FOR THE RADIO ENTHUSIAST . . .

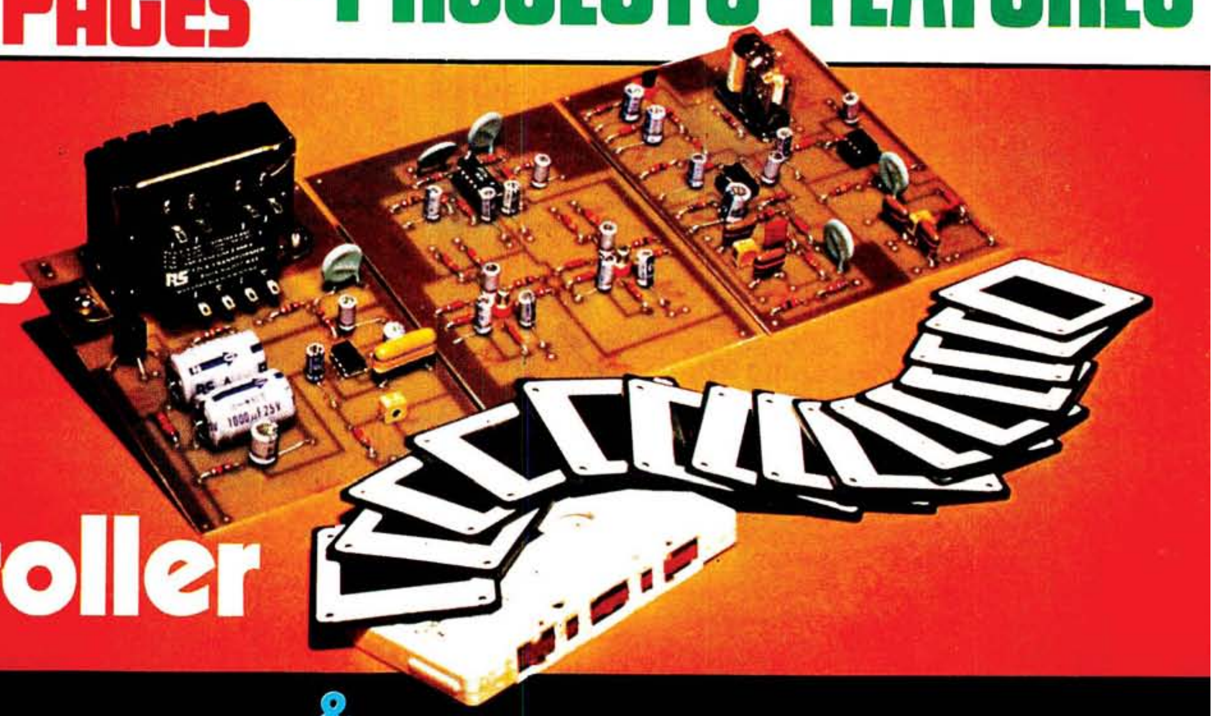
JANUARY 1981

Practical Wireless

Australia $1.15
New Zealand $1.25
Malaysia $4.00

65p

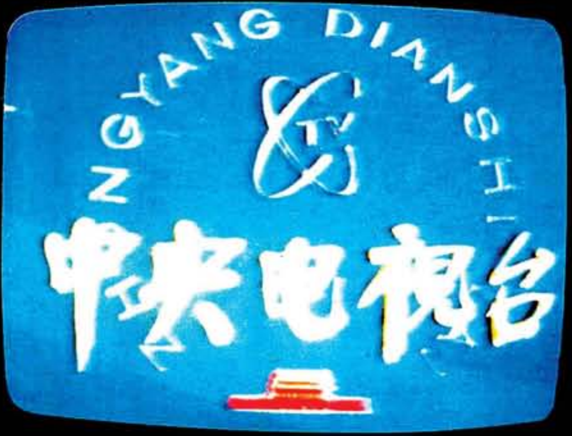
8 EXTRA PAGES OF PROJECTS & FEATURES



tape-slide controller

&

DXTV The Basics



PLUS
PW 'NIMBUS' Scanning Module
Back-up Power Supply for a Portable Radio

AS REVIEWED THIS ISSUE
TRY OUR **TR 7800**
IN OUR SHOWROOM NOW!

Bredhurst electronics

HIGH ST., HANDCROSS, W. SUSSEX 0444 400786

THE IC2E "POCKET PORTABLE"

- Fully synthesized – covering 144-145.995 in 5KHz steps.
- 1.5W power output with 9V battery as supplied.
- Optional 6V or 12V packs for lower or higher power.
- BNC antenna output socket for helical or external antenna.
- Weight – only 450 grams, with supplied battery pack and helical.
- Send/battery indicator – indicates transmit until time for battery recharge.
- Duplex/Simplex switch – Hi/Low power switch.
- Optional external speaker microphone available now.
- Full 12 months guarantee for all rigs bought from Bredhurst Electronics.

£159
inc. VAT & CARRIAGE

This month we thought we would use some of our expensive space to send a seasonal message to all our customers both past and future. Although we are newer than some other dealers in the amateur radio market, we have always "Tried Harder" to give all customers the best advice and service possible. We would like to thank you all for your custom, and we hope to meet many more of you in the coming year.

Best 73 and Merry Xmas from

Richard G30QT **Bob G3VXJ**
Graham G8YYQ

YAESU FT 480R 2M MULTI-MODE

£359, inc. VAT & CARRIAGE

ICOM IC260E 2M MULTI-MODE

£339, inc. VAT & CARRIAGE

TRIO TR9000 2M MULTI-MODE

£345, inc. VAT & CARRIAGE

FDK MULTI 750E 2M MULTI-MODE

£299, inc. VAT & CARRIAGE

TRANSCEIVERS

H.F.	
TRIO TS130V	£404.00
TRIO TS130S	£491.00
TRIO TS520SE	£437.00
YAESU FT707	£499.00
YAESU FT101Z	£488.00
YAESU FT101ZD	£569.00
TRIO TS830S	£639.00
TRIO TS180S (with DFC)	£679.00
YAESU FT107M	£690.00
2.M. MOBILES	
FDK Multi 700EX	£199.00
STANDARD C8800	£250.00
ICOM IC255E	£255.00
TRIO TR7800	£265.00
HANDHELDS	
FDK PALM II	£99.00
ICOM IC2E	£159.00
FDK PALM IV	£159.00
AOR AR245A	£178.00
TRIO TR2300	£166.00
YAESU FT207R	£199.00
TRIO TR2400	£198.00
2.M. MULTIMODES	
FDK MULTI 750E	£299.00
ICOM IC260E	£339.00
TRIO TR9000	£345.00
YAESU FT480	£359.00
ICOM IC251E	£479.00

RECEIVERS

H.F.	
LOWE SRX30	£158.00
YAESU FRG7	£199.00
TRIO R1000	£285.00
YAESU FRG7700	£309.00
2.M. F.M.	
SEARCH 9	£45.00
A.O.R. AR22	£83.00
FDK TM56B	£79.00
BEARCAT 220FB	£258.00
MARINE V.H.F.	
SEARCH 9	£45.00
S.R. 11 (+ scan)	£55.00
FDK TM56B	£79.00
BEARCAT 220FB	£258.00

Contact Bredhurst to order the latest H.F. Receiver from Yaesu FRG7700. **£309.00 or £389.00** with memories.

ACCESSORIES

	Price Carriage
KEYERS HK707 (Up/down)	£10.50 (£0.50)
KEYERS HK704 (Sqeeze)	£14.50 (£0.50)
KEYERS EK150 (Semi/fully auto with monitor) 240V/12V	£74.00 (—)
HELICAL BNC – 2 metres	£4.50 (£0.25)
HELICAL PL259 – 2 metres	£4.50 (£0.25)
DUMMY LOAD DL20	£6.00 (£0.30)
DUMMY LOAD T80	£21.95 (£0.75)
DUMMY LOAD T100	£22.95 (£0.75)
DUMMY LOAD T150	£32.00 (£0.75)
DUMMY LOAD T200	£34.00 (£0.75)
MOBILE SPEAKERS YAESU 8 ohm 6W	£9.95 (£0.75)
POWER SUPPLIES 13.8V 4A	£22.95 (£1.00)
POWER SUPPLIES 13.8V 6A	£29.95 (£1.50)
POWER SUPPLIES 13.8V 25A	£92.00 (£2.00)
MICROPHONES. ADONIS desk compressor	£39.95 (—)
MICROPHONES. ADONIS 3 output desk compressor	£59.95 (—)
MICROPHONES. YAESU YD148 dual imp.	£20.95 (£0.75)
WORLD CLOCK QTR24	£18.40 (£0.75)
WORLD CLOCK QTR24D (Quartz)	£24.50 (£0.75)
LOW PASS FILTERS TRIO LF30A	£18.40 (£0.75)
LOW PASS FILTER YAESU FF501DX	£19.95 (£0.75)
LISTENERS A.T.U. MIZUHO KX2	£29.95 (£0.75)
AUDIO PROCESSOR MIZUHO AP-MI	£33.00 (£0.75)
DIP METER TRIO DM-800	£51.00 (£0.75)
WAVE METER FX1	£28.00 (£0.75)
SWR25	£13.00 (£0.50)
SWR110	£35.00 (£0.50)
SWR CN620 (2M)	£52.00 (£0.50)
SWR CN630 (70cm)	£71.00 (£0.50)
7MHz TRAPS (pair)	£6.95 (£0.50)
FERRITE RINGS 2 OFF	£0.80 (£0.20)

"SAFETY"

KEEP BOTH HANDS ON THE WHEEL
USING THE LATEST IN MOBILE MICROPHONES

These consist of a high quality condensor microphone used in conjunction with an F.E.T. preamplifier with approx. 12dB gain. Fix the boom microphone to a convenient point such as the sun visor. Position the amplifier and TX/RX switch on the gear lever. Connect the mic plug and power lead and its ready for use.

MM202S	**£20.95 inc. VAT** (carriage 50p)
MM202H – Head band	**£28.00 inc. VAT** (carriage 50p)

TRY OUR MAIL ORDER SERVICE

VISIT OUR RETAIL PREMISES
MON-SAT 9-5.30

BUDGET ACCOUNT – ACCESS – BARCLAYCARD – PART EXCHANGE

MID SUSSEX HOUSE · HIGH ST. · HANDCROSS · WEST SUSSEX RH17 6BW

MAIL ORDER **TEL: 0444 400786 9am-5.30pm** RETAIL CALLERS

TO ORDER ANY OF THE ABOVE ITEMS SIMPLY WRITE, ENCLOSING A CHEQUE OR PHONE YOUR CREDIT CARD NUMBER

EDITORIAL OFFICES
Practical Wireless
Westover House
West Quay Road
Poole, Dorset BH15 1JG
Poole 71191

Geoff Arnold G3GSR
Editor

Dick Ganderton C.Eng., MIERE, G8VFH
Assistant Editor

Peter Metalli
Art Editor

John Fell G8MCP
Technical Editor

Alan Martin G8ZPW
News & Production Editor

Elaine Howard
Technical Sub-Editor

Rob Mackie
Technical Artist

Keith Woodruff
Assistant Art Editor

Sylvia Barrett, Sharron Breeze
Secretarial

ADVERTISEMENT OFFICES
Practical Wireless
King's Reach Tower
Stamford Street
London SE1 9LS
Telex: 915748 MAGDIV-G

Dennis Brough
Advertisement Manager
01-261 6636

Roger Hall G8TNT (Sam)
Ad. Sales Executive
01-261 6807

Claire Gerrish
Secretary
01-261 6636

Colin R. Brown
Classified Advertisements
01-261 5762

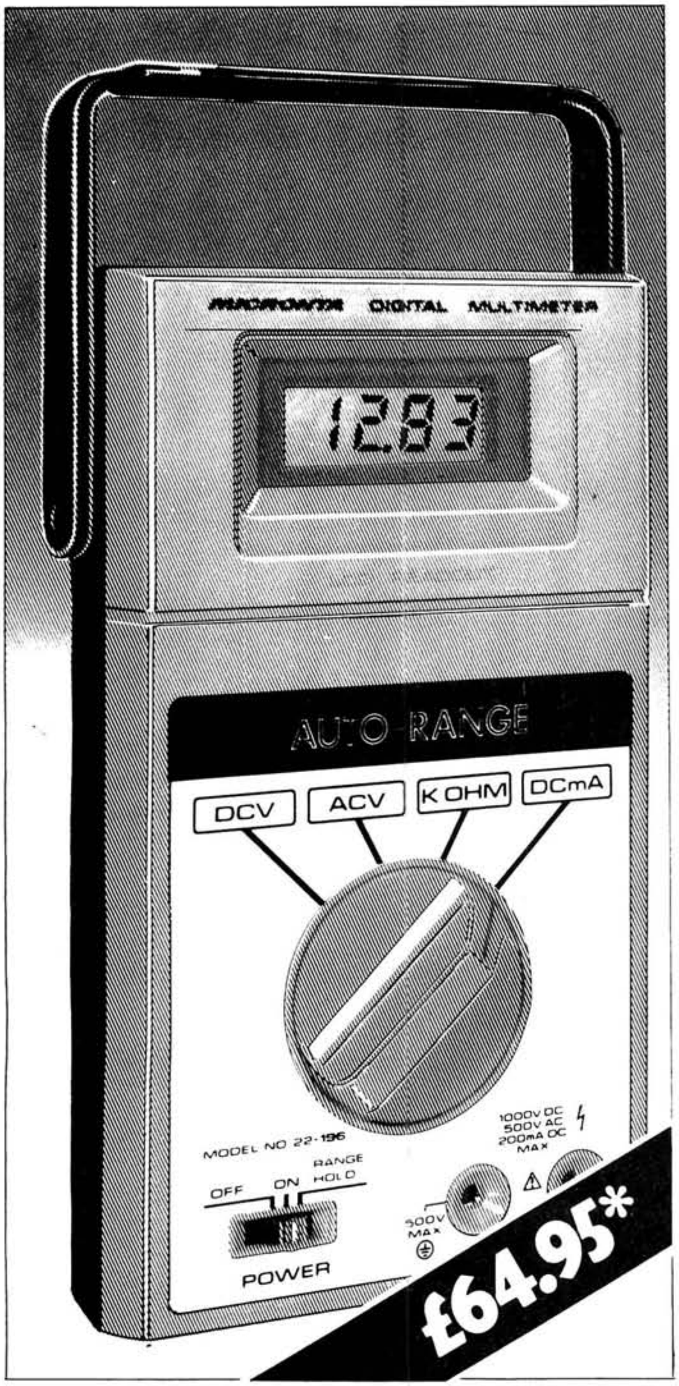
Dave Kerindi
Make-up & Copy
01-261 6570

Practical Wireless

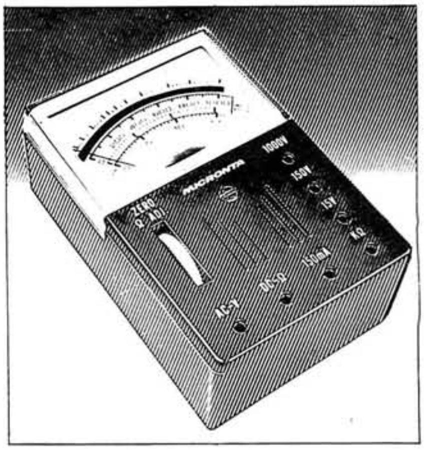
JANUARY 1981 VOL. 57 NO. 1 ISSUE 886

contents

Pure ind

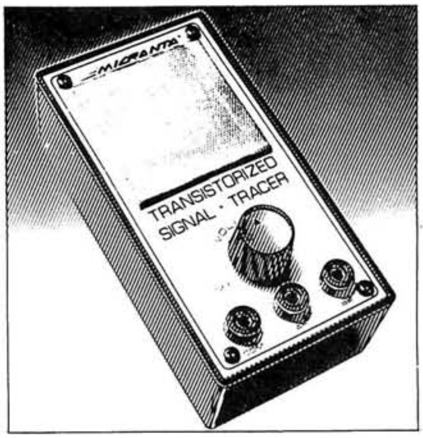


Micronta Auto Range Multimeter Gives you correct polarity, range and measurement – every time. Single function switch lets you choose DC 4 ranges; AC 4 ranges; DC current resistance. 4 ranges. LCD readout. Exclusive range hold facility. 22-196



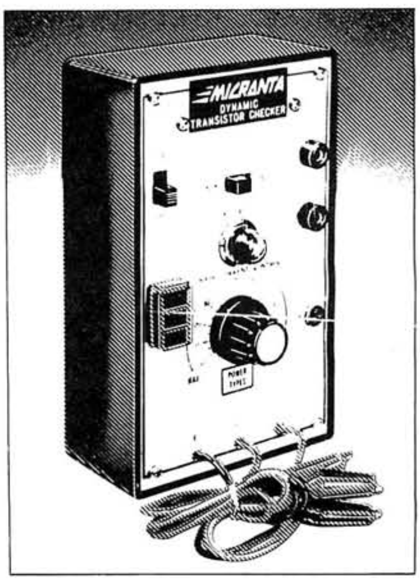
£6.95*

Micronta 1000 Ohms/Volt Multitester Very compact at 89 x 59 x 32 mm. Easy to read colour meter, pin jacks for all *8 ranges*. Reads AC V, DC current and ohms. Mirrored scale. 20-027



£9.95*

Micronta Transistorized Signal Tracer Spot circuit troubles, check RF, IF and audio signals from aerial to speaker on all audio equipment. It has built in 5 cm speaker with volume control. 50 x 143 x 38 mm. 22-010



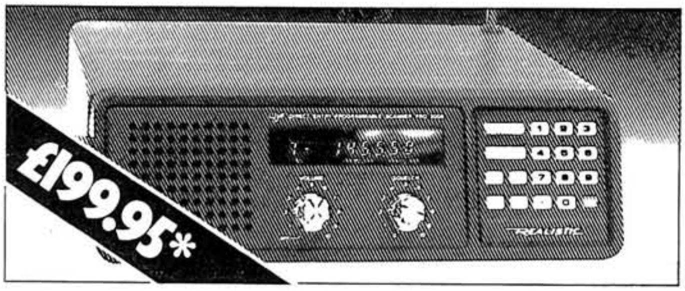
£9.95*

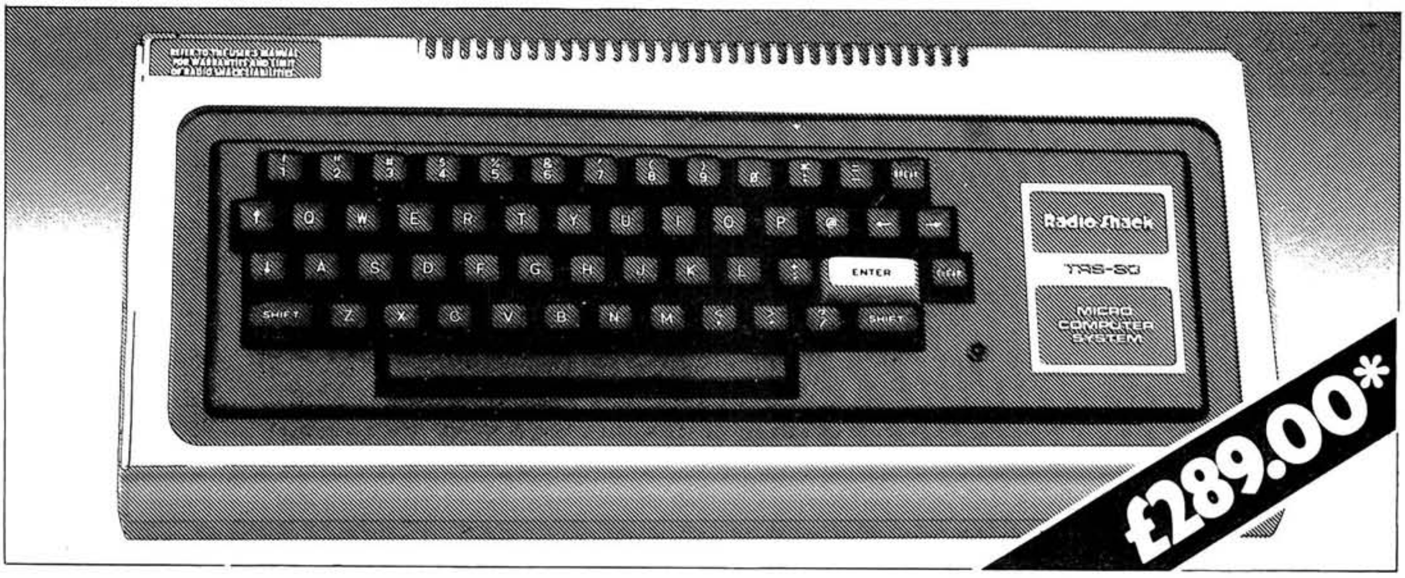
Micronta Dynamic Transistor Checker Shows current gain and electrode open and short circuit. Tests low medium or high power PNP or NPN types. Go/no-go tests from 5-50 m A on power types. "Quick-check" sockets. 22-024

ulgence.

Realistic Direct Entry Programmable Scanning Receiver Hear real-life drama on six exciting bands. With direct access to all frequencies, you can punch in actual frequencies for monitoring, storing in the computer's memory or just exploring. Big fluorescent display. Phase locked loop security. 20-9111

TRS-80 Model I C.P.U.'s Ready to run from your TV monitor. Plug in and start computing. Contains 4096 bytes of user memory and can be expanded to 16K. 26-9051





ACCRINGTON
37 Union Street
ALDRIDGE
15 Central Area Development
BARNSLEY
58 Market Street
BASINGSTOKE
22 London Street
BIRKENHEAD
Kwik Save Centre, Prenton
BRADFORD COMPUTER CENTRE
2/4, Forster Square

BIRMINGHAM AREA

BULL RING
528 Bridge Link Shopping Centre
CAPE HILL
44-46, Cape Hill
CITY CENTRE
57/58 Dale End
CORPORATION STREET
80, Corporation Street
DALE END
57-58, Dale End
EDGBASTON COMPUTER CENTRE
Edgbaston Shopping Centre
ERDINGTON
218 High Street
HALESOWEN
5/7 Queensway
NORTHFIELD
749 Bristol Road South
PERRY BARR
20 Lynton Square
SHELDON
2268 Coventry Road
SMETHWICK
44/46 Cape Hill
WARD END
887 Washwood Heath Road
WEDNESBURY
Bilston Road

BOLTON
5 Nelson Square
BOSCOMBE
548 Christchurch Road
BOURNEMOUTH
132/4 Commercial Road
BRADFORD
9 Petergate
BRIGHTON
70 London Road

BRISTOL AREA

BISHOPSTON
13 Gloucester Road
BRISTOL COMPUTER CENTRE
Colston Centre
CLIFTON
146 Whiteladies Road
DOWNEND
5 Badminton Road
KNOWLE
Broadwalk Shopping Centre
YATE
4 North Parade

BROMSGROVE
6/8 St. John Street
BROWNHILLS
60 High Street
BURY (Lancs)
91 The Rock
CARDIFF
9 Wood Street
CHELTENHAM
31 Cambray Place
CHESTER
Kwik Save Centre
Sealand Road
COVENTRY
4 Hales Street
CREWE
12 Market Street
DARLINGTON
15/16 Priestgate
DERBY
33 Victoria Street
DONCASTER
32/34 Kingsgate
DUDLEY
Trindle Road Roundabout
EASTBOURNE
Langley Shopping Centre
EXETER
13 Paris Street
GRIMSBY
Riverhead Centre
HARROGATE
34 Oxford Street
HUDDERSFIELD
Packhorse Shopping Centre
HULL
Status City, Clough Road
LEAMINGTON SPA
83 Warwick Street
LEEDS
72 Merrion Centre
LEEDS
3 Eastgate
LEICESTER
Market Street
LETCHWORTH
25 Commerce Way
LINCOLN
High Street

LIVERPOOL AREA

ALLERTON
90 Allerton Road
BOOTLE
New Strand Precinct
OLD SWAN
648 Prescott Road
ST. JOHNS PRECINCT
168 Market Way

LONDON AREA

BARKING
8/10 North Street
BAYSWATER
The Collonades
Pochester Road
BECKENHAM
144 High Street
CATFORD
23 Catford Broadway
CHESHUNT
92 Turners Hill
CHINGFORD
3 Hall Lane
CLAPHAM
84 Clampham High Street
COLLIER ROW
27, Collier Row
CROUCH END
42 The Broadway
DAGENHAM
297 Heathway
EDGWARE
128 Burnt Oak
EDMONTON
23, North Mall
ENFIELD
10 Colman Parade
HAMMERSMITH
142/4 King Street
HENDON
24 Sentinel Square
ORPINGTON
5 The Walnuts
PALMERS GREEN
379 Green Lanes
ROMFORD
27 Collier Row Road
SEACOAL LANE
1/2, Seacoal Lane
STREATHAM
254 Streatham High Road
TOTTENHAM
455 High Road
WALTHAMSTOW
123 High Street
WALWORTH
239 Walworth Road
WANDSWORTH
107/9 High Street
WELLING
7 Embassy Court
WIMBLEDON
124/6 The Broadway

LUTON
157 Dunstable Road

MANCHESTER AREA

ARNDALE
Unit 71, Arndale Centre
BRAMHALL
14/15 The Centre
CHADDERTON
67 High Street
CHEADLE
67, High Street
DEANSGATE COMPUTER CENTRE
36, Market Place
HYDE
4/8 The Mall
RADCLIFFE
25 Blackburn Street
SALE
The Mall
CITY CENTRE
Arndale Centre
STRETFORD
Arndale Centre

NEWBURY
14 Bartholomew Street
NORTHAMPTON
Weston Favel Shopping Centre

NOTTINGHAM AREA

ARNOLD
126/8 Front Street
BEESTON
30 The Square

NUNEATON
1 Church Street
OXFORD
9/10 St. Clements
PAIGNTON
35 Hyde Road
PLYMOUTH
64 Royal Parade
PORT TALBOT
Aberafan Centre
READING
18 The Butts Shopping Centre
RUGBY
25 Church Street
RUNCORN
120 Runcorn Shopping City
SCUNTHORPE
140 High Street
SHREWSBURY
20 Shop Latch
SITTINGBOURNE
20 The Forum Shopping Centre
SLOUGH
293 High Street
SOUTHAMPTON
East St. Centre
STAFFORD
6 Sheridan Shopping Centre
ST. HELENS
Fingerpost Centre
STOKE-ON-TRENT
Hanley 16 Charles Street
SUNDERLAND
4 Fawcett Street
SURREY
206 High Street
SUTTON (Surrey)
206 High Street
TORQUAY
134 Union Street

TYNE AND WEAR AREA

NEWGATE
23 Newgate Centre
SHEFFIELD
19-20, Hillsborough Shopping Centre
SHIELDS ROAD
184/6 Shields Road
WASHINGTON NEW TOWN
Galleries
SHOPPING CENTRE

WAKEFIELD
Kirkgate Shopping Centre
WALSALL
74 Bradford Street
WALLASEY
The Precinct
WORCESTER
8 St. Nicholas Street
WORKSOP
7/9 Bridge Place
YORK
5 Church Street

Offers subject to availability. Instant credit available in most cases. Prices may vary in individual stores.

Access, Barclaycard and Trustcard welcome

Most items also available at Tandy Dealers. Look for this sign in your area.

TANDY DEALER

*All prices include VAT.

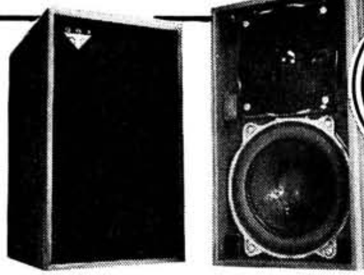
IT'S POSSIBLE, ONLY AT Tandy

Better Equipment. Lower Prices. No Middlemen.

the NEW **VIDEOTONE**

YOU CANNOT BUY CHEAPER — YOU CAN ONLY GET LESS FOR YOUR MONEY!

Introduces DIRECT SELLING - the Ultimate Discount!!!



LOUDSPEAKERS

The complete fully reviewed range of Videotone Speakers which dominate within their class. Now at lowest ever prices.

D 100	£38
Minimax 11	£44
GB3	£50
GB2	£60
GBS	£207
D 93	£40

CORAL CARTRIDGES

Fast becoming one of the top names

MOVING COIL
UK's No. 1 Cartridge

MC 81	£48.87
777EX	£35
777E	£25

MOVING MAGNET

555SX	£7.28
555E	£14.22
666E	£32.48

HEAD AMP

H300	£51.75
T100	£24.75

HEADSHELLS

S100	£6
S101	£7
S200	£4

MICROPHONES

MU 105-22	£29.30
MU 105-12	£22.25
MU 25 C	£17.39

TURNTABLES

Sansui SR222 Mk2	£69.00
JVC LA 11	£64.00
JVC SLQ 3	£140.00

ELECTRONICS

This new range of Electronics from Videotone redefines the words quality and value for money to a new high.

30 watt amp MC input SA4130	£75.00
Stereo Tuner ST4120	£68.00
Cassette full features SC3200	£98.00
50 Watt amplifier WA7700	£77.00
20 Watt amplifier LA2020	£58.00

A MESSAGE FROM VIDEOTONE

Dear Customer

SPECIAL OFFER

This month with a copy of this advertisement from PRACTICAL WIRELESS GB2 speakers £39.50 a pair instead of the regular £60.00.

***Please Note:**

If required by Mail Order, postage and packing £7.00.

Videotone

HEADPHONES

HP 90 Headphone	£12.65
HP 80 Headphone	£9.69

Superbly made with top flight performance.

SEND FOR OUR LATEST FREE BROCHURE

AND DETAIL LIST OF LOCAL SALES OUTLETS IN THE U.K.

VIDEOTONE
98 CROFTON PARK ROAD,
CROFTON PARK, LONDON SE4
Tel: 01-690 8511/2

Please send me your Direct Selling Brochure and list of sales outlets.

Name ______________________

Address ______________________

PW1/81

VIDEOTONE

ALL PRODUCTS ON DISPLAY & CONTINUOUS DEMONSTRATIONS

ALL PRICES INCLUDE VAT

SUPERSOUND 13 HI-FI MONO AMPLIFIER

A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × $7\frac{1}{2}$" deep. AC 200/250V. PRICE **£18·40,** P. & P. £1·60.

HARVERSONIC MODEL P.A. TWO ZERO

An advanced solid state general purpose mono amplifier suitable for Public Address system, Disco, Guitar, Gram, etc. Features 3 individually controlled inputs (each input has a separate 2 stage pre-amp.). Input 1, 15mV into 47k. Input 2, 15mV into 47k (suitable for use with mic. or guitar etc.). Input 3, 200mV into 1 meg. suitable for gram, tuner, or tape etc. Full mixing facilities with full range bass & treble controls. All inputs plug into standard jack sockets on front panel. Output socket on rear of chassis for an 8 ohm or 16 ohm speaker. Output in excess of 30 watts music power. Very attractively finished purpose built cabinet made from black vinyl covered steel, with a brushed anodised aluminium front escutcheon. For ac mains operation 200/240 volts. Size approx. $12\frac{1}{4}$in wide × 5in high × $7\frac{1}{4}$in deep.

Special price **£29·00** + £3·00 carriage and packing.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size $11\frac{3}{4}$" × $14\frac{11}{16}$" × $1\frac{7}{16}$" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details.

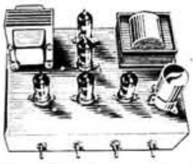
Only **£9·20** each + p. & p. (one £1·20, two £1·50).

A brand new 22 transistor hi-fi stereo amplifier of superior design made by a well-known British manufacturer, for a now cancelled contract order. The unit is supplied new & tested on a printed circuit panel size approx. $6\frac{3}{4}$" × $4\frac{1}{4}$" × $1\frac{1}{2}$" h. using high grade discrete components. Brief specification: 15 watts r.m.s. per channel O/P into 8 ohms. (o/p stages fully protected against s/c) I/P 60mV. for •ceramic cartridge. Provision for tape i/p & o/p. Only requires the addition of a 40 volt @ 2 amp. power supply & the bass, treble, balance & vol. control. (standard types). FULL Circuit diagram & connection details supplied. Price with edge connectors. Only **£9·00** + 80p p. & p. •Suitable 2 stage pre-amp. for mag. cart. RIAA corrected can be supplied @ £2·50 if ordered with amplifier. Suitable components for power supply can be supplied if ordered with amplifier–mains transformer, rectifier, smoothing condenser. **£4·00** + £1·80 p. & p.

MAINS OPERATED SOLID STATE AM/FM STEREO TUNER

200/240V Mains operated Solid State FM AM Stereo Tuner. Covering M.W. A.M. 540-1605 KHz VHF/FM 88-108 MHz.
Built-in Ferrite rod aerial for M.W. Full AFC and AGC on AM and FM. Stereo Beacon Lamp Indicator. Built in Pre-amps with variable output voltage adjustable by pre-set control. Max o/p Voltage 600m/v RMS into 20K. Simulated Teak finish cabinet. Will match almost any amplifier. Size $8\frac{1}{4}$"w × 4"h × $9\frac{1}{4}$"d approx.
LIMITED NUMBER ONLY at **£29·00** + £2·00 P. & P.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple intruction booklet **50p** + SAE (Free with parts). **All parts sold separately.** ONLY **£18·40,** P. & P. £2.00. Also available ready built and tested **£22·50,** P. & P. £2·00.

STEREO DECODER MK.II
SIZE $1\frac{1}{2}$" × 2.5/16" × $\frac{1}{2}$" ready built. Pre-aligned and tested for 10-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions supplied **£7·00** plus 25p P. & P. Stereo beacon light if required **40p** extra.

Mullard LP1159 RF IF module 470kHz **£2·50** + P. & P. 40p. Full specification and connection details supplied.
Pye VHF FM Tuner Head covering 88-108MHz 10·7 MHz I.F. output. 7·8V + earth. Supplied pre-aligned, with full circuit diagram with precision-geared F.M. gang and 323PF + 323PF A.M. Tuning gang only **£3·40** + P. & P. 60p.

STEREO MAGNETIC PRE-AMP. Sens. 3mV in for 100mV out. 15 to 35V neg. earth. Equ. ± 1dB from 20Hz to 20KHz. Input impedance 47K. Size $1\frac{5}{8}$" × $2\frac{3}{8}$" × $\frac{5}{8}$" H. **£3·20** + 22p P. & P.

HARVERSONIC SUPERSOUND 10 + 10 STEREO AMPLIFIER KIT

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integral pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork, high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response: ± 3dB 12-30,000 Hz Sensitivity: better than 80mV into 1M Ω: Full power bandwidth: ± 3dB 12-15,000 Hz. Bass boost approx. to ± 12dB. Treble cut approx. to —16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1·0 amp.
Overall Size 12"w. × 8"d. × $2\frac{1}{2}$"h.
Fully detailed 8 page construction manual and parts list free with kit or send 50p plus large S.A.E.

AMPLIFIER KIT	**£14·95** P. & P. £1·20
(Magnetic input components 33p extra)	
POWER PACK KIT ..	**£6·20** P. & P. £1·50
CABINET	**£6·20** P. & P. £1·50

SPECIAL OFFER—only £25·80 if all 3 items ordered at one time plus £2·80 P. & P.

Full after sales service

Also avail. ready built and tested **£32·20,** P. & P. £2·80.

HARVERSONIC STEREO 44

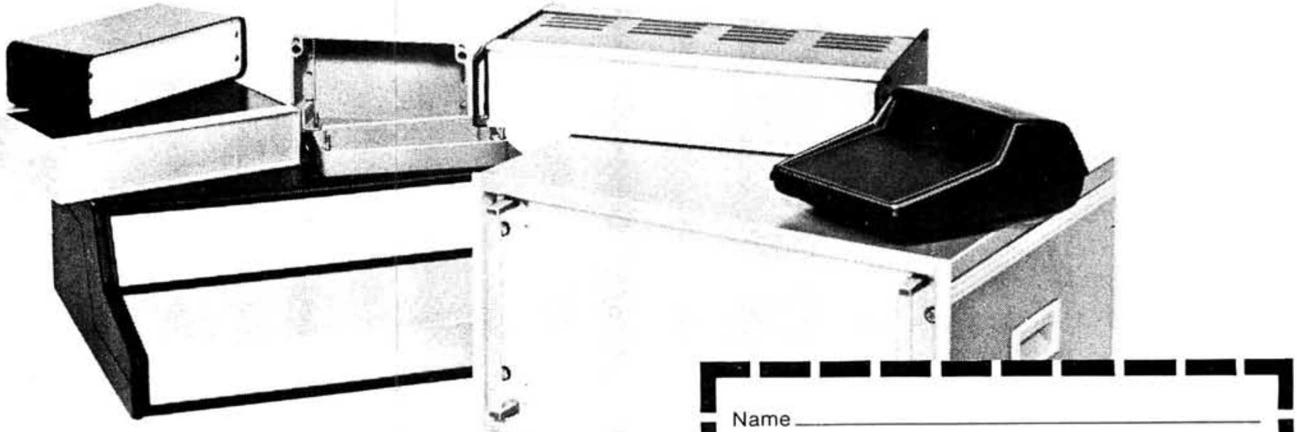
A solid state stereo amplifier chassis, with an output of 3-4 watts per channel into 8 ohm speakers. Using the latest high technology integrated circuit amplifiers with built in short term thermal overload protection. All components including rectifier smoothing capacitor, fuse, tone control, volume controls, 2 pin din speaker sockets & 5 pin din tape rec./play socket are mounted on the printed circuit panel, size approx. $9\frac{1}{4}$" × $2\frac{1}{2}$" × 1" max. depth. Supplied brand new & tested, with knobs, brushed anodised aluminium 2 way escutcheon (to allow the amplifier to be mounted horizontally or vertically) at only **£10·40** plus 90p P. & P. Mains transformer with an output of 17v a/c at 500m/a can be supplied at **£2·15** + 70p P. & P. if required. Full connection details supplied.

All prices and specifications correct at time of press and subject to alteration without notice.

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. SEND SAE WITH ALL ENQUIRIES.

HARVERSON SURPLUS CO. LTD. (Dept. P.W.) 170 MERTON HIGH ST., LONDON, S.W.19. Tel.: 01-540 3985
A few minutes from South Wimbledon Tube Station. ACCESS/BARCLAYCARD WELCOME
Open 9.30–5.30 Mon. to Fri. 9.30–5 Sat. Closed Wed.

The facts of the case



West Hyde have one aim in life, to provide a practical solution to the problem of electronic packaging. The fact of the matter is that we have an ideal case for almost every project featured in this magazine. In this advertisement it is impossible to show you our whole range of nearly 1,000 different instrument cases, or our extensive collection of tools and accessories. Please complete the coupon and, in turn, we will send you our free 80-page catalogue and price list.

Name ____________________

Address ____________________

____

____

WEST HYDE

West Hyde Developments Limited, Unit 9,
Park Street Industrial Estate, Aylesbury, Bucks., HP20 1ET
Telephone: Aylesbury (0296) 20441/5

BI-PAK SEMICONDUCTORS

DEPT. PW1, PO Box 6, WARE, HERTS.

Visit our Shop at: 3 Baldock Street, Ware, Herts.

GIRO NO. 3887006
TEL: 0920 3182
TELEX: 817861

EXPERIMENTOR BREADBOARDS

FROM CSC

No soldering breadboards. Simply plug components in and out of letter number identified. Nickel-silver contact holes. Start small and simply snap-lock boards together to build a breadboard of any size.
All EXP Breadboards have two bus-bars as an integral part of the board. If you need more than two buses, simply snap on 4 more bus-bars with the aid of an EXP 48.

EXP 325 The ideal breadboard for 1 chip circuits. Accepts 8, 14, 16 and up to 22-pin IC's. **ONLY £1·84** 48mm (1.9")

EXP 350 270 contact points with two 20-point bus-bars. **ONLY £3·62** 91mm (3.6")

EXP 300 550 contacts with two 40-point bus-bars. **ONLY £6·61** 152mm (6.0")

EXP 650 For Micro-processors. **ONLY £4·14** 91mm (3.6")

EXP 48 **ONLY £2·65** 152mm (6.0")

EXP 600 As EXP 300 but accepts 24 pin DIL and over. **ONLY £7·25** 152mm (6.0")

All EXP 300 Breadboards mix and match with 600 series.

ANTEX IRONS

1943	15 watt quality soldering iron with 3/32" bit	**£5·12**
1947	Replacement element for 1943	**£2·33**
1944	Iron coated bit 3/32" for 1943	**£0·58**
1945	Iron coated bit 1/8" for 1943	**£0·58**
1946	Iron coated bit 3/16" for 1943	**£0·58**
1948	18 watt iron with iron coated bit	**£5·12**
1952	Replacement element for 1948	**£2·22**
1949	Iron coated bit 3/32" for 1948	**£0·58**
1950	Iron coated bit 1/8" for 1948	**£0·58**
1951	Iron coated bit 3/16" for 1948	**£0·58**
1931	X25 25 watt iron, ceramic shaft and another shaft of stainless steel to ensure strength	**£6·12**
1935	Replacement element for 1931	**£2·05**
1932	Iron coated bit 1/8" for 1931	**£0·58**
1933	Iron coated bit 2/16" for 1931	**£0·58**
1934	Iron coated bit 3/32" for 1931	**£0·58**
1953	SK1 soldering Kit – contains 15 watt soldering iron with 3/16" bit plus two spare bits, a reel of solder, heat-sink and a booklet 'How to Solder	**£7·28**
1939	ST3 iron stand made from high grade bakelite chrom plated steel spring, suit all models – includes accommodation for six bits and two sponges to keep the iron bits clean	**£1·89**
1724	Model MLX as X25 iron but 12 volts	**£5·59**

CASES AND BOXES

VERO plastic case box. These boxes consist of top and bottom sections which include fixings points for horizontal mounting PC boards/chassis plates, the two sections are held together by four screws which enter through the base and are concealed by plastic feet.

No.	Length	Width	Height	Price
170	140mm	40mm	205mm	£4·35
171	140mm	75mm	205mm	£4·85
172	140mm	110mm	205mm	£6·30

INSTRUMENT CASES in two sections vinyl covered top and sides, aluminium bottom, front and back.

No.	Length	Width	Height	Price
155	8in	5½in	2in	£2.01
156	11in	6in	3in	£3.10
157	6in	4¾in	1¾in	£1.93
158	9in	5¼in	2½in	£2.59

ALUMINIUM BOXES made from bright alli, folded construction each box complete with half inch deep lid and screws.

No.	Length	Width	Height	Price
159	5¼in	2¼in	1½in	£0.98
160	4in	4in	1½in	£0.98
161	4in	2¼in	1½in	£0.98
162	5¼in	4in	1½in	£1.10
163	4in	2½in	2in	£0.98
164	3in	2in	1in	£0.67
165	7in	5in	2½in	£1.54
166	8in	6in	3in	£1.98
167	6in	4in	2in	£1.32

SLOPE front aluminium boxes with black vinyl base and sides & aluminium back, top & front – strong construction easily accessable.

169	2¼in	5¾in	2¾in	12in	3½in	8in	£5·45
168	2⅝in	7¼in	4in	16in	4½in	11in	£8·21

AUDIO MODULES

AMPLIFIERS

AL10	3 watt Audio Amplifier Module 22-32v supply	£3·63
AL20	5 watt Audio Amplifier Module 22-32v supply	£4·11
AL30A	7-10 watt Audio Amplifier Module 22-32v supply	£4·78
AL60	15-25 watt Audio Amplifier Module 30-50v supply	£5·92
AL80	35 watt Audio Amplifier Module 40-60v supply	£9·28
AL120	50 watt Audio Amplifier Module 50-70v supply	£15·11
AL250	125 watt Audio Amplifier Module 50-80v supply	£22·54

STEREO PRE-AMPLIFIERS

PA12	Supply voltage 22-32v input sensitivity 300mv suit: AL10/AL20/AL30	£9·83
PA100	Supply voltage 24-36v inputs:– Tape, Tuner, Mag P.U., Suit: AL60/AL80	£20·30
PA200	Supply voltage 35-70v inputs:– Tape, Tuner, Mag P.U., Suit: AL80/AL120/AL250	£20.98

MONO PRE-AMPLIFIERS

MM100	Supply voltage 40-65v inputs: Mag, P.U., Tape Microphone Max. output 500mv	£14.29
MM100G	Supply voltage 40-65v inputs: 2 Guitars, Microphones Max. output 500mv	£14.29

POWER SUPPLIES

PS12	24v Supply suit 2 - AL10, 2 - AL20, 2 - AL30 & PA12/S.450	£1.90
SPM80	33v Stabilised supply – suit 2 - AL60, PA100 to 15 watts	£5.57
SPM120/45	45v Stabilised supply – suit 2 - AL60, PA100 to 25 watts	£7.34
SPM120/55	55v Stabilised supply – suit 2 - AL80, PA200	£7.34
SPM120/65	65v Stabilised supply – suit 2 - AL120, PA200, 1 - AL250, PA200	£7.34
SG30	15-0-15 Stabilised power supply for 2 - GE100MKII	£4.37

MISCELLANEOUS

MPA30	Stereo Magnetic Cartridge Pre-Amplifier-input 3.5mv Output 100mv	£3.76
S. 450	Stereo FM Tuner Supply Voltage 20-30v – Varicap tuned	£29.39
STEREO30	Complete 7 watt per Channel Stereo Amplifier Board – includes amps, pre-amp, power supply, front panel, knobs etc – requires 2050 Transformer	£24.25
BP124	5 watt 12v max. – Siren Alarm Module	£4.43
GE100MkII	10 channel mono-graphic equaliser complete with sliders and knobs	£26.45
VPS30	Variable regulated stabilised power supply 2-30v 0-2 amps	£8.74

TRANSFORMERS

			P&P
2034	1.7 amp 35v suit SPM80	£6.21	£1.21
2035	2 amp 55v	£7.30	£1.47
2036	750mA 17v suit PS12	£3.68	
2040	1.5 amp 0-45v-55v suit SPM120/45, SPM120/55v	£5.98	£1.21
2041	2 amp 0-55v-65v suit SPM120/55, SPM120/65v	£7.82	£1.47
2050	1 amp 0-20v suit Stereo 30	£3.74	£0.75
1725	150mA 15-0-15v suit SG30	£2.04	

ACCESSORIES

139	Teak Cabinet suit Stereo 30, 320 · 235 · 81mm	£8·05
140	Teak Cabinet suit STA15 425 · 290 · 95mm	£9·78
FP100	Front Panel for PA100 & PA200	£2·07
BP100	Back Panel for PA100 & PA200	£1·84
GE100FP	Front Panel for one GE100MKII	£2·05
2240	Kit of parts including Teak Cabinet, chassis sockets, knobs to build 15 watt stereo amplifier (Does not include modules)	£22.94

SPECIAL OFFERS

MINIDRILL 12v hand held battery-operated mini drill, 7,500 r.p.m. Collet chuck. Ideal for drilling printed circuits or model making. No. 1402. Complete with two drills ·1, ·15. **£6.33**

TRANSFORMER 240v Primary 0-20v ⁃ 2A Secondary. By removing 5 turns for each volt from the secondary winding, any voltage up to 20v ⁃ 2A is obtainable. Ideal for the experimenter. No.2042. **£1·50** + 86p. P & P

ANTEX MLX Soldering Iron. Sturdy 25 watt iron complete with: 4½ metres of 2-core cable. Works off a 12 volt battery. Ideal for Car, Boat, Caravan. No.1724. **£5·29**

METAL FOIL CAPACITOR PAKS

16204 – Containing 50 metal foil capacitor like Mullard C280 series – Mixed values ranging from 01uf – 2·2uf. Complete with identification sheet **£1·38**

TRIACS

2 amp volts	TO5 case No.	Price	10 amp volts	No.	Price
100	TR12A/100	£0·36	100	TR110A/100	£0·88
200	TR12A/200	£0·59	200	TR110A/200	£1·06
400	TR12A/400	£0·82	400	TR110A/400	£1·29

6 amp volts	No.	Price	10 amp volts	No.	Price
100	TR16A/100	£0·59	400	TR110A/400P	£1·29
200	TR16A/200	£0·70			
400	TR16A/400	£0·88			

DIACS BR100 £0·23 D32 £0·23

SILICON RECTIFIERS

200mA	
IS920 50V	£0.07
IS921 100V	£0.08
IS922 150V	£0.09
IS923 200V	£0.10
IS924 300V	£0·12

1 Amp	
IN4001 50V	£0.05½
IN4002 100V	£0.06
IN4003 200V	£0.07
IN4004 400V	£0.08
IN4005 600V	£0.09
IN4006 800V	£0.10
IN4007 1000V	£0.12

1.5 Amp	
IS015 50V	£0.10
IS020 100V	£0.12
IS021 200V	£0.13
IS023 400V	£0.15
IS025 600V	£0.16
IS027 800V	£0.18
IS029 1000V	£0.23
IS031 1200V	£0.29

60 Amp	
IS70/50 50V	£0.86
IS70/100 100V	£0.97
IS70/200 200V	£1.38
IS70/400 400V	£2.01
IS70/600 600V	£2.59
IS70/800 800V	£2.88
IS70/1000 1000V	£3.45

3 Amp	
IN5400 50V	£0.16
IN5401 100V	£0.17
IN5402 200V	£0.18
IN5404 400V	£0.20
IN5406 600V	£0.24
IN5407 800V	£0.29
IN5408 1000V	£0.35

10 Amp	
IS10/50 50V	£0.22
IS10/100 100V	£0.24
IS10/200 200V	£0.26
IS10/400 400V	£0.40
IS10/600 600V	£0.48
IS10/800 800V	£0.59
IS10/1000 1000V	£0.69
IS10/1200 1200V	£0.79

30 Amp	
IS30/50 50V	£0.64
IS30/100 100V	£0.79
IS30/200 200V	£1.07
IS30/400 400V	£1.44
IS30/600 600V	£2.02
IS30/800 800V	£2.33
IS30/1000 1000V	£2.66
IS30/1200 1200V	£3.31

THYRISTORS

600ma Volts No.	TO 18 Case Price
10 THY600/10	£0.17
20 THY600/20	£0.18
30 THY600/30	£0.23
50 THY600/50	£0.25
100 THY600/10	£0.29
200 THY600/200	£0.44
400 THY600/400	£0.51

1 amp Volts No.	TO 66 Case Price
50 THY1A/50	£0.30
100 THY1A/100	£0.32
200 THY1A/200	£0.37
400 THY1A/400	£0.44
600 THY1A/600	£0.52
800 THY1A/800	£0.67

3 amp Volts No.	TO 66 Case Price
50 THY3A/50	£0.32
100 THY3A/100	£0.35
200 THY3A/200	£0.38
400 THY3A/400	£0.48
600 THY3A/600	£0.58
800 THY3A/800	£0.75

5 amp Volts No.	TO 66 Case Price
50 THY5A/50	£0.41
100 THY5A/100	£0.52
200 THY5A/200	£0.58
400 THY5A/400	£0.66
600 THY5A/600	£0.79
800 THY5A/800	£0.93

5 amp Volts No.	TO 220 Case Price
400 THY5A/400P	£0.86
600 THY5A/600P	£0.79
800 THY5A/800P	£0.93

7 amp Volts No.	TO 48 Case Price
50 THY7A/50	£0.55
100 THY7A/100	£0.59
200 THY7A/200	£0.66
400 THY7A/400	£0.71
600 THY7A/600	£0.90
800 THY7A/800	£1.06

10 amp Volts No.	TO 48 Case Price
50 THY10A/50	£0.59
100 THY10A/100	£0.66
200 THY10A/200	£0.71
400 THY10A/400	£0.81
600 THY10A/600	£1.14
800 THY10A/800	£1.40

16 amp Volts No.	TO 48 Case Price
50 THY16A/50	£0.62
100 THY16A/100	£0.67
200 THY16A/200	£0.71
400 THY16A/400	£0.89
600 THY16A/600	£1.04
800 THY16A/800	£1.60

30 amp Volts No.	TO 94 Case Price
50 THY30A/50	£1.38
100 THY30A/100	£1.64
200 THY30A/200	£1.87
400 THY30A/400	£2.06
600 THY30A/600	£4.03

No.	Price
BT101/500R	£0.92
BT102/500R	£0.92
BT106	£1.44
BT107	£1.07
BT108	£1.13
2N3228	£0.81
2N3525	£0.89
BTX30/50L	£0.38
BTX30/400L	£0.53
C106/4	£0.69
BT116	£1.73

ZENER DIODES

400 mw (Bzy88) D007. Glass encapsulated range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 39v. **No. Z4 10p**

1w-1·5w Plastic and metal encapsulated. Range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v. **No. Z13 18p**

10w Metal stud type SO10 case. Range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v. **No. Z10 44p**

BRIDGE RECTIFIERS

SILICON 1 amp Type	No.	Price	SILICON 2 amp Type	No.	Price
50v RMS	BR1/50	£0·23	50v RMS	BR2/50	£0·52
100v RMS	BR1/100	£0·25	100v RMS	BR2/100	£0·55
200v RMS	BR1/200	£0·29	200v RMS	BR2/200	£0·60
400v RMS	BR1/400	£0·41	400v RMS	BR2/400	£0·67
			1000v RMS	BR2/1000	£0·78

SILICON 10 amp Type	No.	Price	SILICON 25 amp Type	No.	Price
50v RMS	BR10/50	£1.73	50v RMS	BR25/50	£2.19
200v RMS	BR10/200	£1.96	200v RMS	BR25/200	£2.53

All prices include VAT: Add 50p post per order
—Just quote your Access or Barclaycard number.

Terms: Cash with order, cheques, POs, payable to Bi-Pak at above address
Access and Barclaycard also accepted

BARCLAYCARD VISA

ILP

SIMPLY AHEAD and staying there

The range grows bigger... better...

New Profile Amplifiers - Two New Series

MOSFET

CHOOSE AN I.L.P MOSFET POWER AMP when it is advantageous to have a faster slew rate, lower distortion at higher frequencies, enhanced thermal stability, the ability to work with complex loads without difficulty and complete absence of cross-over distortion. I.L.P's exclusive encapsulation technique within fully adequate heatsinks has been taken a stage further with specially developed computer-verified 'New Profile' extrusions. These ensure optimum operating efficiency from our new MOSFETS, and are easier to mount. Connection is via five pins on the underside. **I.L.P MOSFETS ARE IDENTICAL IN PERFORMANCE TO THE COSTLIEST AMPLIFIERS IN THIS EXCITING NEW CATEGORY BUT ARE ONLY A FRACTION OF PRICES CHARGED ELSEWHERE.**

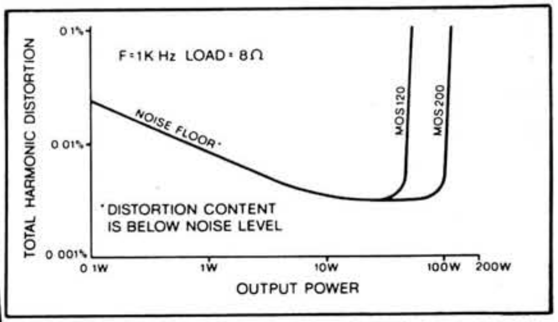
Model	Output Power RMS	Distortion Typical at 1KHz	Slew Rate	Rise Time	Signal/Noise Ratio DIN AUDIO	Price & VAT
MOS120	60W into 4-8Ω	0.005%	20V/μs	3μs	100dB	£25.88 + £3.88
MOS200	120W into 4-8Ω	0.005%	20V/μs	3μs	100dB	£33.46 + £5.02

BIPOLAR

CHOOSE AN I.L.P BIPOLAR POWER AMP where power and price are first consideration while maintaining optimum performance with hi-fi quality and wide choice of models. From domestic hi-fi to disco and P.A., for instrument amplification, there is an I.L.P Bipolar to fill the bill, and as with our new Mosfets, we have encapsulated Bipolars within our New Profile extrusions with their computer-verified thermal efficiency and improved mounting shoulders. Connections are simple, via five pins on the underside and with our newest pre-amps and power supply units, it becomes easier than ever to have a system layout housed the way you want it.

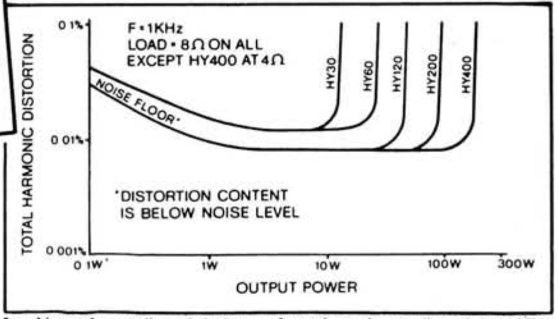
Model	Output Power RMS	Distortion Typical at 1KHz	Slew Rate	Rise Time	Signal/Noise Ratio DIN AUDIO	Price & VAT
HY30	15W into 4-8Ω	0.015%	15V/μs	5μs	100dB	£6.34 + 95p
HY60	30W into 4-8Ω	0.015%	15V/μs	5μs	100dB	£7.24 + £1.09
HY120	60W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£15.20 + £2.28
HY200	120W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£18.44 + £2.77
HY400	240W into 4Ω	0.01%	15V/μs	5μs	100dB	£27.68 + £4.15

ILP POWER AMPS ARE ENCAPSULATED FOR THERMAL STABILITY AND LONGER LIFE



Load impedance both models 4Ω-∞ Input sensitivity both models 500mV

Input impedance both models 100KΩ Frequency response both models 15Hz-100KHz – 3dB

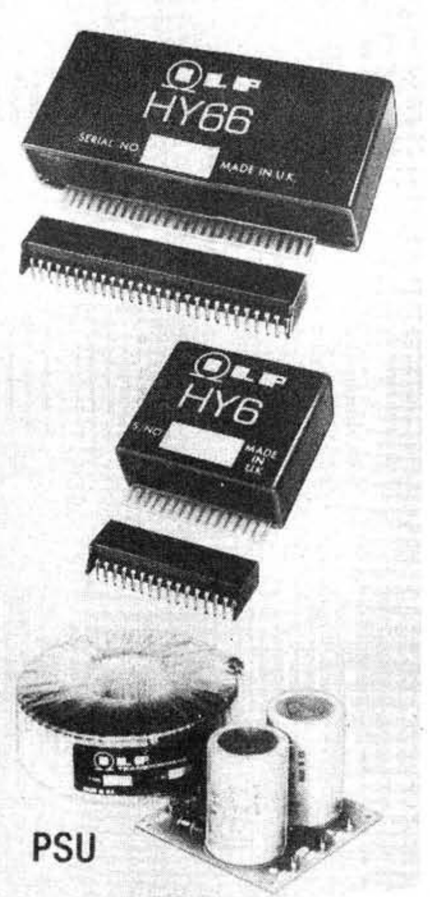


Load impedance all models 4Ω-∞ Input sensitivity all models 500mV

Input impedance all models 100KΩ Frequency response all models 15Hz-50KHz – 3dB

THE NEW PROFILE EXTRUSIONS

The introduction of standard heatsink extrusion for all I.L.P power amplifiers achieves many advantages: – Research shows they provide optimum thermal dissipation and stability. Slotted shoulders allow easy mounting; standardisation enables us to keep our prices competitive. Surfaces are matt black, anodised for lower thermal conductivity. Extrusions vary in size according to module number.



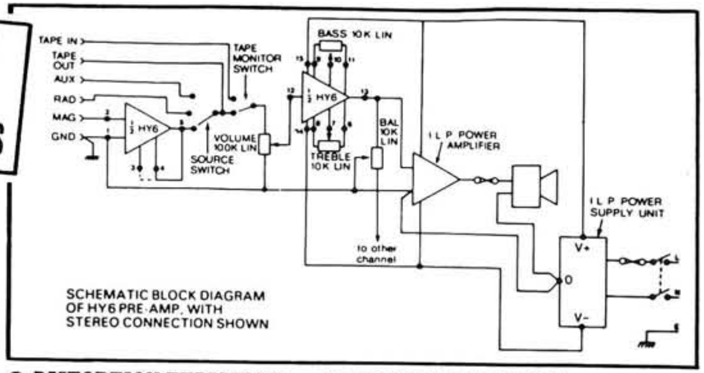
NEW PRE-AMPS

HY6 (mono) and **HY66** (stereo) are new to I.L.P's range of advanced audio modules. Their improved characteristics and styling ensure their being compatible with all I.L.P power-amps both MOSFET and BIPOLAR, giving you chance to get the best possible reproduction from your equipment. HY6 and HY66 pre-amps are protected against short circuit and wrong polarity. Full assembly instructions are provided. Mounting boards are available as below.

Sizes – **HY6** – 45 x 20 x 40 mm. **HY66** – 90 x 20 x 40 mm. Active Tone Control circuits provide ±12dB cut and boost. **Inputs Sensitivity** – Mag. PU. –3mV: Mic – selectable 1-12mV: All others 100mV. **Tape O/P** – 100mV: **Main O/P** – 500mV: **Frequency response** – D.C. to 100KHz – 3dB.

HY6 mono £5.60 + 84p VAT Connectors included
HY66 stereo £10.60 + £1.59 VAT Connectors included
B6 Mounting Board for one HY6 78p + 12p VAT
B66 Mounting Board for one HY66 99p + 15p VAT

COMPATIBLE WITH ALL ILP MODULES



SCHEMATIC BLOCK DIAGRAM OF HY6 PRE-AMP, WITH STEREO CONNECTION SHOWN

- **DISTORTION TYPICALLY 0.005%**
- **S/N RATIO – 90dB (Mag. P.U. – 68 dB)**
- **38 dB overload margin on Mag. P.U.**
- **LATEST DESIGN HIGH QUALITY CONNECTORS**
- **ONLY POTS, SWITCHES AND PLUGS/SOCKETS NEED ADDING**
- **NEEDS ONLY UNREGULATED POWER SUPPLY ±15 to ±60v**

NEW POWER SUPPLY UNITS

IN A RANGE OF 11 MODELS USING LATEST TOROIDAL TRANSFORMERS

Of the eleven power supply units which comprise our current range, nine have toroidal transformers made in our own factory. Thus these I.L.P power supply units are space-saving, more efficient and their better overall design helps enormously when assembly building. All models in the range are compatible with all I.L.P amps and pre-amps with types to match whatever I.L.P power amps you choose.

PSU30 ±15V at 100mA to drive up to 12 x HY6 or 6 x HY66	**£4.50** + 0.68p VAT
• *THE FOLLOWING WILL ALSO DRIVE I.L.P PRE-AMPS*	
PSU36 for use with 1 or 2 HY30's	**£8.10** + £1.22 VAT
• *ALL THE FOLLOWING USE TOROIDAL TRANSFORMERS*	
PSU50 for use with 1 or 2 HY60's	**£9.75** + £1.46 VAT
PSU60 for use with 1 HY120	**£9.75** + £1.46 VAT
PSU65 for use with 1 MOS120	**£9.75** + £1.46 VAT
PSU70 for use with 1 or 2 HY120's	**£13.61** + £2.04 VAT
PSU75 for use with 1 or 2 **MOS120**	**£13.61** + £2.04 VAT
PSU90 for use with 1 HY200	**£13.61** + £2.04 VAT
PSU95 for use with 1 **MOS200**	**£14.75** + £2.21 VAT
PSU180 for use with 1 HY400 or 2 HY200	**£23.02** + £3.45 VAT
PSU185 for use with 1 or 2 **MOS200**	**£24.20** + £3.63 VAT

1971-1980
TEN YEARS OF PLANNED PROGRESS

When, in 1971, Ian L. Potts founded his now world-famous company, he saw the need for a different and more rational approach to exploiting to the full, the potential that lay in modular construction. New thinking was badly needed. The result was a range of modules revolutionary in concept. The rightness of this new thinking is shown by the size of the company today, its new factory, its vast exports, its acceptance by constructors as *the* modules to build with. The range grows bigger and better. Exciting new lines (in no way conflicting with existing ones) are well past drawing board stage. This is why I.L.P are simply ahead and staying there.

NO QUIBBLE 5 YEAR GUARANTEE
7-DAY DESPATCH ON ALL ORDERS
BRITISH DESIGN AND MANUFACTURE
FREEPOST SERVICE

★ **Freepost facility**
When ordering or writing about I.L.P products, you do not need to stamp the envelope. Mark it FREEPOST plus the code shown in the address below. We pay the postage for you.

★ **TO ORDER** Send cheque or money order payable to I.L.P Electronics Ltd and crossed. Or pay by ACCESS or BARCLAYCARD. Cash payments must be in registered envelope; if C.O.D. payment is wanted, please add £1.00 to TOTAL value of order.

BRITAIN'S FASTEST GROWING MODULE SUPPLIERS

To: I.L.P ELECTRONICS LTD. CANTERBURY CT2 7EP

Please supply ....

.... Total purchase price £..........

I enclose Cheque ☐ Postal Orders ☐ International Money Order ☐

Please debit my Access/Barclaycard Account No. ....

....

NAME ....

ADDRESS ....

....

Signature ....

ALL U.K. ORDERS DESPATCHED POST FREE

I.L.P ELECTRONICS LTD.

FREEPOST 1 Graham Bell House, Roper Close, Canterbury, Kent CT2 7EP.
Telephone (0227) 54778 [Technical (0227) 64723] Telex 965780
Available also from MARSHALLS, WATFORD ELECTRONICS and certain other selected retailers

comment...

Inferior Beings?

AS I mentioned last month, the number of candidates for the May 1980 Radio Amateurs' Examination was a record, as was the number of passes. In fact, the number of candidates had virtually doubled compared with two years' previously. The most interesting statistic to emerge from an analysis of the past six years' figures is that the pass rate, i.e., the percentage of candidates who were successful in each exam, has remained almost constant during that period.

This would seem to refute the disturbing view expressed in some parts of the amateur radio fraternity, that new licensees who have passed the multiple-choice form of the RAE are inferior beings, simply because the number of passes has gone up, "therefore the pass-mark must have been lowered." Here I make what I think to be a fair assumption—that it would be untrue to say that only about a thousand people in the UK can be trained sufficiently well to pass the Radio Amateurs' Examination each May/June. (I have to confine my comments to the summer exams, because it is only for these that statistics are available.)

Obviously, it is statistically possible for a candidate with no knowledge whatsoever of radio, to pass the multiple choice RAE merely by choosing answers at random. However, we calculate the probability of anyone doing this to be around one chance in 10^{30}!

The reasons behind the dramatic rise in the number of candidates are probably many. Undoubtedly, some of them must be frustrated CBers looking for a legitimate or a more flexible form of radio pastime. Others will be people who were frightened off by the previous written examinations. But you do not have to be literate to enjoy, nor to contribute to, the hobby of amateur radio. Neither does the ability to express yourself in writing automatically guarantee a sane and considerate attitude towards your fellow amateurs when on the air. It has been my experience in life that there are as big fools around with university degrees as without!

I think that it would be for the benefit of amateur radio as a whole if the newly licensed were welcomed by the old hands (and the not so old) whether individually or in clubs, and encouraged to get involved in experimenting, regardless of what sort of exam they passed. After all, that's what the hobby is supposed to be all about.

Geoff Arnold

services

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

Beginner

A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate

A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

Advanced

A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £11.80 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at 95p each, including post and packing to addresses at home and overseas.

Binders are available (Price £4.30 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

NEWS NEWS NEWS

The 1980 Girl Technician Engineer of the Year

The 1980 Girl Technician Engineer of the Year is Miss Fenella Hume, age 23, a Development Project Leader from Cambridge. At a ceremony in London, on 31 October 1980, HRH The Prince of Wales presented her with a prize of £250 and an inscribed rose bowl. A special award was also made to the runner-up, Miss Sally Buswell, 25, an Assistant Instrument Engineer from Pinner, Middlesex.

Sponsored by The Caroline Haslett Memorial Trust and The Institution of Electrical and Electronics Technician Engineers, this Award aims to focus attention on electrical and electronic engineering as a worthwhile professional career for women.

Fenella Hume holds the position of Development Project Leader with Kent Industrial Measurements Ltd. at Eaton Socon, St Neots, Cambridgeshire. She is responsible for the organisation of design projects, including the allocation of work to technicians and apprentices, and for the detailed design of controller indicators and chart recorders. Fenella finds satisfaction in being able to use her knowledge and experience to create a well-engineered and marketable product, to prove continually the basic principles of electronics whilst designing and testing, and to train her mind to think logically.

The Institution of Electrical and Electronics Technician Engineers, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.

New Book Company

A new company, ZL Communications, has recently been formed to supply technical books to the public on a mail order basis.

Subjects covered will include, amateur radio, audio (Hi-Fi and tape recording), CB radio, computers and microprocessors, electronics, radio and television.

For catalogue and further information contact: *ZL Communications, 35 Burnt House Road, Cantley, Nr Norwich, Norfolk NR13 3RT. Tel: Freethorpe (049 370) 821.*

G9BRY—Mayday, SOS, 10-62, Help

In the October 1980 edition of "10-4", the official newsletter of the Citizens' Band Association, it was announced that the Home Office had issued the CBA with a transmitting licence for 941·975MHz, with the callsign G9BRY.

The purpose of issuing the licence was to enable the CBA to evaluate the possibilities of 900MHz CB or Open Channel. The licence is valid until 30 November 1980, the last day for comment on the Green Paper.

I understand from James Bryant, President of the CBA, that the CBA has met with a major problem—they cannot obtain any equipment for the frequency.

A search has been mounted for a pair of rigs and James assures me that the search has not only covered the UK, indeed, they have sought assistance on a world-wide scale, without success. At the time of going to press (early November) this was still the situation.

Contrary to general opinion, it would seem that 900MHz equipment is unobtainable!

Spreading Out

Amplicon Micro Systems Ltd., the micro computer marketing company of Amplicon Electronics Ltd. have recently opened a new office at Kingston House, Stephenson Way, Three Bridges, Crawley, to provide demonstration facilities and after sales service for the Commodore range of low-cost business systems for use in business, industry, education and the home.

The Commodore PET range of products are available for demonstration, as are the new 8000 series of computers.

Further information from: *Amplicon, Richmond Road, Brighton, East Sussex BN2 3RL. Tel: (0273) 608331.*

Tools Catalogue

TRI-tronic Marketing Ltd. has produced a 12-page catalogue listing tools and hardware for the home constructor.

All the tools are professional quality and supplied at discount prices. An accompanying price list gives prices inclusive of VAT and p&p.

The catalogue is available free-of-charge from: *TRI-tronic Marketing Ltd., 75 Albert Street, Rugby, Warwickshire CV21 2SN. Tel: (0788) 73328.*

NEWS NEWS NEWS

Club News

The Wisbech Radio and Electronics Club inform me that they have changed their meeting nights from Mondays to Thursdays.

The meetings kick-off at 1930hrs, at the address below, on alternate weeks, starting Thursday, 16 October 1980.

The club extend a welcome to anyone interested in amateur radio, short-wave listening, electronics generally or passing the RAE.

Further details can be obtained from: *The Secretary, D. Dunn G8RZN, Five Bells, Parson Drove, Nr Wisbech, Cambs. Tel: (094 574) 231.*

Bye Bye 405

The Home Secretary, in a written reply in the House of Commons earlier this year, made a detailed statement about the closure of the 405-line television services and the further extension of the 625-line service.

His statement began: "The 405-line v.h.f. television services of the BBC and the IBA transmit BBC-1 and ITV in black and white only and are now substantially duplicated by the 625-line u.h.f. services which transmit BBC-1, BBC-2 and ITV in colour, and which will in due course transmit the fourth channel service. Phase II of the current u.h.f. engineering programme for extending the 625-line services to communities with populations of 500 or more (over 99% of the population) should be completed by about 1984.

"The need to close the 405-line services in the early 1980s was recognised by the Pilkington Committee and the Annan Committee on the Future of Broadcasting. The manufacture of sets capable of receiving the 405-line services ceased some years ago and the transmitting equipment is rapidly nearing the end of its useful life. Substantial capital expenditure would be required to extend its life beyond the next few years and such expenditure on a duplicate and obsolescent service could not be justified.

"I have, therefore, agreed with the broadcasting authorities on a timetable for the closure of the 405-line services. Closure will begin in 1982 and will be phased over a period of about 4 years."

The BBC and the IBA are co-operating closely in the implementation of these engineering programmes in order to minimise any inconvenience to the public. As far as possible they plan to close down their 405-line services in Bands I and III at the same time in particular areas, although this will not be possible everywhere since the BBC have 110 transmitters on 405-lines while the IBA have 47.

Stations to be closed earlier in the programme will be those in areas where there is good coverage from the u.h.f. 625-line services. The last stations to be closed will be some of the high-power main stations in areas where 625-line coverage is less complete.

BBC Engineering Publicity, Room 707A, Henry Wood House, Broadcasting House, London W1A 1AA. Tel: 01-580 4468 ext. 5434.

On the Move

Ace Mailtronix has moved into larger premises. The company specialises in electronics components for magazine projects in addition to its electronic component catalogue listing approximately 1000 items available ex-stock by mail order.

The catalogue is available now, priced 30p to mail order customers. This is refundable with subsequent orders over £5.00. Callers are welcome during normal working hours, Monday to Friday and on Saturday mornings, to whom the catalogue is free.

The new premises are at: *3A Commercial Road, Batley, West Yorks. WF17 5HJ. Tel: (0924) 441129.*

Business News

Lascar Electronics, the Essex-based instrument manufacturers have appointed Audio Electronics as their Central London stockists.

All their most popular instruments will be stocked at: *Audio Electronics, 301 Edgware Road, London W2. Tel: 01-724 3564.*

Sinclair Electronics Ltd., has been appointed the sole importer for the UK and Eire for Leader Electronics Corp. of Japan.

Leader manufactures a wide range of competitively priced, high quality test equipment, including single and dual trace oscilloscopes with bandwidths up to 35MHz, and a comprehensive selection of items covering most test requirements in the fields of TV, Video, Audio, Amateur Radio and CB.

Leader products will be stocked in the UK by Sinclair and a few select distributors will be appointed.

Sinclair also markets a rapidly expanding range of portable test equipment, manufactured by them in the UK, under the trade name Thandar.

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

Coals to Tokyo

Following upon last year's State of the Art award for the Quad electrostatic loudspeaker comes the news that the Quad 44 control unit has been voted a "State of the Art" award for 1980 by Japan's foremost audio magazine *"Stereo Sound"*. Products are selected for the award by a panel consisting of eight leading Japanese audio critics.

In Japan the opinion of the audio critics has enormous influence upon the market and the accolade given to the Quad 44 will have significant commercial benefits as well as being a source of pride to the design team at Quad. Fifteen per cent of the Quad 44 production is earmarked for airfreight to Tokyo each month to satisfy demand.

The Acoustical Manufacturing Co. Ltd., Huntingdon PE18 7DE. Tel: (0480) 52561.

Can I Help You!

Are you the secretary, organiser or general dog's body of your local radio club or any other group whose functions may interest readers of *PW*. If so, let me know and I will endeavour to publicise your rally, get-together whatever, through this column. Remember though, we compile the magazine some time ahead of publication day (e.g. this note was written in November), so, the earlier I can have details, the better.

Alan Martin

More on page 90 ▶▶▶

tape/slide controller

PART 1

Fred JUDD

Automatic control of slide projectors from magnetic tape can be done quite easily with audio signal pulses on one track of a stereo tape-recorder leaving the remaining track available for commentary, music and sound effects. With a reel-to-reel recorder a similar function can also be carried out by means of adhesive foil strips on the tape that are used to operate a relay which in turn will actuate the projector slide change mechanism. An electro-optical system could also be used.

However, if one wishes to use the now much more popular cassette deck, most of which are two-channel (stereo) then there is no alternative but to use one track for slide change pulses and the other for music and commentary which prevents having normal stereo recording and reproduction.

The controller described in this article enables automatic slide change to be carried out and yet allows one to retain the full stereo record and replay facility with any cassette or reel recorder. It can also be used with any mono (single track) cassette or reel machine. The slide projector must have the facility for automatic slide change and for this purpose most have a 2-pin connection for the external control. If this is not provided, but the projector has a remote control button, then connection can be made to this.

The controller operates on the principle that music and commentary, etc., can be recorded in stereo as normal, together with projector control impulses on one of the tracks. On replay the pulse is separated from the music, etc., and vice-versa, with the pulse being used to operate a relay. The relay has two contacts (normally open) which are connected to the auto slide change socket on the projector. The controller also incorporates dual channel mixing for stereo microphones and high level input signals, a facility that few cassette decks have, so one has provision for mixing commentary, music and sound effects, or background sound whilst recording and simultaneously programming the slide changes.

The Circuit

With the aid of the block diagram (Fig. 1) the general function of the unit can be followed. About 300mV r.m.s. of 50Hz signal is obtained from the secondary winding of the power supply transformer and fed to the pulse gate, a button-operated "electronic attenuator" i.c. giving a very clean pulse free from switching spikes which would produce audible clicks.

The pulse signal is recorded, as required for a change of slide, together with the left-hand channel audio signals

The completed Tape/Slide Controller ready to be connected to the tape-recorder and automatic slide projector

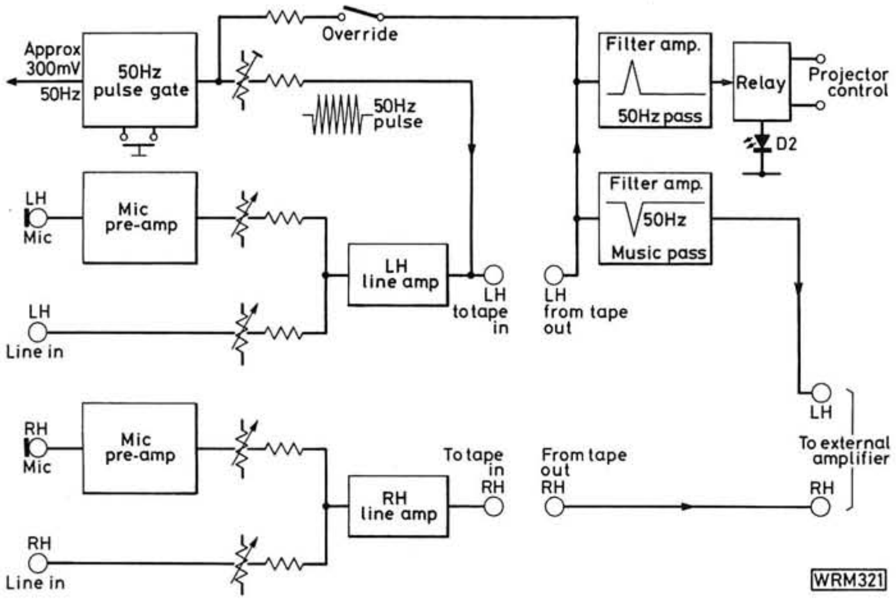


Fig. 1: Block diagram of the Tape/Slide Controller

from the microphone or high level inputs (music, etc.) onto the left-hand channel of the tape-recorder (TO LH TAPE IN). On replay these signals are returned from the left-hand channel of the recorder (FROM LH TAPE OUT). The 50Hz pass filter rejects music signals, even bass notes that might occur at 50Hz, as there is a time delay in the rectifier circuit from which d.c. is obtained (from the pulse) to actuate the relay. Music signals are passed through the 50Hz reject filter (music pass) and then to the output socket for the external amplifier. Signals for the right-hand channel, mic or high level, go to the tape-recorder via "TO RH TAPE IN" and from the tape-recorder through "FROM RH TAPE OUT" and the direct link to the external amplifier.

Most cassette and reel-to-reel recorders have a through monitoring arrangement in which case the slide projector will be automatically operated as a pulse is recorded. One can therefore prepare a commentary and music script marked with the right places for a change of slide. With the slides to be shown loaded in the correct order it is simply a matter of pressing the pulse button at the right moment whilst recording the commentary, etc. On replay (with slides reloaded) the programme is then repeated automatically. Should the recorder not have through monitoring, then the override switch can be used so that slides will still be changed whilst the pulses are being recorded. An example of how to make up a programme and operate the controller will be given later.

The full circuit is given in Figs. 2 and 3. IC1 operates as left- and right-hand channel microphone pre-amp. stages the outputs each being taken to a passive mixer circuit (R5–R8 (RH) and R27–R30 (LH)) which also takes in the left- and right-hand channels for high level signals. The output from each passive mixer section is taken to an output amplifier, one for the left-hand and one for right-hand channel to the tape-recorder. These are together on circuit board 1.

The 50Hz slide control pulse is taken from the i.c. "electronic attenuator" via R55 and coupled to the left-hand channel output of the mixer circuit. Note also that the left-hand mixing circuit IC1b and Tr2 has a reduced bass response so that any strong bass signals very close to 50Hz, from music sources being recorded, are sufficiently attenuated to prevent accidental triggering of the slide control relay. This reduction in bass response is obtained by the use of a low value by-pass capacitor (C18) in series with R35 in the emitter return of Tr2. This does not detract from the overall bass response as most bass signals in stereo are fairly equal on both channels. The right-hand channel response is of course normal.

Signals returned from the left-hand channel of the recorder on replay include the 50Hz pulse which now has to be separated from music and commentary. This is done by a twin-T filter in negative feedback with IC3 (741 op. amp.) which also amplifies the pulse so that about 2V r.m.s. at 50Hz is available at its output. This is rectified by D1 and the d.c. used to turn on Tr3 to operate the relay. Only the relay specified should be used as the circuit design has been optimised for this.

Commentary and music signals (left-hand channel) are taken via IC2 a 741 op. amp. which passes all signals except those very close to 50Hz and also has unity gain so that signals going to the external amplifier are equalised with those from the right-hand channel. Signals for the

CONSTRUCTION RATING Intermediate

BUYING GUIDE

Readers should have no difficulty in obtaining the components for this project. The relay specified is an RS Components type and can be obtained from several of our regular advertisers who offer RS Components parts. Printed circuit boards will also be available from those advertisers specialising in this service. You are advised to study the advertisement pages for the components for this project.

APPROXIMATE COST £35

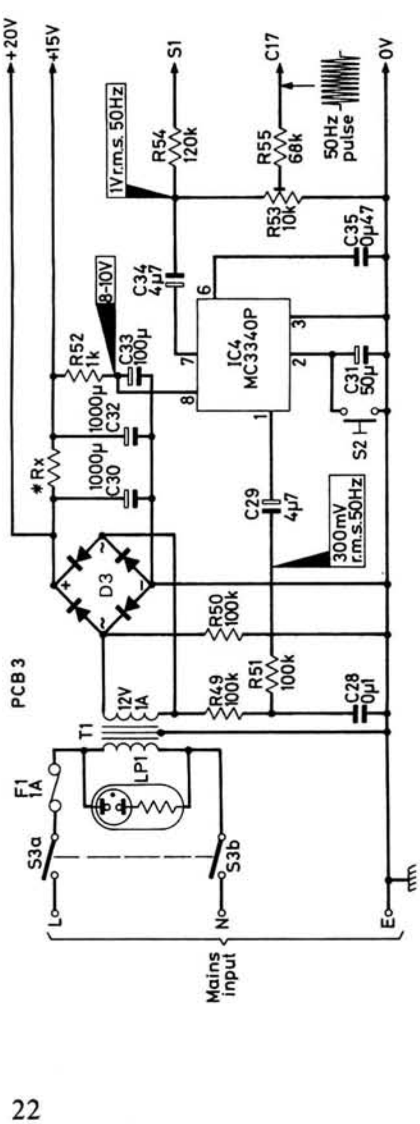


Fig. 2: Circuit diagram of the power supply for the Tape/Slide Controller

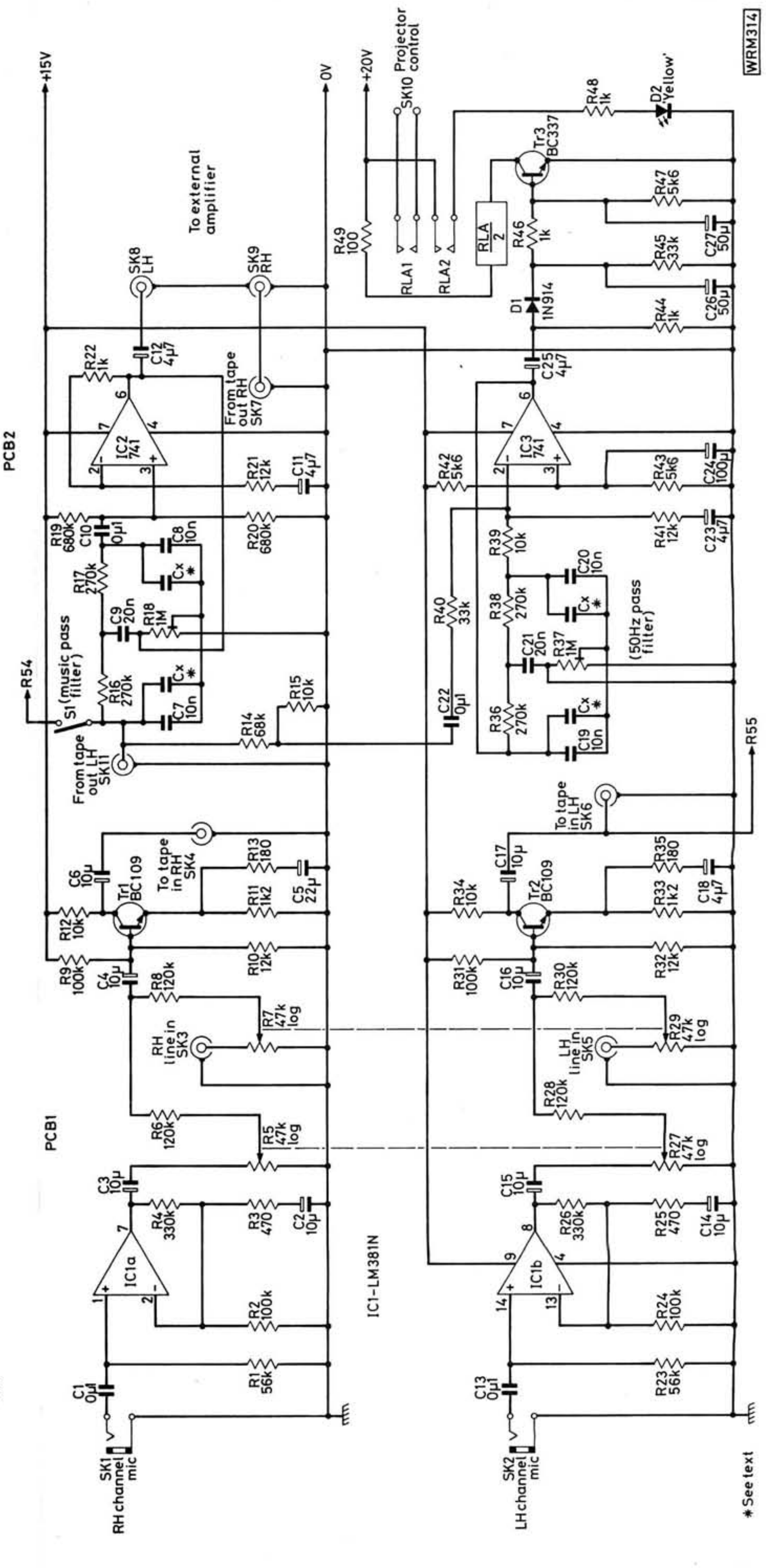


Fig. 3: Circuit diagram of the Tape/Slide Controller

★ components

Resistors		
¼W 5% carbon film		
100Ω	1	R56
180Ω	2	R13,35
470Ω	2	R3,25
1kΩ	5	R22,44,46,48,52
1·2kΩ	2	R11,33
5·6kΩ	3	R42,43,47
10kΩ	4	R12,15,34,39
12kΩ	4	R10,21,32,41
33kΩ	2	R40,45
56kΩ	2	R1,23
68kΩ	2	R14,55
100kΩ	7	R2,9,24,31,49,50,51
120kΩ	5	R6,8,28,30,54
270kΩ	4	R16,17,36,38
330kΩ	2	R4,26
680kΩ	2	R19,20
½W 5%		
270Ω	1	Rx (see text)
Capacitors		
Disc ceramic		
10nF	4	C7,8,19,20
0·1μF	5	C1,10,13,22,28
Polyester		
0·47μF	1	C35
Electrolytic p.c.b. type		
4·7μF 16V	7	C11,12,18,23,25,29,34
10μF 16V	8	C2,3,4,6,14,15,16,17
22μF 16V	1	C5
50μF 16V	3	C26,27,31
100μF 16V	2	C24,33
1000μF 25V	2	C30,32

Potentiometers		
Side adjusting cermet		
10kΩ	1	R53
1MΩ	2	R18,37
Tandem ganged		
50 + 50kΩ log	2	R5 + 27,7 + 29
Semiconductors		
Diodes		
1N914	1	D1
50V, 1A bridge	1	D3
Red l.e.d.	1	D2
Transistors		
BC109	2	Tr1,2
BC337	1	Tr3
Integrated circuits		
741	2	IC2,3
LM381N	1	IC1
MC3340P	1	IC4

Miscellaneous

Relay 12V 250Ω (RS349–658); Min. toggle switch s.p.s.t. (1); d.p.d.t. (1); Phono sockets, Red (4), Black (4); ¼ inch jack sockets (2); 240V panel neon; Knobs (2); 14-pin d.i.l. socket (1); 8-pin d.i.l. sockets (3); Mains transformer 12V 12VA; Min. push-button switch (1); Verobox 75–1412K (205 × 140 × 110mm); Set of three p.c.b.s; 1A fuse; Panel mounting fuseholder; Self-adhesive p.c.b. guides.

right-hand channel (to external amplifier) are taken straight through from the recorder output via the linked sockets marked "FROM TAPE OUT RH" and "EXT AMPLIFIER RH". The two filter circuits IC2 and IC3 and the relay amplifier Tr3 are contained on circuit board 2.

The remaining part of the circuitry is that of the power supply which is quite conventional but contains the electronic attenuator i.c. A 50Hz voltage for the pulse is obtained from the network R49, R50, C28, R51, which provides a sine-wave of about 300mV to the i.c. via C2. In normal operation the push-button is depressed for about 1 second to provide a long enough pulse to actuate the projector control relay. The required pulse level, as will be explained later, is obtained by the pre-set R53.

General Performance

The audio mixing section has a performance comparable with top grade domestic cassette and reel-to-reel recorders. Signal-to-noise, referenced to 0·775V r.m.s.

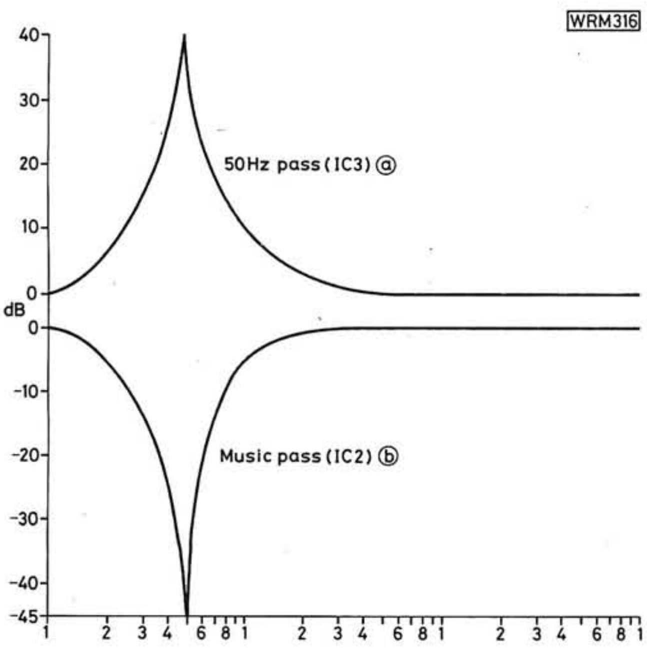


Fig. 4: The filters provide maximum acceptance or rejection of over 40dB at a frequency of 50Hz as shown in these response curves

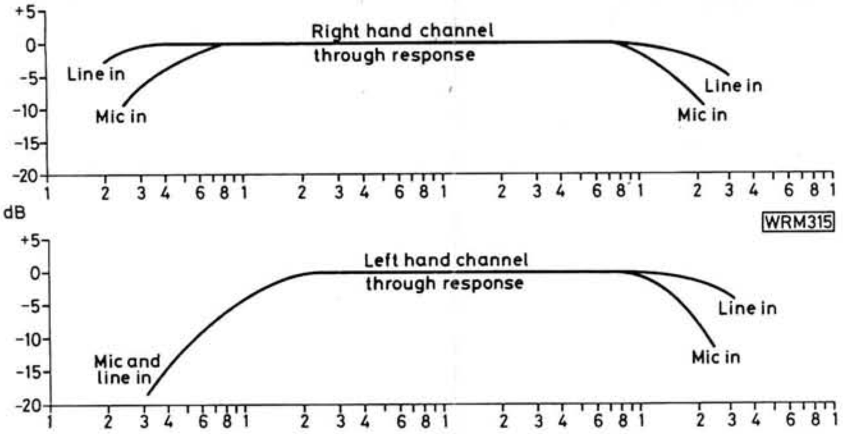
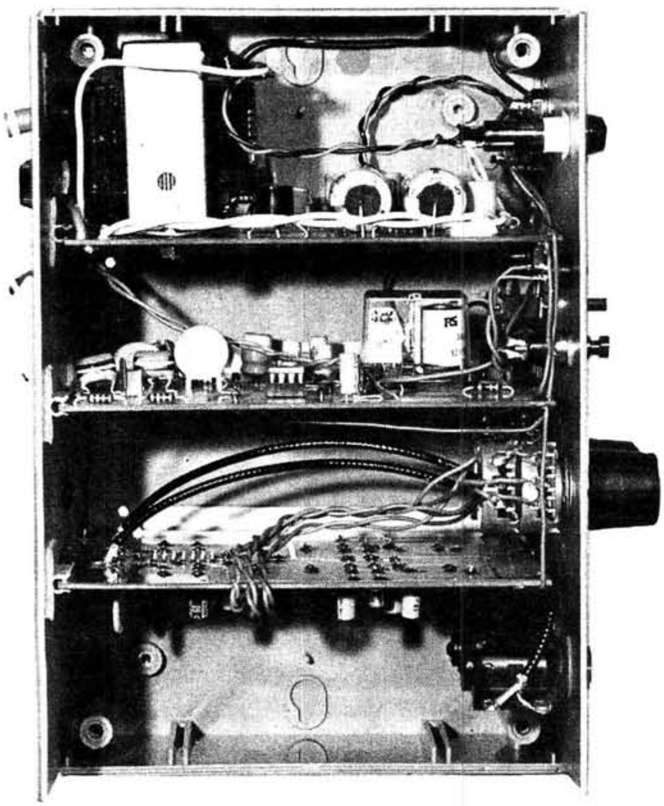


Fig. 5: The overall frequency response for each channel is shown in this diagram. It can be seen that the left-hand channel has a reduced bass response



output, is 70dB for the line inputs and 55dB for the microphone inputs and t.h.d. from either inputs is less than 0·1 per cent. The microphone input sensitivity is 0·5mV for 0·775V output and at the line inputs it is 200mV for 0·775V output. The microphone inputs are suitable for impedances of 200Ω or higher. Very low impedance microphones, 25–30Ω, should have a suitable matching transformer.

Frequency Response

The overall frequency response for each channel is shown in Fig. 5 but as already mentioned the left-hand channel has a reduced bass response. The filter responses are shown in Fig. 4 and provide maximum acceptance and/or rejection at 50Hz to about 40dB. Each filter is tuneable to 50Hz by means of a preset potentiometer and the procedure will be dealt with later.

The second part will deal with construction and use of the unit.

kindly note!

***PW* "Tamar" 28MHz Transverter Driver, September 1980.**

The specifications for RFC6 on the power supply board are:

36 turns of 23 or 24 s.w.g. enamelled copper wire evenly spaced on a 12·5mm diameter toroid. The toroid should be mounted vertically and secured to the p.c.b. with epoxy resin adhesive.

***PW* "Nimbus" Charger/p.s.u., Oct 1980**

There are two minor discrepancies between the circuit diagram and the p.c.b. layout in the p.s.u. charger. The circuit diagram should be taken to be the definitive version. The p.c.b. should be corrected as follows, remove R3 lead from the junction with R1 and re-connect to the track adjacent to C3 positive end. Make a link from the p.c.b. location, vacated by R3 (directly below D2), to BR1 positive track pad.

the things people say

"No, I can't hear you on the input, but that's probably because I'm only running 10 watts here."

. . . Brighton & District RS Newsletter

Have you heard any (printable) comments, funny peculiar or funny ha-ha? If so, why not send them in to our Editorial offices at Poole. We will pay for every one published.

The BASICS of TV DXing

Part 1 Roger BUNNEY

Our heading photograph shows a test card received via single-hop Sporadic E propagation from ORF-Austria by N. E. Parkes, Co. Antrim, using a simple indoor dipole at his home in a block of flats

As the name suggests, DXTV is the art of receiving distant television signals, which in this context are those signals intended for domestic viewing in areas far from the receiving location. Although the broadcasting authorities take great care to engineer transmitter characteristics to minimise interference to other transmitters operating in the same spectrum but at distances far removed from the originating site, under certain propagation conditions those very signals can be carried over hundreds and perhaps thousands of miles, and be received on relatively simple equipment. The purpose of this article is to explain briefly the mechanism by which these signals travel, and to suggest the basic requirements for a receiving installation.

It may be instructive at this stage to consider the television signal itself, since across the European land-mass several transmission systems are in use. The actual vision signal is amplitude modulated onto the carrier but with one sideband partially suppressed. This is known as vestigial sideband modulation (v.s.b.). The modulation may be either negative- or positive-going, Fig. 1 will clearly show the differences. Negative-going video is employed with the UK 625-line u.h.f. transmissions—tuning onto a blank channel will reveal a greyish background with black dots of noise; positive-going video is used on the more elderly 405-line v.h.f. transmissions, a blank channel will show a very dark background with bright white noise dots. The various types of transmission used in Europe are detailed in Table 1, and with few exceptions it will be noted that negative-going vision has been adopted. Sound modulation with negative-going vision signals is generally f.m., those countries still using positive-going vision always have a.m. modulated sound. In passing, it should be mentioned that the TV transmissions that have been received from experimental satellites and those for the future will employ f.m. video modulation; such reception is of rather a specialised nature and will not be pursued further in this article.

Broadcasting of television signals is carried out in certain frequency bands and at the time of writing are as follows: Band I, 40–70MHz; Band III, 162–230MHz; Bands IV/V (u.h.f.) 470–860MHz. Decisions passed at the recent WARC '79 will mean slight alterations to those frequencies, perhaps most significantly in Band I. Study of Table 1 will clearly show that different transmission

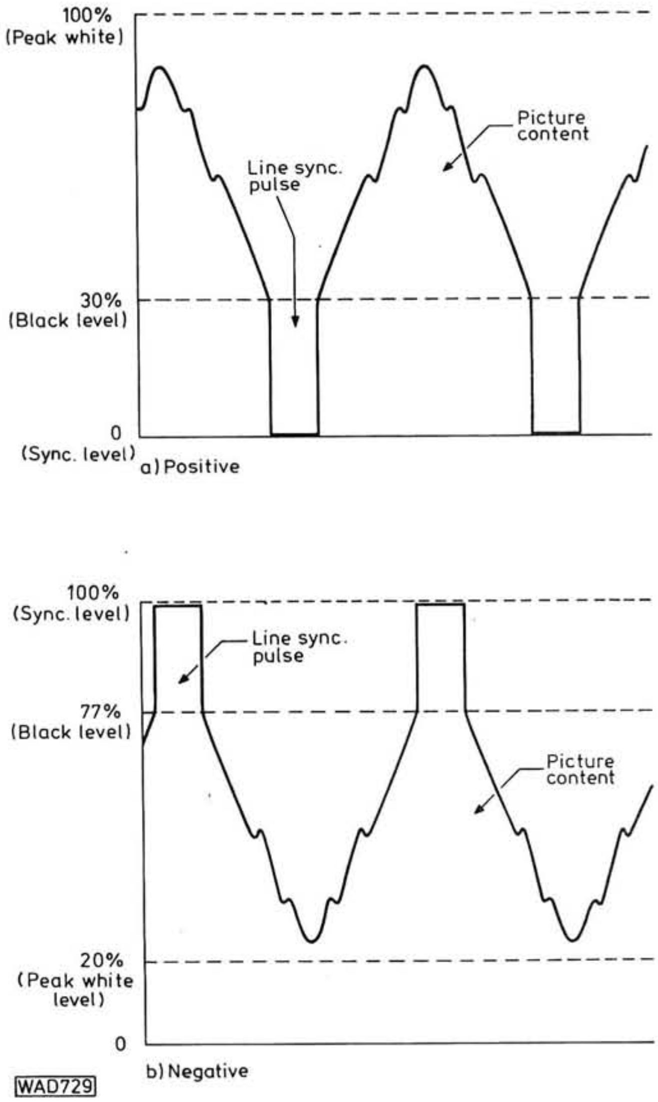


Fig. 1: Vision waveforms for: (a) positive modulation, and (b) negative modulation

Table 1
European TV Systems

System	No. of Lines	Overall Channel Band-width (MHz)	Vision Band-width (MHz)	Sound/ Vision Spacing (MHz)	Vision Modula-tion	Sound Modula-tion
A	405	5	3	−3·5	+	a.m.
B	625	7	5	+5·5	−	f.m.
D	625	8	6	+6·5	−	f.m.
E	819	14	10	±11·15	+	a.m.
G/H	625	8	5	+5·5	−	f.m.
I	625	8	5·5	+6	−	f.m.
L	625	8	6	+6·5	+	a.m.

A = UK — e.g., Ch. B3
B = Western Europe — e.g., Ch. E2 (v.h.f.)
D = Eastern Europe — e.g., Ch. R1 (Not East Germany)
E = France (v.h.f.) — e.g., Ch. F2
G/H = As for System B but u.h.f.
I = UK — u.h.f.
L = France/Luxembourg u.h.f. — e.g., Ch. E21

systems have varying overall channel bandwidths, the 405-line channels on System A have a much smaller bandwidth than 625-line channels. Thus it follows that in a given television band, a greater number of channels can be packed in if the overall transmission bandwidth is small. The vision frequencies used in Band I are detailed in Fig. 2 and whereas five UK 405-line channels are used, only three System B 625-line channels can be employed. In point of fact the latter System B channels extend to 48MHz and no lower, if an extension was made down to 40MHz only one extra channel would result. Band I vision frequencies have been shown, since this particular band does allow quite spectacular reception with the minimum of equipment. A free booklet from the IBA, Engineering Information Service, Crawley Court, Winchester, Hants SO21 2QA, details the UK Band III and the main u.h.f. carrier frequencies for each channel now used throughout Europe—the booklet is called *Transmitting Stations, A Pocket Guide.*

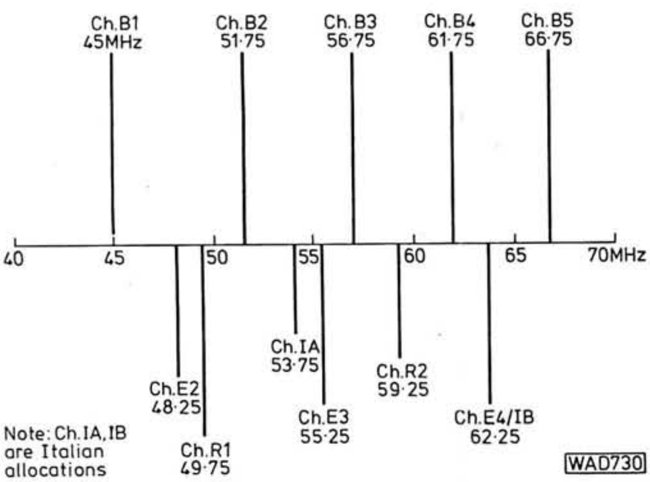


Fig. 2: Vision frequencies in Band I, 40–70MHz

Signal Propagation

Having described briefly the different types of signal waveform used for television transmission, and before going on to suggest the means to receive such elusive signals, it may be wise to detail how the signal arrives by two different modes, that of "weather assisted" or Tropospheric propagation, and that of "Ionospheric assisted" or Sporadic E propagation. There are other types of signal propagation, but for simplicity it seems best to concentrate on the more familiar types and leave the more esoteric forms of signal propagation to further study and experiment at a later stage. I am sure that most viewers have been aware that during certain types of weather condition, interference arises on the "local" TV programmes, if nothing more than an announcement suggesting that viewers may be experiencing difficulties and "do not adjust your set".

The more inquisitive of us may—possibly by accident—whilst tuning between local programmes happen upon weaker signals, perhaps of another ITV programme or if near the coast a foreign programme/test card, etc. During such conditions a glance at the weather map may disclose that the UK is under the influence of a slow-moving high-pressure system (Anti-cyclone). Reception conditions will start to build up particularly if the system is virtually stationary. Usually towards evening, as the sun falls and ground temperatures drop, an inversion may occur, caused by the different rates at which the air and surface temperatures fall. This is particularly marked during clear cloudless summer days followed with equally clear nights. During such conditions, TV signals will be propagated at both v.h.f. and u.h.f. at distances of up to 1000 miles, and certainly until such transmissions close down for the night. As they open up the next morning it will often be found that the signals are still present, but as the sun rises and temperatures rise again so conditions will fall.

This diurnal characteristic is such that an effect known as "ducting" can occur, whereby a distant v.h.f./u.h.f. signal can put an exceptionally strong signal into the UK, but stations in the same direction and at lesser distances are poorly received. The Brocken TV transmitter in East Germany is a favourite for this to be observed on Ch. E6 (Band III) and Ch. E34 (u.h.f.) when no other DX signals are present! In this instance the transmitter is located high in the mountains and literally transmits its signals directly into the duct.

High-pressure systems can also produce spectacular reception, particularly during the autumn/winter months, and foggy conditions often manifest many distant signals. At times a high-pressure system may remain for some days with no apparent improvement in DXTV, but as the system slowly moves away and the high-pressure starts to fall then signals may rise from the noise. Signals can be received along the advancing wavefront of (for example) a fast-moving cold front, where we have an abrupt temperature gradient, similar to a temperature inversion, which can give signal reception up to several hundreds of miles. Such conditions however may be present for an hour or less depending upon the speed and "sharpness" of the front.

Sporadic E

High above the Earth's surface are the various layers of the Ionosphere that support signal reception at medium and short waves, such reflection relating to the time of day, part of the year and prevailing Solar activity. At around the 70 mile height is the E layer. I am sure many readers will recall the (happy?) days for 405-lines when during the summer months BBC1 was regularly shattered with Continental interference. That interference is or was the result of Sporadic E. Normally the E layer will not support v.h.f. signal reflection, it being transparent to signals above about 7–10MHz (this latter figure is very approximate and will vary according to the conditions as noted at the beginning of this section). Certainly for u.h.f. TV in Band I and above, the E layer is just not there during normal conditions. At times however, intense ionisation of a localised nature happens within the E layer and such patches are capable of supporting signal reflection at frequencies in Band I, often Band II (f.m.) and on very rare occasions even at the low end of Band III (I once noted Ch. E7 vision via Sporadic E at 190MHz!). The causes of such ionisation are not confirmed, although recent work by radio amateurs does show a definite connection between Meteor Showers and Sporadic E. However the net result for the DXTV enthusiast is that during the generalised period of early May to late August one can experience "Sporadic E openings".

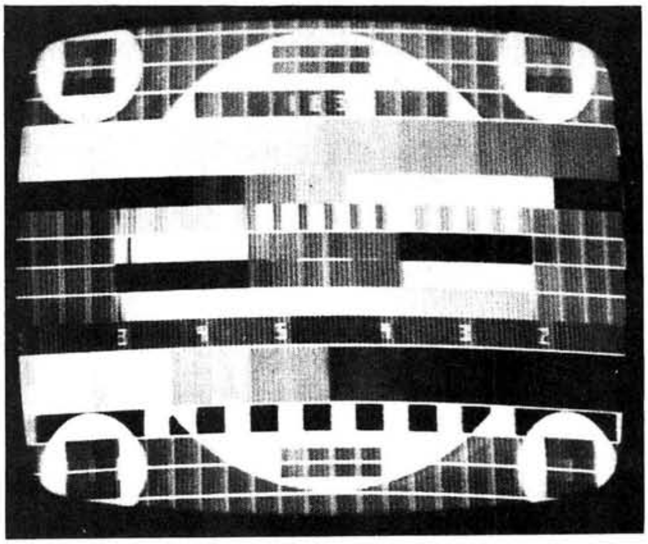
Such openings produce strong or very strong Band I TV signals from one or more stations or countries in either a very localised area or a more widespread tract of Europe, usually via a single hop of 500 miles or more, up to perhaps 1500 miles. Often double hop occurs, giving up to 3000 mile distances; an example that is received on Ch. E3 is the Amman, Jordan transmitter. To receive single-hop signals under 500 miles calls for very intense ionisation, and although this can happen it is very rare.

Sporadic E enjoys a "season" as indicated during the summer months, although as its name implies it can occur anywhere, anytime. Often a mid-winter peak of Sporadic E is noted. Signals, unlike the "fringe" type of the Tropospheric with its slow fading, are spectacular, ranging from a few microvolts to several millivolts and across a time span of seconds. Due to the strength of signals, quite simple equipment can be employed. I recall some years ago experimenting with a dipole array on a 9ft pole in the garden, and comparing the Ch. E2 Madrid signals with those coming down from a 4-element Band I array at 50ft. Signal levels were measured reaching to nearly 3mV and at times similar strength signals were noted from both aerials.

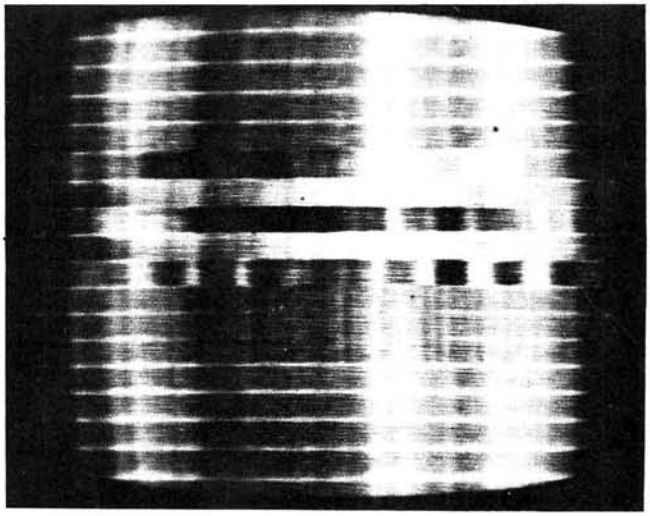
Sporadic E is certainly dramatic, the newcomer to DXTV can easily equip himself with basic apparatus and successfully receive foreign Band I signals, and once having gained experience in receiver and propagation requirements, can advance himself to the other and more difficult forms of signal reception. I personally advise enthusiasts to follow this route since if the knowledge/experience is available to convert an older receiver, minimal financial outlay results and the technical experience thus gained is invaluable for future construction, modification and experimental work. For the non-technical enthusiast such DX is possible even without removing the rear cover of his receiver, by employing a standard u.h.f. domestic TV set.

Equipment

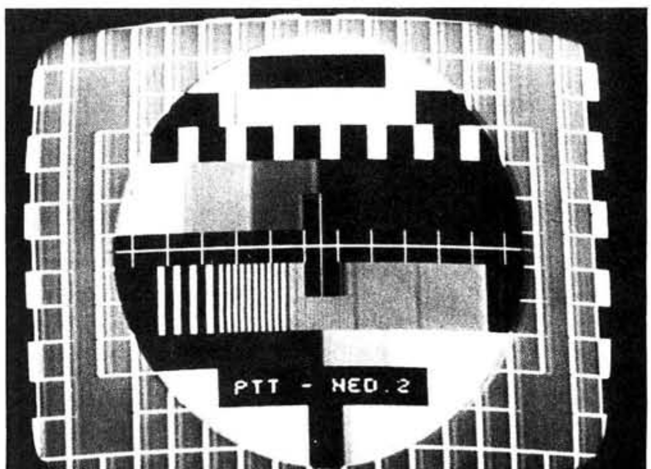
I have been active in DXTV for nearly 20 years, and have written the DXTV column in our companion magazine *Television* since the early '70s. During this time I have encountered most problems likely to beset the newcomer to this hobby. Of course in the 1960's, prior to the 625-line service, any person wishing to undertake serious DXTV operation would have to modify his 405-line set to



An example of single-hop SpE reception, showing the USSR test card on Ch. R2 (59·25MHz) as seen by Gareth Price in Lowestoft



Trans-Equatorial F2 reception of Ch. R1 Vladivostok in Perth, Western Australia by Anthony Mann. Note the characteristic smearing and multiple image effects



Good-quality Tropospheric u.h.f. reception of the Philips 5544 test card from Lopik, Holland on Ch. E27 by Gareth Price, Lowestoft

receive the 625-line negative-going video signals used across Europe (with the exception of France). In these days, with the adoption of 625-lines, little modification is necessary, there are even receivers available that already have v.h.f./u.h.f. tuners fitted and just a few of these may incorporate 5·5/6MHz sound intercarrier switching to enable the sound of the UK u.h.f. and West European v.h.f./u.h.f. services to be resolved. So, for a price, DXTV watching can be extremely easy—the dealer may even wire on the 3-pin mains plug! Unfortunately problems can result with the use of such receivers, which will be expanded on shortly. At this stage consideration of how to receive Sporadic E in Band I must be given, since this provides the easiest means of DXTV operation and at lowest cost (both in terms of labour and finance!).

As already mentioned, the enthusiast can contact his local discount warehouse or TV dealer, establish which receivers have 625-line v.h.f. coverage, possibly with 5·5/6MHz switching, and simply write out a cheque. The question of aerials will be dealt with later. The second way of achieving v.h.f. coverage is to make use of the standard u.h.f.-only receiver, preferably with a continuous tuner (i.e., one marked with Chs. 21–68 on a rotary scale), since push-button tuning—unless there are about 10 buttons—is operationally inconvenient and clumsy. The receiver in its unmodified form can be used directly for u.h.f. Tropospheric DXing, but with the inclusion into the system of a device known as a v.h.f./u.h.f. up-converter, the receiver then can be tuned over Band I and Band III. The up-converter is a small transistorised frequency converter that transfers the 40–250MHz spectrum to an equivalent slot in the u.h.f. bands, often in the Ch. 30 to Ch. 60 region. Therefore, by plugging a Band I aerial into the converter, connecting the output of the converter to the u.h.f. aerial socket of the TV receiver, and tuning the latter over the appropriate u.h.f. channels, Band I will be resolved on the u.h.f. receiver—simple but effective. The up-converter unit will normally be fitted with a wideband r.f. amplifier stage and give a throughput gain of up to 4dB. The noise figure is typically around 6dB but experience has shown that these converters can be used successfully for DXTV operation even on weak Band III Tropospheric signals.

A third means of receiving DXTV signals is by obtaining and modifying an earlier dual-standard (405/625-line) receiver. This does call for a degree of skill in the enthusiast, since modifications will entail separating the video detectors from the i.f. strip, the object being to utilise the narrow i.f. bandwidth (System A) but with the negative detector. The benefits are improved selectivity and higher gain with lower noise. For such work either the existing receiver's v.h.f. tuner can be replaced with a modern varicap equivalent, or the original tuner can be used as an i.f. pre-amplifier stage and tuning carried out with an external varicap tuner unit. The advantage of the latter method is that i.f. shaping and limiting circuits can be fitted in the i.f. feed to the main receiver, such circuits again being aimed at the improvement of weak signal working and rejection of adjacent interference. When such work is undertaken the sound signal accompanying the received video will be lost, since we are working with reduced i.f. bandwidths. With intercarrier sound this signal proceeds along the vision i.f. strip and is then taken into the sound i.f. strip at the video detector/video amplifier. Restriction of the vision i.f. bandpass down to around 3MHz will mean the sound is lost.

At this point I feel that great stress must be placed on the problems of i.f. selectivity. I am aware that many readers will be using imported v.h.f./u.h.f. receivers intended for reception of sound and vision. A glance at the Band I vision allocations will show that in many cases

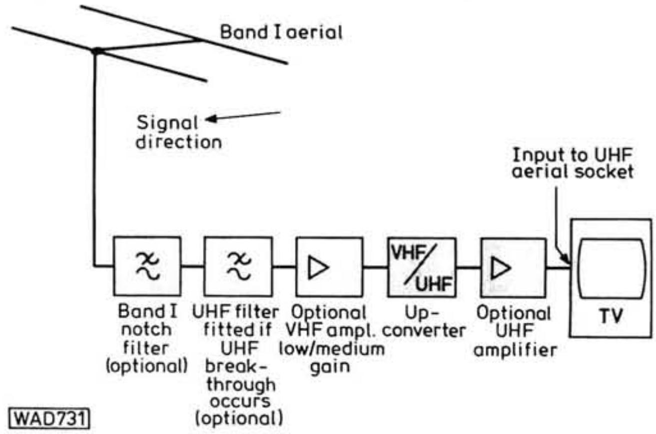


Fig. 3: Using an up-converter to provide v.h.f. coverage on a u.h.f.-only receiver

(assuming a 6MHz sound/vision separation for the UK standard) if a receiver is tuned to, say, Ch. E2 vision at 48·25MHz, the i.f. bandpass of that receiver will be capable of passing incident signals (other than the desired) if they fall within the spectrum of 48·25MHz to 54·25MHz. Indeed if above the 6MHz limit we have a strong "local" Band I station, there is every likelihood of it "splashing down" into the i.f. bandpass. Certainly if such a receiver is used at my home for receiving Ch. R1 video at 49·75MHz, the local Ch. B3 sound at 53·25MHz will all but render Ch. R1 useless, except for very strong signals, by producing "sound splatter". The problem is often made worse by the enthusiast using a high-gain aerial amplifier (pre-amplifier) whereas the correct course of action should be to notch-filter out Ch. B3 sound and then amplify. Even if there is no strong "local" to produce problems, in the first good Sporadic E opening Ch. E2 vision and Ch. R1 vision will tend to overlap and "float" over each other—such are the problems of the wide i.f. bandpass receiver.

Those enthusiasts in London living within 15 miles of the Crystal Palace Ch. B1 transmitter unfortunately tend to suffer badly with the 45MHz vision spreading up into Chs. E2/R1 vision. Again a simple notch filter on 45MHz will remove the problem, but of course the i.f. characteristics are preset, and given conditions when several strong signals are present (such as a Sporadic E opening) the problem will obviously recur. The answer is to use/modify the i.f. strip into the reduced bandwidth state, and this course is usually taken by the serious enthusiast. Such restriction can easily be incorporated by using the Philips G8 Selectivity Panel, a small active filter that has four tuned circuits capable of being "peaked up" and inserted in series with the feed from the tuner to the main i.f. strip. For exceptional selectivity it has been known for two such filters to be connected in series.

A final word if searching for an early receiver to modify. It must have very good field sync (i.e., frame locking on a weak signal) and flywheel line sync is essential. The Bush TV125/TV161 receivers are ideal for DX work and usually can be obtained at nominal cost.

For enthusiasts intending to modify an early receiver, it will almost certainly use a.c./d.c. technique—that is it will have a **live** chassis if connected to the mains the wrong way round. Ensure that you have a "dead" chassis, **no** connections go between chassis and other external units unless via isolation capacitors and always remember that death is permanent—240V will and does kill. So if in doubt—don't!

In Part 2, next month, we deal with aerials and aerial amplifiers for DXing.

Lee Electronics Ltd

LEE

Londons Leading Stockists Of:
STANDARD YAESU ICOM FDK KDK MICROWAVE MODULES LUNAR SST SHURE HI-MOUND CDE STOLLE
TELECOMM ANTENNAE J-BEAM SWAN KATSUMI ETC.

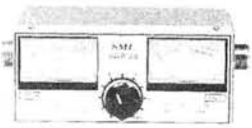
LEE

INTRODUCING THE YAESU FRG7700

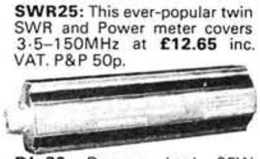
* One-touch frequency selection from long wave to short wave with 12 channels capable direct memory circuitry. (With memory type only).
* 150kHz to 29.999MHz full coverage high stability dual PLL system.
* Strong for cross modulation.
* Automatic band pass filter selection.
* 3 filters for AM reception.
* 2 steps of AGC . . . fast/slow.
* Narrow band FM reception capability.
* Timer facility.
* Back up battery.
* Sinpo coded signal strength meter.
* Receiver noise blanker circuitry.
* 12 kinds of attenuator.
* High quality audio sound.
* Dimmer control.
* AC + DC operation.

BASIC UNIT £309
MEMORY UNIT ONLY £83.95
FRG7700 WITH MEMORY £389

Just a small selection from our comprehensive range of accessories.

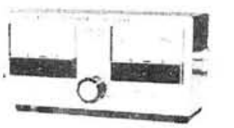


SWR25: This ever-popular twin SWR and Power meter covers 3·5–150MHz at **£12.65** inc. VAT. P&P 50p.



DL-30 Dummy load 25W DC-150 MHz **£6.35** inc. VAT. P&P 25p.
T-100 80W Dummy load DC-500 MHz **£24.10** inc. VAT. P&P 25p.
T-200 150W Dummy load DC-500 MHz **£35.60** inc. VAT. P&P 25p.

SWR200B swr/power meter covering 3–200MHz 50/75 Ohm power range 3–30MHz, 20/200/2kW, VHF 2/20/200W **£40.20.** P&P £1.00.



T-435: VHF/UHF swr and power meter with 2/20/120 watt through line power measurement **£34.45** inc. VAT. P&P 75p.

CT-1 Coax Toggle 3 SO239's **£6.85** inc. VAT. P&P 25p.
CT-2 Coax Toggle 2 SO239's 1 PL259 **£6.85** inc. VAT. P&P 25p.

PX402 13·8V DC 3 amp continuous 4 amp max fully stabilized power supply with overload protection **£22.95** inc. VAT. P&P £2.00.
Also available:
PH5000, 5A continuous, 7A surge. **EP2500,** 25A continuous, 30A surge.

We are London's Largest Stockist of Microwave Modules products.

		Price £ Inc. VAT	Post Rate
TRANSVERTERS:			
MMT28/144	(10m linear transverter	**90.85**	B
MMT144/28	(2m linear transverter	**99.00**	B
MMT432/28-S	(70cm linear transverter)	**136.85**	B
MMT432/144-R	(70cm linear transverter)	**173.65**	B
MMT70/28	(4m linear transverter)	**115.00**	B
MMT70/144	(4m linear transverter)	**115.00**	B
MMT1296/144	(23cm linear transverter)	**184.00**	C
LINEAR AMPLIFIERS:			
MML144/25	(2m 25 watt linear amplifier)	**48.30**	B
MML144/100	(2m 100 watt linear amplifier	**142.60**	D
MML144/40	(2m 40 watt linear amplifier	**69.00**	B
MML432/20	(70cm 20 watt linear amplifier	**69.00**	B
MML432/50	(70cm 50 watt linear amplifier	**113.85**	D
MML432/100	(70cm 100 watt linear amplifier	**228.65**	D
RECEIVE CONVERTERS:			
MM2000	(RTTY to TV converter)	**169.00**	B
MMC28/144	(10m converter)	**24.90**	A
MMC50/28	(6m converter)	**24.90**	A
MMC50/28LO	(6m converter)	**26.90**	A
MMC70/28	(4m converter)	**24.90**	A
MMC70/28LO	(4m converter)	**26.90**	A
MMC144/28	(2m converter)	**24.90**	A
MMC144/28LO	(2m converter)	**26.90**	A
MMC432/28-S	(70cm converter)	**29.90**	A
MMC432/144-S	(70cm converter)	**29.90**	A
MMC1296/28	(23 cm converter, 10m output)	**32.20**	A
MMK1296/144	(23cm converter, 2m output)	**59.80**	B
FREQUENCY COUNTER:			
MMD050/500	(500MHz digital frequency meter)	**69.00**	A
MMD600P	(600MHz prescaler)	**23.00**	A
MMDP1	(frequency counter probe)	**11.50**	A
RECEIVE PREAMPLIFIERS:			
MMA28	(10m preamplifier)	**14.95**	A
MMA144V	(2m RF switched preamplifier)	**29.90**	A
MMA1296	(23cm preamplifier)	**29.90**	A
FILTERS:			
MMF144	(2m filter)	**6.90**	A
MMF432	(70cm filter)	**6.90**	A
VARIOUS:			
MMV1296	(70cm to 23cm varactor tripler)	**34.50**	A
MMS384	(384MHz frequency source)	**27.60**	A
ATTENUATOR:			
MMR15/10	(15dB attenuator, BNC terminations)	**5.75**	A

THE ABOVE PRICES ARE INCLUSIVE OF VAT BUT NOT POSTAGE. PLEASE ADD POSTAGE TO THE ABOVE PRICES AT THE FOLLOWING RATES:
UNITS 'A': £0.675 UNITS 'B': £1.75 UNITS 'C': £2.25 UNITS 'D': £2.75

400 EDGWARE ROAD
LONDON W2
01-723 5521 Tlx: 298765

Buy it with Access — BARCLAYCARD VISA

INSTANT H.P. & P/EX. WELCOME

Send 25p for full details of our range.

air test

USER REPORTS ON SETS AND SUNDRIES

SOMMERKAMP TS-802
2m Hand-held Transceiver

Recently introduced into the UK market is the TS-802 2m v.h.f. f.m. handy-talky, the latest in an expanding range of equipment from the Swiss Sommerkamp Co.

As supplied the rig has a scannable frequency range from 144·025MHz to 146·000MHz in channelised 25kHz steps derived from a phase-locked-loop synthesiser.

Received frequency is indicated on a miniaturised 2-digit, 7-segment red l.e.d. display which takes the form of channel numbers from 1 to 80 and R0 to R9 when repeater mode is selected (600kHz up-shift). The unfortunate result of this method of presentation is that display readings have to be decoded by the operator. For example, display channel 60 = 145·500MHz = S.20. However, until practice makes perfect, a look-up table, on the back panel, can be referred to giving display readings against true frequency.

Scanning of the available channels can be accomplished by manual step-through using the UP/DOWN toggle switch, or continuously by activating the scanning switch. The scan will cease when a signal above the preset reference level is detected.

The receiver circuit incorporates a conventional single-conversion superhetrodyne with an i.f. of 10·67MHz. The sensitivity quoted by the manufacturers is 0·5μV for 12dB SINAD *(0·35μV p.d.),* with a SQUELCH threshold of 0·5μV *(0·1μV).*

Selectivity given at 15kHz and 25kHz are −3dB and −70dB respectively. Italic figures given in brackets are those measured during our test evaluation.

The audio stage develops an output of 250mW into an 8Ω speaker with a specified 10% total harmonic distortion.

On the transmit side, the TS-802 produces 2W *(1·7W)* of f.m. in the HI position and 0·1W *(0·3W)* in the LOW. Spurious harmonic outputs are quoted as −60dB. An internally mounted, front panel capacitor microphone is supplied for normal hand-held use, but various optional handsets and "fist" microphones are available. These are interfaced via the multi-pin socket fitted into the top panel (normally hidden by the circular aluminium blanking plate).

Top-panel features, which are of necessity closely grouped, include separate VOLUME and SQUELCH, combined BATTERY STATE and "S" METER, SCANNER/REPEATER 1750Hz tone switch, SIMPLEX/REPEATER selector and UP/DOWN channel switch. The remaining feature is a BNC connector to take the supplied $\frac{1}{4}\lambda$ flexible rubber antenna. Side-mounted sockets are provided for earphone, charging line and external 12V d.c. supply.

Results

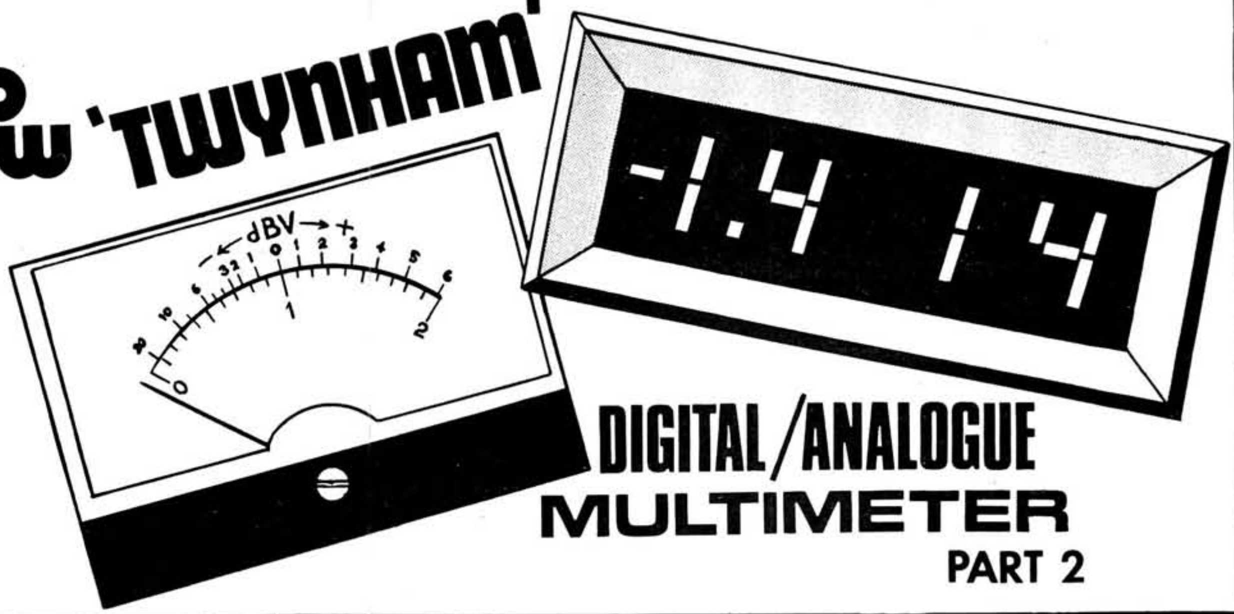
The initial impression of the TS-802 is made by its "chunky" solidarity. This is enhanced by an all-up weight of 1·14 kg. Being physically larger at 80 × 45 × 235mm, than equivalent hand-held rigs it was a surprise to find a conventional sized pack of 10 AA-size NiCad cells. The increased depth is required to house the large complement of on-board logic system integrated circuits (on the single-sided p.c.b.).

In operation the receiver section sensitivity proved adequate for the available power output, and in practice would probably complement a 10W outboard power amplifier if used in a mobile installation. Normal hand-held operation consists of holding the front grille close to the mouth and depressing the side-mounted p.t.t. switch bar. After transmissions in excess of several minutes a "two-handed" technique was adopted to preserve the reviewer's right arm muscles for the application of vocal chord lubrication!

Modulation characteristics of the evaluation sample produced low-level muffled response reports from stations worked, indicating the need for an increase in audio-drive level. Repeater working with manual toneburst, such as that fitted to this rig, is a confirmed "two-handed" affair and for operational convenience auto-tone would be much preferred. Display legibility, in anything but dull ambient light, was found to be poor, caused by a combination of the small character size and lack of brilliance. With economising circuits designed in, an adequate drive level for the displays should not deplete the available power reserves that much.

Included in the basic transceiver package is a carrying case and shoulder strap, earphone and instruction booklet giving outline specification, circuit diagram and basic driving procedures. Detailed service information is not included.

The TS-802 is currently being offered by **Arrow Electronics, 7 Coptfold Road, Brentwood, Essex CM14 4BN. Tel: 0277-226470,** at £129 including VAT and carriage, and at this price merits serious consideration by anyone contemplating purchase of a 2m hand-held. Our thanks to Arrow for the loan of the review unit.



PW 'TWYNHAM' DIGITAL/ANALOGUE MULTIMETER PART 2

Michael TOOLEY B A & David WHITFIELD M A M Sc

With the exception of the input connectors and displays all the components are mounted on a single-sided printed circuit board. The copper-track pattern and associated component layouts are shown in Figs. 18 and 19.

It is essential that the described layout is followed closely since any deviation from the published design may give rise to spurious readings caused by hum and noise.

The components should preferably be fitted to the p.c.b. in the following order: links (10 off); terminal pins (6 off); i.c. sockets; fixed and variable resistors; transistors, diodes and regulators; capacitors; rotary switch unit with the transformer being fitted last.

Switches

The switch assembly can take two forms, either printed circuit board mounting (RS Components 327-311; 6 off 327-591 and 1 pk. 327-327) or a conventional rotary type. The former, although considerably more expensive than the normal type, is much more convenient since the p.c.b. has been designed to mate directly with the pins of the switch wafers, each of which incorporates a small "daughter" p.c.b., thereby eliminating all wiring from the switch to the p.c.b.

Details for assembling the printed circuit switch assembly are shown in Fig. 13. Before assembling the wafers it is first essential to ensure that they are set to position 7, identified by viewing each wafer/p.c.b. assembly from the wafer side and setting the rotating contact to the lower isolated static contact as shown in Fig. 14. Prepare the shafting assembly to accept the wafers as follows: Remove the control nut, lock washer and rotation stop limit from the shafting assembly. Turn the control shaft to the extreme anti-clockwise position (position 1) and then rotate the shaft clockwise counting the stops from position 1 to position 7. Carefully slide the wafers and spacers onto the shafting assembly checking the alignment of each as it is inserted. Note that only 3·2mm miniature spacers are suitable since they define the ultimate wafer pin spacing at the p.c.b.

Carefully insert the completed switch assembly into the p.c.b. pressing down gently starting at the front (first wafer) of the switch. Do not force the assembly as this may damage the pins!

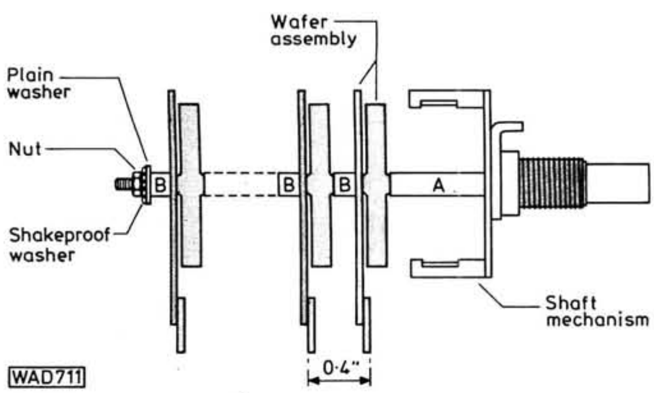
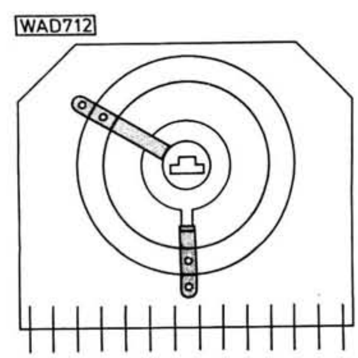


Fig. 13 (left): Details of the printed circuit type of rotary switch Fig. 14 (Right): Ensure that the switch wafers are positioned as shown before assembly



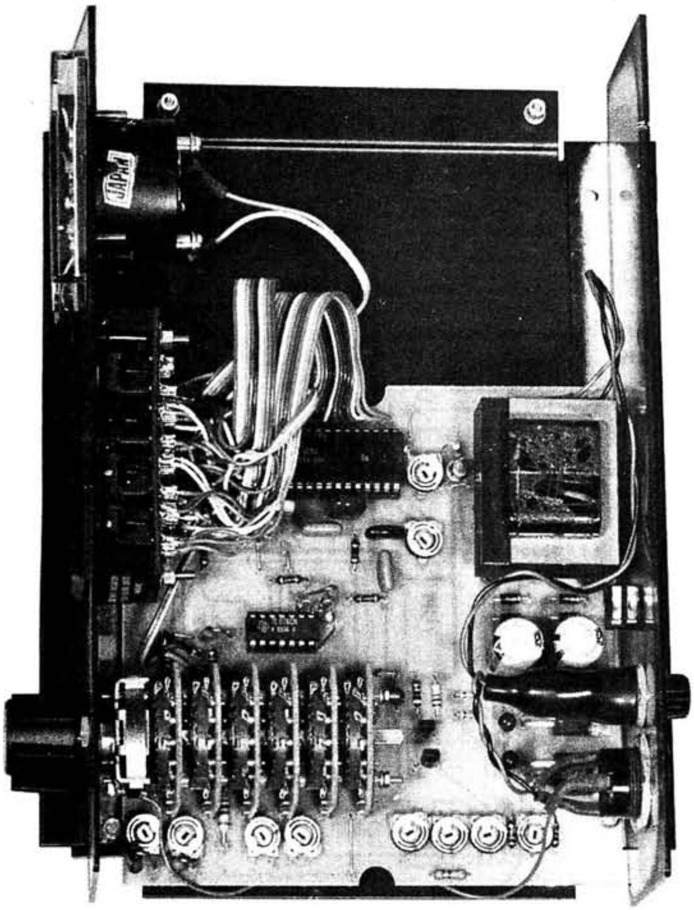
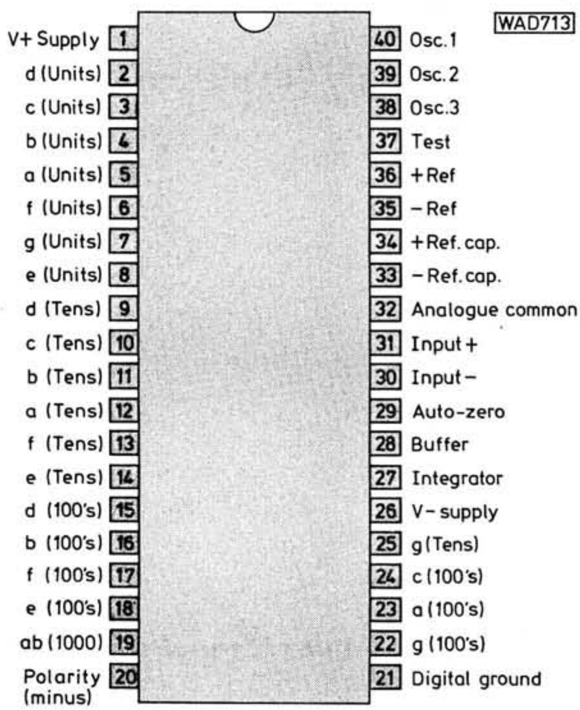
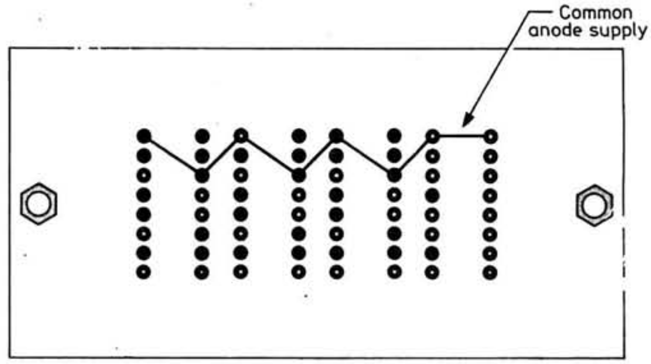


Fig. 15 (below): The pin connections for the 7107 integrated circuit. The photograph above shows the internal layout of the instrument



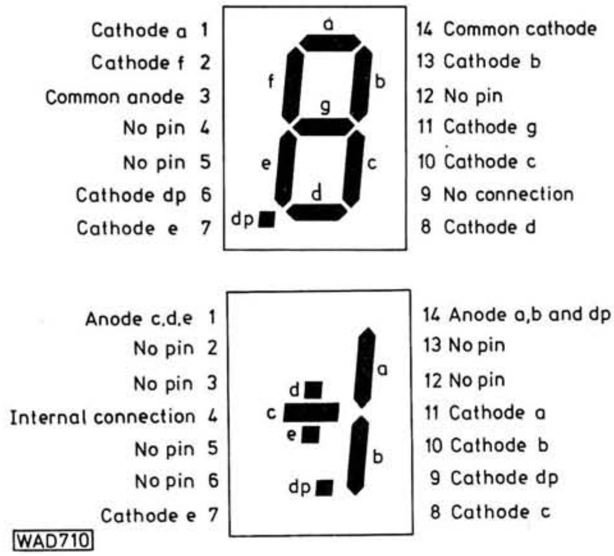


● Not connected
● Connected to main p.c.b. (see figure 19 for pin details)
— Link

WAD714

Fig. 16 (above): The wiring on the back of the display bezel. The bottom row of pins is not used

Fig. 17 (below): Connections to the displays



Wired Rotary Switch

Care should similarly be taken to ensure the correct alignment of wafers when a conventional rotary switch is used. In this case, however, the spacing between wafers is not so critical. The switch wafers will need to be wired to the p.c.b. but note that, since not all the switch positions are used on some wafers, it will only be necessary to make a limited number of connections and some further economy is also possible by linking tags directly on the wafer rather than running all tags to the p.c.b.

In either case, check that the switch does not foul any of the components previously soldered to the p.c.b. and, in particular, it is wise to check that the variable resistors can be rotated throughout their travel. If this is not the case then the offending components can be eased slightly to clear the switch wafers.

Earth Link

When the p.c.b. is complete, carefully check the underside of the board for dry joints and links between tracks, then solder the copper braid link as shown in Fig. 19. This link is essential to eliminate a small (2–3mV) voltage drop

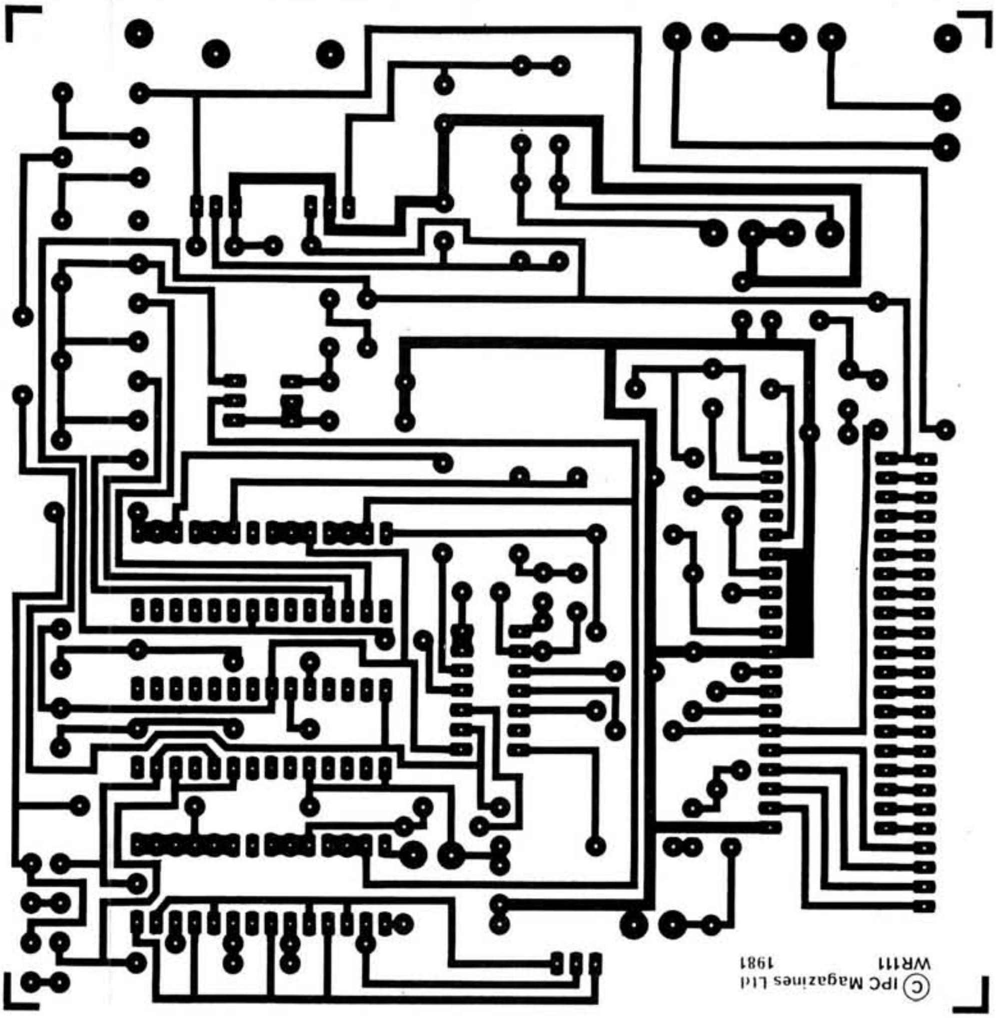
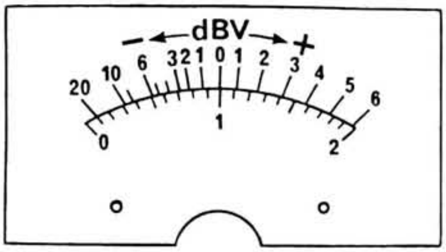


Fig. 18: The copper-track pattern of the p.c.b. shown full size. The component placement diagram, Fig. 17, is shown on the next page



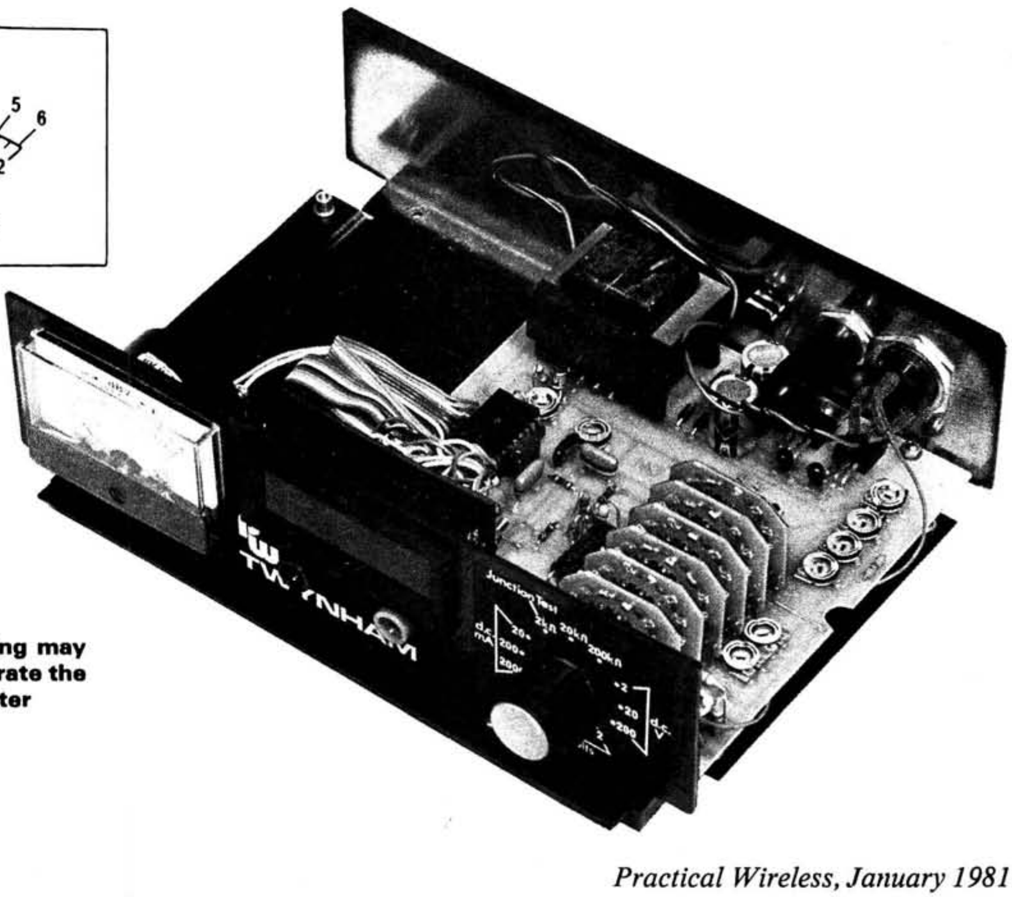
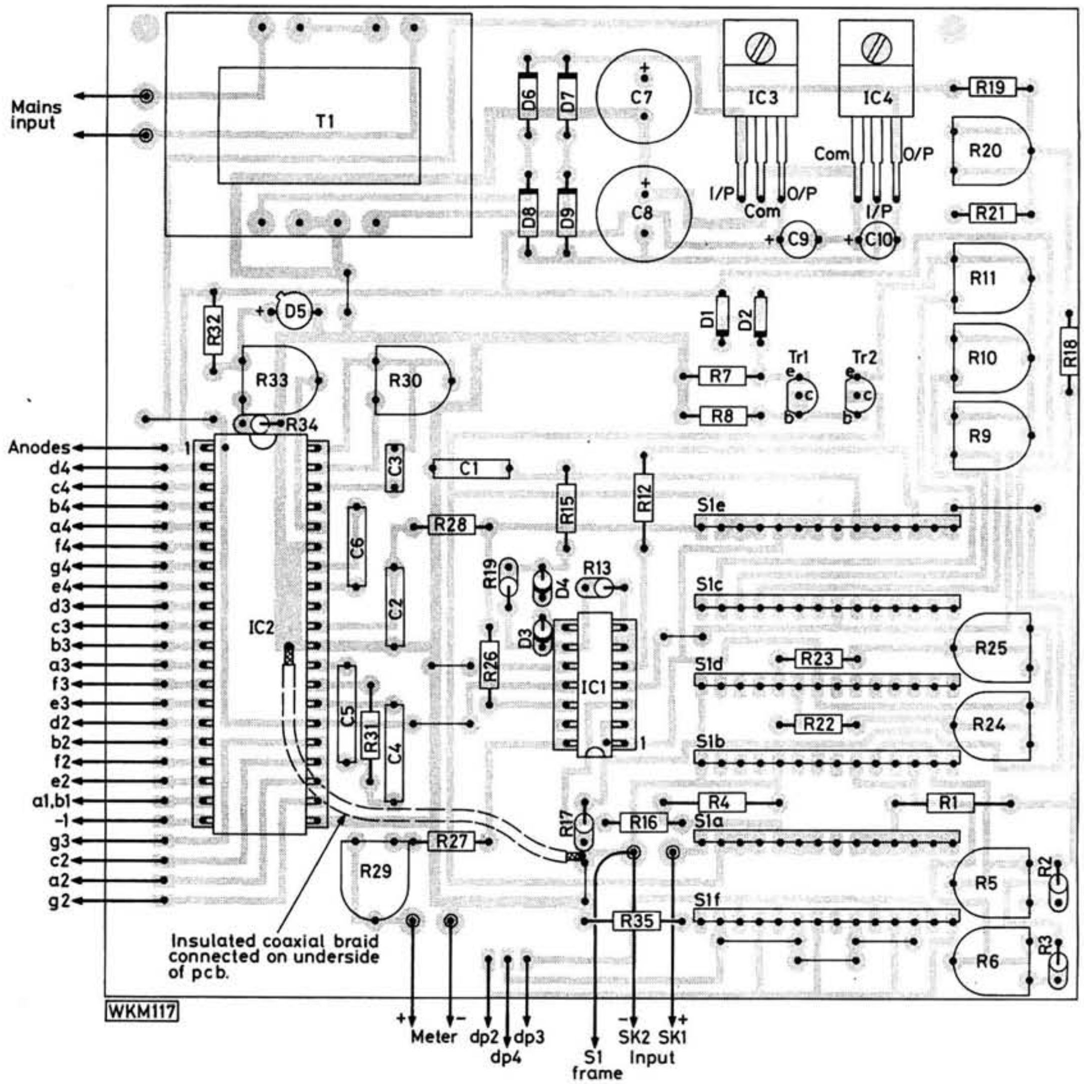


Fig. 20 (above): This drawing may be cut out and used to calibrate the dial of the analogue meter



which appears along the common 0V rail of the p.c.b. between the input terminal and the input pins of the 7107. The link should be as short and direct as possible and should be sleeved in order to prevent short-circuits. A length of coaxial cable would be ideal, with the inner conductor and insulation removed to leave just the braid and outer sleeve.

Finally connect the display to the p.c.b. using two short lengths of 20-way ribbon cable. The pin connections of the common anode l.e.d. displays are shown in Fig. 17, together with the rear of the display module wiring shown in Fig. 16.

Initial Checks

When the wiring is complete the integrated circuits (7107 and LF347) should be inserted in their holders—checking carefully that the pin-orientation is correct! The mains supply should then be connected via the fuse specified in the components list. The l.e.d. display should immediately become illuminated. If a digital frequency meter is available the frequency of the 7107's internal oscillator should be set to 50kHz (R30 set to approximately mid-position). The range switch should then be set to the 2V d.c. position with the input terminals short-circuited by means of a short jumper lead. The display should read "000" (the first digit being suppressed). If the last digit is "1" rather than "0" this usually indicates either the presence of a small common mode voltage or the pick-up of hum and/or noise from the surrounding wiring.

When the short-circuiting link is removed from the input terminals a reading will appear on the display due to static charge accumulating on the input of the 7107. (This is due to the exceptionally high input impedance of the 2V range.) Switch to the 20V and 200V d.c. ranges and the display should read "0.00" and "00.0" respectively. Next check the over-range indication by switching to the three ohms ranges. On each of these ranges the leading digit "1" should be illuminated and the last three digits should be suppressed.

Part 3 will deal with the final calibration and use of the *PW* Twynham.

The following corrections should be made to the text in Part One.

P20: R1 should read R31; C1, C6 and C2, C5.

P21: VR1 should read R5; VR2, R6; VR11, R20; VR3, R9; VR4, R10 and VR5, R11

P23: R10 should read R15; VR9, R30; VR10, R33; R22, R31; R23, R32; R24, R34. R35 was omitted from the components list and is 150Ω $\frac{1}{4}$W. R32 in Fig. 11 is shown as R23 and R30 should be a preset.

PRODUCTION LINES

ALAN MARTIN G8ZPW

4-metre Equipment

Microwave Modules Ltd. have recently introduced a new series of their popular all-mode transverters for the 4-metre band.

Originally only the MMT70/144 was available to down-convert from 144MHz to 70MHz. However, this new series of 70MHz equipment now includes the MMT70/28, which allows 28MHz transceivers to be used on 4-metres.

These new transverters feature the usual high quality construction techniques, with the following features; 10 watts r.f. output from rugged p.a. transistor; linear all-mode operation; low-noise receive converter (2dB noise figure) and r.f. VOX change-over.

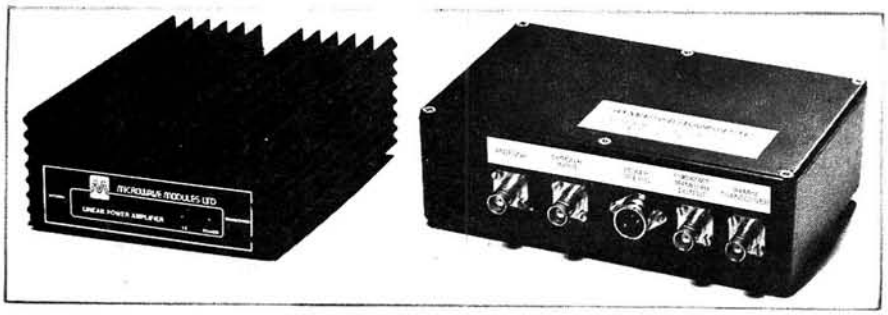
The development of the MMT70/144, which was originally a single conversion device, has resulted in an improved design, built around a double conversion principle, which down-converts the 144MHz signal before the second conversion up to 70MHz. This development has also formed the basis for the MMT70/28.

To complement this transverter range, Microwave Modules have also announced two linear power amplifiers for 70MHz, which will provide 40 watts output (MML70/40) and 100 watts output (MML70/100), both for 10 watts input. (Prospective f.m. operators please note 50 watt power restriction on this band.)

The MMT70/28 and MMT70/144 each cost £115 inc. VAT, plus £1.75 p&p, the MML70/40 costs £69 inc. VAT, plus £1.75 p&p and the MML70/100 costs £142.60 inc. VAT, plus £2.75 p&p.

The transverter range could be of particular interest to Class B licence holders, should the UK Authorities ratify the recommendations made at WARC 1979 in Geneva, which will allow them to enjoy the freedom of working the 4-metre band.

Further details and advice regarding these units may be obtained by contacting: *Microwave Modules Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN. Tel: 051-523 4011.*



Hand-held Box

A pocket size, hand-held box, ideal for housing remote control handsets, instruments, etc., is the latest addition to the Vero range of plastic enclosures.

It incorporates a 20 × 50mm cut-out slot which may be used for fitting a display panel or switches and a 12 × 35mm recessed panel for labelling. A 71 × 107mm p.c.b. can be accommodated in the top section of the two part body by the use of four self-tapping screws, whilst the bottom section will house a 56 × 105mm p.c.b. The two sections snap together and are secured by four screws which enter through the base.

There is an integral battery compartment which will accept a PP3 battery and has a slide-off cover allowing easy access.

This attractively styled enclosure (order No. 652996H) costs £2.90, which includes VAT and p&p, is available from: *Vero Electronics Ltd., Industrial Estate, Chandler's Ford, Eastleigh, Hants SO5 3ZR. Tel: (04215) 66300.*

More on page 64▸▸▸

Light Bender

Edward Fletcher and Partners announce the availability of a new British-made product, the Light Probe.

Comprising a small hand-held torch and 230mm of 3mm diameter flexible fibre optic light guide, the Light Probe can be used for illumination and inspection in inaccessible areas, or where a direct light source will not penetrate. By using fibre optics, the light from the torch can be "bent" around corners as required. The fibre optic light guide can be detached and the torch used conventionally.

Main users might include the handyman, garage mechanic, electrical or electronics enthusiast and model maker. The Light Probe would make an ideal gift or novelty item, and also serve as an introduction to the new technology of fibre optics.

The price of the Light Probe is £1.99, which includes VAT and p&p (two HP7 batteries, not included), and is available only from the manufacturers: *Edward Fletcher & Partners, 25 West Park Road, Kew, Richmond, Surrey TW9 4DB. Tel: 01-876 2204.*

MICROWAVE MODULES LTD

4 FOR 81??

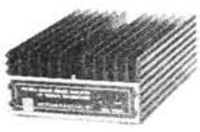
To get the New Year off to a tremendous start, we are pleased to announce a new range of products for 4 metres, which includes both linear transverters and amplifiers.
These Units have been developed as a result of pressure from our customers, indicating a great demand and requirement for such equipment.
Originally we produced the MMT70/144, which allowed 2 metre multimode transceivers to be operated on the 4 metre band.
This popular Unit has now been superceded by an improved, double conversion, unit which down converts the 2 metre signal to 28MHz, before the second conversion up to 4 metres.
The development of this Unit has also formed the basis for the **NEW MMT70/28,** which is a straightforward 10 metre to 4 metre linear transverter (single conversion).

4 METRE LINEAR TRANSVERTERS

Both the MMT70/28 and MMT70/144 have the following features:–
* 10 watts RF output from rugged PA.
* Linear all mode operation.
* Sensitive, low-noise receive converter
* RF Vox changeover.
* 12 month Guarantee – including PA devices.

	MMT70/144	MMT70/28
Frequency coverage	70-70.7MHz	
Input frequency range	144-144.7MHz	28-28.7MHz
Input modes	SSB, FM, AM, CW	
Input drive required	10 watts	5-500mW
Output power	10 watts continuous rating	
Level of spurious output	–60dB	
Conversion principle	Double	Single
Receive converter gain	30dB typical	
Receive converter noise figure	2.0dB maximum	
Power required	12.5 volts + 2.1 amps	
Price	**£115** inc VAT (p&p £1.75)	**£115** inc VAT (p&p £1.75)

4 METRE LINEAR AMPLIFIERS



MMT70/144

This new range of 4 metre linear amplifiers is intended for use with our 4 metre transverters. Also they may be used with any other 4 metre equipment, having an output power of up to 14 watts maximum.

MML70/40

This unit will boost 10 watts input drive to 40 watts minimum output. It also includes a receive preamp which will generally improve reception.
GREAT VALUE AT
£69 inc. VAT (p&p £1.75).

MML70/100

This unit is ideal for both fixed station and mobile/portable use. It provides a 10dB power gain, and requires 12.5 volts + 12 amps maximum.
Features include:
* Linear all-mode operation.
* RF Vox changeover.
* Supplied with all connectors.

£142.60 inc. VAT (p&p £2.75)

MML70/40

BARCLAYCARD AND ACCESS WELCOME

MICROWAVE MODULES
BROOKFIELD DRIVE, AINTREE, LIVERPOOL L97AN, ENGLAND
TELEPHONE: 051 5234011 TELEX: 628608 MICRO G
CALLERS ARE WELCOME, PLEASE TELEPHONE FIRST

HOURS:
MONDAY-FRIDAY
9-12.30, 1-4.30

COMPARE THESE FEATURES

★ MICROPROCESSOR CONTROLLED 32,000 CHANNELS
★ AM & FM ALL BANDS
★ WIDER COVERAGE: 26-58, 58-88, 108-180, 380-514MHz; includes 10m, 4m, 2m, & 70cm Amateur bands.
★ 5kHz & 12½kHz FREQUENCY INCREMENTS
★ 16 MEMORY CHANNELS WITH DIRECT ACCESS
★ SELECTIVE PRIORITY CHANNELS WITH LOCKOUT
★ 2 SPEED SCAN SCAN DELAY CONTROL
★ 2 SPEED SEARCH UP AND DOWN
★ SEARCH BETWEEN PRESET LIMITS UP AND DOWN
★ 3 SQUELCH MODES inc. CARRIER & AUDIO
★ Dx & LOCAL CONTROL
★ RELAY OUTPUT FOR Aux. CONTROL
★ INTERNAL SPEAKER
★ EXTERNAL SPEAKER & TAPE OUTPUTS
★ LARGE GREEN DIGITRON DISPLAY BRIGHT/DIM
★ AM-PM CLOCK DISPLAY
★ 12v DC, 230V AC OPERATION

SX200

THE ULTIMATE SCANNER

"SCAN-X" VHF/UHF BROADBAND FIXED STATION AERIAL £19.90.
Ideal for SX-200 and other VHF/UHF receivers.

£241.50 INC. VAT Delivered

U.K. IMPORTERS & DISTRIBUTORS:
REVCO ELECTRONICS LTD.
POUNDWELL STREET
MODBURY, DEVON, PL21 0RQ
Tel: Modbury (0548) 830665
Dealer enquiries invited

MAIN SERVICE & SALES AGENTS:
GAREX ELECTRONICS
7 NORVIC ROAD
MARSWORTH, TRING
HERTS HP23 4LS
Tel: Cheddington (0296) 668684

introducing RTTY part 5

Jeff MAYNARD G4EJA

The microprocessor has brought quite a revolution to RTTY. The equipment from Hal outlined in the previous part of this series is only possible because of the microprocessor. Also possible is the use of an existing microprocessor-based system for RTTY purposes. So the Pet or Apple, or home-brew system, can be used to decode and display or originate RTTY. The advantages are numerous and include domestic acceptability (how many XYLs appreciate a Creed 7B thumping away in the attic?), availability and versatility. It is the latter that this article will concentrate upon.

Reception

First, the reception of RTTY by home computer. Before a program can start to examine any potential RTTY signals, it is necessary to convert the incoming tones into a suitable (i.e., TTL-compatible) signal. This is easiest to achieve with a p.l.l. as shown in Fig. 36 (Part 2 of this series should be consulted for a full description of p.l.l. demodulators and alignment details for the circuit shown).

With this interface the user can feed TTL-level Baudot code (plus noise, QRM, c.w.), etc., to an auxiliary input port. It is possible of course, to convert the Baudot to parallel form via a UART (universal asynchronous receiver transmitter) and change from a serial- to a parallel-type interface. However, use of a serial interface avoids the need for additional hardware and allows the conversion, when necessary, to be done by software.

In the no-signal condition the RTTY input sits at mark (TTL level high or 1). A new character is always signified by a change from mark-to-space (high to low) for 22 milliseconds. This is of course followed by further mark/space transitions but we can return to these later.

The simplest way to identify RTTY by software is as follows: The program will wait until a mark-to-space transition first occurs; if this space is still present 11ms later it can be taken as a mark. The signal is then examined at 22ms intervals *from this mid-point*—i.e., in the middle of each expected element—and a mark or a space registered. Following the fifth data bit, the signal should revert to mark for at least 33ms ($1\frac{1}{2}$ stop bits). This procedure is shown in the flow diagram of Fig. 37. The output of this routine is a 5-bit representation of each incoming Baudot character. For example, the letter A would be 11000 where 1 is a mark and 0 a space. It is possible to be more selective in the acceptance of incoming RTTY by sampling the character elements more often. For example each element could be examined, say, seven times—every 3 milliseconds—and a decision made as to whether it was a mark or a space by majority. This technique can eliminate

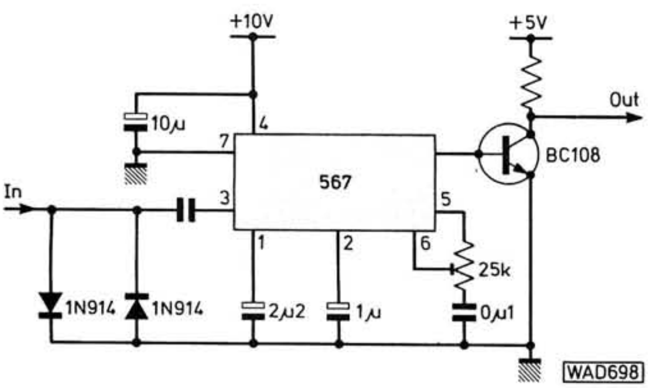


Fig. 36: A TTL interface for the home computer

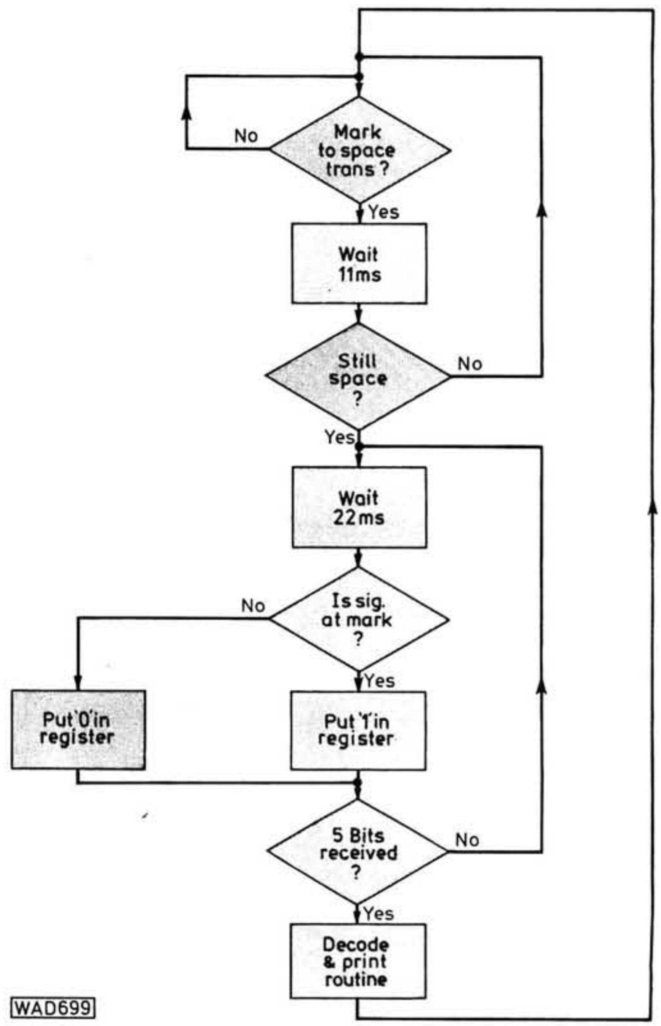
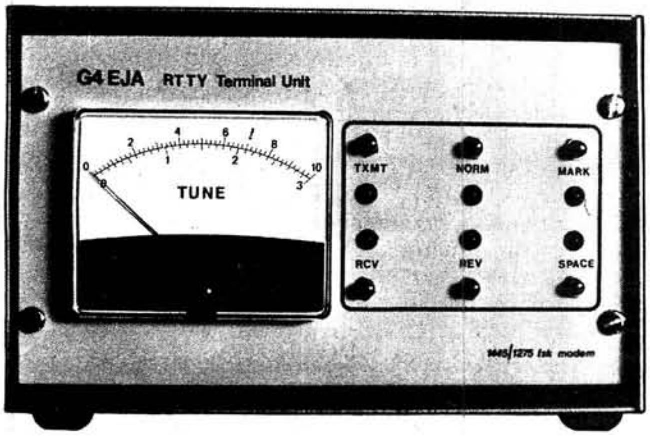


Fig. 37: RTTY to Binary conversion flow diagram



The Terminal Unit of the author's RTTY equipment

some of the problems of short noise bursts that coincide with a sampling point. Some scope for experimentation in respect of sampling frequency is clearly available.

Whichever method is adopted, the next problem is to fill in the box labelled "decode and print routine". The binary pattern (shown overleaf) is a representation of a Baudot character and as such is not directly compatible with an ASCII-based computer. To convert from Baudot to ASCII is quite simple—the Baudot code can be taken as a binary value. For example the letter T is 00001, carriage return is 00010, the letter O is 00011 and so on. Thus if the Baudot code is used as an offset to a table arranged in order of binary value, the appropriate character can be extracted directly. As another example consider the letter L, which having the code 01001 or binary 9 would have the ninth place in the table or list. Baudot codes of course represent two different characters depending on the shift being letter (lower) or figures (upper)—see Part 1. The look-up routine must take account of this by keeping a shift flag and referring to the appropriate table.

There are a number of refinements that can be inserted into a program between the decoding—as outlined above—and the printing or display of the characters. Some of these are discussed below.

Some home computers—such as the Pet—have a screen width less than that normally found on an RTTY machine. It is necessary therefore to insert carriage returns at appropriate places, taking care of course not to split a word.

To overcome the effects of QRM, it is often helpful to force the output to letter shift each time a space character is encountered. The program should include the facility to change shift from the keyboard whilst decoding is taking place.

Logging by program can be done by searching for key words such as "your call sign" DE . . . but more of this later when discussing transmitting by software. The s.w.l. can finish at this point, being unconcerned with the problems of transmitting, and can concentrate on finding the DX. There are a number of awards available for RTTY including those from BARTG, SARTG (Scandinavia), CARTG (Canadian), DARC (German) and *RTTY* magazine. A number of other awards—available to listeners and licensed stations—can be endorsed for RTTY. In this category is the Cheshire Award, administered by the author, for which no RTTY claims have yet been made.

Transmission

To transmit RTTY from a home computer requires first a reversal of the reception procedure. Individual ASCII characters must be converted to Baudot—the simplest method is to use the ASCII absolute value as the offset for a table look-up. The Baudot can be transmitted by switching an auxiliary output off for 22ms for each required space, remembering to leave mark for at least 33ms after the last bit and to precede the bits with a 22ms space. Suitable TTL to AFSK converters to drive the station transmitter have been described earlier in this series.

Note that the Baudot character is extracted bit by bit from the micro word by ANDing with 0000 0001 and then shifting right one bit (assuming that the Baudot representation has the signal bit 1 to the right). Incidentally, readers having difficulty following the programming techniques described might like to read the author's *Computer Programming Made Simple,* published in London by W. H. Allen and recently extensively revised to encompass the latest techniques and technology.

Transcribing from ASCII to Baudot and then to TTL is the simplest of the transmitting options. The greatest scope is in data and message manipulation—the limit being set only by the user's imagination (and perhaps system memory capacity!). Baudot uses figure- and letter-shift characters to assign alternate meanings to codes. Since this is not the case in ASCII, the user's RTTY program will need to insert shift characters as appropriate. A sequence such as shown in Fig. 38 will prove adequate. Many RTTY users find it useful to send a down shift (letter shift) each time a space is encountered.

Letter- or down-shift characters can also be sent during idle periods. For example a program could detect the fact that a key has not been depressed for, say, two seconds and start to send shifts. If text is being sent line by line—i.e., text output only commenced when a carriage return is keyed—the program can automatically send down shifts (this is known as "diddling").

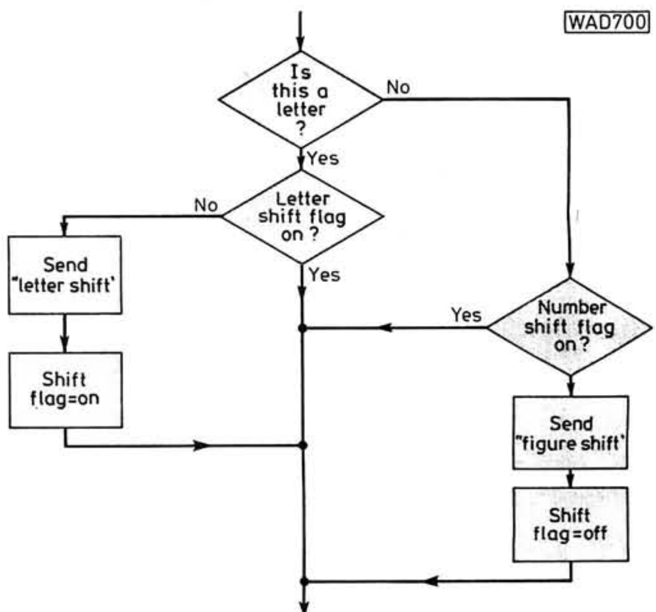


Fig. 38: A flow diagram for shift characters

A single ASCII code will indicate carriage return and line feed (CR/LF) but in Baudot these must be sent separately. It is useful—to the mechanical-based receiving station—if two carriage returns are sent; the inclusion of a down shift is another good idea. Thus, when the user presses "return" on his ASCII keyboard the Baudot sequence:

CR CR LF Let

should be generated.

Generating "standard" messages from a single key is—from the author's own experience—one of the most useful features of a software-controlled RTTY station. A character with no Baudot equivalent—such as $—can be selected to initiate standard messages. Thus the user could introduce ten such messages, for example:

$0 CQ CQ CQ CQ
$1 CQ TEST CQ TEST
$2 CQ DX CQ DX CQ
$3 RYRYRYRYRYRY
$4 THE QUICK BROWN FOX . . .
$5 DE G4EJA G4EJA
$6 IN WIDNES CHESHIRE UK
$7 YOUR REPORT IS RST
$8 PSE QSL VIA BUREAU
$9 DD/MM/YY OO:OO GMT

In the case of $9, the program would of course insert the current date and the time of day. Clearly the user can extend this principle to a comprehensive range of messages including a station description (a popular RTTY topic). Again the limiting factor is imagination and memory capacity. The recording of time and date will be useful for log keeping if a hard copy is available. This is particularly the case in a contest where, to obtain maximum points, the operator must spend a minimum amount of time on clerical work whilst the contest is running. A word of caution though for those without hard copy. If log keeping information is held by software for later entry into the station log, the user must make provision for retrieving the information in case of mains or program (or any other) failure. Regular dumps to disc or cassette should be made just in case.

Reversing the mark/space tones (by inverting the TTL output) and changing the baud rate are two other useful add-ons to an RTTY program. Such is the importance of these parameters that a program-activated alarm (for a second or two) should accompany them.

Buying Software

If the inexperienced programmer finds the work required to achieve the above a little daunting (the more so because assembler language will be required to achieve the necessary processing speed) there is no cause for alarm. Ready-made systems are available for most popular home computers. A supplier of one range of amateur radio software is Nicomtech of Stephens Road, Saltash, Cornwall who has systems for TRS-80, Exidy Sorcerer, Apple and Pet hardware.

RTTY (and Morse) systems (produced by Macrotronics Inc. of California) are available for TRS-80, Exidy Sorcerer and Pet at £96.60, £96.60 and £67 respectively. These prices include a simple (phase-locked loop-based) terminal unit together with the necessary hardware interface for the computer system in question. The manual does point out that, in marginal reception conditions, a better t.u. will be desirable. Output from the terminal unit is polar or +12 volts. Output for transmission is via a transistor (together with sidetone for Morse) which can be used to directly key a c.w. transmitter. For RTTY, however, an AFSK unit will have to be built. Any of the designs described earlier in this series will be suitable.

A package for Apple II users is also available from Nicomtech at £17.82. This provides only the necessary software and the user must construct a terminal unit and the necessary interface circuitry (diagram supplied with the software). From the same source are Apple SSTV programs and satellite prediction and logging for the Pet.

Copying RTTY QSOs on a video is just like reading the c.w. or phone parts of the band as regards format and terminology and so on. Stations will usually be found calling CQ on 20 metres (around 14·090MHz), and a typical RTTY QSO might go like this (author's transmissions underlined):

CQ CQ CQ CQ DE W1ABC
CQ CQ CQ CQ DE W1ABC
CQ CQ CQ CQ DE W1ABC
PSE KKK
W1ABC DE G4EJA G4EJA G4EJA
W1ABC DE G4EJA IN WIDNES
PSE K
G4EJA DE W1ABC
OK OM TNX FOR THE CALL
UR RST HERE IS 579 579 579
NAME IS BOB AND QTH IS NY
SO HOW COPY??
G4EJA DE W1ABC PSE K
W1ABC DE G4EJA
OK BOB, ALL 100% HERE
UR SIG IS FB AT RST 599 599
NAME IS JEFF AND QTH IS WIDNES
RIG IS ATLAS 210 AND 2 ELE TRIBANDER
AT 40 FT. TU IS HOME BREW TO VDU
WITH 8K RAM
W1ABC DE G4EJA KKK
G4EJA DE W1ABC
OK, JEFF ALL COPY GOOD SIG FROM YOUR
ATLAS. RIG HERE IS TR7 FEEDING
3 ELE MONOBANDER AT 60 FT. RTTY IS
DS-3000 FROM HAL.
WX TODAY IS SUNNY AND WARM
THANKS FOR QSO AND QSL IS OK VIA
THE BURO. 73'S FOR NOW JEFF AND
CUAGN. G4EJA DE W1ABC AR SK
W1ABC DE G4EJA OK BOB, WX HERE
NOT SO GOOD. QSL IS OK AND WILL LOOK
FOR YOU IN THE CONTEST NEXT WEEK
73 73 73 DE G4EJA
BI BI

The final line would probably also contain a couple of bell characters. Contest QSOs are similar to those in other modes with the emphasis being on speed of course, although the exchange of information is very important. "Rag-chewing" is also popular on RTTY; the author has been known to chat to a state-side RTTY station for almost two hours, and has a regular sked with a Swedish club station.

RTTY has its adherents, as do the various other facets of amateur radio, and it is for the individual to decide whether RTTY is the mode to follow. The shortage of RTTY in some countries can give a new twist to DX; the author recently worked a station in OX (Greenland) only to be told that he was one of only two RTTY stations currently active in that country! ●

Letters to the Editor intended for publication must be original, and not duplicated to or copied from other publications. We reserve the right to shorten or edit them if necessary.

Letters

CB South Africa

Sir: I read your editorial of the September 1980 issue with more than the usual interest, simply because the situation of CB in your country reminds one of the pre-legalisation period of the same in South Africa a mere sixteen months ago. It started with CB sets being smuggled in from the USA, and "converted" amateur equipment. Within a few months the movement gathered momentum and got so out of hand the government was virtually forced to legalise CB. At that stage there was still the possibility of creating a civilised CB service, because the only way in which the latter can be established, is if the authorities stay one ahead of CBers and the regulations keep pace with technology.

Unfortunately the South African lawmakers did not learn from the American experience, but blundered on the same path bound for chaos—and no excuse, they virtually copied part of the FCC rules. Only nine channels were given, which was the quickest road to frequency congestion and operator frustration. Since most sets were 40-channel, imported from the USA, everyone soon said goodbye to 9-channel CB by pulling out pins and removing hastily-added limiting circuits. With no s.s.b.-only and a.m.-only channels, we just as quickly inherited the American a.m. versus s.s.b. struggle. Unity gain omni-directional antennas were supposed to protect local communication, but eventually simply added to the congestion, which might have been relieved by directional arrays. Foreign DX was forbidden, but apparently the authorities had no knowledge of the sunspot cycle, and even worse, they gave us CB right in the explosion of a monster called Cycle 21.

Anyway, everyone soon got used to the novelty of doing their thing the legal way, and no-one was complaining, least of all the GPO who netted a tidy one million Rands (that's about £550 000) from licence fees within seven months. But then the CBers grew tired of the mess, and after a period of pleading from one side and warnings from the other, the whole thing started falling apart. Forty per cent sold their sets, 30 per cent continued as before, and the rest erected beams and quads, installed linear amplifiers and converted their sets to 11 metre h.f. transceivers.

Right now the whole of the 11 metre band, from 26 to 28MHz, is lost for ever as far as government control is concerned, and the only hope for a truce between circling GPO vans and sneaking pirate stations is the drop of m.u.f. to its lowest readings. So, apparently the formula for establishing CB with some hope for future control, will be to legalise such a service before John Citizen learns that he can key a mike: to give him the whole of the 11m band before he takes it himself: to give separate s.s.b. and a.m. frequencies: to legalise international DX; and to allow virtually any other technical conversion John C can do on his set—e.g., extended clarification on both receive and transmit, which gives more space.

A CB service somewhere in the v.h.f. bands is not going to eliminate illegal operation, and simply because of two factors; cost and lack of DX. A 27MHz system on the other hand gives much greater ground-wave range in relation to money invested. Even if a v.h.f./u.h.f. service is legalised in the UK, the pirate on 27MHz will not simply disappear. Once the "good buddy" operator moves up to the legal band, either because the GPO is getting too hot or because he can afford the more costly equipment, the only one to remain will be the DX operator on s.s.b. He is the backbone of the pirate movement, and being the more careful and clever operator, appears only when "skip is running". I have yet to meet the GPO official who tracks down his man when S9 signals are bombing in from all over the globe.

From what I hear and read, it seems your government is well on their way to contributing heavily to the growth of the international 11m movement. All I can say, is, keep on trying GPO hunters, patience radio amateurs, patience TV owners, patience all of you relying on comunications in civil services, and happy DX UK pirates.

I have worked the world on 25 watts with a sloppy quarter-wave groundplane from Channel 1 to 99, and it was fun while it lasted. Fortunately I heard about amateur radio somewhere along the road, and being a sucker for DX and tinkering with resistors and such, found that there is a safer way in which to enjoy radio electronics. The final crunch came some months ago when the final amplifier stage went up in smoke. I am now converting it to a 10 metre set for the day when I may legally enter the world of amateur radio. But then no regrets about the "old days"—it taught me more than just the wonders of transmitters and receivers, and it's the poor man's amateur radio after all.

The former Tango 7 and others,
Lutzville,
South Africa.
(Name and address supplied)

CB Northern Ireland

Sir: I am writing in reply to your item *Making Haste Slowly* in *PW*, September 1980. I myself run two of these illegal transceiver units known as Citizens' Band Radios, along with at least 13000 other registered "good buddies" in Northern Ireland, and God knows how many others who are not registered.

I have to say that these illegal sets are the best thing ever to happen to Northern Ireland. As everyone is aware, the community in Belfast is divided by both political and religious differences, and there are certain parts of the city where it is unwise to go unless you live there. The CB radio has however broken down these barriers, and the whole community can "modulate" with each other without even caring what religious or political views each other hold. I myself have made several "good buddies" in West Belfast, who I would otherwise never have met as I live in the South Belfast area. The growth of CB radio has done more for the community in one year than all the politicians have been able to do in eleven years!

"Big Muff"
(Name and address supplied)

MODS

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Roger Hall G8TNT(Sam)

No. 3

Judging from the response I have received, modifying equipment is a popular pastime amongst amateurs, and I would like to thank all of you who have already contacted me with material. As this column depends on feedback from readers, please continue to write in if you have any tips to pass on.

In reply to queries regarding the simplicity of the mod for increasing the frequency range of the Trio TR–2400 that appeared in the November issue, it really is as easy as it seems. Just by cutting and resoldering one wire the TR-2400 can be made to cover 143·900–148·495MHz.

For other readers who have said that their TR-2400 is still under guarantee, and who are understandably reluctant to delve inside with a soldering iron, here is a way to "trick" the microprocessor into covering the extended frequency range without modifying the set in any way.

The first step is to hold down the REV REPT button and then key in 5500. Now release the button and the display will change to 6100 (145·500 + 600 = 146·100).

The transceiver can now be tuned between 146 and 148·495MHz by using the UP/DOWN buttons on the front of the set. When the display runs past 148·495MHz it will jump to 143·900. When this happens, only the UP button is effective, because pressing the DOWN button makes the display revert to 145MHz. Any frequency in the 146–148MHz range can be held in a memory for future use, and if one is, it is not necessary to repeat the procedure with the REV REPT button. To get back into the 146–148MHz range just recall this frequency from the memory and then move up or down with the appropriate button.

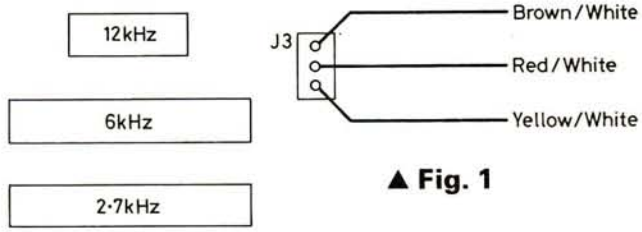
This "trick" only seems to work with early models and they can be recognised easily because their REV REPT buttons will not lock in the down position, whereas they will in the later models.

The major disadvantage with using this technique is that frequencies cannot be entered directly through the keypad.

I would like to thank Lowe Electronics for that idea, and for the following mod for the Trio R-1000.

Some keen DX a.m. listeners have said that they would like the selectivity to be narrower than the standard 12kHz (WIDE) and 6kHz (NARROW). This very simple mod will change it to 6kHz (WIDE) and 2·7kHz (NARROW) whilst leaving the 12kHz filter fitted in the set so that the mod can be reversed whenever required.

First remove the top cover and find J3, which is alongside the i.f. filters (Fig. 1). Then cut the brown/white and red/white wires and re-connect them as in Fig. 2. That's all, the mod is now done. Should 6kHz prove to be too narrow, connecting the wires as in Fig. 3 will give 12kHz (WIDE) and 2·7kHz (NARROW). With both versions of this mod the bandwidth on s.s.b. is 2·7kHz.



▲ **Fig. 1**

Fig. 2 ▶

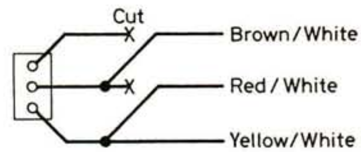
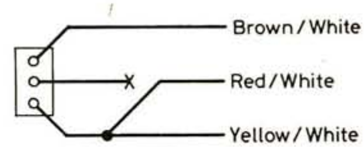


Fig. 3 ▶



WAM 022

Mr Colin Coker G4FCN, has written in with a little-known piece of information about Yaesu Musen and Sommerkamp equipment. Many of the receivers manufactured by these companies have 600Ω tappings on their output transformers, as well as the more usual 8Ω connections. This should be of interest to the many who are interested in RTTY, SSTV, etc.

It should be a very simply job either to fit an additional socket to the rear of the set and to wire it up to the 600Ω tapping, or to remove the wires from the existing extension speaker socket, solder them together and insulate them, and then to connect this socket to the 600Ω tapping. If the latter method is used, it does, of course, mean that an 8Ω extension speaker can no longer be plugged in.

Thanks for the very useful tip Colin.

Wanted

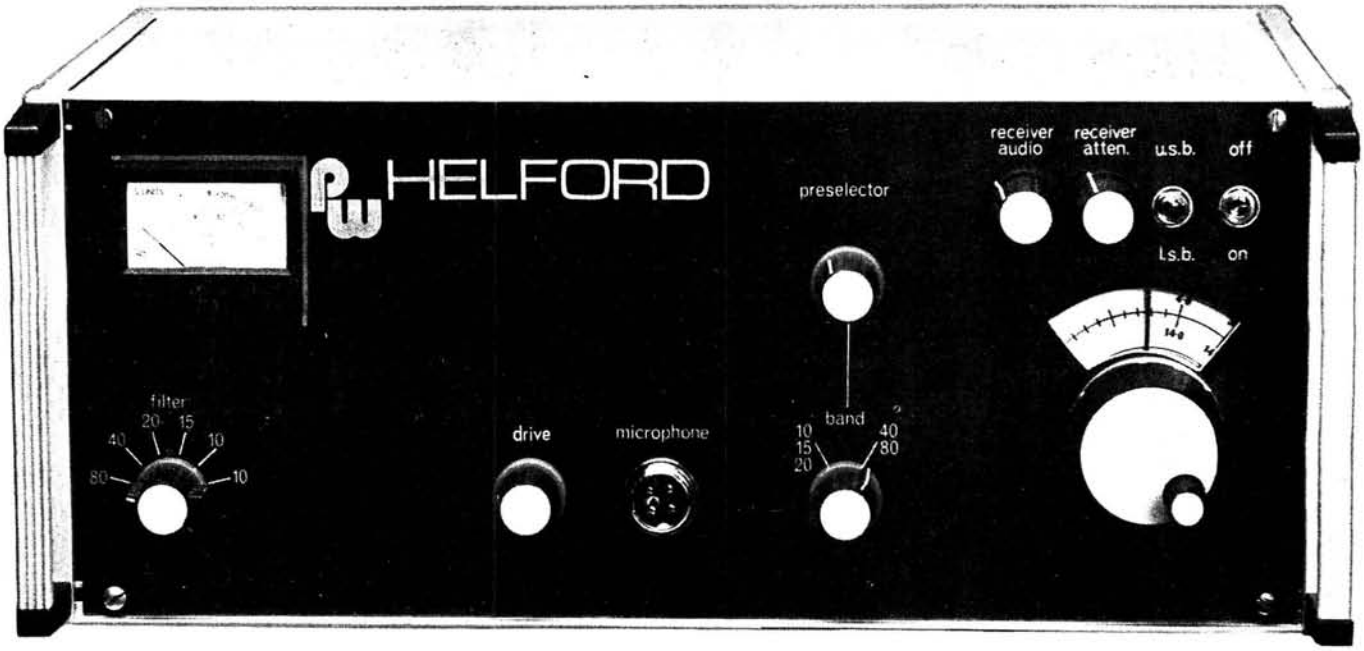
There must be many amateurs who want to modify their rigs, but don't know how. With this in mind, I would like to use this corner to publish requests from readers for mods that they would like to do, in the hope that someone, somewhere, will be able to enlighten them.

One request that I have received "on the air" from several people is for a mod to extend the frequency range of the Trio TR–9000. Can anyone help? If you can, or if you know any other mods, or if you would like to find out about a specific mod, please write to: R. S. Hall, Practical Wireless, King's Reach Tower (Hatfield House), Stamford Street, London SE1 9LS.

73's
Sam G8TNT

PW HELFORD

Part 3



HF SSB TRANSCEIVER

Vic Goom G4AMW

The Preselector circuits are simple filters which are tuneable over the bands selected. Two separate filters are used, the required one being selected by the rotary switch S101.

To match into the G4CLF board a 50Ω port is needed. This is provided by the tap on L103 and L101. The basic impedance of each filter is 1kΩ and this matches into the Transmitter Pre-amplifier. When in the Receive mode the Preselector is connected to the aerial via RLB/1 and S101b and needs an input impedance of 50Ω. Again this is provided by the tap on L102 and L104, these acting as auto-transformers to give the desired impedance transformation.

The four coils, L101–104 are wound on Neosid A6 coil formers which should have 900 grade iron powder screw cores and aluminium screening cans (Table 1).

The preselector circuits are built up on a simple p.c.b. and it is recommended that the alignment is checked before the screening cans are permanently fitted to the board.

The four-gang variable capacitor (Jackson Type 5318/4/102) is fitted with a reduction drive having a 10:1 reduction ratio (Jackson Type 5870/3). The four leads connecting the preselector to the four-gang capacitor (C103,104,105,106) should be as short and direct as possible and pass through the four holes provided in the p.c.b. for this purpose.

Table 1

Band	Turns	Wire	50ΩPort	Former	Core
20m	20	26 s.w.g.	4T	Neosid A6	900
80m	60	30 s.w.g.	8T	Neosid A6	900

Small coaxial cable (RG174A/U or Uniradio 95) should be used for the connections to the 50Ω ports while the plain wire connection to the tops of L102 and L104 should be tucked around the side of the box as low down as possible.

★ components

PRESELECTOR BOARD

Capacitors

Ceramic

1pF	1	C102
33pF	1	C101

Variable, air spaced, 4 gangs

10 to 102pF	1	C103,104,105, 106 (see text)

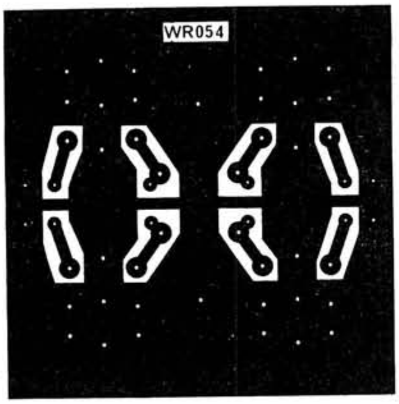
Inductors

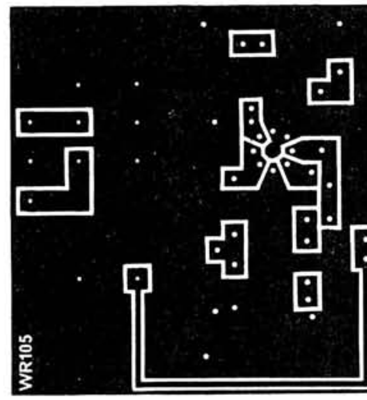
Wound on Neosid A6 formers (see Table 1)

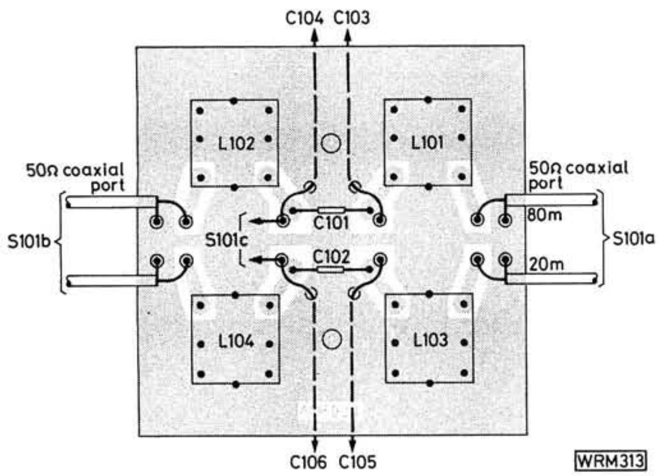
20T tap at 4T	2	L103,104
60T tap at 8T	2	L101,102

Miscellaneous

Printed circuit board; 3p2w rotary switch; Neosid A6 coil formers and cans (4); Reduction drive (see text).







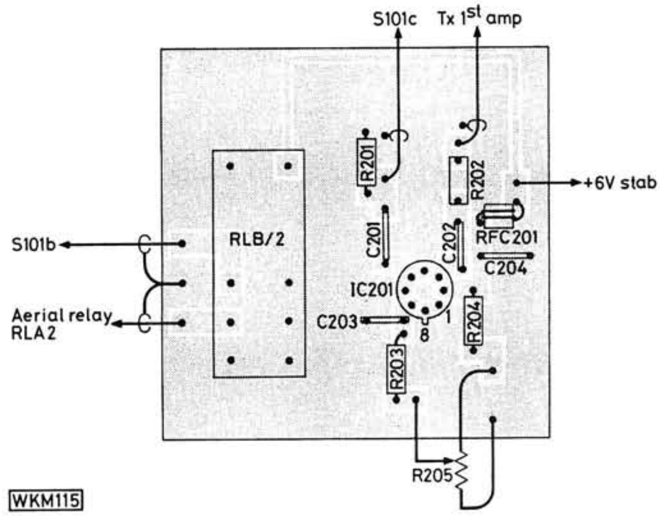
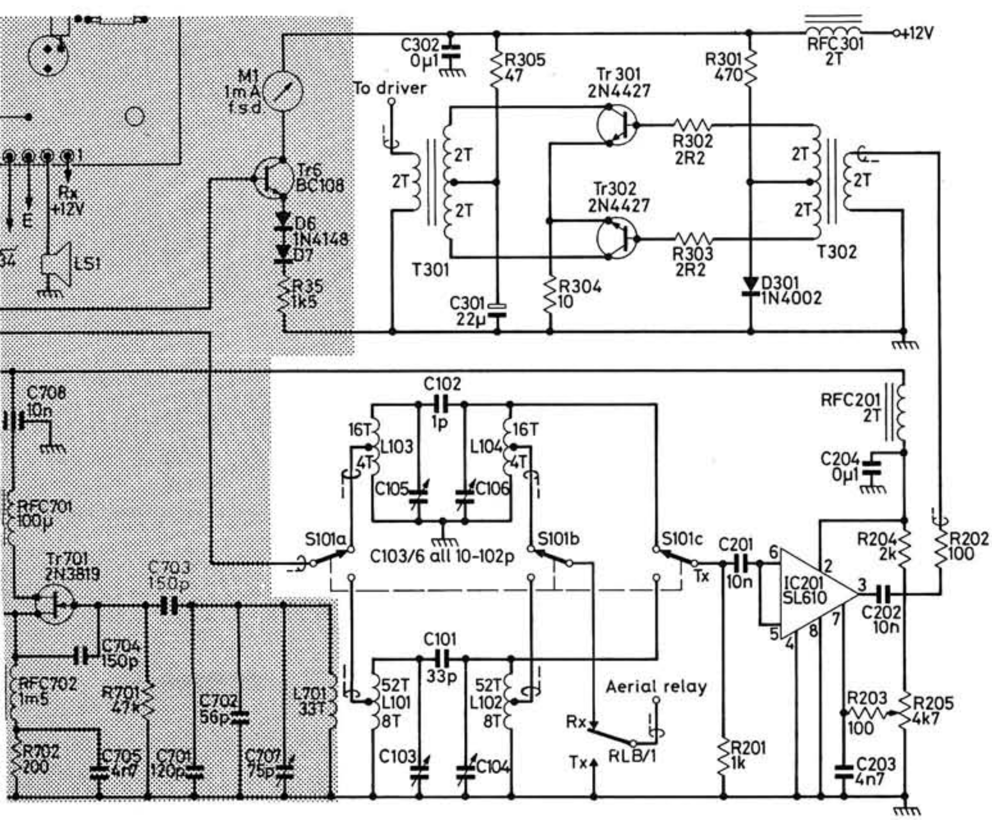


Fig. 7 (top): The copper-track pattern for the Preselector p.c.b. shown full size. Fig. 8 (above): The component placement drawing for the Preselector board

Fig. 9 (top): The copper-track pattern for the Tx Preamplifier p.c.b. shown full size. Fig. 10 (above): The component placement drawing for the Tx Preamplifier board



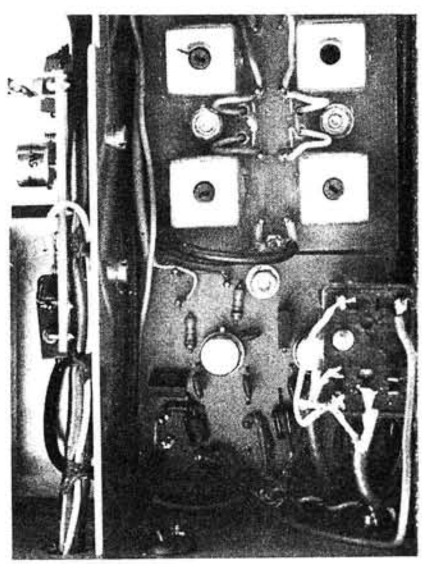


Fig. 11: The circuit diagram of the three boards described in this part. The photograph above shows the Preselector board with the Tx Preamplifier below it

Tx Pre-amplifier

The Transmitter Pre-amplifier is at the front-end of a very high gain, wide bandwidth chain. To cope with this the Plessey SL610 i.c. was used rather than the cheaper 1600 series version.

The input impedance of the pre-amplifier is around 1kΩ and this matches the preselector output impedance.

Adjustment of the transmitter output power is made by varying R205. The output can be varied from zero to full power by this simple means and R205 is mounted on the front panel so as to allow the operator maximum flexibility and economy of battery power.

Constructional Details

The Tx Pre-amplifier is constructed on a simple p.c.b. which will be mounted on 6mm spacers. All component leads should be as short as possible with the body of each part close to the surface of the p.c.b.

Small coaxial cable is used to connect the output of the pre-amplifier to the input of the Tx First Amplifier.

The Tx Pre-amplifier board also carries the additional relay (RLB/2) which is used to disconnect the preselector aerial input and short-out the coaxial aerial lead from the aerial relay RLA/2.

RFC201, and RFC301 in the Tx First Amplifier supply line, are simply 2T of 22 s.w.g. enamelled copper wire wound through an FX1115 ferrite bead.

★ components

PRE-AMPLIFIER BOARD

Resistors		
¼W 5% High Stability Carbon film		
100Ω	2	R202,203
1kΩ	1	R201
2kΩ	1	R204
Potentiometers		
4·7kΩ	1	R205
Capacitors		
Ceramic		
4·7nF	1	C203
10nF	2	C201,202
0·1µF	1	C204
Inductors		
2T on FX1115 ferrite bead	1	RFC201
Semiconductors		
Integrated Circuits		
SL610	1	IC201

Miscellaneous
Printed circuit board; Relay 6V, 2p changeover (RS349-642); FX1115 Ferrite bead;

TRANSMITTER FIRST AMPLIFIER BOARD

Resistors		
¼W 2% Metal Oxide		
2·2Ω	2	R302,303
10Ω	1	R304
47Ω	1	R305
470Ω	1	R301
Capacitors		
Ceramic disc		
0·1µF	1	C302
Tantalum bead		
22µF 16V	1	C301
Inductors		
2T on FX1115	1	RFC301
2T: 2 +2T on Ferrite core	2	T301,302 (see text)
Semiconductors		
Diodes		
IN4002	1	D301
Transistors		
2N4427	2	Tr301,302

Miscellaneous
Printed circuit board; FX1115 Ferrite bead; 2-hole Ferrite core (2); Terminal pins (10).

Readers who intend to operate the Helford should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

Tx First Amplifier

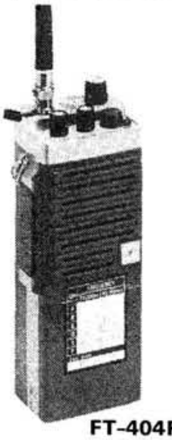
This stage uses a pair of 2N4427 transistors in a push-pull configuration to provide the required level of drive to the r.f. driver stages.

The output from this stage can be increased by reducing R304 from the design value of 10Ω. This will enable you to run the driver stage to 25W output which in a lot of cases will probably satisfy the operator.

continued on page 63 ▶▶▶

AMATEUR RADIO EXCHANGE

Brenda (G8 SXY) and Bernie (G4 AOG) invite you to the only shop in London where you can see and try all the leading makes of Amateur Radio Equipment under one roof . . . YAESU, ICOM, TRIO, STANDARD . . . compare them all . . . and have a cup of Brenda's coffee too!



GET AWAY FROM IT ALL!

Why not get away from it all, to the clean, fresh pastures of 70cm where there's more room to talk to the contacts you really want. 1981 sees the announcement of two great new 70cm rigs from YAESU, the FT-404R handheld (left) and the FT-780R mobile (below). Both have all the features you could wish PLUS that YAESU built-in extra . . . reliability.

FT-404R The handy format of the **FT-202R** with similar 6-channel capability and 1 watt output.

FT-780R The first-ever all-mode 70cm mobile transceiver with full coverage between 430 and 440 MHz on FM/CW/USB/LSB. Special features include 2 VFOs, 4 memories, digital clarifier (RIT), band and memory scan controlled from mic, priority channel, and crystal controlled access tone.

HERE!! NOW!! YAESU'S LATEST RECEIVER – THE SUPERB FRG-7700. The one with all the features including FM right across the band and 12-memory option.

★ General coverage 150KHz-30MHz ★ Digital and analogue read-out ★ Fine tune ★ Attenuator ★ Noise blanker ★ Fast or slow AGC ★ Digital clock and automatic ON/OFF timer ★ Three AM filters, 12KHz, 6KHz and 2.7KHz ★ 12v or mains ★ Receives in LSB, USB, AM and FM ★ Optional 12-memory facility enabling you to store your favourite frequencies for recall at the touch of a button **. . . and our FRG-7700's come complete with exclusive HELSICAN aerial worth £15 . . . FREE!**

★ PHONE FOR LATEST PRICE DETAILS ON ALL YAESU EQUIPMENT ★

Compare our two fantastic new scanning receivers

Bearcat 220FB from the USA

★ Covers three amateur bands plus aircraft, marine and public service bands on these frequencies: 66-88MHz, 118-136MHz, 144-148MHz, 148-174MHz and 420-512MHz.

★ Scans between any two pre-set channels, and also offers a priority-channel signal-finder and a lock-out facility.

★ Operates on mains or 12V, so use at home, in the car or on the boat.

£258.95 inc. VAT

SX-200 from Japan

£240 inc. VAT

★ Scans VHF and UHF bands in both AM and FM modes throughout its frequency ranges, 26 to 88MHz, 108 to 180MHz and 380 to 514MHz ★ 16 memories ★ Memory bank programmable to scan frequencies in any band ★ Display automatically reverts to time/day/date ★ 2-speed scan ★ 3 watts audio out ★ Sensitivity 0.5 v 20db S/N ★ Supplied with AC mains adaptor for 12V operation.

CLOSED WEDNESDAY, BUT USE OUR 24-HOUR ANSAPHONE SERVICE, OR RING MARTIN (G4HKS) ON 01-575 5291 FOR EVENING SALES ENQUIRIES.

LICENSED CREDIT BROKERS – Ask for written quotation.
INSTANT HP FOR LICENSED AMATEURS AND 6-MONTH NO-INTEREST

HP TERMS AVAILABLE.

CREDIT SALES BY TELEPHONE

BARCLAYCARD VISA

2 NORTHFIELD ROAD, EALING, LONDON W13 9SY. Tel: 01-579 5311

So easy for Overseas Visitors – Northfields Station is just seven stops from Heathrow on the Piccadilly Line.

TRIO Photo Acoustics Ltd

APPROVED TRIO DEALER

MICRO COMMUNICATIONS DIVISION

AUTHORISED ICOM DEALER

RADIO COMMUNICATIONS—AUDIO—VIDEO
AND COMPUTER SALES AND SERVICE

TRIO

TS520SE	160-10m 200w transceiver	£437.00
TS-180S	160-10m 200w transceiver	£679.65
TS120S	80-10m mobile 200W transceiver	£432.40
TS120V	80-10m mobile 20W transceiver	£347.30
TS830S	160-10m transceiver (includes new bands, various I.F. options, digital display, 2 × 6146 PA plus many other features)	£639.52
TS770E	2M/70cm multimode base station	£763.60
TR9000	2m multimode mobile/base station	£345.00
TR7800	2m 25W mobile/base station	£288.00
TR2300	2m handheld (80 channels)	£166.75
TR2400	2m synthesised handheld	£198.00

Full range of Trio accessories and oscilloscopes available.

RECEIVERS

R1000	0.2-30MHz	£285.00
R820	Simply the best amateur receiver	£690.00
SRX30	SSB/AM/CW 0.5-30MHz	£158.00
SR9	144-146 or 156-162MHz tunable or xtal	£46.00
AMR217B	Marine or amateur scanner with 8 xtals	£120.75
FS10	10 channel pocket scanner	£82.00
FRG7		£188.00
	Aircraft Receivers from	£12.50
AP12	With batteries and charger	£89.70
AP12	With 12 xtals	£118.45
R512	Air band scanner-fitted 5 channels	£138.00
R517	Air band portable-tunable and xtal	£49.45
	Extra xtals for the above, each	£2.80
SX200	Scanner 26-514MHz and AM/FM	£235.00

ICOM

IC2E	2m handheld	£159.00
IC240	2m 10W mobile	£169.00
IC255E	2m 25W scanning mobile	£255.00
ICE260E	2m multimode mobile	£339.00
IC251E	2m multimode base station	£479.00
IC215E	With S20, 22, RO-9, inc.	£149.00
IC402	70cm ssb portable	£242.00
IC202S	2m ssb portable	£169.00
IC720	HF 0.1-30MHz 100W transceiver all bands ssb, cw, rtty, AM	£680.00

All Icom accessories available – 12 months guarantee, including PA transistors.

AERIALS

Full range of J Beams – Revco – Ascot – Hokushin – G-Whip – G2DYM – Trio etc.

ROTATORS

AR40	For Mini Beams	£59.80
DR7500X	For 3 element HF beams. Preset controller	£98.04
DR7500R	For 3 element HF beams. Round controller	£107.98
DR7600X	Takes up to 2 element 40m beam. Preset controller	£135.00
DR7600R	Takes up to 2 element 40m beam. Round controller	£144.90
KR400	Kenpro rotator	£105.00
	5 core–6 core cable–UR43–UR67 twin feeder	P.O.A.

ACCESSORIES

CN1001A	Automatic ATU and SWR	£129.95
CN620	Cross pointer SWR, 1.8-150MHz	£52.81
CN630	Cross pointer 140-450Mhz	£71.00
CN650	Cross pointer 1.2-2.5GHz	£95.00
T3170L	3.5-150MHz	£12.94
FS7	SWR/power meter	£33.00
RW151D	Watt meter 0.150W, 0-500MHz	£69.00

Full range of MICROWAVE MODULES and S.E.M. products available.

Power supplies – microphones, plugs, sockets, dummy loads, lightening arresters etc, all available.

PET

NEW CBM 8032 – 80 column + 24k Rom	£1029.25
NEW CBM 8050 storage dual drive	£1029.25
CBM 2001-8 – 8k including cassette	£435.88
CBM 3008 – 8k Qwerty keyboard	£457.70
CBM 3016 – 16k Green screen	£569.25
CBM 3032 – 32k Green screen	£718.75
CBM 3022 – 80 column dot matrix printer	£440.45
CBM 3040 – Dual drive mini floppy	£718.75
C2N – Cassette deck	£56.93
KIM 1 – The ideal teaching aid	£106.95
KIM 3B – ram board	£110.40
KIM 4 S Mother board	£74.75

All PET leads and accessories available including manuals.

NASCOM

System 80 – no RAM – FREE ROM	£258.75
Graphics board with 3k RAM	£103.50
Keyboard cases NAS 1/2	£4.03
16k RAM board 'B' will take 48k	£161.00
Power supplies NAS-PEN Zeap 2	P.O.A.
IMP printer	£373.75

ATARI TV GAMES AND CARTRIDGES

VIDEO GENIE

EG3003 Tandy level 2 compatible, with 16k RAM integral cassette boxed and ready to go only £333.00

DOLPHIN

BD80P PET/IEEC Parallel or RS232C high quality matrix printer	£458.85
Ricoh RP1500 Daisy wheel inc. interface	£1828.00
BASE 2 Super print 800 friction or tractor feed inc 3 standard interfaces	£373.75

CONSUMABLES – SOFTWARE

Mini Disks – Box of 10	£22.94
C15 Cassettes – high quality – Box of 10	£4.60
80 Column tractor feed paper – per 100 sheets	£9.66
Labels – per 1000	£8.05
Printer Ribbons	£2.53

Petsoft – Commodore – BSF – Monitor. Everything from Space Invaders to a complete Business System. Large range of books in stock.

PLEASE PHONE FOR QUOTATION ON ANY ITEMS NOT LISTED

ALL PRICES INCLUDE VAT

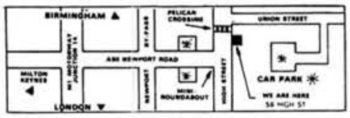
WE ALSO SUPPLY FROM OUR AV DIVISION – VIDEO RECORDERS – TAPE RECORDERS – COPIERS – MIXERS – TELETEXT RECEIVERS – AUDIO – AMPLIFIERS ETC. BY REVOX, UHER, AKAI, SONY, NEAL, MARANTZ, TANDBERG, SHARP, ASSMANN, NATIONAL PANASONIC, ETC.

Have a day out, take the XYL and Harmonics to the superb new shopping centre at Milton Keynes and come and visit our new Showrooms 5 minutes away in the High Street of Newport Pagnell, and have a cup of Steve's tea! Contact Derek, G3TGE, Steve G8PWS or Judy.

MAIL ORDER
SECURICOR DELIVERY

Ask for details of our Credit Card Scheme – £750 instant credit could be available to you now! APR 34.5

MONDAY-SATURDAY 9.30am-5.30pm



We may be a new name in Amateur Communications but we have 12 years of service to the Broadcasting and Recording Industry – Educational and Governmental Depts.

HIRE PURCHASE
PART EXCHANGE
APR 39.60

or let us sell your rig for you – no commission charged if you purchase new rig from us.

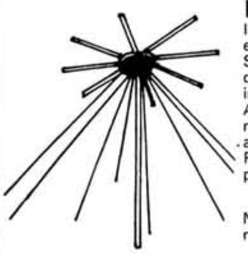
MONDAY-SATURDAY 9.30am-5.30pm

58 HIGH STREET, NEWPORT PAGNELL, BUCKS. ● TEL. 0908 610625

NORTHERN COMMUNICATIONS

AMATEUR • COMMERCIAL • MARINE

Merry Christmas from Richard G3UGF



NORCONE 512 (66-512 MHz)

It's here! A no compromise, precision made, full 16 element discone antenna, made in Britain. Standard S0239 connector, with cover. Supplied with 1" diameter, 30" mounting support mast and complete instructions.

An ideal partner for the "Bearcat" and other scanning receivers. It may also be used for transmission and in particular where antenna space is limited. Full coverage of 70.144,432MHz Amateur bands plus Aircraft, Marine and Commercial bands.

£24.95 p.p. £1.50

NCMK-1. In line vertical mounting kit for 1" to 2" mast.

£2.45 p.p. £0.50

ZL-12 COMPACT YAGI

13db gain, compact 2 metre Yagi. 10'6" boom, lightweight rugged design. Hundreds of this award winning antenna already in use. Send for details.

£28.75 p.p. £1.50

ZL-8 SUPER COMPACT YAGI

9db gain, super compact 2 metre Yagi. 6'0" boom, lightweight rugged design. Ideal for limited spaces and portable operation.

£17.25 p.p. £1.50

YAESU FT480R. FDK 750E MULTIMODES

Both of these new 2 metre multimodes transceivers are amongst our full range of Amateur Radio equipment and accessories. Ring or call for complete information:

NEW – FRG7700

As reviewed in this issue – come in and try it for yourself. **£309.00**

299–303, Claremount Road, Halifax HX3 6AW,
West Yorkshire. G3UGF.

Tues-Sat. 9.45am–5.30pm.
Telephone (0422) 40792.

Buy it with Access

BARCLAYCARD VISA

FREQUENCY DISPLAY UNITS

INTERNAL OR EXTERNAL

FOR

£44.77 SSRI

FRG7
£44.77

£44.77 SRX30

10% OFF UNTIL 31st DECEMBER
£40.29

(All prices inclusive of postage and V.A.T.)

ACCESS

B. BROOKES ELECTRONICS, 69 Leicester Street,
NORWICH NR2 2DZ, ENGLAND.
Tel: 0603-24573.

CHEQUE

STEPHENS-JAMES LIMITED

COMMUNICATION ENGINEERS

47 WARRINGTON ROAD, LEIGH WN7 3EA
ENGLAND
Telephone (0942) 676790

Everything for the Short Wave Listener.

We stock receivers and listening aids by most of the world's leading manufacturers. Full range of VHF receivers—transceivers. Mobile equipment pre-selectors—filters—antennas. Stabilised power supplies from 2 to 20 Amp. Antenna switches—converters. Aluminium masts—clamps. Antenna rotators.

Trio R1000 Receiver
Digital readout general coverage receiver covering 200KHz to 30MHz with a P.L.L. synthesiser. Also incorporating quartz digital clock. £285.20.

Trio R820
Amateur Band Receiver £690.00.

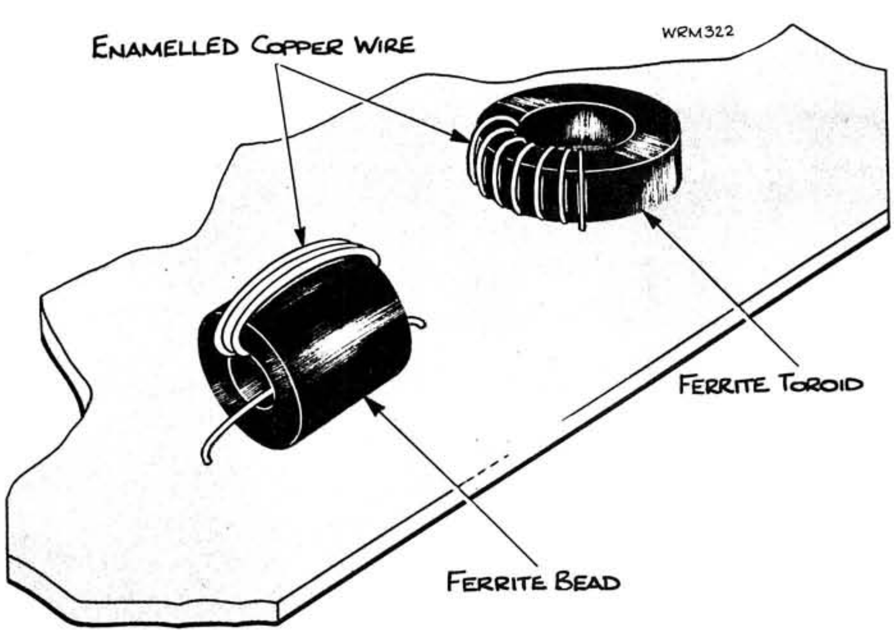
Send for full specifications of our full range of receivers covering from 200KHz to 520MHz. Our secondhand equipment changes daily. Send SAE for up to date lists. Part exchange welcome. Good clean Equipment bought for cash.

We have a good range of secondhand equipment at all times. Send large S.A.E. for details or telephone. Open 6 days a week.

Bearcat 220FB Receiver
Scanning Receiver, 66-88MHz–118-136MHz, 144-148MHz–144-148MHz, 420-450MHz–450-470MHZ, 470-512MHz £258.75.
Send S.A.E. for details of our range Aircraft Band Receivers.

CONSTRUCTOR'S SKETCHBOOK

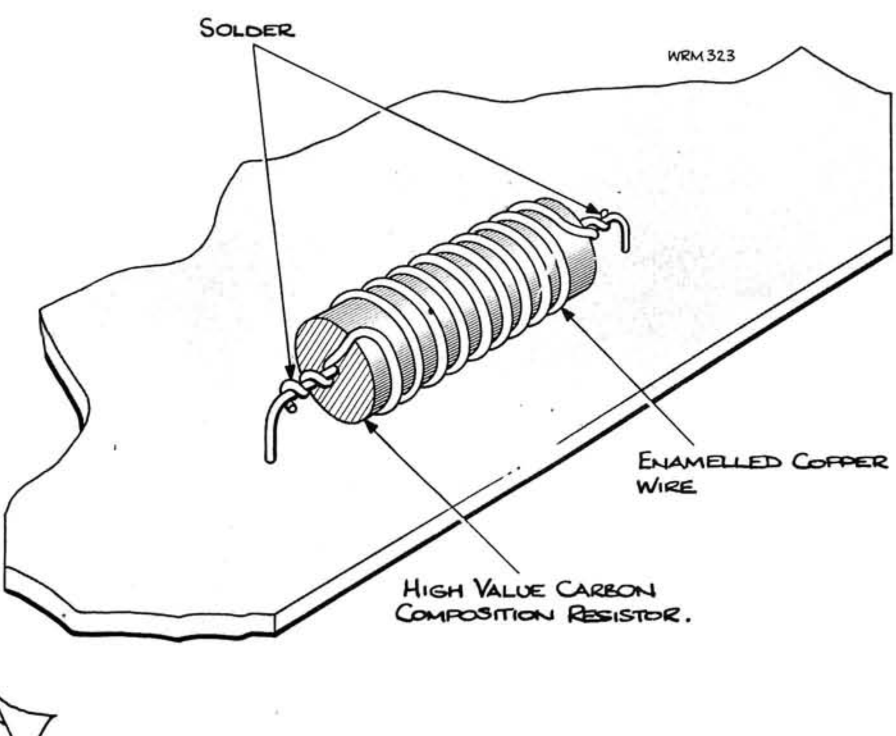
RADIO FREQUENCY CHOKES



USED EXTENSIVELY IN SUCH PROJECTS AS THE P.W. HELFORD TO BLOCK r.f.

COMMERCIAL RANGES ARE AVAILABLE BUT THE TYPES SHOWN HERE ARE SIMPLE TO MAKE.

A FEW TURNS OF ENAMELLED COPPER WIRE WOUND <u>THROUGH</u> A SMALL FERRITE BEAD WILL KEEP r.f. OFF THE SUPPLY LINES. THESE BEADS ARE ALSO USED TO SUPPRESS PARASITIC OSCILLATIONS. JUST THREAD THE BEAD ONTO THE LEAD CONCERNED.
A FERRITE TOROID CAN ALSO BE USED PARTICULARLY WHERE TWO OR MORE WINDINGS ARE REQUIRED.



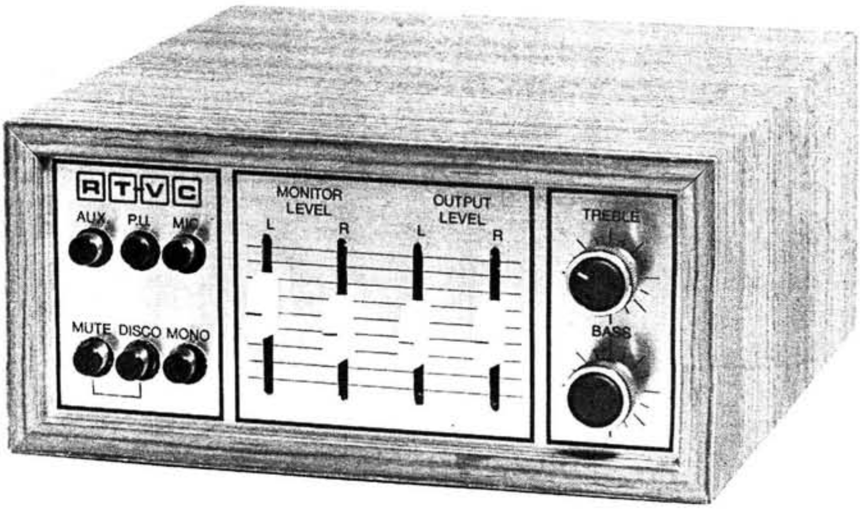
AIR CORED CHOKES NEED A SIMPLE FORMER. A LARGE VALUE CARBON COMPOSITION RESISTOR IS IDEAL. USE A 1W VERSION WITH A VALUE OF AROUND 150KΩ OR HIGHER. OCCASIONALLY A LOW VALUE RESISTOR (50Ω) WILL BE SPECIFIED TO ACT AS A PARASITIC STOPPER AND DAMP THE CHOKE.

THE ENDS OF THE WINDING ARE SOLDERED TO THE RESISTER LEADS — OF COURSE. WRM324

SPECIAL PRODUCT REPORT

RTVC

DISCO AMPLIFIER 12+12



In these days when equipment designs are getting ever more exotic and expensive, it is often forgotten that for some applications, a very acceptable standard of performance can be obtained by far less sophisticated means.

The 12 + 12 Stereo Amplifier Kit from RTVC, although by no stretch of the imagination using "state-of-the-art" techniques, will no doubt appeal to anyone looking for a very inexpensive way of listening to music or running a small p.a. or disco system.

Assembling the Kit

The pre-amplifier/tone control function is taken care of by a Mullard LP1183 module, which is a p.c.b. with 22 pins for external connections of inputs, outputs and controls, and using all discrete components. Two components have to be changed in each channel, and it is essential that desoldering braid is available for this operation, since the p.c.b. track lifts very easily if the soldering iron is applied for too long. (Time taken: 15 minutes including adding power supply links.)

The two power amplifiers have to be assembled from components and p.c.b.s provided. The complementary output transistors are mounted on an aluminium heatsink which doubles as the amplifier mounting bracket, and are connected to the p.c.b. by flying leads. The board is roller-tinned, but unfortunately all the holes have been drilled very much over-size so that mounting components is a very solder-thirsty operation. (Time taken: two hours for two amplifiers.)

All the controls (four slider and two rotary potentiometers, plus two 3-button switch assemblies) are mounted on the front panel, with the pre-amp. board stood off with long screws and spacers. Connecting up this lot is a long tedious process, and a goodly selection of different coloured wires (I used 14) is almost essential if mistakes are to be avoided. (Time taken to assemble and wire, excluding screened leads to input sockets: $2\frac{1}{2}$ hours.)

The rear panel carries DIN input and loudspeaker sockets, stereo headphone socket and the selenium bridge rectifier and low voltage fuse holder for the power supply. There are also holes punched for optional mains on/off switch and neon indicator (not supplied). No hole was drilled for the fuse holder locating pin, and the rectifier mounting hole was under-size. (Time taken to assemble and partly wire: $1\frac{1}{4}$ hours.)

The chipboard base of the amplifier provides a mounting for the front and rear panels, the two power amplifiers, the amplifier output capacitors, the mains transformer and the supply reservoir capacitor. The woodscrews required for fixing are not included in the kit, but must be supplied, along with wire, solder and glue for the cabinet assembly, by the constructor. The transformer weighs around $1\frac{1}{2}$kg ($3\frac{1}{4}$lb), and I personally would not like to risk fixing it with $\frac{1}{2}$in or $\frac{5}{8}$in chipboard screws. Instead, I used 4BA screws and nuts. Placing of the various parts is fairly critical, to allow clearance around everything, so check carefully before screwing down, not forgetting the four screened twin cables which will be required to link the input sockets at the rear with the selector switches at the front.

A "star" solder-tag is provided for the multiplicity of earthing connections, and this is fixed to one of the transformer mounting screws. This tag proved to be completely unsolderable, and reminded me of ones with similar properties which were around in the nineteen-forties and fifties. You can just imagine how popular they were in labs and on production lines! The remedy is to painstakingly file, scrape

★ specification

Power output:	12W r.m.s. per channel into 3Ω, or 24W mono with 2-channel mixing
Load impedance:	3–15Ω
Input sensitivity:	MIC; 2mV into 18kΩ PU; 150mV into 2·2MΩ AUX; 150mV into 2·2MΩ
Tone controls:	Bass; ±12dB at 60Hz Treble; ±12dB at 10Hz
Distortion:	0·1% at 5W at 1kHz
Hum:	Typically −55dB
Power requirements:	220–250V 50Hz a.c.

or glasspaper away every vestige of the plating around the component-lead holes before fitting the tag.

After mounting all the parts on the baseboard, the remainder of the wiring can be completed, and the front fascia fitted before putting on all the control knobs. The shafts on the two rotary potentiometers are too long and have to be cut down. The push-button knobs have a tendency to fly off, which can be either hilarious or annoying, depending upon the circumstances and your frame of mind. A drop of glue in each does the trick.

The cabinet top cover, which is also in plastics-veneered chipboard, is supplied ready mitred, and simply glues together. The recommended method of fixing the cover to the baseboard is by screwing through the mitred edges, but there is very little "meat" there, and I feel that a more secure way would be to use some form of tapped angle brackets.

Final assembly and wiring took a total of $4\frac{1}{2}$ hours, making a grand total for the project (including 30 minutes checking off the components supplied against the list) of 11 hours.

The instruction leaflet is fairly easy to follow, except for the drawing of the input selector switch wiring, which was not too clear. No circuit diagram is given for the LP1183 pre-amp. module.

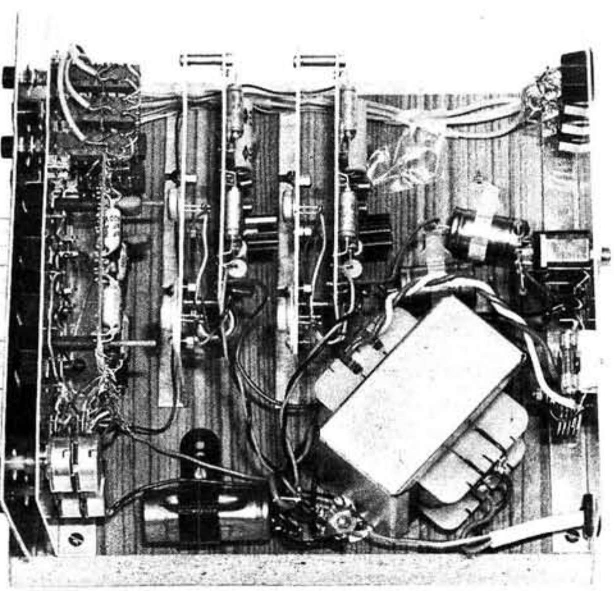
Results

The completed amplifier performed well except that noise emanating from the pre-amps was a little troublesome. This could possibly be improved by experimenting with different transistor types. The mains transformer runs very hot, and I would recommend adding some ventilation to the cabinet for continuous use.

Separate MONITOR fader controls set the output level to the TAPE OUT/MONITOR socket, which is combined with the AUX input socket. A MUTE button allows the power amplifiers to be muted, during recording, etc.

A MONO button allows the right and left pre-amplifiers to be paralleled at their inputs, whilst depressing the DISCO and MUTE buttons together parallels the power amplifier inputs, so that the right and left OUTPUT LEVEL faders then operate as a two-channel mixer.

Because of the design of the unit, construction time is fairly long, as there are a lot of connections to be made. If you have plenty of time to spare, then this kit is good value for money at £13.95 including VAT, plus £2.55 postage and packing if buying by mail order. See the RTVC advertisement in this issue for their addresses for personal shoppers and mail order.



NIMBUS

Modular 2m Transceiver System

16~Channel Scanner

(Part 8)

Michael TOOLEY BA G8CKT
&
David WHITFIELD BA MSc G8FTB

There are two main functional modules, the control logic and the channel oscillators. The control logic provides the means by which the operator's requirements are used to select any of the 16 channels at any given moment, utilising digital logic elements.

The channel oscillators consist of two banks of up to 16 electronically switched crystal oscillators, one each for transmit and receive, employing analogue r.f. circuits.

Operating Facilities

The Nimbus Autoscanner has two main modes of operation, MANUAL and AUTO. In the AUTO mode there are a number of operational sub-modes, and a range of optional features. A diagrammatic representation of the total range of control facilities is shown in Fig. 2, and detailed descriptions follow.

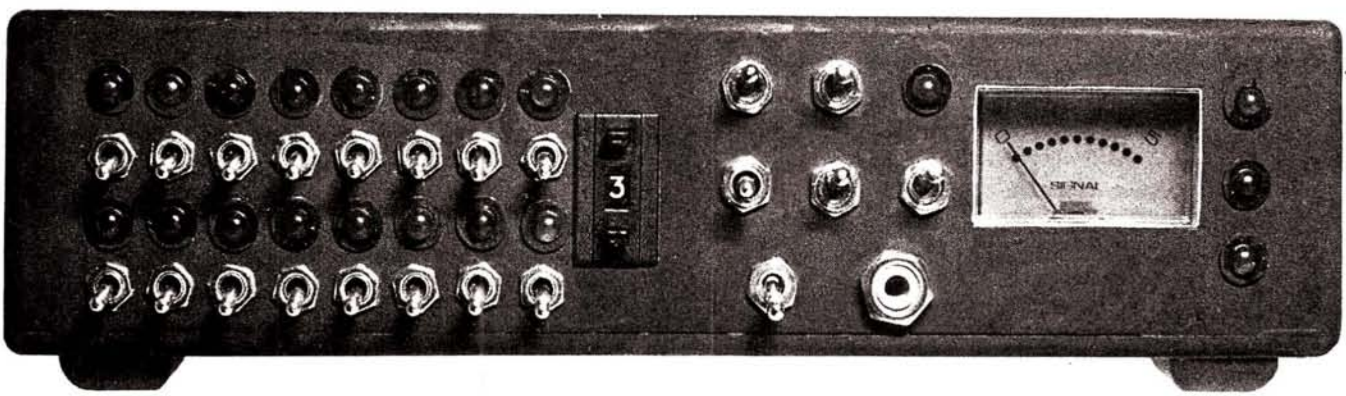
Manual Mode

In MANUAL mode the user selects the active channel directly by means of a hexadecimal-coded thumbwheel switch. Any change of switch setting, however, is ignored whilst the transceiver is in TRANSMIT mode. When the transceiver reverts to RECEIVE, the selected channel is updated to the new setting and continues to follow the switch setting until the mode again changes.

Auto Mode

In AUTO mode there are three operational sub-modes available, with a range of additional facilities, which may be used to tailor the Nimbus Autoscanner to the user's exact requirements. The sub-modes are as follows:

(1) SCAN causes the autoscanner to sweep through each of the 16 channels in turn. The time spent on each channel may be selected by the operator. In the unit



To further complement the Nimbus range of 2 metre equipment, the design presented here will expand the basic portable rig into a fully-fledged base station. It gives the user 16 additional channels that can be "interrogated" in several selectable modes including an intelligent scanning capability. As with the other items in the range, autoscanner may readily be used with similar v.h.f. equipment.

System Description

An outline block diagram of the autoscanner is shown in Fig. 1. The unit to be described either replaces or supplements the four manually switched channels provided in the Nimbus portable transceiver.

described, there are two switch-selected preset intervals of half second and two seconds. The user may also decide, at any time, to ignore any of the 16 channels without affecting either the order of the sweep or the time spent on each of the remaining channels in the sweep. Thus, for example, the autoscanner may be set up to spend two seconds on each of the channels 1–5–6–8–B–F in turn, repeating the sequence every twelve seconds. A further optional feature is the ability to sweep either continuously as just described, or to halt the sweep when an active channel above a predetermined "S" level is encountered. This is useful when monitoring a group of "vacant" channels, waiting for a signal.

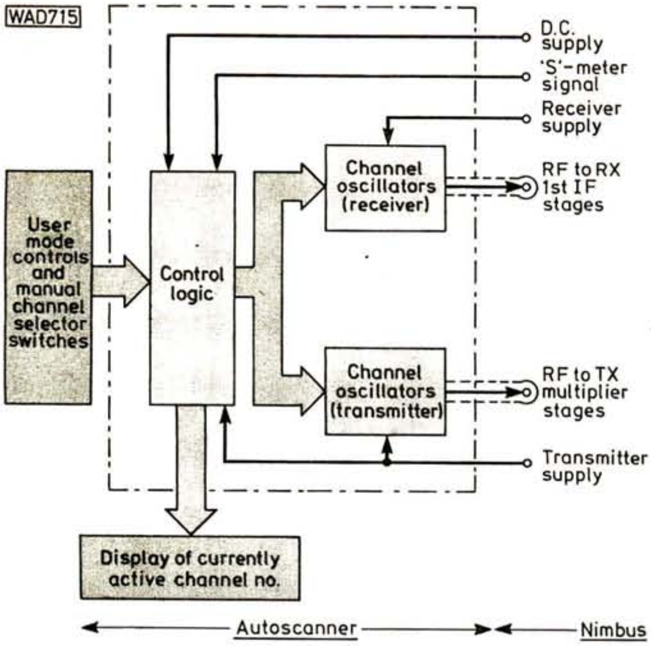
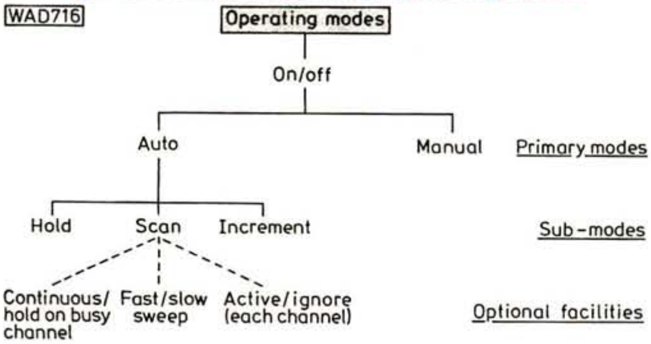


Fig. 1 (above): Block diagram of the *PW* Nimbus Autoscanner

Fig. 2 (below): Autoscanner operating modes



(2) HOLD causes the sweep to halt. This is useful when the hold-on-busy-channel facility in the SCAN sub-mode encounters the required signal.
(3) INCREMENT allows the user to step through each of the 16 channels in turn under manual control.

Channel Change Inhibit

In all modes and sub-modes, with the exception of INCREMENT, channel changing can only occur while the transceiver is in RECEIVE mode. The INCREMENT sub-mode allows channel change during transmission for test and alignment purposes, while making accidental channel change unlikely. At all times, the user is provided with a visual l.e.d. display of the currently selected channel.

Control Logic

The control logic determines which of the possible 16 channels is active at any given time, and thus it may be likened to an electronic channel switch. The different operating modes have already been described, and the mode selected is interpreted by the control logic to enable the appropriate channel at the appropriate time(s). In all cases, only one channel may be active at any given moment, but the manner and the order of selection may be varied at will by the operator. The control logic also provides the operator with a constant l.e.d. indication of the currently selected channel.

A block diagram for the control logic is shown in Fig. 3. There are three main modules: the timing generator, sequencing logic and the channel selector. The logic is essentially TTL and occupies two printed circuit boards: one for the timing generator and sequencing logic and the other for the channel selector.

Timing Generator

The timing generator module provides the autoscanner sequencing logic with a number of related clock signals which are required for timing and control purposes. The idealised waveforms for these signals are illustrated in Fig. 7. In practice, the mark:space ratios will vary according to the scan rate selected, i.e., FAST or SLOW.

The circuit used to generate the timing waveforms is shown in Fig. 4. A precision timer, IC1, is used in an astable configuration to generate the master timing reference signal. The frequency of oscillation is set by R1 (only on SLOW scan rate), R2, R3 and C1. In SCAN mode, the control system is designed such that a new channel is selected for every 32 astable cycles that elapse. Switching R1 in/out of circuit, therefore, allows the sweep rate to be decreased/increased as required. The values specified for the frequency-determining components give sweep rates of approximately one new channel per half second (FAST), and one new channel per two seconds (SLOW). Constructors wishing to employ different sweep rates may use the formulae below to calculate alternative component values.

Fast rate
$$= 0{\cdot}0222(R2+2R3)C1 \text{ seconds/channel}$$
Slow rate
$$= 0{\cdot}0222(R1+R2+2R3)C1 \text{ seconds/channel}$$

Resistances in kΩ
Capacitance in μF

CONSTRUCTION RATING Advanced

BUYING GUIDE

All components required for the *PW* Nimbus Autoscanner are readily available from suppliers advertising in *PW*. Printed circuit boards can be obtained from usual sources. The cost quoted below is for a fully crystalled, 16-channel unit.

APPROXIMATE COST £190 (FULLY CRYSTALLED)

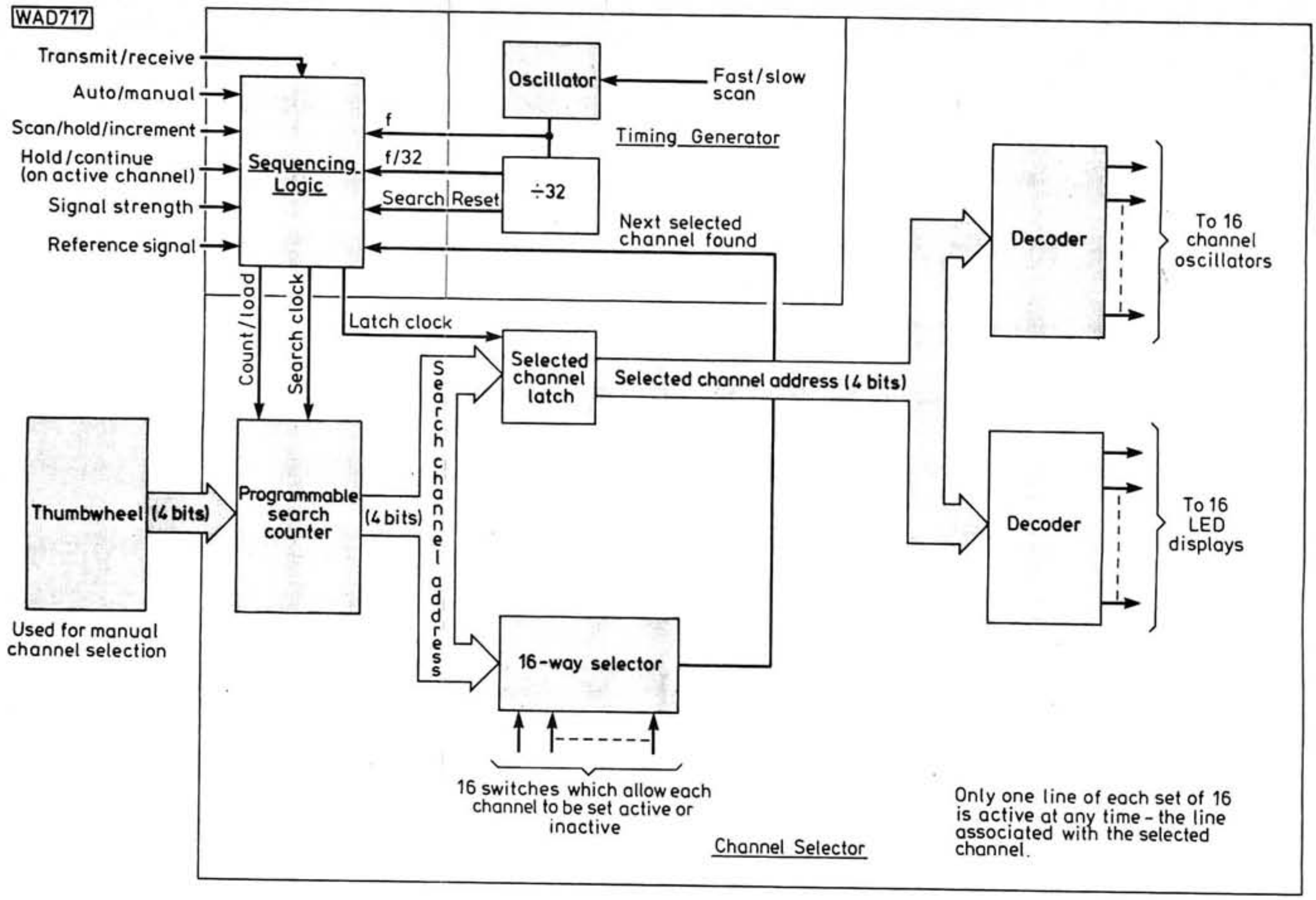
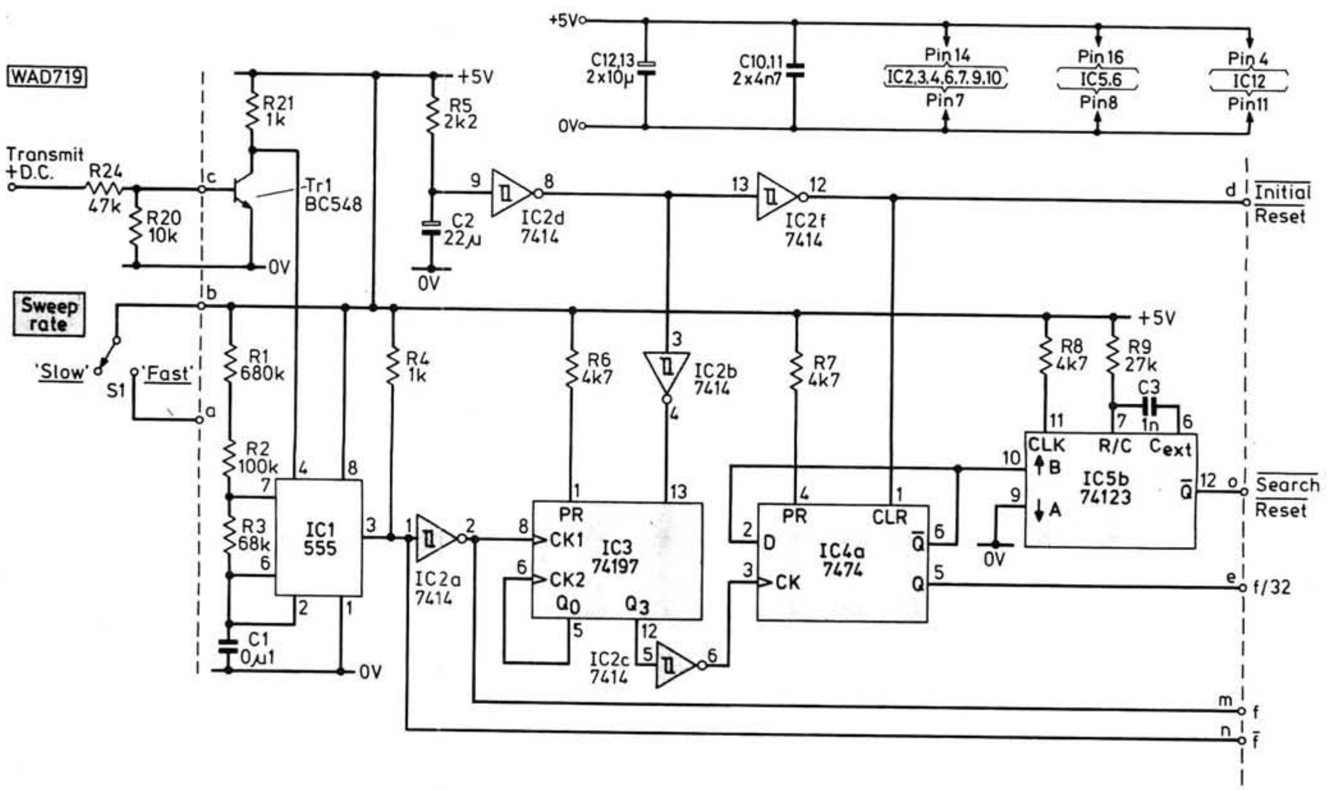


Fig. 3 (above): Block diagram for the control logic

Fig. 4 (below): Circuit diagram for the timing generator and associated power supply rails



If preferred, R1 and R2 may be replaced by a fixed resistor, to set the fastest sweep rate, in series with a potentiometer whose value will set the slowest sweep rate. Typically, a 2·2MΩ potentiometer in series with a 47kΩ resistor will provide a useful range of control.

The remaining timing and control signals are all derived from the astable oscillator output. The original reference ($\bar{f}$) is inverted to produce a second clock phase (f). A binary counter, IC3, and a D-type flip-flop, IC4a, are then used to divide-by-32 to produce the signal f/32. A monostable, IC5b, is arranged to use the falling edge of f/32 to generate a 10μsec negative-going reset pulse after every 32 astable cycles. The pulse duration of this reset is determined by R9 and C3

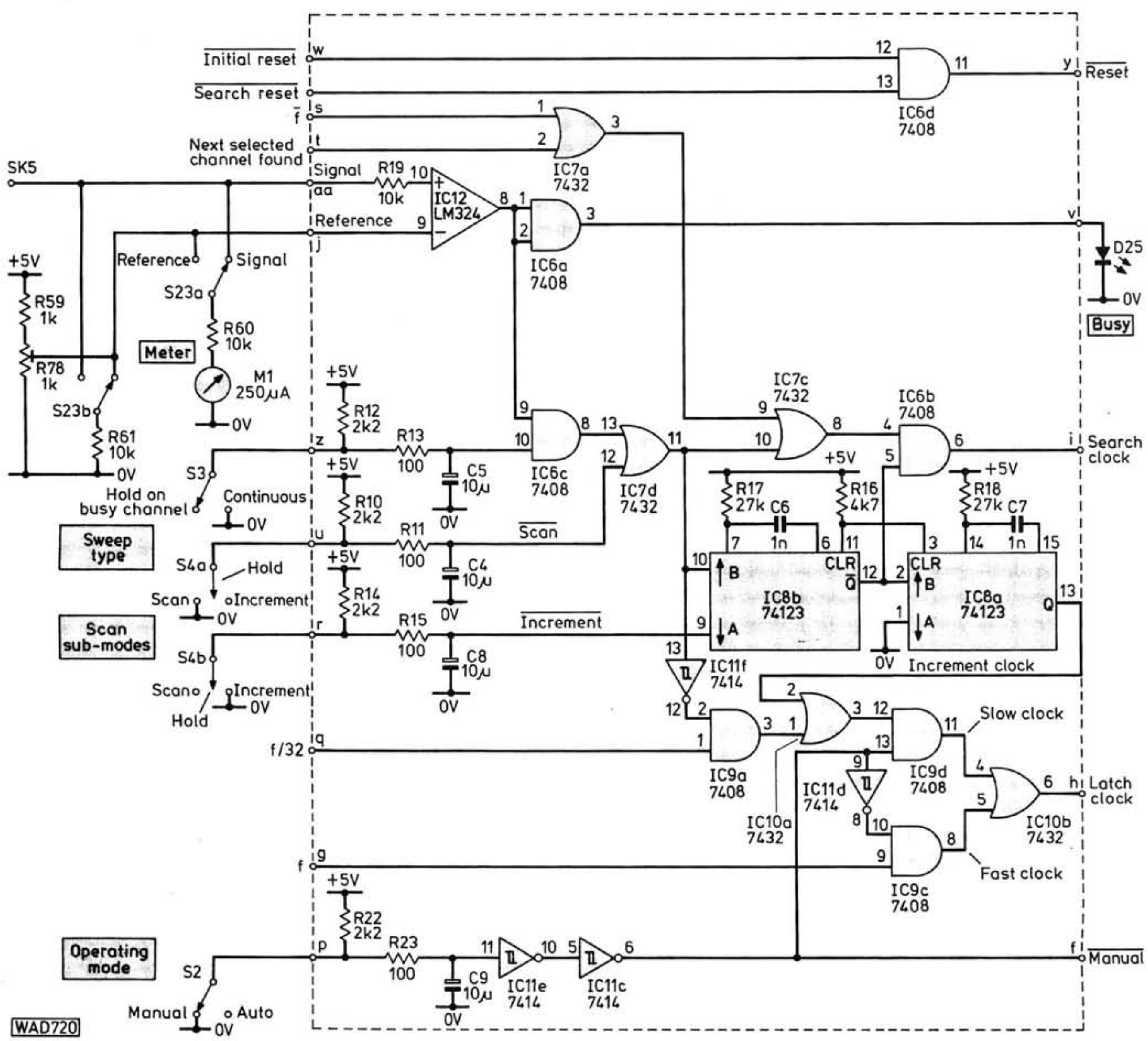
The arrangement of R5, C2 and IC2d is used to provide a "power-on-reset" function whenever d.c. power is newly applied to the autoscanner logic. By this means, the control system is always initialised to a known state at switch-on.

The $\overline{\text{Reset}}$ input on IC1 is used to override the autoscanner control logic and prevent any inadvertent change of channel while the transceiver is in TRANSMIT mode. The TRANSMIT d.c. supply rail is sensed by R20/R21, and turns on Tr1. The collector potential falls to near 0V, which provides a logic LOW to the $\overline{\text{Reset}}$ input of the 555. This inhibits the master clock, and prevents any change of channel in either the MANUAL or the AUTO/SCAN modes. For test purposes, change of channel while in TRANSMIT mode is still possible by means of the AUTO/INCREMENT facility.

Sequencing Logic

The sequencing logic uses inputs from the timing generator and from the user control switches to produce the $\overline{\text{Reset}}$, Search Clock, Latch Clock, and $\overline{\text{Manual}}$ signals used by the channel selector board to determine which of the 16 channels is selected at any time. The circuit diagram for the sequencing logic is shown in Fig. 5.

Fig. 5: Circuit diagram for the sequencing logic



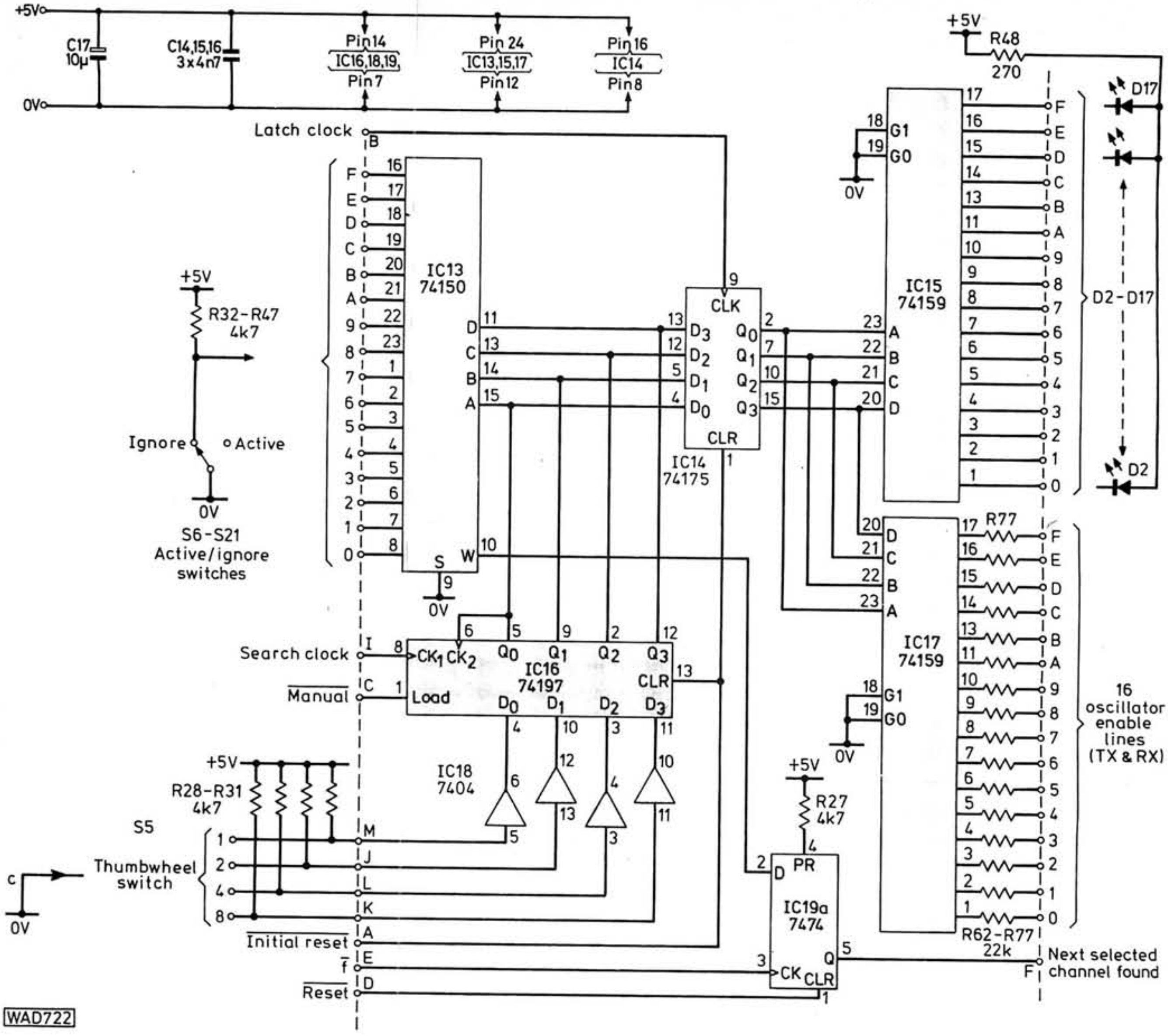


Fig. 6: Channel selector circuit diagram and associated power supply rails

The operating mode for the autoscanner is set to AUTO or MANUAL by S2. The arrangement of R22, R23 and C9, in conjunction with the Schmitt-input gate IC11e, is used to "debounce" the switch. This prevents multiple triggering due to contact bounce when the toggle switch changes over. After buffering, the level selected by S2 ($\overline{\text{Manual}}$) is sent to the channel selector board for use as the primary mode control line and to the on-board Latch Clock steering logic.

The Latch Clock steering logic uses the $\overline{\text{Manual}}$ signal to determine whether the FAST Clock or the SLOW Clock is used to provide the clock function. In MANUAL mode, the FAST Clock (frequency = f) is used, while in AUTO mode, the SLOW Clock (f/32 or INCREMENT Clock, depending on whether the sub-mode is SCAN or INCREMENT, respectively) is used.

The AUTO sub-mode selection is performed by the two-pole three-position toggle switch S4. This switch has a centre-off position, used for HOLD, and is spring-biased-to-centre, used for INCREMENT, in one of the two remaining positions.

The HOLD sub-mode is selected by default by the centre-off position on S4. In this position, the INCREMENT logic is disabled by holding the A-input HIGH on IC8b by means of R14, while the search and latch clocks are disabled by R10 holding the Inhibit Clock line HIGH.

INCREMENT is the sub-mode which provides the means to advance from the channel selected by the HOLD sub-mode. Operating the spring-loaded position on S4 initiates a sequence of pulses which has the effect of stepping the autoscanner on to the next channel. The pulse sequence illustrated in Fig. 8 uses two 1μsec monostables, IC8b and IC8a, to advance the search counter by one, and then update the channel latch on the channel selector board. In this way, the user may step through the 16 channels one at a time in either RECEIVE or TRANSMIT operating mode.

In the SCAN sub-mode, $\overline{f}$ drives the Search Clock line until the Next Selected Channel Found line indicates that the channel selector search counter has advanced to the next selected (i.e., not set to "ignore") channel. The Search Clock is then inhibited for the duration, and the next rising edge of the Latch Clock causes this channel to be enabled.

In this way, the frequency of the Latch Clock determines the rate of sweep; one search-and-enable sequence occurring for each clock cycle.

An alternative to the continuous sweep described above is provided by S3 and IC12. Operation of S3 allows the sweep to be halted when the receiver's sweep sequence encounters an occupied channel. This "busy" channel is then held for as long as the signal remains. IC12 is used to compare the received signal strength with the predetermined reference level (see later), and IC6c uses the comparator output to override the sweep whenever a signal above the threshold is encountered. Where not required, or where no signal strength line is available from the receiver, the HOLD-ON-BUSY-CHANNEL facility may be omitted by replacing S3, R12, R13, C5, IC12 and IC6c by a link between pins 12 and 13 on IC7d.

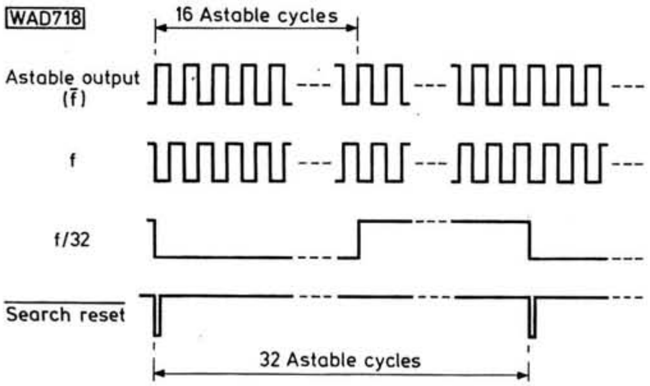


Fig. 7 (above): Timing generator signal waveform

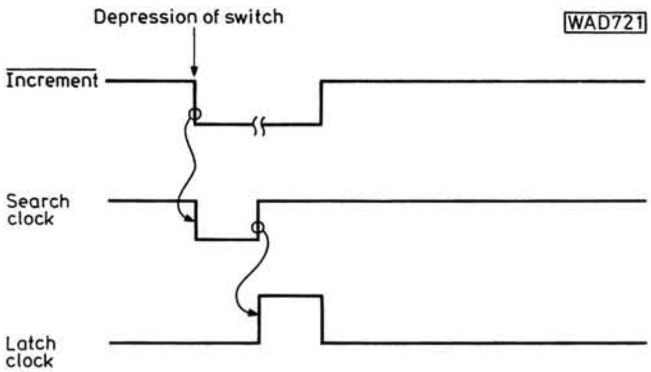


Fig. 8 (below): Pulse sequence for increment mode

Readers who intend to operate the *PW* Nimbus should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

★ components

TIMING GENERATOR AND SEQUENCING LOGIC BOARD

Resistors		
¼W 5% Carbon		
100Ω	4	R11,13,15,23
1kΩ	3	R4,21,59
2·2kΩ	5	R5,10,12,14,22
4·7kΩ	4	R6, 7, 8, 16
10kΩ	4	R19,20,60,61
27kΩ	3	R9,17,18
47kΩ	1	R24
68kΩ	1	R3
100kΩ	1	R2
680kΩ	1	R1
Pre-set cermet multiturn		
1kΩ	1	R78
Capacitors		
Ceramic		
1nF	3	C3,6,7
4·7nF	2	C10,11
0·1μF	1	C1
Tantalum 10V		
10μF	6	C4,5,8,9,12,13
22μF	1	C2
Semiconductors		
Integrated Circuits		
555	1	IC1
7408	2	IC6,9
7414	2	IC2,11
7432	2	IC7,10
7474	1	IC4
74123	2	IC5,8
74197 or 74177	1	IC3
LM324	1	IC12
Diodes		
0·2in l.e.d. (green)	1	D25
Transistors		
BC548	1	Tr1

Miscellaneous

Sub-miniature toggle switch s.p.d.t. (3); Centre-off spring-biased one way sub-miniature d.p.d.t. toggle switch; Sub-miniature spring-biased d.p.d.t. toggle switch; Panel mounting for D25; Panel mounting hardware for R78; 250μA f.s.d. meter (Maplin LB80B).

★ components

CHANNEL SELECTOR BOARD

Resistors

¼W 5% Carbon

270Ω	1	R48
4·7kΩ	21	R27–47
22kΩ	16	R62–77

Semiconductors

Diodes

0·2in l.e.d.	16	D2–17

Integrated Circuits

7404 or 7414	1	IC18
7474	1	IC19
74150	1	IC13
74159	2	IC15,17
74175	1	IC14
74197 or 74177	1	IC16

Capacitors

Ceramic

4·7nF	3	C14,15,16

Tantalum 15V

10µF	1	C17

Miscellaneous

3 off 24-pin d.i.l. sockets; 3 off 14-pin d.i.l. sockets; 1 off 16-pin d.i.l. socket; Sub-miniature hexadecimal thumbwheel edge switch module (RS337–431); Pair of end cheeks (RS337–419); Ultra miniature s.p.s.t. toggle switches (16 off); Mounting hardware for l.e.d.s.

POWER SUPPLIES

Resistors

¼W 5% Carbon

1kΩ	3	R56,57,58

Semiconductors

Integrated Circuits

UA7805KC	1	IC20 (TO3 can 5V 1·5A regulator)

Diodes

1N4001	3	D19,21,23
0·2in l.e.d. (red)	1	D20
0·2in l.e.d. (green)	1	D22
0·2in l.e.d.(orange)	1	D24

Capacitors

Ceramic

4·7nF	4	C24,25,26,28

Polyester

100nF	1	C27

Electrolytic

10µF 10V	1	C29 (axial lead)

Sockets

4mm insulated (red)	3	SK1,2,3
4mm insulated (black)	1	SK4

Miscellaneous

Four-pole double-throw toggle switch (RS316–995 miniature toggle); 4 off anti-parasite beads; 3 off l.e.d. mounting hardware; Die-cast box approximately 220 × 145 × 55mm.

The Nimbus transceiver's signal strength output is connected to SK5 on the Autoscanner, and then via R19 to the non-inverting input of the comparator, IC12. The reference, which is applied to the inverting input of the comparator, is variable from 0 to +2·5 volts, and is derived from the +5V supply rail. The reference level is set by a screwdriver-adjustable panel mounted multiturn trimmer, R62. The signal strength meter, M1, may be used to display either the Nimbus receiver signal strength or the preset reference level. The selector switch, S23, is spring-biased to show the receiver signal strength as the normal setting. The output of the signal comparator is displayed on the l.e.d., D25, i.e., this l.e.d. is illuminated when the signal strength exceeds the reference level.

The final section of the sequencing logic comprises a single gate, IC6d. This gate provides the $\overline{\text{Reset}}$ line for the channel selector board by combining the $\overline{\text{Initial Reset}}$ and the $\overline{\text{Search Reset}}$ signals from the timing generator.

Channel Selector

The channel selector is the module which is responsible for implementing the channel selection, and as such forms the "heart" of the autoscanner. A block diagram is included in Fig. 3, and a detailed circuit diagram is shown in Fig. 6.

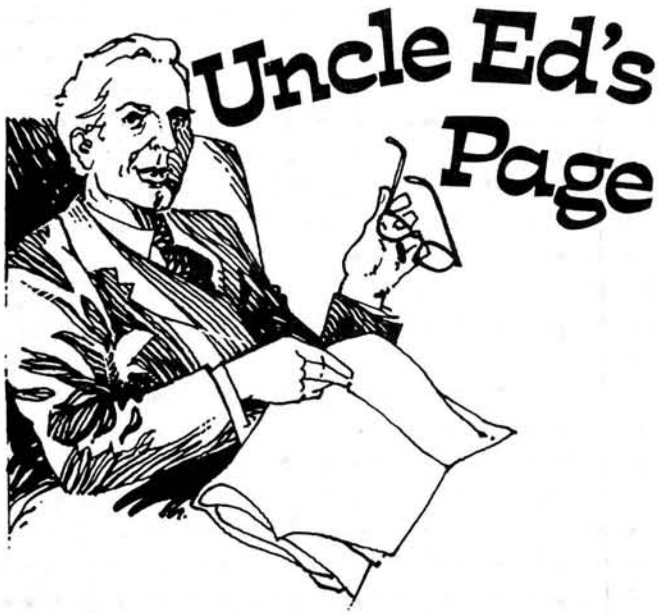
The operation of the channel selector is in one of two modes, depending on whether the primary autoscanner mode is MANUAL or AUTO. The $\overline{\text{MANUAL}}$ line from the sequencing logic is used to control the programmable 4-bit search counter, IC16. In AUTO mode, this counter is clocked by Search Clock, and increments by one for each High-to-Low transition. In MANUAL mode, the counter outputs, Q_0 to Q_3, follow the data presented at the data inputs, irrespective of the state of the clock. The output therefore reflects the current setting of the thumbwheel switch, S5. A change of mode from AUTO to MANUAL holds the last setting of the thumbwheel switch until the next HIGH-to-LOW clock transition.

In AUTO mode, the search counter output drives the 16-way selector, IC13. During a sweep cycle, this selector looks at one of the 16 active/ignore switches (S6 to S21) at a time. The search counter increments until a switch is found which is set "active", i.e., the W output from IC13 goes HIGH. The flip-flop, IC19a, is then set, causing the sequencing logic to freeze Search Clock for the remainder of the sweep cycle, i.e., until the start of the next 32 astable cycles. The saved counter value selects the next channel in the scan sequence when this is updated at the rising edge of Latch Clock. At this edge, the counter output is transferred to the selected channel latch, IC14, and the flip-flop is reset. This new value of selected channel is held in the latch while the Search Clock is re-started and the sweep cycle repeats. The latch output is used to drive two 4-to-16 line decoders, IC17 and IC15, which enable the selected channel oscillator, and illuminate the corresponding channel-selected l.e.d. indicator, respectively.

In MANUAL mode, the Latch Clock frequency is 32 times higher than in the AUTO mode. The thumbwheel switch setting thus appears to the operator to have been implemented immediately, whereas in practice there will be a slight delay of typically 30ms.

Next Instalment

In Part 2 we will be dealing with the channel oscillators, power supplies and full constructional details.



A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.

DIODES

For what is basically a pretty straightforward component, the diode causes a lot of headaches for the newcomer to electronics. The diode is a device which allows current to flow in one direction only, and blocks it in the reverse direction. (This ignores the small reverse leakage current, and the large reverse current that can flow if a critical breakdown voltage is exceeded, as in Zener diodes. I'll talk about these some other time.)

Here we come against our first stumbling block—which is the forward direction and which is reverse? The answer is, it all depends; on whether you're talking about "conventional" current flow or electron flow. While we're on the subject, let me declare myself here and now as an electron-flow man, basically because I like to be able to visualise a problem, and I can "see" those negatively-charged electrons rushing around the circuit towards the positive terminal of the power supply (attraction of opposites). "Conventional" current flow is from the positive side of the power supply to the negative, and was chosen to be that way round in the early days of electrical engineering, before it was discovered that current in a conductor was a flow of free electrons.

Unfortunately, the circuit symbol for the "solid-state" diode, which in those days would have been a copper-oxide type, was laid down to be an arrow and a bar (Fig. 1), with the arrow-head pointing in the direction of conventional current flow. The arrow-head is called the anode (a) and the bar the cathode (k).

If a battery or other source of d.c. voltage is connected across a diode, with its positive terminal to the anode and its negative terminal to the cathode (Fig. 2) a heavy current will flow—I've included the resistor to limit that current, and so stop the diode being burnt out. So, forward current flow in a diode is into the anode and out of the cathode if you're talking about conventional current, or into the cathode and out of the anode if you prefer electron flow. In either case, it happens when the anode is connected to the positive side of the supply, and the cathode to the negative. Reverse the battery and the current flow is blocked.

The bottom end of the resistor in Fig. 2 is connected to the negative terminal of the supply, and the top end is connected (via the diode) to the positive terminal. Looked at another way, there's a current flowing in the circuit, and we've said that electrons flow towards the more positive part of the circuit. Electrons are flowing left to right through the diode, so they must be flowing upwards through the resistor. Therefore the top end of the resistor must be positive compared to its bottom end, as shown.

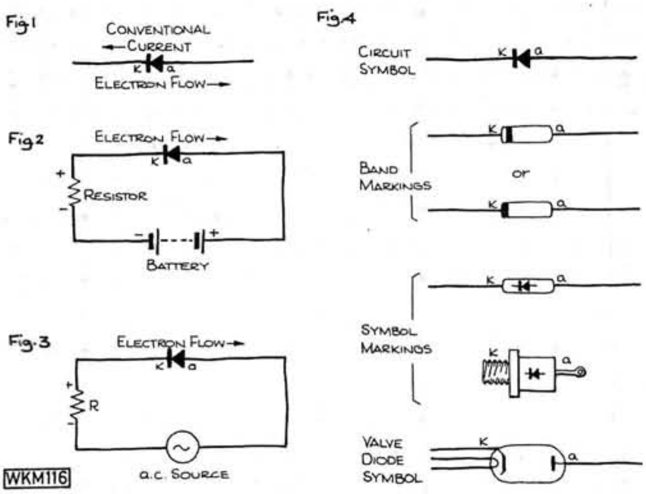
The circuit of Fig. 2 doesn't really do anything very useful, but you could replace the battery by a source of alternating voltage, such as a transformer with its primary connected to the a.c. mains (Fig. 3). The diode would then pass current when the voltage of the source had the same polarity as the battery in Fig. 2, but block it when the polarity of the source reversed. Current flow through the resistor would be intermittent, but always in the same direction. In this application the diode is being used as a rectifier, producing a pulsating d.c. supply from an a.c. source.

This brings us nicely on to another perennial question from the beginner: "Why is the cathode of a diode circuit symbol often labelled with a cross, when everyone knows that a cathode is a negative electrode?" Well, Fig. 3 gives a clue to the answer to this one, because so far as the resistor R is concerned, the cathode of the diode is what it sees as the positive side of the supply. In fact, it is just convention that the cathode of a diode is identified with a cross because it has a positive voltage produced on it when used as a rectifier.

Yet more conventions apply to the physical appearance of real diodes. First, that on diodes with cylindrical bodies, the cathode end is marked with a band. This band can be black, red, white or sky-blue pink, but it is always at the cathode end. Second, on the larger diodes which are bolted to a heatsink or chassis by means of a threaded stud, the stud end is (almost) always the cathode. Exceptions (well, most conventions have some exceptions) are: (a) some diodes are marked with the diode circuit symbol; (b) a few stud-mounted diodes are stud anode—sometimes these can be identified by an "R" at the end of the type number, as they are known as reverse polarity package types.

Although I'm not dealing with thyristors (s.c.r.s) here, it is worth mentioning that they are, by convention, normally stud anode, though a few aren't. People do believe in making life complicated, don't they?

I've tried to summarise these conventions in Fig. 4, with a valve diode as well, for comparison. I'll continue the diode saga next month.



BACK~UP POWER SUPPLY UNIT FOR PORTABLE RADIOS

Keith CUMMINS

It is a well-known fact that the better quality portable radios, with respectable output stages, are somewhat heavy on batteries. Because the radio has sufficient power capability to rise above such ambient noises as washing machines, food mixers, etc., the battery life tends to be very short should the kitchen be the radio's usual location.

My wife owns a Bush TR130 radio which falls into the above category. Its usual working area is the kitchen, but nevertheless it spends a fair amount of time in other parts of the house, where the demand for high volume is much reduced. The last thing the lady of the house is interested in is trailing a power unit around with the radio. Therefore it was considered sensible to install a power unit in the kitchen where the power requirement is greatest. Another point to be taken into account is the ease of operation. The power unit is tucked away in a cupboard, and a flying lead emerges where the radio is used; the lead being electrically dead until the radio is connected to it. When the radio is connected and switched on, power from the battery is used to switch the power supply unit, which then takes over from the battery.

It is necessary to modify the radio circuit, and an l.e.d. was fitted to indicate correct operation of the power supply. The modification is simple and straightforward, the most difficult part being the addition of a 3 pin DIN socket to accept the external power.

Because use of this unit will involve modifications to existing equipment, and also necessitate the wiring of incoming mains via a relay, we emphasise that the project should not be undertaken by anyone who is not confident of what he is doing!

CONSTRUCTION RATING **Beginner**

BUYING GUIDE

Readers should have little difficulty in obtaining the components. The metal box came from Zaerix Electronics Ltd., type-Minibox 521-563.

APPROXIMATE COST **£10**

The layout is quite uncritical, and for this reason, the experienced constructor can devise his own. We would recommend that the unit be built into an earthed metal box, for safety reasons, since it will be permanently connected to the mains. A nasty fault, though most unlikely, will then blow the fuse, with any fire risk rendered negligible.

★ components

Resistors		
10% ¼W		
33Ω	1	R6
220Ω	1	R8
1kΩ	1	R1
2·2kΩ	1	R5
4·7kΩ	1	R4
10kΩ	2	R2,7
22kΩ	1	R3
Semiconductors		
Diodes		
BY164	1	D1
1N4001	3	D3,5,6
6·2V 400mW	1	D2
Yellow l.e.d.	1	D4
Transistors		
TIP31	1	Tr1
BC109	1	Tr2
BFY50	1	Tr3
Capacitors		
Electrolytic		
2200μF 25V	1	C1
22μF 15V	1	C2
47μF 15V	1	C3

Miscellaneous
RLA s.p. make 40Ω coil; T1 240V primary, 14V 1A secondary; F1 100mA antisurge with fuseholder to suit; PL1 3-pin DIN plug; SK1 3-pin DIN socket; Minibox 521-563 (154 × 104 × 60mm). Zaerix Electronics Ltd.

Figs. 1 and 2 show the power supply circuit and the input modifications required by the radio. The two circuits need to be considered together, and for this reason the component numbers run sequentially from Fig. 1 to Fig. 2.

It is best to first consider battery operation of the radio; the power supply will not be plugged in, so nothing is connected to pins 1, 2 and 3. When S1 is turned on, +9V from the battery is conveyed via D6 and the switch to the remainder of the radio. Due to the voltage drop across the diode, the radio circuits are supplied with +8·4V.

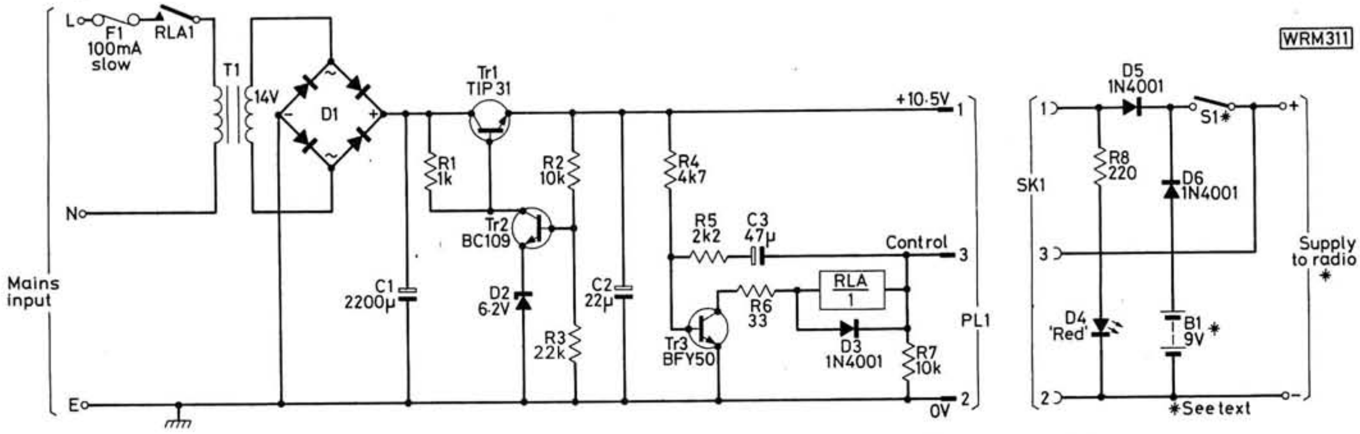
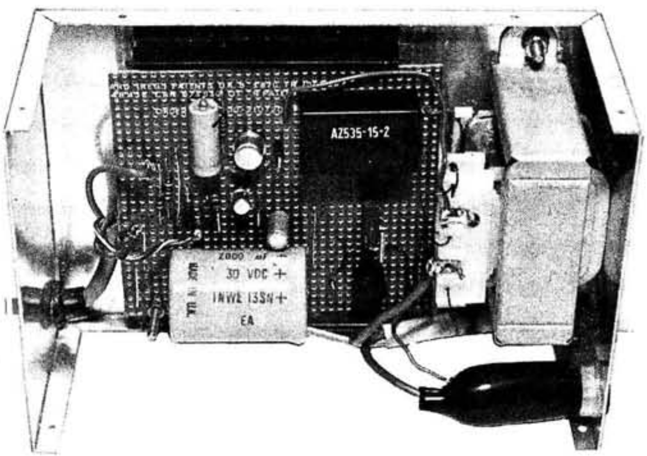


Fig. 1 and Fig. 2: Power supply circuit with the internal input modifications of the radio

If the power supply is connected, or closing S1 (or plugging in while the radio is playing) will apply 8·4V to the control line into the power supply. C3 charges via R5 and the base of Tr3, therefore the transistor turns on, and RLA placed in its collector circuit, (and also fed from the control line), energises. Mains power is applied to T1, resulting in a regulated output of +10·5V appearing at pin 1, this lights D4 indicating mains power available. D5 conducts, and lifts the supply to the radio from 8·4V to 9·9V. D6 is now reverse biased, so no current flows from the battery. R4 in the power unit maintains the base current of Tr3, so ensuring that RLA remains energised even though C3 is charged. The reader will now see the reason for including Tr3; if no mains power is available, RLA energises only for the duration of the charging time of C3. Since no maintaining current flows through R4, the relay drops out again. This ensures that in the event of power failure, or a fault in the power supply, this not left draining the battery.



Internal view of the power supply

Another point worth noting is that the power unit cannot be switched on if the battery is flat. This ensures that a weak, leaking battery cannot be left in the radio while it is running from the power supply unit.

The regulator part of the p.s.u. (Power Supply Unit), consisting of Tr1 and Tr2 and associated components follows a basically classical design. Tr2 is the error amplifier, with voltage reference Zener D2 connected in its emitter, while Tr1 is the series regulator. C2 provides h.f decoupling to ensure stability.

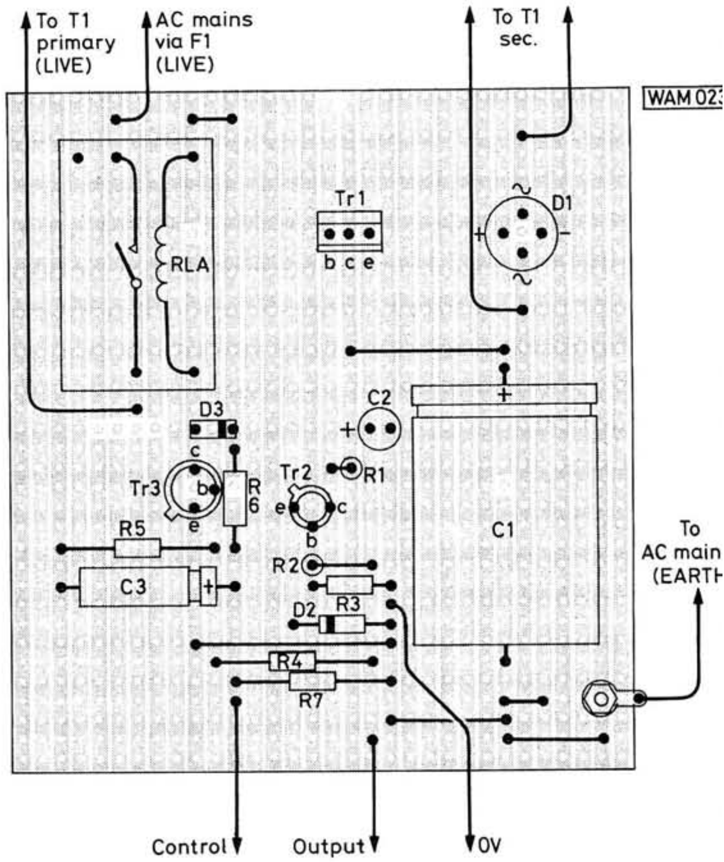


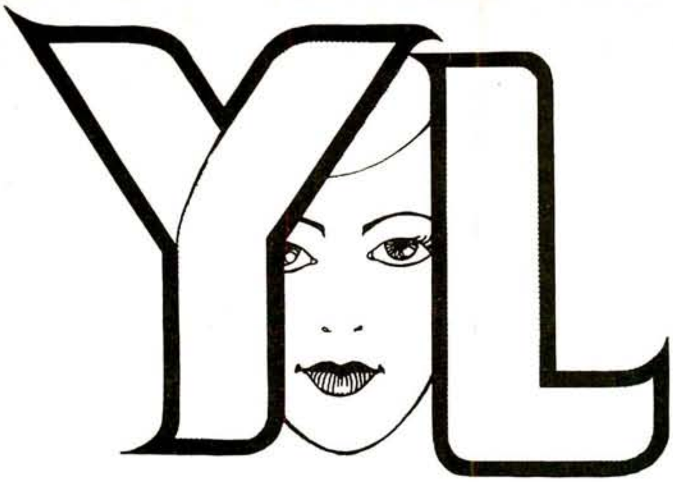
Fig. 3: Prototype Veroboard layout diagram

Choice of Relay

The relay should provide adequate insulation between contacts and frame, since mains is being handled. The resistance is not too critical, the important thing is that it should actuate at about 7V to ensure reliable operation. The relay used in the prototype was a 5 volt, 40 ohms type, hence the use of R6—this component may be omitted where a higher voltage relay is used. R7 is included to provide a discharge path for C3 if the p.s.u. is unplugged from the radio while in use, while D3 is a back-e.m.f. quenching diode.

Care has been taken to ensure that there are no "do's"

continued on page 68 ▶▶▶



the YL COLUMN

Elaine HOWARD

Hello, and welcome to the very first YL column. Let me firstly introduce myself. After originally training as a Marine Radio Officer and being unable to get a job at sea, I started work as a Test Engineer on a Defence Project. It was after this that I decided to change to journalism, and joined *Practical Wireless* back in September. Although I am not a Licensed Amateur as of yet, I sat the Morse exam in the summer and the RAE in December, so hopefully I will be on the air very soon.

Although there are still not many licensed YLs and XYLs in comparison with the total number of licensed amateurs, at least the number is growing. There is an association called BYLARA (British Young Ladies Amateur Radio Association), which brings together like minded YLs from all around the world. They are affiliated to the RSGB and they are open to licensed and non-licensed YLs and OMs wishing to join. When I wrote to the Secretary of BYLARA, G4EZI, she sent me some very interesting information about the group. It's best to start at the beginning of the story, and this is some of the letter she sent to me:

"Now as to the history of BYLARA. The idea for a YL club in Britain was first mooted in 1977, and a meeting took place at the Drayton Manor Rally of that year, chaired by Barbara, G4EKX. This earlier effort met with failure, as it was felt that there were not enough interested YLs at that time to make forming a YL club a possibility.

Nothing was then done until 1979, when Rita, G3NOB, wrote to Mary, G4GAJ, and myself, suggesting that there were so many newly licensed YLs on the band, the time would be right to suggest the starting of a YL club again. Both Mary and I were quite enthusiastic about the idea, and we decided that this time our approach would be different. The earlier effort we feel, met with failure because the approach was: "Should we form a YL club?"—this time, we decided to be more positive about the procedure and the message to put across was: "We are forming a YL club—would you like to join us?"

So the three of us put the word around that there would be a meeting of interested YLs at the Drayton Manor Rally to discuss the proposed formation of a new YL club. At that initial meeting on the 29 April 1979, there were eight YLs present. Mary acted as chairman, and informally proposed the formation of the club, and invited anyone else who was interested to join us. It was all very informal in those days—the aims of the club, newsletter, subscriptions, etc., were all suggested, and Mary, Rita and I agreed to fulfill the duties of chairman, treasurer and secretary, just to get the club started.

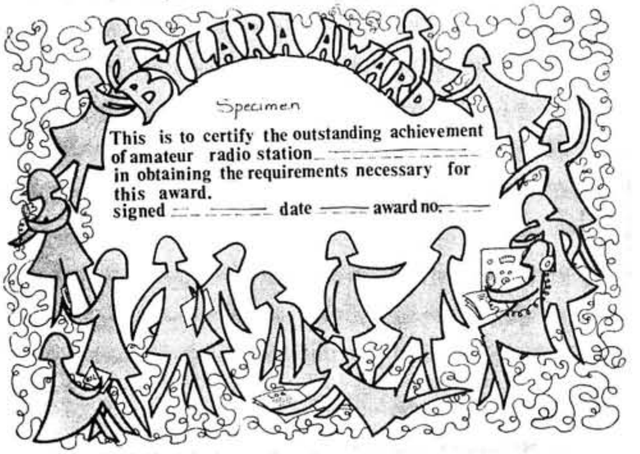
After the meeting I, as secretary, wrote to about 50 YLs to tell them about the club, and invite them to join us. Subscriptions began to roll in. Rita unfortunately was unable to continue as treasurer and was succeeded by Judith G4IAQ.

From thence the club went from strength to strength, with the admission of OMs and DX YLs as associate members.

A formal business meeting took place at Leicester (The Leicester Exhibition, 10 November 1979), to thrash out a formal constitution as the club had expanded so rapidly, and already had over 100 members.

1980 saw BYLARA displays at many radio rallies, including the Leeds White Rose Rally in March. April 1980 at Drayton Manor saw our first AGM and the election of a committee, and in May 1980 we were invited to put on a display at the RSGB Exhibition at Alexandra Palace.

Illustration courtesy of the BYLARA June newsletter



Currently, we have a membership of well over 100 members, run a weekly net on 80m, have meetings at radio rallies, have an attractive YL award and a quarterly newsletter."

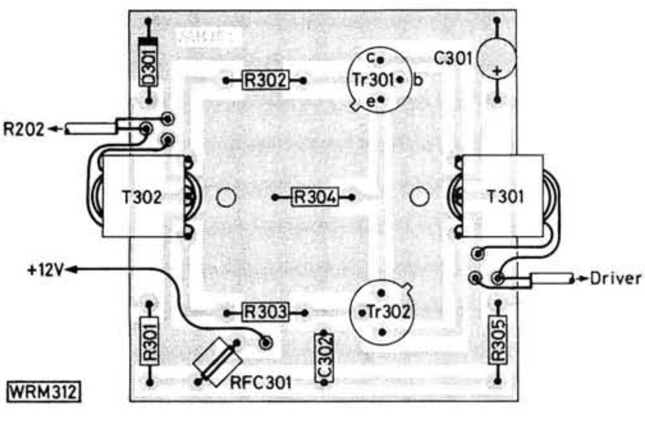
So as you can see there is a very active YL community in the world of amateur radio. I was at the Ally Pally rally and I was very impressed by the stand that BYLARA had. They had collected blank QSL cards from their members and made them into a very colourful display.

If anyone has any comments to make about YLs in Amateur Radio then I would be pleased to hear them.

For further information in BYLARA please contact: Mrs D. Hughes G4EZI, 3 Primley Park Crescent, Leeds LS17 7HY.

PW HELFORD—3

▶▶▶ *continued from page 46*



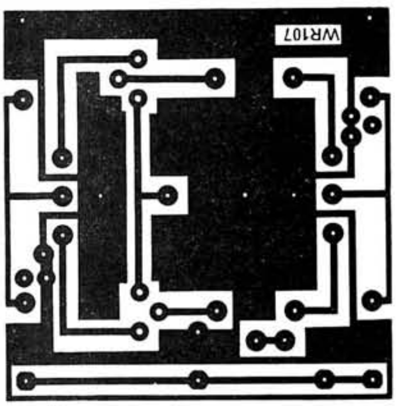


Fig. 12 (far left): The component placement drawing for the Tx First Amplifier board. Fig. 13 (left): The copper-track pattern for the Tx First Amplifier p.c.b. shown full size

Construction

Again this circuit is built on a simple p.c.b. and like the previously described boards all component leads should be kept as short as possible. When the final mechanical assembly of the completed transceiver is carried out this board will be mounted onto a removable screen using 6mm stand-offs. The output from the First Amplifier to the driver stage is made with miniature coaxial cable.

The input and output transformers are wound onto double aperture ferrite cores using 22 s.w.g. enamelled copper wire and taking care not to scratch the insulation. The cores are then fixed to the p.c.b. using epoxy adhesive and the ends of the windings taken to the appropriate pins on the p.c.b.

Table 2

	Primary	Secondary
T301	2T + 2T 22 s.w.g.	2T 22 s.w.g.
T302	2T 22 s.w.g.	2T + 2T 22 s.w.g.

First Trials

It should now be possible to carry out the first tests on the transmitting side of the *PW* Helford, albeit with only a low power output.

In Part 2, C702 was not fully specified. It must have a negative temperature coefficient.

Next month we will describe the r.f. driver amplifier.

PRODUCTION LINES

ALAN MARTIN G8ZPW

Mini TV

Hitachi have just launched a brand new product, the K2300, which is a very compact lightweight monochrome television with combined digital clock.

The set has a $4\frac{1}{2}$in tube and receives both u.h.f. and v.h.f. bands, selected at the touch of a button. Tuning has been simplified by using a vertical line on the screen, which indicates the channel being received and is cancelled by a button once tuned-in correctly. A built-in telescopic aerial is supplied, but for poor reception areas, an external aerial socket is provided. The quartz digital clock can also be set to switch the set on or off at any predetermined time.

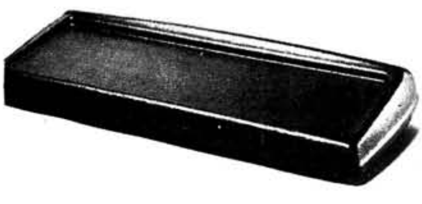
Powered by either a.c. mains, car battery, its own internal batteries or an optional battery pack, the K2300 is also fitted with an audio recording jack and earphone socket.

Priced at £115, which includes VAT, the K2300 is available through normal retail outlets.

Economy Keyboard Case

West Hyde Developments Ltd., the instrument case specialists have added a purpose-designed keyboard enclosure to their Princess range of cases for calculators, data input terminals and microprocessors.

Made in Britain, the enclosure is vacuum-formed in two halves which are clipped then screwed together for rigidity in final assembly. The ABS plastic is easy to drill, punch and clean and the base contains a series of mounting ribs.



The Princess keyboard costs £10.75 plus VAT and overall measurements are 435 × 205 × 70mm high. The 380 × 130mm recessed area allows plenty of room for cutting out apertures to take the keyboard assembly.

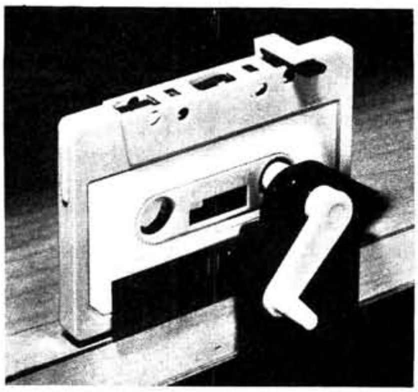
West Hyde Developments operate an efficient 24-hour response, mail order service and also a sales desk at: *Unit 9, Park Street, Industrial Estate, Aylesbury, Bucks HP20 1ET. Tel: (0296) 20441.*

Cassette Accessory

An answer to the perennial problem of tangled cassette tapes, faced by anyone interested in recording or recordings, is provided by Fixotape, a new device just launched by Jorephani Exports.

Simple to use, Fixotape snap-fixes to any table edge or shelf, the cassette is then fitted with the tape fed through a guide, and at the turn of a handle the tangled, twisted, creased or knotted tape is freed.

Fixotape is being marketed through normal retail outlets, particularly hi-fi and record shops, but in the event of difficulty, can be obtained, price £1.99, which includes VAT and p&p, direct from: *Jorephani Exports, Park Lane, Corsham, Wilts. Tel: (0249) 714855.*



UHF/TV Aerial Amp.

Antiference announce the introduction of "XtraBoost" XB1U, a new u.h.f./TV aerial amplifier for indoor use.

Designed to improve reception in difficult areas, the unit is particularly attractive for the DIY enthusiast as it is easy to install and operate.

Specification for the XB1U amplifier is: Bandwidth, 470–860MHz; Gain, 10dB (3 times); Maximum output (4 u.h.f. channels), 30dBmV 31·5mV; Input/output impedance (nominal), 75 ohms; Noise figure <4dB. Powered by a.c. mains, fused at 3A and housed in a brilliant white high-impact plastic case should cost £14.40 plus VAT.

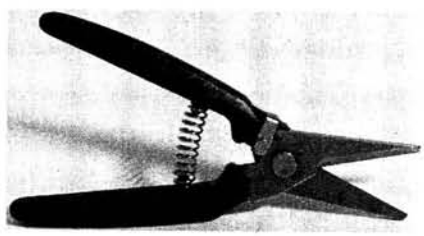
Further information from: *Antiference Ltd., Aylesbury, Bucks HP19 3BJ. Tel: (0296) 82511.*

Cutting Comment

Once in a while a tool is launched on the market which is labelled "universal", "all-purpose", etc., but rarely does it live up to its name.

One that does is the All Purpose Cutter from Vero Electronics. Having had one on trial for several months, its ability to cut just about anything has been proved on paper, cloth, cardboard, 22 s.w.g. aluminium sheet, cotton, string, wire and p.c.b. stock. It will even prune the roses! And after all that it still cuts paper cleanly.

The All Purpose Cutter is made from stainless steel, with plastics coated handles, and is available from Vero stockists, priced at around £4.30 including VAT.



RADIO SPECIAL PRODUCT REPORT

TRIO TR-7800

2m FM TRANSCEIVER

Trio's 2 metre mobile f.m. transceiver, the TR-7800 is the latest in a long line of well engineered, high performance rigs. Its external appearance of solid construction is further enhanced by the available facilities which to date have only been obtainable from the more expensive "multi-modes". At last a manufacturer has realised the potentially suicidal nature of mobile operation and applied a design philosophy allowing operational simplicity.

The evaluation sample arrived soundly packed, complete with mobile mounting bracket, scanning microphone, comprehensive instruction manual and approximately four metres of heavy connecting cable, a welcome change from the previous minimal allocation, which allows direct routing to the battery in most vehicles. The incorporation of in-line fusing is an example of basic installation protection, often left (and forgotten) to the unsuspecting consumer.

This report is based on considerable experience gained over a period of two months under mobile and base station operation. Manufacturers' statistics are quoted for reference in the specifications with measured parameters in italics.

Features

Referring to the accompanying photograph of the front panel, starting at the top left-hand corner, we have standard concentric volume and squelch controls. The squelch is easy to adjust, even with arms length operation it proved to be very precise with minimal closing delay. Audio output in excess of 2W is more than adequate for mobile situations and in most vehicles the internal lid mounted 75mm diameter speaker will suffice. An external 3·5mm jack socket is provided on the rear panel for connecting the optional SP.40 speaker pod.

The frequency display uses a four-digit 7-segment red l.e.d. device for keyboard entered readout and a similar 2-segment device for memorised channels. On-air transmit and busy indication is provided by respective yellow and red l.e.d. devices as is the "S" meter which follows the current bar l.e.d. formation.

Selection of output power is accomplished by the HI-LOW latching push-button at the top right-hand corner. Low power is user-adjustable by accessible rear panel pot and can be set anywhere in the range, up to 15W. A 1750Hz repeater access tone is available by latching the TONE button. Subsequent tones are generated automatically when the microphone p.t.t. switch is depressed.

When operating in repeater mode, input monitoring is accomplished by pressing the REV button, which is of the non-latching variety.

Frequency Control

Keyboard operation of a rig is, in the reviewer's opinion, best kept to base station mode. With this concept in mind the split personality of the TR-7800 becomes apparent. By use of the KEY or MEMORY SELECT button it is possible to select frequency either via the keyboard pad, or the large rotary switch knob for access to the 15 memorised channels. All normal memory programming is conducted via the key pad.

In practice, memory programming is easy to accomplish and is comparable to operating a basic calculator. If you do make an error the displayed characters can be removed by pressing the "C" (clear) button. Inbuilt lockout will inhibit transmission if an attempt is made to enter out-of-band frequencies. Non-standard offset can be provided by using channels 13 and 14 allowing any choice of "in band" splits. This feature is useful when transverting to 70cm where repeater shifts of 1·6MHz are required.

When in keyboard mode it is possible to select frequency via the microphone UP-DOWN shift. By pressing the appropriate button once, the displayed frequency will shift 25 or 5kHz dependent on STEP selection.

In either keyboard or memory mode, holding the microphone UP-DOWN button down, or pressing the keyboard button marked SC, will cause continuous scanning of either the full 2MHz bandwidth or pre-memorised channels. If a

Test equipment

- Bird model 43 Thru-line wattmeter and 50Ω dummy load;
- Marconi TF2370 spectrum analyser with TF2373 frequency extender;
- Racal 9081 synthesised signal generator;
- Marconi TF2011 v.h.f. f.m. signal generator.

The test measurements are shown in italics

★ specifications

GENERAL

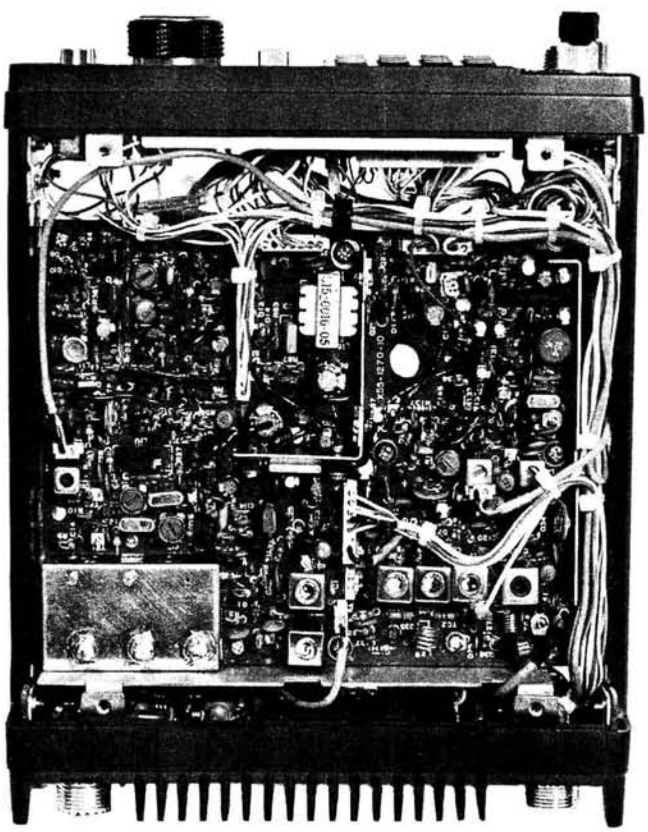
Frequency range:	144·000 to 145·995MHz
Frequency synthesiser:	Digitally controlled, phase locked v.c.o.
Mode:	FM (F3)
Antenna impedance:	50 ohms
Supply requirements:	13·8V d.c. ±15% negative earth
Operating temperature:	−20°C to +50°C
Current consumption:	0·4A in receive mode, squelch closed 6A in HI transmit 2·5A in LOW transmit Memory back-up 3mA
Dimensions:	175 × 64 × 206mm
Weight:	2·1kg

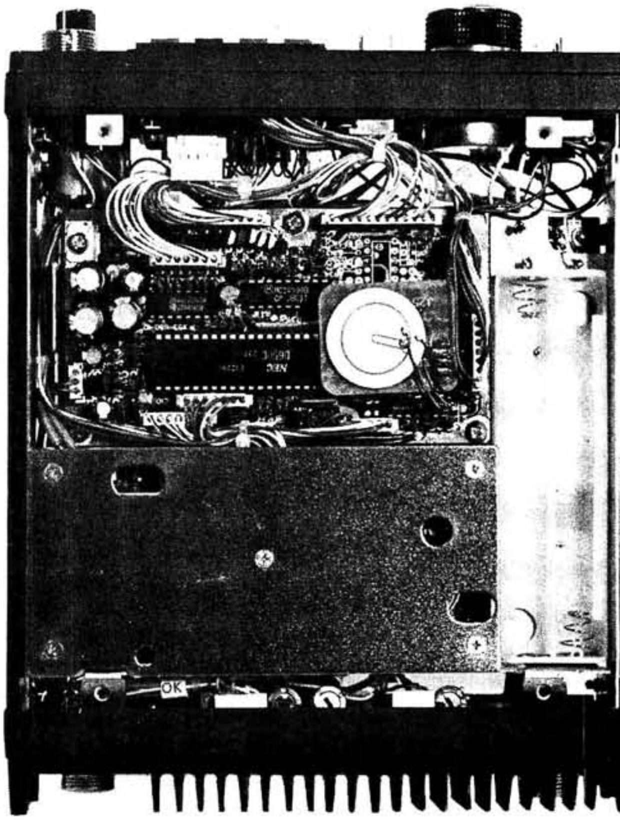
RECEIVER

Sensitivity:	Better than 0·5µV for 30dB S/N Better than 0·2µV for 12dB SINAD *(0·11µV p.d. for 12dB SINAD constant across bandwidth)*
Selectivity:	12kHz (−6dB) 24kHz (−60dB)
Adjacent channel:	*(−88dB)*
Intermodulation response:	*(−78dB)*
"S" Meter calibration:	
l.e.d. No. 1	*(−4dBµV)*
l.e.d. No. 2	*(0dBµV)*
l.e.d. No. 3	*(+5dBµV)*
l.e.d. No. 4	*(+11dBµV)*
l.e.d. No. 5	*(+15dBµV)*
Squelch sensitivity:	0·16µV (threshold) *(0·06µV p.d.)*
Audio output:	2W into 8Ω load *(2·6W 10% dist. 1·7W at onset of clipping)*

TRANSMITTER

RF output power into 50Ω load:	(13·8V d.c. supply)
HI:	25W min. *(32W) (25W at 12V)*
LOW:	5W (adjustable) *(5W) (5W at 12V)*
Modulation:	Variable reactance direct shift
Frequency tolerance:	Better than ±20 × 10^{-6} over temperature range
Spurious output:	HI: Less than −60dB *(Better than 65dB down on carrier 0–1250MHz)* LOW: Less than −53dB *(Better than 60dB down)*
Deviation (max.)	±5kHz
RPT. Tone-burst frequency:	1750Hz
Microphone:	Dynamic 500Ω with p.t.t. and UP/DOWN switches





busy frequency is located the scan will stop automatically for five seconds. Scanning is terminated by pressing the p.t.t. switch or either of the UP-DOWN buttons.

Further features are provided in conjunction with the scanning section. When ALERT is latched in, the selected frequency memorised in channel 14 is checked at 6-second intervals, accompanied by an audible tone "blip", regardless of currently displayed frequency. By pressing the button marked OPER an instant QSY is made to memory channel 14.

Internal construction and layout follows the common Trio format of two separate circuit boards mounted back to back. This affords good access to all components which are clearly identifiable by screen printed lettering. From the r.f. point of view the TR-7800 incorporates conventional phase-locked-loop frequency synthesis, the receiver section being a double-conversion superheterodyne with a first i.f. of 10·695MHz and second i.f. of 455kHz. One interesting constructional feature is the incorporation of a final-stage power amplifier module. As this device is fully integrated all variable matching components associated with discrete final drive stages are made unnecessary, and are factory matched for life.

Operating Impressions

After carefully reading the instruction manual and relating it to the controls, operation became straightforward. Initially the hardest area to grasp was concerned with channel programming but even this soon became instinctive.

Reports received during many QSOs indicated clean, normal levels of transmitted audio with no evidence of excessive tonal colouration. The only adjustments found necessary were to the factory-set, two-second duration and amplitude level of the tone-burst generator. By removing the appropriate side cover the relevant board was easily located and adjustment made. On receive the exceptionally sensitive front-end performance was found to more than complement the rig's 25W-plus high power output. Even operating during crowded "lift" conditions produced no discernible adjacent-channel or cross-modulation effects.

For serious mobile working over distances in excess of 30 miles the transceive compatability offered by the TR-7800 was found to be ideal, ensuring access to repeaters when audible. As a basic guide, it has been found that a transceiver with a receiver section sensitivity of 0·22µV, for 12dB SINAD, requires a matching output power of 25 watts.

As the rig was used in mobile and base-station modes it was found well worth while fitting the optional four AA size NiCad cells to the internal tray. This provided a power supply back-up, claimed by the manufacturers to last up to five days without recharging. Whilst connected to the mobile supply or base p.s.u., internally generated float charging of the cells is provided. For base station use only, a supply can be provided from a standard NiCad charger connected to the rear-mounted socket marked BACK-UP.

Also located at the rear of the rig is the UHF SO239 aerial connection and a further pair of user accessible potentiometers for the adjustment of the r.f. level metering and p.a. module protection circuit. This last facility progressively reduces the output power level delivered by the final stage when a mismatched condition is detected. The clarity of the display sections was found to be adequate for all light levels encountered.

In conclusion, the TR-7800 offers to the base station/mobile user state-of-the-art facilities on 2 metres f.m. at a price of £268.

The Trio 7800 is available from **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbys. Tel: 0629-2817** to whom we offer our thanks for the loan of the review unit.

BACK UP PSU FOR PORTABLE RADIOS

►►► *continued from page 61*

and "don'ts" concerning the operation of this unit. It can be plugged into and unplugged from the radio, whilst the latter is playing, without damage. As soon as the plug is removed, the "latching-up" collapses, the plug becomes totally dead, and the mains transformer in the p.s.u. is de-energised.

Other Voltages

It is possible to make the p.s.u. supply a nominal 6V instead of 9V, R3 should be omitted in this case. Also, R6 should be shorted out if RLA is being energised from a PP6 source.

Modification of the Radio

To simplify the modification of the TR130 radio, its car aerial input socket was removed (it is never used in the writer's car). This made way for the 3 pin DIN socket which was easily fitted after filing out the hole in the chassis. The two halves of the cabinet needed the file treatment as well.

The l.e.d. can be conveniently fitted at the lower right hand corner of the radio dial (in the case in question, just below the "Bush" motif). A hole has to be drilled, and the l.e.d. pushed through. The dial backplate is plastic, so the l.e.d. can be a push fit.

For other radios, the circuit will be the same, but of course, the constructor will need to devise his own layout.

Bearing in mind the cost of batteries these days, a power unit would not take very long to off-set the cost of construction. *Electrical and Radio Trading* journal quoted Ever Ready prices as:

PP3	0·55p
PP9	0·99p
HP2	0·29p
HP11	0·27p

LOWE ELECTRONICS LTD

PART OF THE TRIO LINE

A SUPERB GENERAL COVERAGE RECEIVER

R1000 £285.20 inc VAT
carriage by Securicor £4.50

The R-1000 is a high class general coverage receiver covering 30 bands between 200KHz and 30MHz with a PLL synthesizer that incorporates all of Trio's sophisticated electronic technology developed over recent years.

Both digital display readout (1KHz resolution) and analog display (10KHz resolution) are provided for easy and accurate tuning.

The R-1000 also includes a quartz digital clock with timer, three IF filters, RF ATT and tone control, etc. to ensure the best receiving conditions for each mode.

Due consideration has been given to innovative design and compactness, making the R-1000 an incomparable station receiver for amateur radio operators, professionals, BCL's and SWL's, etc.

THE 2 METRE FM MOBILE TRANSCEIVER

TR7800 £268 inc VAT
carriage by Securicor £4.50

The new TR7800 is the only 2 metre FM mobile transceiver. Its performance both in your car and shack has to be experienced to be believed. Power output is 25 watts, a needle bending signal. The rig has keyboard entry for fixed station use and for programming the 15 memories. When used with the up/down shift switch on the mike the 15 memories, each having a repeater shift facility, make mobile operation a sheer pleasure. The scan facility, both on memory and 25/5Kc on keyboard means no missed contacts. Five second hold on each occupied channel gives you time to identify the station before the rig moves on to the next QSO, press the mike switch and the scan instruction is cancelled. Add the priority facility and you have it, the only 2 metre FM mobile rig.

THE HF SSB TRANSCEIVER

TS520SE £437 inc VAT
carriage by Securicor £4.50

In the face of ever increasing complexity in amateur radio equipment, it's comforting to know that the TS520SE is still in volume production. Radio amateurs all over the world (and dealers too) have voted the TS520SE "my favourite transceiver" because of its astounding reputation for reliability, high sensitivity receiver, and of course the unequalled Trio audio quality coming from the transmitter. The TS520SE incorporates all of the features demanded by today's amateur, and at an outstandingly low price. No wonder it's top of the list in popularity, and comparison with other transceivers will convince you that the TS520SE is the best value for money on the market today.

Of course, the bare figures cannot tell you just how nice the TS520SE feels in use, nor can they tell you the pleasure of hearing other operators saying "never heard better audio OM, what rig are you using?"

THE ABOVE REPRESENTS A SMALL PART OF THE TRIO LINE. SEND 48p FOR FULL DETAILS

HEAD OFFICE AND SERVICE CENTRE

CHESTERFIELD ROAD, MATLOCK, DERBYS. TEL 0629-2817 or 2430 OPEN 9-5.30 TUES-SAT. PHONE 9-9

For personal attention on the South Coast contact John, G3JYG, 16 Harvard Road, Ringmer, Lewes, Sussex. Ringmer 812071.

For equally helpful attention in Scotland contact Sim, GM3SAN, 19 Ellismuir Road, Baillieston, Nr. Glasgow. 041-771 0364.

FOR ALL THAT'S BEST IN HAM RADIO CONTACT US AT MATLOCK.

THE PW 'SHERBORNE' SYNTHESISED AM/FM TUNER

PART 4 W.S.POEL

In this, the final part of the *PW* "Sherborne" series, we deal with the construction of the tuner modules, plus testing of the complete system.

Construction of the Tuner Modules

The f.m. tuner heads are presented as entirely prefabricated and pre-aligned units, so this part of the text will concern only the f.m. i.f./a.m. tuner system, and the stereo decoder.

The a.m./f.m. system p.c.b. layout is shown in Fig. 31. It is very densely packed in comparison to most enthusiast constructional projects, and if you feel this is beyond your skills, this item is also available as a prefabricated module from Ambit International. The unit is designed to fit into a proprietory set of metal work, with push-fit lids, to ensure full screening of the i.f. from any external r.f.i. and vice-versa. There is realistically very little hope of successfully contriving to produce a home-made p.c.b. of this complexity.

The i.c. can be fitted using a socket, although unless you use a Zetronix low-profile type, the fit can be impossibly tight. Care should be exercised in the selection of the correct varicap diodes for the tuned circuits; only the Toko KV1215/1235 types are suited to this application by virtue of their inherent matching. The fact that each tuned circuit is provided with its own individual varicap relaxes the requirement for absolute accuracy of matching of the tuning elements.

The choice of the other components is not very critical in terms of stability considerations. The use of disc or plate capacitors much larger than 5–7mm diameter/section is a nuisance in such a tightly packed environment, and will inevitably lead to untidy construction with unhelpful side effects on the behaviour of the system. The size and complexity of the projects demands that only trustworthy components should be used. Temptations to dip into the junk box should be resisted. The printed circuit board layouts of the ferrite rod antenna switching/tuning arrangements (Fig. 32) and Stereo Decoder module (Fig. 33) are less crowded, and should not present any difficulties.

The design work in producing the circuit of the a.m./f.m. module is as much contained in the physical layout as in the actual diagrammatic representation of the circuit elements, so whilst you are welcome to try to adapt the circuit to incorporate any of your own ideas and innovations, it is as well to start with the basic item as shown, since it is far easier to work from a starting point of a known and proven circuit.

One final point—although it may seem unlikely to those not versed in r.f. techniques, it is really quite important to note the way in which components are fitted, since certain stand-up resistors have a polarity in terms of a "hot" and a "cold" (earthy) end with respect to r.f. considerations.

Take, for example, R14 in Fig. 14 (Part 2). The upper end is decoupled to earth via C13 and can therefore be considered to be earthed from an r.f. point of view. This is the "cold" end. As R14 is the collector load for Tr1 (a 10·7MHz i.f. amplifier), the amplified output from Tr1 is developed across it, and the lower end of the resistor is therefore the point of maximum r.f. potential in the circuit. This is the "hot" end.

In all such cases, the lead at the "hot" end of the resistor should be kept as short as possible. The earthy end is then the longer end.

The careful placement of resistors in audio sections is also advised, since it will then be possible to use the end standing up to connect test probes to check signal path continuity.

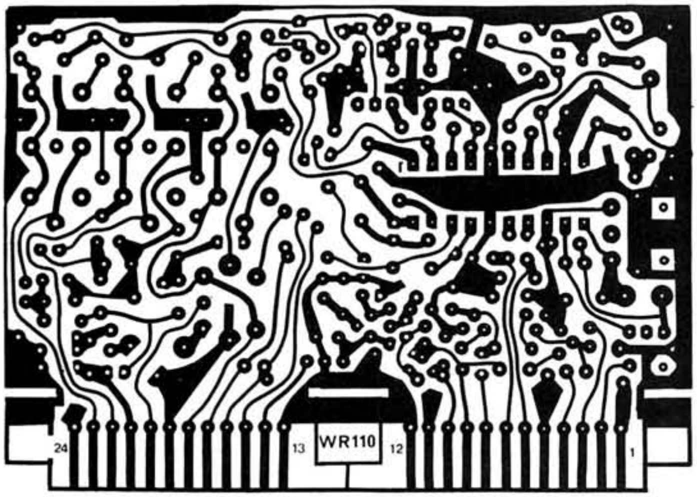
Testing

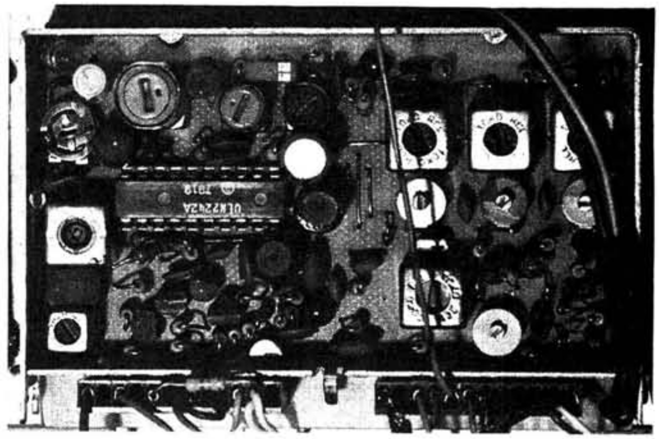
We have now completed construction of the various sections of the complete tuner. Some brief setting up information has been given for the synthesiser section, but for complete checking, the radio must be fully assembled and used in conjunction with all the features of the synthesiser.

Although various aspects of the system are interactive, the synthesiser and radio modules can be used independently if so desired, so the setting up and testing of the radio section should be treated separately in the first instance. This way, faults in the radio construction will not mislead the constructor when a complete system check in conjunction with the synthesiser is attempted.

The f.m. front end can be assumed to be working on arrival, but if you take the lid off to look inside, make sure that you put it back the same way, as the lids are not entirely symmetrical in the UM1181, and can cause the underside track to be shorted out.

The f.m. i.f./a.m. tuner module can likewise be assumed to be working on arrival, but in case you have decided to make it yourself, a few details are included below. You should not attempt to make this section unless you have a signal generator and frequency counter, and are familiar with using them in conjunction with radio fault-finding and alignment.





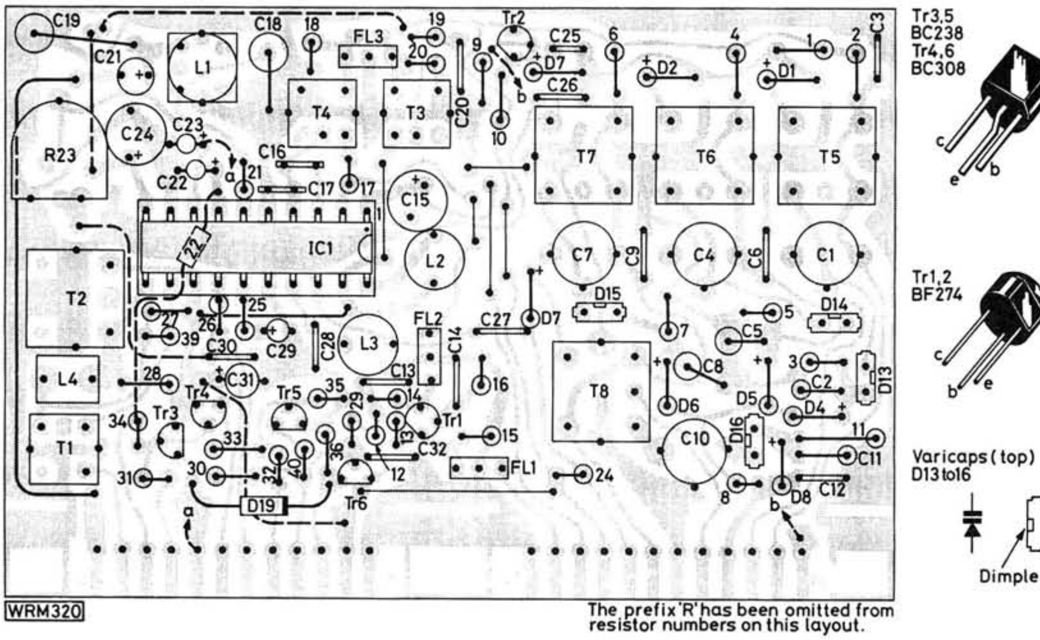
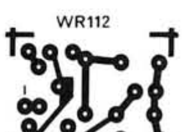
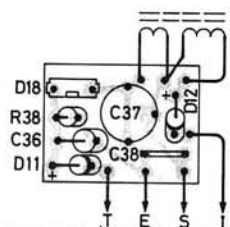


Fig. 31: FM IF and AM Tuner module, showing the p.c.b. pattern (full size) and component layout (approximately 1·3 times full size). The photograph shows a prototype version of the module, which differs in some minor respects from the one in the drawings. The leads to the ferrite rod antenna assembly are connected underneath the board





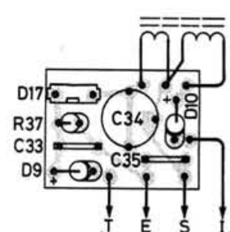
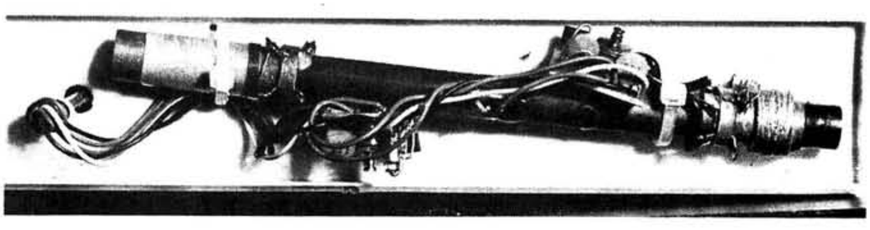
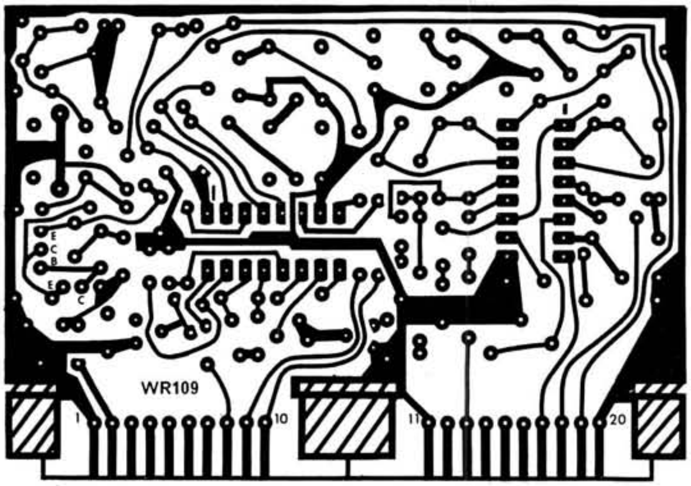
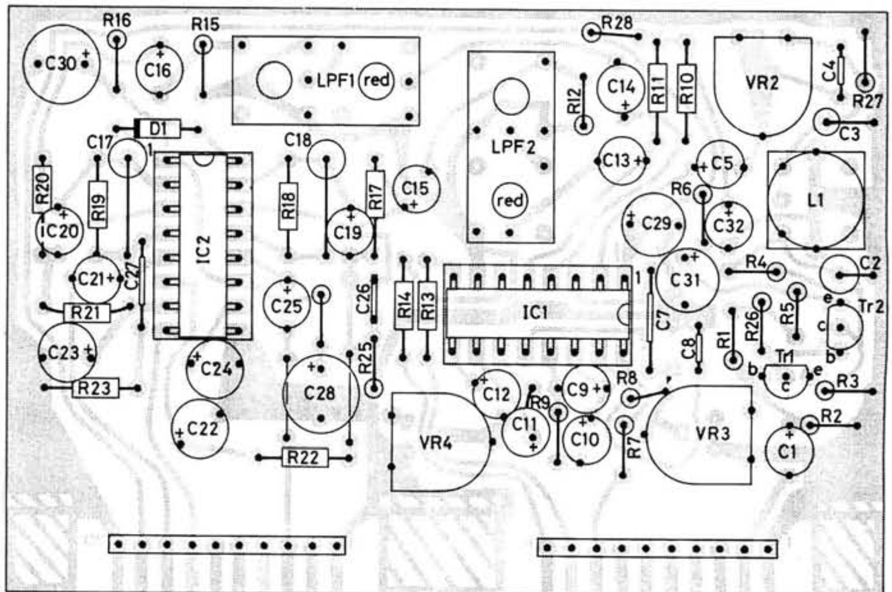


Fig. 32: The ferrite rod antenna p.c.b. pattern and component layouts for the medium-wave and long-wave switching/tuning boards, all shown full size. The photograph shows the completed antenna assembly







WRM319

Fig. 33: The Stereo Decoder and Muting Pre-amp module, showing the p.c.b. pattern (full size) and component layout (approximately 1·3 times full size). The photograph shows the completed module

Aligning the FM IF and AM Tuner

This section should be tested first as an f.m. i.f. and detector, and then as an a.m. radio when the f.m. function is established and working. The unit should be connected up as an f.m. i.f. in the first instance, with an i.f. feed from the tuner head—using a stable 12V tuning supply or a battery. With tuning bias of 2–4 volts, the majority of the local Band II f.m. broadcast stations should be audible. (Remember an antenna!)

The initial switch-on condition should provide smooth white noise at the audio output—with the muting system completely defeated for the time being. (Ground pin 5 of the module.) If the sound is crackling and broken up, then check to make certain that all decoupling capacitors are in place.

A centre-zero meter should be placed across the a.f.c. output (pin 3) and the a.f.c. reference (pin 11), and the detector coil T2 should be rotated for zero offset. If you use a metal trimming tool for this operation, check that the results are the same when you take it out—as it may be necessary to compensate by turning the core a fraction further clockwise before removing the tool. It should be possible to cause the meter to swing from one extreme to the other, with the noise at the centre zero position being the characteristic smooth sound of an f.m. tuner "off station". At either extreme, the heavy d.c. offset in the audio path will cause the signal to be limited on one side, leading to clipping distortion.

An ordinary 12V d.c. meter should be connected between pin 10 and earth, as this is the output of the deviation mute detector. The output should go low when the tuning is swung through the centre of the tuning meter—but remember to disconnect the short from pin 5 to ground to re-enable the mute output, and take pin 8 to ground to disable the effects of the noise mute circuit.

The remaining parts of the muting circuit can be checked by tuning to a station and checking the output at pin 6 of the module. This output is usually high, but goes low when a signal is tuned. The very high gain front end used in this design may possess sufficient noise in the output to cause the mute to operate on inter-station noise alone. In the final system, this is not of too much concern, since the MPU is responsible for the muting whilst tuning is being carried out. However, to establish that this section is working correctly, the mute should go high when the i.f. input is shorted, or the connection from the front end is removed.

Once the noise mute function has been verified, it can be added to the deviation mute by connecting pin 6 to pin 8—or in the case of high-gain front ends, by connecting the a.g.c. output on pin 7 to pin 8, since this output goes low only after some 1000μV of input signal. If the detector persists in displaying a large d.c. offset, check that no part of the a.m. detector transformer secondary is earthed (see Part 2 of this article for a detailed explanation of the mechanism of this problem).

The a.m. section can be checked out by simply leaving pin 15 of the module open-circuit, and grounding the desired band selector. Start with the Long Wave, and tune for approximately 200kHz by adjusting the tuning voltage and then the core of the oscillator coil. See Table 2 for approximate voltage/frequency values. The antenna coil on the rod should be peaked by shifting its position.

Unlike many designs, the Medium Wave is completely independent of any Long-Wave trimming, and so may be treated as an entirely separate entity. Tune and trim at the points shown in Table 2 using the coil at the l.f. end, and the capacitor at the h.f. end with a bit of both in the middle.

Short Wave requires the attachment of a wire antenna at pin 20 of the module. A 10–20pF capacitor should be placed in series at this point, or the loading effect on the SW tuning is too severe for the stage to be tracked with the oscillator. If desired, the SW coils can be substituted by a MW coil for a long-wire type of MW antenna if you are after serious medium wave DX, but then an extra tuned circuit or two in the form of a preselector is a good idea to avoid overload and image breakthrough. A careful design can use the same tuning and switching voltages and still retain its tracking, with maybe a simple "peaking" trimming adjustment for optimisation. In fact, the same basic idea can be carried through to any extension of the front end of such a varicap-tuned radio system.

The major points to watch for when testing this module are simple and obvious things—like the correct orientation of the varicaps and switching diodes. Despite the apparent complexity of the system, a correctly constructed and connected unit can be made to work with the minimum of fuss—provided you have the test equipment mentioned earlier. Playing it by ear can be a lot more long-winded.

The Stereo Decoder

The input birdy filter may be omitted, since this function is carried out by the output filter of the i.f. strip. If correctly assembled, the stereo decoder phase-locked-loop v.c.o. trimming can be carried out by simply tuning to a stereo f.m. signal, and adjusting the preset VR3 until the l.e.d. lights up.

The stereo decoder can be made from component parts with minimal bother, but if you have an oscilloscope and access to alignment equipment, then so much the better. The main alignment consideration here is the accurate setting of the pilot cancel notch, which may be achieved by simply looking at the audio output whilst listening to a stereo transmission, and adjusting the pilot cancel preset VR4 for minimum 19kHz. You will see the 19kHz sawtooth disappear completely at the absolute null point. Since this is a phase adjustment, the correct adjustment of the preceding birdy filter will be interactive, and the birdy filter can only be accurately set up with a sweep generator and spectrum analyser—or by listening for the stereo test tones, and setting the core for maximum separation. A stereo generator could also be used for the purpose if required.

If you are listening to a.m. and there are loud whistles coming through, then remember to use the v.c.o. defeat facility to prevent this problem occurring. Simply using the enforced mono pin will not actually disable the v.c.o. action.

Test the muting action of the output pre-amplifier by placing 4V or so on the muting pin of the module—this effect will be swift and totally silent.

Table 2

Approx. Tuning Voltage	Typical Frequency			
	LW kHz	MW kHz	SW MHz	FM MHz
1·0	—	558	—	—
2·0	—	612	—	90·0
3·0	155	666	—	94·5
4·0	173	738	—	98·0
5·0	191	828	6·2	101·0
6·0	227	999	6·9	104·0
7·0	263	1224	7·8	106·0
8·0	290	1332	8·8	108·0
9·0	317	1476	9·3	—
10·0	335	1557	9·7	—
11·0	353	1611	—	—

Connecting Up

If you have persevered this far through the project, then the moment of complete assembly is at hand. If your synthesiser section is working as far as you can tell from the functions that are independent of radio "feedback", then connect up the entire system as shown in Fig. 10, in Part 2.

Start the final alignment session with at least three hours to spare, and plenty of patience! Things like the correct voltages from the power supply section, the certainty of a working set of tuner modules, etc., are taken for granted. This is no time to start debugging these minor elements of the overall system.

First switch on, see if everything is quite happy, and that there is no nasty "cooking" smell from anywhere. Select MW from the synthesiser control and press the manual tune button until you reach a known local frequency—such as 909kHz. Strong signals should be coming through, and if so, keep going through the band until something goes wrong.

The most likely problem is the loss of lock signal, causing the mute to stay shut at the extremes of the band. This is because it is possible to align the tuner module over a span of tuning voltages so that although on a manual test, the complete 520kHz to 1620kHz range may be covered, the more limited range of tuning voltage available from the synthesiser output may not be enough. Say the unit covers the entire desired frequency span with 1–13V bias, yet the synthesiser tuning voltage is 12·5V maximum. After 12·5V has been reached, the synthesiser will step on, but it will lose lock as the a.m. local oscillator cannot quite squeeze to the necessary frequency.

Adjust the trimmer of the MW oscillator coil until the synthesiser can reach 1620kHz with the voltage output available. The synthesiser will then "go over" and start from 520kHz again. If you find it necessary to do this a couple of times to get the tuning range spot on, load the top and bottom frequencies of each band into the tuning memory (first getting ENABLE to light up—which requires a signal to be present and locked in anyway), and then the adjustment is quite easily performed by recalling each end of the band in turn. You should have no problems with f.m., where the entire tuning span is comfortably within the range of the synthesiser output.

If you get no success at all on a.m., then check the local oscillator output from the module and its connection to the synthesiser. If you continue to draw a blank, move on to the f.m. section to try to determine if the rest of the system such as bandswitching and MPU control connections are in order.

If nothing happens on f.m. either, and you cannot obtain any "locked-on signal", then check that the prescaler supply voltage is being switched on by the switching logic—and make certain the connection is getting through to the prescaler. If you still cannot obtain any working signals on f.m., check the output of the prescaler (the input is a better place, assuming that you have the necessary 100MHz bandwidth 'scope). It is a fairly ragged 10MHz (approx) squarewave, and if it is actually being driven from the f.m. local oscillator, then the frequency will vary if you disconnect the f.m. tuning bias voltage, and reconnect it to a manual tuning system. The low-pass filter at the prescaler output can sometimes be too severe, and if the output of the prescaler after the l.p.f. is heavily attenuated, this can cause problems for the p.l.l. The filter can be bypassed at this stage of the test procedure to see if this is contributing to the problem, although at a later stage, you should refit it (or a slightly less severe version, with reduced turns on the choke), to prevent spurious radiation of harmonics causing birdies in Band II.

If you tune the f.m. to a known Band II frequency, and then set the synthesiser to the same value—check to see if the output of the phase detector of the p.l.l. i.c. indicates a signal that is trying to lock. If there is still nothing doing, but you are getting all the right readings on the display, and the prescaler output seems to indicate that all is getting as far as the p.l.l. input, then the synthesiser control lines to the p.l.l. i.c. may be faulty (bad soldering, bridged joint, etc.). If there is nothing getting to the prescaler, then check the l.o. buffer amplifier stage very carefully.

You will eventually reach a stage when all bands are working—and the last item to sort out is the function of the automatic tuning/scanning. Push the button and see what happens, starting with f.m. The scan stop signal from the i.f should cause the MPU to stop exactly on station. There is no other preset adjustment for the f.m. scanning, and the only problems that arise can be caused by the incorrect setting of the detector coil. If this is so, set the synthesiser to a known local Band II transmission, and check the centre-zero tuning voltage with a meter, as described in connection with the initial testing of this module. The detector should then be trimmed for an absolute null, leading to the deviation mute signal going low exactly on channel.

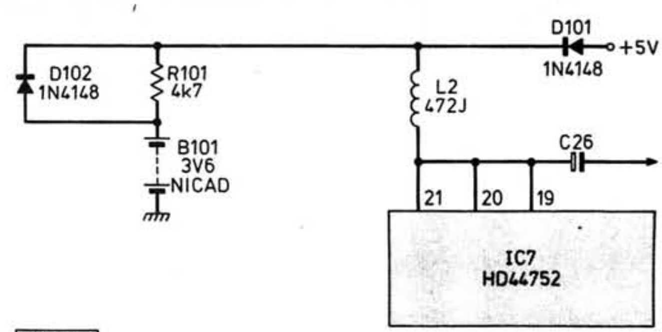


Fig. 34: A simple modification to add battery back-up to the synthesiser station memory

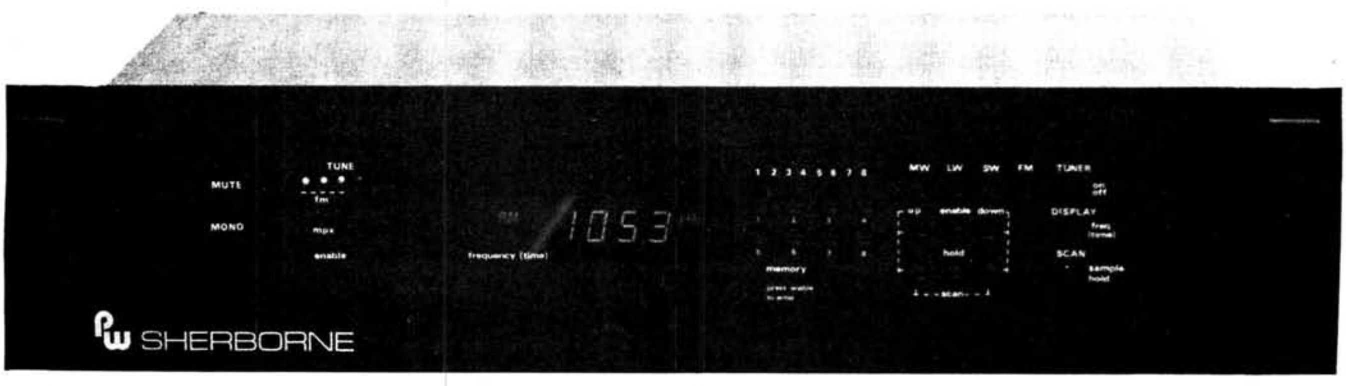
The a.m. scan stop signal is slightly different, and can be preset to stop only on signals above a certain signal level. The preset should be set by experimentation under average listening conditions so that relatively noise-free signals only will cause the scanning to stop. Remember that the MPU will only scan whilst a signal is in lock—so when the scan reaches a band end, and starts from the other end again, it pauses a few seconds while the various filter components on the tuning bias line charge/discharge. Likewise, if the tuner goes out of lock, the scan will stop, and the mute stay shut. The manual tuning controls will still advance the display, but the system will not in fact be doing anything more than changing the readout numbers.

For any additional information on the system or components thereof, you should refer to the manufacturers' data sheets and information. Despite the length and scope of this feature, there is much left still unsaid about other aspects of the system that the more adventurous might like to delve into. For example, the auto rotating m.w./l.w. ferrite antenna, the s.w. converter, etc.

Memory Back-up

For constructors who prefer to switch off their tuner at the mains when not in use, Fig. 34 shows a way of adding a back-up battery to retain frequency and band information for the eight memory channels at all times. It is not possible to keep the clock going since this is controlled by a signal from the p.l.l. i.c. reference divider chain.

The added components are those with reference numbers in the 100 series. Diodes D101 (inserted in the +5V supply line to pins 19, 20 and 21 of IC7) and D102 form a simple gate which connects the higher of the two voltage sources to the MPU. Resistor R101 provides a charging current of around 500µA for B101 so long as the mains supply is connected to the tuner. ●



SOUND ADVICE – SOUND VALUE

A GOOD START is essential to short wave listening and expert advice is important in achieving this – So here's some – If you've made up you're mind to buy a receiver you should be aware it will perform only as well as the antennna it sees. The old adage regarding wire antennas "As long and as high as you can" is still good, but at best is only good for PEAK PERFORMANCE on one or two frequencies, at worst none.

Whichever frequency you tune your receiver to, for PEAK PERFORMANCE on all frequencies you need good matching between your Receiver and Antenna to hear the best from it. If you plan to listen on the high frequency bands up to 30MHz then you know you can't have an antenna for every frequency! Or can you? – Well Not quite! BUT we can offer you MUCH IMPROVED PERFORMANCE from your receiver by using an antenna tuning unit, that will electrically change the length of your antenna to match the frequency you select – In other words – A MATCH AT ALL FREQUENCIES.

You'll see many antennas being advertised under gimmicky names, but when it comes down to it they're only random wires or odd configurations. At the end of the day, if you're expecting the performance the manufacturers want you to have, you'll still have to buy an antenna tuning unit.

Tell you what we'll do – we'll prove it to you – we'll give you one ABSOLUTELY FREE when you buy your FRG 7 or FRG 7000 and we'll give you complete advice on an antenna to suit your available space, which should only cost you a couple of pounds!

So let's put the offer in big print for you!

Yaesu FRG 7 + Amtech 200	**199.00**
Yaesu FRG 7000 + Amtech 200	**£299.00**
Trio R1000 + Amtech 200	**£299.00**
Yaesu FRG 7700S + Amtech 300	**£309.00**
Yaesu FRG 7700S with 2 metres	**£315.00**
Yaesu FRG 7700M + Amtech 300	**£389.00**
Yaesu FRG 7700M with 2 metres	**£399.00**
VAT included	Carriage £3.00

What's the difference between the Amtech 200 and Amtech 300? Well both will tune any random length of wire but the Amtech 300 will do a little extra – it will also match co-axial fed antennas – Their normal selling price, The Amtech 300 £39.95 – The Amtech 200 £25.95 – What can you lose?

So get cracking MAKE A GOOD START! HAVE PEAK PERFORMANCE FROM THE OFF.

JAYBEAM – HYGAIN – BANTEX – AMTECH – CUSHCRAFT – SWAN – ATLAS
and 50 other major lines – all ex stock.

AMCOMM

AMCOMM SERVICES

194A NORTHOLT ROAD, SOUTH HARROW, MIDDX. Tels: 01-864 1166 & 01-422 9585

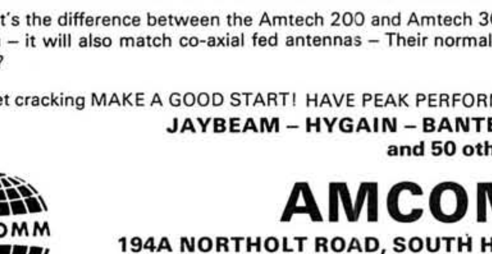
OPENING HOURS: Tues-Sat 9.00-5.30 Sunday by appointment.

YAESU

Zaerix Electronics Limited
46 Westbourne Grove, London, W2 5SF, England.
Telephone: 01-727 5641/2/3
Cables: Zaero, London, W2.
Telex: 261306

INSTRUMENT CASES AND BOXES

a comprehensive, top quality range of products.



Minibox 521 – 563 as used in PRACTICAL WIRELESS

Back-up power supply for a PORTABLE RADIO

Retail supplies are available from—

ELECTRO TECH COMPONENTS LTD.,
364 Edgware Road,
London, W.2.
Tel. 01-723 5667

Minibox 521-563 **£3.00 each** incl. VAT P&P

CB AND AMATEUR RADIO ●
ANTENNAS ● ACCESSORIES
● MAIL ORDER
NEW ● NEW ● NEW

SUPER SLIM JIM – 2 metre omni (LJ2). An even slimmer version of the famous SLIM JIM. An entirely new design by F. C. Judd G2BCX, even more efficient than the original. Only 44 inches long, can be used for BASE STATION or MOBILE OPERATION. Imp: 50 ohms. Completely enclosed and waterproof. Gain 3dB (EIA). Fittings for mast mounting, mobile magnetic or gutter mounting available extra. LJ2 price **£16.00** including VAT, postage and packing.

THE BIG JIM – 27MHz omni – BJ27. An entirely new design – base station antenna for CB radio. Only 9 feet long – no radials. Gain 3dB (EIA). Low angle radiation for local or DX. Two-way 27MHz contacts between the UK and USA have produced S9 plus signals and 10-4 copy. Mast or wall mounting fittings extra. Also tunable for 10M Amateur band. BJ27 price **£67.00** including vat, postage and packing.

THE RED ALERT – VHF antenna checker and RF sensor (ZLS1). Will check any antenna for radiation, correct voltage and current distribution. Repeating audible bleep and visual indication in presence of radiation. Operates any frequency 20-1000MHz. Supplied complete with probe antenna. ZLS1 price **£12.00** including VAT, postage and packing.

THE PERSUADER – Speech Processor (SP15). Increase your talk power by up to 32 times. Average effective speech power gain 15dB. Fully automatic in operation. Red and green indicators show correct operational setting. Operates for SSB, AM or FM. Tailored response for greater readability and harmonic filtering. Suitable all standard mics and rigs. SP15 price **£38.18** including VAT, postage and packing.

DUMMY LOAD – Self indicating (ZL50). Check TX power without radiating. Check co-axial cable runs and antenna match by comparison. Useable with all VSWR meters. Built in LED power indicator. Automatic sensing insures impedance of 50 ohms to within better than 0.5 ohm. Useable power up to 20 watts continuous or 100 watts intermittent. Self VSWR 1 to 1. Frequency limit 200MHz. ZL50 price **£9.00** including VAT, postage and packing.

SAE for further details of above.

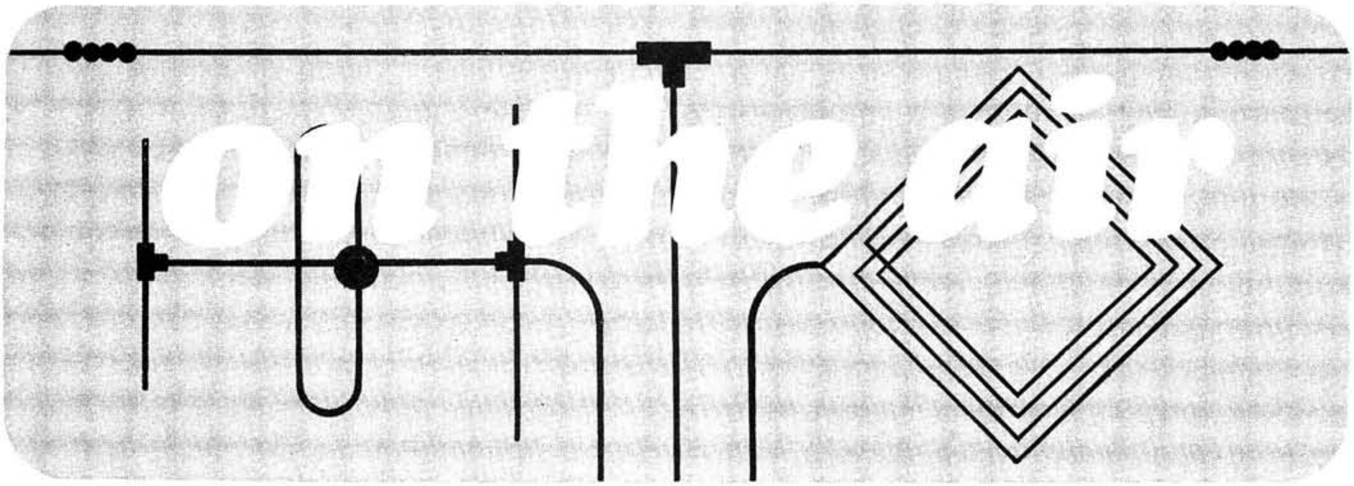
CASH WITH ORDERS ONLY. Cheques, Postal Orders etc., payable to ZL COMMUNICATIONS.**

Wide selection of books on CB Radio, Electronics, Amateur Radio etc. Also CB T-Shirts, badges, car stickers and unique LEARN ALL ABOUT CB cassette tape etc. Send 20p stamp (not SAE) with name and address for full catalogue and accessories list.

ZL COMMUNICATIONS

CANTLEY, NR. NORWICH, NORFOLK, NR13 3RT.
Tel: 049 370 821 (9-5.30 Monday to Friday only).
Callers by appointment only.

IMPORTANT NOTICE
Notice is hereby given that antennas for 2 metre operation called the ZL SPECIAL (series) and the SLIM JIM, which are currently being advertised in various journals as manufactured products, are NOT repeat NOT produced by ZL COMMUNICATIONS. Neither are these antennas approved in any way whatsoever by F. C. Judd (G2BCX), Director of ZL Communications, and who was responsible for their design in the first instance as published in various issues of Practical Wireless and the book "Two Metre Antenna Handbook".



Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

The current debate on the future, or otherwise, of Citizens' Band radio in the UK crops up frequently in letters from readers, opinions usually crystallising into two principal points of view. First, that of younger people, mostly new to the world of radio communications who have, somehow, been led to believe that CB is some miraculous system that will enable them to talk around the world without the bother of having to take and pass an examination.

The second aspect is that of the reader who has experience of short-wave listening and amateur radio, who realises that he is not going to be able to get something for nothing and is prepared to sit the RAE.

The Green Paper issued by the Home Office on the subject of CB, or Open Channel as the HO prefers to call it, suggests frequencies above the u.h.f. TV band, above 928MHz or so. I am personally quite convinced that OC will never be permitted below that frequency and the various CB associations and movements might as well accept this (if the money-grabbing interests will let them). They could then get on with the campaign aimed at getting the Government to implement OC as soon as possible following the November deadline on public comment set in the Green Paper. Let us know soon the precise frequency for the proposed 40 channels, and the mode, not specifically mentioned, but assumed to be f.m.

Clubs and Clubs

Seems this feature does get read by some, judging by the several clubs reporting in this month for the first time. Apart from being a source of knowledge on amateur radio matters generally, a club is often the foundation of lasting friendships and a centre of allied social activities for all the members of a family. It is also the means of avoiding being completely dedicated to the hobby to the extent of neglecting one's family and social responsibilities.

Ipswich RC. Exciting news for members, with the acquisition of a clubroom at the Rose & Crown, Norwich Road, Ipswich, with meetings on the second and last Weds of every month around 8pm. The previous HQ in a school imposed severe restrictions on club activities. However the school will still be used on other Weds for less formal meetings and for code classes. Incidentally, the new clubroom is separate from the bars of the pub so juniors need not fear if they want to barge in and join the club. Contact: Jack Tootill G4IFF, 76 Fircroft Road, Ipswich IP1 6PX, or ring him on 0473 44047. Club magazine *QUA* lists an interesting talk on assembling an amateur radio station, by G4GVW on Dec 10.

Wolverhampton ARS. In the list for the first time, meets every Monday, 8pm, at Neachells Cottage, Stockwell End, Tettenhall. Club station is G8TA. Unusual activity for 2m addicts is a regular DF hunt run on Sundays. All you want to know from John Cook G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton WV3 8HN.

Mid Lanark ARS. Friday nights at 7.30 finds the club in session at the Wrangholm Hall, Community Centre, Jerviston Street, New Stevenson, Motherwell, with club station GM3PXK. Maybe in time (if *PW* is early), is the bring, buy and swop night on Dec 5, with the 19th being devoted to a film night. Try club Sec Doug Smillie GM4FKD at the club QTH.

Exmoor RC. Now has club call G8SSS, 15 licensed members and six passes out of seven candidates in the last December RAE, the lazy fellow passing in May. Mike Jemmison G8RZE runs the club RAE courses, obviously very well indeed, while XYL Pat, taking the next RAE, is club Sec at Homedale, Brayford, North Devon. Dare she **not** pass?! Oh, yes. Club meets 7.30pm every Thursday at Loughrigg, East Street, South Molton with ladies in particular being especially welcome.

Stevenage & District RS. RAE classes already under way, one for absolute beginners and the other for those with a fair knowledge of electronics. What a good idea! Other clubs please copy! After the bigheads have passed their RAE the beginners move up to the advanced class and so on. Worthy of mention are Frank Collet G3OVT organiser, with help from Pat Higham G8JLM and Cliff Barber G4BGP. Meetings Tuesdays 7.30pm at British Aerospace Dynamics Ltd., Plant B, Staff Canteen. Membership costs a mere £3 a year which can't be bad value for money. Trevor Tugwell G8KMV, 11 The Dell, Stevenage, Herts will help further.

Verulam ARC. Lovely to hear from Mary Claytensmith G4JKS, 115 Monshalswich Lane, St Albans, Herts AL1 4UU about the club which meets fourth Tuesday of each month at the Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger near St Albans at 7.30pm. December 16 is AGM and Christmas Social, in that order! Informal meetings on second Tuesdays at the RAFA Club, Victoria Street, St Albans.

Bournemouth RS. Club call now G2BRS and not G3FVU. Meets in the clubroom of the Dolphin Hotel, Holdenhurst Road, Bournemouth at 7.30pm with next meeting on Dec 7 being a skittles event versus South Dorset RS. Radio controlled ones, of course! Very interesting will be a sale of equipment on behalf of the RAIBC coffers which "may take several sessions," says their Newsletter. Not to be missed. Recent change of secretary means writing to Glenn Lloyd, 4 Gorleston Road, Parkstone, Poole, Dorset. I've heard of Poole before, somewhere!

Edgware & District RS. Meets second and fourth Thursdays 8pm at Watling Community Centre, 145 Orange Hill, Burnt Oak, Edgware with other activities like a club net on 160m, slow Morse practice, also on Top Band from G3ASR, the club station call, plus code classes before each meeting at speeds to suit those present. Coming up is a junk sale or, to put it a little more delicately, a sale of equipment surplus to requirements. It's surprising what bargains one can find at a junk sale! This one is on Dec 11. Very sorry to learn from the *Edgware Ham News* of the death of Doug Findlay G3BZG, long standing supporter of the club and RSGB president in 1957. More info on the club from: Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx or try 01-952 6462.

RAIBC. Not a local club as are others reported in this column but a national one for the blind and/or invalid amateur or s.w.l., plus its many supporters, like Audrey, the XYL of Eric Payne G4FHE, who has recorded onto tape the whole of the *Guide to Amateur Radio,* to be copied for the benefit of blind members aspiring to a licence or for beginners to the hobby. This item culled from *Radial,* the club's magazine. Club Secretary is Frances Woolley G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton, Surrey KT6 4TE.

Meirion ARS. New this year, the club has an excellent programme organised right through to next April with the annual dinner on Dec 13. So it's the first Thursday of the month at the Ship Inn, Dolgellau at 7.30pm. New members and visiting folk most welcome. PRO is Dave Morgan GW8PKA, Penybont, Gellilydan, Blaenau Ffestiniog, Gwynedd or ring Maentwrog 341.

Wirral ARS. First and third Weds, 7.45pm, Sports Centre, Grange Road West, Birkenhead, but regret that excellent newsletter does not give events for December. PRO Gordon Lees G3UJX, 30 Manor Drive, Upton will be glad to fill you in, or ring 677 1518.

Hastings Electronics & RC. Active again in recent years after long absence, now with club call G6HH (you've guessed it! Happy Hastings!) and interests covering all aspects of electronics besides amateur radio. Membership no less than 130 which speaks well for the efforts of chairman Terry Ransom G4FET. Own club premises at 479 Bexhill Road, St Leonards, but size of membership means meetings third Wednesday of the month, 8pm, at West Hill Community Centre, Croft Road, Hastings. If you want to play around with the rig then its Bexhill Road every Friday evening. Try Secretary Derek Edwards G8RYG, 214 Hillside Road, Hastings for latest news of events. Should mention club has well-written and properly printed leaflet about the club for intending members, plus ditto monthly magazine *Vital Spark,* which all helps to swell the numbers.

DX Time

The SRX-30 plus dipoles of **Basil Woodcock** BRS44266 (Leeds) seems to have been working overtime, especially on 10m where the log showed the VP8SB and VP8SU, FP0FXP, VQ9TT, VS6CT, S79MC, 3B8CF, 3B6CD, ZE1AR and 9K2EW. Three goodies on 20m were 5V4HD, 8R1RBF, and S8VT whose QTH I'd like to know. In Chadderton, Lancs, 14-year-old **Mark Ryder** BRS43580 concentrated on 20m to find FG0FIS/FS7, FK8DH, FO0CT, HV3SJ, P29CH, S8AAP (there it is again!), VK2AGT/LH (Lord Howe Is), VK9NC, VK0KH, VP2AZE, VP8PP, 6W8FZ, 8P6BX plus 9X5DR. Nice ones on 10m were HH2FH, HK0FBF, VK5RD/VK8 and YS9RVE. Bravely, Mark says he will forego the December RAE because of schoolwork. All the better to ensure a pass OM!

A *PW* amateur bands' receiver plus preselector fed from a G5RV aerial enabled **Paul Flatman** (Ipswich) to dig deep on 21MHz and 28MHz rather than 14MHz which he found patchy. So 21 looked like D68AP (Comoro Is), HS1AMM, FG0FIS/FS7 (QSL K6LPL), J3AH (QSL W2GHK), J6LFH, TJ1AJ, TU4AT, VP5TCI, XT2AW (QSL KN1DPS), YB0CR and YC1GJ. Obliging on 28 were C5AAJ, FM7AV (QSL F6BFH), VP2MPB (QSL W5STI), ZS3KC, 5N8THG and 9J2BO.

Just 200 yards away from Mark Ryder, mentioned above, lives **Mike Howard** with his DX-160 and "XJK" aerial, said to be related to the W8JK (Info please! he screamed) which got plenty of DX on 20m like FH8OM, H44SH, KS6BK, P29CH, TR8DX, VK0KH, VQ9PA, T3AC (Kiribati Is), 3D2FJ and 8Q7BB on the Maldives. On 15m it was FO8EM, TU4AT, ZF1MA, 5N2LED, with A22AJ, VS6GC and YS9TE on the 10m band. Mike reckons the BV2A heard on 14 175kHz is a phoney, so be careful.

Complaints of the confusion over American callsigns are well founded and the only answer is to listen well and get the QTH! I really must try to publish a list of the present situation over there, as those who are using old call books to check calls are in a right mess!

Allan Stevens (Crowthorne, Berks) is still toying with the idea of a commercial up-converter, but used his regular set to copy AI5P/SV5 in the Dodecanese (that's a W!) on 10m for a very rare one plus VP2KAQ, VP2SAM, ZP5CPE, 7X4MD on 15m. **Dave Coggins** in Knutsford, Cheshire, persisted with his phased verticals and FRG-7 to find CE9AF, FP0FXP, FR7BP/T for an excellent one on Tromelin Is, VP8JB, YJ8NPS and 3B8DB on 28MHz; H44JB, KC4USV on McMurdo Base in Antarctica, T2AAA on Tuvalu Is, plus XYL op T2XYL, TR8DX, and VK9NNW on Norfolk Is, copied on 21MHz, not to mention HL9WP, KC4USV again and VK0KH on 14MHz. Down to 7MHz where C31LU, EP2TY, FM7AV and VK3XI appeared, the last around 7095kHz. Yet lower to 3·5MHz to catch UA9AZO and 4X4VE.

As he knew I was holidaying, **Bill Rendell** of Truro kindly kept his log to two entries this month. How kind! But I'm glad you didn't all do that. They were VP8SB on 20m whose c.w. was "very crisp and very, very fast," says Bill, and FR0FLO on Reunion Is, which was a new prefix and new island captured on 15m. A continuous process of updating his HRO keeps Bill pretty busy. In Hull, **Colin Frankland** was satisfied with his month's listening on his Trio 9R59DS with indoor dipoles and Codar PR30 preselector netting EA9IE, J6LDZ on St Lucia, 3D6BP, 5H3FW and 9G1JX on 21MHz while 14MHz produced FP0FXP, J6LDB, PA0FM/PJ3 and XE2AX.

Between swotting for the RAE and copying the slow Morse from G4RS, **Robert Heeley** of Mansfield, Notts, has managed to copy some DX on his FRG-7 to which he has fitted a Microwave Modules 2m converter but we'll ignore that! 10m came up with C5ABK, SU1AL, 3B8LH, and H44WH and AM, with TG9NR for 40m. Problem for Robert is lack of space for a decent aerial so has got down to wire wound on broom handles but it works, he says, aided and abetted by an a.t.u.

Dave Dhuglas GM4ELV of Arrochar, Strathclyde, kindly left his Argonaut QRP rig alone long enough to drop me a line on his DXing achievements with a couple of watts or so, but is very disappointed at lack of any reports from G-land on his c.w. He has abandoned his s.s.b. gear and concentrates entirely on QRP c.w., like CM2ER, CP6EL, CX5CH, HI8VBR, lots of Ws, LU3EEG, PY1HQ, VE1HK, VK6LK, VP2AZG, VP8QG, KB2DF/VP9, YV1DOB, ZP5CD, 4Z4DX, 5B4PA, 6W8AR and 9G1EL, **all on 40m** which is an amazing performance in two-way communication. Dave's YL is studying for the RAE and Dave is off to university to gather up a BA. Best wishes to them both.

A family bereavement has kept **Bernard Hughes** BRS25901 of Worcester away from his receiver for a while. Our condolences OM. 80m came up with some nice catches indeed such as A9XCE, A35TW, CE5BYZ and OX3CO. Up to 40m for FM0FJE, FM7AV, TR8DX and 7X4MD, jumping up to 10m for CE9AF, FR0FLO/T, HK0FBF, K5LBU/ST0, 8Q7BB and lastly 9U5AY.

In General

Quite a few notes and telephone messages from regulars who had passed their May RAE and had been eagerly awaiting their calls. Like **John Dainty** of West Wickham, Kent, who studied on his own for around a year and is an invalid to boot. He is now on 2m with his new call G8YLF, and code practice is under way for a G4 before long.

Arthur White of Aisby near Grantham, Lincs, is an excited G8XYX who has already reached a code speed enough to qualify for a G4. Seems Arthur's teacher G3ZOA is delighted to have got his XYL through the RAE, too, and she is now G4KOA! How about that! For the moment Arthur has a KDK FM-2016E on 2m with a four-element beam at 40ft. Like many others, Arthur complained bitterly at the three months wait before hearing the RAE results followed by a further two months before his licence came along.

In Talgarth, Brecon, Powys **Rod Williams** BRS43353 became GW8YPR and started by charging around the local mountainside with his hand-held Icom IC-2E working people all over the place. From home, using a Slim Jim aerial, Rod has been accessing a repeater 70 miles away.

Located in Haverfordwest, Dyfed, **Royston Price** had waited six weeks for his call at the time of writing, his Trio 7600 all ready to go on 2m. He suggested the RSGB should have sent some of its staff to help out the Home Office staff in issuing the licences!

Getting his feet wet on 20m with an f.e.t./i.c. super-regen receiver, 15-year-old **Stephen Pratt** of Abingdon, Oxon, calls himself a relative newcomer to amateur radio, so welcome to the club. The RAE in December is the next target for Stephen so best wishes OM. **Jeremy Pursall** of the North Bristol ARC writes for the first time although he has been DXing around for four years. Being a trainee communications engineer he does not anticipate any trouble with the RAE very soon. Set-up now is a DX-300 but comments: "Bristol is an amateur radio drop-out when it comes to decent shops", so please note, any retailer thinking of a new market for his bits and pieces!

From **G. A. Cartwright** in Wolverhampton comes a very interesting description of his adventures in YU-land, where he accidentally came across a couple of their clubs where he was made most welcome. Anyone wanting further info, perhaps going there next year, should contact G.A.C. at 1 Patshull Road, Albrighton, Wolverhampton.

A personal appeal. I love getting all your letters and logs but **please** put your full name and QTH on every letter because if you do not I have to go wading through past files to locate the info. I manage to remember those who have been writing for many months past but as someone is reputed to have said: "there's an end to it". Ta!

Letters and logs on DX, etc., by the 15th of the month, general letters any time. Time to say "Happy Christmas" to you all and your families, who, hopefully, will get into the festive spirit and come up with plenty of nice gear for the shack. Now for my favourite Christmas joke! Wife bought the OM two RSGB ties for Christmas. He came down Christmas morning proudly wearing one, "and what's wrong with the other one?" she asked!

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS
132 Segars Lane, Southport PR8 3JG.

Interference from broadcasting stations is the main obstacle to successful medium wave DXing. The loop aerial offers one solution to the problem but there are occasions when it doesn't help. If the interference (QRM) is coming from the same direction as the DX or from the exact opposite direction, then it will not be possible to null-out the QRM and leave the DX. A loop has two nulls 180 degrees apart! What can be done then? One possibility is to listen for DX in those parts of the band where it can be found in-between European stations, and a quick look at the 1978 Geneva Plan will reveal where they are.

Channel Spacing

In North America the channel spacing is 10kHz starting with 540kHz and ending at 1600kHz. This is the system in use at the moment and it is in operation in Central and South America as well, including the Caribbean (ITU Region 2).

The Geneva Plan starts at 531kHz with 9kHz spacing between stations and it continues right up to 1602kHz, yielding a total of 119 channels against the 106 in Region 2. The two systems co-incide every 90kHz starting at 540kHz, then 630kHz, 720kHz and so on up to 1530kHz.

DX Slots

There are also pairs of frequencies across the band where channels of the two systems are farthest apart, the maximum frequency difference possible being 4kHz. These too, occur at intervals of 90kHz beginning with 580kHz/590kHz, then 670/680, 760/770, etc., to 1570/1580. These are the DX slots where Region 2 broadcasts may be heard reasonably clear of interference from European all-nighters, and there are surprisingly, 24 of them. Not every one will yield DX or be free of QRM, but you will greatly increase your chances if you investigate them.

What to Listen For

The following is a selection of what can be heard, starting with two powerhouses; WNEW in New York City on 1130kHz and WCAU in Philadelphia on 1210kHz. Search for VOCM St John's Newfoundland on 590kHz, WJR Detroit on 760, WABC New York 770, WHDH Boston 850, CBH Halifax 860, CBM Montreal 940, WBZ Boston 1030, WERE Cleveland 1300, WLOB Portland 1310, WEGP Presque Isle 1390, CKLM Laval Quebec 1570 (in French).

Among the many Latin Americans around are Radio Jornal in Rio de Janeiro on 940kHz in Portuguese, Radio Vision in Caracas on 950 and Radio Coro 1210 (both in Venezuela), three Colombians, Radio Vision Barranquilla 1220, Radio Vision Bogota 1310 and Radio Universal Barranquilla 1400, and the lone Fort-de-France in Martinique which is on 1310kHz in French.

All this may sound rather complicated and the newcomer might well feel that it is just as easy to tune around the band. DX can be heard that way but it will be time-consuming if you are going to investigate every weak signal, and your rare North American might turn out to be AFN in West Germany.

To be successful the medium wave DXer has to be persistent and ingenious, but there is some satisfaction to be had when one "beats the odds". There are other ways of doing this such as listening early in the morning, but more about that next time.

Loops

There are still a few experimenters about, one of whom is **Andy Small** of Barking. He modified the standard "40 inch" loop aerial with rather surprising results. He writes: "The single inductance turn has been omitted and a length of wire is taken from the earth side of the tuning capacitor to the aerial socket on the receiver—it takes only a few minutes to modify your existing loop. The signal strength is far superior to that from the inductance winding and the tuning is equally sharp. The null works very well also and I would say that this is like having a long wire antenna with all the properties of a loop aerial." Andy then invites my comments on the set up, which is shown in Fig. 1.

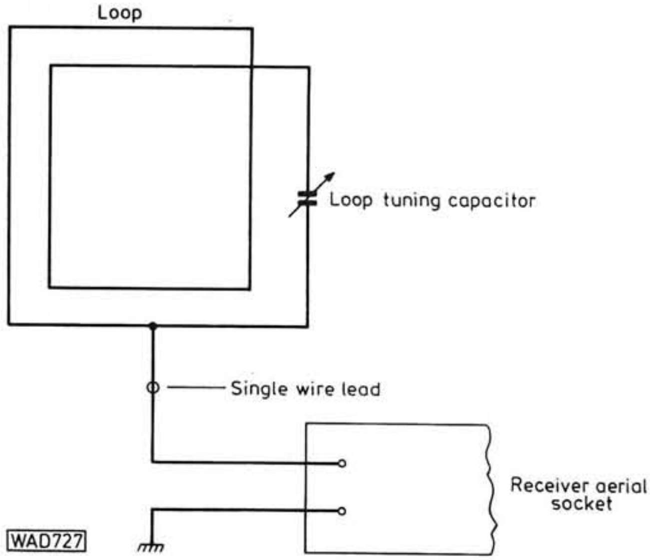
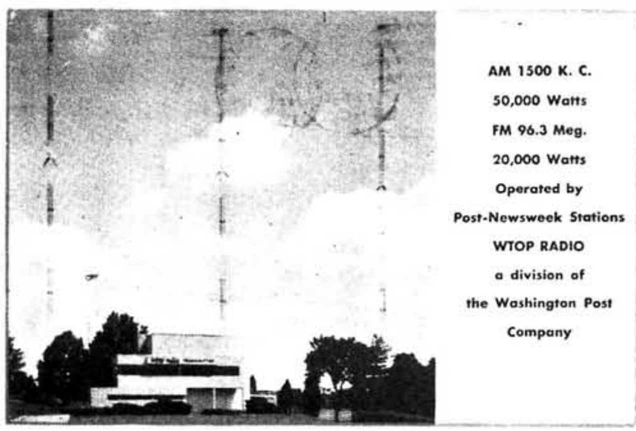


Fig. 1: The direct-coupled loop arrangement proposed by Andy Small

The "aerial" consists of the loop together with the new single wire lead to the receiver. The latter will still pick up signal when the loop's null is pointed towards QRM and the overall effect will be to degrade the null i.e. it will be impossible to null-out a station completely though it may be feasible to reduce its strength to a lowish value especially if the lead is kept short. If you are nulling out a station to get better reception from another one on the same frequency then the residual pick-up by the "downlead" may not be noticeable. It is worth noting however that the additional pick-up required to give the increase in signal strength must be coming from the downlead so you are faced with a compromise between a stronger signal and an inferior null.

The QSL card of WHN New York City



Station WOTP, Washington DC's QSL card

Readers often write to me asking what sort of results will be obtained from various aerial configurations. My answer is always the same—try it and see. Theory is only there as a guide and if we could predict exactly how equipment will perform or what propagation will be like on any particular date then a lot of the fun would go out of DXing on the medium waves.

DX Heard

A good log of North American DX comes from Andy Small who used his Hammarlund SP600JX and modified loop to hear CBM in Montreal on 940kHz, CHER in Sydney, Nova Scotia on 950, WHN New York City on 1050 WEGP Presque Isle in Maine on 1390, CFGO Ottawa 1440, WTOP Washington DC on 1500 and WITS Boston on 1510kHz. Andy has now logged a total of 24 North Americans since making his debut on the medium waves one year ago.

Reader **Bernt Erfjord** of Kvinesdal in Norway has been trying his luck with UK local radio DXing. He reports hearing both Radio Metro and Radio Clyde on 1152kHz and Radio Tees on 1172kHz. The receiver is an FRG-7 with long wire antenna and Bernt has been at the controls now for some two years.

From Malaysia comes a log from 18-year-old **Jeffrey Seow** who "put a few turns" round the ferrite rod aerial of his portable receiver. Stations heard included the Voice of America on approximately 1400kHz at 1310 GMT, the BBC on approx 1190kHz at 2250 and the VOA again on approx 1099 at 1138. Jeff wonders if anyone can suggest what he was listening to. Well, the BBC broadcasts from Cyprus on 1413kHz and from Oman on 1296kHz, but even allowing for poor receiver calibration we are a long way from 1190kHz. So far as I know the VOA does not broadcast near 1400kHz or 1099kHz.

It is risky interfering with the ferrite rod aerial as many receivers are designed to operate with the pick up from this alone. If you apply a larger signal than normal to the aerial circuit there is a risk of overloading and spurious responses. Suggest you try to get hold of a crystal calibrator Jeff so that you can get a more accurate estimate of frequency. Jeff would love to hear from readers of his own age; his address is: 1 North Avenue, Fettes Park, Penang, Malaysia.

A good opening to North America occurred between September 27 and October 3. **Nick Hall-Patch** of Victoria BC on the west coast of Canada reports hearing the BBC on 648 and 882kHz and West Germany on 756kHz. A tape of an unidentified station on 1017kHz logged at 0321 GMT on October 3 and sent to me for information is certainly Istanbul, which really is a good catch from Nick's QTH. An excellent start for North America for this winter.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

Reports: as for medium wave DX, but please keep separate.

Until recently one of the problems facing the short wave listener was how to find the station he wanted to listen to. It is possible to pick up a broadcast on the medium and long waves just by setting the pointer to its frequency or wavelength as marked on the tuning scale. Many scales indeed have station names printed on them. Things are very different on the short waves. Many more stations are packed into the tuning scale so that the unfortunate listener will be lucky if he manages to get within 100kHz of the channel he is looking for.

Tuning Aids

Broadcasters are aware of the problem and some of them put out a distinctive interval signal for a few minutes before the start of a programme. All the listener has to do is to tune across the correct band until this signal is heard. Set manufacturers too try to help. Bandspread scales are provided on some receivers which spread out each international s.w. band. Others have logging scales from which the s.w.l. can prepare graphs of frequency against log scale readings if he is keen, or more likely, just keep a note of the log readings of stations that interest him.

Digital readout of course solves the problem completely, but at the moment it is only the more expensive modern receivers that have it. What can be done to help the owners of the large numbers of receivers still in use that do not have digital readout? A crystal calibrator will go a long way to easing the problem. Although not as convenient to use, the calibrator, which is an accessory and can be used with any receiver, will provide results just as accurate as digital readout.

Crystal Calibrator

This device is really a miniature crystal-controlled radio transmitter whose output is rich in harmonics so that it generates "marker pips" right across the short waves. The calibrator is connected to the set in place of the aerial and it may even contain a switch to enable this to be done easily. A simple calibrator with an output of 100kHz would produce markers at 100kHz intervals across the bands up to and perhaps beyond 30MHz. These will be picked up by the receiver where they will appear as unmodulated carriers, or if the calibrator is modulated, by a carrier with an audible tone on it.

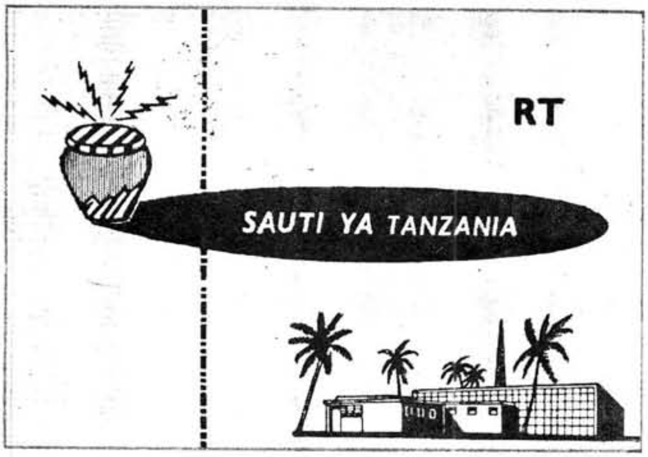
A calibrator with a single output is of limited value. It is more useful to have one with several outputs, like the one offered by Cambridge Kits, who advertise in *PW*, which has separate outputs of 1MHz, 100kHz and 25kHz. When the 1MHz output is used there will be markers on every MHz, i.e. 2MHz, 3MHz and so on across the scale. If the 100kHz output is used there will be markers at 100kHz intervals and the 25kHz output will generate markers at 25kHz intervals right across the spectrum.

Using the Calibrator

How is the calibrator used? Suppose you want to set the receiver onto 9750kHz in the 31m band. Use the calibrator's 1MHz output and locate the 9MHz marker using the receiver tuning scale. It ought to be accurate enough for that! Now switch in the 100kHz output and tune to the 9100, 9200 markers in turn, continuing until you reach 9700. Now turn on the 25kHz output and tune past 9725 to 9750kHz and there you are. If you are looking for Radio Bagdad (reader **R Edwards** please note), then you are only 5kHz away from it and if you tune back slightly you should find this station easily.

It would of course be more convenient to locate 10MHz and then tune down in frequency until you come to 9750, and this is probably what most people would do once they have had a little practice using the device. Similarly, if you want to know the frequency of the station you are listening to, simply switch in the calibrator, locate the nearest 25kHz marker, then the nearest 100kHz and 1MHz markers and you can work it out. A little more complicated than setting the receiver on a chosen frequency but again, a little practice is required to get the feel of using a calibrator.

A rather attractive QSL from Tahiti



Radio Tanzania issues this QSL card

The long-awaited QSL from Uganda

I used a calibrator with outputs of 1MHz, 100kHz and 10kHz for a number of years but confusion can arise when using the 10kHz output as there are so many markers. Some users prefer 25kHz to 10kHz for the lowest output as it should not be too difficult to estimate frequency between two 25kHz marker pips.

Time Signal Stations

The 9th edition of a *List of Time Signal Stations* has just come to hand. It is a 50-page illustrated booklet written in English which contains lists of time signal stations in frequency order and also by country where details of the "programme" are given. The introduction is rather interesting as it explains the different time scales in use such as Ephemeris Time, Atomic Time and Sidereal Time, as well as the definition of such an unlikely quantity as a leap second. Copies are obtainable from Gerd Klawitter, D-4430 Steinfurt, Ochtrupper Str 138, Federal Republic of Germany for 6DM or 7 International Reply Coupons (available in main post offices).

Radio New Zealand

RNZ is coming in well on 15 485kHz in the early morning. **Bernt Erfjord** (Norway) picked it up at 0600 with his FRG-7 and long wire antenna, **Alex Dowie** (Hove) heard it between 0540 and 0700 on his Lowe SRX-30 plus 66ft long wire and **David Appleyard** of Uppsala in Sweden logged it at 0500 with his Panasonic DR49 and 25ft long wire. David also heard it between 1800 and 2000 with a lot of QRM from Radio Pakistan. **Simon Baird** (Taynuilt Scotland) lay in bed listening to a RNZ sports report on his Panasonic RF2200 and telescopic antenna. "Even the XYL who could not be described as an enthusiast, was impressed." How to live dangerously at 0630 on a Sunday morning!

Tony King of RNZ tells me that 15 485 has been providing quite phenomenal reception in Europe around 0400 to 0600. "The beam in this schedule will be via Australia on this frequency."

DX Heard

The time signal station BPV at Shanghai is reported on 10MHz by reader **B. S. Robertson** of Oxford, who heard it at 2000 on September 22. The identification came verbally in English and as "BPV" in Morse. Two other exotic catches heard were Tahiti on 11 825kHz at 0630 and Tanzania on 5050kHz. Tahiti was heard on a number of ocasions early in the day last winter on this frequency; QRM permitting, this is the time to get a QSL from the South Pacific. Listen for the interval signal on the hour. It is quite distinctive, being a Tahitian flute with drums. Many thanks to our reader for lending his QSLs from these stations for publication.

Our Norwegian reader Bernt Erfjord picked up the Singapore Broadcasting Corporation on 5052kHz in English at 1600 until close down at 1630. Also heard were a number of Latin Americans around 0300, the most conspicuous being Ecos del Torbes in Venezuela on 4980 and Radio Sutatenza in Colombia on 5095kHz. Alex Dowie asks about Western Samoa, but unfortunately this country does not broadcast on either the short waves or the tropical bands. The final word is from B. S. Robertson, who much to his surprise received a QSL from Radio Uganda (15 325) after some 13 months, which he reckons is even longer than from Chile.

VHF Bands

by Ron Ham BRS15744

Reports to: Ron Ham BRS15744
Faraday, Greyfriars, Storrington,
Sussex RH20 4HE.

Among the many fascinations of operating during a v.h.f. opening is wondering whether the other bands are better from a DX point of view than the one you are using, and how best to determine the geographical extent of the prevailing disturbance. Such was the case on October 3, when, for a few hours during a lengthy spell of good tropospheric conditions, both the v.h.f. and u.h.f. bands really opened up, a situation duly exploited by most of my readers.

Fig. 1: A solar burst recorded by the author during the mid-day observation on September 30

Solar

Cmdr Henry Hatfield, Sevenoaks and I recorded a 3-minute burst of solar radio noise, Fig. 1, at 136 and 143 MHz respectively, during the midday observation on September 30, and earlier in the morning, Henry, using his spectrohelioscope, saw a large flare take place on the west limb of the sun. We also recorded small bursts of radio noise on October 3, 8, 12, 13, 14 and 17 and mild noise storms on days 9, 14 and 16. On the 9th, Henry observed six sunspot groups. The one near the east limb had about 20 spots, while another was a long chain with about 18 spots. At 1124 he watched a triple flare occur in one group and 16 minutes later the radio noise storm began. **Ted Waring**, at his observatory in Bristol, counted 32 sunspots on September 26, 37 on the 29th, 19 on October 3rd and 50 on the 15th. There is little wonder that, with solar activity like this, the BBC World Service reported ionospheric disturbances during the early hours of October 5 and 12.

The 10m Band

On September 23, 24 and 25, **Harold Brodribb,** St Leonards-on-Sea, heard many s.s.b. signals from stations in Canada and the USA, and at 1030 on the 24th he listened to both sides of a QSO between VK6HPF and W4TFB. With the band open again, Harold identified a variety of harmonics between 28 and 31MHz coming from lower frequency broadcast stations in Alma Ata and Moscow. Like myself, Ted Waring received signals on most days between September 20 and October 15, from the International Beacon Project stations in Bahrain A9XC, Bermuda VP9BA, Cyprus 5B4CY and the two South Africans ZS6DN and ZS6PW. On October 7, **Harold Goble** G4FDQ, Lancing, worked into Guam on s.s.b. and at 1437 on the 10th he contacted a station in Albuquerque, New Mexico, commemorating an International Balloon Festival.

While mobile on October 1, **Stan Williams** G3LQI/M, using a TS-120S, a G3RVM Iambic keyer and a helical "G" whip aerial mounted on the boot of his car, worked N4BP who was running 5 watts from a solar-powered rig. Stan's main interest is h.f. c.w. mobile, and between October 1 and 11 he worked several stations in the USA, one in Alaska and a VP8. On Sunday the 12th, he parked his car outside the radio building at the Chalk Pits Museum in Sussex and made c.w. contacts with five JAs on 15m and three Ws and a VE on 10m, Fig. 2.

Fig. 2: G3LQI/M operating c.w. at the Chalk Pits Museum

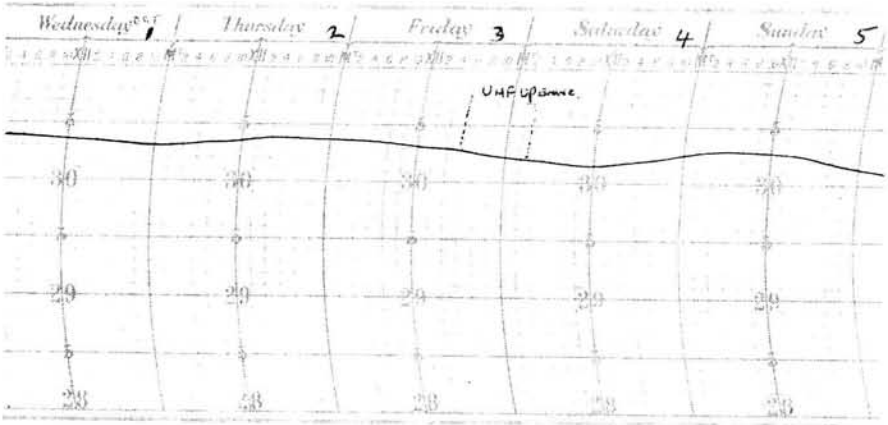
The Brownlow family were also at the museum on the 12th and once again delighted the visitors by showing them how an amateur radio station, G3WMU/P can communicate with other parts of the world, Fig. 3.

Fig. 3: G3WMU watches his son Pete G4ESC operating at the Chalk Pits Museum

Tropospheric

The atmospheric pressure rose sharply from 30·1in (1019mb) at midday on September 28 to 30·3in (1026mb)

Fig. 4: Barograph chart recorded by the author, showing the change in pressure that caused the extensive tropospheric disturbance on October 3



at noon on the 29th and then rose a little more to 30·4in (1029mb) during the evening of the 30th where it hovered, giving good v.h.f. conditions, until about 0200 on October 3. Then a gradual fall began and as expected, there was an extensive tropospheric opening, mainly affecting the u.h.f. bands, between about 1600 on the 3rd and 0300 on the 4th, Fig. 4.

For most of the time from September 28 to around midnight on October 3, I received signals averaging 529 from the 70cm beacon at Sutton Coldfield GB3SUT, with only a dipole feeding my receiver. This signal peaked to 559 at 0740 on October 1 and 599, during the peak of the opening, at 1920 on the 3rd. Throughout the period I heard signals at varying strengths from the Bristol Channel GB3BC R6 and Birmingham GB3BM R5, repeaters. and periodically a selection of continental broadcast stations in Band II. **George Grzebieniak,** London, heard 2m signals from F and PA0 on September 28 and 29, HB9ARI on October 2 and OE2CAL on the 3rd. Between 0500 and 0700 on the 4th, **T. Ampi,** using a National Panasonic DR49 with an indoor aerial, heard eight French and nine other continental broadcast stations in Band II, several of them being stronger than the BBC signals.

At 1623 on September 26, Harold Brodribb heard strong signals from several French stations between 88 and 100MHz, and on the 29th another Sussex station, **Mick Senior** G4EFO, Horsham, worked into Belgium, France and Holland on 70cm and heard strong signals from the Sutton Coldfield beacon. Mick also worked G8OUU in Peterborough, via the Peterborough repeater GB3PB, RB10, This contact was of special interest to Mick because he built the original PB aerials. Another Horsham reader, **Ken Smith** BRS20001, heard French and Dutch stations in Band II: one Dutch station, said Ken "was in full stereo". **John Hill** G8HUY, Hayling Island, Hants, told me that from midday on September 30 to early on October 5, he received signals from the beacons in Switzerland, HB9HB on 2m and HB9F on 70cm. John is a very keen 70cm operator and with 6 watts from his Icom 260E, a Microwave Modules transverter and a home-brew 27-element quad loop aerial, he worked stations in 11 countries, DL, F, G, GJ, GU, GW, HB9, OE, OK, ON and PA0 on October 3.

In nearby Portsmouth, G8HND worked an SP near Russia on 70cm and an OK on 23 cm, and **Geoff Stone** G3FZL, told me that several London stations also worked into OK on 23cm. Around 1400 on October 1, **Alan Baker** G4GNX, Newhaven, heard G8WWU work a French station on the Swiss border through the Brighton repeater GB3SR, R3, and between 2100 and midnight on the 3rd Alan worked DF1CF, near Austria, DF6LN east of Denmark, OK1XW/P (Alan's 21st country on 2m) and DF5DL on 2m c.w. and heard part of an SP's callsign on s.s.b. Along the coast in Lancing, **Barry Ainsworth** G4GPW, also worked into OK on 2m, and **John Cooper** G8NGO, Cowfold, had a wonderful time. On September 27 he worked five PA0s and an OZ, 28th two ONs and seven PA0s, 29th four DLs, five Fs, two PA0s, and G5KW/P in the Scilly Isles "was a fantastic signal," said John. On September 30 he worked 12 Fs and three HB9s, October 1 eight Fs, 2nd three Fs and three HB9s and between 1700 and 2300 on the 3rd he worked five Fs, a GW, five HB9s, four OEs, an OK and 94 West Germans on 2m s.s.b.

Cross Band 10m to 6m

At 1356 on October 16, **John Branegan** GM4IHJ, Fife, heard Bob Billings VE1AVX, Nova Scotia with his automatic keyer on 50·005MHz. Although John did not complete a cross-band QSO with him this time, DK1ITZ did make it, so, to use John's words "6m is officially back in business".

News Items

Within the first fortnight some 45 people had enrolled for the RAE class run on behalf of the Brighton and District Radio Society, by Nigel Hewitt G8JFT, BSc, on Thursdays at 1930, at 47 Cromwell Rd., Hove, Sussex.

Finally, I would like to thank my readers, the Editor and editorial staff of *PW* and my many friends in amateur radio who gave their support to the highly successful Wireless Day at the Chalk Pits Museum on October 5.

TV

by Ron Ham BRS15744

Reports: as for VHF Bands, but please keep separate.

Thanks to the continued support from my readers, we will in future have a column devoted to DXTV, and although this will be specialised, as far as unusual propagation is concerned, the subject will be closely allied to my v.h.f. column.

Fig. 1: Picture received north of Leicester by Bruno Parfect in 1947

Fig. 2: An Austrian programme received by Michael Hahn at 1930 on October 3

Fig. 3: A sports programme from Belgium received by Michael Hahn on October 3

Fig. 4: A west German news programme seen by Michael Hahn on October 3

Fig. 5: SSTV picture received from Japan by Sam Faulkner at 0850 on September 28

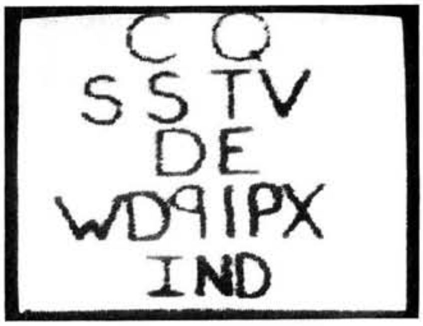


Fig. 6: SSTV picture received by Sam Faulkner at 1745 on September 27

An Early DXer

Although a limited television service operated from Alexandra Palace, London, between November 1936 and the outbreak of war in 1939, large-scale production of sets and the expansion of the service did not begin until transmissions re-started in June, 1946, and the radio factories returned to peace-time work. I well remember those early post-war days when a Channel 1 "H" aerial, a 9in screen, programmes daily from 2030 to 2200, plus an hour on Wednesday afternoons for the ladies, were all we had. For fringe area viewers, like myself, sets were souped up and pre-amplifiers fitted but even then, under normal conditions the pictures were often poor.

One of the early enthusiasts, **Bruno Parfect,** told me that in 1947, when he was living about 10 miles north of Leicester and using a pre-war receiver, an "H" aerial and a home-brew two-stage pre-amp with selected low noise SP61 valves, he received a picture from London, Fig. 1, at that awfully high frequency of 45MHz. Now with worldwide television, Band 1, 40–60 MHz approximately, is a happy hunting ground for long-distance television as **Sam Faulkner,** Burton-on-Trent, found between 1730 and 1930 on September 20 when he watched *Bugs Bunny* cartoons and the American TV series *The Love Boat* from RTVE, Spain on Channels E2 and E3.

Band I

During a sporadic E disturbance from 1300 to 1630 on October 10, I received strong pictures from Russia on Ch. R1 49·75MHz and the associated sound on 56·25MHz. At 1318 a clock appeared showing 1618, followed by a YL announcer and a caption with Russian writing. At 1314 I counted 16 very strong east-European f.m. broadcast signals between 66 and 73MHz. Between 0800 and 0850 on October 14 I watched strong, unsteady pictures, with multiple blurred images on Ch. R1 similar to the F2 disturbances last year. **John Branegan** GM4IHJ, Fife, reports a "dreadfully smeared picture" from Central Asian Russian TV, on Ch. R1 at 0730 on the 16th, so keep your eyes on R1, it could produce some interesting results this winter.

UHF

There were signs of the approaching good tropospheric conditions on September 28 when **George Grzebieniak,** London, received Westward ITV from Huntshaw Cross on Ch. 59 and on the 29th, both Ken Smith, Horsham and I received strong, negative-image, pictures from France on Ch. 21. While heavy patterning was building up on the BBC and ITV signals, I was also receiving a strong picture from the IBA transmitter at Lichfield, Ch. 8, with a dipole feeding the receiver. George Grzebieniak and **T. Ampi,** also from London, were among the many readers I met on the Wireless Communications Day at the Chalk Pits Museum, Houghton, Sussex, on October 5. George and T. Ampi have become good friends and are in the process of modifying equipment at T. Ampi's station.

"On September 29 and October 3, I received good u.h.f. signals from Crystal Palace," writes **Simon Hamer,** from Presteigne, Wales. Simon uses a Bush 176 receiver with a 26-element, Group "A" aerial from a QTH 500ft a.s.l. with a gap in the hills in the south-east. He also has Grundig "Melody-Boy" and "Satellit" receivers and a Pioneer SX450 for Band II. During a visit to a Science Museum in Denmark recently, Simon saw, among the vintage items, a 1952 Bush TV receiver which had been converted from 405 to 625 lines by a Danish enthusiast.

Between 1930 and 2130 on October 3, **Michael Hahn** G4JRB, Rainham, Essex, received strong u.h.f. pictures from Continental stations and watched a programme similar to our *Police 5* from Austria, Fig. 2, sport with interviews with footballers from Belgium, Fig. 3, and a news bulletin from W-Germany, Fig. 4. For most of September 28, Michael received weak pictures from BRT-RTB, Belgium and NED-2 Holland, and at 1700 on the 30th he saw the evening's programmes from BRT start with *Paulus The Gnome* and then watched other items periodically throughout the evening.

T. Ampi first noticed the good conditions on September 26 when he received colour pictures from NED-2 on Ch. 27 and Germany WDR1, Ch. 30 on the 27th. He received further colour pictures from Holland, Ch. 27 on the 29th, four Swiss stations on Channels 29, 31, 32 and 34 between 0640 and 1015 on October 1 and Belgium and Germany on the 3rd. French stations were predominant with T. Ampi from 1015 on the 1st, when he received pictures from Antenne 2 on Channels 21, 25 and 34, and what looked like Ceefax on 57. On Ch. 34 the French station was fighting with the Swiss station +PTT TSI for predominance. On the 3rd he identified many Continental signals between Channels 21 and 69, and at one time he saw BRTF on top of the IBA signal from Bluebell Hill on Ch. 43 and Ch. 44 he saw *Es folgt un 1800 Uhr.*

SSTV

"With excellent conditions on 10m during the latter half of September, my KW202 receiver with Robot 400 was rarely far away from the SSTV calling channel, 28 680kHz" writes Sam Faulkner. "SSTV activity really peaked during September 27 and 28 with pre-fixes W1 to W0 logged between 1540 and 2030 on the 27th" continued Sam, who also received his first colour CQ card (in mono) from W7KPW in Arizona while he was in QSO with WB3KOJ. Between September 23 and October 7 Sam received pictures from LA, JA and many from the USA (Figs. 5 and 6) and ZS. "SSTV from ZS land has been very much in evidence, with ZS6AM and particularly ZS6BFU replaying the video he was copying from the States at 1730 on the 27th," writes Sam, who concluded his letter with "The incredible SSTV QRM at times is an indication of the fantastic popularity this mode now enjoys, especially in Europe and the United States".

NEWS NEWS NEWS

New Mini Computer

One of the smallest computers on the market, the new Tandy TRS-80 Pocket Computer, was launched in the UK in October.

The computer is battery powered which means that a number of programes can be loaded and retained for up to 300 hours (the life of the battery) even when the power is switched off, and also makes it a highly mobile unit that can be used almost anywhere. The TRS-80 measures only 175 × 70 × 15mm and will sell for £119 (including VAT).

There are already eight packages of software available to cover varying needs. These include civil engineering, aviation, maths drill, business statistics, real estate, personal finance and a games package. These too, will be in the shops in late autumn at prices ranging from £8.95 to £13.95 (including VAT).

The TRS-80 has a 4-bit CPU consisting of two microprocessors. It can carry 1.9K of user memory (RAM) and a total of 11K of ROM-7K for BASIC interpreter and approximately 4K for the monitor.

Using the cassette interface (£17.95), multiple programes can be loaded from cassette tape without the previous programe being erased. Each programe in RAM can be executed selectively by a simple key input.

The machine has a display screen and a 57-key alpha-numeric keyboard. A user manual is included.

Tandy Corporation (UK) Ltd., see advertisement pages of your telephone directory for your local branch.

Zaerix Acquires Mazda

Zaerix Electronics recently announced the acquisition, from Thorn Brimar Ltd., of the radio valves and tubes marketing and distribution business based at Rochester. With effect from 1 October 1980, Zaerix will be the exclusive licensed distributors of Mazda valves, and on the same date the business will be transferred to their London HQ.

Zaerix will be taking over the complete valve stock, together with the testing facilities of the Rochester operation. Customer service and quality control procedures will be maintained.

Further information from: *Zaerix Electronics Ltd., 46 Westbourne Grove, London W2 5SF. Tel: 01-727 5641/7774.*

Multicore™

The biggest name in solder worldwide

Products that help you make a better job of it.

Arax Multicore Solder.
Economy pack for general non-electrical use. Replaces solid wire and stick solder. (B.S. 219 Grade L). Econopak 200g reel of 3mm dia. Size 16A.
£4.14 per reel.

Handy Dispensers

		Per pack
PC115	for printed circuits.	£1.15
SV130	for radio and TV. repairs.	£1.61
AR140	for non-electrical applications, except aluminium	£1.38
SS160	for stainless steel and silver jewellery.	£2.53
19A	for printed circuit boards – non-corrosive.	96p
AL150	for aluminium.	£1.93
BCA16	solder cream for stainless steel, jewellery and household products (non-electrical).	£3.22
BCR10	solder cream for electronic and electrical use.	£1.38
BCA14	all purpose solder cream, non-electrical jointing and repairing.	£1.38

Econopak.
Ersin Multicore 5-core solder. Contains non-corrosive flux for electrical applications.
1.2mm dia. 200g Econopak. Size 13A. **£4.14 per reel.**

Toolbox Reels.
Multicore 5-core solder for general use. Suitable for electrical joints (B.S. 219 Grade C).
40/60 tin/lead. 1.6mm dia. Size 3. **£3.91 per reel.**

Savbit.
Multicore 5-core solder for radio, TV. and similar work. Reduces copper erosion. Suitable for service engineers and manufacturers using small quantities of solder.
1.2mm dia. Size 12. **£3.91 per reel.**

Metal Soldering.
Arax Multicore 4-acid-core solder for metal fabrication (not aluminium) and repairs.
40/60 tin/lead. 1.6mm dia. Size 11. **£3.91 per reel.**

Multicore Wick.
Multicore solder-wick for removing solder from virtually any joint.
1.7mm dia. Size AB10. **£1.38 per reel.**

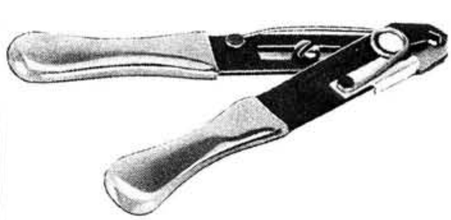
Tip Kleen.
Multicore Tip Kleen.
Soldering-iron tip wiping pad. Replaces wet sponges. (Should not be used above 350°C).
81p per pack.

T.V. and Radio Soldering.
Savbit Multicore for radio, TV. and similar work. Reduces copper erosion.
1.2mm dia. Size 5.
90p per handy dispenser.

Econopak.
General purpose solder suitable for all electrical joints.
40/60 alloy. 1.2mm dia. Size 6. **58p per handy plastic dispenser.**

Aluminium Soldering.
Alu-Sol Multicore 4-core solder for soldering most types of aluminium. No extra flux needed.
1.6mm dia. Size 4. **£11.50 per reel.**

Soldering Flux Pastes.
Multicore soldering flux paste. Extra fast, non-corrosive, rosin-flux for electrical and general purpose soldering.
Rosin R.F.10. 35g net. **69p per pack.**
Multicore soldering flux paste for soft metals (except aluminium) and stainless steel. Non-electrical.
Arax A.F.14. 35g. **69p per pack.**



Wire Stripper and cutter.
Wire stripper and cutter with precision ground and hardened steel jaws. Adjustable to most wire sizes. With handle locking-catch and easy-grip plastic covered handles.
Ref: 9. **£2.69 per pair.**

Bib Hi-Fi Accessories Ltd., (Solder Division),
Kelsey House, Wood Lane End,
Hemel Hempstead, Hertfordshire HP2 4RQ.
Telephone: (0442) 61291.

All recommended retail prices shown are inclusive of VAT. If you have difficulty in obtaining any of these products send direct with 40p for postage and packing. For free colour brochure send S.A.E.

AND THERE'S MORE WHERE THIS CAME FROM

It's a long time since one of our adverts was presented in 'list' form - but simply because we do not try to squeeze this lot in every time doesn't mean that it's not available. Our new style price list (now some 40 pages long) includes all this and more, including quantity prices and a brief description. The kits, modules and specialized RF components - such as TOKO coils, filters etc. are covered in the general price list - so send now for a free copy (with an SAE please). Part 4 of the catalogue is due out now (incorporating a revised version of pt.1).

LINEAR ICs - NUMERIC LISTINGS

TBA120S 1.00
L200 1.95
U237B 1.28
U247B 1.28
U257B 1.28
U267B 1.28
LM301H 0.67
LM301N 0.30
LM308H 0.96
LM308N 0.65
LM339N 0.66
LM348N 1.86
LF351N 0.38
LF353N 0.76
LM374N 3.75
LM380N-14 1.00
LM380N-8 1.00
LM381N 1.81
ZN419CE 1.95
NE544N 1.80
NE555N 0.30
NE556N 0.50
NE560N 3.50
NE562N 4.05
NE564N 4.29
NE565N 1.00
NE566N 1.60
NE570N 3.85
SL624 3.28
TBA651 1.81
uA709HC 0.64
uA709PC 0.36
uA710HC 0.65
uA710PC 0.59
uA741CH 0.66
uA741CN 0.27
uA747CN 0.70
uA748CN 0.36
uA753 2.44
uA758 2.35
TBA810AS 1.09
TBA820M 0.75
TCA940E 1.80
TDA1028 2.11
TDA1029 2.11
TDA1054 1.45
TDA1062 1.95
TDA1072 2.69
TDA1074A 5.04
TDA1083 1.95
TDA1090 3.05
HA1137 1.20
HA1196 2.00
HA1197 1.00
TDA1220 1.40
LM1303 0.99
LM1307 1.55
MC1310P 1.90
MC1330 1.20
MC1350 1.20
HA1370 1.90
HA1388 2.75
TDA1490 1.86
MC1496P 1.25
SL1610P 1.60
SL1611P 1.60
SL1612P 1.60
SL1613P 1.89
SL1620P 2.17
SL1621P 2.17
SL1623P 2.24
SL624C 3.28
SL1625P 2.17
SL1626P 2.44
SL1630P 1.62
SL1640P 1.89
SL1641P 1.89
TDA2002 1.25
TDA2020 3.00
ULN2242A 3.05
ULN2283B 1.00
CA3080E 0.70
CA3089E 1.84
CA3090AQ 3.35
CA3123E 1.40
CA3130E 0.80
CA3130T 0.90
CA3140E 0.46
CA3189E 2.20
MC3357P 2.35
LM3900N 0.60
LM3909N 0.68
LM3914N 2.80
LM3915N 2.80
KB4400 0.80
KB4406 0.60
KB4412 1.95
KB4413 1.95
KB4417 1.80
TDA4420 2.25
KB4420B 1.09
KB4423 2.30
KB4424 1.65
KB4431 1.95
KB4432 1.95
KB4433 1.52
KB4436 2.53
KB4437 1.75
KB4438 2.22
KB4441 1.35
KB4445 1.29
KB4446 2.75
KB4448 1.65
NE5044N 2.26
NE5532N 1.85
SD6000 3.75
SL6270 2.03
SL6310 2.03
SL6600 3.75
SL6640 2.75
SL6690 3.20
SL6700 2.35
ICL8038CC 4.50
MSL9362 1.75
MSL9363 1.75
HA11211 1.95
HA11223 2.15
HA11225 1.45
HA12002 1.45
HA12017 0.80
HA12402 1.95
HA12411 1.20
HA12412 1.55
LF13741 0.33
SN76660N 0.80

FREQUENCY DISPLAY & SYNTHESISER ICs

SAA1056 3.75
SAA1058 3.35
SAA1059 3.35
11C90DC 14.00
LM1232 19.00
LM1242 19.00
MSL2318 3.84
MSM5523 11.30
MSM5524 11.30
MSM5525 7.85
MSM5526 7.85
MSM5527 9.75
MSM55271 9.75
ICM7106CP 9.55
ICM7107CP 9.55
ICM7216B 19.25
ICM7217A 9.50
SP8629 3.85
SP8647 6.00
95H90PC 6.00
HD10551 2.45
HD44015 4.45
HD12009 6.00
HD44752 8.00

CMOS 4000 SERIES

4001 0.17
4000 0.17
4002 0.23
4008 0.80
4009 0.58
4010B 0.58
4011AE 0.20
4011B 0.20
4012 0.55
4013 0.55
4015 0.95
4016 0.52
4017 0.80
4019 0.60
4020B 0.93
4021 0.82
4022 0.90
4023 0.17
4024 0.76
4025 0.17
4026 1.80
4028 0.72
4029 1.00
4030 0.58
4035 1.20
4040 0.83
4042 0.85
4043 0.85
4044 0.80
4046 1.30
4047 0.99
4049 0.52
4050 0.55
4051 0.65
4052 0.65
4053 0.65
4063 1.09
4066 0.56
4068 0.25
4069 0.20
4070 0.20
4071 0.20
4072 0.20
4073 0.20
4075 0.20
4076 0.90
4077 0.20
4078 0.20
4082 0.20
4093 0.78
4175 0.95
4503 0.69
4506 0.51
4510 0.99
4511 1.49
4512 0.98
4514 2.55
4518 1.03
4520 1.09
4521 2.36
4522 1.49
4529 1.41
4539 1.10
4549 3.50
4554 1.53
4560 2.18
4566 1.59
4568 2.18
4569 3.03
4572 0.30
4585 1.10

TTL N and LSN

7400N 0.13
74LS00 0.20
7401N 0.13
74LS01 0.20
7402N 0.14
74LS02 0.20
7403N 0.14
74LS03 0.20
7404N 0.14
74LS04 0.24
7405N 0.18
74LS05 0.26
7406N 0.28
7407N 0.38
7408N 0.17
74LS08 0.24
7409N 0.17
74LS09 0.24
7410N 0.15
74LS10 0.24
7411N 0.20
74LS11 0.24
7412N 0.17
7413N 0.30
7414N 0.51
74LS15 0.24
7416N 0.30
7417N 0.30
7420N 0.16
74LS20 0.24
7421N 0.29
74LS21 0.24
7423N 0.27
7425N 0.27
7427N 0.27
74LS27 0.44
7428N 0.35
74LS28 0.32
7430N 0.17
74LS30 0.24
7432N 0.25
74LS32 0.24
7437N 0.40
7438N 0.33
74LS38 0.24
7440N 0.17
74LS40 0.24
7441N 0.74
7442N 0.70
74LS42 0.99
7443N 1.15
7444N 1.12
7445N 0.94
7446N 0.94
74LS47 0.89
7448N 0.56
74LS48 0.99
74LS49 0.99
7451N 0.17
74LS51 0.24
7453N 0.17
7454N 0.17
74LS54 0.24
74LS55 0.24
7460N 0.17
74LS63 1.24
7470N 0.28
7472N 0.28
7473N 0.32
74LS73 0.38
7474N 0.27
74LS74 0.28
7475N 0.38
7476N 0.37
74LS76 0.38
74LS78 0.38
7480N 0.48
7481N 0.86
7482N 0.69
7485N 1.04
74LS85 0.99
74LS86 0.40
7489N 2.05
7490N 0.33
74LS90 0.90
7491N 0.76
74LS91 1.10
7492N 0.38
74LS92 0.78
7493N 0.32
74LS93 0.99
7494N 0.78
7495N 0.65
74LS95 1.14
7496N 0.58
74LS96 1.20
7497N 1.85
74LS107 0.38
74109N 0.63
74LS109 0.70
74110N 0.54
74111N 0.68
74LS112 0.38
74LS113 0.38
74LS114 0.38
74118N 0.83
74120N 1.15
74121N 0.42
74122N 0.46
74123N 0.73
74LS124 1.75
74125N 0.38
74LS125 0.44
74126N 0.57
74LS126 0.44
74128N 0.74
74132N 0.73
74LS132 0.78
74LS136 0.40
74LS138 0.60
74141N 0.56
74142N 2.65
74143N 3.12
74144N 3.12
74LS145 0.97
74147N 1.75
74148N 1.09
74LS148 1.19
74150N 0.99
74151N 0.55
74LS151 0.84
74153N 0.64
74LS153 0.54
74154N 0.96
74155N 0.54
74LS155 1.10
74156N 0.80
74157N 0.67
74LS157 0.55
74LS158 0.60
74159N 2.10
74160N 0.82
74LS160 1.30
74161N 0.92
74LS161 0.78
74LS162 1.30
74163N 0.92
74LS163 0.78
74164N 1.04
74LS164 1.30
74165N 1.05
74LS165 1.04
74167N 2.50
74LS169 2.00
74170N 2.30
74LS170 2.00
74LS174 1.20
74175N 0.87
74LS175 1.10
74176N 0.75
74177N 0.78
74181N 1.65
74LS181 3.50
74LS183 2.10
74184N 1.35
74185N 1.34
74LS190 0.92
74192N 1.05
74LS192 1.80
74193N 1.05
74LS193 1.80
74194N 1.05
74196N 0.99
74LS196 1.10
74LS197 1.10
74198N 1.50
74199N 1.60
74LS247 0.93
74LS257 1.08
74LS260 1.53
74LS279 0.52
74LS283 1.20
74LS293 0.95
74LS365 0.49
74LS366 0.49
74LS367 0.43
74LS368 0.49
74LS374 1.80
74LS377 1.95
74LS379 1.30
74LS393 1.40

VOLTAGE REGULATORS

78series 0.95
79series 1.00
78Mseries 0.65
78Lseries 0.35
79L05 0.85
78MGT2C 1.75
79MGT2C 1.75
723CN 0.65
L200 1.95
TDA1412 0.75
NE5553N 1.25
LM317MP 1.48
LM337MP 1.48

MICROMARKET

8080A/2 7.50
8212 2.30
8214 3.50
8216 1.95
8224 3.50
8251 6.25
8255 5.40

6800P 7.50
6810 5.95
6820 7.45
6850 4.90
6852 4.85

MC2708 7.50
2114 6.50
4027 5.78
2102 1.70
2112 3.40
2513 7.54
HM4716 4.50
81LS97 1.25

VARICAP TUNING DIODES

BA102 0.30
BA121 0.30
ITT210 0.30
BB204B 0.36
BB105B 0.36
BB109 0.27
MVM125 1.05
BB212 1.95
KV1210 2.45
KV1211 1.75
KV1226 1.95
KV1225 2.75
KV1215 2.55
KV1225 2.75

SWITCHING AND PIN DIODES

SHOTTKY DIODES

1N6263 0.62
BA182 0.19
BA244 0.17
BA379 0.35
TDA1061 0.95

SIGNAL DIODES & RECTIFIERS

1N4148 0.06
1N4001 0.06
1N4002 0.07
1N5402 0.15
OA91 0.07
AA112 0.25
BRIDGES:
1A/50V 0.35
6A/200V 0.75

TOKO COILS AND FILTERS SEE THE EXTENSIVE SECTION IN OUR NEW PRICE LISTS AND CATALOGUE

LF/HF FIXED INDUCTORS —FULL E12 RANGE

7BA series 1uH-1mH 0.16
8RB series 100uH-33mH 0.19
10RB series 33mH-120mH 0.33
10RBH series 120mH-1.5H 0.55

PIEZO SOUNDER PB2720 0.44

CRYSTAL FILTER PRODUCTS

10.7MHZ 2 POLE TYPES:
10M15A 15KHZ BW 2.49
10.7MHZ 8 POLE TYPES:
10M4B1 15kHz BW 14.50
H4402 7.5KHZ BW 15.50
10M22D 2.4KHZ SSB 17.20
HF FIRST FILTER:
B34F8A 34.5MHz HF 32.00

RADIO CONTROL CRYSTALS

(No splits available)
AM TX:-
3rd OT 30pF HC25U 1.65
AM/FM RX:-
3rd OT 30pF HC25U 1.65
FM TX :-
Fund 20pF HC25U 1.85
Pairs FM 3.25
Pairs AM 3.10

CRYSTALS

32.768 kHz 2.70
100kHZ 3.85
455kHZ 5.00
1.0MHz 3.00
3.2768MHz 2.70
4.000MHz 2.00
4.19439MHz 2.30
6.5536MHz 2.10
10.0MHz 2.50
10.6985MHz 2.50
10.7015MHz 2.50
10.245MHz 2.50
10.7MHz 3.00
11.52MHz 2.50
100MHz 3.00

LEDs

5MM RED 0.12
3MM RED CLEAR 0.15
3MM RED 0.15
2.5 X 5MM RED 0.17
5MM GREEN 0.15
3MM GN CLEAR 0.16
3MM GREEN 0.16
2.5 X 5MM GN 0.20
5MM YELLOW 0.15
3MM YELLOW CL 0.16
3MM YELLOW 0.18
2.5 X 5MM YE 0.20
5MM ORANGERED 0.20
5MM ORA CL 0.29
3MM ORANGERED 0.19
2.5 X 5MM ORA 0.24
5MM INFRA RED 0.56
BPW41 IR DET 1.51
IR OPT CPLR 1.44
5MM CLIP 0.04

LCDs

3.5 digit 9.45
4 digit 8.95
5 digit 8.95

SCHOTTKY DIODE BAL MIXERS (SBL1=MD108)
SBL1 1-500MHz 4.25
SBL1-8 .1-200MHz 4.55
SBL1-X 10-1000MHz 5.75
SRA1 .5-500MHz 8.45
SRA1-1 .1-500MHz 9.25
SRA1H .5-500MHz 13.35
SRA3 .025-200MHz 10.25

TRANSISTORS AUDIO DEVICES

BC237 0.08
BC238 0.08
BC239 0.08
BC307 0.08
BC308 0.08
BC309 0.08
BC413 0.10
BC414 0.11
BC415 0.07
BC416 0.08
BC546 0.12
BC556 0.12
BC550 0.12
BC560 0.12
BC639 0.22
BC640 0.23
2SC1775 0.18
2SA872A 0.14
2SD666A 0.30
2SB646A 0.30
2SD668A 0.40
2SB648A 0.40
2SD760 0.45
2SB720 0.45
2SC2546 0.19
2SA1084 0.20
2SC2547 0.19
2SA1085 0.20

AUDIO POWER DEVICES

2SB753 2.34
2SB723 2.34
2SK133 3.00
2SJ 48 3.00
2SK134 3.10
2SK135 3.75
2SJ 50 3.75
BD535 0.52
BD536 0.52
BD377 0.33
BD378 0.33
BD165 0.30
BD166 0.31

SMALL SIGNAL RF DEVICES

BF194 0.18
BF195 0.18
BF224 0.22
BF241 0.18
BF274 0.18
BF440 0.21
BF441 0.21
BF362 0.49
BF395 0.18
BF479 0.66
BF679S 0.55
BFR91 1.33
BFW92 0.60
BFT95 0.99
BFY90 0.90
40238 0.85

RF POWER DEVICES

VN66AF 0.95
2N3866 0.85

SMALL SIGNAL RF FET/MOSFET

BF256 0.38
2SK55 0.28
2SK168 0.35
J310 0.69
J176 0.65
40823 0.65
40673 3SK51
3SK45 0.49
3SK51 0.54
3SK60 0.58
MEM680 0.75
BF961 0.70
BF960 1.24
3SK48 1.64

LCD Module

CM161.
Miniature clock, 12/24 hr., alarm, day, date, backlight.
All for......**9.95**

CAPACITORS
All 5mm or less spacing

CERAMIC 50v
2P2,3P3,4P7,6P8
8P2,10P,15P,18P..0.04
22P,27P,33P,47P
56P,68P,82P,100P.0.05
150P,220P,270P
330P,390P,470P...0.055
1N0,2N2,3N3,4N7..0.06
10N (0.01uF)....0.05
22N,47N.........0.06
100N,220N........0.09
MONOLITHIC CERAMIC
10N,100N.........0.16
FEEDTHRU
1N0 SOLDER IN....0.09
POLYESTER (SIEMENS)
10mm LEAD SPACING
10N,22N,33N......0.17
47N,68N,100N.....0.19
220N,470N........0.22
1uF.............0.29
POLYESTER (GENERAL)
10mm LEAD SPACING
10N,15N,22N,33N..0.06
47N,68N,100N.....0.08
220N............0.11
20mm LEAD SPACING
220N,330N,470N...0.18
MYLAR
5mm LEAD SPACING
1N0,10N,22N,33N..0.08
100N............0.09
20mm LEAD SPACING
220N,470N....... 0.17
POLYSTYRENE
10P,15P,18P,22P,
27P,47P,56P,68P..0.08
100P,180P,220P,
270P,330P,390P...0.09
470P,680P,820P...0.10
1N0,1N2,1N5,1N8..0.11
2N2,2N7,3N3,3N9..0.12
4N7,5N6,6N8,10N..0.13
TANTALUM BEAD CAPS
16v: 0.22,0.33,
0.68,1.0.........0.18
16v: 2.2,4.7,10..0.19
6v3: 22,47.......0.30
10v: 22,100......0.35

ALUMIN ELECTROLYTICS RADIAL (VERT. MOUNT)

(uF/voltage)
1/63,2.2/50,4.7/35
10/16,15/16,22/10
33/6.3..........0.08
22/16,33/10,
47/10...........0.09
10/63,22/50,33/50,
47/16,100/16.....0.10
47/63,100/25,220/16
470/6.3.........0.12
100/63,470/16,
1000/10.........0.18
1000/16,470/63...0.23
1000/63,2200/16..0.30
3300/25.........0.69
1000/100........0.88
10000/70........3.00
AXIAL (HORIZ. MOUNT)
1/25,4.7/16,6.4/25
10/16...........0.08
4.7/63,22/10,22/16
33/16...........0.09
47/25,100/16.....0.10
100/25..........0.11
1000/16.........0.25
2200/16,1000/25..0.36
1000/35,4700/16..0.45
1000/50.........0.58

RESISTORS

0.25W, 5% E12 CARBON
1ohm-10M.........0.02
0.25W 1% E12 METAL FILM
1.1ohm-1M........0.05
HORIZ CARBON PRESETS
10mm TYPE
100ohms-2M5......0.12
HORIZ CERMET PRESETS
1k, 10k..........0.27

PRICES EXCLUDE VAT - PLEASE ADD 15%*
Postage 35p per order. CWO please. (*UK only)

ambit
INTERNATIONAL

CWO PLEASE : Commercial MA terms on application. Goods are offered subject to availability, prices subject to change - so please phone and check if in doubt.

Please send an SAE with all enquiries. Access/Barclaycd (min £5 please) Callers welcome

200 North Service Road, Brentwood, Essex

TELEPHONE (STD 0277) 230909 TELEX 995194 AMBIT G POSTCODE CM14 4SG

CATALOGUES
2 & 3....60p ea
4............75p
(4 inc. rev. of part 1)
ALL PARTS : ....£1.75......

Receivers and Components

BRAND NEW COMPONENTS BY RETURN

HIGH STABILITY RESISTORS.
¼W Carbon Film E12 Series 1R-10M. (E24 2R-6M2)—**1p**
½W, ¼W & 1W Metal Film E12 Series 10R-2M2—**2p**
CAPACITORS.
MULLARD Min. Ceramic E12 100V 2% 1.8pf. to 47pf.—**3p**
2% 56pf. to 330pf.—**4p.** 10% 390pf. to 4700pf.—**4p**
Plate Ceramic 50V Wkg. Vertical Mounting.
E12 22pf. to 1000pf. & E6 1K5pf. to 47Kpf.—**2p**
Miniature Polyester 250V Wkg. Vertical Mounting.
.01, .015, .022, .033, .047 & 068 mfds.—**4p**
0.1—**5p.** 0.15 & 0.22—**6p.** 0.33 & 0.47—**8p**
0.68—**11p.** 1.0—**15p.** 1.5—**20p.** 2.2—**22p**

ELECTROLYTIC. Wire Ended (Mfds/Volts).

0.47/50	5p	22/25	5½p	100/25	7p	470/25	11p
1.0/50	5p	22/50	6p	100/50	8p	470/40	16p
2.2/50	5p	47/16	5½p	220/16	8p	1000/15	15p
4.7/50	5p	47/25	5½p	220/25	8p	1000/25	18p
10/50	5p	47/50	6p	220/50	10p	1000/40	35p
22/16	5½p	100/16	7p	470/16	11p	2200/16	20p

TANTALUM BEAD SUBMINIATURE ELECTROLYTICS.
0.1, 0.22, 0.47, 1.0, 2.2 @ 35V & 4.7 @ 6.3V—**14p**
4.7/16V & 25V—**15p.** 10/16 & 22/6—**20p.** 10/25—**29p**
10/35V, 22/16V, 47/6.3V, 68/3V & 100/3V—**30p**
15/25, 22/25, 47/10—**35p.** 47/16—**80p.** 220/16—**£1.20**
Polystyrene 63V Wkg. E12 Series Long Axial Wires.
10 pf. to 820 pf.—**3p.** 1000 pf. to 10,000pf.—**4p**

TRANSISTORS.

BC107/8/9	10p	BC182L	8p	BF197	9p
BC147/8/9	10p	BC184L	8p	BFY50/51/52	18p
BC157/8/9	10p	BC212L	8p	BFX88	25p
BC547C/8C/9C	7p	BCY70	15p	2N2926	7p
BC557C/8C/9C	7p	BF194	9p	2N3055	50p

8 Pin D.I.L. i.c's 741 Op/amp.—**18p.** 555 Timer—**24p**
Holders 8 pin—**9p.** 14 Pin—**12p.** 16 Pin—**14p.** 28 Pin—**25p**
40 Pin—**30p.**

DIODES (p.i.v./amps).

75/25mA	1N4148	2p	1250/1A	BY127	10p
100/1A	1N4002	4p	400/3A	1N5404	14p
800/1A	1N4006	6p	60/1.5A	S1M1	5p
1000/1A	1N4007	7p	30/150mA	AAY32	12p

ZENER DIODES.
E24 Series 3V3 to 33V 400mW—**8p.** 1W—**10p**
L.E.D.'s 3 mm. & 5 mm. Red—**10p.** Green, Yellow—**14p**
Grommets for 3 mm.—**1½p.** Holders for 5 mm.—**2p**
FUSES. 20 mm. Glass. 100mA to 5A. Q.B.—**3p.** A/S.—**5p**
VOLTAGE REGULATORS+. 5V, 8V, 12V, 15V 100mA.—**35p**
5V, 8V, 12V, 15V, 18V & 24V 0.5A—**60p.** 1A—**65p**
PRESET POTENTIOMETERS
50mW & ¼W 100R to 1MO.—**6p**

THE C. R. SUPPLY CO.
127, Chesterfield Road, Sheffield S8 0RN.
V.A.T. Inclusive Prices, Postage 15p
(FREE over £5.00)

8 PAGE LIST FREE. Thousands of different items, all at cut price. Send SAE to PC Electronics, Thornhill, Romsey Road, Whiteparish, Salisbury.

CLEARANCE PARCELS: Transistors, Resistors, Boards, Hardware. 10lbs only £5.80! 1,000 Resistors £4.25. 500 Capacitors £3.75. BC108, BC171, BC204, BC230, 2N5061, CV7497 Transistors, 10 70p, 100 £5.80. 2N 3055, 10 for £3.50. S.A.E. Lists: W.V.E. (1) 15 High Street, Lydney, Gloucestershire.

TUNBRIDGE WELLS COMPONENTS, BALLARD'S, 108 Camden Road, Tunbridge Wells, Tel: 31803. No Lists. Enquiries S.A.E.

Southern Valve Co.,
2nd Floor, 6 Potters Road, New Barnet, Herts.
Tel: 01-440 8641 for current prices & availability, all popular valves stocked. **NO CALLERS,** SAE Lists. Cash with order. Same Day Postal Despatch. Telephone afternoons preferred.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.
Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Telephone for Shop Hours.

INTERESTED IN ELECTRONICS? Do you need components, tools accessories FAST? Yes. Then you need our first class service. Send today for our catalogue 30p refunded on first order. Lightning Electronic Components. Freepost TAMWORTH. Staffs B77 1BR.

SMALL ADS

The prepaid rate for classified advertisements is 28 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £9.50 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

CIRCUIT BOARDS FOR P.W. PROJECTS

Jan 80	Radio Control Enc. **£2.00**	Apr 80	Nimbus Modulator **£0.75**
Jan 80	Radio Control Tx **£1.50**	May 80	Photographic Timer **£1.30**
Jan 80	Radio Control Rx **£1.50**	May 80	NBFM Demodulator **£1.30**
Jan 80	Speech Processor **£1.60**	Jun 80	Nimbus Base Station **£2.50**
Jan 80	Wideband Amp **£0.70**	Aug 80	Railway Controller **£1.70**
Feb 80	Servo Amp **£0.70**	Sept 80	Tamar (six boards) **£12.00**
Mar 80	Servo Controller **£0.90**	Sept 80	2M Converter **£1.30**
Mar 80	Dual Trace Unit **£5.70**	Sept 80	Nimbus Timeburst **£1.80**
Apr 80	Signal Generator **£2.60**	Oct 80	Direct Conversion Rx **£1.50**
Apr 80	Nimbus Transceiver **£4.90**	Oct 80	Nimbus Charger **£1.00**
Apr 80	Stereo Pre Amp **£1.00**	Nov 80	Linear Resistance Meter **£0.70**
Apr 80	Stereo Main Board **£2.50**	Nov 80	R.C. Wavemeter (two boards) **£1.50**

PRICES INCLUDE VAT, POSTAGE ETC.
DESIGNERS: We can produce prototype PCB's at realistic prices. Send SAE for details of A/Wk requirements etc.
H.T.E. (ELECTRONICS),
Printed Circuit Boards Div., Dept. P.W.,
50 MILNEFIELD AVENUE., ELGIN, MORAY 1V30 3EL

BOURNEMOUTH/BOSCOMBE. Electronic components specialists for 33 years. Forresters (National Radio Supplies) late Holdenhurst Rd. now at 36, Ashley Rd., Boscombe. Tel. 302204. Closed Weds.

TV DX.

SPECIALISED RECEIVERS and amplifiers supplied.

Please send SAE for details to:-
H. Cocks, Cripps Corner, Robertsbridge, Sussex.
Telephone 058083-317.

TONNA (F9FT) AMATEUR ANTENNAS for 2m, 70cm, and 23cm bands. Send 30p for full catalogue. RANDAM ELECTRONICS (PW), 12 Conduit Road, Abingdon, Oxon. OX14 1DB.

VALVES
Radio – T.V. – Industrial – Transmitting
Projector Lamps and Semiconductors
We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 4000 Types in stock, 1930 to 1976. Obsolete types a speciality. List 50p. Quotations S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves, Projector Lamps and Semiconductors.
COX RADIO (SUSSEX) LTD.
Dept. P.W. The Parade, East Wittering, Sussex PO20 8BN
West Wittering 2023 (STD Code 024366)

CRYSTALS MADE TO ORDER within 6 weeks. 4-105MHz, wire or pins. £3.90 each inclusive. HARTLEY CRYSTALS, Green Lane, Milford, Godalming, Surrey GU8 5BG.

CRYSTALS Brand new high-precision. You benefit from very large stocks held for industrial supplies. All normal freq standards, baud rates, MPU, and all magazine projects inc: HC33/U: 1·0, 1·008, 2·5625 MHz, **£3·50.** 1·280 MHz, **£4·15.** HC18/U: 4·0, 5·0, 6·0, 7·0, 8·0, 9·0, 10·0, 10·7, MHz **£3·00.** 12·0, 15·0, 16·0, 18·0, 20·0, 6·9375, 38·6667, MHz, **£3·25.** Selected freqs stocked in Glider, Marine and 27 MHz bands. Any freq made to order in 6 weeks from **£3·90.**
FILTERS Your best source for 6 and 8 pole and monolithics for AM, CW, SSB, FM, on 455 kHz, 1·6, 9·0, 10·7, 21·4 MHz, etc.
Prices inc. VAT and UK post. SAE lists.
P. R. GOLLEDGE ELECTRONICS
G3EDW, Merriott, Somerset, TA16 5NS.
Tel: 0460 73718

WE SUPPLY most Vintage Radio component parts with a friendly service worldwide. British Vintage Radio Components Co., 57, Weldon Park, Weldon, Nr. Corby, Northants. Tel. Corby 61875.

Books and Publications

FULL REPAIR data any named T.V. £5.50, with circuits, layouts, etc., £7. (AUSW) 76 Church Street, Larkhall, Lanarks ML9 1HE.

WHY NOT START YOUR OWN BUSINESS REWINDING ELECTRIC MOTORS. A genuine opportunity to success. LARGE PROFITS. You can't help but make money if you follow the easy, step by step, instructions in our fully illustrated manual showing how to rewind Electric Motors, Armatures and Field coils as used in Vacuum Cleaners, Electric Drills and Power Tools. NO PREVIOUS KNOWLEDGE IS REQUIRED, as the manual covers in 13 chapters, where to obtain all the work you need, materials required, all instructions, rewind charts and how to take data etc. A gold mine of information. How to set up your home workshop and how to cost each job to your customer. £4.50 inclusive of P&P. UK. CWO to: INDUSTRIAL SUPPLIES, 102 Parrswood Rd., Withington, Manchester 20. Dept. PW.

RADIO BOOK SERVICE

WORLD RADIO TV HANDBOOK 1980 Edition	£9-30
Radio Stations Guide	£1-60
How to make Walkie-Talkies	£1-65
Beginners Guide to Microprocessors & Computing	£1-90
How to build your own Metal & Treasure Locators	£1-15
How to build Advanced Short Wave Receivers	£1-35
How to build your own Solid State Oscilloscope	£1-65
ELEMENTS OF ELECTRONICS	
Book 1. The Simple Electronic Circuit & Components	£2-40
Book 2. Alternating Current Theory	£2-40
Book 3. Semiconductor Tech	£2-40
SET OF 3 BOOKS	£7-00

PRICES INCLUDE POSTAGE & PACKING.
4 CHILCHESTER COURT, WICKHAM RD, BECKENHAM KENT BR3 2QW

Build your own
P.A., GROUP & DISCO SPEAKERS
by R. F. C. Stephens
Save money with this practical guide. Plans for 17 different designs, line source, I.B., Horn and Reflex types, for 8"-18" drive units. **£3·95** post free ($8 overseas).

THE INFRA-BASS LOUDSPEAKER
by G. Holliman
(full constructional details for versions using 15", 12" and 10" drive units.) **£2·95** post free ($6 overseas)

THE DALESFORD SPEAKER BOOK
by R. F. C. Stephens
This book is a must for the keen home constructor. Latest technology DIY designs. Plans for I.B., and Reflex designs for 10-100 watts. Also unusual centre-bass system. **£2·20** post free ($5 overseas).

VAN KAREN PUBLISHING
5 SWAN STREET, WILMSLOW, CHESHIRE

Wanted

ELECTRONIC COMPONENTS PURCHASED. All types considered – Must be new. Send detailed list – Offer by return – WALTONS, 55A Worcester Street, Wolverhampton.

WANTED. Instruction manual for Taylor Circuit Analyser model 20B in good condition. E. E. Oglivie, 88 Haslemere Road, Thornton Heath, Surrey.

Aerials

ANTI-TVI TRAP DIPOLES
1981 Range: Shortwave Listener
Indoor models **£14.50 & £27.50**
Outdoor models **£30.00 & £36.00**
Lists 10 × 8 in 17p SAE, Aerial Guide **50p**
Indoor and Invisible Aerials **£3.50**
Callers Welcome Tel: 03986-215
G2DYM, Uplowman, Tiverton, Devon.

COPPER AERIAL WIRE 14swg hard drawn 70' £3.50, 140' £7.00 inc VAT. Postage £1.75. T.M.P. Electronics, Supplies, Britannia Stores, Leeswood, Nr. Mold, N. Wales.

TV-DX

FM-DX and all domestic reception requirements – Fringe or 'Local'. Aerials, Amplifiers, Boosters, Filters, Hardware – and the knowledge. Our new 1981 Catalogue costs 40p. SAE all enquiries, please.

SOUTH WEST AERIAL SYSTEMS
10, Old Boundary Road, Shaftesbury, Dorset.
Tel. (0747) 4370.

JAYBEAM AERIALS Mail order service. SAE to Michael Day Ltd., Place Farm Way, Princes Risborough, Bucks.

Courses

COURSES – RADIO AMATEURS EXAMINATION. City & Guilds. Pass this important examination and obtain your G8 licence, with an RRC Home Study Course. For details of this and other courses (GCE, professional examinations etc) write or phone – THE RAPID RESULTS COLLEGE, DEPT. JX1, Tuition House, London SW19 4DS. Tel: 01-947 7272 (Careers Advisory Service) or for prospectus requests ring 01-946 1102 (24hr Recordacall).

Educational

CAREERS in Marine Electronics, Courses commencing September and January. Further details, The Nautical College, Fleetwood FY7 8JS. Tel. 03917 79123.

TECHNICAL TRAINING

Get the training you need to move up into a higher paid job. Take the first step now—write or phone ICS for details of ICS specialist homestudy courses on Radio, TV, Audio Eng. and Servicing, Electronics, Computers, also self-build radio kits. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277C Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

COLOUR TV SERVICING

Learn the techniques of servicing Colour TV sets through new homestudy course approved by leading manufacturers. Covers principles, practice and alignment with numerous illustrations and diagrams. Other courses for radio and audio servicing. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277C Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

CITY & GUILDS EXAMS

Study for success with ICS. An ICS homestudy course will ensure that you pass your C. & G. exams. Special courses for: Telecoms, Technicians, Electrical Installations, Radio, TV & Electronics Technicians, Radio Amateurs, Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277C Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

Service Sheets

G.T. THE TECHNICAL INFORMATION SERVICE
76 CHURCH ST., LARKHALL, LANARKS ML9 1HE

Any single service sheet for £1 and large S.A.E.

1000's of different service sheets, service manuals and repair manuals always kept in stock for immediate despatch. S.A.E. brings newsletter; pricelist; bargain offers such as service sheets under 40p; quotations for any requested service sheets/manuals without obligation. Phone 0698 883334.

Save time and money – 2 giant catalogues listing thousands of service sheets/manuals plus £4 worth of vouchers free – send £2 + large S.A.E.

SERVICE SHEETS. Radio, TV etc., 10,000 models. Catalogue 24p, plus S.A.E. with orders, enquiries. TELRAY, 154 Brook Street, Preston PR1 7HP.

BELL'S TELEVISION SERVICES for Service Sheets on Radio, TV etc., £1.00 plus S.A.E. Colour TV Service Manuals on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

SERVICE SHEETS from 50p and S.A.E. Catalogue 25p and S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

Record Accessories

STYLI, Cartridges for Music Centres, etc. FREE List no. 29 for S.A.E. includes Leads, Mikes, Phones etc. FELSTEAD ELECTRONICS (PW), Longley Lane, Gatley, Cheadle, Ches. SK8 4EE.

For Sale

OSCILLOSCOPE SOLARTRON CD1016 Dual Beam. Superb condition. £60. Ring Walton on Thames 22323.

D.I.Y. QSL CARDS, just add your own callsign etc. Also listener cards. 50 for £1.70, 100 for £2.75 inc. p+p. Send sae for samples. Also TVI filters, PL259's etc. Lam Electronics, 47, Golden Miller Road, Cheltenham, Glos. 24Hr Tel. 0242 43891.

NEW BACK ISSUES OF "PRACTICAL WIRELESS" available 90p each, post free. Cheque or uncrossed P.O. returned if not in stock. BELL'S TELEVISION SERVICE, 190 Kings Road, Harrogate, N. Yorks. Tel: (0423) 55885.

MULLARD LP1164 AM/FM I.F. MODULES guaranteed unused £1.50 each or ten for £10. P.P. C.W.O. S.A.E. Lists, Tennex, Stock Road, Southend, Essex.

UK AIRCRAFT FREQUENCIES List £1. UK Marine Frequencies List £1. Including HF VHF. PLH Electronics, 20, Vallis Road, Frome, Somerset.

YAESU FRG-7 plus 2M converter, phones. As new, £150. Basingstoke 64688 evenings.

CAPRI TRANSISTOR ORGAN. Eleven treble tones, split keyboard foot pedals. Needs attention. Thirty watt valve amplifier working, sixty watt organ speaker £110. Bromley, Kent. Box No. 151.

Situations Vacant

TESTERS, Test Technicians, Test Engineers – Earn what you're really worth in London Working for a World Leader in Radio & Telecommunications. Phone Len Porter on 01-874 7281 or write – REDIFON TELECOMMUNICATIONS LTD., Broomhill Road, Wandsworth, London SW18.

Miscellaneous

LOSING DX?

DIG out the RARE DX with a Tunable Audio Notch Filter, between your rx and speaker, BOOST your DX/QRM ratio, 40dB notch, **£10.90.**

TIME EXACT? MSF CLOCK is ALWAYS CORRECT – never gains or loses, self setting at switch-on, 8 digits show Date, Hours, Minutes and Seconds, auto GMT/BST and leap year, also parallel BCD output, receives Rugby 60KHz atomic time signals, built-in antenna, 1000Km range, ABSOLUTE TIME, **£54.80.**

V.L.F.? EXPLORE 10-150KHz, Receiver **£13.70.**

MISSING DX? Get SPOT-ON with a Crystal Calibrator, between your antenna and receiver, 1MHz, 100, 25KHz markers to vhf, **£19.80.**

Each fun-to-build kit includes all parts, printed circuit, case, instructions, postage etc, money back assurance so GET one NOW.

CAMBRIDGE KITS
45(PN) Old School Lane, Milton, Cambridge.

OUT NOW!! The 1981 Greenweld Components Catalogue. 60p Discount Vouchers, Reply Paid Envelope. Free bargain List & Data Sheet. Only 75p. Greenweld, 443B, Millbrook Road, Southampton SO1 0HX.

C.W.A.S. ALARM. Send now for the latest discount catalogue of Professional Burlar Alarm Equipment. C.W.A.S. Alarm, 11 Denbrook Walk, Bradford BD4 0QS, W. Yorks. Phone 0274 682674.

PRINTED CIRCUITS. Make your own simply, cheaply and quickly! Golden Fotolak Light Sensitive Lacquer – now greatly improved and very much faster. Aerosol cans with full instructions, £2.25. Developer 35p. Ferric Chloride 55p. Clear Acetate sheet for master 14p. Copper-clad Fibre-glass Board approx. 1mm thick £1.70 sq. ft. Post/Packing 60p. White House Electronics, P.O. Box 19, Castle Drive, Penzance, Cornwall.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Wireless for .... insertions

I enclose Cheque/P.O. for £................................

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME..

ADDRESS ....

....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS,
GMG, Classified Advertisement Dept., Rm. 2337,
King's Reach Tower, Stamford Street,
London SE1 9LS **Telephone 01-261 5846**

Rate
28p per word, minimum 12 words. Box No. **60p** extra.

MAIL ORDER ADVERTISING

British Code of Advertising Practice
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfil orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, PRACTICAL WIRELESS will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of PRACTICAL WIRELESS summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required. We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.
This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example payment made in response to catalogues etc, received as a result of answering such advertisements. Classified advertisements are excluded.

WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
MAIL ORDER, CALLERS WELCOME. Tel. Watford 40588/9

ALL DEVICES BRAND NEW, FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED (TELEPHONE ORDERS BY ACCESS NOW ACCEPTED Minimum £10·00 please). TRADE AND EXPORT INQUIRY WELCOME. P & P ADD 40p TO ALL ORDERS UNDER £10·00. OVERSEAS ORDERS POSTAGE AT COST.

VAT Export orders no VAT. Applicable to U.K. Customers only. Unless stated otherwise, all prices are exclusive of VAT. Please add 15% to the total cost.

We stock many more items. It pays to visit us. We are situated behind Watford Football Ground. Nearest Underground/Br. Rail Station: Watford High Street. Open Monday to Saturday 9 a.m.-6 p.m. Ample Free Car Parking space available.

POLYESTER RADIAL LEAD CAPACITORS: 250V; 10n, 15n, 22n, 27n **6p**; 33n, 47n, 68n, 100n **7p**; 150n **10p**; 220n, 330n **13p**; 470n **17p**; 680n **19p**; 1µ **22p**; 1µ5 **30p**; 2µ2 **34p**.

ULTRASONIC TRANSDUCERS **350p** per pair

ELECTROLYTIC CAPACITORS (Values are in µF).
500V: 10 **50p**; 47 **78p**; **250V:** 100 **65p**; **63V:** 0.47, 1.0, 1.5, 2.2, 3.3, 4.7, 6.8, **9p**; 10, 15, 22 **11p**; 32, 47, 50 **14p**; 63, 100, **27p**; **50V:** 50, 100, 220 **25p**; 470 **32p**; 1000 **80p**; **40V:** 22, 33µF **8p**; 100 **12p**; 220, 3300 **85p**; 4700 **115p**; **35V:** 10, 33 **8p**; 330 470 **32p**; **25V:** 10, 22, 47, 100 **8p**; 160, 220, 250 **15p**; 470 **25p**; 640, 1000 **35p**; 1500 **40p**; 2200 **54p**; 3300 **77p**; 4700 **92p**; **16V:** 10, 40, 47 **7p**; 100, 125 **8p**; 220, 330 **16p**; 470 **20p**; 1000, 1500 **30p**; 2200 **36p**; **10V:** 100 **7p**.
TAG-END TYPE 450V: 100µF **180p**; **70V:** 4700 **165p**; **64V:** 3300 **150p**; 2500 **110p**; **50V:** 3300 **136p**; 2200 **99p**; **40V:** 4700 **130p**; 3300 **98**; 2500, 2200 **92p**; **2000** · **2000 120p**; **30V:** 4700 **110p**; **25V:** 15,000 **195p**; 6400 **120p**; 4700 **100p**; 3300 **85p**; 2200 **60p**.

TANTALUM BEAD CAPACITORS
35V: 0.1µF, 0.22, 0.33, 0.47, 0.68, 1.0, 1µ5, 2µ2, 3µ3, 4µ7, **25V:** 10, **20V:** 6µ8, **16V:** 2µ2, 4µ7, 10 **20p**; **16V:** 22µ, **32p**; 47, 100 **58p**; 220 **80p**; **10V:** 15µ, 22, 33 **28p**; 100 **40p**; **6V:** 47µ, 68µ, 100 **32p**; **3V:** 100 **23p**.

POTENTIOMETERS: Carbon Track 0.25W log & Linear Valves

470Ω, 680Ω 1K, 2K (Lin only) Single	29p
5KΩ to 2MΩ Single gang	29p
5KΩ to 2MΩ Single with D/P switch	69p
5KΩ to 2MΩ Dual gang	88p
1W Wirewound 50Ω, 20K	105p

POLYESTER (MYLAR) CAPACITORS
100V: 0.001, 0.002, 0.005, 0.01µF **6p**; 0.015, 0.02, 0.03, 0.04, 0.05, 0.056µF **7p**; 0.1µF **8p**, **50V:** 0.47µF **12p**

SLIDER POTENTIOMETERS
0.25W log and linear values 60mm track

5KΩ 500KΩ Single gang	60p
10KΩ 500KΩ Dual gang	80p
Self-Stick graduated Alum. Bezels	36p

CERAMIC CAPACITORS 50V
Range: 0.5pF to 10nF **4p**; 15nF, 22nF, 33nF, 47nF **5p**; 100nF **7p**

PRESET POTENTIOMETERS

0.1W 50Ω-2.2M Mini. Vert. & Horiz.	7p
0.25W 100Ω-3.3MΩ Horiz. larger	10p
0.25W 250Ω-4.7MΩ Vert.	10p

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

RESISTORS—5% carbon, High Stab. Miniature, Low Noise

	Range	Val.	1-99	100+
0.25W	2Ω2-4M7	E24	2p	1p
0.5W	2Ω2-5M1	E12	2p	1p
1W	2Ω2-10M	E12	5p	3p
2% Metal Film	10Ω-1M	E24	6p	4p
1% 0.5W	51Ω-1M	E24	10p	8p

N.B. 100+ price applies to Resistors of each type not mixed values.

OPTO ELECTRONICS

LEDs plus clip	
TIL209 Red	13
TIL211 Grn	18
TIL212 Yel	18
2" Red	15
2" Grn Yel	18
Rectangular LED's Red, Green, Yellow	30
3½ Digit LCD	875
4 Digit LCD	975
OCP71	120
ORP12	63
2N5777	45
Infra Red Emit. LD271	40
TIL32 Detector	65
SFH205	98
TIL78	78

7 Seg. Displays Red

.3" C Cath	99
3" C Anod	99
3" +1 Red or Grn	150
5" C Cath	115
5" C Anod	115
6" C Cath	180
8" Orange	275
Burgraph 10 seg.	225

CRYSTALS

100KHz	323
455KHz	385
1MHz	323
1.008M	383
1.6MHz	395

VEROBOARD

Pitch	0.1 (copper clad)	0.15 (copper clad)	0.1 (plain)	0.15 (plain)
2½×3¾	66p	59p	47p	34p
2½×5	75p	69p	—	39p
3¾×3¾	75p	—	—	—
3¾×5	86p	92p	72p	63p
3¾×17	296p	260p	210p	178p
4¾×17	387p	—	—	280p

Pkt of 36 pins **20p** | VQ Board **144p**
Spot face cutter **107p** | DIP Board **326p**
Pin insertion tool **147p** | Veroblock **324p**

COPPER CLAD BOARDS

Fibre Glass	Single sided	Double sided	SRBP 9.5"×8.5"
6×6	90p	110p	95p
6×12	150p	200p	

FERRIC CHLORIDE 1 lb **225p** +40p p&p
EURO BREAD-BOARD 520p
DALO ETCH RESIST PEN 95p
SOLDERCON PINS 100 pins **60p**; 500 pins **275p**
VEROWIRING PEN + spool **325p**

DIL SOCKETS

	Low profile	Wire wrap
8 pin	10p	25p
14 pin	12p	35p
16 pin	13p	46p
18 pin	16p	52p
20 pin	22p	65p
22 pin	25p	70p
24 pin	30p	78p
28 pin	35p	85p
36 pin	—	105p
40 pin	40p	109p

EDGE CONNECTORS

	1	·156
2 10 way	—	85p
2 15 way	—	99p
2 18 way	115p	120p
2 22 way	130p	135p
2 25 way	149p	160p
2 30 way	170p	—
2 36 way	194p	—
2 40 way	210p	—
2 43 way	232p	—

DENCO COILS
Dual Purpose 'DP' VALVE TYPE
Ranges: 1-5 Bl. Yl. Rd. Wht **106p**; 6-7 B.Y.R **95p**; 1-5 Green **130p**
'T'-type (Transistor Tuning) Ranges: 1-5 Bl. Yl. Rd. Wht. **128p**

B9A Valve Base	40p
RDT2	100p
RFC 5 chokes	120p
RFC 7(19mH)	133p
IFT 13/14/15/16/17	110p
IFT 18/1.6	116p
IFT 18/465	132p
TOC1	110p
MW 5FR	112p
MW/LW 5FR	134p

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	205p
500pF	250p
6:1 Ball Drive 4511/DAF	145p
Dial Drive 4103 6:1/36:1	775p
Drum 54mm	55p
0-1-365pF	325p
00 2 365pF	395p
00-2-500pF	550p
0-2 365pF with slow motion drive	450p
00 208/176	395p
with slow motion drive	410p
C804: 5pF; 10	250p
25pF	250p
50pF	250p
100;150pF	335p
'L' 3 - 310pF	725p
00-3 25pF	550p

TRANSISTORS

AC125	35	BC516	40	MD8001	250	ZTX301	16	2N4037	46
AC126	25	BC517	40	MJ400	150	ZTX302	16	2N4058	10
AC127	25	BC547	14	MJ491	175	ZTX303	25	2N4061	10
AC128	25	BC548	14	MJ2955	90	ZTX304	17	2N4062	10
AC141	30	BC549C	14	MJE340	54	ZTX314	25	2N4427	80
AC142	30	BC557	15	MJE370	100	ZTX326	30	2N4859	78
AC176	25	BC558	15	MJE371	100	ZTX341	30	2N4871	55
ACY17	70	BC559	15	MJE2955	99	ZTX500	14	2N5172	18
ACY18	70	BCY70	16	MJE3055	70	ZTX501	15	2N5179	45
ACY19	75	BCY71	18	MPF102	66	ZTX502	15	2N5191	75
ACY20	75	BCY72	20	MPF103	36	ZTX503	18	2N5305	24
ACY21	75	BD131	48	MPF104	36	ZTX504	25	2N5457	36
ACY22	60	BD132	48	MPF105	36	ZTX531	25	2N5458	36
ACY28	75	BD133	60	MPF106	40	ZTX550	25	2N5485	36
ACY39	85	BD135	45	MPSA05	25	40311	60	2N5642	750
AD149	79	BD136	40	MPSA06	25	40313	125	2N5777	45
AD161	42	BD137	40	MPSA12	32	40315	68	2N6027	32
AD162	42	BD138	40	MPSA55	30	40316	85	3N128	112
AF106	70	BD139	40	MPSA56	30	40361	50	3N140	112
AF118	95	BD140	40	MPSA70	25	40362	50	40313	130
AF139	40	BD144	198	MPSU06	55	40408	95	40315	60
AF178	75	BD145	198	OC26	170	40411	280	40316	95
AF239	78	BD205	110	OC28	130	40467	95	40361	50
BC107	10	BD214	115	OC35	125	40468	60	40408	70
BC107B	12	BD245	40	OC36	120	40594	90	40411	285
BC108	10	BD378	70	OC41	120	40595	98	40467	130
BC108B	12	BD434	55	OC42	120	40603	90	40468	85
BC108C	12	BD517	75	OC43	55	40673	95	40594	105
BC109	10	BD695A	85	OC44	120	2N697	23	40595	110
BC109B	12	BD696A	85	OC45	40	2N698	40	40603	110
BC109C	12	BDY56	180	OC70	40	2N699	35		
BC140	30	BF115	35	OC71	35	2N706A	19		
BC142	30	BF167	29	OC72	40	2N708	19		
BC143	30	BF180	38	OC74	50	2N918	33		
BC147	9	BF194	12	OC76	50	2N1131	24		
BC147B	10	BF195	12	OC81	50	2N1132	24		
BC148	9	BF196	12	OC82	50	2N1303	60		
BC148B	10	BF197	16	OC83	40	2N1304	65		
BC148C	10	BF198	16	OC84	40	2N1305	60		
BC149	9	BF199	18	OC140	110	2N1671B	215		
BC149C	10	BF200	30	OC170	85	2N2219A	28		
BC153	27	BF224	24	OC171	85	2N2220A	26		
BC154	27	BF244	30	OC200	85	2N2221A	25		
BC157	10	BF245	28	TIP29	34	2N2222A	25		
BC158	10	BF244B	30	TIP29A	36	2N2369A	17		
BC159	11	BF256	35	TIP29B	56	2N2646	48		
BC160	45	BF257	32	TIP29C	60	2N2904	28		
BC167	10	BF258	32	TIP30	48	2N2905A	26		
BC168C	10	BF259	35	TIP30C	56	2N2906	26		
BC169C	10	BF274	42	TIP31A	45	2N2907A	26		
BC170	15	BF336	40	TIP31C	55	2N2926G	10		
BC172	11	BF451	35	TIP32A	48	2N3053	26		
BC173	11	BF594	30	TIP32C	60	2N3054	58		
BC177	20	BF595	39	TIP33A	65	2N3055	48		
BC178	20	BFR39	23	TIP33C	78	2N3442	140		
BC179	18	BFR40	23	TIP34A	74	2N3663	15		
BC181	20	BFR41	23	TIP34C	88	2N3702	10		
BC182	10	BFR79	23	TIP35A	160	2N3703	10		
BC183	10	BFR80	24	TIP35C	185	2N3704	10		
BC184	10	BFR81	25	TIP36A	170	2N3705	10		
BC182L	10	BFR98	105	TIP36C	199	2N3706	10		
BC183L	10	BFX29	26	TIP41A	60	2N3707	10		
BC184L	10	BFX84	26	TIP41B	68	2N3708	10		
BC187	26	BFX85	28	TIP42A	60	2N3709	10		
BC212	10	BFX86	28	TIP42B	75	2N3710	10		
BC212L	10	BFX87	28	TIP120	90	2N3711	10		
BC213	10	BFX88	28	TIP121	99	2N3822	130		
BC213L	10	BFY50	23	TIP142	120	2N3771	179		
BC214	10	BFY51	23	TIP147	120	2N3772	195		
BC214L	10	BFY52	23	TIP2955	60	2N3773	270		
BC236	10	BFY56	32	TIP3055	60	9400CJ	350		
BC237	14	BFY64	35	TIS43	32	NE529	225		
BC307B	10	BFY81	120	TIS44	45	2N3819	22		
BC308B	16	BRY39	40	TIS45	45	2N3820	45		
BC327	15	BSX20	20	TIS88A	50	2N3822	65		
BC238	14	BSY95A	25	TIS90	30	2N3823	65		
BC338	15	BU105	170	TIS91	32	2N3866	90		
BC441	34	BU205	190	ZTX107	11	2N3903	18		
BC461	34	BU208	200	ZTX108	12	2N3904	18		
BC477	40	E421	250	ZTX109	11	2N3905	15		
				ZTX300	13	2N3906	17		

74LS

LS00	13	LS112	40	74LS398	275
LS01	13	LS113	75	74LS399	230
LS02	15	LS114	40	74LS447	195
LS03	15	LS122	70	74LS490	245
LS04	20	LS123	75	74LS668	105
LS05	23	LS124	180	74LS670	270
LS08	22	LS125	45	74LS673	750
LS09	23	LS126	45	74LS674	850
LS10	20	LS132	60		
LS11	32	LS136	35		
LS12	32	LS138	70		
LS13	40	LS139	70		
LS14	60	LS151	90		
LS15	40	LS153	85		
LS20	21	LS155	75		
LS21	32	LS157	70		
LS22	35	LS158	70		
LS26	44	LS160	90		
LS27	35	LS161	98		
LS28	35	LS162	110		
LS30	20	LS163	95		
LS32	25	LS164	115		
LS33	35	LS165	145		
LS37	30	LS166	175		
LS38	35	LS168	210		
LS40	28	LS169	210		
LS42	66	LS170	288		
LS47	85	LS173	105		
LS51	25	LS174	110		
LS54	30	LS175	110		
LS55	30	LS181	295		
LS73	45	LS183	298		
LS74	35	LS191	120		
LS75	45	LS192	95		
LS76	45	LS193	95		
LS78	50	LS194	125		
LS83	105	LS195	130		
LS85	80	LS196	120		
LS86	38	LS197	85		
LS90	50	LS200	345		
LS91	125	LS221	120		
LS92	75	LS240	225		
LS93	60	LS243	165		
LS95	115	LS244	195		
LS96	120	LS245	350		
LS107	45	LS251	130		
LS109	75	LS253	95		
		LS257	95		
		LS258	120		
		LS259	160		
		LS261	450		
		LS266	75		
		LS273	180		
		LS279	88		
		LS280	250		
		LS283	90		
		LS290	130		
		LS293	130		
		LS295	215		
		LS298	215		
		LS299	420		
		LS323	450		
		LS365	65		
		LS366	65		
		LS367	65		
		LS368	90		
		LS373	150		
		LS375	150		
		LS374	180		
		LS377	199		
		LS378	140		
		LS379	215		
		LS384	250		
		LS390	140		
		LS393	140		
		LS395	210		

VOLTAGE REGULATORS

1A -ve 5V, 12V	
15, 18, 24V	60p
1A ve	65p
100mA ve 5V	
6, 8, 12, 15V	30p
100mA ve	65p
LM309K	135p
LM317K	350p
LM323K	635p
LM723	38p
78H05	595
78HG05	650
TBA625B	80

BRIDGE RECTIFIERS

1A/50V	20
1A/100V	22
1A/400V	29
1A/600V	34
2A/50V	35
2A/100V	44
2A/200V	48
2A/400V	53
2A/600V	65
6A/100V	73
6A/400V	90
BY164	58
VM18 DIL	55

SCRs THYRISTORS

0.8/200V	35
5A/100V	32
5A/400V	39
5A/600V	43
8A/300V	48
8A/600V	85
12A/300V	59
12A/800V	150
15/700V	195
BT106	150
C106D	38
TIC44	22
2N4444	140

TRIACS

3A/100V	48
3A/400V	50
8A/100V	54
8A/400V	64
8A/800V	108
12A/100V	60
12A/400V	70
12A/800V	130
16A/100V	95
16A/400V	105
25A/400V	160
25A/800V	250
T2800D	120

DIAC ST2 **25p**

LINEAR IC's

702	75	LM301A	26	RC4136D	110
709C 8 pin	35	LM308T	95	S556B	275
710*	67	LM311H	70	SAB3210	275
733	75	LM318	240	SG3402	295
741 8 pin	17	LM324	50	SN76003N	240
747C 14 pin	78	LM339	70	SN76013N	170
748C 8 pin	36	LM348	90	SN76018	148
753 8 pin	185	LM349	125	SN76023N	170
810	159	LM379	375	SN76033N	195
AY-1-0212	595	LM380	80	SN76115N	215
AY-1-1313A	660	LM381N	145	SN76131	125
AY-1-1320	225	LM381AN	248	SN76227N	95
AY-1-5050	99	LM382	125	SN76477	175
AY-1-5051	160	LM386	99	SN76660	120
AY-1-6721/6	210	LM387	120	SP8629	299
AY-3-1270	840	LM389	99	TAA621AX1	250
AY-3-8500	390	LM733	75	TAA661A	155
AY-3-8910	850	LM1458	45	TAD100	159
AY-5-1224A	235	LM3900	60	TBA120S	70
AY-5-1230	450	LM3909N	70	TBA540	220
AY-5-1315	595	LM3911	125	TBA550Q	330
AY-5-1317A	639	LM3914	240	TBA641-A12/ BX1 or BX11	250
AY-5-3500	350	LM3915	240	TBA651	190
AY-5-4007D	450	LM13600	135	TBA800	90
AY-5-8100	735	M252AA	625	TBA810S	95
CA3011	110	M253AA	1150	TBA820	70
CA3014	157	MC1303	88	TBA920Q	260
CA3018	68	MC1304P	260	TCA965	120
CA3020	186	MC1310P	150	TDA1004	290
CA3023	191	MC1494	694	TDA1008	310
CA3028A	80	MC1495	350	TDA1022	575
CA3035	235	MC1496L	92	TDA1024	105
CA3036	115	MC1596	225	TDA2020	320
CA3043	275	MC1710	79	TL061CP	46
CA3045	365	MC3302	150	TL062CP	90
CA3046	71	MC3340P	120	TL064CN	159
CA3048	214	MC3360P	120	TL071CP	45
CA3059	195	MC3401	52	TL072CP	90
CA3075	213	MC3405	150	TL074CN	140
CA3080E	65	MFC6040	97	TL081CP	42
CA3081	190	MK50398	635	TL082CP	70
CA3089E	215	MM5303	635	TL083CP	95
CA3090AQ	375	MM5307	1275	TL084CN	120
CA3123	150	MM57160	620	UAA170	170
CA3130	90	MSM5526	850	UAA180	170
CA3140	48	NE515	275	ZN414	95
ICL7106	795	NE543K	210	ZN424E	130
ICL7107	975	NE544	185	ZN425E	415
ICL8038CC	340	NE555	22	ZN1034	200
ICM7205	1150	NE556DB	55	ZN1040E	685
ICM7215	1050	NE560	325		
ICM7216A	1950	NE561	398		
ICM7216B	1950	NE562B	410		
ICM7216C	1950	NE564	435		
ICM7217A	790	NE565A	120		
ICM7555	89	NE566	180		
LD130	452	NE567V	170		
LF356	90	NE570	450		
LM10	395	NE571	420		

COMPUTER IC'S

2102-2	115
2112	110
2112-2N	250
2114	225
2708	440
2716	650

4116 16K	494
4047	750
6502	995
6520	350
6522	650
6532	850
6800	700
6850	485
8085A	1195
74S00	60
74S04	73
74S132	138
74S138	240
74S158	240
74S188	210
74S189	158
74S194	360
74S195	795
74S241	540
74S262	850
74S287	325
74S288	210
74S470	325
74S472	1150
74S475	825
81LS95	135
81LS96	135
81LS97	140
AY-5-2376	920
MC1488	90
TMS4039	250
MC1489	90
MK4027 4K	325
MK4118	2099
MM1702	299
Z80A P10	450
Z80A CTC	550
Z80 CPU2.5	650
Z80A 4M	825
Z80 P10	450
Z80 CTC	450

VDU IC'S

AY-3-1015	550
AY-5-1013	395
IM6402	420
RO-3-2513L	750
SFF96364E	1050
SFC71301	820
SFS80102	205
SN74S262	895
SN75450	80
SN75451	75
SN75452	90
SN75454	225
TMS6011	355

TTL 74 (TEXAS)

7400	11	94	85	188	310
7401	12	95	70	190	130
7402	11	96	80	191	120
03	14	97	176	192	120
04	14	100	130	193	120
05	18	104	62	194	102
06	36	105	62	195	75
07	36	107	34	196	99
08	17	109	60	197	88
09	20	110	54	198	160
10	17	111	68	221	150
11	25	112	170	246	150
12	20	116	180	247	151
13	32	118	85	248	189
14	38	119	120	249	189
16	30	120	105	251	110
17	30	121	35	265	66
20	19	122	50	273	267
21	38	123	65	278	249
22	25	125	50	279	99
23	28	126	45	298	185
25	28	128	65	75108	350
26	43	132	55	75150	140
27	32	136	65	75450	95
28	35	141	75	75451	70
30	19	142	185	75454	225
32	27	143	350	75491	95
33	36	144	350	75492	140
37	35	145	90		
38	32	147	150		
40	20	148	125		
41	68	150	130		
42	58	151	70		
43	120	153	70		
44	116	154	120		
45	105	155	75		
46	132	156	75		
47	72	157	70		
48	75	159	165		
50	20	160	99		
51	17	161	99		
53	20	162	99		
54	20	163	99		
60	32	164	120		
70	40	165	120		
72	30	166	130		
73	35	167	205		
74	34	170	205		
75	56	172	375		
76	40	173	110		
80	52	174	100		
81	120	175	82		
82	75	176	80		
83	90	177	85		
84	99	178	90		
85	105	180	90		
86	33	181	280		
89	205	182	85		
90	42	184	130		
91	84	185	130		
92	50				
93	57				

CMOS*

4000	14	4033	175	4174	110
4001	14	4034	213	4175	120
4002	15	4035	95	4194	115
4006	86	4036	275	4408	790
4007	19	4037	115	4409	790
4008	76	4038	110	4410	750
4009		4039	299	4411	950
4010		4040	85	4412	1250
4011	18	4041	80	4415	480
4012	24	4042	70	4419	280
4013	43	4043	80	4422	
4014	80	4044	80	4433	995
4015	82	4045	175	4435	850
4016	35	4046	96	4440	
4017	70	4047	98	4450	
4018	76	4048	65	4451	
4019		4049	35	4452	
4020	85	4050	38	4490	350
4021	90	4051	86	4500	850
4022	85	4052	86	4501	28
4023	24	4053	86	4502	105
4024	60	4054	130	4503	65
4025	24	4055	130	4504	120
4026		4056	135	4506	75
4027	45	4057	2850	4508	48
4028	92	4058		4510	
4029	98	4059	575	4511	85
4030	55	4060	110	4512	98
4031	185	4061	1225	4512	84
4032	125	4061	1225	4513	225
		4062	995	4514	220
		4063	120	4515	250
		4066	46	4516	90
		4067	430	4517	415
		4068	26	4518	90
		4069	22	4519	80
		4070	25	4520	90
		4071	25	4521	210
		4072	25	4522	150
		4073	25	4526	98
		4075	23	4527	125
		4076	85	4528	100
		4077	30	4529	150
		4078	28	4530	90
		4081	26	4531	130
		4082	25	4532	120
		4085	90	4534	510
		4086	90	4536	310
		4089	150	4538	145
		4093	53	4539	120
		4094	210	4541	150
		4095	95	4543	150
		4096	95	4544	200
		4097	340	4549	395
		4098		4553	399
		4099	150	4554	192
		4160	115	4555	85
		4161	115	4556	60
		4162	115	4557	425
		4163	115	4558	174

DIODES

AA119	18
BY100	24
BY127	12
CR033	158
OA9	45
OA70	12
OA79	12
OA81	15
OA85	14
OA90	7
OA91	7
OA95	8
OA200	9
OA202	8
IN914	4
IN916	5
IN4001/2	5
IN4003/4	5
IN4005/6	6
IN4007	7
IN4148	4
3A/100V	18
3A/400V	20
3A/600V	27
3A/1000V	30

NOISE DIODE Z5J **180**

ZENERS 2V7 to 33V 400mW **8p**; 3V3 to 33V 1.3W **15p**

VARICAPS

MVAM115	140
MVAM2	150
BA102	25
BB104	40
BB105B	40
BB106	40

Switches Knobs Transformers Computers Books etc. Stocked

INDEX TO ADVERTISERS

Published on approximately the 7th of each month by IPC Magazines Limited, Westover House, West Quay Road, POOLE, Dorset BH15 1JG. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. Subscriptions INLAND and OVERSEAS £11·80 payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to V.A.T. and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

for only £255 INCL.

IC-255E– An experts mobile choice

NOW WITH IMPROVED FRONT-END

25 Watts – 5 Memories – Scanning – 600kHz
AND User Selectable Repeater Shift – Full Coverage in 5kHz or 25kHz Steps.

- Crystal controlled Tone Burst
- Full band coverage – extendable to 148MHz if required
- Four digit LED display
- 25 Watts output or 1W low power
- A superb receiver using grounded gate FET front end
- Scanning over a user programmable range
- Memory scan
- Stop on empty or busy channels
- Tuning in 25kHz or 5kHz steps
- 5 Memories – retained while the power is connected to the rig
- Built-in 600kHz Repeater Shift
- Alternative programmable shift
- Reverse Repeater facilities
- RIT (± 3kHz for those off channel stations)
- Scan control from the microphone (optional mic available)
- Good loud audio
- Optically coupled tuning between control knob and CPU
- Multiway 24 pin socket on back for touchpad, computer, or external control
- Rugged modular PA (Guaranteed of course!)
- Mobile mount which can be padlocked
- Up-down scanning microphone available

CAN YOU RESIST SUCH A TEMPTATION

Enjoy VHF mobile at it's best-IC-260E

Replacing the IC-245E, the IC-260E offers such extras as full frequency read out, upper and lower sideband, and scanning as well as FM and CW. Thus, it makes an ideal base station, when used with a DC power supply, as well as a mobile. The use of a microprocessor instead of an LSI chip has enabled Icom to offer this at a lower price than the IC-245E.

£399 INCL.

144MHz ALL-MODE TRANSCEIVER INCORPORATING A MICRO-COMPUTER – CPU control with Icom's original programs provides various operating capabilities. No backlash dial controlled by Icom's unique photo-chopper circuit. Band edge detector and Endless System provides out-of-band protection. No variable capacitors or dial gear, giving problem-free use. The IC-260E provides FM, USB, LSB, CW coverage in the 144-146MHz frequency range. Thus the IC-260E can be used for mobile, DX, local calls and satellite work. Easily extendable to 144-148.

MULTI PURPOSE SCANNING – Memory scan allows you to monitor three different memory channels. Program Scan provides scanning between two programmed frequencies. Adjustable scanning speed. Auto-stop stops scanning when a signal is received, in all modes.

DUAL VFO'S – Two separate VFO's can be used either independently or together for simplex operation, and any desired frequency split in duplex operation.

CONTINUOUS TUNING SYSTEM – Icom's new continuous tuning system features an LED display that follows the tuning knob movement and provides an extremely accurate readout.

Frequencies are displayed in 7 LED digits representing 100MHz to 100Hz digits. When in Duplex and using the tuning-knob the two VFO's track together. Automatic recycling restarts tuning at the top of the band, i.e. 145.999.9 MHz when the dial goes below 144.000.0MHz. Recycling changes 145.999MHz to 144.000.0MHz as well. Quick tuning in 1kHz steps is available, and fine tuning in 100Hz steps in the FM mode, is provided for trouble-free QSO.

OUTSTANDING PERFORMANCE – The RF amplifier and first mixer circuits using MOS FET's and other circuits provide excellent Cross Modulation and Two Signal Selectivity characteristics. The IC-260E has excellent sensitivity demanded especially for mobile operation, high stability and with Crystal Filters having high shape factors and exceptional selectivity. The transmitter uses a balanced mixer in a single conversion system, a band pass filter and a high performance low pass filter. This system provides distortion free signals with a minimum spurious radiation level for an output of 10W or more.

ADDITIONAL CIRCUITS – The IC-260E has a built-in Noise Blanker, CW Break-in CW Monitor, APC and many other circuits for your convenience. The IC-260E has everything you need to really enjoy VHF operation, in an extremely compact rugged transceiver.

Thanet for ICOM

143 RECULVER RD.,
BELTINGE,
HERNE BAY, KENT.
Tel: 02273/63859