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Radio & Electronics

The communications and electronics magazine

World

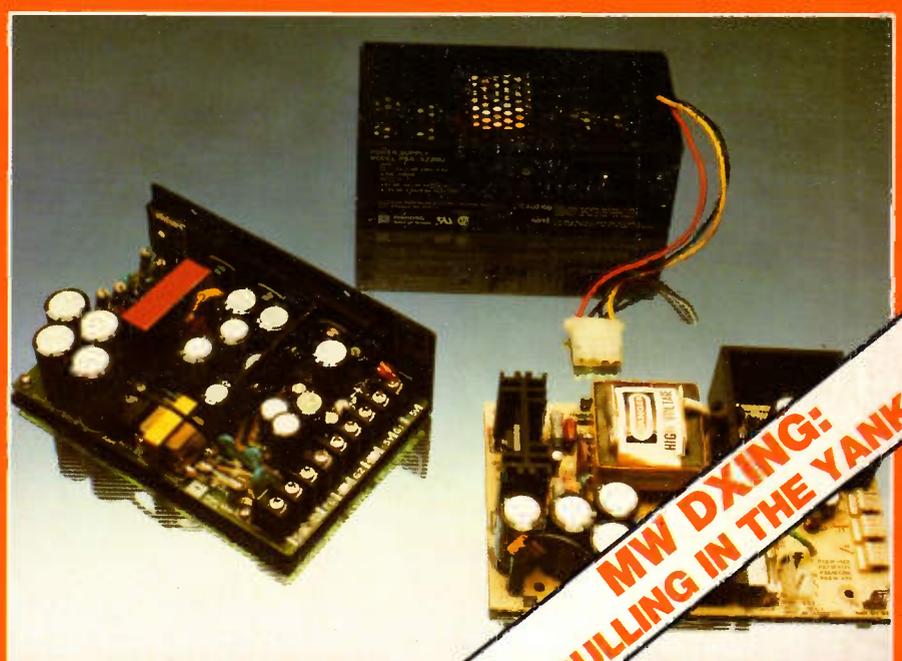
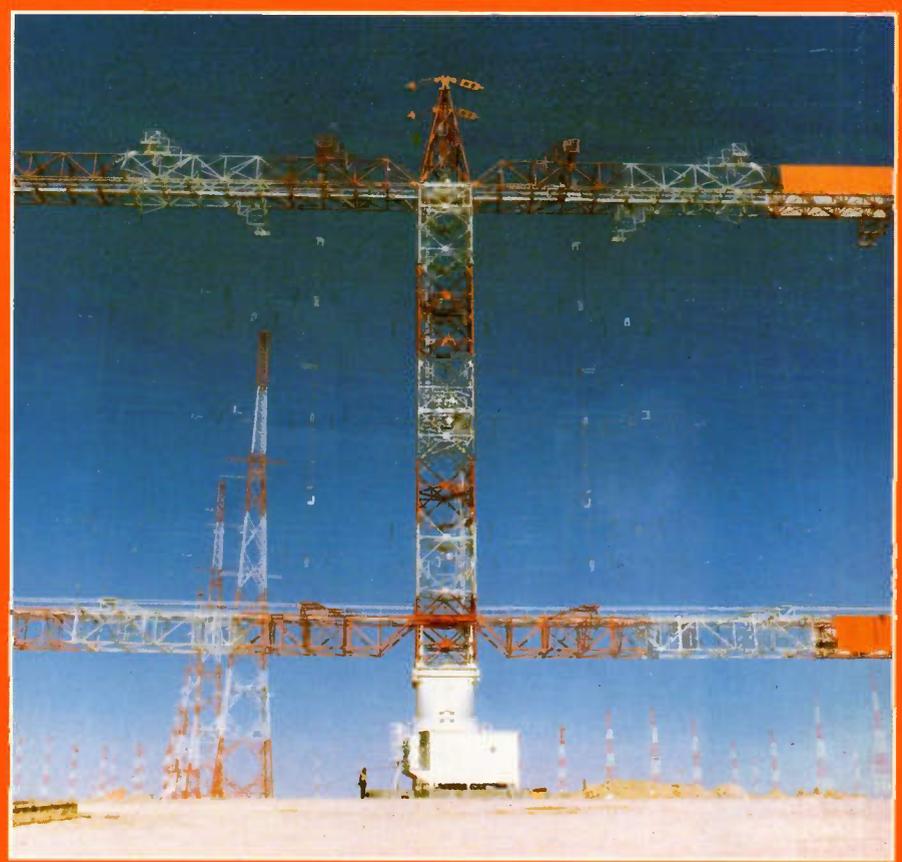
COMPUTING:
VALUES FOR L-C
MATCHING NETWORKS

PCB MAKING:
A NOVEL (AND
SIMPLE!) TECHNIQUE

HF AMPLIFIER:
GIVE YOUR RX FRONT-
END A BOOST

DATA FILE:
STARTING ON
FET DEVICES

POWER SUPPLIES:
COMING TO THE END
OF THE THEORY



MW DXING:
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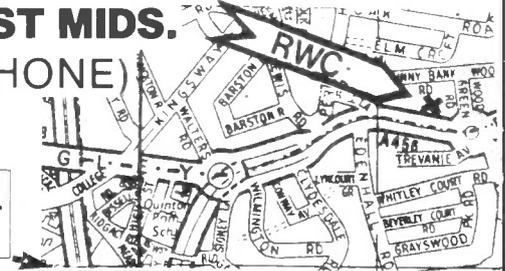


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<p>RAYCOM LINEAR AMPLIFIERS Complete new range of amplifiers to suit your handheld or portable. Various output power available. Prices from £39.50-£89.50. GIVE US A CALL SEND SAE FOR FULL DETAILS</p>		<p>NEW 'R.W.C. SPECIAL'. NEW MAG. BASES TO SUIT EVERY ANTENNA Our own made brand of boxes, available with various fittings including 3/8 stud & 50239. £10.50 with plug connector. P&P £2.50</p>	<p>5/8 OVER 5/8 2 METRE COLINEAR BASE ANTENNA, TERRIFIC VALUE, ONLY £35.98, INCLUDING 5 STAR CARRIAGE TO YOUR DOOR.</p>	<p>THE AMAZING NEW ARM MULTI-P6+ VHF-UHF MOBILE ANTENNA, THE MOST VERSATILE ANTENNA EVER MADE. ONLY £34.50 + £2.50 P&P. Colinear element £4.75.</p>	
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Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk - safety in the shack please, at all times.

Whilst every care is taken when accepting advertisements we cannot accept responsibility for unsatisfactory transactions. We will, however, thoroughly investigate any complaints.

The views expressed by contributors are not necessarily those of the publishers.

Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

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Bottom - New switching PSUs (p5)

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30 Making PCBs

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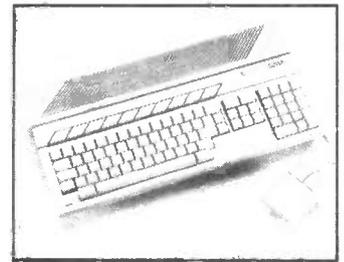
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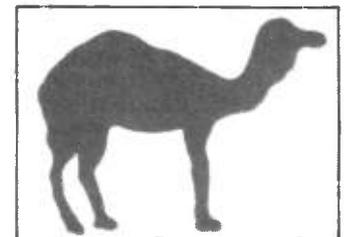
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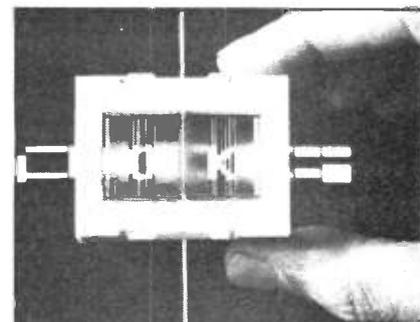
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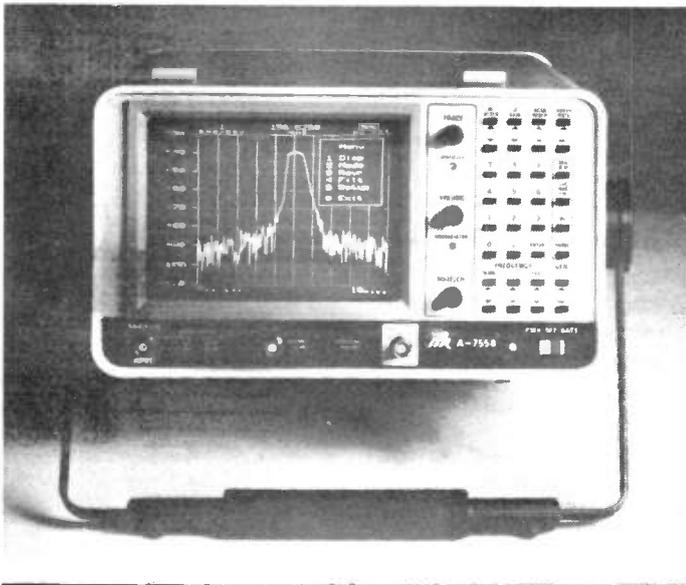
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- Next Issue**
Cover date December 1985 on sale Thursday, 14 November
- Publication Date**
Second Thursday of the month preceding cover date

PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.

Readers, don't forget to mention **Radio & Electronics World** when making enquiries



SPECTRUM ANALYSER

The A-7550 portable spectrum analyser from Fieldtech Heathrow is claimed to be one of the most advanced low cost instruments on the market today.

Two microprocessors, with menu driven display modes and single function keyboard entry, aid the user in the operation of all functions.

A digitised vertical raster scan is used as the display. This system allows the operator to view most analyser parameters simultaneously while monitoring an active or stored trace.

RF frequencies may be manually entered via the front panel keyboard for frequency

selection from 100kHz to 1GHz or by use of the frequency slewing keys for convenient analyser operation.

All special functions of the A-7550 are selectable from menus which can be displayed concurrently with graphic and trace information for uninterrupted viewing of analysed parameters.

Tracking generator, FM/AM 2 microvolt receiver, quasi-peak detector, and IEEE488 or RS232 interfaces are some of the available options.

*Fieldtech Heathrow Ltd,
Huntavia House,
420 Bath Road, Longford,
Middlesex UB7 0LL.
Tel: (01) 897 6446.*

4 3/4-DIGIT DMMs

Levell Electronics now supply 4 3/4-digit bench/portable multimeters that operate from either long-life batteries or ac mains. Ranges cover up to 1.2kV dc, 750V ac, 10A and 32 megohms. Resolution on the liquid crystal display is 10µV, 10nA and 10 milliohms.

The type 1503 has a basic dc accuracy of 0.05% and there is a version available with higher accuracy of 0.03%. The type 1504 provides true rms ac

ranges in place of the mean sensing ac ranges on the other versions. An additional feature of these multimeters is the inclusion of an accurate frequency range that displays up to 4MHz but can be used up to 7MHz with display overflow.

*Levell Electronics Ltd,
Moxon Street, Barnet,
Herts EN5 5SD.
Tel: (01) 449 5028.*

CO-AX CABLE TESTER

Now available in the UK from House of Instruments is the Soar Model 1500 cable checker, a pulse-reflection test instrument that will measure the length of coaxial cable from 5m to 1000m, as well as indicating whether the cable termination is open or short circuit.

The Model 1500 features a 4-digit LCD display which gives a direct readout of cable length in feet or metres, the units being selectable with a convenient front-panel switch. Accuracy is within ±1% of full-scale reading.

Two digital switches are provided to allow easy setting of the instrument's nominal velocity of propagation from 0.01 to 0.99, while interface to the cable under test is via a front-panel BNC connector.

The instrument is designed for portability, measuring 186 × 57 × 180mm and weighing 1.3kg. Power supply is from rechargeable nicads or an ac mains adaptor.

*House of Instruments,
Raynham Road,
Bishops Stortford,
Herts CM23 5PF.
Tel: (0279) 55155.*

4 1/2-DIGIT MULTIMETER

The new Global GDM1-41 is a 4 1/2-digit professional handheld multimeter offering nine measurement functions, including a 200MHz frequency counter.

Featuring a basic dc accuracy of 0.05%, the GDM1-41 provides measurements of dc and ac voltage and current as well as resistance, while additional functions include audible continuity testing, diode checking, a data-hold facility and the built-in frequency counter.

The instrument incorporates ranges five voltage ranges from 200mV to 1kV dc (or 750V ac), six current ranges from 200µA

to 10A, and six resistance ranges from 200Ω to 20MΩ. The ac measurements are true rms, ac coupled from 10% to 100% of the full-scale.

The GDM1-41 incorporates automatic polarity selection and negative polarity indication, automatic zero adjustment, over-range indication, and a 'battery-low' display. Function and range selection is via a simple rotary switch.

The new meter measures 17.5 × 9.1 × 3.6cm and operates from a single 9V battery.

*Global Specialties Corp,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.*

POCKET-SIZE COUNTER

New from Electronic Brokers is the Thandar PFM200A pocket-size counter offering a 20Hz - 200MHz frequency range.

The PFM200A provides a 0.1Hz resolution, a sensitivity of typically 10mV rms, and a timebase accuracy of 2ppm.

Battery operated, it has an 8-digit light-emitting diode (LED) display. Low battery indication is by illumination of all decimal points.

*Electronic Brokers Ltd,
140-146 Camden Street,
London NW1 9PB.
Tel: (01) 267 7070.*



LOGIC ANALYSER

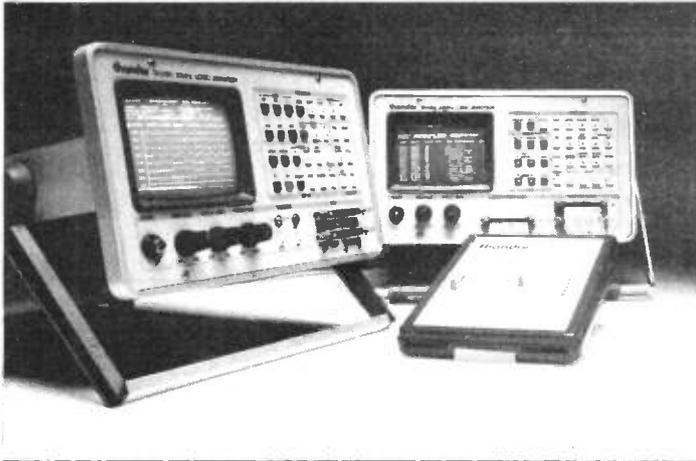
Thandar have announced a new pricing structure covering their range of logic analysers and disassembly options. This means that a TTL standard 20MHz analyser now costs as little as £1,295.00 with disassembly options for as little as £292.00.

Thandar offers two logic analysers in the current range, which is shortly to be extended. The TA2080 is an 8-channel 20MHz logic analyser with on-board VDU, capable of resolving both

timing and state formats, whilst the TA2160 16-channel version incorporates many additional features, including communications, two levels of triggering and two independent clocks.

Disassembly is available for Z80, 6800, 8085, 6809 and 6502.

*Thandar Electronics Ltd,
London Road,
St Ives,
Huntingdon,
Cambs PE17 4HJ.
Tel: (0480) 64646.*



SOUND LEVEL METER

The latest addition to the Castle Associates range of sound level meters, the GA204, is a general purpose low-level Type 2 instrument designed for both industrial and environmental noise work.

Low-level noise measurement often involves working outside and in poor light conditions. The GA204 is constructed in a tough die-cast metal body with a built-in wrist-strap. The analogue meter features a mirror scale and bright pointer which, coupled with LED indication of the range selected, makes the GA204 suitable for use in poor light. The circuitry used is Type 1 in common with the instrument's precision brother, the GA104 meter.

In keeping with other models in the range the GA204 is also available as a kit with companion calibrator in an attaché case or shoulder bag.

*Castle Associates Ltd,
Salter Road,
Scarborough YO11 3UZ.
Tel: (0723) 584250.*

BENCH POWER SUPPLY

Now available from Dawne Instruments is the DA302 series bench power supply. This instrument has a built-in digital voltmeter which enables the user to probe around his circuit without the use of an external DVM. The power supply can be constantly varied from 0 to 30V (usable to 35V) by normal coarse and fine manual controls and is settable to within 10mA between 0.2 amps with the current control.

The DA302 is highly stable with independent digital dual meters for both current and voltage indication. Voltage and current variations as well as ripple and noise have been reduced to a minimum.

The DA302 measures 280mm in length, 170mm in height and 160mm in width, and weighs approximately 5.2kg.

*Dawne Instruments,
4 Donkin Road,
Armstrong Industrial Estate,
Washington,
Tyne & Wear NE37 1PF.
Tel: (091) 4178288.*

LCR METER



A new LCR meter from Telonic shows LCR values on a 3½-digit display while simultaneously reading loss coefficient (D) on another display.

The Adex AX221's auto-range and auto-mode functions automatically choose the optimum range for measuring the unknown component, although manual range selection is an option. Also available is an analogue voltage output proportional to the measurement value, for use with an analogue recorder or a comparator.

Basic accuracy of the AX221 is $\pm 0.3\%$ on LCR readings and 0.5% on D readings. Inductance (L) measurement range covers 0.1 μ H to 199.9H, capacitance (C) measurement range is 0.1pF to 1000 μ F, and resistance (R) measurement range is 1 milliohm to 1999k. Measurement range of D is 0.001 - 1999 and measurement frequency is 1kHz.

*Telonic Instruments Ltd,
Boyn Valley Road,
Maidenhead,
Berkshire SL6 4EG.
Tel: (0628) 73933.*

SWITCHING PSUs

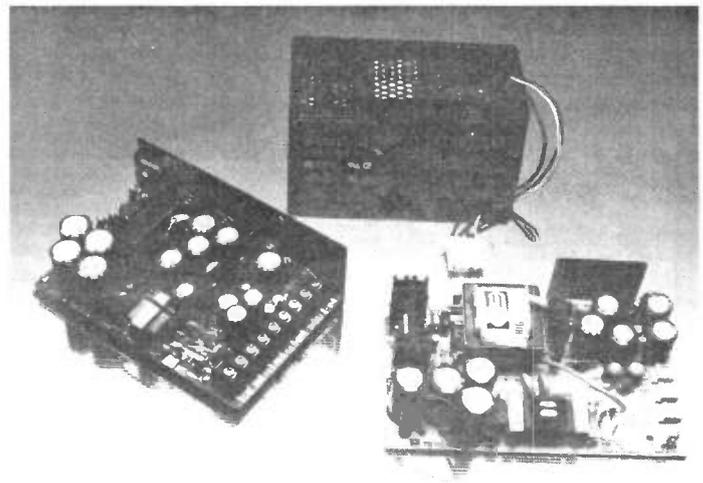
New from Emco Electronics is the Pihong range of switching power supplies.

The range comprises single, dual and triple output models ranging from 15 to 150 watts, many of which conform to international safety standards such as UL, CSA and FCC B.

Emco Electronics, better

known as a supplier of CRT monitors, has the exclusive UK marketing rights for the Pihong range. Pihong, which was founded in 1971, is one of Taiwan's leading power supply manufacturers.

*Emco Electronics Ltd,
129/131 Coldharbour Lane,
London SE5 9NY.
Tel: (01) 737 3333.*



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Carriage on all Keyboards £3.50

PLESSEY VUTEL

Manufactured by PLESSEY Ltd this compact unit, only slightly larger than a telephone, features an all in one TELEPHONE. 24 x 40 character CRT screen, VIEWDATA - PRESTEL modem.

Keypad and electronics to run as a fully fledged PRESTEL terminal or telephone. Ready to plug direct into a BT 600 type jack socket and instantly connect you to PRESTEL etc. Many other features include Memory dialling, Recall button, Off line screen data storage, Picture expand, Standard Mullard LUCY chip set, Integral 5" JVC crt monitor, etc etc. Designed to sell to the EXECUTIVE at over £600! But from DISPLAY, BRAND NEW and BOXED at only £99.00 for DTMF tone dial or £140.00 for standard DIAL PULSE version. Carr. £8.00.

SPECIAL 300 BAUD MODEM OFFER

Another GIGANTIC purchase of these EX BRITISH TELECOM, BRAND NEW or little used 2B data modems allows US to make the FINAL REDUCTION, and for YOU to join the exciting world of data communications at an UNHEARD OF PRICE OF ONLY £29.95. Made to the highest POST OFFICE APPROVED spec at a cost of hundreds of pounds each, the 2B has all the standard requirements for data base, business or hobby communications. All this and more!

- 300 baud full duplex
- Full remote control
- CCITT tone standards
- Supplied with full data
- Modular construction
- Direct isolated connection
- CALL, ANSWER and AUTO modes
- Standard RS232 serial interface
- Built in test switching
- 240v Mains operation
- 1 year full guarantee
- Just 2 wires to comms line

NOW ONLY £29.95

BT 600 Jack plug and cable £2.25 Carriage and Ins. £10.00

PRINTER / TERMINAL SCOOP

A MASSIVE purchase of these attractive stand alone terminal units enables a SUPER BARGAIN offer. Made by the US GENERAL ELECTRIC CORPORATION the GE MODEL 30 features a standard QWERTY 80 key electronic keyboard coupled to a quality built matrix printer with variable 3" to 9.5" forms tractor. The printer is capable of continuous duty printing, with up to 120 characters per line. Standard RS232 interface accepts ASCII data at 110, 150 or 300 baud. Ideal for Terminals, Data loggers, local label printing, or just as a printer! Sold TESTED with data ONLY £95.00. Also available with TWIN MAGTAPE CASSETTE unit for data capture, data preparation etc £150.00 Carriage £10.00.

COLOUR AND MONOCHROME MONITOR SPECIALS

'SYSTEM ALPHA' 14" COLOUR MULTI INPUT MONITOR made in the UK by the famous REDIFFUSION Co. for their own professional computer system this monitor has all the features to suit your immediate and future monitor requirements. Two video inputs: RGB and PAL Composite Video, allow direct connection to the BBC and most other makes of micro computers and VCR's. An internal speaker and audio amplifier may be connected to your systems output or direct to a VCR machine, giving superior sound quality. Many other features included PIL tube, Matching BBC case colour, Major controls on front panel, Separate Contrast and Brightness - even in RGB mode, Two types of audio input, Separate Colour and audio controls for Composite Video input, BNC plug for composite input, 15 way 'D' plug for RGB input, modular construction etc etc.

This Must be ONE OF THE YEAR'S BEST BUYS
Supplied BRAND NEW and BOXED, complete with DATA and 90 day guarantee. SUPPLIED BELOW ACTUAL COST - ONLY £149.00

DECCA 80 16" COLOUR monitor, RGB input. Little or hardly used manufacturer's surplus enables us to offer this special converted DECCA RGB Colour Video TV Monitor at a super low price of only £99.00, a price for a colour monitor as yet unheard of! Our own interface, safety modification and special 16" high definition PIL tube, coupled with the tried and tested DECCA 80 series TV chassis gives 80 column definition and picture quality guaranteed only on monitors costing 3 TIMES OUR PRICE. In fact, WE GUARANTEE you will be delighted with this product, the quality for the price, has to be seen to be believed. Supplied complete and ready to plug direct to a BBC MICRO computer or any other system with a TTL RGB output. Other features are: internal speaker, Modular construction, auto degaussing circuit, Attractive TEAK CASE, compact dimensions only 52cm W x 34 H x 24 D, 90 day guarantee. Although used, units are supplied in EXCELLENT condition, ONLY £99.00 + Carr.

DECCA 80, 16" COLOUR monitor. Composite video input. Same as above model but fitted with Composite Video input and audio amp for COMPUTER, VCR or AUDIO VISUAL use. ONLY £99.00 + Carr.
REDIFFUSION MARK 3, 20" Colour monitor. Fitted with standard 75 ohm composite video input and sound amp. This large screen colour display is ideal for shops, schools, clubs and other AUDIO VISUAL applications. Supplied in AS NEW or little used condition ONLY £145.00 + Carr.

BUDGET RANGE EX EQUIPMENT MONOCHROME video monitors.

All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for 80 column use on BBC micro etc. Even when MINOR screen burns exist - normal data displays are unaffected.
12" KGM 320-1 B/W high bandwidth input, will display up to 132 x 25 lines.

12" GREEN SCREEN version of KGM 320-1 Only £39.95
9" KGM 324 GREEN SCREEN fully cased very compact unit Only £55.00
9" HITACHI VM-906E/K Black and White screen £49.95

Carriage and insurance on all monitors £10.00

D.C. POWER SUPPLY SPECIALS

GOULD OF443 enclosed compact switch mode supply with DC regulated outputs of +5v @ 55a, +12v @ 0.5a, -12v @ 0.1a and -23v @ 0.02a. Dim 18 x 11 x 6 cm 110 or 240v input. BRAND NEW only £14.95

GOULD G6-40A 5v 40 amp switch mode supply NEW £130.00
GREENDALE 19A-BOE Switch mode 60 watt open PCB with a fully regulated DC output of 5v @ 6amps, and three semi regulated outputs of +12v, -12v +15v @ upto 1 amp. Dim only 11 cm x 20 cm x 5.5 cm. Similar to RS 591-994 110 or 240V AC input. TESTED ex equipment. Only £24.95

AC-DC Linear PSU for DISK drive and SYSTEM applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5V @ 3amps, -5V @ 0.6 amps and +24v @ 5amps. Short circuit and overvoltage protected. 110 or 240 V AC input. Dim 28 x 12.5 x 7 cm NEW £49.95.
Carriage on PSU's £3.00

VDU TERMINALS

Standard VDU data entry terminals at give away prices!

QUME QVT108. Current product, state of the art terminal with detachable keyboard, 12" green screen, 2 page RAM, TVI 925 emulation, 25 x 80, Clock, Swivel and tilt base, Printer port, Function keys etc. BRAND NEW and BOXED AT ALMOST HALF PRICE ONLY £425.00

AJ510 - EX RENTAL Z80 controlled, 15" green screen 24 x 80 display, graphics, cursor addressing, printer port etc. Very good condition TESTED complete with manual only £225.00.
ADDS 520 - Dumb terminal, used, 12" b/w screen RS232 interface and printer port. TESTED. ONLY £125.00

Carriage on terminals £10.00
100's of other terminals in stock
CALL for more details.

DISPLAY ELECTRONICS

All prices quoted are for U.K. Mainland, paid cash with order in Pounds Sterling PLUS VAT. Minimum order value £2.00. Minimum Credit Card order £10.00. Minimum BONA FIDE account orders from Government Depts, Schools, Universities and established companies £20.00. Where post and packing not indicated please ADD £1.00 + VAT. Warehouse open Mon-Fri 9.30-5.30. Sat 10.30-5.30. We reserve the right to change prices and specifications without notice. Trade, Bulk and Export

32 Biggin Way, Upper Norwood, London SE19 3XF
Telephone 01-679 4414 Telex 894502 Data 01-679 1888



ERS — PRINTERS — PRINTERS — PRINTERS

SUPER DEAL? NO - SUPER STEAL THE FABULOUS 25 CPS "TEC STARWRITER"

Made to the very highest spec the **TEC STARWRITER FP1500-25** features a very heavy duty die cast chassis and **DIABLO** type print mechanism giving superb registration and print quality. Micro-processor electronics offer full **DIABLO/GUME** command compatibility and full control via **CPM WORDSTAR ETC.** Many other features include bi-directional printing, switchable 10 or 12 pitch, full width 381mm paper handling with up to 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard **RS232** serial interface with handshake. Supplied absolutely **BRAND NEW** with 90 day guarantee and **FREE** daisy wheel and dust cover. Order **NOW** or contact sales office for more information. Optional extras **RS232** data cable £10.00. Tech manual £7.50. **Telex** Fee £140.00. Spare daisy wheel £3.50. Carriage & Ins. (UK Mainland) £10.00.



SUMMER OFFER ONLY £399.99!!

DIY PRINTER MECH

Brand New surplus of this professional printer chassis gives an outstanding opportunity for the **Student, Hobbyist or Robotics** constructor to build a **printer - plotter - digitiser** etc, entirely to their own specification. The printer mechanism is supplied ready built, aligned and pre tested but **WITHOUT** electronics. Many features include all metal chassis, phosphor bronze bearings, **132** character optical shaft position encoder, **NINE** needle head, 2 x two phase 12V stepper motors for carriage and paper control, 9.5" Paper platen etc. etc. Even a manufacturer's print sample to show the unit's capabilities!! Overall dimensions 40 cm x 12 cm x 21 cm.
Sold **BRAND NEW** at a **FRACTION** of cost **ONLY £49.50 + pp £4.50.**

TELETYPE ASR33 DATA I/O TERMINALS

Industry standard, combined ASCII 110 baud printer, keyboard and 8 hole paper tape punch and reader. Standard **RS232** serial interface. Ideal as cheap hard copy unit or tape prep. for CNC and NC machines. **TESTED** and in good condition. Only **£235.00** floor stand **£10.00.** Carr & Ins. **£15.00.**

EX NEWS SERVICE PRINTERS

Compact ultra reliable quality built unit made by the **USA EXTEL Corporation.** Often seen in major Hotels printing up to the minute News and Financial information, the unit operates on **5 UNIT BAUDOT CODE** from a Current loop, **RS232** or TTL serial interface. May be connected to your micro as a low cost printer or via a simple interface and filter to any communications receiver to enable printing of worldwide **NEWS, TELEX** and **RTTY** services.

Supplied **TESTED** in second hand condition complete with **DATA, 50 and 75 baud** xtals and large paper roll.

TYPE AE11 50 Column **ONLY £49.95**
Spare paper roll for AE11 **£4.50**
TYPE AF11R 72 Col. **£65.00**
+ Ribbon
TYPE AH11R 80 Col. **£185.00**
ASCII/BAUDOT
Carriage and Insurance **£7.50**

GE TERMIPRINTER



A massive purchase of these desk top printer terminals enables us to offer you these quality **30 or 120 cps** printers at a **SUPER LOW PRICE** against their original cost of over **£1000.** Unit comprises of full **QWERTY**, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width - up to **13.5" 120 column** paper, upper - lower case, standard **RS232** serial interface, internal vertical and horizontal tab settings, standard ribbon, adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working **GE30 £130.00. GE1200 120 cps £175.00. Untested GE30 £65.00** Optional floor stand **£12.50.** Carr & Ins. **£10.00.**

SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors digital, linear, IC's, triacs, diodes, bridge recs, etc. etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed.
50+ £2.95 100+ £5.15
TTL 74 Series. A gigantic purchase of an "across the board" range of **74 TTL** series IC's enables us to offer **100+** mixed "mostly TTL" grab bags at a price which two or three chips in the bag would normally cost to buy. Fully guaranteed all IC's full spec. **100+ £6.90, 200+ £12.30, 300+ £19.50**

CENTRONICS 710 PRINTERS

Ex **RENTAL** Heavy duty full width carriage printer up to **132 columns** on 17" fan fold sprocket fed paper. 60 cps print speed with standard **RS232** or 20 mA loop interface. Supplied in **TESTED** used condition with data **ONLY £85.00** carriage and insurance **£10.00.**

MAINS FILTERS

CURE those unnerving hang ups and data glitches caused by mains interference with professional quality filters. **SD5A** match box size up to **1000 watt 240 V** Load **ONLY £5.95.** **L12127** compact completely cased unit with 3 pin fitted socket up to **750 watts ONLY £9.99.**

EPROM COPIERS

The amazing **SOFTY 2** The "Complete Toolkit" for copying, writing, modifying and listing **EPROMS** of the **2516, 2716, 2532, 2732** range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o UHF modulator ZIF socket etc.
ONLY £195.00 + pp £2.50.
"GANG OF EIGHT" intelligent Z80 controlled 8 gang programmer for ALL single 5v rail EPROMS up to 27128. Will copy 8 27128 in **ONLY 3 MINUTES.** Internal LCD display and checking routines for **IDIO PROOF** operation. Only **£395.00 + pp £3.00.**
"GANG OF EIGHT PLUS" Same spec as above but with additional **RS232** serial interface for down line loading data from computer etc. **ONLY £445.00 + pp £3.00**
Data sheets on request

**20,000 FEET OF ELECTRONIC
AND COMPUTER GOODIES**
ENGLAND'S LARGEST SURPLUS STORE - SEEING IS BELIEVING!!

DEC CORNER

PDP 1140 System comprising of CPU, 124k memory & MMU 15 line RS232 interface
PPO2 40 MB hard disk drive.
TUI0 9 track 800 BPI Mag tape drive, dual track system. VT52 VDU, etc. etc. Tested and running **£3,750.00**
BA11-MB 3.5" Box, PSU, LTC **£395.00**
DH11-AD 16" x RS232 DMA interface **£1,900.00**
DLV11-J4 x EIA interface **£350.00**
DLV11-E Serial. Modem support **£190.00**
DUP11 Synch. Serial data i/o **£650.00**
DQ200 Dialog - multi RK controller **£495.00**
DZ11-B 8 line RS232 mux board **£650.00**
KDF11-B M8189 PDP 1123 PLUS **£1,100.00**
LA30 Printer and Keyboard **£80.00**
LA36 Decwriter EIA or 20 mA loop **£270.00**
MS11-JP Unibus 32kb Ram **£80.00**
MS11-LB Unibus 128kb Ram **£450.00**
MS11-LD Unibus 256kb Ram **£850.00**
PDP11/05 Cpu Ram, i/o etc **£450.00**
PDP11/40 Cpu, 124k MMU **£1,850.00**
RT11 ver 3B documentation kit **£70.00**
RK05-J 2.5 Mb disk drives **£650.00**
KL8 JA PDP 8 async i/o **£175.00**
M18E PDP 8 Bootstrap option **£75.00**
VT50 VDU and Keyboard - 20 mA **£175.00**
VT52 VDU and RS232 interface **£250.00**

Give your **VT100** a Birthday!!!
Brand New **VT100** Keyboards only **£85.00.**

1000's of **EX STOCK** spares for **DEC PDPs, PDP8A, PDP11** systems & peripherals. Call for details. All types of Computer equipment and spares wanted for **PROMPT CASH PAYMENT.**

MAG TAPE DRIVES

Many **EX STOCK** computer tape drives and spares by **PERTEC, CIPHER, WANGO, DIGIDATA, KENNEDY** etc. Special offer this month on **DEI Cartridge** tape drives **ONLY £450.00 each.**

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

All in one quality computer cabinet with integral switched mode PSU, mains filtering, and twin fan cooling. Originally made for the famous **DEC PDP8** computer system costing thousands of pounds. Made to run 24 hours per day the psu is fully screened and will deliver a massive **+5v DC** at 17 amps, **+15v DC** at 1 amp and **-15v DC** at 5 amps. The complete unit is fully enclosed with removable top lid, filtering, trip switch, power and run leds mounted on all front panel, rear cable entries, etc. etc. Units are in good but used condition - supplied for 240v operation complete with full circuit and tech. man. Give your system that professional finish for only **£49.95 + carr. 19"** wide **16"** deep **10.5"** high. Useable area **16" w 10.5" h 11.5" d.**

Also available less psu, with fans etc. Internal dim. **19" w, 16" d, 10.5" h. £19.95. Carriage £8.75**

66% DISCOUNT ON ELECTRONIC COMPONENTS EQUIPMENT

Due to our massive bulk purchasing programme, which enables us to bring you the best possible bargains, we have thousands of ICs, Transistors, Relays, Caps, PCBs, Sub-assemblies, Switches etc. etc. surplus to OUR requirements. Because we don't have sufficient stocks of any one item to include in our ads we are packing all these items into the **BARGAIN OF A LIFETIME.** Thousands of components at giveaway prices. Guaranteed to be worth at least 3 times what you pay. Unbeatable value and perhaps one of the most consistently useful items you will every buy!!! Sold by weight

2.5kls **£5.25 + pp £1.25**
10kls **£11.25 + pp £2.25**

5 kls **£6.90 + £1.80**
20kls **£19.50 + pp £4.75**

1000's of other **EX STOCK** items including **POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIACS, VDU'S, PRINTERS, POWER SUPPLIES, OPTICS, KEYBOARDS** etc. etc. Give us a call for your spare part requirements. Stock changes almost daily.

Don't forget, **ALL TYPES** and **QUANTITIES** of electronic surplus purchased for **CASH**



PRODUCT NEWS



MICROFRAME ADDITIONS

Gordon Micro Ltd, specialists in Spectrum interfacing and expansion, have now added Microdrive syntax and Hook codes to their Microframe floppy disc interface. This makes the Microframe compatible with the Interface 1 and Microdrive commands, so all program software using Hook codes and Microdrive syntax now operates on the Microframe.

The Microframe floppy disc controller is also a mother-

board expansion system which can take up to 5 interface cards.

Gordon manufacture a full range of interfaces including RS232 modem driver, Centronics parallel printer, digital to analogue converters, analogue to digital converters, 64K paged map memory etc.

*Gordon Micro Ltd,
3 Callendar Road,
Heathfield Industrial Estate,
Ayr KA8 9DJ.
Tel: (0292) 280467.*

DATA BACK-UP



Rapid Recall, authorised distributors for Control Data peripherals, are now supplying the new Sentinel 92192 0.25 tape cartridge subsystem from stock.

This unit provides 70Mbytes

of unformatted storage back-up for Winchester discs and features full 0.5 inch tape transport functions plus automatic track referencing, microprocessor-controlled logic, write/read error logging, an integrated formatter, and tape re-tensioning during the load sequence.

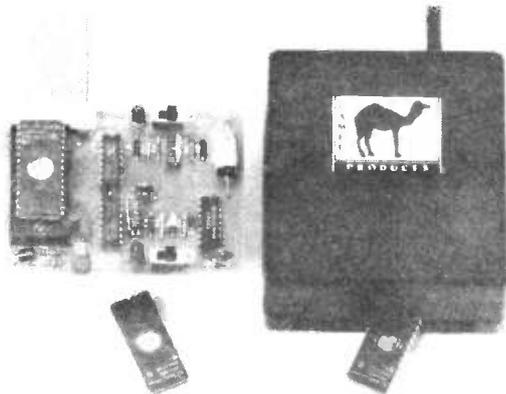
The single-track read/write head records in a serpentine pattern of eleven tracks. Media interchangeability between 92192 drives is ensured by automatically recording a servo track when a cartridge is initially written;

EPROM PROGRAMMER

Cambridge Microelectronics have introduced a cost effective EPROM programmer for the BBC micro.

This programmer, called

BB-PROM, is supplied ready-built and tested. It requires a BBC-B micro plus disc drive, and plugs into the user port of the BBC by means of the connector provided.



MULTIFUNCTION INTERFACE

The PCI 6480 is the latest product available from CIL Microsystems. This instrument is based on the PCI 6380 and brings multifunction interfacing within reach of the smallest budget.

It provides four analogue inputs, programmable in the range $\pm 100\text{mV}$, $\pm 1\text{V}$ and $\pm 10\text{V}$, two $\pm 10\text{V}$ analogue outputs and two relay enclosures rated at 1A, 240V ac.

The basic model is available with IEEE communications and 4K RAM, and is housed in



a bench mounting case.

Various options are available, including RS232 in place of IEEE, 32K extension RAM card, 16 digital input/output lines and a 19in rack mounting enclosure.

The PCI 6480/IEEE is priced at £395.00.

*CIL Microsystems Ltd,
Decoy Road,
Worthing,
Sussex BN14 8ND.
Tel: (0903) 210474.*

on subsequent read operations a stepper motor aligns the head to the servo track and provides drive compatibility. The 92192 uses a 600ft cartridge, has a tape speed of 55in/s and a data transfer rate of 440Kbits/s.

*Rapid Recall Ltd,
Rapid House,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 26271.*

DRIVER/RECEIVER IC

Motorola Telecommunications Group has introduced the MC145406 RS-232-C/V.28 driver/receiver, the first silicon-gate CMOS integrated circuit (IC) fulfilling the electrical specifications of EIA standard RS-232-C and CCITT V.28 on one device.

BB-PROM is entirely self-contained, requiring no extra supplies. The driver program for the programmer is supplied on an EPROM for use as a sideways ROM in the BBC.

It will handle the 2764 (8K) and 27128 (16K) EPROMs. By the addition of an extra resistor, their 'A' versions can also be handled. Frequently used programs can therefore become easily accessible with the well-known speed and reliability of ROMs.

The BB-PROM is available for £34.44 including P&P and VAT.

*Cambridge
Microelectronics Ltd,
1 Milton Road,
Cambridge CB4 1UY.
Tel: (0223) 314814.*

The RS-232-C interface standardises communication between data communication equipment, usually a modem, and data terminal equipment or computers. The RS-232-C specifications define the transfer of data in terms of connector requirements, electrical signals, pin assignments and descriptions, and data rates, all of which are met with the MC145406.

The MC145406 combines three drivers and three receivers in a single 16-pin package. The drivers, operating within a $\pm 5\text{V}$ to $\pm 12\text{V}$ power supply range, feature true TTL input compatibility. Slew-rate output maximum is $\pm 30\text{V}$ per microsecond, eliminating the need for external capacitors to limit the slew rate. The 300 ohms power-off source impedance resistors meet the power-off resistance specification in RS-232-C cable, with output typically switching to within 15 per cent of the supply rails.

The receivers level-shift input voltages in the range -25V to $+25\text{V}$ down to TTL/CMOS logic levels of zero volts to +5 volts, presenting 3 to 7 kilohms input impedance. Hysteresis on the input switch point aids noise immunity in the receivers by changing the threshold.

Power consumption improvement is one of the most significant features of the new silicon-gate CMOS MC145406, which dissipates less than 15mW maximum.

*Motorola Inc,
MOS Logic and Analog
Integrated Circuits Division,
PO Box 6000,
Austin, Texas 78762.*

NO INTERFERENCE

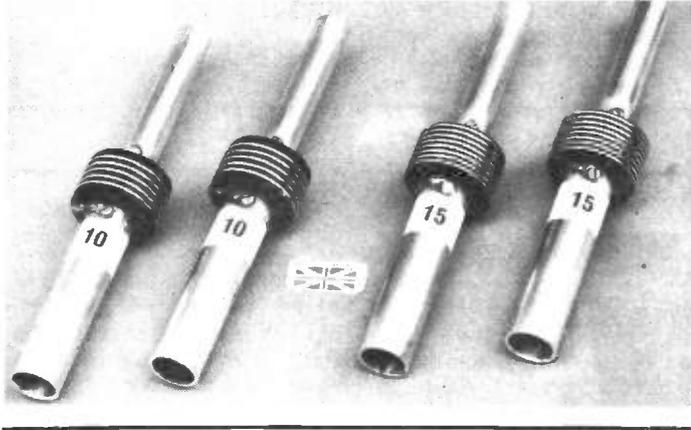
G2DYM Aerials, manufacturers of a range of anti-TVI trap dipoles, have announced the addition of new 10 and 15 metre models to their range of aerial traps for 10, 15, 20, 40 and 80 metres.

The latest models are available with 6 inches of aluminium tube at each end to facilitate the building of two or three element rotary tri-

banders, rotary tri-bander dipoles and trap verticals, either quarter or half-wave in height.

These 10 and 15 metre traps can be obtained for £10 each + £1 P&P.

*G2DYM Aerials,
'Cobhamden Castle',
Uplowman,
Nr Tiverton,
Devon.*



DESIGN KIT

Motorola Microprocessor Products Group has assembled the M68000KIT, a design package which enables the design engineer to develop M68000-based systems. The design kit contains the MC68000 and MC68008 microprocessors, six peripheral devices, related data sheets, application notes, and supportive documentation.

Programmer's reference manuals, handy pocket-sized instruction reference booklets and programming refer-

ence cards for the MC68000 and MC68008 are included. For all devices the kit provides article reprints with actual system design examples. A catalogue lists software and system level hardware available to support the M68000 family.

The complete MC68000KIT is priced at \$68.00.

*Motorola Inc,
Microprocessor Products
Division,
3501 Ed Bluestein Blvd,
Austin, Texas 78721, USA.*

TAXI!

Epson (UK) Limited recently announced the release of its graphics user interface, Taxi, for the IBM PC and 100% IBM compatible systems. Released initially with Epson's latest micro, the QX-16, Taxi offers the IBM user a complete system consisting of a mouse, icons, desk accessories and applications software support – all for £199 (RRP).

Taxi uses no user memory, since all the memory required is present out of the interface board. It has a wide range of desk accessories, comprising a calculator, clock calendar, note pad, printer set-up and a

game (Othello), which are available at any time.

Taxi allows pop-up menus to be easily installed within any applications program and any application program can have mouse cursor control installed.

Epson's Taxi offers a high level of support to standard PC-DOS business packages without modification of the software.

*Epson (UK) Ltd,
Dorland House,
388 High Road,
Wembley,
Middlesex HA9 6UH.
Tel: (01) 902 8892.*



THE LOWE-DOWN

A new monitor receiver, the AOR AR2002, has recently been introduced by Lowe Electronics Ltd.

Frequency coverage is 25 to 550MHz and 800 to 1300MHz. An improved keyboard aims to make operation easier and there is a front panel knob for frequency stepping in addition to up/down buttons. Also on the front panel is an LED

strip S-meter and a headphone jack.

On the rear panel there is a socket for an optional RS232 interface board.

The AOR AR2002 is priced at £375 inc VAT, + £7.00 carriage.

*Lowe Electronics Ltd,
Chesterfield Road,
Matlock,
Derbyshire DE4 5LE.
Tel: (0629) 2817.*

REMOTE CONTROL

IQD has announced its latest tone controlled system, Phonecontrol. This has been selected as the remote switching mechanism for local radio stations' remote studios, and considerable interest has been shown in its wider application.

Accessed through the public telephone network from anywhere in the world, a Phonecontrol unit can activate, monitor and control up to 99 different functions – either incorporated as part of original equipment or as an addition to existing plant.

Authorised callers simply dial a dedicated line number followed by a security access phone code using an acoustic keypad. Phonecontrol responds with a synthesised voice signal confirming the



identity of the function and its current status. The caller can then change status, if desired, by keying a further tone code.

Applications for Phonecontrol include remote supervision of factories and industrial processes, electronic detectors, security and thermostat control.

*IQD Ltd,
North Street,
Crewkerne,
Somerset TA18 7AR.
Tel: (0460) 74433.*

4-STANDARD DECODERS

Following the recent introduction of fully automatic four-standard decoders in Brabury's MCM-B series of broadcast colour television monitors, the company has announced that these decoders are now also fitted in the MCM-A series of general purpose models.

The new decoder gives immediate conversion to 625-line PAL or SECAM or to 525-line NTSC with either 3.58MHz or 4.43MHz subcarrier. In operation the decoder senses the subcarrier frequency and the coding characteristics of the incom-

ing video signal, and automatically configures to the appropriate decoding circuit.

In addition to two switch-selected composite video input channels (with bridged BNC loop-through connectors), the MCM-A monitors are fitted with an EIAJ connector for operation in conjunction with a video cassette recorder. They also accept RGB inputs with separate sync input or sync on green.

*Brabury Ltd,
Unit 1, The Paddock,
Hambridge Road,
Newbury, Berks RG14 5TQ.
Tel: (0635) 33433.*



PCB WORKSTATION

The Solution 2000 is a new PCB design workstation capable of designing boards as large as 812 x 812mm. The system can handle large, multilayer boards of up to 400 14-pin equivalent ICs. It has a gridless database which can utilise either inch or metric units, down to .001 inch. Output can be generated either on-line with a pen or photoplotter or off-line from paper tapes or magnetic tapes created on the system.

The software for the new system uses dual processors and a cache memory for rapid command execution. The CPU is a DEC LSI 11/23+ and is used in conjunction with EIE's own graphics card, enabling rapid redraws and editing. The program supports up to 64 user-defined layers and displays eight different colours on the standard 14 inch monitor.

The standard package

includes a mouse for cursor control, parts and wiring entry, placement, manual artwork routing, automated design rule checking programs, multitasking and output to a printer and paper tape punch.

Optional packages available include schematic capture, a digitiser interface program, a wide variety of output drivers and a conversion program that reads in Gerber-formatted data from magnetic tape.

The Solution 2000 complements the popular EIE 80/10 PCB CAD system and offers the smaller user a system at a realistic cost, with the facility to upgrade and extend as and when necessary.

*Electronic Industrial Equipment,
Old Orchard House,
Old Orchard, Poole,
Dorset BH15 1AE.
Tel: (0202) 684004.*

32-BIT COMPUTER

National Semiconductor Corporation has introduced the first in a family of 32-bit board-level computers, which combine user configurability with performance equivalent to a VAX machine.

This new line of board-level products, called integrated computer modules (ICM), is based on National's Series 32000 32-bit microprocessor family, and is suitable for applications such as workstations, CAD/CAM, robotics, data acquisition, etc.

The first product in the family is the ICM-3216, which utilises the NS32016 CPU, the NS32081 FPU (floating point unit), the NS32082 MMU (memory management unit), the NS32201 TCU (timing and control unit) and the NS32202

ICU (interrupt control unit), along with four serial ports, a parallel port, a small computer system interface and a 16-bit I/O bus - all on a 9 x 11 inch board format.

Depending on the desired size of physical memory, the computer module consists of either two or three printed circuit boards (9.18 x 11.02 inches). One board is a CPU board which provides all computing functions such as CPU, disk/tape control, serial ports and a printer port. Memory occupies either one or two boards, providing from 1 to 8 megabytes of dynamic RAM.

*National Semiconductor,
Industriestrasse 10,
D-8080 Fürstfeldbruck,
West Germany.*

INCREMENTAL ENCODER

A new HCMOS encoder from Texas Instruments, the THCT2000, provides an easy to use interface between mechanical devices and microprocessors.

It can determine the direction and displacement of a mechanical device by using two input signals from transducers placed in quadrature. Applications include robotics, tracker balls and 'mice', lathes, tooling machines, automobiles, conveyor belts and transport mechanisms.

The encoder can also be programmed for the measurement of pulse width, fre-

quency or time. It includes a 16-bit counter which can be used separately. Cascading the THCT2000 to allow data words of over 16-bit length provides increased accuracy.

Other features include full TTL compatibility and a simple read and write procedure.

It is a 28-pin integrated circuit in a dual-in-line package. Operating temperatures can range from 0 to 70°C, while the required supply voltage is 5V.

*Texas Instruments,
Manton Lane,
Bedford MK41 7PA.
Tel: Bedford 67466.*

MINI THERMISTORS

A new range of miniature precision thermistors (negative temperature coefficient resistors), introduced by Iskra, comprises of two families of standard disc-shaped models which are available either with or without wire connections, although specials can also be supplied to suit unusual requirements.

Iskra's Elveterm range of thermistors have specific resistance values between 10⁻¹ and 10⁶ ncm, and the two basic families have the designations UN2 and UN3. The UN2 family has a maximum diameter of 10.5mm and a maximum power dissipation of 1W, while the UN3 mea-

sures 5.5mm diameter (max) and has a maximum power dissipation of 0.5W. Resistance values range from 8.2 to 33 000 ohms for the UN2, and from 33 to 100 000 ohms for the UN3, and in both cases a resistance tolerance of ±5%, ±10% or ±20% is available.

The working temperature range is 0°C to +55°C at maximum power, and -25°C to +125°C at zero power for all models. The thermal time constant is approx 60s for the UN2 family and 20s for the UN3.

*Iskra Ltd,
Redlands, Coulsdon,
Surrey CR3 2HT.
Tel: (01) 668 7141*

ANTI-STATIC PUMP

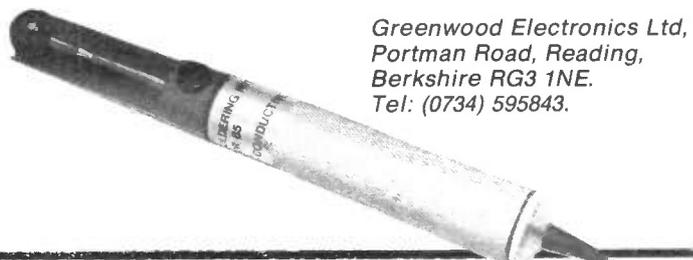
Greenwood Electronics, manufacturers of the popular Oryx brand production tools for the electronics industry, have now released a newly designed anti-static desoldering pump - the Oryx SR3A-ASN.

It was originally built for a UK electronics company who required a low resistance between the desoldering tip and the operator to ensure static-free operation. The design is based on the proven

reliability of the Oryx SR3A pump's simple mechanical construction. However, advanced materials were used throughout with a carbon loaded PTFE tip and aluminium body with conductive plating. This enables a typical resistance of 10 kilohms between tip and operator.

The Oryx SR3A-ASN is suitable for any application that requires anti-static desoldering with operators connected to an anti-static earthing system through wrist straps or a conductive floor.

*Greenwood Electronics Ltd,
Portman Road, Reading,
Berkshire RG3 1NE.
Tel: (0734) 595843.*



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NEWS DESK

Community radio

Following the release of the Government's outlines on community radio, covering the classes of licence and permitted modes of operation, Eddystone Radio has announced the types of package that will be available from the company.

According to the Government publication, the authorised effective radiated power (ERP) for 'small neighbourhood' stations using VHF transmitters will be 10W.

For this type of application Eddystone has a compact, synthesised FM stereo transmitter, type XE-15/T.

For 'community of interest' stations, ie those aimed at a specific group of listeners such as a certain ethnic group, using VHF, the authorised ERP is 100W. Eddystone has developed the 2501 transmitter for this power level.

MF transmitters for small neighbourhood and community of interest stations, which have authorised powers of 25W and 100W respectively, are currently under development.

However, an MF transmitter for 'larger neighbourhood' stations is available - the solid-state B6038 which can

supply the specified 1kW power rating.

PolyMOS process

Siliconix has introduced several new integrated circuits fabricated using the PolyMOS process. The PolyMOS process is a state-of-the-art silicon-gate CMOS process developed and optimised during the last two years. This process uses ion implantation for all impurity introduction steps, makes extensive use of plasma etching, has 5-micrometer feature sizes and uses plasma nitride for final passivation.

The PolyMOS process can be used to fabricate a variety of diodes, resistors, and other circuit elements. With two levels of polycrystalline silicon available, fabrication of fully-isolated, minimum area capacitors is possible, and an on-board diode is available for generating a precision

reference voltage (approximately six volts).

Circuits operate with voltages as low as five volts and as high as fifteen volts. Isoplanar field implants enable these circuits to operate over the full military temperature range of -55°C to $+125^{\circ}\text{C}$ because of their low leakage currents. Threshold voltages on the n-channel and p-channel transistors may be matched.

The PolyMOS process begins with an n-substrate and an ion-implanted p-well. LOCOS with field implants results in minimum surface area devoted to device-to-device isolation. This allows smaller digital circuit design, which is especially valuable for data converters and circuits with analogue and digital functions on the same chip (eg the Si7135 analogue-to-digital converter). The n-substrate also leads to less noise.

For further information, contact: *Siliconix Ltd, Morriston, Swansea SA6 6NE.*

DBS review

The IBA is now inviting approaches from organisations who would be interested in providing one or more DBS television services, following the request by the Home Secretary to review the prospects for launching a viable project by the award of IBA contracts.

Submissions are also being invited by the IBA from any other organisations who wish to provide relevant evidence about the circumstances necessary for DBS services to be successful (*the Home Secretary might care to ponder on the desirability of a somewhat less hypocritical attitude from the Government towards DBS, since it was largely the Government's lack of commitment which gave the kiss of death to earlier proposals*).

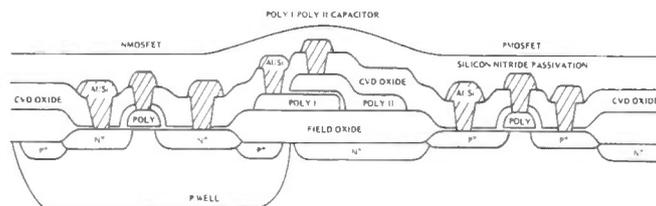
In the light of the IBA's review and his own consideration of other ways by which satellite broadcasting might be developed, the Home Secretary will decide whether the relevant provisions of the Cable and Broadcasting Act 1984, sections 37-41, should be brought into force.

The IBA is issuing guidelines to interested organisations. These are available from: *IBA, 70 Brompton Road, London SW3 1EY. Tel: (01) 584 7011.*

Satellite technology

Marconi Defence Systems Ltd has been contracted to develop what will be Europe's first space-borne 200GHz advanced microwave sounding unit (AMSU-B) for the UK Meteorological Office. This will observe the radiation temperature in the upper atmosphere, lead to a better understanding of weather patterns, and result in more accurate meteorological forecasts.

The flight model AMSU arising from this development will be placed aboard a National Oceanographic and



Low-power telemetry

A new low-power radio telemetry system, Lowtel, has been developed by Tactico for use in hazardous or otherwise impractical remote sensing applications. Lowtel comprises a central station and a remote outstation.

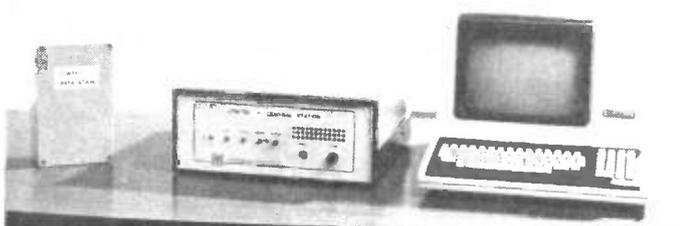
The central station can handle signals from up to 15 outstations over a single UHF

radio channel. Available as either 19-inch rack-mounted or Eurocard modules, the station employs 2-tone angle-modulated frequency-shift keying (AFSK), encoded as standard ASCII serial data. The decoder output is RS232C compatible and has a selectable baud rate in the range 300 to 9600 baud.

The outstation can handle up to 12 TTL/CMOS compatible logic inputs or two ratiometric analogue inputs. Input amplifier can accommodate a wide range of analogue signal levels, and a 5 volt power supply is provided for sensor excitation. Enclosed in a die-cast aluminium weather-proof housing, the outstation has a radiated power output of up to 500mW, adjustable to suit the operating environment.

Power is supplied by an internal battery and stability is better than $\pm 2.5\text{kHz}$ over a temperature range of -10 to $+60^{\circ}\text{C}$.

In addition, Tactico recently announced that they have been appointed the exclusive UK distributor for Microwave Modules products.



Atmospheric Administration (NOAA) advanced TIROS-N weather satellite in 1990. The whole programme is being undertaken with the co-operation of the US National Aeronautical and Space Administration.

The sensors comprise five channels offering 15km resolution. Two will operate at 89GHz and 166GHz, and three at frequencies near the strong 183GHz water vapour resonance. These channels sense water vapour profiles and precipitation over land and sea and are particularly sensitive to ice clouds.

The instrument will work in conjunction with a lower frequency unit (AMSU-A) which will collect data in the oxygen absorption band below 60GHz.

AMSU would scan through nadir, mapping a swath 2,320km wide and providing full coverage every 12 hours for latitudes higher than 30° N/S: the nadir 3dB beam-widths would be ~50km below 60GHz, and would be 15km otherwise. Views would be contiguous in two dimensions, overlapping near the 3dB beam contours.

The 50km resolution of the water vapour images over ocean is adequate to define

the position of a frontal zone with an accuracy of 10 to 20km, and the 15km channels can define it and the associated precipitation cells with even higher precision. The ability of the 89 - 183GHz channels to penetrate cirrus and to respond strongly to ice clouds is unique and a valuable all-weather marker for strong convective activity over both land and sea. The 15km resolution of the water vapour images should mark not only zones of ascending and descending air masses, but also the tops of clouds.

Eurocast '86

New dates have been announced for Eurocast '86 - the European Cable and Satellite Television Exhibition and Conference. It will now be held from 11-13 February 1986 in Basel, Switzerland. The conference was originally scheduled for March.

The Eurocast '86 dates have been changed so as not to overlap with the annual Swiss Industries Fair in Basel.

The venue for the conference is the European World Trade and Convention Centre. All enquiries regarding the exhibition and conference should be made to: *Cable & Satellite Television*

Exhibitions Ltd, 3 Barratt Way, Tudor Road, Harrow, Middlesex HA3 5QG.

Cirkit takes control

In future the marketing and distribution of the WPO Communications range of amateur radio kits is to be carried out by Cirkit Holdings.

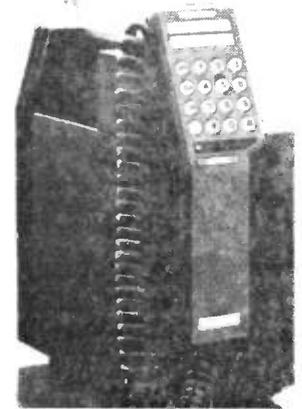
This is to allow Tony Bailey, who masterminded the development of the WPO range, to devote his attention to further product development, write new specifications and to continue communications over the air.

The company's autumn catalogue is now available and features the WPO range for the first time.

Rent a radiophone

A range of portable radiophones, compatible with the BT Cellnet and Racal Vodaphone systems, is now available for rental by the day or week from Microlease plc.

Supplied with magnetic mounted antenna, handset, battery, cigar lighter adaptor and battery charger, the transportable Mobira unit can be installed in the car or hand-carried. The Motorola portable is a compact unit, supplied with either a rapid or an ordinary battery charger.



Facilities soon to be available include a conference call function enabling three-way conversations on one call and a CDLC computer data transmission function which allows the telephone access point to be used as a modem.

The Mobira transportable and the Motorola portable are available at a weekly hire rate from £70 per week (£20 per day) excluding charges.

For a copy of the latest Microlease hire catalogue and further information, contact: *Microlease plc, Forbes House, Whitefriars Estate, Tudor Road, Harrow, Middlesex HA3 5SS.*

Success story

Thanet Electronics Ltd, familiar to most radio amateurs as distributors of Icom equipment, recently moved to new premises at Sea Street, Herne Bay. The new building houses the company's administration department, as well as research and development and in-depth test sections (to test equipment for DTI approval). The £50,000 cost of the place is in addition to a recent outlay of £80,000 on specialised test gear.

Thanet currently boast an annual turnover in excess of £3 million, this income being generated by the supply and installation of radio telephones (including Cellnet units), marine VHF and HF and airborne UHF equipment, radio systems for business use, and, of course, amateur equipment.

The current state of affairs is quite a way removed from

the situation ten years ago when the company was started by a former fireman and a researcher at the University of Canterbury, both of them amateur radio enthusiasts, with £7,000 capital.

Dave Stockley and Paul Nicholson (managing director and chairman respectively) wrote to a number of Japanese companies with the idea of importing amateur radio equipment. When Icom Incorporated replied favourably, Stockley and Nicholson told them that they wanted sole distribution rights in the UK (just goes to show what can be done with a little bit of money and a lot of cheek).

Business was originally conducted from a room at Stockley's Whitstable home, and when that was deemed too small they transferred to a room in Nicholson's home in Herne Bay, later moving again to a shop in Beltinge.

During the Falklands *fracas*

they supplied a radio system to link the three British armed services, being the only British company able to supply such equipment quickly enough. More recently they sponsored three radios on the Virgin Atlantic Challenger, and other users of Thanet equipment include the Duke of Edinburgh on board the

Royal Yacht Britannia, and the sailing ship Zebu, part of Operation Raleigh.

It would seem reasonable to describe Thanet's progress as a success story, and given such a healthy state during the present economic climate we shall certainly be wishing them happy birthday ten years from now.



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Single board 40W per channel stereo amplifier 41-01301 38.00

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5 LED per channel stereo VU meter for use with stereo amplifiers 41-01401 12.65

5W AUDIO AMP

A very compact audio output stage for use in a wide range of equipment 41-01406 4.60

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A universal audio pre-amp with a gain of 10 41-01604 6.85

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Single channel, spring line reverb unit to add echo effects to tape recording etc. 41-01602 11.30

TONE GENERATOR AND DETECTOR

Very low distortion tone generator and signal detector for circuit fault finding 41-01603 10.46

10MHz DFM

8 Digit LED digital frequency meter and period measurement 41-01500 54.10

50MHz PRESCALER

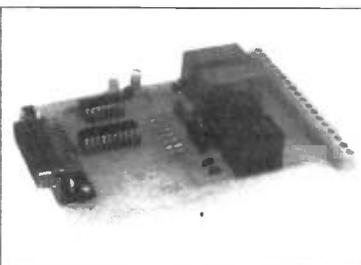
Extend the range of the 10MHz DFM to 50MHz 41-01501 8.55

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Low frequency pre-amp and waveform shaper for the 10MHz DFM 41-01502 5.13

1-30V 1mA-2A PSU

Adjustable 1-30V Power supply with pre-settable current limit from 1mA-2A 41-01600 37.46



Centronics Interface

5-12V 1A PSU

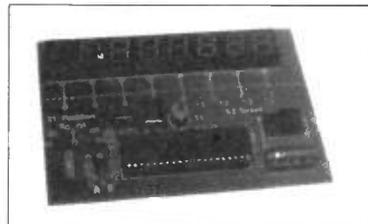
Adjustable PSU from 5-12V with current protection, 1 amp max output 41-01504 6.45

1-30V 1.5A PSU

1-30 volt adjustable PSU with protected output up to 1.5 Amps 41-01402 10.45

3 DIGIT LED DVM

DVM to read up to 99.9 volts or configured as an ammeter to read up to 9.99 amps 41-01403 18.00



10MHz DFM

INFRA RED LINK

Single channel IR Link with relay output 41-01300 9.60

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Thermistor based temperature sensor with relay output 41-01303 6.20

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2M CONVERTER

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2M POWER AMP

20W - 10dB gain - power amplifier for the 2m band. Automatic TX switch over, RX pre-amp, robust construction 41-01404 37.39

70cm PRE AMP

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70cm to 144MHz low noise converter featuring pre-aligned helical filter, schottky diode mixer and low noise transistors 41-01405 23.50

70cm PA

10W Power amp to boost the output of handheld and portable 70cm transceivers 41-01505 38.00

CRYSTAL CALIBRATOR

Crystal reference calibrator for alignment of receivers, outputs at 4.2, 1MHz, 100, 50 AND 10KHz 41-00801 5.18

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Improves to mute performance of the majority of CB rigs 41-01605 5.94

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DATA & PRICES

Type	V(nom)	Capacity	Stock No.	1-9	10-49
AA	1.2V	500mAh	01-12004	0.80	0.74
C	1.2V	1.2AH	01-12024	2.35	1.99
D	1.2V	1.2AH	01-12044	2.00	2.00
PP3	8.4V	110mAh	01-84054	3.70	3.50

CH/4/50

To recharge up to 4 AA size NiCads.
Size: 112 x 71 x 37mm 01-00409 4.95

CH8/RX

Will recharge AA, C, D and PP3 size cells with automatic voltage selection. Will recharge following combinations: 4xD, 4xAA, 4xC, 2xPP3, 2xD + 2xC, 2xD + 2xAA, 2xD + 1xPP3, 2xC + 2xAA, 2xC + 1xPP3, 2xAA + 1xPP3. Charge rate: 11mA for PP3, 45mA for AA size, 120mA for C and D size, for 16hrs. Power: 240V 50Hz. Output Voltage: 2.9V for AA, C and D size, 11.0V for PP3 size. Weight: 0.475kg. Size: 199 x 109 x 55mm. 01-02204 10.45

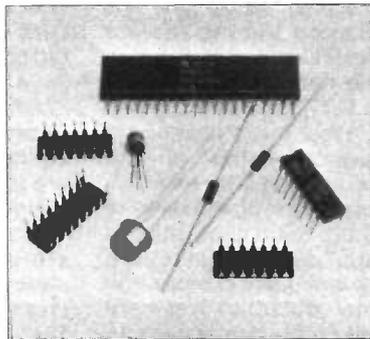


HT320

High quality, high specification meter at a reasonable price. In addition to the usual ranges, facilities are provided for measuring transistor parameters such as I_{ceo} and H_{fe}. Meter movement fully protected against overloads. 3-colour mirrored scale in robust case. Supplied complete with comprehensive instructions, test leads, transistor test leads and batteries (2 x HP-7, 1 x PP3).
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Linear ICs

		Stock No.	Price
LF351	Bi-FET op amp	61-03510	0.49
LF353	Dual version of LF351	61-03530	0.81
LM380N	1W AF power amp	61-00380	1.45
LM381	Stereo pre-amp IC	61-00381	3.27
NE544	14 pin DIL servo driver IC	61-00544	2.20
NE555N	Multi-purpose low cost timer	61-05550	0.45
uA741CN	DIL low cost op-amp	61-07411	0.42
TDA1062	RF oscillator and mixer system for 1-200MHz	61-01062	1.95
TDA1083	Portable radio AM/FM audio in one IC	61-01083	1.95
HA1388	18W PA from 14V	61-01388	4.10
MC1496P	Double balanced mixer/modulator	61-01496	1.25
TDA2002	8W into 2 ohms power amp	61-02002	1.25
ULN2283	1W max 3-12V power amp	61-02283	1.00
CA3089	FM IF amp, detector, mute, AFC, AGC system	61-03089	3.88
CA3130E	BIMOS op amp	61-31300	0.80
CA3140E	BIMOS version of 741	61-31400	0.46
MC3359	Low current dual conversion NBFM IF and det	61-03859	2.95
LM3900	Quad norton amp	61-39000	1.20
LM3909N	8-pin DIL LED flasher	61-39090	1.15
KB4412	Two balanced mixers IF amp with AGC for AM/SSB	61-04412	2.73
ICM7555	Low power CMOS version of 555 timer	61-75550	1.24
HA11225	Low noise FM IF	61-11225	1.45
HA12017	83dB S/N phono preamp	61-12017	0.80
MC14412	300 baud MODEM controller (Euro-US specs)	61-14412	6.85

Selected Lines

PB2720	80dB Piezo Buzzer	43-27201	0.55
10M15A	10.7 Filter	20-10152	2.10
10M08AA	10.695 Filter	20-11152	3.49
FC177	LCD Freq. Meter	39-17700	25.46
CM161	Min LCD Clock	40-80161	12.20
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Dragon to Centronics Connect Cable		03-10017	7.25
C12 Computer Cassette Tape		21-00012	0.55
8 x 0.3"	IC socket	28-00800	0.12
14 x 0.3"	IC socket	28-14000	0.13
16 x 0.3"	IC socket	28-16000	0.13
6V	KUIT-A Relay	46-80000	0.62
9V	KUIT-A Relay	46-80001	0.62
12V	KUIT-A Relay	46-80002	0.62
CX120P	COAX Relay	46-90120	11.96
CX520D	COAX Relay	46-90520	32.00
CX540D	COAX Relay (BNC)	46-90540	32.00

Books

Beginners Guide to Amateur Radio	02-11262	4.50
Beginners Guide to Electronics	02-04134	4.50
Active Filter Cookbook	02-21168	12.70
CMOS Cookbook	02-21398	12.95
TTL Cookbook	02-10358	11.00
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SPECTRUM WATCH

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Geneva is the city of conferences! From 7 August to 13 September the first session of the 'World Administrative Radio Conference on the Use of the Geostationary Satellite Orbit and the Planning of the Space Services Utilizing It', known more simply as WARC-ORB(1), was convened by the ITU.

The ITU is the specialised agency of the UN for telecommunications. It was founded in 1965 and currently has 161 member countries. The ITU's Geneva HQ comprises four main operating departments, the General Secretariat, which handles administration, the International Frequency Registration Board (IFRB), the International Radio Consultative Committee (CCIR), and the International Telegraph and Telephone Consultative Committee (CCITT).

The ITU administratively divides the world into three regions. ITU conferences are either on a regional or world basis. The present WARC-ORB(1) is a world conference, whereas the conference held last year to decide the VHF-FM plan for Europe, Africa and neighbouring regions was a regional one.

The first geostationary satellite was placed in orbit in 1963. Since then there

have been rapid advances in the use of geostationary satellites, particularly for world-wide radio communications and meteorology. The orderly development of space services has been promoted by individual administrations and international organisations, using the co-ordination, notification and registration procedures of the ITU.

However, as the number of satellites and the radio services using them continues to increase, there is concern about the future planning of the geostationary orbit (GSO). The interference and performance limitations of equipment using the radio spectrum, as well as the eventual capacity limitations of the GSO itself, will make it more and more difficult to obtain agreement between countries on the use of particular frequencies and orbit locations for new satellites.

WARC-ORB(1) is a direct result of the World Administrative Radio Conference held in 1979 (which among other things resulted in radio amateurs obtaining three new HF bands). A resolution of WARC-79 was that a world administrative radio conference should be convened 'to guarantee in practice for all countries, equitable access to the geostationary-satellite orbit and the frequency bands allocated to space services'.

Guidelines

WARC-ORB is being held in two sessions. The first session is mainly to decide which space services and frequency bands should be planned and to provide guidelines on procedure and other related matters; the second one, to be held in 12 to 18 months time, is to develop any required plans and regulations.

A major problem facing the conference is that of dealing with the 'first come, first served' allocation system for frequencies and geostationary orbit positions that has existed up to now. Developing countries, who are not yet in a position to have their own satellite, see the present allocation system as an unfair distribution of a natural resource.

However, the major space nations see the alternative solution, which would involve making allocations in the geostationary orbit that may remain

empty and unused for many years, as an inefficient use of the GSO. There is an element of the 'north/south' struggle running through the conference.

To add further confusion, some equatorial countries over whose heads the geostationary satellites are located have made claims (possibly somewhat tongue in cheek) that geostationary satellites located above their countries are in 'their' airspace, even though the satellites are some 36,000km above the earth! (*shades of Robert Heinlein's science fiction story 'The Man Who Sold the Moon'!* - Ed)

Among the 800 delegates from over 100 countries attending the conference there was a delegation from the International Amateur Radio Union (IARU) led by Richard Baldwin W1RU.

IARU president W1RU told *Spectrum Watch* in Geneva that although WARC-ORB had no direct effect on amateur radio, it was important that the IARU is seen to be present as a body at such major international conferences. Informal discussions with delegates and acting as observers during conferences are an important part of the international diplomatic activities of the IARU.

Geneva will also be the location for the WARC for the planning of the HF bands allocated to the broadcasting services (second session), due to be held in early 1987. With continued pressure from HF broadcasters to expand their allocations it will be important to have IARU observers at that conference too.

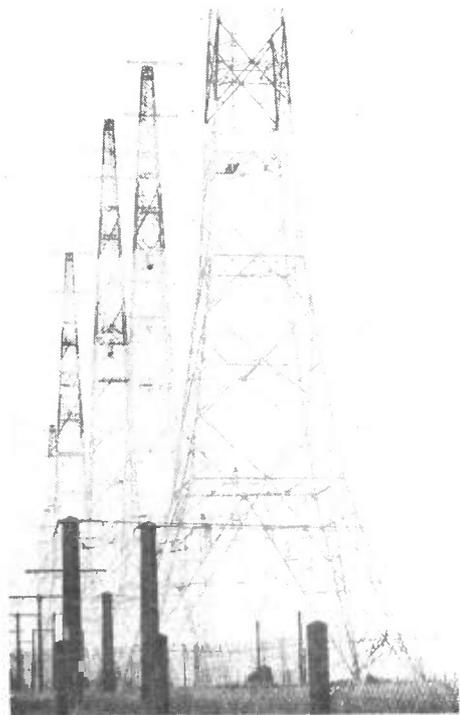
Droitwich

As reported previously in *R&EW*, the BBC is modernising its antenna and transmitter facilities at the Droitwich transmitter site. Two new Marconi 250kW transmitters are replacing the previous Marconi 200kW transmitters.

Although the new transmitters have been on site for some time, they could not be fully fired up until the new antenna had been installed. To carry out these major equipment changes, transmissions from Droitwich had to be closed down for a day, starting at 5.30am on 5 September.

Interestingly enough, when the 1,500m Droitwich transmitters were silent, in southern England it was just possible to hear the Scottish 1,500m transmitters at Burghead and Westerglen during the day-time, although the signal strength was hardly up to listening quality!

Last year the BBC's Droitwich station celebrated its fiftieth birthday. The station went on the air on 6 September 1934, and the original Marconi transmitter was rated at 150kW. The 400kW successor was also a Marconi transmitter. The new (2x250kW) transmitters recently put into service are therefore only the third set of 200kHz/1,500m transmitters to be installed at Droitwich in fifty years.



Part of Radio France's SW antenna installation at Issoudun

All change on LW!

The 'Geneva Plan' for MW and LW which was agreed in 1975, and which began taking effect in 1978, set down that long wave and medium wave broadcasters should align transmitters onto a common set of channels which are both 9kHz apart and direct harmonics of 9kHz.

The channel realignment process on medium wave has been taking place since 1978. Current MW frequencies are all exactly divisible by 9kHz (eg the BBC's main MW outlets are on 693, 1053, 1089 and 1215kHz: these frequencies are all harmonics of 9kHz). The same 9kHz spacing and harmonic relation was also agreed in the Geneva Plan for the long wave, but because of the relative antiquity of many LW installations it was decided to delay the international realignment of LW channels.

The date for the long wave channels to be realigned has now been set as 1 February 1988. For the BBC that will mean that the 200kHz (1,500m) transmissions will be moved down by 2kHz to 198kHz. At these low frequencies a move in carrier frequency of just a few kHz represents a significant percentage change in frequency. After the changeover the BBC's LW transmissions will no longer be on '1,500 metres' but on '1,515 metres'.

Owners of home-made digital clocks which use today's 200kHz Droitwich carrier as a time-standard will be taking life at a slightly slower pace after February 1988!

For listeners to the BBC's LW transmissions who currently suffer from the annoying buzzing sounds of a nearby TV set timebase, the frequency change means good news. The 13th TV timebase harmonic is at 203.125kHz, so that the interfering beat is currently around 3kHz. After the frequency change to 198kHz the buzz will be at a less irritating 5kHz.

The other 'BBC'

'BBC' in the context of broadcasting for most people means 'the Beeb'. But there is another BBC, which is also an important part of international broadcasting. It is the Swiss transmitter manufacturer Brown, Boveri & Company (BBC).

The other 'BBC' are designers and manufacturers of high power sound broadcast transmitters. Their present range consists of long, medium and short wave transmitters with powers from 300kW to 1,000kW.

High power broadcast transmitters require large amounts of energy, and transmitter manufacturers are continually trying to improve the efficiency of their products. Increased efficiency means getting more RF out of the transmitter for a given amount of mains power, or looking at it the other way, it means minimising the amount of mains

energy required for a given RF output.

Current generation Brown Boveri transmitters use a patented modulation technique called pulse step modulation (PSM) which enables overall efficiencies of around 75% to be achieved at powers of 300kW on the medium wave.

Brown Boveri are currently under contract to supply two new 2 megawatt LW stations for installation at Ouargla and Béchar in Algeria.

HF in the sands

HF radio is expected to play an important role in providing communications for the Royal Geographical Society's Wahiba Sands project. The Wahiba Sands are a small isolated 10,000 sq km (the size of Wales) desert in Oman. The RGS is sending a team of thirty British and Omani scientists to explore the desert area. The team will commence investigations in early December and will remain in the area for approximately five months.

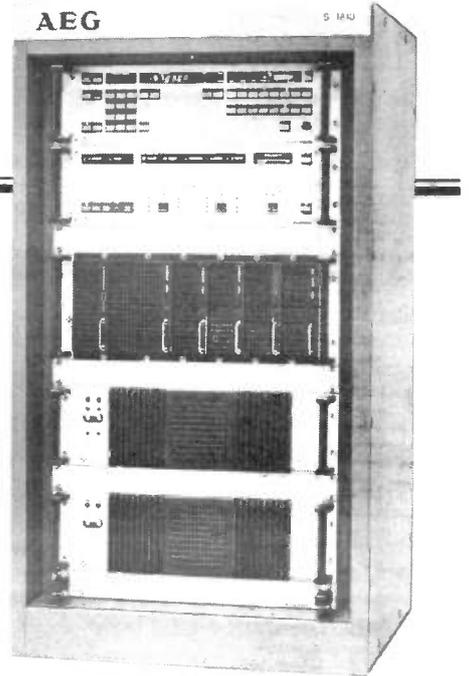
The exploratory expedition will use three base camps from which mobile teams will be sent into the desert. The base stations are each being equipped with a Racal 100W HF transceiver. Five Land Rovers are being kitted out with 20W Racal Syncal HF transceivers. The base stations will be using simple dipole antennas on portable masts.

During the London launch of the project at the RGS' HQ, Racal were demonstrating their HF SSB equipment both running off the mains and also in a Land Rover mobile mount. The demonstration of communications from the Land Rover was unfortunately marred by the fact that the battery of the brand new vehicle appeared to be totally flat! Racal's experimental callsigns (G9BJG and G9BJH) were in use for the demonstration.

As part of their kit, the project will also be using Magnavox Terrain Navigation equipment. Operating in a similar way to marine satellite navigation equipment, the terrain navigator makes use of the network of navigation satellites circling the earth. The satellite positional fix will provide the project team with useful information for surveying and mapping the desert areas of Oman.

Ariane

The European space launcher organisation Arianespace has been having a busy year. Flight 12 in February put Arabsat-1 and Brasilsat-1 into orbit. Flight 13 in May took up France's second national satellite Télécom-1 B and the US G-Star. On July 2, Ariane flight 14 sent the Halley's comet interceptor Giotto on its way (see October's *Spectrum Watch*), and as this month's *Spectrum Watch* is being prepared the countdown continues for Ariane flight 15, which will be carrying aloft Europe's third communications satellite (ECS-3) and the



AEG's new S1810 1kW solid-state communications transmitter

American Spacenet-3 bird'

Arianespace is now planning on an increased frequency of launching from its Kourou Space Centre in French Guiana, South America. A second launch site alongside the original has just been brought into service.

The original decision to build a second Ariane launch site was taken by the European Space Agency (ESA) member states in July 1981, with the aim of being operational in mid-1985. In August 1985 the ESA announced that following tests of the new launch site it had been formally accepted and was ready for service.

The first launch from the new launch area at Kourou is scheduled for December 1985 with an Ariane 3 launcher carrying two spacecraft: the second Brasilsat and the US G-Star 2. NEW

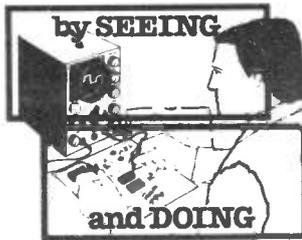
Editorial note: The launch was due to take place in the early hours of Friday 13th September (!). Although lift-off proceeded according to plan, the vehicle strayed from its flight path after an apparent failure in the third stage propulsion system, and the self destruct mechanism was therefore operated. Red faces all round - especially since President Mitterrand was present for the official opening of the second launch site.



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BC547/8/9	-8p	BD135,136	-25p	BSX20	-15p
BC557/8/9	-8p	BD137,138,139	-25p	2N2926	-7p
BC182L	-10p	BF195,7	-12p	2N3055	-50p
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100/50 - 12p, 100/100 - 14p, 220/16 - 8p, 220/25, 220/50	10p
470/16, 470/25 - 11p, 470/35 - 12p, 470/40 - 15p, 1000/16	15p
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As mentioned earlier, damage can occur to the power supply pass transistors and rectifier if the terminals are accidentally short circuited, this being due to the high current that occurs. Some circuitry is required within the power supply to monitor the load current, and when it exceeds a predetermined value start to reduce the voltage at the voltage regulator to ensure that the predetermined maximum current is not exceeded even under short circuit conditions. The easiest way of monitoring load current is to measure the voltage drop across a resistor in series with the load. The price that is paid in doing this is to reduce the regulation of the output voltage as a result of the voltage dropped across this resistor.

The integrated circuit voltage regulator type L723 circuit shown earlier in *Figure 15* incorporates current limiting. The voltage developed across the 0.13 ohm resistor is proportional to the load current. In this circuit the value of the resistor in series with the load determines the value at which the L723 will start limiting. To overcome the problem of regulation resulting from the voltage dropped across the 0.13 ohm resistor, voltage sampling takes place at the terminal side of the power supply.

The value at which current limiting takes place can be made variable, as shown in *Figure 29*. A potentiometer is

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placed across the load-sharing resistor, which has been increased to 0.30 ohms to enhance the range over which current limiting can occur. The L723 current limiting circuit will be activated when 0.65V appears at pin 2 with respect to pin 3.

In *Figure 29* the lowest limiting current will occur with a load current of $0.65 \div 0.3 = 2.1$ amps. If the load-sharing resistor is made any larger, regulation of the power supply will be affected and the additional voltage drop across the resistor will have to be made up for by having a larger value of unregulated voltage.

If the simple circuit first shown in *Figure 11* is used, an added simple current limiting circuit can be used which will protect Tr1 as shown in *Figure 30*. The load current produces a voltage drop across the 1.4 ohm resistor, which also appears across the emitter/base junction of Tr2. When the load current drops approximately 0.6 volts across the load-sharing resistor, Tr2 will become forward biased and will begin to conduct.

Some of the current flowing through R_s will now start to flow through Tr2, starving the base of Tr1 of current. If the base current of Tr1 is reduced, the emitter current of Tr1 will also be reduced. Since the emitter current of Tr1 is the load current, current limiting has taken place.

Take care

Again, care must be taken in choosing a value of load-sharing resistor that will not adversely affect the regulation of the power supply. In the example shown in *Figure 30*, current limiting will occur when the load current reaches $0.6V \div 1.4 = 430mA$.

This current limiting circuit can also be used in the circuit illustrated in *Figure 14*. The collector of Tr2 is taken to the common terminal of the 7812 integrated circuit, *Figure 31*. When approximately 0.6V appears across the 0.4 ohm load-sharing resistor, Tr2 starts to conduct, drawing current from the output of the 7812 voltage regulator. The base current of Tr1 is reduced, reducing the emitter current of Tr1 and hence starting to limit the load current.

Diode D2 has been inserted between the voltage regulator and the collector of Tr2 to provide isolation and prevent any interaction from the collector/base junction of Tr2 when becoming forward biased.

In *Figure 31* current limiting commences at $0.6V \div 0.3 = 2$ amps. The price that is being paid in using a circuit of this type is that an additional 0.6V is dropped across the load-sharing resistor. However, when two or more pass transistors are used in parallel as illustrated in *Figure 16*, the voltage dropped across the load-sharing resistors can be used to provide current

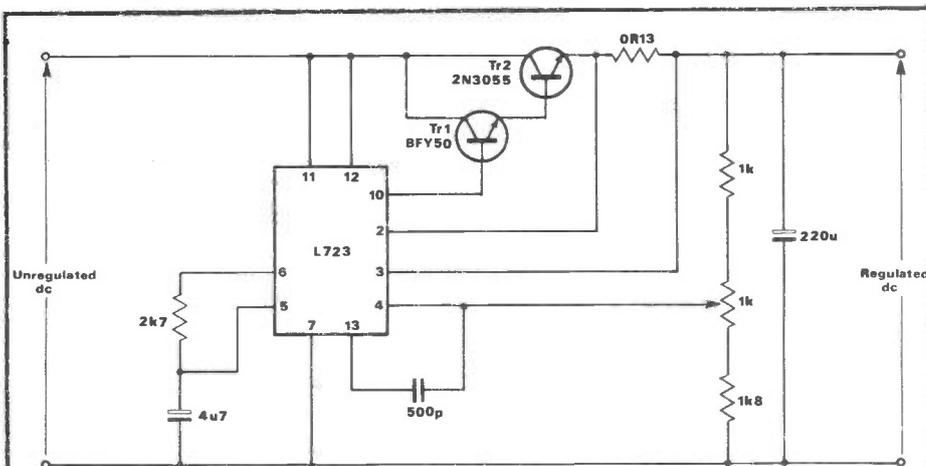


Fig 15 Five amp power supply using the L723 integrated circuit

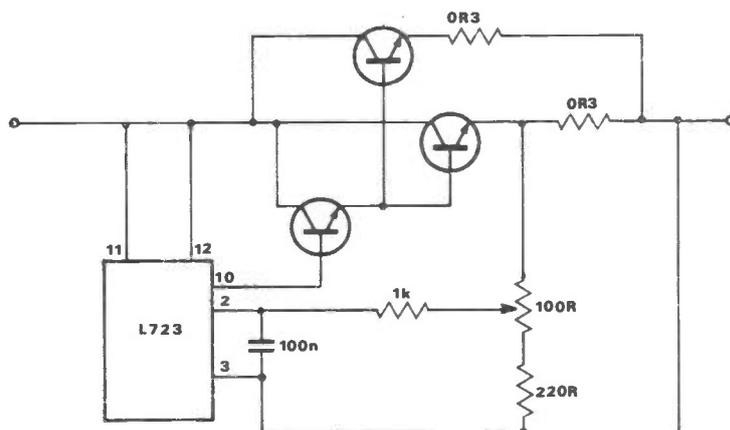


Fig 29 Variable current limiting using the L723

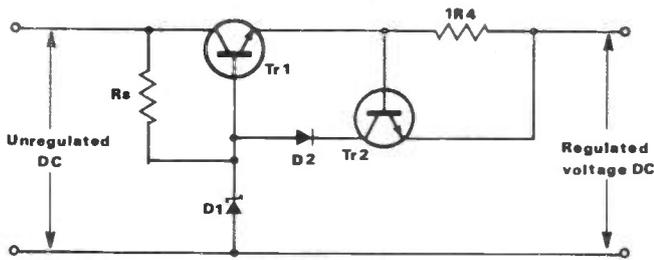


Fig 30 Simple voltage regulator incorporating current limiting

Fig 11 Zener diode and pass transistor voltage regulator

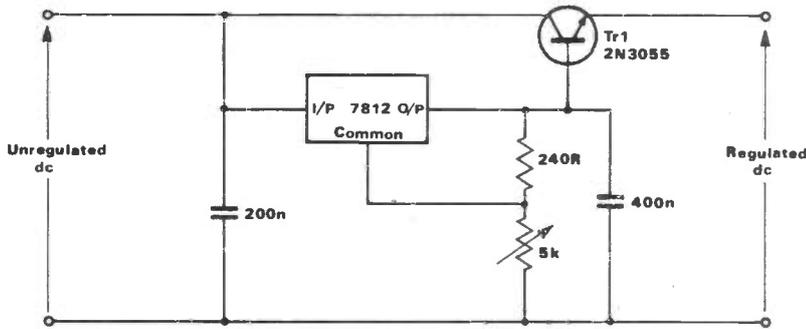
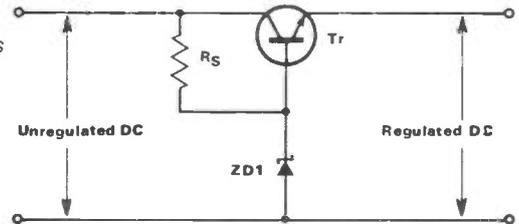


Fig 14 Three-terminal regulator with pass transistor

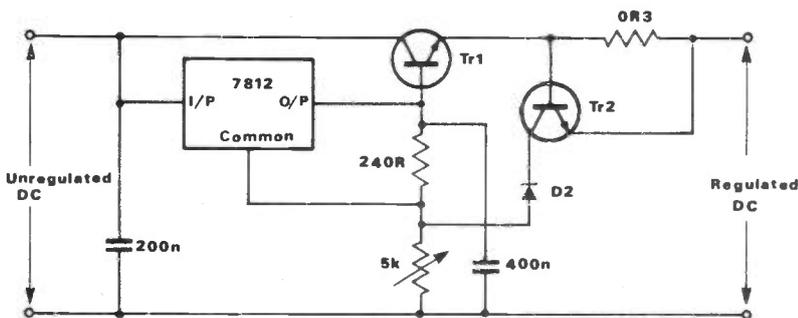


Fig 31 Three-terminal regulator incorporating current limiting

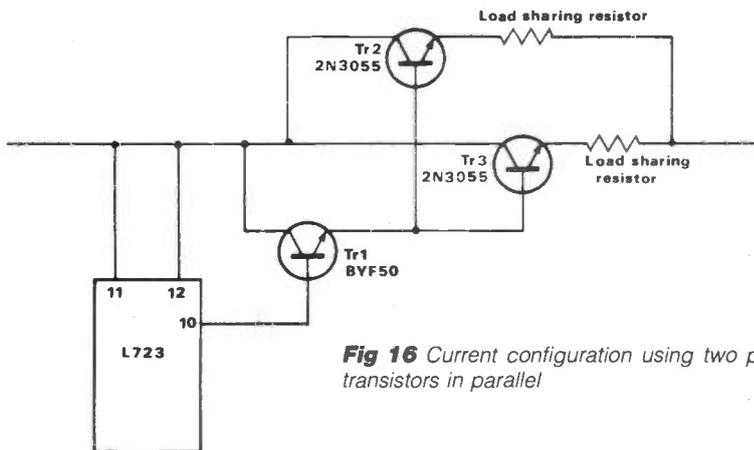


Fig 16 Current configuration using two pass transistors in parallel

limiting without experiencing the disadvantage of having to provide an additional load resistor to drop approx 0.6V.

The time has arrived to put into practice the knowledge gained from reading this article. First, one must decide on the specification for the power supply, possibly modifying this slightly to conform with the components found in the junk box and therefore rationalise the building cost.

The initial idea was to build a versatile power supply which was capable of delivering a load current of 10 amps, while at the same time being able to vary the output terminal voltage. As the power supply is intended to be used in conjunction with the author's building of experimental equipment it would be a good idea if the power supply also contained protection against over-voltage and accidental short circuits of the output. As the output voltage will be adjustable, metering of the terminal voltage and the load current is essential.

The specification

The specification required was for the output voltage to be adjustable between 0 and 20 volts on load with the open circuit noise being no more than 20mV, the current handling to be 10A maximum, with current limiting to be adjustable from 1A up to full load. The over-voltage protection was to be made adjustable from zero volts up to the maximum desired terminal voltage of 20V.

As the transformer used determines the eventual capability of the power supply, a detailed examination of the junk box was carried out. The only suitable transformers to hand were a couple of mains transformers designed to illuminate 12V, 50W quartz lamps. The secondary winding consisted of one untapped coil of unknown turns.

Fortunately the transformer had not been impregnated, and it would be relatively straightforward to either remove or add turns. The alternative was to purchase a suitable transformer. A new transformer capable of delivering 10A was priced at £35.00, and a second-hand one seen on a trade stall at the local mobile rally had a price tag of £10.00. I decided to attempt to use the transformers found in the junk box.

Prior to modifying the transformer the ideal secondary voltage must be calculated. We can assume that the power

supply will consist of a transformer, bridge rectifier (since the transformer secondary does not contain a centre tap), a voltage regulator, two or more pass transistors (as the load current is to be 10 amps), and the associated load-sharing resistors.

Voltage distribution

Figure 32 shows the voltage distribution within the power supply to give a maximum terminal voltage of 27V. Under full load 5A will flow through each load-sharing resistor, dropping 1.5V. The pass transistor's base-emitter voltage will be approximately 0.6V. From examination of the manufacturer's data sheets, the minimum difference between input and output voltage of the voltage regulator will be approximately 3V. The voltage drop across the bridge rectifier under full load will be approximately 2V.

As yet we have not considered the effects of ripple on the voltage across the terminals of the reservoir capacitor when full load current is drawn. From experimentation, I have assumed that with a large reservoir capacitor an allowance of approximately 2.6V drop is reasonable. Therefore the total voltage drop within the power supply is:

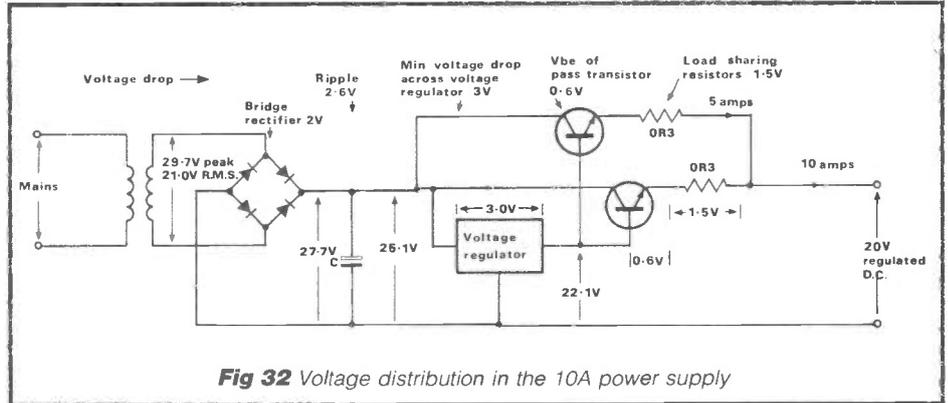


Fig 32 Voltage distribution in the 10A power supply

Load-sharing resistor	= 1.5V
Pass transistor base-emitter	= 0.6V
Voltage regulator	= 3.0V
Voltage drop due to ripple	= 2.6V
Bridge rectifier	= 2.0V
Total	9.7V

Therefore the peak voltage across the secondary of the transformers to maintain an output terminal voltage of 20.0V under full load will be 20.0V+9.7V=29.7V peak, which corresponds to an rms voltage of $29.7 \times \sqrt{2} = 21.1V$.

From the previous discussion on modifying transformers, to obtain a

terminal voltage of 21V rms required an additional 35 turns to be added to the secondary of the transformer. From the calculation made, each transformer after modification was capable of supplying a load current of 2.61A rms. Therefore if a 10A supply is to be constructed a minimum of at least 4 modified transformers will be required.

The next problem to be encountered is how does one parallel up four transformers to give the required operating load current?

A number of ways were considered and these will be outlined next month. **REW**

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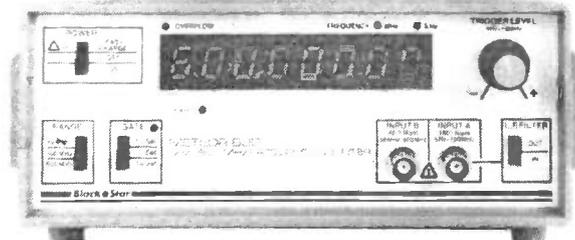
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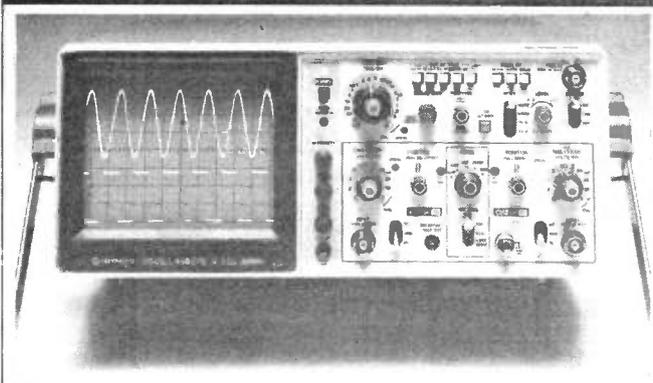
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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

When Oscar 10 was launched there was quite a noticeable decrease in activity on the Russian satellites, as no doubt one would have expected. At least that was the impression gained by the writer, who gets on one or other of the satellites most days.

However, things have changed recently. With Oscar 10 now over the southern half of the world, and optimum times for working it being at 'unsocial' hours, activity on it as far as European stations are concerned has decreased and there has been a marked return to the Russian satellites.

RS5, 7 and 8 have gone through bad patches over the past few months, with very irregular appearances. At the time of writing things seem to have cleared up a bit and signals from all three have been back to their old standards. RS7 has been excellent at times and 5 and 8 have been putting in more regular appearances once again. No doubt the problems were due to low battery voltage from the effects of the 'eclipse' situation through which the RS satellites have been passing recently.

Activity on the RS satellites is likely to continue at a high level, for while Oscar 10 is in its present position the Russian satellites are the only ones providing transponder service. Oscar 10 will go into a long period of eclipse during 1986 so conditions for its operation will not be good, and with the inevitable delays and hold-ups which seem to bedevil satellite launching plans it looks as though it will be some time before any of the planned future satellites will be available. The Russians have a habit of cossetting their satellites, controlling them carefully as becomes necessary, so we hope they will be able to keep the existing three going for some time yet.

In relation to delays, it has been announced that the Iskra-4 Russian satellite, which was mentioned in these notes recently and expected to be launched 'shortly', will not now be launched until at least January 1986 and no transponders will be carried.

Remote imaging group

A new satellite orientated group has recently been organised, directed at the interests of those who are primarily interested in 'viewing' the pictures sent by weather satellites and 'Earth imaging'

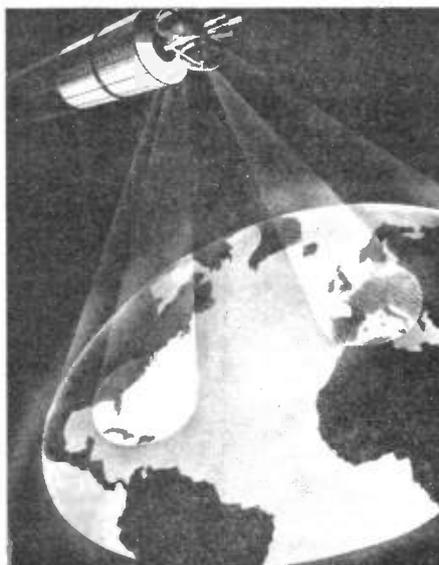
satellites. The intention is to produce a regular newsletter, which includes orbit predictions, satellite status, forthcoming events, launch dates, hints and tips, plus specialised items etc. It is hoped to steadily enlarge the newsletter to include write-ups of current systems and machines like the Mufax, Alden and the Rank Xerox Telecopier 400 and so on.

The aim is to make the newsletter as 'practical' as possible, supplying both the beginner and the professional with news, information and practical help in the field of imaging satellites.

The group originated at a special meeting held at the last VHF Convention at Sandown Park. This meeting was well attended and it was agreed by those present to form a group - now called the RIG - to serve all people who have an interest in receiving images from weather satellites and other sources.

Committee

The meeting was called by Henry Neale, who is now the Chairman of RIG. Over 350 people have since intimated their interest and over a third have paid a subscription. A committee of eight has been formed and to judge from the excellence of their first newsletter the group should be heading for a successful future. Those interested should write to: *Phil Seaford, 12 Jupiter Close, Leighton Buzzard, Beds LU7 8XA.*



Pic courtesy of British Telecom

CB code of practice

There is a two-page leaflet, available at Post Offices, entitled *Citizens' Band Radio - Code of Practice*. This gives much useful information to intending and existing CBers on how to operate, etc. If it was adhered to the continuing complaints about some CBers' activities would soon cease.

Earlier in the year the Secretary of State for Trade and Industry was asked in the House of Commons, 'whether he will bring forward proposals to make breaches of the Code of Practice for Citizens' Band radio users subject to criminal sanctions'.

He replied: 'We have no plans to do so. The CB Code of Practice gives generalised advice on matters such as operating practice and safety and was not designed to be legally enforceable'. Strange this, as every other user of the radio spectrum has a set of international laws which are enforceable by central government!

Amateurs assist yachtsmen

After the disaster of the 1979 Fastnet Yacht Race, when a sudden, unexpected storm wreaked havoc with the large fleet of boats sailing in the race causing fifteen yachtsmen to be drowned and much damage to the yachts, the Department of Trade and Industry reviewed its policy with regard to MF and HF ship to shore communications. As a result of this a number of special dispensations were granted to the Royal Ocean Racing Club in connection with the Admiral's Cup Race held last August.

All UK yachts taking part in the race were given special permission to use specific spot frequencies in the 2, 4 and 6MHz marine bands. In addition to this, the RORC was given a special dispensation to set up a temporary base station using these frequencies and to employ suitable operators to man the base station during the race.

The RORC sought the assistance of a group of almost 40 radio amateurs from the Plymouth area for the purpose of manning the station. The efforts of these radio amateurs met with considerable success. The appalling conditions on the marine bands and the bad weather made communication very difficult, but contact with all yachts was maintained from time to time. The exercise drew favourable comment from the local media.

AMATEUR RADIO WORLD

US Navy satellites

The US Navy has launched two navigational satellites designated Oscar 23 and Oscar 30. There is likely to be some confusion over this designation, one would imagine! There is a long way to go yet before the amateur radio satellites get up to the twenties and thirties but it seems unfortunate that they should have used this designation for satellites which are in an entirely different series.

The Rockall saga

During 40 days on the Island of Rockall, sailor and adventurer Tom McClean did quite a bit of transmitting on the 14MHz band, in spite of the fact that he does not have, and never has had, an amateur transmitting licence. This might have been acceptable in the case of an emergency but Tom McClean was consistently working other amateurs both in the UK and other countries, using the callsign GR1TM. Furthermore, he was using the amateur bands for passing third party messages to members of his family.

It is probable that many radio amateurs are not aware that if they work stations such as Mr McClean's they are in breach of the licence regulations, although it is

unlikely that any action would be taken against them in cases such as this. We understand that the DTI have informed the Radio Society of Great Britain, who have registered a formal complaint against Mr McClean's illegal amateur radio operating, and that the Radio Investigation Service plan to visit Mr McClean on his return home.

From the RSGB's News Bulletin we learn that the DTI have recently provided the society with some statistics regarding prosecutions leading to the conviction of illicit users of wireless telegraphy apparatus. In 1979 there were 174 prosecutions, this figure rising to 509 in 1980, 889 in 1981, and 2,325 in 1982. This dropped to 1,506 in 1983 and in 1984 there were 1,281.

From the same source we learn that a parliamentary written answer dated 26 June 1985 indicated that DTI officials are shortly to put forward proposals for increases in most licence fees. The society has written to the DTI to find out whether this will affect amateur radio licence fees or not.

A DXpedition to Guernsey

An expedition to Guernsey was organised for 19-27 October with the support of the RSGB HF Committee and the

Guernsey Amateur Radio Society for young RSGB members who held amateur radio transmitting licences. This was to coincide with half-term, all the participants being 17 years old or under. The idea was to give them an opportunity to improve operating skills and to take part in the 48-hour CW-WW DX phone contest.

Shuffling Germans

Two German radio amateurs, DG2KM and DD6CF, may be on the Columbia space mission 61A, which at the time of writing was due to be launched in October. Planning was taking place for Oscar type QSOs using 2 metres and 70cm.

Plans also included tape recording equipment to record up-link signals heard. This is presumably a follow-on to the successful mission recently completed from the shuttle Challenger by Dr Tony England WOORE.

Tests of the equipment were carried out by the two radio amateur astronauts from an aircraft flying over Germany on 17 August at 12,000 feet. The flight lasted five hours and the tests were very successful, several hundred up-link signals being successfully recorded. The callsign used was DL0LRK/AM - the /AM indicating 'aeronautical mobile'. **REW**

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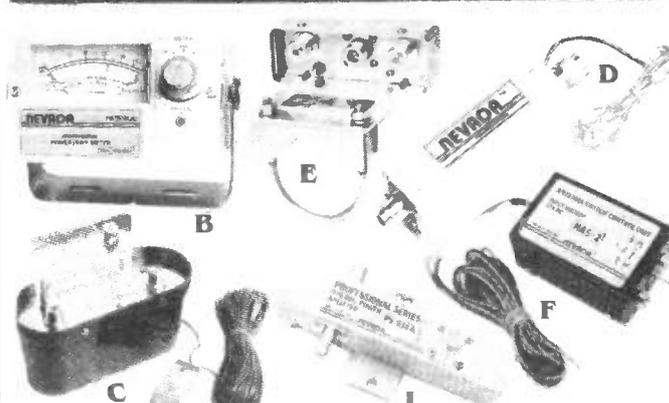
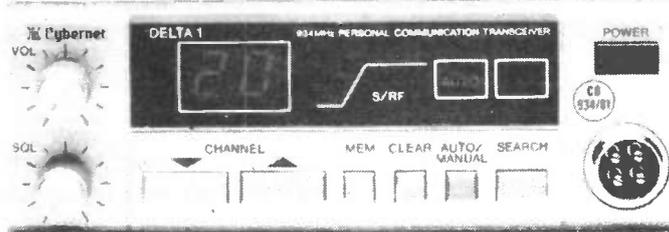
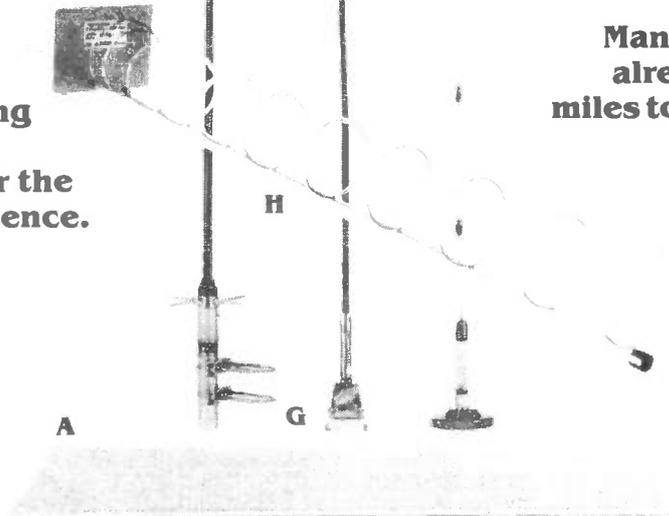
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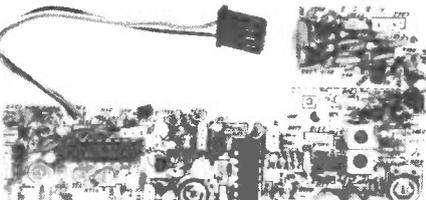
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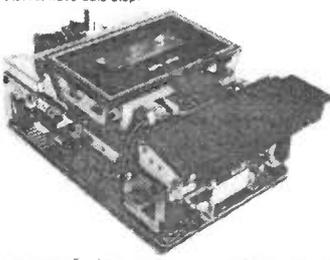
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DIGITASH

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This month's program looks at matching networks which use inductive and capacitive elements and are in consequence frequency conscious, although they dissipate no power in themselves. This contrasts with resistive matching networks, which operate at any frequency but are lossy by their principle of operation (see *R&EW*, Oct 1984).

From the required frequency, Q and input and output impedances, the program will calculate the values of inductance and capacitance, and if desired will also print out a table indicating the frequency response and VSWR of the network.

In common with our previously published programs, this one has been written in standard Microsoft Basic and should require little, if any, modification to run on the majority of home microcomputers. As printed, this listing has been successfully operated on both Sanyo and BBC machines.

The response of L-C networks above and below resonant frequency is asymmetric, and they may therefore be used as high or low-pass filters. These networks also have the advantage of providing an impedance match with minimum loss, a common example being the pi tank circuit used in many transmitters.

Simple L-C networks may take either 'T' or 'pi' configuration, both of which may exhibit high or low-pass characteristics depending on the particular combination of inductors and capacitors. The construction of all these filters is such that the outside elements are of the opposite type to the central element. The four types of filter (high and low-pass, pi and T) are illustrated in *Figure 1*.

Mathematically, there is no difference between high and low-pass networks except for the sign of the phase difference between current and voltage in each branch. Furthermore, it is quite simple to convert from a pi to a T network by performing a series to parallel transformation on the elements in each branch. It is therefore possible to use the same program for all four types of network.

The type of network which should be used for any application depends on the circumstances. If the requirement is for a transmitter output circuit, then a low-pass filter will help to minimise harmonic content. If the circuit uses valves, then adjustment of the input capacitor of a pi circuit can compensate for the valve output capacity, whilst in a solid-state circuit it may well be more convenient to use a T configuration to facilitate compensation for stray inductance. In addition, transistor power amplifiers exhibit a relatively low impedance, and although a pi circuit will work the capacities are often impracticably large (see example 3).

It is usually far more convenient to use a variable capacitor than a variable inductor, and if the former is used, it is easier to earth than insulate the frame of the capacitor which is normally connected to the moving plates.

COMPUTING: L-C NETWORKS

**Anyone got a match?
Well, you will have if you use this
program from Brian Kendal
G3GDU and Jeff Howell G4BXZ**

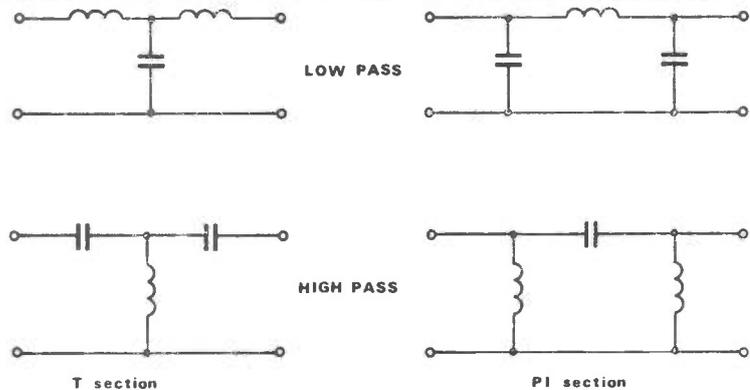


Fig 1 Basic filter configurations

Using the program

After printing the heading, the program first asks whether a high or low-pass filter is required. This entered, the operational frequency is requested, followed by the input and output impedances. The final question asks for the required circuit Q.

With the parameters entered the program then calculates the circuit values for both pi and T filters, followed by a brief menu inviting either a re-run of the program with alternative constants or progression to printing a frequency response and VSWR table.

With the latter selected, the program asks for the lower frequency limit of the table and the frequency difference between consecutive entries. It then prints a table of twenty lines showing the losses and VSWR of the network at frequencies starting with the minimum specified, spaced at the requested intervals.

Deriving the formulae

In order to calculate the impedances of each leg of the network it is necessary to know the terminating impedances and the circuit Q, the value of the latter being constrained by the fact that for any ratio of R_{in}/R_{out} there is a minimum circuit Q which will permit a loss-free match. At this point the impedance of one of the outside elements vanishes, leaving the familiar L-section.

In many cases the network source impedance will be the output impedance of a power amplifier. The exact value of

this is dependent on a great many factors and can usually only be determined by making careful measurements with sophisticated test equipment. Alternatively the manufacturer's data sheets may be consulted. Fortunately, however, there are few applications where such precision is needed, and in general a rough guide is sufficient.

A useful estimate may be made by knowing only the supply voltage and output power.

For valves:

$$R_{out} = \frac{V_{supply}^2}{3P_{out}}$$

For semiconductors:

$$R_{out} = \frac{V_{supply}^2}{2P_{out}}$$

In a classical tuned circuit the Q may be defined as:

$$Q = \frac{X_L}{R_s} = \frac{X_C}{R_s}$$

Now let us consider an L-C network, for example a low-pass T. This is shown in *Figure 2a*, the resistors at either end of the network representing the terminating impedances. The conventional representation of the circuit in *Figure 2a* is equivalent for any given frequency to that in *Figure 2b*. In this drawing of the circuit it can be seen that the circuits L1-R1 and L2-R2 are in parallel, so that the circuit may again be redrawn as *Figure 2c*.

This, it will be noticed, is the same as a conventional parallel tuned circuit of L, C and R whose Q is equal to the

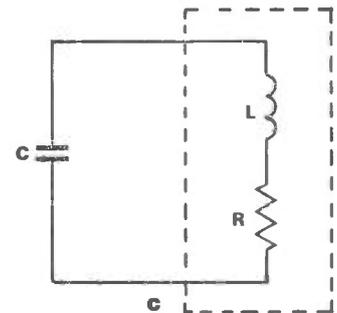
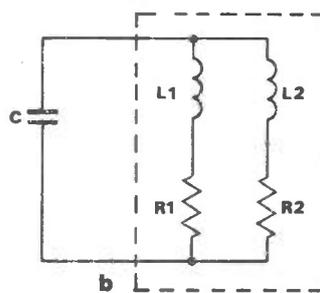
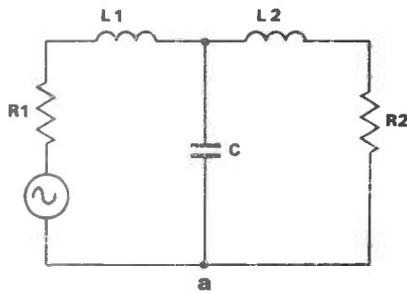


Fig 2 An example L-C network

equivalent series reactance divided by the equivalent series resistance at operating frequency. It is interesting to note that some authors neglect the source impedance in the derivation of their formulae, and in consequence define the Q of the circuit as if it were only loaded by the output impedance. The resulting formulae are equivalent to ours if the specified Q is first doubled.

Having found the network impedances, these must now be converted to physical component values, for which it is necessary to know the operational frequency. Although networks will operate at other than the resonant frequency the impedance match will not be so good, with consequent insertion losses.

Approximate formulae for the calculation of values are readily available for some types of network such as pi tanks.

For example:

$$X_1 = \frac{R_1}{2Q} \left(1 + \frac{\sqrt{R_0}}{R_1} \right) \quad X_2 = X_1 \sqrt{\frac{R_0}{R_1}}$$

These formulae are, however, only accurate when the Q of the circuit is considerably greater than the minimum Q necessary for the match.

When a computer is being used to make the mathematical calculation there is no need for such approximations, and in consequence this month's program can use an exact formula whose result is only limited by the internal accuracy of the computer. We have therefore used the formula:

$$Q_1 = \frac{2Q - \sqrt{4rQ^2 - (1-r)^2}}{1-r}$$

where $r = \frac{R_0}{R_1}$ and $Q_1 = \frac{R_1}{X_1}$ (pi section)

The frequency response is calculated by assuming that the network contains ideal (ie loss-free) capacitors and inductors and is terminated by pure resistances. As the response is the same for both pi and T configurations, only one table need be produced. By definition the network cannot dissipate any power, thus any losses occur due to power supplied to the input port being reflected. This loss is only zero at the network design frequency (F).

The power loss in these networks therefore bears a simple relationship to the voltage standing wave ratio (VSWR), and both sets of figures are printed out. These, however, should be interpreted with caution, for the assumptions made will not be borne out in practice, especially at frequencies far removed from F.

EXAMPLES

In accordance with our normal practice, we have included sample print-outs both to demonstrate the capability of the program and also to enable readers to verify that the program is running correctly on their machines.

MATCHING NETWORKS
 FREQUENCY = 28.5 MHZ
 INPUT IMPEDANCE = 100 OHMS
 OUTPUT IMPEDANCE = 4 OHMS
 FILTER Q = 4

HIGH PASS PI SECTION
 INPUT = 7.97744E-02 UH
 CENTRE = 349.013 PF
 OUTPUT = 2.23369E-02 UH

HIGH PASS T SECTION
 INPUT = 55.8421 PF
 CENTRE = .139605 UH
 OUTPUT = 199.436 PF

RUN FROM FREQ/IMPEDANCE/Q/RESPONSE (F/I/Q/R)?
 R

MATCHING NETWORKS

MIN FREQUENCY AND STEP (MHZ)?
 0 2

FREQUENCY	DB LOSS	VSWR
0	INFINITE	INFINITE
2	-78.1278	INFINITE
4	-59.9868	4.1943E+06
6	-49.2795	338933
8	-41.5712	57553.8
10	-35.4623	14097.5
12	-30.3171	4307.48
14	-25.7822	1514.49
16	-21.628	580.553
18	-17.6835	232.848
20	-13.8042	94.1027
22	-9.86606	36.7772
24	-5.82943	13.2399
26	-2.08577	4.23031
28	-7.75676E-02	1.30697
30	-.49989	1.98405
32	-1.79577	3.78467
34	-3.00187	5.81367
36	-3.95609	7.82057
38	-4.69219	9.68313

RUN FROM FREQ/IMPEDANCE/Q/RESPONSE (F/I/Q/R)?

practice, we have included sample print-outs both to demonstrate the capability of the program and also to enable readers to verify that the program is running correctly on their machines.

The first example shows the coupling circuit for a 28MHz transistor driver to an output stage in which a high-pass circuit was chosen in order to provide dc isolation. It can be seen that a pi section would be unsuitable due to the very low inductances involved, even though this configuration would permit direct supply and bias connections. The frequency

MATCHING NETWORKS

FREQUENCY = 3.75 MHZ
 INPUT IMPEDANCE = 7000 OHMS
 OUTPUT IMPEDANCE = 50 OHMS
 Q = 4.5 IS TOO LOW ! MINIMUM Q = 5.89491

ENTER FILTER Q?
 7.5

MATCHING NETWORKS

FREQUENCY = 3.75 MHZ
 INPUT IMPEDANCE = 7000 OHMS
 OUTPUT IMPEDANCE = 50 OHMS
 FILTER Q = 7.5

LOW PASS PI SECTION
 INPUT = 86.7835 PF
 CENTRE = 21.6436 UH
 OUTPUT = 582.304 PF

LOW PASS T SECTION
 INPUT = 203.806 UH
 CENTRE = 61.8389 PF
 OUTPUT = 30.3742 UH

RUN FROM FREQ/IMPEDANCE/Q/RESPONSE (F/I/Q/R)?

response table is included to verify the infinite loss tests within the program.

The second example demonstrates the minimum Q test in an 80 metre valve transmitter output stage. Old-timers will notice that the pi section values obtained approximate very closely to the long-used rule of thumb that the tank circuit capacity should be 1pF per metre of wavelength! The alternative T section values explain why the pi section is universal in such applications.

The final example illustrates how the T section is often the natural choice for VHF transistor output stages. The alternative pi section component values seem reasonable at first glance, but in practice the associated lead inductance would swamp the specified capacities, thus rendering the circuit useless.

MATCHING NETWORKS

FREQUENCY = 144 MHZ
 INPUT IMPEDANCE = 25 OHMS
 OUTPUT IMPEDANCE = 50 OHMS
 FILTER Q = 8

LOW PASS PI SECTION
 INPUT = 292.01 PF
 CENTRE = 9.90549E-03 UH
 OUTPUT = 207.662 PF

LOW PASS T SECTION
 INPUT = .259577 UH
 CENTRE = 7.9244 PF
 OUTPUT = .365012 UH

RUN FROM FREQ/IMPEDANCE/Q/RESPONSE (F/I/Q/R)?

Break in 590

The first features of the programme are the functions FNA, FNB and FNC at lines 40, 50 and 60. FNA is used to convert parallel impedances in the network to physical values, ie pF or μ H depending on whether the filter is high or low-pass. FNB converts series impedances to physical values, and FNC is a mathematical expression used in the calculations.

Line 70 calls a subroutine at line 860 to print the title. Lines 80 to 130 select high or low-pass filter calculation and prepare the program by reading the constants at line 30 in the appropriate order. Of these, the first three values are used for converting impedance to capacity, the next three from impedance to inductance, and the last two are used in the title.

By reading D\$ twice in line 30, 'HIGH' is overwritten by 'LOW'. The operational frequency is entered and checked at lines 140 to 160, whilst the input and output impedances are entered and checked at 170 to 190 and the required Q is entered at 200/210. Lines 220 to 330 list the problem on the screen and check that the Q requested is acceptable. If this is too low, an error message is printed and an alternative value requested.

The formula cannot handle the situation if $R_{in}=R_{out}$, although the problem is still soluble. In this case lines 340 to 350 bypass the general formula.

The pi and T section impedances are calculated at 360 to 420. As mentioned earlier, there is no difference between high and low-pass filters except for the phase shift, so, depending on component type, the conversion to physical values is achieved by using the appropriate definition of FNA and FNB for both high and low-pass variants.

Finally in this part of the program, lines 530 to 590 invite the user to re-run the program using different parameters or to continue to the next section.

The program will then calculate a table indicating the loss and VSWR of the filter at various selected frequencies. The minimum frequency to be indicated and the step are entered and validated at lines 610 to 630, and the column headings are printed at 640/650. Lines 660/840 form a loop which repeats twenty times in calculating the table of frequency response. Tests at lines 710, 780 and 800 avoid numerical problems with zero and infinite loss cases.

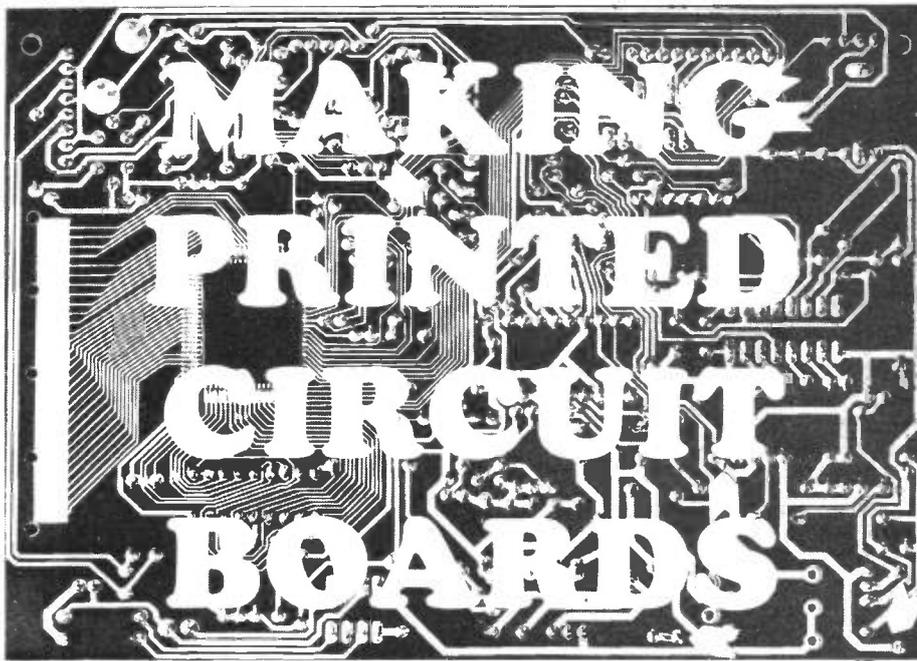
After completion of the table, line 850 returns control to the user at line 540.

Experienced programmers will have noticed that a superior method of defining FNA(X) and FNB(X) would be to use separate DEF statements in lines 100 to 130. However, some Basic interpreters (notably BBC Basic) do not handle run-time function definitions in the conventional way. The method shown was chosen to produce a program with the widest possible application rather than a more elegant solution of less scope.

```

10 REM FREQUENCY SELECTIVE MATCHING NETWORKS
20 REM J.M.HOWELL JUNE 1985
30 DATA 0.15915,1," PF",159150,-1," UH","HIGH","LOW"
40 DEF FNA(X)=G1*X^G2/F
50 DEF FNB(X)=H1*X^H2/F
60 DEF FNC(X)=1/(1+1/X/X)
70 GOSUB 860
80 PRINT "HIGH OR LOW PASS (H/L)?"
90 INPUT A$
100 IF A$="L" THEN GOTO 130
110 READ G1,G2,B$,H1,H2,C$,D$
120 GOTO 140
130 READ H1,H2,C$,G1,G2,B$,D$,D$
140 PRINT "ENTER FREQUENCY (MHZ)?"
150 INPUT F
160 IF F<=0 THEN GOTO 140
170 PRINT "ENTER INPUT AND OUTPUT IMPEDANCES (OHMS)?"
180 INPUT R1,R2
190 IF R1<=0 OR R2<=0 THEN GOTO 170
200 PRINT "ENTER FILTER Q?"
210 INPUT Q
220 GOSUB 860
230 PRINT "FREQUENCY = ";F;" MHZ"
240 PRINT "INPUT IMPEDANCE = ";R1;" OHMS"
250 PRINT "OUTPUT IMPEDANCE = ";R2;" OHMS"
260 R=R2/R1
270 QMIN=SQR(ABS(R-1))/2
280 IF R<1 THEN QMIN=SQR(1/R-1)/2
290 IF Q>QMIN THEN GOTO 330
300 PRINT "Q = ";Q;" IS TOO LOW !   MINIMUM Q = ";QMIN
310 PRINT
320 GOTO 200
330 PRINT "FILTER Q = ";Q
340 Q1=Q
350 IF R<>1 THEN Q1=(2*Q-SQR(4*R*Q*(1-R)^2))/(1-R)
360 Q2=2*Q-Q1
370 X1=R1/Q1
380 X2=R2/Q2
390 X3=FNC(Q1)*X1+FNC(Q2)*X2
400 X4=R1*Q2
410 X5=R2*Q1
420 X6=1/(FNC(Q2)/X4+FNC(Q1)/X5)
430 PRINT
440 PRINT D$;" PASS  PI SECTION"
450 PRINT "INPUT = ";FNA(X1);C$
460 PRINT "CENTRE = ";FNB(X3);B$
470 PRINT "OUTPUT = ";FNA(X2);C$
480 PRINT
490 PRINT D$;" PASS  T SECTION"
500 PRINT "INPUT = ";FNB(X4);B$
510 PRINT "CENTRE = ";FNA(X6);C$
520 PRINT "OUTPUT = ";FNB(X5);B$
530 PRINT
540 PRINT "RUN FROM FREQ/IMPEDANCE/Q/RESPONSE (F/I/Q/R)?"
550 INPUT A$
560 IF A$="F" THEN GOTO 140
570 IF A$="I" THEN GOTO 170
580 IF A$="Q" THEN GOTO 200
590 IF A$<>"R" THEN STOP
600 GOSUB 860
610 PRINT "MIN FREQUENCY AND STEP (MHZ)?"
620 INPUT F1,F2
630 IF F1<0 OR F2<=0 THEN GOTO 600
640 PRINT
650 PRINT "FREQUENCY";TAB(12);"DB LOSS";TAB(28);"VSWR"
660 FOR I=1 TO 20
670 F3=F1+(I-1)*F2
680 PRINT ;F3;
690 K=F3/F
700 IF D$="LOW" THEN GOTO 730
710 IF K = 0 THEN GOTO 825
720 K=1/K
730 IR=1/R2-X5/X6/R2*K^2
740 VR=IR*R1-X4/X6*K^2+1
750 VI=(R1/X6+IR*X4+X5/R2)*K
760 PL=4*R1/R2/(VI*VI+VR*VR)
770 PRINT TAB(10);4.342*LOG(PL);
780 IF PL<.000001 THEN GOTO 830
790 P=0
800 IF PL<1 THEN P=SQR(1-PL)
810 PRINT TAB(25);(1+P)/(1-P)
820 GOTO 840
825 PRINT TAB(12);"INFINITE";
830 PRINT TAB(25)"INFINITE"
840 NEXT I
850 GOTO 530
860 CLS
870 PRINT
880 PRINT "MATCHING NETWORKS"
890 PRINT
900 RETURN

```



Dr Roland Milker, a German chemist, has devised a straightforward method of home PCB production, which he outlines here

Nowadays a printed circuit board (PCB) plays a key role in home-constructed projects, especially since the use of digital circuits has increased tremendously. A well-known bottleneck in making PCBs at home is the problem of applying the etch resist. Either the procedure requires a good amount of patience (eg using a PCB pen) or it doesn't work if you are inexperienced (eg using photo resist).

Now a new special plastic film called TEC 200 allows the production of PCBs in an easy and reliable way. The film is shelf stable and stands temperatures up to 160°C, and it is only necessary to avoid contact with moisture.

Using TEC 200 the manufacture of printed circuit boards is simplified to three steps:

- The desired circuit pattern is photo-

copied onto the special film. Any 'normal paper' copier using toner is suitable.

- The circuit pattern on the film is transferred with a hot roll calender or with a hot iron onto the copper-clad board. The copy material (the toner) melts and forms a varnish-like, acid-proof coating (the etch resist).

- After having removed the film, the board is ready for etching. Any etching agent can be used.

Details concerning this procedure will be outlined in the following application example.

1. PHOTOCOPYING

Photocopy the black circuit pattern with aid of a dry photocopier onto the TEC 200 film (A4 sheet). This film - it doesn't matter what side - is put into the

paper magazine of the photocopier instead of a paper sheet. Take care to get a good contrast, but not so intensive that the whole film is spoiled by the toner.

Run a paper copy first!

If the circuit pattern has not been printed mirror reversed in the original magazine, make a copy from the film copy by laying this first copy upside down on the photocopier. For this purpose the TEC 200 film could be used many times, by removing the pattern with an organic solvent (or simply rubbing it off).

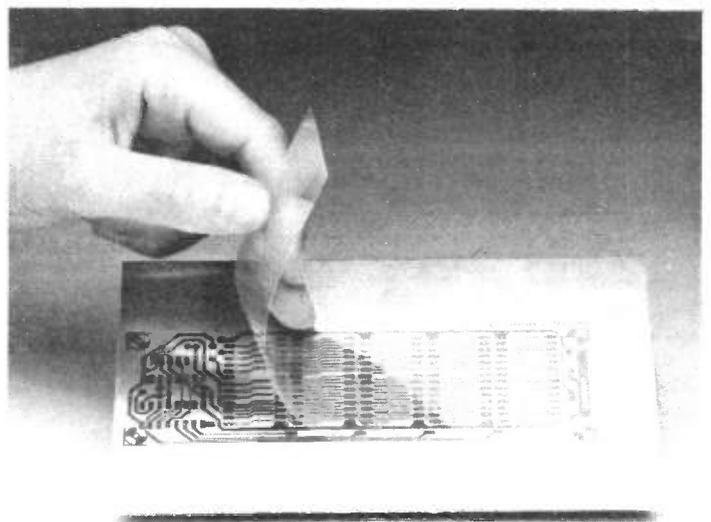
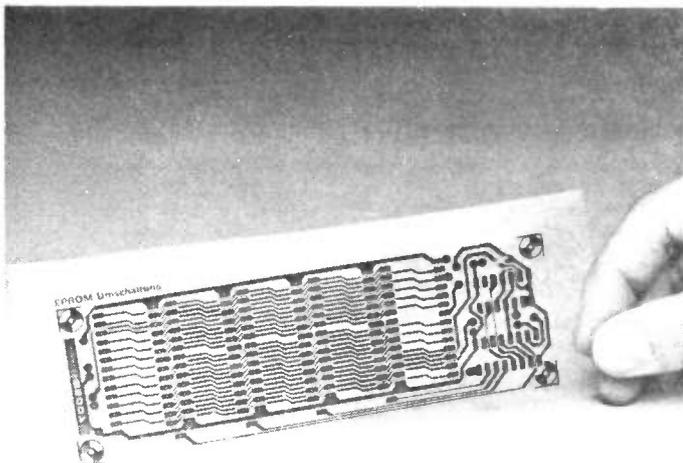
Any type of photocopier is suitable if it copies on normal paper and applies the toner by melting onto the paper. The special film withstands temperatures up to 160°C without appreciable shrinkage, therefore the pattern dimensions will not be distorted, which could otherwise make the insertion of larger components like integrated circuits difficult. The outstanding quality of modern photocopiers contributes to a high reproducibility of the pattern as well.

The final quality of the PCB naturally depends upon the state of the photocopier being used. Old models might not be suitable. At any rate, the photocopier should have been subject to the necessary maintenance (sufficient toner, clean press rolls etc).

2. TRANSFER OF THE PATTERN

After having copied the pattern onto the film, cut it out of the A4 sheet. If you desire to make just one small board, stick a piece of the film with a thin double-sided pressure sensitive tape onto a sheet of copy paper. This runs through the copier transporting the film. Using this trick it is possible to make many PCBs out of one A4 sheet.

Put the film carrying the circuit pattern (pattern side down) on the copper-clad board. Transfer the pattern from the film directly onto the board by pressing a hot iron on the film, at a temperature of approximately 130-145°C (the 'cotton' and 'linen' settings on a domestic iron).



Important: prior to the heat transfer process the copper surface must be cleaned with an organic solvent (eg acetone).

The transfer procedure requires a certain 'feel': if the pressure is too weak and does not last long enough, the transfer of the toner pattern may not be complete; if the pressure is too intense the circuit pattern lines will broaden out.

If you face any problems, try the following method:

- Put the copper-clad board on a heating plate or on a hot iron turned upside down and heat the board to 130-140°C.

- Put the film on the hot board and transfer the circuit pattern with aid of a rubber roller being gently rolled to and fro. Such a roller is available from photographic or art and craft suppliers.

Using this technique even very fine pattern lines will be perfectly transferred.

After the transfer stage the film is pulled off slowly and carefully, leaving the circuit pattern adhering to the board. The board is then ready for etching.

For professional PCB manufacturers the use of a hot roll calender instead of a hot iron is recommended.

If the laminating didn't work successfully, the poor pattern can easily be

rinsed off from the board using an organic solvent like acetone. The board is then ready for a second try. Minor coating deficiencies may be mended with a waterproof writing pen (eg an Edding 400) without any problem.

The layout having been transferred on the board it is to some extent rubproof and scratchproof. It is protected by the adhering film cover, which should therefore be removed just before starting to etch.

TEC 200 film is distributed in the UK by Technibond Ltd, Lisle Road, High Wycombe, Bucks HP13 5SH. Tel: (0494) 448791

3. ETCHING OF THE BOARD

The board can be etched just after the laminating procedure. The film is pulled off and the board is dipped into the acid bath. Depending on the acid strength the etching process lasts only a few minutes. There are no restrictions concerning the etching agent or etching technique chosen. A mixture of 200ml hydrochloric acid (35%), 50ml hydrogen peroxide (30%) and 750ml water is recommended.

When the etching procedure is over, the board is rinsed with water and the toner material still sticking to the pattern lines is washed off with acetone or a similar organic solvent. Finally, spraying with a soldering active finish to prevent oxidation is recommended.

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DATA FILE . . .

Ray Marston discusses FET principles, terminology and circuits

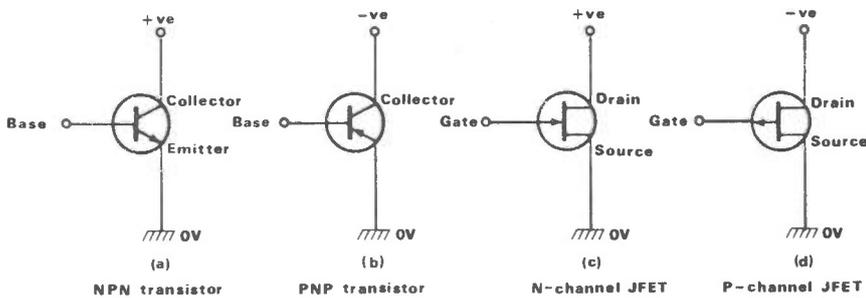


Fig 1 Comparison of transistor and JFET symbols, notations and supply polarities

Field effect transistors are unipolar devices, and offer a number of important advantages over conventional bipolar types. They have a near-infinite input impedance, and thus offer near-infinite values of current and power gain. Their operating speeds are not limited by charge-storage problems, and they can thus out-perform most bipolars in terms of cut-off frequency and switching speeds. Finally, their operating currents are inversely proportional to temperature, and the devices are thus immune to thermal runaway problems.

A large number of different basic types of field effect transistor (FET) are available, and FET literature abounds with terms such as 'depletion type', 'enhancement type', JFET, IGFET, MOSFET, and VFET, etc. In the present edition of *Data File* we look at the basic operating principles of the various FET types, and show basic ways of using them: we will take a more detailed look at specific FET types in some future editions of 'The File'.

FET basics

A FET, like an ordinary transistor, is essentially a three-terminal device. Its terminals are known as the 'source', the 'gate', and the 'drain', and correspond respectively to the emitter, base, and collector of a conventional bipolar transistor. FETs are available as 'n-channel' or 'p-channel' versions, just as normal transistors are available in either npn or pnp versions, and Figure 1 shows the symbols and supply polarities of both types of bipolar and compares them with the two types of FET. Note that the specific FET symbols shown actually apply to a device known as a 'junction-gate field effect transistor' or JFET, which will be discussed shortly.

Figure 2 illustrates the basic construction and operating principle of a simple n-channel FET. The device consists essentially of a bar or channel of n-type semiconductor material with a drain terminal at one end and a source terminal at the other: a p-type control electrode or gate surrounds (and is joined to the surface of) the middle

section of the n-type bar, thus forming a p-n semiconductor junction.

In normal use the drain terminal is connected to a positive supply voltage, and the gate terminal is biased at a voltage that is negative to (or equal to) the source voltage, thus reverse biasing the internal p-n junction and accounting for the very high input impedance of the device. With zero gate bias applied a current flows between the drain and source via the n-type 'channel', the current magnitude being limited only by the characteristics of the n-type material.

When a negative gate bias is applied to the device, a region that is depleted of charge current is formed within the junction. This acts like an insulating or high resistance region that effectively reduces the width of the n-type conduction channel and thus reduces the magnitude of the drain-to-source current. As the gate bias is increased the 'depletion' region spreads deeper into the n-type channel, until eventually, at some 'pinch-off' voltage value, the depletion layer becomes so deep that the n-channel conduction ceases completely.

Thus the basic FET of Figure 2 passes maximum current when its gate bias is zero, and its current is reduced or 'depleted' when the gate bias is increased. Consequently the device is known as a 'depletion-type' n-channel FET. A p-channel version of the device can be made by simply transposing the p and n materials.

The JFET

Two distinct families of field effect transistor are in general use. The first of these is known as the 'junction-gate' type of FET, this term generally being abbreviated to either JUGFET or (more usually) JFET. The second family are known as either 'insulated-gate' FETs or metal oxide semiconductor FETs, and these terms are generally abbreviated to IGFET or MOSFET respectively.

Figure 3a shows the basic construction of an n-channel JFET, and Figure 3b shows the conventional symbol of the

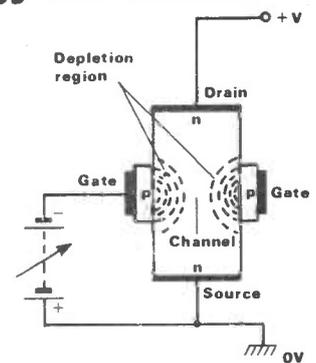


Fig 2 Basic structure of a simple n-channel FET

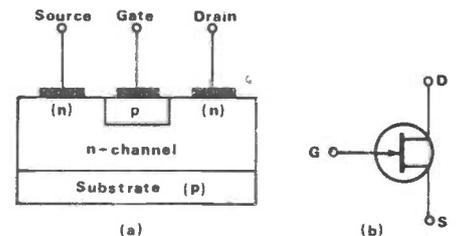


Fig 3 Construction (a) and symbol (b) of an n-channel JFET

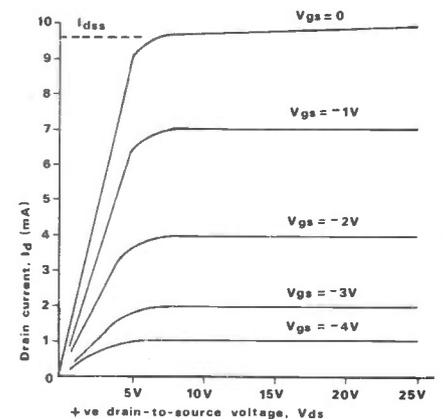


Fig 4 Idealised transfer characteristics of n-channel JFET

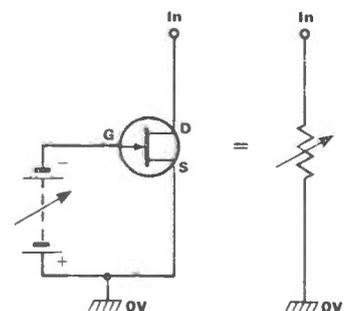


Fig 5 An n-channel JFET can be used as a voltage-controlled resistor

device. A p-channel JFET can be made by simply transposing the p and n materials in Figure 3a, in which case the symbol should be changed by reversing the arrow in Figure 3b.

All JFETs operate in the 'depletion' mode, and work in exactly the same way

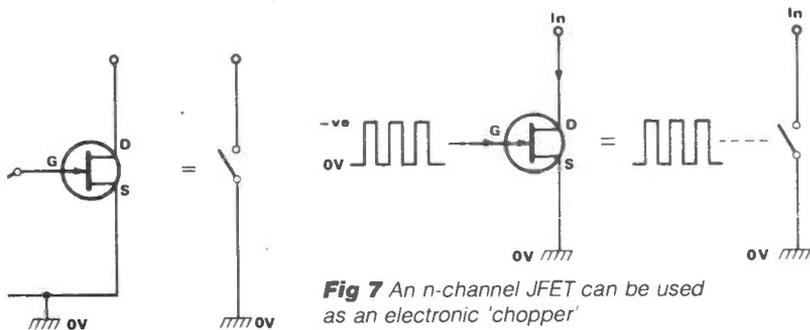


Fig 7 An n-channel JFET can be used as an electronic 'chopper'

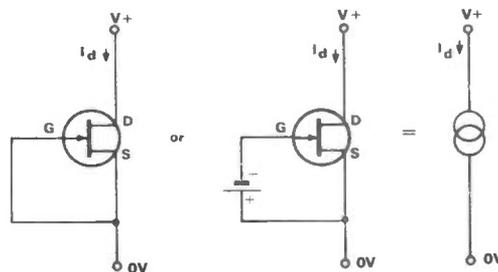


Fig 8 An n-channel JFET can be used as a constant-current generator

5 An n-channel JFET can be used as a voltage-controlled switch

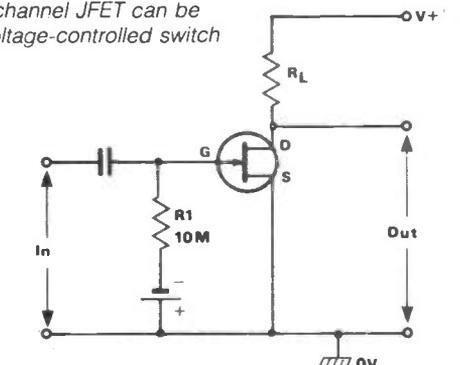


Fig 9 Basic n-channel common-source amp JFET circuit

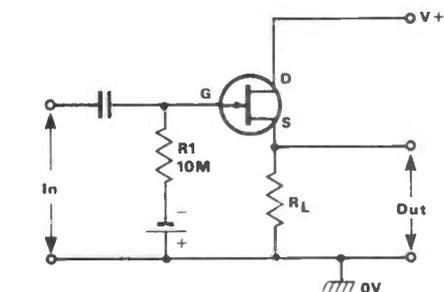


Fig 10 Basic n-channel common-drain JFET circuit

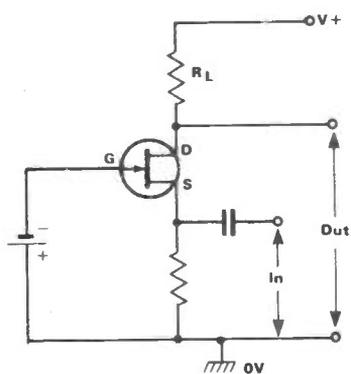


Fig 11 Basic n-channel common-gate JFET circuit

as has already been explained for the device illustrated in Figure 2. Figure 4 shows, in idealised form, the typical transfer characteristics of a low-power n-channel JFET, and illustrates some important characteristics of this type of device. The most important characteris-

tics of the JFET are as follows:

- (1) When a JFET is connected to a supply with the polarity shown in Figure 1 (drain +ve for an n-channel FET, -ve for a p-channel FET), a drain current (I_D) flows in the device. The magnitude of I_D can be controlled via a gate-to-source bias voltage, V_{GS} .
- (2) I_D is at a maximum when $V_{GS} = 0$, and is reduced (to bring the device into a linear operating region) by applying a reverse bias to the gate (negative bias in an n-channel device, positive bias in a p-type). The magnitude of V_{GS} needed to reduce I_D to zero is called the 'pinch-off' voltage, V_P , and typically has a value between 2 and 10V. The magnitude of I_D when $V_{GS} = 0$ is denoted I_{DSS} , and typically has a value in the range 2 to 20mA.
- (3) The gate-to-source junction of the JFET has the characteristics of a silicon diode. When reverse biased, gate leakage currents (I_{GSS}) are only a couple of nanoamps ($1nA = 0.001\mu A$) at room temperature. Actual gate signal currents are only a fraction of a nanoamp, and the input impedance to the gate is typically a thousand megohms at low frequencies. The gate junction is effectively shunted by a capacitance of a few pF, so input impedance falls as frequency is increased.

Avalanches

If the gate-to-source junction of the JFET is forward biased it conducts like a normal silicon diode, and if it is excessively reverse biased it avalanches like a Zener diode. In either case, the JFET suffers no damage if the gate currents are limited to a few mA.

- (4) Referring to the n-channel JFET transfer characteristics of Figure 4, note that, for each value of V_{GS} , drain current I_D rises linearly from zero as the drain-to-source voltage (V_{DS}) is increased from zero up to some value at which a 'knee' occurs on each curve, and that I_D then remains virtually constant as V_{DS} is increased beyond this knee value.

Thus when V_{DS} is below the knee value, the drain-to-source terminals of the JFET act as a resistor with a value dictated by V_{GS} , ie it can be used as a voltage-variable resistor, as shown in Figure 5. Typically, the drain-to-source resistance, R_{DS} , can be varied from a

couple of hundred ohms (at $V_{GS} = 0$) to thousands of megohms (at $V_{GS} = V_P$), enabling the device to also be used as a voltage-controlled switch (Figure 6) or as an efficient 'chopper' (Figure 7) which does not suffer from the offset voltage or saturation voltage problems associated with conventional bipolar versions of such devices.

Above knee value

Returning to Figure 4, note that when V_{DS} is above the knee value the I_D value is dictated primarily by the V_{GS} value, and is virtually independent of the V_{DS} value, ie the device functions as a voltage-controlled current generator. Thus the JFET can be used as a fixed-value constant-current generator by either tying the gate to the source, as in Figure 8a, or by applying a fixed negative bias to the gate, as in Figure 8b. Alternatively it can (when suitably biased) be used as a voltage-to-current signal amplifier.

- (5) The 'gain' of a FET is specified as transconductance, g_m , and signifies the rate of change of drain current with gate voltage, ie a g_m of 5mA/V signifies that a variation of one volt on the gate produces a change of 5mA in I_D . Note that the form I/V is the inverse of the ohms formula, so measurements specified in this way are usually expressed in 'mhos'. Usually, g_m is specified in FET data sheets in terms of mmhos (millimhos) or μ mhos (micromhos). Thus a g_m of 5mA/V = 5mmho or 5000 μ mho.

In most practical JFET applications, the device is biased into its linear region and used as a voltage-to-voltage converter or amplifier by wiring a suitable load resistor in series with its drain-to-source current. Looking at n-channel versions of the JFET, the device can be used as a common source amplifier (corresponding to a bipolar npn common emitter amplifier) by using the basic connections of Figure 9. Alternatively, the common drain or 'source follower' configuration can be obtained by using the connections of Figure 10, or the common gate (similar to common base) configuration can be obtained by using the basic configuration of Figure 11. In practice, fairly accurate biasing techniques must be used in these circuits (we will discuss biasing techniques in next month's Data File).

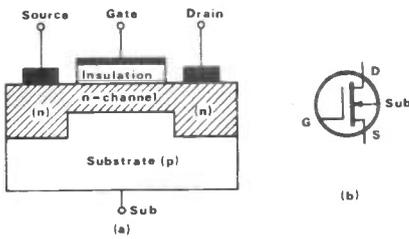


Fig 12 Construction (a) and symbol (b) of an n-channel depletion-mode MOSFET

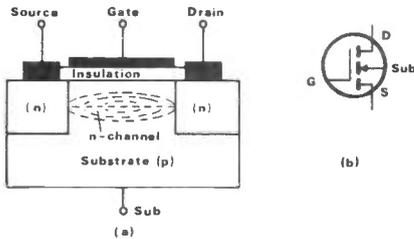


Fig 13 Construction (a) and symbol (b) of an n-channel enhancement-mode MOSFET

The IGFET/MOSFET

The second (and by far the largest and most important) family of FET devices is that known under the general title of IGFET or MOSFET. In these FETs, the gate terminal is insulated from the actual semiconductor body by a very thin layer of silicon dioxide, hence the title 'insulated gate field effect transistor', or IGFET. Also, the devices generally use a 'metal oxide silicon' semiconductor material in their construction, hence the alternative name of MOSFET.

Figure 12 shows the basic construction and the standard symbol of the n-channel depletion-mode FET. The device resembles the JFET, except that its gate terminal is fully insulated from the body of the FET (as indicated by the Figure 12b symbol), but it in fact operates on a slightly different principle to the JFET. It has a normally-open n-type channel between drain and source, but the width of the channel is controlled by the electrostatic field of the gate bias. The channel can be closed by applying suitable negative bias, or can be increased by applying positive bias.

In practice the FET substrate may be externally available, making a 4-terminal device, or it may be internally connected to the source, making a 3-terminal device.

The most important thing about the IGFET/MOSFET is that it is also available as an enhancement-mode device, in which its conduction channel is normally closed but can be opened by applying forward bias to the gate terminal. Figure 13 shows the basic construction and the

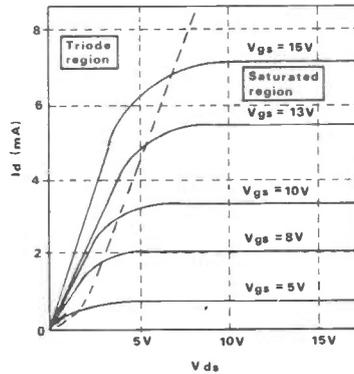


Fig 14 Typical transfer characteristics of the Figure 13 MOSFET

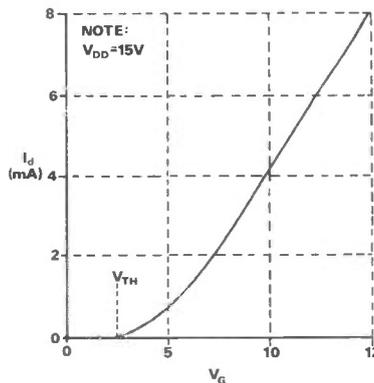


Fig 15 Typical V_{GS}/I_D characteristics of the Figure 13 MOSFET

symbol of the n-channel version of such a device.

In the enhancement-mode device no n-channel drain-to-source conduction path exists through the p-type substrate, so with zero gate bias there is no conduction between drain and source: this feature is indicated in the symbol of Figure 13a by the gaps between source and drain. To turn the device on significant positive gate bias is needed, and when this is of sufficient magnitude it starts to convert the p-type substrate material under the gate into an n-channel, enabling conduction.

Figure 14 shows the typical transfer characteristics of an n-channel enhancement-mode IGFET/MOSFET, and Figure 15 shows the V_{GS}/I_D curves of the same device when powered from a 15 volt supply. Note that no significant I_D current flows until the gate voltage reaches a 'threshold' (V_T) value of a few volts, but beyond this value the drain current rises in a near-linear fashion.

Also note that the Figure 14 graph is divided into two characteristic regions as indicated by the dotted line, these being the 'triode' region and the 'saturated' region. In the triode region the device acts like a voltage-controlled resistor, while in the saturated region it acts like a voltage-controlled constant-current generator.

The n-channel IGFETs/MOSFETs of Figures 12 and 13 can be converted to

p-channel devices by simply transposing their p and n materials, in which case their symbols must be changed by reversing the directions of the substrate arrows.

The very high gate impedance of IGFET/MOSFET devices makes them very liable to damage from even low power electrostatic discharges, and for this reason they are often provided with internal protection via integral diodes or Zeners, as shown in the example of Figure 16. Some IGFETs/MOSFETs are provided with two gate terminals, making them suitable for use as RF mixers, etc. Figure 17 shows the symbol of one such device.

VFET devices

In a normal small-signal JFET or IGFET/MOSFET, the main signal current flows 'horizontally' (see Figures 3, 12 and 13) through the conductive channel of the device. This channel is structurally very thin, and maximum allowable operating currents are consequently very restricted (typically to maximum values in the range 2 to 40mA).

In recent years many manufacturers have tried to produce viable high power/high current versions of the FET, and the most successful of these have relied on the use of a 'vertical' flow of current through the conductive channel of a device. One of the best known of these devices is the 'VFET', an enhancement-mode power IGFET/MOSFET first introduced by Siliconix in 1976.

Figure 18 shows the basic structure of the original Siliconix VFET. Essentially it has a 4-layer structure, with an n-type source layer at the top, followed by a p-type 'body' layer, an epitaxial n-type layer, and (at the bottom) an n-type drain layer. Note that a 'V' groove (hence the 'VFET' title) passes through the first two layers and into the third layer of the device and is electrostatically connected (via an insulating silicon dioxide film) to the gate terminal.

If the gate terminal is shorted to the source and the drain is made positive to the source, no drain-to-source current will flow, because the diode formed by the p and n materials will be reverse biased. If, however, the gate is made significantly positive to the source, the resulting electrostatic field will convert the area of p-type material adjacent to the gate into n-type material, thus creating a conduction channel in the position shown in Figure 18 and enabling current to flow 'vertically' from the drain to the source. As the gate becomes more positive the channel width increases, enabling the drain-to-source current to increase as the drain-to-source resistance decreases. This basic VFET can thus pass high currents (typically up to 2 amps) without creating excessive current density within its channel regions.

The original Siliconix VMOS design of

Figure 18 was highly successful, but not perfect. The sharp bottom of the V-groove, for example, causes an excessive electric field at this point and places an unnecessary limit on the operating voltage of the device. Subsequent to the original introduction of VMOS, Intersil introduced their own version of the basic technique with a U-shaped groove (plus other modifications) that facilitated greater device reliability and higher maximum operating voltages. In 1980, Siliconix added these and other modifications to their own VMOS devices, resulting in further improvements in performance.

Other power FETs

Several manufacturers have produced viable power FETs without using the V or U-groove technique, but still relying on the vertical flow of current between drain and source. Hitachi produce both p-channel and n-channel power MOSFETs with ratings up to 8A and 200V, but these devices are suitable for use only in audio and low-RF applications.

Supertex of California and Ferranti of England produce a range of power MOSFETs with the general title of 'vertical DMOS'. These devices feature high operating voltage (up to 650V), high current rating (up to 16A), low 'on' resistance (down to 50 milliohms) and very fast operating speed (up to 2GHz at 1A, 500MHz at 10A). Siemens of West Germany use a modified version of DMOS, known as SIPMOS, to produce a range of n-channel devices with voltage ratings as high as 1kV and with current ratings as high as 30A.

The International Rectifier solution to the power FET problem is to produce a device which, in effect, houses a vast array of parallel-connected low power vertical MOSFETs or 'cells' which share the total current equally between them and thus act like a single power FET, as indicated in Figure 19. These devices are called HEXFETs after the hexagonal structure of these cells, which have a density of about 100,000 per square centimetre of semiconductor material.

In parallel-connected FETs (as in the

HEXFET) equal current sharing is ensured by the positive temperature coefficient of resistance of the silicon conduction channel. If the current of one FET becomes excessive, the resultant heating of its channel causes the channel resistance to increase, thus reducing the current flow and tending to equalise it with the other parallel-connected FETs. This feature tends to make power FETs immune to thermal runaway problems.

One of the most important applications of FET devices is in digital circuitry, and many modern digital ICs are based on FET technology. The best known range of such devices use the technology known as COSMOS or CMOS, and rely on the use of Complementary-Symmetry pairs of MOSFETs. Figure 20 shows the basic principle of the CMOS device.

The basic CMOS device comprises a p-type and n-type symmetrical complementary pair of enhancement-mode MOSFETs, wired in series with their gates shorted together at the input and

their drains tied together at the output, as shown in Figure 20a. The pair are intended to handle logic 0 or logic 1 digital signals only, and Figures 20b and 20c respectively show the equivalent circuits of the device under these conditions.

When the input is at logic 0 the upper (p-type) MOSFET is biased fully on and thus acts like a closed switch, and the lower (n-type) MOSFET is biased fully off and acts like an open switch. The output is thus effectively connected to the positive supply line (logic 1) via a series resistance of about 100 ohms. When the input is at logic 1 the MOSFET states are reversed, with Tr1 acting like an open switch and Tr2 acting like a closed switch, so the output is effectively connected to ground (logic 0) via 100 ohms. Note that in both cases the entire signal current is fed to the load, and none is shunted off by the CMOS circuitry: this is one of the greatest features of CMOS technology. REW

Fig 18 Basic structure of the VFET power device

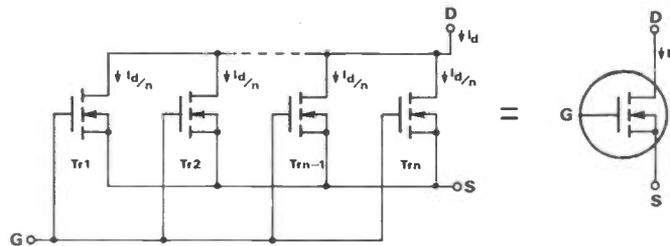
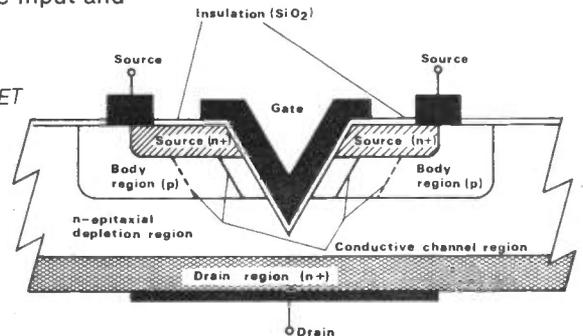


Fig 19 IR HEXFET comprises a balanced matrix of parallel-connected low-power MOSFETs

Fig 16 Internally protected n-channel depletion-mode MOSFET

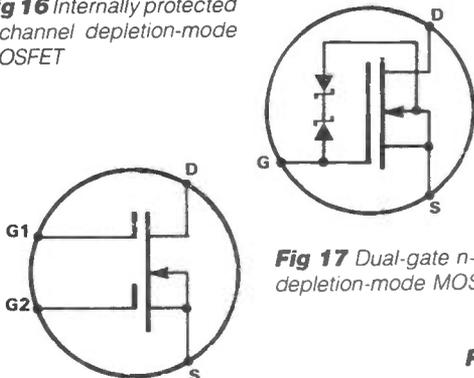


Fig 17 Dual-gate n-channel depletion-mode MOSFET

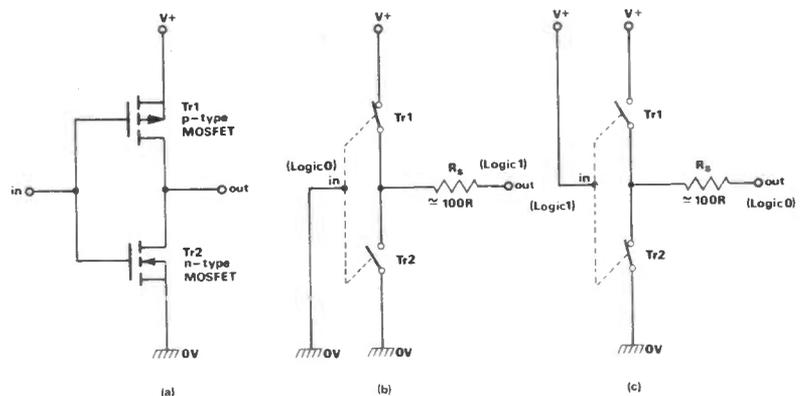
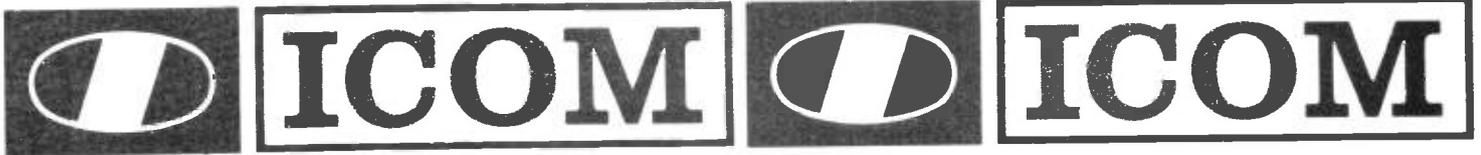


Fig 20 (a) Basic CMOS circuit and its equivalent with (b), a logic 0 input and (c) a logic 1 input

Thanet EI



IC-3200E Dual-band

A new exciting set is the ICOM IC-3200E FM Dual-band transceiver (144-430/440 MHz).

The IC-3200E employs a function key for low-priority operations to simplify the front panel. LCD display is easy to read in bright places, showing frequency, VFO A/B, memory channel duplex mode and S/R/F meter information.

Other features include a 10 channel memory able to store operating frequencies, Simplex or Duplex. A memory lock-out function allows the memory scan to skip programmed channels when not required. The IC-3200E has a built-in duplexer and can operate on one antenna for both VHF and UHF. Options include: IC-PS45 DC. power supply, HS-15 mobile mic, SM6 and SM8 desk mics, SP-10 external speaker and UT-23 speech synthesizer.



IC-735, The Complete HF Radio

This new HF transceiver from ICOM is compact enough to make mobile or portable use a possibility. The IC-735 covers all Amateur frequencies from 1.8MHz to 30MHz including the three new bands 10, 18 and 24MHz. Modes include SSB, CW, AM and FM, all circuits are solid-state and output is approximately 100 watts.

Tuning ranges from 100kHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible. Dynamic range is 105dB with a 70.451 MHz first IF circuit. The direct feed mixer rejects spurious response and gives higher sensitivity and wider dynamic range. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB.

The new IC-735 from ICOM is easy to operate and versatile, it has various scanning functions, comprehensive LCD and 12 memories. Computer remote control is possible via the RS-232C jack.

Options include: the AT-150 automatic antenna tuner and shown here the PS-55 AC power supply and SM-8 desk mic.

Please contact Thanet Electronics or your local ICOM dealer for even more information on this latest HF transceiver – the IC-735.



A BROADBAND HF AMPLIFIER

Want to give your receiver a little help?
How about an amp with a wide bandwidth
and high dynamic range?
E A Heal obliges . . .

The amplifier presented in this article was developed for the front end of an HF superheterodyne receiver. The design possesses very good characteristics, with a gain of 12dB between 100kHz and 35MHz and a useful dynamic range of over 100dB.

It should be borne in mind that at HF there is little point in improving the sensitivity of a receiver beyond that limited by external noise. Thus the only point in providing gain before a mixer in a superheterodyne receiver for HF is to overcome the relatively poor noise performance of the first mixer, and to overcome losses in the preceding band-pass filters.

Bandpass filters at the signal frequency are normally employed to limit the total spectral energy fed into the RF amplifier (and mixer). The necessity for such filters can be appreciated by

considering the number of high power signals present in some portions of the HF bands, for example the 7MHz (40 metre) band at night-time.

Although an amplifier may have a linear range of 100dB, this is for one signal in its passband. Several signals within its linear region, all near the maximum amplitude the stage can cope with, severely depress the maximum linear range.

The reason for this is that if just two signals add within the passband then the overall signal handling capability is reduced by 3dB. Thus several strong signals have a deleterious effect on the linear signal handling capability.

Operation in the non-linear region of the stage can produce intermodulation products and unwanted responses which inhibit the reception of the desired signal.

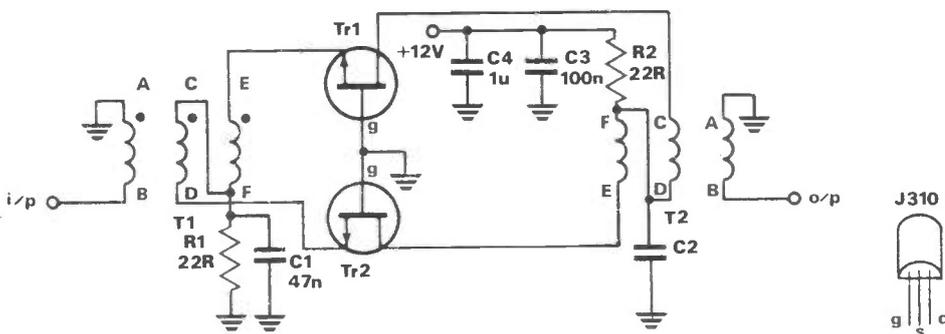


Fig 1 The amplifier circuit diagram

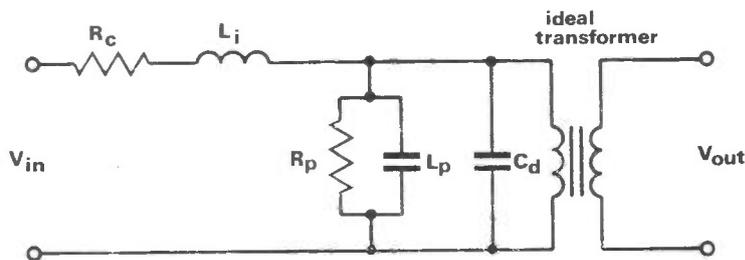


Fig 2 Lumped equivalent circuit of a transformer

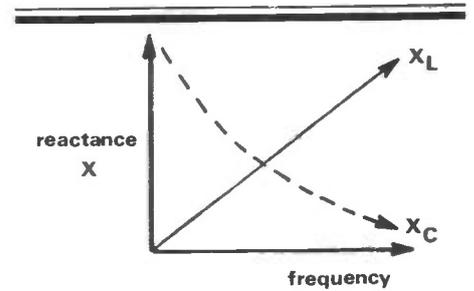


Fig 3 Reactance versus frequency

Unfortunately there is a practical limit to the linear range over which an amplifier can be arranged to amplify. The design presented in this article is good in this respect, and probably represents the best level of performance obtainable with readily available and reasonably priced amplifying devices. Unbeknown to the writer until recently, a similar system is used in a current piece of Yaesu equipment – but without transformer details.

Circuit description

The circuit diagram of the amplifier is shown in Figure 1. Two FET transistors are used in common-gate configuration. The input and output transformers are designed to have a wide bandwidth characteristic and are the most critical items in the amplifier.

These ferrite-loaded transformers are relatively straightforward to design, given sufficient design information.

The basic operation of these 'broadband' transformers may be understood with the aid of Figure 2. This shows the equivalent circuit of a loss-less transformer. The resistors, capacitors and inductor represent the items that generate the losses and establish the low and high frequency operational limits of the device.

In this figure L_p and R_p represent the inductance and losses in the magnetic core of the transformer (the ferrite). They are in parallel with the ideal transformer, and so if the inductive reactance X_p and the resistance R_p of the core are reduced, the output of the transformer is reduced. X_p and R_p are (usually) smallest at low frequencies, and are the elements that are responsible for the low frequency cut-off of the device.

The elements L_i and C_d represent the leakage inductance and winding capacitance respectively. As the frequency is

COMPONENTS

R1,2	22R
C1,2	0.047 μ F
C3	0.1 μ F
C4	1.0 μ F tantalum
Tr1,2	J310 FETs
T1,2	Fairite T73 core, 7 turns 38swg wire (see text)

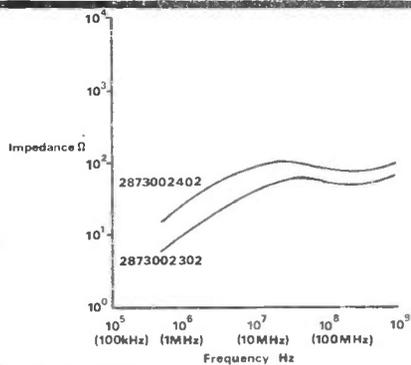


Fig 4 Impedance v frequency of Fairite balun cores. The -2402 is used in this project

increased the reactance of L_i increases and the reactance of C_d decreases, resulting in a reduction of output, ie $X_i = 2\pi fL$ and $X_c = 1/2\pi fC$ (see Figure 3).

In order to design a transformer the values shown in Figure 2 need to be known for a given ferrite core in order to meet a certain bandwidth requirement.

To illustrate this point a graph of impedance versus frequency for a particular ferrite core manufactured by Fairite Products Corporation (USA) is shown in Figure 4. The impedance is shown per turn on the ferrite former. Figure 4a shows how the parameters of the equivalent circuit vary with frequency. For fuller information the reader is encouraged to obtain data sheets from Fairite (UK distributors, Apex Inductive Devices, Alperton. Tel: (01) 903 2944).

The simple approach

A simple way to look at transformer operation is along the following lines: if two wires are in close proximity (say twisted together) then they exhibit mutual coupling which increases with frequency. However, at relatively low frequencies the coupling will be low and hence the output in a transformer configuration will be small.

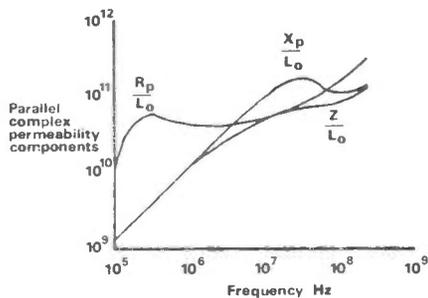


Fig 4a Variation of equivalent circuit parameters with frequency

The inductive value of the wires can be increased by introducing a high permeability material, ie by winding the wires around a piece of ferrite. Thus the effective mutual coupling is increased at a relatively low frequency. Hence at low frequencies the ferrite dominates the coupling, whereas at high frequencies the length and proximity of the wires is the most important parameter.

A well-known example of the use of ferrite transformers is the 'balun', used for feeding balanced antennae with unbalanced feeders, eg a half-wave dipole fed via a balance to unbalance transformer and coaxial cable.

The reason virtually all commercially obtainable baluns do not cover 1.8-30MHz but start at 3.5-30MHz is the difficulty of reconciling the low and high frequency requirements, particularly with respect to the ferrite material if it is to be used for transmission. Although this article is too short to deal properly with this area, it should suffice to say that ferrite is a non-reciprocal substance and therefore can exhibit non-linear characteristics, especially when used in a transmission mode. Non-linearities can manifest themselves in several deleterious effects, such as heating of the

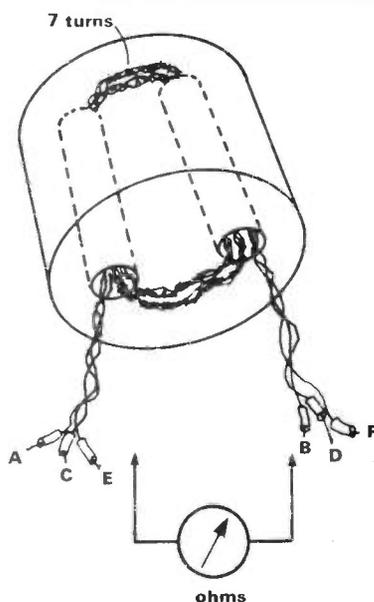


Fig 5 Transformer details. Identify A-B, C-D, E-F with coloured sleeving

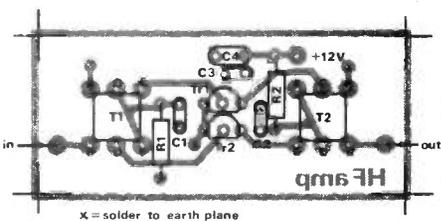
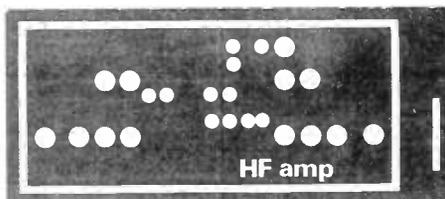
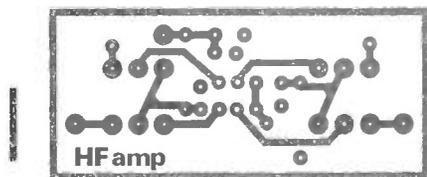
ferrite, unwanted signal generation, poor VSWR, etc.

Practical design details for the transformers developed for the amplifier are given in Figure 5.

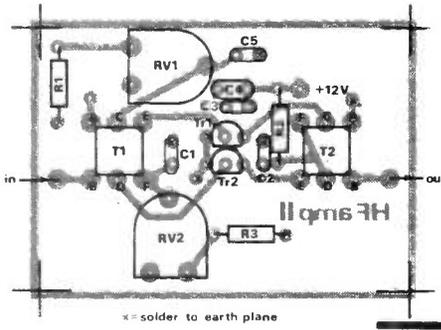
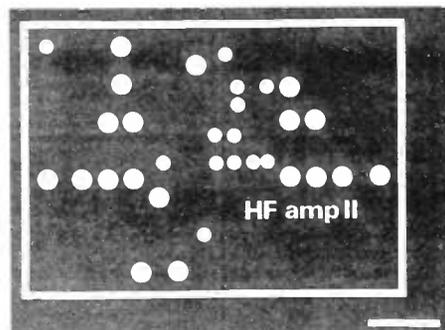
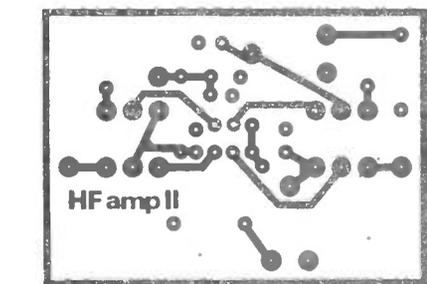
The input and the output of the amplifier can be matched to a wide range of impedances by varying the turns ratio of the input transformer. The given turns match 50 ohms reasonably well.

Construction

Since the gain is kept deliberately low at around 10-12dB (corresponding to a voltage gain of 10 and 15.8 respectively) the amplifier is quite stable. In addition the ferrite transformers specified ensure that their stray fields are very small, and no screening between input and output circuits has been found necessary.



Above: Foil pattern, groundplane and component overlay for the amplifier
Below: Foil pattern, etc, for amp modified to incorporate dc bias balancing



HF AMPLIFIER

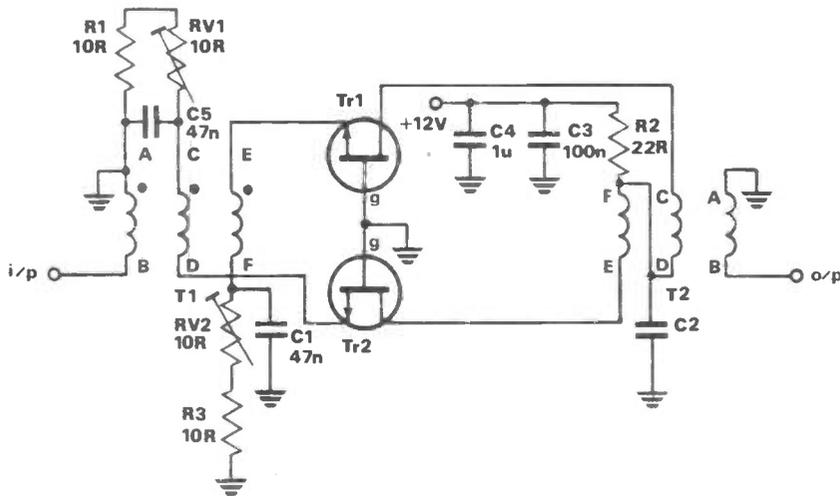


Fig 6 Modified circuit for equalising dc conditions for each FET

It is essential that the transformer windings are in the correct phase. Using the wire suggested the only way of reliably ascertaining that the correct winding is connected to the right end of another winding is with a continuity checker.

The seven turn dual winding in conjunction with the single turn coupling winding should be carefully wound.

Using a hand-drill grip three lengths of wire in a drill chuck. Secure the other ends together and clamp them with a G-clamp onto the workbench. Twist the drill until the wires have about 8 turns per inch. This will ensure sufficient coupling for high frequency operation.

Carefully unwind one of the wires to leave about 1.5cm. Cut this wire leaving about 2cm to make connection to the

amplifier printed circuit board. Now, starting with the three wire end wind 7 turns onto the ferrite core. Both transformers should be wound this way. It will be found difficult to get the final turn onto the former; care must be taken not to strip the enamel off the wire because the ferrite material has a low dc resistance and hence may short out the turns.

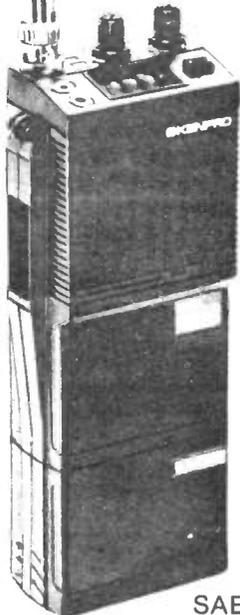
The circuit will work best when the two junction field effect transistors are carefully matched in terms of their dc characteristics. However, in the prototype the advantages which this may yield have not been investigated. The spread in values of typical J310 FETs seems to be acceptably small. Provided the drive from the transformer is balanced and the FETs are balanced, intermodulation distortion performance will be optimised. Any imbalance will not materially affect results, except at the limits of performance. However, if optimum results are required then the modification shown in Figure 6 will allow the dc conditions for each FET to be equalised.

Care should be taken to ensure that the double-sided board is provided with clearance holes for the components but not for earthing points. REW

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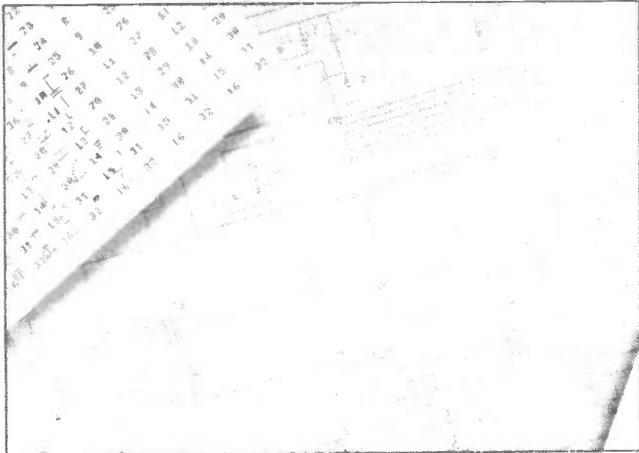
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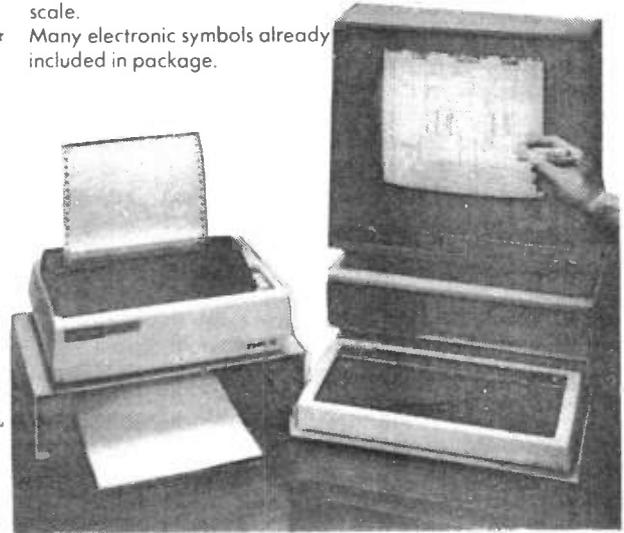
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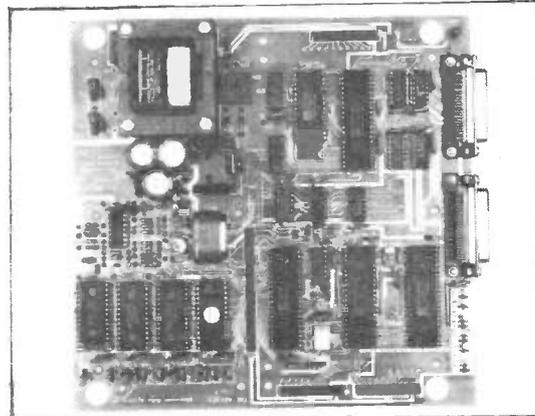
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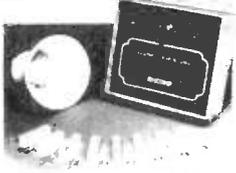
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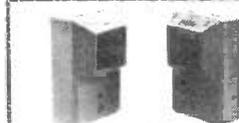
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MEDIUM WAVE



DXING

by Steve Whitt

Even for the experienced DXer the Atlantic Ocean can form a formidable barrier, yet for most UK-based DXers the first taste of really long distance reception will be a station in the Americas. It is often the case that many sleepless nights and much perseverance are needed to hear your first transatlantic station, but having surmounted this hurdle you'll wonder why it's been impossible to hear these stations before! Now to make things a little bit easier here are some suggestions.

The vast majority of stations in North and South America use frequencies that are a multiple of 10kHz, whereas European stations are separated by 9kHz. This means that the two frequency plans are not coincident and that there are certain 'window' frequencies where 4 or 5kHz separation exists between the European and the American channels. The table lists these window channels and the stations that are most likely to be heard on them.

Don't forget that you are likely to encounter a range of languages;

kHz	Most regular station
580	CJFX Antigonish
590	VOCM St Johns
670	CHYQ Musgravetown
680	CIYQ Grand Falls
760	(WJR) Detroit
770	WABC New York
850	WHDH Boston
860	CBH Halifax
940	CBM Montreal
	or R Jornal Rio de Janeiro
950	CHER Sydney
1030	WBZ Boston
1040	R Capital Sao Paulo
1120	(KMOX) St Louis
1130	WNEW New York
1210	WCAU Philadelphia
1220	R Globo Rio de Janeiro
	or CKCW Moncton
1300	(CBAF) Moncton
1310	(WLOB) Portland
1390	WCSC Charleston
1400	(CJFP) Riviera du Loup
1480	(CHRD) Drummondville
1490	(CHYM) Kitchener
1570	CKLM Laval
1580	CBJ Chicoutimi

(stations in brackets are less likely to be heard)

obviously English is the principle language of North America and much of the Caribbean, but there are French stations in Canada and the Caribbean and a few stations in the USA use Spanish or Hebrew. In Latin America the main language is Spanish, but you will hear Portuguese from Brazil, Dutch from Surinam and some English from Guyana.

Additionally there are a number of stations that are almost regular DX signals here in Europe. Examples are CJYQ on 930kHz (St Johns, Newfoundland), WHN on 1050kHz (New York) and R Globo on 1220kHz (Rio de Janeiro, Brazil). The best time to listen for these stations is after midnight GMT, although from September to April they are likely to be heard much earlier if conditions are favourable.

To aid identification, look for a Top 40 pop music format with news on the half hour to find CJYQ (it often identifies as Q Radio), a country and western music and sport format for WHN and a mixture of phone-ins, sports, news and music (all in Portuguese) to find R Globo.

Most American stations regularly use either a callsign (Canada and USA) or a name/logo (Latin America and the Caribbean), so identifying a station is usually not too difficult provided reception is good enough. Incidentally, it is occasionally possible under very good propagation conditions to hear trans

atlantic stations on just a portable transistor radio!

Whilst many DXers enthusiastically chase rare transatlantic DX, they often overlook the DX in their backyard; although many local radio stations can be very difficult or even impossible to log, they are often regarded as not being real DX on account of their close proximity. However, they can present quite a challenge to the listener and a good target for the newcomer.

Local radio

Over the last two decades local radio in the UK has developed from the offshore pirates of the sixties to the extensive network of BBC and IBA stations in existence now, and further expansion is likely in 1986 when a selection of officially licensed community radio stations are due to come on the air. Presently there are in excess of 120 local radio transmitters in operation in the UK alone, and depending upon your location and radio equipment, reception of more than 60 should be possible.

Often the best time to listen for these stations is during the day, when you will hear the weak ground wave signals. At night European sky wave signals tend to dominate. Although it is easy to start listening with a simple portable radio (which can in fact produce very good results, because the directional ferrite rod aerial will often be able to separate two co-channel stations), it is desirable to use a large tuned loop aerial with a communications receiver in order to capture those really weak signals.

You can look forward to finding local stations from most parts of the UK, including, for example, the Channel Isles and the Isle of Man, and most stations will verify accurate reception reports with their own QSL cards or letters. For detailed information on local radio in the UK and Ireland I can recommend a listing produced by the Medium Wave Circle (Reprint No 2), available for £1.00 from Harold Emblem, 55 Halsall Road, Birkdale, Southport.

Finally, do let me know what you hear in the way of local radio DX as well as, of course, the traditional DX. REW

DX FILE

This month's DX file centres on a log sent in by Graham Powell of Pontypridd in Wales, who with a Trio R2000 receiver

WINS New York 1010kHz
 WHN New York 1050kHz
 WBAL Baltimore 1090kHz
 WNEW New York 1130kHz
 WCAU Philadelphia 1210kHz
 WTOP Washington 1500kHz
 WMRE Boston 1510kHzF
 WQXR New York 1560kHz

Canada provided:

VOCM St Johns 590kHz

Graham logged all these stations between 0100 and 0400 GMT, and it just

plus a 20 metre long wire aerial has heard some good summertime DX. From the USA comes:

CKYQ Grand Bank 610kHz
 CHYQ Musgravetown 670kHz
 CJYQ St Johns 930kHz
 CHER Sydney 950kHz
 CKCW Moncton 1220kHz

From Brazil:

R Jornal do Brasil 940kHz
 R Capital Sao Paulo 1040kHz
 R Globo Sao Paulo 1100kHz
 R Globo Rio de Janeiro 1220kHz

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RE

NEW

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Welcome back to our three-monthly activity news spot. It is written, auspiciously I was going to say, on the first day of the annual international ATV contest, but looking out of the window I don't think auspicious is quite the word. After a week of Indian summer, with even a couple of nights of improved tropo conditions, it is raining hard - this will make it interesting for the stations who have elected to go out portable for the contest! Never mind, I hope you had success, anyway.

QRP on seventy...

On seventy centimetres new stations continue to spring up. One such is Rob G4IPL who resides in Towcester, 'a real hole'. (I presume he means from an RF viewpoint, after all they make Towcester cheesecakes there, a most pleasant local delicacy!). With just half a watt he managed to get a P1 signal to Albert G8UGU in Great Brington, which is not bad for a 10 mile path. He has also joined the BATC - welcome aboard Rob.

Talking of QRP, BATC member F2XO in Boulogne tells me of some experiments in the Pas de Calais area. On 1 September F1ESA, in Oye-Plage, tested a new transmitter designed by F3YX. With just 100mW he got a P4 picture over the 18km to F1FCS in Calais.

...and on twenty-four

Moving up the bands we come to twenty-four centimetres, on which Albert G8UGU has now established himself. Continuing our QRP theme, he bought the Solent Scientific 200mW transmitter and was pleased to find this worked first time, giving 150mW into a 20-turn helical set 10 feet above ground.

With this QRO set-up he manages to get a P4 picture to yours truly in Northampton. This is a 6 mile path, almost line of sight, and indicates the possibilities of 24cm. Albert is now working on the PA design from the last issue of *CQ-TV*, and also the new modulator design from Wood & Douglas which will enable him to put audio on his transmissions.

ATV



ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Repeater news now. GB3PV is the proposed TV repeater for the Cambridge area. The chosen site is Madingley, near the BBC aerial. The receiver is already complete and tested, and a licensing application - for 1kW ERP - has been submitted. I have to agree with Chris G4HCL that this 'will hopefully provide a useful service' - certainly the 25 watts ERP allowed on the existing repeaters restricts their coverage unduly. Requests for further info (and letters of support!) to Chris Lorek G4HCL, 11 Bevills Close, Doddington, March, Cambs PE15 0TT.

Hastings repeater

The new Hastings TV repeater is a project of the Hastings Repeater Group, and is to be co-sited with GB3ES and GB3HE. This site is 140 metres above sea level, with a good take-off in all directions. Antennas will be of the Worthing pattern, to cover just Hastings initially but with additional aerials added later to increase coverage.

Special features planned for the repeater are teletext-type pages, accessed at first by RTTY or ASCII commands but later 'hidden' in the vertical blanking interval as per broadcast TV. Another

possible feature is an automatic steerable search aerial. Constructor of the transmitter/receiver and control logic is Brian G4BCO.

Several people in the Hastings area have already built equipment for 24cm TV, including G4KMJ and G1FTX. Present proposals are that the 'box' should be AM or FM in, with output on AM (channel RMT1) only.

Perhaps wiser counsel will prevail, perhaps the RSGB repeater management group will ban AM, perhaps pigs will fly! Anyway, thanks to Tim Anderson for the information.

SSTV, Sussex-style

Finally a letter from Charles Brain G4GUO (Ferring, Sussex). 'I'm getting interested in ATV again after a lapse of a few years and have rejoined the BATC. I've just finished (well, not quite) the G3WCY/G4ENA SSTV system. I did originally put the colour memories in but it didn't work properly so now I'm back with black and white on Rx/Tx.

I still have problems, as when the width is increased for 50Hz pictures every fourth pixel does not get written to. Also I have had to slug the D outlines of the memories with 100pF capacitors to



Some informative pictures from Holland. Are your captions as clear as these?

ATV ON THE AIR



get the Tx board to function properly. (Any ideas, folks?).

'However, it works and I have contacted the normal WW/CDK/OQD crowd on SSTV.

'I intend building a variant of G3OQD's lighten for captions, answering CQ calls and so on, but I wish fewer people would use computers to generate their slow-scan messages as they are very boring – and an inefficient way of using the medium.

'I received a couple of good pictures from the space shuttle using G4BCH's FT290R and my 4-element yagi, and we played them back on Pete's colour SSTV converter. I have seen most of the other pics on 80m and in the Essex 2 metre

SSTV net (I work at Chelmsford for Marconi's in TV development!). That's about it as far as SSTV is concerned.

'Now for 24cm. I'm about half-way to radiating on 24cm: so far I have built a receive converter and two thirds of the transmit chain, with just the tripler to construct. I've already made a Worthing aerial and, because my main station is near Worthing, I'm in a fine position as far as activity is concerned for TV operation, with GB3VR shortly moving to its new site over at Brighton. Well, I hope I've done my bit to show there is some slow-scan activity.'

Not exactly flush

Indeed you have, and thanks for the letter Charles – I can always use more like it! In fact this time we are not exactly flush with activity news, so I thought I'd mention a couple of points which may be of interest if you're keen on construction.

VHF Communications is always a good read but does not regularly carry ATV articles. The 4/84 issue is an exception, with a project by Dieter Meendermann DC1BP for a colour test card generator.

This interesting device produces a choice of two separate PAL colour images stored in a 2764 EPROM. Chip

count is just 15 and the project is built on a standard 100 x 160mm Eurocard, which is available from the magazine. The 'active' devices are a ZNA 234 pulse generator and the LM1886/1889 combination for producing the colour. Two of these jobs have been built and both owners are very satisfied. Check out the magazine at a good library if you are interested.

Let's hear it for the good guys

The other point concerns good mail order service. Most of us have to rely on the post for buying specialised components, and this can be a gamble at times. I am pleased to give credit where it's due, so this is a plug for Bonex Ltd of Acton, London W3. They keep a comprehensive range of Toko coils and **R&EW** kits, usually more than the distributor has in stock, so it is worth trying them first (and avoiding that depressing 'out of stock' print-out). On the one occasion when Bonex sent the wrong item it was corrected by return of post, with some extra components as a bonus, so well done lads!

That's it for this time. We can do with a few more letters for the next round-up, so don't keep all the news to yourselves, drop me a line care of the editor. **REW**



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Exotic DX signals continued to roll in during July. Some enthusiasts viewed the month as something of a disappointment, but only when compared with June, which produced exceptional reception. There were many quiet days during July but this was well compensated for by the series of 'mystery' signals. The most incredible long-range reception took place on July 21st when Iain Menzies of Aberdeen saw the 'ARAMCO TV CHANNEL 3' identification caption floating over a picture from Yugoslavia. Aramco TV operates from Dhahran in Saudi Arabia on channel E3 with all of 5kW ERP! Reception occurred shortly after 1840BST.

Multi-hop sporadic-E signals impinged on the city of Leeds once again during the month. On the 2nd, Mark Dent noted the Canary Islands at 0934 radiating the familiar RTVE bar pattern (usually received from the Spanish mainland) with the identification 'TVE IZANA 3'.

TV signals from Greece on channel E3 and the Italian pirate station on IA have appeared many times throughout the month. These were once classed as being very rare; now they seem more like locals!

Tropospheric activity was in evidence during the first few days of July, with signals at UHF coming from as far as Switzerland and the Polish/Czechoslovakian border. Trop reception was also around towards the end of the month, but signals were mainly restricted to West Germany, France and the Low Countries.

South American TV in the UK?

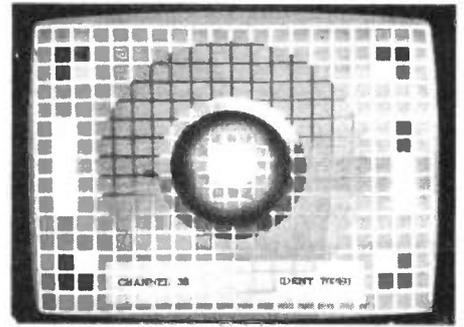
Details have been forwarded concerning a possible exotic signal received in the UK by Iain Menzies. The event took place on June 11th during an opening between 1900 and 2000BST. Portugal and Iceland were being monitored on channel E3 at the time. Both signals faded to be replaced briefly by a third transmission showing a possible news programme caption. It has already been suggested that this could have been Rumania on R2 (spreading over to channel E3). However, TVR's news programme is 'TELEJURNAL'.

Iain can't quite decide whether the first word on the mystery caption was 'tete' or 'tate' or whether the vowels included accents, namely 'tété' or 'táté'. We personally think the word is 'tele', the apparent accents being in fact part of the background design. Iain is fairly convinced that the shape above the text is of the African continent but, upon consulting an atlas, it more closely resembles the shape of South America. Assuming the caption to read 'tele jornal', it could well be of Portuguese origin.

The possibility of it being a system 'N' signal from South America cannot be ruled out. Venezuela immediately springs to mind as a likely candidate. It should be noted that system N is 625 lines, 50Hz and a DX-TV receiver in the UK would not require timebase adjustment, unlike a system 'M' transmission (525 lines, 60Hz) from, say, Brazil.

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

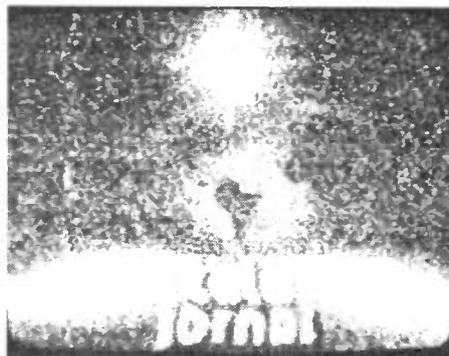


Incidentally, Venezuela uses both systems N and M for TV broadcasting. If any readers overseas can shed any light on the subject and assist with identification, please do so. It would be very interesting to clear up this mystery.

DX-TV log for July

This month we are featuring part of William Maries' reception log. There's no mention of possible South American signals but it is impressive nevertheless!

6/7/85: RAI on test with the 'RAI 1' PM5544 test card with sample 'Videotext' pages during the day on IA and IB; TSS (Russia) with programmes throughout the morning on channels R1 (Band I) and R3 (Band II); TVE (Spain) received on E2, E3 and E4 with programmes at 1124; JRT (Yugoslavia) on test with the PM5534 pattern, which carried the identification 'JRT BGRD'. The test card originated from studios in Belgrade. The PM5544 pattern from Ljubljana was noted on E3 with the inscription 'RTV LJNA', while on channel E4 the Yugoslavian FuBK pattern was present with the inscription 'JRT ZGRB 1'. This is transmitted from studios in Zagreb; TVE-2 (Spanish 2nd network) on channel E2 at 1206 on test; CST (Czechoslovakia) with the 'RS-KH' electronic test card and the FuBK pattern on channels R1 and R2 at around 1230BST; TVR (Rumania) with a 'TVR' identification caption at 1243, received on channel R3; ORF (Austria) with a programme schedule caption at 1220 followed by the monoscopic Telefunken TO5 test card and the PM5544 pattern; MTV (Hungary) with the multi-burst/frequency gratings pattern on R1 at lunchtime. The PM5544 test card was received later on.



Possible South American TV service received in Scotland (pic Iain Menzies)

11/7/85: CST with the EZO-type test pattern at 0845. A colour-bar pattern was noted on E2/R1 at 0850 but this could not be identified.

13/7/85: NOS-1 (Netherlands) on test with the PM5544, received via improved tropospheric conditions during the early morning period on channels E4 (Band I) and E7 (Band III); RTBF-1 (Belgian French language service) with sample teletext pages, noted on E8 and E11 via trop; Canal Plus (France) with programmes in the early morning via trop on channel F5; NRK radiating the PM5534 test card at 1057. This was noted later in the day on E2 carrying the identification 'NORGE TELEVERKET'; RAI with teletext pages on IA; RTP on E3 from 1059 with the FuBK test card and programmes; TVE with a bullfight, news bulletin and cartoon on E2, E3 and E4. Various Spanish transmissions were noted for much of the day.

16/7/85: TSS with the clock caption at 1800BST on R1 showing 2100 Russian time; CST with a news programme on R1; SR/SVT (Sweden) at 1826 with the clock caption followed by programme details. Reception was mainly on channel E3 although signals occasionally appeared on E4.

17/7/85: CST with the news at 1823 on channels R1 and R2; MTV on test with the PM5544 pattern carrying the identification 'MTV-1 BUDAPEST'. Programmes opened up at 1830 on R1 with a logo and jingle.

18/7/85: ARD (West Germany) on E2 with programmes. This service was identified by the anti-pirate 'ARD' caption which appears in alternate corners during most programmes; MTV on R1 with programmes. An 'MTV-1' logo appeared at 2000; RAI on IA and IB with programmes; TSS with progs on R1.

20/7/85: TVE-1 on test with the familiar GTE colour pattern at 1200. Programmes followed at 1218 and were received on channels E2, E3 and E4. While the test card was being noted, two stations were floating on E3 – one had the lower 'tve 1' ident, the other didn't; TVE-2 with the colour electronic GTE test card on channel E2 with programmes at 1400.

22/7/85: CST on R1 at 0901 with the EZO-type test card carrying the identification 'RS-KH'; TSS received at 0902 on R1 with the colour electronic test pattern; RAI on test at 0930 on IA with the PM5544 pattern.

DX-TV RECEPTION REPORTS

23/7/85: NOS-1 radiating the PM5544 test card, received at various times during the day on E4 from the Lopik transmitter; TVE on E4 with the GTE test card and a regional bar pattern with the identification 'MADRID 4'. TVE-1 was received on channels E2, E3 and E4 from 1028; RAI with Videotext at 1115; RTP with the FuBK test card incorporating a digital clock in the lower right-hand corner at 1146; JRT with the PM5544 with a digital clock in the top portion and the ident 'JRT BGRD' at the bottom. Reception was at 1635.

25/7/85: NOS-1 with the PM5544 test card on E4; NOS-2 on test and received via a Band I dipole (!) on the UHF channels E27 and E32 due to enhanced trop conditions; ARD/WDR-1 on test during the early morning with the FuBK test card. This was received on channel E46 via trop using a Band I dipole, and it 'floated' over BBC-1 transmissions; TSS on test with the colour electronic test pattern on channel R1 at 1127; Canal Plus with scrambled programmes on F5 and received via improved tropospheric conditions at 2014BST.

26/7/85: SR/SVT received on E2, E3 and E4 at 0850 with the PM5534; TSS on test with the electronic pattern and the old monoscopic '0249' test card on channels R1 and R2; YLE from Finland on E3 and E4 with the FuBK test card at 0915; NRK radiating the PM5534 with various identifications indicating Norwegian transmitters located at Steigen (channel E2), Melhus (E2), Bagn (E3), Gulen (E2), Hennes (E3), Kongsberg (E4) and Hadsel (E4). Reception occurred at 0926BST; CST on test with the PM5544 carrying the 'SR-1 TV BRATISLAVA' identification on channels R1 and R2. The 'RS-KH' electronic pattern was also noted; TVP (Poland) at 1214 on R1, initially with the PM5544 but also on programmes; TVE with the regional 'RTVE AITANA 3' pattern. Progs were received from Spain on channels E2, E3 and E4; RTP with the FuBK test card at 1621 on channel E3; TVE-2 radiating the GTE colour test card from the Santiago channel E2 transmitter at 1700; RUV from Iceland on channel E4 at 1752 with the PM5544 test card carrying the inscription 'RUV ISLAND'.

29/7/85: NOS-1 on E4 during the day on test with the PM5544; NRK received on channels E4 and E3 at various times with the test card via meteor shower (MS) propagation; SR/SVT on E2, E3 and E4 at various times on test and received via MS; TVP on R1 with the PM5544 test card, received via MS.

30/7/85: NOS-1 on E4 with the PM5544; TSS on test with the '0249', switching to the colour electronic 'Leningrad' pattern on R1 and R2; NRK on E3 with the 'HEMNES' PM5534 pattern; SR/SVT with the PM5534 on E2, E3 and E4 at 1222; TVE 'AITANA 3' regional pattern on E3; TVP on test at 1246 with the PM5544 on channel R1.

31/7/85: NOS-1 on test with the PM5544 test card and later with programmes on E4; NRK with the PM5534, received from the E2 transmitters at Gulen, Steigen and Melhus, Gamlen on E3 and Bremanger on E4; TVE with the GTE colour test card on E3 at 0930; RAI at 1740 on channels IA and IB with programmes; TVR with the FuBK test card carrying the identification 'TVR BUCURESTI'. The station opened up for programmes at 1800 with a clock caption showing GMT +3 hours. Reception was on channel R2; JRT with programmes. Commercials were also received and identified by the letters 'EPP' between each advert. Reception occurred on channels E3 and E4; MTV with the clock caption on R1 at 1829BST followed by the news programme 'TV Hirado'; ORF with a programme schedule on channel E2a at 1827 followed by the Austrian TV clock caption; EPT (Greece) was possibly received on channel E3 at around 1835. A programme was noted with Greek-style writing. It could, however, have been JRT as they transmit special programmes for immigrant workers.

New test cards seen

At least two reports indicate that the Dutch TV service (NOS) has been radiating the FuBK test card instead of the more usual PM5544. So far the pattern has only been aired over the Lopik channel E4 outlet for short periods with the identification 'LOPIK' across the centre.

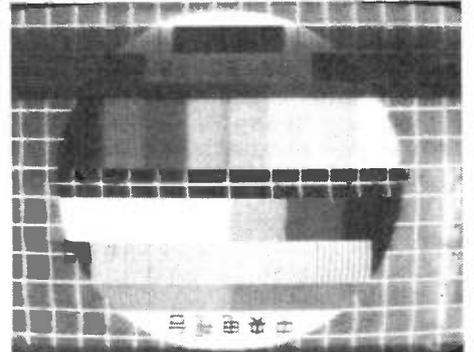
The old EBU bar test pattern has been seen again. During a recent opening from the south RTP-Portugal were noted using it, but only via the E2 transmitter at Muro. The pattern eventually switched to the more familiar low frequency test signal. This resembles a black screen with a broad white vertical central band.

Another pattern from the south was sighted on channel E3 at 1250BST on July 12th. It was composed of a white screen with a broad horizontal multi-step grey-scale through the centre. Did anyone else see this?

Reception reports

In a recent issue of *R&EW* we posed the question, 'What do you do when stropky neighbours object to your hobby?' Well, Iain Menzies of Aberdeen has volunteered some useful suggestions. Roughly translated he suggests inviting them round to sample a few alcoholic beverages during a good tropospheric or sporadic-E opening.

'There's nothing like showing off to people what you can receive. Once they've seen a foreign programme they soon shut up,' advises Iain. He speaks from experience. Most of the neighbours think his DX-TV gear is wonderful and nearly all of them have seen it in action. When he installed equipment for 2 metre work he showed it to his immediate



Chinese colour electronic test card (pic Phil Mead)

neighbours and asked if they were experiencing any interference. If after you've tried your best to keep on the right side of your neighbours all fails, Iain suggests moving out without telling anyone or starting up a CB station to blow their hi-fi's and TVs off their stands! Perhaps that's a bit too drastic??

The present sporadic-E season has brought many new stations for Iain. These include ORF from Austria on the low power 100W relay on channel E3, DDR:F1 (East Germany) on E4 from the Cottbus transmitter and RTS-Albania on channel IC (82.25MHz vision). Oh, and of course Saudi Arabia on E3 mentioned at the beginning of this column. While perusing the DX-TV pages of the August *R&EW*, he was reading our advice about watching out for other signals from the south-east which may be floating over transmissions from Yugoslavia on channel E3. At that point Iain looked up at the screen and there was Saudi Arabia! (*R&EW refreshes the parts etc... Ed.*)

Andy Webster (Billinge, near Wigan) also noted JTV on E3 but his reception was drowned by JRT from Yugoslavia when they came on the air. One very important item which came too late for the last column was his remarkable reception of Dubai in the Middle East on channel E2. Signals were logged at 1100BST on June 20th. A square version of the PM5544 pattern was seen followed by an Arabic announcer and programmes. The following day Andy spotted the East German DDR:F1 test card on channel E3 from the transmitter at Helpterberg. This particular outlet was reported to have closed some years ago.

A very interesting letter has arrived from Kevin Jackson in Leeds. Excellent tropospheric conditions were in evidence in his area at the start of July. On the 3rd the 'BR 3 MCHN' FuBK test card was resolved from the Bayerischer Rundfunk network in West Germany. The channel E9 Südwestfunk (SWF) transmitter at Hornisgrinde was logged in Band III from West Germany together with the Sântis channel E7 outlet in Switzerland. East Germany made an appearance on E34 from the transmitter at Brocken. The signal consisted of the DDR:F2 test card.

On July 4th another East German UHF signal came through but on channel E39. The transmitter is located at Löbau close to the borders with Czechoslovakia and Poland.

Phil Mead (Nottingham) has been sampling the delights of steam railways in China. He's sent a few off-screen shots taken from his hotel TV set.

A test pattern resembling an inverted PM5544 is used, with the identification varying depending upon the studio of origin. The PAL colour system is in use with channel allocations closely following those of Eastern Bloc countries, ie system 'D'.

Gone are the days when the evening entertainment consisted of one of five Peking operas officially approved of by Chairman Mao's wife! Nowadays there is much more variety on the screen with longer programme hours. News bulletins and current affairs take up much of the time, although they do have an occasional comedy series and the odd advert here and there. Recently a course of 'how to speak English' programmes has been broadcast.

DX-TV in Eire

From time to time we receive enquiries from readers in Eire wishing to take up

TV DXing. In some respects it is easier to DX in Eire than it is here in the UK. TV receivers should already be equipped with multi-band tuners, since the national RTE-1 and RTE-2 programmes are aired over Band III as well as at UHF. Band I is relatively quiet, with only one main transmitter in service at Gort. This radiates RTE-1 on channel B. It should be noted that this is the same vision frequency as the Italian channel IA (53.75MHz).

Provided that the Eireann version of the British DTI is more willing and able to ward off intruders such as illegal cordless telephone users, there is very little to impede DX apart from the greater distance to the Continent. Sporadic-E DX in Band I would seem most attractive in this respect, since DXers in Eire would be able to enjoy most of the countries received by UK enthusiasts. We would imagine that the USA or Canada should be an added bonus too under multi-hop conditions.

Unfortunately the UHF band would be less attractive due to the greater distances involved. The same remarks apply to Band III. So, if anyone wants to have a go at TV DXing in Eire, arm yourself with a Band I array and just let those signals roll in...

European cable TV

Iain Menzies tells us that the overhead cable TV service in Naples (Italy) is a great success with the locals. The programmes aren't necessarily good but the cable's ideal as a washing line!

In Denmark the scrambled pay TV system known as Kanal 2 which we mentioned in a recent *R&EW* has gone bust. Many thousands of illegal decoders and a general lack of income are the main reasons for its demise.

The Finnish TV service (YLE) and a company known as NTV are hoping to launch a pay TV channel in the country by 1986/87. Let's hope they will be more successful than the Kanal 2 venture.

Service information

Spain: The following outlets are now in service: Soriguera on channel E39 with 24kW ERP (RTVE-1); Soriguera on E45 with 34kW (RTVE-2); Isla Plana with 1.5kW on E53 (RTVE-1); Paramo on E57 radiating RTVE-2 programmes with 158kW.

East Germany: There is a new transmitter for DDR:F2. It operates on channel E38 and is located at Dietlas in the Suhli region.

Our thanks to Gösta van der Linden (Rotterdam, Netherlands) for supplying this month's service information. **REW**

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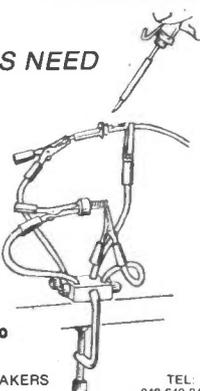
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THE EVER-MIGHTIER MICRO

The home microcomputer market has now 'matured', or so we're told. After an awkward adolescence, some computers have grown into highly desirable creatures. Your editor investigates

With Christmas approaching, and High Street electrical retailers stocking up for the tremendous seasonal increase in sales of microcomputers, this seems an appropriate time to take a look at some of what's available in the way of number crunchers for the home user.

Despite the misconceptions of many, the microcomputer industry is not in the chaotic state commonly supposed. Claims of its imminent demise are a little wide of the mark, and there is now a reasonable degree of optimism evident among the more financially secure manufacturers.

Part of the problem recently has been excessive production of outdated products, with insufficient thought given to the demands of the market place. The subsequent overstocking and cash flow problems could hardly be expected to inspire confidence in investors. Allied to this are the problems of a degree of over-confidence last year in the high tech (or hi-tech, as some would have it) industries on the part of the City, and the shedding of excess weight by companies in the United States who geared themselves to a rate of growth that was not sustained.

The recent 'shake-out' has disposed of many inadequate machines, and the products currently available offer a respectable level of quality and performance (with a few exceptions - but I won't bitch!).

So, what is on offer this Christmas?

Cheap and cheerful

The most popular products are almost certain to be those from Amstrad. Since launching the CPC464 early in 1984, a low cost Z80-based computer with 16K of RAM, integral cassette data storage and monitor (colour or monochrome) included in the price, Alan Sugar's company have been beavering away to produce more price-busting machines.

Earlier this year the CPC664 was launched, this being essentially the '464

with a 3 inch disc drive instead of the cassette unit. Soon after this Amstrad released a version of the machine in the USA which contained 128K of RAM. This computer was at the centre of some dubious behaviour (to say the least) from Amstrad, who assured the British press that the 128K micro would not be sold here. They then proceeded, after waiting sufficient time to clear stocks of the '664, to sell the 6128 in the UK for exactly the same price as the now obsolete '664 (£399 for the colour monitor option, £299 for the green screen), much to the disgust of those unfortunates who had just paid out for the earlier model.

No upgrade package has been offered to owners of the '664 to give them the extra 64K of memory, nor, apparently, will there be such an offer.

The 128K machine overcomes one of the problems of the earlier 64K version. A major selling point had been the ability to run in CP/M mode, for which a great deal of business software is available. However, 64K of RAM is insufficient memory to run much of this software.

The poor man's word processor

Also new from Amstrad is the PCW8256, a cheap word processor package (approximately £460) comprising a Z80-based micro with 256K of RAM running CP/M Plus, a monitor with integral 3 inch disc drive, a printer and software. Notably absent is an RS232 interface, although such a module is available as an optional extra (at extra cost, of course!), and the non-standard 3 inch disc drive unit might limit its appeal slightly.

In addition to their computers, Amstrad also offer a range of peripherals. Many are specifically for the '664 or 6128, but of wider appeal is the new DMP2000 printer. This is a dot matrix unit, with a Centronics interface, offering a speed of 105cps (characters per second), bold, italic, superscript and subscript text, and a respectable near letter quality (NLQ) mode for a very low price.

Three in one magic box

Another micro seen for the first time this summer was the impressive Commodore 128. This computer is unusual in having two central processors, an 8502 and a Z80, and, of course, 128K of RAM. The two CPUs mean that the C128 can act as three different machines. The 8502 (compatible with the 6502 used in the CBM64) allows the massive range of CBM64 software to be run. The Z80



The Rolls-Royce of home micros? Atari's flagship, the 520ST. Guess what I want for Christmas...

allows CP/M operation, with 40 or 80 column modes, and a rumoured RAM expansion will enable the C128 to address 512K in CP/M mode.

The C128 mode implements Basic Version 7, described as excellent in American reviews, with 122K of RAM free. Apparently it suffers none of the more irritating idiosyncracies of Basic on the CBM64.

Talking of idiosyncracies, owners of the C128 will not have to put up with the lethargic 1541 disc drive unit. Commodore have produced a new dual-sided drive, the 1571 (with a low-cost version, the 1570), which is capable of holding up to 340K of data and will operate at up to four times the speed of the pedestrian 1541.

It is also likely that the new Commodore micro will be made available with a built-in disc drive as the C128D.

Buenos dias, mi Amiga!

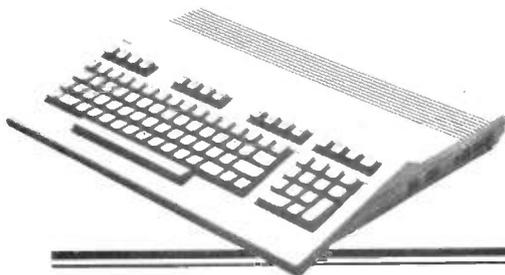
The C128 was displayed prominently at the *Personal Computer World Show* in September, but Commodore's star performer was disappointingly absent from this event (although it was shown privately to trade and press). This star is, of course, the Amiga, which will not be available in the UK until the first quarter of 1986.

The Amiga is based on the powerful 16-bit 68000 processor from Motorola. It has 256K of RAM, 128K of ROM (expandable to 192K), and three custom chips to handle general memory control, I/O operations, and animation. These chips are named Agnus, Portia and Daphne, believe it or not!

What this adds up to is a machine which gives quite incredible graphics and multi-tasking. It will be sold as a package to include a single 3½ inch disc drive and a mouse for a price likely to be just under £1000, although the monitor will be extra.

The Amiga's main competitor in the UK market is already here, in the form of the Atari 520ST, which also had a great deal of space devoted to it at the PCW Show (where it received its official launch).

Three into one will go! The multi-talented C128, by all accounts an excellent machine



The 520ST also uses the 68000 CPU, running at 8MHz, with 192K of ROM and 512K of RAM, four custom chips, and lots of I/O facilities. It will sell for around £750, this price to include a single 3½ inch disc drive, mouse, and monochrome monitor. Like the Amiga, the emphasis is very much on graphics ability and ease of use (although the graphics are not as stunning as the Amiga's). The front end of the 520ST's operating system is the user-friendly GEM (graphics environment manager), very much the flavour of the month judging by some of the computer magazines.

Although the Atari box of tricks does not have the Amiga's multi-tasking ability, it is likely to be more popular in this country because of its price. In America the situation will be less clear cut, since there is no real distinction in the States between home and business micros (it is common to find Apples, Apricots, and even IBM PCs being used as 'home' micros).

The Atari stand at the PCW Show also displayed a cut-down version of the 520ST with a built-in disc drive and 256K of RAM, the 260ST. This is likely to be available only in Europe, but no firm launch date has yet been announced.

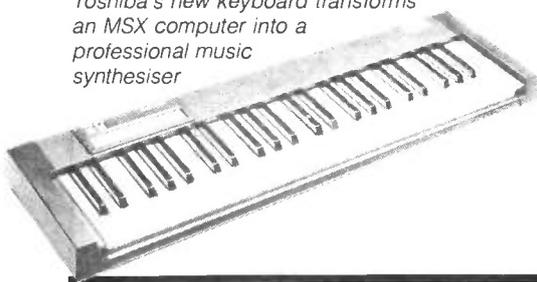
Less exciting – but cheaper!

Sinclair's QL has now had a substantial amount chopped off its retail price, currently selling for around £200. There are now probably as many thoroughly sick QL owners who bought it before the price dropped as there are livid '664 owners!

The QL has 128K of RAM (with 32K of ROM) and the 16-bit 68008 CPU. This processor is a 'cut-down' version of the one in the Amiga and Atari 520ST, and suffers from having a data bus of only 8 bits. The QL cannot offer anything like the performance of these two computers, lacking their custom chips. It is also hindered by its form of data storage, the gimmicky and unreliable Microdrive, with only 100K capacity. It is significant that although Sinclair stated at the time of launching that a disc drive would not be produced, they have now about-faced and made one available.

The price decrease would seem to have been in order to shift large stocks of the QL after the well-publicised failure to reach agreement with Robert Maxwell. Despite this failure Sinclair's fortunes have improved lately, with sales

Toshiba's new keyboard transforms an MSX computer into a professional music synthesiser



up to a healthy level again. However, to maintain any long-term viability the company will have to come up with something new to replace the ageing Spectrum and the disappointing QL.

Weather the storm

Another company which has weathered the storm (barely!) is Acorn, with another injection of capital from Olivetti. The BBC micro has been upgraded to 128K of memory, although despite its undoubted quality it is now an old machine and ridiculously overpriced.

The 128K version will retail at £499, and dealers will be able to upgrade the 64K BBC B+ to 128K for around £30.

New MSX machines are appearing, featuring very impressive graphics and sound and a large software base which is fully compatible between different makes of computer (this compatibility is, of course, central to the philosophy behind MSX).

An interesting development is the ROM card, similar in appearance to a credit card and with a ROM (or EPROM or EEPROM) containing up to 256K of memory mounted on it (1 megabyte versions will be available soon). These cards form a very robust way of buying software, and for use are merely inserted into an adaptor cartridge in the machine.

Another development in memory devices is the CD ROM. This uses a compact disc of the same sort as used in CD audio equipment, and can hold up to 1 gigabyte of data. Although present technology allows only a read-only ability, various companies are developing discs which can be written to by the user.

Christmas goodies...

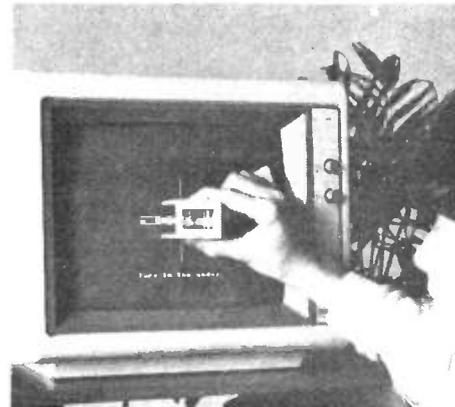
There are already numerous bargains to be found, with various packages on offer from manufacturers and chain stores. A number of Spectrum bundles have made an appearance, along with similar deals for the Acorn Electron, Atari 800XL, etc. A typical package comprises the computer, data recorder, joystick and software (such a pack for the 64K 800XL, for example, retails at £99).

Discounts are available on popular machines: I recently saw a CBM64 on offer for £99, and the new Atari 130XE, which had its recommended retail price dropped from £169 to £140, for £120. The latter micro is one of the new 8-bit computers with 128K of RAM, like the Enterprise 128 and Amstrad 6128. Memotech have also cut the price of their 80K MTX512 and 48K MTX500 to £129.95 and £79.95 respectively.

Bits and pieces

To round off this brief (and far from exhaustive) foray into the home micro scene, let's look at some interesting miscellany.

With software piracy a major problem



Lenslok – decipher the code, key it in, and away you go

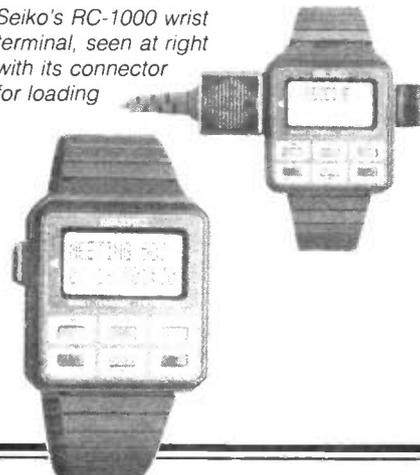
at the moment, a London based company has come up with a novel solution. The Lenslok from Asap Developments is an 'optical key' comprising a special lens which is packaged with the software, and protects against audio copy piracy. It works by means of a two-letter password randomly generated in the computer. This is scrambled using a routine specific to the program, and the scrambled form is displayed for several seconds. When viewed through the special lens these can be deciphered and keyed in. Only then will the program run.

The Seiko RC-1000 wrist terminal is a device of somewhat less certain usefulness. It can store eighty 'pages' of 24 characters each which can be viewed at the press of a button, and is intended as a portable memo device. The pages are downloaded to the RC-1000 from a computer via an RS232C interface. What will they think of next?! (Oh, by the way, it also tells the time!)

And finally...

A new piece of software which caught my eye a little while ago comes from the Mirrorsoft stable (is there any pie that Robert Maxwell doesn't have a finger in?). Called Fleet Street Editor, it offers such features as word processing, layout, design etc, and would seem to be ideal for the production of newsletters. Perhaps I'd better get a copy... **REW**

Seiko's RC-1000 wrist terminal, seen at right with its connector for loading



NEXT ISSUE

Radio & Electronics

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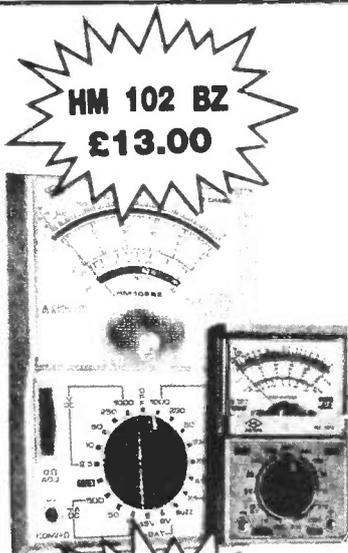
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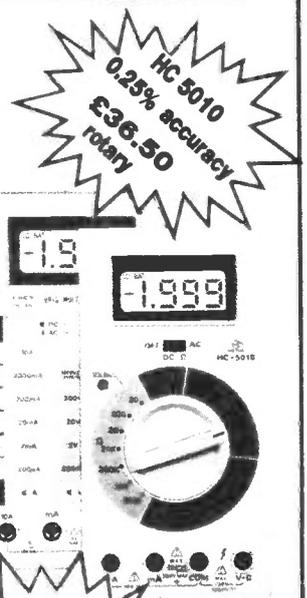
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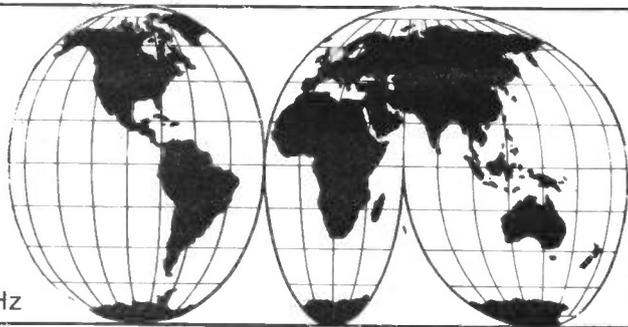
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SHORT WAVE NEWS FOR DX LISTENERS

By Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in kHz



Continuing with our review of some of the African transmitters currently operating on the 90 metre band (**3200** to **3400**), the low-powered stations are now brought to your attention.

Low-powered transmitters on the band are, as one would expect, difficult to log. In general, apart from the receiver characteristics, patience is often the key to eventual success. Sooner or later the prevailing conditions will be such that some degree of achievement may be possible.

Auspicious occurrence

It is sometimes the case that a particular channel is almost inevitably covered by utility QRM except for that one short-lived occasion when the target station is audible. Upon that auspicious occurrence one merely hopes that sufficient time is available to positively identify the source of transmission – usually by (a) the identification, (b) language used, (c) time-check, (d) interval signal, (e) the National Anthem, (f) sign-off time or a combination of some of these clues.

In this, as in previous reviews, only the evening transmissions are quoted, except where a sole morning schedule is apparent.

TWR (Trans World Radio) Mpangela, Swaziland operates on **3240** in vernaculars from 0300 to 0345. With a power of 25kW it is not often reported. This is due, in the opinion of the writer, to the fact that very few DXers are around on the band at the appropriate time. TWR transmits religious programmes, this particular schedule having been logged by the writer twice last winter.

Liberia Broadcasting System in Monrovia has a 25kW transmitter which is scheduled from 1800 to 2400, the programme languages being English, Liberian and some fifteen local vernaculars. This

one is often reported in the SWL press.

The next 25kW transmitter is that of Radio Mozambique, Maputo operating on **3265** with the Foreign Service in English to South Africa from 1800 to 1830 (on Wednesday, Friday and Sunday from 1900). Use of the English language makes identification a simple matter, logging it quite another – the frequency can vary on occasions.

La Voix de la Revolution, Bujumbura, Burundi on a nominal **3300**, radiates the Home Service in French and vernaculars from 1600 to 2100. There is an English programme timed from 1645 to 1700 but this 25kW transmitter is likely to be logged anywhere between **3300** and **3306**. Commercial QRM abounds around the quoted frequencies, resulting in very few loggings of the signals from Bujumbura.

Education

The educational station Radio Candip in Bunia, Zaire, recently updated from 1 to 10kW, operates on **3390** in French, Swahili, Lingala and seven local dialects from 1530 to 1900 daily. Radio Candip has been heard on several occasions now that the power has been increased.

Often logged is one of my favourite 90 metre band 10kW Africans, Radiodiffusion de Kara in Togo. Easily memorised is its three plus all the twos (**3222**) channel, at which point on the dial it operates in French and vernaculars from 1630 to 2305 but does feature a newscast in English at 2000. Should a blank be drawn on **3222** then it may have wandered up to **3223**.

Continuing with the 10kW transmitters, ELWA in Monrovia, Liberia is to be heard on **3230** with the Home Service in vernaculars from 1805 to 2222 (on Tuesday and Thursday until 2202). This one is frequently heard and reported.

Radio Nacional de Angola,

Luanda on **3355** radiates the Home Service 'A' programme in Portuguese from 1800 to 0530. RN de Angola is often mentioned in the SWL press.

Logged several times per year is Radio Tanzania, Zanzibar on **3339**. Another 10kW transmitter, it features programmes in Swahili for local consumption from 1430 to 2000. Well worth logging.

Another easy one to identify – it programmes in English – is Accra in Ghana. The schedule is from 1530 to 2200 and is the GBC2 Commercial Service which has newscasts on each hour, the frequency being **3366**. This one can be logged quite often throughout the year (see under 'Around the Dial').

Radio Mozambique, Beira is a provincial station operating on a nominal **3370** but varying between **3360** and **3372**. At 10kW it presents programmes in Portuguese and vernaculars and identifies in Portuguese, English, French and Swahili. The schedule is from

1500 to 2000. Radio Mozambique is reported from time to time but is not an easy one to log.

The 5kW Radio Rwanda, Kigali is often heard on **3330** radiating the Home Service programme in French and two local vernaculars from 1330 to 2100 (Saturday 0900 to 2100, Sunday 0300 to 2100). Radio Rwanda is frequently logged by UK DXers.

The last in our review of 90 metre band Africans is the rarely reported Radio Comoro, Moroni which has a 4kW transmitter on the air with the International Service in Arabic from 1500 to 1600, in French from 1605 to 1730 and from 1805 to 2000, and in Swahili from 1730 to 1805. The frequency is a nominal **3331** but in practice it can vary from **3327** to **3335**. Reception of Radio Comoro would represent a DX catch of no mean order for a DXer based here in the UK. Good luck with your 90 metre band African Safari.

AROUND THE DIAL

The times and frequencies listed here are those hopefully considered to be of interest to many readers. The channels quoted are those observed by the writer at the times stated.

AFRICA

Benin

Cotonou on **4870** at 1934, YL with a newscast in French followed by music in typical local style in a Home Service programme. The schedule, in French and vernaculars, is from 0400 (Sunday from 0600) to 0800 (Saturday until 1100, Sunday until 2300) and from 1300 to 2300 with a power of 30kW. There is a newscast in English at 2000 on Wednesdays.

Botswana

Radio Botswana, Gaborone on a measured **3355.8** at 1855, OM with announcements in SeTswana, a few bars of local

music then OM with the news after the station identification at 1900.

Egypt

Cairo on **17670** at 1500, YL with the station identification and a newscast in a relay of the Domestic Service timed from 1300 to 1900 on this channel.

Gabon

Africa No. 1, Moyabi on **15200** at 1050, OM with announcements in French during a programme of pop records then OM with the station identification in French at 1100.

Ghana

Accra on **3366** at 2158, OM with announcements in English, YL with a ballad complete with orchestral backing. GBC2 programmes are in English and are on this frequency from 0545 to 0800

SHORT WAVE NEWS

(Sunday from 0900) and from 1530 to 2200 with a power of 10kW.

Liberia

ELWA Monrovia on **3230** at 2150, OM with a religious talk in a local vernacular during a Home Service programme. All transmissions are in vernacular on this channel, the schedule being from 0610 to 0800 and from 1805 to 2225 (Tuesday and Thursday until 2200). The power is 10kW.

Rwanda

Radio Rwanda, Kigali on **3330** at 2015, OM with a talk in French heard with some difficulty amid the co-channel QRM. This 5kW transmitter radiates the Home Service in French, Swahili and a local language from 0300 to 0600 (Sunday through to 2100), from 0900 to 1200 (Saturday until 2100) and from 1330 to 2100.

Zambia

ZBS Lusaka on a measured **3346** at 1905, OMs with a discussion in the English General Service. The power and opening times of this recent arrival on the 90 metre band are not known at the time of writing, but it closes around 2110 from Monday to Thursday and around 2200 from Friday to Sunday inclusive.

CENTRAL AMERICA

Antigua

BBC Relay on **6175** at 0340, OM with a religious talk during one of the English programmes for Canada, Mexico and the USA, scheduled from 2300 to 0730.

Cuba

Radio Rebelde on **5025** at 2230, OM with the station identification in Spanish as 'Radio La Habana' then YL with a folk song in Spanish. The power is unknown but the schedule is reportedly around the clock with some programmes in Russian.

NORTH AMERICA

Canada

Montreal on **5960** at 0322, OM and YL with a discussion about Canadian naval power in an English transmission to Mexico and the USA, timed from 0300 to 0330.

USA

WYFR Family Radio, Okeechobee, Florida on **5985** at 0350, OM with a talk in Chinese in a programme of that language for North America relayed from the Voice of Free China, Taiwan. These relays are scheduled, at the time of writing, from 0200 to 0400 and from 0600 to 0700 on this frequency.

SOUTH AMERICA

Brazil

Radio Difusora do Maranhao, Sao Luis on **4755** at 0019, OM with a local pop song, OM with announcements in Portuguese. This 2kW transmitter is on the air around the clock.

Radio Itatiaia, Belo Horizonte on **4805** at 0034, OM with a sports commentary in Portuguese. As far as could be determined, this programme was also being carried in parallel by R Nacional on **4815**, RN de Manaus on **4845**, RC do Para on both **4885** and **5045**. Obviously an event of some importance nationally. Radio Itatiaia has a power of 0.5kW and works to a 24-hour schedule.

Colombia

Caracol, Neiva on **4945** at 0323, OM with a sports commentary in Spanish with many mentions of Colombia. Caracol, with a power of 20kW, works to a 24-hour schedule.

Radio Sutatenza, Bogota on **5095** at 0114, OM with a news commentary in Spanish. At 50kW the schedule is around the clock.

Ecuador

Radio Iris, Esmeraldas on **3381** at 0012, OM with a political talk in Spanish. With a power of 10kW, Radio Iris is on the air from 1000 (Sunday from 1100) through to 0300.

Radio Centinela del Sur, Loja on **4890** at 0315, OM with a ballad in Spanish, OM with announcements followed by OM with the station identification. The schedule is from 1100 to 1300 and from 2200 to 0300, the latter closing time being variable around that shown. The power is 2kW.

ASIA

China

Radio Beijing on **11600** at 1420, OM with announce-

ments followed by some Chinese music during an English transmission to South-East Asia, timed from 1400 to 1500.

South Korea

Seoul on **9870** at 1601, YL with the station identification, frequencies etc at the commencement of the English programme for Africa, Europe, the Far and Middle East, scheduled from 1600 to 1700.

Pakistan

Radio Pakistan, Karachi on **17660** at 1257, OM with announcements, OM with some songs in the Arabic programme to the Near and Middle East, scheduled from 1215 to 1315.

NEAR AND MIDDLE EAST

Iraq

Baghdad on **15195** at 1523, YL with a song in Arabic in the Home Service 'Voice of the Masses' transmission, on this channel from 1400 to 2200.

Kuwait

Radio Kuwait on **6055** at 0245, quotations from the Holy Quran in the Domestic/External Service scheduled from 0225 to 2215.

Turkey

Ankara on **15220** at 1520, YL with a song, OM with announcements then some music in local style in a transmission for Turks abroad, which may be heard on this channel from 0400 through to 2200.

United Arab Emirates

Dubai on **17775** at 1615, OM with the station identification in English then into a programme of light music, European style, during an English programme for Europe and North Africa scheduled from 1600 to 1700.

CLANDESTINE

Voice of the Fedai on a measured **3941.3** at 1700, choral marching song, choral Internationale then OM with a harangue in Persian with, as far as I could determine, quite a few slogans. Hostile to the Islamic Republic of Iran, the transmission ends around 1745. This one may also be logged on **4680**.

NOW HEAR THIS

Radio Illimani, La Paz, Bolivia on **4945** at 0222, OM with an introduction in Spanish then a political speech about recent internal events. The 10kW Radio Illimani is on the air from 0900 through to 0400 (Sunday until 0300).

NOW LOG THIS

Radio Abaroa, Riberalta, Bolivia on a measured **4718.3** at 0022, OM with folk songs in Spanish, OM with announcements. This one is on the air from 1100 through to a variable closing time around 0400 with a power of 0.5kW.

DOTS AND DASHES

A change of venue to the amateur bands can often provide some thrills and spills – especially if one settles on the CW portions from time to time. The log entries for the past few weeks are as follows. On 1.8MHz, I0ZUT, K1IU, K1ZM, PT9FR, RT4UA, UB5ZAL, UO5GQ, UT5AB, VE1ZZ and W2BHM. On 7MHz, CE0ZIG, CE7SAR, CM2MC, CO1RA, KH6SFY, KH6M, LU8FCS, PY2UZ, TG9FC and YV3BQN.

If you are interested in the amateur as well as the broadcast bands then read on.

PREFIX LIST

The DXNS Prefix/Country/Zone List

This 15-page list is published and edited by Geoff Watts, the founder, editor and publisher of *Dx News Sheet* from 1962 to 1982.

For each country listed, the information provided is its DXCC status, the normal prefix, all special prefixes, the ITU callsign block allocations, the continent, the CQ zone number and the ITU zone number.

Additionally, information is provided on Antarctic and USSR club stations as well as on obsolete prefixes used over the past ten years. Arranged alpha-numerically in prefix order, the list provides sufficient space for updating purposes.

The DXNS Prefix/Country/Zone List is updated and republished quarterly, being available direct from Geoff Watts, 62 Belmore Road, Norwich NR7 0PU, price £1.00 post paid.

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- BD118 - 1 Teak look 5" extension speaker cabinet with back
- BD119 - 2 fibreglass fire fronts log effect & coal effect
- BD120 - 2 component boards with 2 amp 400v bridge rectifier and 15 other recs
- BD121 - 4 push push switches for table lambs etc
- BD122 - 10 mtrs twin flex, screened and outer pvc covered
- BD123 - 100 staples for thin flex white plastic and hardened nail
- BD124 - 25 clear plastic lenses 1 3/4" diameter
- BD125 - 4 items: rev per hour mains motor, counter, coin switch and srpb panel
- BD126 - 4 pilot bulb lamp holders bakelite batten type
- BD127 - 4 pilot bulb lamp metal clip on type
- BD128 - 10 very fine drills for pcbs etc
- BD129 - 4 extra thin screw drivers for instruments
- BD130 - 2 centre zero panel meters 100.0-100 uA
- BD131 - 1 100 uA edge wise balance meter
- BD132 - 2 plastic boxes with windows, ideal interrupted beam kits
- BD133 - 1 Microsonic radio case in leather zipper pouch
- BD134 - 10 model aircraft motors - require no on/off switch, just spin
- BD135 - 10 large and 20 small Screwit porcelain connector/insulators
- BD136 - 2 car radio speakers 5" round 4 ohm made for Radiomobile
- BD137 - 1 5" 4 ohm speaker and matching tweeter 5 watt
- BD138 - 1 9" x 4" 8 ohm 5 watt speaker
- BD139 - 4 600 ohm microphone/speaker inserts
- BD140 - 1 waterproof metal cased plug and socket 3 pin
- BD141 - 10 miniature slide switches 2 pole c/o
- BD142 - 10 4 ba spanners 1 end open, other end closed
- BD143 - 5 100k multi turn pots with knob
- BD144 - 10 chassis mounting fuse holders for 5 mm fuses
- BD145 - 2 4 reed relay kits 3v coil can be normally open or c/o
- BD146 - 20 pilot bulbs 6.5v 3a Philips
- BD147 - 1 Secret switch kit with data
- BD148 - 1 Printed circuit kit with data and 100 circuits
- BD149 - 4 socket covers (protect inquisitive little fingers) for twin 13A
- BD150 - 5 socket covers (protect inquisitive little fingers) for single 13A
- BD151 - 20 4 way terminal blocks 3A 250v bakelite body
- BD152 - 1 Air or gas shut off valve - clockwork operated
- BD153 - 1 Air or gas shut off valve - thermostat operated
- BD154 - 1 12v drip proof relay - ideal for car jobs
- BD155 - 3 Varnicap push button tuners with knobs
- BD156 - 2 pairs Ferrite cores Neosid 56 x 18 mm
- BD157 - 6 2 circuit micro switches - Licon ideal for joystick
- BD158 - 5 12 way connector blocks 2A 250v
- BD159 - 3 12 way connector blocks 25A 250v
- BD160 - 6 pairs 3 way connectors plug in, terminal block type
- BD161 - 1 13A panel socket MK ref 735 WH1
- BD162 - 1 13A fused and switched spur for surface mounting or can be removed from box for flush mounting
- BD163 - 3 13A sockets good British make but brown
- BD164 - 2 13A switched sockets good British make but brown
- BD165 - 1 13A panel switched socket on base for surface mounting
- BD166 - 1 30A panel mounting toggle switch
- BD167 - 1 8 pin flex terminating plug and chassis mounting socket (s.h.)
- BD168 - 2 50 tag component mounting strips
- BD169 - 4 Short wave air spaced trimmers 2 - 10pf
- BD170 - 2 Hiwac nunciator tubes neon type
- BD171 - 1 Shocking coil kit with data - have fun with this
- BD172 - 10 12v 6w bulbs Philips m.e.s.
- BD173 - 1 6v d.c. solenoid with plunger 1" travel
- BD174 - 2 end of travel c/o switches - very robust mounted on heavy metal plate 10A 250v
- BD175 - 1 200 rpm motor mains operated 2 watt
- BD176 - 4 heavy duty push switches - ideal for foot operation 3A 250v
- BD177 - 5 Lilliput bulbs 12v
- BD178 - 3 Oblong amber indicators with lilliputs 12v
- BD179 - 3 Oblong amber indicators with neons 240v
- BD180 - 6 round amber indicators with neons 249v
- BD181 - 100 p.v.c. grommets 5/8 hole size
- BD182 - 1 short wave tuning condenser 50 pf with 1/4" spindle
- BD183 - 1 two gang short wave tuning condenser with 1/4" spindle
- BD184 - 1 three gang tuning condenser each section 500 pf with trimmers and good length 1/4" spindle
- BD185 - 4 ferrite rod aerials 8" x 3/8" rods with long and medium wave coils
- BD186 - 1 3 wafer switch: 18 pole 2 way, 12 pole 3 way, 9 pole 4 way, 6 pole 6 way, 3 pole 12 way, your choice
- BD187 - 22 wafer switches 12 pole 2 way, 8 pole 3 way, 6 pole 4 way, 4 pole 6 way, 2 pole 12 way, any 2 your choice
- BD188 - 1 plastic box sloping metal front, size 160 x 95mm average depth 45mm



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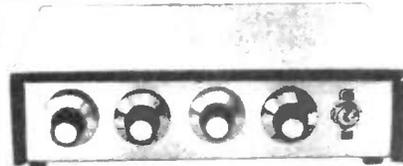
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"IT'S FOR YOU-OU" even if you are in the bath, it's an infinite extension any room and even in the garden - have one on approval or come and try one here. BT approved £120 not yet approved £69, plus £2 post. SOCKETS PLUGS ETC for BT phones. Master socket (has surge arrester - ringing condenser etc) and takes B.T. plug £3.95. Extension socket £2.95. Dual adaptors (2 from one socket) £3.95. Cord terminating with B.T. plug 3 metres £2.95. Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets £11.50.

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- 2P12 - Disk or Tape precision motor - has balanced rotor and is reversible 230v mains operated 1500 rpm
- 2P13 - Sun Lamp switch stays on for 1/2 hr or 1 hr depending on setting of grub screw
- 2P14 - Mug Stop kit - when thrown emit piercing squawk
- 2P15 - Interrupted Beam kit for burglar alarms, counters, etc
- 2P16 - Lockable metal box with 2 keys, ideal for your tools
- 2P17 - 1 rev per minute mains driven motor with gear box, ideal to operate mirror ball
- 2P18 - Liquid/gas shut off valve mains solenoid operated
- 2P19 - Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
- 2P20 - 20 metres extension lead, 2 core - ideal most Black and Decker garden tools
- 2P21 - 10 watt amplifier, Mullard module reference 1173
- 2P22 - Motor driven switch 20 secs on or off after push on
- 2P23 - Long and medium wave radio chassis - with slow motion drive ideal music while you work, could be mounted on extension speaker cabinet
- 2P24 - Clockwork operated 14 hour switch 15A 250V with clutch

MORE BAKERS DOZEN £1 PARCELS

- BD189 - 2 double pole 20 amp 250v flush mounting switches - white
- BD190 - 2 double pole 20 amp 250v surface mounting switches with neon indicators - brown
- BD191 - 6 B.C. lamp holder adaptors white
- BD192 - 3 B.C. to 2 pin lamp holder adaptors with plugs
- BD193 - 6 5 amp 3 pin flush sockets brown
- BD194 - 3 5 amp 3 pin switched sockets surface mounting, brown
- BD195 - 5 B.C. lampholder brown bakelite threaded entry
- BD196 - 1 in flex simmerstat for electric blanket soldering iron etc
- BD197 - 2 thermostats, spindle setting - adjustable range for heaters ovens etc
- BD198 - 1 rod thermostat for water heater etc 11" rod
- BD199 - 1 mains operated solenoid with plunger 1" travel
- BD200 - 1 10 digit switch pad for telephones etc
- BD201 - 8 computer keyboard switches, with knobs, pcb or vero mounting
- BD202 - 1 solenoid mains operated air valve 110v coil
- BD203 - 2 8 push button switch banks 6 interlocking and two independent locking less knobs or one with knobs your choice
- BD204 - 3 push mains voltage switches with integral knobs
- BD205 - 1 ultra small 12v relays 3A gold-plated contacts normally open
- BD206 - 20 metres 80 ohm coax, standard type off white
- BD207 - 20 metres high voltage heavy insulated flex 14.0075
- BD208 - 1 Photo multiplier tube RCA 4555 or equivalent Japanese make
- BD209 - 1 Metal box approx. 8" x 3" x 4" ex equipment but good condition
- BD210 - 4 Transistors type 2N3055
- BD211 - 1 Electric clock mains driven, always right time - not cased
- BD212 - 1 Double 8v 1/2 amp mains transformer ideal for dimming or strobing fluorescent tubes or psu etc
- BD213 - 2 Curly 5 core leads for mobile telephones, transmitters etc, stretched length approx 2 metres
- BD214 - 3 sub-miniature toggle switches spdt with plastic dolly
- BD215 - 5 miniature slide switches dpdt with chrome dolly
- BD216 - 1 Stereo preamp Mullard EP9001
- BD217 - 100 push on tag connector 1/4 straight
- BD218 - 100 push on tag connector 1/4 right angled
- BD219 - 100 soldercon terminals make IC sockets any length and width
- BD220 - 3 Heat sinks for flat ICs predrilled size 40 x 40 x 25mm
- BD22 - matt black, four sided

On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Todmorden Raynet

On 17 August this year the Todmorden Round Table organised a huge charity walk through Summit Tunnel on the Lancashire/Yorkshire border.

Only eight months previously the tunnel had been closed completely after a locomotive with a cargo of petrol derailed and caught fire, causing severe damage.

During and after this incident neither fire nor police officers could establish radio communications from one end of the tunnel to the other. However, a week prior to the charity walk Todmorden Raynet, who had been called upon to assist the St John's Ambulance Brigade establish communications for use during the event, conducted a feasibility exercise with a British Rail engineer and found that, using 70cm, communication was possible from the centre of the tunnel to each end.

The engineer was astounded at the group's efforts - he had felt that if professional people could not succeed in establishing communications in these circumstances then Raynet were wasting their time.

The whole exercise was an outstanding success. Over 6,000 people participated in the charity walk and Todmorden Raynet showed that, although an amateur organisation, they could provide a service in some of the most unusual and difficult circumstances.

Worcester & District ARC

The Worcester and District Amateur Radio Club gathers for club nights and informal meetings at 8.00pm at the Old Felows Hall, New Street, Worcester. Club nights are held on a Monday evening and informal gatherings on a Wednesday.

On club nights they arrange various lectures and demonstrations. On the agenda for August they have a talk on contesting by Richard Marshall G4ERP on the 5th and an informal meeting on the 21st.

Those interested in joining the club or requiring further information should contact: *D W Batchelor G4RBD, Hon Secretary, 14 Oakleigh Heath, Hallow, Worcester WR22 6NQ.*

More ham aid

On 25 May this year, Frensham Heights School, a pioneer progressive school situated near Farnham in Surrey, celebrated its 60th anniversary. For the occasion the school's flourishing amateur radio club obtained a special event call sign, GB4FHR, and went on the air for 12 hours.

Working in two hour shifts, four members of the club endeavoured to make as many contacts world-wide as they could between the hours of 8.00am and 8.00pm.

The main object of this marathon transmission was to celebrate the school's anniversary and to look forward to a further 60 years of educational success. A more serious objective motivated the exercise, however. Teachers, pupils and parents had been asked to sponsor the club for the number of contacts made during the day, the money being earmarked for famine relief in the Sudan.

Conditions were not very good and nearly all the contacts made were in Europe. By 7.00pm four tired operators were looking forward to a little silence and some of what remained of the evening's sunshine.

As guest member Don Murray G1DGI, operating under supervision from G4VCG, was 'signing' with a Dutch amateur, an English voice broke in with an unfamiliar

callsign - ST5ALR. He had overheard Don explaining the sponsorship scheme and he was overjoyed to make contact: he was situated at El Obeid in central Sudan and was a field-worker with an aid organisation. Suddenly flagging spirits were revived: the club had made contact with the very country whose plight had motivated the sponsorship plan.

Excited details were transmitted by ST5ALR and it was arranged that he would send information about the particular activities in which his group were involved in drought-stricken El Obeid. With promises of further contact on the air, the two stations signed.

Whilst Mr Bob Geldof's mighty achievements have yet to be rivalled, the jubilant members of Frensham Heights Amateur Radio Club are looking forward eagerly to participating in direct aid to that troubled part of the world. Already there is talk of the possibility of some kind of organised amateur radio famine relief project involving further sponsored transmissions and contacts with amateurs in the field.

The club would be very interested to hear from anyone who feels that they might be in a position to offer advice or help in the setting up of such a project. The two governing factors must be practicality and observation for international licensing conditions. Write to: *Dick Jones (G1JCD), The Radio Club, Frensham Heights School, Rowledge, Surrey GU10 4EA.*

Fresh ham

The Borehamwood and Elstree Amateur Radio Society is a newly formed organisation with a current membership of 25, and it is hoped to increase this number in the coming months.

The society is open to all interested in ham radio and activities include regular CW lessons, film shows and lectures.

Several special event stations have already been held, the most recent being GB4BWF to celebrate British Film Year.

A number of members were

successful recently in passing the RAE and are now working towards the class A examination. Several members have an interest in RTTY and data transmission.

The club net is often heard on Wednesday evenings on 144.270MHz. Members meet on the first Monday of each month at 7.30pm at the Organ Hall Community Centre, Birstow, Borehamwood, Herts.

Anyone interested in joining should phone Ivor on 953 5287 during office hours or Tony on 207 3809, evenings.

Reshuffle keruffle

There have been some changes in the committee of the Biggin Hill Amateur Radio Club.

The committee is now as follows: Honorary Chairman - Jim Burr G3CTI; Honorary Secretary - Robert Senft G0AMP; Membership Secretary - Graham Chamberlain G8TBZ; Honorary Treasurer - Ron Edgington G0CKN; Events Organiser - Derek Scofield G4UOV; Newsletter Editor - Ian Mitchell G4NSD; Technical Advisor - Ian Daniels G4VTD; Club Auditor - Bill Price G8SQT.

All correspondence should be addressed to: *Robert Senft, Mill Hay, Standard Road, Downe, Kent BR6 7HL.*

Room for improvement

The Glenrothes and District ARC (GM4GRC/GM3ULG) have carried out a lot of work on their clubrooms in the past few months, especially with regard to the installation of various antennas on the roof of the building.

A VHF system is now complete with a 4 element yagi for 4m, 16 element yagi collinear for 2m and 16 element yagi for 70cm installed on a common rotator.

On HF the antennas have been erected but still require tuning before work is complete. The installation consists of a 3 element triband yagi for 10, 15 and 20m and dipoles for 40 and 80m. There is also a possibility that dipoles for 160m and the WARC bands may be added.

Those interested in finding out more about the club and its activities should contact: *Jim Burke GM4TNP, Provosts Land, Leslie, Fife, Scotland.*

Focus on the ACC

A few years ago the original Amateur Computer Club (ACC), founded in 1974, split into two groups: the new Amateur Computer Club, which continues to publish the bi-monthly *ACCumulator*, and the Association of Computer Clubs (also ACC, just to confuse matters!), which represents clubs and user groups at a national level.

The Amateur Computer Club supports the 'hacker' - but members are quick to point out that they do not mean the database pirates who have recently adopted this title but rather the 'true hacker': the enthusiast who builds his own computer and add-ons and writes his own software.

ACCumulator is aimed at the DIY computer enthusiast and has published many designs, including most of the popular microprocessor chips.

The club is run by a committee of amateurs who are elected each year.

Readers who are interested in this aspect of the computer hobby should contact: *Bazyle Butcher (Chairman), ACC, 16 St Peter's Close, Bushey Heath, Watford WD2 3LG.*

Behind the Iron Curtain

We often receive letters from Eastern European amateurs who require equipment, books and magazines relevant to the radio and electronics hobby.

The latest plea comes from Poland. Pazar Stanislaw is willing to exchange copies of the Polish magazine *Radioelektronik*, records or classical music for the *Amateur Television Handbook*, volumes 1 and 2, *CQ-TV* magazine and *Television*, 1980-1985.

If you think you can help, write to: *Pazar Stanislaw, Tarnowiecka 3/35, 04-174 Warszawa, Poland.*

IRTS news

The latest newsletter from the Irish Radio Transmitters Society contains more information about the prizes being offered in the society's homebrew competition. A Wood & Douglas switched 2m pre-amp has been added as further encouragement to the

El home-brewers. More details are available from the editor, EI3CZ.

The editor is always happy to receive contributions, from letters and short articles to photocopies of items of interest seen in technical publications.

Museum pieces

Rae Otterstad OZ8RO is always on the look-out for old equipment for exhibition in his museum in Denmark.

He is particularly interested in the following: R1124c receiver, R1125 marker receiver, R1084 ground station receiver, 10A/11841 control unit, type 12A test oscillator, type 5A test set, TR1196 Tx/Rx, A1134a junction box, AR77 receiver plus any WW2 equipment or manuals, etc.

If you can help, contact OZ8RO at the following address and he will arrange for the equipment to be collected: *Rae Otterstad, Vejdammen 5, DK-2840, Holte, Denmark. Tel: 010-452-801875.*

Poole Club Award

The Poole Radio Amateur Society has announced the Poole Club Award, the rules for which are as follows.

Activity for the award must take place between Sunday 15 December 1985 and Sunday 5 January 1986 inclusive.

Contacts may be made on any bands and modes with stations located in Poole, members of Poole Radio Amateur Society or the club station G4PRS. Points will be awarded for contacts in the following categories:

a) working a station located in Poole - 1 point;

b) working a member of Poole Radio Amateur Society - 5 points;

c) working G4PRS (which may be /A, /P, or /M for part of the time) - 20 points.

To qualify for the award stations must have obtained at least 50 points.

To claim the award, a log detailing claimed contacts should be submitted with 50p (2 IRCs for non-UK stations) to Colin Baverstock G4WCK, 28 Kingston Road, Poole, Dorset BH15 2LP, posted not later than 31 January 1986. No station may feature more than once in a log (even if on a different band or mode).

G4PRS will be active for several hours on most days during the period, mainly on 80m, 2m and 10m, although some activity on other HF and VHF bands is likely.

Restoration project

We recently received a plea for help from Mr W M James in Zimbabwe, who plans to restore some old equipment but is unable to obtain the relevant circuit/service diagrams and parts.

The instruments in question are a Rogers stereo amplifier, model HG88 Mk II, and an Erskine Laboratories Ltd oscilloscope Type 13, serial number 187, reference number 10S/825.

If you think you can help, write with details to: *Mr W M James, 32 Cawston Street, North End, Bulawayo, Zimbabwe.*

Microwaves

Glen Ross G8MWR, who writes the 'On the Beam' feature for our sister publica-

tion *Amateur Radio*, will be giving a talk on microwaves on 23 October for the Crawley Amateur Radio Club.

The club has also organised a junk sale on 16 November.

Details of both events can be obtained by contacting the Secretary, Dave Hill G4IQM, on Crawley 882641.

Digital filters

The Verulam Amateur Radio Club is hosting a talk on 26 November entitled 'Digital Filters', by John Masterton G8FUL, beginning at 7.30pm.

The club meets at the RAF Association Headquarters, New Kent Road, St Albans, Herts on the second and fourth Tuesdays of each month.

More information on the club and its activities is available from: *Hilary Claytonsmith G4JKS (Honorary Secretary), 115 Marshalswick Lane, St Albans, Herts.*

Maltby lectures

The Maltby Amateur Radio Society's November schedule includes a talk by G4BVV on the 8th on the subject of smoke detectors, three mini lectures on the 15th, and on the 29th G6OYL covers meteor scatter.

The society holds meetings every Friday in the Church Buildings, Church Lane, Maltby, and details can be obtained from the Secretary, Ian G3ZHI, on Rotherham 814911.

Lincoln short wave

The programme of events of the Lincoln Short Wave Club for November is as follows:

6 November - CW/RAE class
13 November - Activity Night
20 November - CW/RAE class
27 November - Simple Test Equipment for the Radio Amateur, a talk by G3MGX.

Further details of club activities and membership are available from: *Mrs Pam Rose G4STO (Secretary), c/o City Engineers Club, Central Depot, Waterside South, Lincoln.*



Members and friends from the Ballymena ARC (G13FFF), who operated the special event station GB2MRI on Rathlin Island in August. Motley looking crew, ain't they?

Why not send us a photo of your club?

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FOR SALE

- Yaesu FT227R, 10W 144-148MHz. Good condition, with mobile mount, £125. Europa transverter + spare QQV0640A, all leads, £40. Collins UHF ground Rx. Ex-USAF, good condition, good performer, but large. Bargain at £85. AR2001 scanner, like new, £275. Excellent performance. Tel: Leeds 677101.
- Leitz 10x40B binocs superb glass, 3 months old, cost £420, used twice. With cash for quality HF gear, modern with digital readout, ie Icom 71/70 or equivalent Rx. High quality transceiver considered. Tel: Manchester (061) 834 2053 after 7pm or weekends. Ask for Ken.
- President Grant multimode converted to 10 metres. Perfect, with matching mike, £45. Copal 24hr clock and date, as new, £8.50. 240V Olivetti portable typewriter, as new, £22. Grundig reel to reel tape recorder in excellent condition, with many tapes, £22. Or exchange lot for comm receiver. 40 Rooley Crescent, Bradford, West Yorks BD6 1BX. Tel: (0274) 728219.
- Autek QF1A audio filter, \$170. VTVM, \$30 and HT probe, \$20. Musicolour 3 channel, \$100. Maplin audio processor, \$70. 2 inch printer, \$25. 16 x 4116 ICs \$24. HT panel meters 230V ac relays, many values. Substitution unit. Send for list, 2 IRCs or SAE. Rout, 3/137 Champion St, Christ-Church, New Zealand.
- Burndept 470/471 UHF H/H parts. All used, tested and in good working order. First local oscillator - high band, £8.00. 10.7 amp, £6.00. Second mixer, £8.00. Second local oscillator, £7.00. Disc/amp, £8.00. Mute/standby, £10.00. Audio amp, £12.00. Tx osc/multiplier - low band, £17.00. First PA - high band, £5.00. Second PA - low band, £10.00. Modulator £8.00. Volume control, £5.00. Transducer, £5.00. Aerial, £5.00. Steve. Tel: Portsmouth (0705) 831641.
- For real, HFDX HyGain 'Long John' model 205BA five-element 20m beam, £175.00. Mosley Eian 3 element, 10 & 15m beam, £50.00. Both one. Thurlow G3WW QThr. 2 Church Street, Wimbington, March, Cambs PE15 0QS. Tel: (0354) 740255.
- Pye reflectometer SWR power meter. HF type RFL4 as new, £30 plus post. Agavox magnetic disc audio typist's recorders with all associated equipment, stethophones, remote control, stop/start, discs. All good working order, £5 each plus post. Offers for seven? PSU 240V computer smoothed and regulated 20V 5A dc and 25V 6A dc in one unit, £10 plus post. Walker, 23 Forest Hill, Yeovil, Somerset BA20 2PF. Tel: Yeovil 25225.
- RX80 Epson printer. As new, boxed. Both parallel and serial inputs (known as Centronics or RS232), £150. Post, carr, insurance extra. P Last, 4 Hillside, Marham, Kings Lynn, Norfolk. Tel: (0760) 337463.
- RA17, spare valves & manual, good condition, £120. P Koker, 27 Greenhill Avenue, Kidderminster, Worcs DY10 2QU. Tel: Kidd 755370 evenings.
- Ferrograph reel/reel tape recorder, good order. Felcon humidifier, as new. Welson portable organ, working, needs restoration. Quantity printed circuit board and Veroboard. Quantity 3ohm elliptical speakers, lots of other items, room wanted. Tel: Southampton 788278.
- FT One general coverage transceiver with every conceivable extra factory fitted. With matching speaker and mike. Suitable amateur or commercial use. Also factory suggested mods, not yet fitted. Virtually unused and in as new condition, worth over £2,000 new. Tel: (0248) 714655 evenings, John GW3VVC QThr.
- Fairmate AS32320 AM/FM scanning receiver, 12 volt car, 110MHz-162MHz, 296MHz-368MHz, 20 memories, £75. Also Band I, II, III, IV, and V aeriels plus rotor, £50. Tel: (027581) 4858 office or (0272) 685767 home.
- WW2 radar units (Gee and Loran indicators etc), mains xfms, over 250 valves, *Wireless World* 1943-48, *Electronic Engineering*, 1950-57, £250 ono. Would split. Tel: (021) 422 3994, evenings only.
- Icom IC280E 2m fully synthesised 10W FM mobile, base use only, £140. Yaesu FT101B, good condition, £250. Yaesu FT707 HF mobile, good condition, £375. Sinclair Spectrum 48K and PSU boxed, £60. Scarab systems RTTY interface for Spectrum, £60. Commodore C64, PSU and Datasette unit, plus programmers' guides, £140. Paul G4SLX. Tel: (08926) 62790.
- Micropolis disc drive 80 track D/S D/D, £75. Workshop manual Trio TR9000, £5. Manual FT225RD, £5. 800 MFD 450V electrolytics, £5. New Pye car suppressor, £5. Pye Tulip mike, £5. 2732 memory chips, £1. Constant voltage transformers 100W £5, 250W £10. Variacs £5. Pre-scalers 8630B, £5. Lots of meters, variable capacitors, mains and isolation transformers, xtals, relays, valves, transistors, ICs, etc. Roy Reynolds, 6 Church Way, Stratton, Swindon, Wilts SN3 4NF. Tel: Swindon 822055.
- B/W TV camera with Tamron F1.6/16mm lens vid/RF output suitable for ATV, £25. Pair of CCSI (contact cooled 4CX250B) with HS10A heatsinks and 2 UHF bases, £30. Valves & bases new and unused. 100m 5 core rotator control cable, £15. Buyer collects. Mr G Dawson, 10 Seven Acres, Thame, Oxon, OX9 3JQ. Tel: (084421) 5857.
- Fairmate scanner receiver model AS-32320, covers 110-136MHz, 136-162MHz, 296-368MHz AM-FM on any band, plus 20 memories. £95.00 ono, or exchange for HF receiver, ie FRG7, R1000, EC10, etc. Tel: Dave on (01) 560 0194, 9-5pm.
- Super Star 2000 rig. 200 channel all mode + kHz shift, 25.995-27.995MHz on slide mount. SWR, power ant matcher meter + plugs, leads, dummy load + 2 mobile ant plus 120 channel (40 FCC upper + lower 40s). AM with most of features, inc SWR RF gain, etc, £200 lot or will swap for good 2m mobile unit or gen coverage Rx. Alan. Tel: Bursledon (Southampton) 4427.
- Cirkit 720 channel fully synthesised air band receiver. 118-136MHz in 25Kc steps. Needs finishing and setting up. Complete with Nicads and spare ICs and full instructions etc, including details for conversion to scanner. £50 ono/exchange WHY. Tel: Ipswich (Suffolk) 718390.
- Wayne Kerr CT500 pulse generator set, variable pulse width and frequency 100Hz to 60kHz, variable amplitude, positive or negative pulse, external trigger, sync, and modulation if required. This is a mint condition laboratory instrument, complete with leads. Size 17 inches by 9 inches by 14 inches, weight 10kg. Sensible offers invited. A R Box. Tel: (0225) 708240 (Wiltshire).
- Eddystone communication receiver, model 840A. Nice condition, with copy of instruction manual. £65. Avometer 8 Mk V. Good condition, with batteries, leads and operating instructions, £55. AWA Teleradio transmitter/receiver, model 60A. 2-10MHz, 35 watt AM output, 12 volt dc power supply, 6883 valve PA. With mic, speaker and detailed manual, believed working, £15. Tel: Petersfield 62049.
- FT290R 2m multimode, mint condition, boxed, 1 owner from new £275 ono. BNOS LPM-144-3-100 2m linear 6 weeks old, boxed £150. Realistic DX-302 communication receiver, digital frequency read-out 10kHz-30MHz, excellent condition + Mizuho ATU, £120. Buyer inspects + collects. All above can be seen working! Mike G11UC. Tel: Leyland 424878, after 6.00pm.
- Yaesu transceiver FT757GX, automatic ATU FT757AT, power supply switch mode FP757GX, £775. Middleton, 49 Wolseley Road, Stafford ST16 3XW.
- Yaesu desk mic YD844, new in box, £27. Burndept B473 VHF handi, fitted R5, S22, S17, no Tx-xtals, comp with CCT & batts, £50. 18W + 18W stereo car booster 12V, £15. Bargraph LED, Taco 12V, suit any car, £7. QZQ3-20, used £2. 22 inch b/w TV £10. 20 inch colour TV £25. 12 inch b/w portable £20, ideal ATV. All carriage extra or collect. Tel: Ben (021) 525 9772.
- Electronic junk still unsold, only one caller to date! See ad June issue. Will strip everything and salvage components if not sold by November. Must get rid, no room in flat. Would consider splitting. TVs, record players, panel meters, relays, computer keyboard, alarm, key switch, radio-grams, PCBs. Swap for scope, video recorder, unused components, WHY. Only £60 ono. Bring roomy transport (van, bus?)! Includes unwanted 20 kilo parcel bought in error recently from Display Electronics. Any offers? S Harper, 8 Birchtree Road, Thorpe Hesley, Rotherham, S Yorks. Junction 35 M1. Then second right off A629. See you soon after 5pm?
- Tandy TRS-80 mod-1 level-2, 48K, upper/lower case, twin 40-track Tandon drives, two cassette recorders, lots of software - including Basic instruction course, assembler/editor, Sublogic Flight Simulator, games. 80 micro magazines, all manuals, £300. Tel: (024 026) 2718.
- Two digit LED dice, £4. TBA540Q, TBA990Q, £1 each. Uncoded BC107 25/£1. Diodes, fall outs, 250/£1. All new. First write, first served. Limited quantities. Could use some radio and TV servicing volumes and Babani publications. Anyone want to get rid? S Harper, 8 Birchtree Road, Thorpe Hesley, Rotherham, South Yorks S61 2TH.
- Yaesu FT-290R 2m transceiver, Nicads, charger, mobile mounting bracket, carry case and speaker mike. All boxed, as new, £260. L Green, 8 Hollies Close, Royston, Herts SG8 7DZ. Tel: Royston (0763) 44532.
- One pair pocket phones RB/SU8 plus Night Call charger amp, spare Nicads, three extra receivers, £35. Trio JR310 Rx satellite mod, 10m/160m gwo, £90. Kenwood TR8300 UHF FM Tx Rx, xtalled, all even rptrs plus three simplex, operating and service manual, £90. All above ono. Tel: (0302) 841530, G6UGU QThr FL110. PX considered on above items.
- Murphy 27MHz FM base station CB rig. Boxed, as new, £40. Modulator Saturn base station antenna. Never used, £10. Micronta 27-range multimeter hardly used £10. ZX81 computer, broken but good for spares, £5. 16K RAM-pack, working £5. PSU, £5. Also some tapes for ZX81, and manual etc. Swap for 48K Spectrum, or similar, WHY? Buyer collects. Graham Johnson, 95A Coventry Road, Nuneaton, Warwicks CV10 7AA. Tel: (0203) 341368.
- Broadcast transmitter, FM 88-108MHz, 80 watts output. Frequency stability and modulation quality excellent. Mains power supply included, but can be operated from car batteries. Compact and portable. Use with simple dipole antenna or more complex array. Instructions provided. Will pass stereo signal. Price only £150. Also medium wave transmitter, 40 watts output. Crystal controlled. Superb audio reproduction. Mains operation. Portable, £150. Range of either Tx can be 30 miles or more. Official Home Office licences will be available late 1985 for 'Community Radio'. Private individuals or groups will be allowed to own and operate a radio broadcasting station. Details tel: 01-769 8605.
- Sony ICF2001 portable communications receiver, PLL synthesized, microprocessor controlled, AM 150-29999kHz. FM 87.5-108MHz c/w 110-250V adaptor, service manual, perfect £85. Barlow Wadley XCR30 portable crystal controlled communications receiver AM 500kHz-31MHz, FM 87.5-

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■ Tandy model 100 expansion RAM, bargain at only £38. Professional keyboard with display PCB, needs only monitor TV to make VDU with 64 chars per line x 16 lines. RS232, only £18. Mick. Tel: 01-751 2262, after 6.00pm.

■ Valve voltmeter CT54, 10kHz to 200MHz, 13inx10inx5in, as new condition, inc RF probe, requires batteries. Six ac-dc volts ranges, five ohms ranges: £12. TEL power control unit N23045 C2T, indicator lamps, 2 coils, 4 fuses, 3 relays, 12inx10½inx6in: £4. Ex-RAF Xtal monitor, requires batteries: £8. Canadian 58 set, 6 to 9MHz AM transceiver, vgc, complete with headset and mic, vibrator unit with two uncharged cells: £40. Heathkit DX-40U plus VF-1U VFO, complete, 5-bands, CW/AM transmitter, good condition. Amplion Corvette mains power supply, output 1.5V or 2V, 150V HT, £5. Omron 24V DP encapsulated relay, octal base and socket, new: £2. Hallicrafter xtal filter, 10X base, 455kHz: £1. 3-pin wavemeter dual xtal, 100/1000kHz: £2. Approx 250 valves, mainly ex-equipment, heater-tested. Xtals, var bases, ranges within 4, 5, 6, 7, 8, 10, 14, 21, 23, 35, 36, 37, 38MHz: 25p to £1 each. All above, collect or add carriage/postage. A W McNeill, 40 Turnpike Road, Newbury, Berks RG13 3AS. Tel: Newbury 40750.

■ Belcom LS102L 26-30MHz multimode mic bracket box, £140 ono or swap for 70cm multimode or WHY. 20 amp homebuilt PSU, problems, £25 cost £50. Datong VCI £80. CB to MW converter, ideal for Grundig etc. IF MW to 80m, £10. 27 MW R2000 plus VHF converter, £360. Hirshman rotator, £25. 4 ele quad 2 metre, £10. LEC fridge ideal for burner, £25. 2 metre MM convert 28MHz IF, £25. Write Alan Fordham, 31C Anerly Park, Penge SE20.

■ Pet 2001/8K computer integral screen cassette, hardly used, good working order, manuals, very suitable for expansion, very cheap at £80. K F

Arnold. Tel: 01-733 3552.

■ Tektronix oscilloscope type 453. 50MHz two channel dual timebase fully transistorised, recently calibrated and in good condition. Price includes two probes and delivery via carrier if required. £300. Tel: (0555) 840409.

■ Complete 2m station comprising Icom IC-271H 100W multimode base station muTek FE fitted, in superb condition, complete with IC-PS30 25A PSU and IC-SP3 speaker. Also IC-02E handheld. Offers. All equipment has hardly been used. Save money on purchasing new equipment. Genuine reason for sale. Ian G6NKB QThr. (0509) 502989 (Leics).

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■ Handbooks, circuits, data, for sale or loan for copy: KW Valiant transmitter and PSU, multi-elmac PMR-7 receiver and PSR-12 PSU, Dependapac (London) toroidal/transistorised Tx PSU. A W McNeill, 40 Turnpike Road, Newbury, Berks RG13 3AS. Tel: Newbury 40750.

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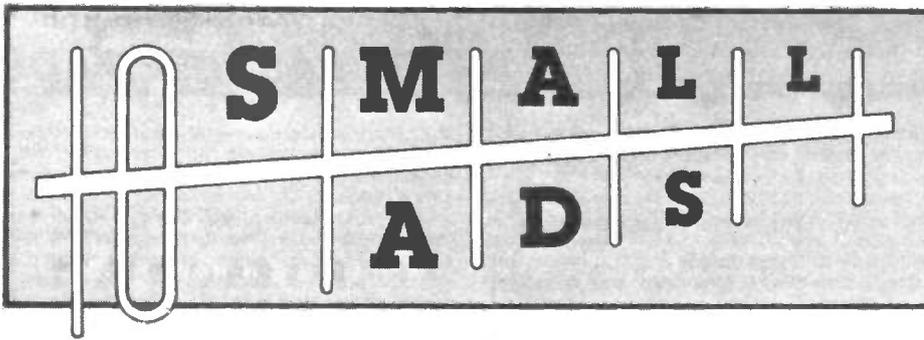
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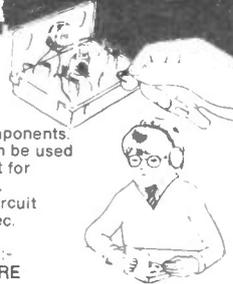
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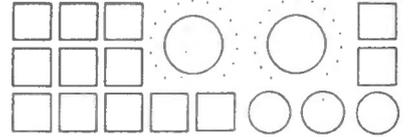


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ULN2216 75p	TIP 131 30p	BC663 10p	BC328/338 pair 15p		
SN2984B 50p	TIP 136 30p	BC664 10p	BC337 10p		
SN2970BN £1.00	TIP 140 30p	BC665 10p	BC338 10p		
SN2971BN £1.00	TIP 640 50p	BC666 10p	BC339 10p		
SN7402N £1.00	TIP 655 30p	BC667 10p	BC347 10p		
SN7427N £1.00	T6032 30p	BC668 10p	BC349b 10p		
SN74107 70p	T6040 40p	BC669 10p	BC350 20p		
SN7427N 20p	T6047 40p	BC670 10p	BC365 10p		
SN75108AN £1.00	T6049 40p	BC671 10p	BC384 10p		
SN76001 £1.00	T6051 40p	BC672 10p	BC394 10p		
SN7603 £1.00	T6052 40p	BC673 10p	BC413 10p		
SN76013ND £1.00	T9004 40p	BC674 10p	BC417 10p		
SN76018 £1.00	T9005 40p	BC675 10p	BC422 10p		
SN76023N £1.50	ZTX 102c 10p	BC676 10p	BC423 10p		
SN76033 £1.50	ZTX 107 10p	BC677 10p	BC424 10p		
Diodes	ZTX 108c 10p	BC678 10p	BC425 10p		
BY127 10p	ZTX 109k 5p	BC679 10p	BC426 10p		
BY133 10p	ZYX 213 5p	BC680 10p	BC427 10p		
BY134 10p	ZYX 341 10p	BC681 10p	BC428 10p		
BY164 50p	ZYX 342 10p	BC682 10p	BC429 10p		
BY176 25p	ZYX 384 10p	BC683 10p	BC430 10p		
BY179 25p	ZTX 451 10p	BC684 10p	BC431 10p		
BY184 25p	ZTX 550 10p	BC685 10p	BC432 10p		
BY187 10p	MJ 2253 60p	BC686 10p	BC433 25p		
BY190 40p	MJ 3040 60p	BC687 10p	BC437 25p		
BY196 30p	MJ 2209 60p	BC688 10p	BC439 50p		
BY198 8p	SP 8385 10p	BC689 10p	BC440 50p		
BY204/4 8p	SAB 3208 £1.00	BC690 10p	BC441 50p		
BY206 8p	SAB 4209 £1.00	BC691 10p	BC442 50p		
BY206/800 8p	SPECIAL OFFER CVC21	BC692 10p	BC443 50p		
BY210/400 5p	Chassis complete £35	BC693 10p	BC444 50p		
BY210/800 10p	Computer Transformer	BC694 10p	BC445 50p		
BY223 60p	20v/2.25A, 20v/1.5A, 17/5A, 19/5A, 28/0.5A £3	BC695 10p	BC446 50p		
BY224/800 4 8A/ 600v/bridge £1.00	Mains ViewData	BC696 10p	BC447 50p		
BY226 15p	Transistors	BC697 10p	BC448 50p		
BY227 15p	240V/240V/4 amp/vf 500mA in/out	BC698 10p	BC449 50p		
BY228 20p	BD 517 30p	BC699 10p	BC450 50p		
BY229/400 30p	BD 519 30p	BC700 10p	BC451 50p		
BY237 30p	BD 534 30p	BC701 10p	BC452 50p		
BY254 10p	BD 544 30p	BC702 10p	BC453 50p		
BY255 30p	BD 595 30p	BC703 10p	BC454 50p		
BY298 10p	BD 610 30p	BC704 10p	BC455 50p		
BY299 10p	BD 646 30p	BC705 10p	BC456 50p		
BY406 8p	BD 676 30p	BC706 10p	BC457 50p		
BY527 20p	BD 678 30p	BC707 10p	BC458 50p		
GY407A 20p	BD 681 30p	BC708 10p	BC459 50p		
Min 12volt relays £1.00ea	BD 681 30p	BC709 10p	BC460 50p		
R 1038 40p	BD 681 30p	BC710 10p	BC461 50p		
R 1039 40p	BD 681 30p	BC711 10p	BC462 50p		
R 2009 80p	BD 681 30p	BC712 10p	BC463 50p		
R 2010b £1.00	BD 681 30p	BC713 10p	BC464 50p		
R 2029 80p	BD 681 30p	BC714 10p	BC465 50p		
R 2210 80p	BD 681 30p	BC715 10p	BC466 50p		
R 2257 80p	BD 681 30p	BC716 10p	BC467 50p		
R 2265 80p	BD 681 30p	BC717 10p	BC468 50p		
R 2305 80p	BD 681 30p	BC718 10p	BC469 50p		
R 2306 80p	BD 681 30p	BC719 10p	BC470 50p		
R 2322/2323 pair 80p	BD 681 30p	BC720 10p	BC471 50p		
R 2323 80p	BD 681 30p	BC721 10p	BC472 50p		
R 2396 80p	BD 681 30p	BC722 10p	BC473 50p		
R 2461 80p	BD 681 30p	BC723 10p	BC474 50p		
R 2030 80p	BD 681 30p	BC724 10p	BC475 50p		
R 2443-BD124 40p	BD 681 30p	BC725 10p	BC476 50p		
R 2737 40p	BD 681 30p	BC726 10p	BC477 50p		
R2738-TIP41 30p	BD 681 30p	BC727 10p	BC478 50p		
	BD 681 30p	BC728 10p	BC479 50p		
	BD 681 30p	BC729 10p	BC480 50p		
	BD 681 30p	BC730 10p	BC481 50p		
	BD 681 30p	BC731 10p	BC482 50p		
	BD 681 30p	BC732 10p	BC483 50p		
	BD 681 30p	BC733 10p	BC484 50p		
	BD 681 30p	BC734 10p	BC485 50p		
	BD 681 30p	BC735 10p	BC486 50p		
	BD 681 30p	BC736 10p	BC487 50p		
	BD 681 30p	BC737 10p	BC488 50p		
	BD 681 30p	BC738 10p	BC489 50p		
	BD 681 30p	BC739 10p	BC490 50p		
	BD 681 30p	BC740 10p	BC491 50p		
	BD 681 30p	BC741 10p	BC492 50p		
	BD 681 30p	BC742 10p	BC493 50p		
	BD 681 30p	BC743 10p	BC494 50p		
	BD 681 30p	BC744 10p	BC495 50p		
	BD 681 30p	BC745 10p	BC496 50p		
	BD 681 30p	BC746 10p	BC497 50p		
	BD 681 30p	BC747 10p	BC498 50p		
	BD 681 30p	BC748 10p	BC499 50p		
	BD 681 30p	BC749 10p	BC500 50p		
	BD 681 30p	BC750 10p	BC501 50p		
	BD 681 30p	BC751 10p	BC502 50p		
	BD 681 30p	BC752 10p	BC503 50p		