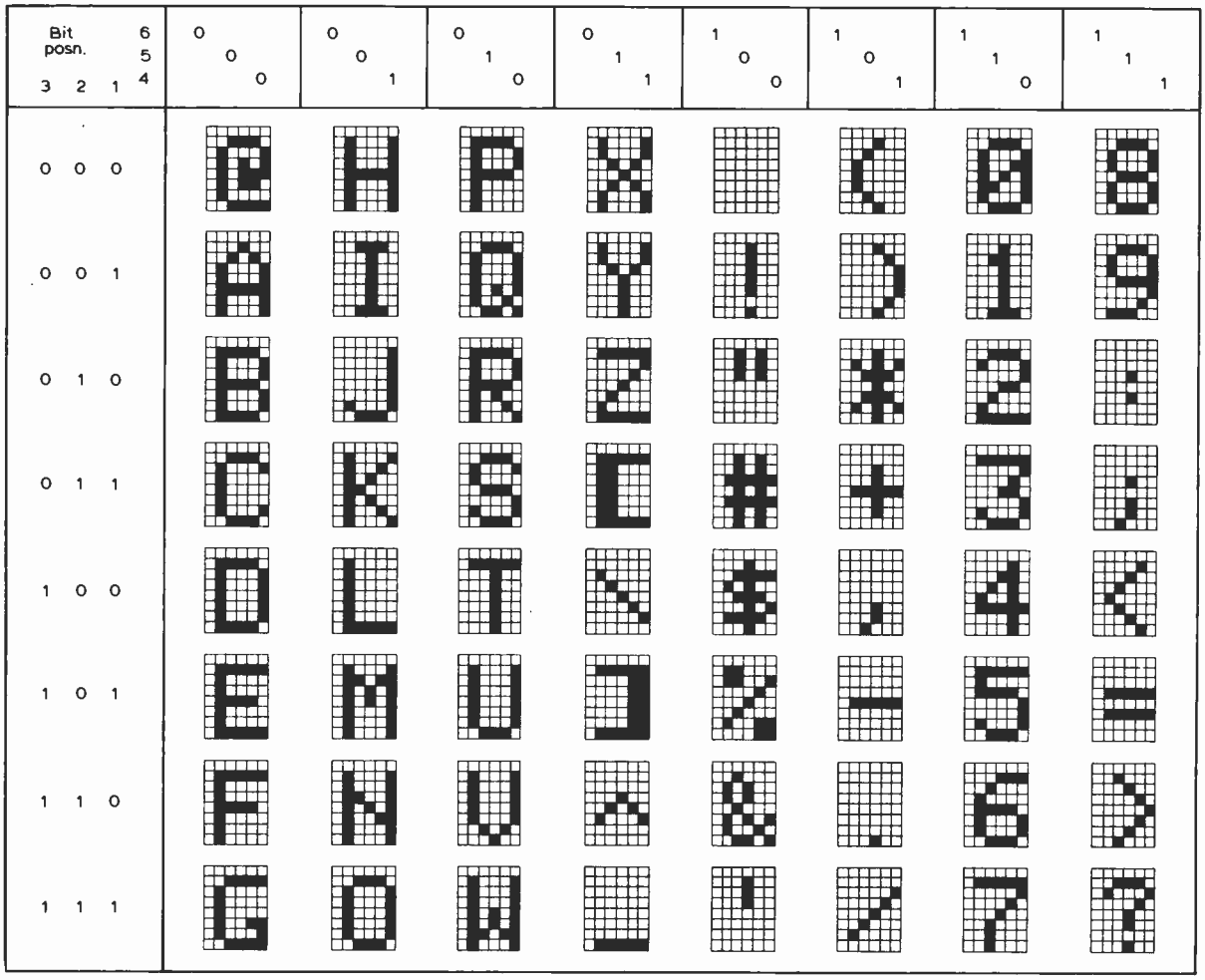
It is not sufficient to have just this information because different rows within the character cell will have different states of picture points, bright or dark. We thus have to tell the ROM which row we are interested in and this depends on which part of the cell the display raster is entering.

Let us assume that we are just entering the top left hand corner of the cell. Our Address Counter tells the ROM this by a 3 bit binary code 000. The ROM is pre-programmed to assume that the top row of picture points in any cell must be blank so it produces an output of "0" on each of its five output lines. The Address Counter is so designed that it will repeat this instruction when the correct position of the next line occurs because we are allowing two lines for every picture point. When the raster gets to the third line the Address Counter changes its ROM ADDRESS output to give the code 001 which instructs the ROM to put out the signals which describe the next row of picture points of the character within the cell.

In the case of "E" all the 5 lines will go to level "1". This is repeated for the fourth line of the raster and on the fifth line the ROM Address is changed to 010. It will respond by making its output line corresponding to the most left hand column of picture points "1" and the other 4 lines will go to "0". This is duplicated for the sixth line and so on until the last raster line within the cell has been dealt with. Bear in mind that this is not a static operation. As the raster progresses horizontally from cell to cell the address to the RAM will be changing. We are concerning our description only with what happens when the raster gets back to the same cell on subsequent line scans. The same argument could apply to any of the 32 possible cells along a line of text!

LATCH FUNCTIONS

It takes up to 1·25μs for the RAM and the ROM to respond to their instruction from the Address Counter therefore it is not possible to display the information at the same instance as the memory is addressed. A latch is therefore inserted into the system which "catches" the 5 bits of data from the ROM as they are generated and holds them until the time of the character cell AFTER the address. The timing for this operation is again controlled by the Address Counter. The effect of this latching operation means that an addressing operation is being carried out while the preceding character is being displayed on the screen.



W240

Fig. 4. Character Fount and the ASCII coding used to designate each character.

MULTIPLEXING

In order to display the state of the 5 picture points that describe a row within a cell we have to take the 5 lines from the delay latch, which are identical to the input lines except that the data is delayed by one cell width and serialise the information to make the raster spot go bright or dark as is appropriate. This is done with a Multiplexer which is designed to serialise 6 inputs. The extra input corresponds to the inter-character gap (to the left of the character) and is always dark (corresponding to logic level "0"). The six parallel inputs are selected one after another and presented on a single output line by means of a 3 bit binary code generated within the Address Counter.

Code 000 always outputs "0" because this is the inter-character gap; code 001 will cause the most left-hand bit of data describing the picture point of the character to be fed out on the serial line. Code 010 will select the next column within the cell and so on until the sixth code, 101, is reached. This corresponds to the picture point on the extreme right of the cell row in question. Following the code 101 the Multiplexer Address is reset to 000 which is then the inter-character gap for the next character cell which occurs on that particular raster line.

All this happens in synchronism with the line and field drive signals for every picture point within every cell that occurs within that particular field. It only remains to blank the signals during periods when margins should appear on the screen and then mix the sync pulse chain with the data to produce the final television signal. This is normally at video level (1V peak-to-peak) but can be fed to a UHF modulator if aerial socket access to the receiver is desired.

The only part of the system that contributes to the display which has not, as yet, been covered is the Cursor. This requires some knowledge of the Write operation of the instrument which will be described next month.

VISUAL DISPLAY UNITS

Before finishing this part a word ought to be said about the monitor shown in the photograph. It is a Heathkit GR-9900 chosen because of its convenient size, pleasing appearance and because it was exceedingly straightforward to modify it to accept a video level input. It is understood that Heath (Gloucester) Ltd still have a limited number of these kits available for those who wish to make everything for this project. For those who do make use of this kit the modification to allow a video input is to break the printed circuit wiring at the point on the IF/Video/Sound board at the junction between R16 and C18. The video output of the Video-writer is fed directly into C18, the other connection being to the chassis ground. A switch can be connected across the break in the board for normal TV reception. As a transformer is already incorporated in this model there is no worry about chassis isolation.

If the constructor does not wish to use this set as a monitor any domestic 625-line television will do if a modulator is used. **UNDER NO CIRCUMSTANCES** attempt to convert a domestic set to accept video signal unless an isolating transformer is used on the mains input!

Our next issue starts construction information.

CASSETTE POWER SUPPLY *continued from page 309*

★ components list

Resistors

R1	2·2K	¼W (see text)
R2	3·3K	¼W (see text)
R3	1Ω	1W
R4	2·2K	¼W
R5	2·2K	¼W

Capacitors

C1	1000μF	16V or 25V (see text)
C2	20μF	10V
C3	50μF	10V

Semiconductors

D1	1N4001
D2	5·6V 400mW Zener (see text)
Tr1	2N3055, TIP3055, etc.
Tr2	BFX84, BFY52, 2N3053, etc.
Tr3	BC107/8/9 or BC182/3/4
Tr4	as Tr3

Miscellaneous

F1 0·5A anti-surge and holder. PCB (Readers PCB Service). Box to suit. Connecting cable, plugs and sockets. Tr1 insulating kit.

Construction

The circuit was built on a printed circuit board for which a layout is given in Fig. 2. The board itself was mounted in an aluminium box, but any enclosure will do provided adequate provision is made for heatsinking Tr1, which can dissipate 8 to 10W under fault conditions. Tr1 may be any NPN power transistor able to handle 1A at 20V or more. Some of the 'unmarked but tested' types available would be perfectly adequate.

Modifications

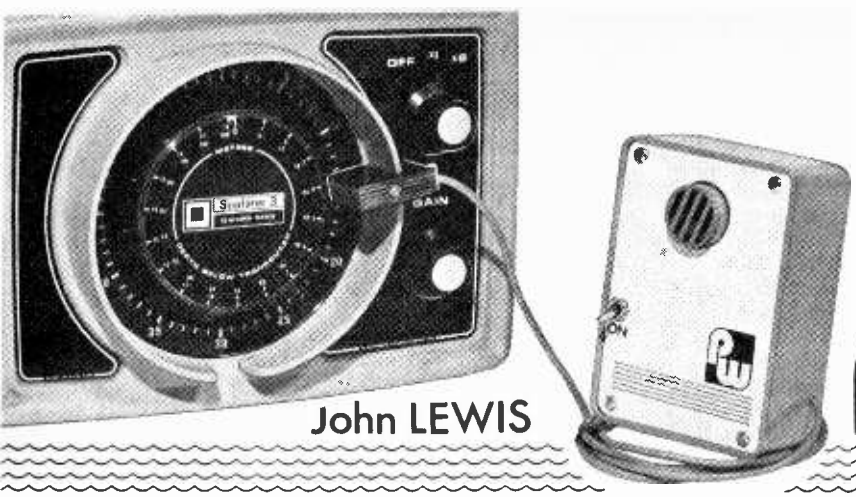
The values given are for an output of 6V. To give other voltages, modify values as follows:—

	D2	R1	R2
7·5V	6·8V	1·8k	2·7k
9V	8·2V	1·2k	2·2k

The only critical values in the circuit are R3 and D2, the other values can be altered to the next E12 series value either way without adverse effects.

Mains operation

The circuit can be modified to work from the mains by replacing D1 with a bridge rectifier or 4 × 1N4001 diodes and supplying it with 8 to 12V AC from a transformer rated at about 0·5A minimum. It may be necessary to increase C1 to about 2500μF to avoid hum.



AUDIO DEPTH ALARM

John LEWIS

ONE of the hazards facing any sailor is the possibility that he may go aground! Years ago a crew member was stationed in the bow with a lead line to plumb the depths but today we rely on echo sounders. Most small boats which have one of these fitted do not use the type which gives a continuous printed record of the depth but rather the 'flashing light' design. This type of depth gauge is fairly simple, yet robust. The light, which may be either a neon or a light emitting diode, is fitted to the end of a rotating arm of about 10cm diameter, which is rotated at a constant speed. As the light passes the zero mark on the scale a pulse of ultrasonic waves is transmitted from a transducer fitted to the hull of the boat. These travel down to the sea floor and a small proportion is reflected back up to be received by the transducer. The signal is amplified and fed to the light which it causes to flash, the process being repeated every revolution of the arm so a bar of light appears at a point on the circumference of the rotating arm. By suitable calibration of the scale, related obviously to the rate of revolution of the arm and the speed at which the pulse travels in water, one can read off the depth of water below the hull.

The problem with this class of depth gauge is that someone has to keep an eye on it at all times to see what is happening. This may not be so easy in a boat with a crew of one or two, especially if the conditions are rough or hazardous. On many boats the depth gauge is mounted inside the boat and not in direct view of the helmsman. What is needed, therefore, is some form of alarm which sounds automatically when the depth of water reaches a predetermined value.

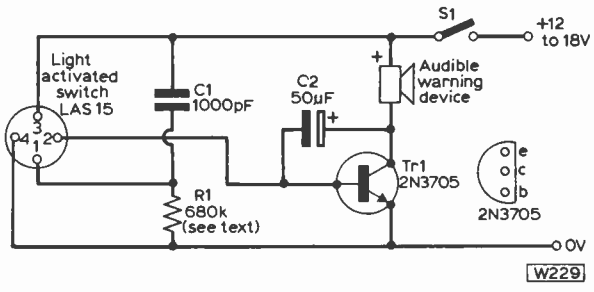


Fig. 1: Circuit diagram of the Audio Depth Alarm. The audible warning device gives a very penetrating note of about 2·6kHz. It is NOT a loudspeaker.

In order to achieve this aim it was decided to use a photo electric cell to sense the flash since any internal connections to the gauge itself might cause difficulty. On testing it was found that the flash was rather weak and that quite a lot of amplification was needed in order to produce a suitable trigger for the alarm. It was therefore decided not to use a light-dependent resistor followed by operational amplifiers but rather to utilise a Light Activated Switch. This is available in either 5 or 15V versions and consists of a photosensitive device with an associated amplifier in a TO18 can, the BC108 size. Its sensitivity can be adjusted by means of an external resistor and capacitor.

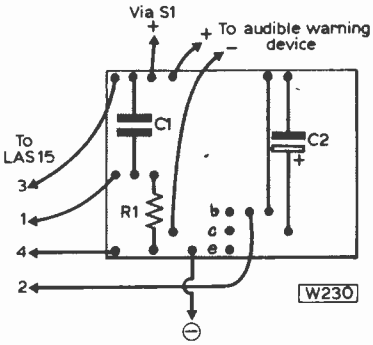
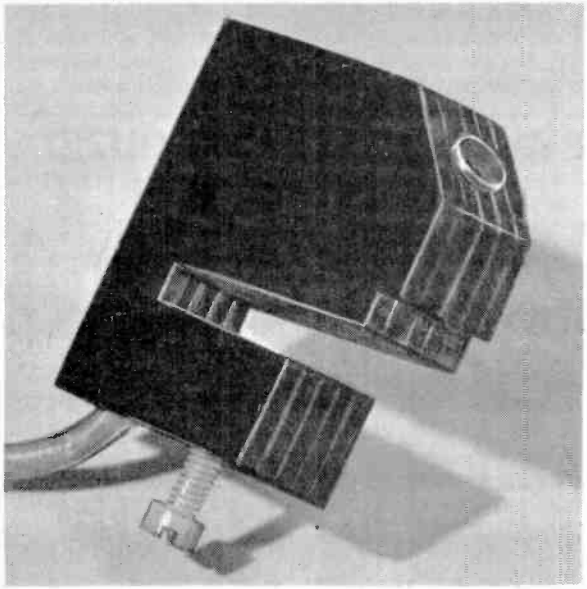


Fig. 2: The layout of the few components on a small piece of 0·1in. stripboard.

The output from the LAS is used to drive a 2N3705 transistor which has an audible warning device as its load. The circuit diagram is given in Fig. 1 with the stripboard layout in Fig. 2. The capacitor C2 gives a steadier note to the alarm which would otherwise switch as the light passed it.

SENSOR HEAD

The LAS is built into a sensor which clips over the shade of the depth guage. The prototype was designed for a Seafarer-3 instrument and modifications may be necessary for other makes and models to ensure that it does fit and that the LAS is directly in line with the light. A full size template of the prototype sensor is given in Fig. 3. It was constructed from 5 layers of $\frac{1}{16}$in SRBP bonded together. The first one was carefully cut out, filed to shape, glued up and then drilled, finally being finished with a light touch of emery paper. The



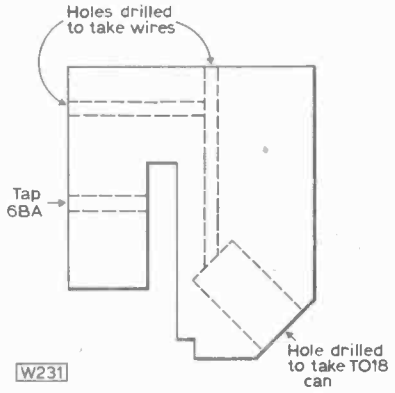
The photograph, left, shows the construction of the sensor head with the 'window' of the TO-18 style light-activated switch which allows light to fall on the internal photodiode.

problem was then to insert the LAS together with its wiring—and it could not be done! So another had to be made, only this time the laminations were not glued during the initial construction. They were in fact clamped together during these stages. The whole was then taken to pieces and built up again layer by layer with the LAS and its wiring being inserted in the correct places before a layer was glued to its neighbours. To ensure a good join it is necessary to roughen the faces of the SRBP with sandpaper. Once assembled the completed sensor was clamped whilst the glue dried and then finally cleaned up, care being exercised not to damage the lens of the LAS nor to cut the wire.

To save drilling an oversize hole when fitting the LAS the brim round the can may be carefully filed off, provided of course that the leads have been positively indentified. The connecting wire to the control box is about a metre long and was surplus GPO 4-core wire. The joints at the LAS end must be soldered with care and then insulated, preferably with heat shrinkable tubing. A further hole at the rear of the sensor can then be drilled and tapped to take a suitable 6BA clamping screw. On the prototype a nylon screw was used.

HOUSING

The alarm and circuit board were housed in a plastic box though anything could be used. The front panel was made from an offcut of Formica, drilled to take the alarm resonator, a switch and



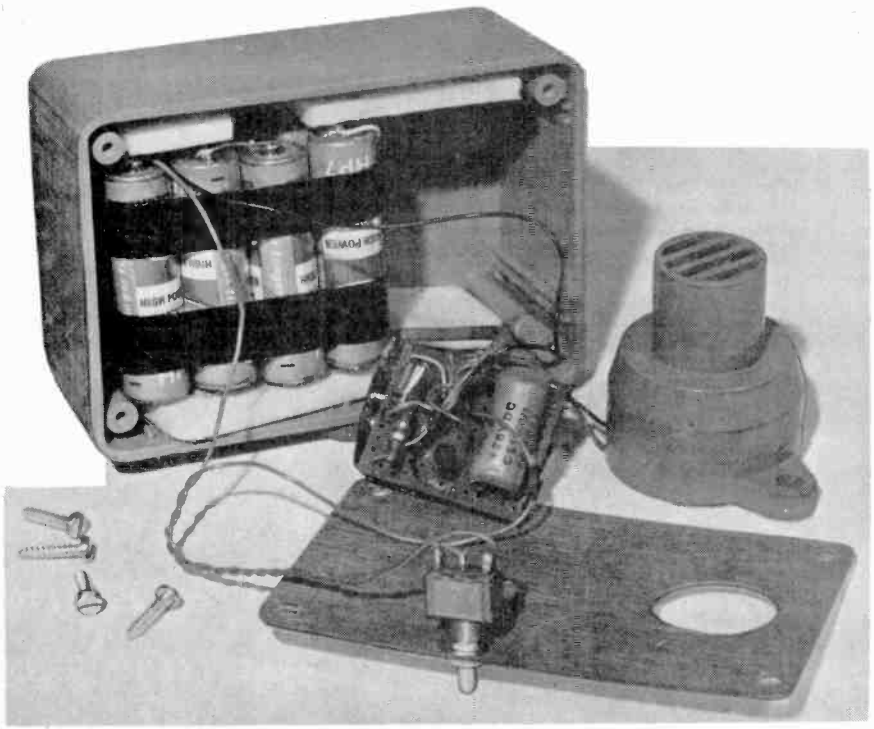


Fig. 3: above, is a full size template of the five pieces of SRBP required for the sensor head. Holes are drilled as indicated to accommodate the wiring. The photograph, left, shows the individual parts of the Alarm before being assembled in the box.

★ components list

R1 680kΩ ½ or ¼W but see text. C1 1000pF. C2 50μF 15V minimum. Tr1 2N3705. Light activated switch (RS Components 305-327, 15V). Audible Warning Device (RS Components 248-808 12V) RS Components items available from Doram. S1 miniature on-off switch. Plastic box 100 x 75 x 45mm deep (4 x 3 x 1¾in.) or similar. Small piece veroboard 0·1in. matrix. Terminal pins. 4-core wire, about 1m. SRBP 1/16in. five pieces 38 x 32mm (1½ x 1¼in.)

the securing screws. Internally there are eleven HP7 batteries to supply power. For boats which have their own 12V supply one could dispense with the batteries and run direct from this source. The reason why eleven batteries were used was because they fitted nicely inside the box and gave, I thought, a slightly louder alarm. The current drain when 'on watch' is about 0·5mA at 12V rising to about 1mA at 18V.

The only adjustment needed is with R1 since this affects the sensitivity of the instrument to the flash. The prototype used a value of 680kΩ and this gave reliable results in sunlight conditions, with other models this may not necessarily be the case and some experimentation may be needed. The higher the value of R1 the greater the sensitivity. A potentiometer could be fitted initially.

If it is planned to use the unit in a position where it might be subjected to spray then the face plate should be sealed to the box with a bath caulking compound with the wires being sealed in a similar fashion.

Whilst this is a very useful navigational aid one must emphasise that it is only an aid and that its use can not absolve a skipper from his total responsibility towards the safety of his craft and crew. PW

PW TECHNICROSS PUZZLE

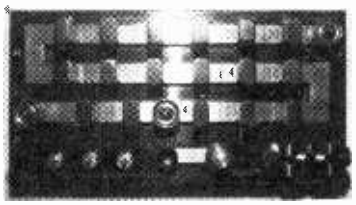
Solution to No. 14 presented last month

1L	O	2W	P	3A	S	S	F	4I	L	5T	E	6R	
I	■	A	■	T	■	■	■	S	■	R	■	I	
7N	E	T	W	O	R	8K	■	O	■	I	■	P	
E	■	E	■	M	■	9I	L	L	■	10O	A	P	
A	■	R	■	■	■	L	■	A	■	D	■	L	
11R	I	S	O	12T	T	O	■	13T	H	E	M	E	
■	■	■	■	H	■	W	■	O	■	■	■	■	
14H	O	15M	E	R	■	16A	C	R	O	17B	A	18T	
O	■	E	■	O	■	T	■	■	■	O	■	U	
19O	A	R	■	20T	O	T	■	21D	■	N	■	N	
K	■	I	■	T	■	22S	W	I	N	D	L	E	
U	■	N	■	L	■	■	■	S	■	E	■	R	
23P	H	O	N	E	T	I	C	C	O	D	E	S	

GOING BACK—*continued from page 314*

Anyone help?

A LETTER arrived here the other week from Mr. H. Toon, 38 Mountfield Avenue, Reepham Road, Hellesdon, Norfolk. He sends the photograph of the British Standard Ohms unit and wonders if any readers could advise him where these were first used (date on it is 1915). When he discovered it, it was rather grubby but otherwise in mint condition. If anyone can advise, please could they contact Mr. Toon.



Adey 4

MR. **D. Vickrage** writes from 27 South Road, Boscombe, Bournemouth, Hants to say that he is the proud owner of an "Adey 4" receiver. All the valves bear the name of Adey—one is a multi grid and the other three are marked self-coupling. All have three bands of fine wire around the bakelite base insulator and one of the self-coupling valves is open circuit.

The set appears to have had an extra short wave circuit added. Whether this was an Adey mod, Mr. Vickrage does not know but it has an aerial trimmer control, and a two gang tuner with slow motion drive.

If anyone can let him know the valve equivalents or put him in touch with a supplier of Adey valves. Mr. Vickrage would be most grateful. To quote his own words, "I would like to get the old gal going again".

Vintage CQ

FOR DISPOSAL

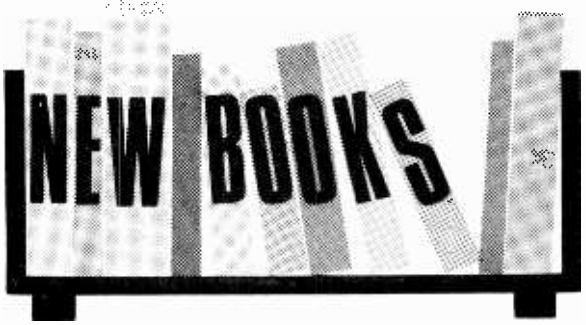
Practical Wireless from September 1950; Newnes Practical Electrical Engineering (1932); Newnes Complete Wireless (19??); The Superheterodyne Receiver by Wills (1939); Modern Electrical Engineering by Magnus McLean (1919); Modern Radio Servicing by Alfred Ghirardr (1935) and lots of others.—P. M. Gray, 17 Redmead Close, Kings Norton, Birmingham, B30 1EY.

Wireless Terms Explained (1942) 73pp; Newnes Short Wave Manual (1941) 216pp; Wireless for Beginners (1946) 264pp; Radio (1958) Vol. 3, 249pp; Guide to Broadcasting (1961) 99pp. Offers to ART, 6 Longlands, Blackbird Leys, Oxford, Oxon.

WANTED

Early radio magazines and books. We are trying to form a library. —Star Radio Club Leeds, 599 Dewsbury Road, Leeds 11. (attn. G8BUU/G3ZWA.)

Osram PT2K (small bulb PT2), plug-in Eddystone coils 4 and 6 pin various ranges wanted. Osram KL1 and KH1 sought (can exchange new Osram DG2, DEL612, DE5 etc). I am renovating a Marconi V2 and am searching for DER valves with top pips. —Philip Taylor, 14 Willow Walk, Canewdon, Rochford, Essex.



VHF/UHF MANUAL—3rd EDITION
By D. S. Evans, G3RPE and G.R. Jessop, G6JP
Published by Radio Society of Great Britain,
35 Doughty Street, London, WC1N 2AE.
404 pages 24·5cms×19cms
Price £4·95 plus 68p p & p

SINCE 1969 the RSGB *VHF/UHF Manual* has been a best seller around the world as the standard textbook on the theory and practice of Amateur radio transmission and reception at frequencies above 30MHz. It is this part of the radio spectrum, particularly the microwave bands, that has offered the greatest challenge to Amateur radio experimentation in recent years, thus creating a need for a source book of both pioneering ideas and tried-and-tested designs.

This third edition continues to offer the most comprehensive and up-to-date coverage of VHF/UHF techniques available, and includes for the first time a complete chapter on Amateur microwave techniques for bands up to 24GHz Another innovation, resulting from the increasing use of Amateur communication satellites, is a chapter on space communication which will enable the user to make the most of this exciting development. A useful data section has been added, and of particular interest will be the inclusion of inductance charts for small VHF coils and rods.

The whole book has been revised and augmented by acknowledged experts in each specialist topic, and is now presented in a larger format to do justice to the profusion of diagrams, charts and photographs it contains.

Chapter titles are (1) Introduction (2) Propagation (3) Tuned circuits (4) Receivers (5) Transmitters (6) Filters (7) Aerials (8) Microwaves (9) Space communication (10) Test equipment and accessories (11) Data.

SERVICING WITH THE OSCILLOSCOPE
(2nd Edition)
By Gordon J. King
Published by Newnes-Butterworths,
Borough Green, Sevenoaks, Kent TN15 8PH.
208 pages 22·5cms x 14cms
Price £4·50

ANOTHER gem from our good friend Gordon King—a highly respected doyen of servicing and audio journalism.

In this book Mr. King shows just what a valuable aid an oscilloscope can be for servicing and fault-finding in radio, television and audio equipment—including some of the latest colour TV circuits and stereo receivers.

Mr. King, being a practical man, has written his book in a practical manner. The illustrations include many off-screen photographs showing 'scope trace examples that could be expected in good and faulty equipment. In the TV chapters, the 'scope traces are supplemented by off-screen television faults. All the pictures have been taken in Mr. King's own laboratory over several years of design, experimentation and development.

This second edition has been brought right up-to-date and expanded and it would prove an exceedingly valuable reference for both the engineer who services radio, audio equipment and colour TV receivers, and the technician who has both to evaluate and make tests on such equipment.

ELECTRONICS POCKET BOOK
Edited by P. J. McGoldrick
Published by Newnes Technical Books,
Butterworths, Borough Green,
Sevenoaks, Kent, TN15 8PH
349 pages 19cms x 12·5cms
Price £3·75

THE first edition of this book was published thirteen years ago, and who would have ever dreamt of the technological advances that have taken place during that time? Semiconductor devices and all their derivatives are a part of our lives now and as the author points out, their small size, low power consumption and even simplicity have twisted our thoughts into thinking small. This may be the case very often but we must realise there is still a need for thermionic devices in the R.F. and industrial control fields where the semiconductor is un-economic or still operationally limited. The third edition of this pocket book (and you will need pretty big pockets!) concentrates mainly on semiconductors but the author has not entirely discarded information on thermionic devices. Contents include such chapters as Transistor Circuit Techniques, Amplifiers, Pulse Circuits, Logic Circuits, I.C.s, Photo-Electric Devices etc. and take the reader through to major electronic applications like industrial control systems and computers.

The aim of the book is to bring together up-to-date and concise information on the techniques and basic circuits used in electronics. It is written from a "practical" point of view and does not get the reader too tied up with maths.

Mr. McGoldrick's book provides a helpful and fairly wide-ranging reference manual for technicians, students of electronics and home constructors.

GATE ALGEBRA
By K. D. Turnbull
Published by Arthur H. Stockwell Ltd.,
Elms Court, Ilfracombe, Devon.
37 pages 18cms x 12cms
Price 75p

THIS book is a rationalised and systemised version of Boolean algebra. Gate algebra, as well as Boolean regards the gate as a "black box" with inputs/output rather than be concerned with the workings of it. The output is a function of the inputs and Gate algebra is concerned with expressing the output in terms of the inputs.

2-input gates are considered mainly as they are basic and restricted in numbers allowing cataloguing in a systematic manner within a reasonable space. Gate definitions apply equally well to multi-input gates and the text's only omission is that of truth tables for multi-input gates. Chapter 1 sets out the benefits of Gate algebra in relation to Boolean in terms of basic concepts. Chapters 2, 3, 4, 5 and 6 set out the basic principles and rules of Gate algebra and show how a system of gates is composed. The vocabulary is the same as that for Boolean algebra. A knowledge of algebra up to the simple factorisation stage is a must for the complete understanding of the text.

AUDIO HI-FI CONSTRUCTION PROJECTS
By B. B. Babani
Published by Babani Press,
The Grampians, Shepherds Bush Road, London W6 7NF
95 pages 18cms x 11cms
Price 85p

THE compiler has taken some of his material from the magazine *Electronics Australia* and the contents comprise three major projects—Playmaster 143, Playmaster 145 and Playmaster 140. These are a 12·5W per channel stereo amplifier, 8-input stereo/mono mixer and a 4 x 14W quadraphonic amplifier.

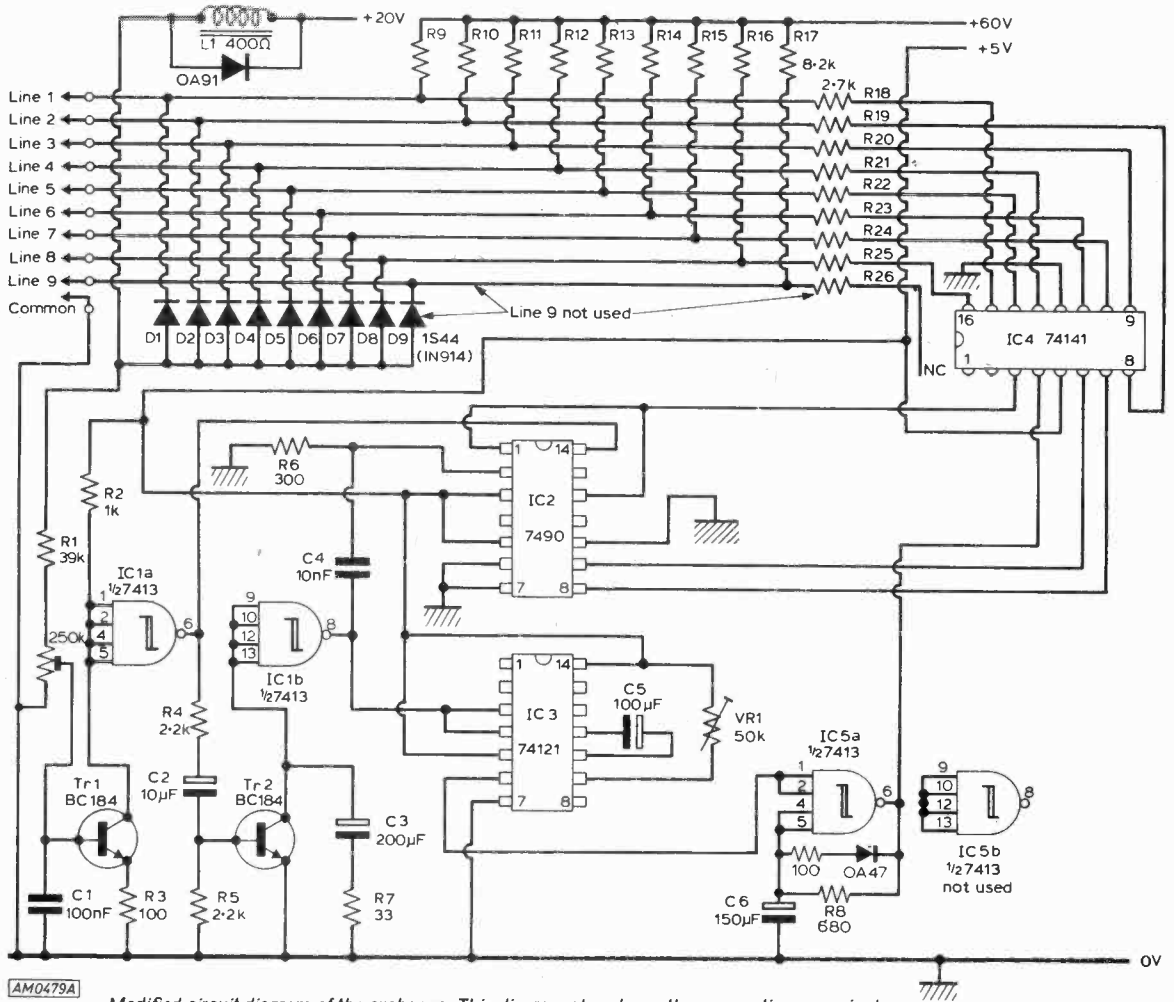
In each case the projects are split into sections and full constructional details are provided. Since the projects are fairly complex it is recommended that only experienced constructors should attempt them.

REFERRING to the design for an updated Home Telephone Exchange published in the March edition of *PW*, experience has shown that two minor modifications will almost certainly be necessary if the exchange is to function reliably.

(1) The junction of Tr1 base and C1 should not be connected directly to R1. Instead R1 should be connected to a 220kΩ preset. The other end of the preset should be grounded and C1/Tr1 base connected to the slider.

(2) The mark-space ratio of IC5a oscillator needs to be modified. To do this, R8 should be increased to 680Ω. A new resistor of 100Ω should then be connected in series with an OA47 diode and this combination be connected in parallel with R8. The positive end of the diode (cathode) should be connected to pins 9, 10, 12, 13 of IC5b.

If an exchange of 8 or less lines are required, then the circuit can be simplified by omitting IC6. The BCD outputs of IC2 should be connected directly to the BCD inputs of IC4 with the exception of the connection between IC2 pin 11 and IC4 pin 4. The latter should be connected to IC5 pin 6. IC5b and pin 11 of IC2 are not used. R25 should connect with pin 16 of IC4 instead of pin 1. Finally connect an OA91 diode across the choke—Cathode to +20V supply. PW



Modified circuit diagram of the exchange. This diagram also shows the connections required for operating an 8-line exchange by omitting IC6 and not connecting IC5b.

The Family Show

by Colin Riches

NEVER has there been a greater need for a return of the old-style radio shows where everyone is under one roof. We have had various exhibitions scattered about the country which, some say, appear to be dying natural deaths but let's hope that Sound and Vision at the Birmingham National Exhibition Centre will continue to thrive in years to come, even though attendance was not as high as forecast.

In the past few years, manufacturers of radio and television equipment have held 'private' dealer-only exhibitions in the London hotels. This has not really been of much help to the consumer—and after all, he's the one who keeps the trade turning over!

As well as the manufacturers' stands with new products were the BBC and IBA with their engineering stands demonstrating CEEFAX and ORACLE. The Post Office displayed their VIEWDATA communications system (the August issue of our 'sister' magazine *Television* includes a report on these) and the Home Office had a detector van and its associated equipment on display.

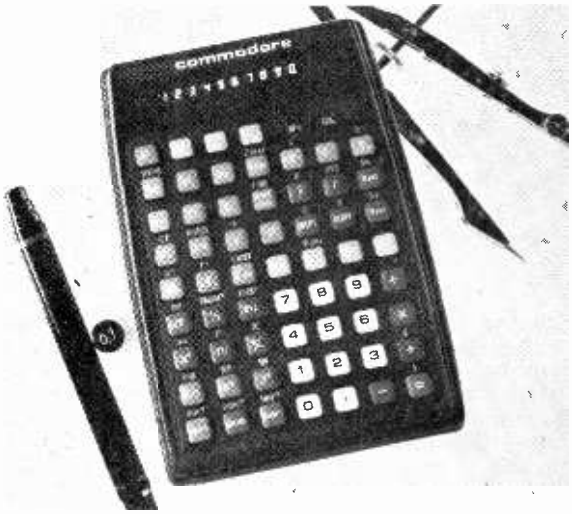
As space is somewhat limited, we have chosen a few of the items on show at the NEC Birmingham 28-31 May, which we think will interest readers.

Telefunken exhibited a good range of equipment and what caught our eye was the TRX 2000. It is a sophisticated receiver covering 87·6MHz-108MHz FM and 14·5-22·3MHz (SW1) 5·8-12·43MHz (SW2) 515-1630kHz (MW) and 141-331kHz (LW) AM. The crystal-controlled frequency indication is by a 5-digit numicator display which doubles as a 24-hour clock. Seven FM stations can be preset and quickly re-tuned by touch buttons. The AFC circuitry is automatically switched out during tuning. Ten input sockets are provided for 2 or 4 channel tapes and record decks etc. and a SQ matrix decoder is built in.—*AEG-Telefunken (UK) Ltd., Bath Road, Slough, SL1 4AW.*

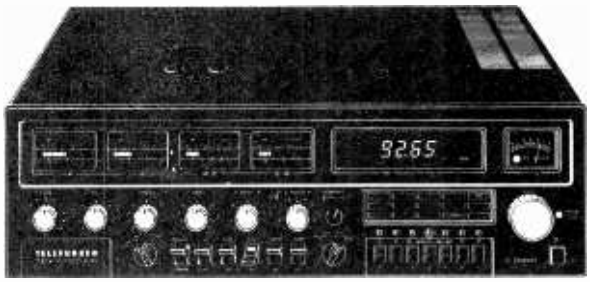
From CBM Business Machines Ltd. came the news that they had reduced the prices of their scientific calculators. SR419OR is now £49·95, the SR4148R is £36·50, the SR1800 £24 and the SR7919D, £14·50. A new machine from the CBM stable is the Commodore 'Statistician' with a spec. longer than your arm (see picture).—*CBM Business Machines Ltd., Industrial Estate, Eaglescliff, Stockton-on-Tees, Cleveland, TS16 0PN.*

Goldring demonstrated their Lenco cassette deck C-2003, priced at about £350. Features include double capstan drive, 3 head system with separate erase, replay and record heads and an illuminated panel showing all functions as they are selected. Frequency response is quoted as 39Hz-18Hz±3dB. With multiplex filter 30Hz-16kHz ±3dB. Weighted S/N less Dolby is −56dB and with Dolby −65dB.—*Goldring Limited, Anglian Lane, Bury St. Edmonds, Suffolk, IP32 6SS.*

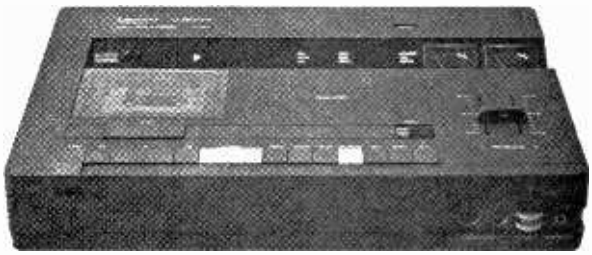
Videomaster were showing their 'Rally' TV game. It offers tennis plus three others. Pressing a button



The CBM Commodore 'Statistician' calculator priced at £99·95 inc VAT

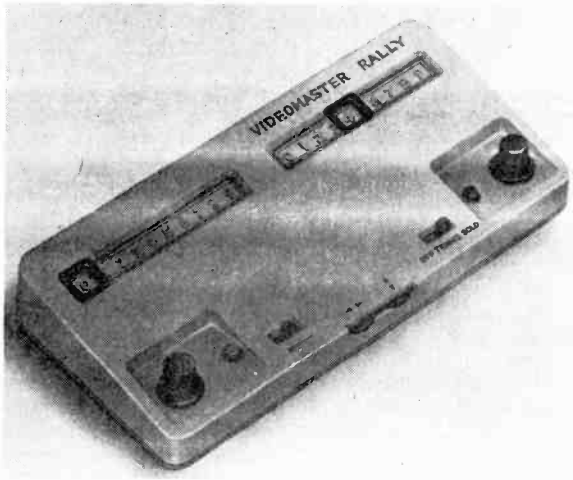


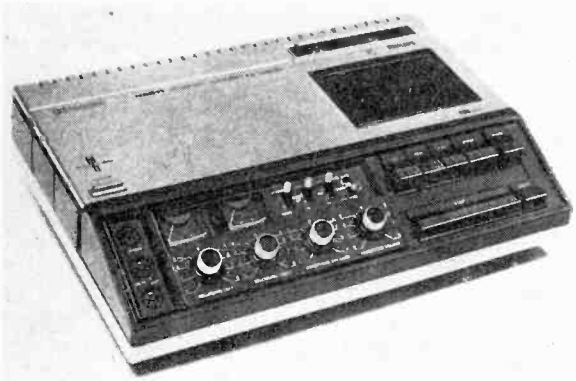
Telefunken's TRX 2000 receiver. Price has not yet been fixed.



Goldring's new Lenco cassette deck. New this month. Supplies should be available around August

brings the ball onto the screen and a 'click-along' indicator enables the players to keep the score. Variable speed controls are provided and a single PP3 supplies the power. Vertical and horizontal hold controls are a feature as is a cleverly designed 'space' behind the console to store the cable away after use. Price is £30 plus VAT.—*Videomaster Ltd., 14-20 Headfort Place, London, SW1X 7HN.*





From Philips came the N2511 stereo cassette deck with both DNL and Dolby. It takes Fe_2O_3 and CrO_2 cassettes and a tacho motor control and hysteresis friction clutch ensure smooth tape transport. The head for record/playback is an FSX long-life type and the double-gap erase head is of ferrite. Separate recording level controls are provided for each channel.—*Philips Electrical Limited, Century House, Shaftesbury Avenue, London, WC2H 8AS.*

ITT announced a new range of equipment including the 'Sport' receiver at £11·95 covering long and MW bands. Features include earphone socket, 'roller' controls and logging scale. The speaker grill has special dust/damp protection. — *ITT Consumer Products (UK) Ltd., Maidstone Road, Sidcup, Kent, DA14 5HT.*

The most expensive radio on show was the National Panasonic RF-8000. It covers 150kHz to 230MHz in 24 bands (12 SW, 2 Marine, 1 LW, 1MW and 8 VHF). Four separate aerials are provided and the set will run from mains, dry battery or car battery. Price is around £1,500. National Panasonic say, "It costs the earth but it gives you the world!". — *National Panasonic, 107-109 Whitby Road, Slough, Berkshire, SL1 3DR.*

The Videomaster Rally TV games unit (top left)

The Philips N2511 cassette deck with both DNL and Dolby (bottom left)

The ITT 'Sport' receiver priced at £11·95

Nice to take on your hols! (The Panasonic RF-8000 of course)

SWLs and MWLs

Short Wave Listeners and Medium Wave Listeners—if you would like to send in reports, the addresses are as below:

BROADCAST BANDS, Short Wave—these reports should be sent by the 15th of the month to Derek Bell, c/o Practical Wireless Editorial Department, Fleetway House, Farringdon Street, London, EC4A 4AD.

BROADCAST BANDS Medium Wave—also by the 15th of the month to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS — logs covering any Amateur band or bands in band/alphabetical order by the 25th of the month to Eric Dowdeswell, G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.

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7407	39p	7496	84p
7408	17p	7497	291p
7409	22p	74100	116p
7410	14p	74104	45p
74H10	20p	74105	45p
7411	24p	74107	32p
7412	25p	74118	90p
7413	34p	74121	32p
7414	65p	74122	52p
7416	32p	74123	73p
7417	32p	74126	75p
7420	15p	74132	75p
7421	43p	74136	81p
7422	19p	74141	70p
7423	36p	74145	75p
7425	33p	74148	173p
7427	40p	74150	135p
7428	39p	74151	77p
7430	14p	74153	92p
7432	28p	74154	164p
7437	28p	74155	82p
7438	28p	74156	82p
7440	15p	74160	107p
7441	70p	74161	107p
7442	64p	74162	107p
7443	116p	74163	107p
7444	116p	74164	130p
7445	81p	74166	136p
7446	75p	74174	120p
7447	75p	74175	92p
7448	75p	74176	131p
7450	16p	74177	100p
7451	17p	74180	108p
7453	17p	74181	322p
7454	18p	74182	89p
7460	16p	74185	146p
7470	29p	74190	155p
7472	27p	74191	140p
7473	32p	74192	130p
7474	32p	74193	130p
7475	40p	74194	116p
7476	32p	74195	83p
7480	54p	74196	99p
7481	103p	74197	108p
7482	75p	74198	214p
7483	85p	74199	197p
7484	103p		

C-MOS ICs

4000	18p	4029	189p
4001	18p	4030	58p
4002	18p	4042	150p
4006	104p	4043	218p
4007	18p	4046	150p
4009	67p	4047	130p
4011	18p	4049	68p
4012	19p	4050	50p
4013	55p	4054	210p
4015	90p	4055	210p
4016	54p	4056	145p
4017	123p	4060	250p
4018	247p	4069	40p
4019	50p	4071	29p
4020	270p	4072	29p
4022	180p	4081	19p
4023	19p	4082	29p
4024	125p	4510	142p
4025	19p	4511	200p
4026	200p	4516	140p
4027	81p	4518	108p
4028	152p	4528	130p

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VOLTAGE REGULATORS

FIXED—Plastic 3 Terminals

1 Amp	Positive	
5V	7805	150p
12V	7812	150p
15V	7815	150p
18V	7818	150p
24V	7824	150p
1 Amp	**Negative**	
5V	7905	215p
12V	7912	215p
15V	7915	215p
18V	7918	215p
24V	7924	215p

LM309K (TO3) 5V 1 Amp 150p
LM323K (TO3) 5V 3 Amp 695p
TBA625B(TO5) 12V 0·5A 99p
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VARIABLE VOLTAGE REGULATOR

723 2V to 37V 150 mA 14 Pin DIL 45p

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AC125	18p	BC184	14p	BFR39	37p
AC126	13p	BC187	32p	BFR40	37p
AC127	13p	BC212	14p	BFR79	37p
AC128	12p	BC213	12p	BFR80	37p
AC176	12p	BC214	17p	BFR88	37p
AC187	14p	BC478	32p	BFX30	32p
AC188	14p	BCY70	20p	BFX85	27p
AD149	46p	BCY71	24p	BFX86	28p
AD161	39p	BD123	120p	BFX87	22p
AD162	39p	BD124	95p	BFX88	26p
AF114	18p	BD131	39p	BFY50	17p
AF115	18p	BD132	43p	BFY51	16p
AF116	18p	BD135	54p	BFY52	17p
AF117	18p	BD136	55p	BRY39	39p
AF139	40p	BD139	79p	BSX19	18p
AF239	55p	BD140	67p	BSX20	18p
BC107	10p	BF115	24p	BU105	175p
BC108/B	10p	BF167	25p	BU108	312p
BC109C	11p	BF170	25p	MJE340	49p
BC147	9p	BF173	27p	MJ2955	110p
BC148	9p	BF177	28p	MJE2955	107p
BC149	10p	BF178	30p	MJE3055	70p
BC157	11p	BF179	35p	MPSA06	37p
BC158	13p	BF180	35p	MPSA12	62p
BC159	13p	BF181	35p	MPSU06	78p
BC169C	15p	BF182	35p	MPSU56	98p
BC171	12p	BF184	24p	OC28	70p
BC172	11p	BF185	24p	OC35	70p
BC173	13p	BF194	13p	OC41	18p
BC177	20p	BF195	11p	OC42	18p
BC178	17p	BF196	17p	OC45	18p
BC179	20p	BF197	18p	OC71	25p
BC182	12p	BF200	40p	TIP29A	50p
BC183	12p	BF257	34p	TIP29C	62p
		BF258	39p	TIP30A	60p
				TIP30C	72p
				TIP31A	56p
				TIP31C	68p
				TIP32A	63p
				TIP32C	85p
				TIP33A	97p
				TIP33C	120p
				TIP34A	124p
				TIP34C	160p
				TIP35A	243p
				TIP35C	290p
				TIP36A	297p
				TIP36C	360p
				TIP41A	70p
				TIP41C	84p
				TIP42A	78p
				TIP42C	96p
				TIP2955	78p
				TIP3055	60p
				TIS93	28p
				ZTX108	11p
				ZTX300	16p
				ZTX500	19p
				ZTX504	60p
				2N697	16p
				2N698	32p
				2N706	18p
				2N708	19p
				2N918	43p
				2N930	19p
				2N1131	19p
				2N1132	19p
				2N1304	36p
				2N1305	36p
				2N1306	40p
				2N1307	40p
				2N1613	22p
				2N1711	22p
				2N1893	32p
				2N2219	22p
				2N2222	22p
				2N2369	15p
				2N2484	32p
				2N2904/A	22p
				2N2905/A	22p
				2N2906/A	22p
				2N2926RB	9p
				2N2926OG	11p
				2N3053	19p
				2N3054	43p
				2N3055	54p
				2N3439	72p
				2N3442	151p
				2N3702	14p
				2N3703	14p
				2N3704	14p
				2N3705	14p
				2N3706	12p
				2N3708	11p
				2N3709	11p
				2N3707	14p
				2N3773	320p
				2N3866	90p
				2N3904	22p
				2N3905	22p
				2N3906	22p
				2N4058	19p
				2N4060	19p
				2N4123	22p
				2N4124	22p
				2N4125	22p
				2N4126	22p
				2N4289	24p
				2N4371	142p
				2N4348	173p
				2N4401	34p
				2N4403	34p
				2N5089	34p
				2N5401	62p
				40360	43p
				40361	43p
				40362	45p
				40410	65p
				40409	65p
				40411	243p
				40594	85p
				40595	97p

FETs

BF244	45p
MPF102	37p
MPF103	37p
MPF104	37p
MPF105	37p
2N3819	27p
2N3820	50p
2N3823	54p
2N5457	37p
2N5458	37p
2N5459	37p
3N128	81p
3N140	92p
3N141	81p
40603	63p
40673	58p

UJTS

TIS43	34p
2N2160	95p
2N2646	45p
2N4871	37p

PUJT

2N6027	60p

DIODES SIGNAL

OA47	9p
OA70	10p
OA81	10p
OA85	11p
OA90	7p
OA91	9p
OA95	9p
OA200	8p
OA202	10p
1N914	4p
1N916	11p
1N4148	4p

RECTIFIER

BY100	31p
BY126	15p
BY127	15p
1N4001	6p
1N4002	6p
1N4004	7p
1N4005	7p
1N4007	8p

ZENER

2·7 to 33V 400mW 11p 1W 22p

TUNNEL

AEY11 75p

VARICAP

BB105 33p

NOISE

Z5J 140p

BRIDGE RECTIFIERS

1A 50V	25p
1A 100V	27p
1A 400V	28p
1A 600V	32p
2A 50V	40p
2A 100V	48p
2A 400V	56p
3A 600V	63p
4A 100V	75p
6A 50V	72p
6A 100V	78p

TRIACS

Amp	Volts	
3	400	130p
6	400	162p
6	500	194p
10	400	200p
10	500	270p
40	430	108p
40	669	105p

DIAC

BR100 30p

OP. AMPS

301A	Ext. Comp. 8 pin DIL	40p
536T	FET Op. Amp TO 99	300p
709	Ext. Comp. 8/14 pin DIL	30p
710	Diff. Comp. 14 pin DIL	45p
741	Int. Comp. 8/14 pin DIL	25p
747	Dual 741 14 pin DIL	76p
748	Ext. Comp. 8 pin DIL	40p
776	Prog. Op. Amp TO 99	153p
1458	Dual Op. Amp. 8 pin DIL	75p
3130	CMOS/Bipolar Mosfet	108p
3900	Quad. Op. Amp. 14 pin DIL	60p

LINEAR I.Cs.

CA 3028A	Diff. Cascade Amp. To 99	112p
CA 3046	5 Transistor Array 14 pin DIL	55p
CA 3048	Quad. Low Noise Amp.	250p
CA 3053	Diff. Cascade Amp. TO5/DIL	60p
CA 3089E	FM IF System 16 pin DIL	250p
CA 3090AQ	FM Stereo Decoder QIL	500p
ICL8038BC	VCO Fun.ken 14 pin DIL	600p
ICL8038CC	VCO Fun.ken 14 pin DIL	340p
LM380N	2W Audio Amp 14 pin DIL	115p
LM381N	Stereo Pre Amp 14 pin DIL	200p
M252	Rhythm Ken 16 pin DIL	850p
MC1310	FM Stereo Decoder 14 pin DIL	220p
MC1351P	Lim/Det. Audio Preamp	104p
MC1495	Multiplier 14 pin DIL	370p
MC1496	Bal. Mod/Demod 14 DIL	115p
MFC4000B	½W Audio Amplifier PCB	75p
MFC6040	Electronic Attenuator PCB	160p
NE540L	Audio Pwr. Driver TO99	140p
NE555V	Timer 8 pin DIL	40p
NE556	Dual 555 14 pin DIL	108p
NE561B	PLL with AM Demod	350p
NE562B	PLL with VCO 16 pin DIL	350p
NE565	PLL 14 pin DIL	200p
NE566V	PLL Function Gen 8 pin DIL	165p
NE567V	PLL Tone Decoder 8 pin DIL	200p
2567	Dual 567 16 pin DIL	400p
SN72733	Video Amplifier 14 pin DIL	150p
SN76003N	Audio Pwr. Amp with Int. HS	275p
SN76013N	Audio Pwr Amp with Int HS	175p
SN76023N	Audio Pwr Amp with Int HS	175p
SN76033N	Audio Pwr. Amp with Int. HS	275p
TAA661B	FM IF Amp Lim/Detector QIL	150p
TAA641B	Audio Amp QIL	300p
TBA800	5W Audio Amp QIL	112p
TBA810	7W Audio Amp QIL	125p
TBA820	2W Audio Amp QIL	100p
TDA2020	20W Audio Amp QIL	405p
XR2240	Prog Timer/Counter 16 pin DIL	400p
ZN414	TRF Radio Receiver TO18	140p

OPTO-ELECTRONICS

PHOTO-TRANSISTORS

OCP70	33p
OCP71	120p
2N5777	43p

LDRs

ORP12	60p
ORP60	75p
ORP61	75p

LEDs

TIL209 Red	15p
TIL211 Green	32p
TIL32 Infrared	81p
MV5025	27p

0·2"

Red	17p
Green	29p
Yellow	32p

SEVEN SEGMENT DISPLAYS

3015F Minitron 0·3"	175p
DL704 Com. Cathode 0·3"	160p
DL707 Com. Anode 0·3"	160p
DL747 Com. Anode 0·6"	250p

OPTO-ISOLATORS

Phototransistor TIL112 (IL 12) 6 Pin DIL	151p
Photodarlington ILCA55 6 Pin DIL	270p

DRIVERS

75491 Quad Segment Driver 14 Pin DIl	78p
75492 Hex Digit Driver 14 Pin DIL	97p

SCR THYRISTORS

1A 50V TO5	43p
1A 100V TO5	45p
1A 400V TO5	50p
3A 400V STUD	81p
7A 400V TO5 + HS	97p
8A 50V Plastic	142p
16A 100V Plastic	173p
16A 400V Plastic	195p
16A 600V Plastic	238p

BT106	150p	2N3525	104p
C106D	70p	2N4444	200p
MCR101	27p	2N5064	43p

RHYTHM GENERATOR

Semiconductor Kit for above "PW" Project. Includes all I.Cs., Trs., Diodes and DIL sockets £14·00 inc. VAT and P & P.

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Ferguson Stereogram Chassis. Model 3357. All transistor. Med/LW. FM. 3 watts per channel S/M. With connection data. Less tuning scale. £18·00. P/P free.

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Transmitter. 455KC. AM. 5 for £1·00.

Electrolytics. 32/32/32μF, 325v. 2" x 1¼" 35p; 80μF 150v 1¼" x 1" 20p; 2000μF 30v 2¼" x 1" 25p; 2000μF 35v 3" x 1" 30p; 470μF 100v 3" x 1¼" 25p; 2000/2000μF 25v 2" x 1¼" 35p; 700μF 200v 3½" x 1¼" 30p; 16/16μF 275v 1¾" x 1" 20p; 4500/900/900μF 30v 2¼" x 1½" 50p; 2500μF 40v 3" x 1¼" 40p; 470μF 25v 1¼" x ¾" 15p; 4,000μF 25v 3" x 1¼" 40p; 32μF 450v 1¼" x 1" 30p; 8μF 16μF 450v 1¼" x ¾" 30p; 1000μF 12v 1¼" x ¾" 15p 5000μF 50v 2" x 1¼" 50p; 150/200/200μF 300v 3" x 1¾" 50p; 16/16/16μF 350v 2" x 1" 30p; 50/50μF 500v 3½" x 1" 50p; 400μF 40v 1½" x ¾" 20p.

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Coil Formers. 50 mixed. £1·25.

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U.H.F. 625. Transistor push button tuner (NSF Telefunken), as used on Decca MS2400. Brand new and boxed. Circuit diagram supplied. £3·00.

Thorn T.V. IF. Chassis 950 Series (less valves) £1·60.

Aluminium Chassis. 7½" x 5½" x 2¼" 65p. 10" x 7½" x 2¼" 75p. 11" x 7½" x 2¼" 85p. + 8%.

Thorn TA/28. Slide synchroniser for 4 track reel to reel recorders. 6 pin DIN socket models. £4·50.

Please add 10% P/P. Unless stated free P.P. VAT 12½% to be added to total order unless stated 8%. No goods despatched outside U.K.

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SURPLECTRONICS

215 LEAGRAVE ROAD, LUTON, LU3 1JD, BEDS.

EXPERIMENTERS CORNER

THIS simple circuit gives an early warning of the discharge of batteries. In many cases, due to the varying loads on lead-acid batteries, it is often difficult to determine their state of charge. The simplest method is to use a voltmeter, and keep an eye on it when drawing current. This is adequate if the user can read a meter out of the corner of his eye, and is in a position where he can obtain meters at reasonable prices.

The circuit here will give a 'GO' or 'NO GO' visual indication of any significant fall in supply voltage. The zener diode D1 is chosen for the voltage below which an indication is required. (The values shown in this case are for 12V operation). In this instance the zener was a 10V device and was chosen as it puts about 2V on the junction of R1/R2 causing Tr1 to conduct. The collector voltage subsequently falls to a low value keeping Tr2 switched off. Should the supply drop, however, to below 10V, D1 will cease conducting causing Tr1 to shut off. Its collector voltage will now increase, causing Tr2 to start conducting via LED1 and its limiting resistor R4.

$$R4 = \frac{\text{voltage of zener diode} - 2}{\text{LED current}}$$

Layout is by no means critical, as fifteen prototypes have been built with uses ranging from a car battery indicator to a battery indicator in a cheap 9V radio. D1 in this particular case was a 6·8V zener.

★ component list

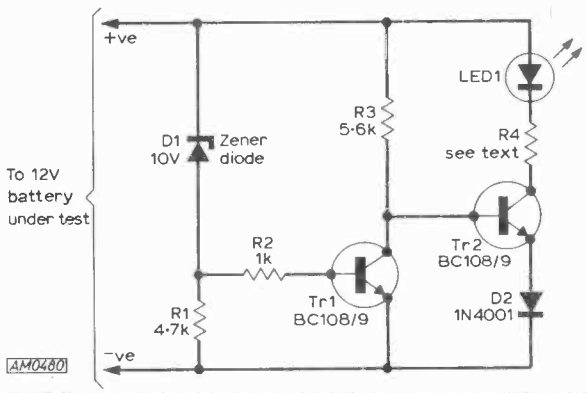
Resistors

R1	4·7kΩ	R3	5·6kΩ
R2	1kΩ	R4	see text

All resistors ¼W 10%

Semiconductors

Tr1	BC108 or 9	D2	1N4001
Tr2	BC108 or 9	LED1	Any LED such as TIL209
D1	Zener diode BZY88 for value see text		



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The Publishers of *Practical Wireless* are members of the Periodical Publishers Association which has given an undertaking to the Director General of Fair Trading to refund monies sent by readers in response to mail order advertisements, placed by mail order traders, who fail to supply goods or refund monies owing to liquidation or bankruptcy. This arrangement does not apply to any failure to supply goods advertised in a catalogue or in a direct mail solicitation.

In the unhappy event of the failure of a mail order trader readers are advised to lodge a claim with *Practical Wireless* within three months of the date of the appearance of the advertisement, providing proof of payment. Claims lodged after this period will be considered at the Publisher's discretion. Since all refunds are made by the magazine voluntarily and at its own expense, this undertaking enables you to respond to our mail order advertisers with the fullest confidence.

For the purpose of this scheme, mail order advertising is defined as—

'Direct response advertisements, display or postal bargains where cash had to be sent in advance of goods being delivered'. Classified and catalogue mail order advertising are excluded.

POST BAG

The on-going increase in postal and telephone charges does not seem to have made any difference to our post bag or our telephone bell. Enquiries continue to flood in.

We find that there are two points we are constantly mentioning. In the first place we just cannot afford to reply to any *readers' letters*, particularly those not associated with projects we have published, unless they are accompanied by a *stamped addressed envelope*. Were we to undertake to do so our post bill would become astronomic.

We cannot deal with *technical enquiries by telephone*. Readers should write in, giving details of symptoms and perhaps some test point readings, when requesting technical help so that we can at least give the relevant author some idea of the problems involved.

Finally, whilst we normally supply details as to source of components in each project we do assume that the constructor refers to advertisements and has an awareness of general sources. Thus, where goods are generally available we do not specify a source. You could save the cost of a letter by reading the advertisement pages first.

We regret that we are unable to supply any back copies of Practical Wireless.

PRODUCTION LINES

colin riches

HEATHKIT EDUCATION

One of Heath's basic business philosophies has been that of education. The firm now takes this philosophy one step further by announcing the Continuing Education Series—an instructional electronics course.

At present there are four courses covering DC Electronics, AC Electronics, Semiconductor Devices and Digital Techniques. Another, to be announced later in the year, will cover Electronic Circuits and Applications.

All Heathkit Individual Learning Programmes (ILP's) are self-instructional electronics courses designed to allow thorough, independent study at your own pace. You study when you want to and for as long as you want, repeating any section as many times as you wish. Should you wish to take the optional final examination, a passing grade will bring you a Certificate.

The ILP system teaches subjects thoroughly and efficiently. Comprehensive learning materials integrated with programmed instruction lessons and kit experiments lead you step-by-step to a good knowledge of electronics. Self-evaluation quizzes help check your progress.

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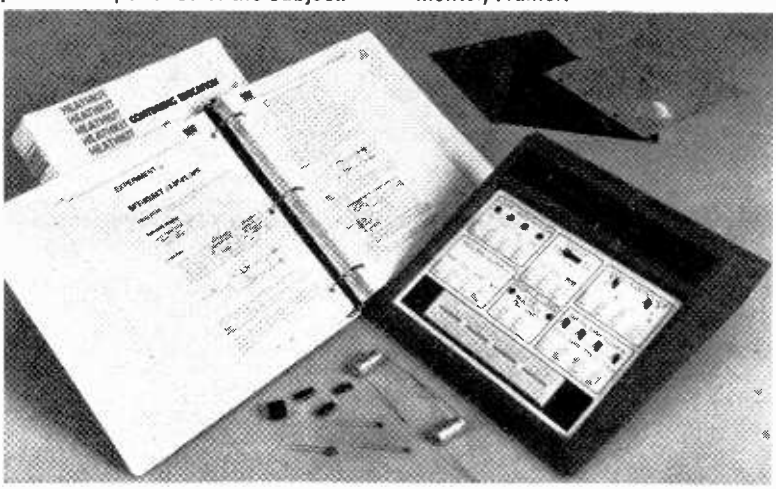
The Experimenter Trainer for the Heathkit Fundamental programmes—helps you perform each project quickly and easily. And after you finish the programmes, it's ideal for "breadboarding" your own design projects. It has solderless breadboarding sockets for fast, easy component connections, 2-range variable sine and square wave signal source, dual-variable power supplies for positive and negative voltages (both variable over 1·2 to 16 volts, current rating 120 mA, both regulated and short-circuit protected). Built-in 1k and 100k linear potentiometers. Centre tapped power transformer secondary provides 30V rms, 50Hz for line experiments.

The three basic programmes and the ET3100 trainer cost £89·90. The Digital Techniques programme and Digital Design Experimenter/Trainer are priced at £65·30.

For a fully comprehensive illustrated leaflet on the series write to *Heath (Gloucester) Ltd., Gloucester, GL2 6EE. Telephone (0452) 29451.*



An instruction manual together with gramophone records, components and the Heath Digital Design Experimenter/Trainer.

STUDENT'S CALCULATOR

The European Calculator Division of Texas Instruments Ltd. has introduced a hand-held calculator specifically designed for secondary school students. It is designated TI-1270. The 4-function machine features a store and recall "scratch pad" memory and four keys recommended by maths educators for student use: reciprocal, square, square root and π.

The TI-1270 is a single-chip calculator with a price tag of £12·95 inc. VAT. A mains adapter (AC 9900A) costs £2·95 inc. VAT—*European Calculator Division (Dept. PW), Texas Instruments Ltd., 165 Bath Road, Slough, SL1 4AD.*

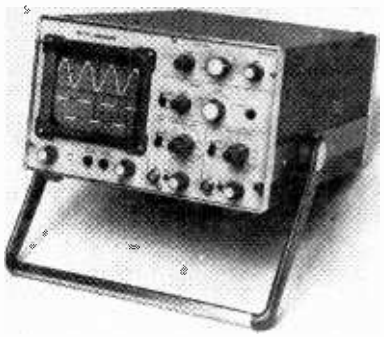
A NOVEL IDEA

A novel idea—that's what we thought when we heard about the Hadley SX4500. It's a cassette recorder with a built-in calculator. The recorder has auto level control and built-in microphone, while the calculator has the basic 4-functions, constant × or ÷, power calculation, memory and % and goes to 7 places of decimals. The unit, which can be battery or mains operated is priced at £75 plus 8% VAT. Further information may be obtained from *Hadley Sales Services, (Dept. PW) 112 Gilbert Road, Smethwick, Birmingham, B66 4PZ.*

RECHARGEABLE SOLDERING IRON

New from Kelgray Products Ltd. is the Engel rechargeable soldering iron, model B.50. It comes with a charger unit and is said to give 100 operations without a recharge (which can be done in 8 hours). The B.50 is fitted with a B.50D bit for work up to 2·5mm². It heats up to about 350°C in seven seconds. The price complete is £13·55 plus VAT and the B.50 can be obtained from the sole U.K. agents, *Kelgray Products Ltd. (Dept. PW) Bywell House, South Godstone, Surrey.*

ADVANCE 'SCOPE



New from Gould Advance Ltd. is the OS250A oscilloscope—an upgraded, re-styled version of the OS250. It incorporates a new input y-amplifier that gives a maximum sensitivity of 2mV/cm. It is a 10MHz dual-trace instrument with a 10 x 8cms display. The two channels may be viewed separately or alternately at high timebase speeds, or may be chopped at 250kHz at low timebase speeds. A variable level trigger control is provided with the option of a bright line in the absence of a signal, or when the trigger level is outside the range of the input signal. Price is **£229** excluding VAT. Further information may be obtained from *Gould Advance Limited (Dept. PW) Roebuck Road, Hainault, Essex.*

. . . AND DATA BOOK

A new 68-page data book from Gould Advance Ltd. gives full technical details on the entire range of products supplied by the company's Instrument Division.

THUNDER EASYDRIVERS

The Easydriver Ratchet Ball, which drives from one side and reverses from the other, is the heart of this tool system. Because of its shape the turning power is said to be twice that of a normal screwdriver to make jobs faster and easier.

The system is flexible and versatile with three different lengths of drive shaft which accept a variety of insert bits to fit most types of screw head. There are two socket adaptors for driving 1/4" and 3/8" sockets, and for yet more torque a special handle fits over the ratchet ball.

The Easydriver System can be bought in various packs, or the individual pieces separately. This system can be built up to fit individual requirements for jobs in the home, in the factory, for use on the car and wherever tools are needed. *Thunder Screw Anchors Ltd., (Dept. P.W.) Industrial Estate, Southwater, Horsham. Sussex RH13 7HQ.*

CABLE LOCATORS

Warrior Products Limited have introduced three new metal and cable locators.

The 'Metalloscope 40' registers any metal and has a penetration depth of about 10in. Price is £12·32.

The 'Electroscope 50' detects all live wires up to a depth of 16in. Price is £11·75.

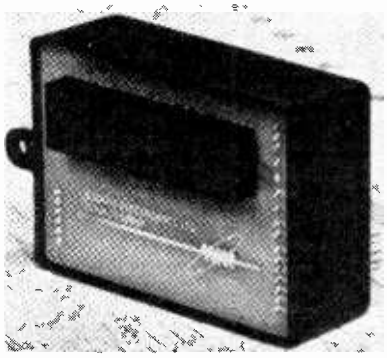
The 'Electro-Metalloscope 70' combines both operations and detects metals and live wires. It detects live wires up to a depth of 16in. and metal 10in. It produces a different signal for each. Price is £16·60.—*Warrior Products Limited, 8 Scrubs Lane, London N.W.10. Telephone 01-969 8201.*

DIGITAL PANEL METER

From B. Davis Electronics Ltd. comes the digital panel meter type DPM/3·5/01/F. Features include auto polarity with indication, large bright 12mm LED display and overrange indication. Input is 0-1·999V protected; input (Z) 1MΩ ±2% and accuracy ±0·1 ± 1 digit. Power input across rails is 12V minimum and 15V maximum. Size of the DPM is 85mm x 60mm x 30mm deep. Fixing centres are 93mm.

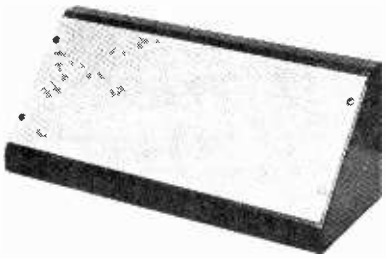
This meter has been designed as a direct analogue replacement. It uses MOS/MSI devices. The price for 1-9 units is £23·85 each.

A matching power supply type SPS/DPM/01/F or 01/G is available at £9·26 for 1-9 units. Input is 110-240V at 40-60Hz (F) or 5V d.c. at 250mA (G). It's twin rail (+VE 6V at 150mA/—VE 7·5V at 50mA). The PSU is short-circuit proof and will run two DPMs.—Further information from *B. Davis Electronics Limited, Castleham Industrial Estate, St. Leonards-on-Sea, Sussex, TN38 9NR.*



INSTRUMENT CASES

Olson Electronics inform us that they can supply cases and metal work to suit many P.W. projects at the keenest prices. They are shortly announcing a new range of cases and if readers would care to send them a stamped, addressed envelope, they will send out their price lists and brochures. A typical example of one of their cases is the sloping panel type shown which measures 250mm x 100mm, with a depth of 95mm and a height of 95mm. Price of this particular model is £1·95. *Olson Electronics Ltd., Factory No. 8, 5-7 Long Street, London E2 8HJ.*



"MICRO-POTS"

Lemo (UK) are now marketing what must surely rank among the smallest variable resistors ever made: the Siegert Type VW 00. The cylindrical body of this p.c.b. or hybrid-circuit resistor measures only 2·45mm high by 2·6mm diameter. It is of dust-tight design, and as it has a stainless-steel body it has good corrosion resistance: for example it resists perspiration.

Linear tracks are offered, from 100Ω maximum to 100kΩ, at a power rating of 70mW at 40°C. The screwdriver slot that is used to adjust the resistance also indicates the approximate setting of the wiper, which turns through about 240°.

Applications suggested by Lemo include car and pocket radios, paging devices, computers, hearing aids, calculators, electronic watches and defence circuitry.

Further information and prices from: *Lemo (UK) Ltd. (Dept. P.W.), 6, South Street, Worthing, Sussex BN11 3AE. Tel: 0903 204651.*

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22 Ranges plus AF/IF Oscillator 20,000Ω/Volt.
Vdc—0·5—1000V in 7 ranges
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Idc—0·05—500mA in 5 ranges
Resistance—5Ω—1MΩ in 4 ranges.
Accuracy—5% of F.S.D.
OSCILLATOR—1KHz and 465KHz (A.M.) at approx. 1 Volt.
Size—180 x 97 x 40mm.
Supplied complete with carrying case, test leads and battery.
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34 Ranges. High sensitivity. 20,000Ω/Volt.
Vdc—0·6—1200V in 9 ranges.
Vac—3—900V in 8 ranges.
Idc—0·06—3A in 6 ranges.
Iac—0·3—3A in 5 ranges.
Resistance—25Ω—5MΩ in 5 ranges.
Accuracy—dc and R—2½% of F.S.D.
ac and db—4% of F.S.D.
Size—167 x 98 x 63mm.
Supplied complete with storage case, test leads, spare diode and battery.
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27 Ranges plus Transistor Tester. 16,700Ω/Volt.
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Resistance—2KΩ—2MΩ in 4 ranges. Accuracy—dc—2½% ac—4% of F.S.D.
jfe—10—350 in 2 ranges.
Size—115 x 215 x 90mm.
Complete with carrying case, test leads, and battery.
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20,000Ω/Volt, High accuracy, mVdc—75mV.
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Idc—60—120 microamps in 2.
Idc—0·6—1500mA in 6 ranges.
Iac—0·6—1500mA in 6 ranges.
Resistance—1KΩ—1MΩ in 4 ranges.
db scale—10 to + 12db.
Accuracy—dc—1½%, ac—2½%.
Size—115 x 215 x 90mm.
Complete with carrying case. test leads and battery.
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4001/14001	0·15	4032/14032	0·85	4061/ —	16·40	4700/ —	1·50	14536/ —	2·85
4002/14002	0·15	4033/ —	1·10	4062/ —	7·30	7083/ —	4·25	14537/ —	15·25
4006/14006	0·95	4034/14034	1·55	4063/ —	0·90	14501/ —	0·15	14539/ —	1·05
4007/14007	0·15	4035/14035	0·95	4066/14066	0·55	14502/4502	1·00	14541/ —	1·80
4008/14008	0·75	4036/ —	1·80	4067/ —	2·95	14505/ —	3·30	14543/ —	1·50
4009/14009	0·45	4037/ —	0·75	4068/14068	0·15	14506/ —	0·35	14549/ —	2·95
4010/14010	0·45	4038/14038	0·85	4069/14069	0·15	14508/4508	2·35	14552/ —	8·05
4011/14011	0·15	4039/ —	2·85	4070/14070	0·15	14510/4510	1·10	14553/ —	3·50
4012/14012	0·15	4040/14040	0·85	4071/14071	0·15	14511/4511	1·25	14554/ —	1·20
4013/14013	0·45	4041/ —	0·65	4072/14072	0·15	14512/ —	1·05	14555/4555	0·70
4014/14014	0·80	4042/14042	0·65	4073/14073	0·15	14514/4514	2·55	14556/4556	0·70
4015/14015	0·80	4043/14043	0·80	4075/14075	0·15	14515/4515	2·55	14557/ —	3·20
4016/14016	0·45	4044/14044	0·75	4076/14076	1·25	14516/4516	1·10	14558/ —	0·90
4017/14017	0·80	4045/ —	1·15	4077/14077	0·15	14517/ —	5·40	14559/ —	2·95
4018/ —	0·80	4046/14046	1·10	4078/14078	0·15	14518/4518	1·00	14560/ —	2·95
4019/14519	0·45	4047/ —	0·70	4081/14081	0·15	14520/4520	1·00	14560/ —	1·55
4020/14020	0·90	4048/ —	0·45	4082/14082	0·15	14521/ —	2·00	14561/ —	0·45
4021/14021	0·80	4049/14049	0·45	4085/ —	0·55	14522/ —	1·50	14562/ —	5·25
4022/14022	0·75	4050/14050	0·45	4086/ —	0·55	14524/ —	N/S	14566/ —	1·20
4023/14023	0·15	4051/14051	0·75	4089/ —	0·65	14526/ —	1·50	14572/ —	0·35
4024/14024	0·60	4052/14052	0·75	4093/14093	0·65	14527/4527	1·20	14580/40108	6·00
4025/14025	0·15	4053/14053	0·75	4094/ —	1·50	14528/4098	0·85	14581/40181	3·05
4026/ —	1·40	4054/ —	0·95	4095/ —	0·85	14529/ —	1·30	14582/40182	1·15
4027/14027	0·45	4055/ —	1·05	4096/ —	0·85	14530/ —	0·65	14583/ —	0·71
4028/14028	0·70	4056/ —	1·05	4097/ —	2·95	14531/ —	1·25	14585/ —	1·45
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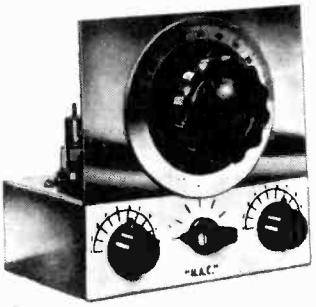

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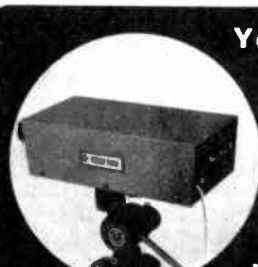

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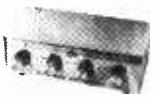

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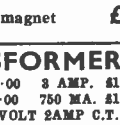

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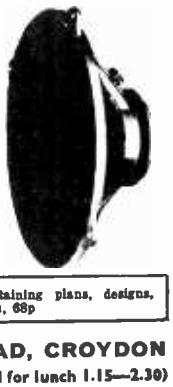

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AMATEUR BANDS

by Eric Dowdeswell G4AR

THERE is a treat in store for those of you who can get to the RSGB's Radio Communication Exhibition at Alexandra Palace in North London on Friday and Saturday 30-31 July from 1000 to 2000 hrs and on the Sunday, 1 August, from 1000 to 1600 hrs. There are exceptionally good road and public transport facilities to the show with adequate car and coach parking. The opening ceremony will be performed at 1200 hrs on the Friday by Lord Wallace of Coslany, next year's President of the RSGB, and a stalwart supporter of the Amateur cause for many years.

There will be talk-in stations on 160, 80 and 2m and the entrance fee is a very reasonable 40p, and 20p for the kids. Take all the family because there are many attractions at Alexandra Palace besides the lure of Amateur radio!

Stephen Budd A8713 of Worthing in Sussex is very enthusiastic about the Geoff Watts DX News Sheet and swears by the propagation forecasts contained therein and originated by W4UMF. Perhaps that ought to be MUF! Taking advantage of a predicted good period Stephen logged 11 KH6's, 17 KL7's, plus KS6, KM6, KJ6 and lots of other attractive calls. I have a feeling that the 'Zygi' two-element beam (Radcom July 73 and October 75) for 20m helped a great deal here although it was only a few feet off the ground. Even then it was better than his 150ft wire at 35ft. Geoff Watts can be reached at 62 Belmore Road, Norwich, for those interested in the DX-NS.

R. Donaldson, Trimdon Colliery, Co. Durham, sent a first log for 20m for both SSB and CW I'm glad to say, where he uses a Codar CR70A and a long wire. On 2m a Telford TC7 plus the G8AEV converter uses a dipole and a J-Beam crossed dipole which has brought in quite a lot of stations via Oscar 7. On 160m an Eddystone EC10 does yeoman service. How about that then? A different set for each band! R.D. is also swotting for the RAE plus the code examination.

Young **Jeremy Hinton** did it! Now G4EZE and what a lovely callsign! He is already hard at it working the DX for a change on 10 to 80m with an FT200. Jeremy met fellow correspondent Martin Kessel and found that they had both been to the same school and now frequent the same radio club, and that Martin is now G8LKF so congrats all round seem to be in order. **Paul Barker,** Sunderland, sent the usual long list of things seen on SSTV on the 20m band with nice things to say about the pics from 9K2DO and F6CHU followed closely by ON4IS. Paul found some late afternoon openings to SE Asia on 20m SSB plus quite a lot of /M, /MM1 and /MM2's scattered around the high seas. Paul comments on the excellent signal from 7Z1AB in Jeddah who, I think, must be old friend HZ1AB who operated for so many years from the Dhahran Air Base, and was a W1 when at home.

Alastair Dyksman living in Stockton-on-Tees managed to log a few stations on a Heathkit transceiver before he had to hand it back! As he is just finishing off a PW designed receiver he shouldn't be off the air for too long. Alastair has a trapped dipole plus an inverted Vee with the top at about 40ft. The far end of the Vee is earthed which provides a good aerial usable over quite a wide range of frequencies. A go at the May RAE plus some work on the code ought to bring along yet another G4+3 before too long. A final question from Alastair was 'Do you favour black boxes'? In general I don't, unless one has already had some experience in building equipment such as receivers and transmitters and thus has a reasonable knowledge of what goes on inside those very expensive black boxes!

The latest bit of excitement for **Peter Allen** A8677 of Taunton is the arrival of a new FR50B receiver which he finds much better than the 9R59DS, which is hardly surprising! In particular he is pleased at the very much improved frequency read-out. Peter is also active on 2m with an 8-over-8 J-beam at 20ft. He finds the cost of getting QSL's is a bit too much but still enjoys it and 'worth every penny'.

Log extracts

P. Allen:- 15m 5H3JR 9Q5DM ZP5SD JH2EUY **2m** DJ3CY GM8BKE PA0GUS

A. Dyksman:- 20m KZ5JM SV0WZ (Rhodes) A3GJ 5V4CX TA1MB

S. Budd:- 80m HK0COP ZF1MA **20m** CE0AE CR9AJ FR7AT HL9WI UA9VH/JT1 KS6DV/KB6 KJ6BZ TJ1AF TL8AR VK9XX VR8A ZK1DA 9M8HB **15m** DK5EC/ET3 KC4AAC VK9XX (QSL to WB7ABK) ZD8PL

R. Donaldson:- 20m CE6BFG CT3OK VP9GE 6Y5DA **2m via Oscar 7** DC9ZP HB9AS I3CLC OE5KDG OZ1EHD W1JAA

P. Barker:- 20m SSTV CT1JI F6CHU G4BFB OE5DPL/6 OK3ZAS ON4IS 9K2DO **20m** HM1ED VS5DB 5N2NAS 7Z1AB (?HZ1AB) 9V1NR VE8RCS.

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750	18·65	O.A.	30·80	1	—	O.A.	1·20
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SHORT WAVE BROADCASTS

by Derek Bell

ONCE upon a time a QSL was all that a BC station ever sent but with the advent of power politics on the radio scene the humble DXer is the target of ideological propaganda pushing all shades of opinion. One has scheds, magazines and extracts from Presidents speeches delivered, and the most unusual I have ever heard of, a consignment of dates! **Ken Smith** from Ross-on-Wye reports that the Voice of America, one of the most enthusiastic dispensers of literature, has started to lose strength on its Greenville transmitter in the early morning due to the changing pattern of daylight hours. The enthusiasm of this organisation is confirmed by the report from **John McCleod** of Inverness who says that they are distributing a special Bi-Centennial bookmark in return for reports. John also states that the Adventist World Radio is now giving an address for reports as "The voice of Prophecy," 123 Regent Street, London W1R 7HA."

While dwelling on matters trans-Atlantic, Radio Canada have sent me their new style QSL. This is the one that they require listeners to fill in and send back for verification. It is black with a projection of the globe in orange and white, covered in blue concentric circles. RCI have also sent a sched, with details of their coverage of the Olympic Games starting on July 17 from 0600 to 2230, in blocks of twenty minutes on 11915, 11720, 9680 7155, 6145, 6125 and 1295 in the medium waves. As a rough guide the nearer to midnight GMT the higher the frequency with an odd slot on 15325 at 2159 to 2230. Running down the side of the sched is a handy conversion table of metres to MHz. Although there is a sports slot in every transmission RCI promise special Olympic coverage and for us in the UK. This could mean more up-to-date news than with our own domestic coverage. To me, if I may inject a personal note, this is the true way to use the short wave bands, rather than for purely political motives.

In recent months I have been chuntering on about Latin American stations and the fact that they are heard here most of the year. What we hear are the domestic transmissions serving the inaccessible parts. These stations, since they are for internal listeners, do not seem to bother QSLing anyone overseas. One who is not bothered about QSLs is **Roberto Levinststein**, a Brazilian student at present in London and on his General TFC2500 he has the time of his life keeping up to date with his homeland every night. Roberto has logged Radio Globo RDJ as early as 1830 on 11805 and the pick of his log is as follows:—

Radio Relógio RDJ on 4906 at 2345
Radio Rio Mar on 9695 at 0020
Radio Aparecida on 9635 at 2350
Radio Clube de Pernambuco on 11865 at 0030

Roberto says that such stations as BBC, Deutsche Welle, RCI, etc don't seem to care about the LA listener as much as they do about the Europeans. This has not stopped the Brazilians from forming the Clube de Brasil who's address is Caixa Postal Numero 30, Recife, Pe Brasil. So, for horse's mouth information, Latin American fans should drop them a line.

Out of the ionosphere our old friend **George Hewlett** has another goodie for those fans of the time signal stations. He pulled in VNG Australia the other morn while DXing in the early bright (I wish I could get up that early). This station is only a 10 kilowatter and suffers QRM from Moscow but George assures me they will QSL, the signal is a beat note with verbal at 0745. As I mentioned earlier books and leaflets are a big part of the DX scene and **Robin Bayley** of Albrighton has sent a list for the novice. These are as follows "Introduction to SW Listening" 59p from Tandy shops, or the Radio Nederland "All-Round DXers Course" free from Radio Nederland, PO Box 222, Hilversum, Holland. The latter is a test course and to complete it questions are set for the student at the end of each block. I take a fatherly attitude to this latter one since when it was being prepared I met the author at an EDXC conference and he was good enough to ask for my thoughts on its contents.

Almost matching the LA and North American countries in the plentitude of stations is the USSR. Two stations that bother my next correspondents are Stancia Atlantica and Stancia Rodina. **Derek Gilbert** who is from Farnham, and is the spokesman for a group of three youngsters, assures me they are Russian since they follow Moscow on the same frequency. These stations are a puzzle to me since I must admit to not having heard them so if enyone can cast a ray of light, three youngsters would be obliged.

Having mentioned previously the unwillingness of Latin American stations to QSL **L. Pissas** of Que Que, Rhodesia has partly proved me wrong! Since I started compiling this month's column LPs letter has been delivered and he is in somewhat of a puzzlement. He has had a reply from Radio Nueva Esparta, Venezuala in the form of a booklet and two stickers all in Spanish and what seems to be a blank QSL card. Unless the station is following the policy of RCI in having the listener fill in the card and return it for stamping then it must be a case of sloppy secretarial work. The address of this station as given by LP is DX reports Dept., P.O. Box 58, Porlamar, Venezuela. So this would seem that the station is alive to the reports that DXers send in, and it might be worthwhile trying them, so let me know if you have any success.

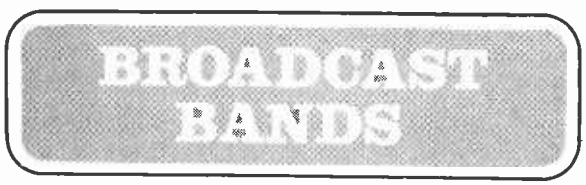
To continue the address theme **John Blackie** of Glasgow has offered SBC, 3000, Berne, Switzerland and requires in exchange Radio Cairo which is Engineering Dept. of Propagation, P.O. Box 1186, Cairo, Egypt. One of the favoured ploys of stations is to obtain the address of a listener and put the said listener on a mailing list. This is mentioned by **Cameron Lees** of Orpington who writes to say that Radio Budapest have started a DX club and want letters to Brody Sandor 5-7, Budapest VIII for de-

tails. This I feel will result in regular items of mail every few weeks that the listener is not interested in, a gripe of DXers and SWLs for years.

David Wyatt of Oswestry has a problem. He has a set that is run from a battery eliminator and it is picking up electrical noise. Well, given that the earth is good, all that I can say from this distance is that it might be worth while running the set as far away from sources of noise such as mains cable, electric motors and colour TV sets. Having said that I must admit that in areas where there is a lot of industrial plant then machines, especially with thyristor devices, can play havoc and short of complaining to the Post Office, not a lot can be done. Despite the "mush" David logs the following:—

Radio Pekin on 6270 at 2130
Voice of Vietnam on 15012 at 1808
Pakistan on 17910 at 1100
Radio Kuwait on 9555 at 1700
Radio New Zealand on 9540 at 0800

From Berkshire, to be exact the QTH of **Bill Reid,** comes the final log this month. Using a Yaesu FR101 with an old faithful Joymatch ATU hung on the end of a 60-foot inverted L, Bill reports Radio Grenada on 15105 at 2130 and a rarity 4EVH Haiti on 11835 at 2330. That rounds things up for this month I am sorry that space does not permit the inclusion of several letters from this months exceptionally heavy post bag, so 73s to you and yours.



MEDIUM WAVE DX

by CHARLES MOLLOY

REPORTS again from **Harold Emblem,** of Mirfield in Yorkshire, wtih a log of summertime North American DX. Using his Eddystone 730 and medium wave loop aerial he heard three stations in Newfoundland; CBN in St. John's on 640kHz, CKVO in Clarenville on 710kHz and CJON St. John's on 930kHz. Others heard were WINS in New York City on 1010kHz, WCAU in Philadelphia on 1210kHz, WMEX in Boston on 1510kHz and a new Canadian outlet, CIGO in Port Hawkesbury, NS on 1410kHz. CIGO, which identifies as "Go Radio C-I-G-O" or "Cigo Radio" is located on Cape Breton Island. It transmits with a power of 10kW into a directional aerial which has a lobe pointing along the great circle bearing to the UK. Harold's reception report was the first received from England since the station came on the air last October. The address for reception reports is "Eastern Broadcasters Ltd, PO Box 1410, Port Hawkesbury, NS, BOE 2VO, Canada. A fine catch Harold and congratulations on being the first from England!

Robin Beyley who writes from Albrighton, Staffs, is a newcomer to the band. With his Grundig Prima Boy and internal ferrite rod aerial he logged Trans World Radio, Montecarlo on 1466kHz and an unidentified signal with the call LIC in morse, at the LF end of the band, below Athlone on 566kHz. LIC is the call of a radio beacon which is used for navigation. It is located at Lichfield in the UK and transmits on 543·5kHz just inside the lower limit of the medium waveband. Robin is constructing a medium wave loop which he hopes will help him to pull in some North American DX.

The DXer can check if an ATU is likely to give improved results with his receiver and aerial. A tapped inductor can be made by close winding 24 turns of insulated wire on a $\frac{3}{4}$in diameter insulated former, the tappings being a loop made on every second turn. The aerial goes to one side of the inductor and the other side is led to the receiver aerial socket. A flying lead from one end of the inductor ends on a crocodile clip which can be attached to any tap. Two 500pF variable capacitors are used. The fixed vanes of each are connected together and are joined to the receiver earth terminal and the earth lead. The moving vanes of one capacitor go to one side of the inductor and the moving vanes of the second capacitor are connected to the other side of the inductor. By varying the position of the croc clip and adjusting the two capacitors, the optimum setting can be found. An ATU may be suitable for use with a portable receiver that has only a single socket for use with an external aerial.

A further report from **Harold Emblem** gives a rundown of his efforts to log Turkish stations. Izmir on 926kHz and Istanbul on 1016kHz are described as easy. Diyarbakir on 1061kHz as more difficult while Cukurova on 629kHz and Antalya on 890kHz are unexpectedly hard. Istanbul on 701kHz is often clear after 0100. Turkish medium and long wave stations would not, until recently, reply to a reception report. This policy seems to have changed and medium wave DXers who have Turkey on their "wanted list" now have the chance of adding to their list of Asiatic countries verified. The address for reception reports, which should be accompanied by an International Reply Coupon and perhaps a report of a Turkish shortwave transmission as well, is:—The Chief Engineer, Turkish Radio and Television Corporation, Mithatpasa Caddesi No 37, Ankara. Turkish medium and long wave stations identify on the hour and sometimes on the half hour as well, with "Burasi Turkii". *(Careful! Methinks Istanbul counts as Europe!—AED).*

Any country can use a common frequency provided it does not cause interference to other users. The BBC uses both channels for local radio, so DXing in some parts of the UK will only be possible between midnight and 0600. It is always worth checking these two frequencies especially during the small hours in summer. The technique is to stay on a channel for a time and hope that the slow fading, so characteristic of MW propagation, will produce a surprise. A loop aerial is a help with QRM. The writer's best catch on 1484 was a 250W American Forces station in the US base at Kenitra in Morocco, which was heard at sunrise during the month of June.

SEE PAGE 338 FOR REPORTS ADDRESSES

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BC107-8-9 All **£7·50**/100 2N3055 **£30/100.** 33pF ceramic plate 2% **£6**/1000.
Send SAE for Wholesale list.

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400 asstd. carbon resistors	£1·35
250 Hi-Stabs, 1, 2, 5% ¼ -1W	£1·25
100 Wirewounds 2-15W	£1·90
200 Miniature resistors, ¼, ½ and ¼W, mostly carbon film	£1·20
200 poly, mica, ceramic caps	£1·10
100 Polyester, ·01-2·2µF	£1·00
200 miniature electrolytics, but many unmarked so only	£1·00

15 Useful switches, micro, toggle, rocker and rotary. **£2·00.**
35 Crystals, mostly HC11U, at least 30 diff. freqs. 4-8Mhz **£1·30.**

TRANSFORMERS
All have mains primaries: 6-0-6V 100mA **90p**; 9-0-9V 100mA **97p**; 12-0-12V 50mA PC mntg **85p**; 12-0-12V 100mA **£1·00**; 24-0-24V 500mA **£2·95**; Multitapped transformer to give 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 or 30V, or 12-0-12, or 15-0-15V 1A version **£3·15**; 2A version **£4·45**; 30-0-30V 1A **£3·25**; 6-0-6V 1½A **£1·95**; 12-0-12V 1A **£2·15**; 25V 1¾A **£2·00**; 29V 50mA **75p**; Type LGC: 17V @ 2·4A, 15·7V @ 1·25A, 12V @ ½ A. Only **£2·50.** Type JBS: 110V Primary, 31V 300mA Sec. Use 2 (Series pri) to get 31V @ 600 mA, or 62V @ 300mA. Price for 2 **£1·65.** Type SMS: 12V 130mA, 5-0-5V 120mA, 11-0-11V 10mA **£1·20.** Few only, 16V 20A **£6·50.**

RELAYS
Miniature Plug-in types: 1250 ohm 4c/o **40p**; 700 ohm 4c/o **50p.** PO 3000 type 650 ohm with 6 heavy duty c/o contacts (Ex-equip) **75p**; 10 for **£4·00.** 6 1" easily removable reeds in 3580 ohm coil **50p**; Plug in relay, B7G Base 17mm dia x 42mm long 10k coil 1c/o contact **40p.** Omron MK3P plug in relay. 230V AC coil, 3 sets 10Ac/o contacts. **£1·20.**

WIREWOUND POTS
30k 5W; 10k 3W; 50Ω 3W; 90Ω 3W; 68Ω 3W; 80Ω 3W; 100k 3W. All **25p** each, any 10 **£2·0**

SEE PRACTICAL ELECTRONICS FOR INDIVIDUAL COMPONENT PRICES
All prices quoted include VAT AT THE NEW RATE and UK/BFPO postage.
Most orders despatched on day of receipt. SAE with enquiries please.
Send 10p for Multimeter catalogue—free on request on orders over £3. Official Orders accepted from Schools, etc. (Minimum invoice charge £5). Export/Wholesale enquiries welcome. Surplus components always wanted.

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QUALITY PRODUCTS
FOR HI-FI, DISCO,
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A BRAND NEW RANGE OF AMPLIFIER MODULES 5 to 100 WATT/RMS

Choose the power *you* need from these five pure complementary amplifiers
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All amplifiers feature a pure complementary symmetry output stage for low distortion and high reliability—the highest grade components (by Mullard—Texas, Plessey—RCA, etc.) used throughout

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TAM50 5W RMS 25V supply	£3·20
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For 1 or 2 TAM50/100	£4·25 (carr 50p)
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"MORE POWER— MORE TORQUE"

12v. – 14v. DC

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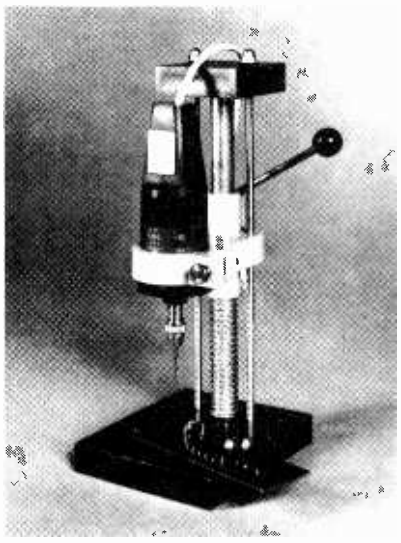
SAE for illustrated leaflet and order form



4-STATION INTERCOM

£18·30

Solve your communication problems with this 4-Station **Transistor Intercom** system (1 **master** and 3 **Subs**), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from **Master** to **Subs** and **Subs** to **Master**. Ideally suitable for Business, Surgery, Schools, Hospitals and Office. Operates on one 9V battery. On/off switch. Volume control Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 85p.

MAINS INTERCOM NEW MODEL

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. **Price £29 24** per pair P. & P. 85p

NEW! AMERICAN TYPE CRADLE

TELEPHONE AMPLIFIER

ONLY
£12·95
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Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates a switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. On/Off switch, volume. Direct tape recording model at £13·95 + VAT £1·12 P. & P. 70p, 10-day price refund guarantee.

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Continuous Display LCD Watches

UNIQUE ALTERNATING DISPLAY FEATURE

The watch normally displays HRS. and MINS. with MONTH, DAY and SECONDS on demand. The owner selects the feature where the HRS. and MINS. or MONTH and DAY display alternately for 2 second intervals until owner resets to normal display. During the alternating cycle seconds are still available on demand.

The MOS chip is micro welded to a gold plated printed circuit and hermetically sealed to provide trouble free service. The latest long life field effect liquid crystal display is mounted on the printed circuit by means of flexible elastomeric connectors combining low resistance and a shock absorbing cushion for the display.

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- ***All important: U.K. factory manufacturing and servicing facilities. by old established electronic instrument company.

1113-10 1113-20

£34·50 INCL. V.A.T. & P.&P.

Watch despatched with matching Gold plated bracelet, in presentation box with instruction booklet and guarantee. Model 1113-10 is also available with a stainless steel bracelet.

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SALE

DRILL CONTROLLER

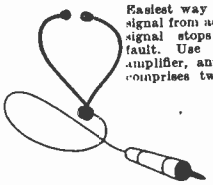
CONTROL DRILL SPEEDS

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. £2·95 including post and VAT. Made up model £1·00 extra.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN11 Price £1·25 each, 20p Post and VAT.

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, £2·95, twin stetho-set instead of earpiece 88p, VAT & postage incl. in price

MAINS TRANSISTOR PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts 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: main transformer rectifier, smoothing and load resistor condensers and instructions. Real snip at only £1·75 including post and VAT.

MOTORISED DISCO SWITCH

With six 10 amp changeover switches, adjustable over 360° switches are rated at 10 amp each so a total of 2000w's can be controlled and this would provide a magnificent display. The motors are 50V, but are of such a low wattage only 2 watts that they can be driven by a resistor or condenser voltage dropper. PRICE £2·25. DITTO BUT 12 SWITCH £3·65 POST AND VAT PAID

CAR TESTING OSCILLOSCOPE

Enables the electrical performance of the entire ignition circuit to be observed whilst the engine is running. It takes into account working conditions including compression and temperature, both of which directly affect the sparking plug firing voltage. Intermittant and/or definite faults are clearly shown by changes in the image display. Made by E.E. these are self-contained with carrying handle in a crackle finish metal case. PRICE £12·50 + £1 Carriage £2 + 8p with operating instructions.

WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make. £3·25 post and VAT paid.

EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic feet per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact. 5½" casing comprises motor, fan blades sheet steel casing, pull switch, mains connector and fixing brackets. £4·75 INCLUDING POST & VAT. Monthly list available free; send long stamped envelope.

28 RPM GEARED MAINS MOTOR

This is a substantial motor (1" stack induction type) quite powerful definitely large enough to drive a rotating display or a tumbler for polishing stone, etc. Approximate overall size 4" × 3½" × 2½" these are ex-unused equipment, carrying our normal ex-equipment guarantees. PRICE £2·95 POST & VAT PAID.

GLAMORIZE YOUR ROCKS

The way to make rock samples, stamps etc, really show themselves off is to light them by means of our miniature UV tube. This is only 6w's so the electricity costs are negligible. Complete kit comprises UV tube and it's 2 mounting holders, control choke and starter.
Total price £3·75 POST & VAT PAID.

TELESCOPIC AERIALS

for portable car radio or transmitter. Chrome plated—six sections, extending from 7½ to 47in. 50p + 15p. Post & VAT. KNUCKLED MODEL FOR F.M. 80p + 17p Post & VAT.

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only £14·00 including VAT and postage.

LIGHT PIPE

A mains operated travelling light array. 24ft long it uses 130 miniature bulbs which flash in sequence to make bands of light move along the tube. The tube can be draped around a particular item or set and cannot fail to attract attention—complete kit consists of—24ft of translucent tubing—140 min lamps—8yds multicore cable—motorised switch—taps for quick connections and full wiring instructions. £15 for complete kit. Post and VAT paid.

TWIN OUTPUT POWER PACKS

These have two separate R.C. smoothed outputs so can operate two battery radios or a stereo amp without cross modulation (they will of course operate one radio/tape cassette/calculator, in fact any battery appliance, and will save their cost in a few months). Specs: Full wave rectification, double insulated mains transformer – total enclosed in a hard P.V.C. case – three core mains lead terminal output – when ordering please state output voltage 4½v, 6v, 7½v, 9v, 12v or 24v. Price £3·95. Post and VAT included.

AUDIO DEPTH ALARM

All parts to build this featured project including plastic box £7·95 Post & VAT Paid

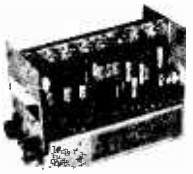
VIDEO WRITER

Send £30 for first batch of components—pay for the rest as they arrive.

SHORTWAVE CRYSTAL SET

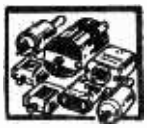
Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 31, 29 metre bands–Kit contains chassis front panel and all the parts, £1·50—crystal earphone 55p including VAT and Postage.

BREAK-DOWN UNIT



Contains hundreds of useful parts some of which are as follows—66 silicon diodes equivalent OA91, 68 resistors, mostly ¼ watt 5% covering a wide range of values 4 × ·1 mfd 400v mfd condensers, 15 × ·01 mfd 100v condensers, 2 RF chokes 8 × B9 valve holders, 1 × 4H choke, 1 × 115v transformer, 1 boxed unit containing 4 delay lines also tag panels, trimmer condensers, suppressors, etc., on a useful chassis sized approx. 9" × 5" × 7". Only 75p (the 66 diodes would cost at least 10 times this amount). This is a snip not to be missed. Post and VAT 75p.

ONLY £1·50 FOR SEVEN ELECTRIC MOTORS



7 powerful batt. motors as used in racing cars and power models. Output and types vary for use in hundreds of projects—Tools, toys, models, etc. All brand new reversible and for 1½-12v batts. Wiring diagrams inc. VAT, Post PAID.

SMITHS CENTRAL HEATING CONTROLLER

Push button gives 10 variations as follows: (1) continuous hot water and continuous central heating (2) continuous hot water but central heating off at night (3) continuous hot water but central heating on only for 2 periods during the day (4) hot water and central heating both on but day time only (5) hot water all day but central heating only for 2 periods during the day (6) hot water and central heating on for 2 periods during the day time only—then for summer time use with central heating off (7) hot water continuous (8) hot water day time only (9) hot water twice daily (10) everything off. A handsome looking unit with 24 hour movement and the switches and other parts necessary to select the desired programme of heating. Supplied complete with wiring diagram. Originally sold we believe at over £15. We offer these while stocks last at £8·95 each INCLUDING VAT and Postage.

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.
24in × 18in £1·99. Post & VAT 50p.
13in × 10in £1·50. Post & VAT 50p.

LIGHT OPERATED SWITCH FOR 12-24V BATTERY OPERATION

This is completely encapsulated and so make weather proof against all the elements. It can, therefore, be put to many useful applications. To name a few (1) Automatic switch for a mast head light on a boat. (2) Automatic switch on for battery operated lights or alarms in remote places. (3) Auto parking light for a vehicle, no doubt other applications would be found by our readers and we would be glad to hear about them.
Encapsulate unit measures approx. 1·6" × ·9" × 1·5" deep. This can be conveniently mounted through the front panel of a conduit box or similar.
Price £1·95 post & VAT paid.

TERMS: Where order is under £5 please add 30p surcharge to offset packing expenses

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(Dept. P.W.), 103 TAMWORTH ROAD,
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MAINS TRANSFORMERS

All standard 230-250 volt primaries		£ p
1v	1 amp (special)	1·75
2·4v	5 amp	1·85
6·3v	2 amp	1·25
6·3v	3 amp	1·75
9v	1 amp	·95
9v	3·5 amp	2·50
12v	1½ amp	1·50
12v	1 amp	1·00
6·5v-0-8·5v	1 amp	1·50
18v	1 amp	1·50
24v	2 amp	2·25
24v	3 amp	3·80
12·0·12v	50mA	1·20
6·0·6v	50mA	1·20
8.0-8v	½ amp	1·50
25·0-25v	2 amp	3·50
25v	1½ amp	1·95
50v 2 amp & 6·3v	1 amp	4·50
60v 5 amp & 5v	1 amp	7·50
27v	8 amp	4·50
30v	37 amp	22·00
80v tapped 75v & 70v	4 amp	5·50
230v-60mA & 6·3v	1·5 amp	1·75
275-0-275v at 90mA & 6·3v	3 amp	2·25
EHT Transformer 5000v 23mA	(intermittent)	5·60
Charger Transformers		
6v and 12v	2 amp	1·50
6v and 12v	3 amp	2·25
6v and 12v	5 amp	3·50

Add 40p per £1 to cover Post & VAT.

SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in box all ready to work. £7·95 plus 95 VAT and postage.

INTRUDER ALARMS

These kits are for the alarm described in a back issue of "Everyday Electronics".
PRICE £4·95. POST & VAT PAID.

SMITHS 24-HOUR TIMER HEART

Really the 'Autoset' without it's plastic case. This is a 24 Hour twice on, twice off, clock switch which will repeat until reprogrammed. Switches rated at 15 amps. Limited supplies.
PRICE £3·95 INCLUDING POST & VAT.

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.

Model 1153 500mW power output £1·10 including Post & VAT.
Model 1172 1W, power output £1·35 including Post & VAT.
Model EP9000 4 watt power output £2·40 including Post & VAT.
EP 9001 twin channel or stereo pre-amp. £2·50 including Post & VAT.

MULTI SPEED MOTORS

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 and 15,500 r.p.m. Shaft is ¼ in. diameter and approximately 1 in long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia × 5 in. long. Price £1·50 including Post & VAT.

SPIT MOTOR WITH CARTER GEAR BOX

Probably one of the best spit motors made. Originally intended to be used in very high priced cookers however this can be put to plenty of other uses, for instance your garden bargeque or to drive a tumber for stone polishing; in fact, there are no ends to its uses. Normal mains operation SPECIAL PRICE DURING MAY & JUNE. £2·50 + 20p post + 2p.

PP3/PP9 BATTERY ELIMINATOR

Made in Japan for Bush Radio. This is very neat little transformer driven full wave unit totally enclosed with input mains and output leads. This power supply unit which was originally marketed by Bush at over £6 is offered as this months snip. PRICE £2·00 INCLUDING POST & VAT.

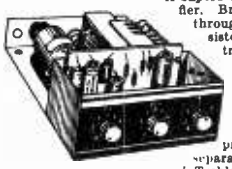
NEED A SPECIAL SWITCH

Double lead contact. Very slight pressure closes both contacts 12p each. Plastic pushrod suitable for operating. 10p each, 10 for 68p.

SPEED CONTROLLER 9V MOTOR

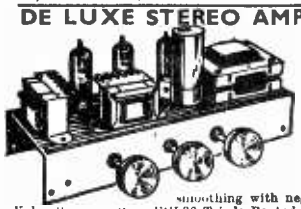
This is a motor with a governor 9v operation intended for record players and tape recorders. These are reversible and electro magnetically and acoustically screened. Size approx. 1¼" diameter by 1" deep with good length spindle. Japanese made, portable replacement in a good many popular cassette and record players.
PRICE 95p + 12p post 10p + 1p.

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. **PRICE £13·75.** P. & P. £1·00.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:- 2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **£12·40.** P. & P. £1·30.

HAVERSONIC STEREO 44

A solid state stereo amplifier chassis, with an output of 3–4 watts per channel into 8 ohm speakers. Using the latest high technology integrated circuit amplifiers with built in short term thermal overload protection. All components including rectifier smoothing capacitor, fuse, tone control, volume controls, 2 pin din sockets & 5 pin din tape rec./play socket are mounted on the printed circuit panel size approx. 9½" × 2½" max. depth. Supplied brand new & tested, with knobs, brushed anodised aluminium 2 way escutcheon (to allow the amplifier to be mounted horizontally or vertically) at only £7·50 plus 50p P & P. Mains transformer with an output of 17v a/c at 500m/a can be supplied at £1·50 + 40p P & P if required. Full connection details supplied.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price **£1·50 yd. length.** P. & P. 50p per yd. (min. 1 yd.). S.A.E. for samples.

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 3in. long × 3½in. wide × 3in. deep. Price **£2·90** P. & P. 90p.

MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500 mA. **£1·50.** P. & P. 60p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. **£1·65.** P. & P. 60p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. **£2·35.** P. & P. 90p.
Pri. 200/240V Sec. 23V at 1·5amp, 6V at ·6 amp, 8V at 50mA. **£2·00** + 65p P. & P.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1¾" x 1¾" x ¾". Brand new complete with instructions. Price **£1·80.** P. & P. 15p.

STEREO-DECODER
SIZE 2" x 3" x ¼" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. **£5·63** plus 20p. P. & P. Stereo beacon light if required **40p** extra.

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 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE **£6·20,** P. & P. 90p.
ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE **£7·30,** P. & P. £1.

HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER

Enjoy fabulous stereo radio at this low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12¾" wide × 8" deep by 2¾" high. Supplied ready built, fully tested and fully guaranteed. A/C Mains 200/240v (not available in kit form).

SPECIAL OFFER £22·50 + £1·40 p. & p.

LATEST ACOS GP91/18C mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. **£1·60** P. & P. 18p.

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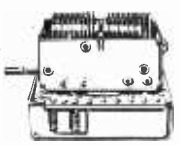

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ECC83	0·70	EL95	1·02	PCL83	0·97	UABC80	1·01
ECC84	0·83	EM81	1·24	PCL84	0·93	UBC81	0·80
ECC85	1·02	EY51	0·89	PCL85	0·72	UBF89	0·65
ECC88	1·22	EY86	0·50	PCL86	0·97	UCC85	0·66
ECC189	0·77	EY86/87	0·70	PCL805/850	0·97	UCH81	1·73
ECF80	0·63	EY88	0·81	PD500	2·62	UCL82	1·02
ECF82	0·90	EZ80	0·84	PFL200	1·23	UCL83	1·02
ECF86	0·76	EZ81	0·70	PL36	1·40	UL84	1·23
ECH81	1·73	GY501	1·73	PL81	1·23	UY85	0·73
ECH83	1·06	GZ34	1·22	PL81A	1·40	6/30L2/ ECC804	1·20
ECH84	1·50	OC83	0·80	PL82	0·48	6F23/EF812	1·16
ECL80	1·02	PC86	1·40	PL83	1·73	30C1/PCF80	0·84
ECL82	0·69	PC88	1·40	PL84	1·02	30C15/ PCF800	1·22
ECL83	0·93	PC97	0·70	PL500	1·40	30C17	1·29
ECL86	0·82	PC900	0·84			30C18/ PCF805	1·29
						30F5/PF818	1·35
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						30FL12	1·44
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DF91	0·40	EF95	0·45	PCC88	0·85	U26	0·85
DF96	0·60	EF98	0·80	PCC89	0·55	U191	0·75
DK91	0·50	EF183	0·40	PCC189	0·65	UABC80	0·40
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DK96	0·75	EL32	0·60	PCF82	0·43	UBC41	0·60
DL92	0·50	EL33	8·00	PCF86	0·65	UBC81	0·50
DL94	0·48	EL34	0·70	PCF801	0·60	UBF80	0·50
DL96	0·55	EL36	0·60	PCF802	0·55	UBF89	0·50
DY86	0·45	EL37	3·40	PCF805	0·90	UCC85	0·80
DY87	0·45	EL41	0·90	PCF806	0·80	UCH42	0·80
DY802	0·47	EL42	1·65	PCF808	1·00	UCH81	0·50
EABC80	0·28	EL84	0·35	PCL82	0·45	UCL82	0·40
EAF42	0·70	EL95	0·60	PCL83	0·70	UCL83	0·70
EB91	0·30	EM80	0·55	PCL84	0·50	UF41	0·75
EBC33	1·00	EM81	0·60	PCL85	0·60	UF89	0·50
EBC41	0·75	EM84	0·40	PCL86	0·50	UL41	0·85
EBC81	0·40	EM85	1·00	PCL805/85	0·60	UL84	0·50
EBF80	0·40	EM87	1·00	PD500	1·50	UY41	0·55
EBF83	0·40	EY51	0·45	PEN45	0·85	UY85	0·45
EBF89	0·32	EY86	0·50	PL36	0·63	VR105/30	0·40
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						6BR7	1·25
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						6BW6	1·00
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						6CD6G	1·60
						6CH6	2·20
						6CW4	3·00
						6F23	0·90
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						6F28	0·75
						6J5M	0·65
						6J5G	0·45
						6J6	0·85
						6J7G	0·80
						6J7M	0·65
						6K4GT	0·80
						6K7G	0·85
						6K7M	0·45
						6K8G	0·45
						6K8M	0·70
						6K25	1·00
						6L6G	1·25
						6L6GC	0·80
						6Q7G	0·40
						6Q7M	0·60
						6SL7GT	0·55
						6SN7GT	0·55
						6SQ7GT	0·40
						6U5G	1·50
						6V6G	0·80
						6V6GT	0·60
						6X4	0·45
						6X5G	0·45
						6X5GT	0·55
						7B6	0·80
						7B7	0·80
						7C5	2·00
						7C6	1·00
						7H7	0·80
						7R7	1·30
						7S7	2·25
						7Y4	0·80
						12AT6	0·45
						12AT7	0·45
						12AU6	0·50
						12AU7	0·88
						12AX7	0·88
						12BA6	0·50
						12BE6	0·60
						30C1	0·40
						30C15	1·00
						30C17	1·00
						30C18	0·90
						30F5	1·00
						30FL1	1·00
						30FL2	1·00
						30FL14	1·00
						30L15	0·95
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AF186	0·48	BFY52	0·20	OC140	1·50	2N696	0·18
AF239	0·44	BR100	0·40	OC170	0·30	2N697	0·16
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SN7413	0·36	SN7460	0·16	SN74118	0·90		
SN7416	0·36	SN7470	0·36	SN74119	1·58		
SN7417	0·36	SN7473	0·41	SN74121	0·50		
SN7420	0·16	SN7474	0·42	SN74122	0·70		
SN7422	0·25	SN7480	0·60	SN74123	1·00		
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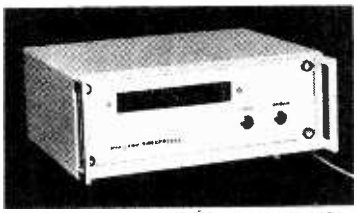

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AC125*	32	BC137	15	BF115*	22	OC26*	48	TIS43	25	2N2907A*	22
AC126*	18	BC142	24	BF154	18	OC28*	58	TIS44	18	2N2926G	10
AC127*	18	BC143	24	BF156	25	OC29*	58	TIS46	31	2N2926O	8
AC128*	18	BC147	7	BF173	25	OC35*	54	TIS48	25	2N2926R	8
AC141*	28	BC148	7	BF177	26	OC36*	58	TIS49	32	2N2926Y	8
AC141K*	34	BC149	9	BF178*	28	OC41	18	TIS50	32	2N3011	16
AC142*	28	BC153	99	BF179*	33	OC42	18	TIS74	31	2N3053*	20
AC142K*	25	BC154	20	BF180	33	OC44	18	TIS91	20	2N3054*	45
AC176*	18	BC157	10	BF181	33	OC45	18	ZTX107	12	2N3055*	49
AC187*	18	BC158	12	BF182	33	OC46	21	ZTX108	12	2N3525	76
AC188*	19	BC159	13	BF183	33	OC70	17	ZTX109	13	2N3614*	99
ACY17	35	BC168	12	BF184	32	OC71	17	ZTX300	14	2N3615*	99
ACY18	28	BC169C	14	BF185	30	OC72	27	ZTX301	14	2N3702	10
ACY19	25	BC170	11	BF194	10	OC74	28	ZTX302	18	2N3703	12
ACY20	24	BC171	11	BF195	10	OC75	35	ZTX303	15	2N3704	10
ACY21	29	BC172	11	BF196	14	OC76	37	ZTX304	24	2N3705	12
ACY22	16	BC177*	18	BF197	15	OC77	56	ZTX311	10	2N3706	10
ACY28	21	BC178*	16	BF198	15	OC79	30	ZTX314	16	2N3707	10
ACY39	78	BC182	11	BF224A	12	OC81	18	ZTX341	19	2N3708	9
ACY40	24	BC182L	12	BF244	17	OC81D	24	ZTX500	16	2N3709	9
ACY41	28	BC183	10	BF256*	34	OC82	18	ZTX501	13	2N3710	12
ACY44	39	BC183L	11	BF257*	34	OC82D	30	ZTX502	18	2N3711	12
AD140*	48	BC184	11	BF258*	38	OC83	28	ZTX503	14	2N3771*	140
AD149*	48	BC184L	12	BF259	41	OC84	44	ZTX504	47	2N3772*	175
AD161*	38	BC186	22	BF594	20	OC84N	44	ZTX531	28	2N3773*	225
AD162*	38	BC187*	28	BF595	18	OC122	135	ZTX550	18	2N3819	20
Mtch.pr.*	86	BC212	12	BFR39	30	OC123	115	2N526	40	2N3820	40
AF114*	23	BC212L	13	BFR80	30	OC139	94	2N696*	15	2N3823	50
AF115*	23	BC213	11	BFR79	30	OC140	100	2N697*	13	2N3824	89
AF116*	23	BC213L	13	BFX18	54	OC141	157	2N698*	30	2N3866*	69
AF117*	23	BC214	14	BFX29	28	OC170	30	2N699	33	2N3903	15
AF118*	44	BC214L	16	BFX38	38	OC171	32	2N706*	12	2N3904	15
AF121*	33	BC307B	15	BFX53	40	OC200	43	2N706A*	15	2N3905	17
AF124*	30	BC328	18	BFX54	40	OC201*	80	2N707*	50	2N3906	17
AF125*	30	BC441*	30	BFX64	38	OC202*	90	2N708*	15	2N4037	34
AF126*	30	BC461*	40	BFX81	140	OC203	60	2N914	18	2N4058	15
AF127*	30	BC462*	30	BFX84	24	OC204*	70	2N916	27	2N4061	13
AF139*	33	BC549C	65	BFX85*	28	OC270*	50	2N920*	51	2N4062	14
AF178	49	BCY30	65	BFX86*	28	OC71*	65	2N930*	18	2N4871	34
AF179	59	BCY31	92	BFX87	33	ORP12*	60	2N961	61	2N4922	52
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AF181*	48	BCY34	150	BFY50*	18	TIC44*	30	2N1090	85	2N5138	12
AF185	60	BCY39	90	BFY51*	18	TIC45		2N1091	51	2N5457	36
AF186	48	BCY40	90	BFY52*	18	TIP29	43	2N1131	22	2N5458	42
AF239*	34	BCY55	204	BSY25	25	TIP29A	45	2N1132	23	2N5459	42
AFZ.1	138	BCY59	18	BSY28	28	TIP29C	58	2N1301*	20	2N6027*	35
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ASY29	40	BCY72*	20	BU105*	260	TIP30B	56	2N1304*	24	40311	38
ASY50	17	BCY78	20	M3055*	85	TIP30C	76	2N1305*	28	40313	98
ASY26	31	BCZ10	70	MJ400*	120	TIP31*	54	2N1306*	28	40316	60
ASY76	45	BCZ11	60	MJ491	160	TIP31A*	58	2N1307*	28	40317	38
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AU104	125	BD121*	115	MJE340*	45	TIP31C*	84	2N1671	120	40327	48
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BC107*	9	BD124*	75	MJE371*	80	TIP32A*	68	2N1893*	30	40348	73
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BC113	15	BD138*	45	MPF105	42	TIP34A*	115	2N2222*	22	40494	73
BC114	16	BD139*	45	MPSA06	30	TIP34B*	167	2N2303*	30	40495	84
BC115	18	BD140	60	MPSA56	30	TIP35*	258	2N2369*	14	40603*	58
BC116	18	BD142	53	MPSA70	32	TIP35A	225	2N2483*	30	40636	110
BC117	20	BD145*	55	MPU1131*	39	TIP35C	280	2N2484*	30	40673*	55
BC118	15	BDY11	115	NKT720	35	TIP36A*	370	2N2646	41	Matched Pair	
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7408	17	7485	144	74162	216
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7410	13	7489	314	74164	152
7412	23	7490	46	74165	152
7413	40	7491	92	74166	161
7414	70	7492	55	74167	362
7416	39	7493	45	74170	246
7417	42	7494	92	74172	590
7420	17	7495	73	74173	175
7422	30	7496	82	74174	173
7423	26	74100	155	74175	106
7425	30	74104	46	74176	118
7426	31	74105	46	74177	116
7427	31	74107	38	74178	163
7428	44	74109	62	74179	163
7430	18	74110	49	74180	123
7432	28	74111	73	74181	345
7433	41	74116	196	74182	95
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7438	31	74119	185	74185	199
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7443	138	74123	73	74191	194
7444	120	74125	62	74192	143
7445	99	74126	92	74193	143
7446	120	74128	80	74194	143
7447	92	74132	80	74195	91
7448	80	74141	72	74196	118
7450	17	74142	306	74197	118
7451	17	74143	314	74198	248
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4012AE	18p	4013AE	46p
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4017AE	83p	4018AE	83p
4019AE	46p	4020AE	92p
4021AE	83p	4022AE	78p
4023AE	18p	4024AE	64p
4025AE	17p	4026AE	142p
4028AE	74p	4029AE	94p
4030AE	46p	4033AE	115p
4034AE	156p	4040AE	88p
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4044AE	77p	4045AE	115p
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4055AE	108p	4056AE	108p
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741C	22p	MC1496	91p
741 TO5	32p	MC1710CG	55p
747C	70p	MFC4000B	55p
748C	28p	MFC6040*	105p
8038CC	270p	MK50253*	550p
AY-1-0212	550p	NE350	150p
AY-1-5051	120p	NE515A	210p
AY-5-1224*	349p	NE555*	45p
AY-1-67216	175p	NE556DB*	99p
AY-5-3500*	610p	NE560	225p
CA3011	82p	NE561*	325p
CA3014	137p	NE562B*	270p
CA3018	72p	NE565A*	200p
CA3020	145p	NE566*	150p
CA3023	139p	NE567V*	200p
CA3028	90p	SL403D	176p
CA3035	132p	SL414A	178p
CA3036	137p	SN76003	280p
CA3043	157p	SN76013	155p
CA3046	59p	SN72733	135p
CA3048	210p	SN76023	155p
CA3053	40p	SN72702	80p
CA3075	150p	SN76033	150p
CA3081	150p	SN76227	175p
CA3089E	150p	SN76115	200p
CA3090AQ	375p	TAA550B	36p
CA3123E	140p	TAA621A	203p
CA3130	105p	TAA661A	180p
ICL8038CC*	270p	TAA960	
LM300H	170p	TAD100	130p
LM301A	38p	TAD110	170p
LM301 TO5	45p	TBA540Q	265p
LM308	120p	TBA641B	225p
LM318	70p	TBA800	80p
LM380	94p	TBA810S	95p
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M253	85p	TCA270SQ	399p
		ZN414	105p

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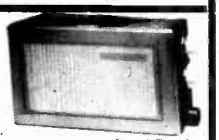
POCKET FIVE

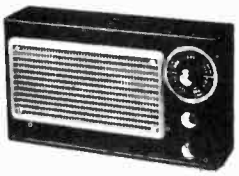


NOW WITH 3" LOUDSPEAKER

3 Tuneable wavebands. M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" × 1¼" × 3½" approx.

All Parts including Case and Plans. Total Building Costs **£3·60** INC. VAT P&P+Ins. 50p.

NEW Everyday Series



Build this exciting new series of designs.

E.V. 5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" × 5¼" × 2¾" approx. All parts including Case and Plans.

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E.V. 6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" loudspeaker, etc., MW/LW coverage. Push Pull output.

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E.V. 7. Case and looks as above, 7 Transistors and 3 diodes. Six wavebands, MW/LW, Trawler Band SW1, SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" Loudspeaker.

All parts including Case and Plans

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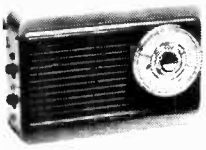
TRANSONA FIVE



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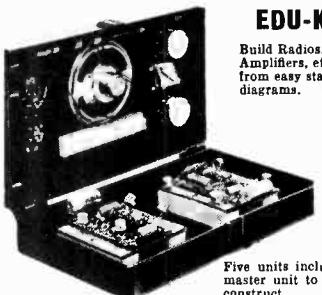

Build Radios, Amplifiers, etc. from easy stage diagrams.

Five units including master unit to construct.

Components include: Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine tone 3" moving coil Speaker: Terminal Strip: Ferrite Rod Aerial: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ¼" 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.

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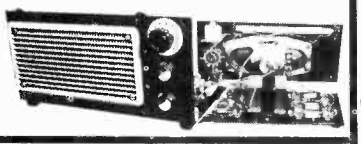
ECK2 Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull output. 3" Loudspeaker, Gain Control. Superb 9 section swivel ratchet and retractable chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit).

Complete kit of parts including construction plans **£7·15** INC. VAT P & P and Ins. 55p.



ECK 4 7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5" × 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor. Resistors, Capacitors, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans. **£6·55** INC. VAT P & P and Ins. 55p.

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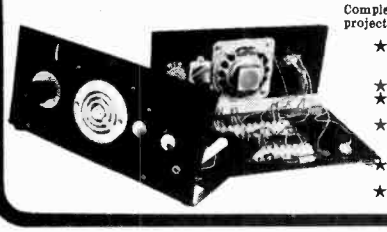

- ★ Crystal Radio Medium Wave Coverage — No Battery necessary.
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- ★ 2 Transistor Regenerative Radio.
- ★ 3 Transistor Earpiece Radio Medium Wave Coverage.
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- ★ Electronic Noise Generator
- ★ Electronic Metronome.
- ★ 4 Transistor Push/Pull Amplifier.

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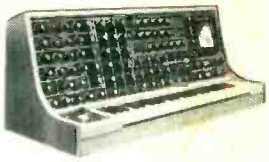

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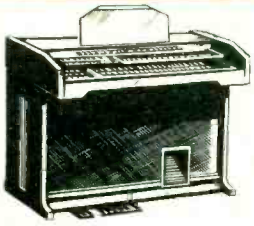

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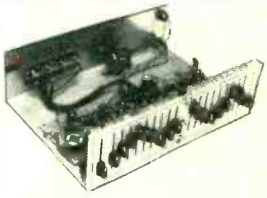

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