JULY 1981

Practical Wireless

Australia $1.25
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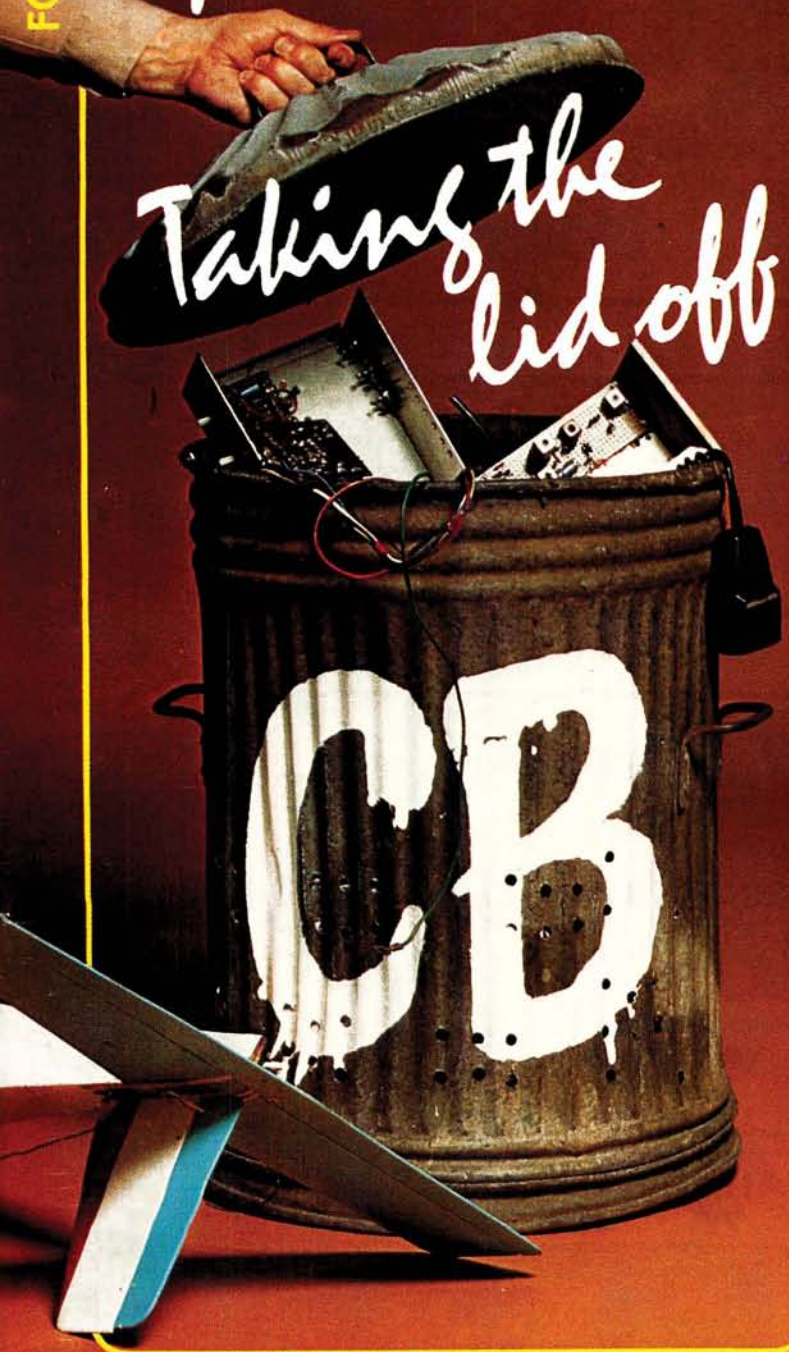
65p

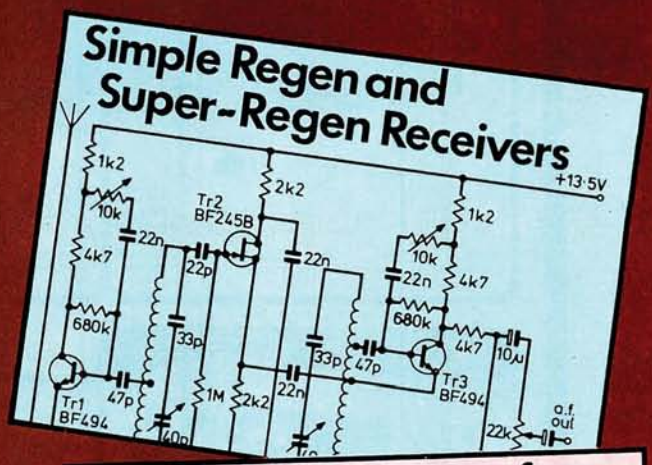
FOR THE RADIO ENTHUSIAST . . .

★ Special 8 Page Supplement

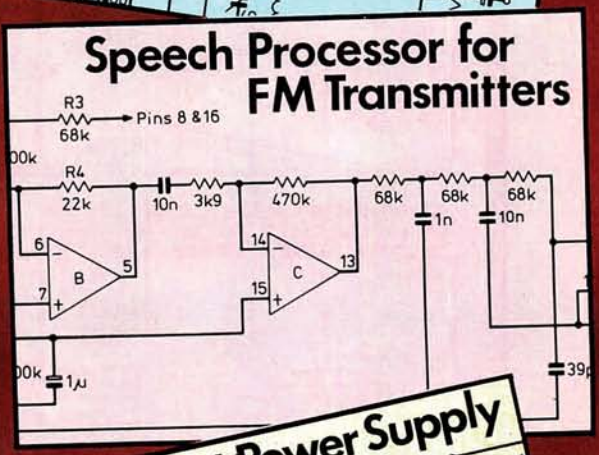
Taking the lid off



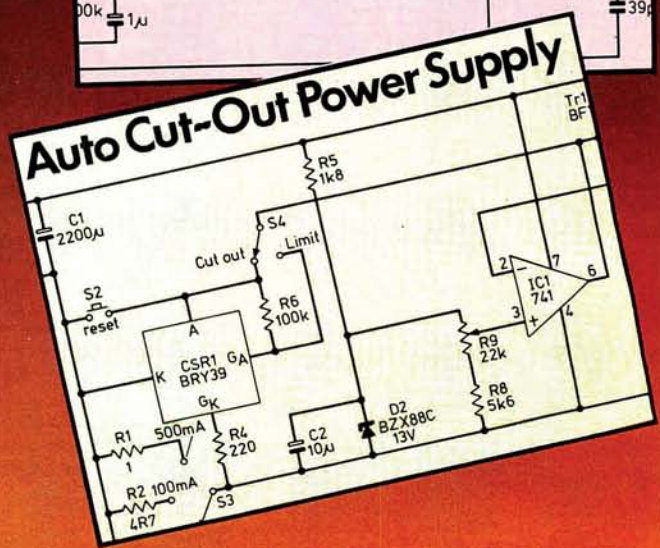
Simple Regen and Super-Regen Receivers



Speech Processor for FM Transmitters



Auto Cut-Out Power Supply



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FOR TWO METRES

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inc. VAT & CARRIAGE

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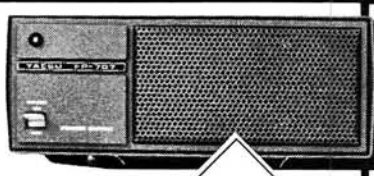
£199, inc. VAT free Delivery

YAESU FT480R

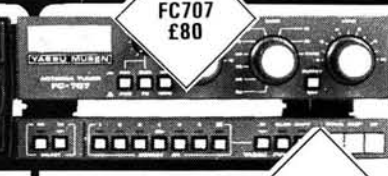
£359 inc. VAT free Delivery

TRANSCEIVERS



FP707 £109

FT707 £529



FC707 £80

FV707 DM £178

H.F. (All fitted new bands)

TRIO TS130V	£404.00
YAESU FT707S	£465.00
TRIO TS130S	£491.00
YAESU FT101Z	£529.00
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FDK PALM II	£99.00
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FDK Multi 750E Multimode	£299.00
ICOM IC260E Multimode	£339.00
TRIO TR9000 Multimode	£345.00
YAESU FT480R Multimode	£359.00

RECEIVERS

TRIO R1000 £285

H.F.

LOWE SRX30	£158.00
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2.M. F.M.

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SEARCH 9	£45.00
FDK TM56B	£89.00
BEARCAT 220FB	£258.00

YAESU FRG7700 £309

ACCESSORIES

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MK 704 Squueze paddle	£10.50 (£0.50)
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EKM12 Matching side tone oscillator	£10.95 (£0.50)
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TOYO T435 (144 435 MHz)	£34.45 (£0.75)
DAIWA SW110A (1.8 150 MHz)	£35.00 (£0.75)
WELZ SP200 (1.8 150 MHz)	£49.95 (£0.75)
WELZ SP400 (130 500 MHz)	£49.95 (£0.75)
DAIWA CN620A (1.8 150MHz)	£52.80 (—)
WELZ SP300 (1.8 500MHz)	£69.95 (—)
DAIWA CN630 (140 500MHz)	£71.00 (—)
SAFETY MICROPHONES	
ADONIS MM202S Clip on	£20.95 (£0.50)
ADONIS MM202H Head Band + Up/Down	£29.00 (£0.50)
ADONIS MM202FU Swan Neck + Up/Down	£30.00 (£0.50)
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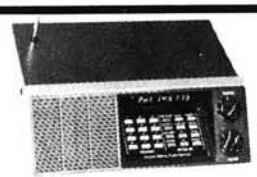
ADONIS AM802 Compressor Mic 3 O/P	£59.00 (£0.75)
PROBLEMS WITH T.V.I.	
YAESU Low Pass Filter FF501DX (IKW)	£22.50 (0.75)
TRIO Low Pass Filter LF30A (IKW)	£18.40 (£0.75)
HP3A High Pass Filter (TV down lead)	£3.50 (£0.25)
Ferrite Rings (Pair)	£0.80 (£0.20)



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For 4M, 2M, 70cm FM Amateur, Low Band Mobile, Aircraft, Public Service, Marine, UHF.

£258 inc. VAT, CARRIAGE.

Suitable antenna for 40-700 MHz Discone DCX, £13.80, carriage £3.00

MOBILE ANTENNAE (All with PL259M fitting)	Carriage
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28 MHz 1/4 (10SE)	£11.50 (£1.50)
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MMT 432/285 transverter	£149.00 (£1.00)
MMT 432/144R transverter	£184.00 (£1.00)
MMT 1296/144 transverter	£184.00 (£1.00)
MML 144/25 linear	£59.00 (£0.75)
MML 144/40 linear	£77.00 (£0.75)
MML 144/100P linear	£142.60 (£1.00)
MML 432/20 linear	£77.00 (£1.00)
MML432/50 linear	£119.00 (£1.00)
MML 432/100 linear	£228.00 (£1.00)
MMD 50/500 500 MHz counter	£69.00 (£0.75)
MMA28 10M Preamp	£14.95 (£0.75)
MMA 144V Preamp RF switched	£34.90 (£0.75)

Buy it with Access

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Practical Wireless

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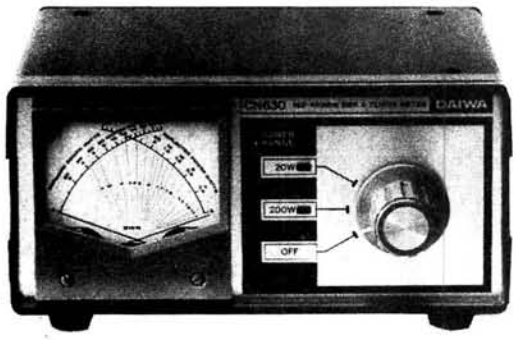
contents

We regret that, due to pressure on editorial space, the concluding parts of "Suppressing & Protecting Thyristors" and "Computers in Radio" have had to be held over

DAIWA POWER METERS

CN620A	1.8-150 MHz up to 1KW	**£52.81** inc VAT
CN630	140-450 MHz up to 200W	**£71.00** inc VAT
CN650	1.2-2.5 GHz up to 20W	**£95.00** inc VAT

Until recently, the in-line measurement of RF power and SWR involved calculation or the use of two instruments. Now, DAIWA have introduced a range of power meters which provide an elegant solution to the whole problem of RF measurements. Utilising two toriodal current transformers to detect true forward and reflected power, and feeding the outputs to a twin movement meter with crossed pointers, it is now possible to measure forward power (LH scale), reflected power (RH scale) and SWR (where the pointers cross) at a single glance. The DAIWA CN series power meters represent the ultimate power meter for the professional and amateur alike, and are indispensable in the fully equipped station. Three models are currently available covering frequencies right up to 2.5GHz so there's one for you whatever your interests.

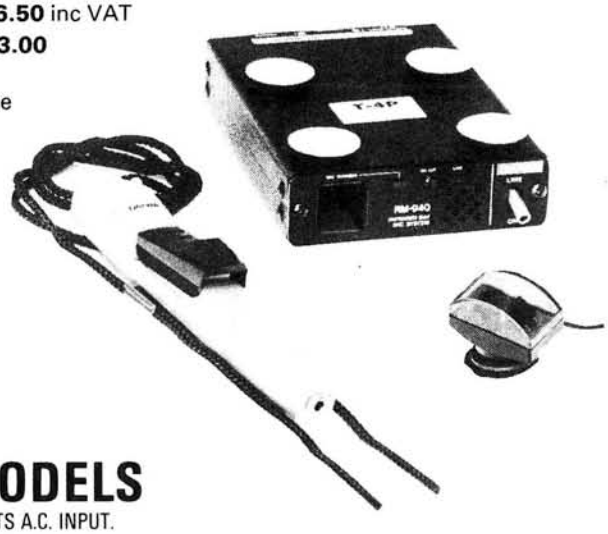


CARRIAGE ON METERS **£1.25**
CARRIAGE ON MIKE SYSTEM **£1.50**

DAIWA CORDLESS INFRA RED MIKE

The Daiwa infrared mike system, comprising of a control box, sensor and infrared mike enables you to dispense with the hand mike and cable when operating in your car or shack. By using an infrared beam audio is transmitted from the mike to the sensor and then to the control box which activates the transmitter. To transmit, press the locking switch on the mike and talk. To receive, release the switch and your rig immediately returns to receive. When you have finished your contact return the mike to its slot in the control box and the mike nicad battery is maintained at full charge. For those of you who like fresh air and drive with all windows open there is a matching wind shield available at an additional 75p. So there we are, the latest technology to bring safety to your mobile operation, the Daiwa infrared mike.

RM 940 **£45.00** inc VAT
S9 spare sensor **£6.50** inc VAT
M9 spare mike **£13.00** inc VAT
Windshield for mike **75p** each.



POWER SUPPLIES

JRC Japan Radio Co., Ltd.
Since 1915

THE 3 MODELS

ALL MODELS 240 VOLTS A.C. INPUT.

the PP1305 4 amp 13.8 volts d.c. ***£18.40*** *inc. VAT.*
the PP137 7 amp 13.8 volts d.c. ***£32.00*** *inc. VAT.*
the PP1310 10 amp 13.8 volts d.c. ***£49.50*** *inc. VAT.*

Carriage £2.00

NRD 515

The NRD 515 is a PLL-synthesised communications receiver of the highest class featuring advanced radio technology combined with the latest digital techniques.
The new NRD 515 is full of performance advantages including general coverage, all modes of operation, PLL digital VFO for digital tuning, 24-channel frequency memory (option), direct mixing, pass-band tuning, etc. JRC's 65 years of radio communications experience will give you "the world at your fingertips".
The NRD 515 is but a single item from the JRC product range which extends all the way to full marine radio installations for supertankers.

NRD 515 SYNTHESISED HG RECEIVER	**£948.75** inc VAT
NHD 515 MULTI CHANNEL MEMORY UNIT	**£161.00** inc VAT
NVA 515 LOUDSPEAKER	**£27.60** inc VAT
CFL 260 600Hz CW FILTER	**£34.50** inc VAT

LOWE ELECTRONICS
CHESTERFIELD ROAD MATLOCK DE4 5LE TEL 0629 2817

TRIO *pacesetter in amateur radio*

TR-7800 2 METRE FM TRANSCEIVER
The only 2 metre FM mobile **£268**

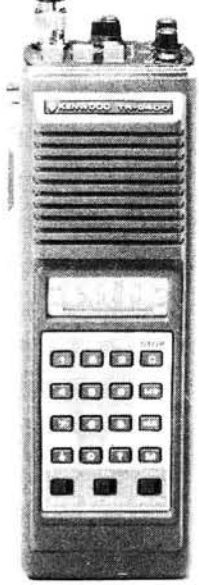
TS770E 2m/70cm DUAL BANDER
"towards new horizons" **£730.25**

TR2300
2M PORTABLE
£166.75

TR-8400 70cm FM TRANSCEIVER *"70cm is on the move."*
£279

TR-9000 2M MULTIMODE
"A new direction" **£345**

TR-2400 2M HAND PORTABLE *"handshack"* **£198.95**



R-820 AMATEUR RECEIVER **£690**

TS 130 S/V *"a big little rig"* **£491/£404**

TS 830S 160-10M TRANSCEIVER
"top notch" **£639.52**

R1000 GENERAL COVERAGE RECEIVER
"hear there and everywhere" **£285**

TS180S 160-10M TRANSCEIVER **£679.65**
PS30 POWER SUPPLY UNIT **£85.00**

NOTE PRICES AS OF MARCH 1981
ALL PRICES INCLUDE VAT. CARRIAGE ADDED TO ALL ITEMS £4.50.

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Chesterfield Road, Matlock, Derbys. Tel. 0629 2817 or 2430.
Open Tuesday-Friday 9-5.30, Saturday 9-5.00. Closed for lunch 12.30-1.30.
For all that's best in ham radio, contact us at Matlock.
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LE

FREE OUR CURRENT BARGAIN LIST WILL BE ENCLOSED WITH ALL ORDERS.

TRANSMITTER SURVEILLANCE *
Tiny, easily hidden but which will enable conversation to be picked up with FM radio. Can be made in a matchbox – all electronic parts and circuit. **£2.30.**

RADIO MIKE *
Ideal for discos and garden parties, allows complete freedom of movement. Play through FM radio or tuner amp. **£6.90** comp. kit.

SAFE BLOCK
Mains quick connector will save you valuable time. Features include quick spring connectors, heavy plastic case and auto on and off switch. Complete kit. **£1.95.**

LIGHT CHASER
Gives a brilliant display – a psychedelic light show for discos, parties and pop groups. These have three modes of flashing, two chase patterns and a strobe effect. Total output power 750 watts per channel. Comlete kit. **Price £16.** Ready made up **£4 extra.**

FISH BITE INDICATOR
Enables anglers to set up several lines then sit down and read a book. As soon as one has a bite the loudspeaker emits a shrill note. Kit. **Price £4.90.**

6 WAVEBAND SHORTWAVE RADIO KIT
Bandspread covering 13.5 to 32 metres. Based on circuit which appeared in a recent issue of Radio Constructor. Complete kit includes case materials, six transistors, and diodes, condensers, resistors, inductors, switches, etc. Nothing else to buy if you have an amplifier to connect it to or a pair of high resistance headphones. **Price £11.95.**

SHORT WAVE CRYSTAL RADIO
All the parts to make up the beginner's model. Price **£2.30.** Crystal earpiece **65p.** High resistance headphones (gives best results) **£3.75.** Kit includes chassis and front but not case.

RADIO STETHOSCOPE
Easy to fault find – start at the arial and work towards the speaker – when signal stops you have found the fault. **Complete kit £4.95.**

INTERRUPTED BEAM
This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components – relay, photo transistor, resistors and caps etc. Circuit diagram but no case. **Price £2.30**

OUR CAR STARTER AND CHARGER KIT has no doubt saved many motorists from embarrassment in an emergency you can start car off mains or bring your battery up to full charge in a couple of hours. The kit comprises: 250w mains transformer, two 10 amp bridge rectifiers, start/charge switch and full instructions. You can assemble this in the evening, box it up or leave it on the shelf in the garage, whichever suits you best. **Price £11.50** + £2.50 post.

GPO HIGH GAIN AMP/SIGNAL TRACER. In case measuring only 5¾in x 3¼in x 1¼in is an extremely high gain (70dB) solid state amplifier designed for use as a signal tracer on GPO cables, etc. With a radio it functions very well as a signal tracer. By connecting a simple coil to the input socket a useful mains cable tracer can be made. Runs on standard 4½v battery and has input, output sockets and on-off volume control, mounted flush on the top. Many other uses include general purpose amp, cueing amp, etc. **An absolute bargain at only £1.85.** Suitable 80ohm earpiece **69p.**

NEW KIT THIS MONTH!
CB RADIO – Listen in with our 40-channel monitor. Unique design ensures that you do not miss sender or caller.
Complete kit with case and instructions only **£5.99.**

8 POWERFUL BATTERY MOTORS
For models, Meccanos, drills, remote control planes, boats etc. **£2.50.**

WATERPROOF HEATING WIRE
60 ohms per yard, this is a heating element wound on a fibre glass coil and then covered with p.v.c. Dozens of uses – around water pipes, under grow boxes in gloves and socks. **23p** per metre.

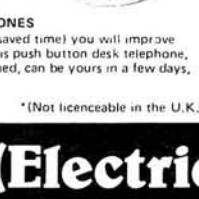
COMPONENT BOARD Ref. W0998
This is a modern fibreglass board which contains a multitude of very useful parts, most important of which are: 35 assorted diodes and rectifiers including 4 3amp 400v types (made up in a bridge) 8 transistors type BC107 and 2 type BFY-51 electrolytic condensers, SCR ref 2N 5062, 250uf 100v DC and 100uf 25v DC and over 100 other parts including variable, fixed and wire wound resistors, electrolytic and other condensers. A real snip at **£1.15.**

FRUIT MACHINE HEART. 4 wheels with all fruits, motorised and with solenoids for stopping the wheels with a little ingenuity you can defy your friends getting the "jackpot". **£9.95. + £4 carriage.**

4-CORE FLEX CABLE
White pvc for telephone extensions, disco lights, etc. 10 metres **£2,** 100 metres **£15.** Other multicore cable in stock.

MUGGER DETERRENT
A high-note bleeper, push latching switch, plastic case and battery connector. Will scare away any villain and bring help. **£2.50** complete kit.

EXTRACTOR FANS



Mains operated – ex. Computer.
5" Woods extractor
£5.75 Post £1.00.
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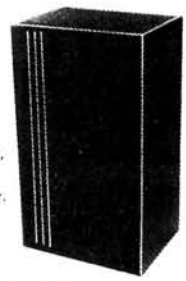
6" Plannair extractor
£7.50 Post £1.00
4" x 4" Muffin 115v.
£4.50 Post 50p.
4" x 4" Muffin 230v.
£3.75 Post 50p.

PUSH BUTTON G.P.O. TELEPHONES
FOR **£25** (quickly recoverable in saved time) you will improve your image and efficiency with this push button desk telephone, ex. G.P.O. thoroughly reconditioned, can be yours in a few days, if you send today.

*(Not licenceable in the U.K.)

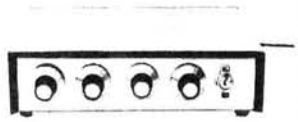
SUPER HI-FI SPEAKER CABINETS



Made for an expensive Hi-Fi outfit – will suit any decor. Resonance free cut-outs for 8" woofer and 4" tweeter. The front material is carved Dacron, which is thick and does not need to be stuck in and the completed unit is most pleasing. Colour black. Supplied in pairs, price **£6.90** per pair (this is probably less than the original cost of one cabinet) carriage £3.50 the pair.

LOUDSPEAKERS
8" woofer and 4" tweeter, 4 ohms 35 watts power rating **£6.90** per pair.
Ditto but 8 ohms, **£11.50 per pair.** Post £2.00.

3 CHANNEL SOUND TO LIGHT KIT



Complete kit of parts for a three-channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four-pin plug and socket facilitate ease of connecting lamps. Special snip price is **£14.95** in kit form or **£19.95** assembled and tested.

THIS MONTH'S SNIP

UNIVAC KEYBOARD Model No. FI 308-00

Has 57 encoded key switches and 10 mini toggle switches. As well as a P.C.B. with many IC's etc. These keyboards are in very good condition. Price only **£11.50** + post £2.00. Well worth it for the switches alone.

POCKET AUDIO COMPONENT TESTER

With it you can quickly test diodes, rectifiers, transistors, capacitors, check wiring and p.c. boards for open circuits, find the anode and cathode of a diode or rectifier and whether a transistor is PNP or NPN, which are the base collector and emitter connections. Condensers, if bad give a continuous signal but if good, give intermittent signals of varying length depending on their value. The test current is very low (2uA) and the voltage only 1.4v, so it is also possible to check MOS devices, as well as sensitive transistors with out fear of damaging them. The unit is supplied complete with internal battery, which should last many months. **Price £3.45p.**

MINI-MULTI TESTER Deluxe pocket size precision moving coil instrument, Jewelled bearings - 2000 o.p.v. mirrored scale. 11 instant range measures: DC volts 10, 50, 250, 1000.
AC volts 10, 50, 250, 1000.
DC amps 0 – 100 mA.

Continuity and resistance 0 - 1 meg ohms in two ranges. Complete with test prods and instruction book showing how to measure capacity and inductance as well. Unbelievable value at only **£6.75** + 50p post and insurance.

FREE Amps range kit to enble you to read DC current from 0 - 10 amps, directly on the 0 - 10 scale. It's free if you purchase quickly, but of you already own a Mini-Tester and would like one, send **£2.50.**

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost anyone. In easy to assemble modular form this should sell at about £30 – but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only **£16.75** including VAT and post.
FREE GIFT – buy this month and you will receive a pair of Goodman's eliptical 8"x5" speakers to match this amplifier.

VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95.** These are new but without case, but we can supply plastic cases (base and cover) **£1.75** or metal case with window **£2.95.** Also available is adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30.**

DELAY SWITCH

Mains operated – delay can be accurately set with pointers knob for periods of up to 2½hrs. 2 contacts suitable to switch 10 amps – second contact opens a few minutes after 1st contact. **£1.95.**

LEVEL METER

Size approximately ¾" square, scaled signal and power but cover easily removable for rescaling. Sensitivity 200 uA. **75p.**

STEREO HEADPHONES

Japanese made so very good quality. 8 ohm impedance. padded, terminating with standard ¼" jack-plug. **£2.99** Post 60p.

BRIDGE RECIFIER

1 amp 400v 30p each.
10 for £2.50. 100 for £20.00

TIME SWITCH BARGAIN
Large clear mains frequency controlled clock, which will always show you the correct time + start and stop switches with the dials. Comes complete with knobs. **£2.50.**

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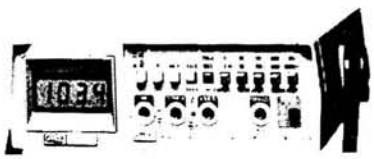

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ECC82	0.60	EL90	1.00					1T4	0.45	6BJ6	1.30	6SN7GT	0.80
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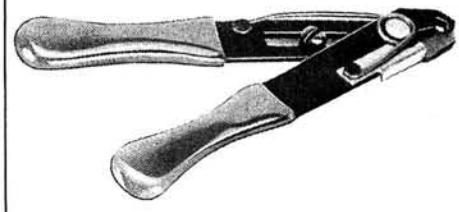

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E88CC	3·36	EY88	1·75	PY500A	1·80	6AS6	4·98	6SK7	1·30
E180F	8·40	EY500A	1·94	PY800	0·84	6AS7GA	6·75	6SL7GT	2·68
E810F	14·47	EZ80	0·84	PY801	0·84	6AT6	0·85	6SN7GT	1·60
EA8C80	1·20	EZ81	0·84	QQV02-6	12·56	6AU5GT	4·32	6SS7	1·80
EB91	0·82	GY501	2·75	QQV03-10		6AU6	1·08	6SG7M	2·50
EBF80	0·50	GZ32	1·25		5·80	6AW8A	3·39	6U8	0·80
EBF89	0·85	GZ33	4·00	QQV03-20A		6B7	1·50	6V6GT	1·60
EC91	7·56	GZ34	2·50		17·50	6B8	1·75	6X4	1·20
ECC33	3·50	GZ37	4·00	QQV06-40A		6BA6	1·00	6X5GT	0·85
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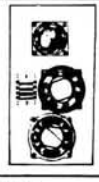

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SPECIFICATION

LINEAR AMPLIFIER

Power output	:	100 watts RMS typical
Power input	:	10 watts nominal for 100 watts output
Frequency bandwidth	:	144-146 MHz at—1 dB
Power requirements	:	13.8 volts at 12 amps for 100 watts output. (15 V maximum)
Quiescent current	:	1 Amp nominal at 13.8 volts (with zero drive)

RECEIVE PREAMP

Overall gain	:	12 dB typical
Overall noise figure	:	Better than 1.5dB
Frequency bandwidth	:	144-146 MHz at—0.5 dB
Receive current	:	130 mA nominal at 12.5 volts

GENERAL

RF input connector	:	50 ohm BNC	**Weight**	:	1.5 kg (3lb 5oz)
RF output connector	:	50 ohm BNC	**Overall size**	:	265 × 117 × 54 mm (107/16 × 4⅝ × 2⅛")
Power connector	:	5 pin DIN			

DESCRIPTION

This new 144MHz solid state linear amplifier, MML 144/100-S, is intended for use with any existing 144MHz equipment having an output power of 10-15 watts. When used in conjunction with such a drive source this linear amplifier will provide an output power of 100 watts.

Several front panel mounted switches controlling the internal switching circuitry, allow the unit to be left in circuit at all times. The linear power amplifier and the ultra low-noise receive preamplifier, which are incorporated into the unit, can both be independently switched in and out of circuit. In this way, all four operational combinations are possible.

By means of an internal RF vox circuit the linear will automatically switch onto transmit, when 144MHz drive is applied to the input socket. It is possible to override this facility by the connection of an earth to pin 1 of the 5 pin DIN power socket, located on the rear panel. This connection is compatible with all current transceiver PTT lines. The RF vox circuit is suitable for both SSB and FM modes.

The inclusion of the latest state of the art power transistor (rated at 145W dissipation) guarantees highly reliable and ultra-linear performance, thus making the unit ideal for all modes of operation (SSB, FM, AM, CW and SSTV).

The amplifier utilises recently developed matching techniques, which allow safe operation even when improperly subjected simultaneously to 50% overdrive and a supply voltage of 15V. The PA transistor is thermally tracked against temperature variation and operational temperature rise.

The receive preamplifier uses one of the latest dual-gate MOSFETs (3SK88) in a noise-matched configuration. This technique together with careful optimisation of overall gain makes the preamplifier ideal for use ahead of any popular 2 metre transceiver. The sensitivity of most current 2 metre transceivers is such that a preamplifier gain of 12dB is sufficient to ensure an excellent overall system noise figure. A preamplifier with gain in excess of this figure will prove unduly detrimental to the strong signal-handling performance of the transceiver.

All circuitry is constructed on high quality glass-fibre printed circuit board and protection is included against reverse polarity. The unit is housed in a highly durable, extruded aluminium enclosure, RF input and output sockets are located on the rear panel together with the 5 pin DIN power socket. The unit is supplied with all necessary connectors.

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MOS200	120W into 4-8Ω	0.005%	20V/μs	3μs	100dB	£33.46 + £5.02

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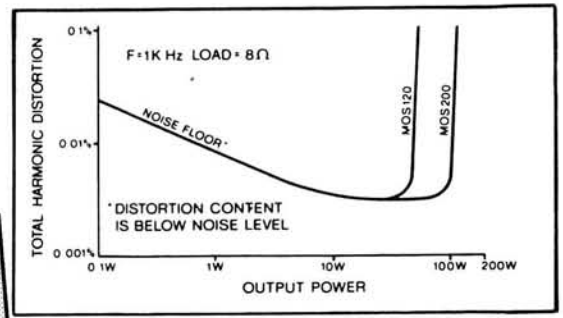

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Input impedance both models 100KΩ Frequency response both models 15Hz-100KHz - 3dB

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HY120	60W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£17.48 + £2.62
HY200	120W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£21.21 + £3.18
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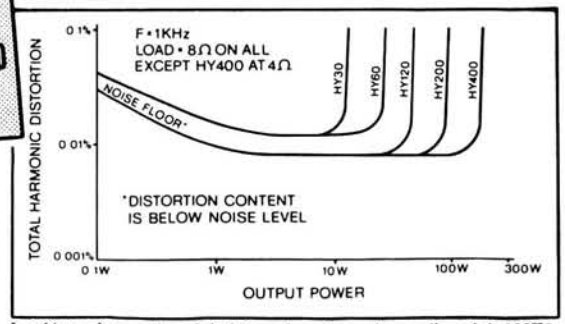

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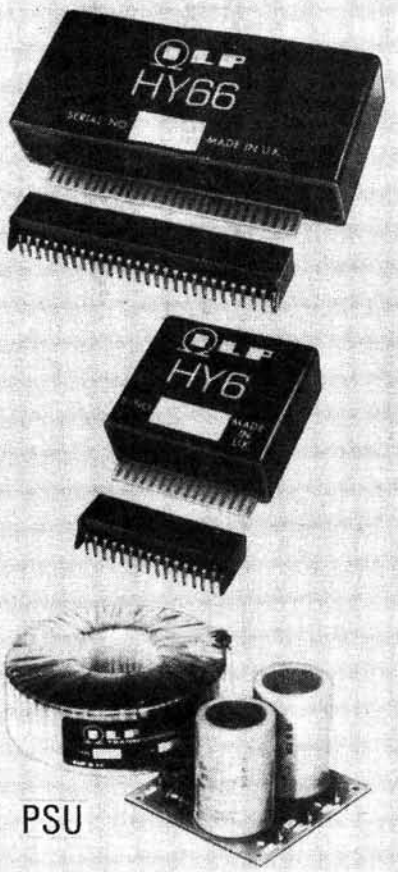

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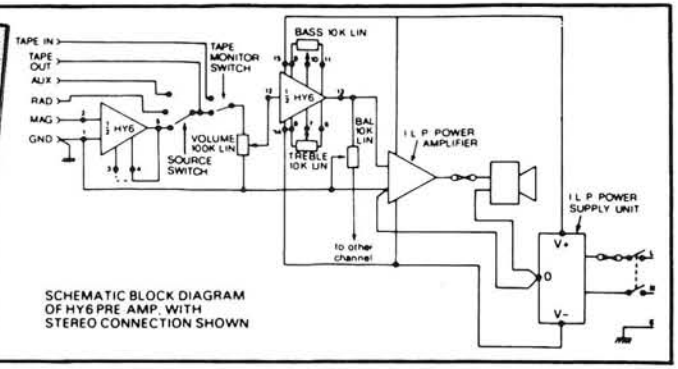

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Cracking the Code

THE IDEA of a Novice grade amateur licence for the UK, perhaps along the lines of that available in the United States, is a subject that comes up again and again, but a new proposal that has recently been put to me by several people (quite independently, I am assured), is for a limited c.w. facility for Class B licence-holders.

What they have in mind is to set aside a small segment of the 2m band where amateurs who have learned the Morse code characters but not attained 12 w.p.m., could practise "on the air", either with others in a similar position to themselves or with co-operative Class A licensees. It would certainly be a boon to amateurs living in areas remote from radio clubs or other amateurs with whom to practise, and could well encourage more people to become G4s.

Maybe there would need to be some sort of elementary test at a speed such as 4 or 5 w.p.m. (anything much below that becomes difficult to read as a plain language message anyway). This could be entrusted to a local volunteer, in the same way that the Novice examination is done in the USA. Otherwise, perhaps all G8s and G6s could be given the facility, on the principle that if they were too slow they'd get nowhere, and would hopefully do a little more private practice before trying again later.

It is strange how this idea has come up when many people are condemning c.w. as a dead art. I would guess that the recent availability of multi-mode 2m transceivers has had something to do with it, with proud owners having explored f.m. and s.s.b. and got round to wondering about the last position on the mode switch.

Another proposal is for Class B licensees to be allowed to use automatic Morse senders and receivers, possibly on the h.f. bands as well as v.h.f. I've got to try not to let my prejudices as an ex-professional c.w. operator show here, but my first reaction is that this isn't what amateur radio is about. What do you think?

Geoff Arnold

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auto cut-out power supply

R.A.PENFOLD

Since, with a very few exceptions, electronic circuits all require some form of power supply, a bench power supply is a very desirable asset to have in an electronics workshop. This relatively simple power supply is designed to meet the needs of the constructor who does not need the performance and facilities of a laboratory standard instrument, but still wants a fairly high level of performance.

The nominal output range of the unit is 2·5 to 13 volts, and the output voltage alters by about 1 per cent between zero and maximum load current of 500mA. This is virtually equivalent to the stability of the Zener reference source employed. This supply can therefore be used to operate most electronic circuits, such as TTL and c.m.o.s. logic circuits, radios, small amplifiers, household gadgets, etc.

An unusual feature of the circuit is an electronic cutout which automatically reduces the output voltage to zero in the event of an overload. The trip current can be set at either 50mA, 100mA, or 500mA. This is a valuable feature when experimenting with delicate semiconductor devices as it greatly reduces the risk of them being damaged due to incorrect connection or something of this nature. With some types of circuit, such as a Class B amplifier, where quite high peak currents may briefly be drawn from the unit, the auto cutout feature can be a nuisance, with the current peaks tripping the cutout. In such cases ordinary current limiting is more suitable, and the circuit has the option of output current limiting.

Stabiliser Action

Where a well-stabilised variable voltage supply is required, the configuration of Fig. 1(a) is that most frequently adopted. An operational amplifier has its non-inverting (+) input fed from a stable reference voltage, and the inverting (–) input is connected to the slider of a potentiometer across the output of the supply. A buffer stage is usually needed at the output of the op. amp. in order to provide a realistic output current.

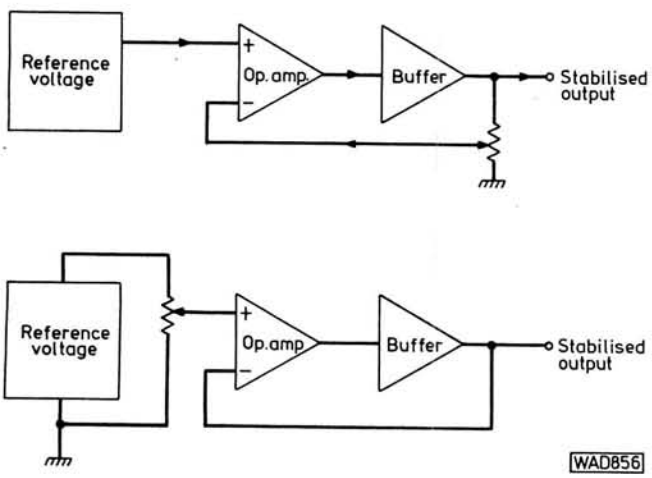


Fig. 1

With the slider at the top of its track, the output voltage will be identical to the reference voltage. This must be so, since a lower voltage would take the inverting input below the non-inverting input's potential, causing the output to assume a higher voltage and balance the two input voltages. Conversely, a higher output voltage would take the inverting input to a higher potential than the non-inverting, causing the output to swing lower in voltage and once again balance the input voltages.

The output is thus stabilised by a negative feedback action, and as a voltage difference of less than a millivolt at the input of an op. amp. is usually sufficient to send the output fully positive or fully negative, as appropriate, the output is maintained very accurately at the reference voltage.

If the slider of the potentiometer is moved down its track, the negative feedback will still stabilise the output voltage, much as before. However, if, for example, the slider is precisely half way down its track, the output voltage will need to be double the reference potential in order to balance the input levels to the op. amp. The further the slider is taken down its track, the higher the output voltage. In this way the output voltages can be varied over a wide range.

One drawback of this type of regulator is that if the control knob of the potentiometer is marked with a scale calibrated in terms of output voltage, this scale will not be linear. With the slider half way down its track the output voltage will be $2V_{ref}$, three quarters of the way down it will be $4V_{ref}$, seven eighths of the way down it will be $8V_{ref}$, and so on. This gives severe cramping at the high voltage end of the scale.

This is not too important if a voltmeter is to be used to monitor the output voltage, but it is a major drawback in a fairly simple design of this type where the output voltage will be set using the scale of the voltage control potentiometer.

Therefore, the slightly modified arrangement of Fig. 1(b) has been adopted in this design. Here the output is connected direct to the inverting input of the op. amp. and the output is stabilised at the voltage fed to the non-inverting input. The latter is fed with the reference voltage by way of a potentiometer, so that, in effect, the output is varied by varying the reference voltage. This gives a linear output voltage scale.

The Circuit

The full circuit diagram of the unit is shown in Fig. 2.

T1 is the step down and isolation transformer, and its primary winding is fed from the mains via the on/off switch S1. The secondary feeds bridge rectifier D1 and smoothing capacitor C1 by way of fuse F1.

The combination of R5, D2 and C2 produce a stabilised 13 volt reference source, and approximately 2·5 to 13 volts is available at the slider of voltage control potentiometer R9. Tr1 and Tr2 are connected as a Darlington Pair emitter follower, and act as the output buffer stage.

Resistor R7 is the series current limiting resistor for the l.e.d. pilot light D3. If the auto cutout circuit comes into operation, this will be indicated by D3 extinguishing.

The cutout circuitry is based on CSR1, which is not an ordinary thyristor but is a component known as a silicon controlled switch, or s.c.s. It consists basically of a pair of integrated transistors connected as shown in Fig. 3, If either transistor is switched on by a suitable base current, it provides the other transistor with base current. The second transistor is therefore switched on, and provides the first transistor with a base current, causing the device to latch in the *on* state.

An s.c.s. therefore provides a sort of thyristor action, but it has high sensitivity with a gate current of a few hundred microamps being sufficient to trigger the device. It also has a low 'hold on' current of less than 1mA. These characteristics enable an s.c.s. to function perfectly in a circuit such as this where an ordinary thyristor would probably fail.

The auto cutout is very simple in operation. One of the three switched resistors, one for each value of trip current, is connected in the negative rail to the regulator circuitry. The cathode and gate cathode terminals of the s.c.s. are connected across the selected resistor via a current limiting resistor. If the output current should exceed the trip level, the voltage across the sensing resistor will exceed the trigger voltage of the s.c.s., causing it to switch on and hold the output of IC1 at about 1 volt. Around 1·3 volts is dropped between IC1 output and the output of the supply due to the stand off voltage of Tr1 and Tr2, and so the output falls to zero.

CONSTRUCTION RATING Beginner

BUYING GUIDE

Readers should have no difficulty in obtaining any of the components used for this simple project. Any suitable metal instrument case can be used providing it is large enough to house the transformer and other components. Study the advertisements for suppliers of the components used.

APPROXIMATE COST £12

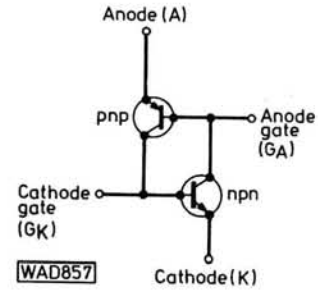


Fig. 3: The silicon controlled switch

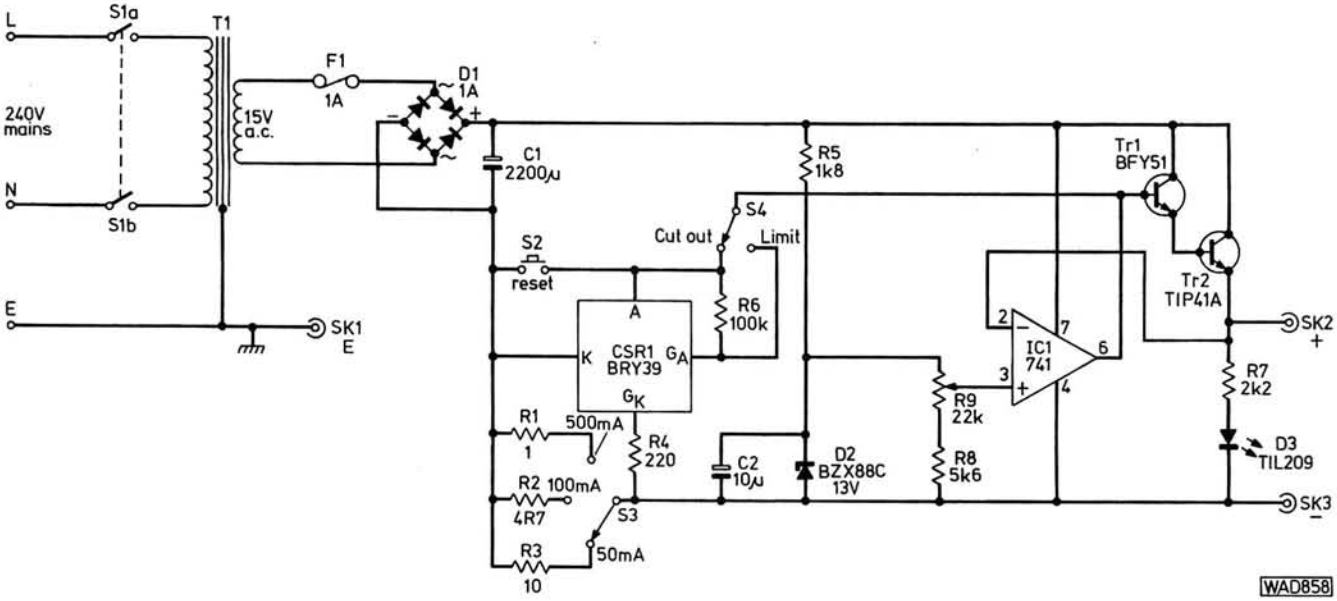


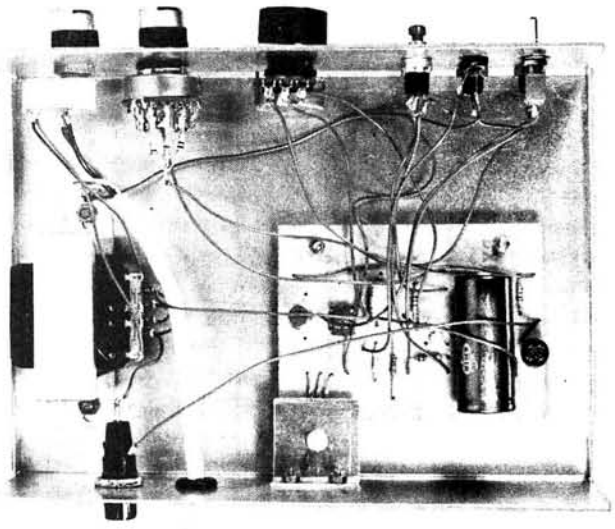
Fig. 2: Circuit diagram of the complete supply

The current sense resistors are R1 to R3, and S3 selects the required resistor. R4 is the current limiting resistor and R6 is needed to prevent spurious triggering of the s.c.s. S2 is the reset switch, and when operated it short circuits the anode and cathode terminals of the s.c.s., reducing the current through it to zero and thus switching it off. If the overload is still present when S2 is operated, no harm will come to the unit since the output will be held at zero by S2, and when S2 is released, the cutout will simply be retriggered.

In the CURRENT LIMIT mode, S4 connects the output of IC1 to the gate anode terminal of CSR1, rather than to its anode. Reference to Fig. 3 will show that CSR1 is now effectively used as an *npn* transistor, as the anode terminal is unused and the *pnp* transistor is inoperative. Now when an overload occurs, the transistor will switch on and reduce the output voltage to a level which limits the output current to about 65, 130 or 650mA, depending on the position of S3.

These currents are somewhat higher than the trip currents obtained in the OUTPUT mode. This is because the voltage across the current sense resistor must be adequate to bias the *npn* transistor of the s.c.s. hard on in order to cause the necessary reduction in output voltage. In the CUTOUT mode the *npn* transistor only has to be brought to the point where it begins to conduct, and then the regenerative action of the s.c.s. causes it to trigger to the on state and cut off the output.

The output from the unit is well smoothed with only about 1mV of hum and noise appearing on the output.



★ components

Resistors		
¼W 5%		
1Ω	1	R1
4·7Ω	1	R2
10Ω	1	R3
220Ω	1	R4
1·8kΩ	1	R5
2·2kΩ	1	R7
5·6kΩ	1	R8
100kΩ	1	R6
Potentiometer		
Carbon track		
22kΩ lin.	1	R9
Capacitors		
Electrolytic, Axial lead		
10µF 16V	1	C2
2200µF 25V	1	C1
Semiconductors		
Diodes		
1A 50V Bridge Rec.	1	D1
TIL209	1	D3
BZY88C13V	1	D2
BRY39	1	CSR1
Transistors		
BFY 51	1	Tr1
TIP 41A	1	Tr2
Integrated Circuit		
741	1	IC1
Switches		
1p 3w rotary	1	S3
s.p.d.t. min. toggle	1	S4
Push-to-make	1	S2
Rotary mains d.p.	1	S1

Miscellaneous

Transformer 15V 12VA; Printed circuit board; Panel mounting fuseholder and 1A fuse; Case 203 × 140 × 63mm; Wander sockets, Red (1), Black (1), Green (1); Insulating set for Tr2.

Construction

The circuit is assembled on a printed circuit board using the track pattern and component layout shown actual size in Figs. 5 and 6. A small instrument case makes a suitable housing for the project. The controls, sockets, and l.e.d. in-

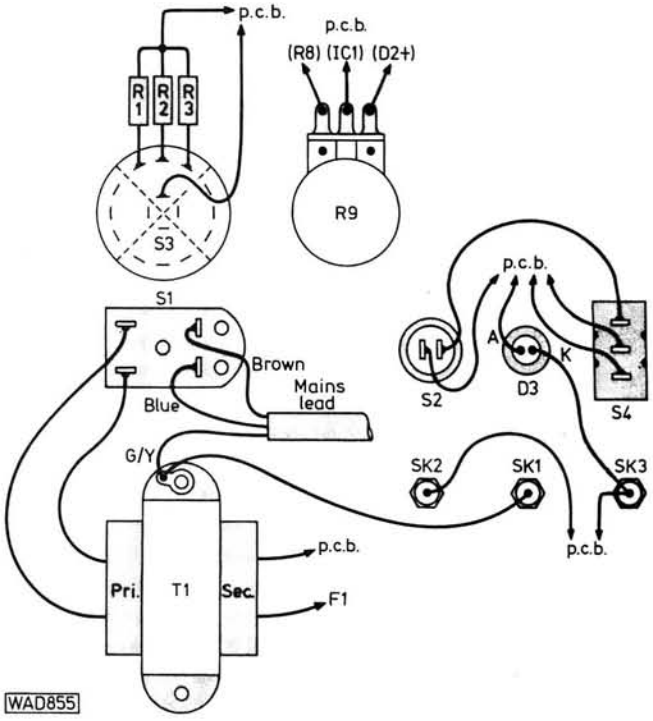
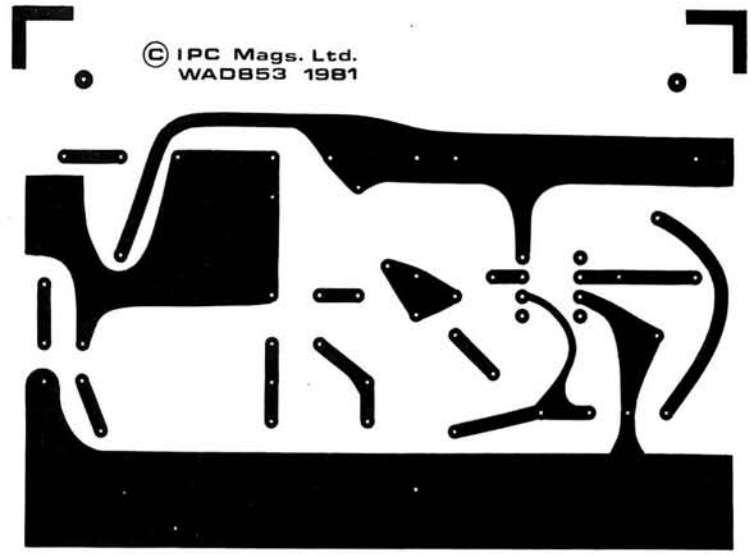


Fig. 4: The point to point wiring of the unit

Fig. 5: The copper track pattern of the p.c.b. shown full size



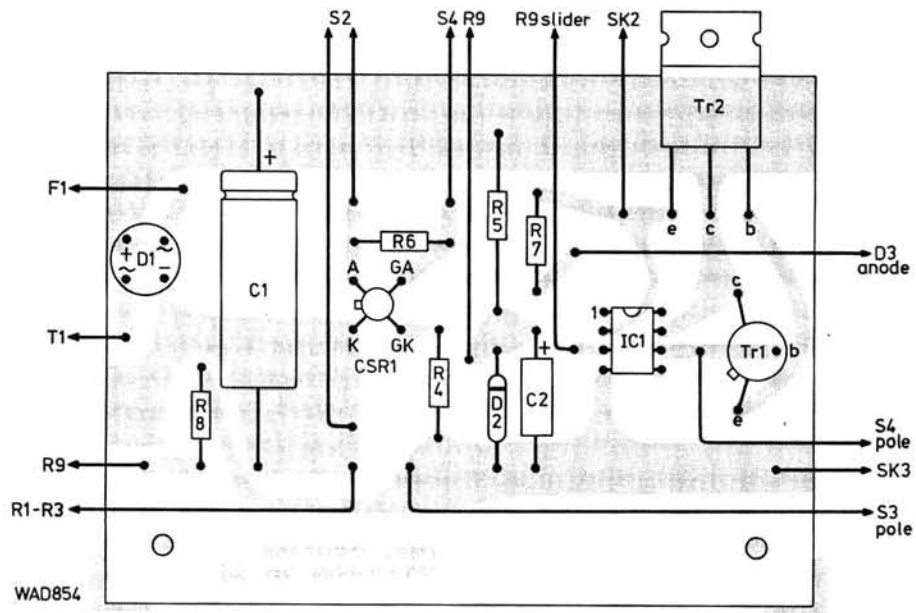


Fig. 6: The component placement drawing showing the positions of the components on the printed circuit board

dicator are mounted on the front panel, and the fuseholder is situated on the rear panel. The rear panel is also drilled with an entrance hole for the mains lead, and this should be fitted with a grommet.

Transistor Tr2 is fitted with an L-shaped 18 s.w.g. aluminium bracket at least 30mm wide. This bracket is bolted to the rear panel of the case, as shown in the photograph, so that together with the metal case it provides the necessary heatsinking. Tr2 must be insulated from the bracket using a suitable insulating set.

Care must be taken when completing the point to point wiring, since an error here, or anywhere in the unit for that matter, could result in costly damage. All the point to point wiring is illustrated in Fig. 4.

Testing

Connect a multimeter set to read 25V f.s.d. across the output of the unit, then switch on and check that the output range of 2·5 to 13 volts is covered by R9. The control knob of R9 should have a suitable calibrated scale made and fitted.

It is advisable to check that the cutout and current limiting circuitry is functioning properly. This can be achieved by adjusting the unit for about 10V at the output, and connecting a wirewound 10Ω resistor of several watts rating across the output.

With S4 in the cutout position, connecting the resistor across the output should trip the circuit regardless of the position of S3 and it should be possible to reset the circuit using S2 once the resistor has been disconnected.

In the LIMIT mode, a multimeter in series with the resistor and set to a suitable range should indicate roughly the currents mentioned earlier, at the three settings of S3.

If there should happen to be a fault in the protection circuitry, the 10Ω resistor will prevent severe overloading occurring. **It is not advisable to check the protection circuitry simply by short circuiting the output.**

In use it will often be found that the output is tripped when the unit is initially connected to an item of equipment, and that operating the reset switch will be ineffective. This is due to the supply decoupling components in the equipment, and can be overcome by momentarily switching S4 to the LIMIT position so as to enable these capacitors to charge up. ●

air test

USER REPORTS ON SETS AND SUNDRIES

DAIWA CN-630 SWR and Power Meter

Using conventional forms of instrumentation, a transmitter operator wanting to keep an eye on both output power and antenna-system standing wave ratio has problems. He must either insert two instruments in the feeder, with increased risk of power loss due to mismatch, or perform a calculation based on observed forward and reflected power levels, using the formula:

$$\text{v.s.w.r.} = \frac{\sqrt{P_f} + \sqrt{P_r}}{\sqrt{P_f} - \sqrt{P_r}}$$

where P_f is the forward power and P_r is the reflected power, or else settle for watching power or s.w.r., but not both at the same time. And unless he's got an automatic s.w.r. meter, he will have to check occasionally that his reference adjustment is still correct.

The CN-630 is one of a series of combined s.w.r. and power meters by the Daiwa Corporation which gets over all these problems in a rather novel way. The conventional forward and reflected power meters are combined into a "crossed-pointer" unit, with a third scale, calibrated in s.w.r., which is read according to the crossing point of the two needles. In effect, the meter is an animated version of a reference-book "abac", with the pointers replacing the straight-edges or pencil lines which you would use there.

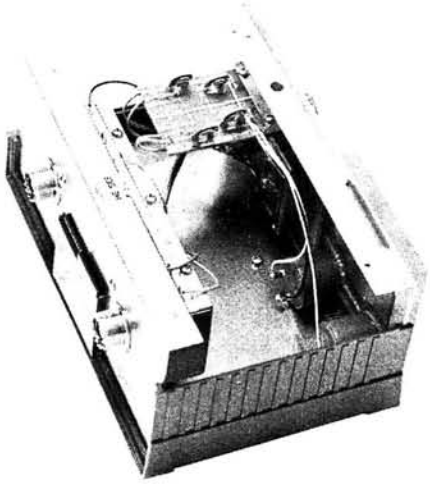
The CN-630 is intended for use in 50Ω systems at frequencies between 140 and 450MHz; the connectors are SO-239 (UHF) type. Two power ranges are provided: 20W or 200W forward, with corresponding reflected power ranges of 4W or 40W. Power readings are accurate within ±10% at full scale. The overall dimensions of the CN-630 are approximately 95 × 182 × 140mm, and the weight around 0·9kg.

Results

The manufacturer's leaflet says that the CN-630 "makes tedious adjustments of s.w.r. and power during antenna tests, matching and tuning of transmitters a breeze", and on the whole I don't think I could argue with that. My only criticism would be of the power ranges chosen.

The leaflet lays down that a minimum of 5W is required for s.w.r. detection, but what it doesn't add is that a minimum of 50W is needed on the 200W range, in order to get the crossing point of the two needles up onto the s.w.r. scale. This has the unfortunate result that the s.w.r. indicator is not operative for transmitter output powers between about 20 and 50W. This means that the popular 25W 2m rigs are out of s.w.r. range on full power, and right on the border-line for their 5W low-power setting. You can, of course, still read forward and reflected power, but it seems a pity that Daiwa didn't give their clever idea wider application by choosing different (and more) ranges, perhaps 20, 60 and 180W forward, which would have given useful overlaps.

The Daiwa CN-630 is available, price £71.00 including VAT, from **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE, telephone Matlock (0629) 2817,** to whom we offer our thanks for the loan of the review meter.

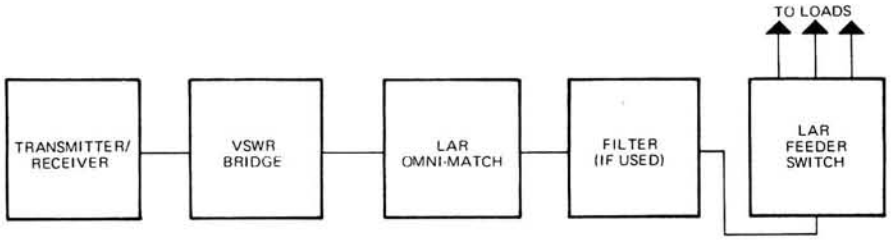


LAR MODULES VHF Antenna Matching Unit

This device, produced by the Yorkshire based LAR Modules Ltd., has been designed to improve the matching between v.h.f. amateur and commercial transceivers and their antennas.

With the increasing use of in-built protection circuits for the output stages of v.h.f. transmitters, it is becoming very necessary to provide a close impedance match during transmission in order to obtain the full rated power output.

Variations in *antenna* impedance in the range 17 to 150Ω, with an attendant v.s.w.r. of up to 3:1, may be successfully accommodated by the Omni-match providing a non-reactive 50Ω load for the transmitter p.a. stage and the close realisation of the much sought after 1:1 standing wave ratio.



The heart of this professionally designed and constructed unit is based on a well proven passive matching network technique, adjustment of which is accomplished via a pair of, externally mounted, insulated control knobs. To obtain correct operational indication the matching unit should be connected as shown in the diagram. By using the LAR feeder switch up to three separate antennas may be matched and monitored variations between antennas being tuned out consistent with lowest reflected/ highest indicated forward power on the v.s.w.r. bridge.

At the reviewers QTH the Omni-match has been successfully used in conjunction with several popular 2m amateur antennas, amongst which a six element quad and home brew Slim Jim have benefited from the exercise. Careful adjustments resulted in reports of increased received signal strengths from several stations worked. Whilst outside the specified operating frequency range of 144–174MHz, the Omni-match has even aided a home constructed 70cm 20-element quad loop Yagi!

Constructed to a high standard, the Omni-match will grace the shack of any discerning amateur and with its modest overall dimensions of 150 x 130 x 75mm will not take up too much vital operating space.

Input/output connections are made via SO239 u.h.f. connectors mounted at the rear of the module; a through power handling of 750W should accommodate all legal UK input drive levels.

For further information about the Omni-match, which is priced at £34·90 inc VAT plus £1·50 p&p, and details of other products in their expanding range of equipment, contact **LAR Modules Ltd., 60 Green Road, Leeds LS6 4JP. Tel: 0532 782224** to whom we offer our thanks for the loan of the review sample.

WOOD and DOUGLAS 70cm 10W Power Amplifier

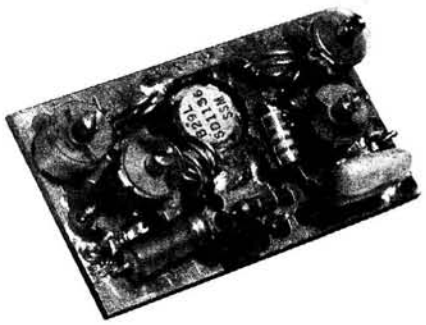
Wood and Douglas offer a wide range of realistically priced kits for both 70cm and 2m as well as some microwave related gear. We reported on our experiences with their single channel 70cm transceiver in *Practical Wireless,* October 1980 and this is still working very well. It has recently been re-crystalled to cover RB0 now that GB3DT is on the air and this required no adjustments at all, just the new crystals plugged in.

One of their kits for 70cm received for review was a 3W in 10W out p.a. which when our tests are completed will be donated by Wood and Douglas to GB3DT for permanent use as the main p.a. stage.

The kit comprises all the components mounted on the small glass fibre p.c.b. together with a rather spartan looking instruction sheet. A check sheet is also provided which contains any substitutions or component changes and this is a very useful aid to understanding the instructions.

Assembly is very simple, all the coils being preformed and the only stage that needed thinking about was just how short to crop the tabs on the output transistor.

The completed amplifier measures a mere 46 x 26 x 14mm and requires fitting into a suitable diecast box equipped with sockets and a means of feeding the supply to the board.



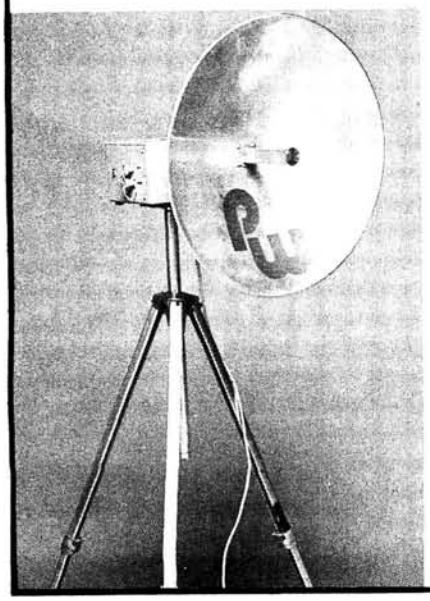
All the components were of good quality and fitted the holes drilled in the p.c.b. with no problems. Some component leads had to be soldered to the copper ground plane on the component side of the board as well as the copper track side but this proved quite easy as long as some thought was given to the order in which components were placed on the board.

For an input of 3W the completed amplifier gave an output of 10W with a 12V d.c. supply. The output transistor was bolted to the bottom of the diecast box and this should give adequate heatsinking.

Care must be taken not to short-circuit the output pins as there is no protection for the transistor.

Wood and Douglas, 9 Hillcrest, Tadley, Basingstoke, Hants RG26 6JB have a range of 70cm p.a. kits covering 1W, 3W and 5W output for 500mW input and the version reviewed here which costs £13·95 in kit form or £18·80 made up.

PW EXE PARABOLIC DISH OFFER



The antenna system designed for the *PW* Exe uses a specially designed and spun aluminium dish and arrangements have been made for the supply of this special item to our readers.

Although designed primarily for the *PW* Exe project, this 128mm focal length, 460mm black anodised aluminium parabolic dish should be useful for many other projects in the future, some of which are more than just "pie in the sky".

The special offer price is £7.50 if collected direct from *PW* offices. Post and packing is £2·00 for one dish and £2·50 for two dishes. Please make your cheques or postal orders payable to IPC Magazines Ltd.

NEWS NEWS NEWS

TV/DX Reception Group

A national DXTV (long distance) reception group has been formed mainly at the instigation of the well-known v.h.f. personality George Grzebieniak (RS41733) from Chiswick, West London.

The group has held several meetings in the London area since February 1981. Many of the members have already acquired and used a large range of various pieces of TV equipment, from a five inch multi-band B/W TV set to a 27 inch full colour model, which incorporates provision for satellite reception.

A considerable wealth of experience and practical ability has surfaced from the membership so far, and this is regularly pooled, advice and help freely flows between the members, enabling everyone to maximise the pleasures of TV DXing.

Anyone interested in joining the group should write (s.a.e. please) to: *George Grzebieniak, c/o 185 Fleet Street, London EC4A 2HS.*

Exhibition

The Leeds Electronics Show will be celebrating its 18th anniversary when it is held between 10 June and 2 July 1981.

The show organised by the Department of Electrical and Electronic Engineering will be much larger than last year and will be held at: *The Department of Electrical & Electronic Engineering, University of Leeds, Leeds.*

Technical Literature

A new six-page information sheet dealing with more than 100 r.f.i. power line filters, produced by Corcom, designed for international applications and fully approved by the major national safety organisations, is now available in Britain.

Among the information supplied is an extensive table setting out interference filter requirements and specifications relating to Europe and North America.

The leaflet is available from: *MCP Electronics Ltd., 38 Rosemont Road, Alperton, Wembley, Middlesex HA0 4PE. Tel: 01-902 6146.*

Queen's Awards for GEC–Marconi

Two GEC–Marconi companies have won Queen's Awards for Technological Achievement. The awards, bestowed on Marconi Communication Systems and Hall Automation, make a total of 25 received by the group—12 for Technological Achievement and 13 for Export.

The award received by Marconi Communication Systems for a complete new range of h.f. fast tuning radio communication equipment, which has achieved more than £50M of orders since its initial launch.

Hall Automation, a leader in the robotics field, is one of the smallest companies ever to receive a technology award. The new HAL System 90 is a new all solid-state control unit designed to control the company's present and future types of industrial robots.

Apart from one year the GEC–Marconi Electronics group has won at least one Queen's Award every year since the scheme's inception in 1966.

Rallies and Events

Nunsfield House Community Association Amateur Radio Group—G3EEO, G3ZBI, G8KGC have organised the twelfth Elvaston Castle Mobile Radio Rally on Sunday 14 June 1981.

The rally will be held on the showground at Elvaston Castle Country Park, which is five miles south-east of Derby, on the B5010.

Further details from: *Ian Cage G4CTZ, 25 Petersham Drive, Alvaston, Derby. Tel: (0332) 71875/799452.*

The second Sussex Mobile Rally to be held at Brighton Race Course, will be on Sunday 19 July 1981, from 1030 to 1800hrs. Last year nearly three thousand people attended the rally which is organised by six amateur radio clubs in the Sussex area.

Further details from either: *A. K. Baker G4GNX, 38 Elphick Road, Newhaven, Sussex. Tel: (07912) 5327 evenings, or J. Trimmer, Tel: (0273) 693655 Ext 2266 office hours.*

Scarborough Amateur Radio Society's mobile rally will be held on Sunday 26 July 1981, starting at 1045hrs. This year the rally moves to a new location, The Spa Ocean Room on the sea front.

Further details from: *Margaret Crofts G4JAQ, 43 Broadlands Drive, East Ayton, Scarborough, N. Yorks YO13 9ET. Tel: (0723) 862638.*

Summer DX-pedition

A Summer DX-pedition has been organised at a site 6km SW of Glenluce, QRA locator XO18h, by members of the University of Liverpool Amateur Radio Society G3OUL/G8JUL.

The station will be operational between 10 and 20 July and will be attended by as many of the licensed members of the Society as possible, including G8KWX, GM8OFV, G8LGL, G4FXD, G4IKK, G4ELJ. G8NOY and G6AZJ.

Callsigns GM3OUL/P and GM8JUL/P will be used, with the possibility of a special event callsign. UOLARS hopes to be active on all bands up to 23cm, skeds for the latter being arranged on 144MHz.

Further details from: *Guild of Undergraduates, 2 Bedford Street North, Liverpool 7.*

On The Move

Gain Electronics have moved to new premises at: *63 High Street, Princes Risborough, Aylesbury, Bucks HP17 0AE. Tel: (08444) 7116.*

FieldTech, together with its associate company Field Aviation Ltd., have moved to new premises on the north-west side of London's Heathrow Airport. In addition, the company have changed their name slightly.

Their new name and address is: *Fieldtech Heathrow Ltd., Huntavia House, 420 Bath Road, Longford, Middlesex UB7 0LL. Tel: 01-897 6446.*

Name Change Coming

The US parent company of CSC, Continental Specialties Corporation, has recently changed its name to Global Specialties Corporation: the UK company will follow suit as soon as legal formalities are concluded.

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FRG7700 £309
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FT202R £109
1W. 6 chnl. 2m Handheld

FT207R £195
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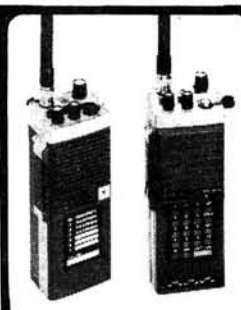

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FT404R £179
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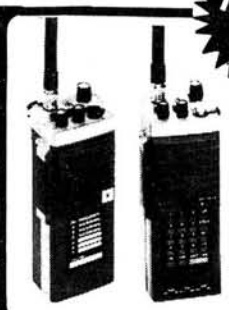

FRG7 £199
0°5 30MHz General Coverage Receiver. 230V ac. 12V dc, + Battery pack. AM/SSB

FT480R £359
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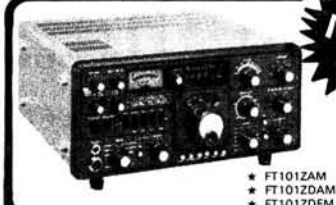

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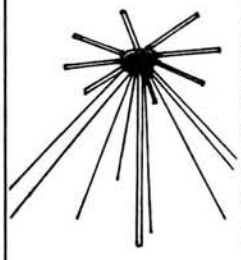

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SIMPLE & SUPER REGENERATIVE RECEIVERS

Tore LUNDAHL

The author is involved in teaching radio and electronics at a school in Sweden, and has carried out many experiments on simple receivers of various types. Some of his circuits and the results they give are described here, in the hope that they may inspire others to further investigation.

A beginner in the fascinating hobby of building radio receivers wants something with a simple radio frequency section and yet good performance. In these respects, it is difficult to beat the super-regenerative receiver, which is both sensitive and simple. You can't get the best out of this sort of receiver without a detailed understanding of what is going on in the circuit, so let us start with the question: "What is really going on in a super-regenerative receiver, and how does it differ from a regenerative one?"

The circuits of a regenerative receiver, a super-regenerative one and an *LC* oscillator are very similar. They all have a tuned circuit, a transistor or valve that amplifies the oscillations in the tuned circuit, and a feedback path that sends oscillatory energy back to the tuned circuit in the correct phase to maintain the oscillations. The difference between them lies in how much energy you feed back.

The Regenerative Receiver

In a regenerative receiver, the signals from the antenna are applied to the tuned circuit, and the oscillations there follow the part of the antenna signal having the right frequency. You feed back as much energy as is necessary to compensate for the losses in the tuned circuit, but no more. The oscillations still follow the antenna signal, but at a higher level than without feedback.

It has been said that it is impossible to design a single-transistor regenerative receiver which gives smooth control in the same way that a one-valve receiver can. At the Haga School in Dals-Ed, Sweden, we have used such a circuit for some years (see Fig. 1). The circuit can be brought to a point just short of oscillation and tuned to a station with no problems with instability, but the slightest detuning to either side will bring the circuit smoothly into oscillation.

The BF494 transistor has a very sharp knee at the bottom of the V_B—I_C curve, and the large value base resistor R2 places the working point in that knee, so that the transistor operates as a rectifier, amplifying only the positive half of the signal. A larger signal gives a larger mean collector current, but that gives a larger voltage drop over the collector resistor (R3 + R4), and less base current for the transistor, so reducing the amplification as required.

It is impracticable to have the emitter tap on the coil adjustable for the correct amount of regeneration. It is easier to position the tap for a little too much regeneration and then introduce negative feedback through R1 and C4. The coil we used can be tuned to the 19m, 16m and 13m bands, and consists of $17\frac{1}{4}$ turns wound on a 15mm diameter former at a 0·7mm pitch, with taps at $1\frac{1}{4}$ turns and $5\frac{1}{4}$ turns from the bottom (earthy) end. A long antenna is best connected to the emitter tap on the coil, and a short one to the base tap. The receiver had a very slight backlash of the regeneration control, perhaps because of the high frequency, but was very sensitive.

The next step is to build a receiver with two tuned circuits. I have searched for a circuit with regeneration on both the tuned circuits, but could not overcome instability problems until I tried the arrangement of Fig. 2. It proved to be stable without the need for any screening between the tuned circuits, provided they were not placed closer than 150mm, and gave very much better selectivity and sensitivity than Fig. 1. Transistor Tr1 operates as a *Q* multiplier for the antenna circuit.

The circuit of Fig. 1 has also been used as i.f. amplifier and detector in a simple superheterodyne receiver with only two tuned i.f. circuits at 1·6MHz, but with a fairly good performance thanks to the regeneration.

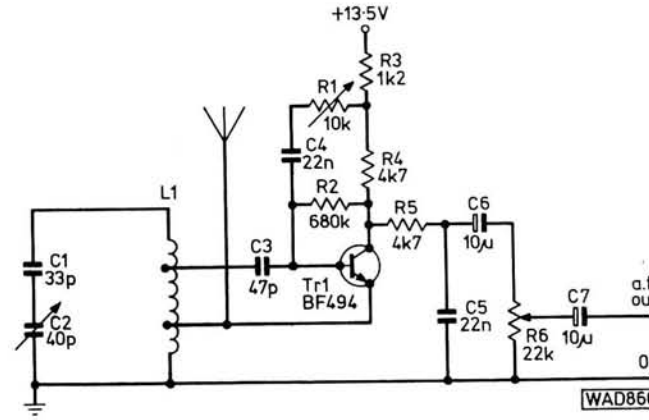
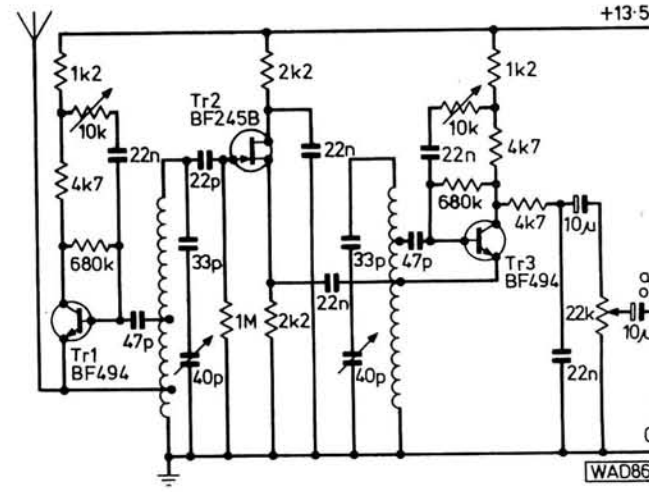


Fig. 1 ▲

Fig. 2 ▼



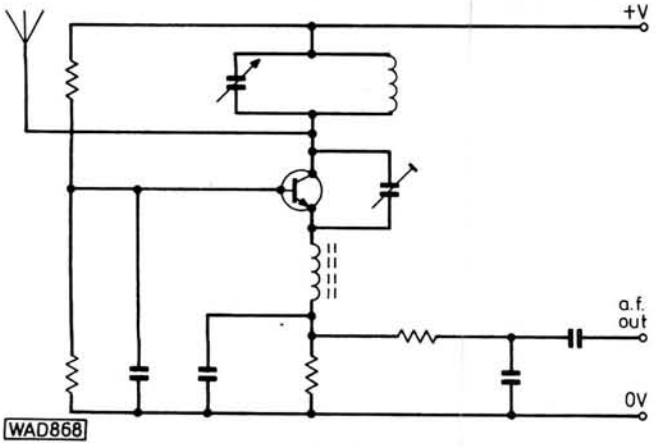


Fig. 3

The Oscillator

In an *LC* oscillator, you feed back more energy than is required to make up the losses. The oscillations increase rapidly and so does the energy fed back. After a short while, the oscillator reaches an equilibrium between losses and energy fed back, and the oscillations stabilise at a high level.

The Super-regen

In the super-regenerative receiver, the amount of energy fed back is periodically changed. The period starts with low feedback that increases with time, and soon the feedback is large enough to change the circuit to an oscillator with rapidly-increasing oscillations. The period ends with a sudden decrease in feedback, so that the large oscillations stop and the next period starts with low oscillations and low feedback again. If the large oscillations are not completely stopped before the next period, the receiver is unstable and produces loud howling and hissing noises.

The point in the period when the circuit changes to an oscillator is important, and we can call it the starting point (of the oscillator). The boundary between the two parts of the period is not sharply defined, but the idea of a starting *point* helps in understanding the working principle.

How is this periodical working of the receiver arranged? It is done by changing the gain of the oscillator transistor. In many receivers this is achieved by connecting a capacitor in parallel with the emitter resistor (see Fig. 3). We can call such receivers *CR* receivers. Another way is to feed the base of the oscillator transistor with the output from another oscillator, called the steering oscillator, together with the signal from the tuned circuit. This method involves a more complex circuit, though not in the r.f. part, nevertheless it has important advantages. A German writer, Lothar Sabrowsky, reports from his experiences with super-regenerative receivers for radio control, that receivers with separate steering oscillators have markedly better selectivity than *CR* receivers. Selectivity is usually a weak point with super-regenerative receivers, so this is a strong argument in favour of a separate steering oscillator. Another is that this way, you have good control over the receiver and much more scope for varying the receiver's working conditions, as will be seen later (see Figs. 4 and 5).

Do the oscillations in the tuned circuit of a super-regenerative receiver follow the antenna signal? The answer is both yes and no! The fundamental fact is this: the antenna signal determines where the starting point comes in this period. A strong antenna signal gives somewhat larger oscillations in the first part of the period, a higher mean current in the transistor, and therefore a higher degree of amplification. The starting point thus comes earlier in the period. An early starting point gives a greater part of the period with the circuit operating as an oscillator with increasing amplitude, so the mean value of the oscillations in a period is much larger with a strong antenna signal than with a weaker one. If you speak of the mean value in one period, you can say that the oscillation in the tuned circuit is a function of the antenna signal, but it isn't necessarily a linear one! If this function is not linear, the audio output will be distorted to some degree.

After rectification and filtering out of the r.f. variations with a capacitor, the output of the detector consists of the audio signal (more or less distorted), together *with a signal* at the steering frequency, which has a larger amplitude than the audio signal. This steering frequency signal cannot be heard, as its frequency is too high (in the range 30-100kHz), but its large amplitude can overload the following audio amplifier stages if suitable precautions are not taken.

Where there is no antenna signal, the starting point comes late in the period, and is subject to random influences. The jitter which results is evident as a noise signal in the output, this noise between stations being typical of a super-regenerative receiver. It proves that the receiver is operating in the correct mode, but there is no need to adjust for maximum noise, as is sometimes recommended. Often the best sensitivity is obtained when the noise threshold is just reached.

Another feature of the super-regenerative receiver is the way it radiates via its antenna. The antenna is connected to a tuned circuit carrying large irregular oscillations with many frequency components, capable of causing severe interference to other receivers nearby. A radio-frequency amplifier stage before the super-regenerative circuit can help to reduce the problem.

Circuit Descriptions

The circuit shown in Fig. 4 is based on one by Lothar Sabrowsky. It is very sensitive, and for a super-regenerator the selectivity is excellent, but when receiving f.m. broadcasts in Band II (88-100MHz) its sound quality is not too good, having too much bass and not enough treble. The flank or slope demodulation technique used gives

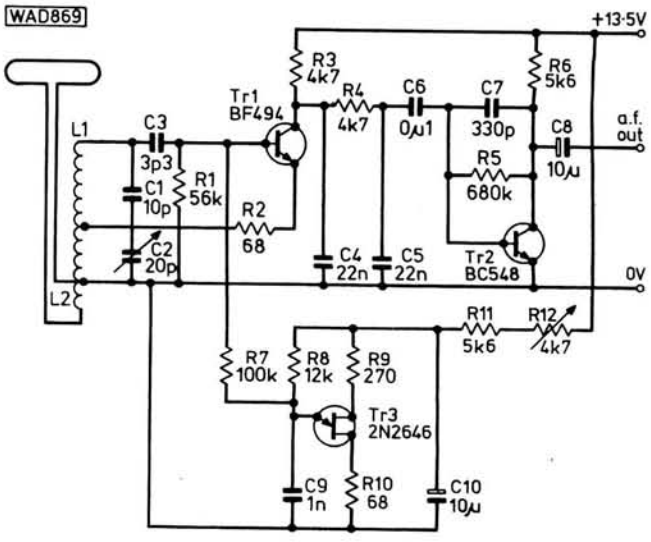


Fig. 4

some distortion, but most of this seems to come from the super-regenerative detector. I believe that its performance would be excellent on a.m. v.h.f. services.

The signal oscillator is of the well-known Hartley type, with feedback through the emitter circuit. The details of the coils are as follows: L1 7 turns with a tapping one turn from the ground tap, L2 2 turns, wound as one coil on a 1mm pitch, with a diameter of 10mm, self-supporting (no former used). The emitter resistor R2 limits the amplitude of oscillations. The steering oscillator used a uni-junction transistor Tr3, and its output has a similar waveform to that produced in *CR* receivers, see Fig. 6. This output is fed to the base of the signal oscillator transistor Tr1 through the voltage divider R7/R1. The important fine adjustment of the steering oscillator is made by means of R12. Transistor Tr2 and its associated components form an audio pre-amplifier with negative feedback at higher frequencies provided via C7. Thus the stage provides greater amplification at audio frequencies than at the steering frequency.

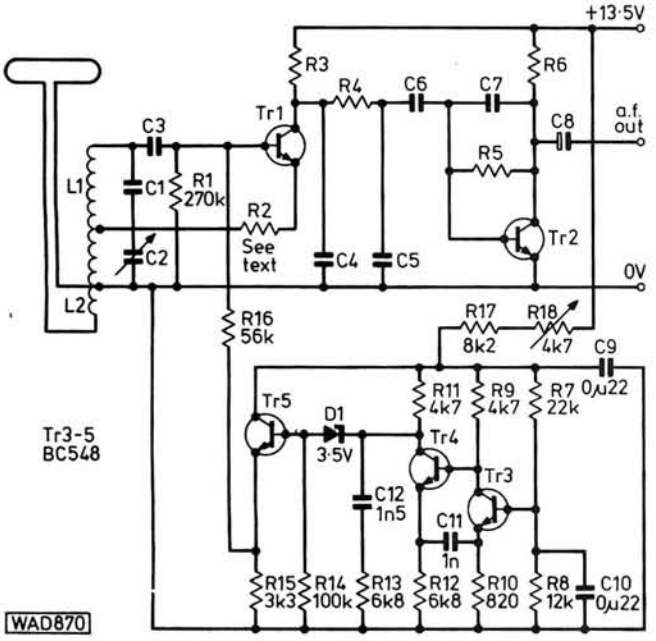


Fig. 5

I had the idea that if I changed the waveform of the steering oscillator to something like Fig. 7, I could improve the sensitivity a little more, so I built a receiver to the circuit of Fig. 5. With the small slope on the top of the steering oscillator waveform, a small change in the antenna signal will produce a large change in starting point, and with it, I thought, very high sensitivity. This didn't happen, however; I had to select the value of R2 in the range 20–100Ω to get the receiver stable, but the sound quality was greatly improved, and listening to music broadcasts on Band II f.m. was a real joy.

The steering oscillator of Fig. 5 has some twenty components, but none of them is expensive. Transistors Tr3 and Tr4 form an emitter-coupled astable multivibrator giving asymmetrical squarewaves. The slope on the top comes from the combination C12/R13, and can be adjusted by using different values for R13—less resistance gives a steeper slope. The steering frequency can be altered by changing the value of C11—a lower capacitance gives a higher frequency. The Zener diode D1 acts as a voltage shifter, so that the oscillations have the correct d.c. component for the base of Tr1 after passing through the emitter follower Tr5. Fine adjustments are made with R18.

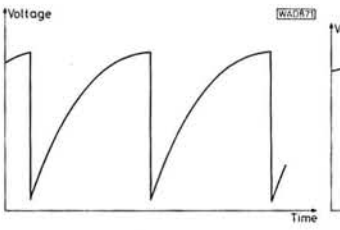


Fig. 6

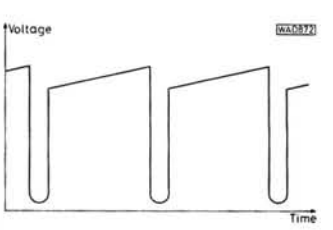


Fig. 7

The steering waveform can be checked by means of an oscilloscope connected to the emitter of Tr5. The integrator formed by R16/C3 changes the shape a little at Tr1 base, but connecting the oscilloscope there will distort the waveform considerably, due to the effect of the 20-30pF input capacitance of the oscilloscope. I believe that the best picture will be obtained by connecting the oscilloscope to Tr5 emitter via an 8·2kΩ resistor, which with the 'scope input capacitance, will have about the same time constant as R16/C3. If you change the coil L1,2 to suit the higher short-wave bands, it is best to connect the antenna to junction with R2.

I have operated this receiver on the f.m. broadcast band with an r.f. amplifier stage in front of the detector with good results (see Fig. 8). When receiving the local station the receiver was trimmed so that the starting point wasn't quite reached when the antenna was disconnected. The sound quality was then excellent, and completely free from noise. Coil L4 is 7 turns on a 1mm pitch and 10mm diameter, self-supporting. Coil L5 is 2 turns on a 1mm pitch and 14mm diameter, placed around L4.

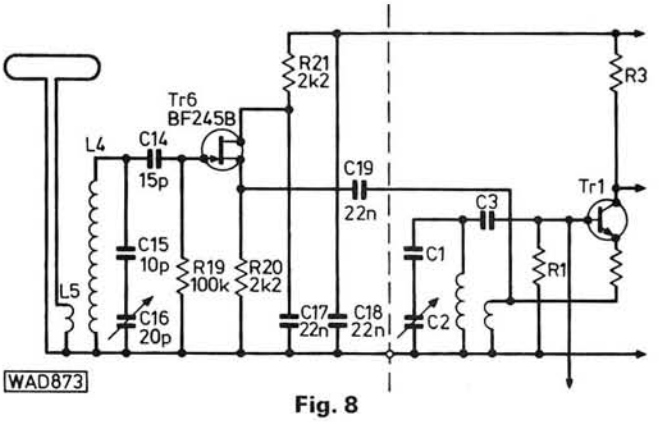


Fig. 8

There seems no reason why the r.f. amplifier should not work just as well on the other bands, or with other circuits such as that in Fig. 4. It is essential to screen the amplifier from the detector. It isn't necessary to gang the two tuning capacitors, as the amplifier tuning is much broader than that of the detector. Varicap diodes (BB105) have been tried, but without such good results.

There is much scope for investigation of the following questions: Would a little more slope on the top of the steering waveform, together with a lower emitter resistance in the signal oscillator, give improved sensitivity? Is it better to make the receiver stable by shortening the ramps and lengthening the intervening pulses in the steering waveform, rather than by increasing the emitter resistance? Are there better steering waveforms than those shown in Figs. 6 and 7? Will another type of steering oscillator give better results? Why don't you start experimenting to find the answers, and pass them on to this magazine? ●

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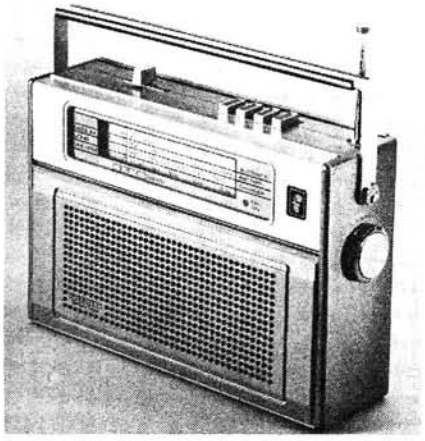
Fly the Flag

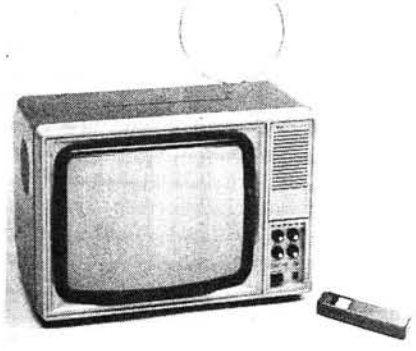
Fidelity Radio Ltd. have recently introduced two new British designed products for the domestic electronics market.

First, a three waveband (l.w., m.w. and f.m.) battery/mains portable radio which incorporates a unique dry battery charging circuit.

The radio is powered by a PP9 or equivalent battery which is automatically recharged when the radio is plugged into the mains, whether or not the radio is switched on. The battery can be recharged up to four times.



It is expected that the radio will retail at about £20.00 and it is estimated that, over a five year period, savings on replacement batteries could amount to very near the original cost of the radio.



Second, is the CTV 14R, a highly advanced 14in portable colour television with an infra-red remote control facility.

Utilising the new technology they developed for their monochrome portable TV, Fidelity claim to employ 40% less components than conventional designs. It is expected that this remote control portable will retail at around £200 which is today's approximate price for other non-remote designs.

Advance orders for the CTV 14R, based on its *specification* alone, already top 25 000 and as a result of its introduction it is likely that around 100 new jobs will be created, which can't be bad.

Fidelity Radio Ltd., Victoria Road, London NW10 6ND. Tel: 01-965 8771.

TVI

Waters & Stanton introduce a new, British designed, TV interference filter, of a more advanced design than their earlier models, and designated the HP4A.

The unit is a high-pass design providing an extremely high rejection of interfering signals below 180MHz and is suitable for all UK TV areas.

It is claimed the unit produces no noticeable degrading of the TV picture quality yet totally rejects unwanted signals such as CB on 27MHz. Isolation of the TV coaxial braiding is also provided, which is another common source of interference.

The HP4A costs £5.95 (inclusive of VAT and p&p) and is obtainable from retail stores throughout the UK, or direct from: *Waters & Stanton Electronics, Warren House, 18–20 Main Road, Hockley, Essex. Tel: (0702) 206835/204965.*

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Speech Processor for FM Transmitters

James M. BRYANT G4CLF & Peter E. CHADWICK G3RZP

This article describes a microphone amplifier and audio processor for f.m. transmitters using an SL6043 quad-operational amplifier. It consists of a high input impedance pre-amplifier (which may be omitted if a high input impedance is not required), an amplifier, a pre-emphasis circuit and a Sallen and Key low-pass filter. The circuit complies with the CEPT specification for deviation against modulation as exemplified in various national PTT transmitter specifications. It is therefore suitable for use in amateur, marine, p.m.r. and military f.m. transmitters.

The SL6043 has been specially developed for use in radio applications. The operating current of each amplifier is programmed by an external pin, with pin 8 biasing amplifiers B, C and D, and pin 16 biasing amplifier A. It is therefore possible to bias one amplifier at a totally different point to the others if this should be desirable in a particular application. Uses of the SL6043 include amplifiers, buffers, filters, comparators and voltage regulators. The circuit of an SL6043 is illustrated in Fig. 1.

The circuit diagram of the system is shown in Fig. 2. It consists of a high input impedance non-inverting stage with a gain of 16dB, a main amplifier with a gain of 38dB, a pre-emphasis stage with a response rising at 6dB/octave and a low-pass Sallen and Key filter with an 18dB/octave roll-off above 3kHz. The pre-emphasis stage is arranged to have symmetrical limiting so that it will also serve as a peak clipper.

The input amplifier uses operational amplifier A in the non-inverting mode and the d.c. working point is deliberately set at $0{\cdot}4V_{cc}$ rather than $0{\cdot}5V_{cc}$ so that the electrolytic interstage coupling capacitor is correctly biased. This stage has an input impedance of approximately 400kΩ and a gain of 16dB. The gain is set by R1 and R2 and may be altered by changing the value of R2 according to the formula:

$$\text{Gain} = \frac{R1 + R2}{R2}$$

The gain of this stage may be varied from unity if R2 is omitted, to 26dB when R2 is reduced to 27kΩ. This is the minimum recommended value for R2—if more gain is required it should be added externally.

If a low impedance dynamic microphone is used the input amplifier is not necessary and may be omitted. In that case, op. amp. A may be used for some other purpose or not at all. In either case it may be necessary to detach pin 16 from R3, either to power down op. amp. A altogether, or to power it up to a higher level. If the input amplifier is not used the input signal is applied to point X, which should also be decoupled to ground by a 1nF capacitor.

The main amplifier is a conventional inverting "see-saw" amplifier. Its gain, which is set by R4, is normally 38dB but it may be varied between 20dB when R4 is 2·7kΩ, to 40 dB when R4 is 27kΩ. The input coupling capacitor sets the l.f. roll-off of 6dB/octave below 300 Hz. This amplifier, and the one following it, are biased so that any large signals are clipped symmetrically. Clipping is essential to ensure that the transmitter does not over-deviate on transients. Symmetrical clipping ensures that only odd-order harmonics are present in the clipped signal (3rd, 5th, etc.) which are less unpleasant and, being higher in frequency, more easily filtered than the second harmonic which would result from asymmetric clipping.

The third stage is another inverting "see-saw" amplifier, but the input half of the "see-saw", consisting of a 10nF capacitor in series with a 3·9kΩ resistor, is capacitive up to 4kHz and so gives a rising 6dB/octave response up to this frequency. This stage is the one most likely to limit. The signal from the pre-emphasis circuit goes to a third-order Sallen and Key low-pass filter which gives an 18dB/octave cut above 3kHz. This filter consists of three capacitors, three 68kΩ resistors and op. amp. D used in the unity gain non-inverting mode.

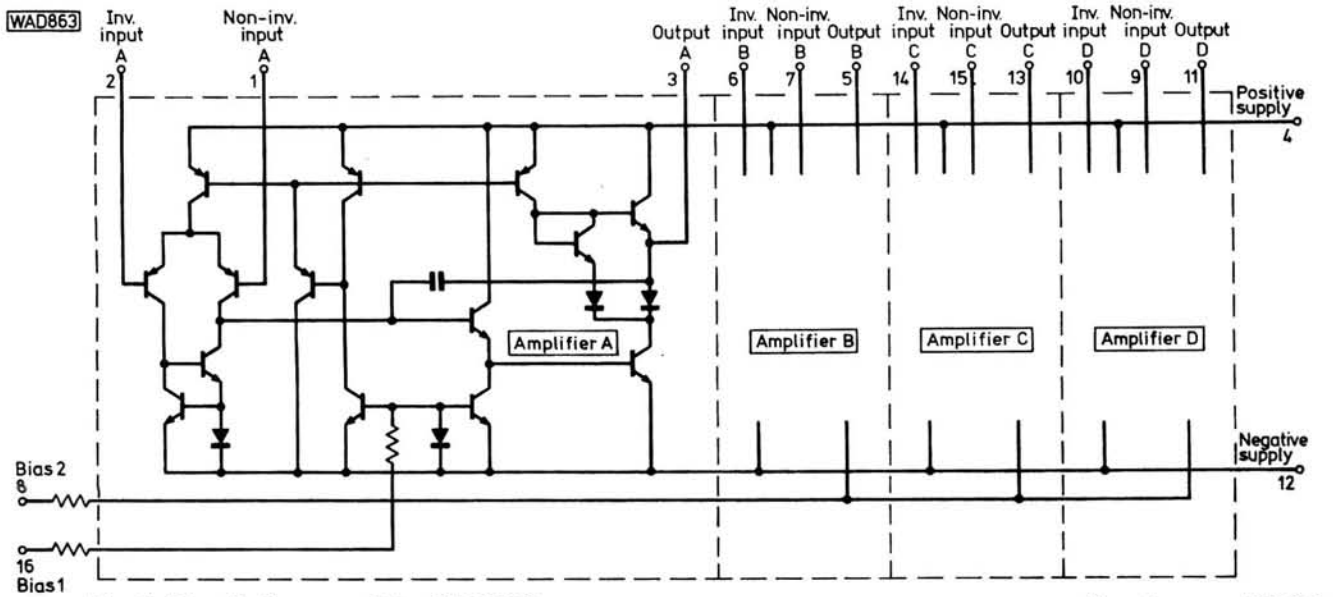


Fig. 1: Circuit diagram of the SL6043C

continued on page 36

'EXE' MICROWAVE TRANSCEIVER

Part 2

Dick GANDERTON G8VFH & John M.FELL G8MCP

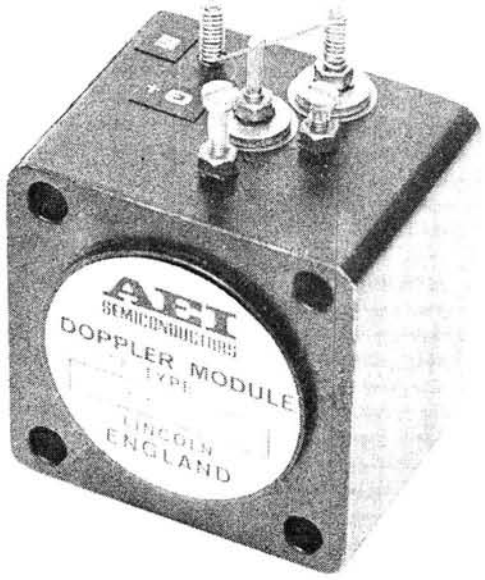
In the first part of this series we explained the basic principles and thinking behind the *PW* Exe. In this part we commence the constructional details of the system starting with the interesting and to most amateurs the unusual bit, namely the 'plumbing' or microwave head.

In the *PW* Exe we have been very careful to keep the metalwork to a minimum and as far as possible we have used ready-made pieces of microwave equipment. It is possible to make your own Gunn oscillator from scrap lengths of waveguide and bits of brass and copper, but for the beginner to microwaves this approach leaves a lot to be desired since the accuracies involved are quite demanding if good results are to be obtained.

With all this in mind we decided to use a commercially available microwave burglar alarm unit and to modify this to give variable tuning over the amateur 3cm band. Any microwave burglar alarm unit operating around 10·6GHz can be used but for the *PW* Exe we decided that it would be better to use one that could be bolted directly to Waveguide 16. This narrowed the field down to just two units, the Plessey GDHM 1 and the AEI Doppler Module.

The Plessey unit was the initial choice and performed well as a receiver but suffered from a severe drop in r.f. output when retuned from 10·687GHz down to 10·1GHz.

The AEI module is popular with many amateurs and we decided to adopt this unit for the *PW* Exe.



The modifications needed to retune the AEI module and provide variable tuning over the amateur 3cm band are straightforward and simple. Fig. 7 shows the mechanical details of the microwave head assembly for the *PW* Exe. The micrometer head is a very useful means of setting the band of operating frequencies but if desired can be omitted and a length of 4BA ptfe studding substituted. In this case, however, a suitable bracket will have to be fabricated to anchor the AEI module to the side of the diecast box. Nylon can be used instead of ptfe but is more lossy than ptfe. The adaptor bush for the micrometer head is turned from aluminium or brass bar and if you do not own a lathe we suggest that you try the local model engineering society or a small engineering company. Most model engineers will be only too pleased to help with a simple piece of turning such as this.

Modifying The Module

Care must be taken when working on the r.f. module to avoid damaging the inside walls of the cavity or the two diodes and screws. **Under no circumstances remove the shorting link between the Schottky diode and the earth post until final electrical connections have been made.**

1. Carefully remove the 8BA brass screw to the rear of the Gunn diode. **Do not touch the other screw.**
2. Using a 1·75mm drill, carefully drill a hole through the opposite wall of the cavity using the tapped 8BA hole as a guide. Alternatively, mark out and drill from the opposite face of the module.
3. Working from the opposite side to the screws and connections, open up the new hole to 3·2mm diameter and carefully remove any burrs formed inside the cavity. This is tricky but possible using a small screwdriver blade as a scraper, avoiding the Gunn diode.
4. Using a 9·5mm drill ($\frac{3}{8}$inch), open up the hole for a depth of 10mm checking that the micrometer adaptor bush fits without too much shake. Deburr the outer rim of this large hole.
   NB If the micrometer head is not being fitted, use a 3·0mm drill and tap the hole 4BA before deburring. Do not open up with the 9·5mm drill.
5. Drill 2·3mm diameter from the back face of the module to break into the 9·5mm diameter hole and tap 6BA to take the clamp screw for the adaptor bush.
6. Replace the 8BA brass screw removed in 1. so that the underside of the head is 7mm from the body. Lock in place with the locknut.

The r.f. head is now complete and should be put away in a small box until you are ready to bolt it to the antenna and diecast box.

Antenna

The antenna chosen for the *PW* Exe is based on a parabolic dish fed from the rear via a 'Penny Feed' based on an original design by G4ALN.

The feed is simply a length of Waveguide 16 fitted with a flange at one end and two slots cut in the broad faces of the guide at the other end. Fig. 7 shows the dimensions of the slots. Super accuracy is not needed but try to get as close as possible to the dimensions shown. All burrs must be removed before soldering the old penny onto the end. Actually a copper or brass disc 30mm diameter is what is needed but an old penny is near enough and convenient. When soldering the disc in place take care not to get solder inside the waveguide or on the face of the disc as solder is very lossy at microwave frequencies. If you have access to brazing equipment then silver solder the disc in place.

Before soldering the disc onto the end of the guide remember to slide the dish mounting flange onto the guide—the correct way round of course. This mount is made from a standard flange of the type which allows the guide to pass right through, which has a 4mm hole drilled as shown in Fig. 7 and tapped 2BA to take the clamp screw. The four holes in the flange can be tapped 2BA to make fitting the dish easier.

Micrometer Tuning

The 3mm diameter ptfe rod is cut to the length shown in Fig. 7 and a small hole drilled across it. A length of 20 s.w.g. copper wire is threaded through this hole and the ends wound neatly round the ptfe rod as drawn. The small spring is of the type used in cheap ball-point pens.

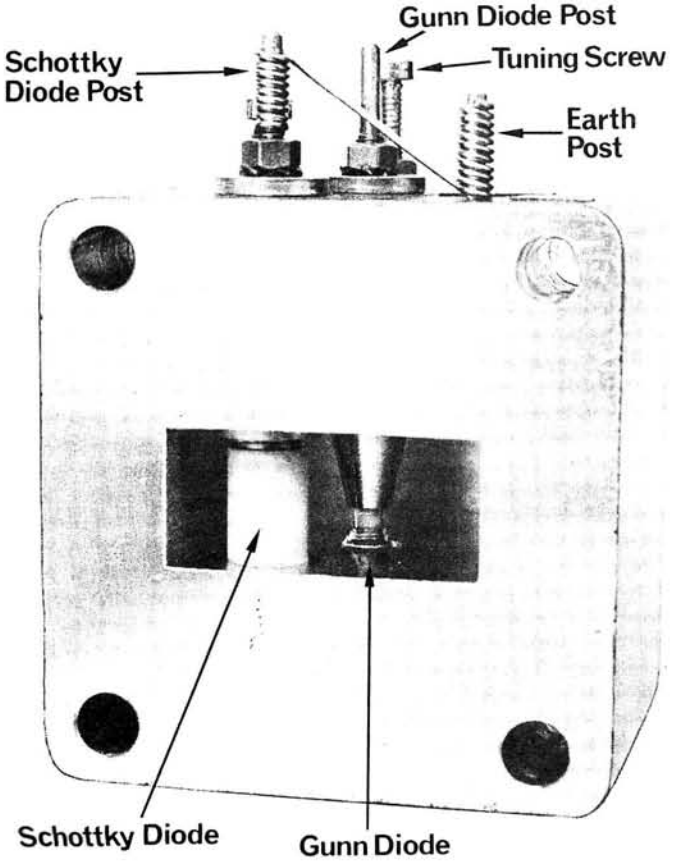
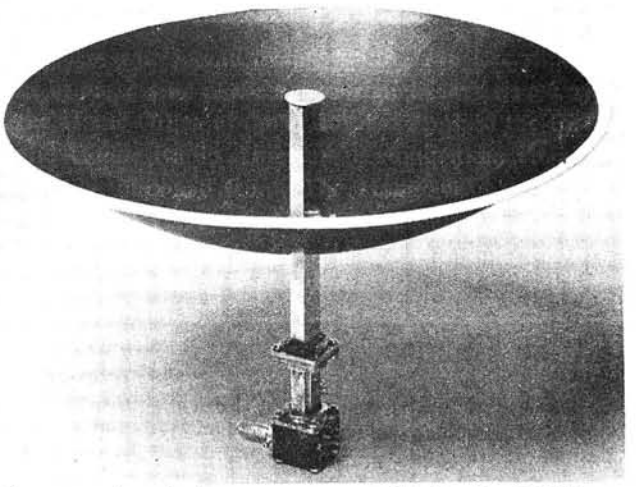


Fig. 7: This photograph shows the position of the various parts of the AEI module used for the microwave source in the *PW* Exe



The completed microwave assembly for the *PW* Exe

A Mitutoyo 0 to 0·5 inch micrometer head was used for the prototype unit and was in fact a discarded unit which a local factory had declared worn-out and useless. However, new heads can be bought from any engineering suppliers—note that you do not have to buy a complete micrometer! The head should be carefully dismantled and the thimble removed from the spindle by unscrewing the screw in the end of the thimble. You may have to use a small tommy bar for this as some makers use a circular head.

Now you have to cut off the spindle immediately below the start of the threaded portion. This is most easily done by using a grinding wheel to neck the spindle until it has broken off. The grinding wheel can then be used to round off the end of the spindle. The head is re-assembled carefully when it is ready for fitting to the microwave head using the bush.

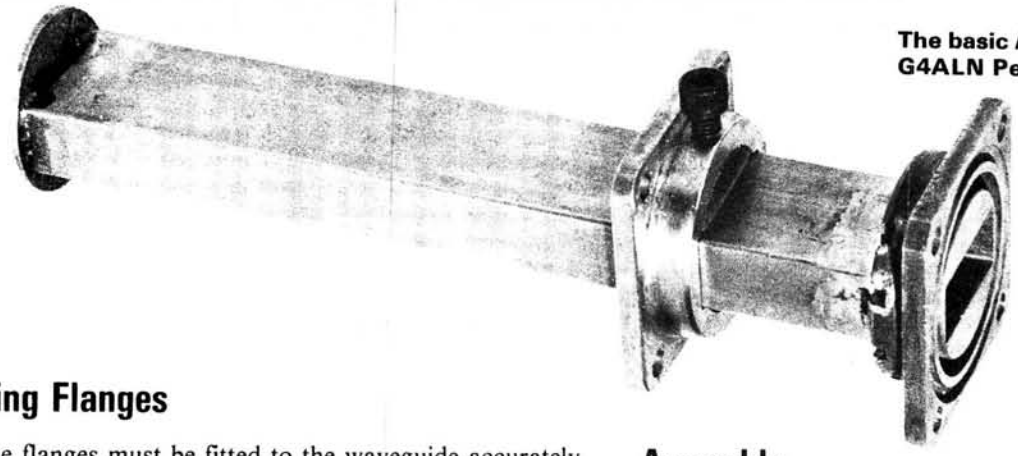
Matching Section

The antenna feed will probably need matching to the r.f. head for best results and this is achieved by inserting brass screws into the broad face of the waveguide at positions which will effect the necessary changes in the waveguide characteristics.

Fig. 7 shows a separate matching section made from a piece of Waveguide 16 fitted with flanges at each end. The three matching screws are fitted along the centre of the broad face at the spacing shown on the drawing. The spacing is important, the longitudinal positioning of the group of three screws is not.

With the set-up shown, it is a simple matter to fit any type of antenna. However, if you only want to use the dish then the matching section can be made integral with the penny feed and one pair of flanges omitted. This will save you around £3.00.

Readers who intend to operate the *PW* Exe 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.



The basic *PW* Exe version of the G4ALN Penny Feed

Fitting Flanges

The flanges must be fitted to the waveguide accurately and this is really very simple. The waveguide is cut as square as possible and all burrs removed. The end is cleaned thoroughly on all faces using wire wool or fine emery cloth and then carefully inserted into the flange. Some flanges allow the guide to pass right through and with these the guide should be allowed to protrude by a small amount.

The assembly is then heated using a small blowlamp until the solder runs freely into the joint. Silver soldering is best if you have the equipment.

When the assembly has cooled down the protruding waveguide is carefully filed flush with the flange face and the whole face is then rubbed on a piece of emery cloth held on a really flat surface to ensure that the mating face of the flange is perfectly flat.

Some flanges do not allow the guide to pass right through and with these it is essential to file the end of the guide perfectly square and true before fitting into the flange and soldering. For our purposes the type that allow the guide to pass right through are easier to use.

It is possible to make the *PW* Exe head and antenna assembly without having to fit flanges by obtaining lengths of used waveguide already fitted with flanges. So long as the lengths are not shorter than those shown, the actual lengths do not matter. It pays, however, to ensure that the flange faces are flat and true using the emery cloth method described earlier. The minimum lengths needed are 170mm for the penny feed and 60mm for the matching section. The flange which you saw off to make the penny feed can be cleaned up and used to mount the dish.

The Parabolic Dish

As mentioned in the first part we have designed, and have made available, a parabolic dish spun from aluminium for use with the penny feed. We considered that a diameter of 460mm was optimum if the whole system was to be easily portable and to be fitted into a small family car with the XYL, Mother-in-Law, half-a-dozen kids and the picnic hamper.

The dish as supplied by *Practical Wireless* is black anodised with a small hole to mark the centre. It is necessary to cut a hole 31mm diameter exactly in the centre of the dish to allow the penny feed to pass through the dish. The four 2BA clearance holes are marked off using the Waveguide 16 flange as a template. The four holes can then be drilled 5mm which will allow quite a leeway on positioning. 2BA screws fitted with large flat washers should be used to secure the dish to the mounting flange. The dish can be positioned by sliding the mount along the waveguide for optimum performance before locking it in position with the 2BA screw. The focal length of the dish is 128mm and the dish should be positioned initially at this distance from the penny. **Do not overtighten locking screw.**

Assembly

The component parts of the r.f. head are bolted together with the appropriate size screws, nuts and washers, ensuring correct alignment at each joint. The flanges are not symmetrical so that you should not be able to assemble them incorrectly. The AEI module is fitted to the matching section flange with 4BA studding.

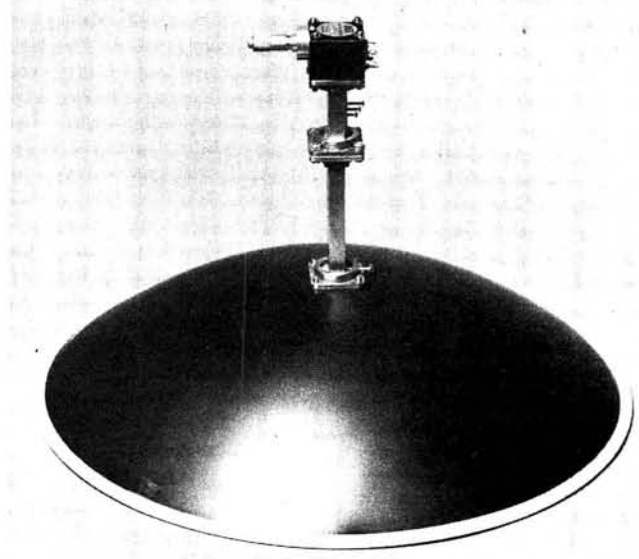
Diecast Box

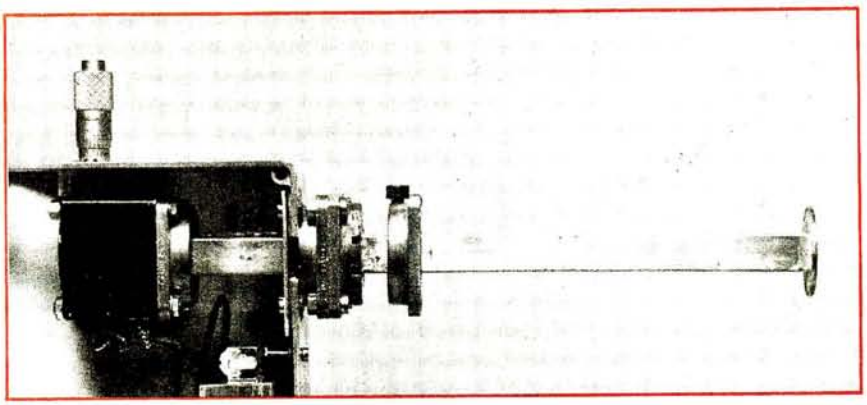
The *PW* Exe is built completely inside a standard diecast box with only the antenna feed and dish outside. This ensures good screening for the sensitive electronics used.

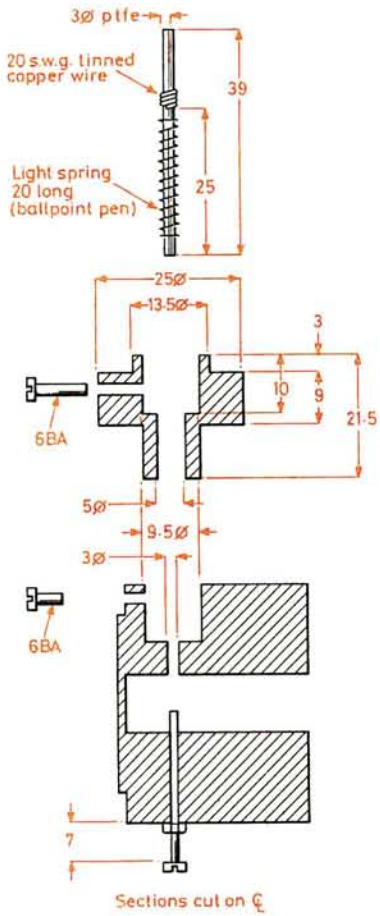
The microwave head assembly fits into the box as shown in the photographs. No dimensions are given for the positions of fixing holes or slots as these will depend on the final size of your assembly. Note that the waveguide has its broad faces vertical.

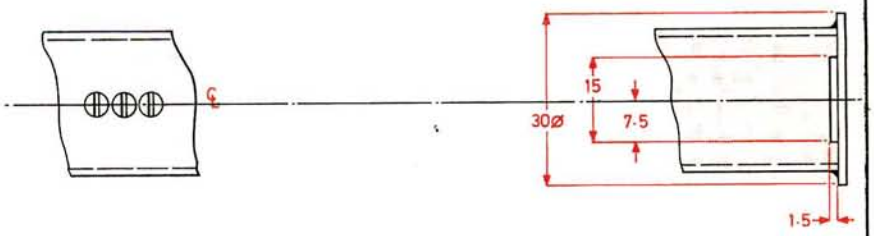
The head assembly is mounted through a slot cut in the box front and a hole in the side of the box which accepts the micrometer head adaptor bush. Two small self-tapping screws through the side of the box and into the bush will firmly hold the assembly in place. An aluminium plate across the top of the front slot prevents the antenna from lifting and also completes the box.

While you are working on the box the other holes can be drilled. Actual positioning of the controls, etc, is not important and the details given in Fig. 8 can be taken as a guide. The speaker is mounted in the bottom of the box under the microwave head and a suitable pattern of holes









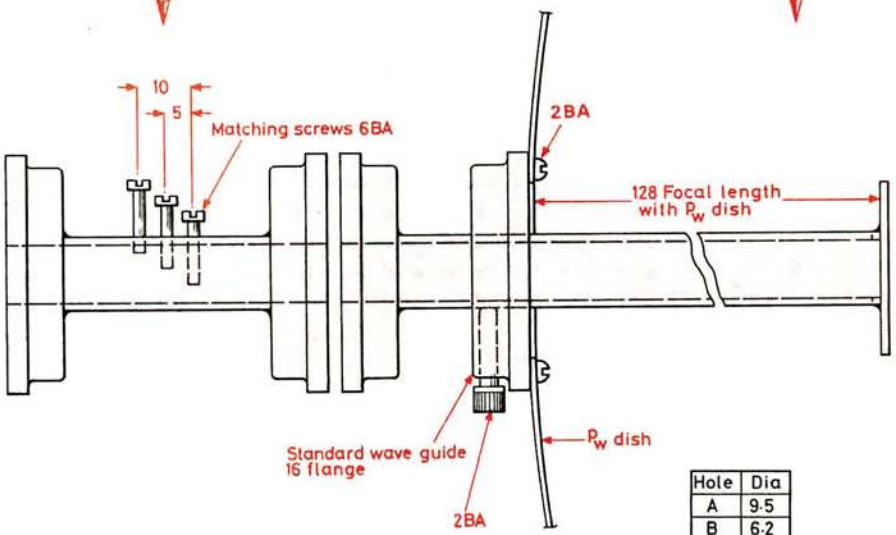
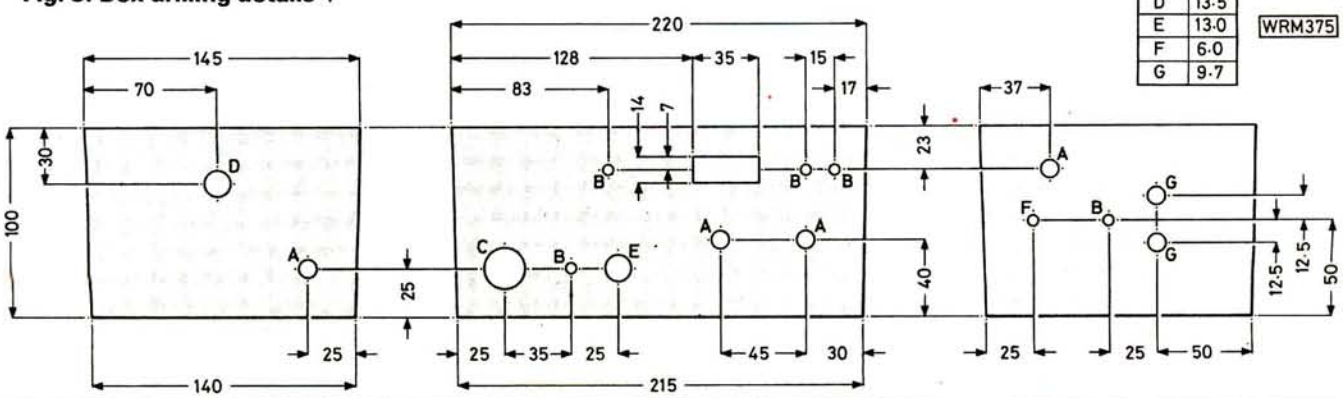


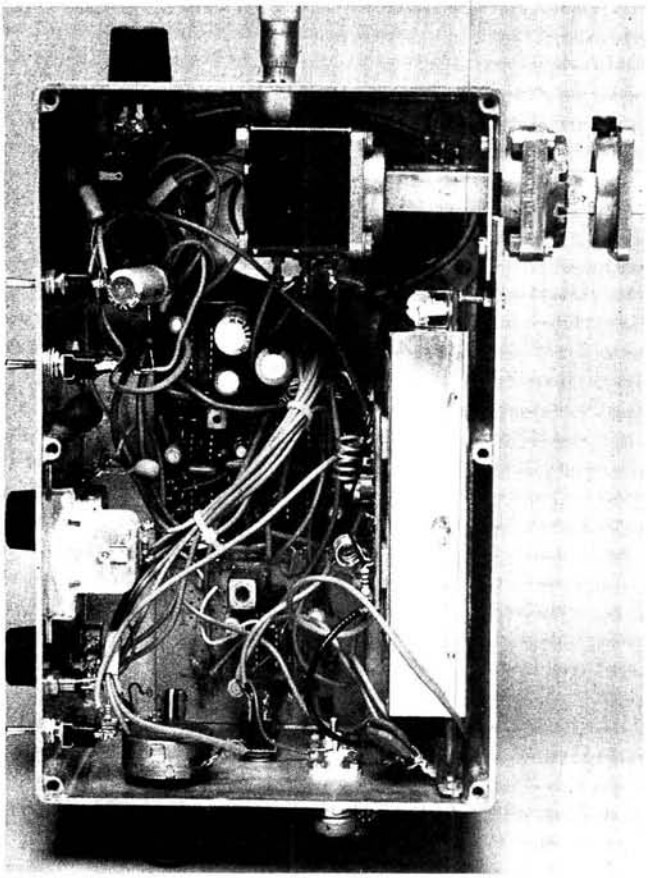
Fig. 7. Microwave head details ▲

Fig. 8. Box drilling details ▼

Hole	Dia
A	9·5
B	6·2
C	19·4
D	13·5
E	13·0
F	6·0
G	9·7

WRM375





The prototype *PW* Exe 10GHz microwave transceiver showing how the microwave head is positioned in the diecast box

★ components

220mm Waveguide 16; Flanges (4); Copper disc 30mm diameter; 60mm ptfe rod 3mm diameter; Micrometer head (see text); Aluminium bar 25mm diameter for adaptor bush; AEI Doppler Module DA8525/6; Diecast box 140 x 220 x 100mm; Small springs (see text); nuts, screws, washers.

JMG Electronics, 50 East Street, Horsham, Sussex can supply Waveguide 16 flanges as well as lengths of used flanged waveguide 16. The micrometer head is available from most engineering suppliers. (*Yellow Pages*). The ptfe rod can be obtained from your local plastics suppliers (*Yellow Pages*). The AEI Doppler Module can be obtained from Pascal Electronics, Hawke House, Green Street, Sunbury on Thames, Middlesex, TW16 6RA.

should be drilled in the bottom of the box to allow the sound to emerge. Before bolting the speaker in place, a piece of heavy-gauge polythene sheet should be put between the bottom of the box and the speaker to keep water out. Remember that you could be operating from the top of a mountain in pouring rain when the microwave bug bites.

Some means of mounting the box onto a tripod is necessary and how this is done will depend to a large extent on the tripod you use.

Part 3

The next part will cover the electronics of the system, when most readers will be on more familiar ground.

FM SPEECH PROCESSOR

▶▶▶*continued from page 31*

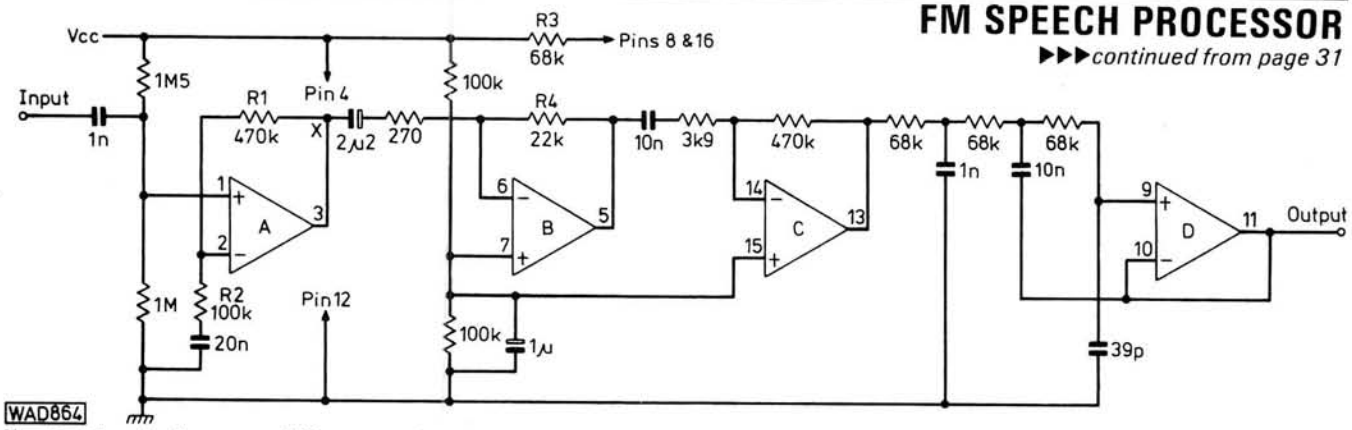
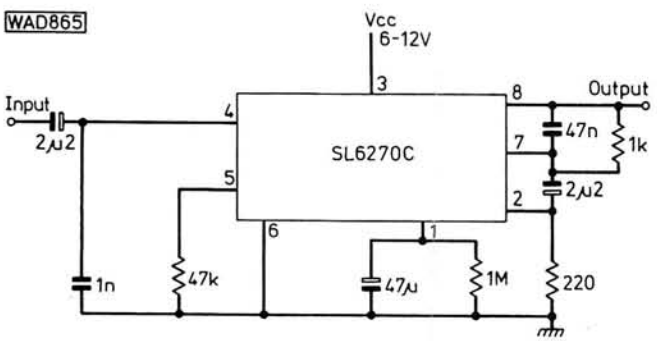


Fig. 2: Circuit diagram of the speech processor ▲

Fig. 3: VOGAD using the SL6270C. May be used in place of the input stage if audio a.g.c. is required ▼



The output level from the system is dependent on the input level and the gain since no a.g.c. is used. The gain of the first two stages should be set so that the output level is around 1·5V to 2V r.m.s. with normal speech into the microphone to be used. This ensures a reasonable, but not excessive, level of clipping. If audio a.g.c. is required the input amplifier should be replaced with the SL6270 VOGAD, used in the circuit shown in Fig. 3, and R4 should be 5·6kΩ.

The power supply is a single 12V but *this is not critical* and may be varied from 6V to 24V without any effect but a change in the clipping level. The supply should, however, be well decoupled to a.f. and r.f.

No printed circuit board has been designed for this system since it is so simple that it is likely to be used in many widely differing applications. No special precautions are needed in construction—save to isolate the high impedance input from the output and, if it contains hum, the power supply. ●

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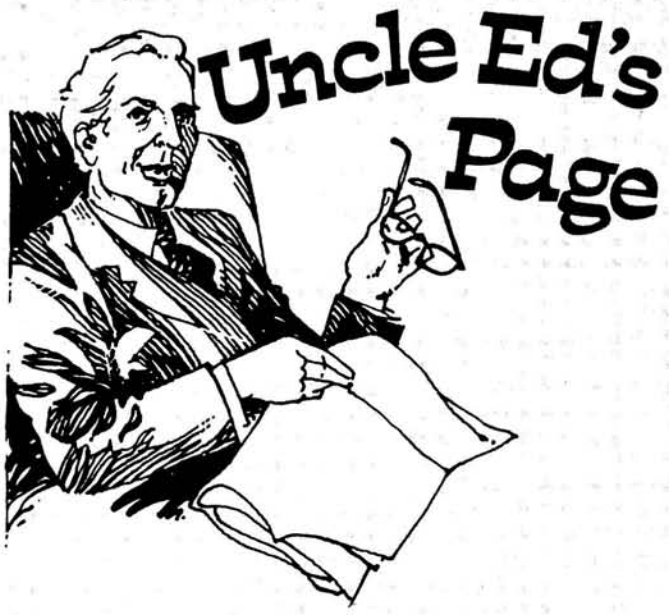


A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.

Previously, I started talking about Thevenin and constant voltage or current sources. I left you with a question: why does a constant current source have a high internal impedance? The answer is that, regardless of the impedance of the load, the current flowing stays almost the same. The high internal impedance is said to **swamp** the load impedance, so that the value of the latter becomes unimportant.

The next question that people usually ask is: What do you mean by a high or low internal (or source) impedance? Resisting the temptation to come back with the smart-aleck response of "It all depends", I suppose the simple answer is: high or low compared with the normal range of load impedances that you would expect to connect to that particular source. The ratio will usually by 100:1 or greater, though could sometimes be less.

If we took the example I used last time, a 10 volt supply which dropped to 9 volts on full load, we decided this had an internal resistance of 1 ohm. The load had to draw a current of 1 amp, so it must have had a resistance of about 10 ohms. To be more accurate, the total resistance of the circuit must have been 10 ohms, and since the source accounted for 1 ohm, the load was in fact 9 ohms. Approaching the problem from the opposite direction, the load must have been 9 ohms, because we said it was passing 1 amp and it had 9 volts across it. In a circuit like this, the figures must work out whichever way you look at it—if not, either you've made a mistake in the calculations or you've got a leak, an electrical one which is providing an additional path for current from the source.

Between constant voltage and constant current sources lies a whole range of source/load impedance ratios, including the special case where they are exactly equal, when they are said to be matched. At audio frequencies, 600 ohms is a common impedance, while at radio frequencies, 50 and 75 ohms are common. In a matched system (Fig. 4), the p.d. is half the e.m.f. (see last time for an explanation of these terms).

In a matched system, the power that is dissipated in the load is the maximum that can be obtained from that particular supply. For a simple understanding of why this should be so, remember that power is the product of current and voltage ($W = IV$). If the value of the load resistance is made smaller, I will increase but V will drop. If, on the other hand, it is made larger, I will decrease and V will rise. I don't propose to go into the maths of it here, but you will find an explanation in most text-books on elementary electrical theory.

As you no doubt have realised, we can use the facts I've outlined to find out what the internal impedance of a source is, and that's the way it's usually done in practice. The only point to watch is that there are some sources that will not take kindly to being run with no load, and the test is more often performed by measuring the change in terminal voltage with quite a small change in the value of the load. You can use a similar technique to discover the input impedance of an amplifier or pre-amplifier, by treating it as a load of unknown impedance connected to a source (a signal generator) of known impedance.

continued on page 43 ▶▶▶

WRM368

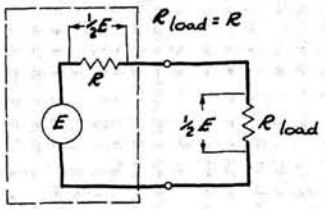


Fig.4

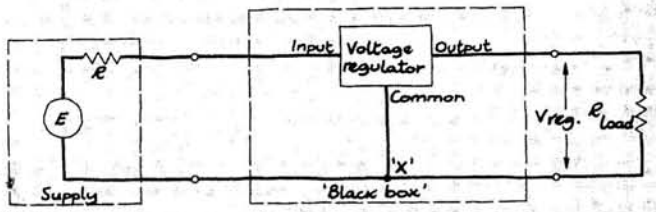


Fig.5

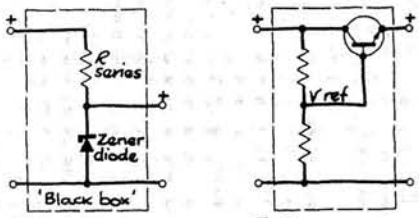


Fig.6

Fig.7

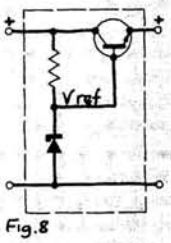


Fig.8

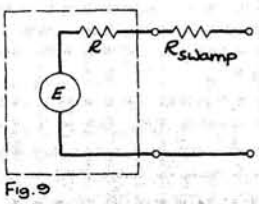


Fig.9

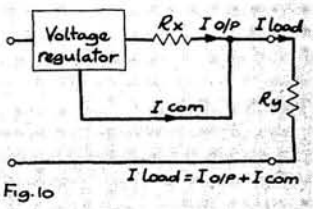
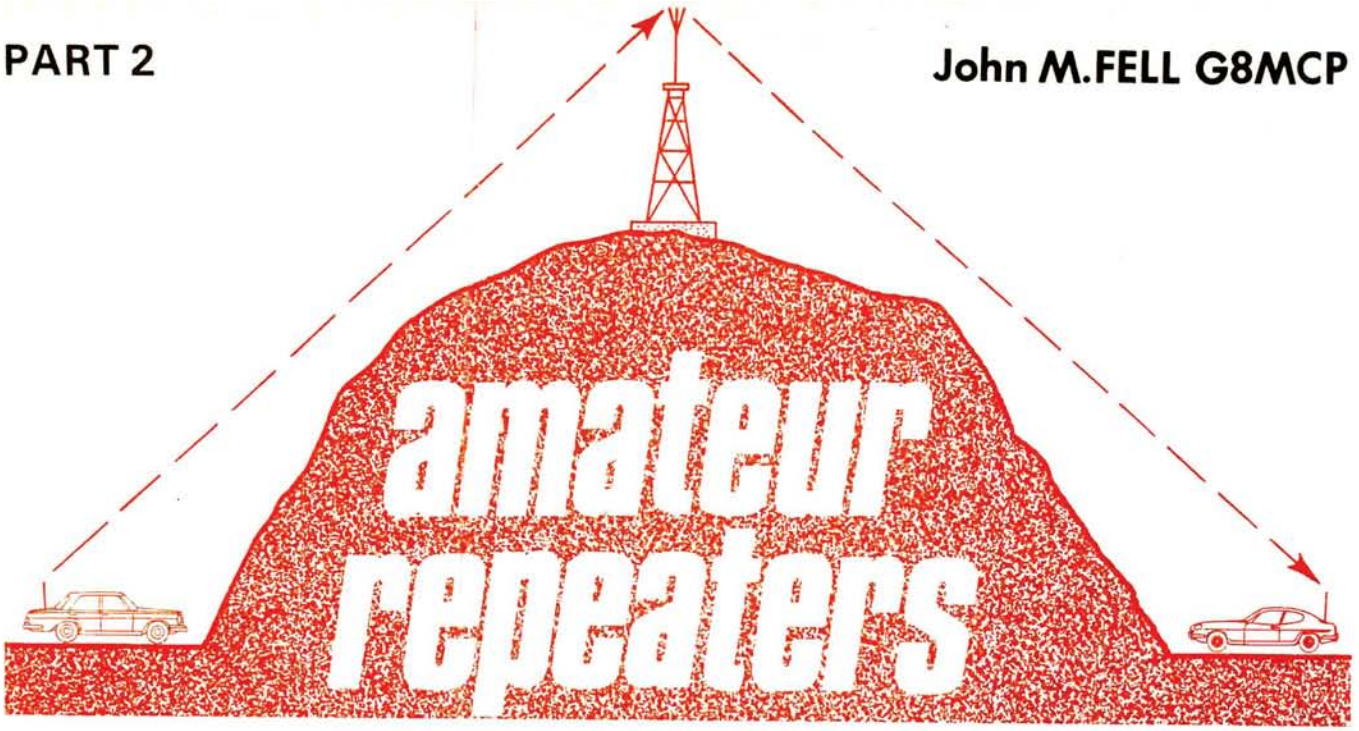


Fig.10

PART 2

John M.FELL G8MCP



Following the description of hardware in part 1 this concluding part considers the history of the UK Repeater network and future developments.

Antenna Systems

As mentioned, for the best transceive characteristic a single point source antenna system represents the ideal. High passive gain is normally provided by the use of a multiple element colinear antenna of substantial mechanical rigidity to withstand the extremes of weather found at the repeater site.

A popular antenna design, amongst 70cm repeater builders, is the twin full wavelength, centre-fed dipole system, evolved by one of the early UK repeater pioneers Chris Morcom G3VEH. The Weymouth repeater, GB3SD, shown in the photographs features this layout.

With antennas often co-sited at BBC and IBA transmitter sites, employing high mast structures, the feeder system employed by the repeater has to be of a very low loss variety. Andrews Heliax is a popular choice, affording minimal attenuation and a good mechanical construction; gold plated N type connectors are the preferred terminations!

A study of the attenuation characteristics of normal "good quality" feeder will reveal the necessity of such seemingly exotic materials: several 2m repeaters have feeders in excess of 180m between the antenna and the site of the unit.

Repeater Planning

Since its inception on 18 October 1975, the Repeater Working Group of the RSGB has handled the enormous task of planning, monitoring and co-ordinating the UK repeater network.

The group was created as a branch of the RSGB VHF Committee, to whom it was responsible for the initial purpose of determining a national v.h.f. and u.h.f. repeater network plan, acceptable to the Home Office.

Since the early days this group, democratically elected from the ranks of repeater builders, have vetted technical applications from repeater groups on a continuous basis, a task that often involves its members in many hours of unpaid work. It can be said with full justification that the effectiveness and extent of the present repeater network is directly related to the dedication shown by RWG members, most of whom are also the constructors and maintainers of their own repeater devices.

Each and every repeater proposal is considered by the RWG before being passed for final approval to the Home Office. By the time this article is published in excess of 200 repeater projects will have been processed.

The Repeater Plans

Repeater planning has always been a contentious subject amongst radio amateurs. During the first year of its existence the RWG formulated a national proposal, at the request of the Home Office, to define the projected coverage and location of v.h.f. and u.h.f. repeaters for the following 10 years.

G3VEH 70cm full-wave dipole system on GB3SD

★ specification for 2m and 70cm Repeaters

RECEIVER

Sensitivity:
20dB quieting (or 12dB SINAD) for a 0·5μV input signal.

IF bandwidth:
Minimum ±8kHz at −3dB points; maximum ±25kHz at −80dB points.

Spurious emissions:
With the receiver terminated in its design input impedance, the level of any signal power at this point should not exceed 20nW.

Frequency stability:
The input centre frequency shall remain within ±1kHz of nominal for 2m units, and 1·5kHz for 70cm units, under all operational conditions.

Squelch:
Hysteresis should be designed into the squelch such that the level required to open the squelch is 4-6dB greater than that required to shut the squelch.

TRANSMITTER

Power output:
Not to exceed 25W e.r.p.

Modulation level:
Under no operational conditions shall the peak modulation deviation exceed ±5kHz.

Modulation response:
The nominal modulation bandwidth shall be 300-3400Hz. At 6kHz modulating frequency the deviation should not exceed ±1·5kHz, and at 20kHz modulating frequency the deviation should not exceed ±80Hz. The progression between these two frequencies should be smooth and at a rate of greater than 14dB per octave.

Spurious radiation:
With the transmitter delivering a normal unmodulated signal into a dummy load, the power of any spurious signal greater than 50kHz from the carrier frequency shall not exceed 2·5μW. This may need to be improved upon if a particular spurious emission is proven to be causing interference to other spectrum users.

Frequency stability:
The output centre frequency shall remain within ±1kHz of nominal for 2m units, and 1·5kHz for 70cm units, under all operational conditions.

CONTROL LOGIC

Access:
The repeater should not be directly carrier accessed from "cold" and adequate immunity should be provided against access by speech. Access shall be by a tone of 1750 ± 25Hz at half system deviation. The minimum acceptance time of the tone shall be 300ms ±100ms.

Re-access:
Once the repeater transmitter is switched on, subsequent control of talkthrough may be by tone or carrier as desired. Carrier re-access is recommended by the Repeater Working Group and is used by most operational repeaters.

Time-out:
This is optional and the timing is at the discretion of the group. A time-out period of less than 90 seconds is not recommended.

Close-down:
When the repeater is no longer required (no signals on input) it should automatically close down within a recommended period of 5-15 seconds. From this point, access must require a further tone-burst. (In exceptional cases the repeater may remain carrier accessed for up to 30 seconds after it has shut down.)

Station identification:
The callsign stated on the repeater licence (or as otherwise notified by RSGB HQ) must be transmitted automatically at not greater than 15 minute intervals, preferably more frequently, in F2. A tone frequency of 1750Hz is recommended at 500Hz peak deviation.

ANTENNAS/FILTERS

Desensitisation:
With a signal input of 0·5μV p.d., the associated transmitter should cause the receiver quieting ratio to decrease by no more than 1dB (this will, of course, be influenced by aerial separation and filters, as well as the receiver performance).

Antenna:
Vertical polarisation must be used for all 2m and 70cm speech repeaters.

ADMINISTRATION

Changes:
All changes to the repeater's parameters (antennas, logic, output power etc.), or to the list of closedown operators, must be notified to the General Manager at RSGB HQ.

Off-air periods:
All off-air periods exceeding one hour are to be notified to RSGB HQ.

These plans, having been considered and eventually approved by the HO, were adopted by the RSGB and have thereafter formed the basis for the consideration of repeater licences.

The plans are based on several "weighting" factors namely: density of the total population; the number of current amateur radio licence holders in total population; existence of current repeaters or proposals. Added to this are the practical aspects of local geography influencing coverage from existing repeaters. As a rough rule-of-thumb 2m repeater installations are planned to cover an area approximately the size of a county, whilst 70cm units are defined as local community devices. Within their nominal coverage area a 70 per cent effective level is anticipated.

The effect of repeater planning can be seen from the location maps, high density population areas such as London and Birmingham being allocated a proportionally greater number of repeaters to accommodate the higher usage. For the newcomer to amateur radio it is perhaps hard to appreciate that the repeater network of today, with its near nationwide coverage, has evolved in less than 10 years.

Repeater History

The earliest operational UK repeater GB3PI was built by members of the Pye Telecommunications Amateur Radio Group during 1972.

Inspiration for this experimental device was probably due to the reception, by members of the group, of repeaters then in operation on the continent. At this time repeaters were also beginning to appear in USA, New Zealand and Australia.

The first UK device inspired many other amateurs in its 12 months' provisional licence period, during which time many experiments were conducted into this specialised communication aid. Unlike the European devices GB3PI was licensed to operate with the then unique input/output separation of 600kHz, a daunting technical hurdle and one that could well have proved insurmountable.

Following this initial year of operation PI was relocated at Barkway and provided an increased coverage, helping amateur v.h.f. operators over a wide area of the Home Counties. In early 1974 proposals were made for the licensing of 2m repeaters at London (GB3LO), Mid-Severn (GB3MH), Hampshire (GB3SN) and South Wales (GB3BC), with substantial enquiries from a further five 2m and many more 70cm groups. At this time the RWG and a National plan did not exist; the Home Office, who had taken over licensing from the Ministry of Posts and Telecommunications, suspended the issue of repeater licences and demanded the creation of full technical

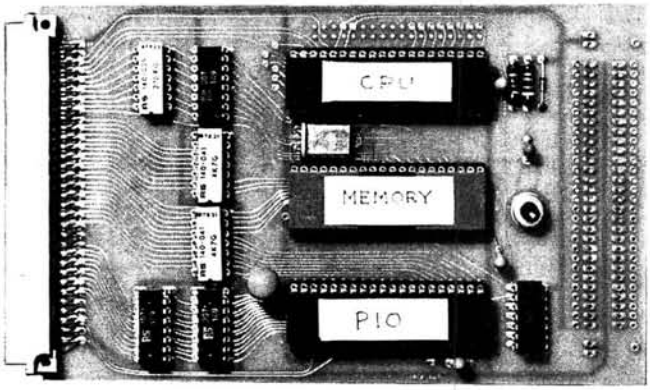


Fig. 6: GB3SC microprocessor logic card

specifications and ground rules before further progress could be made.

This action led to a meeting of all interested repeater builders at Brunel University and the subsequent creation of the Repeater Working Group. Many questions were passed to the RSGB at this meeting, the most infamous being a requested elaboration of what was then known as the "100 mile rule". This ruling, which effectively restricted the initial growth of the repeater network, was supposedly originated at the request of the Home Office. In hindsight this restriction of 100 miles between adjacent 2m repeaters appears to have been the subject of a misunderstanding and referred only to co-channel spacing restrictions.

The 70cm bandplan was passed to the Home Office in February 1976 and soon adopted, accompanied by an avalanche of additional proposals, a large proportion of which were probably from frustrated 2m repeater builders.

Following the approval of the 70cm plan a period of high level negotiation followed between the RSGB and the Home Office, culminating in the approval of the 2m plan and the resumption of 2m repeater licence issue. Such was the extent of co-operation between these two bodies that all subsequent proposals submitted by the RWG have met with approval by the Home Office Radio Regulatory Department.

Latest Developments

The following information has recently been received from Mike Dennison G3XDV, chairman of the RSGB Repeater Working Group, regarding the latest proposals for UK repeater installations.

The 23cm, 1296MHz, proposals represent a new phase of experimental installations designed to promote the use of this microwave band and to allow the study of signal propagation. All the proposals listed are soon to be forwarded to the Home Office for technical vetting and approval.

VHF—2m Proposals

GB3RD	Reading	Not specified
GB3MB	Lancaster	Not specified
GB3WD	Devon	Not specified
GB3HG	N. Yorks	R1
GB3BX	Wolverhampton	R2
GB3AM	S. Birmingham	R6
GB3LM	Lincoln	R5
GB3LU	Corbridge	Not specified
GB3EV	Appleby	Not specified

UHF—70cm Proposals

GB3UL	Belfast	RB11
GB3HA	Hornsea	RB6
GB3GC	Goole	RB4
GB3WP	East Manchester	Not specified
GB3GH	Gainsborough, Lincs.	RB15
GB3HB	St. Austell	RB15
GB3FN	Farnham	RB15
GB3PD	Peterhead, Grampian	RB10
GB3WU	Wakefield	RB11

23cm—1·3GHz

Channels to be designated RM (Repeater Microwave)

Channel	Input	Output
RM0	1291·000MHz	1297·000MHz
RM3	1291·075MHz	1297·075MHz
RM6	1291·150MHz	1297·150MHz
RM9	1291·225MHz	1297·225MHz
RM12	Reserved for future	RTTY
RM15	1291·375MHz	1297·375MHz

23cm Proposals

GB3AA	Alveston Nr. Bristol	RM0
GB3BH	Bushey Heath	RM0
GB3BW	Brentwood	RM6
GB3CP	Crawley	RM3
GB3WX	Brighton	RM9*
GB3MC	Manchester	RM0
GB3WM	Wolverhampton	RM6
GB3LN	S.E. London	RM15
GB3PS	Barkway, Herts.	RM3
GB3RU	Reading	RM9

* With possible weather telemetry

All to be horizontally polarised and designed to allow propagation research. Specifications are provisionally as for normal repeaters. One group has even specified time-out!

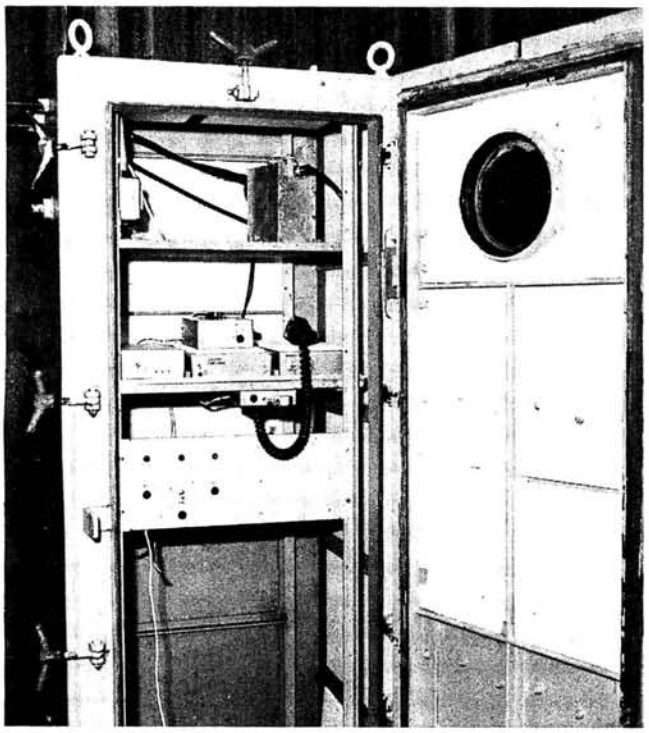


Fig. 7: GB3SD in ex-W.D. enclosure; note porthole!

Raynet

The Home Office has recently appoved the use of an in-band talk-through system for use during emrgency situations. A request must be forwarded, via the RSGB Emergency Officer, to the Home Office before establishing the link.

Future Developments

Apart from the relaying of telephony on 2m and 70cm, repeater installations are under consideration for higher frequencies and cross-band links. Proposals have been made for a s.s.b. repeater and operational RTTY repeaters are already in existence. There is no doubt that with their usual resourcefulness amateurs will continue to expand their activities, searching for better performance and experimentation well into the microwave regions.

Repeater Support

Over 60 per cent of RSGB members currently use the UK repeater network. Apart from the annual licence fee, provided by RSGB, all repeaters remain in existence through your continued support. A donation to your local group will ensure the future availability of these communication aids to the licensed amateur and s.w.l.

Acknowledgements

Grateful thanks for help during the preparation of this article are expressed to: Dr. D. S. Evans G3RPE, Mike Dennison G3XDV, Chris Morcom G3VEH, Chris Goadby G8HVV and the builders of GB3SD and GB3SC.

On behalf of all licensed amateurs and s.w.l.s who have benefited from the availability of the repeater network, the author expresses his gratitude to the RSGB Repeater Working Group members, past and present, and the many nationwide repeater builders wishing them well for the future. ●

UNCLE ED

▶▶▶ *continued from page 39*

Simple **constant voltage** sources can be produced by connecting a "black box" in the output leads of a power supply of unknown regulation. This "black box" can be literally that if you use one of the 3-terminal regulator i.c.s available nowadays (Fig. 5). You can also make up your own. One method is to use a resistor and a Zener diode (Fig. 6). This is a special diode which tries to maintain the voltage across its terminals constant. If the voltage from the supply alters, the drop across R_{series} will change to compensate for it. If the current drawn by the load changes, the current through the Zener diode alters to compensate for that. The current through the Zener diode is like that leak I was talking about earlier.

Yet another method is to use a transistor as shown in Fig. 7. The two resistors form a potential divider providing a reference voltage V_{ref}. If too much current is drawn from the divider, V_{ref} will fall, but the transistor acts as an amplifier, so that a widely varying load current will produce only a small variation in the current drawn from the potential divider by the transistor base. Since the voltage between base and emitter of a transistor is reasonably constant over quite a wide range of emitter current (typically 200-300mV for a germanium transistor and 600-700mV for a silicon transistor), the output voltage is thus stabilised against load variations. What it will not do is to keep the output voltage constant if the supply voltage changes. However, we can combine the circuits of Figs. 6 and 7 as shown in Fig. 8 to overcome this problem, providing what is effectively an amplified Zener diode.

A disadvantage of all the circuits Figs. 5-8, and of the more complex circuits used to provide constant voltage sources, is that the "black box", otherwise known as a voltage regulator, must have a voltage drop across it for it to work. This means that the supply voltage has to be greater than the final output voltage required.

Moving on to **constant current** sources, the simplest way to achieve a high impedance source is to add a high-value resistor externally, in series with one lead (Fig. 9). Another technique which has become very popular is to use a 3-terminal voltage regulator in a rather cunning circuit. If you look back to Fig. 5, you will see that if V_{reg} is constant (which it should be) and R_{load} is constant, a constant current will flow through the load. If we could break into that circuit and insert our load requiring a constant current, we could make use of this fact. However, we can't put it in the circuit between the output terminal of the regulator and point "X" on Fig. 5, or its value would effectively be added to that of R_{load} and the current flowing would change. If we break into the circuit to the left of point "X" instead, it should do the trick, and indeed it does. If you look at the circuit of Fig. 10, you will realise that this is Fig. 5 rearranged, with the old R_{load} renamed R_x and the new load called R_y. The only snag with this circuit is that a certain current I_{com} flows in the common lead of the regulator i.c., and this is added to the output current I_{op}. The value of I_{com} is not very closely specified by the i.c. manufacturers, and seems to be typically in the range 2–10mA. The result is that the performance of this circuit with low values of current in the load can be a bit unpredictable.

Next month, I shall talk about another subject where Thevenin's theorem is helpful—attenuators.

Next month in PW

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Slow-scan television (SSTV) is a way of sending still TV pictures using no more bandwidth than a voice transmission. Learn how it's done from our new series, covering techniques and equipment, for monochrome and colour

PRODUCTION LINES

ALAN MARTIN G8ZPW

If you please

Please mention "Production Lines", when applying to manufacturers or suppliers featured on this page.

Time Out

GVB Electronics announce the availability of their T.O.1 2m repeater time-out indicator which is fully automatic, battery operated and is suitable for both mobile and base stations.

Housed in a black metallised ABS box, the T.O.1 features three pre-set time constants, a test facility and an auxiliary position which allows the amateur to configure the T.O.1 to his own specific needs.

RF sensing, up to a three metre radius, means that the T.O.1 is easy to use whilst low current consumption ensures long battery life.

The T.O.1 measures 120 x 65 x 40mm, costs £15.57 (includes p&p) and is available exclusively from: *GVB Electronics, 95 Old Worthing Road, East Preston, Littlehampton, West Sussex BN16 1DU. Tel: (09062) 70260.*

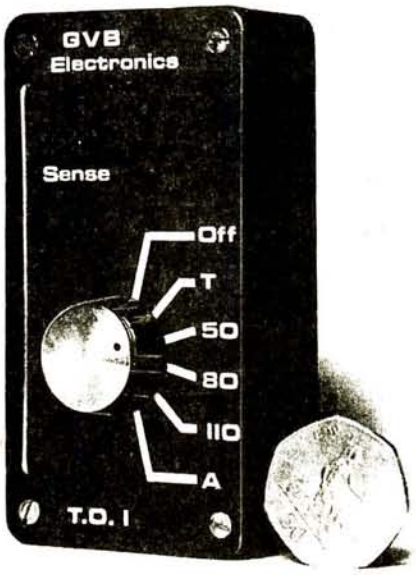


Photo PCB Supplies

Marshall's inform us that they are now marketing a very competitively priced range of pre-sensitised printed circuit boards designated at Fotoboards.

The boards are protected by a peel-off plastic sheet and are ideal for the production of prototypes and small runs of p.c.b.s. The boards may be developed by exposing in an ultra-violet exposure unit for 10 minutes or alternatively by being left in the sunshine for a whole day.

In addition to supplying the board they also have available a kit for a UV exposure unit, drafting sheet, track, transfers, developing trays and Fotoboard developer, which is only available at their shops as it is not suitable for postal despatch.

Claimed to be extremely competitively priced, details of these products are available from: *Marshall's, Kingsgate House, Kingsgate Place, London NW6 4TA. Tel: 01-624 8582.*

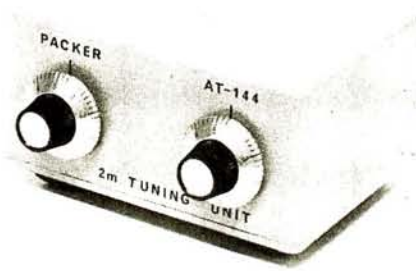
2m a.t.u.

Before you can expect the best performance from your rig, it is essential that the antenna impedance is matched to that of the rig. An antenna tuning unit can correct an imbalance and Packer Communications can supply the AT-144, a π-matching a.t.u. designed specifically for 2m.

The unit will cover between 30 and 100Ω and has been tested at 500W, well over the maximum UK legal power limit.

Ideal energy transfer can be severely affected by incorrect antenna impedance, the use of old or cheap coaxial cable (whose characteristic impedance may vary between 45 and 100Ω) and the often overlooked fact that not all rigs require to see 50Ω. When used in conjunction with a good v.s.w.r. meter, the unit could produce a dramatic improvement on both transmit and receive.

Housed in a diecast box measuring 100 x 55 x 85mm, the AT-144 costs £19.95 (which includes VAT and carriage) and is available from: *Packer Communications, Bridge End Barn, Soutergate, Kirkby-in-Furness, Cumbria LA17 7TW. Tel: (022 989) 448.*



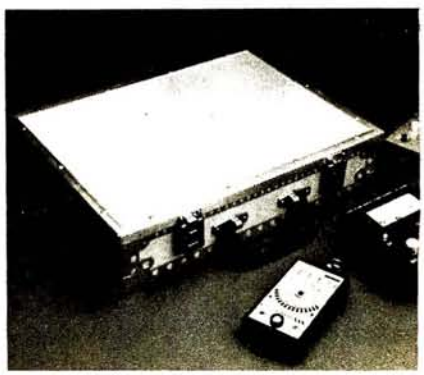
Safety Case

A "brief case" for electronics engineers from Nefab in steel reinforced plywood protects fragile electronics components or instruments from all weathers and is claimed to be unbreakable in normal use, yet is exceptionally lightweight.

The tough 4mm surfaces in an attractive natural wood finish are as durable as twice the thickness of softwood. They are further bonded by self-riveting galvanised steel plate that gives four times the strength of conventionally riveted steel. Double treated with thermoset resin, all surfaces are rust proof, anti-static, and resistant to flame, weather, alcohol and most solvents.

Weighing only 2·2kg, the hinge-lidded box has a carrying handle, two catches and can be readily locked for greater security. Measuring 420 x 340 x 95mm, the Nefab all-weather safety case looks equally in place in the office or workshop.

Priced at £25 which includes VAT, the case is available from: *Nefab Ltd., 6 Osyth Close, Brackmills, Northampton NN4 0DZ.*



PW 'STOUR' TOP-BAND TRANSCEIVER

PART 3

David G. BARRELL G4BMC

Following the description and circuit diagrams of Boards 2, 3 and 4, we continue this month with their layouts and full details of Board 5.

Board 5—PA Board

The p.a. board contains the following circuitry.

1. Push-pull amplifier 5Tr1, 5Tr2.
2. IC1, a low voltage bias regulator.
3. D1, heat sensor.

Circuit Description

The 2MHz drive from filter F2 is fed via 5C1, a 0·1μF capacitor, to the broad-band input transformer 5L1. Resistor 5R1 is included to reduce the drive to the p.a. and was soldered directly across the input Veropin and the earth plane. (Should it be found necessary to alter this value then the filter values on Board F2 will have to be altered to keep the response flat.)

Broad-band output transformer 5L2 represents a compromise between the maximum power output, using say 13·5V (when used from the base station power supply) and 11·0–12V if used in a portable situation.

This may be easily understood by looking at the output impedance transformation.

Assume total power out as 25 watts (12·5 watts each transistor).

For each transistor the output impedance approximates to:

$$\frac{(Vcc)^2}{2Po}$$

Assuming supply voltage of:—	13·5V	or	11V
each Collector Z =	$\frac{13{\cdot}5^2}{2\times12{\cdot}5}$	or	$\frac{11{\cdot}0^2}{2\times12{\cdot}5}$
=	7·29Ω	or	4·84Ω
Therefore total Collector Z =	14·58Ω	or	9·68Ω
Assuming a 50Ω load resistance then the impedance ratio required =	$\frac{50}{14{\cdot}58}$	or	$\frac{50}{9{\cdot}68}$
=	3·43:1	or	5·16:1
Turns ratio = √Impedance ratio =	1·85:1	or	2·27:1

A single turn was tried on the primary but a better match was obtained by using three turns for the primary. The new ratios then became 5·6:3 or 6·8:3.

In practice 6 turns were used on the secondary and this gave a reasonable match. Negative feedback is used via a one turn link through the output transformer which is coupled to the bases through 5R2 and 5R3.

The BDY90 p.a. transistors have proved rugged in use, the output having been subjected to both open and short circuit load with full drive applied. It is not suggested that this practice is adopted on a regular basis! However, it is good to know that no harm should come to the p.a. transistors if this occurs accidentally.

During normal operation a standing wave ratio of 1·5 : 1 or less is recommended. This will ensure that the transistors operate within their design limits. Operation into a load giving a high standing wave produced a rough sounding signal, although the p.a. remained stable.

The bias supply uses a 723 voltage regulator with the output at pin 1 being controlled by 5R7. This regulator circuitry should be checked thoroughly before being connected to the p.a. transistors. A 22Ω resistor should be connected between pin 1 and earth temporarily. Potentiometer 5R7 should allow a voltage adjustment somewhere in the region of 0·4–0·8V. If the voltage is adjusted to around 0·6V, and a further 22Ω resistor connected in parallel with the first, no change in voltage should occur. Another worthwhile check is to touch the soldering iron on one of the sensing diode connections. This should reduce the output voltage 50mV (approximately) after a second or two. (Alternatively, directing a cleaning solvent or freezer spray onto 5Tr3 should show a similar increase in output voltage.)

Readers who intend to operate the Stour 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.

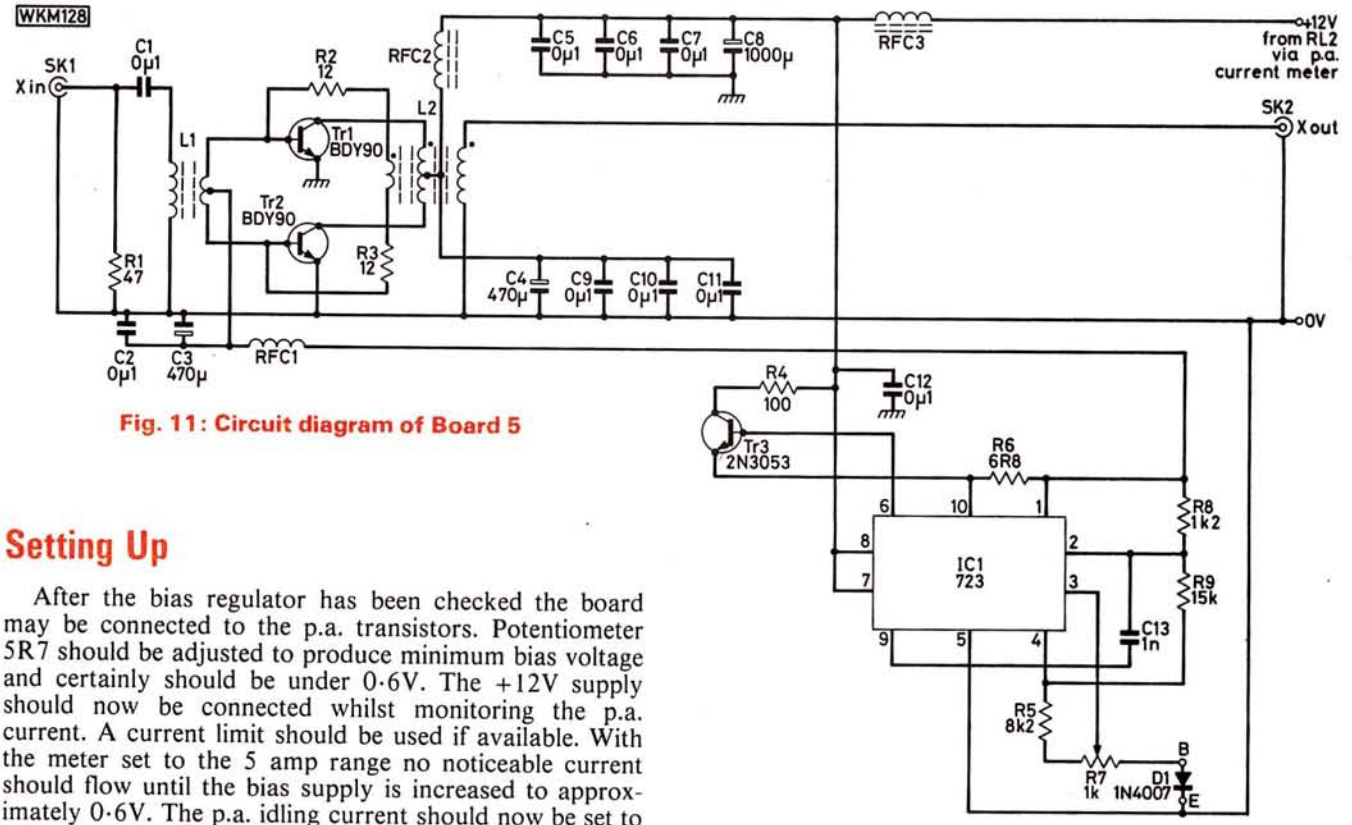


Fig. 11: Circuit diagram of Board 5

Setting Up

After the bias regulator has been checked the board may be connected to the p.a. transistors. Potentiometer 5R7 should be adjusted to produce minimum bias voltage and certainly should be under 0·6V. The +12V supply should now be connected whilst monitoring the p.a. current. A current limit should be used if available. With the meter set to the 5 amp range no noticeable current should flow until the bias supply is increased to approximately 0·6V. The p.a. idling current should now be set to 250mA total. With the circuit as shown the adjustment of 5R7 will be fairly critical but no problems should be encountered if it is carefully adjusted.

If everything remains stable, with a 50Ω dummy load connected to the output (or filter F3 into a 50Ω dummy load), drive should be applied. The p.a. current and output should be monitored. If the rest of the transceiver is used to drive the p.a., a temporary potentiometer should be used at a convenient point (say, at the 5R1 position) to allow the drive to be slowly increased. The normal precautions should be taken to ensure that no "jumps" are noticed as the drive is increased. The p.a. current should be able to be driven to 4–5 amps quite readily. The wire used to feed the +12V to the p.a., and indeed the wire used to feed the whole transceiver, should be fairly heavy to minimise any voltage drop along it during transit. Even one tenth of an ohm at 4 amps will drop 0·4 volts.

50Ω screened cable should be used to feed both the input and output to ensure that the filters are terminated correctly.

Room on the prototype board was left for traps for 80m but these were not required, as the output filter F3 worked sufficiently well.

The 12V supply is enabled during transmit only. (Relay connections are used for this purpose.) Relay connections are also used to switch the front panel meter between the S Meter function and p.a. current indication (Fig. 7).

Connections to Board 5

1. X in from filter F2 via SK1.
2. X out to filter F3 via SK2.
3. +12V to supply rail via metering and relay switching.

Constructional Details

The p.a. board is constructed on double sided glass fibre board with all ground plane connections soldered top and bottom where practical.

A suitable heatsink measuring 125 x 95mm was used in the prototype with the p.a. printed circuit board also made to this size. The BDY90 cases are also the collector connections, thus insulating washers must be used to ensure that the mounting screws do not short the casings to earth.

It is very important when mounting the transistors that the various holes in the heatsink and p.c.b. align correctly. This allows connections to be made between the transistors and the board. Small lengths of wire are required to connect the collectors and extend the base emitter connections. These wires then protrude through the board on the component side and are soldered to the relevant Veropins

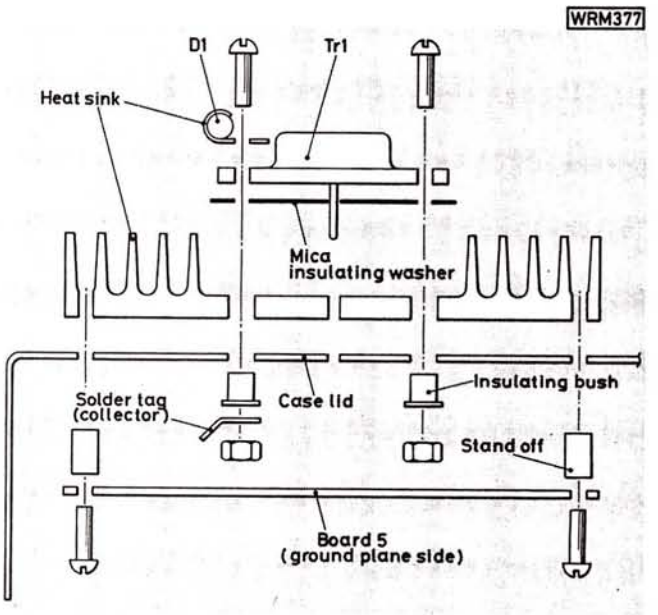


Fig. 12: Heatsink details of Board 5

★ components

BOARD 5

Resistors

¼W 5% Carbon Film		
6·8Ω	1	R6
47Ω	1	R1
1·2kΩ	1	R8
8·2kΩ	1	R5
15kΩ	1	R9
½W 5% Carbon Film		
100Ω	1	R4
1W 5% Carbon Film		
12Ω	2	R2,3
Miniature Horizontal Pre-set		
1kΩ	1	R7

Capacitors

Disc Ceramic		
1nF	1	C13
0·1µF	9	C1,2,5,6,7,9–12
Single-ended Electrolytic 16V		
470µF	2	C3,4
1000µF	1	C8

Semiconductors

Integrated Circuits		
723	1	IC1
Transistors		
BDY90	2	Tr1,2
2N3053	1	Tr3
Diodes		
1N4007	1	D1

Miscellaneous

Neosid 28-034-36 toroids (2); 28-512-31 toroid (1); 35-530-31 toroids (2); Neosid 28-057-26 toroid (2); 20 s.w.g. enamelled copper wire; 22 s.w.g. enamelled copper wire; heatsink; p.c.b. (1).

Note: all component refs. in the text are prefixed with the board ref. 5.

or earth plane. Small solder tags are used to make connections to the collectors.

The heat sensor diode has a small heatsink, constructed from a thin piece of sheet metal, wrapped around it. This is then mounted on one of the collector mounting screws. The connections to this diode are made via wires connected to the track side of the board which are routed through a hole in the heatsink. (Points E and B.)

When the unit is assembled it is essential to use silicone grease between the transistors and insulating washers and again between the washers and heatsink. This also applies to the heat sensor which should have grease smeared around it.

Four spacers are used between the p.c.b. and the top cover, the screws passing through the p.c.b., spacer, top cover and then into the heatsink, where a threaded hole is made to take the securing bolts. If facilities for tapping holes are not available the bolts may be inserted the opposite way round and a nut used on the board side. The spacers must have sufficient depth to ensure that the solder connections do not touch the metalwork.

The heatsink used proved more than adequate and even after 15 minutes of carrier at approximately 20 watts p.e.p. output the heatsink and top cover became only moderately warm.

Fig. 13 ▶

Fig. 13: Full size track pattern of the underside of Board 2. Fig. 14: Component overlay.
Fig. 15: Component side ground plane pattern

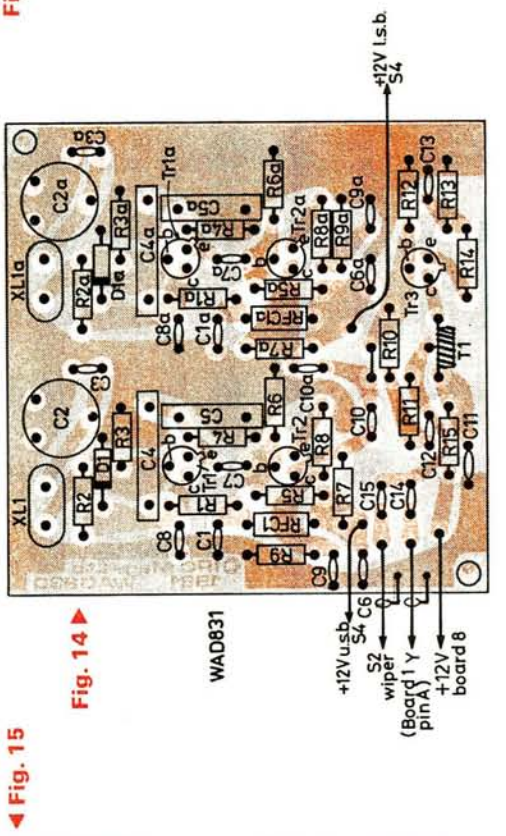


Fig. 14 ▶

Fig. 16: Full size component side ground plane pattern of Board 3. Fig. 17: Component overlay.
Fig. 18: Track pattern of board underside

◀ Fig. 15

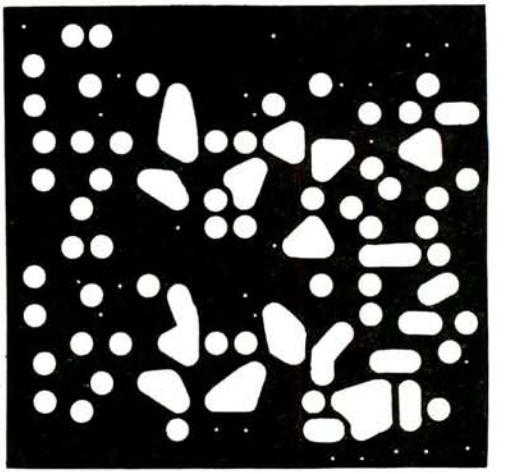


Fig. 19: Full size component side ground plane pattern of Board 4. Fig. 20: Component overlay.
Fig. 21: Track pattern of board underside

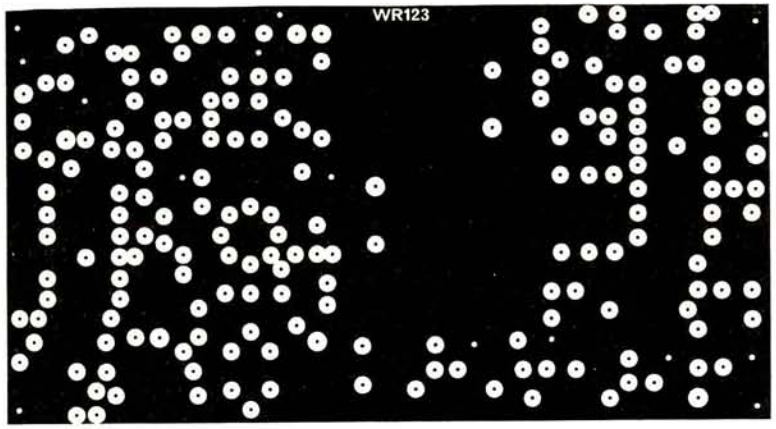
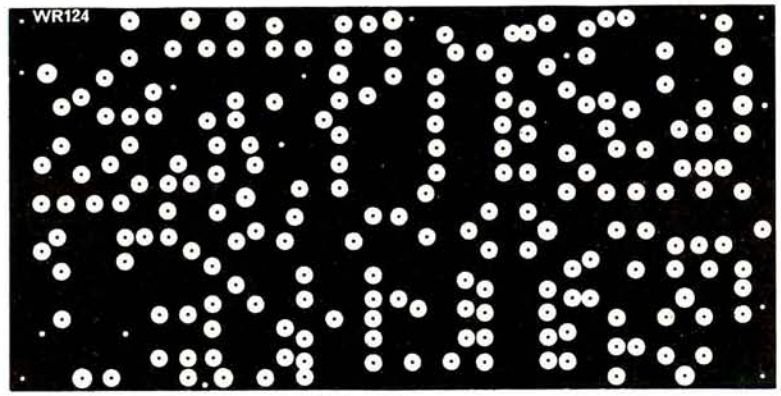


Fig. 16 ▶



◀ Fig. 19

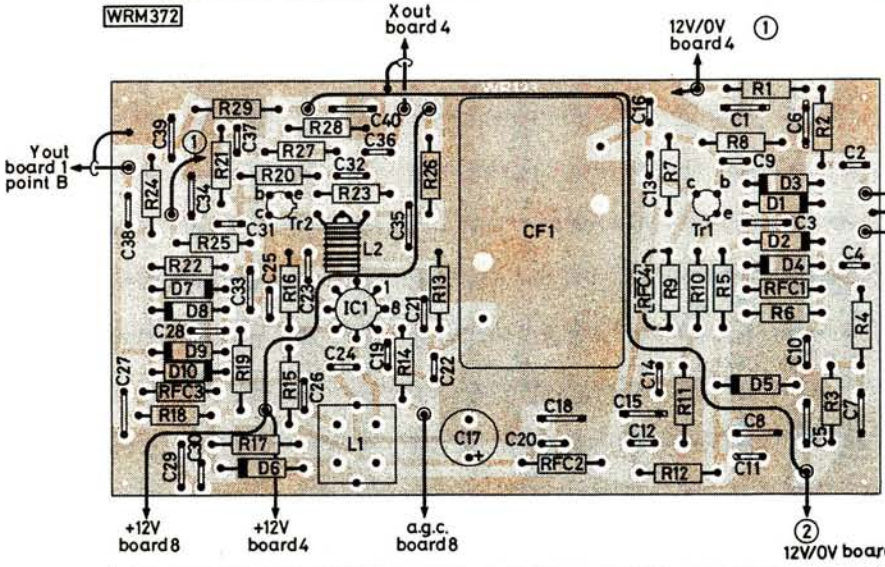
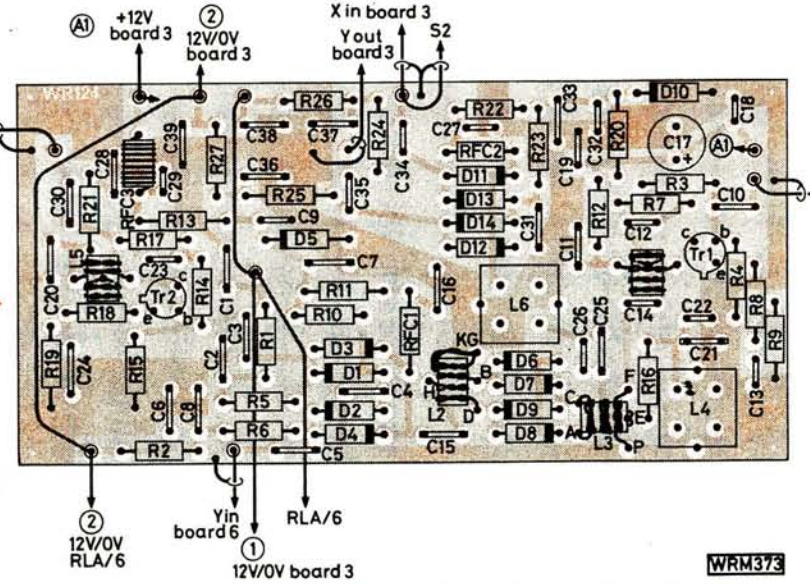
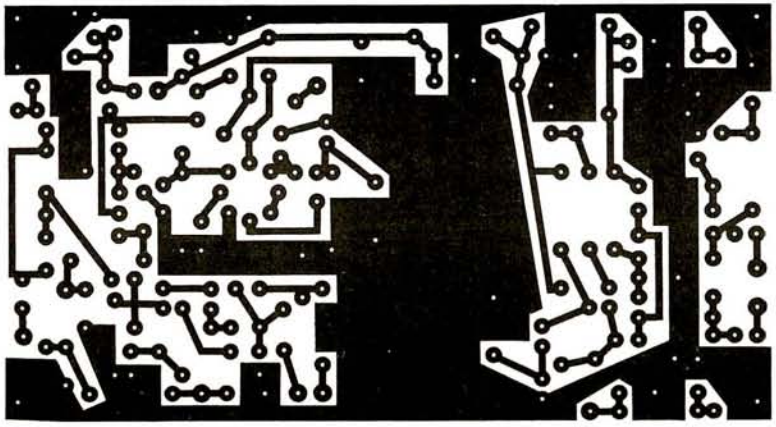


Fig. 17 ▶



◀ Fig. 20

Fig. 18 ▶



◀ Fig. 21

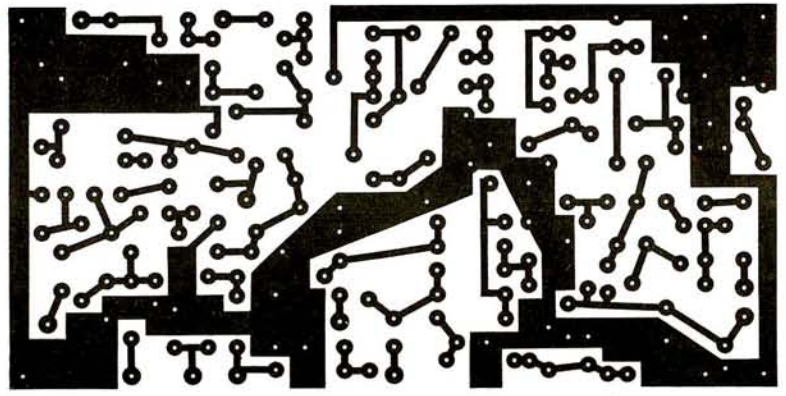
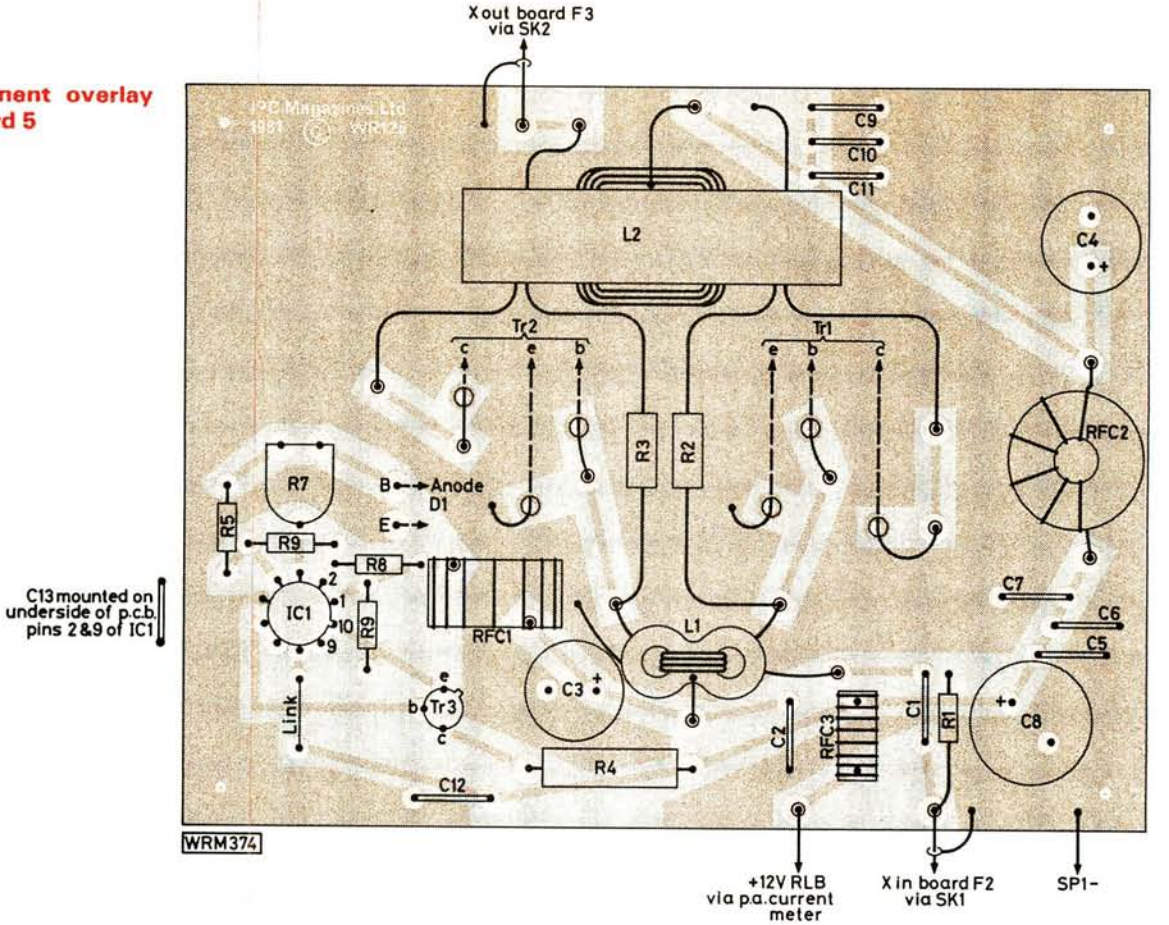


Fig. 22: Component overlay of Board 5



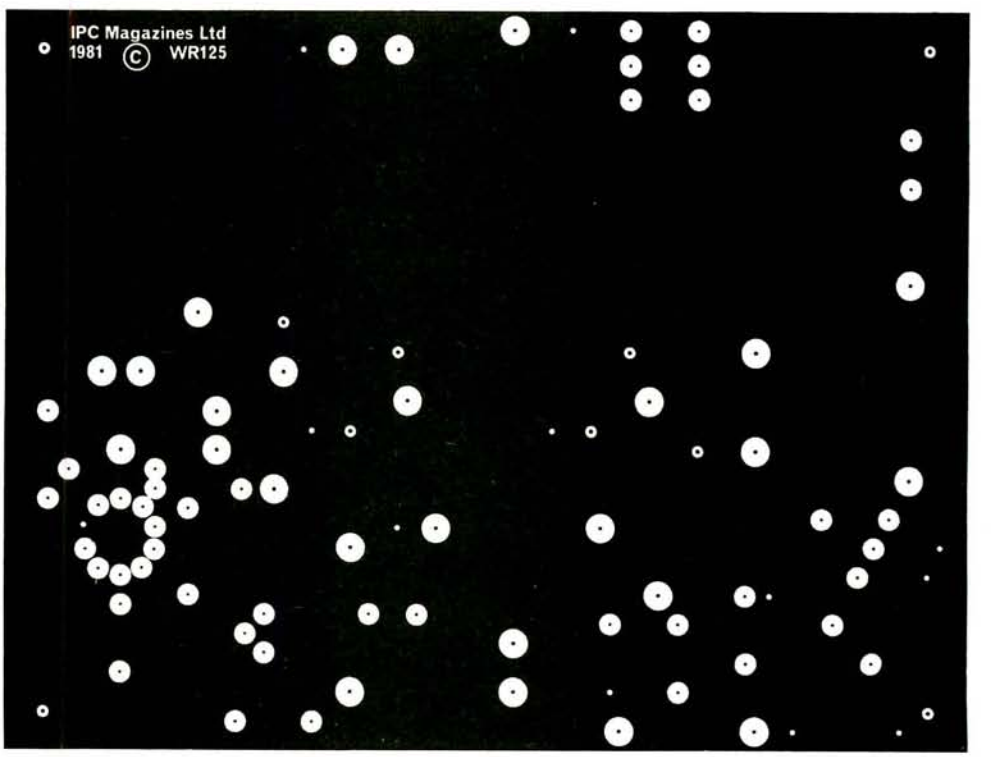


Fig. 23: Full size component side ground plane of Board 5

In the prototype a plated steel grille was used for the top cover. If a solid cover is employed there is no reason why it should not be used as the heatsink, making a worthwhile saving in drilling and marking out.

It is worth noting that on the prototype the heatsink was drilled first and the transistors mounted ensuring that adequate clearance was given to the base and emitter connections. The transistors were then removed from the heatsink, and the p.c.b. (before drawing or etching) was clamped to it. The holes in the board were then drilled for

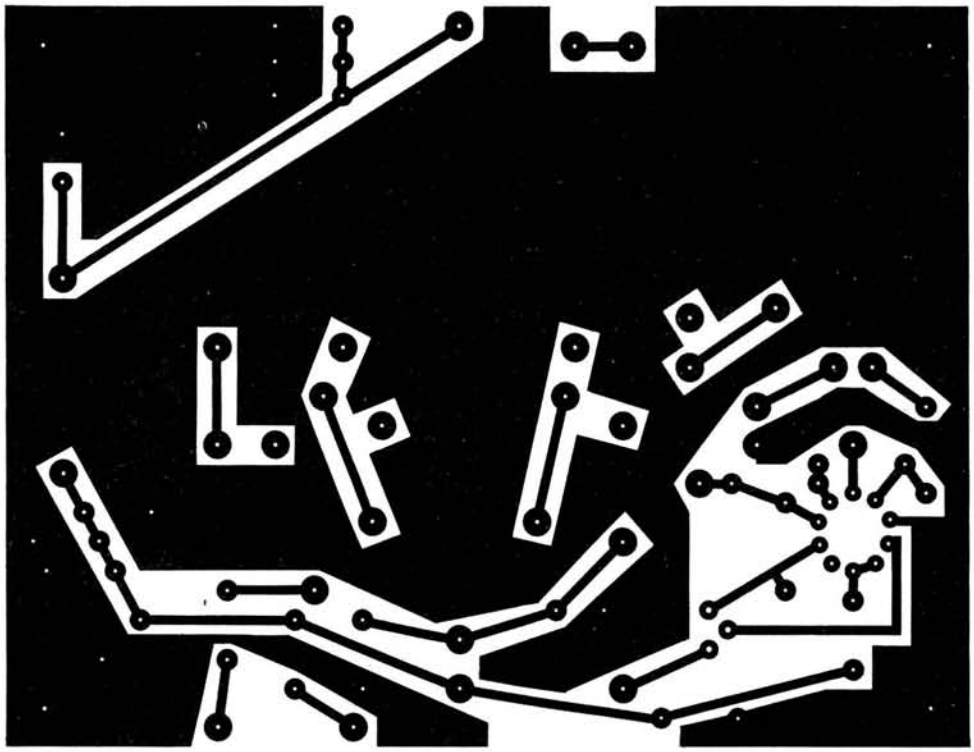
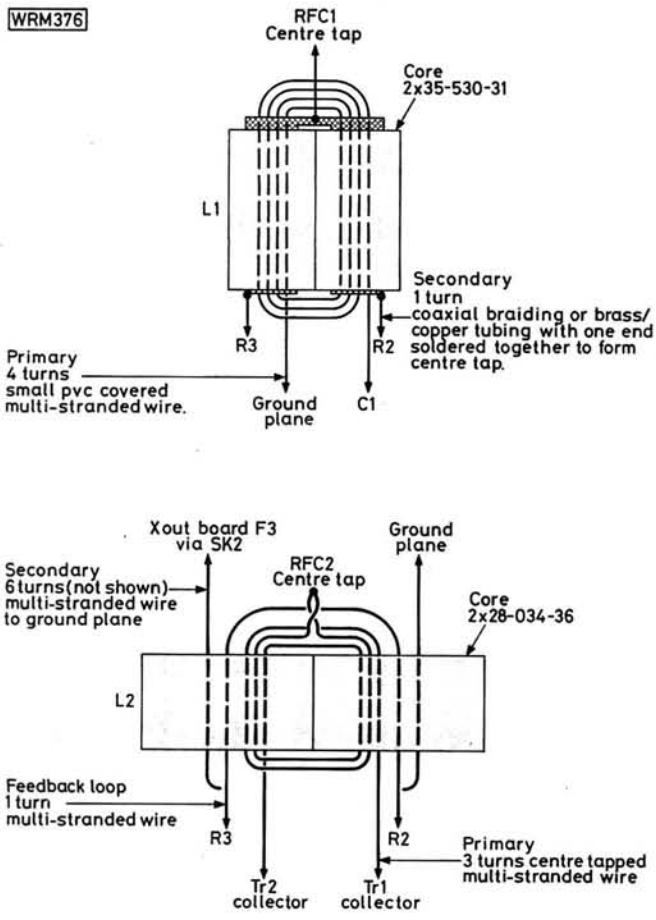


Fig. 24: Full size track pattern of the underside of Board 5

Fig. 25 (below): Constructional details of p.a. transformers



the transistor connections using the required holes in the heatsink as a guide. The same method was adopted when drilling the hole for the heat sensor connections and the top cabinet.

When connecting the base and collector connections it is essential to see that the wires do not touch against the ground plane on the bottom of the p.c.b. To avoid this effect it is a wise precaution to remove the ground plane surrounding the appropriate holes.

Capacitor 5C13 is located on the track side of the board and resistor 5R1 is soldered between the Veropin input and top ground plane.

Inductors

Transformer 5L1 consists of a primary winding of 4 turns of p.v.c. covered wire and a secondary of 1 turn, centre tapped. The core consists of 2 Neosid 35-530-31 ferrite tubes as shown in Fig. 25.

Transformer 5L2 primary is 3 turns, centre tapped, of heavy stranded p.v.c. covered wire; secondary 6 turns of similar wire. A single turn coupling is required for the feedback circuit. The core for 5L2 is formed by taping two 28-034-36 Neosid toroids, side by side.

Radio frequency choke 5RFC1 is produced by winding 9 turns of 22 s.w.g. wire on a 28-057-26 toroid. Choke 5RFC2 consists of 6 turns of 20 s.w.g. wire on a 28-057-26 toroid and 5RFC3, 18 turns of 22 s.w.g. wire on a Neosid 28-512-31 toroid.

NEXT MONTH

Part 4 of this article will deal with the constructional details of the r.f. amplifier, a.f. amplifier/balanced modulator and a.g.c./regulator boards.

RADIO SPECIAL PRODUCT REPORT

IC-451E ICOM

430MHz MULTI-MODE TRANSCEIVER

For the discerning amateur, requiring a multi-mode 70cm rig of the highest quality, design and performance, the IC-451E, latest top flight u.h.f. base-station transceiver from Icom, will prove ideal.

The IC-451E embodies a large range of operational features to allow the user uninterrupted coverage and flexibility within the full 430-440MHz band, without cluttering the unit with non-essential gimmicks or detracting from an essential ease of operation.

Layout and Controls

Front panel layouts have recently tended to become overcrowded with the advent of increased numbers of designed-in features, so it is a pleasure to report on the clearly laid out controls of the IC-451E together with their associated ease of access.

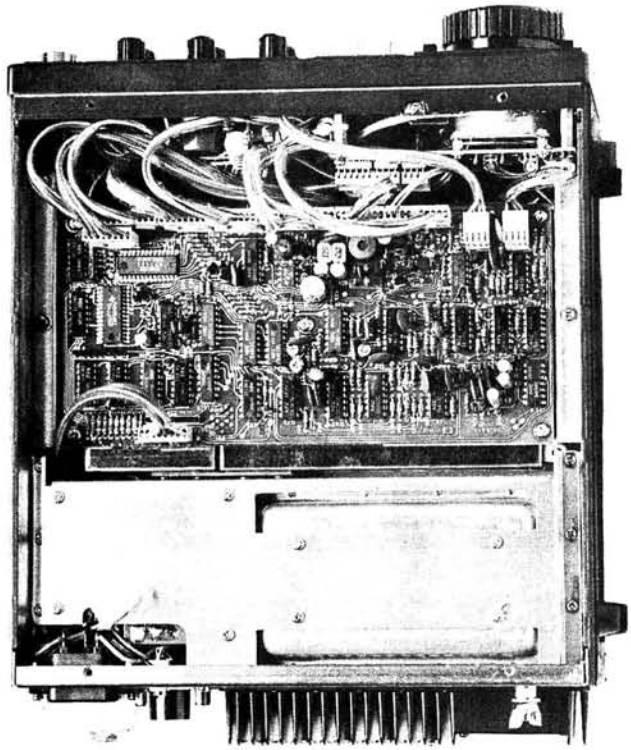
Located along the top section of the front panel are the rotary controls for microphone gain and output r.f. level adjustment. The mic. gain control also provides the location for a 1750Hz repeater access toneburst push-button. A large well calibrated moving coil meter is provided, allowing the display of received signal strength and relative r.f. output level during transmission. When the mode select switch is set to the FM-C position during reception, the meter provides a centre-zero discriminator reading, allowing accurate netting to received frequency.

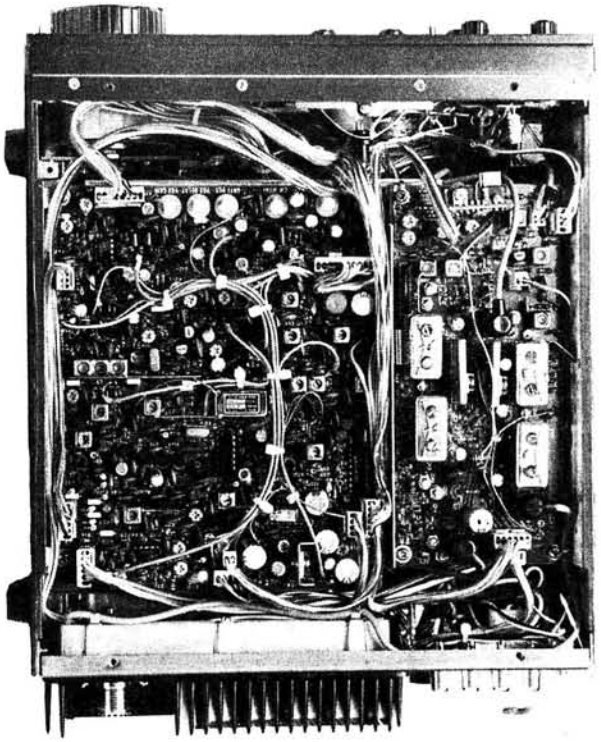
Light emitting diodes, in different colours, are provided to indicate transmission, tuning speed (25kHz or 1kHz on f.m.) and received signal presence. A 7-digit green luminescent display tube, located directly above the frequency control knob, indicates operating frequency with a resolution to 100Hz for s.s.b. and c.w. This easily read display also provides a prefixing character to indicate the selected operating mode; i.e. L for l.s.b. or F for f.m.

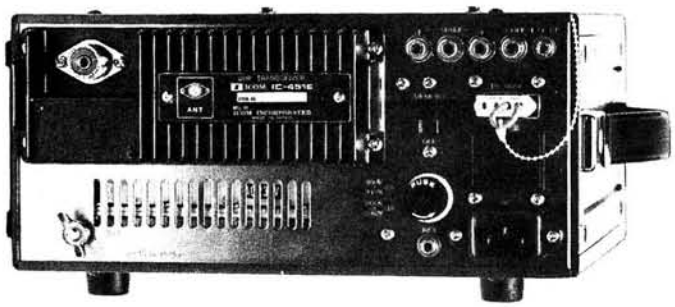
A second tier of front panel features contains the power switch push-button, 6mm phone socket, squelch, mode selector and v.f.o./memory switches, together with toggle switches to enable r.i.t., noise blanker and tuning speed (1kHz increment) control.

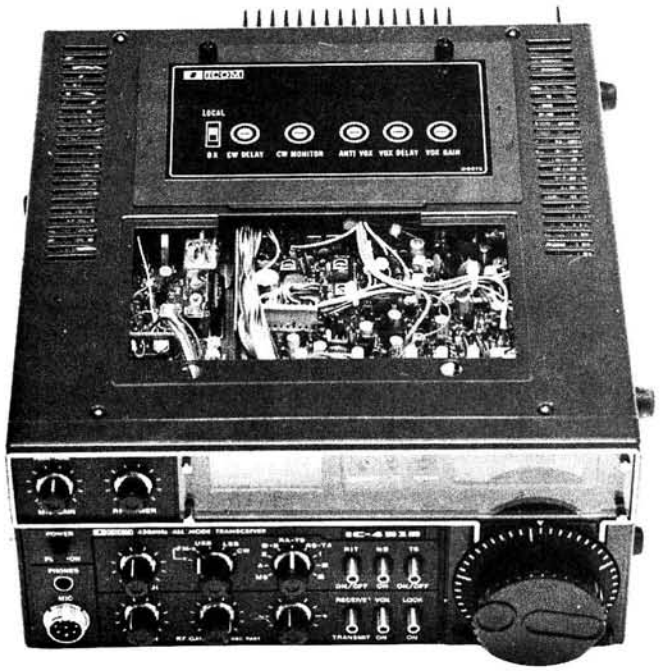
The v.f.o./memory switch allows the operator to select a comprehensive list of simplex, duplex or memory transceive options and, in conjunction with the memory, various scanning alternatives. Continuous scan of three preset frequencies or scanning between preset frequency limits can readily be accomplished. Unlike some scanning transceivers the IC-451E provides the operator with the ready means to tailor the scan pattern and rate to individual preference.

Third tier features include an 8-pin microphone socket, a.f. gain control, r.f. gain control, incorporating an a.g.c. time constant selector switch and r.i.t. ±800Hz control. Toggle switches for the manual control of transmit/receive, VOX circuit activation and locking of the tuning control knob are also provided. The VOX circuit characteristics may also be









tailored to the individual operator requirements with controls, mounted beneath a top cover access hatch, to adjust trigger level, hang time and anti-VOX to prevent spurious triggering of the transmitter.

The most prominent front panel feature is the 50mm diameter tuning control knob which is graduated in vernier type markings, corresponding to 100Hz steps when operating in s.s.b. and c.w. or 5kHz in the f.m. mode (this may be reduced to 1kHz steps when the TUNING SPEED switch is depressed).

To allow for rapid frequency shifts a 1MHz STEP button is provided adjacent to the tuning dial with a composite action MEMORY WRITE/SCAN START/STOP button on the opposite side of the dial. When the band edges are encountered both the indicated display and operating frequencies are automatically reset without the necessity to back track through the band.

Rear panel features comprise an SO-239 antenna socket, three uncommitted phono sockets for user designated interfacing and phono socket for scope connection to the 39·38MHz i.f. signal from the mixer. A 3·5mm socket is provided for the connection of an external speaker and Morse key. Additional control and input/output data signals may be passed to the rig via a 24-pin socket, making micro computer control interface feasible. Power connector sockets are available for external 13·8V d.c. or 240V a.c. mains, to supply the compact and efficient switched mode p.s.u.

A final feature on the rear panel is the earth stud which **must be terminated** if the rig is run on mains supply via the moulded-on 2-pin plug. Failure to observe this safety procedure may result in an electric shock. We have been assured by Thanet Electronics that the moulded-on plug will be removed by them, allowing the user to terminate the three-core lead with a suitably fused and earthed plug.

Internal construction and layout of the IC-451E is to a high standard with all components clearly marked and identifiable on the p.c.b.s, cross referenced to the circuit diagram and comprehensive layout drawings.

★ specifications

GENERAL

Frequency coverage: 430·000-439·999MHz
Frequency resolution: s.s.b. 100Hz steps; f.m. 5kHz steps, 1kHz steps selectable via TS switch
Frequency control: microcomputer based 100Hz step digital p.l.l. synthesiser. Independent Transmit — Receive frequency capability with two v.f.o.s
Display readout: 7-digit luminescent to 100Hz
Frequency stability: Within ±0·001%
Antenna impedance: 50Ω unbalanced
Supply requirements: 13·8V d.c. ±15% (negative earth) 4A max or 240V a.c.
Dimensions: 111 x 241 x 264mm
Weight: 7·2kg

TRANSMITTER

Output power: s.s.b. 1 — 10W p.e.p. } adjustable
c.w. 1 — 10W } from front
f.m. 1 — 10W } panel
Emission modes: s.s.b. (A3J-J3E u.s.b./l.s.b.) c.w. (A1-A1A) f.m. (F3-F3E)
Spurious emission: More than 60dB below peak power output
Carrier suppression: More than 40dB below peak power output
Microphone: 1·3kΩ dynamic with built-in pre-amplifier
Operating modes: Simplex, duplex (any inband separation programmable)

RECEIVER

Receiving system: s.s.b., c.w. double conversion superheterodyne
f.m. triple conversion superheterodyne
Intermediate frequencies: s.s.b., c.w. 39·38MHz, 10·75MHz
f.m. 39·38MHz, 10·75MHz, 455kHz
Sensitivity: s.s.b., c.w. better than 0·5µV for 10dB S + N/N
f.m. more than 30dB S + N + D/N + D at 1µV. Less than 0·6µV for 20dB noise quieting
Selectivity: s.s.b., c.w. greater than ±1·2kHz at −6dB. Less than ±2·4kHz at −60dB
f.m. greater than ±7·5kHz at −60dB less than ±15kHz at −60dB
Audio output power: more than 2W into 8Ω load

Operating

Before attempting to operate the IC-451E a detailed examination of the 37-page manual was found to be essential.

As mentioned earlier in this review the control layout is exceedingly good with all operational features clearly marked and located to avoid inadvertent adjustment.

Whilst operating on s.s.b. during a recent 70cm contest, the IC-451E was tested to the full and admirably demonstrated its ability to cope with an abundance of high level r.f. energy. No problems of selectivity were encountered during an operational period of several hours, the precise tuning capability, made available by the slow rate control and 100Hz digital display, being excellent.

Several OSCAR 8 mode J and beacon signals were copied whilst using simple crossed dipole antennas and again the tuning rate and display resolution was used to good advantage allowing an actual measurement of Doppler effect frequency shifts.

Audio response from the internally mounted speaker was adequate for the majority of signal levels encountered but the provision of a phone outlet and the use of even normal domestic headphones enhanced copy of low level s.s.b. The noise blanker circuit also proved very effective in removing ignition and pulse type interference breakthrough.

Signal reports received during many QSOs testified to the quality of transmitted audio; normal response levels were obtained with the mic. gain set to half scale.

Operation within the f.m. section of the 70cm band produced equally satisfactory performance results. Provision is made for internally mounting and charging a NiCad memory back-up supply, allowing v.f.o. repeater offsets to be retained when the main supply had been removed. Required offsets, which may be between any in-band frequencies, are set by individually programming the two v.f.o.s, reverse repeater operation being available by selecting the appropriate point on the v.f.o. selector switch.

Power output levels measured at 13·8V were 14W with the r.f. power control fully advanced and 0·5W in the start position, continuous variation over the range being available.

Whilst the IC-451E, at the VAT inclusive price of £579, is not the cheapest multi-mode 70cm transceiver, in terms of design, performance and comprehensive facilities it is in a class of its own.

Our thanks go to **Thanet Electronics, 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: 0227 363859** for the loan of the review sample.

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NORTH EAST – NORTH EAST AMATEUR RADIO, DARLINGTON 0325 55969
SOUTH EAST – AMATEUR ELECTRONICS, UK – COASTAL, CLIFTONVILLE, KENT KEN McINNES, G3FTE, THANET (0843) 291297, 9 a.m. 10.30 p.m.

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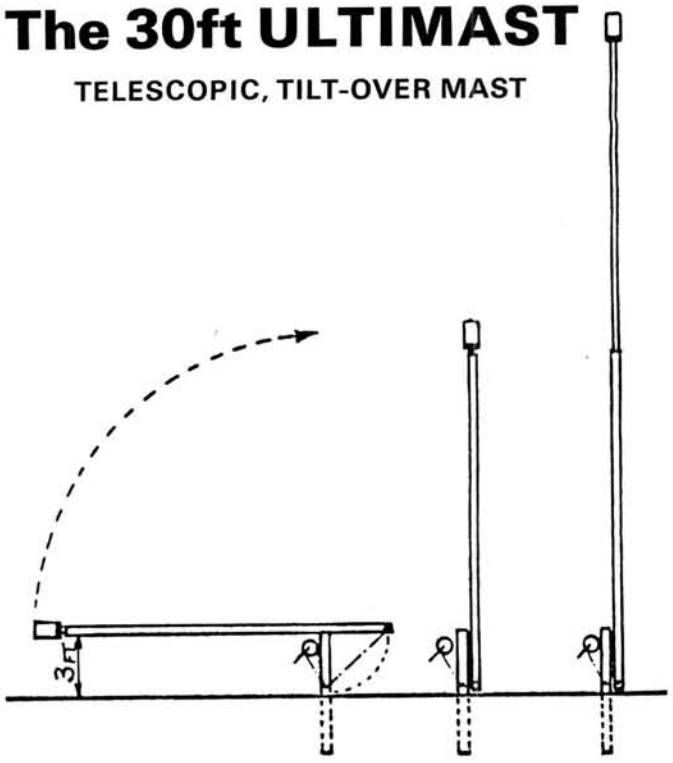

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70FM05TR In case you missed October's review of this single channel FM transceiver for 70 cms here are a few details. The receiver sensitivity is typically 0.4μV and uses dual gate MOSFETS and a high quality crystal filter. *The audio output drives an 8Ω speaker.* The transmitter gives 500mW of RF and has a modulator on the pcb. Both boards use readily available crystals and measure a very compact 6" by less than 1¼".

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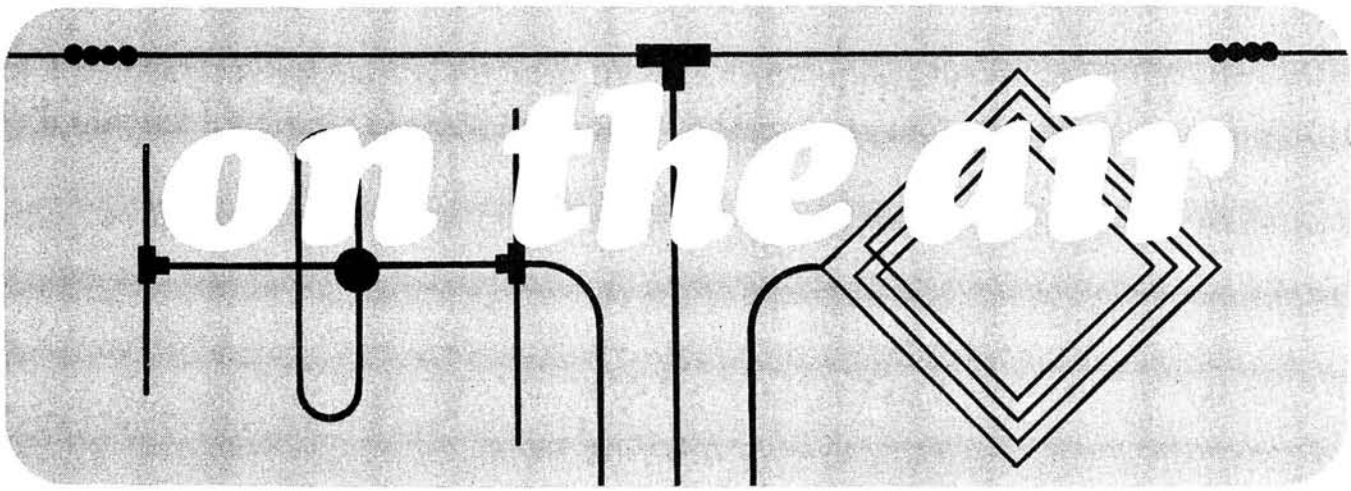

Amateur Bands

by Eric Dowdeswell G4AR

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

One of the best bits of news that's come my way recently concerns the re-emergence of KW Electronics, now to be known as KW Communications, on to the amateur radio scene as an independent company once again. Famous for the world-renowned KW2000 series of transceivers Rowley Shears G8KW has become his own master once more with new factory facilities in Chatham, Kent, to be called the Vanguard Works, a name that will bring a lump to the throat of many an old timer. Even Chris Ridley, long-time service manager with Rowley, is part of the new set-up.

In a long chat with Rowley he prophesied being able to make the Japs "sit up and take notice" in due course, which will be good news for the many amateurs both here and abroad who would prefer to buy British if it were available. With the complexities of modern amateur radio gear it takes a brave man, albeit a foolish one, to open up his black box when something goes wrong. He is entirely in the hands of his supplier who may or may not have adequate spares or back-up facilities, which emphasises the importance of making a wise choice of dealer in the first place.

Frequently the rig may have to be sent away, an expensive exercise in itself these days, with more delays if the spare board or whatever has to be airmailed from the Far East. One might be very lucky of course and have some duplicate gear. In the past one could frequently diagnose a fault and put it right in no time, learning something in the process. Now that the black box has to be sent away there is no chance of such instruction with the result that the owner often just does not know what goes on inside it. I may be old-fashioned, but that is not my idea of amateur radio.

Nor are the repeaters which now infest our v.h.f. and u.h.f. bands although this is not really a matter for comment in this column. Nevertheless, I get a lot of usually adverse comment on them from my readers. If mobile operators want to work greater distances then they should look to improving their equipment, antennas or mode of operation using our native ingenuity in the process. Commercial enterprises have borrowed much from amateur radio in the past but now the boot seems to be on the other foot, which is a great pity. *(In fact, the amateur repeater builders and users have beaten the commercial boys at their own game, achieving standards of performance which are the envy of private mobile radio operators. Ed.)*

General Chat

David Warr BRS44127 (Weymouth) comments, as do many others, on the QRM on the 7MHz band and wonders if a vertical antenna would help. I'm afraid this QRM is probably another example of intermodulation in the receiver and some sort of attenuator should be fitted right across the antenna and earth terminals to cut down the signal input before it enters the receiver. This method can work wonders on many sets, even those employing so-called "high technology"!

A note from **Ken Jones** G3PSZ who runs the 2443 Okehampton ATC with an appeal for any radio gear surplus to requirements, including components or anything suitable for stripping down. Ken will be happy to arrange collection of anything offered and he can be contacted at "Ockton House", 24 Station Road, Okehampton, Devon.

From long-time correspondent **Mike Stollov** G4HWB, normally in Manchester, comes news that the BBC has taken him under its wing at the Wood Norton training establishment. He soon made contact with the Ariel Radio Club G3PPG, with its enviable range of gear and antenna systems. Mike went to the Belle Vue do and was appalled at the prices of secondhand equipment, commenting that the prices of new gear have remained more or less steady while the s/h stuff has rocketed.

On the Bands

Using a CR150 with two long wires, **C. Griffiths** in Northam, N. Devon, logged C5ADY, VP5GCI (Turk & Caicos) and W5JMM/SU in the Sinai Desert on 10m. Unfortunately the last will probably be gone by the time this appears in print. ZL1AUM, CP6EL, ZB2GR and XT2AW turned up on the 15m band, all on s.s.b. as are all these reports unless stated otherwise. Reports of c.w. activity seem to be zero these days, although there is just as much activity on the bottom end of these bands as ever.

Haven't heard from **Phil Charlesworth** G8SNG for a while but now he tells me that he has a commission in the RAF and is undergoing training at Cranwell. He is enjoying modifying an SRX-30 and is pleased with the results. Phil informs that the Dominion Observatory at Ottawa transmits standard frequency signals on 3·330MHz (300W) and 7·335MHz (3kW), which are close enough to the respective amateur bands to act as very good propagation indicators. Phil ends by promising to get down to code practice very soon!

Dennis Sheppard in Earl Shilton (Leics) now seems to be equipped for reception on just about all the spectrum up to 70cm with appropriate antennas on a 12 metre-tall mast. Why is Dennis the only lad that writes in concerning RTTY activity?

There have just got to be others who'd like to exchange notes on this mode. But on 80m s.s.b. Dennis heard HK0SBS, OY5NS, VK4NIC/3X, VP2MGT, 4Z4DX and 8P6GG, while RTTY was copied from AP2MQ, C5ACL, DU1SS, FP8HL, FR7AT, JA1ACB, KL7HDY, PY2CME, TI2XG, VK1GM, VK3JW, YB2BLI and 9K2KA on the 20m band, with 15m coming up with JA1DXY among many others. Finally, on 10m RTTY came from FG7XA, JA1AVB, PP7GV, TR8WR and ZS3L.

The US Senate club station W3USS was an unusual catch for **Jonathan Kempster** BRS45205 on 10m with his FRG-7 and newly-acquired SST-T2 antenna tuner, also finding HR3JJR, 9H4G and J73PP on the 21MHz band. TL8CN, TG9FU and 5Z4RT appeared on 28MHz. Jonathan comments on VP8QI in Antarctica using a 580 metre per leg "V" beam! The good news is that Jonathan's sister Lorna has taken to amateur radio like the proverbial duck to water, using his rig while he was away at school to log, among others, C5ADY, 9G1YS and FM0HEW, which can't be bad! Here's hoping Lorna will honour us with her own reports in future!

Another family group is reported by **Mr and Mrs E. Bambrey** of Poole, Dorset, introduced into the world of DX by son G8AFG, on an AR88 with 10 metre-long wire, finding that VP8QI, and VP8PU in the Falklands plus VK3SK and VK4ARC, all on 20m. I look forward to regular logs from now on.

A later report from David Warr shows HK0FBF, J28CC, P29GC, SU1BA and ZP5RG on 10m, DU1CGC, FK8CR, HL1TP, YC2CTW and 4S7FG on 15m. Only one of interest on 20m was KH6FLG.

Thinking he had captured a rare one in KS6O **Bill Rendell** (Feoch, Truro) was a bit fed up to find it was just another W6 instead of Samoa. As he remarked: "Is nothing sacred?" Noting a lot of weak and echoing G stations on 10m on March 24, Bill went back later to find VKs coming in at S8 and 9 plus many Ws as late as 2230GMT. Other loggings included VK2AVA and ZL4AV on 40m, CE0AE, C31YF, KC4AAA, VK0-JS/VK9 on Norfolk Is, VP8PP (Box 224, Stanley, Falkland Is), VP8QI (QSL G4CHD), ZD7SS and 5T5AY who said QSL to W4LZZ, all on 20m. Unusual ones on 15m were HM1KR, J88AM, KG4KK, S79RD, 5V7HL (QSL W2TK) and 7P8AF. Finally, FH8OM said QSL to DJ1TC, and VP2DMS wants them via W2IRS; also logged were KH6SB on Maui Island, P29NRL, VP5RFS (QSL N5BET), VP8QG, YB1AEG (QSL HB9AJD), ZD7BW and 6T1YP (QSL DF3NZ). That 6T1 is the Sudan and a seldom-used prefix there.

First-time report from **Bob Gibson** of Wadhurst, East Sussex, who uses an FRG-7 plus 14 and 28MHz fan dipoles, the RX having been fitted with a 2kHz i.f. filter just to make life easier. A frequency counter has also been added. Favourite 28MHz band brought in 8Q7AV, 9X5OW, HL9DX, KA6JD of Okinawa, VK8NTT, VS5PP, VS6CT and YS0BST. Taking c.w. lessons from an amateur friend, Bob reckons he'll be sending in logs for that mode soon. Well, that will be one more than I get now!

I particularly liked the opening paragraph of a recent letter. "Can I say a heartfelt 'thank you' to yourself and the other lads who compile the *On the Air* feature for being so patient and helpful towards newcomers like me? I've been taking *PW* for about 18 months now and you've really made me feel at home in your company." Especially as it came from YL **Anne Edmondson** of Edinburgh, who has now equipped herself with a DX200 receiver and 10 metres of wire, with a 25-metre job in the offing. With her Morse "stuck" at 10 to 12 w.p.m. I can see Anne will be on the air 'ere long.

Anne is 27, on the dole, to use her own words, but studying to become a computer programmer and enjoying the first "holiday" she has had in ages. Only one other thing to do, Anne, join a local club! Her DX included 5B4HF, 9H1GP and ID9XRU.

The DX160 plus inverted "V" for 80m and dipoles on the other bands kept **Mike Howard** of Oldham busy from Top Band to 10m, mostly on s.s.b., like EA9EU, KP4ES, K7TZZ in Montana, OH0XX/OJ0, UG6YLA, UK1PRO in Franz Josef Land and VP2VHL, all on 160m believe it or not! On 80m Mike logged FH8OM, FY7AN, HP1XRK, KH6CC, VP2AZG, VP2VHL, VP8QG, VP9II, 3A2EE and 6W8AR, while 40m came up with FH8OM again, PJ7KM, and VP2VHL for another repeat. A good one on 15m was CE0AE as was FM0FSN, this time on c.w., with HS1BV, K6LBL/CE0Z, 7P8AC and 9U5JM on s.s.b. Finally, on 10m it was DF3NZ/ST2, HP1XOG, J28CL, P29NDX, VP2MCL, VP5RFS, VP8PU and VP9KB. Incidentally Mike is also BRS44755 and will have sat the RAE by the time this appears in print, so let's hope you did well OM!

Dave Coggins (Knutsford, Cheshire) has also ranged far and wide with his FRG-7700 and vertical whip and "L" antenna plus a.t.u., but does not find this set as good as his old FRG-7 on 28MHz. Sounds like the old intermodulation problem again. A mains filter unit has made a big improvement on Top Band, especially eliminating TV timebase QRM. Goodies on 10m were DJ5RT/6W8, HM0U, HS4AMI, J88AQ on St. Vincent, KH3AB supposed to be on Johnston Island and QSL to KB7MO, VK3NIC/3X, VP1MK and 4V2BM. Easter Island came alive for Dave with CE0AE; VR6TC and ZL3AFH/A on Campbell Island were also excellent on 20m plus 9V1UQ. Unusual one on 40m was CO5GV with VU2NKR, ZD8RH, 7X5AB and AP2P. Dropping down to 160m it was EA3RF, EF6BDX reputedly in the Balearic Islands, YT0R and 4N3EF, with a brief listen on c.w. revealing OZ1W and EZ5AAU, among many other Europeans copied during the CQ WW contest.

Club Time

Thornton Cleveleys ARS. Announce a change of venue and meeting time. Now it will be the Sports Centre, Victoria Road, Cleveleys, every Monday at 7.30pm, plus RAE classes on Fridays at the same time, given by G3GIY, with slow Morse on 1·975MHz Mons and Thurs between 7 and 8pm from G3ZRZ. If you want to know more contact A. Park G3IWP, 43 Argyle Road, Poulton-Le-Fylde, Lancs, or try 884931.

Mid-Lanark ARS. Open Day, Sunday, June 21, at normal meeting place Wrangham Hall, Jerviston Street, New Stevenson, Motherwell, with trade stands, lectures, bring and buy sale and all usual attractions, from 1pm. Talk-in on S22 and GB3CS. Normal meetings Fridays, so try Gordon Hunter GM3ULP, 12 Airbles Drive, Motherwell, for info. Gordon is new secretary and can also be found on Motherwell 53394.

Chesham & District ARS. The search goes on for new premises with current meetings being held at the Chesham Whitehill Centre on Weds at 8.30pm. Andy G8PUC emphasises the problem a lot of clubs have of members moving QTH, etc., and not letting the club know. Keep in touch, says Andy, even if only by telephone. Contact Andy at 8 Lynton Road, Chesham, Bucks or (02-405) 5625.

West Kent ARS. Fridays at Adult Education Centre, Monson Road, Tunbridge Wells, with July 17 seeing local County Emergency Planning Officer discoursing on the amateur's role in an emergency. However, this may be in time to tell you about the tour of the zone centre telephone exchange on June 5 at 8pm and the DF foxhunt from the Drill Hall on the 19th. More info from Brian Castle G4DYF, Sevenoaks 56708.

Maidstone ARS. Fridays, 8pm, YMCA, with special date on June 12 when G3SXE shows films of his trip to Gibraltar as ZB2CV and to VQ9R land. Try G.D. Edy G4AXD, 29 Beech Road, East Malling, Maidstone, Kent, or W. Malling 841021.

Denby Dale & District ARS. Don't forget the mobile rally at Shelley High School, near Huddersfield, on Sunday, June 21, two miles from Denby Dale and one from the Emley Moor TV station. J. Clegg G3FQH, 8 Hillside, Leak Hall Lane, Denby Dale, Huddersfield, has all the gen.

Alresford Wireless Club. Club magazine *Alresford Calling* to hand with 12 pages of well-produced and interesting information for all tastes. Last Wed each month at 8pm at Badgers, 37 Nursery Road, Alresford, Hants, from where R.J. Farley G3SSJ will be glad to help newcomers to the club or ring Alresford 3816.

Mansfield ARS. John Coates G4GYU is new Sec and can be found at 30 Abbott Road, Mansfield, Notts, or on 27257. Club meets first Friday at 7.30pm at the New Inn, Westgate, Mansfield.

Midland ARS. An in-line v.h.f. wavemeter is one item in latest MARS mag *Probe*. Only event I can tell you about is the cheese and wine party on Tuesday, June 23, at the Broad Street HQ, but as no other meeting details given suggest you write editor Stewart Laing G8ODT, 138 Hillside Road, Great Barr, Birmingham B43 6NQ.

Southdown ARS. Excellent newsletter with details of meeting place and names and QTHs of all the committee on the first

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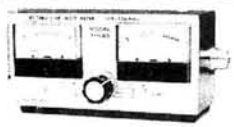

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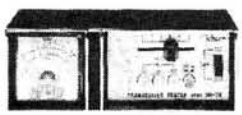

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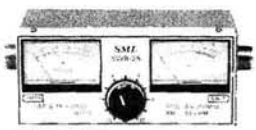

SWR25: This ever-popular twin SWR and Power meter covers 3.5-150MHz at **£12.00** inc. VAT. P&P 50p.

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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 your mind to buy a receiver you should be aware it will perform only as well as the antenna 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 specified, then 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 7700 or FRG 7700M 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!

1 YAESU FRG 7700 + AMTECH 200 ATU £309.00
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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 tune co-axial fed antennas – Their normal selling price? The Amtech 300 **£43.95** – The Amtech 200 **£29.95** – What can you lose? So get cracking MAKE A GOOD START! HAVE PEAK PERFORMANCE FROM THE OFF.

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page where bods like me like to see them. It is the Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, at 7.30pm. I like also the emphasis on what's going to happen instead of harping on past meetings! New members welcome on the first Monday of the month. Secretary is R.E. Holtham G4EKS, 2 Benbow Avenue, Eastbourne, E. Sussex or E'bourne 32777.

Chichester & District ARC. First Tuesday and third Thursday (seems complicated!), 7.30pm, in Room 34A of the Lancastrian Wing, Chichester High School for Boys, Basin Road, Chichester, plus club net at 7pm every Monday on S11 which is 145·275MHz. Meeting of note is the special event station GB2CHI at the Chichester 906 Festival, Friday/Saturday, July 10/11, at the Guildhall, Priory Park, Chichester. The 19th is day of Sussex Mobile Rally at Brighton racecourse. Secretary, S. Talbot G8FCX, 31 Pier Road, Littlehampton, W. Sussex, or Littlehampton 5082.

Crawley ARC. Newsletter gives a lot of space to the activities of its individual members with main club activity in DF hunts and contest operating. More from Vernon Davis G3MSK, 16 Newmarket Road, Furnace Green, Crawley, W. Sussex, or Crawley 26316.

North Devon RC. Change in meeting times to second Wed of the month, except August, at Bideford Community College, Abbotsham Road, Bideford, on even months from 7.30pm, and at the Pilton Community College, Chaddiford Lane, Barnstaple, on the odd months, 7.45 to 9.45pm (even more complicated!). However, G. Hughes G4CG, Crinnis, High Wall, Sticklepath, Barnstaple, can help further.

Edgware & District RS. Second and fourth Thursdays, 8pm, Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, plus club net on 1·875MHz, Mondays at 10pm, and slow code from G3ASR on Mondays and Thursdays. June 11 is constructors contest and NFD briefing, with a summer junk sale and VHF FD briefing on June 25. Hon Sec is Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx, which is also 01-952 6462.

Sefton ARC. Using my calendar to find out what "alternate Weds from May 6" is, I find the club will be meeting on 3rd and 17th June et seq., at 8pm, at the Liverpool Prison Officers' Social Club, Hornby Road, Walton, L'pool 9. Special trip will be on Saturday, June 13, to the Maghull & District Round Table Carnival. Write to Len Gurney G4LBJ, 1 Endborne Road, Orrell Park, L'pool L9 8DP, or ring him on (051-523) 6077.

Leighton Linslade RC. Another lot on the move! New venue is the Vandyke Community Centre College, Vandyke Road, Leighton Buzzard, and new night is Mondays, with code practice to start with at 7pm and meetings from 7.30 to 10pm. So it's a note to Clive Wood G8UGN, 2 Stivers Way, Harlington, Dunstable, Beds, for more info.

Wirral ARS. First and third Weds at 7.45pm, Sports Centre, Orange Road West, Birkenhead, with local nets on 7·050MHz on Sundays at noon, and most evenings on 145·800MHz or 3·680MHz. On June 17, Norman Kendrick G3CSG holds forth on new electronic keyers, with July 1 seeing Len Roberts G3EGX on antennas in confined spaces. Make a note of the treasure hunt by radio on July 15. Your club PRO is Gordon Lee G3UJX, 30 Manor Drive, Upton, on 677 1518.

Wolverhampton ARS. Extensive and varied newsletter shows meetings on Mondays at the Wolverhampton Chamber of Commerce, 93 Tettenhall Road, W'hampton. Club call is G8TA. Home-built equipment competition night is June 1, with a natternight on the 6th, while on the 15th G4IRD talks on pre-war Hornby electric trains. Better mention July 6 when G3ZLJ discusses 10m conversion of the Liner-2. Contact is John Cook G8EDG, 75 Windmill Lane, Castlecroft.

Bedford & District ARC. Location of the club G3WTP is still a bit difficult to describe, hence the map on the front of the club magazine! It's three miles north of Bedford, opposite the car park just south of the "Horse and Jockey" and Ravensden church! Wednesdays, with June 3 being DF hunt time and the 10th homebrew evening. Call in on 2m or through GB3BD. Contact is Dave G4FEV, 16 Fairmead Crescent, Rushden, Northants.

Cheshunt & District RC. Wednesdays, 8pm, Church Rooms, Church Lane, Wormley, near Cheshunt, Herts, with sec Mike Bragg, 2 Elm Drive, Cheshunt (0920) 4316, or chairman Jim Sleight G3OJI, 18 Coltsfoot Road, Ware, Herts, wanting to hear from prospective members. June 10 is natternight and code practice with an outing on the 10th to Bass Hill Common, complete with a 2m outfit. Two exhibition stations could materialise during June and July if all goes according to plan.

Maidenhead & District ARC. First Thursday and third Tuesday at the Red Cross Hall, The Crescent, M'head, at 7.45pm, with June 4 and 16 devoted to FD preparations while July 2 is time for a discussion on second-hand and surplus equipment. Important date is July 21, the 2m DF foxhunt. For more, contact John Patrick G3TWG at Bedford Lodge, Camden Place, Bourne End, Bucks or (06285) 25275.

Worcester & District ARC. Mike Tittensor G4EKG, 16 Durcott Road, Evesham, Worcs (Evesham 41105) is pleased with the result of former mentions of the club in this column, although it means more work for him, in the way of new members. June sees the club participating in several contests and ending with the Longleat rally on the 28th. Special date is July 12 with the Radio Rally at the Droitwich High School with entertainment for all the family. Club meetings on the first Monday, at 8pm, Old Pheasant, New Street, Worcester, and visitors are very welcome, of course.

Cambridge & District ARC. Glad to hear from David Wilcock G2FKS again. He lives at 19 Cavendish Avenue, Cambridge, with club station G2XV located at the Tower Room of the Coleridge Community College with Friday meetings at 7.30pm in the college's Visual Aids Room. The college is located in Radegund Road, Cambridge. A c.w. training net operates on Wednesdays on 3·515MHz, at 8.45. Other code sessions are run by chairman Wilf Dunell G3BYW.

Cheltenham ARA. Regular meetings on first Thursday and third Friday at the Old Bakery, Chester Walk, Clarence Street, Cheltenham, according to club magazine *CARA News*, with over 50 present most times. On June 4, G3LRM talks on the way radio used to be, the 19th is natternight, while on July 2 G3ASR reviews the 1980 transatlantic meteor scatter tests. More from Grant Cratchley G4ILI on Cheltenham 43891.

Braintree ARS. *BARSCOM* is the name of the club's mag, with such varied offerings as an article on v.m.o.s. and making a fruit cake by XYL of G3PEN! First and third Mondays at the Braintree Community Centre, Victoria Street, Braintree, next to the bus station, around 7.45pm should be OK. Club station now sports two calls, G4JXG and G6BRH, but Alan Heritage G4EOG, 25 York Gardens, Braintree, can tell you more, or ring 20900.

St Helens & District ARC. Thursdays, 7.45pm, at the Conservative Club, Boundary Road, St Helens, with code practice beforehand. Club nets Sundays 11.30am on S23 and on 1·950MHz on Weds at 7.30pm. Paul Gaskell G8PQD is secretary at 131 Greenfield Road, St Helens, which is also 25472. Incidentally, s.w.l. George White, 19 Abbots Hall Avenue, Clock Face, St Helens, has responded to enquiries on the Grundig Satellit 2000 receiver and s.s.b. unit shown in a recent photo in *PW* with 'stat copies of relevant info. Club mag *Ground Wave* has wide spread of articles and news and is well produced.

Fareham RC. First and third Weds at 7.30pm at Portchester Community Centre, Room 12, with June 3 devoted to questions of measurement and the 17th to oscilloscopes. July 1 is propagation and antennas night, says secretary Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants, also 234904.

Barking Radio & Electronics Society. Club calls G3XBF and G8XBF at Westbury Recreation Centre, Westbury School, Ripple Road, Barking, Essex, where meetings are held on Mons, Tues, Weds and Thurs every week! Two rooms are exclusive to the club, one for the TV activities and the other for meetings. Activities are legion, like code practice, trouble-shooting and repairs, beginners and advanced groups, constructional and regular meetings. Alan Sammons G8IZN, 80 Lyndhurst Gardens, Barking, will be glad to hear from potential members.

Cray Valley RS. Meets first and third Thursdays at 7.30pm at the Christchurch Centre, Eltham High Street, Eltham, London SE9, with club interests like s.w.l. topics, contests, outside visits, RTTY, RAE and code practice classes and the like. Special event station GB4LCS will be organised at the Lambeth Country Show on July 18/19, but before that, on June 4, is a demo of amateur antennas and testing by G3BHF, the 18th being natternight. July 2 has a talk and the 16th sees a summer portable station at the Royal Eltham Scouts Ground. Although

the club has over 130 members, John Acott G4ILH, 42 Shooters Hill Road, London SE3, would still like to hear from possible new members.

Don't forget to contact someone before visiting a club as it makes so much difference to go along the first time with a member who will gladly introduce you to the officers and members. So often a likely member strolls in and grumbles afterwards because no-one seemed to be interested in him, which is quite the wrong approach. Clubs thrive on new members, the more the merrier, and the more activities can expand to suit all tastes.

Logs by the 15th of the month and other letters, etc., at any time. Club events need six weeks' advance notice it they are to appear in this column in time.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

In recent issues we have had a look at summertime DXing on the medium waves. At this time of year a path of darkness between transmitter and receiver is not so easy to find, such a condition being necessary for long-range reception on these frequencies. We have seen how it is possible to listen to North America at sunrise and to Spain and Portugal at sunset. Is there anything else to look for?

Ramadan

Although there is a path of darkness between the UK, North Africa and the Near East at sunset, this is not normally a productive time of day for DXing this area, as many of the stations we might pick up will already have signed off for the night. However, Ramadan starts this year on July 3 which means that transmissions in Moslem countries will be on extended schedule, many staying on the air all night giving the beginner to m.w. DXing a chance to pick up a few of the stronger stations, and the experienced DXer the opportunity to log a few rarities. This situation will continue throughout July and the best time to start listening is half an hour before sunset.

There are two stations to look for on the long waves. Azilal in Morocco is on 209kHz with its Arabic service, and Tipaza in Algeria can be found on 254kHz. The latter has an English programme every night starting at 2100.

On the medium waves you will find Egypt on 621kHz, Tunis on 629kHz, Algeria (Voice of Free Sahara) on 927, Istanbul 1017, Babylon (Iraq) 1035, Kuwait 1134, Teheran 1188, Bagdad 1197, Tripoli (Libya) 1251, Jeddah (Saudi Arabia) 1521 and Sharjah in the United Arab Emirates on 1575kHz. These are only a few of what should be heard. A complete list of North African and Middle East broadcasts can be found in the *World Radio and TV Handbook*.

Identification can be a problem. In Arabic look for the key word Huna which means "this is" as it will be followed by the station name. "Huna Ribat" means "this is Rabat" while Sowt el Arab is the Voice of the Arabs in Cairo. Other key words to look for are Burasi in Turkish, Inja in Farsi (Iran) and Dahab in Berber.

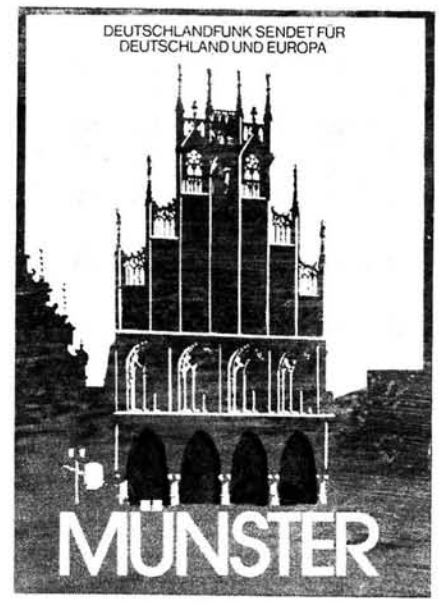
Receiver Modifications

A Grundig Melody Boy is in use at New Radnor by **Simon Hamer** who says: "The Melody Boy is slightly modified for medium and long wave DX. I have wound 20 turns of 32s.w.g. enamelled wire on the ferrite rod antenna." One end of this additional winding is connected to a long wire antenna while the other end of the winding is connected to the receiver "chassis" which is earthed.

With this arrangement Simon pulled in 20 UK local radio stations during the day, including Manx Radio on 1368kHz and Radio Finland with its Foreign Service programme in English on 963kHz between 1930 and 2000. Simon also has a Satellit 1400 which does not have an external antenna socket for the m.w. and l.w. bands. By placing this receiver close to the Melody Boy with long wire connected, the DX performance is improved by induction from the ferrite rod antenna of the Melody Boy.

An interesting point emerges from a long letter from **T.W.G. Elsenham** of Waltham Cross, who comments on the fact that modified receivers seem to be more sensitive than the commercial item. This is inevitable. A commercial set is made to a specification which must be repeatable on a production line. I once wrote an article called *Improving the CR100*. I wish I'd thought of a better title but what I meant was "Hotting up the CR100". It is possible to tweak-up almost any piece of equipment if you know what you are doing but it is wiser to confine this activity to home-made gear.

Two cards from reader Simon Hamer:
Deutschlandfunk is on 1269kHz
A listener card from Finland on 963kHz



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C.	140-150 MHz,	150-160 MHz,	160-170 MHz
D.	118-130 MHz,	140-150 MHz,	70- 80 MHz

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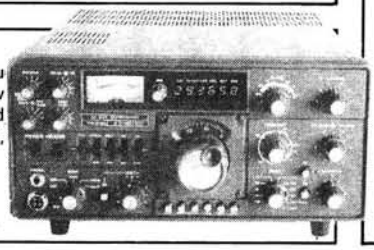
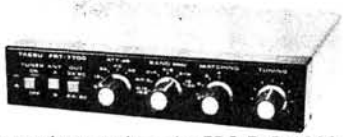


FRT-7700



Designed by Yaesu to match the FRG-7700, but also compatible with many other popular receivers such as the FRG-7, R-1000 and DX-300, this ATU lets you peak up on the signals you want and attenuate those you don't. Great performance and value at just **£33.75.**

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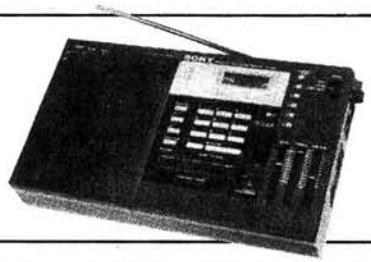

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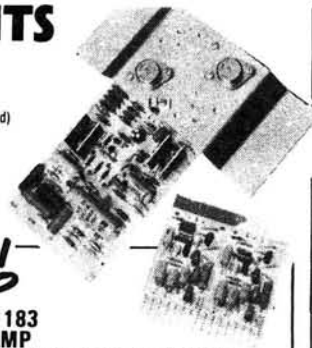

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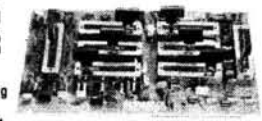

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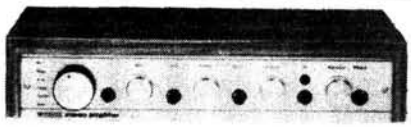

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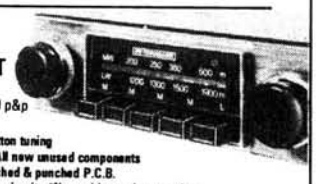

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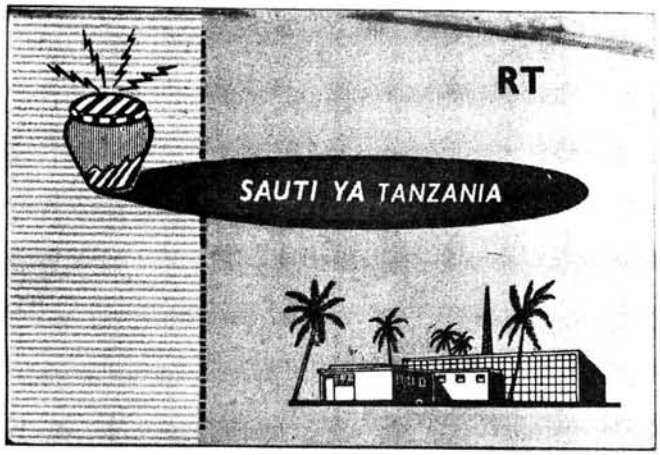


My 1966 QSL card from Dar-es-Salaam

Receiver Servicing

My note in the April 1980 *PW* about snags with spares and servicing the BRT400 communications receiver brought an interesting reply from **John Rayner** of Byfleet. When he was having his AR88 serviced by Dryborough Communications Services of Daventry, he found that the owner of the firm had helped to design the BRT400. John goes on to say that he picked up a BRT400 in mint condition a couple of years later for £45. When comparing the two sets he says that the BRT400's extra facilities make up for any slight loss in sensitivity.

Ron Roberts G3TAR does his own servicing. When the first r.f. valve of his BRT400, which is a W81, went defunct and he could not locate a spare he cut away the valve down to its base and wired a 9-pin socket to it. He then fitted an EF183 and the set was fine again. It is a wonder the poor receiver didn't take off! A more usual choice would be the 6BA6. I once fitted an EF183 as a replacement r.f. valve for my old R1155 and the cross-modulation on the medium waves was incredible.

Andorra

Details of the current situation, radio wise, in this tiny republic in the Pyrenees have been received from reader **Roy Patrick** of Derby. Radio Andorra transmits on 702kHz (427m) with a power of 300kW, programming being in Catalan and Spanish. Sud Radio puts out 900kW on 819kHz (371m), the programmes being in French.

The licences for these two stations have run out and the government of Andorra has refused to renew them as it wants to control and operate the stations. This has led to a dispute between Spain, France and Andorra, and at the time of writing the stations seem to be on and off the air from day to day. The short wave international service of Radio Andorra on 6·220MHz is not affected.

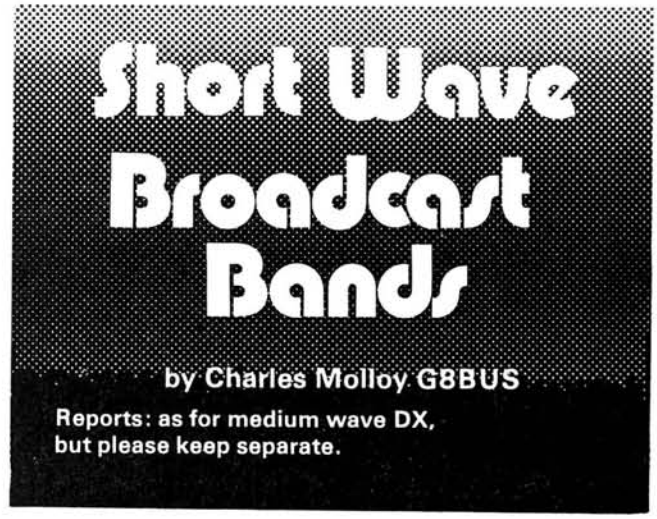
No doubt the problem will soon be resolved to allow the DXer the chance of picking up an interesting country. Both stations QSL. Write to Radio Andorra, BP1, Andorra and to Sud Radio, Radio des Valles d'Andorre, BP7 Andorra. An International Reply Coupon along with the reception report, which can be in English, will ensure a reply.

DX Heard

Our Norwegian reporter **Bernt Erfjord** writes to say that he has been pulling in the DX with his modified FRG-7. He changed the 7kHz i.f. filter for a 3kHz one. Radio San Sebastian was heard on 1260kHz, Radio Bilbao on 990kHz which has an international programme in several languages at midnight on Saturday night, La Vox del Miño which is now on 1428kHz and Radio Intercontinental Madrid which is on 918kHz. From the UK, BBC Radio Norfolk was heard on 855kHz, Mercia Sound on 1359kHz and Radio Tay on 1161kHz and 1584kHz.

Nearer to home **Harold Brodribb,** who uses a CR100 and long wire, expresses surprise at the strength and reliability of Radio Norfolk at his QTH at St Leonards-on-Sea. He also mentions the BBC transmitter at Crowborough on 810kHz which "sends out a loud clear harmonic on 1620kHz".

Reader **Keith Dwyer,** who lives in Pietermaritzburg in RSA reports hearing the BBC (Cyprus Relay) on 639kHz at 2200, Radio Dar-es-Salaam on 1200kHz signing off at 2100, and Radio Botswana with excellent reception on 1000kHz at 2100. One man's local is another's DX! I logged Dar-es-Salaam on 638kHz from my QTH a number of years ago and was lucky enough to receive a rather attractive QSL card from them.



Where can I find Radio— on the short waves? This is a question frequently asked by recruits to international broadcasting, but unfortunately there is seldom an easy answer. Unlike the medium waves where stations occupy the same channel year in, year out, those on the short waves change frequency on a seasonal basis. The move is towards higher frequencies in summer and lower ones in winter.

Programme Timings

The timing of your favourite programme can change too. Many broadcasters like Radio Canada International, beam their English programmes to Europe at the same time in GMT (UTC) throughout the year. This means that *Sunday Weekend Magazine,* for example, is on the air at 7pm, UK time in winter and at 8pm in summer. Other stations change their programmes in line with the introduction of summer time, but whose summer time? Although 19 countries in Europe changed over on March 29 this year the same procedure will not be followed in the autumn when the UK reverts a month later than most of the others.

A further complication is that summer time in the northern hemisphere corresponds to winter time in the southern, while there are a few places that do not use daylight saving at all. All this means that one's regular programmes may suddenly disappear either to reappear on a different frequency or at another time of day.

Programme Schedules

Fortunately there is an easy way out of this labyrinth. Nearly every major broadcaster issues a programme schedule which comes out at least once a year, and may appear as frequently as four times in March, May, September and November. Frequencies that are expected to be in use, the times of the different language slots plus programme details are contained in the programme schedule which is available free of charge, just for the asking. Once you get on the mailing list it will come

automatically, though stations do like to hear from you now and again especially if you comment on the quality of their programmes.

Who do you write to? The station address often comes at the end of the programme but if you quote the name of the station, the city and country, it will probably reach its destination. The full address of Radio Sweden is S–105, Stockholm, Sweden but your letter will surely be delivered if the post code is omitted.

Time Signal Stations

"Is it possible to receive CHU Canada and WWV USA time signal stations and if so, when is the best time to receive them?" writes reader **D.L. Keegan** from Eastbourne.

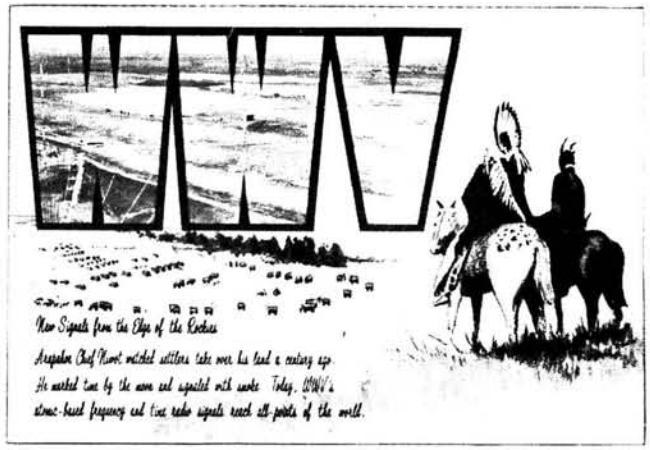
CHU, which is located in Ottawa, is on the air 24 hours a day on 14·670MHz with a power of 3kW and 7·335MHz with 10kW. The higher frequency will give better reception during the day and evening, while the lower should come in best at night. Neither station is strong at my QTH but both are receivable on the BRT400. The "programme" consists of one second pulses. A voice recording of the time occurs each minute with "CHU Canada Eastern Standard Time" and the announcement alternates in French and English from minute to minute. The address for reception reports is Radio Station CHU, Ottawa, Ontario, Canada K1A 0S1.

WWV is located at Fort Collins in Colorado and transmits continuously on 2·5MHz with a power of 2·5kW, on 5MHz, 10MHz and 15MHz with 10kW, and on 20MHz with 2·5kW. A voice announcement quoting Co-ordinated Universal Time (UTC), which for practical purposes is the same as GMT, is given during the last 7½ seconds of each minute. In addition there is station identification during the first and thirty-first minute of each hour. WWV can be heard in the UK on 15MHz and 20MHz, during the day, and its address is Radio Station WWV, US Dept of Commerce, National Bureau of Standards, Fort Collins, Colorado, USA.

Propagation Pointers

Although stations such as CHU and WWV are primarily intended as a source of accurate time and frequency, they are of considerable value to the short-wave listener as a guide to propagation. In Australia there is VNG located at Lyndhurst in Victoria which is on 4·5MHz from 0945 to 2130GMT, on 7·5MHz continuously with a break from 2230 to 2245 and on 12MHz from 2145 to 0930. There is a full identification during the 15th, 30th, 45th and 60th minute each hour.

A programme schedule from Italy



David Lyndon Evans' QSL from WWV

VNG can be heard on all three frequencies in the UK at various times of the day and year when propagation is favourable. I have used the 4·5MHz transmission as a guide to conditions on 60 metres during the winter, and have picked up VLM4 of the Domestic Short Wave Service at 1900 sign-on as a result. This station transmits on 4·920MHz with a power of 10kW.

Time signal stations provide a fascinating diversion for the DXer and a list of these stations, including addresses and programme information, is in the *World Radio and TV Handbook*. Most of these stations QSL, and if you want one from VNG write to Box 249, Clayton 3168, Victoria, Australia.

World Radio and TV Handbook

The 1981 edition of the *WRTH*, aptly called the DXers telephone directory by Arne Skoog of Radio Sweden, has just come to hand. It has 600 pages and contains station lists, countries lists detailing frequency lists and addresses to write to for a QSL. The current issue has a 60-page *Listen to the World* section which includes *WRTH* tests with portable short-wave receivers and accessories, an article on Tropical Bands reception and several others of interest to the DXer.

The *WRTH* is distributed in the UK by Argus Books, 14 St James Road, Watford, Herts and can be ordered through bookshops. The 1981 edition costs £9.50, which sounds a lot but it could be a very acceptable birthday present for a radio enthusiast.

Broadcasts Heard

A Hitachi TRK 5330E radio cassette with telescopic antenna is in use at Inverness by **William Don Clyde** who pulled in the Voice of Nigeria on 15·120MHz in the 19m band at 2134, Cuba on 7·135MHz in the 41m band at 2234 and Radio Japan on 11·796MHz at 2200. **Trevor Corns** (Sheffield) using his FRG-7700, KXZ a.t.u. and short inverted "L" antenna also picked up R. Japan on this frequency. At this time of day you will get a better signal if you tune to the Radio Japan relay in Portugal which is on 15·305MHz in the 19m band from 2200 to 2230.

David Lyndon Evans of Neath notes that the transmissions direct from Japan to Europe are on the air at breakfast time. He had a good signal on 21·610MHz in the 13m band at 0800 using his Grundig Ocean Boy with telescopic antenna. David also picked up WWV on 15MHz at 0030 which brought him a QSL card and a folder giving the history of the station.

The Austrian Schulungssender has been heard with music and Morse training on 6·221MHz until close-down at 1430 by reader **Bernt Erfjord** who lives in Kvinesdal in Norway. The receiver in use is an FRG-7. Bernt mentions Radio Nacional de Paraguay which can be heard most evenings on 11·914MHz in the 25m band at 2230. He has picked up La Voz de Nicaragua on 5·950MHz (49m) in the morning and the Voice of Hope in Lebanon on 6·215MHz with country and western music, religious programming and classical music (quite a mixture). This station, which is actually on board ship somewhere in the

Lebanon Israel area, can easily be confused with Radio Andorra on 6·220MHz.

Another report from a distant reader is from **Keith Dwyer** of Pietermaritzburg RSA who writes: "I have decided to write in and tell you about DXing in my area." The receiver is a Concerto valved radio with a 30 metre-long wire, and his catches include Austria on 17·773MHz (16m) with close-down at 1900, FEBA in Seychelles with a good signal on 11·860MHz (25m) at 1800 and the Voice of Greece in the 13m band at 1845.

Radio New Zealand is coming in well these mornings, reports **George E. Lee** of Ossett who heard it on 11·945MHz (25m) at 0830 with some interference from Bucharest. The receiver is an HRO with 10 metre-long wire. **Roy Patrick** reports hearing Radio Pakistan at 1100 on a new channel of 21·785MHz (13m) with slow-speed news in English. They can also be found on 17·665MHz (16m) at the same period.

Radio New York World-Wide

"Can you tell me if RNYWW is still on the air?" asks reader **B.E. Poole** who lives in Newton Abbot. This station signed off for the last time several years ago but its successor, which is WYFR, can be picked up easily in the 25m, 19m and 16m bands during the evening. A programme schedule is available from Family Stations Inc, 290 Hegenberger Road, Oakland, California 94621, USA. The transmitters are located at Okeechobee in Florida.

VHF Bands

by Ron Ham BRS15744

Reports to: Ron Ham BRS15744
Faraday, Greyfriars, Storrington,
Sussex RH20 4HE.

There is little doubt that the aurora borealis and the extensive h.f. blackout in mid-April were caused by the intensive activity (seen by Cmdr Hatfield) which took place within a large group of sunspots, proving once more that, where the sun is concerned, anything can happen at any time.

Solar

Both **Cmdr Henry Hatfield,** Sevenoaks, and I recorded individual bursts of solar radio noise at 136 and 143MHz respectively, Fig. 1, on March 21–25 and 27 and April 3 and 10, and noise storm conditions on March 19, 20, 24 and 25 and April 12–15, 17 and 19. On several occasions Henry's second radio telescope, working at 198MHz, showed interesting comparisons of the differing solar output at the two radio frequencies. Among the more spectacular bursts were two lasting 3 minutes on March 21, an 8-minute series of strong bursts on the 23rd and one lasting 4·5 minutes at 1258 on April 3. Henry traced much of this late March activity to a pair of active sunspot groups which he saw with his spectrohelioscope on the 20th.

One of the bursts which occurred on April 8 and lasted for 6 minutes was more intense at 136 than 198MHz, but a short-lived burst just before the main peak was much stronger at 198MHz. Later, at 1325, Henry saw a large eruptive prominence on the east limb of the sun which he estimated was some 70 000 miles high and covered 5 angstroms of the spectrum. Although there was little radio noise on the 9th, he counted five sunspot groups containing about 35 sunspots and surrounded by some 32 angry looking filaments. A series of bursts at midday on the 10th again drew Henry's attention to the sun and he saw three active flares near the east limb, so we were not surprised when more radio noise came from the sun

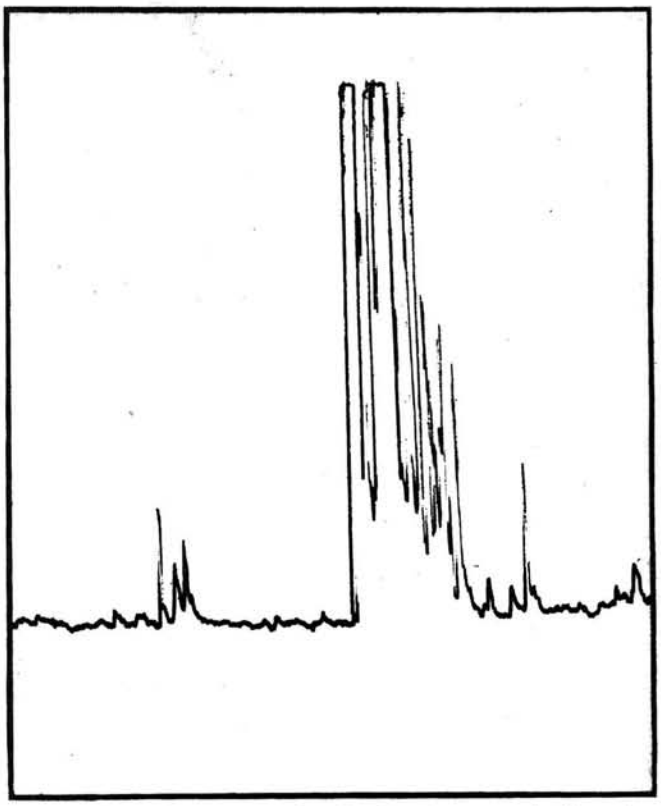


Fig. 1: One of a series of solar bursts recorded by the author on March 25 at 143MHz

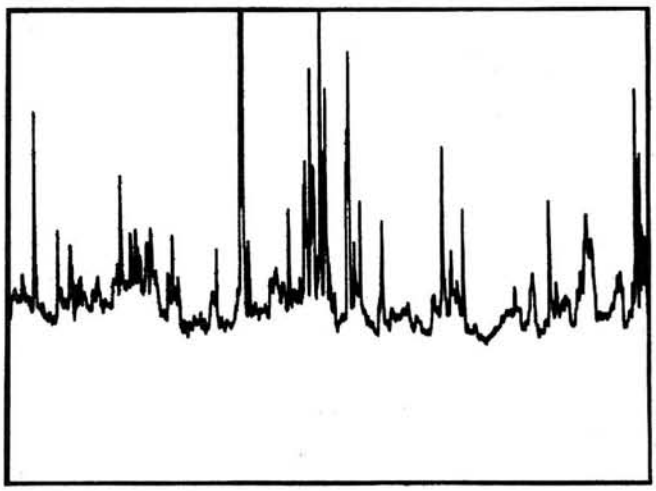


Fig. 2: Part of the noise storm recorded by the author as the sun was leaving the antenna beam on April 15

during the afternoon of the 12th, developed into a noise storm on the 13th and was further recorded on the 14th and 15th, Fig. 2.

At 1440 on the 12th, Henry saw the remains of two flares in the active area which he observed on the 9th and at 1550, although there were no visible flares, the area looked very angry and there is little doubt that this was the region responsible for the radio noise. Although the sun was emitting bursts at 136MHz during the afternoon of the 12th there was a gradual increase in the noise level at 198MHz. In Bristol, **Ted Waring,** who projects the sun's image through his telescope, counted 33 sunspots on March 20, 28 on the 26th, 37 on April 1, 63 on the 11th and 56 on the 14th.

The 10m Band

The 10m band was to say the least fascinating between March 17 and April 19, and during this period I frequently

heard signals from stations in JA, VE, VK, W and ZL. Around 0900 on March 17 I heard ZL2BFU, at 58, call CQ Europe and then work G4AET in Worthing, Sussex, to give the G4 his first ZL contact on 10m. At 0900 on the 19th, signals from VK5PX and ZL2AZU were thumping in as were the JAs around 0915 on the 22nd and 24th. At 0911 on the 27th there was a strong echo on a DL's signal, while he was in QSO with a VK4, and at 0843 on April 1 the band was relatively quiet, which was not surprising in view of the prevailing solar activity.

Although there was some DX about, such as a few VKs and a strong local QSO I heard between two VEs, the band was generally unsettled from April 1 to 15 and at times it was almost totally closed especially from the 12th to 14th. Although the band was dead on the 13th, **Ron Munn** G2ALO, Storrington, Sussex, using a Drake Twin Set and a TH3 antenna on a 12 metre-tall tower, heard a lone VK6, about 54, and although 15m was dead and full of noise, Ron heard a weak and watery signal from VP5TC. For the past 18 months Ron has had a daily sked on 20m at 0730 with ZL3MF, always 59 both ways, but on this morning the ZL was weak and echoing.

"The band has been almost silent for the past couple of days," wrote Ted Waring on April 14 "I hope it's the sunspot group that is the cause and not something wrong with my receiver". How true this is Ted, it's hard to believe that such an active band can suddenly become so dead and you are not the first to think of a receiver fault. **Pete Brownlow** G4ESC, operating G3WMU/P at The Chalk Pits Museum, Amberley, Sussex, for most of the day on April 12 had to use 20m because 10m was so dead. Like many of us, Ted Waring keeps an ear on the International Beacon Project stations, and between March 17 and April 14 he heard signals from the beacons in Bahrain A9XC on 19 days, Bermuda VP9BA and Cyprus 5B4CY on 16 days, Canada VE2TEN and Germany DL0IGI on 5 days, Mauritius 3B8MS on 11 days, South Africa ZS6DN on 16 days, but like me, he heard no beacon signals on the 12th or 13th. Despite the poor conditions I received 529 signals from the New Zealand beacon ZL2MHF 28·230MHz, at 0905 on April 3, 0807 on the 4th, 0845 on the 5th, 1300 on the 8th, 0806 on the 11th and 0930 on the 18th. As with Ted, the most consistent beacon signals I heard were A9XC and DL0IGI.

While **Steve Bowler** RS46105, Wakefield, has been trying various antennas for his Trio R-1000 and notching up some DX with a half-wave dipole on 10m, **Harold Brodribb,** St Leonards-on-Sea, Sussex, has kept an ear on the m.u.f. and tells me that between March 19 and 30 it hovered around 37MHz. At 0940 on April 3 he heard a very strong JA8 calling CQ. During the period Harold logged amateur signals from Canada, Russia and the USA and harmonics around the 10m band from lower frequency broadcast stations such as Alma Ata on 29·800MHz.

Aurora

In view of the intense solar activity I was not surprised to hear that **George Grzebieniak** RS41733, London, heard auroral signals from a GI, four GMs and an SM on 2m between 0100 and 0300 on April 13 and that **Alan Baker** G4GNX, Newhaven, Sussex, worked two GMs on c.w., two on s.s.b. and a GI on s.s.b. between 0200 and 0330.

From Spark to Space

Gerry Brownlow G3WMU has built and installed a 9 metre-tall tilt-over mast near the radio building at The Chalk Pits Museum for use by his amateur station, G3WMU/P, at weekends and as GB2CPM on special days. On Sunday April 12, Gerry and his son Pete fitted an HF-5, 80–10m vertical antenna to the mast. They soon had their FT-101E on the air, and during the day worked s.s.b. stations in DL, I, LA, OK, OZ, SM and YU on 20m. One of the museum's visitors who watched while Pete was operating, was 85-year-old **Edward Emlyn Davies** from Farnham, Surrey, a veteran wireless operator from the 1914–18 war and aptly nicknamed "double dot" (EE). Before the war, Edward was a GPO telegraphist and his knowledge of Morse code enabled him to join the Royal Signals and to work as a "wireless spy" at Armentieres, and for a time at GHQ Intelligence.

While he listened to the s.s.b. signals coming from the FT-101E and looked at Gerry's new antenna, he told us about the time he was fired at while up a tree installing one end of a long wire antenna and how, under battle conditions, he took down an SOS message warning of a big German attack. Several museum visitors were fascinated to see a Sinclair 1 inch TV receiver on the table next to the FT-101E. Although it is normally used to check for TVI, on this occasion, at 1300 it was carrying the pictures of the historic launch of the American space shuttle, *Columbia*. On Easter Sunday, Richard Brownlow G4LCV operated the museum station and showed visitors how to use a Morse key and during the day had c.w. contacts with stations in F, I, OK, OZ, SP and WA3 on the h.f. bands.

The 6m Band

At 1240 on March 26, **Barry Ainsworth** G4GPW heard activity on the 6m band, and during the following hour heard 579 signals from the South African beacon ZS6PW, 599 from the beacon ZS1STB and 599 from ZS6LN who was operating in beacon mode. Barry called ZS6LN for a cross-band QSO, and although Barry was running 400 watts to a 3-element beam on 10m he was only getting a report of 55 in South Africa, yet the ZS signal on 6m was 59+ with Barry in Lancing, Sussex. The opening must have continued through the afternoon because at 1800 Barry heard the beacon mode of ZS6EE at 599. "A very good opening," said Barry, who explained that most ZS stations run their 6m transmitters with an automatic keyer in beacon mode. Between 1316 and 1400 on March 20, **Hugh Cocks** in East Sussex heard a ZS station on 6m in cross-band QSO with a G4 on 10m.

RTTY

RTTY enthusiast **Phil Hodson** G8RBY, Melton Mowbray, has installed two 16-element Tonna antennas and as he says "With a transmit gain of about 16dB, and 400 watts p.e.p. up the spout I think I should be heard OK."

A good example of the interest one can get by "listening" to teleprinter signals came at 0840 on March 22 when I checked 14·090MHz and in 27 minutes logged 11 stations in 6 countries: DJ, HB9, I, IT, OZ and SM. During the period of March 17 to April 19, I logged a total of 85 stations and added a further 12 countries to the March 22 score: EA, F, HA, K, LA, LX, OE, OH, OK, UK, VK and YU. I received good, two-way copy from QSOs between EA and SM at 1914 on March 21, EA and I at 1734 on the 22nd, two Italian stations at 0826 on April 3 and 0820 on the 4th, DF and OE at 1235 on the 7th, OH and VK at 0805 on the 8th, I and W at 0800 on the 15th, and EA and I at 1341 on the 16th. Most of the other signals were CQ calls or else I received only one side of the QSO. During the Easter weekend, several members from various Sussex radio clubs tested the RTTY gear which they had installed ready for the IARU conference and worked stations in HK2 and LU3.

Tropospheric

The atmospheric pressure gradually rose from 29·9in (1012mb) at midday on April 1 to 30·3in (1026mb) at midnight on the 4th, and then slowly fell during the 5th and 6th. As expected, a mild tropospheric opening took place and around midnight on the 2nd I heard GW mobiles working through the Bristol Channel repeater GB3BC R6. By 0905 on the 3rd I was hearing signals from the Sutton Coldfield beacon GB3SUT on 70cm with only a dipole antenna. At 1305, **Lawrence Hatfield** G8VJC worked GW4JKD/M via the Derby repeater, GB3HH R4, from his home in Kent and at 0800 and 1700 on the 4th I heard strong signals through GB3BC and the repeaters in Birmingham GB3BM R5 and Kent GB3KR R4. During the evenings of the 4th and another short-lived opening on the 15th, **Ken Smith** BRS20001, Horsham, heard several strong French broadcast stations in Band II.

Simon Hamer, Presteigne, using a Grundig Satellit 1400 receiver, is a very keen Band II listener, and spread through the evenings of March 18, 26, 28 and 30 he frequently heard BBC radios London and Solent, ILR Capital, LBC and Medway, a Belgian and a couple of French stations. In addition to his usual UK DX, Simon heard signals from Belgium and France during the evenings of April 1, 3, 7, 10 and Belgium, France, Holland

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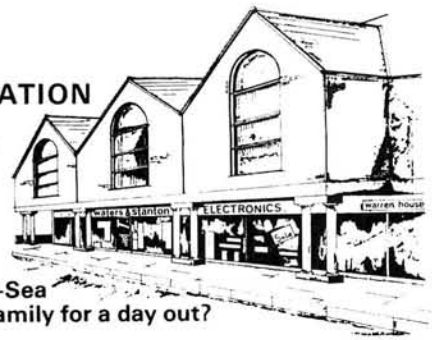

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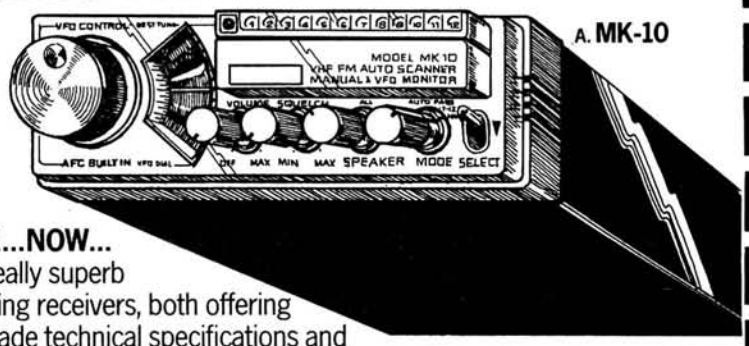

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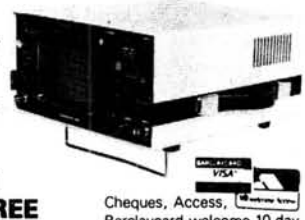

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73's from Bob, Ian and Paul.

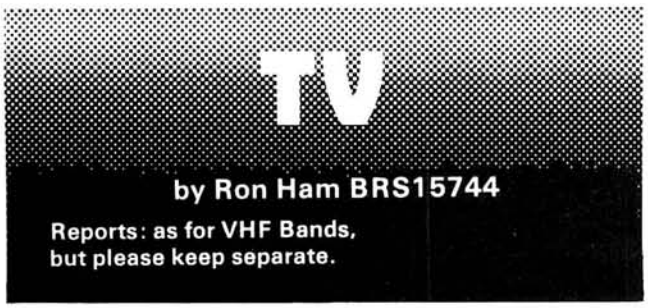
and Germany on the 15th. Among the many interesting programmes he heard on the 15th was at 2330 from the British Forces Broadcasting Service (Langenberg) called *The Night Show* with phone-in questions about BFBS-TV. One caller asked who supplied the beer to the "Rovers Return". This was followed by Manfred Mann's "Pretty Flamingo" and the news carried from our BBC Radio 2.

Matthew Phillips, Halstead, Essex, using a music centre and a loft dipole, heard three French broadcast stations between 88 and 95MHz on April 12, and hopes to install a larger Band II antenna outside. I again received mobile signals through GB3BC and GB3BM at 1951 on the 14th, and at 0747 on the 16th I received strong signals from G4IHF/P out walking his dog on Rochdale golf course in QSO with F1GAL/P in Normandy via the Derby repeater. Soon afterwards the French station worked G8YYB in London.

News Items

During Easter week many Sussex radio club members were busy installing two 3-element Tribanders for 20, 15 and 10m, dipoles for 160, 80 and 40m, a 4-element beam for 4m and a crossed-8 for 2m, all some 60 metres a.g.l. at the Hotel Metropole in Brighton, ready for the IARU conference.

It was with deep regret that I learned of the deaths of Eric Arnold G4JDJ, one of the Brighton Club's blind members, and Vic Hartopp G8COB, known to many of us for his work with J-Beams on v.h.f. aerials. Both of these men will be missed in the world of radio and we extend our deepest sympathy to their relatives and many friends.



With the summer months ahead, now is the time to check your antennas for winter damage and carry out repairs or be forced, as I was by a storm, into replacing the system. Be warned, don't leave it, because there is plenty of DX to come by all types of propagation, and nothing is more frustrating than being told about a big opening and seeing the main station antennas lying in the garden.

New Sets

I have recently purchased a JVC CX-610GB receiver, and although this 6in colour TV monitor has its own rod antenna, I am feeding it with an Antiference MH311 beam, for Bands I and III, and they both perform very well. The receiver is tunable through the v.h.f. Channels 2–4 and 5–12 and u.h.f. Channels 21–69, and can automatically switch between PAL-B, G or I and SECAM-B, G, D, K or K1 systems (CCIR continental and OIRT standards). Another advantage for the TVDXer is the 3-position sound switch for CCIR countries 5·5MHz, UK 6MHz and OIRT countries 6·5MHz. The set can be powered from a selection of voltages between 110 and 240V a.c., 12V d.c. for cars and boats, and a dry battery pack. A comprehensive leaflet on this set is available from JVC in London or their dealers.

Andrew Wright A44211, Leeds, has purchased a Tandberg CTV and asks about the frequency range of Channels 2–11 v.h.f. and 21–68 u.h.f. Briefly, Andrew, this is 48 to 68MHz for the European Channels 2–4, 175–230MHz for Channels E5–12 and 470–850MHz for the u.h.f. Channels 21–68. DX in the v.h.f. range 48–68MHz is caused by sporadic-E disturbances during the summer months of May to August, and "F2" openings during the mid-winter period, whereas DX on the other ranges is mainly due to tropospheric openings which are associated with fine weather and high atmospheric pressure.

Band I

On most days between March 17 and April 19 there were frequent short bursts of signals on Channel R1 49·75MHz. Although this was typical of the pre-sporadic-E season, I found the band generally quiet, as did **Sam Faulkner.** Despite the short bursts I did manage to identify the test card from Poland on several occasions and CST Czechoslovakia at 1240 on April 2. Now I have a mystery, at 0835 on April 3 I saw a caption on Channel E3 55·25MHz, which had an analogue clock showing 1035 (2 hours ahead of GMT) in the top left corner and the word PAUZE in the top right and the large letters TV in the bottom right. Any ideas?

Tropospheric

The moving high atmospheric pressure systems during the first half of April caused a few relatively short tropospheric disturbances, during which I often received pictures from the IBA transmitter at Lichfield with only a dipole feeding my receiver. During the early mornings of April 3 and 4, I saw ATV's "Good Morning" caption and some of the programme *Hawaii 50* at 1950 on the 14th. The opening during the evening of the 15th affected frequencies between about 60 and 250MHz, because at 2100 I received pictures from Holland on Channel E4 62·25MHz (unusually low for tropo), and Belgium, which is normal, on Channel E10 210·25MHz. One of the pictures from Belgium was labelled "Antwerpen", another "Brugge", and the name "Roger Raveel" accompanied an announcer on what looked like an arts programme.

The first programme I saw on E4 was *Panoramiek* in colour, which I think was part of NOS-Nederland 1; this was followed by *Studio Sport* with football, ice-hockey and some form of lottery called *Lotto X Toto*. At 2239 there were adverts for soft drinks and cigarettes and at 2255BST the Dutch station showed a clock, 2355, and closed down. On Channel E11 there was table tennis, and one caption I saw was "SPENS '81" while at 2328 another caption "ARD Sports Extra" was seen behind an announcer. At 2330 a clock appeared showing 0030 and before they closed down there was a 5-minute news bulletin followed by a future programme list. During the evening, **Simon Hamer,** realising from his Band II listening that conditions were good, connected his Teleng up-converter between his Band II antenna and his Bush TV and received a test card from Belgium RTBT-1, with "WAVRE Canal 8–10" written on it. Just to prove that viewers in other countries suffer from propagation interference, **Reg Moores** gave me a photograph, Fig. 1, of a caption to this effect, along with a French test card, Fig. 2, which he received at his home in Brighton during one of the events last year.

Antennas

Like **Phil Hodson** (VHF Bands), Sam Faulkner has changed his antenna system and now has a 4-element beam for Band I, an 11-element for Band III, a 91-element for u.h.f. and a Hy-Gain 3-element for SSTV on 10m. I bet they look good Sam, all horizontally polarised on your 18 metre-tall telescopic mast. Your Band III seems to be working well with your consistent signal (although weak) from Radio Telefis Eireann (RTE) on Channel H.

I also made an antenna change, because during a gale on March 24 the 50mm steel mast carrying my dipoles on the chimney wilted over like a dead daffodil, fortunately with no damage to the roof tiles. An examination showed that the mast had rusted through at a "water trap" by a fixing bracket. Furthermore, because during its 8-year life the antennas had been subjected to much rain, gales at times reaching 50 knots, smoke from the chimney and temperatures ranging from 20 to 90°F, I was not surprised to find that cracked insulator blocks had let in water and caused corrosion where the copper braid of the coaxial cable touched the alloy of the antenna connection.

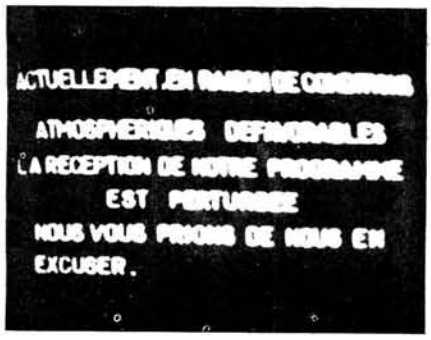


Fig. 1: An interference apology caption received from France by Reg Moores in Brighton

Fig. 2: A French test card received by Reg Moores in Brighton during 1980

Fig. 3: A SSTV picture of Saturn taped by Sam Faulkner during December 1980

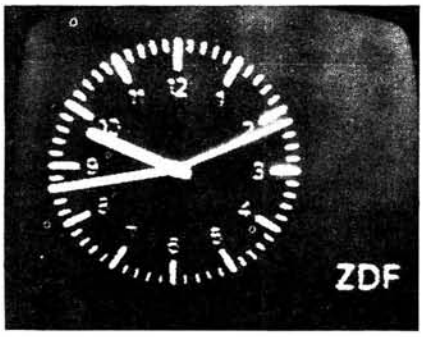


Fig. 4: TV captions from Germany and Italy, supplied by Keith Hamer and Garry Smith

My new installation consists of vertically polarised dipoles for 1·5m, 2m and 70cm on the chimney, and a rotatable Antiference MH311 for Bands I and III on my 9 metre-tall tower.

SSTV

"I have been enjoying the excellent conditions on 10m during the latter half of March and early April", writes Sam Faulkner, who received slow-scan television pictures from stations in EA, VE and Ws 1 to 0. Sam noted an improvement in band conditions around March 22 when he recorded good video from KP4YD, followed by VE3EGO at 1745 on the 24th and WD9IPX and WA0PFP at 1800 on the 25th. He saw the graphics from LU4DDR and LU4EGO at 1800 on the 28th, and W6WI around 1745 on the 30th.

The European SSTV contest took place on April 4 and 5 and added considerably to the usual weekend activity on the calling channel, 28·680MHz. "As many stations from around the world were using keyboard and camera there was much compulsive viewing during the period," said Sam, who at 1130 on April 4 recorded keyboard video from VK3BVH calling another VK3, and at 1330 he copied superb pictures of KP4YD and his family. Later he received pictures from HK3DBQ, LU4DDR and LU5AN.

Sam's most interesting logging by far was ZL2AAV, 914m a.s.l. in Waieuru, working ON and JA around 0755 on April 5. The CQ card from the ZL was a Kiwi with operator's name and callsign followed by pictures of himself in the shack operating his equipment and a photographic view from his shack window of an erupting volcano.

At 0930 Sam had excellent copy from JA3CF who used the outline of a gramophone for his CQ card, and during the afternoon he received pictures from CX2GB, LU4DDR, VE6AYE, ZS6BFU and ZS6BQT. "Throughout the weekend stateside stations were booming signals, and all prefixes except W7 were seen on the 5th," writes Sam, who made up for that on the 6th when he logged W7KPW and VE2KQ. All the time Sam is viewing SSTV his audio tape recorder is set on RECORD, with the pause button down, so when a signal appears that he wants to keep he releases the button and the picture pulses are stored on a good quality tape. Sam normally uses TDK tape because he is satisfied with both its electrical and mechanical performance. Recording has many advantages such as easy storage of signals, QSLing and demonstrating equipment and if, as per Fig. 3, Sam wants to photograph a shot of particular interest then all he has to do is play the audio tape back through his Robot SSTV converter.

Amateur TV

Barry Ainsworth G4GPW is now equipped to receive amateur television signals on 70cm and has been receiving pictures from his fellow Worthing Radio Club members **Robin Stevens** G8XEU and **Martin Newell** G8KOE.

Philip Sado, London, has a Trio R-1000 for the h.f. bands, a Sony receiver with multi-line capability, including 819-line, for DXTV and hopes to be operational with SSTV in due course. During the 1980 sporadic-E season Philip received pictures from Iceland and Spain, and French u.h.f. TV during tropospheric openings.

Keith Hamer and Garry Smith, authors of *Guide To World-Wide Television Test Cards,* sent photographs of two TV captions. Germany and Italy, for us to look for during future events.

kindly note!

Boat Engine Hours Counter April 1981

We have been advised of an alternative 7-digit counter suitable for this project which may be obtained from K.R. Whiston Ltd., New Mills, Stockport SK12 4PT, at the very reasonable price of £2.58 inclusive of p.&p. and VAT. Specify catalogue 98 item No. 3012 Electric counter 48V a.c.

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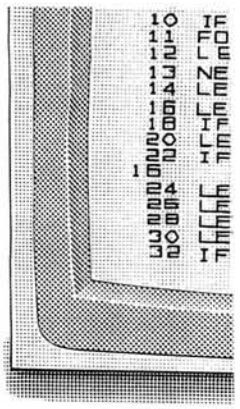

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Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

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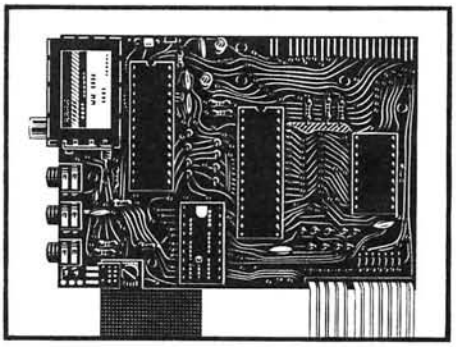

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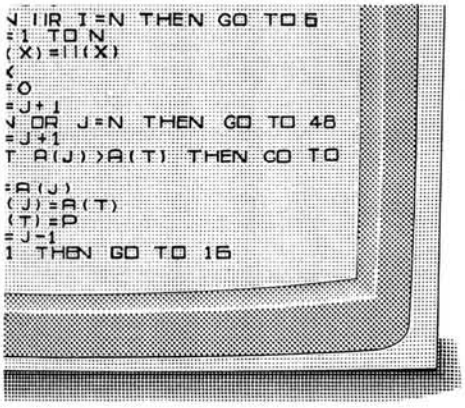
New Sinclair teach-yourself BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs. You need no prior knowledge – children from 12 upwards soon become familiar with computer operation.



If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon- the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics across 32 columns, *and* highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!

16K-BYTE RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

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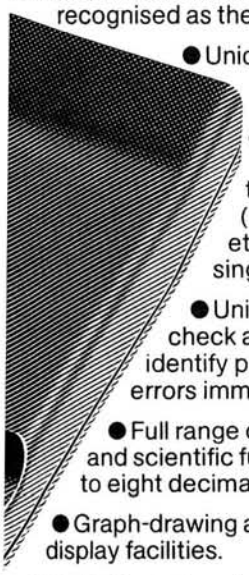
● Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.



● Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.

● Unique syntax-check and report codes identify programming errors immediately.

● Full range of mathematical and scientific functions accurate to eight decimal places.

● Graph-drawing and animated-display facilities.

● Multi-dimensional string and numerical arrays.

● Up to 26 FOR/NEXT loops.

● Randomise function – useful for games as well as serious applications.

● Cassette LOAD and SAVE with named programs.

● 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.

● Able to drive the new Sinclair printer (not available yet – but coming soon!)

● Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

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	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

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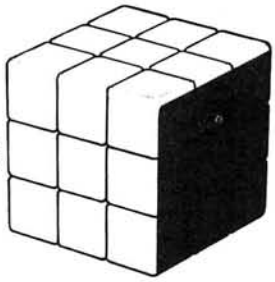

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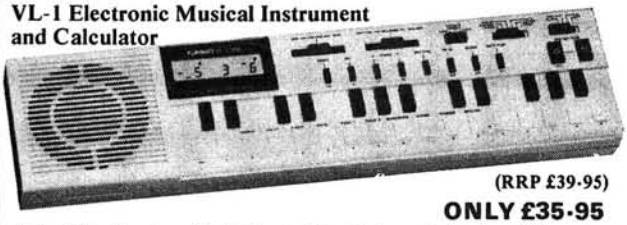

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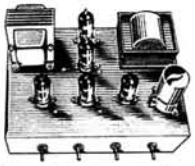

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	1X012	12+12	1.25	
	1X013	15+15	1.00	
	1X014	18+18	0.83	
	1X015	22+22	0.68	
	1X016	25+25	0.60	
	1X017	30+30	0.50	
50VA 80x35mm 0.9 Kg	2X010	6+6	4.16	**£4.93** +£1.10 P/P +0.90p VAT
	2X011	9+9	2.77	
	2X012	12+12	2.08	
	2X013	15+15	1.66	
	2X014	18+18	1.38	
	2X015	22+22	1.13	
	2X016	25+25	1.00	
	2X017	30+30	0.83	
	2X028	110	0.45	
	2X029	220	0.22	
	2X030	240	0.20	
80VA 90x30mm 1 Kg	3X010	6+6	6.64	**£5.47** +£1.43 P/P +£1.04 VAT
	3X011	9+9	4.44	
	3X012	12+12	3.33	
	3X013	15+15	2.66	
	3X014	18+18	2.22	
	3X015	22+22	1.81	
	3X016	25+25	1.60	
	3X017	30+30	1.33	
	3X028	110	0.72	
	3X029	220	0.36	
	3X030	240	0.33	
120VA 90x40mm 1.2 Kg	4X010	6+6	10.00	**£6.38** +£1.43 P/P +£1.17 VAT
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	4X012	12+12	5.00	
	4X013	15+15	4.00	
	4X014	18+18	3.33	
	4X015	22+22	2.72	
	4X016	25+25	2.40	
	4X017	30+30	2.00	
	4X028	110	1.09	
	4X029	220	0.54	
	4X030	240	0.50	

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	5X014	18+18	4.44	
	5X015	22+22	3.63	
	5X016	25+25	3.20	
	5X017	30+30	2.66	
	5X018	35+35	2.28	
	5X028	110	1.45	
	5X029	220	0.72	
	5X030	240	0.66	
225VA 110x45mm 2.2 Kg	6X014	18+18	6.25	**£10.06** +£1.73 P/P +£1.77 VAT
	6X015	22+22	5.11	
	6X016	25+25	4.50	
	6X017	30+30	3.75	
	6X018	35+35	3.21	
	6X026	40+40	2.81	
	6X028	110	2.04	
	6X029	220	1.02	
	6X030	240	0.93	
300VA 110x50mm 2.6 Kg	7X016	25+25	6.00	**£11.66** +£1.73 P/P +£2.01 VAT
	7X017	30+30	5.00	
	7X018	35+35	4.28	
	7X026	40+40	3.75	
	7X025	45+45	3.33	
	7X028	110	2.72	
	7X029	220	1.36	
	7X030	240	1.25	
500VA 140x60mm 4 Kg	8X017	30+30	8.33	**£15.53** +£2.05 P/P +£2.64
	8X018	35+35	7.14	
	8X026	40+40	6.25	
	8X025	45+45	5.55	
	8X033	50+50	5.00	
	8X028	110	4.54	
	8X029	220	2.27	
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	P2403	6+6	0.25	
	P2404	7.5+7.5	0.20	
	P2405	9+9	0.17	
	P2406	12+12	0.12	
	P2407	15+15	0.10	
	P2409	20+20	0.07	
6VA	P3401	3+3	1.00	**£1.91** +£30p P/P +33p VAT
	P3402	4.5+4.5	0.67	
	P3403	6+6	0.50	
	P3404	7.5+7.5	0.40	
	P3405	9+9	0.33	
	P3406	12+12	0.25	
	P3407	15+15	0.20	
	P3408	17.5+17.5	0.17	
	P3409	20+20	0.15	
	P3410	25+25	0.12	
12VA	P4401	3+3	2.00	**£2.09** +58p P/P +40p VAT
	P4402	4.5+4.5	1.33	
	P4403	6+6	1.00	
	P4404	7.5+7.5	0.80	
	P4405	9+9	0.66	
	P4406	12+12	0.50	
	P4407	15+15	0.40	
	P4408	17.5+17.5	0.34	
	P4409	20+20	0.30	
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7402	14p	74104	65p	74259	250p	74LS195	140p	74C161	155p	AY1-1313	668p			MC3360	120p
7403	14p	74105	65p	74265	90p	74LS196	120p	74C162	155p	AY1-5050	212p			MK50398	750p
7404	14p	74107	34p	74278	290p	74LS221	100p	74C163	155p	AY5-1224A	225p			NE531	100p
7405	18p	74109	55p	74279	140p	74LS240	175p	74C164	120p	AY5-1315	600p			NE543K	225p
7406	32p	74110	55p	74283	190p	74LS241	175p	74C173	120p	AY5-1317	750p			NE555	25p
7407	32p	74111	70p	74284	400p	74LS242	175p	74C174	160p	AY5-1320	320p			NE556	70p
7408	19p	74116	200p	74285	400p	74LS243	175p	74C175	210p	CA5019	80p			NE561B	425p
7409	19p	74118	130p	74290	150p	74LS244	195p	74C192	150p	CA3046	70p			NE562B	425p
7410	15p	74119	210p	74293	150p	74LS245	260p	74C193	150p	CA3048	225p			NE565	130p
7411	24p	74120	110p	74294	200p	74LS251	200p	74C194	220p	CA3080E	72p			NE566	155p
7412	20p	74121	28p	74298	200p	74LS257	120p	74C195	110p	CA3089E	225p			NE567	175p
7413	30p	74122	48p	74365	150p	74LS259	175p	74C221	175p	CA3090AQ	375p			RC4151	400p
7414	60p	74123	48p	74366	150p	74LS298	240p	**4000 SERIES**		CA3130E	100p			SP8515	750p
7416	27p	74125	55p	74367	150p	74LS373	200p	4000	15p	CA3140E	70p			TBA641B11	
7417	27p	74126	60p	74368	150p	74LS374	195p	4001	25p	CA3160E	75p				225p
7420	17p	74128	75p	74390	200p	81LS95	140p	4002	20p	FX209	750p			TBA800	90p
7421	40p	74132	75p	74393	200p	81LS96	140p	4006	95p	ICL7106	925p			TBA810	100p
7422	22p	74136	90p	74490	225p	81LS97	140p	4007	25p	ICL8038	340p			TBA820	90p
7423	34p	74141	70p	**74 LS SERIES**		81LS98	140p	4008	80p	LM301A	36p			TCA940	175p
7425	30p	74142	200p	74LS00	14p	8T28	230p	4009	40p	LM311	190p			TDA4500	260p
7426	40p	74145	90p	74LS02	18p	9301	160p	4010	50p	LM318	200p			TDA1004	328p
7427	34p	74147	190p	74LS04	14p	9302	175p	4011	25p	LM324	70p			TDA1008	300p
7428	36p	74148	150p	74LS08	22p	9308	316p	4012	18p	LM339	90p			TDA1022	600p
7430	17p	74150	100p	74LS10	20p	9310	275p	4013	50p	LM348	95p			XR2206	400p
7432	30p	74151A	70p	74LS13	38p	9311	275p	4014	84p	LM377	175p			XR2207	400p
7433	40p	74153	70p	74LS14	78p	9312	160p	4015	84p	LM380	75p			XR2216	675p
7437	35p	74154	100p	74LS20	22p	9314	165p	4016	45p	LM381AN	150p			XR-L240	400p
7438	35p	74155	90p	74LS22	28p	9316	225p	4017	80p	LM389N	140p			ZN414	90p
7440	17p	74156	90p	74LS27	38p	9322	150p	4018	89p	LM709	36p			ZN424E	135p
7441	70p	74157	70p	74LS30	22p	9368	200p	4019	45p	LM710	50p			ZN425E	400p
7442A	60p	74159	190p	74LS47	90p	9370	200p	4020	100p	LM733	100p			ZN1034E	200p
7443	112p	74160	100p	74LS55	30p	9374	200p	4021	110p	LM741	28p			95H90	800p
7444	112p	74161	100p	74LS73	50p	9601	100p	4022	100p	LM747	70p				
7445	100p	74162	100p	74LS74	40p	9602	228p	4023	22p	LM748	35p				
7446A	93p	74163	100p	74LS75	50p	**INTERFACE I.C.s**		4024	50p	LM3900	70p				
7447A	70p	74164	100p	74LS83	110p	MC1488	100p	4025	20p	LM3911	130p				
7448	80p	74165	130p	74LS85	100p	MC1489	100p	4026	130p	LM4136	120p				
7450	17p	74166	100p	74LS86	40p	75107	160p	4027	50p	MC1310P	150p				
7451	17p	74167	200p	74LS90	60p	75182	230p	4028	84p	MC1458	48p				
7453	17p	74170	240p	74LS93	60p	75450	120p	4029	100p	MC1495	400p				
7454	17p	74172	720p	74LS107	45p	75451/2	72p	4030	55p						
7460	17p	74173	120p	74LS112	100p	75491/2	96p	4031	200p	**VOLTAGE REGULATORS**					
7470	36p	74174	93p	74LS123	75p	**C-MOS I.C.s**		4033	180p	**Fixed Plastic TO-220**					
7472	30p	74175	85p	74LS132	900p	74C00	25p	4034	200p	1A +ve			1A −ve		
7473	34p	74176	90p	74LS133	60p	74C02	25p	4035	110p	5V 780b	60p		5V 7905	70p	
7474	30p	74177	90p	74LS138	60p	74C04	27p	4040	100p	12V 7812	60p		12V 7912	70p	
7475	30p	74178	160p	74LS139	60p	74C08	27p	4041	80p	15V 7815	60p		15V 7915	90p	
7476	35p	74180	90p	74LS151	100p	74C10	27p	4042	80p	18V 7818	90p		18V 7918	90p	
7480	50p	74181	200p	74LS153	60p	74C14	90p	4043	90p	24V 7824	90p		24V 7924	90p	
7481	100p	74182	90p	74LS157	60p	74C20	27p	4044	90p	**100mA TO-92**			**100mA TO-92**		
7482	84p	74184A	150p	74LS158	120p	74C30	27p	4046	110p	5V 78L05	35p		5V 79L05	80p	
7483A	90p	74185	150p	74LS160	100p	74C32	36p	4047	100p	12V 78L12	35p		12V 79L12	80p	
7484	100p	74186	500p	74LS161	100p	74C42	110p	4048	55p	15V 78L15	35p		15V 79L15	80p	
7485	110p	74190	100p	74LS162	140p	74C48	250p	4049	40p						
7486	34p	74191	100p	74LS163	100p	74C73	75p	4050	49p	**OTHER REGULATORS**					
7489	175p	84192	100p	74LS164	120p	74C74	70p	4051	80p	LM309K	135p		TBA625B	120p	
7490A	30p	74193	100p	74LS165	80p	74C85	200p	4052	80p	LM317T	200p		TL430	65p	
7491	36p	74194	100p	74LS173	110p	74C86	65p	4053	80p	LM323K	625p		78HO5KC	675p	
7492A	48p	74195	95p	74LS174	110p	74C90	95p	4055	125p	LM723	37p		78MGT2C	140p	
7493A	36p	74196	95p	74LS175	110p	74C95	130p	4056	135p						
7494	36p	74197	80p	74LS181	320p	74C107	125p	4059	600p	**OPTO-ELECTRONICS**					
7495A	78p	74198	150p	74LS190	100p	74C150	250p	4060	115p	2N5777	45p	ORP12	90p	ORP61	90p
7496	65p	74199	150p	74LS191	100p	74C151	280p	4063	120p	OCP71	130p	ORP60	90p	TIL78	70p
								4066	55p						

TRANSISTORS

AC127/8	20p	BFY51/2	22p			TIP41C	78p	2N3866	90p	**DIODES**	
AD149	70p	BFY56	33p			TIP42A	70p	2N3903/4	18p	BY127	12p
AD161/2	45p	BFY90	90p			TIP42C	82p	2N3905/6	20p	OA47	9p
BC107/8	11p	BRY39	45p			TIP2955	78p	2N4036	65p	OA81	15p
BC109	11p	BSX19/20	20p			TIP3055	70p	2N4058/9	12p	OA85	15p
BC147/8	9p	BU105	190p			TIS43	34p	2N4060	12p	OA90	9p
BC149	10p	BU108	250p			TIS93	30p	2N4061/2	18p	OA91	9p
BC157/8	10p	BU205	220p			ZTX108	12p	2N4123/4	22p	OA95	9p
BC159	11p	BU208	240p			ZTX300	11p	2N4125/6	22p	OA200	9p
BC169C	12p	BU406	145p			ZTX500	15p	2N4289	20p	OA202	10p
BC172	12p					ZTX502	18p	2N4401/3	27p	1N914	4p
BC177/8	17p	MJ2501	225p			ZTX504	30p	2N4427	90p	1N916	7p
BC179	18p	MJ2955	100p			2N457A	250p	2N4871	60p	1N4148	4p
BC182/3	10p	MJ3001	225p			2N696	35p	2N5087	27p	1N4001/2	5p
BC184	11p	MJE340	65p			2N697	25p	2N5089	27p	1N4003/4	6p
BC187	30p	MJE2955	100p			2N697	45p	2N5172	27p	1N4005	8p
BC212/3	11p	MJE3055	70p			2N706A	20p	2N5179	27p	1N4006/7	7p
BC214	12p	MPF102	45p			2N708A	20p	2N5191	83p	1N5401/3	14p
BC461	38p	MPF103/4	40p			2N918	30p	2N5194	90p	1N5404/7	18p
BC477/8	30p	MPF105/6	40p			2N930	18p	2N5245	40p	**ZENERS**	
BC516/7	50p	MPSA06	30p			2N1131/2	28p	2N5296	55p	2·7V–33V	
BC547B	16p	MPSA12	50p			2N1613	25p	2N5401	50p	400 mW	9p
BC549C	18p	MPSA56	32p			2N1711	25p	2N5457/8	40p	1 W	15p
BC557B	16p	MPSU06	63p			2N2102	60p	2N5459	40p	**SPECIAL OFFERS**	
BC559C	18p	MPSU56	78p			2N2160	120p	2N5460	40p	100+ 741	
BCY70	18p	OC28	130p			2N2219A	30p	2N5485	44p	£16	
BCY71/2	22p	OC35	130p			2N2222A	20p	2N6027	48p	100+ 555	
BD131/2	50p					2N2369A	30p	2N6247	190p	£20	
BDY56	200p	R2008B	200p			2N2484	30p	2N6254	130p	100+	
BF200	32p	R2010B	200p			2N2646	50p	2N6290	65p	RCA 2N3055	
BF244B	35p					2N2904/5A	30p	2N6292	65p	£36	
BF256B	70p	TIP29A	40p			2N2906A	24p	3N128	120p	**BRIDGE RECTIFIERS**	
BF257/8	32p	TIP29C	55p			2N2907A	30p	3N140	100p	1A 50V	21p
BF259	36p	TIP30A	48p			2N2926	9p	3N201	110p	1A 100V	22p
BFR39	27p	TIP30C	60p			2N3053	30p	3N204	120p	1A 400V	30p
BFR40	27p	TIP31A	58p			2N3054	65p	40290	250p	2A 50V	30p
BFR41	27p	TIP31C	62p			2N3055	48p	40360	40p	2A 100V	35p
BFR79	27p	TIP32A	68p			2N3442	140p	40361/2	45p	2A 400V	45p
BFR80	27p	TIP32C	82p			2N3553	240p	40364	120p	3A 200V	60p
BFR81	27p	TIP33A	90p			2N3565	30p	40408	70p	3A 400V	90p
BFX29	30p	TIP33C	114p			2N3643/4	48p	40409	65p	3A 600V	72p
BFX30	34p	TIP34A	115p			2N3702/3	12p	40410	65p	4A 100V	95p
BFX84/5	30p	TIP34C	160p			2N3704/5	12p	40411	300p	4A 400V	100p
BFX86/7	30p	TIP35A	225p			2N3706/7	12p	40594	97p	6A 50V	90p
BFX88	30p	TIP35C	290p			2N3708/9	12p	40595	105p	6A 100V	100p
BFW10	90p	TIP36A	270p			2N3773	300p	40673	75p	6A 400V	120p
BFY50	22p	TIP36C	340p			2N3819	25p	40841	90p	10A 400V	200p
		TIP41A	65p			2N3820	50p	40871/2	90p	25A 400V	400p
						2N3823	70p				

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30 VOLT RANGE (Split Sec)
Sec Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V or 12V-0-12V or 15V-0-15V.

Ref.	Amps 30V	Amps 15V	Price	P&P
112	.5	1	**2.90**	1.00
79	1	2	**3.93**	1.00
3	2	4	**6.35**	1.20
20	3	6	**7.39**	1.44
21	4	8	**8.79**	1.60
51	5	10	**10.86**	1.60
117	6	12	**12.29**	1.72
88	8	16	**16.45**	1.96
89	10	20	**18.98**	1.84
90	12	24	**21.09**	O.A.
91	15	30	**24.18**	O.A.
92	20	40	**32.40**	O.A.

50 VOLT RANGE (Split Sec) Pri 120/240V Sec 50V Voltages available 5, 7, 8, 10, 13, 15, 17, 20, 33, 40 or 20V-0-20V or 25V-0-25V.

Ref.	Amps 50V	Amps 25V	Price	P&P
102	.5	1	**3.75**	1.20
103	1	2	**4.57**	1.20
104	2	4	**7.88**	1.44
105	3	6	**9.42**	1.60
106	4	8	**12.82**	1.72
107	6	12	**16.37**	1.84
118	8	16	**22.29**	2.20
119	10	20	**27.48**	O.A.
109	12	24	**32.88**	O.A.

MAINS ISOLATORS (SCREENED)
Pri 0-120; 0-100-120V (120, 220, 240V) Sec 60-55-0-55-60 twice to give 55, 60, 110, 115, 120, 125, 175, 180, 220, 225, 230, 235, 240.

Ref.	VA	Price	P & P
*07	20	**4.84**	1.20
149	60	**7.37**	1.20
150	100	**8.38**	1.44
151	200	**12.28**	1.72
152	250	**14.61**	2.04
154	500	**22.52**	2.20
155	750	**32.03**	O.A.
156	1000	**40.92**	O.A.
157	1500	**56.52**	O.A.
158	2000	**67.99**	O.A.
159	3000	**95.33**	O.A.

*Pri 0-240V Sec 115 or 240V State sec. volts required.

CASED AUTO TRANSFORMERS
240V cable in 115V USA flat pin outlets

VA	Price	P & P	Ref
20	**6.55**	0.95	56W
75	**8.50**	1.20	64W
150	**11.00**	1.44	4W
250	**13.39**	1.44	69W
500	**20.13**	2.04	67W
1000	**30.67**	2.20	84W
2000	**54.97**	O.A.	95W

60 VOLT RANGE (Split Sec)
Pri 120/240V. Voltages available 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 or 24V-0-24V or 30V-0-30V.

Ref	Amps 60V	Amps 30V	Price	P&P
124	.5	1	**4.27**	1.20
126	1	2	**6.50**	1.20
127	2	4	**8.36**	1.60
125	3	6	**12.10**	1.72
123	4	8	**13.77**	1.96
40	5	10	**17.42**	1.84
120	6	12	**19.87**	2.04
121	8	16	**27.92**	O.A.
122	10	20	**32.51**	O.A.
189	12	24	**37.47**	O.A.

12 OR 24V OR 12-0-12V
Pri 220-240 volts

Ref	Amps 12V	Amps 24V	Price	P&P
111	0 5	0 25	**2·42**	0.95
213	1 0	0 5	**2·90**	1.00
71	2	1	**3·86**	1.00
18	4	2	**4·46**	1.20
85	0 5	2 5	**6·16**	1.20
70	6	3	**6·99**	1.20
108	8	4	**8·16**	1.44
72	10	5	**8·93**	1.60
116	12	6	**9·89**	1.60
17	16	8	**11·79**	1.72
115	20	10	**15.87**	1.84
187	30	15	**19.72**	2.04
226	60	30	**40.41**	O.A.

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**2·83**	0.50
212	1A, 1A	0-6, 0-6	**3·14**	1.00
13	100	9-0-9	**2·35**	0.50
235	330, 330	0-9, 0-9	**2·19**	0.60
207	500, 500	0-8-9, 0-8-9	**3·05**	0.95
208	1A, 1A	0-8-9, 0-8-9	**3·88**	1.20
236	200, 200	0-15, 0-15	**2·19**	0.60
214	300, 300	0-20, 0-20	**3·08**	1.00
221	700 (DC)	20-12-0-12-20	**3.75**	1.00
206	1A, 1A	0-15-20	**5.09**	1.20
203	500, 500	0-15-27	**4.39**	1.20
204	1A, 1A	0-15-27	**6.84**	1.20
239	50	12-0-12	**2·88**	0.50
234	500	6-0-6	**2·19**	0·44

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AUTO TRANSFORMERS
Voltages available: 105, 115, 190, 200, 210, 220, 230, 240, for step up and step down.

Ref.	VA (Watts)	£	P&P
113*	15	**2.73**	1.00
64	80	**4.41**	1.20
4	150	**5.89**	1.20
53	350	**10.00**	1.44
67	500	**12.09**	1.84
84	1000	**20.64**	2.20
93	1500	**25.61**	O.A.
95	2000	**38.31**	O.A.
73	3000	**65.13**	O.A.
80S	4000	**84.55**	O.A.
57S	5000	**98.45**	O.A.

*0, 115, 220, 240.

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Ref			P & P
171	500 mA	**2·30**	0.60
172	1A	**3·26**	1.00
173	2A	**3·95**	1.00
174	3A	**4·13**	1.20
175	4A*	**6·30**	1.20

NEW RANGE TRANSFORMERS
Pri 120/240V
2 windings 0-36V-48V/36V-0-36Vm 48V-0-48V 72V or 96V.

Amps	Ref.	Price	P&P
1.0	431	**8.12**	1.44
2.0	432	**13.35**	1.22
3.0	433	**16.17**	1.96
4.0	434	**20.65**	2.04
5.0	435	**29.30**	2.20
6.0	436	**36.69**	O.A.
8.0	437	**40.03**	O.A.

Split Bobbin Type. Pri 0-115, 0-115. Sec 0-12-15-20-24-30 to give 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24, 30V, 2 amps **£4.65.** P&P £1.10 + VAT.

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Telephones – Latest model 746, boxed, 2 tone grey **£11.50** + VAT, Ivory **£12.50** + VAT. P&P £1.20 + VAT.

METAL OXIDE RESISTORS £1 per 100 (Electrosil) TR4 5% 390Ω/470Ω/510Ω/560Ω/820Ω/1K/1K1/1K2/1K6/1K8/2K/2K4/ 3K/16K/20K/22K/24K/47K/82K/100K/110K/120K/130K/ 180K/220K/270K/300K. P&P 50p + VAT.

100W Soldering Gun includes bulb for spot-on joints **£5.39** + VAT.

PANEL METERS

43mm · 43mm		82mm · 78mm	
0 50μA	**6·20**	0 50μA	**6·70**
0 500μA	**5·95**	0 500μA	**6·70**
0 1mA	**5·95**	0 1mA	**6·70**
0 30V	**5·95**	0 30V	**6·70**

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Type	Gain (db)	Output (watts)	Volts	Freq.	Price
2N6083	5.7	30w.	12	175MHz	**£6.50**
BLY87A	9	8	12	175	**£4.00**
SD1212-6	8.2	3	12	175	**£2.50**
BLW16A	10	¾	12	175	**£0.75**
PT4236A	10	1 min.	12	175	**£0.75**
PT4555	8	25	12	80	**£3.50**
PT4556C	7	40	12	80	**£4.50**
2N5070	13	25(pep)	24	30	**£5.00**

MDA800 8 amp 50 volt bridge rectifier OK for 12v PSU etc. **65p. 2 for £1.15.**
DUAL-GATE MOSFETS 3SK51 (40673) **80p,** BFR84 **75p.**
FETs E5565 (2N3819) **30p,** TIS88A **40p,** BF256C **40p,** 2N4381 **40p.**
BIPOLARS:– BF576, pnp VHF RF amp. FT1200 MHz **20p,** 2N4957 pnp VHF/UHF RF amp nf only 3½db @ 1GHz **30p,** BF180 **30p,** BF166 VHF RF amp **25p,** BFY90 UHF RF amp **95p,** BF152 VHF mix/osc. **15p.**
SILICON PIN DIODES for switching oscillators etc. up to 1000MHz – BA243 (VHF) **20p,** BA244 (UHF) **25p.**
AUDIO AMP IC. TDA1010 6 watt output adjustable to 9 watt, @ 14 volt single-in-line type & ideal for transceivers, receivers, record players, cassette players etc. BARGAIN OFFER ONLY **£1.35** two for **£2.40.** Supplied with data sheet showing construction of stereo amp. full data sheet (19 pages) **20p.**
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BAG OF MIXED RESISTORS ¼ watt carbon film pre-formed type all with long leads plus some ½ watt std types 250 for **£1.60.**
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PRICE LIST 15p STAMP – FREE WITH ORDER.

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RESISTORS: ¼W, Low Noise, High Stab. 5% Tolerance, Carbon Film, E12 Series, 2.2 ohm to 10M **2p** each, **15p**/10, 100 for **95p,** 1000 mixed in 100's only **£8.00.**
SPECIAL RESISTOR PACK: 10 of each value 2.2Ω to 2M2, 730 resistors only **£6.00.** Amazing value. 1W Resistors, E12 range from 2.2 ohm to 10M. All 5%, **5p** each. 2W Resistors, E12 range from 100 ohm to 10M. All 5%, **8p** each.
CERAMICS: 63V Working. Subminiature, Low Tolerance, 1.8pF-100nF, **4p** each.
TANTALUMS: 35V, 0.1μ, 0.15μ, 0.22μ, 0.33μ, 0.47μ, 0.68μ, 1.0μ @ **12p** each. 2.2μ, 3.3μ, 4.7μ, 6.8μ, 35V @ **14p** each. 10/35V **18p,** 22/35 **38p.** 47/10V **25p,** 33/10V **22p,** 100/3V **20p,** 68/3V **20p** each.
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TRANSISTORS: BC107/8/9 **10p,** BC147/8/9 **8p,** BC182/3/4 **9p,** BC172 **8p,** BF200 **28p,** BC212/3/4 **9p,** 212L/3L/4L **10p,** BF180/81 **29p,** AC128 **20p,** AD161/2 **45p,** 2N3055 **45p,** 2N3819 **23p,** 2N3053 **20p,** BC125 **10p,** BF262/3 **30p,** 1N4001 **5p,** 1N4007 **8p,** 741 **20p,** NE555 **25p,** LM380 **80p.**
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ELECTROLYTICS: A is Axial; R is Radial; 1/63C A **7p,** 2.2/25 R **4p,** 4.7/25 R **5p,** 10/16 R **4p,** 22/16 R **4p,** 22/63 R **8p,** 25/25 A **3p,** 47/16 R **5p,** 47/25 A **6p,** 100/3 A **5p,** 100/16 R **6p,** 220/16 A **9p,** 470/16 A **12p,** 1000/16 A **16p,** 1000/63 A **62p,** 4700/16 R **55p.** 2200/40 A **65p,** 4700/63v T/E **£1.90.**

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240v:	6-0-6v	100m/a	**58p**	**52p**	**43p**
240v:	6-0-6v	500m/a	**65p**	**60p**	**48p**
240v:	9-0-9v	200m/a	**75p**	**70p**	**58p**

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ULTRASONIC TRANSDUCERS **395p** per pair.

ELECTROLYTIC CAPACITORS (Values in µF). **500V:** 10 **52p;** 47 **78p; 250V:** 100 **65p; 63V:** 0·47, 1·0, 1·5, 2·2, 3·3, **8p;** 4·7 **9p;** 6·8 10 **10p;** 15, 22 **12p;** 33 **15p;** 47 **12p;** 100 **19p;** 1000 **70p; 50V:** 47 **12p;** 68 **20p;** 220 **24p;** 470 **32p;** 2200 **90p; 40V:** 4·7, 15, 22, **9p;** 3300 **90p;** 4700 **120p; 25V:** 1·5, 6·8, 10, 22 **8p;** 33 **9p;** 47 **8p;** 100 **11p;** 150 **12p;** 220 **15p;** 330 **22p;** 470 **25p;** 680, 1000 **34p;** 2200 **50p;** 3300 **76p;** 4700 **92p; 16V:** 40, 47, 100 **9p;** 125 **12p;** 220 **13p;** 470 **20p;** 680 **34p;** 1000 **27p;** 1500 **31p;** 2200 **36p;** 3300 **74p;** 4700 **79p.**
TAG-END TYPE: 450V: 100µF **65p; 70V:** 4700 **245p; 64V:** 3300 **198p;** 2200 **139p; 50V:** 3300 **154p;** 2200 **110p; 40V:** 4700 **160p; 25V:** 10,000 **320p;** 15,000 **345p.**

TANTALUM BEAD CAPACITORS: 35V: 0·1µ, 0·22, 0·33 **15p;** 0·47, 0·68, 1·0, 1·5 **16p;** 2·2, 3·3 **18p;** 4·7, 6·8 **22p;** 10 **28p; 16V:** 2·2, 3·3,**16p;** 4·7, 6·8, 10 **18p;** 15 **36p;** 22 **30p;** 33, 47 **40p;** 100 **75p; 10V:** 15, 22 **26p;** 33, 47 **35p;** 100 **55p.**

POLYESTER (MYLAR) CAPACITORS: 100V: 1nF, 2n, 4n, 4n7, 10n **6p;** 15nF, 22n, 30n, 40, 47 **7p;** 56, 100n, 200 **9p; 50V:** 470nF **12p.**

CERAMIC CAPACITORS 50V
Range: 0·5pf to 10nf **4p**
15nF, 22nF, 33nF, 47nF **5p** 100nF **7p**

POLYSTYRENE CAPACITORS
10pF to 1nF, **8p** 1·5nF to 12nF, **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.

VEROBOARDS: 0·1"

	Clad	Plain
2½×3¾"	73p	52p
2½×5"	83p	—
3¾×3¾"	83p	—
3¾×5"	95p	79p
3¾×17"	326p	211p
4¾×17"	426p	—

Pkt of 100 pins	50p
Spot face cutter	118p
Pin insertion tool	162p
'VQ' Board	150p
'DIP' Board	330p
Vero Strip	144p

PROTO – DECs

Veroblock	375p
S-DeC	350p
Eurobreadboard	520p
Bimboard 1	785p
Superstrip SS1	998p

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	78p
5KΩ to 2MΩ Dual gang	88p
1W Wirewound 50Ω-20K	115p

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm track

5KΩ 500KΩ Single gang	70p
10KΩ 500KΩ Dual gang	110p
Self-Stick graduated Alum. Bezels	36p

PRESET POTENTIOMETERS

0·1W 50Ω-2·2M Minl. Vert. & Horiz.	7p
0·25W 100Ω-3·3MΩ Horiz. larger	10p
0·25W 250Ω-4·7MΩ Vert.	10p

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3" C Anod	99
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5" C Anod	115
6" C Cath	180
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3½ Digit LCD	675
4 Digit LCD	750
OCP71	120
ORP12	86
2N5777	45
(Infra Red Emitter) LD271	46
TIL32	58
Detector SFH205	91
TIL78	60

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Fibre Glass	Single-sided	Double-sided	SRBP 9·5"×8·5"
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DIL SOCKETS

	Low profile	Wire wrap
8 pin	8p	25p
14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	35p	80p
36 pin	—	105p
40 pin	30p	99p

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2 10 way	—	82p
2 15 way	—	98p
2 18 way	140p	120p
2 22 way	150p	125p
2 25 way	165p	160p
2 30 way	188p	—
2 36 way	197p	—
2 40 way	205p	—
2 43 way	250p	—

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	120p
RFC 5 chokes	120p
RFC 7 (19mH)	133p
1FT 13/14/15/16 17	110p
1FT 18/1·6	120p
1FT 18/465	135p
TOC1	110p
MW 5FR	112p
MW/LW 5FR	134p

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	205p
500pF	250p
6:1 Ball Drive 4511/DAF	160p
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
00-2-208/176	395p
,, ,, with slow motion drive	450p
C804: 5pF; 10	250p
25pF	290p
50pF	290p
100;150pF	350p
'L' 3×310pF	725p
00-3×25pF	550p

TRANSISTORS

AC125	35	BD131/2	48	OC36	120	2N2904	28
AC126/7	25	BD133	60	OC41/2	120	2N2905A	26
AC128	25	BD135	45	OC43	55	2N2906	26
AC141/2	30	BD136/7	40	OC44	120	2N2907A	26
AC176	28	BD138/9	40	OC45	40	2N2926G	10
ACY17/18	70	BD140	40	OC70/71	40	2N3053	26
ACY19/20	75	BD144/5	198	OC74/76	50	2N3054	58
ACY21	75	BD205	110	OC81/82	50	2N3055	48
ACY22	60	BD214	115	OC83/4	40	2N3442	140
ACY28	75	BD245	45	OC140	110	2N3663	15
AD149	79	BD378	70	OC170/1	85	2N3702/3	10
AD161/2	42	BD434	55	OC200	85	2N3704/5	10
AF106	70	BD517	75	TIP29	34	2N3706/7	10
AF118	95	BD695A	85	TIP29A	36	2N3708/9	10
AF139	40	BD696A	85	TIP29B	56	2N3710/11	10
AF178	75	BDY56	180	TIP29C	60	2N3771	179
AF239	78	BF115	35	TIP30	48	2N3772	195
BC107	10	BF167	29	TIP30C	58	2N3773	270
BC107B	12	BF180	38	TIP31A	45	2N3819	22
BC108	10	BF194/5	12	TIP31C	55	2N3820	45
BC108B	12	BF196/7	12	TIP32A	48	2N3822/3	65
BC108C	12	BF198	16	TIP32C	60	2N3866	90
BC109	10	BF199	18	TIP33A	65	2N3903/4	18
BC109B	12	BF200	30	TIP33C	78	2N3905	15
BC109C	12	BF224	24	TIP34A	74	2N3906	17
BC140	30	BF244	30	TIP34C	88	2N4037	46
BC141/2	30	BF244B	30	TIP35A	160	2N4058	10
BC143	30	BF256	35	TIP35C	185	2N4061/2	10
BC147	9	BF257/8	32	TIP36A	170	2N4427	80
BC147B	10	BF259	35	TIP36C	199	2N4859	78
BC148	9	BF274	42	TIP41A	55	2N4871	55
BC148B	10	BF336	40	TIP41B	68	2N5172	18
BC148C	10	BF451	35	TIP42A	60	2N5179	45
BC149	9	BF594	30	TIP42B	75	2N5191	75
BC149C	10	BF595	39	TIP120	90	2N5305	24
BC153/4	27	BFR39	23	TIP121	99	2N5457	36
BC157/8	10	BFR40/41	23	TIP142	120	2N5485	36
BC159	11	BFR79	23	TIP147	120	2N5642	750
BC160	45	BFR80	24	TIP2955	60	2N5777	45
BC167	10	BFR81	25	TIP3055	60	2SA715	60
BC168C	10	BFR98	105	TIS43	32	2SC495	70
BC169C	10	BFX29	28	TIS44/5	45	2SC496	70
BC170	15	BFX84	26	TIS88A	50	2SC1096	85
BC172/3	11	BFX85/6	28	TIS90	30	2SC1173	125
BC177/8	20	BFX87/8	28	TIS91	32	2SC1306	150
BC179	20	BFY51/2	23	ZTX107	11	2SC1307	220
BC181	20	BFY56	32	ZTX109	12	2SC1449	85
BC182/3	10	BFY64	35	ZTX300	13	2SC1678	140
BC184	10	BFY81	120	ZTX301	16	2SC1923	50
BC182L	10	BRY39	40	ZTX302	16	2SC1945	225
BC183L	10	BSX20	20	ZTX303	25	2SC1953	90
BC184L	10	BSY95A	25	ZTX304	17	2SC1957	90
BC187	26	BU105	170	ZTX314	25	2SC1969	198
BC212	10	BU205	190	ZTX326	30	2SC2028	85
BC212L	10	BU208	200	ZTX341	30	2SC2029	180
BC213	10	E421	250	ZTX500	14	2SC2078	155
BC213L	10	MD8001	250	ZTX501/2	15	2SC2091	85
BC214	10	MJ400	150	ZTX503	18	2SC2314	85
BC214L	10	MJ491	175	ZTX504	25	2SC2166	165
BC236	10	MJ2955	90	ZTX531	25	2SC1679	190
BC237	14	MJE340	54	ZTX550	25	2N6027	32
BC307B	15	MJE370	100	2N697	23	3N128	112
BC308B	16	MJE371	100	2N698	40	3N140	112
BC327	15	MJE2955	99	2N699	48	40311	60
BC338	15	MJE3055	70	2N706A	19	40313	125
BC441	34	MPF102	66	2N708	19	40315	68
BC461	34	MPF103/4	36	2N918	35	40316	85
BC477	40	MPF105	36	2N1131	24	40361	50
BC516/7	40	MPF106	40	2N1132	24	40362	50
BC547	14	MPSA05	25	2N1303	60	40408	95
BC548	14	MPSA06	25	2N1304	65	40411	280
BC549C	14	MPSA12	32	2N1305	60	40467	95
BC557/8	15	MPSA55	30	2N1671B	160	40468	60
BC559	15	MPSA56	30	2N2219A	28	40594	90
BCY70	16	MPSA70	25	2N2220A	26	40595	98
BCY71	18	MPSU06	55	2N2221A	25	40603	90
BCY72	20	OC28	130	2N2222A	25	40673	95
		OC35	125	2N2369A	17		
				2N2646	45		

74LS (TEXAS)

74LS00	13	LS164	115	LS299	420
LS01	13	LS165	145	LS300	175
LS02	15	LS166	175	LS323	325
LS03	15	LS168	210	LS324	200
LS04	16	LS169	210	LS325	320
LS05	23	LS170	288	LS326	330
LS08	22	LS173	105	LS327	315
LS09	23	LS174	110	LS346	185
LS10	20	LS175	110	LS347	150
LS11	32	LS181	295	LS348	190
LS12	32	LS183	298	LS365	65
LS13	40	LS191	95	LS366	65
LS14	60	LS192	95	LS367	65
LS15	40	LS193	99	LS368	90
LS20	21	LS194	125	LS373	150
LS21	32	LS195	130	LS374	150
LS22	35	LS196	120	LS375	150
LS26	44	LS197	85	LS377	199
LS27	35	LS200	345	LS378	140
LS28	35	LS202	345	LS379	215
LS30	20	LS221	120	LS384	250
LS32	25	LS240	165	LS390	140
LS33	35	LS241	165	LS393	140
LS37	30	LS242	165	LS395	210
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LS75	45	LS258	120		
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LS83	105	LS266	75		
LS85	80	LS273	180		
LS86	38	LS275	320		
LS90	50	LS279	88		
LS91	125	LS280	250		
LS92	75	LS283	90		
LS93	60	LS290	130		
LS95	115	LS293	130		
LS96	120	LS295	215		
LS107	45	LS298	215		
LS109	75				
LS112	40				
LS113	75				
LS114	40				
LS122	70				
LS123	75				
LS124	180				
LS125	45				
LS126	45				
LS132	60				
LS136	55				
LS138	62				
LS139	70				
LS151	90				
LS153	85				
LS155	75				
LS157	70				
LS158	70				
LS160	90				
LS161	98				
LS162	110				
LS163	95				

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	595p
78HG05	650p
79HG	850p
TBA625B	80p

BRIDGE RECTIFIERS

1A/50V	20
1A/100V	22
1A/400V	29
2A/50V	35
2A/400V	46
2A/600V	65
6A/100V	83
6A/400V	95
10A/200V	215
10A/600V	350
25A/200V	240
25A/600V	395
BY164	56
VM18 DIL	50

SCRs THYRISTORS

1A/200V	58
5A/100V	32
5A/400V	40
5A/600V	48
8A/300V	60
8A/600V	95
12A/400V	95
12A/800V	188
BT106	150
BT116	180
C106D	38
TIC44	24
TIC47	35
2N4444	130

TRIACS

3A/100V	48
3A/400V	56
3A/800V	85p
8A/100V	60
8A/400V	69
8A/800V	115
12A/100V	78
12A/400V	82
12A/800V	135
16A/400V	105
16A/800V	220
25A/400V	185
25A/800V	295
30A/400V	525
T2800D	120

DIAC
ST2 **25p**

DIODES

AA119	15
BY100	24
BY127	12
CR033	250
OA9	40
OA70	12
OA79	15
OA81	15
OA85	15
OA90	8
OA91	8
OA95	8
OA200	8
OA202	8
1N914	4
1N916	5
1N4001/2	5
1N4003/4	6
1N4005/6	6
1N4007	7
1N4148	4
3A/100V	15
3A/400V	16
3A/600V	17
3A/1000V	19
6A/400V	50
6A/800V	65

NOISE DIODE
Z5J **195**

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709C 8 pin	35	LM318	240	SG3402	295	2716-5V	390
710*	67	LM324	50	SN76003N	240	2732 450	£10
733	75	LM339	70	SN76013N	170	4116-16K	190
741 8 pin	15	LM348	90	SN76018	148	4315 CMOS	995
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748C 8 pin	36	LM379	.415	SN76033N	195	6520	325
753 8 pin	185	LM380	80	SN76115N	115	6522	570
810	159	LM381N	145	SN76131	125	6532	795
9400CJ	350	LM381AN	195	SN76227N	95	6551	785
AY-1-0212	675	LM382	125	SN76477	175	6800	490
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AY-1-5051	160	LM733	75	TAA661A	155	6850	485
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AY-3-8500	390	LM3900	60	TBA120S	70	8080A	499
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AY-5-1230	450	LM3914	240	TBA641-A12/ BX1 or BX11	250	81LS96	125
AY-5-1317A	639	LM3915	240	TBA651	190	81LS97	125
AY-5-8100	735	LM3916	225	TBA800	90	8251	700
CA3011	110	LM13600	135	TBA810S	95	8253	1275
CA3014	157	LS7220	280	TBA820	70	8T26A	190
CA3018	68	M252AA	625	TBA920Q	260	8T28A	195
CA3020	186	M253AA	1150	TCA965	120	8T95N	160
CA3023	191	MC1303	88	TDA1004	290	8T97N	150
CA3028A	80	MC1304P	260	TDA1008	310	AY-3-1015	420
CA3035	235	MC1310P	150	TDA1022	575	AY-5-1013	365
CA3036	115	MC1494	694	TDA1024	105	AY-5-2376	750
CA3043	275	MC1495	350	TDA1490	295	MC1488	90
CA3045	365	MC1496L	92	TDA2020	320	MC1489	90
CA3046	71	MC1596	225	TL061CP	46	MC14411	950
CA3048	214	MC1710	79	TL062CP	90	MC14412	1250
CA3059	195	MC3302	150	TL064CN	159	MK4027-2	450
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ICM7216B	1950	NE561	398	ZN1034	200	74S189	158
ICM7216C	1950	NE562B	410	ZN1040E	685	74S194	360
ICM7217A	790	NE564	435			74S241	540
ICM7555	85	NE565A	120			74S262	850
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LM10	395	NE570	450			74S470	325
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		S566B	265				

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2114L 300n	175
2114L 200n	225
2532 32K	£10

TTL 74 (TEXAS)

7400	11	7489	205	74181	280
7401	11	90	42	74182	85
7402	11	91	84	74184	130
7403	14	92	50	74185	130
7404	14	93	57	74188	310
7405	18	94	85	74190	130
7406	36	95	70	74191	120
7407	36	96	80	74192	120
7408	17	97	176	74193	120
7409	20	100	130	74194	102
7410	17	104	64	74195	75
7411	25	105	62	74196	99
7412	20	107	34	74197	88
7413	32	109	60	74198	160
7414	38	110	54	74221	150
7416	30	111	68	74246	150
7417	30	112	70	74247	151
7420	19	116	180	74248	189
7421	38	118	85	74249	189
7422	25	119	120	74251	110
7423	28	120	75	74265	66
7425	28	121	35	74273	267
7426	43	122	50	74278	249
7427	32	123	65	74279	99
7428	35	125	50	74298	185
7430	19	126	45	75108	350
7432	27	128	65	75150	140
7433	36	132	55	75450	95
7437	35	136	65	75451	70
7438	32	141	75	75454	225
7440	20	142	185	75491	89
7441	68	143	250	75492	95
7442	58	144	250		
7443	120	145	90		
7444	116	147	150		
7445	105	148	125		
7446	132	150	130		
7447	72	151	70		
7448	75	153	70		
7450	20	154	120		
7451	20	155	75		
7453	20	156	75		
7454	20	157	70		
7460	20	159	165		
7470	40	160	99		
7472	30	161	99		
7473	35	162	99		
7474	34	163	99		
7475	56	164	120		
7476	40	165	120		
7480	52	166	130		
7481	120	167	205		
7482	75	170	205		
7483	90	172	375		
7484	99	173	110		
7485	105	174	100		
7486	33	175	82		
		176	80		
		177	85		
		178	110		
		180	90		

CMOS*

4000	14	4028	92	4162	115
4001	14	4029	98	4163	115
4002	15	4030	55	4174	110
4006	86	4031	185	4175	120
4007	19	4032	125	4194	115
4008	76	4033	175	4408	790
4009	46	4034	213	4409	790
4010	50	4035	95	4410	750
4011	18	4036	275	4411	950
4012	24	4037	115	4412	1250
4013	43	4038	110	4415	480
4014	80	4039	299	4419	280
4015	82	4040	85	4422	570
4016	35	4041	80	4433	995
4017	70	4042	70	4435	850
4018	76	4043	80	4440	999
4019	42	4044	80	4450	350
4020	85	4045	175	4451	350
4021	90	4046	96	4490	350
4022	85	4047	98	4500	850
4023	24	4048	65	4501	28
4024	60	4049	35	4502	105
4025	24	4050	38	4503	65
4026	170	4051	86	4504	120
4027	45	4052	86	4506	75
		4053	86	4508	280
		4054	130	4510	85
		4055	130	4511	98
		4056	135	4512	98
		4058		4513	225
		4059	575	4514	220
		4060	110	4515	250
		4061	1225	4516	90
		4062	995	4517	415
		4063	120	4518	90
		4066	46	4519	80
		4067	430	4520	90
		4068	26	4521	210
		4069	22	4522	150
		4070	25	4526	98
		4071	25	4527	125
		4072	25	4528	100
		4073	25	4529	150
		4075	23	4530	90
		4076	85	4531	130
		4077	30	4532	120
		4078	28	4534	510
		4081	26	4536	310
		4082	25	4538	145
		4085	90	4539	120
		4086	90	4541	150
		4089	150	4543	150
		4093	53	4544	200
		4094	210	4549	395
		4095	95	4553	399
		4096	95	4554	192
		4097	340	4555	85
		4098	115	4556	60
		4099	150	4557	425
		4160	115	4558	174
		4161	115	40174	160

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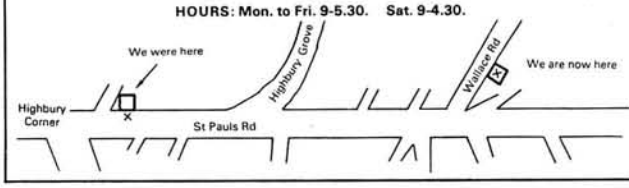

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The new THETA 7000E means that every Amateur can enjoy the visual display of CW, RTTY and ASCII in both transmit and receive modes. Just connect the TONO to any TV set via the antenna terminals or to a page printer from the parallel port provided. Bring up your CW speed in receiving or sending by either watching receiver sent or from recorded cassettes. Connection to the transceiver is via the key, phone and mic sockets.

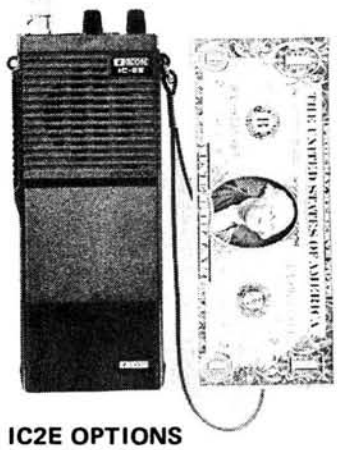
Some of the Outstanding Features
COMMUNICATIONS COMPUTER THETA 0-7000E
0-7000E
UHF and Composite Video Output * Printer interface * Wide range of transmitting and receiving speeds – 10CW speeds + 8RTTY * Built-in demodulator for high performance for 170, 425 and 820 Hz shift * Crystal controlled modulator for ASFK – Hi or Lo tone * Convenient ASCII key arrangement * Large capacity display memory – 2 pages 32chr x 16 lines split screen for Rx & Tx if required * Automatic transmit/receive switch * Anti-noise circuit * Battery backed-up memory 7 channels of 64chrs * Send function * Buffer memory – 53 character type ahead, rub out function * Simultaneous access of the memory – 53 character type ah
LF (line feed) cancel function * Cursor control function * Word mode operation * Automatic CR/LF (72, 60 or 80 chrs per line) * Echo function * Word Wrap around function * Transmit/receive in ASCII mode or RTTY * CW indentification function * Mark and break (space and break) system * Monitor circuit & CW practice function * Variable CW weights * Cross pattern checking output terminal * Log computer output provided * Test message function (Ry and QBF).

Phone or write for the price list of accessories for this unit.

Thanet for ICOM 2 YEAR WARRANTY

ITS GOOD AS IT IS –
BUT TAKE A LOOK AT THE "MODS"

IC-2E Handy Talky £159 INCL.



CHECK THE FEATURES

FULLY SYNTHESIZED – covering 144-145.995 in 400 5kHz steps.
POWER OUTPUT – 1.5W with the 9V rechargeable battery pack as supplied – but lower or higher output available with the optional 6V or 12V packs.
BNC ANTENNA OUTPUT SOCKET – 50 ohms for connecting to another antenna or use the Rubber Duck supplied.

SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't light indicating the need for a recharge.
FREQUENCY SELECTION – by thumbwheel switches, indicating the frequency.

+5kHz SWITCH – adds 5kHz to the indicated frequency.
DUPLEX SIMPLEX SWITCH – gives simplex or plus 600kHz or minus 600 kHz Transmit.
HI-LOW SWITCH – reduces power output from 1.5W to 150mW reducing battery drain.
EXTERNAL MICROPHONE JACK – If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.
EXTERNAL SPEAKER JACK – for speaker or earphone.
This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

IC2E OPTIONS

BATTERY PACKS

ICBP3	9 VOLT PACK (AS FITTED) REPLACEMENT	£15.50
ICBP2	(7.2 VOLT) (1 WATT)	£22.00
ICBP4	EMPTY CASE (WILL TAKE SIX 'AA' SIZE NI-CADS)	£5.00
ICBP5	11 VOLT PACK (2-3 WATTS)	£30.50

CHARGERS ETC

IC-DC1	9 VOLT REGULATOR PACK	£7.50
IC-CP1	CAR CHARGER LEAD WITH CIGAR PLUG	£2.75
IC-BC25	CHARGER FOR BP3 AS SUPPLIED	£3.70
IC-BC30	DESK CHARGER FOR ALL NI-CAD PACKS FAST FOR IC-BP5 + BP2 (1½ hours)	£34.00

THE LATEST 2M MULTIMODE BASE STATION
the ICOM IC 251E – £479 INCL.

Facilities Include:
Fm, USB, LSB & CW.
Built in scanner and memories.
Bright Green Digital Readout.
Two VFO,S
Variable Power 1–10W.
Mains or 12V.

Also 70cm Version IC451E £579 INCL.

SEND FOR TECHNICAL DETAILS

AGENTS (PHONE FIRST – evenings and weekends only)

Scotland	Jack GM8GEC (031-665-2420)	Wales	Tony GW3FKO (0874 2772)
North West	Gordon G3LEQ (Knutsford (0565) 4040)	Midlands	Tony G8AVH (021-329-2305)

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IC-255E-

25 WATT Fm 2m mobile

for only £255 INCL.

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See us at ELVASTON CASTLE RALLY JUNE 14th

See us at ELVASTON CASTLE RALLY JUNE 14th

25 Watts — 5 Memories — Scanning — 600kHz
AND User Selectable Repeater Shift — Full Coverage in 5kHz or 25kHz Steps.

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- Alternative programmable shift
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- RIT (± 3kHz for those off channel stations)
- Scan control from the microphone (optional mic available)
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- 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

Multimode VHF mobile
The IC-260E

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. Now supplied with up-down scanning mic.

£339 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.

"BUY DIRECT FROM US AND GET A FULL TWO YEARS WARRANTY."

Thanet for ICOM

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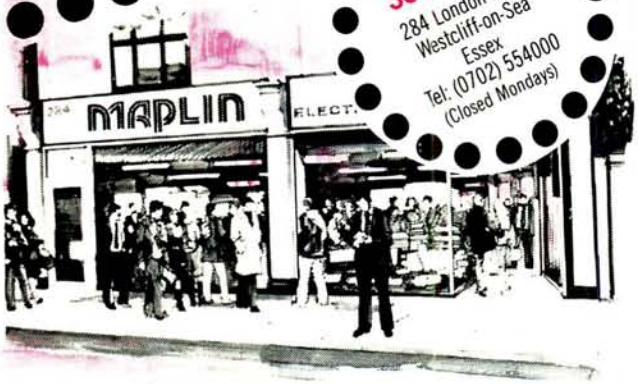

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