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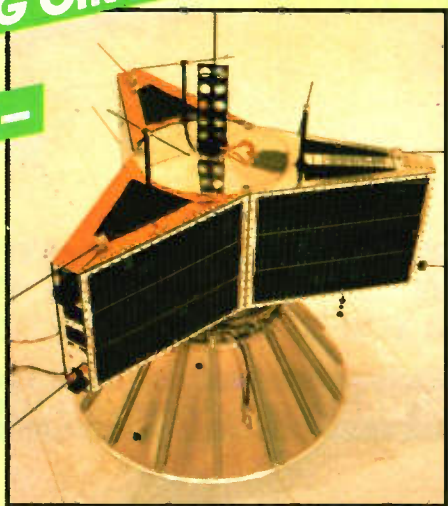
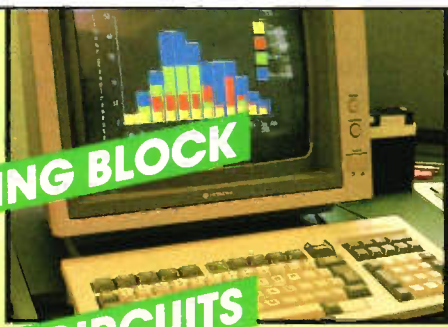
SWITCH MODE POWER SUPPLIES

COMMUNICATION BUILDING BLOCK

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AMATEUR RADIO WORLD - SATELLITES

PRODUCT NEWS - KEEP UP TO DATE



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The communications, electronics & computers magazine **World**

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NEW EDITOR

We are pleased to welcome Dennis Hayes as the new Editor of **Radio & Electronics World**.

Dennis has many years of wide experience in the communications and electronics fields and is intent on producing an even better magazine.

READER SURVEY

Since taking over **Radio & Electronics World** we have been carrying out an extensive survey to establish exactly what you, the readers of **Radio & Electronics World** would like to see in your magazine each month.

The result of this survey is that the majority of readers would like to see **Radio & Electronics World** concentrate more on amateur radio, with an emphasis on projects to build, and we are now planning future issues to achieve this. We will be pleased to receive any further comments and suggestions you may have.

HAVE YOU THOUGHT OF BECOMING AN AUTHOR?

We are always interested in receiving articles to be considered for publication and are particularly keen to hear from anyone who has something to say related to the amateur radio field. As mentioned before, projects for fellow readers to build are most welcome.

You don't need to be an expert writer. If you can get your ideas down on paper, preferably typed, with drawings that we can follow and photographs where relevant, we will sort out the style, grammar, spelling, etc.

If you have an idea for an article, or have designed and built a project that you think others would be interested in, but still have doubts about becoming an author, why not write (giving brief details and your *telephone number*) or telephone Dennis Hayes . . . and of course you will be paid for your effort.

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 also taken to ensure that the contents of **Radio & Electronics World** are accurate, we assume no responsibility for any effect from errors or omissions.

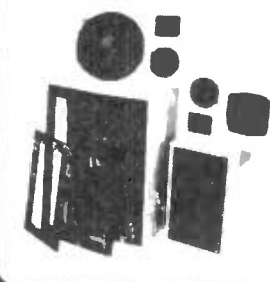
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MULLARD SPEAKER KITS

Purposely designed 40 watt R.M.S. and 30 watt R.M.S. 8 ohm speaker systems recently developed by MULLARD'S specialist team in Belgium. Kits comprise Mullard woofer (8" or 5") with foam surround and aluminium voice coil Mullard 3" high power domed tweeter. B.K.E. built and tested crossover based on Mullard circuit, combining low loss components, glass fibre board and recessed loudspeaker terminals. SUPERB SOUNDS AT LOW COST. Kits supplied in polystyrene packs complete with instructions. 8" 40W system - recommended cabinet size 240 x 216 x 445mm
Price £14.90 each + £2.00 P & P.
5" 30W system - recommended cabinet size 160 x 175 x 295mm
Price £13.90 each + £1.50 P & P.

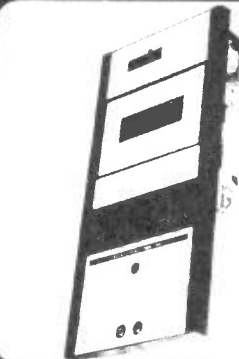
Designer approved flat pack cabinet kits, including grill fabric. Can be finished with iron on veneer or self adhesive vinyl etc.
8" system cabinet kit £8.00 each + £2.50 P & P.
5" system cabinet kit £7.00 each + £2.00 P & P.



STEREO CASSETTE TAPE DECK MODULE

Comprising of a top panel and tape mechanism coupled to a record play back printed board assembly. Supplied as one complete unit for horizontal installation into cabinet or console of own choice. These units are brand new, ready built and tested.

Features: Three digit tape counter. Autostop. Six piano type keys, record, rewind, fast forward, play, stop and eject. Automatic record level control. Main inputs plus secondary inputs for stereo microphones. Input Sensitivity: 100mV to 2V. Input Impedance: 68K. Output level: 400mV to both left and right hand channels. Output Impedance: 10K. Signal to noise ratio: 45dB. Wow and flutter: 0.1%. Power Supply requirements: 18V DC at 300mA. Connections: The left and right hand stereo inputs and outputs are via individual screened leads, all terminated with phono plugs (phono sockets p/vided). Dimensions: Top panel 5 1/2" x 11 1/2". Clearance required under top panel 2 1/2". Supplied complete with circuit diagram and connecting diagram. Attractive black and silver finish.
Price £26.70 + £2.50 postage and packing.
Supplementary parts for 18V DC power supply (transformer, bridge rectifier and smoothing capacitor) £3.50.



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THREE QUALITY POWER LOUDSPEAKERS 15", 12" and 8" See Photo Ideal for both Hi-Fi and Disco applications. All units have attractive cast aluminium surrounds finished in an expensive all bronze Specification and Prices.

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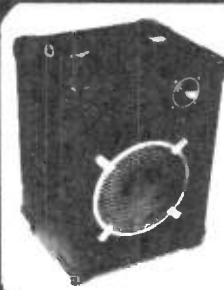
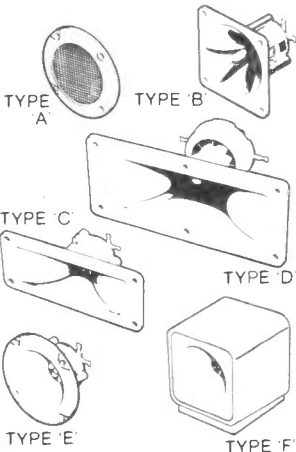
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TYPE 'A' (KSN2036A) 3" round with protective wire mesh ideal for bookshelf and medium sized Hi fi speakers Price £4.29 each.
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TYPE 'D' (KSN1025A) 2" 6" wide dispersion horn. Upper frequency response retained extending down to mid range (2KHz). Suitable for high quality Hi fi systems and quality discos. Price £7.99 each.
TYPE 'E' (KSN1038A) 3 1/2" horn tweeter with attractive silver finish trim. Suitable for Hi fi monitor systems etc. Price £4.99 each.
TYPE 'F' (KSN1057A) Cased version of type E. Free standing satellite tweeter. Perfect add on tweeter for conventional loudspeaker systems. Price £10.75 each
P&P 20p ea. (or SAE for Piezo leaflets).



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Ported tuned cabinet in hard-wearing black vinyl with protective corners and carry handle. Built and tested, employing 10in British driver and Piezo tweeter. Spec 80 watts RMS, 8 ohms, 45Hz-20KHz. Size 20in x 15in x 12in. Weight: 30 pounds

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3 WATT FM TRANSMITTER 3 WATT 85/115MHz varicap controlled professional performance. Range up to 3 miles 35 x 84 x 12 mm (12 volt) Price: £12.49p

SINGLE CHANNEL RADIO CONTROLLED TRANSMITTER/RECEIVER 27MHz Range up to 500 metres. Double coded modulation. Receiver output operates relay with 2amp/240 volt contacts. Ideal for many applications. Receiver 90 x 70 x 22 mm (9/12 volt) Price: £16.49 Transmitter 80 x 50 x 15 mm (9/12 volt) Price £10.29 P&P All Kits +50p S.A.E. for complete list.

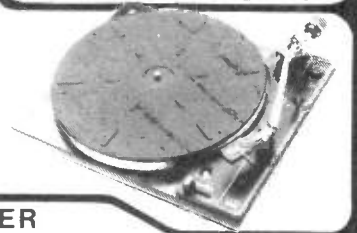


3 watt FM Transmitter

BSR P256 TURNTABLE

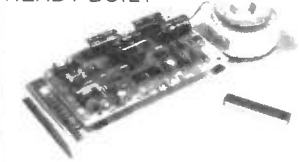
P256 turntable chassis • S shaped tone arm • Belt driven • Aluminium platter • Precision calibrated counter balance • Anti-skate (bias device) • Damped cueing lever • 240 volt AC operation (1Hz) • Cut out template supplied • Completely manual arm. This deck has a completely manual arm and is designed primarily for disco and studio use where all the advantages of a manual arm are required.

Price £31.35 each. £2.50 P&P



OMP POWER AMPLIFIER MODULE

READY BUILT



New model.
Improved specification

NEW OMP100 Mk.II POWER AMPLIFIER MODULE Power Amplifier Module complete with integral heat sink toroidal transformer power supply and glass fibre p.c.b. assembly incorporates drive circuit to power a compatible LED Vu meter. New improved specification makes this amplifier ideal for P.A., Instrumental and Hi-Fi applications.

SPECIFICATION
Output Power: - 110 watts R.M.S.
Loads: - Open and short circuit proof 4/16 ohms
Frequency Response: - 15Hz - 30KHz - 3dB.
T.H.D.: - 0.01%
S.N.R. (Unweighted): - -11dB ± 3.5dB
Sensitivity for Max Output: - 500mV @ 10K.
Size - 360 x 115 x 72 mm. Price - £31.99 + £2.00 P&P Vu Meter Price - £1.00 + 50p P&P

MOSFET versions available up to 300W. R.M.S.

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ALSO Stereo Version as above price £69.99 + £2 p&p



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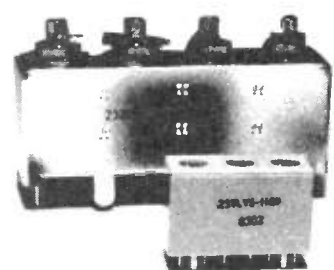
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GET READY FOR THE SPRING EDITION

We must apologise to our readers for missing out with our Winter edition — but we've been preparing something a little special to tempt you out of your Winter hibernation and back to the soldering iron.....



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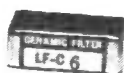
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The 6002 measures frequencies from 5Hz to 1GHz, and as an added bonus we throw in period measurements from 1 μ s to 200ms.

Its 10MHz crystal-oven oscillator gives an impressive stability — half a part per million — and drift is less than one part per million over a whole year.

We've also made the 6002 easy to use, with new, light touchbutton controls and a big, bright LED display. And you can select three different resolutions as well as a low-pass filter for audio and ultrasonic measurements.

Flexibility is ensured by two separate inputs, one covering 5Hz to 100MHz, and the other covering 80MHz to 1GHz. A multiplication mode speeds lower frequency measurements.

And, of course, the 6002 has all the usual features you'd expect in a quality instrument from GSC — like leading-zero blanking, a contrast-enhancement filter, ready and warning signals, and a flip-up leg for benchtop use.

So, whether your measurement needs are in the design, testing and maintenance of audio, VHF, RF or digital systems, the 6002 has something to offer for you.

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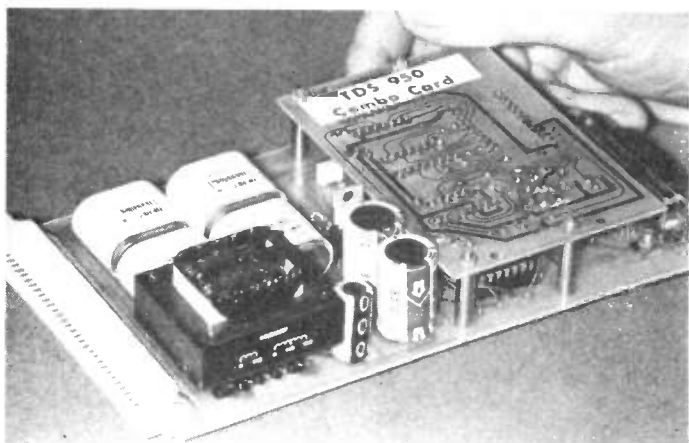
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PRODUCT NEWS

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



COMBINATION CARD INTERFACE

The TDS950 Combo Card inserts in the RS232C line between a computer and a VDU terminal and it allows data to be put on a cassette at a data rate of 1200 bauds. Playback not only loads the data back into the computer, but also displays the content of the tape on the screen. It is single Eurocard size and can be used either with Triangle's own TDS900 FORTH computer card, or with other microcomputers.

Also included on the board is a mains power supply and 200mAh of back-up battery.

Triangle Digital Services Ltd
100a Wood Street,
Walthamstow, London. E17
3HX.

BENCH POWER SUPPLIES

A family of four high performance bench power supplies, the GPL Series, has been introduced by Gresham Powerdyne Ltd. Offering a choice of single, dual and triple output models, they feature excellent voltage and current regulation, low ripple and noise and compact mechanical construction.

The smallest model is the GPL 20, a light weight unit which has a variable 0-30 volts

(1 Amp max) output plus a fixed 5V output (1 Amp max). Ripple and noise is less than 0.5mV rms on both rails, and the variation in output voltage for a 10% mains variation is also less than 0.5mV. Output resistance is less than 5 milliohms and output impedance less than 100 ohms at 100 kHz. The GPL 23a triple output unit has two independently variable outputs each of 0.30V, (2 Amp max) with a choice of constant current or constant voltage modes. Additionally, a fixed 5V, 3Amp output rail provides regulated power for a substantial microcircuit load if required. Load

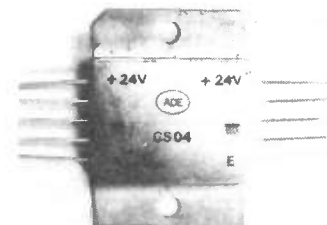
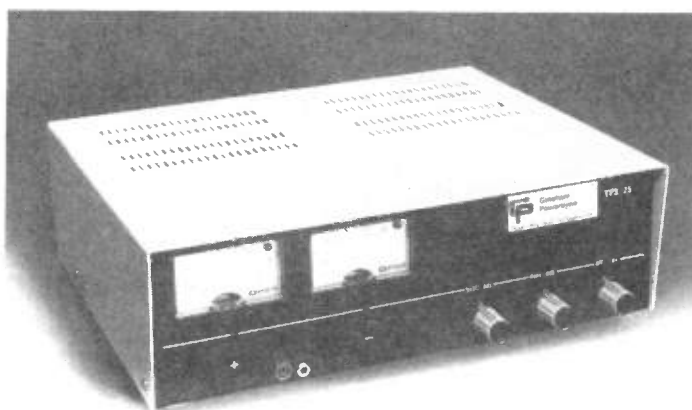
regulation for the variable rails is better than 3mV (zero to full load), ripple and noise less than 1mV in constant voltage mode and line regulation is better than 0.5mV for a $\pm 10\%$ mains change. For the fixed 5V rail, load regulation is better than 50mV (zero to full load) with ripple and noise less than 5mV rms.

Setting resolutions are better than 5mV and metering is accurate to approximately 1% of full scale deflection.

The Model GPL 25 provides 0-40V up to 1 Amp and has variable current limiting. Two instruments provide simultaneous indication of voltage and current. The unit has 0.5mV max output regulation for a $\pm 10\%$ mains change, ripple and noise less than 0.5mV rms and output resistance less than 5 milliohms.

The largest unit in the series (GPL 28), has a single 0-60V, 2 Amp output with dual tracking (0-30V, 2A) as standard facilities. It has the same high standard of regulation found on other units in the series.

Gresham Powerdyne Ltd.,
Osborne Way, Station Rd.,
Hook, Hampshire.



MEDIUM POWER AMPLIFIER

The CSO4 medium power integrated amplifier was developed for the French General Post Office and is featured in a range of new ADE products available from Nore Microwave Limited.

The amplifier operates over the frequency range 5 to 200 MHz and has a noise figure of 3 dB, gain 29 dB ± 1 dB and gain flatness within ± 1 dB. The output power is +24 dBm (250 mW) at 1 dB CP, input and output VSWR 1.5: 1 and the third order intercept point is +40 dBm. The characteristics are almost identical when the device is operated over an extended frequency range (3 to 300 MHz) and customized versions in respect of noise figure, bandwidth, gain and output power are available. The manufacturer guarantees compliance with the specification when the device is operated in the temperature range -25 to +85°C (using a heat sink adequate for 3W dissipation).

The amplifiers are housed in packages measuring 28.7mm x 20.2mm x 4.5mm overall (excluding leads) and have fixing centres 22.9mm apart.

Nore Microwave Ltd, 36
Towerfield Road,
Shoeburyness, Essex, SS3
9SH.

70 CMS ANTENNA

New from Ant Products, the Tiger LY9 for 70 cms. A lightweight antenna with a heavyweight signal, it offers a high 11dB gain on a 58 inch

PRODUCT NEWS

boom length. Great for vertical or horizontal mounting. The new antenna is supplied in matched pairs for the ultimate Oscar station complete with all hardware for mounting with elevation control. It is precisely adjustable for angle in order to get the best performance and also includes a matching unit for circular polarisation. Right or left hand can be chosen with equal efficiency.

Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, W. Yorks.

continuity bleeper. The third model (JF77) offers 0.3% accuracy, with a carrying holster and unique touch-hold facility allowing the user to concentrate on positioning

test leads without watching the display. The meter beeps when it senses a stable reading and this reading is held until new test points are selected.

The series all measure dc voltage to 1000V, ac voltage to 750V, current to 10A and resistance to 32M Ω and have a single eight position switch for simplified function selections.

Electronic Brokers Limited, 61/65 Kings Cross Road, London WC1X 9LN.



ANALOGUE/DIGITAL MULTIMETERS

Three fully autoranging multimeters manufactured by Fluke are available from Electronic Brokers Ltd., all incorporating a fast analogue bar graph display as well as a 3½ digit display.

The basic model is the JF73 with 0.7% accuracy and the JF75 adds 0.5% accuracy, manual override of autoranging and audible

SPECTRUM MORSE-TUTOR

A morse tutor for either the 16K or 48K. Sinclair Spectrum is available from Scarab Systems. The program offers the following facilities—adjustable speed; random letters/figures/mixed groups; adjustable group length; printout during or after the test, selectable number of groups; keyboard output section; adjustable tone. Messages can be stored and sent endlessly.

Scarab Systems, 39 Stafford St, Gillingham, Kent.

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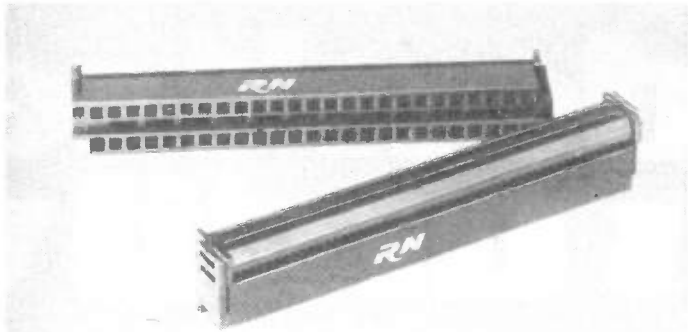
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PRODUCT NEWS



BACKPLANE SOCKET CONNECTORS

A new series of backplane socket connectors that interface directly with .025in square backplane wrap pins on 0.1 x 2 in grids is announced by Robinson Nugent Ltd.

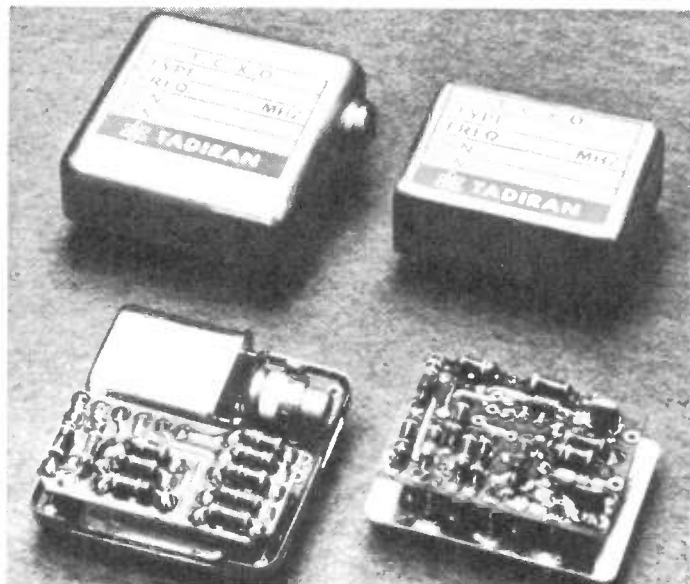
Known as IDB Series, they are available in 50-pin sizes and terminate to flat cable on a .050in pitch. Single piece construction lowers total assembly cost and stainless steel strain release is optional. Contacts may be in phosphor bronze or beryllium copper.

Robinson Nugent Ltd., 74 London Road, Riverhead, Sevenoaks, Kent.

TEMPERATURE CONTROLLED CRYSTAL OSCILLATORS

The Steatite Group have now introduced the Tadiran range of temperature controlled crystal oscillators (TCXO) for professional and military applications.

Tadiran specialise in high



stability units, achieving 1ppm between -40°C and +85°C if required. Relaxed versions are also available but generally they are supplied to specifications such as MIL-Q-55310 or better.

The frequency range extends from a fraction of one hertz (using dividers) to 25MHz. Typical power consumption is 60mW but special versions are available for lower requirements.

Steatite Insulations Ltd., Hagley House, Hagley Road, Birmingham B16 8QW.

NEW DIGITAL MEASUREMENT CENTRE

Philips new PM 2519 Digital Measurement Centre (DMC) is a complete multifunction instrument with power and versatility to solve more testing problems than any conventional digital multimeter (DMM) in its class.

This bench top/portable DMC includes a bar graph display for easier analogue



circuit setting, electronic calibration via the front panel (or optional, low cost IEEE bus) and is fully auto-ranging for easier, more convenient operation. It has full V, I and R capabilities (10 μ V to 20A) with a basic 0.1% accuracy and an automatic counter function allowing frequency measurement up to 1 MHz via the same V, I, R input. DB may be measured on both AC and DC voltage ranges and there are 16 selectable reference values from 50 ohms to 8k ohms.

Relative reference measurements are possible on all ranges using the 'Dial-a-Reference' feature and non-volatile memory.

The instrument has a 50-point logarithmically scaled bar graph which indicates some digitally displayed values, providing a virtual analogue display which facilitates null adjustments. The bar graph can also be used in the relative reference mode enabling rapid and simple adjustment to be made to specific values, using the non-volatile memory.

The extended 4-digit LCD display includes a range of user information and warning symbols including clear messages that warn when it is being used beyond a specified range or when potentially dangerous voltages are being measured.

An 'Error' message alerts the user attempting to make other measurements with the 10A input still connected, and other types of operating errors.

Range (as distinct from function) and relative offset are both programmable on the IEEE bus version. The PM 2519 can make more than four measurements a second and may be triggered via the bus or from a hand-held probe.

Self-test for correct functioning is provided and, in the event of a fault, the built-in signature analysis fault-finding technique permits fast detection and repair. A full overload protection circuit is provided.

Pye Unicam Ltd, York Street, Cambridge CB1 2PX

DUAL TRACE OSCILLOSCOPE WITH COMPONENT COMPARATOR

Currently available from Electronic & Computer Workshop Ltd., is the new Crotech type 3132 20MHz dual trace oscilloscope. This has a 5in CRT and replaces the type 3131 dual trace oscilloscope. It features a 2mV/div calibrated sensitivity on both channels, algebraic addition and subtraction, a 40ns/div to 0.2s/div timebase, 14 trigger functions with triggering to

We don't sell our sets until we know them inside

The new IC-02E Push-button Perfection



ICOM introduces the new top-of-the-line IC-02E to compliment its existing line of popular handheld transceivers and accessories. The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included.

Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. The IC-02E has an easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Charging may be done from a top panel connector for 13.8 volts which will also power transceiver operation. The IC-02E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

We do not sell any sets until we know them inside out. A bold claim, but true. Our engineers have been trained by ICOM in Japan, and can guarantee the best after-sales maintenance service available.

As well as the 02E, 751, 745, 271, 471, R70, 290D, 490E, 25H, 45E, 2KL, AT100, AT500, 120, 2E, 4E in the ICOM range we also stock such famous names as Tono, Telereader, Cue Dee, Versatower, Yaesu, Jaybeam, Datong, Welz, G-Whip, Western TAL, Bearcat and RSGB Publications. Thanet Electronics can offer you the most comprehensive and thorough service.

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with instructions for other output ports 2k or more memory required. £4-40 post free. A. Wallbank G4CIZ 22 Oakfield Road, Pamber Heath, Basingstoke, Hants RG26 6DN

● KM4000 memory keyer, uncased, £30. Beermat 14MHz D.C. receiver, 10 turn dial etc, uncased, £20. IC2E, with speaker/mic, nicads, charger, 3 aerials, £125. Field strength meter £3. F. Robertson, 22 Denmead, Two Mileash, Milton Keynes, Tel: 0908 653961 (daytime)

● 2 ele cubical quad io 15 m f/glass spreaders (one repaired) 6 extension spreaders for 20m. £55 onvo Yaesu MO1 scanning desk mike good condition £30 inc carriage. Prefer buyer collects quad or pays postage. Clive Field, 84 Ram Gorse, Harlow Essex CM20 1PZ Tel: (0279) 28857

● Digital car radio cassette player for sale with speakers at £60 + car cassette player for sale at £12.50. If interested please phone Nottingham 624185.

● Bargain Creed 7E Teleprinter modified for amateur use and can be used with ST5 terminal unit. Complete with silence cover and two governors for 45.5 and 50 bauds. £25 buyer collects. Tel: Stoke on Trent (0782) 535316 G8KXM QTHR

● MML144/ICO linear p.a. Excellent cond. Full output £95.00 Phone G8UYZ QTHR (0532) 586406 after 6pm

● Philips SG7000 Video game E70 comes with 26 game cartridges. Nigel Alford, Longdrift, Whitepost Lane, Culverstone, Kent, DA130TN. Tel: Fairseat 823598

● ZX81 plus 16K memory with over £15 software yours for £35. H.H. Exley, 'Woodlands', Half Acre Drive, Rochdale, Gr. Manchester OL11 4BU. Tel: Rochdale 46585

● PCB boards with Z80 and eight 2708 memories, lots of other comps. £4-50. Strumech 60ft telescopic tower wall mounting £250. 5 H.P. motor £15 also 3 H.P. and 1.5 H.P. GEC C.T.V. tuner/IF/de-coder/video O.P. boards £4.50. Colour TV faulty £10. 4CX250 and base, 1931 radio. Ultra-sonic alarm panels, call Tony 01-452-6724 leave message

● Phillips N1700 long play video 4x2h tapes as new condition but picture not 100% offers to 0621 828807

● Realistic h/held 27MHz C.B. transceiver with charger, batteries, antenna adaptor, also ZX81 complete and boxed with many mags. Both items £100 ono. May consider split sale tel: 01-791-1331 can deliver

● Trio TS530 AT230 SP230 mike headphones narrow filter. List price £800. Best offer secures. 22 foot telescopic galvanised mast. Best offer secures. Would consider solid state HF gear part exchange or multi mode VHF. Andy G401N 021 451 2571

● Partridge Supermatch A.T.U. and mini antenna 3.5 to 30 MHz £30 electronc Oric BBC programs motor tutor £4.50 Qth locator £4.50 BBC Rtty £5 Pye PFI RX adaptor £5 MML 144/100 2m 100 watt linear £75 13 volt 18 amp power supply £80 T. Tugwell, 11 The Dell, Stevenage, Herts Tel: 0438 354689

● Mizuho MX2 SSB/C.W. handheld with speaker-mic. £75 or part exchange for W.H.Y. John (G8BXO) QTHR. J.H. Stacey, 3 Westpark, South Molton, Devon EX36 4HJ. Tel: 07695-3382

● Facsimile (weather map) printer and electronic unit (see R&EW January issue), Muirhead, with data. £50. Marconi mobile data equipment items: miniature printer £35, soft copy unit (scrolling 32-char. alphanumeric L.E.D. display) £35. Futaba proportional ratio control outfit, complete and almost new, £30. Much more: instrument cases, meters, rotator, aerials, 200-400MHz FM manpack transceiver, keyboards, V.D.U. cases, etc. Write for list - Bob Sayers, 40 Royal Oak Drive, Leegomery, Telford, Shropshire TF1 4SS.

● Heath HW101 home built PSU £125 LG300 TX no PSU £25 ONO Phillips N.1700 VCR no colour £20 Geloso V.F.O. 3.5/28MHz £10 Cybernet CB fitted Xtal filter £15 fruit machine 5p 10p £20 jackpot on stand £60. R Brown G3GZH, 33 Tomlinson Avenue, Luton Beds LU40QL

● ZX81 personal computer with loads of software from magazines and on tape, plus ZX articles - £30. Phone Reading (0734) 482742.

● Pye moto fone MFSAM on glider FX 130.1MHz £55.00 Pye moto fone MFSAM on rally FX

72.375MHz. Phone G8RHU 0273-516801 (Newhaven)

● Two old radio's probably homemade. Twin 'Catswhisker' set and two valve set, one PM1HF valve only with box. No coils or other details. Also wireless-world January 1977 to May 1980. Any offers? Chris Wheeler, Reigate (Surrey) 41510

● MM 144 30LS microwave modules 30 watt power amp pre amp as new £50 161 Boundary Rd, Wood Green London N22 01-888 1393. Plus Yaesu FT208R with charger and case as new £150

● Newbrain programs 'QRA' gives bearings, distances, displays path on map of Europe, converts lat/long to locator. 'Logbook' keeps details of stations worked. 'Data' keeps club membership details etc. 'Microwave' converts NGR to path details and draws path contours, allowing for earth curvature. £6 each. G8MWR, 81 Ringwood Highway, Coventry. Tel: (0203) 616941

● Standard C8800 2m FM £145.00 ONO. FDK 800D 2m FM with head up display 25w £145.00 ONO. Tel: 01 267 8635

● F.D.K. multi 2000 2 meter SSB/CW/FM. Mains/12v transceiver. 10w output 144-148 MHz coverage. Complete with mains and 12v leads. Commercial pre-amp. Automatic tone-burst and repeater shift ideal home or mobile. £160 G3YZQ 021-779-2194

● Trio 3200 70cm FM portable TRCVR 7 channels £95 ONO. FDK Quartz 16 FM 2m. Mobile trcvr 10 channels £75 ono. Lafayette HA230 GnrI coverage valve Rcvr immac. £35 ono. Ring Dave G4NOW 01-850-4848 evenings + weekends. S.E.9.

● FT.902DM. Mint condition. Very little use. Original packing. £650. 021.458 3537

● FT101E and spare PA valves. £390 Yaesu. 7000 receiver £200. FT101ZD mint condition £500. RD Marshall G4GIQ Qth, 87 Cariton Rd, Witton Park, Northwich, Cheshire CW95PW Tel: 45584

● Yaesu FT101E h.f. trans first class condition plus FC707 antennatuner G4MH aerial with rotator spare PA valves many books more key first with £525 gets this super bargain. Phone Peter 051 428 6231 any eve after 6pm Liverpool also Tandy TRS-80 models 48k with printer and word pro many books games £450 ono. SP Hepworth, Alston 127 Quarry Street, Woolton, Liverpool, Merseyside, L25 6HD. Tel: 051 428 6231

● Yaesu FT221R 2m multi mode TX/RX with Mutek front end board. £320 ono. Icom IC24G 2m FM TX/RX £100. W.S. No. 19 set and rotary P.S.U. £45. 30 foot free standing lattice tower, dismantled ready for collection £45 Ring Dursley 811454

● Stereo system record player with LW MW FM 4SW bands two 24in x 12in x 12in speakers £40.00 Tel: Brighton 0273 601380

● ITT 2020 Apple II compatible computer plus software including visicalc screenwriter and many games £300 ono Tel: (0323) 639351 day 35606 evens

● Yaesu FT101E 160-10m, inc. 27MHz. Plus holdings FM unit (TX & RX) £300. MMT 144/28 transverter, £90. Datong mouse tutor £40. Maplin Organ (assembled) £450. Tel: Leeds (0532) 673251

● Communication antenna's for sale. All brand new and at silly prices. Selection from 27MHz to 500MHz available all types bought from bankrupt stock four months ago YL says theyve got to go. Also Boonton type 202H signal generator 54-216mc in working order. Tel: 0256 83528. Ask for Stewart

● MM144/28 transverter one month old. Sale due to obtaining FTV901R to match HF Rig £80 Tel: Alsager 3879 after 6pm Ken G6MBS

● IC45E 70cms 10w mobile £240 IC4E 70cms handheld with ½ aerial and leather case £140 Hameg 103 oscilloscope 10MHz single trace brand new cost £180 sell at £150. Contact Ken G4UQN 14 St Peters Road, Wisbech, Cambs. Tel: 0945 581099 days 0945 61029 evenings

● Sinclair Micro telly £60 anti TV1 bandpass filter £4. Anti BC1 stereo speaker filter £4. Pye compact battery charger £10. Two chargers 4 x AA Nicads £5 each PP3 charger new £5. 50m drum UR67 £40 100m reel 300 OHM ribbon feeder £9. DA Cushman G8MZV, 329 Welford Road, Leicester LE2 6BJ Tel: 0533 704284

● Realistic DX302 excellent condition £100. Reason for sale, passed RAE and Morse. P. Skivington G4UUM, 24 Sterling Avenue, Waltham Cross, Herts, EN88DE Tel: 0992 34329.

● Satellite TV dish - one metre suitable for 4 or 12 GHz spun aluminium - dish only £60 buyer collect or pay carriage. D J Standen, Woodman's Cottage, Cropton-Pickering-North, Yorks. Telephone: 075-15-598.

● Icom IC260 2m Multimode Mobile £220 Microwave Modules 100W 2m Linear Amplifier 10W in £90 G8IFN. Chelmsford 441504.

● Cossor 1035 scope Trans-US £10. Receiver type 46116 1.5-9Mc £10. BCC TX/RX N69D £10. Record Player £10. Dennis Arthur Griggs, 5 Collingwood Ave, London N10 3EH.

● For sale. Base two model 800 Matrix Printer with all interfaces. R J Redding, September House, Cox Green Lane, Maidenhead, Berks, SL6 3EL. Telephone: (0628) 24929.

● Heathkit Mohican General Coverage Receiver. All transistor 0.6-30 MHz. With mains PSU and Nicads, internal whip aerial. Buyer inspects and collects (demo). Manual and circuits included £30. Mr A R Churchley (G4EAQ), 46 Birchdale Road, Appleton, Warrington, Cheshire, WA4 5AW. Telephone: 0925 65813.

● Hitachi portable video recorder VT6500 colour camera VKC600 carrying case for recorder AC adaptor. Six hour battery ideal for all home or business purposes 18 months old. £650.00 ono. Icom IC240 £110.00 ono. Ring M'bro 0642 817089.

● Datong RFC speech processor £25; 432MHz Varactor Tripler Microwave Modules 30 Watt input £20; Hukushu 7/8X 144MR Vertical £8; Pair Heathkit Avon speakers, bookshelf type 15: walnut £20; Relays magnetic devices type 951 OK to 23cm offers? G C Badger G3H0C, 22 Lowercroft Way, Four Oaks, Sutton Coldfield, West Midlands, B74 4XF. Telephone: 021-352 0199.

● Datong FL3 VGC £95. KW-107 ATU 12mths old £105. YC-355D DFM £85. 'Toni-Tuna' for RTTY £25. Corner Reflector 1296 Mcs new £30. FT-708 and accessories £200. Polar SWR Bridge £25. RTVC Stereo AMP low 4Ω £15. All plus carriage. B M Kermode, 56 Brantwood Road, Bradford, West Yorkshire, BD9 6QA. Telephone 0274-45611.

● 6800 based computer. £70 ono. Used to/for teaching 6800 M/C Keyboard + PSU. Many I/O lines using 6821 IC's. 6821 IC's new and unused £1.20 each. John Taylor, 47 Spur Road, Orpington, Kent, BR6 0QT. Telephone: 0689 35353.

● Bargain, HW14 Line Printer, 132 char. per line, 100 lines per minute. Excellent condition, £130, cost over £300. Phone 01-751 2262 after 6.30pm.

● Pye Europa TX/RX 4 MTS FM 6 channel 30 watts 70.48 MHz complete with cradle and installation kit, and handbook £65. Sperry Univac paper tape punch and reader type 0925-01 5 and 8 level £10 CRT VCR139A £5. Watson G3WMQ QTHR Wembley 01-903 4362.

● Signal Generator 'Tech TE20D' 120kHz to 500MHz (130MHz on fundamentals). AF/RF output, mains powered, VGC, little used, £30. Philips 'Pocket-Memo' mini cassette recorder, uses Tandy 'mini 30' cassettes or similar, cost new £40, accept £8 VGC. Taylor 0709 70021.

● TV Studio clearance, monitors, mixers, cameras, VTR, etc:- 19in colour monitor working £65. Non working £25. Send SAE for list. Eddystone 770U RX £75. Teleprinter paper rolls. Air conditioner £25. Early wv mags. 1960 onwards offers? Mr. Summers G8GQS, 13 Church St, Gainsborough, Lincs. Phone 3940.

● Radio Amateur Callbook US and Foreign 1983 editions complete with Spring, Summer and Fall supplements. Set of eight books, cover price £2.90 US Dollars for £20.00 including postage. Steve Gibbs GU3MBS. Telephone: 0481-57605.

● Scan receiver Nichiya SR-119 VHF-FM 8CH 7XTALS £25 ono. Nottm 0602 892046 G6FHE.

● Hitech High Res. colour graphics card (S100 bus) and software £150. Eprom UV erasing lamp (takes 4 eproms) £30. Must clear. Phone Crawley (0293) 515201.

● G2 VF Frame Antennae for long medium and short wave bands 80 to 10 metres. SAE for details to F Rylands, 39 Parkside Avenue, Millbrook, Southampton, SO19AF. These are Do It Yourself jobs for listeners and hams.

● Rascal RA17L general coverage communications receiver 0-30MHz in thirty bands. Superb 5FT/MHz film scale. Good condition. Can be heard

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working. £150. Telephone: Evesham 881373.

● FT707 HF transceiver and FDR 750E Multimode 2M transceiver both excellent. Will be demonstrated if required by owner GW4MTY near Swansea. £625 cash for the pair. J D Jones, 70 Waterloo Road, Capel Hendre, Nr. Ammanford, Dyfed, SA18 3RY. Telephone: 0269 844061.

● TR10 TR7500 2metre 80 channel FM Mobile transceiver £110 Microwave Modules MMT 432/144R. 70cm transverter 2metre input £100. Both good condition. With handbooks post extra. Mr C P Howard, 52 Fairview Way, Stafford, Staffs, ST17 0AX. Telephone: (0785) 52693.

● MM 2001 RTTY decoder little used £140.00 PC Prosser. 43 Val Plaisant St. Helier, Jersey. 0534 33648 G34TVZ.

● Exchange my 28 foot Wharram catamaran worth £2000 for ham equip to same value or WHY Poverty dictates so accept anything reasonable even money. Please phone (0933) 664524.

● FDK 750A Multi Mode 2m rig hardly used in mint condition £240.00. Phone Canvey Island 694597 any time.

● Short wave mag. Nov. 1964 to April 1979. With indexes £15. Collected. Pryse, 36 Hart Road, Byfleet, Surrey, KT14 7NH.

● You need wire? I have a number of 100 metre coils of PVC-covered stranded connecting wire (approx. wire diameter 1.2mm) for £2.00 each including postage. Will split if required to 10 of 10 metre lengths in different colours at same price. M J Ferguson, 79 Coles Road, Cambridge, CB4 4BL.

● NEC PC8001 Micro computer with 64K ram joystick and software. Reqs monitor (RGB) or B/W inc. disk interface £350 ono. RHC Lilley, 6 Beatrice St, Ashington, Northumberland, NE63 9BT.

● TVDX converter, receives all VHF TV bands 1, 2 and 3 on any UHF TV. Plugs into aerial socket £20.00. Tel: 0702-8858.

● Transverter MMT 432/144 £80. Further details, ring Bury St Edmunds (0284) 68262 weekends.

● Realistic DX200 communications receiver, 150kHz to 30MHz, bandspread on all ham bands, superb MW DX (was new £199), bargain at £79. FDK multi-700EX, 2m transceiver, 25W, 18 months old, bargain £135. Realistic 'Patrolman Pro47' VHF/UHF scanner, with 5 Xtab, practically new, half new price at £70. G6ASA phone Oxford 863333.

● Ex BT Modems. One pair of 20/3 Modems as sold by Display Electronics at over £100 each. Full working order plus data up to 1200 Baud full duplex or 600 Baud half duplex assync £100 the pair, or might split or exchange anything useful WHY. B G Oldford, 4 Field Close, Malinslee, Telford, Shropshire TF4 2EH. Tel: 507312.

● YAESU FT1012D MK3 with FM unit and narrow CW filter. New bands etc standard. £450 ono. Phone 0952 613824 or write G4FBZ, 1 Greenacres, Kettle Bank, Telford, Salop TF2 ODU.

● Acorn Atom fully extended, tool box excellent condition lots of programs power supply £120 ono. L P Jones, 72 Rodborough, Yate, Nr Bristol, Avon BS17 4SG. Tel: 0454 314745.

● RSGB communications from Jan 1965 to Dec 1983, any reasonable offer accepted. Will help with delivery. Hague, 75 Woodland Drive, Anlaby, Hull, North Humberside HU10 7HN. Tel: 0482 657439.

● Trio TR3200 70cm Portable, 12 channels fitted, CW MIC, 3/4 whip, helical, carrying case, DC lead, charger, nicads, manual, good condition. £99. G4MTQ QTHR. Tel: Saltash (07555) 7578.

● TR2200GX +10W Amp £65. Intel 8086 and 8087 £80. ICL Termi printer 30cps RS232 £150. Honeywell printer 120cps 132 Column tractor feed RS232 £250. Both used with BBC Micro. Colour Video DAC £15. Phone 07842 51409 after 8pm.

● Hallicrafters S27 VHF receiver 26-140MHz. Works but needs some attention. Big and heavy so buyer collects. £10. D Lauder. Tel: 01-449 1553 (Barnet).

● Several bits and pieces, transformers, diodes, rectifiers, transistors, switches, pots, 5 sets boxed speakers. T A J Cooling, 4 Norfolk Rd, East Ham, London E6 2NJ.

● Marconi TF1066B, 10-470 MHz, AM/FM signal generator, 0.3uV -10mV calibrated output, 4 ranges £225. ICOM IC-720A AM8 FM filters, AT500, PS20, new unused, mint condition handbook, the lot £950. J-Beam 10 ELE 2m £10. 6ELE 2m QUAD £10.

Andy, Guildford (0483) 34954.

● Micronta low distortion generator Cat No NRZZ-9510 has 10mv- 0.1v- lv- output SIN+ square wave, output. Two scales on one dial, +2db- -30db on inner, on outer 1v-0.1v to 00 on other dial outer scale 6-100 H3 with X1 X10, X100, X1K selector switch for this scale. Cost £49.95 new, as new £28. Plus P+P. Phone Jake 01-803 6678.

● CB Radio -LCL 2740FM, just serviced 3 month guarantee £24.95. Also pair Codecall 4096 by Datong, cost £58 sell £35 or £18.95 each. YAESU FT-75B with DC-75B, mobile HF transceiver, SSB/CW, 80m thru 10m in 5 bands, 100w max DC input power £75. Cobra 148GTLDX with 200w linear £150. Highcliffe (04252) 71794.

● Icom 720A. HF transceiver. PS20 Power supply and speaker. AT500 aerial tuner. 2KL500 linear amplifier. 2KLPS power supply unit. SM5 microphone. IC-FL32 CW-N/720 Crystal filter. IC FL34 AM/720 Crystal filter. IC BC10A/E Backup. HK706 Hand key. CT300Welz dummy load. Icom 251E VHF Multimode base station. Tono 9000E sender/decoder. Tono CRT1200G 12inch green display. PX402 power supply. Datong morse tutor D70. Daiwa CN620A SWR meter. All less than a year old and very little used as receivers, and not used at all as transmitters. (No licence!) Offers to: CL Hesp, 1 Evesham Grove, Sale, Cheshire M33 2EY. Where the equipment can be seen working (by appointment).

● Heathkit 10-18u single beam Oscilloscope. 5 inch screen, good working condition, with manual. £45. Tel: Worcester 775206.

● Icom 215 2metre portable transceiver with nicads, helical antenna and telescopic whip. Crystals for ROTO R9 and S19 to S23 fitted. Extra crystals for 145.300 TX and RX, and 145.800 TX included. Price £95 + carriage. Will demo if buyer is local. Tel: Cramlington (0670) 714645.

● Acorn Atom PSV floating point 12K plus 12K, games packs 5, 8, 9, 11 plus others £150 ono. Tel: 04215 3083.

● Icom IC22A mint condition, boxed with circuits £100.00. Phone Dennis around 6pm. Weymouth 787747 or 834322.

● IC202S with usual accessories VGC £90 or swap for computer NOT ZX81 or good GC RX e.g. ICF2001 etc or FM TCVR. W Jones, 24 Underhill Crescent, Abergavenny, Gwent NP7 6DF.

● Nascom-2 48K Gemini RAM board, Nas-case, Nas sys-3 graphics, prototype board with twin sound generators, extension basic, text formatter, games, toolkits assembler, dis-assembler, excellent condition little used. £350 or offers, may deliver, call Driffield 0377 46919 evenings.

● FRG7 Gen Cov RX with ATU £150. IC24G 2M FM TCVR £100. Acorn atom computer 12K ROM 12K RAM £75. Full documentation and very good condition (all items). Wanted 70CM hand held, top band rig, 10M FM 2M power amp, audio filter, decent heavy construction morse key. G4TGJ. Phone Richard 0707 51449.

● NV-B44 Tapes. VC60 Tapes, N1500 video recorder, advance constant voltage transformer, advance transistor tester, elektor games computer, keyboard contact assemblies, 48inch projector screen, 872B valve, 9.5v 3.5A stabilising transformer, various mains transformers, transistors, resistors, capacitors. Offers. Parris, 124 Chelston Avenue, Yeovil, Somerset BA21 4PR.

● KW2000B AC PSU speaker manual Q multi £200. May exchange with cash for FT790 FT780. G4RVR Steve. Tel: 0742 656880 Sheffield.

● Sony AVC4000 studio camera 625 viewfinder cable £100. Roband RO50A scope £15. 5ADP7 scope CRT £3.50. Kryston Sax-47051 £4. 52 set RX offers. Labgear VHF/UHF upconverter £3. Vidicon 8844 3/4inch new £20. 4CX350A valve Ex-Eq £4. Teletext decoder B & O 8000 series manual info £35. Would swap any of above for HF VHF gear WHY? Mr R Hill G6TSL, 7 Willowbrook, Greytree, Ross-on-Wye, Herefordshire HR9 7HN.

● Rascal RA17 with case £175, Kenpro KP100 Keyer £55 Icom 255E 2metre TX/RX £190, Liner 2 2metre TX/RX £75. All items buyer collect or carriage extra - contact: Mike G4UPD on 0532 491366 after 6pm

● Tristar 747 with UK.FM £80 Mike Turner 500 (desk) £30, Belcom mobile multi mode 10/11 metres £225 also 11metre 3ele Yagi £20. Maureen

Edwards, 178 Norrey's Ave, Wokingham, Berkshire RG11-1UH. Tel: 787883

● Black-white monitor, uncased, suits Nascom/Gemini £25; keyboard RCA, 74- keys (membrane), ASCII encoded, parallel interface full documentation, as new, paid £72 will accept £35; Feltec L.C.D., 128 characters display, full documentation, as new, paid £190 will accept £95 O.N.O. Tel: Dormans Park (034 287) 659 after 7pm

● Pye VHF system. Base plus 12 mobiles £250. Receivers, Eddystone 880/2 £125. SR600 £45, others including WW11 gear. S.A.E. list. Cain, 18 Oaky Balks, Alnwick, Northumberland

● Pascal (from Molimerx) for Video Genies/TRS80 model 1 £60. Video Genie EG3008 and expander EG3014 with 48k ram, double density disk board, green screen monitor, Tandon magnetics TM1003 80 track disk drive, Ldos, Accel 4, Edas 3.52, write for full list and prices to, Mike Tubby, P.O. Box 119, Leicester. LE2 7EP

● BBC Model B plus dust cover blankcassettes and recorder leads manuals mags. £330 ONO Hewlett Packard HP-32E advanced scientific calculator plus 2 rechargeable battery packs and mains charger boxed £30 ONO. Tel: Chris, Burgh Heath 61452

● Printers in need of attention - suit hobbyist. Centronics 101AL parallel interface 132 character printer with stand. Not working but includes maintenance manual. £75 ONO. Honeywell serial interface printer with keyboard. Upper case only. Working but needs commissioning. Casing damaged. £75 ONO. Tel: Liss 2720 Tony Simmons.

● Trio R1000 RX with matching speaker hardly used boxed £195 ONO. FDK multi phalm - sizer 240 channel synthesizer with carrying case Nicad charger 5/8ins whip plus rubber duck and speaker mike £70 or will swop for elevation rotator of same value. R.A. Hillum G6PAE, 143 Spurrions, Laidon Essex SSI55NE. Tel: Basildon 414574

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● Icom 740 Nith AC PSU, FM board, desk mic. As new. £600. Phone G30NU 0923-676344 after 7pm

● C.B. transceiver, Harrier CBX. 80ch, 6watts, modifier, accessory jacks at rear, TX switch, internal relay, fitted, possible C.W. installation. Boxed, good condition, £80, Italian P.G. Electronics P.S.U. 4 Amp £10, Italian Zetagi Matcher (mobile) £5. Power reducer 100%, 50%, 10% settings, boxed, new £15 AM CB monitor £15 VSWR Meter Motorola £2. (Essex) Ingrebourne 45969

● Yaesu FRG7 RX 500 KHz to 30 MHz AM SSB CW no mods fine tuning VGC £110 ONO Page G4JOC, Phone Stalbridge (0963) 62082

● Sharp SG400 music centre cost 370 exchange for Yaesu FRG 7700 amateur radio or Trio R600 must be in good condition, with manual instruction, Franco Amoroso, 13 Tootal Rd, Weaste 5, Lancs Tel:061 743 1570

● FT707, FP707, Datong R.F. Clipper and YD148 Mic £550 ONO. FRG7 and KX2 A.T.U. £150 ONO. G4PWT (Qthr as G8WVE) Phone 061-881 2970

● Icom ICR70 receiver. FM option fitted. Warranty until August. £420. Gemqud 2-EL Triband beam good CondX £65. G3TXQ, 21 Green Street, Milton Malsor, Northampton NN7 3 AT.

● FT480R Yaesu mint. Unused transmitter. Complete £300 ONO. FRDX400S receiver. 2m. 6M. Manual. £100. S.M.C. P.S.U. 13.8V 6A. £20. J. Beam 5Y2M Yagi £9. M.M. Linear pre-amp 144/25 £40. All O.N.O. G3BRT. Tel: 0272 657997 after 7pm

● Wavemeter Drae VHF Model £15.00 Jaybeam 2M 8El. Yagi. 9.5DB £10.00 Nigel not Qthr 021-744-8672

● FT102, FL2100Z, DX33, KR600RC. All mint condition £1100.00 or split. Going Q.R.T. GW3XCR not Qthr: 0792 401058

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G4DID Qthr Downland 54130

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● Signal Generator type Hewlett Packard 608E
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● Trio TS510, 80-10m, TX/RX 200w, new PA's, spare
set of valves, £200. KC221 frequency meter, incl
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Holcombe Close, Teignmouth, Devon TQ14 8RE.
Tel: (06267) 3834

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Good condition. Owner moving house to flat. Cost
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between 6 and 7 if possible

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£140 ONO. Tel: 022985669 Cumbria. Wanted: DG5
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● Official service manual for Trio Kenwood
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£5. Plus post. May, Liss 2143

● Shack sortout: Eddystone 730/4 Gen Cov Rx vg
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TX/RX beautifully built, 3.5 7. 14. 21 MHz bands inc
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Telephone 0823-4275.

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Write for the prices and shipping cost. Behzad
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● AVO multi-range test meter £40, VHF 2M

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● Trio TS130S transceiver with mobile mount and
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CQM39 both xtalled 70.26 70.48 £50 together, or will
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£1. 244 Ballard Lane, London, N120EP Telephone:
01-445-4321.

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manuals from 1968 1974 7 volumes £15.00. Mr B A
Smith, 27 Dartmouth Road, Ruislip, Middlesex,
HA4 0DD. Telephone: Ruislip 32341.

● Racial RAIWV receiver for sale very good
condition with hand book. £165 ono. S O Hesweth,
91, Woodley Hill, Chesham, Bucks, HP5 1SP.
Telephone: Chesham 785557.

● Mains transformer 350-0-350V 120MA 6.3V 5A
CT. 5V 5A (12V series). £5. LF smoothing chokes.
Early 'Varley' push pull output transformer double
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Hunts 2MFD 1.2kV working £1 each. Transformer.
Suit Linear Amplifier 500-0-500V 425mA 2.5-0-2.5V
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Edwards, Telephone: 01-445-4321.

● Music centre for sale: Pye 1612 music centre
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WANTED

● Any manuals for Govt surplus radio equip
especially RAF AP2276 series US Army TM11-487
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ries for US AN/GRC and AN/VRC series equipment and
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TX/RX. I.G. Mant G8AVJ, 28 Welbourne Road,
Childwall Liverpool L16 6AJ. Tel: 051-722 1178

● Any WWII R.A.F. airborne equipment also
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Crosland, Red Lion Cottage, Holt Heath, Worces-
ter - 0905 620041 home or 021 454 8585 business.

● Wanted handbook and 2M conversion data for
Burnded BE201 transceiver contact Brian Robin-
son, 68 Langholm Drive, Heath Hayes, Cannock,
Staffs. Tel: (0543) 77581.

● Valve mixer Vortexion type 3/PPM also leak
valve power amplifier type TL/50 plus good price
paid for clean equipment. K.J. Forster, 10,
Springfield Oval, Witney, Oxon OX8 5EG.

● Radio Amateur/electronic fan - wanted for
exchange of experience and difficult/obtainable
expensive electronic parts. My rig is IC 211 and
Video-Genie 3003. Arne Bruun: Vestervangen 45:
DK-6900, Skjern, Denmark.

● SSB adaptor for Racial RA17K. Model RA63 or
RA98 preferred but RA121 or RA218 acceptable.
Good condition essential. All replies answered.
State price and delivery details. Alan Thompson,
16, Ena Avenue, Neath, West Glam: SA11 3AD. Tel:
0639-4040

● AVO 8 CCT. DIA to repair OHMS range. For sale
servicing UK CB radio cost £14.95 accept £10 inc
P.P. Electric guitar £10 EF91 75p (new) ECC91 £1
both plus P.P. Also EB91's 25p each. Mike Walker,
96 Sunnybank, Hull, N. Humberside HU3 1LF. Tel:
(0482) 447202

● Wanted please circuit manual or diagram for
RCA AR88D willing to buy or photocopy please
ring Bridgwater (0278) 423288 plant.

● Wharfedale 100.1 Multiplex. Receiver diagram
and service data. E. Lark, 10 Colman Ave, Stoke
Holy Cross, Norwich NR14 8NA. Tel: 050-86-2573

● Collins 32S-1 75S-1 spares. Mechanical filter
V.F.O. dial xtals 6955kc 8677.5kc 12177.5kc scrap set
considered. T.L. Simpson G3NSF, 58 Cemetery
Road, Houghton Regis, Dunstable, Beds. LU5 5DA.
Tel: 0582 62621

● One clean copy Newnes Technical Book Radio
Circuits explained by Gordon J. King. At reason-
able price. John Baird, 9 Alburne Park, Glenrothes,
Fife, Scotland, KY7 5RB. Tel: 0592/752992.

● Marihe and Air Band Battery or mains receivers
also multi band Uniden CR 2021 or similar portable
covering ham bands. Phone Bradford Yorks 676556
after 6pm.

● Will swap Olympus pen EF auto camera built in
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counter digital type. Tel: 061 969 0785

● Your old radio amateur equipment and any
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cash. Apply in writing with details to Mr Hughes, 85
Portfield Haverfordwest.

● Manual for Tektronix 564 storage scope with
type 351 dual trace sampling unit and type 3T77A
sampling sweep. Mr G.J. Wimpenny, 30, Faircross
Way, St. Albans, Herts AL1 4SD. Tel: St. Albans
(0727) 52003

● Pre 1978 World Radio and TV handbooks. Price
wanted and condition please to Geoff Mersereau,
Crucible Theatre, Sheffield S1 1DA. Tel: 0742-
760621

● Wanted Ediswan B8F base for 4CX250, UHF type
with screen bypass capacitor of approx 1000pF
with or without chimney. Also needed SK606

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Eimac chimney for SK600 series base. Phone G4RUL Eastbourne 53618 evenings only please.

● Circuit diagrams for C.B. rigs AM FM SSB and legal UK CB rig. Diagrams required especially wanted Hy-gain 5 model 2795 diagram. Any information contact I Wiseman, 13 Swift Gardens, St Giles, Lincoln LN2 4NA.

● Circuit diagram or manual for Nagard type 5002A double pulse gener'r. Even list of valves used would help. D Anderson, The Croft, Albert PStreet, Nairn. Tel: Nairn (0667) 53256 any time

● AR88D fair price for good condition or cheap for repairable model. 888A 750 or others considered. D. Muldoon, 68 Wroxham Drive, Wollaton, Nottingham NG8 2QS. Tel: 284195

● AM10D or AM10B Cambridge or Vanguard for newly formed A.T.C. unit. Must be high band and working or W.H.Y. Tel: Halstead (0787) 476925 after 7.00 p.m. G4DPZ QTHR

● Wanted circuit/info on Taylor model 33A scope. Donald J. Munro, 3 Sinclair Terrace, Wick Caithness KW1 5AD. Tel: (0955) 2085

● Wanted 2M 144MHz Transceiver Trio Yaesu Aov lcom FDk would like any base mobile hand held like IC2E AR240 FT208R would like side band CB or would like 2 pye 70s hand held pmr-s or any mobile base hand held on any MHz. Alastair Hunter, 27 Crichton Rd, Pathhead, Scotland, Midlothian EN37 5RH. Tel: 0875 320 642

● Wanted circuit diagram Eddystone 840 receiver loan or purchase. Underwood, 15 London Road, Stroud, Glos GL5 2AR.

● New members for new club!! (not CB) come along any Tuesday to the 308 Arc. At the Coach House behind St. Marks Church, Church Hill Rd. Surbiton - or contact Sec. Dave (G6YQD) 01-399 5487

● Camera control unit Akai CCU 150 or video recorder Akai VT 150. Iain McHardy, Navity, Cromarty Ross-shire IV11 8XY. Tel: Cromarty 451

● Exchange Trio R1000 receiver 100kHz, - 300MH for good solid state H.F. TX/RX 80-10 metres. Mike Thomson, 1 Osborne Terrace, Arbroath, Angus, Scotland. GM4JeJ QTHR

● Racial SSB adapter - may be able to collect from near London or Liverpool or North Wales - also want BBC micro software for RTTY and other communications - write or phone, Bob, 17 Aled Drive, Colwyn Bay, CLWYD/0492 40780

● Nombrex or similar battery signal generator also Heathkit Mohican, working or needing repair. Details first please. R. Wilson, 4 Brookside, Pathfinder Village, Exeter EX6 6DE

● Wanted pair Tannoy Windsor speakers, Smallfield (034-284) 3149

● PSU for Yaesu FT 200 or mains x former for same. G. Irvine G140H1, 22 Carrnreagh Bend, Newtown Abbey, Co Antrim, N. Ireland. BT37 9EQ. Tel: 0231 60243.

● Collins 51S1 Gen. Cov. receiver. Details Tel: 0473 79186.

● Sommerkamp FL100B or FL200B. S. Tubb, 11 St Andrews Rd, Bexhill on Sea Sussex. TN40 2BQ.

● Tuner Unit AT7672/24 for Labgear signal strength meter type E5188. Phone Ferndown (0202) 877920 evenings or weekend.

● Electronics circuit note book. Mohammad Bomjanian, 649 Neshat, Post Box Esfahan, Iran. 649. Tel: 30209.

● Information handbook on Oscilloscope, Type C1-5, 3in, made in USSR, 1968. I will pay for photostats, etc. Please write, Nussey, 11 Newland Road, Droitwich, Worcs. WR9 7AF.

● Small scope required in good order. Physical size is important. Full details to: J.I. Boyle, 35 Cannon Street, Preston Lancs. Tel: Preston 50193. (2-5pm only).

● 2X Spectrum 48K computer. I. Kendall, 4 Howlets Terrace, Chelmondiston, Ipswich.

● Acorn Atom owners. I would like to buy or exchange programs, especially radio application, although any will be greatly appreciated. Also especially a Morse tutor program. Other information about the Atom also wanted. Have you any information on the vintage No 19 set? For either please write to: Kevin Lewis, c/o 36 Victoria Road, Salisbury, Wilts. SP1 3NG.

● RTTY and CW for the ZX Spectrum: need good software. I have built both decoders and use Usart

8251A interface for the Micro. Will correspond and exchange diagrams too. Also interested in Spectrum, I/O Ports and A/D converters etc. Filip Register. 4 Kroendaalplein, B-Igoo, Overijse, Belgium.

● A14, A14 spares, A13 A43 A42 C12 C11 C13 C42 and B48 transceivers. GRC9, PRC316, PRC361. W/S31 12/24V PSU R216 receiver. B70 VHF transceiver B44 MII/III Tripod, phones, aerial. Contamination meter No.1. Information on GR310. Navy diving equipment, book, training manuals. Phone Terry G8MQT (07073) 27233.

● Circuit diagrams, suitable 1920's Radio Case 10in x 8in x 7in and any information whatsoever on vintage receiver Chakophone No 1B three valve, desparate collector. All costs refunded immediately. A.J. Humphriss, 21 Gould Road, Hampton Magna, Warwick CV3 58TU.

● PLL Synth chip - Toshiba TC9105P as used in some synthesised SSB/AM/CB radios (Motorola) or equivalent or data etc. Tel: 0454 414423 after 6 pm (Bristol).

● Manual or copy for Tertronix 3A1 plug-in. Write to Mr. P. Alliot, 20 Windmill Avenue, Blisworth, Northampton, NN1 3EQ or Phone 0604 858467 evenings. or 0604 51720 daytime.

● Wanted solid state second hand oscilloscope 20 MHz dual beam. M. Zahid Mian. 1 Lexington Gdns, Sherwood. Nottingham, NG5 3FE. Tel: 624185 (Nott).

● Wanted 2 MTR Multimode transceiver: can offer new Yaesu FT 227 transceiver in box. Also a 12in cut power saw 'Frontier' (F35) 12 hours use only. Cost £150 last year: FDK TM56B 2MTR/Marine 16xtal receiver portable. Sort a swop from above or any ideas? As local to QTH as I'm Raibc Disable person. Mr. S.A. Buttle, 12 Badnam Close, Bursledon, Southampton. SO3 8EG. Tel: Bursledon 4333 (Hants).

● Racial RA17 receiver and HQ1 Minibeam. Phone Gavin, G4UCR, Selborne, (Hant)362.

● Xtals for 3200, need RB0 RB2 RB14 RB15 SU19. George G8WZN QTHR: Phone 0302 68339.

● Have you a faulty and unwanted HRO receiver? Reading School Amateur Radio Club are looking for one as a re-building project. Coils and Handbook would be welcome. Will collect. G4RSC Tel: Reading (0734) 61406 Daytime. 871330 Evenings.

● RCA 8122 valves. John Moxham G8KBQ, 22 Whiting Road, Windmill Hill, Glastonbury, Somerset. BA6 8HP. Tel: 0458/33145 (daytime).

● HQ1, Also 2 or 3 ele Tribanders considered. Also Shure 526T or 444. Clive Field, 84 Ram Gorse, Harlow, Essex. CM20 1PZ. Tel: (0279) 28857.

● Empty tape recorder spools 5 1/4in diameter. Parker, 133 Station Road Cropston, Leicester LE7 7HH.

● Manual or circuit or anything helpful on Sylvania SC181W, your price paid. Mr H Lear, 86-205 Wensley Road, Reading, Berks.

● Wanted: GA8 and 6X5 metal valves close wartime period. Also required 1A4, 1A6, 1B5/255, IC6, IF4, IF6 or octal equivalents. Valves must be of USA origin. Telephone: Bath 891254.

● Components PCB and RF devices plus practical information on UHF Linear projects up to 900 MHz. This includes authorised self help television projects. Having used equipment up to 600 MHz with good results now find no available technology for higher freqs. Any help gratefully received and shared, including home made fibreglass parabolic aerial construction. D J Walsh (E15CD), 17 Owenabue Rise, Carrigaline, Co. Cork, Ireland.

● Vic 20 - any carriage software except - Superexp, Roadrace, Rat race, Voodoo Castle, Superslot, Omega Race, and EMI Music Composer. Will swap for any of above except Superexp. Also consider good utility/business/educational cassette software. Also required parallel (Centronics) printer interface and disc drive, working or not! Highcliffe (04252) 71794.

● Any information diagrams or parts for 19 set MkIII. Same for 62 set MkII in particular for 62 set ATU which is missing from the set. I have beginner looking for help please. A Armstrong, 1 Montfalcon Close, Peterlee, Co. Durham, SR8 1DD. Telephone: Peterlee 864500.

● GEC tube LD924E. Dennis Arthur Griggs, 5

Collingwood Ave, London, N10 3EH.

● Can anyone supply any information and circuit and details on how to operate the battery-mains TV-Radio set The Plustron TVR 5. Also an adaptor (TVR 5) for mains use is wanted for this set, all expenses paid by me. Mr N A G Mortimore, 62 Ashbourne Road, Mitcham, Surrey, CR4 2BA.

● Receiver covering 50 to 500MHz Eddystone 770U AOR2001 or similar. Mk products SSTV filter PCB using seven 741 IC's. Microwave modules receive convertors for ATV and 136MHz. Will collect reasonable distance. Please phone Middlesbrough 0642 318451 after 6pm or weekends.

● Urgently wanted for exhibition - crystal set or valve set of the early 1920's. Genuine article only. Fair price offered. Please write or telephone details to - Stan G3XON, 14 Dagden Road, Shalford, Guildford, Surrey, GU4 8DD. Telephone: 0483 36953.

● Repair manual (or any help) for a Hitachi Shibaden VDU model VM-126K. Mr F B Honnor, 46 York Road, Huyton, Liverpool, L36 1XB.

● Wanted the Dynamoter you removed from your BC348 rcvr. Will pay £5 plus carriage for good working specimen. N Kirk G3JDK, 54 Allendale Road, Rotherham, Yorkshire, S65 3BY. Telephone: Wickersley 541606.

● Exatron stringy floppy for RS232 input or details to modify TR880 unit. Also plug-ins for Soloload memory unit for video genie. R J Redding, September House, Cox Green Lane, Maidenhead, Berks, SL6 3EL. Telephone: (0628) 24929.

● Secondhand video genie software data-base and games programs also reqd, hardware for same any type wanted as I've just bought this computer and would like to expand cheaply. FT225RD wanted. Phone around 6pm, Dennis, Weymouth 787747 or 834322.

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● Have telequipment S22 Oscilloscope. Would swap for any UHF equipment suitable for operation on D.Y (Derby) Repeater, scope complete with mains adaptor cable and nicads, would also consider microwave equipment or extended basic cartridge for T199/4a, call G6TPZ on 2 metres or write to Paul, 2 Mosley Drive, Uttoxeter, Staffs, ST14 7EY.

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● Wanted DR49 or DR31 receiver; offering DR28 plus cash adjustment. Telephone: 01-959-7715.

● Meccano wanted for young boy any condition or age. Telephone: Ingrebourne 45969.

● G.N.Patchett's book - Colour Television - with particular reference to the Pal system. 5th or later edition. Reasonable condition will pay reasonable price plus postage etc. Phone Allan GM6 PYD (031) 336 4904.

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● Wanted: computer and necessary software. Write to 84745; PO Box 8, Southern Evening Echo, Hythe, Southampton, Hampshire.

● KWATU or any similar ATU. Squeeze Keyer dummy load 75Ω, LPF. Telephone Geoff on Reading 883508 or RDG 875123 ext 7631 office hours.

● Wanted High voltage variable capacitor 160pf or thereabouts - preferably surplus component from TU9 unit. Also Eddystone ceramic coil former. H M Humphreys Gi3EVU, 10 Mount Eden Park, Malone, Belfast, BT9 6RA. Telephone: 0232 668979.

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- Job wanted for honest hard working Telecom Tech interested in all fields of electronics especially construction and maintenance of digital equipment. Interview early 1984. Mr S J Wadeley, 67 Wetton Road, Wynberg, R S A, 7800. Telephone 021-77-0164.
- Wanted user's handbook for metrix wobuloscope type 232. Will gladly refund any costs. M J Pavier, 18 Partridge Way, High Wycombe, Bucks, HP13 5JX. Telephone: 0494-23326.
- Thermistors: can anyone supply a small quantity of Mullard 100Ω disc thermistors, Ref 2322 642 62101? Please contact Barry Knight, A M Lab., Fortress House, Savile Row, London W1X 2HE.
- Heathkit power unit HP23C-PS23 with illustration booklet and circuit diagram. Telephone: Cheltenham 35856.
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- Wanted mobile telephone BT-30K Bohsei or airphone 1325 by APT. Must be in perfect condition and with all accessories. Hillman G, 12 Abingdon Road, London W8. Telephone: 937 9385.
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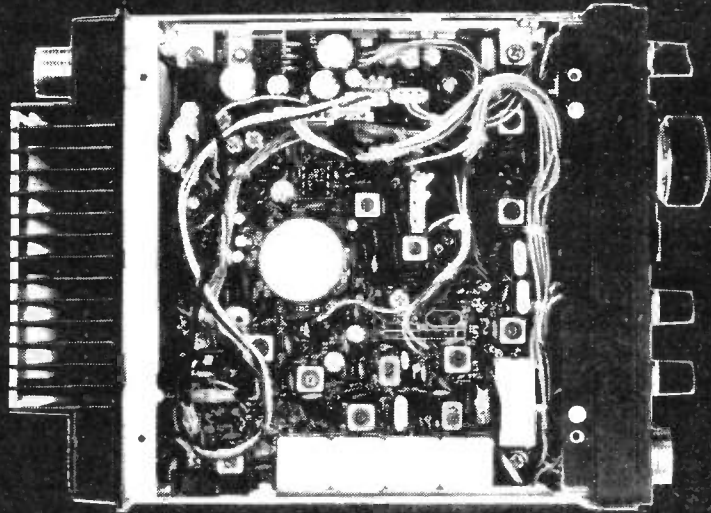
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IC-751, £969. HF Transceiver

The IC-751 supercedes the already popular IC-740. Improvements such as the addition of 36 memory channels, do away with mechanical bandswitching and add full HF receive capability (0.1-30 MHz), which is even an improvement on the famous R70, and you get a pretty good idea of what the IC-751 is like. It is fully compatible with Icom Auto units such as the AT-500 and IC-2KL and a further option for computer control can be added. There is also a digital speech synthesizer option which will be ideal for blind operators. For power supplies you have the option of the IC-PS740 (which fits inside) or the PS-15/PS20 range for external use.

As you would expect there is a built in speech processor, a switchable choice of a J-FET pre-amp, straight through or a 20dB pin diode attenuator and two VFOs allowing split frequency operation.

Other standard features include:- 36 memory channels with scan facility and start/stop timers, a marker, 4 variable tuning rates, Pass Band Tuning, notch, variable noise blanker, monitor switch, DFM (direct feed mixer) in the front end, full break-in on CW and AMTOR compatibility. The first IF is 70.045 MHz. Any XIT and RIT adjustment is shown on the display. The transmitter features high reliability 2SC2904 transistors in a low IMD (-32dB@100W) full 100% duty cycle. Power is restricted to 40W on AM and adjustable from 10W on all modes. FM and the IC-FL44A crystal SSB filter are both fitted as standard.

As you can see from this brief description the IC-751 is certainly a transceiver worth considering - Why not call us for further details?

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Radio & Electronics
The communications, electronics & computers magazine **World**

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
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263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

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Apr 84	9 Feb 84	15 Feb 84	17 Feb 84	9 Mar 84	
May 84	15 Mar 84	21 Mar 84	23 Mar 84	13 Apr 84	
June 84	9 Apr 84*	16 Apr 84*	18 Apr 84*	11 May 84	

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<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p>COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>
<p>Printed — web-offset.</p> <p>PAYMENT All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the 15th of the month following invoice date.</p> <p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE (0277) 219876</p>	<p>Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>

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OPTO

TIL 32 55p	TIL 38 40p	TIL 78 50p	TIL 100 100p	TIL 111 85p	2N5777 50p	4N25 80p	4N28 70p	4N33 128p	4N35 150p	4N37 300p	BPX 38 100p	BPX 43 340p	TIL 221 20p	(high output clear red)
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CA 3090A0 300p	LM 733 75p	SN76660 90p
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CA 3140E 44p	LM 748 35p	TBA520Q200p
CA 3160E100p	LM 1458 36p	TBA550 240p
CA 3161E140p	LM 3900 47p	TBA570Q200p
CA 3240AE 165p	MC 1455 18p	TBA625 100p
CA 3240E 110p	MC 1458 34p	TBA800 70p
CA 3260E 100p	MC 1476 70p	TBA810A595p
CA 8100M 250p	MC 1748 35p	TBA810S 95p
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LF 351 45p	MC 3401 68p	TBA820M 78p
LF 353 80p	MC 3403 65p	TBA920 195p
LF 355 85p	NE 529 220p	TBA950 210p
LF 356 88p	NE 531 160p	TC A270 120p
LF 357 110p	NE 532 56p	TC A800 250p
LM 301A 26p	NE 544 200p	TC A940 180p
LM 307A 54p	NE 550 160p	TDA1022550p
LM 311 60p	NE 555 16p	TDA1024 130p
LM 318 120p	NE 556 45p	TDA2002 190p
LM 324 40p	NE 558 170p	TDA2003 220p
LM 339 46p	NE 565 140p	TDA2004 470p
LM 348 60p	NE 570 395p	TDA2005M 395p
LM 358 48p	NE 571 395p	TDA2006 325p
LM 380 80p	NE 644 P.O.A.	TDA2020 250p
LM 380 80p	NE 645 P.O.A.	TDA2030 220p
LM 381 140p	RC 4558 48p	TDA2040 450p
LM 381 120p	SAA1027 850p	TDA2054M 130p
LM 384 125p	SAA1056 495p	TL061 40p
LM 386 90p	SAA5000 350p	TL062 80p
LM 387 135p	SAA5010 780p	TL064 120p
LM 393 70p	SAA5020 620p	ULN 2001 80p
LM 555 18p	SAA5030 £10	ULN 2003 80p
LM 556 45p	SAA5040 £18	ULN 2004 80p

CAPACITORS

Electrolytic radial/axial.	Tantalum bead.
Value/ V price	Value/ V price
0.47 25 5p	0.1 µF 35 12p
0.47 63 6p	0.22 35 12p
1 µF 63* 6p	0.33 35 12p
2.2 16 5p	0.47 35 12p
2.2 63* 6p	0.68 35 12p
4.7 25 6p	1 µF 35 12p
4.7 63* 6p	2.2 µF 35 16p
10 µF 10 5p	3.3 µF 35 18p
10 µF 16 6p	4.7 µF 25 20p
10 µF 25* 6p	6.8 µF 25 20p
10 µF 63* 7p	10 µF 16 20p
22 µF 16 6p	15 µF 16 28p
22 µF 25 6p	22 µF 16 35p
22 µF 63* 9p	33 µF 16 60p
47 µF 10 7p	33 µF 10 36p
47 µF 25 8p	47 µF 10 60p
47 µF 63 12p	68 µF 10 80p
100 10* 6p	60 µF 6.3 60p
100 16 8p	100µF 6.3 70p
100 25 10p	100µF 3 38p
100 63 18p	150µF 6.3 90p
220 10* 8p	
220 16 10p	Ceramic Plate
220 25* 14p	63/100 V
220 63 24p	1.8 pF to 4N7
470 10 14p	5p.
470 25* 20p	
1000 10 18p	Polystyrene 5%
1000 25* 28p	63 V 10 pF to
2200 10 32p	1 nF 9p each.
2200 25* 45p	1n2 to 10 nF
	12p each.
	Polyester C352
	series 250 V
	0.01, 0.015,
	0.022, 0.033,
	0.047p.
	0.068, 0.1 8p
	0.15, 0.22 10p
	0.33, 0.47 12p
	0.68 18p. 1 µ
	22p.
	Disc Ceramic:
	10 N 4p

DIODES

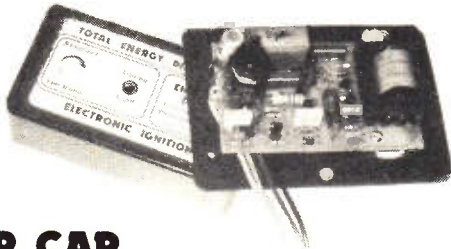
AA 119 9p	BAX 13 5p	BAX 16 6p	OA 47 9p	OA 90 7p	OA 95 8p	OA 200 7p	OA 202 8p	1S44 6p	1S921 9p	1N914 3p	1N916 4p	1N4148 3p	1N4149 4p	1N4001 3p	1N4002 4p	1N4003 4p	1N4004 5p	1N4005 5p	1N4006 6p	1N4007 6p	1N5401 11p	1N5402 12p	1N5403 13p	1N5404 13p	1N5405 14p	1N5406 14p	1N5407 15p	1N5408 16p	6A/100V 25p	6A/200V 28p	6A/400V 30p
AA 119 9p	BAX 13 5p	BAX 16 6p																													

electronize

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KITS OR READY BUILT

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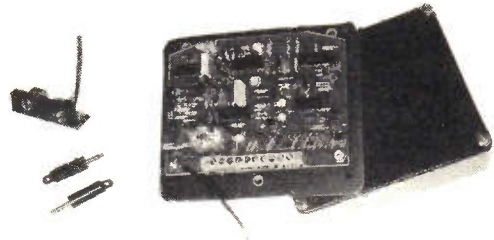
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- ★ Is it **ECONOMICAL** or does it "go off" between services as the ignition performance deteriorates? Total Energy Discharge gives much more output and maintains it from service to service.
- ★ Has it **PEAK PERFORMANCE** or is it flat at high and low revs. where the ignition output is marginal? Total Energy Discharge gives a more powerful spark from idle to the engines maximum (even with 8 cylinders).
- ★ Is the **PERFORMANCE SMOOTH**. The more powerful spark of Total Energy Discharge eliminates the "near misfires" whilst an electronic filter smoothes out the effects of contact bounce etc.
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LOADED OUTPUT VOLTAGE
 50pF load — 38kV, 50pF + 500k — 26kV
 We challenge any manufacturer to publish better performance figures. Before you buy any other make, ask for the facts, its probably only an inductive system. But if an inductive system is what you really want, we'll still give you a good deal.
- ★ **All ELECTRONIZE electronic ignitions feature:**
EASY FITTING, STANDARD/ELECTRONIC CHANGEOVER SWITCH, STATIC TIMING LIGHT and DESIGNED IN RELIABILITY (14 years experience and a 3 year guarantee).
- ★ **IN KIT FORM** it provides a top performance system at less than half the price of comparable ready built units. The kit includes: pre-drilled fibreglass PCB, pre-wound and varnished ferrite transformer, high quality 2uF discharge capacitor, case, easy to follow instructions, solder and everything needed to build and fit to your car. All you need is a soldering iron and a few basic tools.

Most **NEW CARS** already have electronic ignition. Update **YOUR CAR**

ELECTRONIZE ELECTRONIC CAR ALARM



HOW SAFE IS YOUR CAR ?

More and more cars are stolen each week and even a steering lock seems little help. But a car thief will avoid a car that will cause him trouble and attract attention. If your car has a good alarm system - well there are plenty of other cars to choose from.

LOOK AT THE PROTECTION AN ELECTRONIZE ALARM CAN GIVE :

- ★ **MINIATURE KEY PLUG** A miniature jack plug attaches to your key ring and is coded to your particular alarm.
- ★ **205 INDIVIDUAL COMBINATIONS** The key plug contains two 1% tolerance resistors, both must be the correct value and together give 205 different combinations.
- ★ **ATTRACTS MAXIMUM ATTENTION** This alarm system not only intermittently sounds the horn, but also flashes the headlight and prevents the engine being started.
- ★ **60 SECOND ALARM PERIOD** Once triggered the alarm will sound for 60 seconds, unless cancelled by the key plug, before resetting ready to be triggered again.
- ★ **30 SECOND EXIT DELAY** The system is armed by pressing a small button on a dashboard mounted control panel. This starts a 30 second delay period during which the owner can open and close doors without triggering the alarm.
- ★ **10 SECOND ENTRY DELAY** When a door is opened a 10 second delay operates to allow the owner to disarm the system with the coded key plug. Latching circuits are used and once triggered the alarm can only be cancelled by the key plug.
- ★ **L.E.D. FUNCTION INDICATOR** An LED is included in the dashboard unit and indicates the systems operating state. The LED lights continuously to show the system is armed and in the exit delay condition. A flashing LED indicates that the alarm has been triggered and is in the entry delay condition.
- ★ **ACCESSORY LOOP - BONNET/BOOT SWITCH - IGNITION TRIGGER** These operate three separate circuits and will trigger the alarm immediately, regardless of entry and exit delays.
- ★ **SAFETY INTERLOCK** The system cannot be armed by accident when the engine is running and the car is in motion.
- ★ **LOW SUPPLY CURRENT** CMOS IC's and low power operational amplifiers achieve a normal operating current of only 2.5 mA.
- ★ **IN KIT FORM** It provides a high level of protection at a really low cost. The kit includes everything needed, the case, fibreglass PCB, random selection resistors to set the code and full set of components etc. In fact everything down to the last washer plus easy to follow instructions.

fill in the coupon and send to:

Please send more information

ELECTRONIZE DESIGN Dept H · Magnus Rd · Wilnecote · Tamworth · B77 5BY · tel 0827 281000

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- Assembled ready to fit **£26.70 £19.95**
- D.I.Y. parts kit **£15.90 £14.95**

TWIN OUTPUT for cars and motor cycles with dual ignition

- Twin, Assembled ready to fit **£36.45 £29.95**
- Twin, D.I.Y. parts kit **£24.55 £22.95**

INDUCTIVE DISCHARGE (12 volt only)

- Assembled ready to fit **£15.95 £12.75**

Add £1.00 P.&P.(UK) per unit Prices include VAT

CAR ALARM (12 volt negative earth)

- Assembled ready to fit (All wires and connectors incl.) **£37.95 £29.95**
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VISA

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PRODUCT NEWS

40MHz, Z modulation and a 10 x 8 div display.

A unique component comparator incorporates two testers which can be used as comparators for checking both active and passive components or as a circuit signature comparator.

A triple output dc source is available on 2mm sockets mounted on the front panel which includes a +5V output, +12V and -12V dual source and +24V or -24V output.

General Manager, Electronic & Computer Workshop Ltd., 171 Broomfield Road, Chelmsford, Essex. CM1 1RY

HIGH SPEED STATIC RAM

The Semiconductor Division of Toshiba (UK) Limited has introduced a 16K bit static random access memory (SRAM) with fast access time and a very low active and stand-by current specification.

Organised at 2048 words by 8 bits and operating from a single 5V supply, the Toshiba TMM 2016 AP-90 features a maximum access time of 90ns and a maximum operating current of 80mA. A power down feature places the device in a low power standby mode in which the maximum current is 7mA.

This high performance speed and power combination makes the new TMM 2016AP-90 ideally suited for use in microcomputer peripheral memory where low power applications are required. Another technology requiring access times below 100ns is high speed video applications. The MOS SRAM features directly TTL compatible inputs and outputs and output buffer control.

The TMM 2016AP-90 is fabricated with ion-implanted N channel silicon gate MOS technology, a key factor in providing the performance and reliability. It is supplied in a 24 pin plastic 0.6in package.

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey. GU16 5JJ.

NEW PERSONAL COMPUTER

The Hitachi MB 16001 has a built-in 16 bit microprocessor and expandable address



space allowing memory capacities up to 384k. The high resolution colour can display up to 2000 characters in 15 different colours while a video RAM provides 640 dot (horizontal) x 400 dot (vertical) graphic resolutions in eight different colours. Twin 320K mini floppy disk drives are built in to the main frame with provision for extra 5¼in or 8in drives if required. The keyboard is independent of the mainframe which contributes to more convenient operation. The MB 16001 can accept programs written in BASIC or more sophisticated programs in FORTRAN, COBOL or PASCAL.

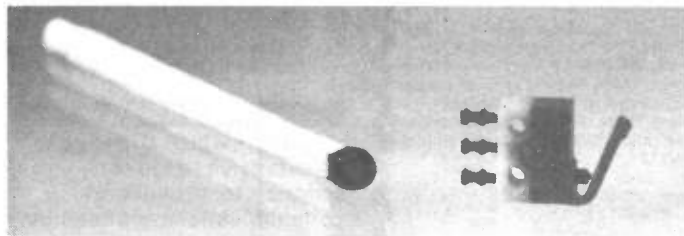
GSL Computing, 2 North Way, Andover, Hampshire. SP10 5AZ.

include the tamper proofing or safety switching of small equipment including security equipment such as sensors and for switching scale models and, indeed, in any other miniaturised equipment.

Semiconductor Supplies International Ltd, 128/130 Carshalton Road, Sutton, Surrey. SM1 4RS.

GIGAHERTZ FREQUENCY COUNTER

A new low-cost gigahertz frequency counter, the Model 6002, has been launched by GSC which measures frequency from 5Hz to 1GHz and also offers period measurement from 1µs to 200ms.



MINIATURE MICROSWITCH

An ultra miniature 50-volt microswitch with actuator arm is announced by Semiconductor Supplies International, Sutton.

This 300 MA single pole changeover switch weighs 0.3 grams. The dimensions are: height (inclusive of pins and with lever compressed) 10mm, width 8mm, thickness 3mm.

The actuating lever of this switch is shaped for cam follower applications as well as for ordinary compression applications.

Other possible uses

A 10MHz crystal-oven oscillator timebase ensures a stability of within ± 0.5 parts in 10^6 from 10°C to 40°C and a variation of less than one part in 10^6 per year.

Designed for ease of operation, with touch-button controls and a large, bright, 8½-digit LED display, three different resolutions can be selected via front-panel buttons and a switchable low-pass filter provides a 6dB/octave roll-off at 60kHz to facilitate audio and ultrasonic measurements.

Two front-panel AC-coupled input connectors provide a high degree of measurement flexibility. The 'A' input, incorporating a low-pass filter, accepts signals from 5Hz to 100MHz with an input impedance of 1 megohm at 20pF, resolutions of 10Hz, 1Hz and 0.1Hz, and a x100 multiplication mode for speeding lower-frequency measurements. The 'B' input accepts signals from 80MHz to 1GHz with an input impedance of 50Ω at 10pF and resolutions of 1kHz, 100Hz and 10Hz.

The instrument has leading-zero blanking, a contrast-enhancement filter for bright-light viewing, LED lamps for gate-open, oven-ready and overflow indication and a flip-up leg for benchtop use.

It is equally suited to audio or VHF measurements in communications, data processing, process control, radio-frequency design, digital design, quality control and maintenance.

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



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WESTMINSTER W15/W30AM RxRF 68.88MHz or 148.174MHz £6.95 10.7MHz IF (inc. 12½kHz xtal filter) £8.25 2nd Osc £2.10 455KHz IF £5.65 455KHz block filter (12½kHz) £7.35 Squelch £1.45 Aerial relays £1.50 **PYE SPARES ARE OUR SPECIALITY COMPLETE UNITS ALSO AVAILABLE**
GAREX FM DETECTOR and squelch conversion for Pye R/T equipment Ready Assembled, full instructions. Tailor-made, easy-fit design, replaces existing squelch board, with minimum of modifications. For AM Cambridge £6.30; for Vanguard AM25B (Valve RX) £6.10; for Transistor Vanguard AM25T £6.95

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PRODUCT NEWS

PORTABLE PROJECTION COLOUR TV

Matsushita has recently announced the availability of 'the world's first 6.5-inch screen portable rear-projection colour TV' (shown here). This weighs only 3kg (about half the weight of conventional 7-inch screen TVs) and is collapsible, folding down into an attache case 25cm x 8.5cm x 31cm.

The technology used is the same as that of Matsushita's large screen projection TV systems, with three 5-cm projection tubes—one for red, green and blue—performing the role played by the CRT of

a conventional TV.

In addition to receiving regular broadcast programmes, the new projection TV (which consumes only 12W) can be used as portable display terminal for teletext, viewdata and other video information services.

There are no plans at present to introduce it into the UK but further information about this TV can be obtained from National Panasonic.

*National Panasonic (UK) Ltd,
300-318 Bath Road, Slough,
Berks S116JB*



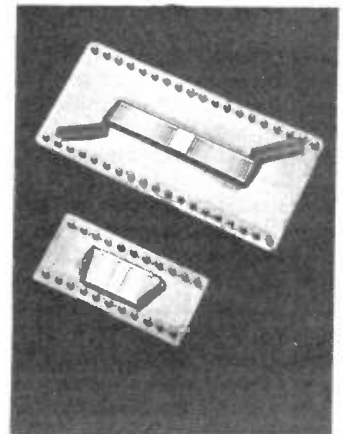
SAW FILTERS

Tadiran, which already has an extensive range of products for broadband communications applications (for example, chirp expanders/compressors, delay lines, MSK generators and fast frequency synthesisers), has now introduced a new SAW filter that is constructed using hybrid thin film technology. The new device is a 32-bit electronically programmed PSK matched filter, consisting of a SAW tapped delay line, CMOS switches and control logic which determines their positions. It operates at IF with a carrier frequency of 70MHz; the taps correspond to a bit length of 200µsec (5Mbit/sec).

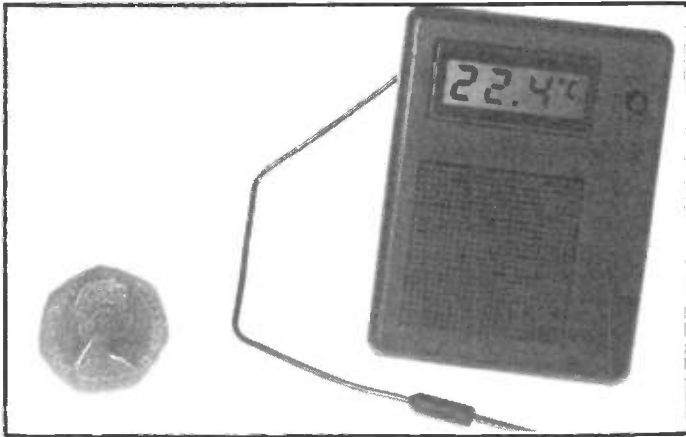
The device is being

marketed in the UK by the Steatite Group.

*Steatite Insulations Ltd,
Hagley House, Hagley Road,
Birmingham B16 8QW (Tel:
021-454 6961)*



PRODUCT NEWS



MULTI-PURPOSE THERMOMETER

Electronic Temperature Instruments has introduced a new electronic multi-purpose thermometer with some distinct advantages over any glass instrument and indeed the majority of its competitors. Not only is it reasonably compact (82mm x 63mm x 23mm) but it also features an easy-to-read liquid crystal display, long battery life and a waterproof, non-corroding sensor. The thermometer measures temperatures within the range 0–99°C with an accuracy of 0.1°C. Its usefulness is further enhanced through its ABS case incorporating a built-in wall mounting bracket and a table-top stand.

The Thermotron is believed to be particularly well suited to the measurement of air, liquid and semi-solid temperatures in such areas of industry as process and production, plant maintenance, heating and ventilation, health and safety – as well as generally in the laboratory.

Electronic Temperature Instruments, Highdown Avenue, Worthing, Sussex (Tel: Worthing 692161)

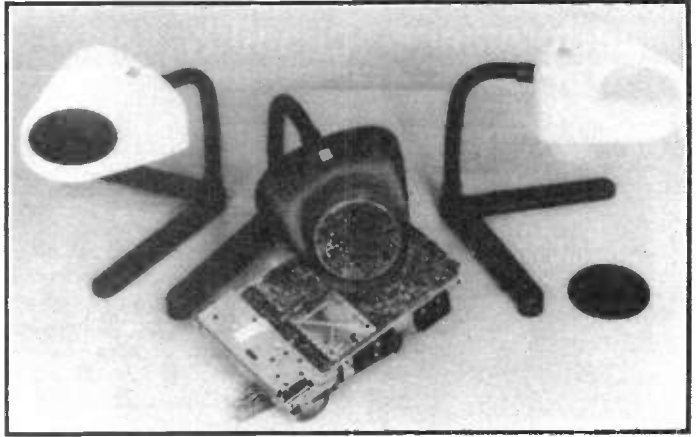
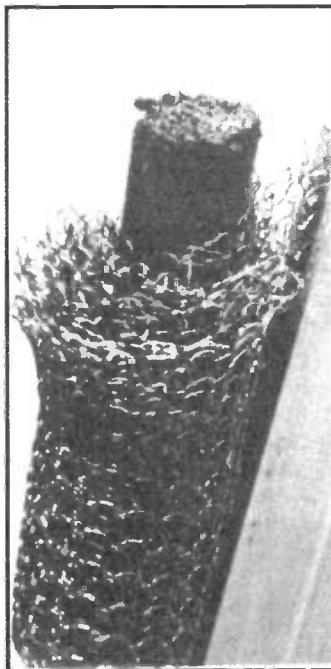
RIGID RFI GASKET

Extrudashield is a new composite RF interference gasket material from RFI Shielding. The material, which comprises strips of knitted wire mesh (or a combination of a mesh and an elastomer), all retained within an aluminium extrusion (see picture herewith). It provides up to 110dB at 10MHz and is supplied in individual strips up to 4m long and 3.18–15.9mm wide. Alternatively it can be supplied welded into

punched or drilled frames and based on a wide variety of metal extrusions, depending on the needs of the specific application.

One of the advantages of Extrudashield is that the metal extrusion can be attached to enclosure flanges and covers, thus eliminating the problems associated with loose gaskets. The extrusion additionally acts as a compression stop for the mesh, preventing it from being compacted, though the latter is knitted from Monel wire which is capable of withstanding a high compressive force. For lower compression joints, either sponge, solid silicone or neoprene elastomer is combined with the mesh.

RFI Shielding Ltd, Warner Drive, Springwood Industrial Estate, Rayne Road, Braintree, Essex CM77YW (Tel: Braintree 42626)



BENCH MAGNIFYING LIGHT

Tally Ho Lighting has introduced a magnifying lens incorporating a lamp, which has been designed to assist small intricate work in the laboratory. It should therefore be of benefit to both the individual constructor and those working in many electronics engineering plants.

The unit is moulded in a tough plastic has a twin-arm base and a flexible coil arm. The lamp section incorporates a magnifying lens and a 40W bulb. The lens accentuates the light to produce good illumination while magnifying the object of interest at the same time.

Tally Ho Lighting Company, 10 Pennine Parade, Pennine Drive, London NW2 1NT (Tel: 01-445 5060)

BARRIER LAYER CAPACITORS

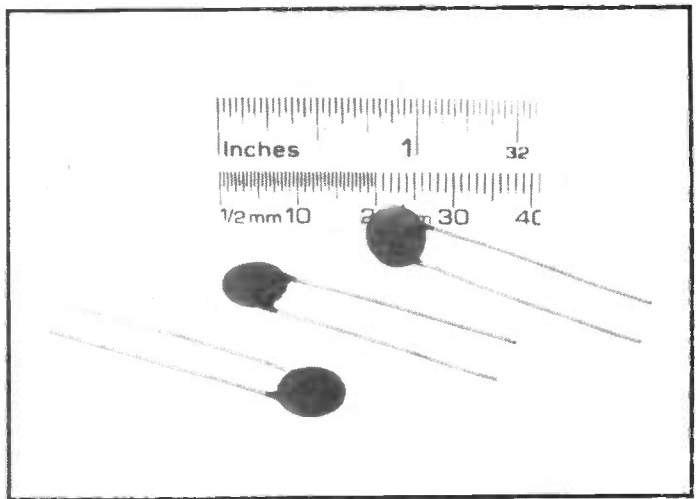
Murata Erie have extended their range of barrier layer capacitors with the introduction of new components which are both physically small and inexpensive.

The new capacitors are surface layer types featuring high reliability and low temperature coefficients, the capacitance varying by less than $\pm 15\%$ over the temperature range -25°C to $+85^{\circ}\text{C}$.

This range was developed primarily for coupling and decoupling applications and includes 16V, 25V and 50V rated components with preferred capacitance values from 0.01 to 0.1 microfarads, all the devices being available on tape for auto insertion if preferred.

The low cost DD 308 style incorporates new 'F' characteristic ceramic material which provides 0.1 nF capacitance at 25V in a disc of only 8mm diameter. The temperature coefficient is $+30\%$ to 80% over the temperature range -25°C to $+85^{\circ}\text{C}$ which ensures the component is suitable for decoupling applications.

Murata Erie Electronics UK Ltd, 104 Albert Street, Fleet, Hampshire GU13 9RN (Tel: 02514 21247)



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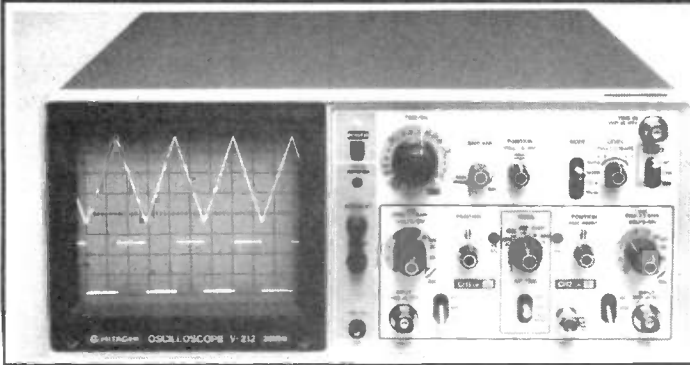
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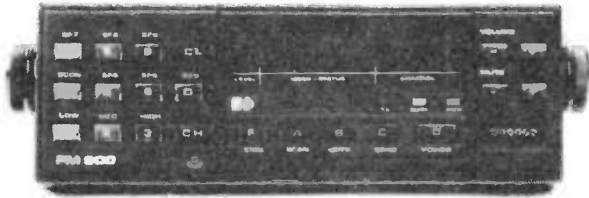
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PRODUCT NEWS



INTELLIGENT TWO-WAY RADIOS

Pye's FM900 and MX290 mobile radios are seen as representing a new generation in advanced two-way radios. Their solid state circuitry has been developed to handle data transmission and telemetry, as well as speech, with a high degree of reliability and minimal maintenance down time.

The FM900 (pictured here) is a frequency-synthesised device that incorporates a 'large-capacity' microcomputer and has been designed to offer a number of sophisticated software options without increasing its operational complexity. Members of the MX290 series also incorporate frequency

synthesisers, offering up to 250 channels accessible from either a conventional control or a key pad, and they have been designed on a modular basis to allow users to tailor the system features to their requirements.

The important aspect of these radios is the way they have been designed specially for such users as bus operators to whom the collection and display of fast, regular management control information is of benefit. Thus the FM900 is able through its software to interface with vehicle location and monitoring systems, whilst obtaining information like how full the bus is and whether it is on schedule via a 'handshake' with an

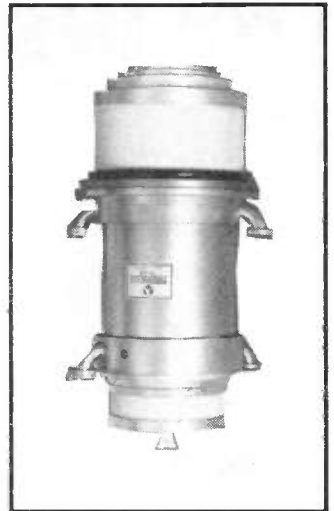
equivalent device in the electronic ticket-issuing machine over a standard datalink.

*Pye Telecommunications Ltd,
St Andrews Road, Cambridge.
CB4 1DW*

1MW+ TETRODE

The TH539 tetrode from Thomson-CSF shown here can deliver up to 1.2MW of RF carrier power at up to 2MHz or up to 4MW CW output power at frequencies as high as 50MHz. The device, which is described as being 'at the summit of the electron-tube art', incorporates 'Pyrobloc' pyrolytic-graphite grids which are expected to give it very high stability, reliability and a long operational life. At the same time, its 'Hypervapotron' water circulation system allows up to 1MW to be dissipated on the anode with a wide margin of safety with respect to overload.

Combined with TH558 tetrodes (which use the same technology), the TH539 is



expected to form the basis for compact 'superpower' MW or LW radio transmitters that operate with higher electrical efficiency and greater reliability than their counterparts.

Thomson-CSF Components and Materials Ltd, Ringway House, Bell Road, Basingstoke, Hants. RG24 0QG

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	4001/4011 tester	£0.99
	SL6270 Data brief	£0.99
Jan 84	FAX receiver	£4.65
	FAX processor	£4.35
	8211	£0.99
	7665	£0.99
	Capacitance meter (control)	£3.85
	Capacitance meter (display)	£1.40
	Cymar Q meter	£2.65
	Zener diode checker	£0.99
Feb 84	REW Bichron 11B	£4.55
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	Step attenuator	£1.30
	Audio amplifier	£0.99
	Crowbar protection circuit	£0.99

All prices are inclusive of postage, packing etc

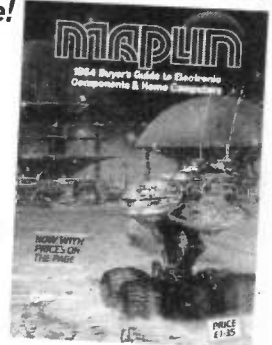
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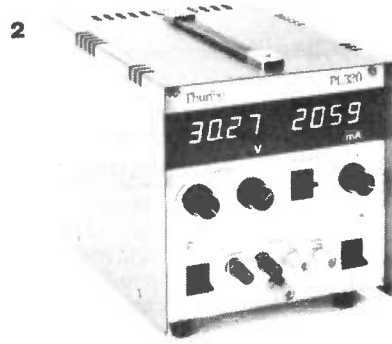
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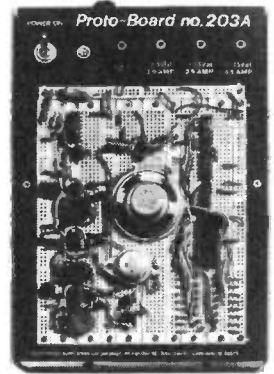
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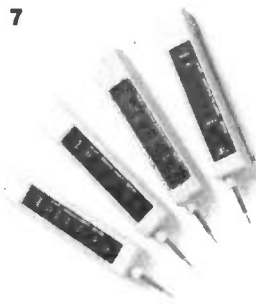
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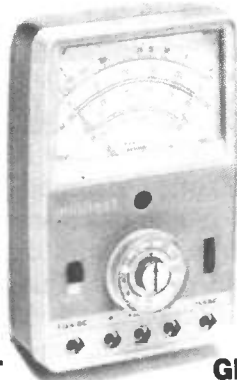
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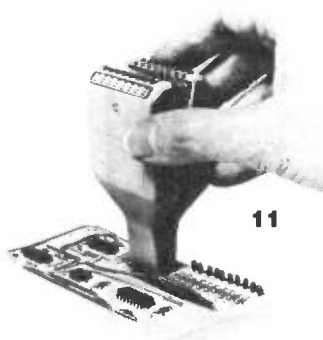
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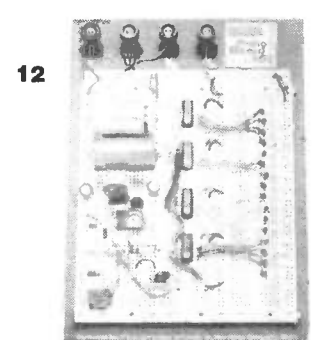
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NEWS

Columbia to Jordan

Astronaut Owen Garriott, who had fitted his amateur radio equipment in the European Spacelab, made an unusual contact whilst orbiting in the space-shuttle 'Columbia' recently.

Having passed over the Gulf of Aqaba, he made contact with King Hussein of Jordan who was very excited about his first direct contact with a fellow-amateur in the shuttle.

At a height of 155 miles above ground, the whole of Jordanian territory was in view and the astronaut was able to provide the ruler with his first extra-terrestrial description of his Kingdom.

Amateur radio transmissions from Grenada during US intervention

An American student, Mark Baratella, assisted by other operators provided the only reports that were available to the press when US forces landed in Grenada during October 1983.

The press reporters were prohibited from accompanying US Marines during landings and depended on the amateur radio experience of Mark who operated from the Grand Anse campus of Saint George's Medical School, providing up-to-the-minute accounts of the situation.

We understand that US radio amateurs, Bob Cunningham and Tim Daniel, contacted Mark and have written a comprehensive account of the events which began on October 25th, 1983. This account has been published by '73 Magazine'.

A plea for planning

John Carlton, Chairman of the Mobile Radio Group of ECREA (the European Conference of Radio and Electronic Equipment Associations), made a call at a recent convention on land mobile radio services for long-term frequency planning. He asked 'Can we not agree internationally a long term aim to set aside frequencies between 30MHz and 1000MHz for mobile applications only, where

radio is the proper – indeed the only possible – tool to give us communication.' The reason that it would have to be a long term aim is, of course, that these frequencies are currently occupied by other services – so the process of change will probably take twenty years or more.

His argument is that mobile communications requires use of the radio spectrum, while these other services could change to wire or optical cables. Moreover, if these changes weren't made, we would be restricting ourselves and not providing the sort of freedom to communicate that not only enhances the quality of life but can save lives.

Mr Carlton also feels that, in this communications age, the public should be made aware of the facilities that new technology brings. 'We must become more skilled in new technologies like cellular radio, LSI/VLSI, switching and system software, satellite systems, spectrum utilisation techniques and voice storage and retrieval.

FORTHCOMING EVENTS

A two metre FM contest

This contest will be held on Sunday 15th April 1984 between 1300 and 1700 GMT in the 144.5-144.845MHz and 145.2-145.475MHz sections of the band.

It is open to members and non-members of the Stevenage and District Amateur Radio Society and there will be three classes of entry as follows:-

1. Stations operating up to 25 watts output.
2. Stations operating more than 25 watts output.
3. Short wave listeners.

For further information, please write (enclosing a stamped, addressed envelope) to:- *The Contest Secretary, Bernard Dean G6NZC, 82 Lingfield Road, Stevenage, Herts, SG1 5SN.*

WARNING TO USERS OF FT290R EQUIPMENT

Norman Bedford (G4NJP) has drawn our attention to a potential hazard concerning use of FT290R equipment and we suggest that immediate

action is necessary to avoid possible serious damage to equipment and the surrounding area.

Norman was using the FT290R as a mobile setup and made an emergency stop when his car filled with smoke from the equipment. Upon investigation, he discovered that the positive battery lead was trapped between the case of the battery holder and an earthing post thereby short-circuiting the fully charged Nicad batteries.

After clearing the fault and removing the debris, he found that the 290 worked as well as normal. He has since heard of three other sets that have suffered short-circuited batteries for the same reason, thus it seems that a particular degree of care should be exercised when fitting the batteries. Further, other owners have mentioned that another problem is

associated with the Nicad battery pack area of the equipment, ie, the external power connector socket does not disconnect the Nicads when the external supply is connected.

Apart from these problems, Norman seems to be well-satisfied with his equipment.

For beginners

A beginners' course in Morse Code will commence at Brooklands Technical College, Weybridge, Surrey, on Thursday 9th February. The class will run for ten weeks and will meet on Thursdays from 6.30pm to 8.00pm. Enrolment will take place at the college on Thursday 2nd February from 6.30pm to 7.00pm. For further details contact Chris Roberts at the *Dept of Technology, Brooklands Technical College, on Weybridge 53300 extension 246.*

Company News

Distributor

Hawke Electronics Ltd., has been appointed a franchised distributor for *Virtual Microsystems Limited*. Established to market throughout Europe the products of its American parent, *Virtual Microsystems Inc.*, the new UK company will eventually supply and support a range of hardware and software products which enable non-DEC operating systems to be run on DEC mini-computers. The first product to be made available allows the established operating system CP/M from Digital Research to run on all DEC mini- and microcomputers from the VAX downwards. This includes the PDP-11/LSI-11 series.

British Telecom signs

British Telecom has signed an agreement with a major television programme provider to distribute programmes to local cable networks by satellite. The agreement, with *United Cable Programmes* – a consortium which includes

Rediffusion, Plessey, Rank Satellite and Cable, UIP Pay TV and Visionhire Cable – is a breakthrough for British Telecom, which will soon be distributing new programmes to hundreds of thousands of cabled homes throughout the UK. The service, which has already been demonstrated to programme providers and cable operators, will begin on March 1, 1984, and British Telecom will transmit programmes via the Intelsat V satellite to cable head-ends equipped with small satellite dish aerials. Sir George Jefferson, Chairman of British Telecom said: 'The cabling of Britain provides one of the major opportunities for business growth in the UK and BT is determined to play a major role in this.' Mr. Nicholas Mellersh, Chief Executive of UCP, said: 'In British Telecom, we know we have the best possible partner for our new venture. From March 1 next year UCP will be supplying Rediffusion, Visionhire, Greenwich Cablevision, as well as an existing cable operator with

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NEWS

TEN, The Entertainment Network.' British Telecom is now engaged in negotiations offering other programme providers extra TV channels by satellite. These additional TV programmes can also be accessed by cable head-ends using the same receiving dishes necessary for the UCP project.

British Telecom is also offering to lease television receive only (TVRO) terminals to cable operators for use at their head-ends.

PCB's for EEC

Supplying printed circuit boards to the majority of EEC countries, *N.V. Kling* have now appointed *C.R. International* to be their exclusive agents in the UK. The company produce single side, double side and through hole plated boards and various types of materials can be provided. Finishes include roller and electrolytic tinning, gold plating including various types of printing and protective masking.

Plessey chairman

Mr F K Chorley has been appointed Executive Chairman of *Plessey Telecommunications and Office Systems Limited (PTOSL)* with immediate effect. He is also appointed a Deputy Chief Executive of *The Plessey Company* and therefore a member of the Chief Executive Office. Mr Chorley, who has been with *The Plessey Company* since 1974, moves to *PTOSL* from *Plessey Electronic Systems Limited (PESL)*, where he has been Deputy Chairman and Managing Director. At the same time Mr Eric Clark has been appointed Managing Director of *PTOSL*, reporting to Mr Chorley, with responsibility for both UK and US operations. Mr Clark was Chief Executive of *Plessey Telecommunications Limited*, a subsidiary of *PTOSL*.

London move

Industrial Science Ltd are moving their Dover based operation to new and larger premises in South West London. The new location is 18, The Osiers Estate, Osiers Road, London SW18 1NL.

The move will enable the company to greatly increase its stockholding in addition to offering an even better distribution and delivery network.

£50,000 order

Crow of Reading Ltd. has received an order worth £50,000 from *Robert Bosch GmbH, Darmstadt, West Germany*, for automatic video signal linear-distortion correction instrumentation. The units to be supplied are Model ACG 2037 Automatic Video Equalizers, (AVE), a type specially designed and manufactured to meet a stringent EBU specification. A significant number are in service in PTT switching centres which terminate video signal links, and form a standard part of the Eurovision picture quality control system.

The Independent Battery Specialists Association

The Independent Battery Specialist Association (known as *IBSA*) has been formed to act as an effective monitoring body dedicated to the upholding of established standards in the installation, operation and maintenance of secondary battery systems. The new association intends to provide assurance to contractors, specifiers, end users and others that member companies can be relied upon to meet the stringent demands imposed by both legislation and systems manufacturers.

A steering committee comprising the four founder member companies has been established, these four companies being: *Ensura Systems Limited* of Rossendale Road Industrial Estate, Burnley, Lancashire, telephone (0282) 29261/2/3. *Telavex Limited* of 1a Church Road, Epsom, Surrey, telephone (03727) 22911. *Computer Battery Services Limited* of Aysgarth, Wedmore, Somerset, telephone (0934) 712147. *Sterling Safety Systems* of 8 Station Road, Kenilworth, Warwickshire, telephone (0926) 58241.

General Secretary of the association is Mr J.M. Snowdon, at *IBSA*, 60

Waterloo Road, Wolverhampton, West Midlands, WV1 4QQ. Advice and assistance on any problems associated with standby power systems can be obtained by contacting Mr Snowdon or any of the four founder member companies. Enquiries regarding membership should be directed to Mr Snowdon.

Further information from: *Adfield-Harvey Public Relations, PO Box 161, Grassy Lane, Wolverhampton WV10 8PS. Telephone (0902) 20702.*

Marconi places satellite antenna contract

Ottawa, Canada. Under the terms of a £1.3M contract awarded here today by *Marconi Space & Defence Systems Limited*, an Ottawa-based company, *Canadian Astronautics Limited*, is to finalise the design, build and deliver an advanced communications antenna for the *Skynet 4* military communications satellite for which *British Aerospace* is prime contractor.

As lead communications contractors to *British Aerospace* on the *Skynet 4* programme, *MSDS* has designed a powerful UHF/SHF/EHF payload for the two satellites that will provide ships of the Royal Navy and land forces of the British Army with secure, highly efficient and flexible voice, data and telex links from 1985 onwards.

The UHF antenna to be supplied by *CAL* as part of the payload has been selected on the basis of its compact size (for launching purposes), its ability, when deployed, to handle the satellite's high output power and its highly innovative design.

Prestige contract

British Telecom is to supply the new telecommunications system for the *Imperial College of Science and Technology*.

The contract involves the installation of an *SL-1* digital exchange and a *BTS 123* communications management system from *British Telecom National Networks*.

Researchers at the *Imperial College*, one of Britain's premier high technology institutions, chose the *SL-1* and *BTS 123* combination because of the extensive and continuing development of these products.

The system has been designed to take full account of past and future compatibility. It can operate with both the *ISDN* (Integrated Subscriber Digital Network) and the new *System X* public telephone exchanges. This advanced private telecommunications switching system is compatible with existing public exchanges, *PBXs* and conventional telephones.

The *SL-1*, manufactured in the UK by *GEC*, is computer-controlled. The features and services are defined by a software program instead of wiring circuits. Capabilities can be modified, added to or deleted by altering the software rather than the hardware, allowing much greater flexibility.

More than 100 features and services are available from *SL-1*'s advanced technology. These range from direct inward dialling ('*DID*') - allowing incoming calls to reach specific extensions without operator assistance - to six-party conferencing, and all forwarding. Other capabilities include 'splitting', which enables the operator to consult privately with either the source or destination party on a call. Access to paging equipment is available too.

No preventive maintenance is required on the *SL-1*. Fault detection gear is built in, enabling the system to check itself. A diagnostic printout is provided automatically should a fault occur, allowing rapid remedial action.

The *SL-1* works equally well in small businesses needing 100 extensions as for larger organisations with several thousand extensions.

The *SL-1* digital exchange provides additional facility in that no preventative maintenance is required because comprehensive fault-detection equipment is built in enabling the system to self-check its operation.

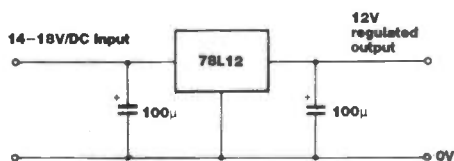
— QUESTIONS & — — ANSWERS —

Do you have any technical or practical questions that you would like an expert answer to? A selection of readers' questions will be answered each month on this page. We regret that we cannot enter into individual correspondence with readers

Write to Q & A, **Radio & Electronics World**, Sovereign House, Brentwood, Essex, CM14 4SE

Ronald Bray, who is making a crystal calibrator (Aug 1983 issue), says he would like confirmation of the voltage to be supplied.

The crystal calibrator, being a CMOS device, will work from any voltage from 5 to 15 volts, but for reliable regulation the supply should be regulated. An example is shown below:-



Harry Grant asks, 'is it possible for you to let me have the address of Leader Electronics as I am interested in one of their test units.'

Information concerning Leader equipment is available from the sole UK importers:- Thandor Electronics Ltd., London Road, St. Ives, Huntingdon, PE17 4HJ.

With reference to the project 'ac Control Data Brief on the VAL CSR Range' (April 1983), could you please advise a list of stockists, addresses and general guide to price. Peter Deacon.

The VAL CSR 1504A and 1504B are available from Ambit International, 200 North Service Road, Brentwood, Essex. CM14 4SG. Telephone (0277) 230909. Their stock Nos 61-01504 and 61-01514 cost £8.43 plus VAT and 60p postage.

TG Mitcherall wishes to find a reference for world-wide stations and operating frequencies for SWL.

We are advised that a comprehensive list is published in 'World Radio & TV Handbook', available from Billboard Ltd, 7 Carnaby St, London, W1V 1TG. This is an annual publication, fairly expensive and contains information additional to that required. We suggest you try the local reference library first to see if a copy is available there.

The subject of my enquiry is 'Communication Building Blocks', Part 1 (Oct 1983) and various Data Briefs.

I have been planning a project using

IC's based on Data Briefs but have had difficulty in selecting some of the other components (for the 'Communications Building Blocks' circuit, Figure 2 in Oct 83 issue), e.g. transformers and filter.

The filter F1 will have to be 10M15A with input/output impedance of 3K. This leaves the requirement to know what is used for T2, T3 and, also, what is used in the T4 position to match into KB4413 and match a diode detector/agc circuit.

I note that the PCB's in the article differ from those in the Data Briefs, does this mean that project packs will be available for these and will the Data Brief PCB's still be available.

The project I have in mind is a simple 160m AM receiver that can be further developed into a TX/RX with single knob tuning. J F Perry, G4FJP.

The transformer you want for T2 is a KACS3894A (35-38940), and T3 is a YHCS-1A590R (35-05900).

The output coupling IF (T4) can be the same as T3 - although a YLE4A888EK presents a lower primary impedance - which can help if the circuit is prone to instability. Both should work with a diode detector - and don't forget the AGC is positive-going to reduce gain.

The rest of your proposed circuit is very interesting - my only observation being that if you chose oscillator high, then there are a couple of modules and ICs capable of giving you a DFM readout.

You could of course use NBFM instead of AM: the advantages are many, and disadvantages few. I'm rather keen to try and see if we can encourage an NBFM movement for 160/80/40 since this could solve a lot of TVI problems, as well as provide a very cheap and strain-free local communication medium.

As far as continued availability of the data brief PCB and project packs is concerned they may not be available for a couple of months. These boards will be superseding the databrief PCBs in due course anyway, since I hope we can maintain a reasonably standard set of dimensions.

The planned range of building block options is fairly well established - although the order of appearance will be decided by circumstances, requests and (hopefully) readers' own submissions. I hope that you will bear this in mind when pursuing your project.

I have a SONY ICF 2001 radlo (illus-

trated in December 83 issue) and get excellent reception on BBC programs but AM is not so good and SSB does not produce any results. W A Wilson.

We have spoken to the author of 'Communication Building Blocks' (which mentions this receiver) and he was surprised to hear of your lack of success with SSB as he regards the ICF 2001 as a particularly good receiver. He mentioned that the best frequency oscillator (BFO) adjustment is rather sensitive and recommends that extreme care is exercised when setting this as it is easily possible to 'miss' the station when setting up. It would be interesting to know if other readers with the Sony have had similar experiences and we invite their views about it.

100W power amp

I am building a 100W power-amplifier similar to that described in your May and June 1983 issues. However, I wish to run a pre-amplifier off the ±15V secondaries and I would like to know how much current I can draw off them while the ±42V secondaries are delivering 7A (after rectification).

Could you also advise me on how the current may be increased without sustaining loss of voltage. (The pre-amp runs off several voltage lines:- ±15V, ±12V, ±9V, ±4.5V).

Alexander Bhinder, Herts.

The transformer specified for use in the 100W PA is rated at 250 VA, which means that if run within its ratings it can supply 3.0A total ie 1.5A from each of the 42V windings. When run at 100W o/p the amplifier draws approximately 1.1A from each of the windings, leaving several hundred milliamps spare capacity which should be enough for most preamplifiers.

Can you help me with problems that I am having with the acoustic modem (featured in the Feb 83 issue of Radio & Electronics World)? The band pass filter sections around IC1b and IC1c burst into self oscillation and cause the problems. Do you know of any cure for this?

M J Pearce, Cannock.

We have come across this problem before, due to a wrong value of resistor supplied in the kit. R4 should be 270R, but

QUESTIONS & ANSWERS

27R was supplied. If this is not the problem, it is suggested that you check all values of resistors around the filter.

Would you please advise if, as a general rule, the receiver sections in transceivers are of higher quality than those in a 'straight' receiver?

G Young, Sydney, Australia.

As a general rule the receiver sections in transceivers are of no better quality than separate receivers. On the contrary, separate receivers should perform better because no compromises are necessary as in transceivers where often one or more sections of circuitry are shared between the transmitter and receiver sections.

'Poor man's spectrum analyser'

We have received a number of letters on this article which was reprinted from 73 Magazine, August 1982. We have no other information apart from that printed in the original article. The most commonly asked questions are:-

The value of the V.C.O. emitter resistor in Figure 5 Nov R & EW?

In the original this is shown as a small stripline inductor! No dimensions are given, we suspect it just represents inductance of connections so return emitter lead to earth.

What are the components referred to as FT37-43, L43-12 and T37-6?

The FT37-43 is a toroidal core, the L43-12 is an RF transformer, both of these are

manufactured by Amidon. The T37-6 is a toroidal core manufactured by Micrometals and available from Ambit International.

In Figure 8 the transistors are 2N 2709 yet in the text they are referred to as 2N 2907?

They are 2N 2907.

In the L-PAO SAMPLER (Figure 3) what is 'FUSE 1/2in'?

This is described in original as 1/2 to 3/4in length of hair thin wire.

The pin numbers are missing from one 1/4of the op-amp in Figure 8, what are they?

Pin 5 is non inverting i/p. Pin 6 is inverting i/p. Pin 7 o/p.

Where can I get the TL 084C o/p amp?

This is a BiFet op-amp made by Texas and should be available from some of the advertisers in this magazine.

What are the dimensions of the Bandpass filter in Figure 6?

The notes were accidentally left off this diagram which is reproduced below.

Doppler DF System

I am a final year degree student studying electrical and electronic engineering. As part of the course I have to do a project. I chose to base my project on the feature in June and July 1982 R & EW magazines, called 'A Doppler DF System'. Unfortunately in

the feature there is no information on the programs for the two 74S287 PROM's which are used in the Control Voltage Waveform Generator.A.J. McKinnon (G4IQI), Stourbridge.

The complete set of parts is available from Doppler D.F. Systems, 5540 E. Charter Oak, Scottsdale, AZ 85254, USA. Tel: 602-998-1151

Printed circuit boards

I would be most interested to know if you, or an outside manufacturer, produce ready-made printed circuit boards for the projects that appear in R & EW.

I have searched through several copies and can find no reference to this. Edward Peak, West Kirby.

From now on you will see that PCB's for most projects are available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM8 3UL - Ed.

720 Channel air-band receiver (Sept 82)

Are there any modifications or different setting-up procedures for the TOKO KV1310 VHF tuning diodes that are used to increase the range, as suggested in Oct R & EW 1982?

Has there been a follow up article - if so when? A Simon, Edinburgh.

The lower end of the tuning voltage remains substantially as before but the 135MHz point will drop in voltage. This will cause some change of ratio between voltage and hum/noise level on the varicap line, thus it will be necessary to experiment with the levels. A follow-up has not been published.

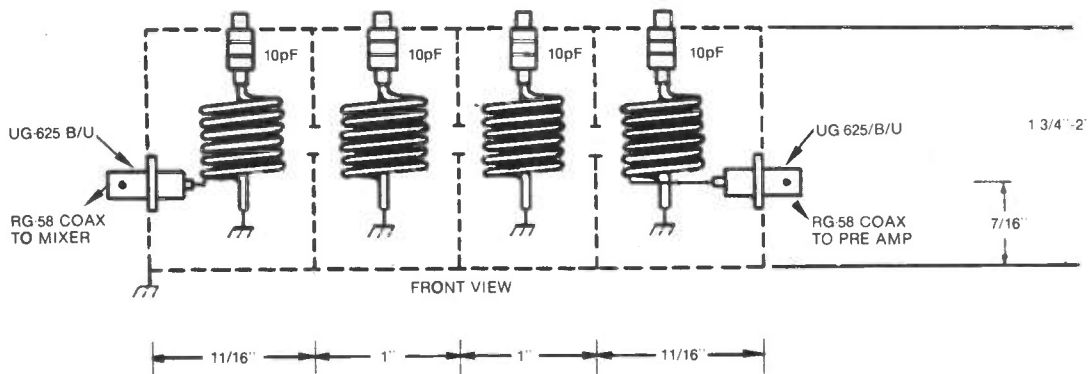


Fig 6 Bandpass filter

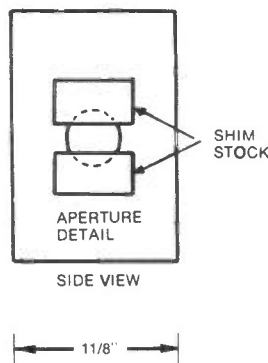
Note 1 Coils are 6 turns of #12, 1/2in inside diameter, 3/8in long, taps at 1/4 turn

Note 2 10p-F piston trimmer, Sprague-Goodman GGP8R500 or equivalent; alternate, air-variable, Johnson 189-564-1

Note 3 Filter box 1-1/8in deep made from single/double-sided G-10 circuit board plus copper shim stock

Note 4 Mount BNC connectors near front side

Note 5 Coupling apertures are 3/8in x 3/8in. Drill 3/8in diameter holes in compartment wall pieces and then solder copper shim strips across tops and bottoms to narrow apertures



IMPORTANT NOTICE

We are pleased to receive letters from readers either airing views or seeking technical information but regret that we are unable to enter into individual correspondence.

A selection of letters (and answers) will be published in Letters to the Editor and Questions & Answers each month.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee, G2UK

Satellite news and events scheduled for the immediate future, then down to earth discussion of the radio amateur examination and its validity

Satellites

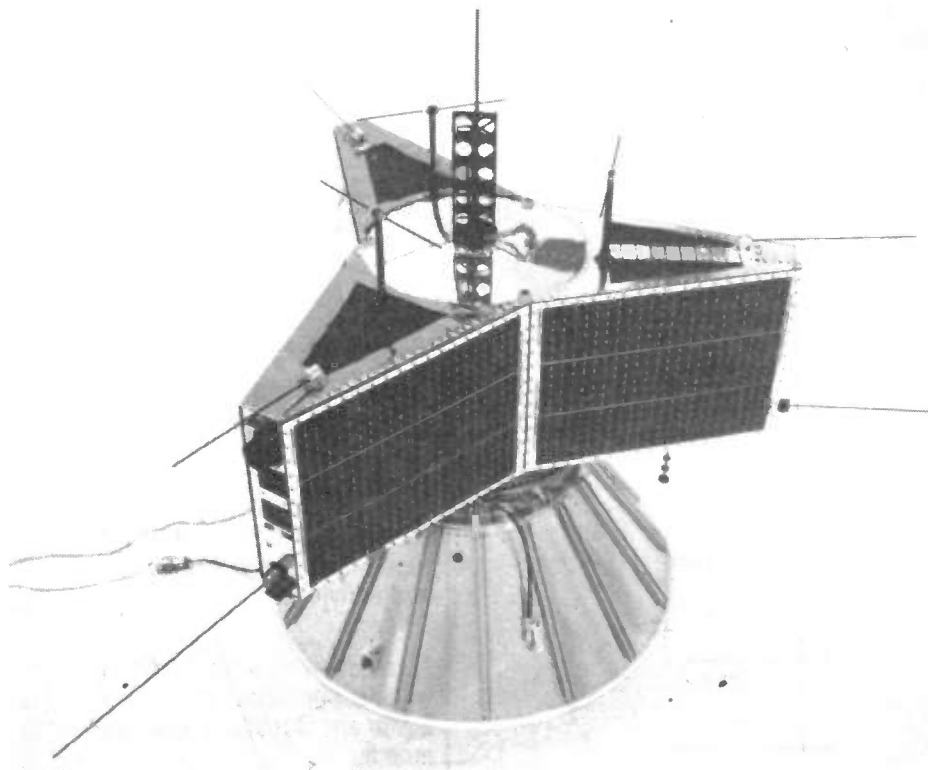
Satellites continue to provide the leading interest in the amateur radio world. Oscar-10 is functioning well, and in spite of its 'wow' modulated signal which makes SSB signals in particular very difficult to read at times, is receiving more and more attention from satellite enthusiasts. Even if you are well up in VHF techniques, there is much new to

learn in relation to Oscar-10 communication. Its orbit is elliptical and therefore presents some new concepts in comparison with the circular orbits of earlier satellites, notably its Mean Anomalies, its Argument of Perigee and other terms more familiar in astronomical spheres than radio circles. The computer buffs are having a ball devising complex software programmes for its orbital

predictions and there seems no end to the new scientific disciplines which it is bringing into the satellite mode of amateur radio. If you want something really new to get into, Oscar-10 should provide all the mental stimulus you may be seeking! Our photo gives a very good impression of its aerials and it is not surprising that one got damaged at its separation from its launch vehicle, which has been responsible for the satellites characteristic 'wow'. At least its characteristic signals help to distinguish one's own 'up/down' signal from the multiplicity of stray signals one seems to find in the 2 metre satellite band!

Satellite news

The most exciting satellite news is that another UOSAT satellite is being built by Martin Sweeting and his team at the University of Surrey. This has now been given official approval and acceptance and its construction is already progressing well. The launch date is scheduled for March next, a tight programme indeed! It will be a similar project to UOSAT 1, but with improvements. The camera is to be improved and the digitalker will speak English – not American! Frequencies will be as UOSAT 1. The orbit will also be similar but should give signals over England in the mornings and afternoons – not midday as UOSAT 1. It should be noted that UOSAT's are designated 'A', 'B', 'C', etc, whilst on the ground and become UOSAT 1, 2, 3, etc, when launched. There is news too, of another satellite in the offing. The Japanese are planning one for launch in 1985-6. It is planned to have an orbit similar to the R.S. series



The Oscar-10 satellite

satellites, with similar transponders plus a 1269 MHz up, 436 MHz down, transponder. More on this as further information becomes available.

The Shuttle

Taking advantage of a nearby suitable location, your scribe went out to see if the shuttle was visible in the NW evening sky as predicted on 28th November last. Of course, a cloud bank obscured the sky at 1620 UTC. Believe it or not, the cloud parted at the crucial moment and a good view of it was obtained. Amateur radio transmissions from it were not due until five days into the mission and it's going to be very interesting to see how these work out and who the lucky ones who obtain contacts with it will be.

'Whatever next?'

I could hardly believe my ears the other Sunday morning, when, trying to tune in the BARTG RTTY News Bulletin - 1st and 3rd Sundays at 1200 UTC, around 3590 KHz - several kc/s down the band, well into the CW part of 80 metres, three over-modulated phone stations were having a natter using AM - yes, *amplitude modulation*! Well it's true that there seems to be a cult for 'things old' at the moment, but one did not expect to see it splashing over into amateur radio! 'And why not AM, you may ask?' Well, the whole object in present day amateur radio techniques is to keep QRM down and, whatever you may think about 'your rights', using AM in a crowded band like 80 metres on a

Sunday morning is a bit 'anti-social'! True, AM is getting quite popular on 'Top Band', but up there it is on a band which is virtually unoccupied and anything which gets it used by radio amateurs is to be welcomed.

Radio amateur's examination

An awful lot is being said and written in the various amateur radio magazines at the moment about the RAE and the Radio Amateur's Examination is the 'hot topic' for discussion at the moment. As was pointed out in the RSGB's *Radio Communication* editorial for November last, 'The existence of the RAE depends directly on the International Radio Regulations which govern the operation of all radio communications, both professional and amateur, throughout the world. For those unfamiliar with it, the specific regulation states: 'National Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an amateur station'.

There is much debate as to whether the present RAE does in fact ensure that the above quoted regulation is being covered. To quote from this editorial again, 'Equally important is the question of whether or not it covers the right ground. Many make the point that yesterday's amateurs often served a long apprenticeship as SWLs, frequently under the tutorship of experienced amateurs and as club members, thus they

did not need to be tested on practicalities. Many of today's amateurs, while being proficient technically, are often unfamiliar with general operating procedures which the more experienced take for granted, but which are part of neither the syllabus nor the examination.' How true! If we are going to have high powered AM transmitters back on to all the HF bands, chaos is going to rule!

Amateur licences

The Department of Trade and Industry states that at the end of June 1983, there were 23,204 Class A amateur radio licences, 22,904 Class B licences and 1,694 reciprocal licences issued to overseas amateurs whilst visiting this country or resident therein. The G5 plus three letter call signs are being phased out at the end of 1983. Reciprocal call signs will be of the G4/callsign of the overseas licensee type. Three types of reciprocal licence will be issued, ie, mobile for 2 metres, temporary for up to one year and permanent licences for long term overseas residents in the UK.

From September last, amateur radio licencing was transferred from the Radio Regulatory Division of the Department of Trade & Industry, back to the Post Office. It is anticipated that computerisation of the records will result in much speedier processing of these records than before. The address of the Department concerned is now: Radio Amateur Licensing Unit, Chetwynd House, Chesterfield, Derbyshire S49 1PF.

B.N.O.S. ELECTRONICS

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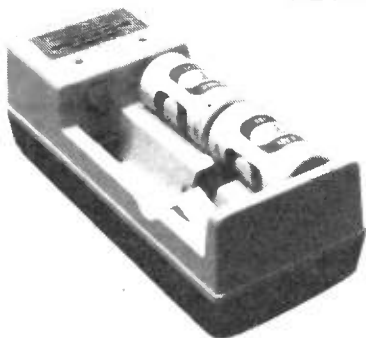
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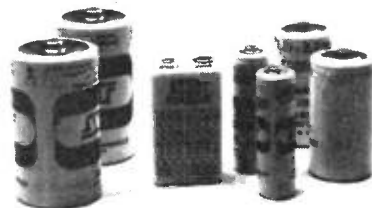
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AAA*	0.10	18.0	14.3	1.58	1.50	1.44
AA*	0.24	28.1	14.3	1.45	1.37	1.32
AA	0.50	50.2	14.3	0.90	0.85	0.82
AA*	0.50	50.2	14.3	0.96	0.91	0.88
AA*	0.45	28.1	17.3	1.53	1.45	1.38
RR*	1.20	42.1	22.6	1.70	1.61	1.52
C	2.20	49.7	25.9	2.40	2.30	2.20
D (sub)	1.20	60.5	32.9	2.40	2.30	2.20
D	4.00	60.5	32.9	3.50	3.32	3.15
D*	4.00	60.5	32.9	3.59	3.41	3.24
F*	7.00	91.3	32.9	6.85	6.50	6.20
SE*	10.00	91.3	41.7	10.50	9.50	8.90
PP3	0.11	49 x 26.5 x 17.5		4.35	4.10	3.85

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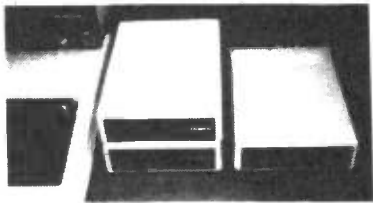
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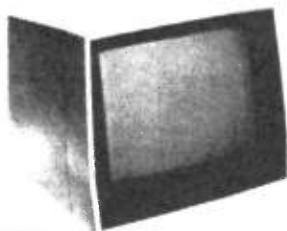
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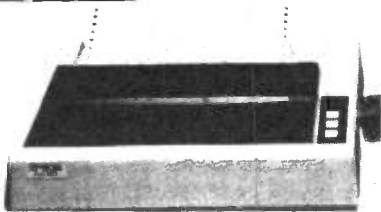
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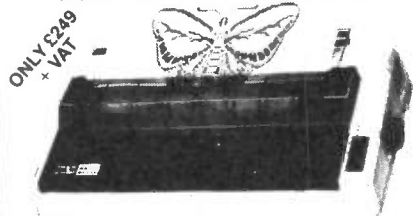
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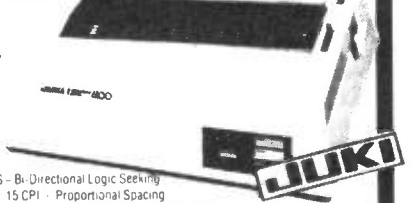
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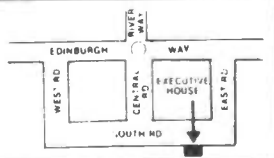
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SWITCHED MODE POWER SUPPLIES

This PSU is small, efficient and has low operating temperature

The switched mode power supply (SMPSU) presents a viable alternative to the older linear power units that have been in vogue for many years. Although offering many advantages such as ease of design and construction, the linear power supply is a bulky and heavy, inefficient unit with problems in heat dissipation, etc. The SMPSU, conversely, is a little more difficult to design but is small, extremely efficient and presents few problems of heat dissipation.

Because the circuits tend to be complex, the semiconductor manufacturers have provided a range of integrated circuits that very much simplify the design of the SMPSU. Typical are the NE5560, and the SG1526 which are popular with the professional designer, offering advantages such as temperature compensation, remote operation and soft start (slow rise to full voltage) as optional facilities. These options are in addition to the standard facilities which include over-voltage protection and current limiting.

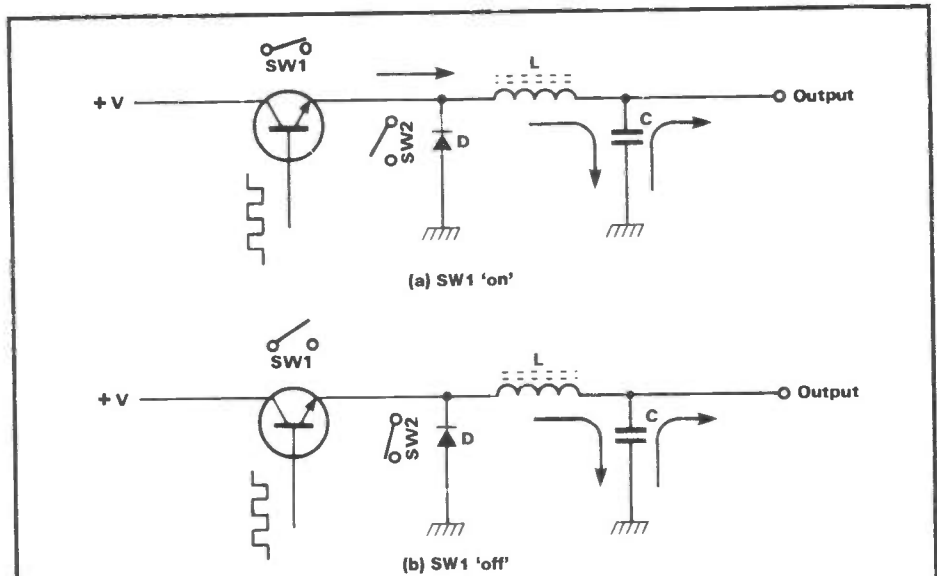
How they work

A very basic circuit is illustrated in Figure 1. If we operate the transistor switch (SW1) at a very fast rate we will obtain a square wave output at a frequency equal to the switched rate. The peak-to-peak output is equal to the input voltage, but the average voltage is equal to the peak voltage multiplied by the ratio of the 'on' time to the 'off' time. This figure can be realised by passing the switched voltage through a switched LC filter (as shown). This type of circuit is known as a 'buck regulator'.

The operation of the filter is relatively simple and acts as follows:-

Switch (SW1) 'on' - the capacitor is charged via the inductor. Since the rate of charge is high, the inductor will exhibit a high impedance thus limiting the rate. Simultaneously, the inductor will form a magnetic field. The values of the capacitor and inductor are chosen such that the full input voltage of the switch will not be realised during this period of operation, i.e. the time constant exceeds the time period for a full cycle of the switched input.

Switch (SW1) 'off' - the capacitor now has a positive charge which can be supplied to the load. The current through the inductor becomes zero which causes the magnetic field to collapse. This



NOTE: Arrows indicate direction of conventional current flow
Fig 1 Simplified operation of Buck Regulator

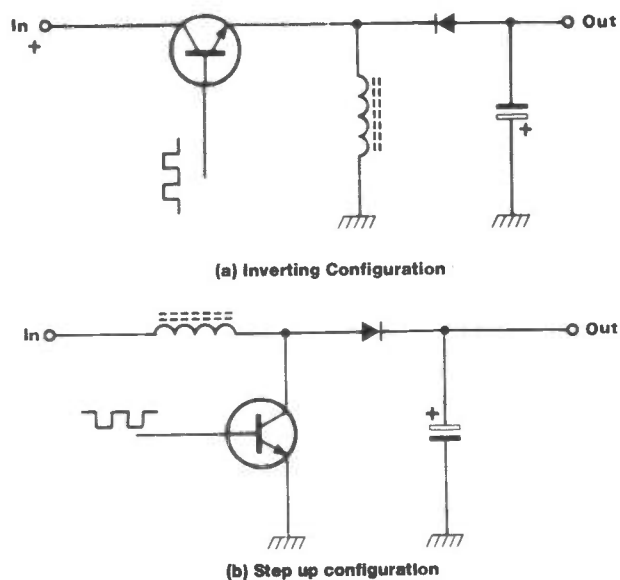


Fig 2 Configurations

results in an emf being generated which has a polarity opposite to that experienced during the 'on' period. This emf will result in the diode switch (SW2) being turned 'on' and so placing the inductor in parallel with the capacitor and adding its back emf to the charge

held in the capacitor.

By rearranging the circuit it is possible to alter the operation of the regulator to achieve an output voltage that is (a) the opposite of the input voltage or (b) that is greater than the input voltage. These circuits are shown in Figure 2.

SWITCHED MODE POWER SUPPLIES

Practical designs – which IC?

As was previously mentioned, the NE5560 is already popular and so is readily available. However, before we can start on the actual design it is necessary to understand how the NE5560 works (block diagram shown in Figure 3).

The NE5560

PINS 1,2 and 12 – these are connected to the stabilised power supply which, at voltages below 18V, is operated as a normal series stabiliser to give an output of approximately 8.5V (V_z), available at pin 2 (max 5mA current). When input voltages exceed 18 volts, pin 1 is current fed via a resistor, and when this method is used on chip components, limit the voltage to approximately 23V at 10mA or 30V at 30mA. When operated at 12V the IC will consume approximately 10mA, provided the pin 2 is open circuit and the resistance between pins 7 and 12 exceeds 20kilohms (pin 12 is usually grounded).

PINS 7,8,9 and 16 – the sawtooth generator that is the heart of the circuit is accessed at these pins. A resistor between pins 7 and 12 determines the constant current that charges a capacitor connected between pins 8 and 12. This results in a voltage which starts at 1.1V, linearly increases to 5.6V and then resets, the time for this operation being determined by the values of the resistor and capacitor. Figure 4 shows a plot of oscillator frequency versus the timing components. If necessary, the NE5560 can be synchronised with an external oscillator by making the free-running frequency higher than the input and injecting synchronising pulses into pin 9.

Pin 16 is the feed-forward input, and adjusts the charging current of the capacitor to allow for variations of the input voltage. The voltage on this pin is normally set midway between V_z and the input voltage V_{cc} .

PINS 3 and 4 – these pins access the error amplifier, which has an open loop gain of 60dB, and is connected to the output of the SMPSU (usually via a potential divider). The gain of this amplifier will set the output regulation. For most practical purposes a gain of 100 is usually adequate.

PIN 6 – normally connected to a potential divider between V_z and ground, it determines the maximum duty cycle of the pulse-width modulator (PWM). Figure 5 demonstrates the relation between the resistance ratios and the maximum duty cycle (which determines maximum output voltage). A capacitor between pin 6 and ground defines the 'soft start' characteristics, such that the higher the capacitance the slower the rise of output voltage from zero to operating voltage.

PIN 5 – this provides a facility for an external pulse-width modulator facility. Normally, when the power supply is an independent unit, it is not connected unless a constant current supply is required.

PIN 11 – this pin provides the

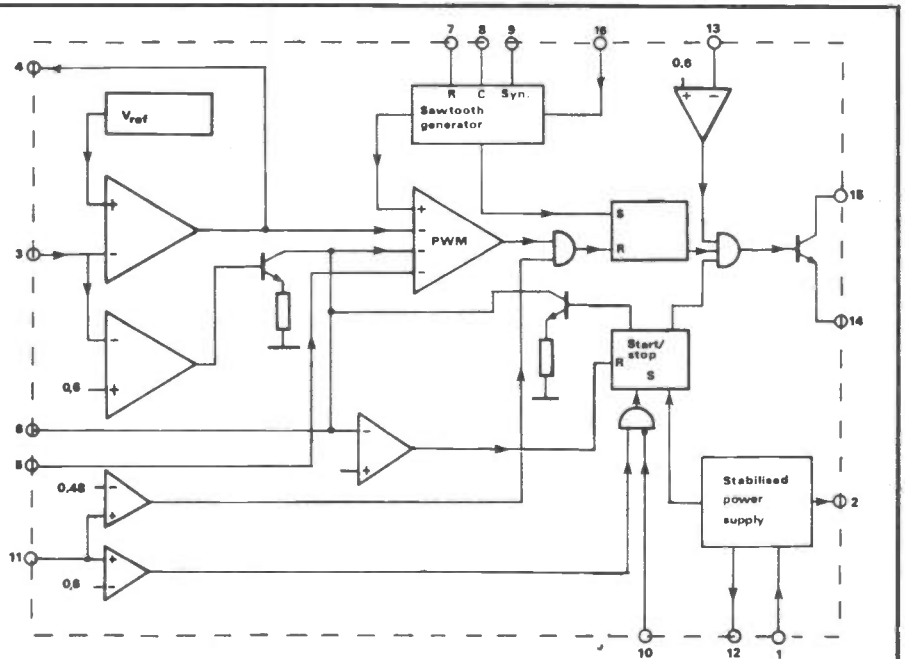


Fig 3 Block diagram of NE5560

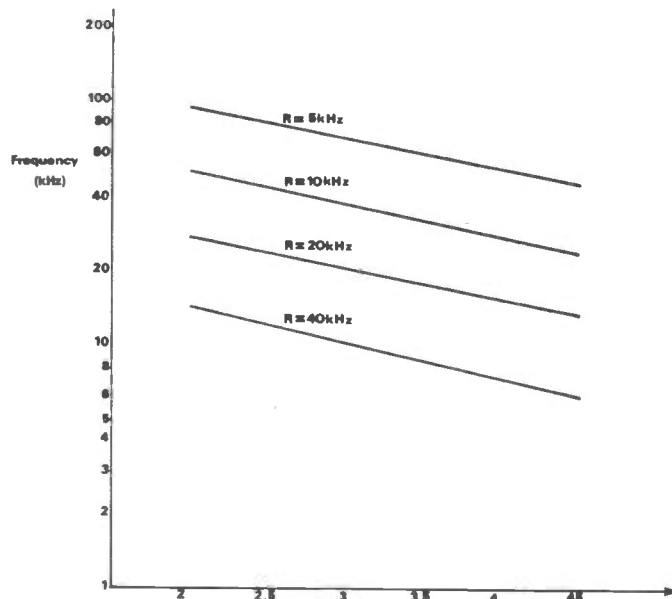


Fig 4 Effects of timing components on frequency

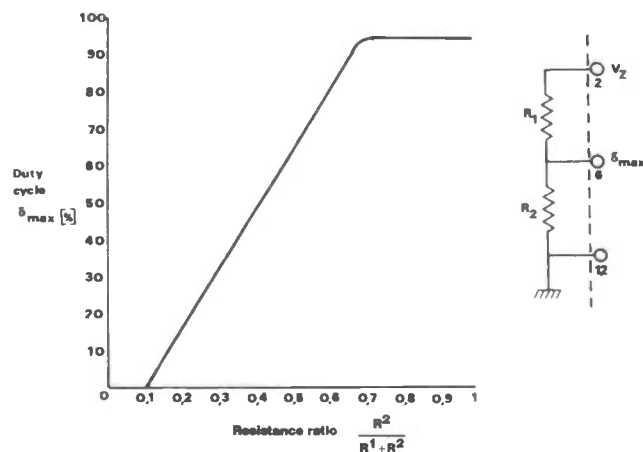


Fig 5 Relationship between resistance ratios and maximum duty cycle

SWITCHED MODE POWER SUPPLIES

overcurrent protection and if the input voltage exceeds 0.48V, the PWM reduces the duty cycle and the output voltage drops. When minimum duty cycle is reached the PWM output is inhibited if the fault persists or if the input voltage exceeds 0.6V. After a certain 'dead time' the circuit will try to restart but will again inhibit if the faults persist. This procedure is termed the 'hiccup' mode.

PIN 10 – this is a remote on/off facility that is seldom used in normal practice. The input is TTL compatible and, when left floating or connected to a voltage exceeding 2V, allows the IC to function normally. When reduced below 0.8V it inhibits the output of the PSU.

PINS 14 and 15 – these are the emitter and collector of the output transistor and are capable of sourcing or sinking a maximum of 40mA with a saturation voltage lower than 0.5V. Although not shown in the drawing a clamping diode from the collector to the input voltage protects against over-voltage.

PIN 13 – used in circuits with transformers in the output circuit. It inhibits the output transistor when the input level exceeds 0.6V. The facility is usually driven from a winding on the output transformer (when used) and prevents the core from being saturated. If not used this pin should be grounded.

The final design

With the information given it is now possible to generate most of the design for a basic power supply. As an example we will consider the parameters for a 5 volt 1 ampere unit as shown in *Figure 6*.

Resistors R1 and R2 determine the maximum duty cycle and thus the overvoltage limit before the shutdown occurs (PSU turns off). Since we are considering a 5V unit a minimum shutdown voltage of 6V will be used. The second factor which determines the duty cycle is the minimum input voltage. Reference to the manufacturers data shows that this is 11 volts for the NE5560 and the maximum duty cycle will, therefore, be 54.5% (Output voltage maximum – input voltage minimum). Reference to *Figure 5* will now give us a resistance ratio of 0.42:1 and if we let R1=10k this will give us a value for R2 of 7.24k. Unfortunately the nearest standard value of 6.8k will cause shutdown at 4.5V so it is necessary to use 8.2k. Alternatively a preset potentiometer could be used to set the overvoltage limit and if the PSU is to be used for operating TTL circuits it would in fact be recommended since these IC's have a maximum rating of 7V.

The soft start facility is provided by C2 and can be varied according to the users requirements. Omission is not recommended since voltage overshoot can occur, possibly resulting in damage to the unit being supplied. In practice a value of 47µF was found to be adequate for most applications. The error amplifier gain is controlled by R3 in conjunction with VR1 and R9. Since, as has been previously stated, a gain of 100 is

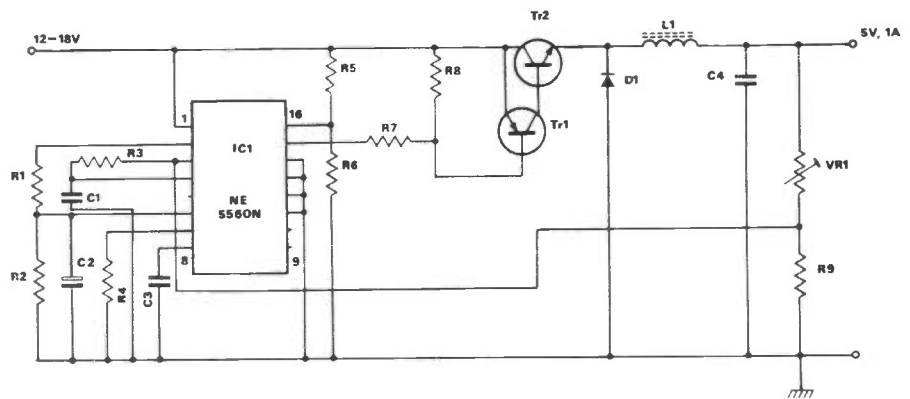


Fig 6 5V 1A SMPSU

PARTS LIST

R1,R2	10K	R6	8K2	C1	2n7	TR1	TIP41A
R3	100K	R7	2K2	C2	47µ	TR2	2N3638A
R4	22K	R8	220R	C3	2n7	D1	BYW29
R5	1K5	R9	3K9	C4	470µ	L1	900µH
		VR1	4K7			IC1	NE5560N

adequate the value of 100k was used for R3. C1 is used to limit the bandwidth of the error amplifier and so remove any possibility of high frequency instability.

Operating frequency

The operating frequency is determined by R4 and C3, whose values are determined from *Figure 4*. By convention, a frequency of 25kHz was used, which results in values of 22 kilohms and 2200 pF respectively. Higher operating frequencies can be used with the resulting increase in efficiency and reduced values (and sizes) of the output LC filter. However, this would also result in increased price for the switching transistor and an increase in radio frequency radiation.

Inductor and capacitor values

We now reach the most important part of the design and also the so far unspecified section, namely the values of inductor and capacitor in the output LC filter. The methods used for specifying the values of these components vary and in order to avoid complex formulae, the following equations were formulated:-

$$L = \frac{V_o - \frac{V_o^2}{V_{min}}}{2f \cdot I_{min}} \approx 900 \mu\text{H} \quad \text{and} \quad C = \frac{I_{min} \left(1 - \frac{V_o}{V_{max}}\right)}{4V_r \cdot f \left(\frac{1 - V_o}{V_{min}}\right)} \approx 470 \mu\text{F}$$

Where V_o = Output voltage (5V)
 V_{min} = Minimum input voltage (11V)
 V_{max} = Maximum input voltage (18V)
 V_r = Output ripple voltage
 f = Switching frequency (25 kHz)
 I_{min} = Minimum output current (100mA)
 I = Maximum output current (1A)

No originality is claimed for these since it is possible for any competent engineer to derive them from available information. Although the values obtained are not optimum, they are close enough to satisfy most requirements.

Once the values are known it is then necessary to specify the components in detail, this especially applies to the inductor since it acts as an energy storage device and if a random inductor is used it will probably result in the demise of the PSU. Fortunately Micrometals Inc. make the specification of this component very much easier than it might otherwise have been.

It is first necessary to determine the amount of energy storage that is required. This is derived for the simple equation $Q = 0.5LI^2$ where L is the inductance value (in Henries) and I is the maximum current rating of the power supply (in amperes). Reference is then made to graphical data on the available cores (see *Figure 7*) and a suitable core is chosen. Once we have our core, further reference to the data is made and the value of AL is extracted (for the T106-26 core this is 900) and is inserted, along

SWITCHED MODE POWER SUPPLIES

$$N = \frac{L \times 10^6}{A_L [100 - \text{Sat}]}$$

Where N is number of turns
L is inductance in microhenries
 A_L is a constant for core in use
Sat is percentage saturation
(extracted from Figure 7)

with the inductance value, into the equation for N above.

Now wind the inductor using wire of sufficiently large gauge to carry the current but small enough to enable the turns to fit onto the toroid. Purists may add additional requirements but it is felt that the above is sufficient for most applications.

The capacitor used should be suitable for the type of application. It should have low self inductance and low ESR (equivalent series resistance) and, hence, a high self resonant frequency. Operation above this frequency results in the capacitor exhibiting inductive characteristics. In this particular design it is

possible to use a general purpose type of electrolytic, although the output ripple performance is degraded. However, if larger values of capacitance or a higher frequency is used, it is strongly recommended that a purpose built capacitor is used.

In the design example we have been using, the inductor and capacitor settled on were as follows:-

L = 900 μ H and is composed of 100 turns of 22 SWG enamelled wire wound on Micrometals toroid, type T106-26
C = 470 μ F 25V

Conclusion

The information given concerns a design based on pure theory, but in practice not many components are perfect so minor modification to the circuit was required. Only one component, R2, was affected and it was found necessary to increase this value from the 8.2k calculated to 10Kilohm.

Performance of the supply was not quite equal to the design, this being affected by variables such as the ESR of

the capacitor and the DC resistance of the inductor. The output ripple was 50mV P-P (equal to 17.5mV rms) and not 10mV as was anticipated in the design limitations. Other than this, the circuit worked admirably. The following limitation must be borne in mind by readers who wish to design their own power units: with the type of core specified the output voltage must not exceed half the input voltage or the core will saturate. If you wish to do this, there are saturable cores available but the design work is a little more complex than that previously described.

Users of this type of supply should ensure that there is adequate filtering at the input and output of the unit. In most applications, 0.1 μ F capacitors are adequate but in certain situations, e.g. when RF equipments are present, a more thorough procedure may be required. However having said this, it is pointed out that this type of PSU is ideal for transmitter power amplifiers. When used as such, transmit keying can be accomplished by using the remote on/off facility on pin 10 of the NE5560.

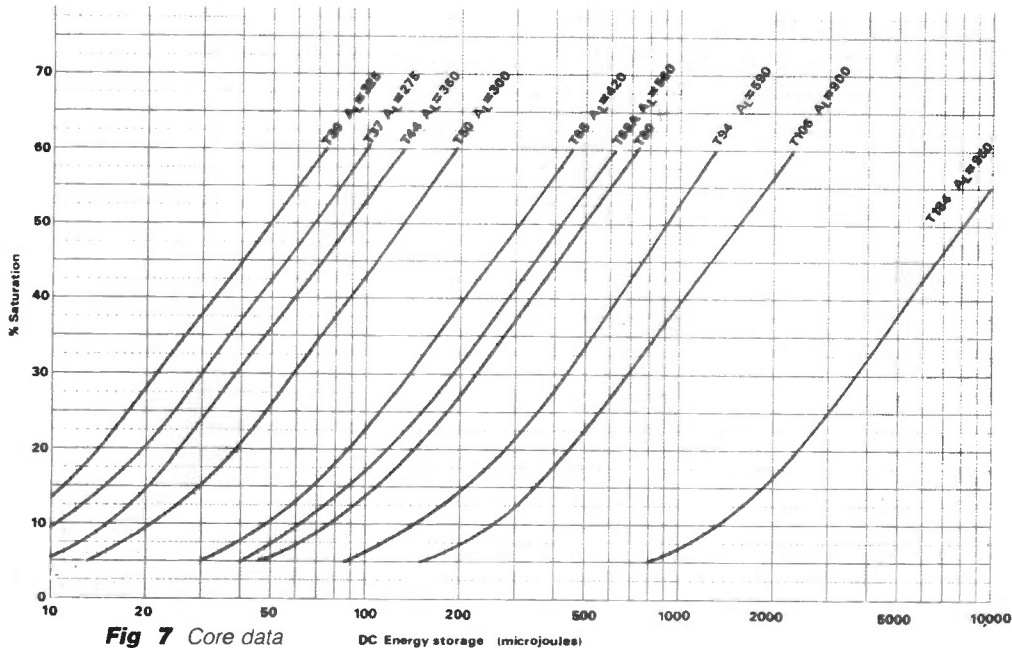


Fig 7 Core data

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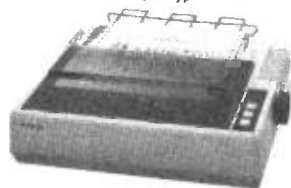
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One Night's Work

'Crowbar' Protection circuit to ensure your equipment doesn't go 'bang' by Stephen Ibbs G4LBW

If you have an expensive item of equipment connected to a dc supply, the last thing wanted is a power supply fault which may possibly cause your precious equipment to go 'bang'. What is needed is a protection circuit that will sense any voltage rise and blow the fuse before damage occurs to the rig!

Specialised IC, MC3423

A specialised IC, labelled MC3423 has been developed for just such a purpose. It works by sensing the voltage of the power-supply continuously and as soon as it rises above a predetermined point, set by VR1 it trips, turning on the external thyristor. Once on, a thyristor latches and acts almost like a short-circuit across the supply terminals – hence the common name for this type of circuit a 'crowbar'. It's like putting a crowbar across the terminals. This will cause the fuse of the power supply (assuming one has been fitted – as it should!) to blow.

Noisy supply lines

It may be that the supply lines are 'noisy' and cause the device to trip unnecessarily. To counteract this, a capacitor can be inserted between pin 4 and earth. In this case pin 3, normally connected to pin 2, would *instead* be connected to pin 4. The value of the capacitor determines the delay before the thyristor is turned on, with 1000pf giving 10 μ S delay, and 1.0 μ F giving 10mS delay. In use, VR1 is simply adjusted so that if, for example, the equipment requires 13.8 μ F, the thyristor fires at 15V. (Note: the prototype had 0.47 μ F fitted between pins 3, 4 and earth).

Pcb designed

A pcb has been designed, and there should be no problems provided care is taken to mount the components the correct way round. Voltages above 36V should not be used and the choice of thyristor depends on the current it may have to carry. The one selected for the prototype will handle 2.5 amps, and turns on in 1-2 μ S, but this can be changed easily to cater for other requirements. Supply switch-on may cause a spurious spike which will cause the thyristor to be triggered so, if possible, the rise time should be slowed down. Preferably switch on, and turn the voltage up from 0V to the desired supply level.

PARTS LIST

R1	47 Ω
VR1	10k min horiz preset
CSR1	C106D thyristor
C1	see text
IC1	MC3423

Note: The MC3423 is stocked by R S Components and can be ordered via your local component shop. All other components, including the thyristor are widely available.

PCB for this project is available from Edwardschild Ltd, 453a Becon-tree Ave, Dagenham, Essex RM8 3UL at 99p each.

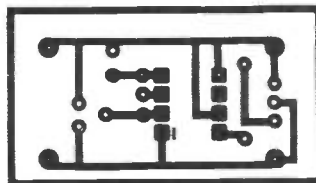


Fig 2 PCB foil pattern corresponding to Figure 1

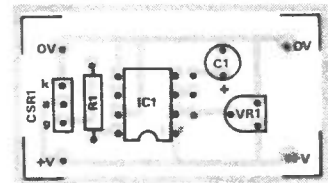


Fig 3 Component overlay

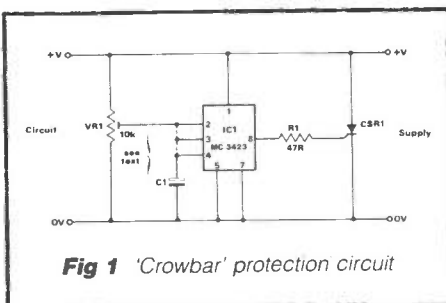
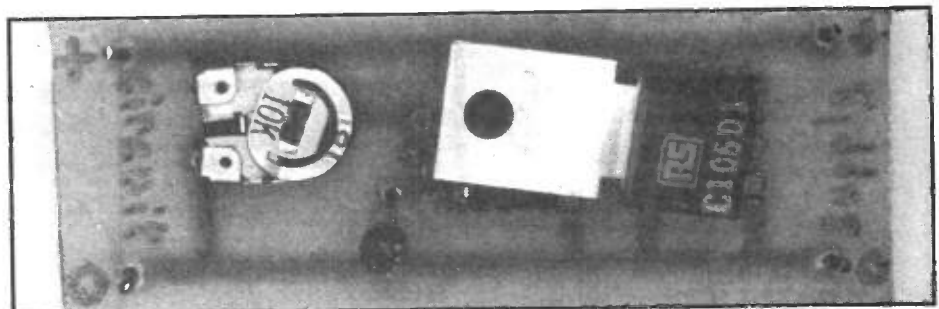
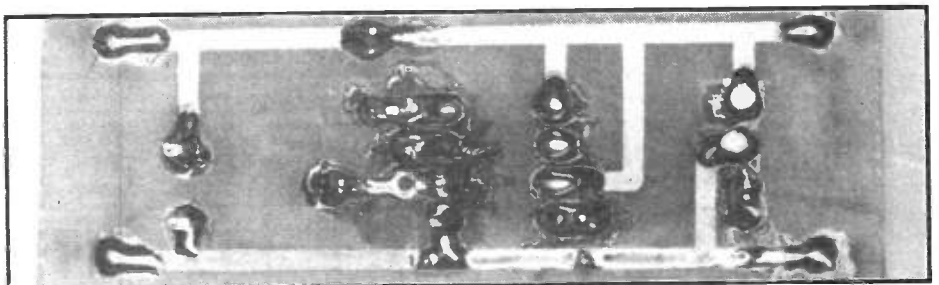


Fig 1 'Crowbar' protection circuit

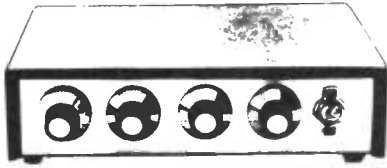


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ditto 12v resettable	£3.45
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Timer Omron STP NH 110v AC Coil	£6.90
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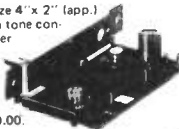
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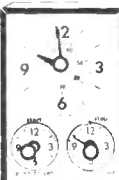
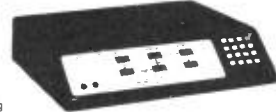
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DATA FILE

Ray Marston continues his survey of op-amp principles and applications by looking at various oscillators and switching circuits

In the last two editions of 'Data File' we've taken an in-depth look at the operating principles of conventional voltage-differencing operational amplifiers, and at various practical ways of using them to make linear amplifiers and active filters. This month, we look at ways of using op-amps to make various types of oscillators and switching circuits.

Sine-Wave Oscillators

An op-amp can be made to act as a sine-wave oscillator by connecting it as a linear amplifier in the basic configuration shown in Figure 1, in which the amplifier output is fed back to the input via a frequency-selective network and the overall gain of the amplifier is controlled via a level-sensing system. For optimum sine-wave generation, the feedback network must provide an overall phase shift of zero degrees and a gain of unity at the desired frequency. If the overall gain is less than unity the circuit will not oscillate, and if it is greater than unity the output waveform will be distorted.

One practical way of implementing the above principle is to connect a Wien Bridge network and an op-amp in the basic configuration shown in Figure 2. The frequency-sensitive Wien Bridge network is constructed from R1-C1 and R2-C2. Normally, the network is symmetrical, so that $C1=C2=C$, and $R1=R2=R$. The main feature of the Wien network is that the phase relationship of its output to input signals varies from -90° to $+90^\circ$, and is precisely 0° at a centre frequency (f_0) of $1/6.28CR$. At this centre frequency the symmetrical network has a voltage gain of 0.33.

Thus, in the Figure 2 circuit, the Wien network is connected between the output and the non-inverting input of the op-amp, so that the circuit gives zero overall phase shift at f_0 , and the actual amplifier is given a voltage gain of x3 via feedback network R3-R4, to give the total system an overall gain of unity. The circuit thus provides the basic requirements for sine-wave oscillation. In practice, however, the ratios of R3-R4 must be very carefully adjusted to give the overall voltage gain of precisely unity that is necessary for low-distortion sine-wave generation.

The above circuit can easily be modified to give automatic gain adjustment and amplitude stability by replacing the passive R3-R4 gain-determining network with an active gain-control network that is sensitive to the amplitude

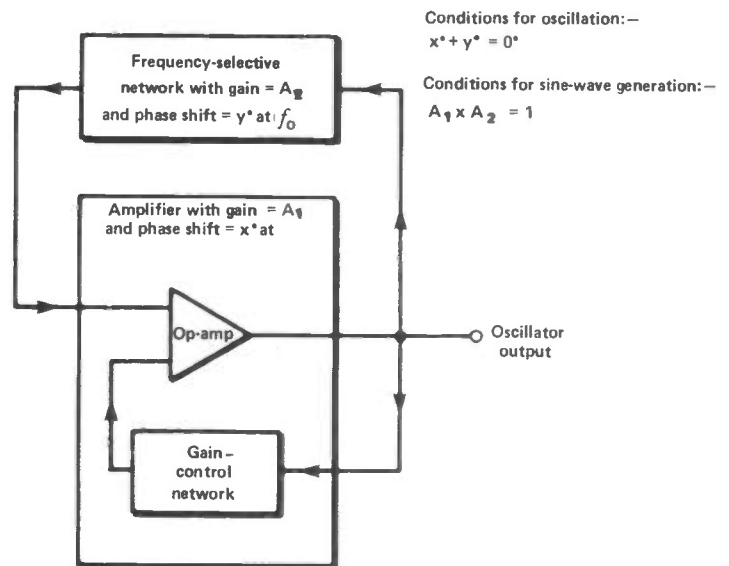


Fig 1 Conditions for stable sine-wave oscillation

NOTES:- $C1=C2=C$ $R1=R2=R$ $f_0 = \frac{1}{2\pi CR}$

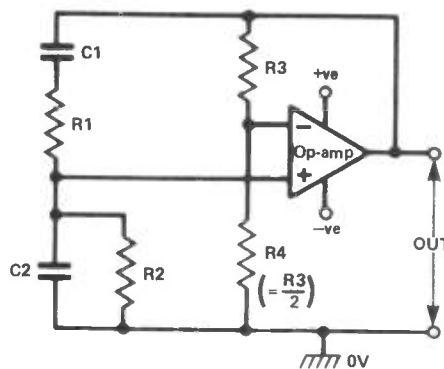


Fig 2 Basic Wien-Bridge sine-wave oscillator

of the output signal, so that gain decreases as the mean output amplitude increases, and vice versa. Figures 3 to 7 show some practical versions of Wien Bridge oscillators with automatic amplitude stabilisation.

Thermistor-Stabilised Circuits

In the 1kHz fixed-frequency oscillator circuit of Figure 3 the output amplitude is stabilised by an RA53 (or similar) negative-temperature-coefficient thermistor. TH1 and RV1 form a gain-determining feedback network. The thermistor is heated by the mean power output of the

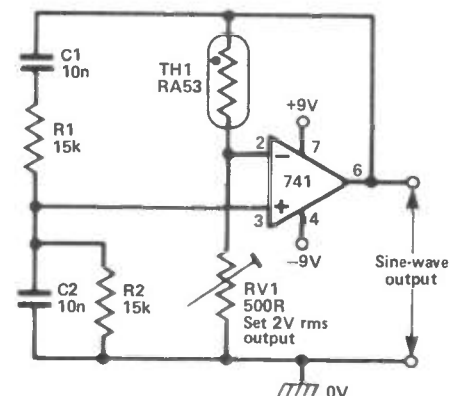
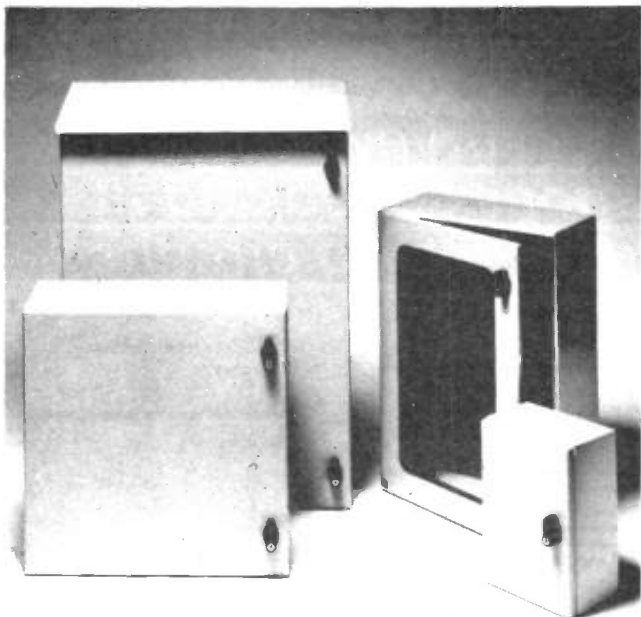


Fig 3 Thermistor stabilised 1kHz Wien Bridge oscillator

op-amp, and at the desired output signal level has a resistance value double that of RV1, thus giving the op-amp a gain of x3 and the overall circuit a gain of unity. If the oscillator output amplitude starts to rise, TH1 heats up and reduces its resistance, thereby automatically reducing the gain of the circuit and stabilising the amplitude of the output signal.

An alternative method of thermistor stabilisation is shown in Figure 4. In this case a low-current lamp is used as a positive-temperature-coefficient thermistor, and is placed in the lower part of the gain-determining feedback network.



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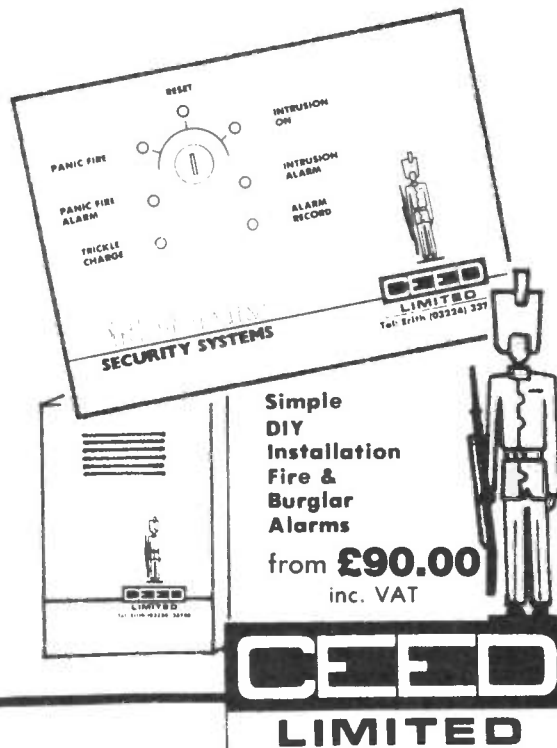
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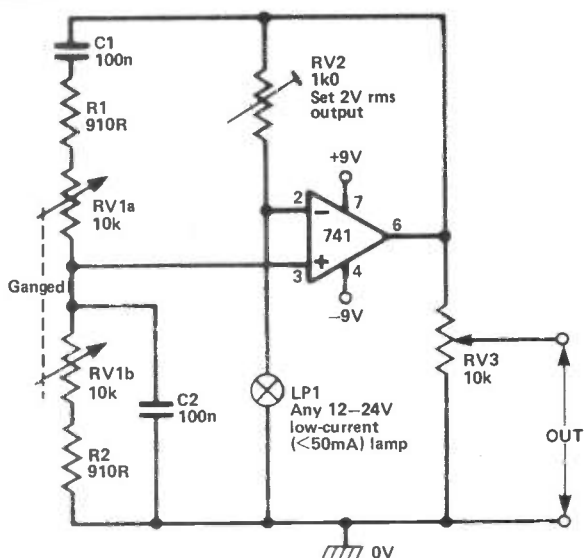


Fig 4 150 Hz – 1.5kHz lamp-stabilised Wien-Bridge oscillator

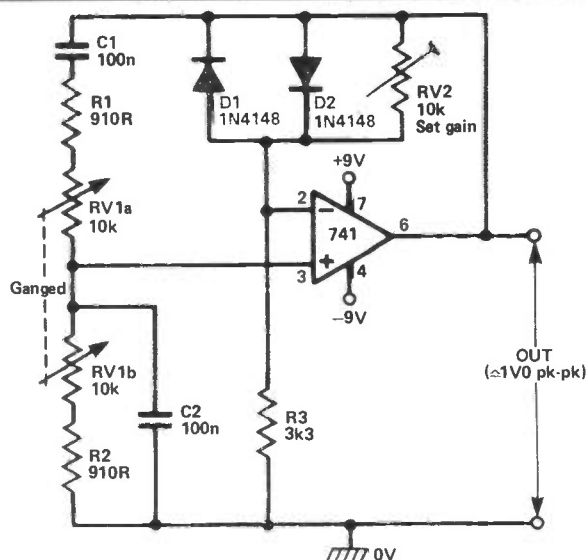


Fig 5 Diode-regulated 150Hz – 1.5kHz Wien Bridge oscillator

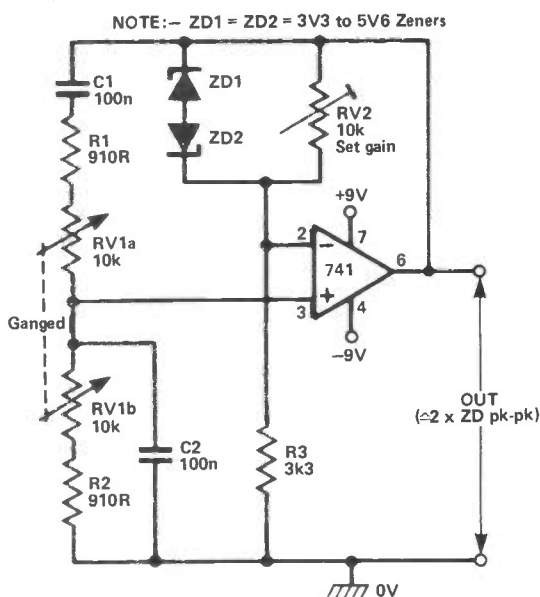


Fig 6 Zener-regulated 150Hz – 1.5kHz Wien Bridge oscillator

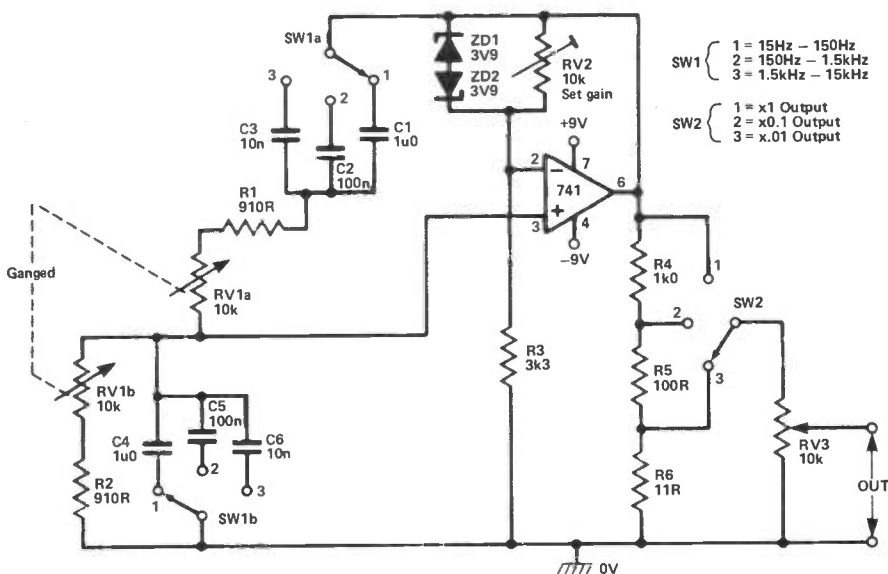


Fig 7 Three-decade (15Hz – 15kHz) Wien Bridge oscillator

Thus, if the output amplitude increases, the lamp heats up and increases its resistance, thereby reducing the circuit gain and providing automatic amplitude stabilisation. This circuit also shows how the Wien network can be modified by using a twin-gang pot to make the oscillator frequency variable over the range 150Hz to 1.5kHz, and how the sine-wave output amplitude can be made variable via RV3.

In the *Figure 3 and 4* circuits, the preset pot should be adjusted to set the maximum mean output level to about 2V rms, and under this condition the sine-wave has a total harmonic distortion of about 0.1%. Note that a slightly annoying feature of thermistor-stabilised circuits is that, in variable-frequency applications, the output amplitude of the sine-wave tends to judder or 'bounce' as the frequency control pot is swept up and down its range.

Diode-Stabilised Circuits

The amplitude 'bounce' problem of variable-frequency circuits can be mini-

mised by using the basic circuits of *Figures 5 or 6*, which rely on the onset of diode or zener conduction for automatic gain control. In essence, RV2 is set so that the circuit gain is slightly greater than unity when the output is close to zero, causing the circuit to oscillate, but as each half-cycle nears the desired peak value one or other of the diodes starts to conduct and thus reduces the circuit gain, automatically stabilising the peak amplitude of the output signal. This 'limiting' technique typically results in the generation of 1% to 2% distortion on the sine-wave output. The maximum pk-to-pk output of each circuit is roughly double the breakdown voltage of its diode regulator element.

In the *Figure 5* circuit, the diodes start to conduct at 500 mV, so the circuit gives a pk-to-pk output of about 1V0. In the *Figure 6* circuit, zener diodes ZD1 and ZD2 are connected back-to-back, and may have values as high as 5V6, giving a pk-to-pk output of about 12V. Each circuit is set up by adjusting RV2 to the maximum value (minimum distortion) at

which oscillation is maintained across the whole frequency band.

The frequency range of all the above circuits can be altered by changing the C1 and C2 values; increasing the values by a decade reduces the frequency values by a decade. *Figure 7* shows the circuit of a variable-frequency Wien oscillator that covers the range 15Hz to 15kHz in three switched decade ranges. The circuit uses zener diode amplitude regulation, and its output is adjustable by both switched and fully-variable attenuators. Note that the maximum useful operating frequency of this type of circuit is restricted by the slew-rate limitations of the op-amp. The limit is about 25kHz with a 741 op-amp, or about 70kHz with a CA3140.

Twin-T Oscillators

Another way of making a sine-wave oscillator is to wire a Twin-T network between the output and input of an inverting op-amp, as shown in *Figure 8*. The Twin-T network comprises R1-R2-R3-RV1 and C1-C2-C3, and in a 'balanced'

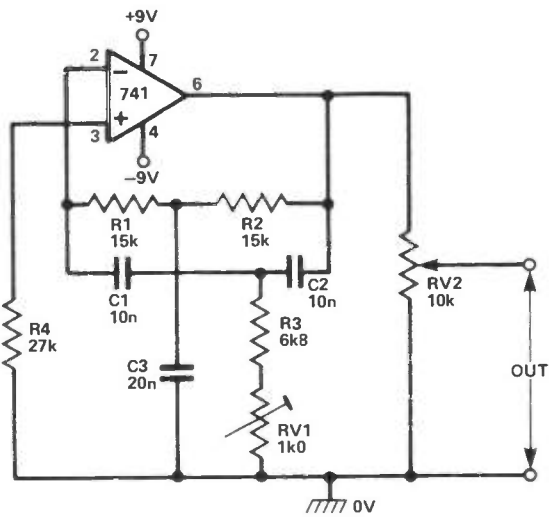


Fig 8 1kHz Twin-T oscillator

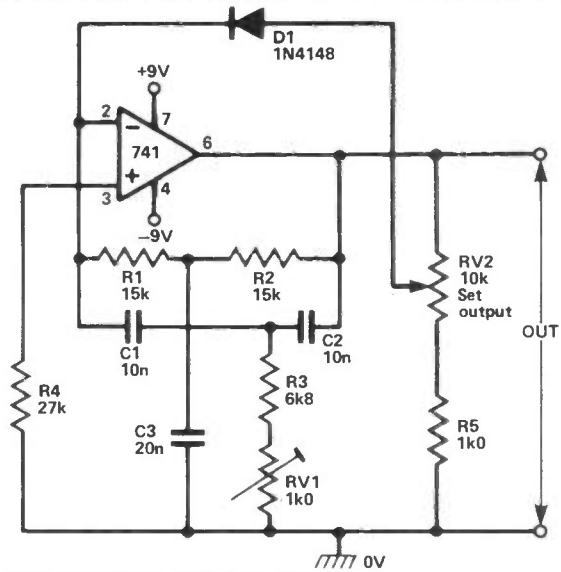


Fig 9 Diode-regulated 1kHz Twin-T oscillator

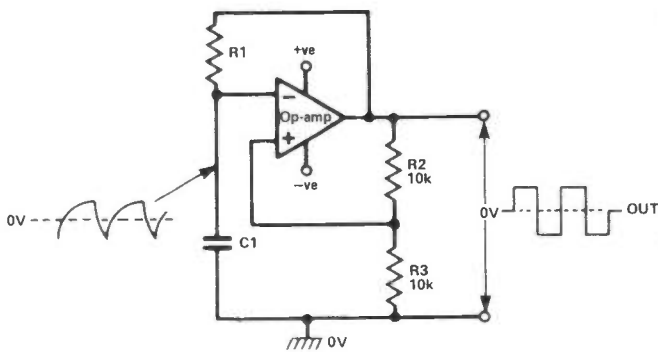


Fig 10 Basic relaxation oscillator circuit

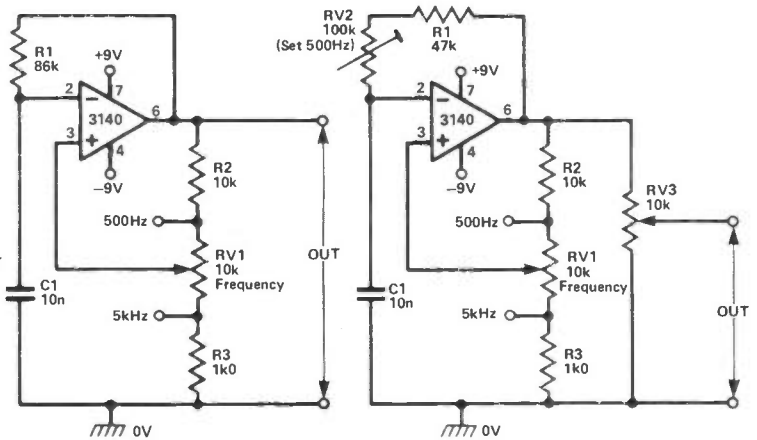


Fig 11 Simple 500Hz-5kHz square-wave oscillator

circuit these components are in the ratios $R1 = R2 = 2(R3 + RV1)$, and $C1 = C2 = C3/2$. When the network is perfectly balanced, it acts as a frequency-dependent attenuator that gives zero output at a centre frequency (f_0) of $1/6.28 \times R1 \times C1$, and a finite output at all other frequencies. When the network is imperfectly balanced, it gives a minimal but finite output at f_0 , and the phase of this output depends on the direction of the imbalance: if the imbalance is caused by $(R3 + RV1)$ being too low in value, the output phase is inverted relative to the input.

In *Figure 8*, the Twin-T network is wired between the output and the inverting input of the op-amp, and RV1 is critically adjusted so that the Twin-T gives a small phase-inverted output at f_0 . Thus, zero overall phase inversion occurs round the feedback loop, and the circuit oscillates at a centre frequency of 1kHz. In practice, RV1 is adjusted so that oscillation is barely sustained, under which condition the sine-wave output has less than 1% distortion. Automatic amplitude control occurs because of the progressive non-linearity of the op-amp as the output signal approaches clipping level. The output amplitude is fully variable from zero to about 5V rms via RV2.

Figure 9 shows an alternative method of amplitude control, which results in slightly less distortion. Here, D1 provides a feedback signal via potential divider RV2. This diode progressively conducts and reduces the circuit gain when the diode forward voltage exceeds 500mV. To set up the circuit, first set RV2 slider to the op-amp output and adjust RV1 so that oscillation is just sustained; under this condition the output signal has an amplitude of about 500 mV pk-pk. RV2 then enables the output signal to be varied between 170mV and 3V0 rms.

Note that the above two Twin-T circuits make good fixed-frequency oscillators, but are not suitable for variable-frequency use, due to the difficulties of varying three or four network components simultaneously.

SQUARE-WAVE GENERATORS

An op-amp can be used to generate square-waves by using the basic relaxation oscillator configuration of *Figure 10*. The circuit uses dual power supplies, and the output switches alternately between the positive and the negative saturation levels of the op-amp. Potential divider R2-R3 feeds a fraction of this voltage back to the non-inverting input of the op-amp, to provide the circuit with

an 'aiming' voltage, and feedback components R1-C1 act as a time-constant network.

The basic operation of the *Figure 10* circuit is such that, when the output is high, C1 charges up via R1 until the C1 voltage reaches the positive 'aiming' value set by R2-R3, at which point the op-amp output regeneratively switches negative, causing C1 to start to discharge via R1 until the C1 voltage falls to the negative 'aiming' value set by R2-R3, at which point the op-amp output regeneratively switches positive again, and the whole sequence then repeats ad infinitum. The action is such that a symmetrical square wave is developed at the output of the op-amp, and a non-linear triangle waveform is developed across C1; these waveforms swing symmetrically either side of the zero-volts line. A fast op-amp, such as the CA3140, should be used if good output rise and fall times are needed from the square wave.

Note that the operating frequency of this circuit can be varied by altering either the R1 or C1 values, or by altering the R2-R3 ratios. This circuit is thus quite versatile. *Figure 11* shows how it can be adapted to make a practical 500Hz to 5kHz square-wave generator, with fre-

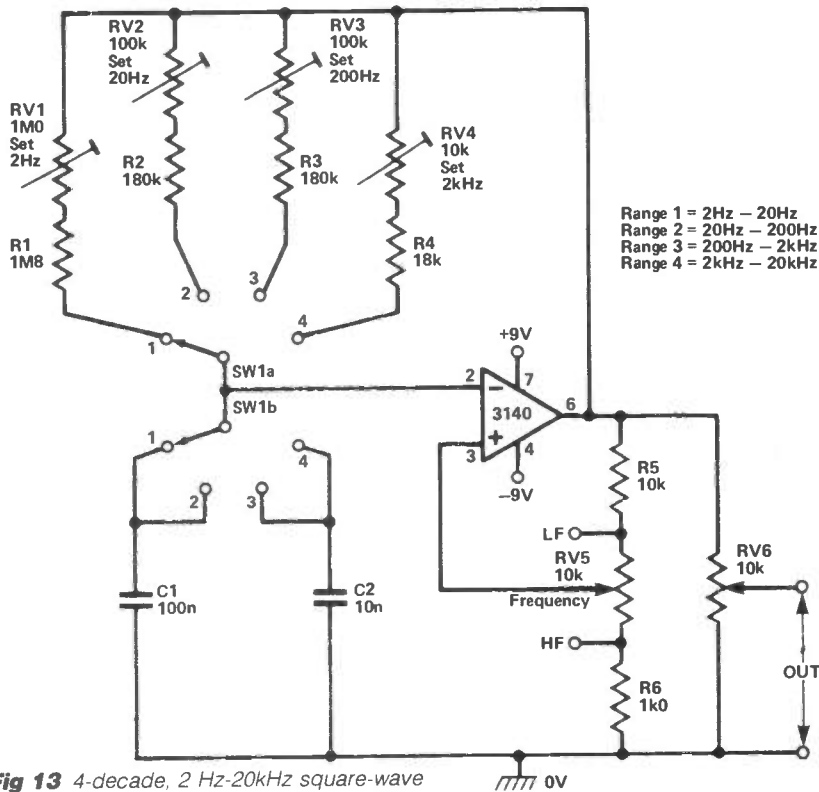


Fig 13 4-decade, 2 Hz-20kHz square-wave generator

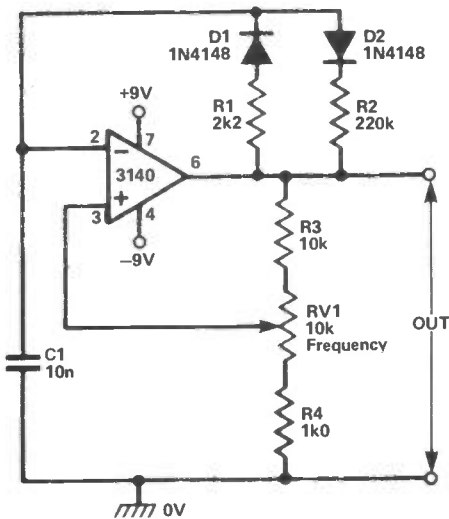


Fig 15 Variable-frequency narrow-pulse generator

quency variation obtained by altering the attenuation ratio of R2-RV1-R3. Figure 12 shows how this circuit can be improved by using RV2 to pre-set the range of the RV1 frequency control, and by using RV3 as an output amplitude control.

Figure 13 shows how the above circuit can be modified to make a general-purpose square-wave generator that covers the 2Hz to 20kHz range in four switched decade ranges. Pre-set pots RV1 to RV4 are used to precisely set the minimum frequency of the 2Hz - 20Hz, 20Hz - 200Hz, 200Hz - 2kHz, and 2kHz - 20kHz ranges respectively.

Variable symmetry

In the Figure 10 circuit, C1 alternately charges and discharges via R1, and the circuit generates a symmetrical square-

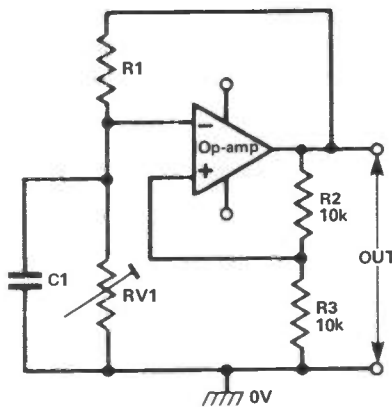


Fig 16 Basic resistance-activated relaxation oscillator

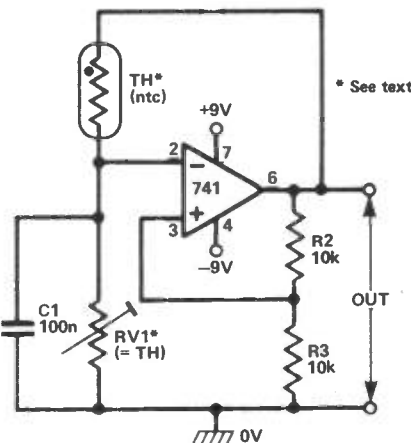


Fig 18 Precision over-temperature oscillator/ alarm

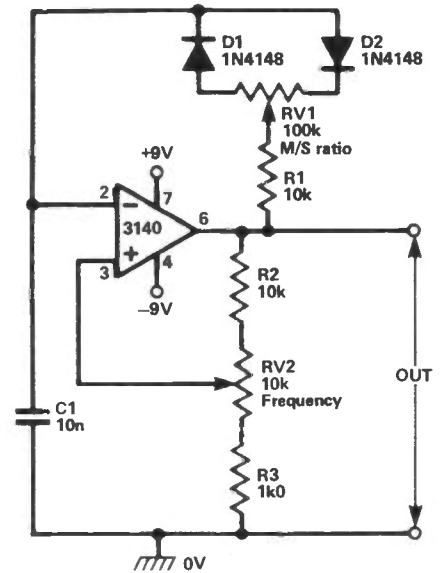


Fig 14 Square-wave generator with variable M/S ratio and frequency

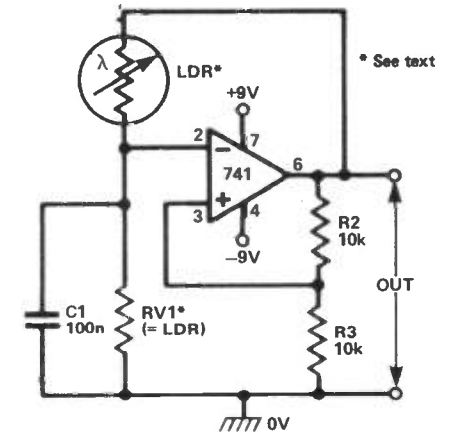


Fig 17 Precision light-activated oscillator/ alarm

wave output. The circuit can easily be modified to give a variable-symmetry output by providing C1 with alternate charge and discharge paths, as shown in Figures 14 and 15.

In the Figure 14 circuit, the MARK/SPACE (M/S) ratio of the output waveform is fully variable from 11:1 to 1:11 via RV1, and the frequency is variable from 650Hz to 6.5kHz via RV2. The circuit action is such that C1 alternately charges up via R1-D1 and the left-hand side of RV1, and discharges via R1-D2 and the right-hand side of RV1, to provide a variable-symmetry output. Note that variation of RV1 has negligible effect on the operating frequency of the circuit.

In the Figure 15 circuit, the MARK period is determined by C1-D1-R1, and the SPACE period by C1-D2-R2; these periods differ by a factor of one hundred, so the circuit generates a narrow pulse waveform. The pulse frequency is variable from 300Hz to 3kHz via RV1.

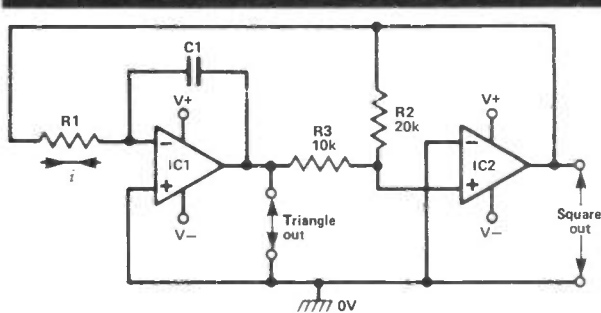


Fig 19 Basic triangle-square function generator

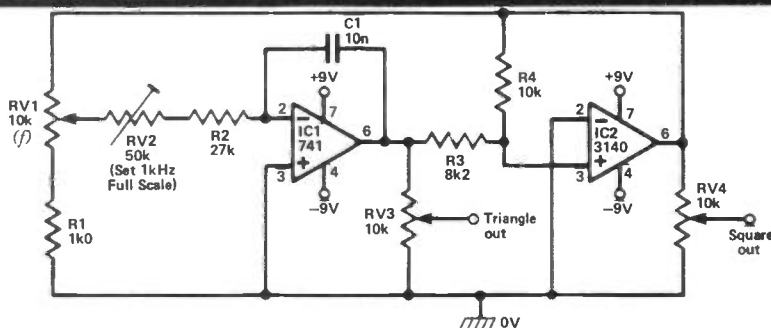


Fig 20 100Hz-1kHz triangle-square function generator

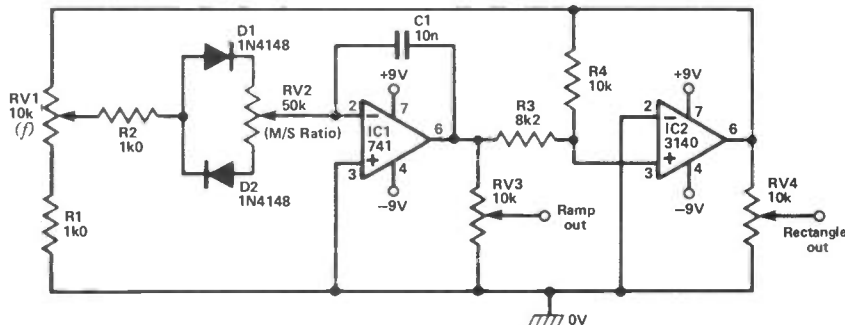


Fig 21 100Hz-1kHz ramp-rectangle generator with variable slope - M/S ratio

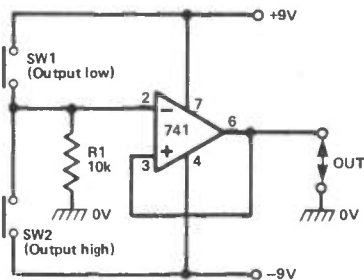


Fig 22 Simple manually-triggered bistable

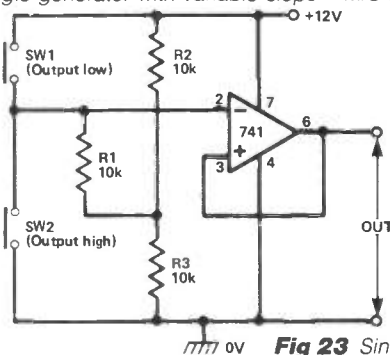


Fig 23 Single-supply manually-triggered bistable

Resistance activation

Note from the description of the *Figure 10* oscillator that the circuit actually changes state in each half-cycle at the point where the C1 voltage reaches the 'aiming' value set by the R2-R3 potential divider. If C1 is unable to attain this voltage, the circuit will not oscillate. Consequently, if the circuit is modified as shown in *Figure 16*, in which RV1 is wired in parallel with C1 and forms a potential divider with R1, and R2-R3 have a 1:1 ratio, the circuit will oscillate only if RV1 has a greater value than R1. This circuit can thus function as a resistance-activated oscillator.

Figures 17 and 18 show two practical applications of the resistance-activated oscillator. The *Figure 17* circuit acts as a precision light-activated oscillator or alarm, and uses an LDR as the resistance-activating element. The circuit can be converted to a 'dark-activated' oscillator by transposing the LDR-RV1 positions. The *Figure 18* circuit is similar to this, but uses negative-temperature-coefficient thermistor TH as the resistance-activating element, and acts as a precision over-temperature oscillator/alarm. The circuit can be converted to an 'under-temperature' oscillator by transposing TH and RV1.

In the above two circuits, the LDR or TH can have any resistance in the range 2kΩ

to 2MΩ at the required trigger level, and RV1 must have the same value as the activating element at the desired trigger level. RV1 sets the trigger level; the C1 value can be altered to change the oscillator frequency.

TRIANGLE-SQUARE GENERATION

Figure 19 shows the basic circuit of a function generator that simultaneously generates a linear triangle and a square waveform, using two op-amps. IC1 is wired as an integrator, driven from the output of IC2, and IC2 is wired as a differential voltage comparator, driven from the output of IC1 via potential divider R2-R3, which is connected between the outputs of IC1 and IC2. The square-wave output of IC2 switches alternately between positive and negative saturation. The circuit functions as follows.

Suppose, initially, that the output of IC1 is positive and the output of IC2 has just switched to positive saturation. The inverting input of IC1 is a virtual earth point, so a current (i) of $V_{sat}/R1$ flows into R1, causing the output of IC1 to start to swing down linearly at a rate of $i/C1$ volts per second. This output is fed, via the R2-R3 divider, to the non-inverting input of IC2, which has its inverting terminal referenced directly to ground.

Consequently, the output of IC1

swings linearly to a negative value until the R2-R3 junction voltage falls to zero, at which point IC2 enters a regenerative switching phase, in which its output abruptly switches to negative saturation. This reverses the inputs of IC1 and IC2, so IC1 output starts to rise linearly, until it reaches a positive value at which the R2-R3 junction voltage reaches the zero volts reference value, initiating another switching action. The whole process then repeats ad infinitum.

Important points to note about the *Figure 19* circuit are that the pk-pk amplitude of the linear triangle waveform is controlled by the R2-R3 ratio, and that the operating frequency of the circuit can be altered by changing either the ratios of R2-R3, the values of R1 or C1, or by feeding R1 from a potential divider connected to the output of IC2 (rather than directly from IC2 output). *Figure 20* shows the practical circuit of a variable-frequency triangle/square generator that uses the latter technique.

In *Figure 20*, the input current to C1 (obtained from RV2-R2) can be varied over a 10:1 range via RV1, enabling the frequency to be varied from 100Hz to 1kHz; RV2 enables the full-scale frequency to be set to precisely 1kHz. The amplitude of the linear triangle output waveform is fully variable via RV3, and of the square-wave via RV4.

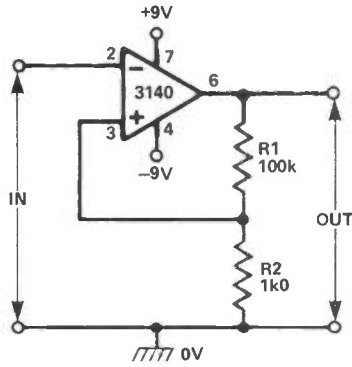
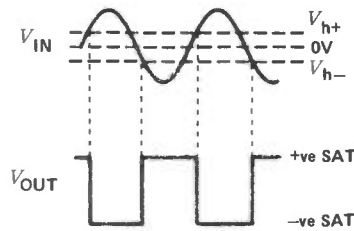


Fig 24 Schmitt trigger



The *Figure 20* circuit generates symmetrical output waveforms, since C1 alternately charges and discharges at equal current values (determined by RV2-R2, etc). *Figure 21* shows how the circuit can be modified to make a variable-symmetry ramp - rectangle generator, in which the slope of the ramp and the M/S ratio of the rectangle is variable via RV2. C1 alternately charges via R2-D1 and the upper half of RV2, and discharges via R2-D2 and the lower half of RV2.

SWITCHING CIRCUITS

To conclude this edition of 'Data File', *Figures 22 to 24* show three ways of using op-amps as simple regenerative

switches. *Figure 22* shows the connections for making a simple manually-triggered bistable circuit. Note here that the inverting terminal of the op-amp is tied to ground via R1, and the non-inverting terminal is tied directly to the output. The circuit operates as follows.

Normally, SW1 and SW2 are open. If SW1 is briefly closed, the op-amp inverting terminal is momentarily pulled high and the output is driven to negative saturation; consequently, when SW1 is released again, the inverting terminal returns to zero volts but the output and the non-inverting terminal remain in negative saturation. The output remains in this state until SW2 is briefly closed, at which point the op-amp output switches

to positive saturation, and locks into this state until SW1 is again operated. The circuit thus gives a bistable form of operation. *Figure 23* shows how the circuit can be modified for operation from a single-ended power supply; in this case the inverting terminal of the op-amp is biased to half-supply volts via R1 and the R2-R3 potential divider.

Finally, *Figure 24* shows how to connect an op-amp as a Schmitt trigger, which can, for example, be used to convert a sine-wave input into a square-wave output. The circuit operates as follows.

Suppose initially that the op-amp output is at a positive saturation value of 8V0. Under this condition the R1-R2 divider feeds a positive reference voltage of $8V0 \times (R1+R2)/R2$ (= about 80mV in this case) to the non-inverting pin of the op-amp. Consequently, the output remains in this state until the input rises to a value equal to this voltage, at which point the op-amp output switches regeneratively to a negative saturation level of -8V0, feeding a reference voltage of minus 80mV to the non-inverting input. The output then remains in this state until the input signal falls to -80mV, at which point the op-amp output switches regeneratively back to the positive saturation level. The switching levels can be altered by changing the R1 value.

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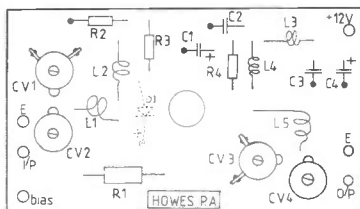
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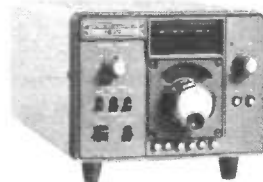
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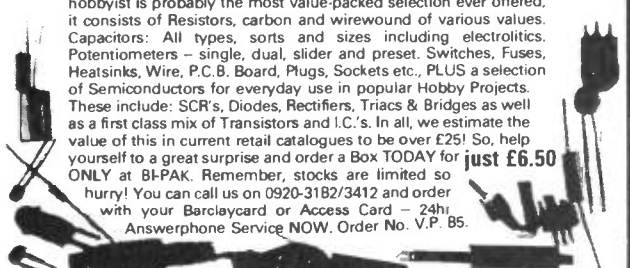
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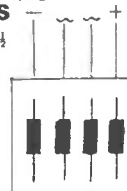
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Six Antennas from Three Wires

by Fred Hopengarten, K1VR and Bob Clarke, N1RC

With these modified Beverage antennas, you double your directions without doubling your cost

An old antenna

First described in a 1922 article by H. H. Beverage, (see ref 1) the Beverage is a receiving antenna described by one friend as an antenna that works poorly in general, but less poorly in one direction. Its principal advantages are:

- It increases your received signal-to-noise ratio (reduces QRN) for low-angle signals (i.e., DX!)
- It has a narrower beamwidth than typical 80-metre antennas. Belrose VE2CV has described the azimuthal beamwidth as 77 degrees. (see ref 2).
- It is much less susceptible to precipitation static, so that a snowstorm in February is less likely to shut down low-frequency operations.
- It is capable of excellent front-to-side performance to reject all that static coming from around the equator.
- It reduces the need for inserting attenuation to protect the solid-state front end of your receiver or transceiver.

● It is not unusual to see 20-25 dB front-to-back thus exhibiting advantages when more powerful stations are located in adverse directions to the installation.

A Beverage is a single-wire antenna used in receiving only. It is end-fed, $\frac{1}{2}$ to 4 wavelengths long, strung horizontally from 6 to 15 feet above ground. Many Beverages are fed at one end, left open-circuited at the other, far end, and are bi-directional in line with the wire (see *Figure 1*). Adding a terminating resistor to the far end, as in *Figure 2*, makes the Beverage unidirectional, but you can't switch directions. Some Beverage users use a dc relay and switch the terminating resistor in and out, but this still does not provide unidirectional performance in each direction. (see refs 4, 5, 6, 7).

However, if you go one step further – feed both ends of a Beverage, select either feedline and terminate the other – you can indeed have two directions from a single wire. This is what we have done,

not with just one wire, but three, for six directions!

A new construction

The form of construction described in this article is desirable because few of us live on a piece of land large enough to stretch out a Beverage in each desired direction. But if you can have one wire, you can have two directions!

The system has the following components: a control head in the shack, three Beverages, six feedlines, and six 'Beverage Boxes'.

The control head has two switches: A Beverages/transmit antenna switch (to select the transmit antenna to listen on, if desired), and a rotary switch for selecting a favoured direction.

Outdoors, we used three Beverages, which we strung between trees, but more or fewer can be used. Each end of each Beverage wire is connected through a Beverage Box to one of the feedlines.

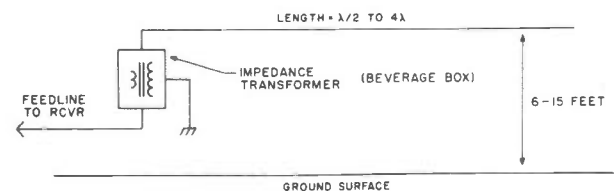
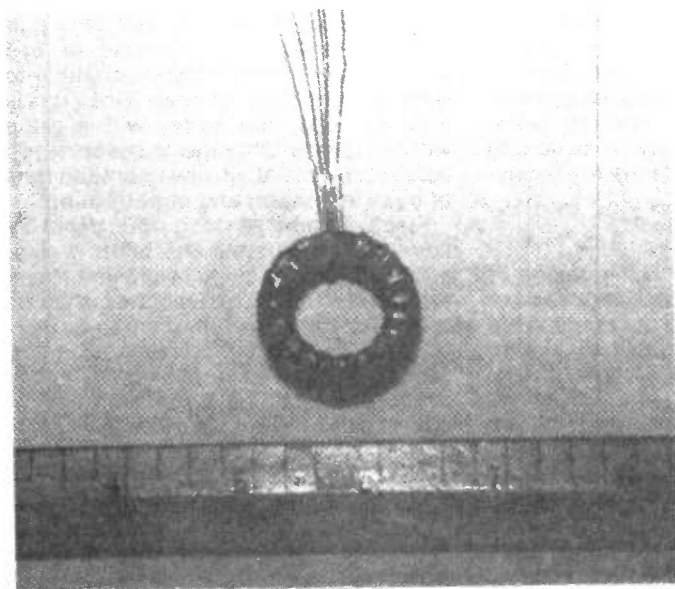


Fig 1 A basic Beverage antenna. The directivity pattern is bi-directional along the axis of the horizontal wire. The Beverage box contains a transformer which matches the impedance of the antenna to the impedance of the feedline

Photo 1 A view of toroidal matching transformer, showing method of winding

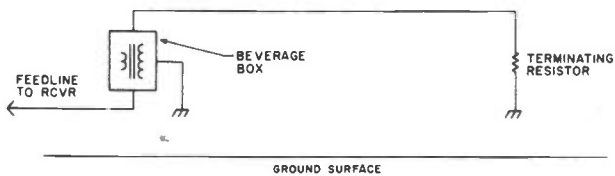


Fig 2 A terminated Beverage is uni directional towards the terminated end of the antenna. The resistor is a non-inductive type, and experience suggests a value between 300 and 800 ohms

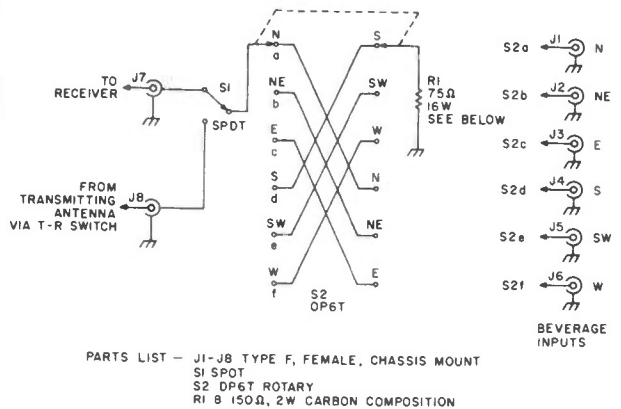
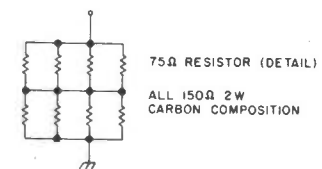


Fig 4 Control-head schematic diagram



Fig 3 The directivity pattern of the K1VR/N1RC Beverage is reversible. A control head at the operating position selects one of the two feedlines and routes it to the receiver while terminating the second feedline with a resistance. The antenna is directional towards the end with the terminated feedline. By using three such antennas and a rotary switch six different directions can be selected



See Figure 3. All feedlines end in the shack at the control head. Our Beverages range from 220 to 325 feet long, limited by the size of K1VR's yard.

It sounds simple because it is simple. Results: improved signal-to-noise, front-to-back, and front-to-side operation when compared with dipoles and delta loops. And you thought you couldn't rotate an 80-metre antenna!

The control head

In the original control head, the transmitting antenna was assigned position number 1 on the rotary switch. With a little experience, however, we soon learned that comparing reception on the Beverage to reception on the transmitting antenna was much easier with a separate toggle switch. In addition, the rotary switch had a nice even number of positions, with no empty space opposite the transmitting antenna.

The double-pole, six-throw (DP6T) rotary switch we used was the type that lets you select the number of positions desired by successively removing stops. We 'crosswired' the switch as shown in Figure 4, so that when one feedline is selected, the feedline coming from the opposite end of the same Beverage is connected to the 75-ohm terminating resistor. Thus, if we select, say, the northeast end of Beverage A, then the south-west end of Beverage A is terminated.

Pay close attention to the wiring and labelling, or you will surely have to rewire several times, as we did, to make the switch go nicely around the compass, terminating the other end of the direction selected.

In locating the control head at the operating position, remember that while you may change bands only two or three times per hour at most, you will change directions for receiving repeatedly. So choose a location near the transceiver dial or antenna rotator, to be used by the

hand you do *not* write with. The control head should also be plainly visible, so that you won't strain to hear someone only because you've forgotten to 'point' the right antenna at him (or her!).

We used F connectors because they are cheap, readily available, take up much less back panel space than UHF connectors, and are much, much easier to install (a single 5/8 in hole)! BNC connectors would also be appropriate. But note it is a good idea not to use a connector which may also be used in a transmitting application in your shack. Remember, Beverage antennas are for receiving only!

Finally, as we got around to attaching feedlines, it became apparent that as soon as they were identified, it was important to label them with Brady markers, tie-wrap tabs, or even masking tape to indicate direction. Without marking, eight identical RG-59 ends with F connectors quickly became confusing.

The jumper connecting the control head to the transceiver at K1VR was RG-59 with an F connector on one end and an RCA phono plug on the other. Note that a small modification may be necessary to your transceiver to permit operation with a separate receiving antenna while maintaining the flexibility of switching back to the transmit antenna for receiving, if desired.

Feedline

Of course, the magic in the design of these antennas is that the feedlines are so inexpensive. With the advent of cable TV, so-called 'drop cable' has become widely available at very attractive prices. This is the cable which is run from the telephone pole on the street to the home.

Drop cable comes in two sizes: RG-59 and RG-6. At 5MHz, RG-59 has an attenuation of approximately 0.55 dB/100 feet; RG-6, which is more expensive, is approximately 0.45 dB/100 feet (source:

Belden catalogue). Therefore, since loss is inconsequential (the more feedline loss, the less attenuation you will have to insert to prevent front-end overload), choose the line on which you get the best deal. However, other considerations may contribute to your decision.

If you live near a strong local station or intend to operate in the multi-operator/multi-transmitter category in various contests, you may wish to consider the question of shielding. RG-59 is commonly available in 40% braid/100% foil or 60% braid/100% foil. The more ingress of signal that you expect, the more you should consider using 60% braid or even 95% braid. *In extremis*, these cables are also available with double shielding and double foil. Double-braided RG-6 is the choice for direct burial installations.

In any ham station, the question of splicing wire often arises. A few words of advice are appropriate. If you have to put a cable in conduit to get out of your house and into the backyard, *never* put a splice inside the conduit. If you must splice outdoors, splicing and then putting the splice underground is bad business, as it is just too susceptible to water getting into the coax. Since this is a foam coax, the water will migrate without mercy. The coax is cheap; if you value your time at all, use unbroken runs of coax in conduit and underground!

Finally, when working with cable-TV coax, remember that the braid is generally going to be made of aluminium and will not solder. This dictates that all connectors must be either crimp-on BNC or crimp-on F. As for the crimping, it may be awkward, but be sure to borrow or buy the correct crimping tool. Merely using a pair of pliers will not do the kind of rf-tight crimp which will last.

BEVERAGE BOXES (THE TERMINATIONS)

The Beverage Box is the interface between one end of a Beverage antenna and its 75-ohm transmission line. It

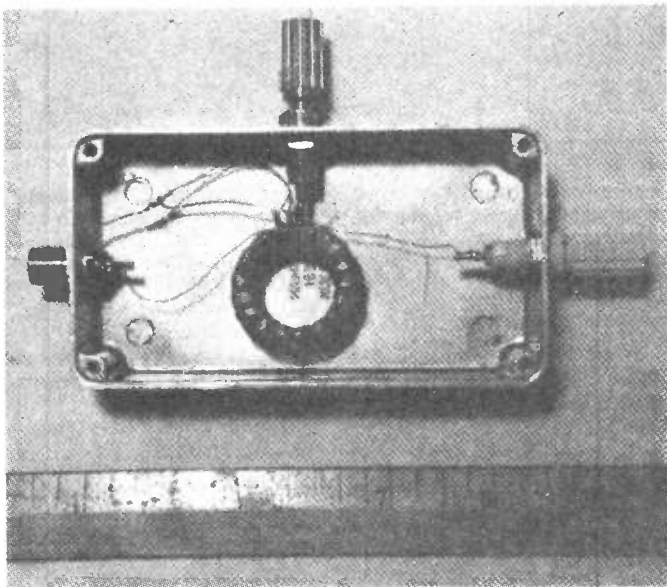


Photo 2 Inside view of a Beverage Box

and its 75-ohm transmission line. It should have minimum insertion loss, operate efficiently over a wide frequency range, and be weatherproof.

As a starting point, we knew that, according to the literature, Beverage impedances could range from 400 to 800 ohms or so, but that we could reasonably expect an impedance in the 500-600 ohm range. Furthermore, we decided that rather than design a multiple-impedance matching transformer, a single 600-ohm-to-75-ohm design would be used. The thought of many treks into the woods to adjust taps aided in this decision!

The actual construction of the box was divided into smaller units of decision-making.

Connectors

F connectors were selected for the very same reasons we used them in the control head.

Also, watertight boots which go over F connectors are readily available. Filling them with silicone grease (not caulk) before tightening will make a very good setup. Remember to put the boot on before putting on the F connector. The authors have forgotten this rule more than once.

Binding Posts

We selected commonly-available posts and have very little to contribute to the discussion. However, it is a good idea

to get the type with a hole through the post to ensure a good contact even after oxidation has begun. Also, note that some binding posts (the cheapest type) are not feedthrough types. That is, they are not insulated from the surface in which they are mounted. These should be avoided.

The Transformer

The transformer design meets the following criteria:

<i>Impedance</i>	
Ratio (Ohms).....	6.00:75 (8:1)
Bandwidth.....	1.0 to 30MHz
Insertion loss.....	negligible

The transformer was quadrifilar wound (Figure 5), one winding serving as the 75-ohm secondary, the other windings connected in series as the 600-ohm primary. All windings were 16 turns, #0.28 enamel wire, close-wound (Photo 1), on an Indiana General 626-12-Q1 core (available from Permug Northeast Corp., 10 Fortune Drive, Billerica MA 01865; (617) 273 2890). Each winding had a self-impedance of 375 ohms (5 x 75). The core of the transformer had a 0.75in inner diameter, a 1.25in outer diameter, and a 0.375in width.

Note that the late Jim Lawson W2PV found that in the presence of very high rf levels – a local AM radio station – the

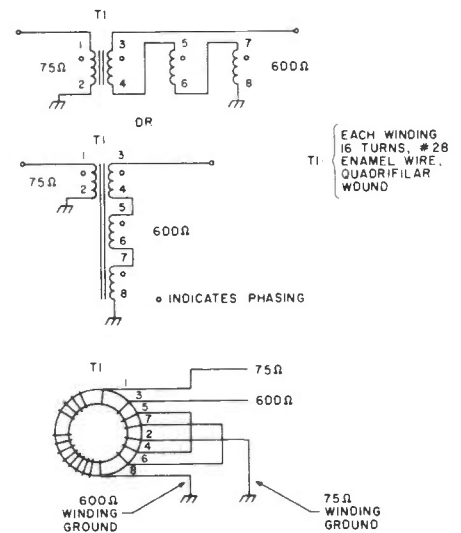


Fig 5 Transformer winding details

toroid core saturated. He used L/C networks for transformers instead of toroids at his location.

Both a network analyzer and an rf-vector impedance metre (75-ohm impedance) were used to verify transformer performances. Test setups are shown in Figures 6 and 7; measurements are listed in Tables 1 and 2. Measurements made using the network analyzer are return loss as measured in decibels. Return loss is the relation between the power returning down the line from a mismatched load to the power incident to that load'. (Stephen F. Adam, *Microwave Theory and Applications*, Prentice Hall, 1969.) It is related to vswr by the formula: $R1 = -20 \log_{10} (vswr - 1/vswr + 1)$. Equivalent vswr's are included in Table 2.

All measurements were made with the transformer terminated in a 600-ohm load consisting of two 1200-ohm, quarter-Watt, carbon composition resistors in parallel.

N1RC also tried a measurement setup which the average ham can do at home to get a rough indication of Beverage performance. Although the transformer is designed for a 600-ohm-to-75-ohm impedance transformation (an 8:1 ratio), it can also be used for 400-ohm-to-50-ohm applications. Bob made a 400-ohm dummy load of 8-50-ohm, 10-Watt wire-wound resistors and connected it to the 600-ohm side of the transformer. After connecting the 75-ohm side to the 'Antenna' connector of a vswr bridge and

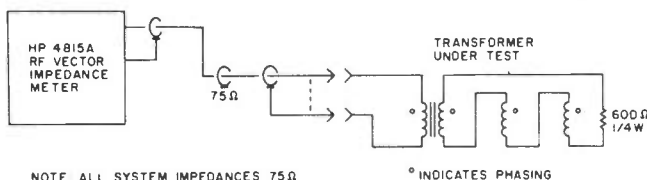


Fig 6 Impedance-measurement test set-up

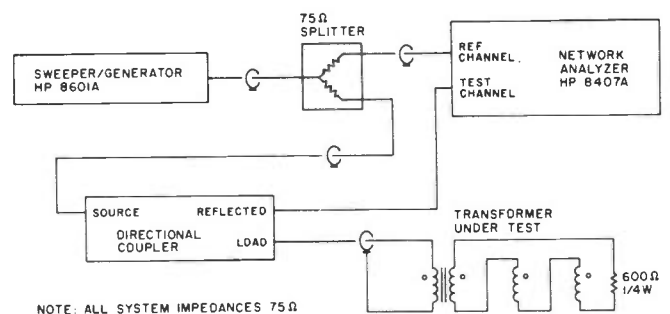
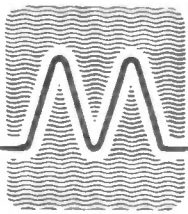


Fig 7 Transformer return-loss test set-up



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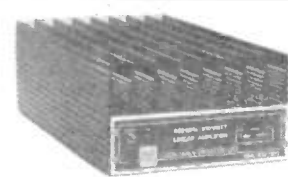
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applying enough power to get a full-scale deflection, he measured the *vswr* (quickly!) on 160, 80, and 40 metres. It was 1.5, 2, and 3, respectively, and into a reactive load.

Winding Tips

Leave about three inches of wire free on each end of each winding. Tin each end for about 1/4in, remove the enamel by burning it off with a hot soldering iron. Wipe the tip of the iron frequently on a wet sponge to clean it. When all eight ends are tinned, identify each winding using a continuity tester or VOM. Separate out one winding as the 75-ohm winding. Carefully solder the other three windings in series, removing excess wire (you don't need six inches), and re-tin ends before connecting the two end windings to the centre windings. Pay careful attention to polarity (phasing).

Box assembly

Each transformer is mounted in the Beverage Box on a platform built up of clear uncured RTV. When this cures, the toroid will be held securely in place. The ground ends of the windings are connected together to the ground binding post and a chassis ground. The 75-ohm and 600-ohm windings are connected to the F connector and input binding post, respectively (see *Photo 2*). Be careful not to reverse these connections as we did in one box. If you need to identify windings, disconnect the ground ends from ground and from each other. The 600-ohm winding will then show continuity from the 'hot' end to the connections between its centre winding and outer windings.

Another consideration is the location of the 600-ohm binding post, the 75-ohm binding post, and the F connector. We placed the 600-ohm binding post and the F connector on opposite ends of the long axis of the Beverage Box with the ground binding post placed on the side. In this way, the box could be 'hung' from a Beverage. The F connector and 75-ohm feedline hang vertically from the bottom of the box with no right angle bends in the cable and a natural drip path for the water off the box.

The box

We chose an aluminium Hammond 1590 B box (109 x 58 x 25 mm), equivalent to

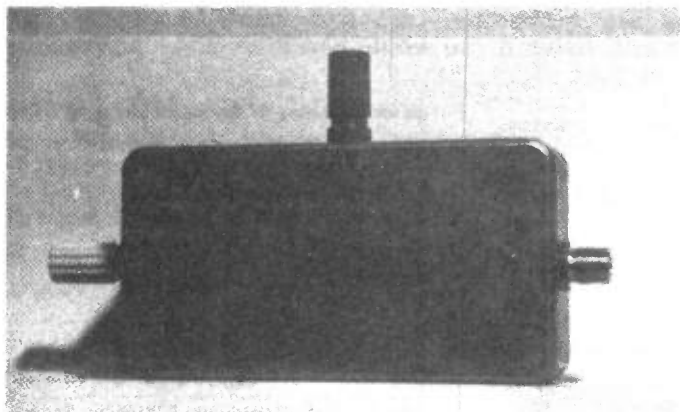


Photo 3 Assembled and sealed Beverage Box. The system of three reversible Beverages at K1VR required six of these boxes

Bud box number CU 124, because it was reasonably priced – in the \$6.00 area – and had an inner lip which protects the circuitry from the weather. All seams in the box and connectors were coated with clear nail polish to form an inexpensive and watertight seal. *Photo 3* shows a completed box.

F(MHz)	Z(Ohms)	θ °
1.8	70	+ 6
2.0	70	+ 6
3.5	70	0
4.0	71	0
7.0	68	+ 2
7.3	67	+ 2
14.0	56	- 2
14.35	54	- 4
21.0	42	+ 8
21.5	42	+ 9
28.0	38	+30
28.5	37	+37

Table 1. Transformer vector-impedance measurements

Grounding

This is a subject all its own. But it is probably worth a few words here. The Beverage antenna will be erected only 8-15 feet off the ground. Therefore, it is unlikely to receive a direct hit from lightning.

To a certain extent, the feedlines to the Beverage Boxes act as counterpoises, since the most convenient route from the shack to the Beverage Boxes furthest from the shack was almost always along the ground beneath the Beverages. All feedline braids were grounded at each end. However, this counterpoise effect caused by the feedlines is not a designed-in part of the Beverage system and cannot be depended upon to either improve or degrade system performance. It just must be accepted as one result of this design.

In the installation of this antenna, several four-foot cable-TV ground rods were used. In addition, several six-and eight-foot ground rods were used. Six-foot-by-3/8in or eight-foot-by-5/8in ground rods seem to be the grounding system of choice. But the best strategy seems to be this: Erect something, and if you are unsatisfied with performance, go

F(MHz)	Return Loss (dB)	Vswr
1	20	1.22
2	30	1.06
2.7*	45	1.01
3	35	1.04
4	30	1.06
5	28	1.08
6	25	1.12
7	22	1.17
8	20	1.22
9	19	1.25
10	18	1.28
11	17	1.34
12	16	1.38
13	16	1.38
14	16	1.38
15-30	>10	<1.9

*Resonance in transformer produced (out of ham band) measurement anomaly.

Table 2: Transformer return-loss measurements.

out and add more ground rods a few feet away or add radials to the existing ground rod.

Incidentally, since number 6 copper ground wire was available, we simply used two strands of number 12 (approximately equivalent to one number 9 wire) to ground the termination boxes.

Place the ground rod a few feet away from the tree and you will have a better chance of avoiding thick roots when you drive the rod(s) into the ground.

Note that a six-direction Beverage system uses seven ground rods; the last one is for ground back at the shack. But you have already installed a good ground for your station, haven't you?

Wire and height

Beverages will work best, it seems, at heights from 6 to 15 feet. Above that, they begin to look like conventional long-wires. We caution you to put the wire up at least 10 feet, however, because one Massachusetts ham is now the defendant in a lawsuit resulting from a trespasser on horseback who was toppled from her horse when she hit the Beverage wire.

At K1VR, due to constraints imposed by lot size, the Beverages were only between 220 and 325 feet long. Widely-circulated folklore suggests that two wavelengths, or 450 feet at 80 metres, is optimum. There is some experience, at W4BVV and W1ZA, to suggest that 1000-1200 feet is too long at 80 metres. Almost any wire will do but we recommend stranded and insulated, approximately number 16 or number 18 AWG. Finally, if you want the wire to be seen, because you cross an open field perhaps, make it white or yellow. On the other hand, if you live in a more suburban area and wish to hide it a bit, choose green, brown, or black insulation.

The best mounting method yet discovered is to use standard electric fence wire standoff insulators made of plastic. They can be hammered into a tree in seconds.

Remember, when installing your wire, to keep it as far away as possible from

towers and other metallic structures which may have the undesired effect of capacitive coupling. In the case where a 300-foot wire is supported in the middle by your tower, it is more likely to behave as if it were a 150-foot wire.

We chose stranded wire because, over such long runs, supported by trees, a solid wire would be flexed frequently, leading to stretching and breakage.

Conclusions

We set out to make a unidirectional receiving antenna for the low bands which would be very good for DX and reject signals from the side and back. For a modest amount of work, on a plot of modest size, we attained that goal.

Once we had the antennas up and working, we did notice something about their operation that deserved a bit of attention. Occasionally a signal seemed to peak on the wrong antenna. There are two reasons that this can occur. For one, a particular Beverage may not so much favour one direction as it nulls the interference coming from another. This gives the appearance of peaking a signal on the wrong antenna. In trying conditions, this means that some judicious switching is worthwhile. For another, Beverages are essentially low-angle antenna. As a result, a close (0-300 miles) station may actually be louder on the high-angle side lobe of a completely different direction Beverage than on the Beverage favouring that direction. At K1VR, this means that K2s often peak

north or northeast. Locals, it seems can peak almost anywhere.

Having established that we had a working antenna system and knowing full well that nothing good ever lasts, we decided to make records of baseline resistance measurements at the control head. There is variation due to feedline lengths, and maybe even grounding, but by measuring between the centre conductor and ground at the output of the control head (removing the jumper that goes to the receiver), lines measured between 6 and 40 ohms.

It is really neat to peak up the weak ones and reject the strong ones by changing directions so easily. If you've long bemoaned the noise and crud on 40, 80, and 160, try a Beverage and double your fun by feeding both ends!

Acknowledgments

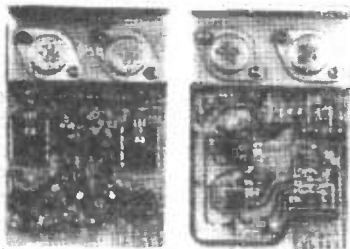
This interesting adaptation of Beverage aerials appeared in the October 83 issue of '73 Magazine' and we thank the publishers for permission to reproduce it for our readers.

Thanks to W1CF who erected the prototype version on Martha's Vineyard. And thanks to W1FC who took the first cut at designing the transformer. Both men work at M/A-COM, where we used some lab instruments for testing. Thanks also to N1BC for some helpful hints. K1VR thanks his company, Channel One, for offering a good deal on some RG-59 left over from satellite cable-TV installations.

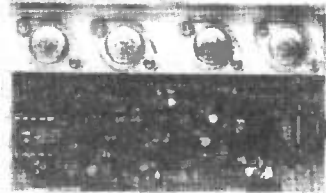
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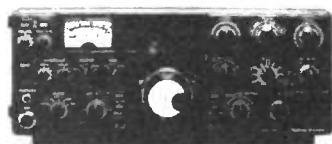
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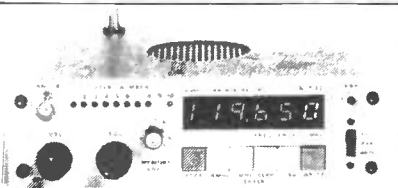
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A Switched Step Attenuator with help from a TRS-80

by Tony Bailey G3WPO

This article describes the construction of a switched attenuator which is useful for putting ahead of receivers to reduce cross modulation effects, and can be placed at the input and output of test equipment to reduce the signal by a given number of dB. It has a constant impedance input/output of 50 or 75 ohms and is usable from DC to 30MHz.

Strange value resistors

Anyone who has had occasion to build test equipment that has required an

attenuator in specific dB steps has probably come up against the problem of needing resistors with strange values such as 79.2 ohms or 39.6k etc. Unfortunately these values are required for accurate attenuators especially where you are trying to match into 50 or 75 ohm loads. There may be other occasions when this type of resistor is required.

Even if you can get hold of them, these resistors are expensive. An easy way to get the value you require is to connect a number of values in series or parallel

until the value wanted is obtained. The series method is probably the most commonly used, but you tend to need a lot of resistors and the tolerances do not always cancel out as you might hope. A better way is to use the parallel method, as with 2 resistors from the E24 series it is possible to get within 1 or 2% of any value you might require using 1% metox resistors.

If you haven't met the E24 series then the set of values you probably are familiar with is the E12 series where the

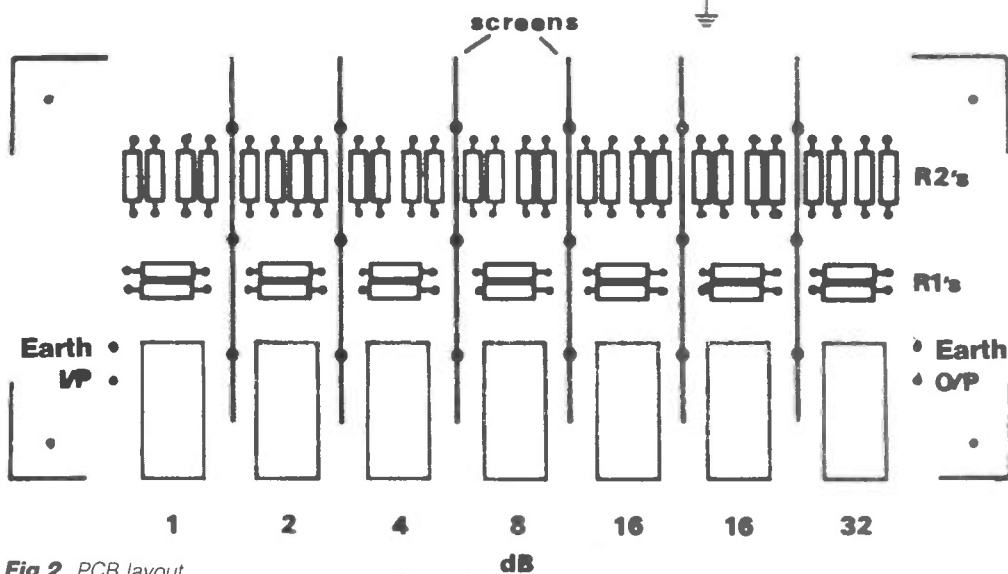
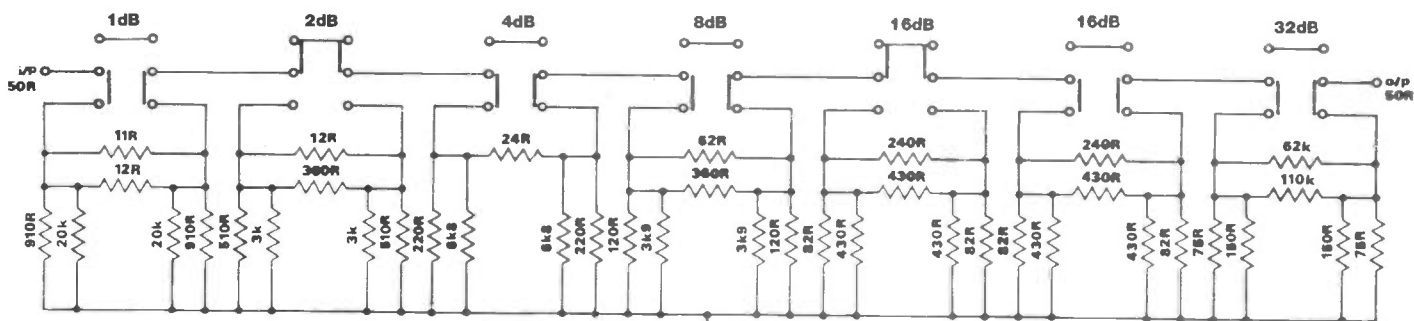


Fig 2 PCB layout

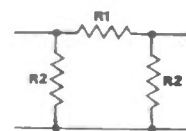


Fig 1 Diagram of attenuator values for 50Ω impedance

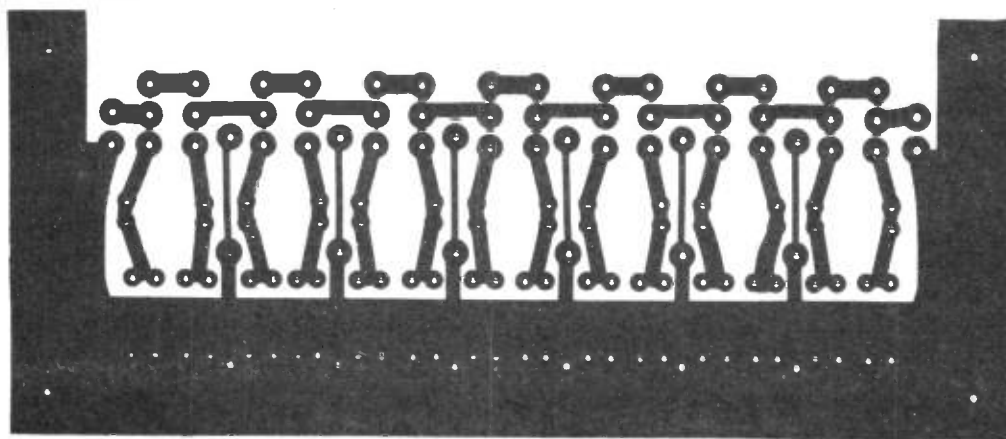


Fig 3 PCB foil pattern

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R1	4 0284	8 0569	12 0854	14 9916	18 1281	44 9750	
R2	4 0291	8 0583	12 0875	14 9944	18 1312	44 9833	
R3	4 0298	8 0597	12 0895	14 9972	18 1343	44 9916	
R4	4 0305	8 0611	12 0916	15 0000	18 1375	45 0000	
R5	4 0319	8 0638	12 0958	15 0055	18 1437	45 0166	
R7	4 0326	8 0652	12 0979	15 0083	18 1468	45 0250	
S8	—	—	12 1000	14 9444	18 1500	44 8333*	
S9	—	—	12 1020	14 9472	18 1531	44 8416*	
S10	—	—	12 1041	14 9500	18 1562	44 8500*	
S11	—	—	12 1062	14 9527	18 1593	44 8583*	
S12	—	—	12 1083	14 9555	18 1625	44 8666*	
S13	—	—	12 1104	14 9583	18 1656	44 8750*	
S14	—	—	12 1145	14 9638	18 1718	44 8916*	
S15	—	—	12 1145	14 9638	18 1718	44 8916*	
S16	—	—	12 1167	14 9667	18 1750	44 9000*	
S17	—	—	12 1187	14 9694	18 1781	44 9083*	
S18	—	—	12 1208	14 9722	18 1812	44 9166*	
S19	—	—	12 1229	14 9750	18 1843	44 9250*	
S20	4 0416	8 0833	12 1250	14 9777	18 1875	44 9333	
S21	4 0423	8 0847	12 1270	14 9805	18 1906	44 9416	
S22	4 0430	8 0861	12 1291	14 9833	18 1937	44 9500	
S23	4 0437	8 0875	12 1312	14 9861	18 1968	44 9583	

SR = Series resonance *HC25 only

The above list includes crystals for the following equipment R0 to R7 and S8 to S23 for following Belcom FS1007, FDK TM56, Multi 11 Quartz 16 and Multi 7, Icom IC2F, 21, 22A and 215. Trio Kenwood 2200, 7200, Uniden 2030 and Yaesu FT2FB, FT2 auto, FT224, FT223 and FT202.

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basic values are in steps of 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades. The E24 series has an extra set of a further 12 values included (11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75 and 91).

Rather than sit down with a calculator and work out the values required, a TRS-80 microcomputer was set the task of doing the donkey work by calculating the parallel values, knowing the single resistor value required. The program used, including comments is listed at the end of this article. If you have another machine the Basic dialect used is reasonably easily translated to an alternative.

An example of the program output is given - if you want, the PRINT instructions can be changed to LPRINT for hard copy. The program will give all resistor combinations in the E24 series which meet the % tolerance requirements you have entered. You may well find other uses for the program not connected with attenuators.

For those who don't have such a machine, the values required for pi-network attenuators in commonly required steps are given in the table, both for 50 & 75 ohm input and output impedances. 1% metal oxide resistors

should be used for best accuracy, with the single resistor given consisting of two paralleled resistors with the values shown.

This attenuator is intended for general use and uses the values of 1, 2, 4, 8, 16, 16 & 32dB with each value on a pushbutton switch which can be selected or bypassed at will. With this combination of steps any value between 1 and 79dB can be selected, although even with the careful design and screens between all switches, the unit loses accuracy above about 60 - 70dB due to leakage. A suitable pcb design is given for the attenuator, using the ALPS SUE range of pcb mounting switches. The parts including the case, are readily available.

Construction

The construction of the attenuator is very simple (refer to Figures 2 & 3). Solder the resistors into place keeping the leads as short as possible, then mount the switches directly on the pcb, after fixing into the retaining bracket. Suitable screens are supplied with the kit, or they can be fabricated from tinfoil, 6 are required, size 17 x 50mm, and mounted using pcb connection pins in the holes provided. The whole unit is held against the front panel of the case

with 1/2in spacers and 6BA screws, with the panel drilled to suit the switch (15mm centres).

Input and output sockets are required, and 50 or 75 ohm BNC sockets are advised, with connections to the pcb made by short lengths of coaxial cable of the correct impedance, earthed at both ends. In the prototype illustrated, the sockets were on the back panel. The case shown is relatively expensive, but matched the author's other test equipment - a cheaper version can be used if preferred.

Amateur bands

If you have trouble on the amateur 7MHz band at night, or on the shortwave bands from strong broadcast stations, try this attenuator unit - you will be surprised how stations you couldn't previously hear are perfect copy with a few dB's in the antenna lead. **DON'T transmit** into the unit though. Note that in a few cases, only a single resistor is wanted where the value required is part of the E24 series. 68/240 = 68 ohms in parallel with 240 ohms etc. The single resistor value above each pair is the theoretical value required, and is obtained with the parallel combination shown below it.

PARTS LIST

Set of resistors as required for impedance chosen 7 way SUE switch assembly, push to make, push to break types.

4 0.1" connection pins.

Case

Case

6BA screws

2x 0.5" spacers.

2x 50 or 75 ohm BNC panel mounting sockets.

6 tinfoil screens 17 x 50mm

Short lengths of coaxial cable.

A PCB for this project is available from Edwardschild Limited, 453a Becontree Ave, Dagenham, Essex RM8 3UL at £1.30 each.

TABLE OF RESISTOR VALUES FOR ATTENUATOR

dB	50 ohm		75 ohm	
	R1	R2	R1	R2
1	5.7 11/12	870 910/20k	8.5 10/56	1k3 1k3
2	11.6 12/360	436 510/3k	17.4 18/510	653 5k1/750
4	24 24	213 220/6k8	36 36	320 470/1k
8	52.9 62/360	116 120/3k9	79.2 82/2k4	174 180/5k1
16	154 240/430	69 82/430	231 240/6k2	103.5 120/750
32	1k 1k	53 68/240	1k5 1k5	79.5 82/2k7

100 'PARALLEL RESISTOR VALUE CALCULATION

110 'FOR TRS - 80 MODEL 1 LEVEL 2

120 'PROGRAM REQUIRES 1.9K OF MEMORY WITH REM STATEMENTS

130 'COPYRIGHT R & EW 1982

140 CLS:PRINT@460,"PARALLEL RESISTOR VALUE CALCULATIONS

150 FOR X%=1 TO 2000: NEXT

160 CLS:DIM R(121):M=1

170 X\$="££,£££,££££":Y\$="££,£££,££££££"

180 'READ VALUES OF DECADES AND MULTIPLY

190 FOR Y%=0 TO 96 STEP 24:FOR X%=1 TO 24:READ R(X%+Y%):

R(X%+Y%)=R(X%+Y%)*M:NEXT X%:RESTORE:M=M*10:NEXT Y%:R(121)=1000000

200 'SET PERCENTAGE TOLERANCE FOR ACCEPTANCE

210 INPUT"ENTER % TOLERANCE ALLOWED FOR ANSWERS":L

220 IF L=0 OR L>20 PRINT"OUT OF LIMITS":GOTO 210

230 'INPUT AND SET LIMITS AT +/- L

240 C%=1:INPUT "ENTER RESISTOR VALUE REQUIRED IN OHMS":Y

250 IF Y<5.24 OR Y>500000 PRINT"VALUE OUT OF PROGRAM RANGE":GOTO 240

255 Y1=Y*(1+L/100):Y2=Y*(1-L/100)

260 'STORE RECIPROCAL OF FIRST VALUE

270 FOR A%=1 TO 121:T!=1/R(A%):C%=C%+1:IF C%=122 THEN 350

280 'CHECK IF DECADE TOO LOW

290 P=1/(T!+1/R(121)):IF P < Y2 THEN 350

300 FOR B%=C% TO 121:P=1/(T!+1/R(B%))

310 'CHECK IF DECADE TOO HIGH

320 IF P>Y1 THEN B%=121:GOTO 340

330 IF P>Y2 AND P<Y1 THEN PRINT USING X\$;R(A%):

PRINT" IN PARALLEL WITH" USING X\$;R(B%):

PRINT" GIVES" USING Y\$;P

340 NEXT B%

350 NEXT A%:PRINT:GOTO 200

360 DATA 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91

370 END

ENTER % TOLERANCE ALLOWED FOR ANSWERS? .5

ENTER RESISTOR VALUE REQUIRED IN OHMS? 34

36 IN PARALLEL WITH 620 GIVES 34.02

39 IN PARALLEL WITH 270 GIVES 34.08

43 IN PARALLEL WITH 160 GIVES 33.89

62 IN PARALLEL WITH 75 GIVES 33.94

ENTER % TOLERANCE ALLOWED FOR ANSWERS? .2

ENTER RESISTOR VALUE REQUIRED IN OHMS? 1208

1,500 IN PARALLEL WITH 6,200 GIVES 1,207.79

ENTER % TOLERANCE ALLOWED FOR ANSWERS? _



AMATEUR RADIO

★ INSTANT HP FACILITIES ★ ACCESS ★ BARCLAYCARD ★ FREE FINANCE ★ MAIL ORDER /

YAESU		PHONE
0010 FT1	Gen Cov HF t'ceiver	2450
0020 Key T901	Curtis keyer for above	2480
0030 DCT1	DC power cable	2490
0040 RAMT1	Non-volatile mem board	2490
0050 FMU1	FM unit	2760
0060 XF8 9KCX	300Hz CW filter	2770
0070 XF8 9KC	600Hz CW filter	2810
0080 XF8 9KA	6kHz AM filter	2840
0090 XF10 7KC	CW filter	2850
0100 FS90	Gen cov HF t'ceiver	2870
0110 SP980	Matching speaker	2890
0130 FT102	9 band HF transceiver	2900
0140 FC102	9 band matching atu	2950
0150 FV102DM	Remote vfo for above	2960
0160 SP102	External speaker	2970
0240 FM AM	Unit for above	2520
1341 MH1B8	Scanning hand mic	2570
0290 FT77	8 band 100 watt t'ceiver	2580
0450 Marker unit		2530
0460 FM Unit		2610
0410 FP700	PSU for FT77	1100
0420 FC700	ATU for FT77	990
1449 FL2100Z	150-10m linear amp	4580
0810 FT290R	2m Multimode portable	2380
0840 FT790R	70cm Multimode Portable	2880
0860 NC11C	FT290/790 AC charger	920
0880 CSC1A	FT290/790 carrying case	385
0870 MMB11	FT290/790 Mob mount	2490
0900 FL2010	290R Linear amplifier	580
0700 FT208R	2m FM handheld 2JW	1880
0710 FT708R	70cm FM handheld 1W	2090
0750 NC9C	Slow charger	805
0720 FVB2	Spare Ni-cad battery pack	1995
0740 FBA3	Charging sleeve	535
0760 NC7C	Base master charger	3085
0770 NC8C	Base master quick charger	5980
0780 N43	Charger 12v DC	1420
0800 MMB10	Mobile mounting bracket	690
1000 FT230R	2m 25W FM mob t'ceiver	2550
1010 FT730R	70cm 10W FM mob t'ceiver	2480
1020 FT726R	3 band all mode base station	3085
1040 430T726	70cm module	2300
1050 50T726	6 metre module	1700
1051 HFT726R	HF module	1800
1060 SA1726	Full duplex x/band unit	900
1090 FRG700	0.2-30MHz gen cov rec	1800
1100 FRG700M	7700 with memory unit	2530
1110 MEMGR700	Memory module	580
1120 DCRC7700	DC modification kit	295
1130 FR7700	Antenna tuner unit	425
1201 FRA7700	Active Antenna	3870
1140 FF5	Low pass filter	995
1150 FRV700A	118-130, 130-140, 140-150MHz	7895
1160 FRV700B	118-130, 140-150, 50-59MHz	8470
1170 FRV700C	140-150, 150-160, 160-170MHz	7475
1180 FRV700D	118-130, 140-150, 70-80MHz	8090
1190 FRV700E	118-130, 140-150, 150-160MHz	8395
1200 FRV700F	118-130, 150-160, 170-180MHz	8595
0490 FT57GX	Multi Mode Gen. Cov.	PHONE

ICOM		CONT	PHONE
2450 IC490	Multimode 70cm 12v DC	459.00	
2480 IC2E	2m synth h/held 1.5w	159.00	
2490 IC4E	70cm synth h/held 1.5w	189.00	
2760 MMB2	Mobile mounting bracket	12.50	
2770 MMB5	Mobile mounting bracket	12.50	
2810 MMB9	Mobile mounting bracket	12.50	
2840 MMB12	Mobile mounting bracket	11.50	
2850 HM3	4 pin hand mic	12.50	
2870 HM7	8 pin hand mic	12.50	
2890 HM9	L/S mic for IC2E/4E	15.00	
2900 HM10	Up/down scan mic	20.00	
2950 SM2	4 pin desk mic	29.00	
2960 SM5	8 pin desk mic	29.00	
2970 SP3	External loudspeaker	39.00	
2520 LCX3	Cases for IC2E/4E	4.25	
2570 BC25	Standard mains charger	5.75	
2580 BC30	Base hnd type charger	49.00	
2610 BP2	Low voltage pack	30.00	
2620 BP3	Standard pack	23.00	
2630 BP4	Empty battery box (AA cells)	6.95	
2640 BP5	High power battery pack	44.00	
2650 CP1	Charger lead for 12V supply	4.49	
2660 DC1	12v Regulator pack	11.99	

TRIO/KENWOOD		PHONE
1450 TS300S	160-10m t'ceiver with gen cov	1095.00
1460 AT330	Automatic ATU 80-10m	141.75
1470 SP330	External speaker unit	98.00
1490 YK88A-1	6kHz AM filter	32.25
1500 YK88C-1	500Hz CW filter	32.25
1510 YG455C-1	500Hz CW filter	77.50
1520 YG455CN-1	270Hz CW filter	91.75
1530 TS430S	160-10m with gen cov rec	736.00
1540 PS430	Mains PSU for TS430S	112.75
1550 SP430	Speaker for TS430S	29.50
1570 FMA30	FM option unit TS430S	34.50
1580 YK88C	500Hz CW filter	31.75
1590 YK88CN	270Hz CW filter	37.25
1600 YK89SN	1.8kHz SSB filter	32.50
1650 TL322	160-10m 2kw linear	724.50
1670 MC60 N4	Desk microphone	51.50
2980 MC60 S6	Desk mic with up/down	53.50
1890 MC60A	Desk mic with pre-amp	95.25
1900 MC35S	Dist mic 50K imp	14.75
1910 MC30S	Fist microphone 500ohm imp	14.75
1920 MC40S	Up/down mic for TR9000/7000	14.75
1930 MC42S	Up/down mic (TS930S)	15.25
1940 LF30A	LF low pass filter	21.25
1950 TS780	2m/70cm all mode t'ceiver	785.00
1980 TR9130	2m multimode mobile	433.50
1934 TW4000	FM transceiver 2m/70cm	425.00
1680 TR2500	2m FM synth handheld	219.00
1700 ST2	Base stand and charger	51.75
1710 SC4	Soft case and belt hook	13.75
1720 MS1	Mob stand and power unit	31.75
1730 SMC25	Speaker/microphone	16.00
1750 LH2	Deluxe leather case	24.00
1770 DC25	Power supply from 12V	16.00
1780 TR3500	70cm handheld trans	225.00
1790 TR9500	70cm multimode mob	395.00
1800 R600	Gen cov rec 150kHz-30MHz	239.00
1820 R2000	Gen cov rec	389.00
1821 HC10	World time clock	62.00

DATONG		PHONE
3880 PCL	Gen cov converter	137.40
3870 VLF	Very low frequency converter	29.90
3670 ANF	Freq agile audio filter	67.85
3660 FL2	Multi-mode audio filter	89.70
3650 FL3	Auto filter for receivers	129.00
3700 ASP/B	Speech clipper for Trio	82.80
3700 ASP/A	r.f. speech clipper for Yaesu	82.80
3710 D75	Manual RF speech clipper	56.35
3740 D70	Morse Tutor	56.35
3750 MK	Keyboard Morse sender	137.40
3910 RFA	RF switched pre-amp	33.90
3800 AD270	Active dipole indoor	47.15
3820 AD370	Active dipole outdoor	64.40
3810 AD270-MPU	As above with mains p.s.u.	51.75
3830 AD370-MPU	As above with mains p.s.u.	69.00
3980 PU0	Mains power unit	6.90
3730 RFC/M	RF speech clipper module	29.90
3920 PFS1	Tone squelch unit	46.00
3640 SRB2	Auto Woodpecker blanker	86.25

MICROWAVE MODULES RANGE		PHONE
3130 MML28/100-S	10m 100W lin/preamp	129.95
3140 MML70/50	4m 50 watt lin/preamp	85.00
3150 MML70/100-S	4m 100W lin/preamp	139.95
3160 MML144/30LS	2m 30W linear amp	89.95
3170 MML144/50S	2m 50W lin/preamp	85.00
3180 MML144/100S	2m 100W lin/preamp	139.95
3190 MML144/100LS	2m 100W (1 or 3W i/p)	199.95
3200 MML432/30L	70cm 30W lin/preamp	95.00
3210 MML432/50	70cm 50W lin/preamp	109.95
3220 MML432/100	70cm 100 watt linear	228.65
3230 MMC435/51	70cm ATV con. UHF out	37.90
3250 MMC435/600	70cm ATV con. UHF out	27.90
3270 MIV435	70cm ATV 20W t'mitter	149.00
3290 MM1000KB	Converter with keyboard	99.50
3300 MM2001	RTTY to TV converter	189.00
3320 MM4001KB	RTTY term with keyboard	299.00
3330 MMS1	The MORSETALKER	115.00
3340 MMS2	Advanced Morse trainer	169.00
3350 MMT28/144	10m linear transverter	109.95
3360 MMT70/28	4m linear transverter	119.95
3370 MMT70/144	70cm linear transverter	109.95
3380 MMT144/28	2m linear transverter	109.95
3390 MMT432/28S	70cm linear transverter	159.95
3400 MMT432/144R	70 cm linear transverter	184.00
3410 MMT1296/144	23cm linear transverter	184.00
3425 MMT21/MW	27MHz to med wave conv	19.95
3430 MMT144/28	10m to 2m up conv	29.90
3440 MMT50/28	6m to 10m down conv	29.90
3450 MMT70/28	4m to 10m down conv	29.90
3460 MMT70/28L0	4m to 10m down conv	32.90
3470 MMT144/28	2m to 10m down conv	29.90
3480 MMT144/28L0	70cm to 2m down conv	37.90
3490 MMT432/28S	70cm to 2m down conv	37.90
3500 MMT1296/144S	23cm to 10m down conv	34.50
3520 MMT1296/144	23cm to 2m down conv	89.95
3530 MMT1691/137.5	169.1MHz Meteosat con	129.95
3540 MMTA28	10m low noise preamp	16.95
3550 MMTA144V	2m RF switched preamp	34.90
3560 MMTA1296	23cm low noise preamp	34.90
3570 MMT4500/500	500MHz digital freq meter	75.00
3580 MMT4500P	600MHz-10 prescaler	29.90
3590 MMDP1	Freq counter amp/probe	14.90
3620 MMTS86A	384MHz freq source	29.90
3630 MMR15/10	15dB, 10W attenuator	11.90

AZDEN		PHONE
4060 PCS4000	2m FM transceiver 25W	228.00
4130 MEX55	Mobile boom safety mic	28.50

FDK		PHONE
5779 M 750X	2m FM/SSB/CW 10W t'ceiver	315.00
5782 EXP 40X	M.750 70cm transverter	249.00
5772 KP100	AC/DC Electronic Keyer	69.00
5780 ATC270	Synth air monitor 110-138MHz	159.00
5781 RX40	Synth FM mon 140-180MHz	149.00

MUTEK LTD		PHONE
5850 SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
5860 SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870 SLNA 70u	70MHz low noise unswitched preamplifier using BF981	22.40
5880 SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890 SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900 SLNA 144u	144MHz low noise unswitched preamplifier using BF981	22.40
5910 SLNA 144ub	Unboxed version of SLNA 144u	13.70
5920 SLNA 145sb	Transceiver optimised preamplifier with antenna c/o switching using BF981. Intended for the FT290R, but has many other applications!	27.40
5930 GFBA 144e	Ultra-high performance environmentally housed switched gasket preamplifier using advanced negative feedback circuitry for superb dynamic performance. Supplied with ATCS 144s controller	129.90
5940 TLNA 432s	Very high performance bipolar transistor switched preamplifier for 430-440MHz using BFQ69 for 1.4dBn and 0dBm input intercept performance	74.90
5950 TLNA 432u	Unswitched boxed variant of TLNA 432s	29.40
5960 TLNA 432ub	Unboxed TLNA 432u	20.00
5970 GLNA 432u	Series 432 MHz gasfet switched preamplifiers	PHONE
5980 BLNA 432ub	Sub-miniature 1.3dBn BFQ69 preamplifier	13.70

MUTEK LTD CONT		PHONE
5990 BLNA 1296ub	Noise matched NE64535 1.3GHz Ina	PHONE
6000 RPB1 144ub	Complete replacement front-end for the FT221 and FT225	PHONE
6010 RPB1 251ub	Complete replacement front-end for the IC211 and IC251	PHONE
6020 HDRA 95u-1	1.5dBn/8.5dB gain high dynam range 88-108MHz preamplifier	PHONE
6030 HDRA 95u-2	11.5dB gain variant	PHONE
6040 BBBA 500u	20-500MHz broadband high dynamic range preamplifier	PHONE
6050 BBBA 860u	250-860MHz broadband low noi amplifier	PHONE
6060 XBP7 700b	Microstrip line bandpass tvi filter	PHONE
6070 PPSU 012	12V (nominal) mains psu for HDRAS & BBBAS60	PHONE
6080 CISA 001	'UHF' (f) to BNC(m) coaxial adap	PHONE
6090 ATCS 144s	Transmit receive changeover sequence and controller	PHONE

WRAASE ELECTRONICS	
SLOW SCAN EQUIPMENT	
4720 SC140	SSTV receive board
4730 SC160	SSTV transceiver board
4740 SC442A	SSTV TX/RX + colour
4775 SC.1	SSTV + FAX TX/RX
4750 FG422A	Light pen
4760 KB422A	Keyboard
4780 Prince	12" green display vdu

SCANNING RECEIVERS HV/VHF	
5573	Sony ICF7600D Digital receiver 'NEW'
5574	Power supply mains, for above
5580	Bearcat BC1000 synthesised/hybrid VHF/UHF
5610	Bearcat BC2020B AM/FM VHF/UHF
5650	JH SX200N AM/FM VHF/UHF
5651	JH SX400 26-510MHz AM/FM
5659	Gemscan Synthesised VHF/UHF scanner 'NEW'
5641	AOR2001 Synth. 26-520 AM/FM
5770	Fairmate AS32320 AM/FM VHF/UHF + militan airband
5760	Corona CD6000 AM airband receiver, digital
5781	FDK RX40 pocket synthesised receiver 140-180MHz
5780	FDK ATC720 pocket synthesised airband receiver

VHF/UHF AMPLIFIERS	
TONO PRODUCTS	
5340 2M-50V	40W linear for 2 metres
5350 2M-100W	90W linear for 2 metres
5360 MR-150W	140W linear 2 metres
5370 MR-250W	210W linear for 2 metres
5380 MR28	100W linear for 10 metres
5390 4M60	50W linear for 70cms
TOKYO HY-POWER LABS INC	
5670 HC150	3.5MHz to 30MHz ATU. 150W
5680 HC200	1.8MHz to 30MHz ATU. 2Kw
5690 HL 92V	2M linear amp min 80W O/P includes Mosfet preamp
5700 HL-160V	2M linear amp min 160W O/P includes J.Fet preamp 3 or 10W I/P
5709 HL45U	70cm linear amp 10W I/P 40-50W O/P
5711 HL90U	70cm linear amp 10W I/P 100W O/P 'NEW'

ALINCO ELECTRONICS	
5720 ELH230E	2M linear min 30W O/P 1/3W I/P small
5730 ELH710	70cm linear amp 10W O/P-1/3W I/P
5740 ELH730	As above but 30W O/P
5741 ELH730D	As ELH730 but with pre-amp (switched)
5742 ELH2500	2M linear 50W O/P 1/3W I/P pre-amp (switched)

DAVETREND LTD	
4670 VHF/W	Wavemeter 120-450MHz
4680 4AFSU	4 amp 13.8V psu prot.
4690 6AFSU	6 amp 13.8V psu prot.
4700 12AFSU	12 amp 13.8V psu prot.
4710 24AFSU	24 amp 13.8V psu prot.
4711 MT1	Morse tutor with mains psu



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CONT

Matched NE64535 1.3GHz	26.90
Replacement front-end FT221 and FT225	71.00
Replacement front-end IC211 and IC251	76.90
18.5dB gain high dynamic range 108-10MHz preamplifier	32.90
Gain variant 108-10MHz high dynamic range pre-amplifier	29.00
108-10MHz broadband low noise pre-amplifier	22.60
Triple bandpass tv filter (original) mains psu for 5 & BBBA860	6.90
to BNC(m) coaxial adaptor to receive changeover cable and controller	22.60

RONICS

Receive board	179.00
Transceiver board	299.00
TX/RX + colour	695.00
+ FAX TX/RX	795.00
per board	40.25
Green display vdu	119.00

IVERS HV/VHF/UHF

Receiver 'NEW' for above	169.00
Unshielded h/held VHF/UHF	345.00
AM/FM VHF/UHF	258.75
HF/UHF	299.00
AM/FM P.O.A.	259.00
VHF/UHF scanner 'NEW' 20 AM/FM	149.00
AM/FM VHF/UHF + military	99.00
Airband receiver, digital synthesised receiver 140-	119.00
Synthesised airband	149.00

IFIERS

Linear for 2 metres	69.00
Linear for 2 metres	129.00
Linear for 2 metres	169.00
Linear for 2 metres	325.00
Linear for 10 metres	85.00
Linear for 70cms	159.00
INC	
Hz to 30MHz ATU 150W	62.50
Hz to 30MHz ATU 2kW	276.55
near amp min 80W O/P	
uses Mosfet preamp	144.50
near amp min 160W O/P	
uses J.Fet preamp 3 or 10W	242.40
Linear amp 10W I/P 40-0/P	115.00
Linear amp 10W I/P 100W 'NEW'	259.00

near min 30W O/P 1/3W I/P	49.00
Linear amp 10W O/P-1/P	59.00
ove but 30W O/P HZ30 but with pre-amp	59.95
near 50W O/P 1/3W I/P mp (switched)	99.00
Microwave Module amplifiers	

meter 120-450MHz	27.90
13.8V psu prot.	30.75
13.8V psu prot.	49.00
13.8V psu prot.	74.00
13.8V psu prot.	105.00
tutor with mains psu	49.00

MORSE KEYS

HI-MOUND KEYS		
5430 HK702	Up/down on marble	26.94
5440 HK704	Up/down super deluxe	17.65
5450 HK705	Up/down deluxe	13.80
5460 HK706	Up/down economy	14.60
5461 HK707	Up/down popular	13.75
5470 HK708	Basic unit up/down	13.26
5480 MK704	Squeeze keyer manipulator	12.65
5490 MK705	As 0548 with metal base	21.28
5501	Ex-ministry No. 8 key, original packing	4.95

BENCHER PRODUCTS

5220 BY1	Keyer paddle (black base)	37.95
5230 BY2	Keyer paddle (chrome base)	48.30
5240 BY3	Keyer paddle (gold plated)	92.00
5250 ZA1A	Balun 3.5-30MHz for dipoles	15.00
5260 ZA2A	Balun 14-30MHz for beam antennas	17.25

RTTY/CW READERS

Tasco Products		
5400 CWR685E	Tele reader - RTTY/CW/ASCII	769.00
5410 CWR670	Tele reader - as above, RX only	349.00
5420 CWR610E	Tele reader - as above, basic unit	159.00
Tono Products		
5270 9000E	CW/RTTY/ASCII/Editor/lite pen, term L	669.00
5280 550E	CW/RTTY/ASCII/Terminal RX	299.00
5290 350	CW/RTTY/ASCII/Terminal RX only	259.00
5300 CRT120G	VDU 12 inch green screen - mains power	125.00
5310 CRT1200G	VDU 12 inch for 80 columns	136.00
5320 HC800	Line printer centronics	449.00
5330 SK7	Plug adaptors for printers	8.50

ICS ELECTRONICS

4900 AMT-1	Amtor RX/TX	275.00
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BNOS ELECTRONICS

5800 12/6A	Power supply 13.8V 6 amp, fully protected	48.30
5810 12/12A	Power supply 13.8V 12 amp, fully protected	85.40
5820 12/24A	Power supply 13.8V 25 amp, fully protected	125.45
5830 12/40A	Power supply 13.8V 40 amp, fully protected	225.40
5831 1144/1/100	1 watt input linear	138.00
5832 1144/3/100	3 watt input linear	138.00
5833 1144/10/100	10 watt input linear	115.00
5834 LPM144/1/100	1 watt input linear/preamp	172.50
5835 LPM144/3/100	3 watt input linear/preamp	172.50
5836 LPM144/10/100	10 watt input linear/preamp	149.50
5837 1144/25/160	25 watt input linear	155.00
5838 LPM144/25/160	25 watt input linear/preamp	185.50
5839 1144/10/180	10 watt input linear	178.00
5840 LPM144/10/180	10 watt input linear/preamp	212.50

TONNA ANTENNAS F9FT

50MHz	L(M)	W(kg)	
6100 5 element	3.5	3.2	34.30
144MHz			
6102 4 element	0.87	0.5	14.95
6110 9 ele fixed	3.3	1.9	17.71
6120 9 ele portable	3.3	1.7	20.00
6130 9 ele crossed	3.5	2.0	32.43
6140 13 ele portable	4.5	2.5	31.05
6150 17 ele fixed	6.60	4.5	37.66
435MHz			
6190 19 element	3.2	1.1	20.70
6189 19 ele crossed	3.3	1.8	34.27
6200 21 element	4.6	2.6	29.82
6210 21 element ATV	4.6	2.6	29.67
144/435MHz			
Oscar Special			
6160 9 & 19 element	3.3	2.0	4.27
1.250MHz or 1.296MHz			
6213 23 element	1.8	0.9	25.90
6214 4 x 23 ele antennas - power splitter - stacking frame			140.00

Full range of J Beam, T.E.T. and Yaesu antennas available!

WELZ

4980 SP200	1.8-160MHz PWR/SWR	69.95
4990 SP300	1.8-500MHz PWR/SWR	97.00
5000 SP400	130-500MHz PWR/SWR	69.95
5010 SP600	1.8-500MHz PWR/SWR	97.00
5040 SPI0X	1.8-150MHz PWR/SWR	24.45
5020 SPI5M	1.8-160MHz PWR/SWR	35.00
5030 SP45M	130-470MHz PWR/SWR	51.00
5050 SP250	1.8-60MHz PWR/SWR	49.50
5060 SP350	1.8-500MHz PWR/SWR	59.95
5080 AC28	3.5-30MHz ATU 400w PEP	65.00
5160 TP05X	50-500MHz 0-5W meter	13.95
5131 CA35A	Static protector	10.75
5132 CA23N	Static protector	12.60
5090 CT15A	15/50W dummy load PL259	7.95
5100 CT15B	15/20W dummy load N plug	13.95
5110 CT15C	15/400W dummy load	35.50
5120 CT300	300/1kW dummy load	49.50
5130 CT03N	3W dummy load -1.3GHz	30.00
5140 CH20A	2 way coax switch SO239	17.95
5150 CH20N	2 way coax switch N socket	31.95
5133 DF72C	144/430MHz duplexer	18.95

WELZ DIAMOND AERIALS

7800 RH2B	2m 1/2 wave whip BNC	8.95
7810 RG2008	2m half wave whip BNC	18.95
7820 RH102B	70cm 2 x 5/8 whip BNC	15.00
7830 M285	2m 5/8th mobile PL259	8.50
7840 M287	2m 7/8th mobile	14.95
7850 EL170E	Dual band 2m/70cm mobile	18.95
7860 B285	2m 5/8th base with radials	14.95
7870 GH22	2m 2 x 5/8th base	27.95
7880 GH72	70cm 2 x 5/8th base	27.50
7890 DP100S	80-10m mobile system 100w	79.95
7960 GLS	Gutter mount with 4m cable	8.95
7970 GLP	SO239 vehicle mount	2.75
7980 SPM	Heavy duty magnetic base	12.95
7990 TRB	Heavy duty trunk lip mount	11.50
8000 LOR	14" elevated ground plane	18.50
8010 LBR	Heavy duty base spring	9.50
8020 BDS	Bumper mounting strap	10.50
8030 BSB	As LBR with ball adjustment	8.50
8040 EL80	Base loaded whip 3.5MHz	37.00
8050 EL40	Base loaded whip 7MHz	32.50
8060 CP4	6-10-15 vertical with G.P.	69.00
8070 CP3	10-40m vertical with G.P.	89.00
8080 CP5	10-80m vertical with G.P.	115.00
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9960 SWR145	VSWR + power meter 144-155MHz 250W	27.95
9965 SPC6A	Insert for 300/WV3 0-2W/0-20W 50MHz	15.95
9970 SPC6B	Insert for 300/WV3 0-20W/0-200W 50MHz	15.95
9975 SPC2A	Insert for 300/WV3 0-2W/0-200W 144MHz	15.95
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DESIGNER'S UPDATE

This month, a look at helical filters – in particular those produced by TOKO

Since TOKO discovered a virtually untapped market a couple of years back with their 'stock' series of helical filters for UHF, the interest and demand that these engendered has caused the series to blossom into a complete range covering from 130MHz to 1GHz – with only a couple of gaps.

The availability of preset selectivity over this range of frequencies has both spawned a number of more adventurous designs in amateur communications equipment, and taken some of the strain off designers of pagers and other professional miniature communications equipment where predictable and repeatable selectivity at VHF and UHF is generally about half the design battle.

When selecting a helical filter for signal path applications, the prime concern will be attenuation at the image frequency. This is twice the IF frequency away from the desired signal – which

Examples

Item	Type	7 HW	7 HT	HRW
Center frequency		435MHz	855MHz	435MHz
Band width (1dB)		15MHz	15MHz	11MHz
Attenuation	$f_o + 30\text{MHz}$	23dB	18dB	22dB
	$f_o - 30\text{MHz}$	25dB	22dB	27dB
Ripple		0.1dB	0 dB	0.3dB
Insertion loss		1.6 dB	3 dB	0.3dB
Input-output impedance		50 Ω	50 Ω	50 Ω

Item	Type	HRQ	CBW	CBT
Center frequency		435MHz	145MHz	145MHz
Band width (1dB)		11MHz	3 MHz	3 MHz
Attenuation	$f_o + 10\text{MHz}$	28dB	20dB	28dB
	$f_o - 10\text{MHz}$	31dB	22dB	35dB
Ripple		0.7dB	0.3dB	0.5dB
Insertion loss		1.8dB	1.3dB	2 dB
Input-output impedance		50 Ω	50 Ω	50 Ω

Specifications

		Applicable frequency range	Band width	Input-output impedance
7 HW	Double-tuned type	230 ~ 1000MHz	over 6 MHz	50 Ω ~ 500 Ω
7 HT	Triple-tuned type	230 ~ 1000MHz	over 6 MHz	50 Ω ~ 500 Ω
HRW	Double-tuned type	350 ~ 520MHz	over 6 MHz	50 Ω
HRQ	Quadruple-tuned type	350 ~ 520MHz	over 6 MHz	50 Ω
CBW	Double-tuned type	130 ~ 220MHz	over 2 MHz	50 Ω ~ 500 Ω
CBT	Triple-tuned type	130 ~ 220MHz	over 2 MHz	50 Ω ~ 500 Ω

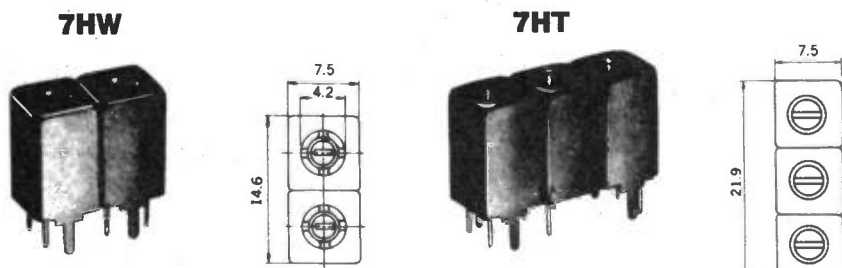


Fig 4 Unit dimensions (mm)

7HW : 252HN-1423 F

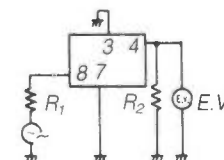


Fig 1 Test circuit

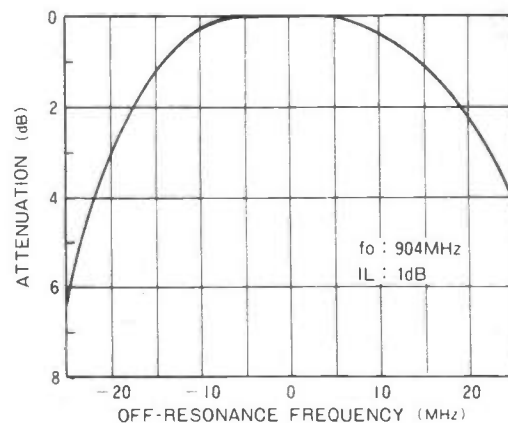


Fig 2 Bandwidth characteristic

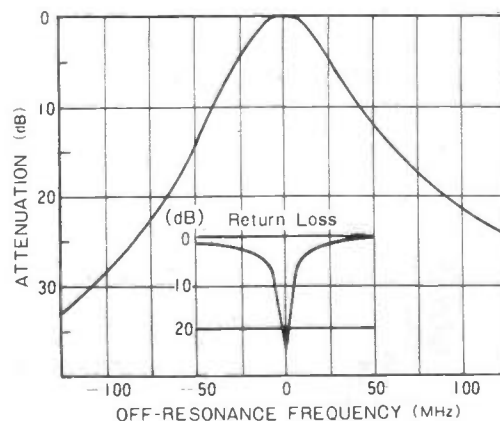


Fig 3 Selectivity

means 42.8MHz in most UHF applications where 21.4MHz is used (800–900MHz applications tend to use 45MHz) and 21.4MHz in VHF systems with an IF of 10.7MHz.

Helical filters right at the antenna socket will degrade the system noise figure by their insertion loss: so only use them without low noise pre-amplification where it is essential to do so. Used at the output of the RF stage, the insertion loss should not present any problems as the receiver noise figure will already have been determined.

Remember that helical filters tend to be nearly as good at the third harmonic of the fundamental as they are at the fundamental operating frequency. If this is likely to cause problems, then the filter should be used in conjunction with a simple low pass filter that will be effective at the third harmonic. A good example is the third harmonic of 160MHz. Quite a lot can be happening at 480MHz that you don't want cluttering up the input to your mixer.

UHF

The miniature UHF series (primarily for application in hand portables and pagers) comprises the 7HW and 7HT, which have two and three chambers respectively. The 7HW is for use both around the main amateur and commercial UHF frequencies from 410–470MHz, while the 7HT has been specifically prompted by the increasingly widely used 800MHz commercial band (primarily in the USA) and latterly by applications involving CB and cordless telephones which occur around 900MHz.

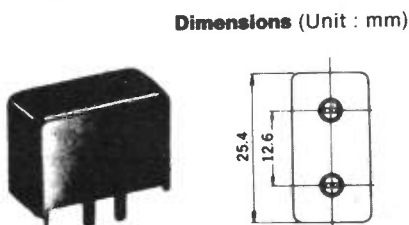
Miniature though these devices be, the 7HT is now also available in a slightly lower case size where the height above the PC board is limited to 12mm.

Where space is less of a problem, the HRW and HRQ may be used. These make up a 'full format' series that features lower insertion losses and a generally more stable all round environmental performance. The *Q* is naturally somewhat higher and, by very tight control of the manufacturing process and with exceptionally fine trimmer adjustments, the resulting bandpass characteristics are nearly 'textbook' representations of the genre.

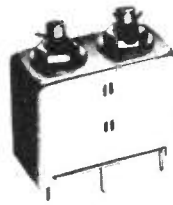
VHF

The CBW and CBT series for VHF are to be found very widely both in amateur 2m transceivers and in marine radio-telephones at 160MHz. Both two and three chamber versions are available,

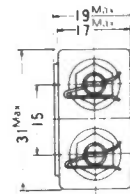
CBW type



HRW type



Dimensions (Unit : mm)



HRQ type

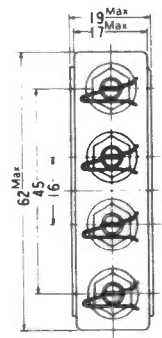
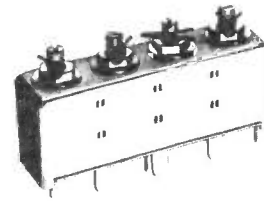


Fig 3

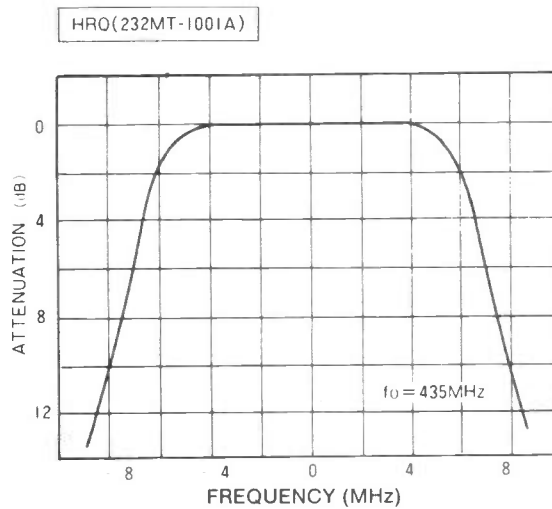
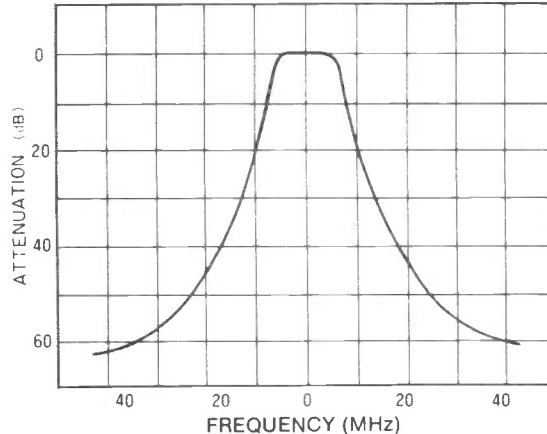


Fig 4



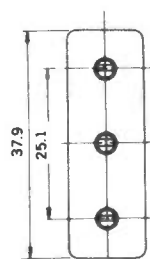
although no miniature types are envisaged in view of the relatively longer wavelengths below 230MHz. (This frequency is in fact where the 7HW and 7HT series start.)

General comments

A filter is only as good as its terminations. Match the impedance stated on the data sheet and ensure that the ground (earth) has the lowest possible impedance. A double sided layout where the top is a ground plane is conventional at these frequencies.

The input and output must be well screened – although a controlled degree of 'feed-across' can produce some deep notches at the edges of the passband skirt (at the expense of ultimate stop-band). The same principles are used to design the steep edges of ceramic and crystal filters – and it's worth bearing in mind that exactly the same mathematical principles apply to the design of UHF filters as do for LF: it's a matter of scale and practicality.

CBT type



T.V. SOUND TUNER SERIES II

BUILT AND TESTED

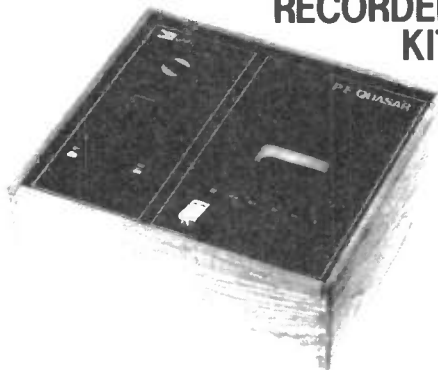


£26.50 + £2.00 p&p.

E.T.I. kit version of above without chassis, case and hardware. £16.20 plus £1.50 p&p.

In the cut-throat world of consumer electronics, one of the questions designers apparently ponder over is "Will anyone notice if we save money by chopping this out?" In the domestic TV set, one of the first casualties seems to be the sound quality. Small speakers and no tone controls are common and all this is really quite sad, as the TV companies do their best to transmit the highest quality sound. Given this background a compact and independent TV tuner that connects direct to your Hi-Fi is a must for quality reproduction. The unit is mains operated. This TV SOUND TUNER offers full UHF coverage with 5 pre-selected tuning controls. It can also be used in conjunction with your video recorder. Dimensions: 10½" x 7½" x 2½".

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• NOISE REDUCTION SYSTEM • AUTO STOP • TAPE COUNTER • SWITCHABLE E.Q. • INDEPENDENT LEVEL CONTROLS • TWIN V.U. METER • WOW & FLUTTER 0.1% • RECORD/PLAYBACK I.C. WITH ELECTRONIC SWITCHING • FULLY VARIABLE RECORDING BIAS FOR ACCURATE MATCHING OF ALL TAPES. — METAL, CHROME DIOXIDE, ETC.

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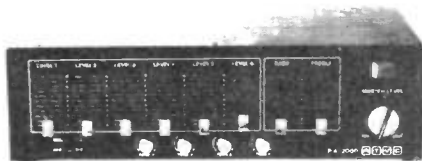
Just requires mains transformer and input/output sockets and a volume control to complete. Supplied with full connection details.



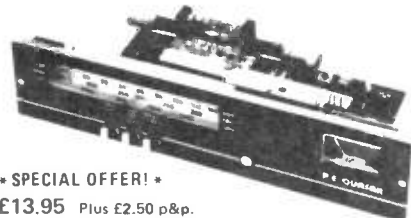
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50 WATT Six individually mixed inputs for two pick ups (Cer. or mag.), two moving coil microphones and two auxiliary for tape tuner, organs, etc. Eight slider controls six for level and two for master bass and treble, four extra treble controls for mic. and aux. inputs. Size: 13¼" x 6½" x 3¾" approx. Power output 50 watts R.M.S. (cont.) for use with 4 to 8 ohm speakers. Attractive black vinyl case with matching fascia and knobs. Ready to use.



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FEATURES: VHF, MW, LW Bands, interstation muting and AFC on VHF. Tuning meter. Two back printed PCB's. Ready made chassis and scale. Aerial: AM - ferrite rod, FM - 75 or 300 ohms. Stabilised power supply with 'C' core mains transformer. All components supplied are to strict P.E. specification. Front scale size: 10½" x 2½" approx. Complete with diagram and instructions.

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ACCESSORY: Stereo/mono mains power supply kit with transformer. **£10.50** plus £2.00 p&p.

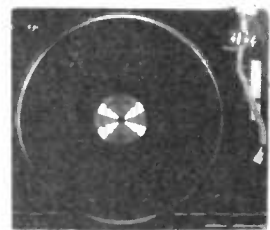


SPECIFICATIONS:

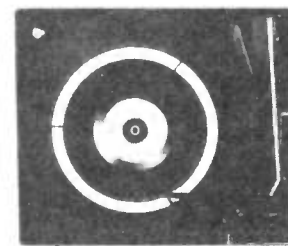
Max. output power (RMS): 125W.
Operating voltage (DC): 50 - 80 max.
Loads: 4 - 16 ohms.
Frequency response measured @ 100 watts 25Hz - 20KHz.
Sensitivity for 100 watts: 400mV @ 47K.
Typical T.H.D. @ 50 watts, 4 ohms: 0.1%.
Dimensions: 205 x 90 and 190 x 36 mm.

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Moving Pictures From WAX – ‘Phonovision’

**Don McLean
G6AWI**
reviews some
Historical TV
experiments

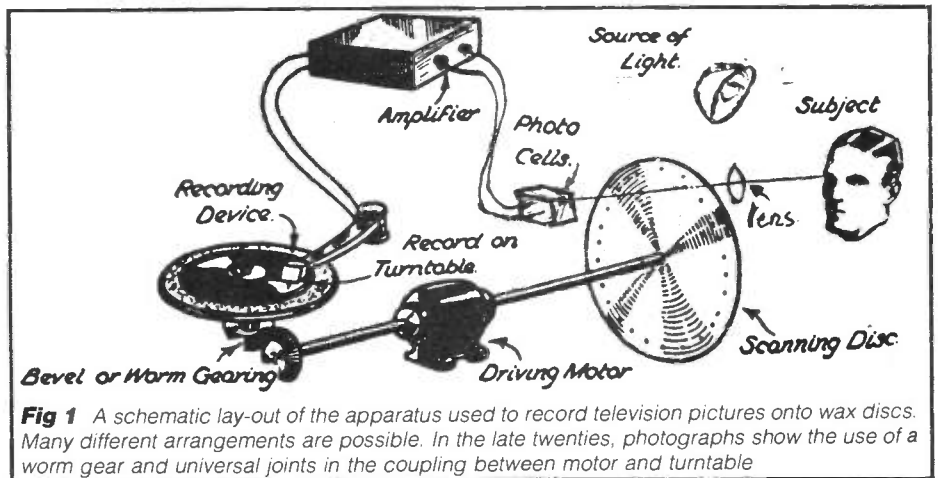


Fig 1 A schematic lay-out of the apparatus used to record television pictures onto wax discs. Many different arrangements are possible. In the late twenties, photographs show the use of a worm gear and universal joints in the coupling between motor and turntable

‘Phonovision’ – the first electrical TV recordings

The first television broadcasts in Britain began in the late 1920's when pictures were transmitted by the BBC using the Baird system. This television system was based on a mechanical approach to the problem of generating and displaying the picture. Each picture was built up from only 30 lines. It was crude even by the standards of the late 1930's when television as we know it first went on the air on a regular basis.

In the early days before 1930, the experimental work done by such pioneers as J L Baird served as a proving ground for the television that we have in our homes today. To Baird, though, must go the credit for the first electrical recordings of television signals and, in 1927, this invention (which he called ‘Phonovision’), was announced. The signal from his camera was recorded directly onto wax discs during the process.

How could wax discs be used to record television pictures in the 1920's when today we have to use advanced techniques and equipment? The answer is that the Baird system was quite different to today's systems and only used 30 lines to make up each picture, whereas we now use 625 lines per picture. The 30 lines of Baird's system were only repeated 12½ times every second to give the illusion of movement but today the picture is shown 25 times every second. Consequently, the Baird TV signal contained much lower frequencies than today's television signal. This allowed the television signal to be transmitted in a voice channel on the medium waveband and also to be recorded onto wax discs.

Features of the recordings

The ‘Phonovision’ recordings had to be played at high speed (250 revolutions per

minute) to give the Baird standard of 750 pictures every minute. We can say directly that there were three 30 line pictures recorded on each turn of the wax disc. It is quite from studying the video signal that the main scanning disc rotated once for each picture (at 750rpm). Hence for each revolution of the wax disc being recorded, the scanning disc made three revolutions.

The direct consequence of such a high speed is that the recordings were very short-lasting, on average, just under one minute at 250rpm.

It is clear that ‘Phonovision’ was not in itself practical and the general public would not have accepted ‘vision-only’ recordings that only lasted one minute.

Synchronisation – keeping the picture steady

Unlike the 30-line transmissions of the time, ‘Phonovision’ recordings were intended to overcome the problem of synchronising the camera in the studio with the home display. Synchronisation

was and still is all important in television in order to keep the displayed picture correctly framed.

When the wax discs were recorded, the scanning mechanism indirectly rotated the recording turntable through a gearing arrangement. This meant that it was only necessary to have an identical linkage between the playback turntable and the display scanning disc when replaying a ‘Phonovision’ disc. Having an identical linkage would ensure that a perfectly stable picture would appear on the display.

This was fine in theory and the process was well publicised at the time but, in practice, all the ‘Phonovision’ discs suffered badly from serious picture distortion.

Recording speed variation

The earliest discs unfortunately suffer from fast fluctuation in the recording speed. This variation appears on the discs themselves and repeats every three pictures (one turn of the disc) randomly varying in size throughout the

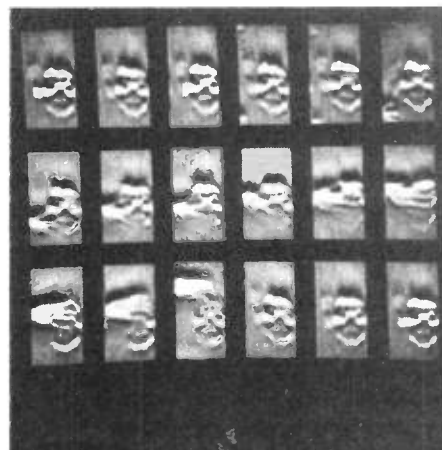


Fig 2 18 frames from the September 1927 disc



Fig 3 A single frame from the September 1927 disc

recording. The speed variation gets less towards the end of the recording, which is the innermost part of the disc.

An eye-witness remembers a 'Phonovision' recording session with the Columbia engineers discussing the disc being cut slipping on the smooth surface of the recording turntable. The very high recording speeds and the use of a heavy cutter arm on the disc increased the possibility of the disc slipping on the turntable and could have caused the speed variation.

Mechanical problems

If the effect of speed variation is removed, a surprising amount of information can be deduced from the picture shape. The misplaced lines of the picture that remain shifted throughout a recording were caused by poor workmanship in the construction of the disc that scanned the scene.

In the two earliest recordings, misplaced lines indicate that there was an error of about a half degree in positioning the 11th and subsequent holes around the circumference of the scanning disc. Each hole on the disc corresponds to a line in the picture. Because the same error appeared on two recordings which were dated four months apart, it is apparent that the same apparatus was used in both recordings.

Large displacement of the lines is evident in the latest of the 'Phonovision' recordings. This March 1928 recording shows great distortion and it is difficult to understand that it was due to poor construction of the scanning disc (particularly because earlier recordings show much less line shift). The shift may be due to vibration in the coupling shaft and bearings that link the scanning disc and the gearing arrangements.

The Major Radiovision disc - not 'Phonovision'

There has been some confusion about what constitutes 'Phonovision' as generated by Baird's late 1920's experiments. In 1935, a double-sided 30-line television disc was manufactured by the Major Radiovision Co.Ltd. and sold through the London store, Selfridges, for 7/6d. This has been claimed to be a 1928 'Phonovision' recording and is the easiest of all to buy, but for the serious collector it is important to establish the truth.

Table 1 summarises the main features of all the discs that have been studied from that period. The evidence shown here indicates that it is extremely unlikely that the Major Radiovision recording was made in 1928. It seems more likely that it was made during 1934-35 and may be as early as 1932. Another similar recording on a Major Radiovision disc has been associated with the 1934 period. The higher quality of these recordings excludes them from being copies of the earlier discs and the quality difference surely reflects the improvement in recording techniques and materials from 1927 to 1935. Despite the higher quality, the subject material of the later discs is of little interest today, showing as it does motionless cartoons of objects and people.



Fig 4 'Miss Pounsford' from the March 1928 disc

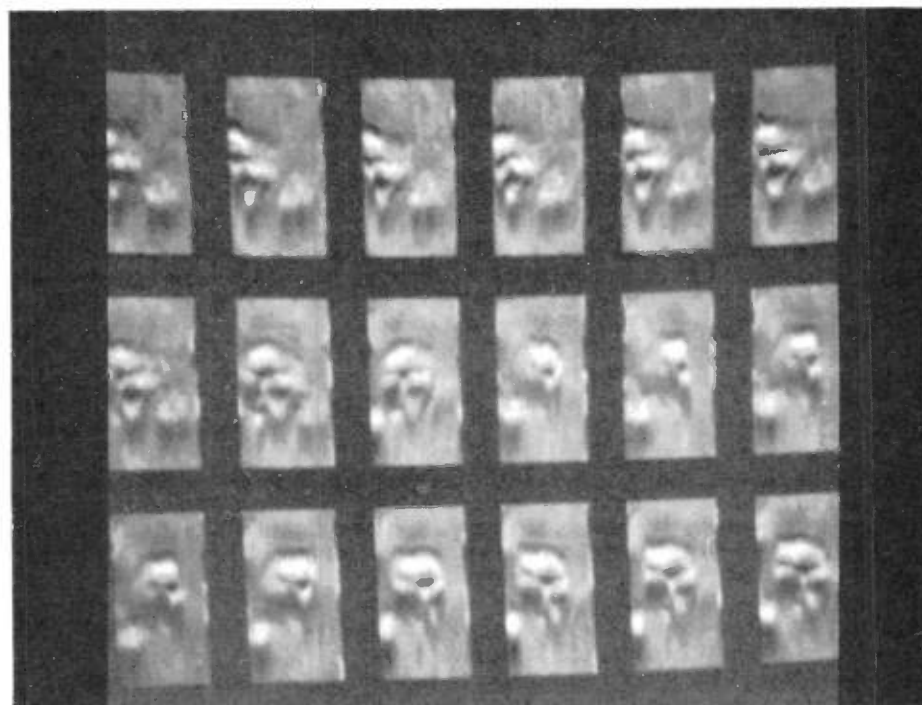


Fig 5 18 Frames from the March 1928 disc

'Alive' pictures

What material did Baird use for these 'video discs'? Although we might expect to see engineering test patterns, we have been treated to pictures of 'live' subjects. One disc (September 1927) *Figure 2*, shows the face of a ventriloquist's dummy moving from side to side. At one point a hand comes into view, covers the dummy's face and quickly disappears. A few seconds later the fingers re-appear, 'wagging' in a life-like manner beside the face.

A recording made a few months later (in January 1928) shows the head of a man. There is very little side-to-side movement and the subject only moves to and from the camera into a pool of light. Lighting in this and the previous recording seems to come from above the subject and is angled steeply down-

wards. The nose, forehead and chin appear in succession as the face comes into the light. The last feature to come into view is the man's shoulders.

A later disc (March 1928) *Figure 5*, is entitled 'Miss Pounsford' and is signed by Baird himself. This recording does not suffer from the speed variation that plagued the earlier discs. However, the scene is badly distorted by the static pattern already mentioned. Once this effect is removed, the detail and movement become clear showing a view of a lady's head and shoulders. She turns from side-to-side, opens her mouth and shows the ringlets in her hair when she turns her head.

Assessing 'Phonovision'

In order to reproduce 'Phonovision' pictures, the signal from the wax disc is



Fig 6 Label of the September 1927 'Phonovision' recording



Fig 7 Label of the March 1928 'Phonovision' recording

Table 1 — Summary of Features

	Recordings dated 1927-1928	Major Radiovision and its sister disc
Playback speed	250rpm	78rpm
Duration	1 minute	5 minutes
Scene content	Various heads clearly in quite agile motion	Sequences of cartoon stills — no movement
Picture quality	Very poor requiring a lot of enhancement	Extremely good with very little enhancement needed
Identification	Consistent sequence of catalogue numbers	No catalogue numbers
Synchronisation	Directly from turntable rotation	Derived from the video signal



'recorded' into a home computer. A program is then run to remove most of the distortion and the result is shown on a modern TV display. The inherent limitations of a small computer mean that only a few seconds of the recording can be processed at a time, but the capability certainly exists today to process the entire contents of one disc and display the end product as a movie. The cost and effort of the process would, however, be considerable and details of such complex processing are beyond the scope of this article. A more comprehensive account of the methods used in reproducing these pictures was published in the October 1983 issue of 'Wireless World'.

This recent study of historical recordings and their reproduction does not illustrate the power of the computer as much as it emphasizes the poor quality of the recordings. It would not be recommended that the 30-line Baird system is judged by the sole evidence of the wax discs because they were made for test purposes only and are not necessarily representative of what was possible at that time.

Thanks go to T H Bridgewater, W C Fox, R M Herbert, B Clapp, J Ive, D P Leggatt, P Waddell and Mrs Baird for their help in uncovering the secrets of Phonovision.
Don McLean is a Consultant in Image Processing with Logica UK Ltd

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Transmitter 6 Channel adaptor	70MCO6T	19.85	11.95
Receiver 6 Channel Adaptor	70MCO6R	27.15	19.95
Synthesiser (2PCB's)	70SY25B	84.95	60.25
Synthesiser Transmitter Amp	A-X3JU-06F	27.60	17.40
Synthesiser Modulator	MOD1	8.10	4.75
Bandpass Filter	BPF433	6.10	3.25
PIN RF Switch	PS1433	7.10	5.95
Converter (2M or 10M if)	70RX2/2	27.10	20.10

TV Products			
Receiver Converter (Ch 36)	TVUP2	26.95	19.60
Pattern Generator	TVPG1	39.93	32.53
TV Modulator	TVM1	8.10	5.30
Ch 36 Modulator	TVMOD1	10.15	6.95
3W Transmitter (Boxed)	ATV-1	87.00	-
3W Transceiver (Boxed)	ATV-2	119.00	-

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3W to 10W	70FM3/10	19.75	14.20
10W to 40W	70FM40	58.75	45.20
Combined Power Amp/Pre-Amp	70PA/FM10	48.70	34.65

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3W to 10W (Compatible ATV1/2)	70LIN3/10E	39.10	28.95

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Piptone	PT3	6.90	3.95
Kaytone	PTK3	8.20	5.95
Relayed Kaytone	PTK4R	9.95	7.75
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UNIVERSAL NICAD CHARGER

by D R Locke

The unit described here will provide a constant current source for charging batteries up to a voltage of 9v

With the recent greater emphasis on portable equipment, NiCad batteries are to be found more and more. Most battery manufacturers recommend that these batteries are charged from a constant current source in order to obtain the best possible charge condition. The unit described here will provide several preset constant currents through cells up to 9V in voltage.

Use of this unit offers a considerable

improvement over the familiar constant voltage or series resistor charging systems and thereby aims to ensure an extended working life for the battery.

The circuit

The circuit diagram is given in *Figure 3*. The mains input is stepped down to 12V by transformer T1, rectified by D1-D4 and smoothed by C1 to produce about 14.5Voc

at point A. The current/load sensing is carried out by the 7805 regulator (IC1). Capacitor C2 and diode D5 are included to provide stability; if these are omitted, the regulator is likely to oscillate and overheat. Switch S1 switches different values of R into the circuit to control the preset current limit.

Charge time with the unit is dependent upon the cell state and capacity but a 1Ah cell charged at 100mA will take about 10

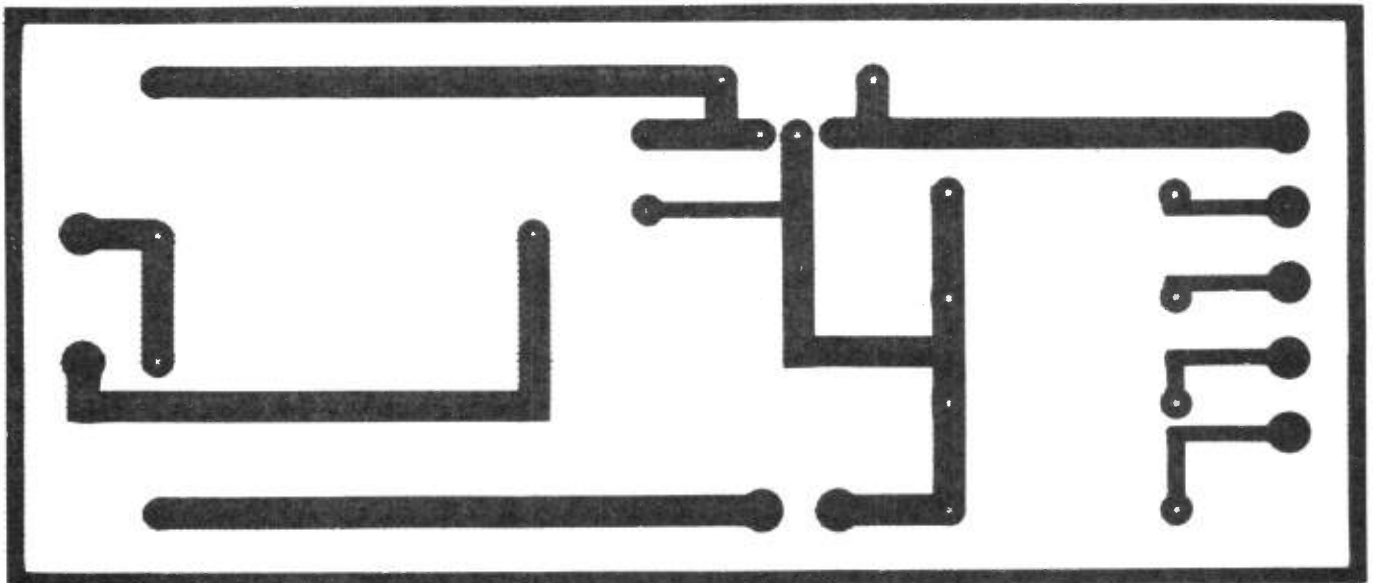


Fig 1 PCB foil pattern

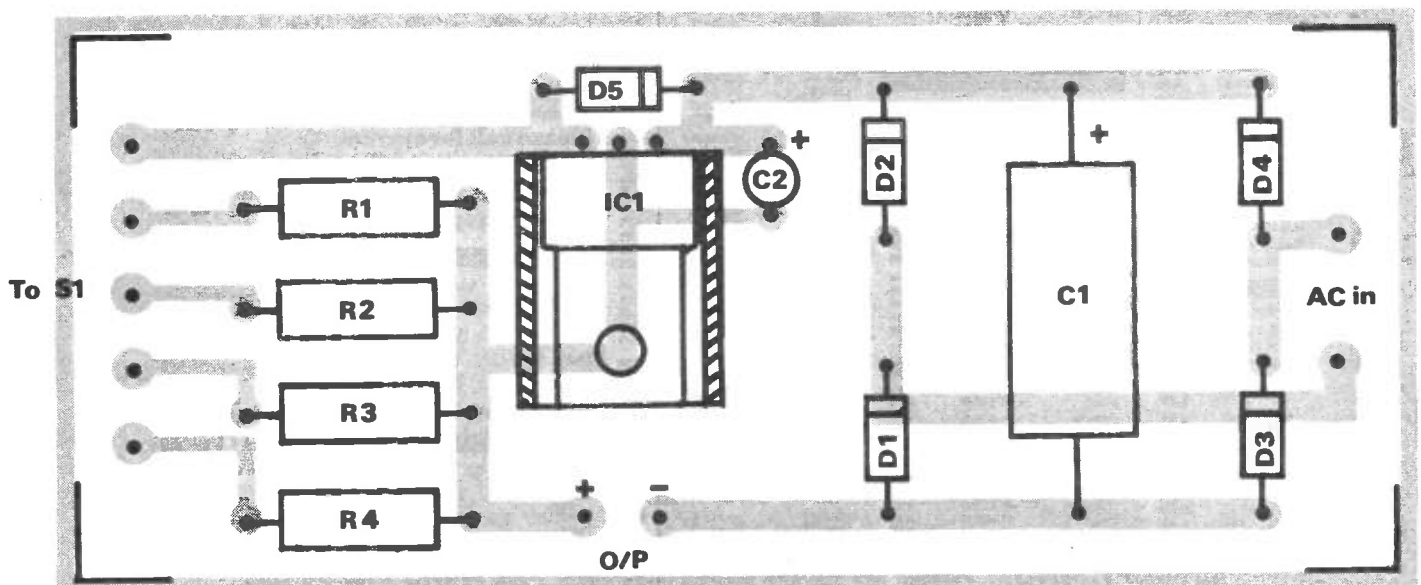


Fig 2 Component overlay

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BC307	58-00307	0.08
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2N2905	58-02905	0.25
2N3905	58-03905	0.10
2S8646A	58-03646	0.30
2S8648A	58-03648	0.40
2SD666A	58-03666	0.40
2SD668A	58-03668	0.30
2SA872A	58-02872	0.19
2SA1084E	58-01084	0.25
2SA1085E	58-01085	0.25
2SC1775A	58-01775	0.19
2SC2646E	58-02646	0.24
2SC2547E	58-02547	0.24

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BF241	58-06241	0.18
BF273	Use BF241	
BF274	Use BF241	
BF362	58-06362	0.49
BF440	58-06440	0.21
BF441	58-06441	0.21
BF479	58-06479	0.66
BF679S	58-06679	0.55
BFR91	58-07091	1.33
BFR96	58-07096	1.45
BFT95	58-10095	0.99
BFW92	58-08092	0.60
BFY90	58-09090	0.90
NE21936	58-21936	5.00
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2N2369A	58-02369	0.38

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BF961	60-06961	0.70
BF963	60-06963	0.99
BF981	60-06981	1.20
J310	59-02310	0.80
J176	59-02176	0.65
MEM680	60-05680	0.75
2SK55	59-01055	0.37
2SK168	59-01168	0.37
3SK45	60-04045	0.49
3SK51	60-04051	0.54
3SK60	60-04060	0.58
3SK81	60-04081	1.32
3SK88	60-04088	1.20
40673	Replaced by 3SK51	
40822	Replaced by 3SK45	
3SK112	60-04112	4.60

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BD180	58-15180	0.41
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TIP32A	58-15032	0.35
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2SJ49	60-01049	3.10

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2SJ83	60-01083	3.55
2SK135	60-00135	4.25
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TDA1061	12-10617	0.95
PW02	12-62006	0.75
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IN4002	12-40026	0.07
IN4004	12-40046	0.07
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IN5404	12-54046	0.16
IN6263	12-62637	0.62

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BA121	12-01215	0.30
BB105B	12-01055	0.30
BB109B	12-01095	0.27
BB204B	12-02045	0.36
BB212	12-02125	1.95
ITT210	12-02105	0.30
MVAM115	Use KV1235	
MVAM125	Use KV1225	
KV1210	12-12105	2.45
KV1211	Use KV1236	
KV1225	12-12255	2.75
KV1235	12-12355	2.75
KV1236	12-12365	2.55
KV1310	12-13105	0.40
KV1320	12-13205	0.40

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ZNA234	61-02340	8.50
U2378	61-00237	1.28
U2478	61-00247	1.28
U2578	61-00257	1.28
U2678	61-00267	1.28
LM301AH	61-03010	0.98
LM301AN	61-03011	0.44
LM308CN	61-03081	0.65
LM311CN	61-03011	0.46
LM324	61-03240	0.48
LM339N	61-03390	0.88
LM346	61-00346	3.72
LF347	61-00347	1.82
LM348	61-03480	1.26
LF351	61-03510	0.49
LF353	61-03530	0.78
LM380N	61-00380	1.00
LM381	61-00381	1.81
LM382	61-00382	1.81
ZNA19CE	61-00419	1.98
ZNA423	61-02430	1.40
ZN425E/B	61-04250	4.50
ZN426E/B	61-04260	3.48
ZN427E/B	61-04270	6.80
ZN428E/B	61-04280	5.50
ZN429E/B	61-04290	2.50
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NE542	61-05420	1.20
NE544	61-00544	1.80
NE555N	61-05550	0.21
NE556N	61-05560	0.50
SL560C	61-05600	2.24
NE564	61-00564	4.29
NE565	61-00565	1.00
NE566	61-00566	1.40
NE567	61-00567	1.30
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JA710HC	61-07100	0.64
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JA709PC	61-07111	0.22
JA741CN	61-07470	0.70
JA748CN	61-04780	0.40
JA758	61-00758	2.35
TBA820M	61-00820	0.78
TDA1028	61-01028	2.11
TDA1029	61-01029	2.11
TDA1034	61-01034	2.10
LM1035	61-01035	4.50
LM1054M	61-01054	1.45
TDA1062	61-01062	1.95
TDA1072	61-01072	2.69
TDA1074A	61-01074	5.04
TDA1083	61-01083	1.95
TDA1090	61-01090	3.05
HA1196	61-01196	2.00
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TDA1220	61-01220	1.40
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HA1370	61-01370	1.90
HA1388	61-01388	1.75
LM1458N	61-01458	0.45
MC1496P	61-01496	1.25
SL1610	61-01610	2.10
SL1611	61-01611	2.60
SL1612	61-01612	2.10
SL1613	61-01613	2.35
SL1620	61-01620	2.17
SL1621	61-01621	3.50
SL1623	61-01623	3.50
SL1625	61-01625	1.90
SL1630	61-01630	1.62
SL1640	61-01640	3.50
SL1641	61-01641	2.10
MC1648	61-01648	3.25
TDA2002	61-02002	1.25
ULN2240	61-02240	3.25
ULN2242	61-02242	3.05
ULN2283	61-02283	1.00
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KB4423	61-04423	2.30
KB4424	61-04424	1.85
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KB4431	61-04431	1.95
KB4432	61-04432	1.95
KB4433	61-04433	1.72
KB4436	61-04436	1.53
KB4437	61-04437	1.75
KB4438	61-04438	2.22
KB4441	61-04441	1.35
KB4445	61-04445	1.29
KB4446	61-04446	1.75
KB4448	61-04448	2.65
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SL6640	61-06640	2.30
SL6690	61-06690	3.75
SL5700	61-06700	3.20
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ICM7555	61-75550	0.98
ICL8038CC	61-80380	4.50
MSL9362	61-09362	1.75

Device	Stock No.	Price
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TK10321	61-10321	2.75
HA11223	61-11223	2.15
HA11225	61-11225	1.45
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UNIVERSAL NICAD CHARGER

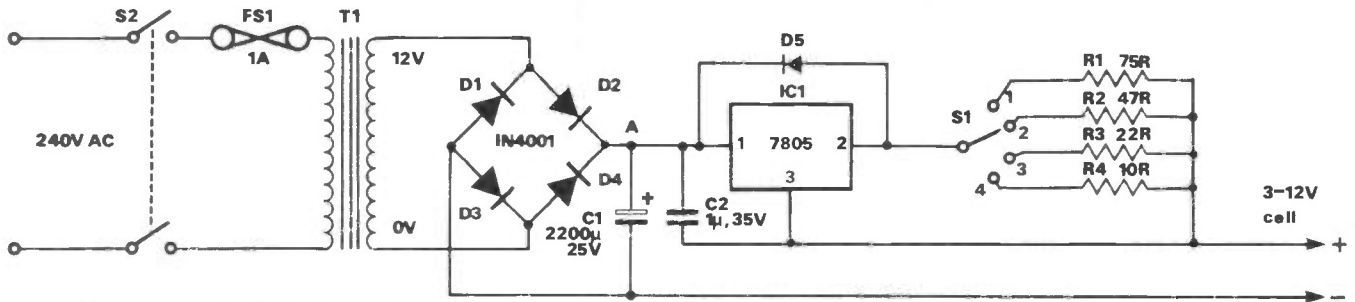


Fig 3 Circuit for the universal NiCad charger

S1 position 1 current limit 66 mA
 " 2 " " 100 mA
 " 3 " " 250 mA
 " 4 " " 500 mA

hours. The manufacturer's information will give the optimum charging rate for the cell. This should be followed as closely as possible.

Construction

The prototype unit was constructed in veroboard taking care that the regulator was mounted on a suitable heatsink. Naturally, it is also possible to mount the components on a PCB, a design for which is given in Figures 1 and 2. As the regulator case is not connected to ground (0V), the case itself cannot be used as a heatsink unless some suitable insulating kit is used when mounting the regulator. A suitable heatsink is one of the TV40-type. A 1A fuse is included on the mains supply side of the unit for

safety. The wiring is quite straightforward but care should be taken to ensure that the mains wiring is routed well away from the outputs.

The prototype was built in a plastic verobox but any suitable plastic or metal

box could be used. If a metal case is used, the case body should be connected to earth.

The regulator itself incorporates overload and overcurrent protection and will start to limit the current at 1A.

PARTS LIST

Resistors

R1	75Ω 0.5W
R2	47Ω 1.0W
R3	22Ω 2.5W
R4	10Ω 2.5W

Capacitors

C1	2200µF 25V
C2	1µF 35V tant.

Semiconductors

IC1	7805 voltage regulator
D1-D5	1N4001

Miscellaneous

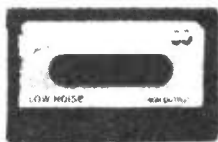
A 1-pole 4-way rotary switch; 1 transformer (240V primary; 12V secondary); 1 fuseholder and 1A fuse; 1 veroboard/PCB; a suitable case

The PCB for this project is available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM6 6RR at £1.65 each.

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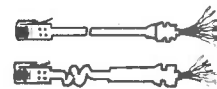


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Phono Plug To Co-Ax Plug	85p
2 x 3.5 Jack to 2 x 3.5 Jack	85p

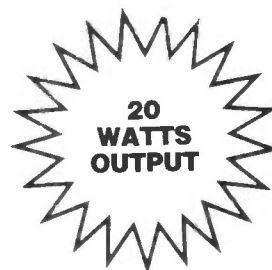
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IF AMPLIFIERS-1

LINEAR IF'S FOR AM AND SSB

Intermediate frequency amplifiers tend to be the Cinderella circuits of communications design. Designs can range from the very basic to the outlandish and still provide a similar perceived performance, why?

IF's and buts

If amplifiers are RF amplifiers operating at a fixed single frequency. An IF amplifier may operate between 455kHz (a very familiar place) and 1.8GHz, it's a matter of the designer's choice. The factor that is most likely to determine the choice of IF frequency is likely to involve some consideration of the filtering requirements of the receiver system concerned.

In the early days of communication receiver design, filters were pretty much limited to what could be wrung from L/C (inductor and capacitor tuned circuits) combinations. The famous AR88 and many of its era used very low frequency intermediate frequencies in order to achieve an acceptable degree of selectivity consistent with a reasonable bandpass - and centre frequency stability.

Most such sets were inspired by aero or general military applications and the military have always tended to be unsympathetic towards designs that are only suitable for operation in a domestic environment.

Putting these design requirements together meant that IF's in the region 80kHz to 100kHz were required, which immediately pointed out other features of the design, e.g. the image rejection ratio of a receiver is only as good as it's RF selectivity permits. To differentiate between 29MHz and it's image at 29.2MHz (assuming a 100kHz IF is in use) requires a degree of RF selectivity that simply cannot be achieved. (Extremes aside).

Q and bandwidth

Assuming a reasonably practical Q factor for the IF tuned circuits (between 150 and 200), there was no alternative available. The problem of image rejection could only be cured by placing the IF at a higher frequency where the wanted and image channel frequencies were more widely spaced. If an IF of 10.7MHz were to be used in the above example, the image frequency would be at (29+21.4MHz), which can be reasonably well avoided by use of the combination of a low pass filter and signal frequency tuned filters in the RF stages. (Figure 1) But a Q of 200 at 10.7MHz yields a bandwidth of 53.5kHz: hardly the sort of

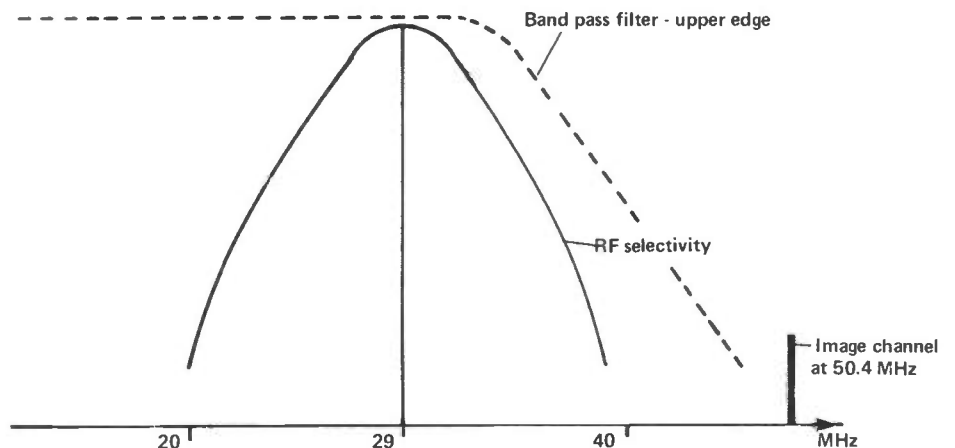


Fig 1 10.7MHz IF considerations

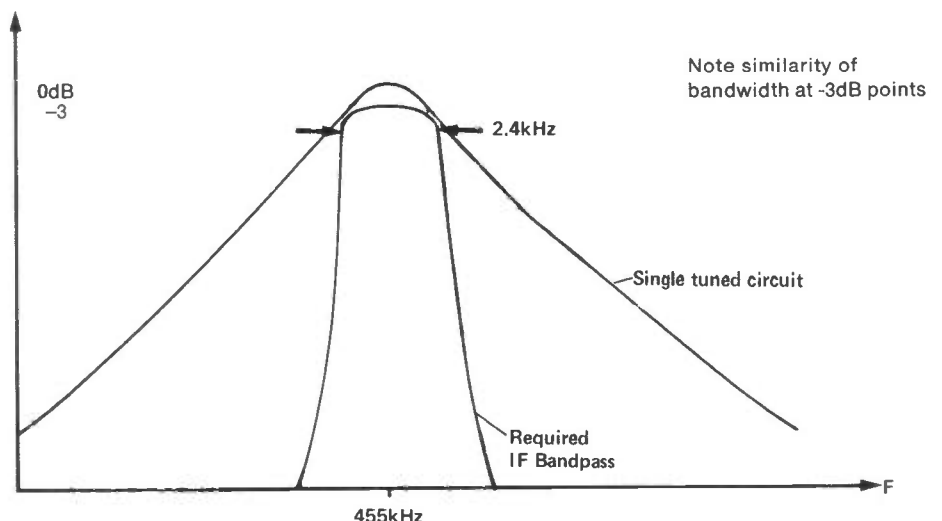


Fig 2 Required bandpass for AM/SSB compared with single tuned circuit response

thing to excite the average SSB enthusiast where 2.4kHz is the norm. A second IF conversion is required to take the result to a more manageable frequency. At 455kHz, a Q of 200 leads to a bandwidth of 2.3kHz at -3dB. This is getting warm, but the formulae relating Q and bandwidth need to be watched carefully ($Q = \text{IF centre frequency} / \text{IF bandwidth at } -3\text{dB}$), since the shape of the bandpass of a single tuned resonant circuit bears little relation to the ideal bandpass for an

AM or SSB signal (Figure 2). The receiver IF filter bandpass is a more complex shape (generally the Butterworth) built from multiple pole filtering techniques. Without going into detail, this means that although a 3dB bandpass can be achieved, this does not necessarily imply that the skirt of the bandpass will be acceptable.

Crystal filters

Modern receiver design has set the IF

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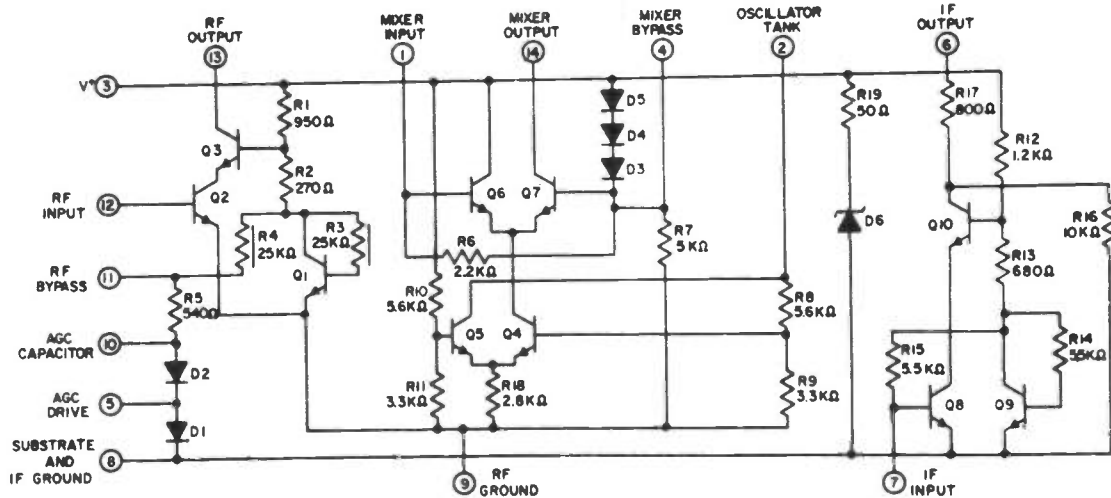


Fig 3a Diagram of CA3123E

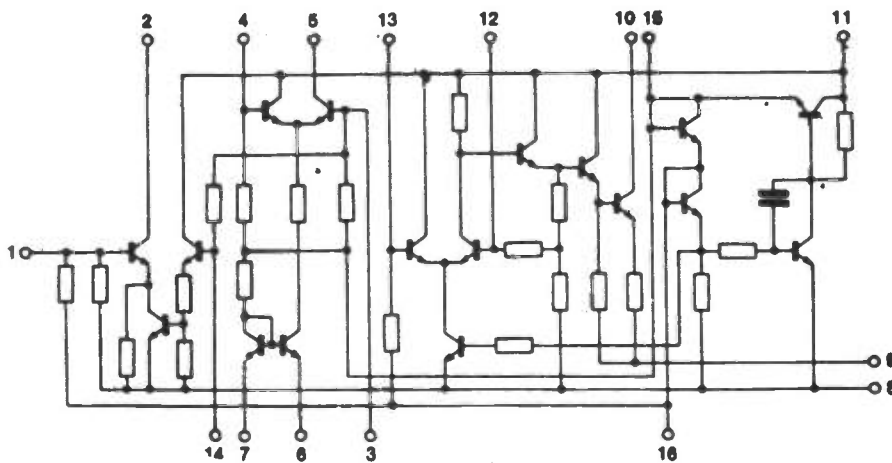


Fig 3b Diagram of TBA651

generally above 45MHz. This is almost exclusively due to the improvement in high frequency crystal filters and the corresponding improvement in the price/performance ratio. The advantages of placing the IF at this frequency are many – the most significant being that an image frequency so far removed from the wanted RF signals means that gang-tuned RF selectivity is unnecessary and relatively broadband (band-pass) filters can take its place.

Low cost crystal filters at 45MHz cannot provide more than roofing selectivity (the term widely adopted to mean 'preliminary' selectivity). Even some very expensive ones cannot measure up to the requirements of the modern IF specification, so a second conversion is essential. However, some filters are specifically tailored for use with a second IF of 455kHz and actually drop a carefully construed notch in their bandpass at the image point (45.910kHz).

What's in a frequency?

Not a lot these days. Once again, early IF's were influenced by the way in which valves ran out of steam at higher frequencies, but these days very few semiconductor devices are going to be frequency limited, unless by design. An IF amplifier provides a substantial amount of gain at a single frequency. Anyone with practical experience will confirm that the higher the frequency in use, the more likely are the problems that arise from positive feedback and self-induced oscillation because the impedance of the extraneous path between the input and output inevitably drops as the frequency increases.

This philosophy once led to IF designs that went to some trouble to place a few inches between the input and the output, with the amplifier arranged in a neat line with plenty of screening. However, modern IC's provide less than 10mm in which everything has to happen so tech-

niques have grown up to suit this state of affairs.

Implementations

The original transistor IF amplifier systems are well illustrated by reference to either a cheap transistor radio or a radio control receiver circuit. The 'classic' three transistor IF system is one that has stood the test of time and one that any aspiring communications engineer really ought to try and master by way of experience and penance. The simplest circuits in the world frequently have the most pitfalls. Many millions of exceptionally cheap transistor radios operate with circuits that do not inspire the admiration of the communication engineer but evidently satisfy the requirements of the user.

Integrating this approach has been tried by Texas Instruments – who merely put the discrete packages onto one cheap IC. Needless to say, it suffered the

COMMUNICATIONS BUILDING BLOCKS

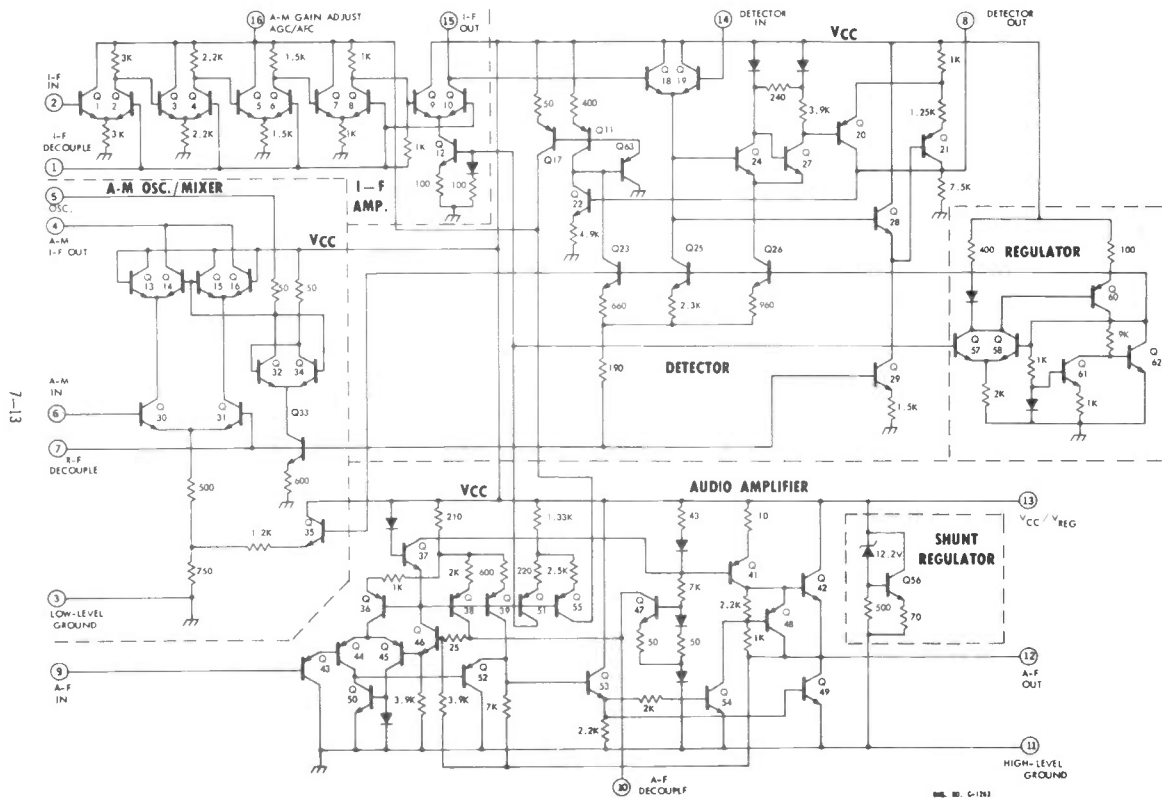
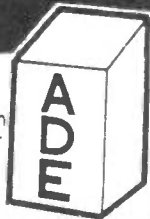


Fig 4a Inside the ULN2204

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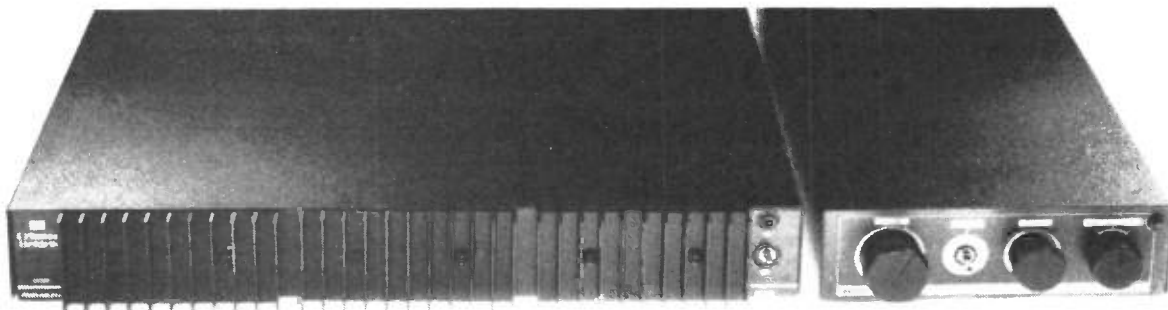
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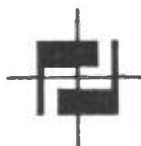
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John Hardaker describes the way in which he uses the R&EW Tiny Basic Development System to tell the time

The R&EW Z8 Development System was described by its designer, Jon Burchell, in February '82, March '82 and April '82 issues of the magazine.

Having assembled the Z8671 card into a Vero KM6 rack, connected up the power supply and VDU, and checked that everything was operational, it was considered useful to try reading and writing to an external device. The Hitachi HD 146818P was chosen for this exercise because its data sheet said that it was compatible with 8-bit microprocessors – and because, at around £5, it is not expensive.

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- Binary or BCD representation of time and calendar
- Interfaced with software as 64 RAM locations, comprising 14 bytes of clock and control register and 50 bytes of general purpose RAM

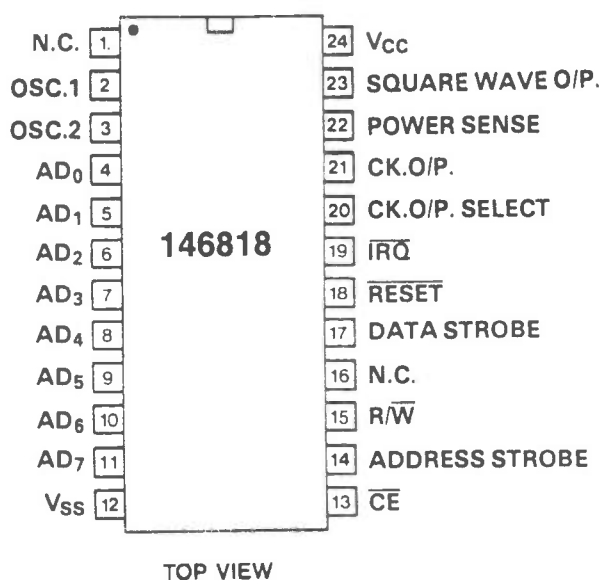


Fig 1 146818 pin-out

The pin-out of the device is shown in Figure 1.

Putting the idea into practice

Connecting the 146818 to the TBDS board proved simple as only the AS (Address Strobe) line needed inverting.

REAL TIME CLOCK

The resulting circuit, shown in *Figure 4*, was wired with Verowire on a standard Eurocard. However, care had to be taken with the crystal oscillator part of the circuit because this is susceptible to pick-up.

The other point to note is that pin 11 of IC9 on the TBDS board is linked to line a15 on the edge connector of the present circuit. READ or WRITE %4xxx selects this line. The short routine that was written to set up and read the 146818 is shown here as *Program 1*.

Initially, a starting address of %3000 was selected but then the program didn't behave as expected. The reason for this is that, while addresses 1000-2FFF are allocated to RAM, the top of RAM is used for Z8 variable and stack storage. Now, at 'switch on', the microprocessor looks for the top of RAM by looking for an empty address space: thus it is essential that the real-time calendar clock (or, indeed, any such add-on) is placed *non-contiguously* with the Z8 RAM so that it is not 'labelled' as part of main system RAM and is thus 'safe'. The starting address shown here - %4000 - proved quite safe, as is demonstrated by the sample output shown below the program.

Program

```

LIST
10 REM ; SHORT ROUTINE TO SET UP AND READ THE HD 146818 REAL TIME CLOCK.
20 REM ;
30 REM ; TYPE RUN TO READ CLOCK AND GOTO 100 TO SET UP. J.H.H. 7/83
40 REM ;
90 GOTO 320
100 @%400A=%X00:@%400B=%X80
140 "YEAR":;INPUT A
150 "MONTH":;INPUT B
160 "DATE":;INPUT C
170 "DAY":;INPUT D
180 "HOUR":;INPUT E
190 "MIN":;INPUT F
300 @%4009=A:@%4008=B:@%4007=C
310 @%4006=D:@%4004=E:@%4002=F:@%4000=0
320 @%400B=%X16
340 IF @%400C=%X90 GOTO 400
350 GOTO 340
400 " THE TIME IS ";@%4004;" Hrs ";@%4002;" Mins and ";@%4000;" Secs";
410 IF @%4006=1 " Sunday ";
420 IF @%4006=2 " Monday ";
430 IF @%4006=3 " Tuesday ";
440 IF @%4006=4 " Wednesday ";
450 IF @%4006=5 " Thursday ";
460 IF @%4006=6 " Friday ";
470 IF @%4006=7 " Saturday ";
500 PRINT @%4007;" / ";@%4008;" / ";@%4009
520 REM ; LINE 530 IS OPTIONAL
530 GOTO 340
600 STOP

RUN
THE TIME IS 11 Hrs 28 Mins and 14 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 14 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 15 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 16 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 17 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 18 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 19 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 20 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 21 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 22 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 23 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 24 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 25 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 26 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 27 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 28 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 29 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 30 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 31 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 32 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 33 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 34 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 35 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 36 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 37 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 38 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 39 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 40 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 41 Secs Monday 25/7/83
THE TIME IS 11 Hrs 28 Mins and 42 Secs Monday 25/7/83
    
```

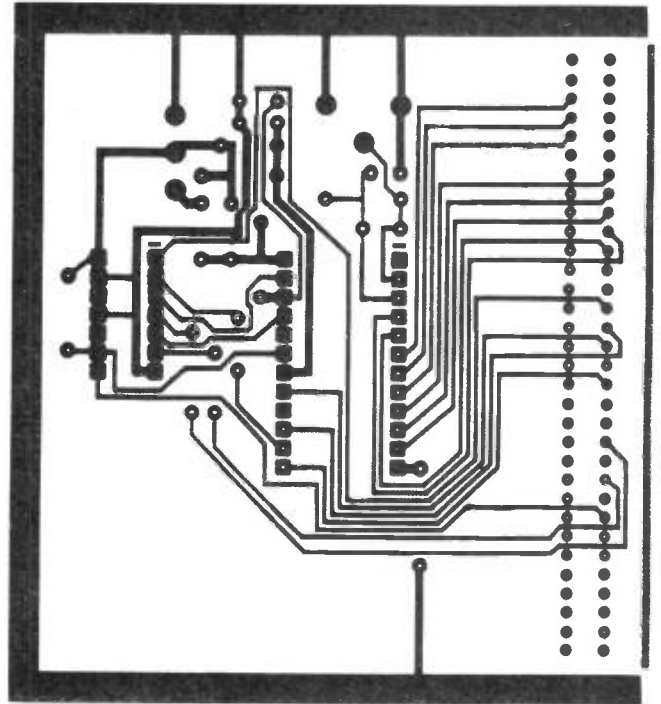


Fig 2 PCB foil pattern

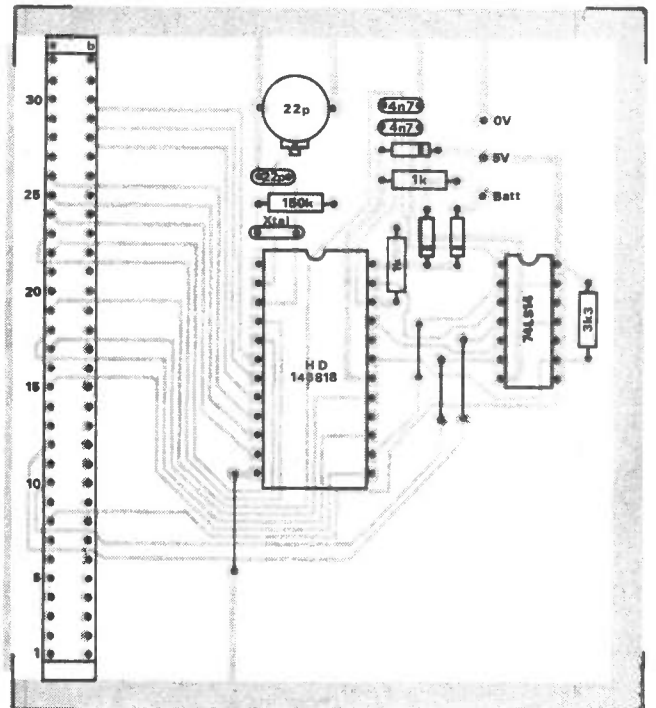
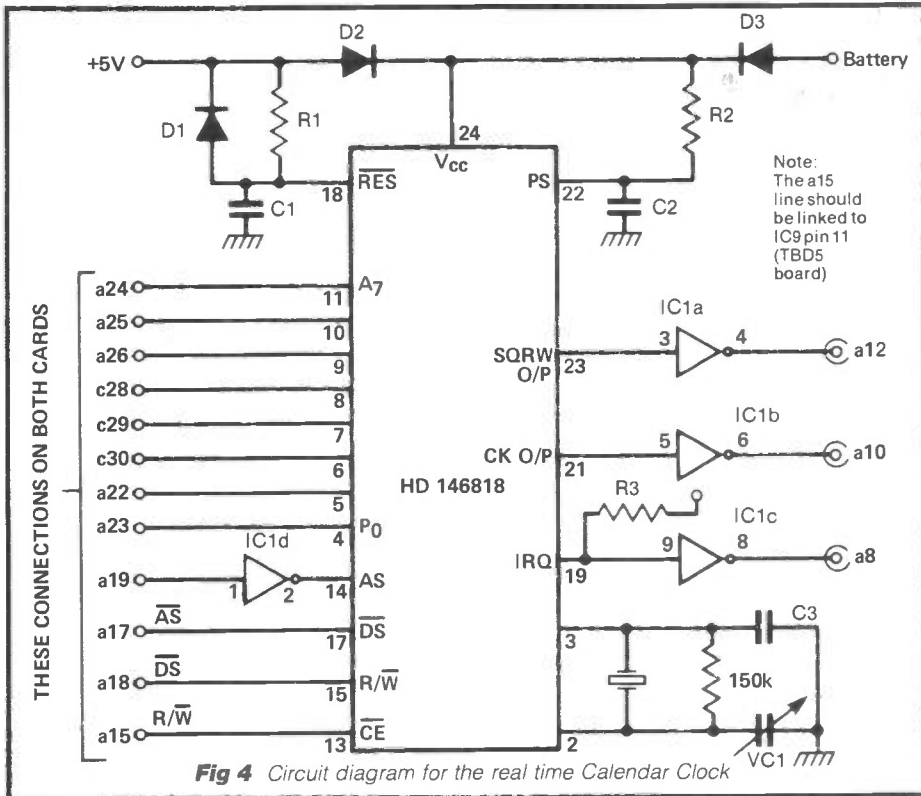


Fig 3 Component overlay

REAL TIME CLOCK



REAL TIME CALENDAR CLOCK

PARTS LIST

Resistors

R1, R2	1k, 5%, 1/8W
R3	3k3, 5%, 1/8W
R4	150k, 5%, 1/8W

Capacitors

C1, C2	4700pF, fixed ceramic
C3	22pF, fixed ceramic
VC1	Variable 3 to 40pF, Mullard 808/809 series

Semiconductors

IC1	Hex inverter, 74LS14. Two gates unused. Vcc pin 14 (5V), 0V pin 7
-----	---

Miscellaneous

X1	Crystal, frequency 4-194304MHz
----	--------------------------------

NOTE: Parts are available from Cricklewood Electronics or STC Harlow. Both stock IC's and crystal. The Battery is 3.6V PCB mounting

PCB

The PCB for this project is available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM6 6RR at £2.45 each.

Postscript

The 146818 is capable of much more than this short program uses. The data

sheet (to be found, for example, in the Hitachi Databook) provides full information on this useful device.

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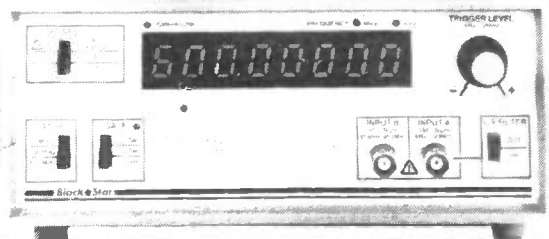
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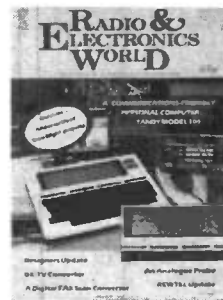
JUNE 1983

Projects — RF/RGB TV Interface (switchable converter); Synthesiser Control System (70cm and 2m bands); Data Brief 1-Universal Counter; Data Brief 2-Preamplifier; Wideband LCD-DFM; 2m Update; FRG7700 Memory Expansion; 100W Power Amplifier II. **Features** — Optical Astronomy; Zilog Z8000; Weather Satellite Reception. **Reviews** — AMS1 (Audio Measuring System); GSC 50000 (latest counter/timer); ICR70/R2000 Receivers; Circuit Modeller (CAD for CPM)



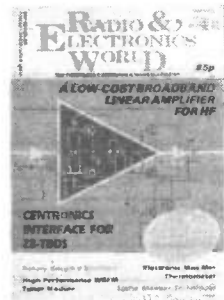
JULY 1983

Projects — Radio Amateur's Test Card; Central Heating Controller; Data Brief 1-DC/DC Converter; Data Brief 2-Up/Down Counter; TX10-RGB (another conversion); Z8 Backplane; Universal interface; Synthesiser Control System II; Solid State Coupler; SSB Adaptor for the SX200-N; Digital Capacitance Meter; DTMF Signalling System; PF1 Conversion. **Features** — RF TMOS; Zilog Z8000; HF Receiver Performance; Signal Analysis; RF Filters II; Pass Band Tuning Techniques; ATV on the Air, new series for amateurs. **Reviews** — Sony TC-DSM (Live Performance Recorder); Datong ANF (Removes Heterodynes); PMS PROM1 (Plug-in Programming)



AUGUST 1983

Projects — Analog Probe; Data Brief 1-Tape Controller; Data Brief 2-RMS-to-DC Converter; Synthesiser Control System III; Crystal Reference; Test Card EPROM Expansion; Continuity Tester; WB RF Amplifiers (Two basic designs); DX Converter. **Features** — Euro-broadcast TV Services (Station information); Zilog Z8000; Polar Orbiting Satellites; Digital FAX Conversion (More on Meteosat); ATV on the Air; HF Rx II. **Reviews** — PDF-11M; TV Aerials; Tandy Model 100 (Communications computer?); 2m Synthesiser



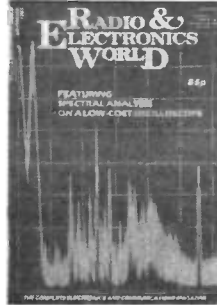
SEPTEMBER 1983

Projects — Max/Min Thermometer; 4 Channel Audio Mixer Morse Key Oscillator; Wideband FM Stereo Tuner Module I; Rotary Encoder Interface (to Control TTL); Centronics Interface for Z8-TBDS (Parallel printer interface); Linear HF Power Amplifier; **Features** — Weather Fascimile Reception; Zilog Z8000; Data Brief 1-ZN419CE Servo IC



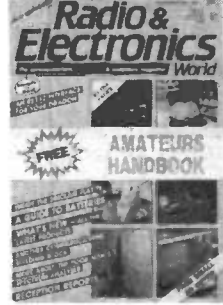
OCTOBER 1983

Designs — Modular Communication Systems Part 1; 4 Channel Audio Mixer Part 2; Tone Bursts; PF70 Conversion. **Features** — Noise Blanking Techniques; The Lambda Diode; A Guide to HF Coils Part 1; The Chromicor (Colour Processing); Timeplex; Data Brief — The NEC PC1037H Double Balanced Modulator; Amateur Radio World. **Reviews** — Tandy VSC-1000 (Variable Speech Control); Yaesu FT-77 (Solid State HF Transceiver)



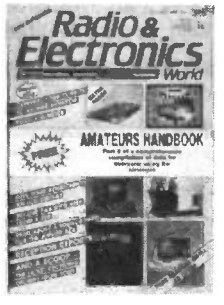
NOVEMBER 1983

Designs — Communications Building Blocks (Front Ends); Poor Man's Spectrum Analyser; Wideband FM Stereo Tuner Module Part 2; 4 Channel Audio Mixer Part 3; Three Digit Timer. **Features** — Squelch Systems; Expansion Bus (First add-on — A light pen); A Guide to HF Coils Part 2; Data Brief — NE564 PLL Tone Decoder. **Reviews** — Meteor 100, 600, 1000 (All-British Frequency Counters); Personal Pearl (For text and information manipulation)



DECEMBER 1983

Designs — Poor Man's Spectrum Analyser Part 2; Communications Building Blocks Part 2; A 4001/4011 Tester; Continuity Tester. **Features** — Inside the Sinclair Flat TV. An in-depth probe; A Circuit Designers Guide to Batteries; Data File on Op-Amps Part 1; Metal Detectors in Warfare; Data Brief 1-LM1821S Video IF PLL Synchronous Detector; Data Brief 2-SL6270 Gain Controlled Audio Amplifier; An RS232C Interface for Your Dragon 32. **Reviews** — ALDEN Weather Chart Recorder Kit; Digithurst MicroSight 1.



JANUARY 1984

Designs — Communication Building Blocks (Active Antennae); FAX Receiver; RGB Interface for the Ferguson TX-90; A Couple of Voltage Detectors; LCD Capacitance Meter; Cymar Q-meter (An aid to winding coils); Zener Diode Checker; A Drinker's Delight; LCD Display Option for the Rewlichron II. **Features** — A Novel Receiver (Sony); Capacitors for Coupling, De-coupling and Filtering; Data File on Op-Amps Part 2; Farewell to Test Card 'F'; A Soundboard for the Jupiter Ace; Data Brief — MC1377 Colour Signal Encoder.

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Computers, Communications and Applications

A brief survey of the current trends in the use of computers, in which we discuss those of interest to the radio amateur

Learning to love the micro

R&EW readers tend to regard computers as the work of the devil. Suggestions are made to the effect that if readers want to read about computers, then there's fifty plus magazines on the bookshelf that deal solely with that subject and little else. Whilst this is true, you won't find much relevant to amateur radio in the computer magazines, and the problem seems to be that once a radio enthusiast gets bitten by the computing bug, too easily they can disappear off the communications scene whilst exploring their new interests. If 'he' then writes any software pertinent to amateur radio, then we'd certainly like to hear about it!

We attempt here to reveal the relevance of computing to the communications enthusiast, to see if we cannot encourage a more rational view of the subject, and to get some software and hardware published that is of positive benefit. With the present bottomless market for arcade games (now supported by a top twenty chart much like the pop record scene), don't hold your breath for anyone else to come up with the goods for the communications enthusiasts....

Humbug

Love them or hate them, computers are unavoidable in any aspect of modern life. But what can you do with one?

There's not much chance that you can escape the computer revolution for long. Current estimates place some 2 million machines in the hands of the great British public. The ZX Spectrum and ZX81 have run away with first prize, scoring around a half million each in the past year, and even if you don't own one yourself, the chances are that you know someone that does.

By understanding more of what they can do, you can perhaps try and persuade your computer obsessed friends to divert their skills and efforts to writing some software to perform a communications task or two. Indeed, the writer of this piece took a while to learn to love the microcomputer. The secret seems to be finding out what you can actually do with one that is relevant to your interests.

Is there life after space invaders?

The fad for arcade 'action' games seems to have got the home computer off to a bad start where the radio amateur is

concerned. There really has been distressingly little serious application software published that is relevant to the communications enthusiast. The fact is that virtually any of the present generations of small personal computers offer the chance to expand the interests of the computer enthusiast in any number of ways: as they say in the ads., only limited by your imagination!

Are people who claim to be sick of computers actually confessing to having a lack of imagination? Or is that the marketing of the hardware has not yet bothered to address itself to the relatively specialised concerns of us communications enthusiasts as long as there's a remarkably bottomless pit of people willing to spend their lives chasing block graphics around the phosphors.

The more specialist programs that are published as listings require typing—and that's another skill that must be acquired if you are to master the art—and you'll be doing yourself no favours to settle for anything less than a real keyboard.

CW, RTTY, AMTOR and SSTV made easy

Communications using computers is a very natural extension of the CW and RTTY that have long been part of the hobby. Sending ASCII data files across the airwaves is relatively simple, and the better high resolution machines offer plenty of scope for slow scan TV and other forms of picture transmissions: you can even send circuit diagrams, PCB plotting details: in fact, anything the computer can send 'internally' on pieces of wire can be serialised and broadcast—albeit at a somewhat slower speed due to the bandwidth limitations on the low frequency bands. Move up to UHF and SHF and your transmissions can be as fast as you like.

The hardware for computer aided RTTY and CW (HAL, Tono etc) has been around a while, yet it is quite possible to do both by writing your own software for most of the more popular computers. It's a shame that there aren't many programs published which point this out. Packet switched networks have grown from Canada, through the US and are at last being talked about in the UK.

So what's the catch?

When someone coined the phrase 'language' for computer instructions sets, they hit the nail squarely on the head. If you don't understand the language of computing, then its like trying to net on 40m amongst a group of Latvians speaking their local dialect.

The conversation could be about the most riveting topics imaginable, someone could be offering to pin a £10 note to his QSL cards—but you wouldn't know a thing about it. Moreover—and here's the rub—you wouldn't care a whole lot either. Learning a language is a tiresome business, best done when you are relatively young and have the patience for such tasks. If you don't speak computerese, then you don't know what you are missing.

The next catch in this process of familiarisation is the simple fact that there is no substitute for buying a machine—which is quite a hurdle if you don't actually believe that you are interested in the subject. It's hard to part with £200 if you imagine you are going to be bored with the results. Reading books is nearly impossible as a means of absorbing computing—like languages, you have to practise expressing yourself, and seeing if you are understood. It's called programming.

Tailor made

Most commercial communications software emanating from the US (from Kantornics and others) is written primarily for the Apple, which although the US market leader, lags a long way behind in the UK as a result of the implementation of a dollar/pound policy. Thanks to the fragmentation of the marketplace, the Sinclair Spectrum and BBC computer are not yet widely accepted in the USA. The Spectrum sold in the USA bears little relation to the UK product, anyway.

Diversions tactics

The communications enthusiast must be well aware that a lot of the new blood is being diverted into computing at present. The peak computer buying market is in the 15-18 year and 27-32 year age brackets, which is the same as seen in the average amateur radio event.

However, amateur radio and computers do not appear to mix. Lowe Electronics have tried to blend the two

when they started handling the Video Genii, but they quickly discovered that the two markets were poles apart and separated their operations into two distinct divisions.

The US amateur radio magazines go to some pains to print programs and applications, yet they are some way behind the UK in terms of computer numbers in the home. There's a superb feature article in the May 1983 issue of QST titled 'Designing Narrow Band-Pass Filters with a BASIC Program' - a classic example of computing with a purpose. When did anyone last see that sort of feature in one of the popular personal computer magazines?

More programs for designing radios

There's a brilliant new program being offered by Number One Systems of St Ives for modelling circuit characteristics using either a BBC or Spectrum computer. You may recall the review we ran on Harcourt systems sophisticated 'Circuit Modeller' package for CP/M systems. CP/M systems are not generally found in the home, but BBC's and Spectrums certainly are, so here's an ideal applications program that helps you to design active circuits - 'it' even designed the GHz front end of the new Meteor range of frequency counters offered by Black Star. Costing about £35 it will accurately model the gain, phase and frequency

characteristics of most types of circuit encountered in linear design. This is only just the start of a wave of serious enthusiasts applications software that will begin to make the radio amateur sit up and think about computers.

Yet more

The graphics capabilities of personal computers has already led to applications software for the BBC computer that emulate storage oscilloscopes, and this is only a start. It takes little computing effort to devise an interface that will produce a spectrum analyser display, calibrate the frequency and amplitude axes, and build up a pattern of band usage by storing signals and their characteristics for later recall and analysis.

The use of colour displays can provide a lot more useful information to help separate the information - and sooner or later someone is going to find out what goes on behind those promising interface sockets on every new rig that hits the dealers' shelves. We've already seen one application to control an Icom R70 and provide on-screen information with a BBC computer. So what - there's knobs for that anyway.

The same computing can provide the CW and RTTY display, frequency management by searching the band for a clear channel to call, taking into account

the band plan in force...the possibilities are endless, and we'd very much like to hear from readers with ideas so that we can begin to gather some useful software. There's also an opportunity for the experienced amateurs to get their hands on some new 1984 computers to implement communications based programs and thus try and bring their more reticent colleagues along with the revolution.

Signs of the times

One of the most disturbing aspects of the past year in amateur radio has been the relative decline of interest being shown by the youngsters who have been trapped by computing. Yet the opportunities for enhancing the hobby both in circuit design and station operation offered by computing are more obvious than in most other pastimes where computing can be 'applied'.

If the gardeners can use computers to help them grow their beans, what's keeping the radio fraternity from getting inside the technology and applications. Radio and Electronics World would like to spearhead the growing awareness, so let's have your views please.

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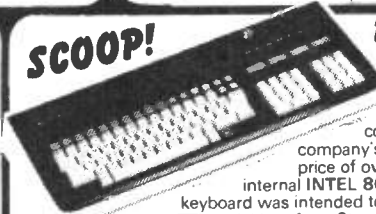
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SD5A As recommended by ZX81 news letter. matchbox size up to 1000 watt load **£5.95**
L2127 compact completely cased unit with 3 pin fitted socket Up to 750 watts **£9.99**

COOLING FANS

Keep your hot parts COOL and RELIABLE with our range of BRAND NEW professional cooling fans.
ETRI 99XU01 Dim. 92 x 92 x 25 mm. Miniature 240 v equipment fan complete with finger guard. **£9.95.**
GOULD JB-3AR Dim. 3" x 3" x 2.5" compact very quiet running 240 v operation. **NEW £6.95.**
BUHLER 69.11.22. 8-16 v DC micro miniature reversible fan. Uses a brushless servo motor for extremely high air flow, almost silent running and guaranteed 10,000 hr life. Measures only 62 x 62 x 22 mm. Current cost **£32.00.** OUR PRICE ONLY **£12.95** complete with data.
MUFFIN-CENTAUR standard 4" x 4" x 1.25" fan supplied tested EX EQUIPMENT 240 v at **£6.25** or 110 v at **£4.95** or BRAND NEW 240 v at **£10.50.** 1000's of other fans Ex Stock. Call for Details. Post & Packing on all fans **£1.60.**

SCOOP!



BRAND NEW CASED WORD PROCESSOR KEYBOARDS

Made by the famous 'KEYSWITCH' corporation, for a well known computer company's top of the range word processor at a price of over **£200.00!** Constructed around an internal INTEL 8048 cpu this superbly styled 106 key keyboard was intended to interface with a main computer via a TTL serial interface. Standard HALL EFFECT long life switches are utilised on an XY matrix, buffered by 74 series TTL ic's to the eight bit CPU port enabling simple modification to your own custom decoding logic via an EPROM etc. Many other features for the most exacting user include: numeric keypad, cursor control pad, ten clear top function keys, LED indicators, single 5v supply on-off lock switch etc. Supplied BRAND NEW and boxed with circuit diagram. **ONLY £49.95 + £2.00 P&P**

DRE 7100

8" Disk Drives
New **£225 + VAT**

VIDEO MONITORS

12" CASED. Made by the British KGM Co. Designed for continuous use as a data display station, unit is totally housed in an attractive brushed aluminium case with ON-OFF, BRIGHTNESS and CONTRAST controls mounted to one side. Much attention was given to construction and reliability of this unit with features such as, internal transformer isolated regulated DC supply, all components mounted on two fibre glass PCB boards - which hinge out for ease of service, many internal controls for linearity etc. The monitor accepts standard 75 ohm composite video signal via SO239 socket on rear panel. Bandwidth of the unit is estimated around 20 Mhz and will display most high def graphics and 132 x 24 lines. Units are secondhand and may have screen burns. However where burns exist they are only apparent when monitor is switched off. Although unguaranteed all monitors are tested prior to despatch. Dimensions approx. 14" high x 14" wide by 11" deep. Supplied complete with circuit. 240 volt AC operation. **ONLY £45.00 PLUS £9.50 CARR.**
24" CASED. Again made by the KGM Co with a similar spec as the 12" monitor. Originally used for large screen data display. Very compact unit in lightweight alloy case dim. 19" H x 17" D x 22" W. All silicon electronics and composite video input make an ideal unit for schools, clubs, shops etc. Supplied in a used but working condition.
ONLY £55.00 PLUS £9.50 CARR & INS.

SAVE SUPER PRINTER SCOOP



CENTRONICS 739-2

The "Do Everything Printer" at a price that will NEVER be repeated. Standard Centronics interface, full graphics, 4 type fonts with high definition & proportional spacing for word processor applications, 80-132 columns, single sheet, roll or sprocket paper handling plus much more. Available only from DISPLAY ELECTRONICS at a ridiculous price of only **£199.00**
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Interface Cable **£10.00**

TELETYPE ASR33 I/O TERMINALS

FROM **£195 + CAR. + VAT**
Fully fledged industry standard ASR33 data terminal. Many features including ASCII keyboard and printer for data I/O auto data detect circuitry. RS232 serial interface. 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order
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KSR33 with 20ma loop interface **£125.00 +**
Sound proof enclosure **£25.00 + VAT**

SOFTY 2

The amazing SOFTY 2. The complete "toolkit" for the open heart software surgeon. Copies, Displays, Emulates ROM, RAM and EPROMS of the 2516, 2532 variety. Many other features include keyboard, UHF modulator. Cassette interface etc. Functions exceed capabilities of units costing 7 times the price! Only **£169.00** pp £1.95 Data sheet on request

QUALITY INTERFACE CABLES & CONNECTORS

18/3B D255 to 10ft 18 way **£4.90**
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12/15 10 way cable 12ft long **£1.00**
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SUPER DEAL? NO - SUPER STEAL!!

The FABULOUS 25GPS TEC Starwriter
Daisy wheel printer at a fraction of its original cost.
BRAND NEW AT ONLY **£499 + VAT**

Made to the very highest spec the TEC Starwriter FP1500-25 features a heavy duty die cast chassis and DIABLO type print mechanism giving superb registration and print quality. Micro-processor electronics offer full DIABLO/QUIME command compatibility and full control via CPM Wordstar etc. Many other features include bi directional printing, switchable 10 or 12 pitch, full width 381 mm paper handling with upto 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.** Tractor feed **£140.00.** Spare daisy wheel **£3.00.** Carriage & Ins. (UK Mainland) **£10.00.**



SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors, digital, linear, I.C.'s triacs, diodes, bridge recs, 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 I.C.'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 I.C.'s full spec. 100+ **£6.90** 200+ **£12.30** 300+ **£19.50**

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Join the communications revolution with our range of EX TELECOM data modems. Made to most stringent spec and designed to operate for 24 hrs per day. Units are made to the CCITT tone spec. With RS232 i/o levels via a 25 way 'D' sct. Units are sold in a tested and working condition with data. Permission may be required for connection to PO lines.

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MODEM 20-2 same as 20-1 but 75 baud receive 1200 baud transmit. **£130.00**
MODEM 20-3 Made for data rates up to 1200 baud in full duplex mode over 4 wire circuit or half duplex mode over 2 wires. **£130.00**

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DATA PUMP MODEM compact unit up to 1200 baud full duplex over 4 wires or half duplex over 2 wires. BELL specification with data i/o via RS232 25 way D socket, remote test etc. 240 v operation. Supplied complete with data **£65.00** carr. **£4.50.**
For more information or details of other types of ex. stock modems contact sales office.

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AC/SZ/PEN 8.50	EBF89 0.70	EL36 3.15	KBR/3 45.00	PL21 2.50	SF817 5.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AG8 1.50	307 5.00
AH221 39.00	EBF93 0.95	EL37 3.00	K8/3 45.00	PL23 1.25	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
AH238 39.00	EBF99 0.70	EL37 3.00	K8/3 45.00	PL23 1.25	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
AL60 6.00	EBL1 2.50	EL38 6.00	K166 USA 7.15	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
ARP12 0.70	EC52 2.00	EL42 2.00	K166 GEC14.95	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
ARP34 1.25	EC70 0.75	EL81 6.95	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
ARP35 2.00	EC80 9.50	EL82 0.58	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
BL63 2.00	EC81 4.50	EL84 0.75	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
BS450 5.00	EC86 1.00	EL85 4.50	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
BS450 5.00	EC86 1.00	EL85 4.50	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
BS814 55.00	EC90 1.20	EL90 1.20	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
CIK 18.00	EC91 7.00	EL91 6.00	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
C3JA 16.00	EC92 1.25	EL95 0.70	K166 Gold Lion	PL26 0.95	SF833 28.95	XK1002 28.00	4CX250B 1.10	6C18 2.50	12AL5 0.90	329 5.00
C110 32.00	EC93 0.90	EL153 12.15	K763 1.20	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
C1134 32.00	EC95 7.00	EL183E 3.50	L102/2K 6.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
C1148A 118.00	EC97 12.50	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
C1149/1 130.00	EC98 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
C1150/1 136.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
C1534 32.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
COA 2.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
CC3L 0.90	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
CL33 2.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
CV Nos Prices on request	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DA75 1.20	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DAF91 0.70	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DC70 1.75	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DC90 1.20	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DCX4-1000 12.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DD4-5000 25.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DET22 28.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DET24 29.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DET25 22.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DF1 0.70	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DF2 0.60	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DF96 0.85	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DF97 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DH83 1.20	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DH77 0.90	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DH79 0.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DH149 2.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DK91 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DK92 1.20	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DK96 2.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL32 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL63 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL70 2.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL73 2.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL91 1.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL92 0.60	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL93 1.10	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL94 2.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL96 2.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL97 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL98 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DL99 1.00	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50	6CB6 1.95	12AT6 0.65	388A 17.50
DM150 13.50	EC99 10.00	EL183P 3.50	L12/2K 9.00	PL802 3.95	SU42 4.95	XL1-5V 1.50	4C 250B 37.50</			

VARICAPS FOR HF & VHF

Electrical Characteristics
9V Series (Ta = 25°C)

Item	Symbol	Characteristics			Unit	Condition
		Min.	Typ.	Max.		
Reverse Voltage	V _{BR}	20	—	—	Vdc	I _R = 10μA
Leakage Current	I _R	—	—	100	nAdc	V _R = 15V
Capacitance	C _{1V}	445	490	535	pF	V _R = 1V, f = 1MHz
Capacitance	C _{9V}	—	25	—	pF	V _R = 9V, f = 1MHz
Cap. Ratio	C _{1V} /C _{9V}	16.9	—	23.5	—	f = 1MHz
Capacitance Tolerances	ΔC	—	—	2.5	%	(3 Unit) V _R = 1V
		—	—	2.0	%	(2 Unit) V _R = 1V
		—	—	0.3pF+3	%	(3 Unit) V _R = 9V
		—	—	0.3pF+2	%	(2 Unit) V _R = 9V
Q	Q	200	—	—	—	V _R = 1V, f = 1MHz
Temp. Coef.	TC _Q	—	500	—	PPM/°C	V _R = 5V, f = 1MHz

Classification Rank X C_{1V} = 445~500pF, C_{9V} = 23.6pF (Typ.)
 Rank Y C_{1V} = 480~535pF, C_{9V} = 25.3pF (Typ.)

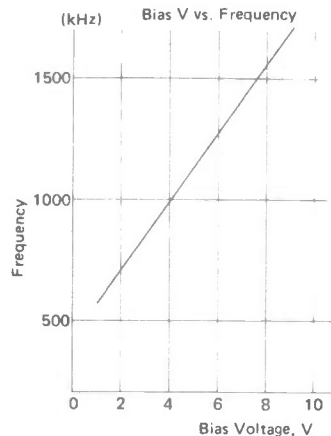
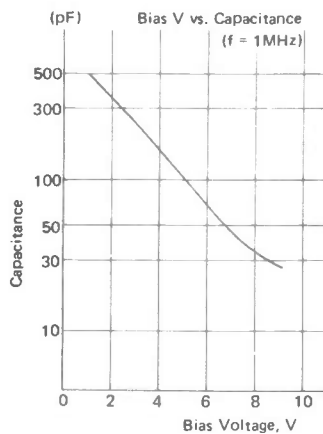
The widespread use of frequency synthesis technology in the consumer radio field has seen a rapid development of varicap diodes designed to provide a wide capacitance swing with a relatively small voltage swing. Early varicaps that provided 20:1 capacitance swing were very expensive - £5 was about average.

However, TOKO who are better known for coils than varicaps saw the opportunity opening up with frequency synthesis and have developed a range of low cost wide range varicaps that provide all the necessary features of high Q, wide capacitance range (with low minimum capacitance), and accurate matching.

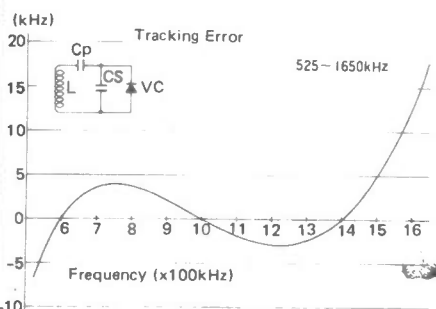
The last of the above features is vital to ensure good matching between stages - although the up-conversion process coupled with wideband front-end technologies is gradually replacing multiple-ganged tuned circuits.

The general rule is to use the largest voltage swing available, since compress

9V Series



Tracking Error

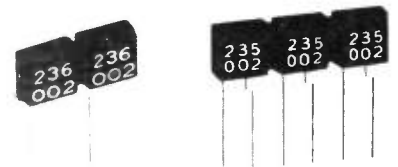


(Rank X)

C _p = 479	(pF)	Typ.	Lower	Upper
C _{MAX}	(pF)	474	450	498
C _{MIN}	(pF)	23.7	26.5	21.7
ANT	CS (pF)	24.4	18.7	29.3
	L (μH)	189.2	200	179.9
OSC	CS (pF)	36.2	31.5	39.9
	L (μH)	107.9	111	105.2

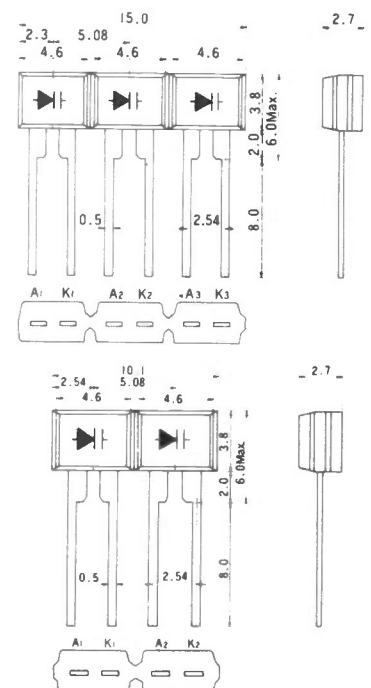
(Rank Y)

C _p = 511	(pF)	Typ.	Lower	Upper
C _{MAX}	(pF)	506	482	530
C _{MIN}	(pF)	25.3	28.3	23
ANT	CS (pF)	26.1	20.1	31.3
	L (μH)	177.3	186.8	169
OSC	CS (pF)	38.6	33.7	42.7
	L (μH)	101.1	103.8	98.7



2 Unit Choco-Break. 3 Unit Choco-Break

Dimensions/Pin Assignment

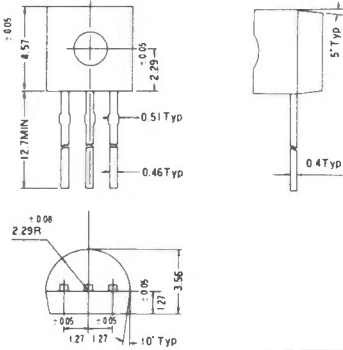


for FM Radios



DIMENSIONS

(Unit = mm)



ing the capacitance swing over a small voltage swing means that the tuning voltage must be exceptionally pure and free from interference. Notwithstanding this, TOKO are shortly introducing a 4.5V version of the KV1235, which should do away with the need for DC-DC conversion in low powered portable synthesised radios. Battery portables do not suffer from hum and other mains borne problems.

Points to watch

When using a varicap, remember that the Q of the tuned circuit it is controlling

depends on the dynamic resistance of the circuit. Feeding the tuning voltage to a varicap with a low value resistor will damp the circuit in the same way as if the resistor had been connected directly across it. But by keeping this resistor as a very high value, you are providing a very high impedance line that will be susceptible to hum pickup.

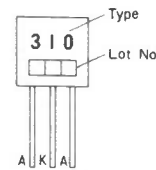
Care is needed in laying down a varicap tuned circuit to extract the best performance—oscillator circuits must be particularly carefully considered to avoid extraneous FM, and unnecessary noise from an overall Q that is too low.

MAXIMUM RATINGS

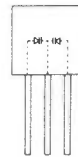
Ta = +25°C

Item	Symbol	Rating	Unit
Reverse Voltage	V _R	18	V
Forward Current	I _F	50	mA
Power Dissipation	P _D	100	mW
Operating Temperature	T _{opr}	-55 ~ +80	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

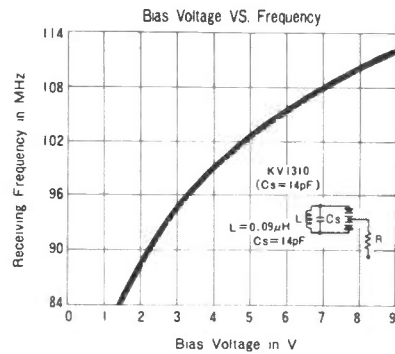
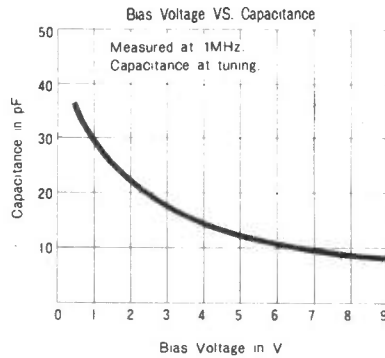
BLOCK DIAGRAM



PIN ASSIGNMENT



CHARACTERISTIC CURVES



ELECTRICAL CHARACTERISTICS

● Ta = 25°C

Item	Symbol	Characteristics		Unit	Condition
		Min.	Max.		
Reverse Voltage	V _{BR}	16		V	I _R = 10µA
Reverse Current	I _R		100	nA	V _R = 10V
Capacitance (2 V)	C _{2V}	76.50	97.98	pF	V _R = 2 V, f = 1 MHz
Do. (4 V)	C _{4V}	52.51	69.97	pF	V _R = 4 V, f = 1 MHz
Do. (6 V)	C _{6V}	38.25	50.96	pF	V _R = 6 V, f = 1 MHz
Do. (8 V)	C _{8V}	32.01	42.64	pF	V _R = 8 V, f = 1 MHz
Inter-terminal Capacitance Tolerance	ΔC		3	%	V _R = 2, 4, 6, 8V, f = 1 MHz
Series Resistance	r _s		0.5	Ω	V _R = 2 V, f = 70MHz
Capacitance Variation Ratio	A	2.0	2.8		C ₂ /C ₈ , f = 1 MHz

- NOTES: 1. Capacitances are given for back-to-back connections. In use, the capacitance values will be one-fourth (1/4).
 2. Capacitance measured with YHP 4275A, or equivalent; level, 30mV ± 5mVrms
 3. Series Resistance measured with YHP-4191A, or equivalent.

POINT OF CONTACT

In order to facilitate ready contact between radio amateurs, **Radio & Electronics World** will publish a monthly updated list of licensed readers, including some of the bands they favour, approximate times and days of the week when they operate and a few other details.

If you wish to be included in this scheme, would you please complete and return the form below and send to: **Radio & Electronics World**, Sovereign House, Brentwood, Essex CM14 4SE.

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 Bands usually preferred.....
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 Equipment.....
 Phone/CW.....
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 Most interesting contact made to date.....

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BC547/8/9	- 7p	BD135,136	- 25p	BSX20	- 15p
BC557/8/9	- 7p	BD137	- 25p	2N2926	- 7p
BC182L	- 8p	BF195,7	- 10p	2N3055	- 50p
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NOTES FROM THE PAST

We learn how twentyfive and more years ago there was considerable controversy on whether radio amateurs were really amateurs if they used commercial equipment instead of building their own. That there ever was such a controversy may be a surprise to many of our readers.

The other topic concerns the silly claim that one particular scientist was the "inventor of radio"

When the Russians first came up with the story that Popov was the 'inventor of radio' – as if it could have been invented by one man! – it was mildly amusing. As the claim became more and more frequently made, apparently to make sure nobody missed it, it became irritating. Nowadays it seems to be impossible to find any Russian-inspired publication which fails to repeat the claim, usually with reports of celebrations and homages in honour of the 'Inventor of radio – A S Popov'. Apparently they have borrowed a page from Goebbels text-book and hope that by repeating the same story enough times it will eventually become accepted as true.

Personally, I can scarcely recall hearing of Popov's work until the Russians very belatedly 'discovered' him a few years back. He died over a half-century ago and very little can be found about him in reference books. Like all decadent democrats I learned to accept that scientists and physicists of many nationalities shared in the discovery and development of the knowledge that enabled Marconi to successfully undertake his practical work.

Possibly Popov did add something of value, or he may have even made some vital discovery independently without knowing he had been preceded, but if so he seems to have been mightily secretive about it. To allege, as it has been, that his ideas were pirated can only be acceptable to those who have been indoctrinated into swallowing the party line on all matters. Even they must be puzzled why so little was known about his

work until some forty years after his death.

When amateurs were amateurs!

In the early days after the war, when ex-WD gear was cheap and plentiful, many old-timers viewed with some disapproval the tendency for transmitting amateurs (and to a lesser extent broadcast receiver constructors) to use Services type gear rather than build up their own. Many openly voiced the view that it wasn't cricket – or rather, wasn't radio – or in modern parlance, that it was non-U. Before the war transmitting licences were granted only for experimental work. The actual communications side was merely incidental, and was intended to be used for the purpose of testing and proving. Hence the opening gambit 'Calling Test' used by British amateurs, instead of 'Calling CQ' as in post-war years.

Although at first it was considered slightly *infra dig* it was regarded as excusable in view of the difficulty in getting suitable new components. With the success, and extraordinary cheapness of ex-WD surplus, plus a large number of new entrants to the hobby, the use of services and commercial gear became more and more widespread. Even until fairly recently many of the old-time amateurs yearned for the days of low power, although they recognised that design was a more exact science rather than the trial-and-error methods of yesteryear. However, that would have been amply covered by the widened range of cheap technical books. Indeed, a very good case can be made out for a

modernised form of pre-war licensing conditions.

For several years now, what remained of the old tradition has completely gone by the board. Today's fashions are not limited to converted ex-WD equipment, but the fully-built, ready for immediate use, maximum-powered amateur transmitting station is definitely 'in'. A half a dozen firms are specialising in providing amateurs with professionally built equipment, and an increasing number of amateurs are buying it, some of whom have never built anything worth mentioning of their own. Such a state of affairs would have been considered unthinkable in pre-war Britain, although the tendency had already started in the United States.

An examination of the lists of leading stations in any of the recent contests will reveal (where the equipment used is specified) that they all used professionally made gear. A strange contrast to the 'thirties when self-respecting amateurs even made their own microphones and a shack without a workbench would have been looked on as a sham! An unfortunate aspect of this use of commercially equipped 'amateur' stations is the unfair advantage gained by those with the deepest pocket. Indeed, since writing the preceding part of this paragraph, a correspondent in the RSGB 'Bulletin' questions the ethics of using expensive commercially-built equipment in contests.

Editor's Note: The *RSGB Bulletin* was the title of the Radio Society of Great Britain's monthly magazine, now known as *Radcom*.

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Sporadic-E activity returned with a vengeance during October. Indeed on many days conditions were as good as anything experienced during the summer months. Practically every European country was seen in Band I. The return of such active conditions meant that many of us were able to see the new Rumanian colour test card without having to wait until next summer.

A tropospheric lift occurred between the 22nd and 27th of October giving excellent colour signals from the Benelux countries and West Germany. The best trop signals were received in the north of England with tropospheric ducting from Spain and Central Europe while DX-TV enthusiasts further south found conditions fairly normal with only old favourites being received.

Reception reports

Andrew Webster (Billinge, near Wigan) was surprised to find an OIRT signal co-channel to his semi-local channel H signal from RTE (Dublin). This was on the 22nd and we suspect the transmission emanated from the Plezn channel R10 outlet (100kW) in western Czechoslovakia. On the 25th and 26th he was startled to find the TVE test card on channel E11 propagated by tropospheric ducting. This displayed the 'SANTIAGO 4' studio/transmitter identification. At first Andrew thought it was a strong E4 signal playing havoc with his amplifiers. The highest powered E11 outlet listed for Spain is at Caceres (45kW) in the south-west of the country which is some distance from Santiago in the north. On the 23rd while checking the ATV band Andrew noted the callsign of a French operator (F3YX) located in Paris. His full log for October is featured this month and it reflects the excellent tropospheric conditions as well as the unexpected upsurge in SpE activity:-

3/10/83: TVE (Spain) on channel E2; RAI(Italy) IA,IB,JRT (Yugoslavia) E3 using the 'JRT TV BGRD' PM5544 test card; ORF (Austria) E4 from Patscherkofel on test pattern; SRG-1 (Switzerland) E2 from Bantiger radiating the 'PTT SRG 1' FuBK test card. All reception via Sporadic-E (SpE).

4/10/83: JRT E3 on PM5544 test pattern, also programmes on E3 and E4; ORF E2a and the rather rare channel E3 outlet with the 'ORF FS 1' PM5544; SR-1 (Sweden) E3 on 'TV 1 SVERIGE' PM5544; CST (Czechoslovakia) R1 with the 'RS-KH' EZO-type test pattern, also CST R2 radiating the 'SR 1 TV BRATISLAVA' PM5544; TVR (Rumania) R2 showing the monochrome EBU Bar; RAI IA, IB, on progs; MTV (Hungary) R1, R2 on 'MTV-1 BUDAPEST' PM5544; unidentified progs on R1 and R2, possibly of Russian origin. All signals via SpE.

5/10/83: RTP (Portugal) E3 from Lousa on programmes via SpE.

18/10/83: RAI IA on progs; JRT E3, E4 on progs via SpE

22/10/83: ZDF (West Germany, 2nd Network) on FuBK test card and progs on channels E21, 29, 34, 35 and 37:DDR:F (East Germany) on E6 from Brocken and E12 (Sonneberg); HR (West Germany-Hessischer Rundfunk) E37 on FuBK test card followed by 'RHON KANAL 37' identification slide; HR on channel E8 (Grosser Feldberg transmitter) on 'HR 1 F' FuBK, SWF (West Germany-Suiwestfunk) E25 from Haardtkopf showing the 'SWF-HRF' FuBK; WDR (Westdeutsches Fernsehen from studios in Cologne) on E9 (Langenberg outlet), E24 (Aachen) and E30 (Nordhelle); NOS(Netherlands) E5 from Roermond: RTBF 1 (Belgium) with progs on E3 (Liege), E8 (Wavre) and E11 (Anlier); RTE 1 (Eire) channel H with a co-channel Eastern-bloc country on R10 (similar vision frequencies). This had the OIRT 6.5MHz sound-spacing.

23/10/83: RTBF 2 on PM5544 with 'ANDERLUES CANAL 61' transmitter identification at the top between 0100 and 0215GMT. Later in the day(!) WDR E11 (Teutoburger Wald) and E30 (Nordhelle) were noted using the 'WDR1' FuBK. Also received via enhanced trop conditions were: WDR3 on E40, E48 radiating the 'WDR3' FuBK; ZDF on E35, E37; RTBF E57 (Tournai on PM5544), RTBF 1 on E8, E11 with progs; BRT (Belgium) E10 on PM5544; NOS-1 on PM5544 followed by progs on E4 from Lopik, also on channel E6 (Smilde), E29 (Goes) and E39 (Wieringermeer); NOS-2 progs seen on E27 (Lopik), E31 (Roermond), E32 (Goes) and E45 (Wieringermeer).

25/10/83: TVE (Spain) E11 on test card with 'SANTIAGO' identification followed by progs; NOS E4 with PM5544 and progs; BRT E10 on progs; ZDF E34 with progs; TDF (France) in Band III showing Antiope teletext pages.

26/10/83: TVE E11 on test card; Belgian, Dutch, French and West German trop signals present throughout the day.

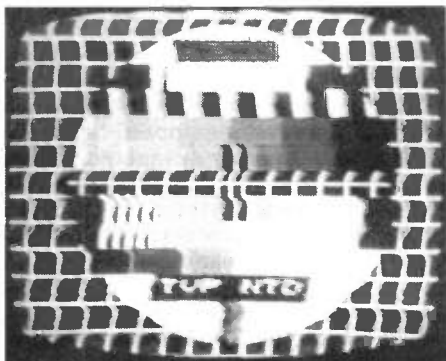
27/10/83: TVE E4 via SpE. Trop reception from France, Belgium, Netherlands and West Germany but on a reduced scale.

28/10/83: TSS (Russia) R1, R2 on colour electronic test card followed by programmes; 1SS R2 showing the 'Letterbox' test pattern; CST R1, R2 on 'RS-KH' EZO test card; CST R2 radiating the 'SR 1 TV BRATISLAVA' PM5544 pattern; RAI IA, IB on progs; ORF E2a, E3 and E4 on PM5544. Many Italian private FM radio links were heard throughout Band I during the opening. All reception via SpE.

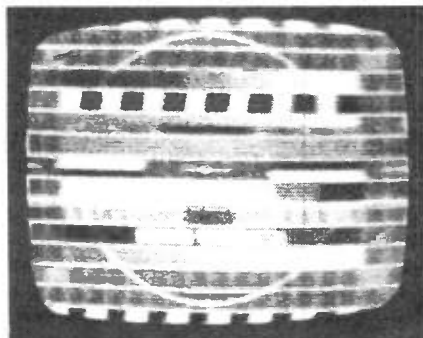
31/10/83: TVE E3 on programmes; (RTP Portugal) E3 on a black and white bar test pattern via SpE.

Full details of channel frequency allocations were given in page 69 of the August 1983 edition of *Radio & Electronics World*.

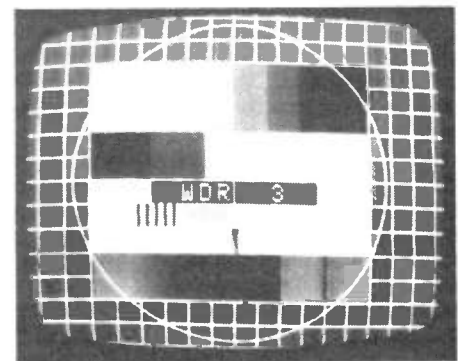
Over in Leeds, Kevin Jackson saw some of his best ever trop reception on the 22nd and 23rd. Using indoor aerials he received the East German test card snow-free on E31 much to the surprise of a visitor. The EZO test pattern from Czechoslovakia appeared on channels R10 and R31 between 1155 and 1224GMT from the Plezn transmitter. This tends to confirm Andrew Webster's reception noted later in the day. The 23rd was full of 'exotics' for Kevin. He switched on at



Polish PM5544 test card with identification TVP NTD



The new Rumanian colour electronic test card with the inscription TELEVIUNEA ROMANA



FuBK test card transmitted by WDR3 (West Germany)

0605GMT to find RTBF Tournai on channels E57 and E63, totally snow-free. At 0627 a programme on E40 was seen at fair strength but on the 525-line system from an AFN-TV outlet. A little later an AFN caption appeared on E34 followed by cartoons. The 500W relay in Brussels was noted at 0635 on the PM5544 test card with 'TELE 2' identification. Not content with those stations he discovered the Polish test card on channel R35 (Jelenia Gora) and R28 (Kielce) – a distance of some 1560km! Many other stations were received later in the day including the 1kW relay of NOS on E51 at Eys. A total of 8 Belgian, 19 French, 8 Dutch, 1 East German, 2 Polish and 21 West German transmitters were logged plus one in Luxembourg. On the 26th an FuBK pattern on E52 displayed the identification 'HESSEN DREI'. This was the 3rd Network of the West German service Hessischer Rundfunk and was preceded by the FuBK test card showing 'HR3 FFTM' identification and a digital clock. This particular test card was featured in the May 1983 edition of **Radio & Electronics World**.

We have reports of a suspected sighting of Greece on channel E3. Cyril Willis (Little Downham, Cambs) noted their 'EPT' caption floating with other programmes around lunchtime on the 28th. We do not know of a transmitter officially operating on this channel but in the past there have been sightings of the Greek test card by DX-ers in the Netherlands. The only Band I transmitter listed at present is on E4 with a low ERP. During the same SpE opening Cyril saw many other countries including Austria from their 100W channel E3 relay. He also noted Rumania on R2 radiating the monochrome EBU Bar test pattern.

October was also a good trop month for Simon Hamer at his farm in Powys. On the 22nd he received BRT on E43, Messischer Rundfunk on E37 from Rhon and TDF (France) on channels E21, 24, 31, 34 and 40. The following day he noted signals from NOS (Netherlands) on numerous channels in Bands I, II, IV, and V. Belgium, France and West Germany were also logged. East Germany (DDR:F2) made an appearance on E34 during the 26th and was a 'new catch' for Simon. Another novelty for him was reception of an amateur TV enthusiast (ATV) on 430MHz. The call-sign on the test card was G4IMO, based in Essex. Incidentally, the DX-TV converter which we featured in the August '83 edition of *R&EW* should cover the amateur band for those interested in ATV reception.

It's good to know that *R&EW* is read way up in the Arctic Circle. That's where Chris Hall is presently stationed. His Norwegian location at Krokeivdalen isn't recommended for DX-TV reception however since strong magnetic storms are frequently experienced in the 'auroral oval'.

African reception

Television signals from Africa have been received by Clive Athowe in Blofield, Norfolk. On the 7th Zimbabwe Television was seen using the PM5534 test card going onto a chequer-board



Photo 4 Satellite TV reception by Hugh Cooks (East Sussex) of the Saudi Arabian PM5544 complete with palm tree and crossed swords in the centre

pattern. Programmes were resolved at 1811BST. They were also noted on the 11th and the 14th from the same channel E2 transmitter at Gwelo. The reception on the 14th was accompanied by Italian transmissions on channel LA. Very often ZTV-Zimbabwe is propagated to the Mediterranean area by trans-Equatorial skip and then by Sporadic-E to the UK. SpE reception was noted on many days by Clive and signals included MTV (Hungary) on R1 and R2, TVE (Spain) E3, NRK (Norway) E2, E3 and E4, YLE on E3 from Finland, TVR-Rumania on R2 and TSS (Russia) on channels R1 and R2. During an opening on the 4th there were many OIRT FM radio stations present at the top end of Band I. Clive identified Bulgarian radio on 67.88, 67.10 and 66.32 MHz.

Rumanian TV

We briefly mentioned last month that Televiziunea Romana have introduced a new electronic test card. Thanks to the SpE activity we are able to feature the test card this month (see *Photo 2*). This coincides with the introduction of colour transmissions by TVR. Surprisingly they have opted for the PAL system rather than the usual SECAM which the Eastern-bloc countries favour. The new colour test card has been received several times recently in the UK. It is similar to the East German one and two versions are in use: one with identification, the other without. One enthusiast in the north-west has seen this in PAL colour on channel R2. At first this was a head-scratcher since no identification was present. The old style opening captions are still used but propagation was not good enough here in Derby for colour reception. The ubiquitous Philips PM5544 is rumoured to be in use as well with the identification 'TVR BUCURESTI' at the bottom.

New DX magazine

A new magazine specifically for radio and TV DX-ers has been established by the authors of this column to help enthusiasts get the most from their

hobby. The subscription rate for six bi-monthly editions is £4.50 (£7.00 for Air Mail delivery world-wide) and the magazine, called 'TeleRadio News', is available from 17 Collingham Gardens, Derby DE3 4FS.

Service information

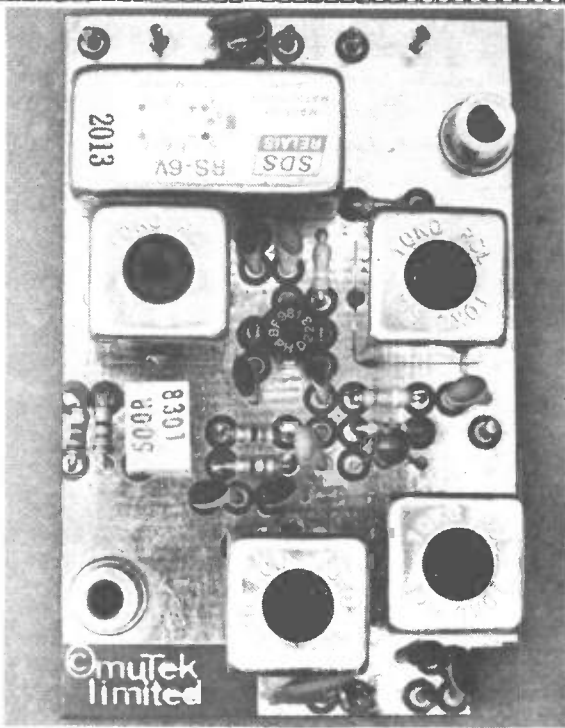
Belgium: For those DX-TV enthusiasts who may be wondering why they were unable to receive BRT on UHF channel E25 (TV2) and RTBF on E28 (Tele2) during October the answer is quite simple. Severe storms caused the collapse of the UHF transmitting mast at Wavre. Apart from the loss of TV programmes, FM networks were also affected. The Wavre Band III channels E8 and E10 were not affected as a separate mast is used for VHF.

France: Amended channel allocations have been announced by Telediffusion de France (TDF) for the new service 'Canal Plus'. Programmes are now scheduled to commence before the end of 1984 using the following Band I (VHF) channels:- Channel 1 : 55.75 – 49.25MHz; Channel 2 : 60.50 – 54.00MHz; Channel 3 : 63.75 – 57.25MHz. Band III channel frequencies are to remain unchanged but will be numbered 4 to 9 rather than 1 to 6. Full details of TDF frequency allocations were given on page 69 of last August's *R&EW*.

India: The Indian TV service (All India Radio-Doordarshan) is now broadcasting in PAL colour but the old monoscopic Telefunken and Retma test cards are still radiated during test transmissions.

Egypt: There are two 900-watt transmitters in operation by the EBT at Dumyat. The 1st network radiates on channel E4 and the 2nd network on E2. Bearing in mind that signals from very low-power transmitters can be received via SpE propagation it may be possible to see Egyptian TV during the forthcoming DX season.

Service Information this month was kindly supplied by Gosta van der Linden (Netherlands), Alexander Wiese (West Germany) and the European Broadcasting Union (Belgium).



Bigger Ears Than Dumbo!

— the SLNA 145sb preamplifier
for the FT290.

£27.40 + 1.20 p&p inc. vat

There are usually two reasons for the less than adequate sensitivity of current 144MHz transceivers. Firstly, the receiver designer's brief includes a dynamic range specification which leads him to balance large signal handling with sensitivity. With devices currently available at prices the transceiver manufacturer is prepared to pay, the balance comes-out to around 4dB noise figure and 70dB intermodulation-free dynamic range in ssb bandwidths.

The second point is that, also to save money, designers shy away from the use of electromechanical relays for antenna change-over switching and tend to use various forms of diode switch. These inevitably introduce greater insertion losses than suitable relays, approaching 4dB in some circumstances. Thus it's not unusual for the overall noise figure of a transceiver to reach 8dB.

At 144MHz sky-noise limits the maximum usable sensitivity of a receiver used for terrestrial communications to about 2dB noise-figure. (This about the same as 0.05µV for 10dB s+n/n in ssb bandwidths). Lower noise figures are easily obtainable with modern devices, but they won't let you hear any more! However there is a distinct advantage in using a very low-noise preamp to improve the sensitivity of a transceiver — if it has been designed properly.

Overall (or system) noise-figure depends not only upon the noise figure of the preamplifier, but also on its gain and the noise figure of the subsequent stage (the transceiver, in this case). By adjusting the gain of the preamplifier it is possible to set the system noise-figure to any wanted value greater than that of the intrinsic noise figure of the preamplifier.

Why bother to adjust the gain? Because any preamplifier will degrade the strong-signal performance of the receiving system. The name of the game is to use as little gain as possible ahead of the receiver; just enough low-noise gain to set the overall sensitivity to a level where external noise is the limiting factor is all that is required. Use any more and the dynamic performance of the receiver will suffer unduly. A very low noise preamplifier will minimise the gain needed ahead of the transceiver and hence the degradation of the dynamics.

The SLNA 145sb is a preamplifier which has been designed using the principles summarised above specifically for incorporation in the FT290. It will also complement other 144MHz transceivers for which no complete front-end modification is available. Ask us about FDK 700's and 750's for example.

A low-loss nitrogen-filled relay provides a same alternative to diode switching. This is followed by a BF981 in an input noise-matched, output conjugately matched configuration for a very low noise-figure and optimum dynamic performance. Following the output matching a variable attenuator provides gain control without compromising the dynamic performance, which would be the case if the normal amateur practice of providing gain control by varying the bias on G₂ of the BF 981 was followed.

After the attenuator, a properly designed Butterworth bandpass filter provides substantial rejection of out-of-band signals.

The preamplifier is constructed and tested to very high standards. A plated-through-hole epoxy fibreglass pcb is employed and bushed mountings are provided for mounting in the FT 290R. A cable kit utilising high quality pte dielectric cables is also provided.

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— DATES FOR — — YOUR DIARY —

Dates for your diary is updated every month.

Club secretaries and organisers are requested to send information of forthcoming events as early as possible to *Radio & Electronics World*, Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

14th January	RSGB Presidential Installation	Cardiff Castle	RSGB Potters Bar 59015
16th January	DX Operating by G3OLU	Braintree DARC	Pat Penny 0376 26487
	Annual Constructors Contest	Stourbridge DARS	Robert Taylor 021-357 5171
	Ring club for details	Rhyl DARC	John M'Cann 0745 583467
17th January	Informal	Fylde ARS	F. Whitehead 0253 737680
	Grand Auction	Stevenage DARS	Cliff Barber 0438 89376
19th January	Moulded Case Circuit Breakers	Leeds	IEEIE 01-836 3357
	Talk on Crime Prevention	East Kent RS	—
23rd January	Construction (bench facilities available)	Stratford upon Avon DARC	Ian Hopwood 0789 68863
24th January	Annual General Meeting	Biggin Hill	Ian Mitchell G4NSD 0959 75785
	What have you made?	Mid-Warwickshire ARS	Carol Finnis 092681 4765
25th January	Liquid Crystals – Beautiful and Useful	Hull College of Further Education	IEEIE
	Activity Night/Night on the Air	Lincoln Short Wave Club	01-836 3357
26th January	Annual General Meeting	Greater Peterborough ARS	Pam Rose G4STO
	Operational Use of Europeans Communications	IEE, Savoy Place	—
	Satellite by the European Broadcasting Union	London	IEEIE
3rd February	A junk auction	Axe Vale ARC	01-836 3357
			Bob Newland G3VW
5th February	Bury Radio Society Ham Feast	The Mosses Centre, Cecil St, Bury	Roger Jones G3YMK
8th February	Lecture and slides on Astro photography	Lincoln Short Wave Club	Upottery 468
21st February	Demonstration of 10GHz operation	Biggin Hill	MHS Bridge G3VC
22nd February	Activity Night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
2nd March	A talk by Rex Williams G3RSJ	Axe Vale ARC	Ian Mitchell G4NSD
			Pam Rose G4STO
			Bob Newland G3VW
			Roger Jones G3YMK
			Upottery 468
14th March	Lecture – Amateur Radio on a Shoestring	Lincoln Short Wave Club	Pam Rose G4STO
16th March	BCS/Computing Award Winner	Lancaster Polytechnic	BCS, Coventry Branch
18th March	4th Annual Components Fair	Carleton Community Centre, Pontefract	A. Mason G4TGU
			N. Whittingham G4ISC
28th March	Annual General Meeting	Lincoln Short Wave Club	Pam Rose G4STO
1st April	White Rose ARS Rally	University of Leeds	A.N. Bramley G4NDU
11th April	Lecture – UHF then and now with a look at RSGB Metre-Wave Awards System	Lincoln Short Wave Club	Pam Rose G4STO
	Two-metre FM contest	Stevenage & District ARS	Bernard Dean G6NZC
15th April	Activity Night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
25th April	RSGB National Amateur Radio Exhibition	National Exhibition Centre, Birmingham	RSGB, Potters Bar 59015
28–29th April			

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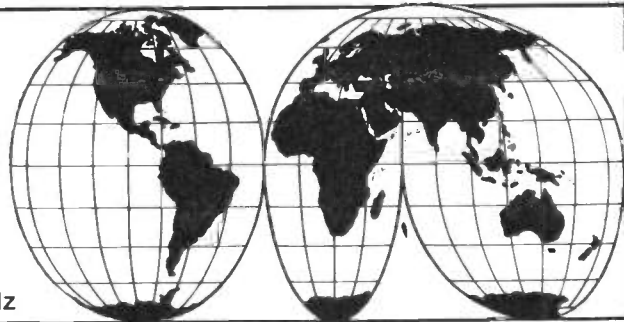
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SHORT WAVE NEWS FOR DX LISTENERS

by Frank A Baldwin

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



In the previous issue I brought to the attention of readers some of the Indonesian stations that could be received here in the UK now that the season for reception of transmitters in this area of the world is in full swing. Mostly, these were the more powerful transmitters which, of course, provide the best chance of getting through to our own islands here in the Northern Hemisphere. In this instalment of the South-East Asian saga some Indonesian stations operating on the more difficult 90 metre band (**3200 – 3400 kHz**) are brought to notice.

Commencing at the low frequency end of the band the first 10kW transmitter is that of RRI (Radio Republik Indonesia) Bukittinggi in Propinsi Sumatera Barat (Province Sumatera West) from which location it is on the air from 0930 to 1600 (Saturday until 1700). It is in parallel on **4910** but the frequency that interests us here is **3232**.

RRI is a network owned by the Indonesian government and the stations in this organisation are those most often logged and reported by Dxers on the short wave bands. The main station is sited at Jakarta, the capital of the Republic, this transmitter radiating national programmes and feeding programme material to various regional networks. Most Indonesian stations are required to relay the news bulletins from Jakarta.

On **3250** you may be fortunate enough to hear RRI Banjarmasin in Propinsi Kalimantan Selatan (Province Borneo South). With a 10kW signal, it is on the air from 2200 to 0100 and from 0900 to 1520. On Sunday, the former time-slot is amended to 2300–0715. This one is often reported in the SWL press. GMT + 8 hours.

RRI Gorontalo is on **3265** from Celebes, the schedule being from 2100 to 2400 and

from 0830 to a variable sign-off time around 1520. GMT + 8 hours.

As mentioned in the previous issue, the best time to listen for these Indonesian stations is at their opening times, usually from around 2100 to 2200 and just prior to the closing times, roughly from around 1500 onwards.

The **3265** channel is also occupied by another Indonesian in the shape of RRI Bengkulu. This one opens at 2300 and finally closes at 1600, the power being 10kW. GMT + 7 hours.

RRI Dili, Timor, operates on **3305** opening at 2155 and finally closing at 1415. GMT + 8 hours. The power is 10kW but the final closing time is not favourable as far as UK listeners are concerned. However, one never knows – logging Indonesian stations is something of a game of chance, one must be on the right channel under the right conditions at the right time – and that brings in Lady Luck! Select your channels and 'visit' them as often as possible – perseverance is the real key.

On **3325** there is RRI Palangkaraya, Borneo, opening at 2200 and finally signing-off at 1520. The power is 10kW and this one is also often reported by Dxers. GMT + 8 hours.

Then there is RRI Ternate on **3345** at 10kW, opening at 2020 and closing at 1415 but may also be heard – if you are lucky – in parallel on **3946**.

This one is more often reported than RRI Pontianak on the same channel with a 5kW signal, opening at 2200 and finally closing at 1520 but also working in parallel on **3995** but with a 10kW transmitter. Ternate (Moluccas) GMT + 9 hours; Pontianak (Borneo) GMT + 8 hours

A tune to **3385** might bring success with RRI Kupang, Timor from where it opens at 2130 and finally closes down at 1520. The power is 10kW and is sometimes listed in Dxers

loggings. GMT + 8 hours.

The last 10kW Indonesian transmitter on the band under review is that of RRI Tanjungkarang, Sumatra on **3395** at which point on the dial it opens at 2200 and finally closes at 1600. GMT + 7 hours.

Apart from the government owned RRI stations, there are five regional Nusantaras (Networks) each with a main station, thus Nusantara I (satu) covering Sumatra has a main transmitter at RRI Medan. Likewise, Nusantara II (dua) covers Java and Bali from RRI Yogyakarta; Nusantara III (tiga) from RRI Banjarmasin covers Borneo; Nusantara IV (empat) covers Celebes and Timor from RRI Ujung Padang whilst Nusantara V (lima) covers West Irian and the Moluccas from the main station at RRI Jayapura.

There are many other Indonesian stations that may be heard – albeit with some luck and quite a lot of effort – on both the 60 and 90 metre bands but in the main these are of the low-powered variety, from 1 to 5kW and therefore theoretically more difficult to log here in the UK. I shall be mentioning some of these in the next issue.

AROUND THE DIAL

Within which you will find the times, the frequencies and the programme contents of stations in the short wave spectrum that may, we hope, interest many of our readers. A start is made with –

AFRICA

Tunisia – Sfax on **15225** at 0557, songs and music in the Arabic style in a programme of the National Network and also for the Middle East, scheduled on this channel from 0430 to 2230.

Morocco – Tangier on **15335** at 1840, OM with songs, Arabic music in the Domestic Service Network 'A', timed on this frequency from 0700 to 2400.

Tangier on **15595** at 1503, YL with announcements in Arabic then dance music in the European style, all in the Domestic Service which may be heard at this point on the dial from 1000 to 2100.

Tangier on **17595** at 1507, OM with announcements in Arabic on the Domestic Service which is scheduled here from 1000 to 2100.

Madagascar – Radio Nederlands Relay on **15220** at 2107, OM with an English programme, all about the use of home computers by Dxers as an aid to their hobby. This was in the English programme intended for Central and West Africa and scheduled from 2030 to 2120.

Nigeria – Lagos on **15120** at 2055, local-style music then YL with station identification and announcements in English, the 'Talking Drum' interval signal at the commencement of the English transmission to Europe and North Africa which is timed from 2100 to 2200. The programme commenced with another station identification, frequencies, target areas and a programme review.

Kenya – Nairobi on **4950** at 1855, OM with a talk in vernacular, OM with announcements, OM's with choral anthem prior to sign-off at 1900.

Benin – ORTB (Office de Radiodiffusion et de Television du Benin) Parakou on **5025** at 0455, interval signal which sounded similar to an off-tune violin, the theme being repeated many times then YL with an African chant-like song.

Guinea – Conakry on a measured **15308** at 2032, OM with a song in vernacular complete with musical backing in the local style and rhythm. The schedule is from 1600 to 0730 and the power is 80kW.

AMERICA – SOUTH

Ecuador – HCJB Quito on **15295** at 2030, OM with station identification, frequencies and target areas, all in English prior to the French programme commencing. HCJB Quito on **17890** at 2130, OM and YL with announcements in Spanish during the transmission in that language to the Americas and timed from 1530 to 2145.

Brazil – Radio Nacional, Brasilia on **15290** at 0122, OM with a talk in the Spanish programme to North and Central America, scheduled from 0100 to 0145. It was all about Brazilian politics.

Radio A Voz de Oeste, Cuiaba on **4775** at 0426. The power is 1.5kW and the schedule is around-the-clock.

Radio Bare, Manaus on **4895** at 0247. Just audible under a USSR transmitter on the same channel. Radio Bare is on the air from 0900 to 0430 at 5kW.

Radio Cultura do Para, Belem on **5045** at 0300, OM with station identification in Portuguese, an electronic sound effect and then off at 0302.

Peru – Radio Rioja on **5045** at 0303 immediately after RC do Para (above) had signed off. OM with a song in Spanish followed by OM with promos. This one is on the air from 1100 to 0445, power not known.

CLANDESTINE

'Voice of the Free Sons of the Yemeni South' on **11180** at 1420, YL with a song in Arabic until 1425 when OM with exhortations also in Arabic. In Arabic this one identifies as 'Sawt Abna' Janub al-Yaman al-Ahrrar' and is hostile to the government of the PDR Yemen located in Aden. It is on the air from 1300 to 1500.

EUROPE

Spain – Madrid on **15125** at 2030, YL with station identification in Spanish, OM with announcements then into a programme of Spanish music in Programa Mundial (Worldwide Programme) which may be heard on this channel from 1900 to 2230 Monday to Friday inclusive.

Madrid on **15395** at 1958, OM and YL with the 'Topical Affairs' programme during the Spanish transmission which is on this channel from

1057 to 2200 Monday to Saturday inclusive.

Bulgaria – Sofia on **15110** at 0748, OM and YL with the English programme for Europe, scheduled on this frequency from 0730 to 0800. All about space exploration.

Romania – Bucharest on **15340** at 0529, interval signal, OM with station identification then YL with a newscast in the English programme for Africa, timed from 0530 to 0600. Another English transmission to Africa from Radio Bucharest may be logged on **15365** from 1730 to 1800.

NOW LOG THIS

Your attention is drawn this month to having a go for Wellington, New Zealand. Probably the best chance of reception for UK listeners is around the time it was recently logged here. Try on **15485** from 0430 onwards, actually heard by the writer at 0450, OM with announcements in English followed by a programme of brass band music.

The transmitter is somewhat elderly to say the least and is rated at 7.5kW. Programmes are mainly rebroadcasts of the Domestic Services and that logged was in the schedule for Australia and the North West Pacific Area, timed from 2015 to 1115.

The address is Radio New Zealand, PO Box 2092, Wellington. Dx reports must be accompanied by 3 International Reply Coupons and cassettes by 5 IRC's if return is required.

The interval signal consisting of the call of the NZ Bell Bird must be heard to be believed – it really does sound just like a bell.

FAR EAST

Burma – Rangoon on **4725** at 1544, YL with announcements in Burmese prior to sign-off without the National Anthem at 1546. The schedule is from 1030 to 1545 (Sunday until 1445) and the power is 50kW.

South Korea – Seoul on **15575** at 1415, YL with the station identification during the English transmission directed to North America and timed from 1400 to 1500.

MIDDLE & NEAR EAST

Pakistan – Azad Kashmir on **4980.5** at 1530, OM with a talk

in Urdu, announcements, then into a religious programme. Sited at Muzaffarabad this 10kW transmitter is scheduled from 1400 to 1800. Languages used are Urdu and Kashmiri.

Islamabad on **5060** at 1520, OM with a talk in Urdu in the Regional Service, on this channel from 0045 (December to March 0130) to 0230 (September to October 0210, 1400 to) 1600 (November to February 1630) to 1800. The power is 100kW but the frequency can vary at times from **5056** to **5062**.

Iran – Tehran on **15315** at 0534, OM with a talk in the Arabic programme for the Middle East and North Africa which is on this frequency from 0330 to 1300.

Iraq – Baghdad on **9610** at 2125, YL with the station identification, military music, various announcements followed by some Arabic music at the commencement of the English programme for Europe, scheduled from 2130 to 2230.

Baghdad on **15400** at 0525, YL with a song in the Arabic language Home Service Programme II, 'Voice of the Masses', on this channel from 0230 to 1800.

United Arab Emirates –

Dubai on **15300** at 1840, OM with a song in the Arabic programme for Europe, North and East Africa, scheduled here from 1645 to 1700 (not Friday, Saturday or Sunday) and from 1700 to 2050. Also logged in parallel on **15320**.

Saudi Arabia – Holy Koran Radio, Mecca on **11730** at 0602, OM with quotations from the Holy Koran. This station is on the air from 0500 to 0700 daily.

India – Hyderabad on **4800** at 1539, YL with a newscast in English of local events. Hyderabad closes at 1740, has a power of 10kW and English newscasts at 1230 and 1530.

Calcutta on **4820** at 1540, same news as above, this one losing at 1740 and having an English newscast at 1530. The power is 10kW.

Delhi on **3925** at 1537, YL with the local news in English. With a power of 10kW this transmitter has English newscasts at 1530 and 1730.

SOUTH-EAST ASIA

Singapore – BBC Kranji on

3915 at 1536, YL with announcements in English during a programme of classical music. This station is on the air from 1300 to 1500 in Burmese, Indonesian, Bahasa Malaysian and Vietnamese and from 1500 to 1830 (May to October until 1745) in English. The power is 100kW.

SBC Singapore on **5050** at 1530, YL with announcements in English during a programme of popular light music on records. The schedule is from 2230 to 1610 (Sunday until 1700). The power is 50kW.

Malaysia – Kuala Lumpur on **15295** at 1548, YL with a song in the Arabic programme for South East Asia, scheduled from 1530 to 1700.

Radio Malaysia, Kuching, Sarawak on **4950** at 1524, OM and YL with a discussion in English. This one is scheduled from 2200 to 0100 and from 0830 to 1600 in both English and Chinese. The power is 10kW.

Guam – KTWR Agana on **11350** at 1320. OM with a talk in the Mandarin programme directed to China, scheduled from 0815 to 1500.

Indonesia – RRI Ujung Pandang on a measured **4719** at 1511, OM in Indonesian. The schedule is from 0830 to 1530 (Saturday until 1600) and the power is 50kW. RRI Banda Aceh on **3905** at 1537, OM's with a discussion, presumably, in Indonesian. Banda Aceh is scheduled from 1100 to 1600 and the power is 50kW.

RRI Palembang on a measured **4856** at 1519, OM with announcements in Indonesian, some local-style music then OM with more announcements. Palembang is scheduled from 2200 to 0115 (Sunday until 0700) and from 0900 to 1600. The power is 10kW.

NOW HEAR THESE

RRI Bukittinggi in Sumatra on a measured **4910.4** at 1522, OM with a talk in Indonesian. With a power of 1kW, Bukittinggi is on the air from 2300 to 0300, from 0500 to 0715 and from 0930 to 1600.

Or you may like to try for Melbourne, Australia on **6035** at 1555. OM with station identification and the news at 1600, all in the External Service to the Pacific Area, Papua/New Guinea and Asia, scheduled on this channel from 1530 to 2200.

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How to construct a unit that matches the solid-state transceiver with narrow-bandwidth low impedance antennae

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OSCAR-10

Terry Weatherley provides detailed orbital information about the latest OSCAR – a must for satellite enthusiasts

AMTOR

An introduction to Amateur Telex Over Radio, followed by a description of a baud rate generator suitable for AMTOR timing

ONE NIGHTS WORK

Another of these popular projects from Stephen Ibbs. Next month he describes an audio amplifier using the LM380

DATA BRIEFS

The Hitachi HA 1197 is the subject of the March issue Data brief

PLUS all the usual features!

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DONT MISS the March issue – on sale **10th February**

To be sure of your copy of *Radio & Electronics World*, complete the newsagent order form on page 86 or take out a subscription by using the form on page 73

CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.

We occasionally receive suggested modifications from readers who have constructed projects from **Radio & Electronics World** and we will publish those that would interest other readers. For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information. Write to Corrections and Mods, **Radio & Electronics World**, Sovereign House, Brentwood, Essex, CM14 4SE.

A Fax receiver Jan 84

To my eternal shame I have found an error in the 2716 EPROM HEX listing (page 35). BYTE 010F should be altered from 07 to 03. Fortunately the offending bit can be programmed down manually. A ready programmed 2716 is available for £5.50 inclusive from:- J & F Computers, Rosehill, Ladock, Truro, Cornwall TR2 4PQ

'Poor man's Spectrum Analyser', Part 1 (Nov 83 issue).

The following notes should be added to the relevant Figures. Please note that some of the notes refer to American part numbers and it is suggested that the equivalent UK numbers would be available from suppliers.

Figures 5 & 7: Resistors are 1/4W, 5%. Unspecified capacitors are 50V ceramic. Those marked 'SM' are ±5% silvered-mica. Those marked 'FT' are 1000pF feed-thru. Shielded boxes made from single and double-sided G-10 circuit board plus copper shim stock.

Additionally (Figure 5) the emitter of the VCO transistor should be connected straight to earth, not via a resistor as shown and the MV209 or MV309 varactors may be substituted for MV10-9's (all Motorola products).

Also (Figure 7), L43-12rf transformers and FT37-43 toroids are Amidon supply.

Figure 6: Filter box is 1 1/2in deep, made from materials listed above. Coils are 6 turns of #12. Dimensions, 1/2in inside diameter, 3/8in long, taps at 1/4 turn.

10pF piston trimmer is Sprague-Goodman GGP8R500 or equivalent, alternatively, air variable Johnson type 189-564-1.

Mount the BNC connectors near front side.

Coupling apertures are 3/8in x 3/8in. Drill 3/8in diameter holes in compartment wall pieces, then solder copper shim strips across tops and bottoms to narrow apertures.

'Facsimile reception' (Sep 83 Issue).

Keith Mitchell has drawn our attention to corrections to **Figure 2** (see diagram A).

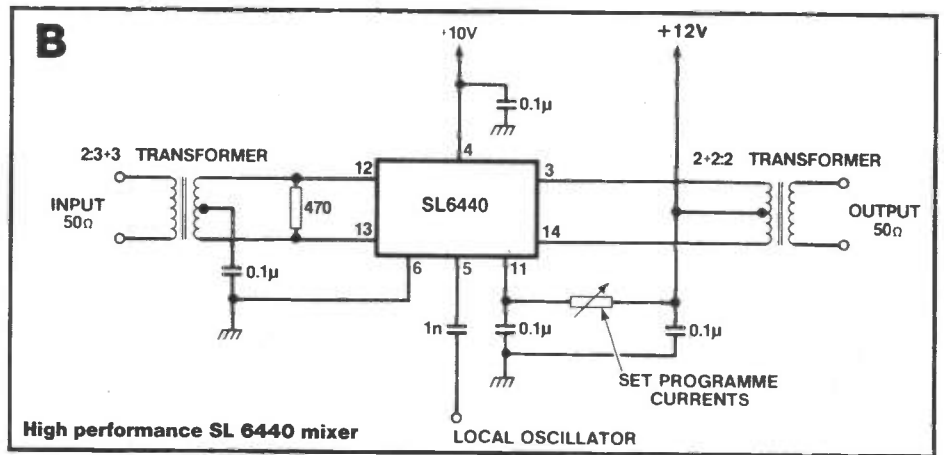
LCD display option for the Rewbichron 11 (Jan 83 issue)

Stephen Ibbs advises the following correction. In **Figure 2** pins 2 and 4 of IC2 should be joined together; pin 6 of IC3 should be joined to pins 2,9 and 13.

Communications Building Blocks (Dec 83 issue, page 43, Figure 9).

We regret that the circuit diagram is

not in accordance with the caption. The correct diagram for the Plessey SL6440-based mixer circuit is given in diagram B below.



High performance SL 6440 mixer

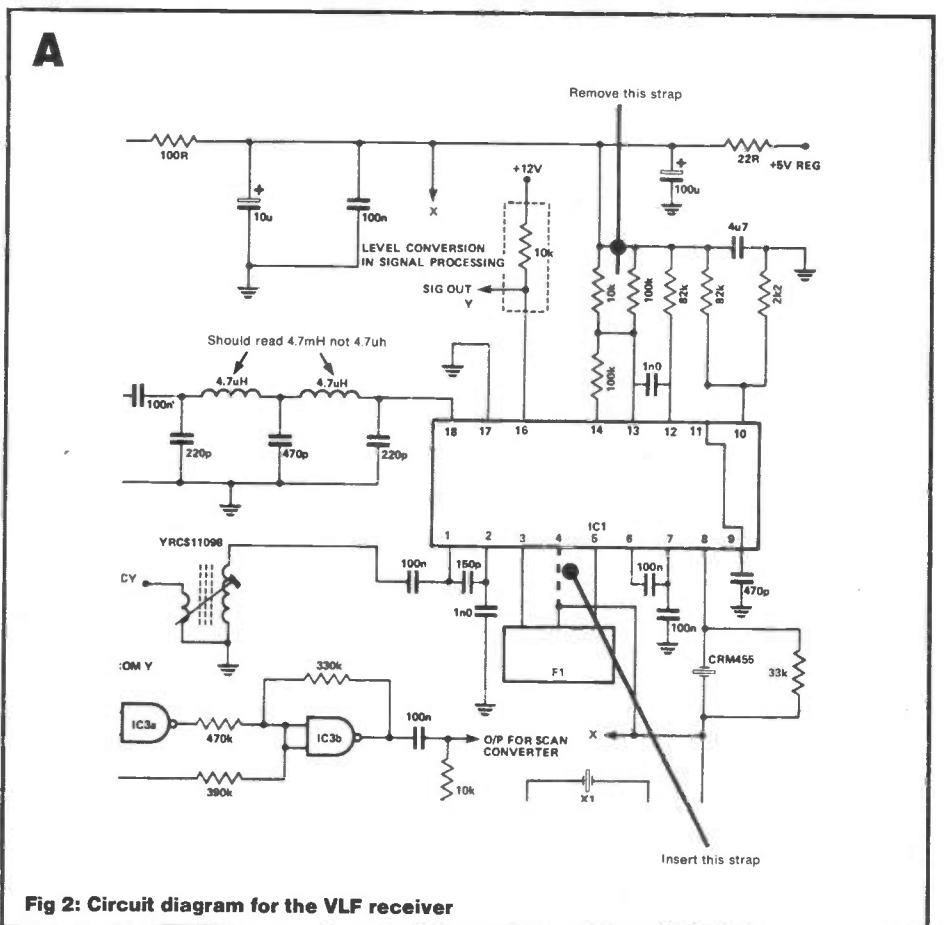


Fig 2: Circuit diagram for the VLF receiver

ATV on the Air

Presented by Andy Emmerson, G8PTH



More super SSV pictures, sent on two metres by F1EDM to G8CGK and printed on a computer printer

Seventy centimetres

Seventy centimetres is our natural starting point and on 'that weekend' conditions were wide open. What's more, operating standards were high, reflecting great credit on all concerned, excepting the space-shuttle enthusiasts who occupied our calling channel on Sunday morning, giving us an object lesson on how not to work DX! Anyway, there were some excellent signals around - I have to single out Brian G8DTQ (Caterham), Ken G8DIR (Shrewsbury) and Jean-Francois F1EDM (Bordeaux-St.Clair) who all put out P5 pictures. All three used QRO amplifiers, which does help, but even 10 watt stations had a field day as well. F1EDM was so strong that he overloaded my masthead preamp here at Northampton and I had to unpower it to see his pix properly. He worked as far north as Shrewsbury at least, which is several hundred kilometres, and fair DX in anyone's book.

Other stations who were active recently include: G4MDU (Stoke Bruerne), G8CHK (Pattishall), G8JBQ (Milton Keynes), G3TGE (Newport Pagnell), G3UDC (Bletchley), G8FAK (Cranfield), G4CPE (Luton), G4HGZ (Dunstable), G4CRJ (High Wycombe), G8UGU

(Long Buckby), G6LUV (Bletchley), G3UMF (Oxford), G8BWC (Nottingham), G8MNY (South London), G6TRX (Romford), GU8FBO (Guernsey), G6SKO (Somercotes), G6CUQ (Redditch), G8JMJ (Stoke), G3VPC (Wimborne), G4HMG (Iver), G6YLG (Sedgeley), G8VBC (Woodville), G1BTF (AL32e),



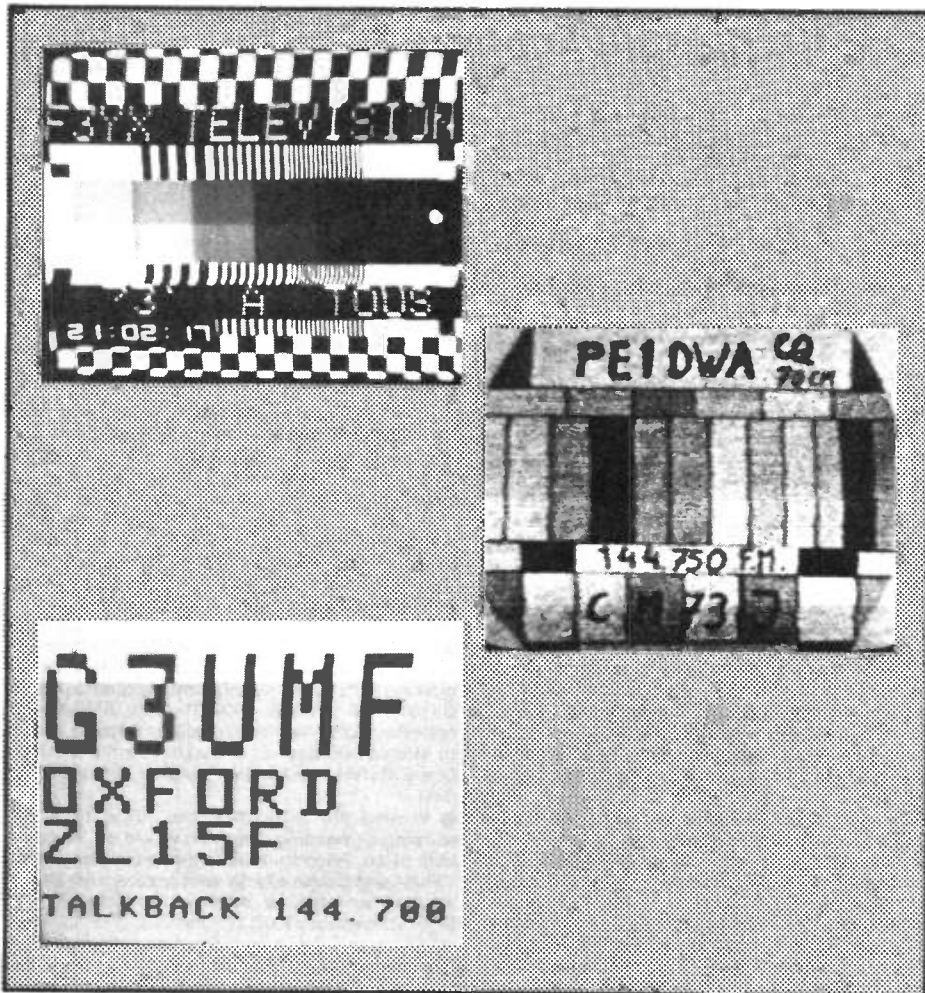
Closed circuit quality (colour) SSV received by G3WW on 30 November 1983, from Italy.

G4EUF (Leicester), GU6EFB (Guernsey), G3YQC (Rugby) and yours truly G8PTH (Northampton). Obviously there are many more, but these are the callsigns reported to me! DX stations logged in the Midlands included DD5CE, PE1GVS, PE1DWQ, F3YX, PE1HLA and PE1DWA. Just because you don't live near the coast it doesn't mean you are debarred from seeing/working continental stations! In fact, this year has been very good for UHF openings and as long as you keep an eye on the 'DX indicators' (ie patterning on out of area ITV channels) you shouldn't miss the lifts.

Incidentally, during the December opening I noticed a couple of stations were having difficulty with solid state 'linears'. Basically, they were tuning for maximum power on the output meter. Unfortunately, this doesn't work with TV and merely produces a cramped and unwatchable picture with no syncs. TV is negative modulation, so in fact you should tune for minimum on the power meter - this sounds crazy but it's (almost) true! You really can't transmit TV unless you can see the outgoing waveform and this means having a detector in the antenna feedline coupled to a 'scope. Apart from getting some tolerant person to 'talk you in' there is no other way of sending a properly modulated TV signal.

News from North Wales: Derek GW3FDZ (Dyffryn Ardudwy) and Keith GW8WNB (Tal-y-Bont) are on 70 cm TV every Wednesday evening at 8pm (talk-back on 144.75). They'd welcome extra folk in the net, so why not join in? Their locations enable them to cover most of Cardigan Bay and they will be pleased to arrange schedules (ring Dyffryn 343 or 7714).

Our Scottish scribe, Norrie GM4BVU has been transmitting SECAM as well as NTSC! Monday night is activity night in central Scotland: stations to watch out for are Keith GM8HGT (Shettleston), Angus GM4JYZ (Kirkintilloch), GM4UBJ (Motherwell), George GM6AOR (Longridge), Iain GM6HFH (Stonehouse), Tom GM4PRO (Chapelhall), Tom GM3HBT (Larkhall) and Willie GM8FAA (Moodiesburn). To finish 70 cm, the following had their pictures in the



A selection of 70cm pictures received from near and far during October 1983 by Andy G6LTZ at Old Stratford, Bucks. F3YX is near Paris and PE1DWA in Zoetermeer, Netherlands

Benelux DXers magazine, having been received on 18th June in Holland: G3RJM, G6BIA, G3UMF, G3ZUP.

1200MHz and up

The excellent opening mentioned above was just as good on 24 centimetres, and several stations exploited this fact. CQ-TV editor John G3YQC in Rugby saw plenty of activity on the 3rd December and had a P5 two-way contact with G4CPE in Luton. John also transmitted to F1EDM who was able to receive his signals at P4.5 and then transmitted them back on 70cm to prove the point.

Another who played this trick was Rod G8VBC (Woodville, Derbys.), who also had a P5 two-way with G4CPE and managed to get a P5 report from Jean-Francois (40W rf output). Rod also saw his own pictures coming back. Unfortunately F1EDM's 24 cm transmitter was out of commission but Rod achieved his first two-way to France when F3LP (Le Havre) returned his signals. This contact was P1 in both directions. F1EDM clearly has an excellent site and appears to launch straight into the ducts.

Rod remarks that radar interference from Clee Hill is awkward at all times, but during this lift it was intolerable, wiping out all reception with Rod's normal rather wideband FM system. He had to resort to slope detecting signals with an AM receiver (narrower band). This at least gave recognisable pictures but

even then the screen was blanked out every seven seconds.

Other 24cm news has been received from Ian G8CQE (near Croydon) who has been starting QRP tests with Dave G8GKQ in Penge. Dave is slope detecting, using a R&EW design converter. Tony G8XRX in Lancing is one of the Worthing Repeater crowd and is on the air on 24cm. To transmit he uses the RadCom microwave drive source and a 'black brick', the blue ones having run out! This gives 4 watts ready for a varactor tripler; the diode for the latter cost just £1 and works just as well as the expensive ones (which are available again from Wood & Douglas). The receiver is a BATC converter and BATC FM IF strip. The antenna is a homemade 23 element yagi. Tony is building a 2C39 PA to the CQ-TV design and is just waiting for the DX...

Repeater news is good - GB3VR is operating for tests under manual control at G8KOE's residence and seems great. GB3GV has also been tested as a beacon, and as soon as the proper licences come through we can expect great things. 1984 will be the year of the repeater!

Slow-scan news

This time I have lots of SSTV news. I actually met an SSTVer at the Leicester rally and he assured me there are others like him, though he was reluctant to identify himself or put pen to paper,

presumably for fear of incriminating himself. A bolder type is Grant G8CGK in Ross-on-Wye, who received good pix on two metres during the December opening from PA0APM, DF8BA and F1EDM. Signals from the latter were so good that they look like closed circuit quality, proved by the printout Grant sent in. He has his receiver linked to a computer system and an Epson MX-80 dot-matrix printer which does a superb job with the SSTV image. Grant also bemoans inconsiderate FM stations who say 'QSY 1 MHz down' from S20, land on the SSTV calling channel and then complain of 'thermostat' interference. It's a pity that some folk are not aware of band plans and speciality modes; perhaps they don't read this column.

Richard G3WW (Wimblington) sends a comprehensive list of active stations: noteworthy are Keith G4GZN (Catford) and G3CCH. Richard has now worked 1,937 SSTV stations two-way in more than 111 countries, a remarkable record and mentions two SSTV nets held every Saturday, IVCA at 1500 GMT on 14230 and the USA net at 1830, again on 14230. He mentions two new SSTV periodicals hailing from the States, 'SSTV Today' and 'Vision'.

Colour is the thing in SSTV these days, with a variety of standards and commercial solutions for achieving the colour signals. The G3WW and G4GZN method is 24 seconds single frame, with a Volker Wraase SC-1 converter and Kaga 12in RGB colour monitor. These monitors will work with a 'fix' of Richard's but he has not yet found a way of getting analogue input or contrast control for these monitors.

Amateur Radio Exchange have the new Wraase SC-1 scan converter mentioned above. The first person to get one was Albert G4NJI (Rotherham), who proudly collected his at the Doncaster rally and rapidly put it to good use. The SC-1 will also receive the American 16 and 32 second monochrome transmissions, also FAX. Another new gadget is the American 'Blinky' audio tuner, which takes the skill/guesswork out of lining up SSTV, RTTY and CW signals for computer terminals such as the Robot 800 multi-mode terminals. Some amateurs still use long persistence CRTs, of course, and you can work SSTV with very modest equipment.

Final notes

Robin G8XEU has enhanced his Spectrum program mentioned previously, and it is now available on Microdrive for £10.50 inclusive. A BBC version is on the way, too. Details in return for SAE to Robin Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. Ask for details of other radio-orientated software. In Athens, BATC member Bill Mercer has at last got a working SECAM coder, using the Hitachi HD4007 i.c., which also produces all the pulses for a subcarrier locked PAL coder. Bill is also building the John Goode PAL coder.

That's it: there has been a lot this time, so apologies if I had to trim down your news. Let me have more for next time and send it to me care of the editor.

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- ICOM IC-260E 2M all mode transceiver, three memories, tone burst, input for microprocessor control, ten or three watts switched, £240 ono. Write or phone, P.R. Smith, 17 Aled Drive, Rhos on Sea, Colwyn Bay, Clwyd, LL28 4UU. Tel 0492 40780. May be able to deliver by arrangement.
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- IC-720A Gen. Cov Tx and Rx. 18 months old, orig. packing £795. 13.8v. 25A continuous 35a surge SMC PSU £85. Both for £850. SEM tranzmatch 160-10m ATU £60. Homebrew 13.8v 15A PSU overload protection etc. only £30. Superb admiralty morse key, one owner since new, orig. packing £85 ono. Genuine reason for sale. Please write to Simon Langlois, GJ40DX, Merchant Navy College, Greenhithe, Kent, DA9 9NY. All replies answered.
- Trio 2200GX all X tals ni-cads charger case £60. Tel: Connolly, Bristol 851285.
- Two Pye Cambridge low band one boot mount one dash £20 each. Pye reporter £5. WW2 1372 RX £5. Avo valve tester £5. Taylor Ditto £5. All collect or plus carriage. Edwards, 2 Beach Rd., Burton Bradstock, Bridport, Dorset. DT6 4RF. Tel: 0308 897625.
- Dragon Disasse M61Y programs for sale £3.00 each. Adrian Stokes, 104 Exhall Close, Church-Hill, Redditch, Worcs. B98-9HZ. Tel: (75) 60495.
- Hacker Radio RP38 £25 ono. Murphy B815A Radio £25. Both excellent condition. Tel: Nuneaton 388449 will swap for DF set. M. Alton 59 Purcell Ave., Nuneaton, Warwickshire. CU11 4SN. Tel: 388449
- ICOM IC-22A FM 2 MTR transceiver 12 XTLS 1/10 watts, auto tone, burst £70 ono Tel: Taunton (0823) 84266.
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- Ex Nasa satellite diversity telemetry receiver. ME3577 Fully synthesised dual AM/FM VHF 130-137 MHz 19in x 7ft rack system. comprises of synthesiser, spectrum display unit, receiver, diversity combiner signal generator PSU. All leads and manual plus complete set of spare units. Enough for second system. Ideal for weather sat reception. Must be seen at £900 the lot. J. Watson, 80 Salisbury St. Beeston, Nottingham. NG9 2EQ. Tel: 0602 253665.
- Robot 800 RTTY, Morse sender/decoder with Tandy green screen monitor £425. B Joiner, 25 Garston Lane, Watford, Herts. Tel: 09273 76489.
- QRN-free Qth for retiring Ham unlimited antenna space Mull of Kintyre North Shore West Loch Tarbert timber semi in forest hamlet five miles Tarbert. Three bed spacious living room in very good condition. New roof. £14,000 for quick sale. G3LXB Tel: 0900 823269.
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- UK101 Kompukit computer 8k with wemon monitor switchable and sound board reverse video plus £50 worth of software in smart case £80 ono or poss. swop for communication receiver. Rock Cottage, Bulthy Middletown, Nr. Welshpool. Powys. Tel: 0743 78514.
- Jaybeam 48 element multibeam-70cm aerial. Assembled but never used. £25. Adonis 202F safety boom mike, never used. £25. Prefer buyer collects. Phone Dave G6UPQ. Evening/weekends. Witney (0993) 75241. (Oxfordshire).
- Yaesu FRG7 receiver with handbook. Excellent condition. £115. Mile Norman G6OPE. 55 Unwin Road, The Reddings, Cheltenham. Glos. Tel: 0242 510138.
- Four channel synchronised sound to light sequence chaser for clearance £40 plus two matching four channel cabinets for clearance £30 each. Tel: Innerleithen 830796.
- Yaesu FT227R 2M 5KC and 25KC Scanning auto tone Bvest Rev. RPTR original packing mobile mount £110.00. Mr. J. Jacobs, 17 Cotswold Drive, Albrighton, Wolverhampton, WV7 3DQ. Tel: 090 722 3975.
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- Amstrad cb901 with antenna power pack £45 PYE Bantom £10. Atari TV game with games etc. £70 TR 7800 etc £208. Alastair Hunter. 27 Crichton Rd., Pathhead, Midlothian, Scotland. EH37 5RA. Tel: 0875 320 642.
- Unused and in very good condition, Mullard equipment rack. Will hold up to 32 standard cards. Offers around £10. Also 6802 development board. Offers around £50. John Taylor, 47 Spur Road, Orpington, Kent. BR6 OQT. Tel: 0689 35353.
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- Scope CD1212 40 MHz and dual plugins with trolley. £80. Counter 35MHz £15. Ultra cuts R1 R4 Nicads charter £20. FRE7 SSB filter mods to SSB exciter £120. Ian G3ROO. Tel: 0304 821588.
- Heathkit HW12 80 Metre 200w SSB transceiver bench mobile power packs, Mic spare valves, manuals, good condition £95 or swop 2M hand held. Tel: Penketh 2381.
- Drake TR4C AC4 PSU plus mobile PSU, perfect working order £375. GW4JQQ. Tel: 0558 823301 evenings.
- IC-700 TX, RX and PSU (INOUE) good condition £175 ono. Merchant Navy College ARC Club. Station (G4MNC). Please contact Treasurer G4RWT. Tel: 089 283 2590 evenings and weekends. Buyer inspects and collects.
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- Yaesu FT 290R includes Nicads original packing. Jaybeam 8 Ele beam. Araki 1/2 GP colinear R68 and RG213 Co-ax in lengths approx. 30 ft. One 12ft 2 in dia ali pole. One 10ft 1 1/2 in dia ali pole. Various other bits and pieces. Offers for any or all of above. SAE or phone for further details. J. Peerless, 157 Fairmead Crescent, Edgware, Middlesex. 01 958 6887.
- Nascom 64K, running at 4MHz, NAS-SYS 3, UDG, ZEAP 2-disassembler-debug, Pascal, Forth 8k basic and extension, Sargon chess and other games. Buffered to Nasbus, manuals, cased. £180 ono. Tel: 0933 53844.
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- FT902DM absolutely mint used TX 12 mins only RX 3 months only complete with hand mic manual original packing. Known history certified up to spec by Holdings Blackburn £565 ex computer PSU. Variable volts 7v 22v 18/20 amp very ugly very heavy very efficient £35. RS52125 John Tel: 01 857 8096. 263 Dunkery Road, London SE9.
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- Modem Racal Milgo 2200 Modems 1200 or 2400

- BPS with options. BT approved tested good working order. £30 each or £50 for the pair. Keyboard enclosed alloy case. 76 good quality reed keys - ideal for use with ZX81 and other computer or RTTY uses £6. Tel: Ralph G4PEY Horsham (0403) 69835.
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- Tektronic RM503 Scope £95. Lambda regulated power supplies 125v A.C. input 325/500v 400ma D.C. Output £20, two for series or parallel operation. 19in 6foot rack £5. All carriage extra. Telephone 0625 828526.
- Belcom Liner 430 432MHz SSB transceiver fitted Preamp. £120 ono. Pye Antenna filter AT29908 132 to 174 MHz. £10. Pye A200 Linear Amplifier two BLW60's in output £40. Pye Wisam Westminster mid band as new £65. Marconi TF144H signal generator £85. Ceramic 2C39A valves. £10. each. John Moxham G8KBQ., 22 Whiting Road, Windmill Hill, Glastonbury, Somerset. BA6 8HP. Tel: 0458/33145 (daytime).
- ATV Program for the 48K Spectrum as reviewed in Nov 83 R & EW now with 36 features including testcards, maps, large printing, QRA calculator and much, much more. The price which includes a 16K version and full instructions is only £5.50 inc.p.& p. from R. Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. For list of other programs send sae. Tel: Worthing 67228.
- Oscilloscope. Hitachi V302B DC-30MHz dual trace mint condition. £220. PU Briggs, 23 Station Rd, Banks, Southport, Merseyside PR9-8BB Tel: Southport 29036
- Icom IC730 HF transceiver, condition as new, superb portable or fixed station, £390 ono. Valradio 12 volt DC to 240 AC converter, ideal field portable use, offers invited. Mr BCA Kenneford G3MIN, 2 Mill Lane, Shoreham-by-Sea, W. Sussex BN4 5AB Tel: Shoreham 3552
- Roband T111 power supply. 0-50v at 5A. £48. Furzhill V200A V.V.M. 100µv-100v AC. 10Hz-10MHz + manual £19. Heathkit MMU-1U Multi-meter + manual as new £25. Phone 01-660-5418
- Yaesu Sommerkamp FT DX 150 HF transceiver in superb working order and condition 12v DC or mains. First £299 secure write Alain Unit 49, P.O. Box 4 Ledbury HR8 2YA
- FREE to collector, Practical Wireless Magazines, 1974 to 1978 with index plus a few later issues. Must be collected. Phone Droitwich (0905) 772417 evenings
- Phillips N1700 + tapes 'working' but cassette holder stuck. Anybody with B16 hammer? £50 ono Mr CG Holloway, 42 Oban Street, London E14 OHZ tel: 01-987-2296
- Shugart floppy disk DS DD not used since purchased - with manual - Datong FL1 filter - Datong speech module with home brew case - Europa 2m transvtr as new used once. Two Morse code readers from USA one with 16 segment display one used with monitor. Elec. Multi-meter,

- RF probe Model CT471A - Heath HW17A with FM module - Heath VFO 2m to 10m model HG10B - offers to G4DEL Hornchurch 51410 (Essex)
- Scope Tektronix 556 dual beam main frame fully operational plug ins. Require attention £65. Also large ST-CM of BC- BS- BF new transistors for sale. Mr DP Jason, 142 King Street, Great Yarmouth, Norfolk NR30 2PQ.
- FT101E HF TX/RX, Handbook, Manual, AC and DC leads, serviced by S.M.C., vgc £350. Reason for sale: want to buy new All mode 2m rig. Contact G4RGB, Medway (Kent) 0634 30822. Ansafone.
- FRDX400 RX 160 to 10 also CB 2m and 4m converters 4 filters FM unit xtal marker £100. Creed 444 only 128 hours use 45 baud best offer preference to Raynet member RF2200 mobile transceiver LSB USB AM 4 channel only 40m fitted 100 watt PEP ATV workshop manual £75 G31DW (0793) 822055
- Marconi pulse generator type TF675F pulse freq. from 50kHz to 0.1kHz in good working order offers. Also Marconi signal generator type TF801B range from 10MHz to 500MHz needs attention offers. Chris Hodges G4PQN, Rosling Cottage, Horfield Common, Horfield, Bristol BS7 8UU Tel: (0272) 41356
- 16mm Bell and Howell film and sound projector. Films. Spares. GWO. Part of auto thread missing but easy to load. Swap or sell any amateur radio gear W.H.Y. cheap as room required £40. FRG White G4IFP, 1, Langstone Drive, Exmouth, Devon EX8 4HT. Telephone Exmouth 727295
- Transverter Yaesu FTV107R/144 new and unused also cables to match it to FT102 transceiver £75 plus carriage etc. Hill, tel: 061 480 4550 (work) 061 366 0927 (home)
- IC255E 2M 143.8-148.2 1@25W Excellent condition. £160 Tel: 029.922 279 (Clows Top) Worcs. Exchange for 2m 10Win 50-80W out. Lin-amp wave meter WHY.
- Linear 3-30MHz 150 PEP approx 2xMRF454 13.8v push pull FM-SSB input .5-12w PEP. Output 50w 100w 150w switched 3 pos. Suit mobile. Phone Barrock Scotland 243 8pm any day. £89
- Trio 9130, 2m all mode TX/RX, hardly used, still boxed. Also brand new Welz SWR/power meter, two mobile aerials, gutter mount and mobile speaker. All in excellent condition. £380 o.v.n.o. Tel: Warrington 64435
- Icom ICB1050 10 metre F.M. transceiver £30. Airmec modulation meter type 210A. Covers 3MHz to 300MHz complete with manual £45. Heath DX40 TX with VFI-u VFO all circuits and spare valves. £40. Minimitter home brew TX covers 160 80 40 metres £20. Tel: G4AQZ after 6pm on Clacton on Sea 861632
- Shure 201 mike £10. Various DC current meters. R.F. ammeters. Old pattern valves. Fixed caps 2kv. Working. Parker, 133 Station Road, Cropston, Leicester LE7 7HH
- Trio 9000 Multimode 2m Very good condition mobile bracket, scanning mike £230 also 8 Ele Quagi SQY08 and Hirschman Rotator £70 will split or £280 the lot. All twelve months old G6LVT. Ring Crewe 0270 60770 No offers please
- PFI Pye pocket phones two pairs unmodified with batteries £8.00 a pair Elliott 0767 80043 (Sandy Bedfordshire)
- FRG.7 Yaesu receiver mint with FM £140. Also ham Int'l 'Jumbo' complete with service manual boxed mint. £250 ono. Please ring after 6pm. TG Hellyar, 'Harlyn Place', Harlyn Bay, Padstow, Cornwall PL28 83Q Tel: 0841 520000
- Cavity wave meters. 2mts 70cont 23cm. All in one. Plus Alpha keys. A key for the Connoisseur. P. Sergeant, 6 Gurney Close, Costessey, Norwich 0603 747782
- Kenwood SSB transceiver TS-120V 80m-10m good cond plus matching 200w linear amplifier TL-120 £250 ono. Also available external VFO VFO120 brand new £30 yes £30 all this would have cost £565 3 years ago! For sale to licenced amateurs only! Mr G Bailey, 70 Deepfield Way, Coulsdon, Surrey, CR3 2SR Tel: 660 5689
- ZX81 morse keyboard sending program. 50chr buffer (type into buffer during sending) plus fixed messages/variable length gaps for contests. 2-180wpm, uses G4CIZ port Sep 82 'Radio Communication' includes M-S send facility that article