FOR THE RADIO ENTHUSIAST ...

Practical Wireless

FEBRUARY 1982

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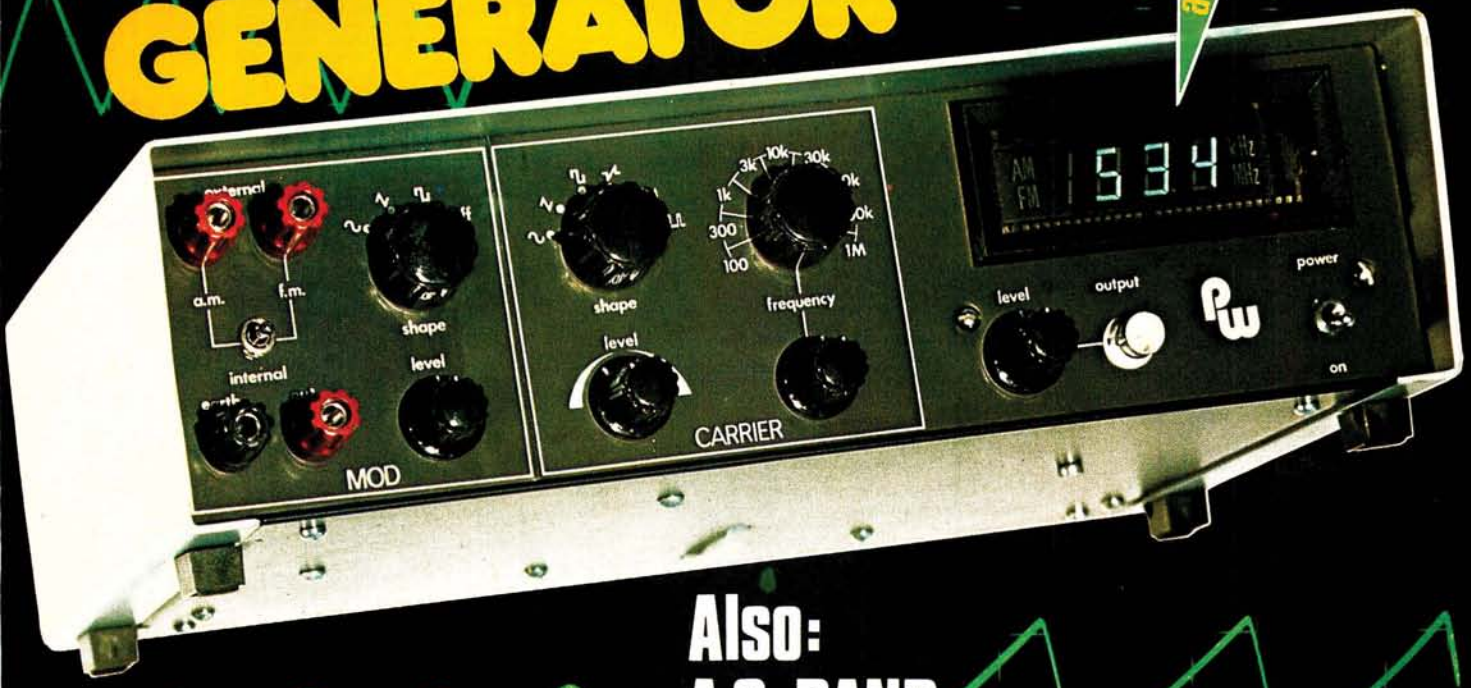

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TS 7730

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		£	Carr.
TRIO			
TS830S	160-10m Transceiver 9 Bands	694.00	(—)
VFO230	Digital V.F.O. with Memories	215.00	(2.00)
AT230	All Band ATU/Power Meter	119.00	(2.00)
SP230	External Speaker Unit	34.96	(1.50)
DFC230	Dig. Frequency Remote Controller	179.00	(1.50)
YK88C	500Hz CW Filter	29.60	(0.50)
YK88CN	270Hz CW Filter	32.66	(0.50)
TS130S	8 Band 200W Pep Transceiver	525.00	(—)
TS130V	8 Band 20W Pep Transceiver	445.00	(—)
VFO120	External V.F.O.	85.00	(1.50)
TL120	200W Pep Linear for TS120V	144.00	(1.50)
MB100	Mobile Mount for TS130/120	17.00	(1.50)
SP120	Base Station External Speaker	23.00	(1.50)
AT130	100W Antenna Tuner	79.00	(1.50)
PS20	AC Power Supply – TS130V	49.45	(2.50)
PS30	AC Power Supply – TS130S	88.50	(5.00)
MA5	5 Band Mobile Aerial System	86.00	(5.00)
MC50	Dual Impeadance Desk Microphone	25.76	(1.50)
MC35S	Fist Microphone 50K ohm IMP	13.80	(0.75)
MC30S	Fist Microphone 500 ohm IMP	13.80	(0.75)
LF30A	HF Low Pass Filter 1kW	17.90	(0.75)
TR9000	2M Synthesised Multimode	371.00	(—)
BO9	Base Plinth for TR9000	34.90	(1.50)
TR7800	2M Synthesised FM Mobile 25W	284.00	(—)
TR7730	2M Synthesised FM Compact Mobile 25W	247.00	(—)
TR2300	2M Synthesised FM Portable	166.00	(—)
VB2300	10W Amplifier for TR2300	58.00	(1.50)
MB2	Mobile Mount for TR2300	17.71	(1.50)
RA1	Flexible Rubber Antenna for TR2300	6.90	(0.50)
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IC BP3	9V Nicad Pack for IC2E	17.70	(1.00)
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IC BP5	11.5V Nicad Pack for IC2E	30.50	(1.00)
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	Toroid Filter TV Down Lead	2.00	(0.50)
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	Trio Low Pass Filter LF30A 1kW	17.90	(0.75)
	Yaesu Low Pass Filter FF501DX 1kW	23.00	(0.75)
	HP4A High Pass Filter TV Down Lead	5.95	(—)
ANTENNA BITS			
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Please send total postage indicated Any excess will be refunded.

MICROWAVE MODULES			
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MMT432/28S	70cm Transverter for HF Rig	149.00	(—)
MMT432/144R	70cm Transverter for 2M Rig	184.00	(—)
MMT70/28	4M Transverter for HF Rig	115.00	(—)
MMT70/144	4M Transverter for 2M Rig	115.00	(—)
MMT1296/144	23cm Transverter for 2M Rig	184.00	(—)
MML144/25	2M 25W Linear Amp (3W I/P)	59.00	(—)
MML144/40	2M 40W Linear Amp (10W I/P)	77.00	(—)
MML144/100S	2M 100W Linear Amp (10W I/P)	129.00	(—)
MML432/20	70cm 20W Linear Amp (3W I/P)	77.00	(—)
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MMC70/28	4M Converter to HF Rig	27.90	(—)
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MMF144	2M Band Pass Filter	9.90	(—)
MMF432	70cm Band Pass Filter	9.90	(—)
MMS1	The Morse Talker	115.00	(—)
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ASP/B	Auto RF Speech Clipper (Trio Plug)	79.35	(—)
ASP/A	Auto RF Speech Clippers (Yaesu Plug)	79.35	(—)
D75	Manually controlled RF Speech Clipper	56.35	(—)
RFC/M	RF Speech Clipper Module	26.45	(—)
D70	Morse Tutor	49.45	(—)
AD270	Indoor Active Dipole Antenna	37.95	(—)
AD370	Outdoor Active Dipole Antenna	51.75	(—)
MPU1	Mains Power Unit	6.90	(—)

MORSE EQUIPMENT			
MK704	Squeeze Paddle	10.50	(0.50)
HK707	Up/Down Key	10.50	(0.50)
HK704	Deluxe Up/Down Key	14.50	(0.50)
EKM1A	Practise Oscillator	8.75	(0.50)
EK121	Elbug	29.95	(0.50)
EKM1A	Matching Side Tone Monitor	10.95	(0.50)
EK150	Electronic Keyer	74.00	(—)
ROTATORS			
KR250	Kenpro Lightweight 1-1½" mast	44.95	(2.00)
Hirschman	RO250 VHF Rotor	49.95	(2.00)
9502B	Colorotor (Med. VHF)	49.95	(2.00)
KR400RC	Kenpro – inc lower clamps	99.95	(2.50)
KR600RC	Kenpro – inc lower clamps	139.95	(3.00)
DESK MICROPHONES			
SHURE 444D Dual Impeadance		29.95	(1.50)
SHURE 526T Mk II Power Microphone		39.95	(1.50)
ADONIS AM502 Compression Mic 1 O/P		39.00	(—)
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2M Thread for TR2300 or FT290R (state which)		4.50	(0.50)
70cm BNC		4.50	(0.30)

YAESU			
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FC902	All Band A.T.U.	135.00	(1.50)
SP901	External Speaker	31.00	(1.50)
FT101Z	160-10m 9 Band Transceiver (FM)	590.00	(—)
FT101ZD	160-10m 9 Band Transceiver (FM) Digital R.O.	665.00	(—)
DCT101Z	DC/DC Power Pack	42.55	(1.50)
FAN101Z	Cooling Fan for 101Z/ZD	13.80	(0.75)
FT707	8 Band Transceiver 200W Pep	569.00	(—)
FT707S	8 Band Transceiver 20W pep	485.00	(—)
FP707	Matching Power Supply	125.00	(5.00)
FTV707R(2)	Transverter – 2M	198.00	(—)
FV707DM	Digital V.F.O.	186.00	(—)
FC707	Matching A.T.U./Power Meter	85.00	(1.00)
MR7	Metal Rack for FT707	15.70	(1.00)
MMB2	Mobile Mounting Bracket for FT707	16.10	(1.00)
FRG7	General Coverage Receiver	189.00	(—)
FRG7700	200KHz-30MHz Gen. Coverage Receiver	329.00	(—)
FRG7700M	As above but with Memories	409.00	(—)
FRT7700	Antenna Tuning Unit	37.00	(1.00)
FT208R	2M FM Synthesised Handheld	209.00	(—)
FT290R	2M Portable Synthesised Multi-mode	249.00	(—)
FT708R	70cm FM Synthesised Handheld	219.00	(—)
NC7	Base Trickle Charger	26.88	(1.30)
NC8	Base Fast/Trickle Charger	44.10	(1.50)
NC9C	Compact Trickle Charger	8.00	(0.75)
FBA2	Battery Sleeve for use with NC7/8	3.05	(0.50)
FNB2	Spare Battery Pack	17.25	(0.75)
PA3	12V DC Adaptor	13.40	(0.75)
FT480R	2M Synthesised Multimode	379.00	(—)
FT780R	70cm Synthesised Multimode (1.6MHz Shift)	459.00	(—)
FP80	Matching 230V AC Power Supply	63.00	(1.50)

★ AS REVIEWED ★

FT290R 2M Portable Synthesised Multimode **249.00 (—)**

MMB11	Mobile Mounting Bracket	20.70	(1.00)
CSC1	Soft Carrying Case	3.45	(0.75)
NC11C	240V AC Trickle Charger	8.05	(0.75)
FL2010	Matching 10W Linear	64.40	(1.20)
Nicads	2.2 AMP HR Nicads Each	2.50	(—)
FL2100Z	160-10m 1200 Watt Linear	425.00	(5.00)
FF501DX	H.F. Low Pass Filter 1kW	23.00	(0.75)
FSP1	Mobile External Speaker 8 ohm 6W	9.95	(0.75)
YH55	Headphones 8 ohm	10.00	(0.75)
YH77	Lightweight Headphones 8 ohm	10.00	(0.75)
QTR24D	World Clock (Quartz)	28.00	(0.75)
YM24A	Speaker/Mic 207/208/708	16.85	(0.75)
YD148	Stand Microphone Dual IMP 4 Pin Plug	21.00	(1.50)
YM34	As 148 but 8 Pin Plug	21.45	(1.50)
YM38	As 34 but up/down Scan Buttons	24.90	(1.50)
FDK VHF/UHF EQUIPMENT			
Multi 700EX	2M FM Synthesised 25W Mobile	199.00	(—)
Multi 750E	2M Multimode Mobile	289.00	(—)
Expander	70cm Transverter for M750E	219.00	(—)
STANDARD VHF/UHF			
C78	70cm FM Portable	219.00	(—)
CPB78	10W Matching Linear	67.50	(1.50)
C58	2M Multimode Portable	239.00	(—)
CPB58	25W Matching Linear	79.50	(1.50)
CM8	Mobile Bracket	19.95	(1.00)
CL8	Soft Carrying Case	6.95	(0.75)
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WELZ SP400	2M/70	59.00	(0.75)
DAIWA SW110A	H.F/2M	35.00	(—)
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DAIWA CN630	2M/70 Cross Pointers	71.00	(—)
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DL60	PL259 60W MAX	8.80	(0.70)
DL60	N TYPE 60W MAX	16.50	(0.70)
DL600	SO239 600W MAX	29.95	(1.50)
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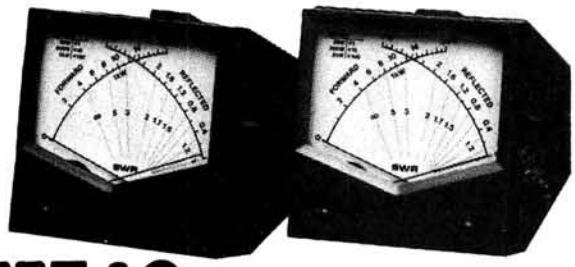
Practical Wireless

FEBRUARY 1982 VOL. 58 NO. 2 ISSUE 899

contents

OUR SPECIAL OFFER THIS MONTH
Timestep DFC4 Frequency Meter Kit
(see page 45)

UHF VHF



CN540
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CN520
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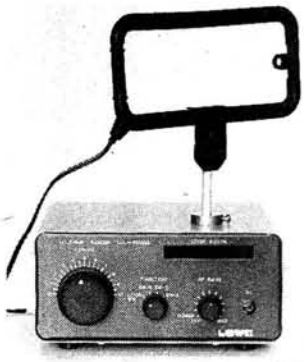

The UL1000 is a new concept in receiving station accessories and will help any keen listener to improve the performance of his station, particularly in the difficult conditions existing in the medium wave band (500KHz-1.6MHz).
The UL1000 is a self-contained variable gain, tuned preamplifier suitable for use with various aerial systems. A particular feature of the UL1000 is the use of a high Q loop aerial for the 500KHz-1.6MHz band.

UL1000
£39.50 inc VAT Carriage £1.50

HONOR
Carriage on meters £1.00
KRT100 £5.75 KRT200 £10.50 KRT500 £19.50

For those of you who enthuse over portable SSB operation on the hills and mountains of the UK, or wish to chat to the local lads whilst seated by your fireside, then the Mizuho SB2X 2 metre SSB portable is the rig for you. One watt output on the SSB frequencies 144.000 to 144.600 and the ability to listen to the beacon frequencies from 144.800 to 145.000 (also transmit).

£165.00 inc VAT Carr £4.50

MIZUHO SB2X

TR9000 The exciting TR9000 2-metre all-mode transceiver combining the convenience of FM with long distance SSB and CW in a very compact, very affordable package. Because of its compactness the TR9000 is ideal for mobile installation, add on its fixed station accessories and it becomes the obvious choice for your shack.

TR 9000
£394.00 inc VAT. Securicor carr £4.50

The TR9500, a 70cm multimode mobile giving SSB, FM and CW operation in a compact rig based on the phenomenally successful 2 metre 9000. Combining the convenience of FM with the "DX ability" of SSB on the 70cm band this is the rig all discerning VHF and UHF amateurs have been waiting for.

TR 9500
£449.88 inc VAT. Securicor carr £4.50

TR7800 Trio's remarkable TR7800 2-metre FM mobile transceiver provides all the features you could desire for maximum operating enjoyment. Frequency selection is easier than ever, and the rig incorporates new memory development for repeater shift, priority, and scan. The TR7800 by Trio, the only FM mobile.

TR 7800
£284.97 inc VAT. Securicor carr £4.50

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TRIO *pacesetter in amateur radio*

HF

We've handled a lot of equipment in our time as radio amateurs but the TS830S really took us by storm. As you will hear if you listen on the air, it's reputation is high all round the world. We think the TS830S is exactly right for the operator who has carefully considered all the features necessary for top performance, put aside all the gimmickry and found the TS830S.

This rig offers you all band coverage; true frequency readout on all modes; variable bandwidth *and* passband tuning; rugged, reliable 6146B valves in the PA; top quality both in construction and design; and, above all, the Trio reputation for giving you the best equipment at a reasonable price. Thousands of happy users worldwide will confirm that if you want total satisfaction, try the TS830S. Send for comprehensive details today.

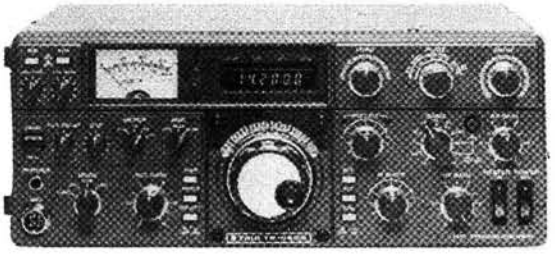
TS 830S

£694.30 inc VAT Securicor Carriage £4.50

A recent addition to the Trio HF range, and proving amazingly popular is the new TS530S. Designed as a "little brother" to the TS830S, the TS530 uses the same PLL system, same RF boards, same readout system and many other features of the 830 but without the variable bandwidth facility. You do, of course, have the famous Trio I.F. shift system for dodging the QRM.

We really believe that the TS530S is the finest mid-price HF base station transceiver on the market and we would like the opportunity to prove it to you. Why not call us, or call in person to see and try out this super rig.

If you like to read lists of features, how about 160-10 metres including new bands: passband tuning on all modes: 6146B PA tubes for low intermod: low power tune up: digital readout shows true frequency at all times: VOX built in: CW sidetone: speech processor: noise blanker: etc. etc.

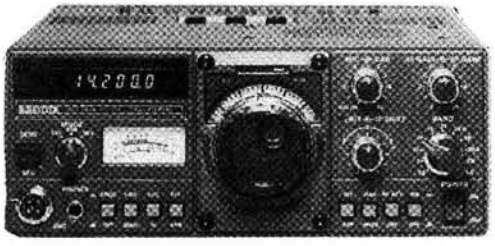


TS 530S

£534.98 inc VAT Securicor Carriage £4.50

For the keen mobile/portable enthusiast, the "no-tune" solid state transceiver has proved irresistible, and the Trio TS130S is probably the best of the bunch. When the original TS120 was introduced, there were gasps of amazement at Trio's achievement in making a first class HF rig in such a small size. With the advent of the TS130S, the mobile rig really comes to maturity. Imagine an 8 band transceiver with digital readout, I.F. shift, vox, speech processor, single conversion PLL derived transmitter and receiver, 100W output, red hot receiver – and all in a package you can carry on the palm of one hand. It's really a staggering thought.

The unquestioned excellence of Trio design and manufacture shows in every aspect of the TS130S – why not see it and try it for yourself.



TS 130S.V

£525.09 inc VAT Securicor Carriage £4.50

The compact DFC230 Digital Frequency Controller provides maximum efficiency and flexibility for mobile and fixed operation by combining a 20Hz step digital VFO with 4 memories. ● 20Hz step digital VFO: ● Four memories: Frequency can be transferred from VFO to memory or from memory to VFO. ● Built-in digital display: Shows digital VFO or memory frequency. ● Perfect for mobile installation. ● UP/DOWN manual scan: Frequency can be shifted with UP/DOWN microphone (supplied with DFC-230) or with FAST STEP switch on front panel. ● Cross-operation switch: Allows split-frequency operation, with transceiver VFO on transmit and DFC-230 (VFO or memory) on receive, or vice-versa. ● RIT (receiver incremental tuning). ● RIT, VFO, and MEMO indicators: LEDs show functions in operation. ● Compatibility with TS-830S, TS-120S/V and TS-130S/V.

DFC 230

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Amazingly small, yet very sensitive. Two VFO's, five memories, priority channel, full duplex and reverse, LED S-meter, 25KHz or 5KHz step tuning, same multi-scanning functions as the 290 from mic or front panel. All in all the best 2M FM mobile ICOM have ever made.

IC290E. 2M Multimode Mobile.

10W RF output on SSB, CW and FM. Standard and non-standard repeater shifts. 5 memories and priority channel. Memory scan and band scan, controlled at front panel or microphone. Two VFO's. LED S-meter. 25KHz and 1KHz on FM – 1KHz and 100KHz tuning steps. Instant rev-repeat.

IC24G. 10W 2M FM Mobile.

This is the low-cost, easy to use economy model. Full bank – 80 channels at 25KHz spacing by easy to use press button switches. 12½KHz spacing if required, and the same reliable performance as the famous IC240. Price £169.

IC202S/402 3W 2M or 70cm. SSB Portables.

These two have been around for a long time and are well proven. SSB, CW and side-tone. They come fitted with 144 – 144.4 (IC202S) and 432 – 432.4 (IC402). Battery or 12v operation. Built-in antenna or socket for external antenna.

IC2E £159 - IC4E £199

– Nearly everybody has an IC2E – the most popular amateur transceiver in the world – now there is the 70 cm. version which is every bit as good and takes the same accessories. Check the features:

Fully Synthesized – Covering 144 – 145.995 in 400 5KHz steps. (430-439.999 4E).

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 (flexible ¼ λ whip – 4E)

Send/Battery Indicator – Lights during transmit but when battery power falls below 6v it does not 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 600KHz transmit (+ 1.6MHz and listen input on 4E).

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.

A full range of accessories in stock.		**£ p**
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BP4	Empty battery case for for 6 x AA cells	**5.80**
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DC1	12 volt adapter pack	**8.40**
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ICI/2/3	cases	**3.60 each**

All prices include VAT

The IC4E is going to revolutionise 70cm!

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ICOM produce the complete HF line-up!

IC730. 100W HF All Band Mobile.

80 – 10M, 8 bands SSB, AM and CW. Two VFO's with 10Hz – 100Hz and 1KHz steps. Memory for each band. Noise blanker, vox, CW monitor, APC and SWR detector. Speech processor and fan. Switchable RF pre-amp and WWV. 13v DC operation or use ICPS15 mains.

IC720A. 100W HF +Gen Coverage Transceiver.

This is the best money can buy. AM, SSB, RTTY and CW. Built-in fan, speech processor, two VFO's and APC. Tuning rates down to 10Hz and memories. General coverage receiver from 100KHz to 30MHz (transmit too if you have a licence!) Run from 13vDC or use PS15 mains PSU.

For the complete station.

Controlled remotely from the ICOM range (or by one switch for other HF rigs):-

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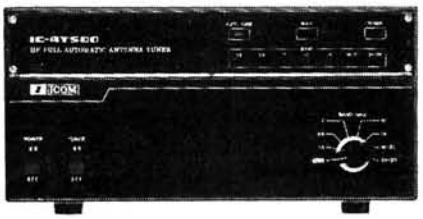
ICAT500.



Automatic ATU which really is automatic and even selects the correct antenna for you! Faster than its competitors. Handles 500W (1Kw PEP) – 100W version is AT-100.

IC251E and IC451 2M and 70cm. All Mode Base Stations.

Both well proven designs with twin VFO's, variable tuning rates and power output, scanners and memory channels, automatic repeater operation with full reverse, 144 – 146 or 430 – 440, low output on FM, SSB and CW, built-in 12 and 240v supplies. None other like them.

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HC900	Intelligent Line Printer 4 Cases +	590.00
HC800	Line Printer Centronics	449.00
SK7	Plug Adaptor For Printers	8.50
	Linears	
2M-50W	40 Watt Linear For 2 Metres	65.00
2M-100W	90 Watt Linear for 2 Metres	115.00
MR-150W	140 Watt Linear For 2 Metres	159.00
MR-250W	210 Watt Linear For 2 Metres	259.00
MR28	100 Watt Linear for 10 Metres	65.00
UC70	50 Watt Linear For 70cms	149.00
	Preamps	
RX-144	Mast Head Preamp For 2 Metres	65.00
RX-430	Mast Head Preamp For 2 Metres	70.00
	SWR/Power	
ASW-180	1.8-160 Mhz	45.80
ASW-430	430 Mhz	49.50
	TASCO TELEREADER Communications	
CWR-685	CW/RTTY Terminal + VDU + Keyboard. Tx & Rx	699.00
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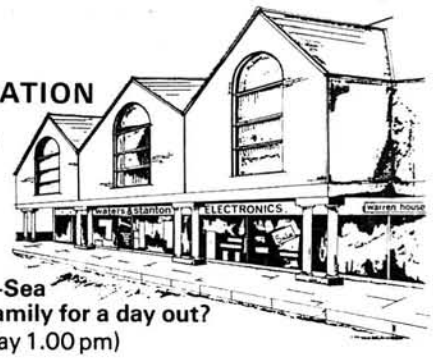

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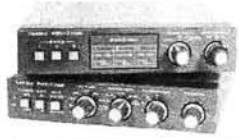

NEW FROM SONY – ICF-2001

The new SONY ICF-2001 is a desk top receiver that covers the World. 150kHz to 30mHz SSB and AM plus FM 76-108mHz. Full digital readout, scanning and memories are included and controlled by a microprocessor. Power requirements are either 230v AC, 12v DC or internal HP2 cells. At present deliveries are slow so please phone for latest information.

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HP4A TV FILTER £5.95

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Trio	AT230 Aerial tuner & power meter	£119.00	(2.00)
Trio	TS530S SSB/CW 100w 230V AC	£534.00	(n/c)
Trio	TS130S SSB/CW 100W 12V DC	£525.00	(n/c)
Trio	TS130V SSB/CW 10W 12V DC	£445.00	(n/c)
Trio	MB100 Mobile mounting for above	£17.00	(1.50)
Trio	PS30 230V PSU for TS130S	£88.50	(5.00)
Yaesu	FT-1 AM, FM, SSB & CW 100W	P.O.A.	(n/c)
Yaesu	FT101ZFM SSB/CW/FM 100W 230V AC	£590.00	(n/c)
Yaesu	FT101ZDFM As above with digital	£645.00	(n/c)
Yaesu	FT902DM AM/FM/SSB/CW 100W 230V AC	£885.00	(n/c)
Yaesu	FL2100Z 160-10M 1.2kw linear	£425.00	(n/c)
Yaesu	FT707 SSB/CW/AM 100W 12V DC	£549.00	(n/c)
Yaesu	FP707 230V AC PSU for above	£125.00	(5.00)

VHF TRANSCEIVERS

Trio	TS770E 2m/70cm 10W 230V AC	£784.00	(n/c)
Trio	TR9000 2m FM/SSB 10W 12V DC	£374.00	(n/c)
Trio	PS20 AC PSU for above	£49.00	(2.50)
Trio	B09 Base plinth for TR9000	£34.95	(1.75)
Trio	TR7730 2m FM 25W 12V DC	£247.00	(n/c)
Trio	TR7800 2m FM 25W 12V DC	£284.00	(n/c)
Trio	TR7850 2m FM 40W 12V DC	£314.00	(n/c)
Trio	TR2300 2m FM 1W Portable	£166.75	(n/c)
Trio	TR2400 2m FM 1W hand-held	£198.00	(n/c)
Trio	TR2500 2m FM 1W hand-held	P.O.A.	(n/c)
Trio	TR8400 70cm FM 10W 12V DC	£334.00	(n/c)
Trio	TR9500 70cm FM/SSB 10W 12V DC	£449.00	(n/c)
Yaesu	FT480R 2m FM/SSB 10W 12V DC	£365.00	(n/c)
Yaesu	FT290R 2m FM/SSB 3W portable	£249.00	(n/c)
Yaesu	FT208 2m FM 2W portable	£209.00	(n/c)
Yaesu	FT708 70cms FM 2W portable	£219.00	(n/c)
FDK	M700EX 2m FM 25W 12V DC	£199.00	(n/c)
FDK	M750E 2m FM/SSB/CW 10W 12V DC	£289.00	(n/c)
FDK	Expander 70cm adaptor for above	£219.00	(n/c)
FDK	PS750 230V AC PSU	£66.00	(2.00)
FDK	T1200 2m FM portable	£179.00	(n/c)
FDK	Palm II 2m FM portable	£109.00	(n/c)
FDK	Palm IV 70CM FM portable	£149.00	(n/c)
Azden	PCS3000 2m FM 25W 12V DC	£219.00	(n/c)
Azden	PCS300 2m FM 3W portable	£184.00	(n/c)
Azden	PCS2800 28mHz FM 10W 12V DC	£179.00	(n/c)

HF RECEIVERS

Trio	R1000 200kHz-30mHz SSB/AM/CW	£297.00	(n/c)
Trio	R600 200kHz-30mHz SSB/AM/CW	P.O.A.	(n/c)
Yaesu	FRG7 500kHz-30mHz SSB/AM/CW	£199.00	(n/c)
Yaesu	FRG7700 200kHz-30mHz SSB/AM/FM/CW	£319.00	(n/c)
Yaesu	FRG7700M As above but with memory	£409.00	(n/c)
Yaesu	FRT7700 Matching a.t.u.	£37.75	(1.50)
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NOTE: above convertars only work with FRG7700 receivers.

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AR22M	Marine version of above	£95.00	(1.50)
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WELZ SP45 140-470MHz 3-20-100W	P.O.A.	
WELZ SP15M 1.8-160MHz 2.5-20-200W	£29.95	(n/c)

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PS125 13.8V 5 amp DC power supply	£29.95	(2.50)
Global PS15 6 amp DC power supply	£32.95	(2.50)
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Deluxe Telegraph morse key (manual)	£10.50	(0.75)
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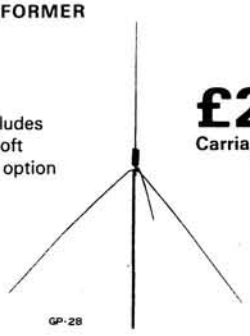

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An swr meter is essential if you want the strongest signals and also protection for your rig. We have seen many models but without doubt we haven't seen anything that will beat the YW-3 for accuracy. Its great value. Order yours today.

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NEW! DATONG "CODE CALL" £29.30 p&p 50p

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INTERNAL SWITCH SETTING MODEL

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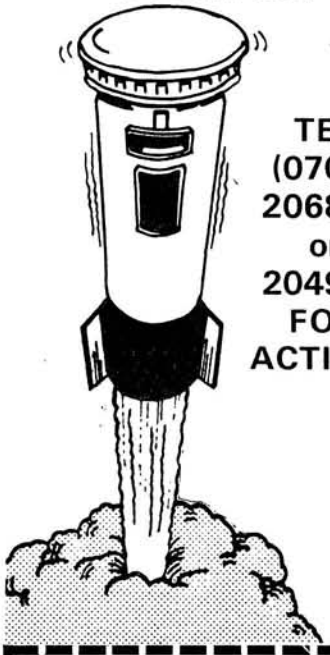

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3 Watts FM
144-146MHz
12½KHz steps

£184

inc battery & charger

Available February

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FDK

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FDK

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★ Priority scanning
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AR8	0.75	EF89	1.05	PC88	0.95	U301	0.85	5Z4G	0.75	6L6G	2.50	20P1	0.85
ARP3	0.70	EF91	1.50	PC97	1.50	U600	11.50	5Z4GT	1.05	6L6GC	2.10	20P3	0.75
ATP4	0.60	EF92	2.90	PC900	1.15	U801	0.90	6/30L2	0.90	6L6GT	1.25	20P4	1.25
B12H	3.90	EF95	0.85	PCC84	0.50	U8C41	1.20	6AB7	0.70	6L7G	0.85	20P5	1.35
CY31	1.40	EF96	0.80	PCC85	0.70	UABC80	0.75	6AC7	1.15	6L18	0.70	25L6GT	0.95
DAF96	0.70	EF183	0.80	PCC89	0.85	UAF42	1.20	6AG5	0.80	6L06	2.95	25Z4G	0.75
DET22	24.95	EF184	0.80	PCC189	1.05	UBF80	0.70	6AH6	1.15	6LD20	0.70	30C15	0.50
DF96	0.70	EF89	1.05	PCF80	0.80	UBF89	0.70	6AL5	0.60	6N6GA	2.70	30C17	0.50
DH76	0.75	EF812	0.75	PCF82	0.70	UBL21	1.75	6AL5W	0.85	6Q7G	1.30	30C18	2.45
DL92	0.60	EFL200	1.85	PCF84	0.75	UCC84	0.85	6AK5	0.65	6SA7	1.00	30F5	1.15
DY86/87	0.85	EH90	0.85	PCF86	1.50	UCC85	0.70	6AK8	0.60	6SG7	1.15	30FL2	1.40
DY802	0.70	EL32	1.10	PCF87	0.50	UCF80	1.30	6AL5	4.20	6SJ7	1.05	30FL12	1.25
E55L	14.90	EL34	1.80	PCF200	1.60	UCH42	1.85	6AM6	1.50	6SK7	0.95	30FL14	2.15
E88CC	1.60		2.90*	PCH200	1.35	UCH81	0.75	6AN8A	2.50	6SL7GT	0.85	30L15	1.10
E88CC/01	3.10	EL37	4.40	PCL81	0.75	UM80	0.90	6AQ4	3.40	6SN7GT	0.80	30L17	1.10
E92CC	1.20	EL81	2.45	PCL82	0.85	UM84	0.70	6AQ5	1.00	6SR7	1.10	30P12	1.15
E180CC	2.80	EL82	0.70	PCL84	0.90	UY82	0.70	6AQ5W	1.80	6SQ7	0.85	30PL13	1.25
E180F	6.30	EL84	0.80	PCL86	1.05	UY85	0.85	6AT6	0.90	6V6G	1.50	30PL14	2.45
E182CC	4.95	EL86	0.95	PCL805/85	1.25	VR105/30	1.25	6AU6	0.60	6V6GT	0.95	35L6GT	1.40
EA76	2.25	EL90	1.00	PD500/510	4.30	VR150/30	1.35	6AV6	0.85	6X4	0.75	35W4	0.80
EABC80	0.80	EL91	4.20	PFL200	1.10	X66	0.95	6AX4GT	1.30	6X4WA	2.10	35Z4GT	0.80
EB91	0.60	EL95	2.80*			X61M	1.70	6AX5GT	1.30	6X5GT	0.80	40KD8	3.15
EBC33	1.15	EL504	1.70	PL36	1.25	XR1–6400A		6BA6	0.55	6Y6G	0.90	50C5	1.15
EBC90	0.90	EL803	5.90	PL81	0.85		82.90	6BW7	0.90	6Z4	0.70	50CD8G	1.35
EBF80	0.80	EL509	2.70	PL82	0.70	Z759	19.00	6C4	0.50	11E2-	19.50	723A/B	11.90
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ECC86	1.70	EY86/87	0.80	PY82	0.85	1T4	0.45	6F7	2.80	12E1	12.85	957	1.05
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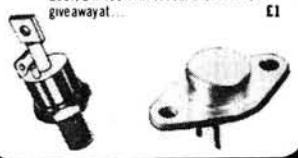

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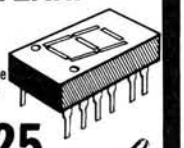

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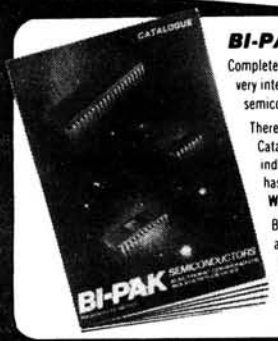

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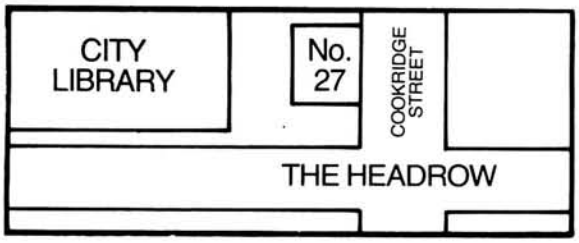

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The Unexpected

IN THE FIRST FEW WEEKS after the legalisation of CB in the United Kingdom, an amazing change has taken place in the pattern of activity on the 27MHz band. Despite the limited number of rigs available so far, the new legal f.m. channels are even busier in the Bournemouth and Poole area than the a.m. band was earlier in 1981, and the a.m. channels are almost deserted. Our spies tell us that the pattern is much the same in London and the other big cities too. I am sure that not even Willie Whitelaw or Timothy Raison in their wildest dreams would have forecast that such a state of affairs would come about so soon. Interference from sideband CB operation, particularly Italian and French, is still a problem during daylight hours, spreading right across the UK f.m. band, though this should soon disappear with the falling sunspot count. It is to be hoped that the Home Office will quickly clamp down on s.s.b. operation here, possibly by the simple expedient of making it illegal to **possess** any unlicensable transmitter.

CB has aroused an interest in many people who have moved on to amateur radio, swelling the clubs, filling the RAE evening classes, and completely overwhelming the Home Office department which deals with amateur licences. The final licence resulting from the May 1981 exam wasn't issued until the end of November, and there were 5000 (yes, 5000) entrants for the December 1981 exam.

While amateur radio clubs have been enjoying a rapid rise in membership, the CB clubs have seemingly been melting away. One south coast group is said to have dropped from a membership of well over a thousand to just one hundred after legalisation.

Quite a few of our readers have queried what *PW*'s coverage of CB will be, now that we have a legal system. Well, we shall be treating it as just another application of radio of interest to the hobbyist, with articles on installation which will also be of help to radio amateurs, plus some rig reviews.

What we shall very definitely not be doing is to devote space to DXing on the CB bands—CB is intended to be a short-range mobile telephone system, not another amateur radio service. Nor shall we be giving coverage to "10-codes", jive talk, truckers' talk, etc. If CB is to be the most use to the most people, plain language is absolutely essential, and the whole system must be easily understood. The *CB Code of Practice*, which you will find on page 62 of this issue, really tells the CBer all he needs to know, and covers several points which are of relevance to amateur radio too.

Geoff Arnold

services

QUERIES

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

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

PROJECT COST

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

CONSTRUCTION RATING

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

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

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

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

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Subscriptions are available to both home and overseas addresses at £13.00 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

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

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

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

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

PRODUCTION LINES

ALAN MARTIN G8ZPW

New Inexpensive d.m.m.

Recently introduced by Centemp is a very competitively priced digital multimeter called the Model 3T.

This d.m.m. provides six functions in 16 ranges which permits measurement of d.c. voltages, a.c. voltages, d.c. current, resistance, diode/continuous check and a transistor h_{FE} measurement facility, all displayed on a 12·5mm high liquid crystal readout.

Function selection is via push-button switches at the side of the instrument which is of robust construction and is claimed to have a long battery life.

Supplied complete with battery, test leads and instruction manual, the Model 3T costs just £49·99 which includes VAT and carriage, and is obtainable from: *Centemp, 62 Curtis Road, Whitton, Hounslow, Middlesex TW4 5PT. Tel: 01-894 2723.*

Antenna Mount

Most amateur radio enthusiasts, at some time, will have experienced difficulty in fixing their base station antenna mount, especially if they live in a flat. The Altron QM1 could help to solve this problem.

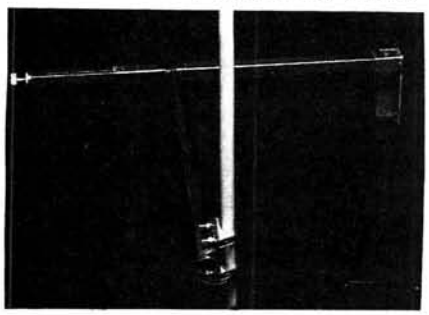
Designed to fit into window apertures, the QM1 antenna mounting system is capable of accommodating small or light antennas such as those for v.h.f., u.h.f., CB or TV.

Installation is simple and fast, requiring no drilling of walls and the unit locks in position, either vertically or horizontally, in most window apertures between 635mm and 1·07m (other sizes are available).

The QM1 is supplied zinc plated for weather protection and with a range of optional accessories provides a versatile mounting system that can be adapted to accommodate a small rotator and even a v.h.f. beam. Further details are available in return for an s.a.e.

Prices for the QM1, which includes VAT, are £27·60 for the standard bright metal finish and £29·60 for the deluxe black finish, plus £1·50 p&p.

The QM1 is obtainable on a cash-with-order basis, from the manufacturer: *Allweld Engineering, Unit 6, 232 Selsdon Road, South Croydon CR2 6PL. Tel: 01-680 2995, 01-681 6734.*



New Trio from Trio

Latest information from Lowe Electronics lists three new pieces of Trio equipment.

First, the TR-2500, a compact 2m f.m. hand-held transceiver which features keyboard channel selection, 10 channel memory with improved memory back up, memory scan, programmable automatic band scan, r.f. power 2·5W (Hi) and 0·3W (Low), plus a variety of new accessories. The photograph shows the TR-2500 installed in the ST-2 base stand/charger which allows the unit to be used whilst the NiCad battery pack is being recharged. Price for the TR-2500 will be in the region of £210.

Second, the R-600, a basic general coverage receiver designed specifically for the newcomer to short wave listening and intended to complement Trio's range of general coverage receivers. Price will be approximately £250.

And last, but by no means least, the TS-780 v.h.f./u.h.f. all-mode dual bander base station.

Among its many features are: frequency ranges 144-146MHz on 2m and 430-440MHz on 70cm, 10 memories including two priority memory positions (9 and 10); comprehensive scanning facility of programmed frequencies or band of frequencies; i.f. shift and r.i.t.; two v.f.o.s allow independent frequency setting within either band which enables efficient cross-band operation. The price is expected to be around £750.

All three of these products should be available in the UK by early January 1982. For further details of price and availability contact: *Lowe Electronics Ltd., Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817 or 2430.*

▲The R-600

◀The TR-2500

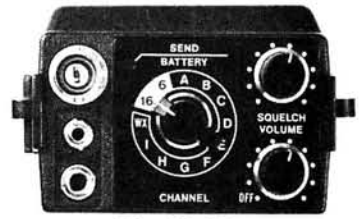
▼The TS-780

IC-2E Offsprings

Thanet Electronics has recently introduced two new Icom hand-held transceivers, whose design is based on the very popular IC-2E.

First, the IC-4E, a 70cm f.m. transceiver which possesses the following features: frequency range 430 to 439·995MHz; receiver sensitivity 0·5μV (0·3μV); transmitter output power 1·5W (2·3W) on the BP3 battery pack (as supplied) to 2·3W (3·3W) on the BP5 (high-power) battery pack; repeater shift +1·6MHz; tone burst (via push switch on volume control) 1750Hz ±0·1Hz; and finally a very useful new feature is the switch selectable "listen-input" facility which allows the repeater input to be monitored by lifting the receiver input by 1·6MHz. The figures shown in brackets are test results obtained, by Thanet Electronics, from their demonstration model.

The IC-4E



The IC-M12

The second new transceiver is the IC-M12, probably the first synthesised hand-held marine band transceiver, which has 12 channels (pre-programmable to the customer's choice), semi-duplex operation, which is automatic, and r.f. output power of 1W.

Many of the optional accessories for the IC-2E are suitable for use with these transceivers, excepting those which are frequency sensitive.

The VAT and p&p inclusive price of the IC-4E is £199 and it is expected the price of the IC-M12 will be about the same.

By the time this issue of *Practical Wireless* is published, these transceivers will be obtainable from: *Thanet Electronics Ltd., 143 Reculver Road, Beltinge, Herne Bay, Kent CT6 6PL. Tel: (02273) 63859.*

Power Supplies

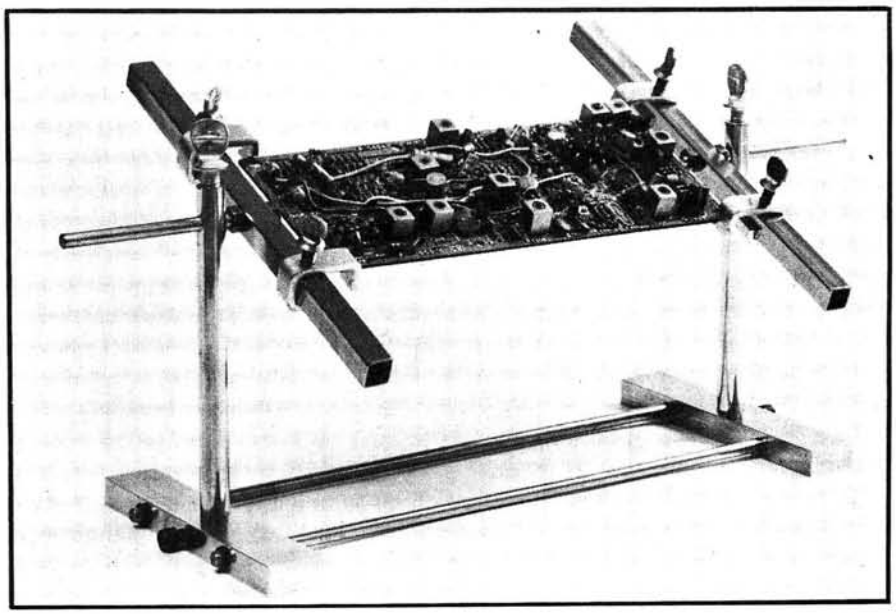
Yorkshire-based Fisher Karpark Industries Ltd., one of the UK's leading auto accessory and transformer manufacturers, has launched two new mains-operated power supply units, called CB Radio Powerpaks.

Both units provide a regulated 13·8V d.c. with a ripple factor of less than 50mV r.m.s. at their respective continuous rating.

The smaller model is designed to deliver 3A continuously and accommodate short surges of up to 5A; the larger unit delivers 6A continuously and 8A at peak. Both units feature electronic short-circuit and overload protection. Prices are 3-5A model £15.90 and 6-8A model £20.45.

Both F.K.I. Powerpaks carry a 12 month guarantee and are available from Halfords or most CB shops.

Fisher Karpark Industries Ltd., Gratix Works, Gratix Lane, Sowerby Bridge, West Yorkshire HX6 2PH. Tel: (0422) 33533.



PCB Holders

Two new p.c.b. holders have recently been announced by their British manufacturers, Carlton Nichol & Co. Ltd. Both are constructed of aluminium and plated steel, and allow easy rotation of p.c.b.s through 360° with positive locking at any angle.

First, the CNC 6 will accommodate p.c.b.s measuring up to 254 x 178mm which are held in the frame by spring-loaded clips. The larger CNC 9 will accept p.c.b.s up to 203 x 203mm and these are held in position by sliding vee clamps. The clamps locate on the very edges of the board thus avoiding the risk of face damage to the p.c.b.

An anti-static foam pad is also available as an optional extra. The pad, which is on a backing plate, clips on to the rotating arms of the p.c.b. holder.

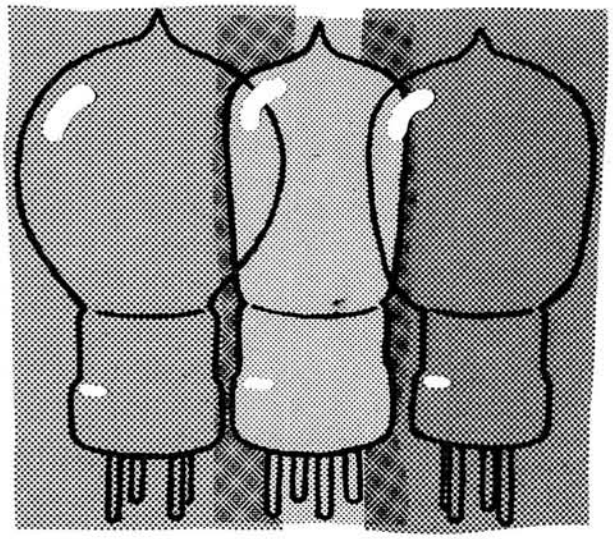
A larger version of the CNC 9 will shortly be available and this will accommodate double-Euro size boards.

The VAT inclusive prices for these products are: CNC 6 £13·80, CNC 9 £15·95 and the anti-static foam pad (203 x 203mm) £9·20 plus £1·50 p&p.

The holders are available direct from: *Carlton Nichol & Co. Ltd., Goldkey Industrial Estate, Kelvedon, Essex.*

If you please

Please mention "Production Lines", when applying to manufacturers or suppliers featured on these pages.



Valves used in the early days

G. JESSOP G6JP

In the early days of wireless it was necessary to buy a receiving licence for even the simplest of receivers. If you wanted to conduct transmitting experiments you had to apply to the Post Office for an experimental licence. You had to detail the experiments you wanted to carry out, if they were not satisfied then the licence would not be granted.

It was at the outbreak of the First World War that these licences were revoked, and there was a considerable delay before experimental licences were then restored. Even then the licences for receiving apparatus included the following restriction. "Thermionic valves shall not be used without special permission from the Post-Master General." As a result of pressure by the Wireless Society of London and its affiliated societies, the Post Office introduced a new Wireless Telegraphy Bill for the approval of Parliament, and experimental licences became available in the spring of 1920.

British experimenters were therefore about 18 months behind the Americans. The British had not been idle, they had been busy getting to know something of the new devices, the thermionic triode, so that they could introduce them into their equipment, replacing the spark transmitters and crystal receivers.

During the war very substantial developments in the production of valves had been made so that as soon as the experimenters were permitted to use them there was a considerable supply both from war surplus and also new production.

Bright Emitter Types

All the valves were fundamentally of elementary electrode construction and there were both "soft" and "hard" versions of receiving types available, the "soft" valve being gas filled and the "hard" valve being devoid of all gas. The "soft" valve had been favoured by both the Navy and the Air Force for detector purposes on account of its considerably higher sensitivity than the "hard" type; however, critical adjustment of its operating conditions eventually caused it to be discontinued.

The basic valve which was to be used in quantity by the experimenters was the "R" type. This was generally similar to the valve developed by the French Telegraphie Militaire known as "TM" type, and was made by all the existing manufacturers: Osram-Robertson Lamp Works, Z Electric Lamp Co., Edison-Swan Electric Co., British Thomson-Houston Co.

The electrode system had a cylindrical electrode mounted at right angles to the pinch (seal), which only had the minimum of electrode support wires. The filament used was a single straight wire of pure tungsten. Commercially, some of the makers used different types of references for the same model of valve.

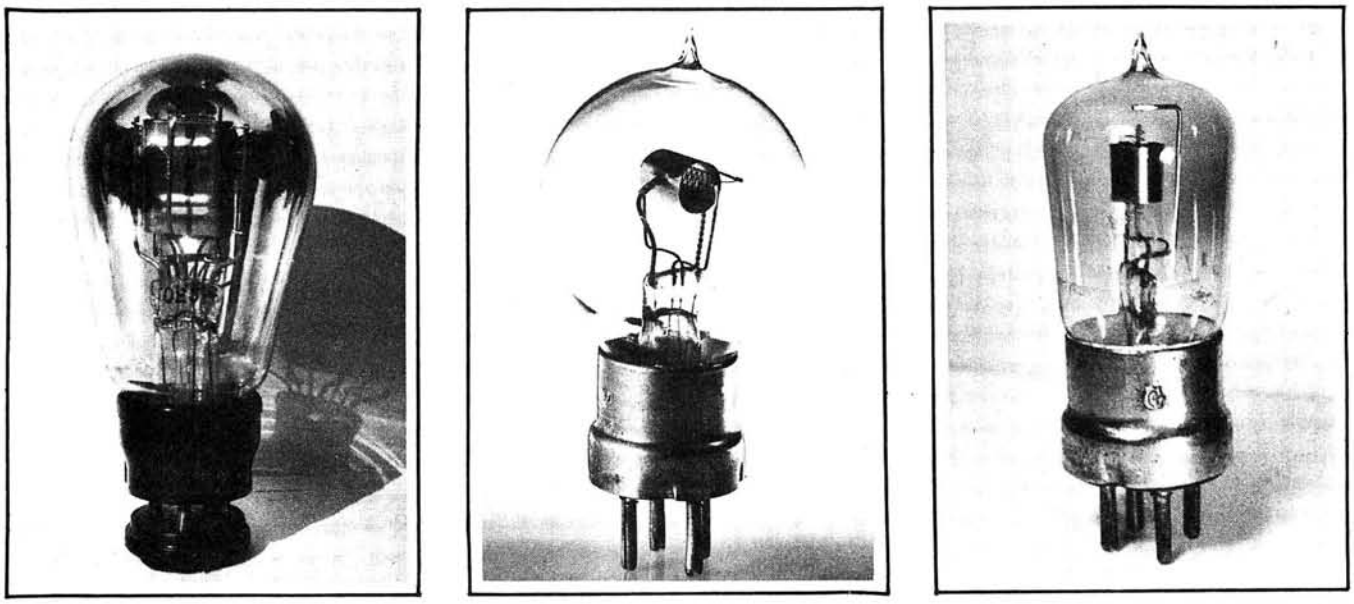
Although the "R" valve was initially used both for transmission and reception, both by the services and later experimenters, there were a number of variants of the basic type for transmission purposes. In these, higher power was needed and for this a larger filament was used. To get this within the electrode system the filament was either crimped or coiled, with such type references as "B", "B2", "A" or "T15" given to these variants.

All these valves were substantially of similar characteristics, having an amplification factor (M) of around 9, anode impedance (R) of 30kΩ and a "slope" (M/R) mutual conductance of about 0·3mA/V. With this low slope it was often found that oscillation over a wide band could not be maintained. It should be remembered that at this time wavelengths of 440m (685kHz) and 1000m (300kHz) or more were being used and this together with an interest in short waves such as 200m (1494kHz) led to a good deal of circuit experimentation. Probably the most notable change was the use of a separately tuned aerial circuit in place of the then customary direct connection of the aerial to the oscillatory (anode and grid) circuit, often with the valves' h.t. voltage on the aerial.

The same type of valves had to be used in all stages of the receiving equipment—for high frequency amplifiers, detectors and low frequency amplifiers. In the h.f. amplifiers one of the most often used circuits was resistance capacity coupling or aperiodic (untuned) transformers which were often wound with resistance wire to reduce any tendency to self-oscillate.

In the detector (rectifier) stage, the most important item was the high resistance grid leak, which in the early days had to be home-made. It was often made adjustable using anything from wet cotton in an electrolyte to a pencil lead track on a suitable bobbin with a roller or sliding contact.

In low frequency stages, these were almost always transformer coupled, although resistance capacity couplings were soon adopted, often being claimed to be less



Three examples of early valves each with its very distinctive shape, all of these and many others are in the author's own collection

noisy! Because of the low gain obtained with these low slope valves, there was a tendency to use multiple stages if you could afford the cost of valves and components.

In addition to the generic "R" type there was a radically different design produced by Osram for Captain H. J. Round (Marconi Co.); this was the low capacity tubular type "V24". Characteristically the "V24" was similar to the "R" valve, but a different type was developed for rectifier purposes. This had a high amplification factor (50) and was known as the "Q", which had a grid mesh; the "QX" variation followed shortly after with a close pitch wound grid. Both of these valves were intended to operate effectively without a grid leak as anode or bottom bend rectifiers.

Another type which was developed by Captain Mullard had a small vertically mounted electrode system which was fitted into a special cap known as "Acorn". This, the 53, had the anode and grid contacts at the side and one of the filament contacts at the bottom, the other filament connection was a small piece of metal connected by copper tape to the base, the metal cap being cemented to the top pip of the bulb. Larger versions of these valves were known as "C" and "D" (soft versions) and commercially as ORA "B".

This design may have had the apparent advantages proposed by the "V24"; they were in practice rather unsatisfactory owing to poor insulation of the acorn cap material. In addition to this they did not possess the low capacity feature of the "V24".

A newcomer to the valve producers, "Cossor", produced a valve "P1" of very different electrode structure. In this the filament was arranged as part of a loop enclosed by a grid, formed into an inverted mesh basket which was enclosed by a hood type anode.

All these valves having bright emitter filaments (pure tungsten), in order to obtain adequate emission, had to be operated at or near their maximum rated voltage. Most filament supplies were at this time obtained from accumulators, which in a fully charged state were higher than the nominal 2V per cell, and the valves were rated with odd voltages, making it necessary to provide some means of setting the voltage to the rated value. Also because valves varied slightly, in multi-valve sets it was necessary to provide individual adjustable resistances (rheostats).

The life of such filaments was limited, and there was some advantage in reducing the operating temperature to the lowest possible consistent with adequate performance, if for no other reason than to prolong the life as much as possible.

As mentioned earlier the stage gain obtainable using these valves was quite small, but it soon became apparent that when reaction was applied, if critically adjusted, a detector's sensitivity was vastly increased. This method of improving a receiver's performance soon became standard practice. Sometimes the reactance was applied from the detector to the aerial circuit even when there were several h.f. amplifiers between the aerial circuit and the detector.

Usually, when reaction was applied to the aerial circuit there was some radiation from the aerial, which caused considerable interference. Some experimenters used to key their receivers by use of a finger being applied to the aerial connection for short distance contacts (several miles).

So far the valves mentioned have largely referred to those used for receivers; however, there were power valves for transmitters. By the end of 1919 triodes of anode dissipation of more than 500W were available. These were also all bright emitter filaments and of a miscellany of filament voltages. Probably the most popular with the transmitting experimenters were the Marconi Osram "T50", "T100", "T1" or "T250", or the Mullard "0/50", "0/150" and "0/250". In service considerable operational experience was gathered by the makers, from their use at decreasing wavelengths by the experimenters, thus enabling them to introduce improvements into the valve structures.

All the early Mullard transmitting valves were distinguished from the Marconi Osram types by the relatively large extension tubes at the top and bottom of the bulb. One of these was the exhaust tube, the lower was the filament seal. This practice was subsequently dropped and the more usual seal off made at the side of the bulb. These transmitting types were of course of relatively high impedance for use with anode voltages between 1500V and 5000V. Their cost was quite high and they were only used in the early days by those of substantial income.

The usual circuit used at this period was in the main a single valve self-oscillator for c.w. operation. Modulation was either some form of variable grid-leak provided by a valve, an absorber valve connected to the aerial circuit, or

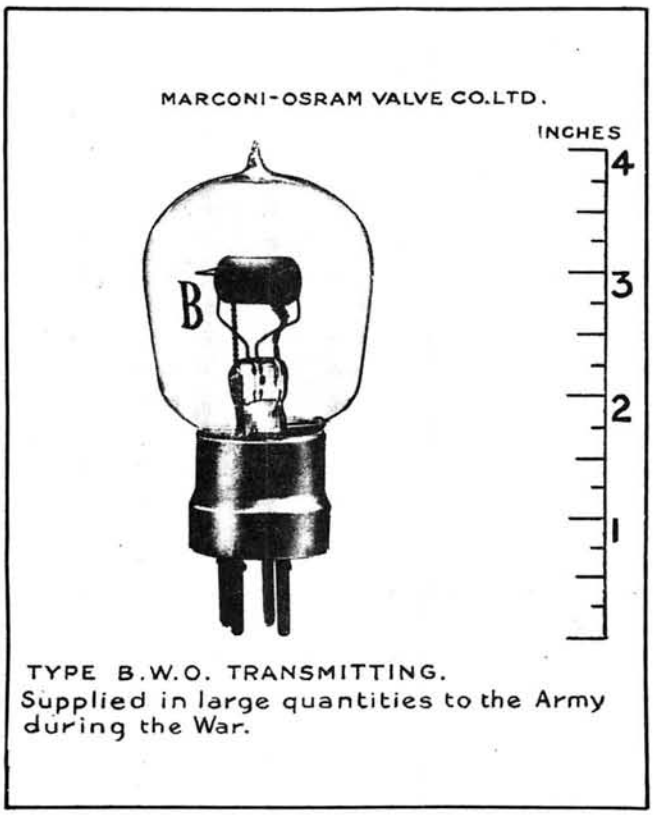
in the so called choke control method, where the oscillator and the modulator were connected together with an iron cored choke in series with the h.t. supply.

In some more elaborate transmitters a second r.f. valve was used; this was an oscillator to drive an amplifier usually of a larger power size. The main problem was the prevention of self-oscillation in the amplifier, neutralisation was not developed until some years later.

Dull Emitter Types

The first major step forward in higher efficiency occurred when filaments were made of thoriated tungsten, which only required a quarter or less of the power needed by the earlier types, though the other characteristics were very similar. Many new types appeared at fairly regular intervals from most of the makers, though they were mainly intended for the entertainment market (broadcast receivers). There were a few "power" valves intended for the output stage of these receivers, which because of their improved characteristics, especially lower impedance, attracted the experimenters for use in their transmitters. Perhaps the best of these were the "B4", "DE5" and "LS5". All of these had a slope of around three times that of the old "R" type. They all had filaments of some form of "V" shape in place of the earlier single wire, they also had a flat oval shaped grid and a correspondingly larger anode.

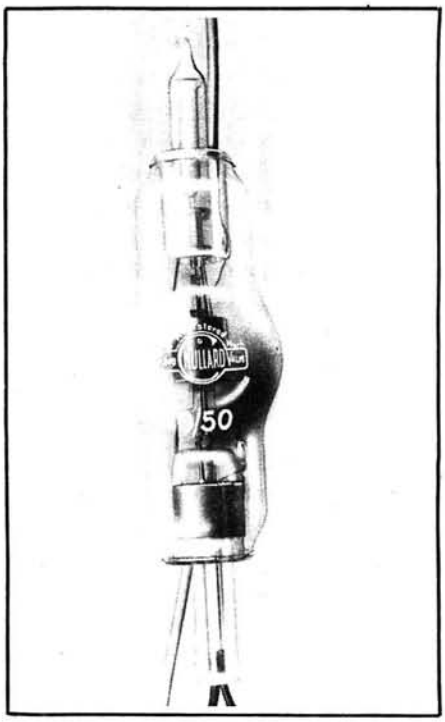
Of these types the "LS5" was probably used by a larger number of operators than any other type. Although its characteristics were similar to the others, it had a higher anode rating, both in power and maximum voltage. Apart from its use as indicated, it was adopted by the Post Office for telephone repeater service, where it was known as "VT25".



An early Marconi-Osram Valve Co. transmitting valve

(Marconi Co.)

Mullard 0/50 valve showing the two extension tubes at the ends of the glass envelope



(Mullard Ltd)

This valve was eventually made in three different impedances with corresponding amplification factors. The high impedance type was the "LS5B" intended for use in resistance capacity coupled low frequency amplifiers. The low impedance type "LS5A" was intended for low frequency output stages to drive large loudspeakers of the moving coil type. Later, yet another version appeared known as the "LS5D" and was similar to the "LS5", but

Dull Emitters

Company	Type No.	Volts	Amps	M	R	M/R
BTH	B4	6·0	0·25	6	7kΩ	0·86
BTH	B5	2·8	0·06	7·5	20kΩ	0·375
BTH	B6	3·0	0·12	7·5	10kΩ	0·75
Ediswan	R	4·0	0·75	8	25kΩ	0·324
Ediswan	AR	4·0	0·65	5·5	22kΩ	0·4
Ediswan	ARDE	1·8	0·3	10	25kΩ	0·4
Ediswan	ARO6	2·7	0·06	13	45kΩ	0·29
Mullard	DO6LF	2·2	0·06	7	25kΩ	0·28
Mullard	DO6HF	2·2	0·06	20	55kΩ	0·36
Mullard	D3HF	1·8	0·35	10·5	40kΩ	0·26
Mullard	D3LF	1·8	0·35	6	15kΩ	0·4
Mullard	DFORA	2·6	0·07	4·5	17kΩ	0·225
Osram	DER	1·8	0·37	8	25kΩ	0·32
Osram	DE3	2·8	0·06	6	17·5kΩ	0·34
Osram	DE5	5·0	0·25	7	8kΩ	0·875
Osram	DE5B	5·0	0·25	20	26kΩ	0·77
Osram	DE6	1·8	0·4	5	13kΩ	0·385
Osram	LS5	5·0	0·8	5	6·5kΩ	0·77
Osram	DEV	2·75	0·2	6	22kΩ	0·27
Radion	Az	3·5/4	0·25	5·5	42·5kΩ	0·129
Radion	D4	3·5/4	0·25	11·5	55kΩ	0·21

continued on page 36▶▶▶

MODS

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

Roger Hall G8TNT(Sam)

No. 13

In Mods 12, memory back-up and semi-reverse repeater details were given for the Trio TR-9000. This month continues with further mods for this popular 2m multi-mode rig.

Memory Scan

I said last month there are some mods that are recommended only for the very experienced constructor.

The same is true of this next mod from Kris G8AUU, who is probably better known as the co-author of the *International v.h.f. f.m. Guide*. Kris has noticed that several of the Trio rigs use the same microprocessor even though they don't all make use of the same functions, and he has suggested taking a closer look at the µPD 650C inside the TR-9000. This is the same chip that is used in several other sets and they have memory scan on them. It is then reasonable to assume that this chip can be persuaded to scan the memories of the TR-9000 and if we look at Fig. 5 we can see how easily this can be achieved.

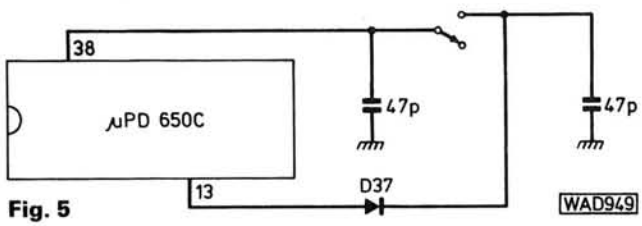


Fig. 5

Merely connecting a diode (almost anything will do) between pins 13 and 38 on the chip will start it scanning. The interconnecting lines should be decoupled, as in the diagram, and the switch can be mounted anywhere you like. You may even be able to use a couple of the pins inside the microphone socket, if you don't mind losing the Up/Down scan facility.

Extending the Frequency Range

The last of this month's mods deals with extending the frequency range. Mr J. R. Walker sent in a very descriptive letter which detailed the procedure for doing this. He suggests moving a diode (D32) and running two new wires and his idea works perfectly, but Kris G8AUU has improved on the original idea.

When rigs are made in Japan, the manufacturer knows that he has to sell his product all over the world and the trend now is for them to make sets that will work anywhere in the world with only one or two small mods needed to adjust the band edges and channel spacing. The Trio TR-9000 conforms to this pattern and the two key components are D31 and D32.

There are four basic markets for 2 metre amateur equipment and as you can see from Table 1, the TR-9000 can be made to work in any of them by just altering the two diodes. Mr Walker suggested moving the diode in position D31 to position D32 and this would indeed give us an extended frequency range *but* it would also give us channel spacings of 10 and 5kHz. This may suit some people but I far prefer 25kHz spacing when I'm operating mobile and I find it inconvenient to have to keep spinning the dial on a rig that has 5kHz spacing. Kris has solved the problem very simply and in the process he has made the TR-9000 into a rig that will work anywhere in the world, with any of the band edges coupled with any of the channel spacings and all for the price of a switch and two resistors.

Table 1

Zone	Diodes	Band Limits	Channel Spacings	
Japan	None	144·000–145·999	20	10
USA	D31	143·800–148·995	10	5
Europe	D32	144·000–145·9875	25	12½
Aus/NZ	D31+D32	144·000–147·995	25	5

First of all remove all the knobs and the microphone socket threaded ring from the front panel. Then remove the top and bottom covers and the four screws holding the front panel, which can now be carefully pulled forward enough to allow the l.e.d.s to be disconnected. Remove the two screws on each side to allow the front chassis to drop forward and then it should be possible to remove the multiway connectors from the MPU board. In the middle of this board is D32 and you should now lift the anode end of this diode.

You will need an s.p.d.t. switch (RS No. 316-973 is suitable) and this should be mounted anywhere you like on the set. Mine is on the back panel because there is a space for another hole there, but the position is not important.

Now run a wire from the anode of D32 to the common tag on the switch, then run two more wires from the other two tags back to the p.c.b. and solder them to the anode pads for D32 and D31. These are printed on the board and you will be able to see where the anodes would go if the diodes were there (see Fig. 6).

Two 470 ohm resistors should now be soldered to pins 17 and 18 on Q15 on the control board (X53-1160-61) and then two wires should then be soldered onto the free ends of these resistors. The other ends of these wires can then be soldered to pins 14 and 15 of Q15 on the p.l.l. board. The resistors should be properly sleeved and then they can be allowed to lie on the top of the chip.

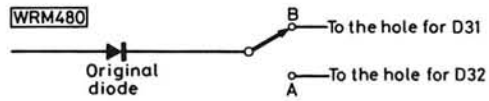


Fig. 6

The mod is now complete but it still needs to be explained. We must first differentiate between powering-up the set and turning it on. To power up something is to apply power to the power input socket, whereas turning something on means rotating the On/Off switch.

continued on page 57▶▶▶

air test

USER REPORTS ON SETS AND SUNDRIES

SOTA COMMUNICATION SYSTEMS SCL 144PS Linear Amplifier

Introduced to their expanding range of amateur radio equipment during last year, the Sota SCL 144PS is a very well constructed, mains powered 2m linear amplifier.

When provided with an input r.f. drive level of 10W the amplifier will deliver 100W from its single SD 1416, high gain r.f. power device.

To complement this 10dB TX gain, a switchable receiver pre-amplifier is included within the package. The p.c.b. mounted pre-amplifier features a U310 low noise and wide dynamic range f.e.t., providing a realistic 12dB gain figure and respectable associated 1·5dB noise factor. Pre-amplifiers that achieve a greater gain are realisable, but with currently available receiver front-end stages, apart from a "psychological" "S" Meter boost, the degradation in strong signal handling and reduction in spurious-free dynamic range incurred, make the exercise non-viable.

Power for the amplifier is obtained from a conservatively rated, compact mains p.s.u., featuring an ILP toroidal transformer and 25A full wave bridge rectifier, series regulated by three TIP 3055 power transistors. All the active components of the p.s.u. are mounted on a large, 200 x 130 x 25mm, black anodised finned heatsink, which forms one of the end cheeks of the housing. Heatsink fins are configured vertically to provide maximum thermal efficiency.

Due to the efficient layout of the r.f. amplifier and p.s.u. stages a resulting compact, 250 x 140 x 205mm, overall size is obtained. All operating controls are mounted on the grey stove enamelled aluminium front panel and comprise a large mains rocker switch and three small toggle switches for selection of p.a., pre-amp and f.m./s.s.b. operation options. The latter switch selects the "hang" time constant appropriate for the operating mode.

A phono type socket is provided on the rear apron to allow direct p.t.t. line over-ride, "hard" switching, if required, supplementing the alternative r.f. VOX operation. In the mains off condition the amplifier reverts to straight-through bypass operation. LED indicators, adjacent to the front panel

toggle switches, are provided to display the selected operating pattern.

Additional rear apron features include INPUT/OUTPUT SO 239 u.h.f. sockets and a 15A fuse receptacle, providing protection on the d.c. supply line.

Operation

The SCL 144PS has been extensively tested over a period of six months, during which time it has constantly performed, on demand, without any discernible problems.

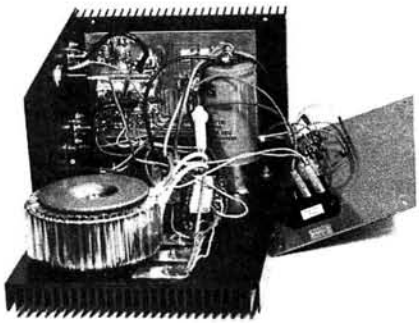
It should go without saying that any amplifier device that has survived without incident the rigours of a 24-hour outing during v.h.f. National Field Day must have a lot going for it! Judging from the reports received by members of the Bournemouth Radio Society, during and after the event, all were well pleased. The reviewer was able to observe "on air" signal performance first hand on this occasion, being located within 15 miles of the NFD site and beaming head-on. A very clean, spurious-free, linear signal was received from the contest station exhibiting none of the splatter effects occasionally encountered as a result of the search for the last drop of drive.

During subsequent operations from the home QTH in Poole, the SCL 144PS has been used in conjunction with several current 2m transceivers, including the Trio 7800, Yaesu FT-290R and Icom 202-S. In all cases a very useful increase in range capability was obtained, the lower powered rigs producing a proportionally reduced output.

With rigs such as the Trio 7800, which are able to provide well in excess of the normal input requirements of the amplifier, an attenuator must be fitted. In this event Sota are able to provide this facility, once furnished with relevant details of the driving rig.

Whilst the r.f. power transistor used in the SCL 144PS is extremely rugged and reliable, normal precautions should be taken to avoid operation into open or short circuit loads, or high v.s.w.r. conditions.

John M. Fell



Our thanks for the extended loan of the review sample go to Mr. Ian Barton of: **Sota Communication Systems Ltd., 24–26 Childwall Lane, Bowring Park, Liverpool L14 6TX. Tel: 051-480 5770.**

The current VAT inclusive price of the SCL 144PS linear amplifier is £172.50 and it is available direct from the above address.

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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 the phono 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 phono socket, fuseholder and power lead. The unit is supplied complete with all necessary connectors.

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- ★ STRAIGHT THROUGH OPERATION WHEN TURNED OFF
- ★ ULTRA-LOW NOISE RECEIVE PREAMP – FRONT PANEL SELECTABLE
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- ★ SUPPLIED WITH ALL CONNECTORS

SPECIFICATION

Power output:	100 watts (within 0·5dB) typical
Power input:	10 watts nominal
Power requirements:	13·8 volts @ 12 amps for 100 watts output
Overall preamp power gain:	12dB
Overall preamp noise figure	Better than 1·5dB
RF connectors:	S0239
Weight:	1·5Kg (3lb 5oz)
Overall size:	265 × 117 × 54mm ($10\frac{7}{16} \times 4\frac{5}{8} \times 2\frac{1}{8}$in)

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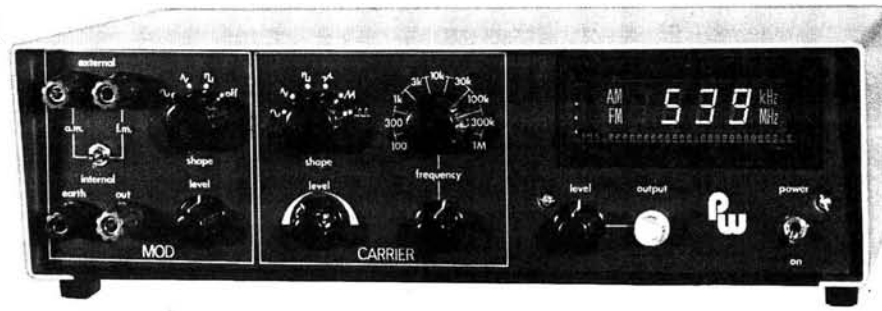
MODULATED WAVEFORM GENERATOR

Geoff ARNOLD G3GSR



Though many home constructors like to design and build their circuits from transistors, resistors and capacitors, others take advantage of the wide variety of "building blocks" available to them. These building blocks are often just integrated circuits, though some of these are extremely complex in themselves, but more and more sub-assembly kits or modules are offered to the enthusiast, giving him the chance to put together a complex unit quickly and easily. That unit can generally be modified or adapted to do the particular job that the constructor has in mind.

The *PW* Modulated Waveform Generator is a unit based on this sort of approach, though as presented here it has not started on its process of development or adaptation. The data sheets which come with the two kits used give many ideas for other functions. The rest is up to you.

Modulated waveform generators or function generators—sources of sine, square or triangular waveforms, etc., are fairly common animals nowadays, giving outputs well up into the lower radio frequency bands. Many of them can be frequency modulated or swept, but so far as I know, the only reasonably priced generator i.c. providing amplitude modulation (including suppressed carrier d.s.b.) by means of an on-chip balanced modulator is the Exar XR-205.

The XR-205 comes in a 16-pin dual-in-line package and has three separate circuit sections: a voltage-controlled oscillator (v.c.o.) which generates the basic periodic waveforms; a balanced modulator which provides amplitude or phase modulation; and a buffer amplifier section with a low-impedence output (typically 50Ω) and high current drive capability of around ±10mA peak-to-peak. The system block diagram and pin-outs of the XR-205 are shown in Fig. 1.

The combination of v.c.o. and balanced modulator can provide sine, triangle, square, sawtooth, ramp and pulse waveforms; double-sideband amplitude modulation, including suppressed carrier modulation; frequency modulation; sweep generation; tone-burst generation; simultaneous a.m./f.m.; frequency-shift keyed (f.s.k.) signal generation; phase-shift keyed (p.s.k.) signal generation; on/off keyed oscillation. Power supply requirements are either a single +12V rail or balanced ±12V rails.

By using two XR-205 i.c.s, one to provide the carrier signal and the other the modulation, a versatile, easily-assembled signal source for testing purposes, or for generating demonstration waveforms for use in classrooms or lecture theatres, is produced.

Generator Circuit

The circuit diagram of the *PW* Modulated Waveform Generator, based on the XR-205K kit, of which more later, is shown in Fig. 2. The modulation generator, IC1, can provide sine, square or triangular wave outputs, as selected by S3, at a fixed frequency of about 1·2kHz. This could be made variable if required. The output of IC1 is available at front-panel terminals for external use, with a peak-to-peak amplitude of about 2·6V (sine), 2·1V (triangle) or 1V (square). It is also fed via S4, which selects internal a.m. or f.m., to IC2. The a.m. input is applied via pin 3 to the balanced modulator, whilst the f.m. input is applied to the v.c.o. via pin 13, where it is superimposed on the standing voltage from the wiper of R31, the CARRIER FREQUENCY control. External a.m. and f.m. can

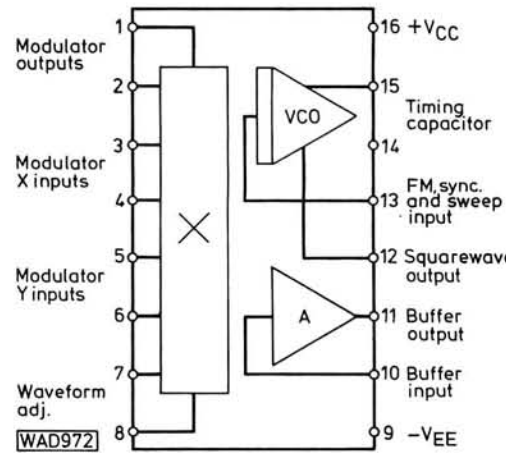


Fig. 1: XR-205 system block diagram and pin-outs

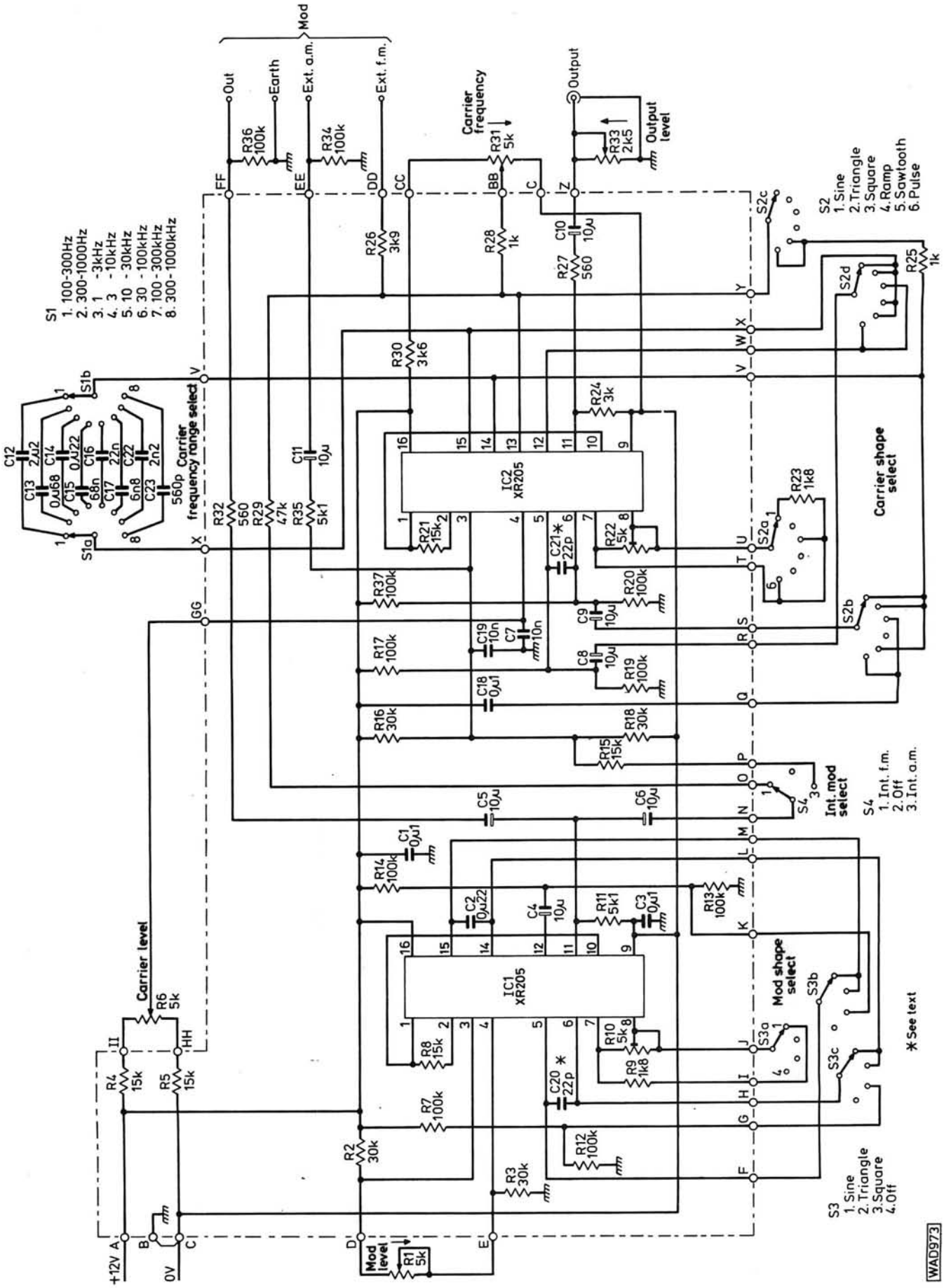


Fig. 2: Circuit diagram of the modulated waveform generator, less power supply

also be applied via front panel terminals, so that simultaneous a.m. and f.m. can be imposed on the output waveform. The output level from IC1 is set by R1, the MOD LEVEL control.

The carrier signal is generated by IC2, providing sine, triangle, square, ramp, sawtooth or pulse waveforms, as set by S2, the CARRIER SHAPE switch. The carrier frequency range is selected by S1 in a 1—3—10 sequence from 100Hz to 1MHz (nominal). In fact, at least 10 per cent overlap is provided at either end of each range, and the overall span (depending upon component tolerances) will be about 70Hz to 1·15MHz.

The CARRIER LEVEL control, R6, applies a bias voltage to one input of the balanced modulator (pin 4) of IC2. When R6 is set to approximately mid-position, the carrier will be suppressed (specified as typically −52dB at the null point for frequencies below 1MHz), allowing double-sideband, suppressed carrier (d.s.b.s.c.) amplitude-modulated signals to be produced. Carrier will be produced with increasing amplitude as R6 is turned to either side of the null, with the sawtooth, ramp and pulse outputs having a polarity dependent on which way the control is moved.

For simplicity, a single-rail power supply configuration was used, based on a 12 volt 3-terminal regulator i.c. The circuit is shown in Fig. 3. The measured current requirement of the completed waveform generator board is around 30mA maximum, and so a 100mA rated supply would be more than adequate. However, in looking at the prices of the necessary mains transformer, rectifier bridge, reservoir capacitor and regulator chip, it seemed worth while to spend a little extra and build in a power supply with a reserve of capacity which could be used to drive other circuits needing a 12V d.c. stabilised supply, providing they did not mind the negative rail being earthed. Therefore, a 1A supply was included, available to the outside world via terminals on the back panel. The regulator i.c. is foldback-protected against overload, so there is no danger to it from external short-circuits, and no point in putting a fuse in the line to the back panel terminals.

Frequency Readout

Although not an essential part of the waveform generator, we decided that it would be useful to demonstrate one application of our Special Offer this month (see page 45), by building in a digital frequency readout. The Timestep DFC4 has two limitations which affect its use in this particular project; these are its 1kHz resolution and its lower frequency limit of 10kHz, but it has still proved very useful. The Timestep data sheet suggests improving the audio frequency performance by the use of an external clock oscillator with dividers, instead of the on-chip crystal oscillator, but this has not been tried.

The alternative to using a digital frequency readout would be to calibrate the CARRIER FREQUENCY control, R31, although this would probably require some juggling of the values of capacitors associated with the CARRIER FREQUENCY RANGE switch, S1, to make the scales coincide, unless panel space could be found for a separate scale for each range.

Circuit diagram information for the DFC4 comes with the kit, but Fig. 4 shows the power supply circuitry, and Fig. 7 the p.c.b. external connections. The DFC4 incorporates a bright blue-green phosphorescent $3\frac{1}{2}$-digit readout, and requires +12V, −9V and 3V a.c. supplies. It is therefore not possible to run it from the same supply as the waveform generator board, and in any case the kit includes its own power supply components.

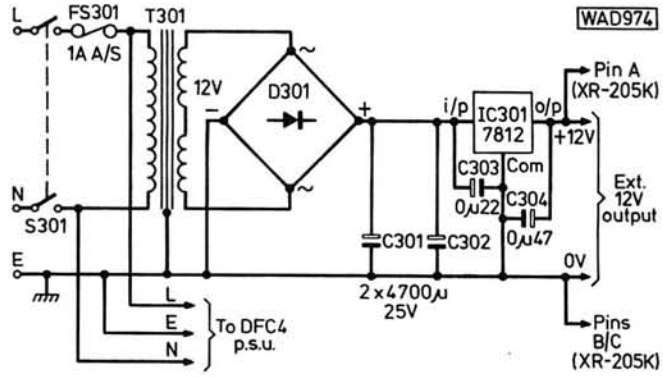


Fig. 3: Waveform generator power supply circuit

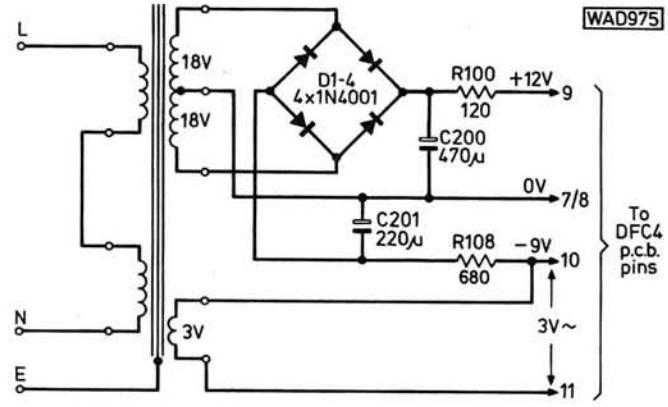


Fig. 4: Power supply for the DFC4 digital frequency counter

Construction—Generator

A kit comprising two XR-205 i.c.s, a printed circuit board etched and drilled ready for assembly, plus comprehensive data and instructions is available in the UK from Rastra Electronics Ltd. The rest of the components (resistors, capacitors and switches) plus a power supply and a box to build it all into, have to be provided by the constructor.

The p.c.b. which comes with the kit is fairly big (140 × 76mm) but there is really little point in making it smaller in view of the large number of external controls required, which means that you cannot use too small a box or case.

Most of the waveform generator components mount on the supplied p.c.b. as shown in the layout drawing supplied with the XR-205K kit, the exceptions being the four potentiometers, three fixed resistors, and the frequency range capacitors which are mounted on S1. To avoid problems with parasitic oscillations, S3 should be mounted as close as possible to IC1, and similarly S2 and IC2. Capacitors C20 and C21 can be fitted if necessary to suppress parasitics. The instructions supplied with the kit suggest that the interconnecting wiring to S2 and S3 should not be longer than about 50mm. The layout of the prototype as shown in the photographs does not quite achieve this ideal, though it could be improved by mounting the switch wafers further back on the mechanisms. The rotary switches used are supplied with rear shafts about 60mm long, which are cropped to the required length. See the comments under "Operation".

Switch S1 should have the range capacitors soldered into place between the two wafers, and flying leads at-

tached to the rotor contact tags before mounting the switch on the front panel. If you have difficulty locating the correct value capacitors for C13 and C15, they can be made up by paralleling 0·47μF and 0·22μF, and 47nF and 22nF respectively.

Switch S2 should also have flying leads, plus all the links and resistors R23 and R25 attached before mounting, otherwise the underneath contact tags are inaccessible. S3 is a single-wafer switch and all its tags are accessible after fitting, so that it does not matter whether the connecting wires are attached to the switch or the p.c.b. first.

It is essential to fit terminal pins to the p.c.b. for all external connections. The board is mounted on the floor of the case using two 4BA screws and nuts with short spacers.

Apart from the transformer and reservoir capacitors, all the waveform generator power supply components can be easily accommodated on a small piece of Veroboard, as shown in Fig. 5. The board can be mounted by means of the heatsink tab of the 7812 regulator, with Sticky Fixers between the board edge and the case rear panel to minimise flexing of the regulator package legs. The board is so light that no further fixing is really required.

Two 4700μF capacitors (C301 and C302) are used rather than a single 10 000μF for the reservoir, partly because of a slight cost saving and partly because they are smaller and easier to accommodate. They are secured by means of a nylon cable-tie, fitted through two holes drilled in the case floor. The holes should have their sharp edges chamfered to prevent cutting into the tie when it is tightened.

CONSTRUCTION RATING Intermediate

BUYING GUIDE

The wafer switch parts and other items listed with RS Components stock numbers are available from several of our advertisers, including C. Bowes Electronics Ltd. The XR-205K kit is available from Rastra Electronics Ltd., 275-281 King Street, Hammersmith, London W6 9NF, price £16.99 including post, packing and VAT. See page 45 for availability of the Timestep DFC4 kit.

APPROXIMATE COST £85

Construction—Counter

The Timestep DFC4 kit comes with instructions for assembly and wiring into equipment, plus programming

★ components

Resistors

½W 5% Carbon film

560Ω	2	R27, 32
1kΩ	2	R25, 28
1·8kΩ	2	R9, 23
3kΩ	1	R24
3·6kΩ	1	R30
3·9kΩ	1	R26
5·1kΩ	2	R11, 35
15kΩ	5	R4, 5, 8, 15, 21
30kΩ	4	R2, 3, 16, 18
47kΩ	1	R29
100kΩ	10	R7, 12-14, 17, 19, 20, 34, 36, 37

Potentiometers

½W linear law, ¼in spindle

5kΩ	3	R1, 6, 31*

½W log law, ¼in spindle

2·2kΩ	1	R33 (or 2·5kΩ)

¼W Cermet presets

5kΩ	2	R10, 22

Switches

S1 2-pole, 8-way
S2 4-pole, 6-way } See Table 1
S3 3-pole, 4-way
S4 Single-pole changeover with centre "off" position, miniature toggle
S301 2-pole on/off, miniature toggle

Capacitors

Ceramic plate

22pF	2	C20, 21*

Ceramic disc

10nF	2	C7, 19
0·1μF	3	C1, 3, 18

Polyester film, 250V

22nF	1	C16
68nF	1	C15*
0·22μF	2	C2, 14
0·68μF	1	C13*
2·2μF	1	C12

Polystyrene

220pF	1	C24
560pF	1	C23
2·2nF	1	C22
6·8nF	1	C17

Tantalum bead, 35V

0·22μF	1	C303
0·47μF	1	C304

Electrolytic, 25V double-ended

10μF	7	C4-6, 8-11
4700μF	2	C301, 302

* See text.

Semiconductors

Integrated circuit regulator

7812	1	IC301 (12V 1A)

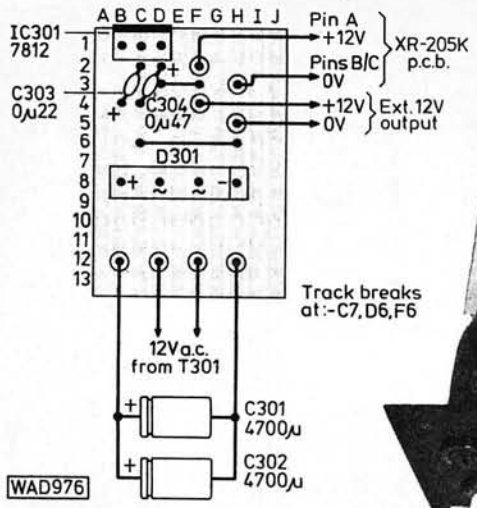
Diode bridge

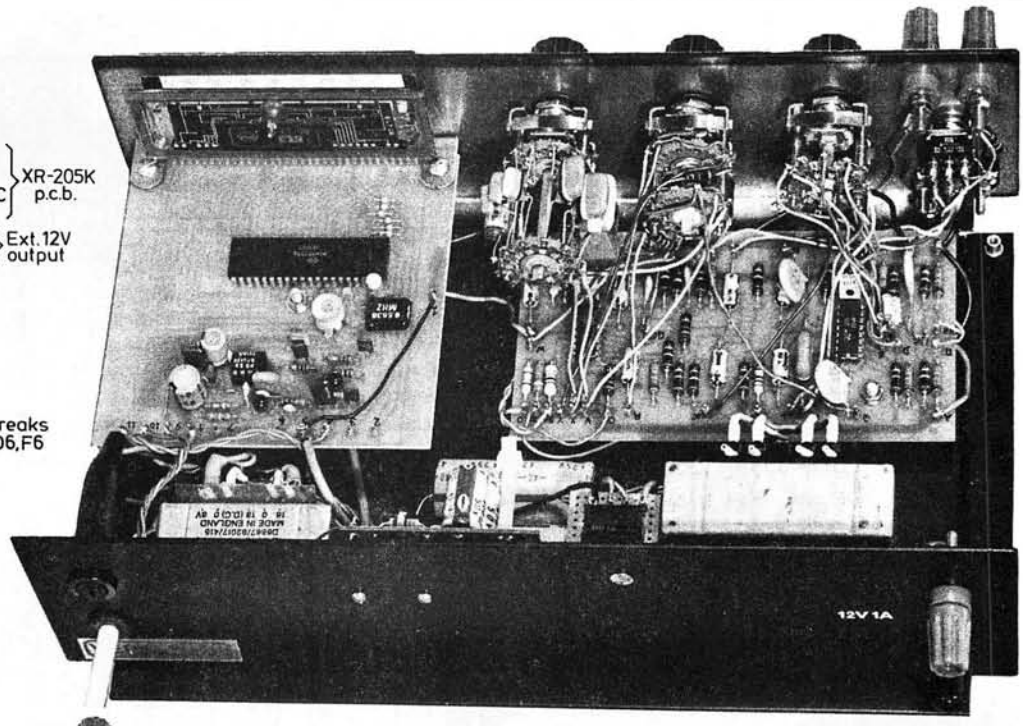
200V 1·6A	1	D301 (RS Components 261-491)

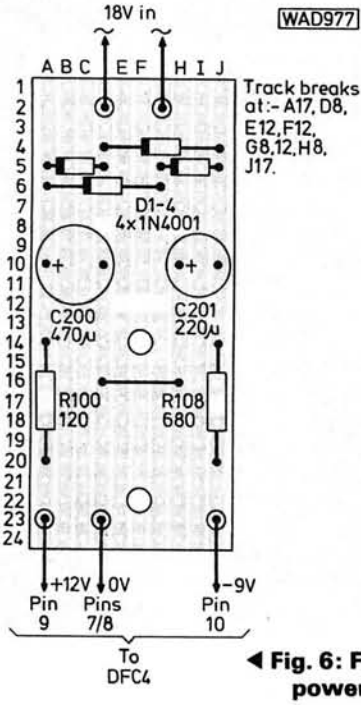
Miscellaneous

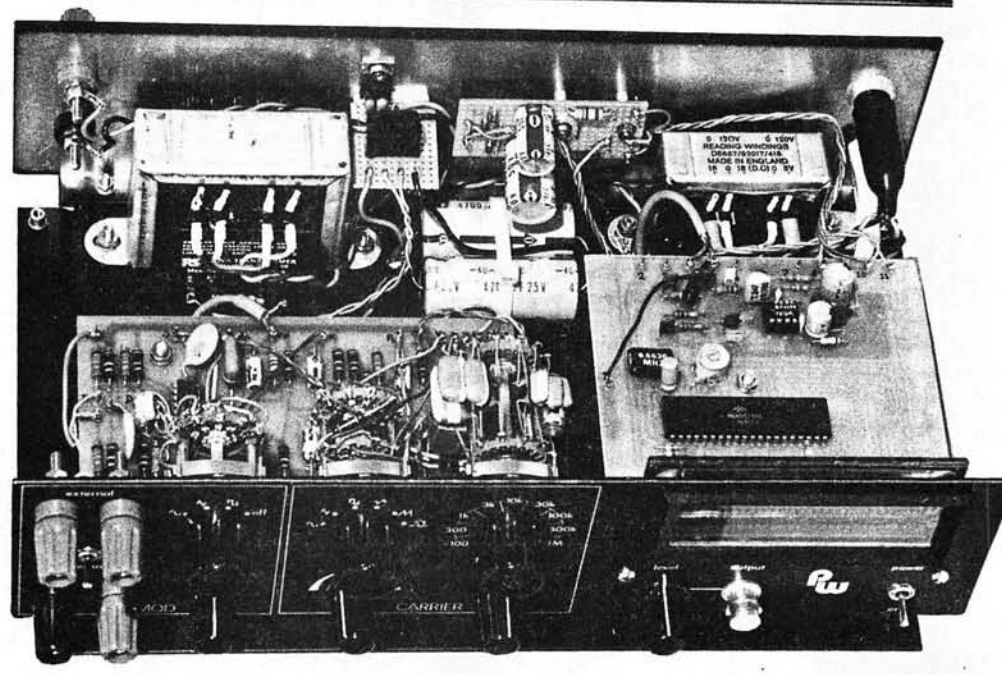
Mains transformer T301, 12V 1·6A secondary. Fuse FS301, 1A anti-surge, 20mm with holder. BNC round socket with earth tag. Screw terminals/4mm sockets: 4 red, 2 black. Pointer knobs: 3 21mm, 4 14·5mm, for ¼in shafts. Case, Vero 202-21091E. Display bezel, Vero 203-22236A. Exar XR-205K kit, comprising 2 XR-205 *i.c.s*, p.c.b. and data sheets. Timestep DFC4 kit, comprising all components, display, p.c.b. and data sheets. Veroboard. Terminal pins.

Fig. 5: Waveform generator rectifier/regulator board▼









◀ Fig. 6: Frequency counter power supply board

details to achieve the required frequency offsets when used as a tuning readout in a radio receiver. In the present application, the DFC4 is required to operate as a straight frequency counter, without i.f. offset, using the direct (long/medium wave) input. Drive for the counter is tapped off from the OUTPUT LEVEL control, R33, via a 220pF capacitor, C24, and a short length of screened cable. The board is secured at its front edge by means of two small angle brackets (not part of the kit), fixed to the board by 4BA screws and nuts and to the front panel by 4BA screws and hank bushes. If hank bushes are not available, nuts can be used instead but are much more difficult to fit. The board is steadied by a long 4BA screw and a 34mm spacer between its centre and the case floor.

Unfortunately, there does not seem to be a bezel specifically designed for phosphorescent displays. Or if there is, it's not available on the hobbyist market. So, to

Table 1 — Wafer Switches

S1 — S3 are all made up from RS Components Miniature Switch Kits. Each comprises a mechanism, **Stock No. 327-311 (total 3 required),** fitted with wafers and spacers as follows:

S1 **2 off 1-pole, 12-way wafers, Stock No. 327-349** spaced 40mm apart, using 20 spacers (10 per side)

S2 **2 off 2-pole, 6-way wafers, Stock No. 327-355** spaced 13mm apart, using 8 spacers (4 per side)

S3 **1 off 3-pole, 4-way wafer, Stock No. 327-361** spaced back from mechanism by 6 spacers (3 per side)

Mechanism end-stops set for correct rotation limits (S1 used as 8-way only).

Total of 34 spacers used **(4 packs Stock No. 327-327 required** (10 spacers per pack)).

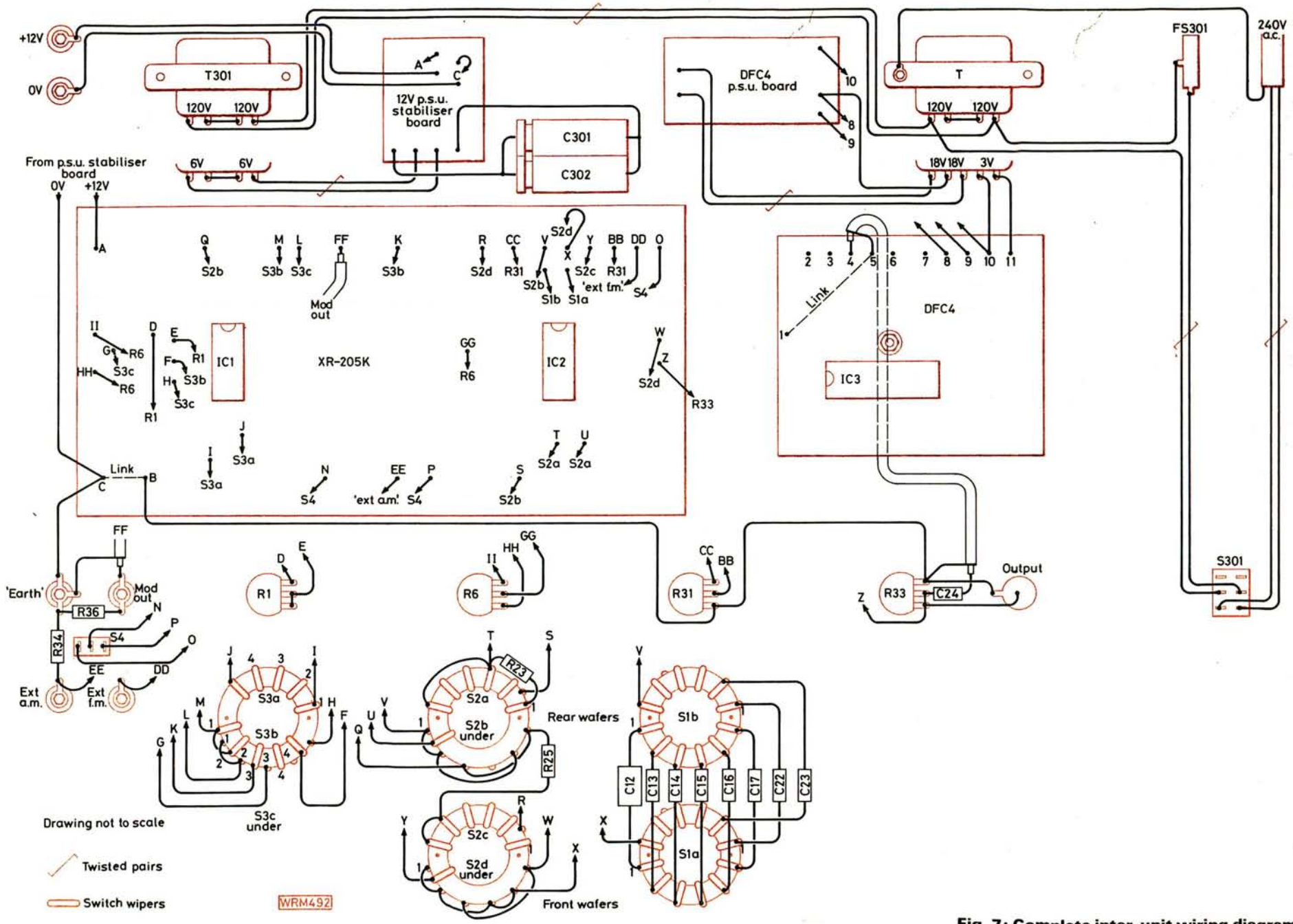
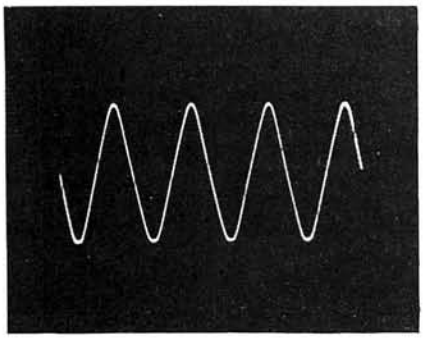
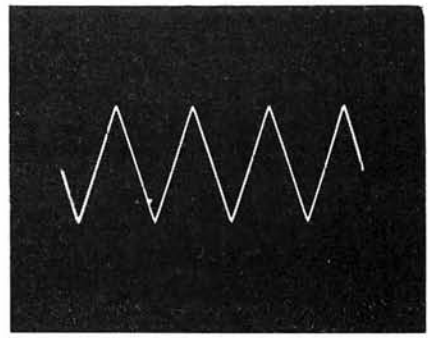


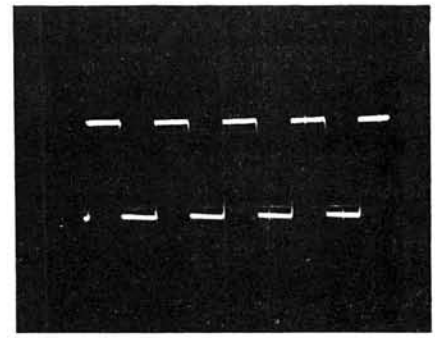
Fig. 7: Complete inter-unit wiring diagram



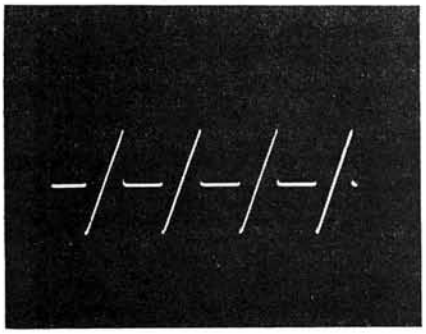
Sinewave



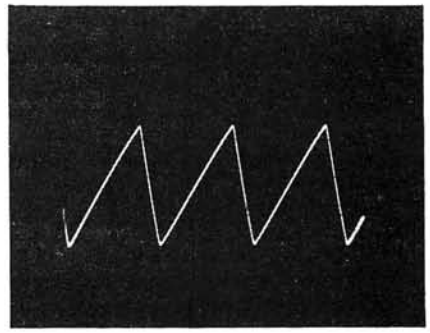
Triangular wave



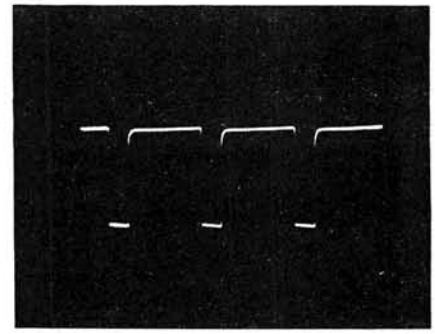
Squarewave



Ramp



Sawtooth



Pulse

The six basic output waveforms

Transparent film overlays of the front panel are available from the Editorial Office at Poole, price £1.60 including post and packing.

finish off the display cut-out neatly, we used a Vero bezel, adapting it to fit by removing the usual fixing screws and clamps, and securing it to the front panel by a few dabs of glue. As shown in the photographs of the finished unit, the "AM", "FM", "kHz" and "MHz" legends on the display are visible through the bezel window, though they are not used when operating without frequency offset. You may like to hide them by painting the ends of the display with photographic dead-black or blackboard paint.

The power supply components are mounted on another small piece of Veroboard, stood off the case rear panel with two 6BA screws and short spacers. The layout is shown in Fig. 6.

Details of all the inter-unit wiring are shown in Fig. 7. For safety reasons, all terminals carrying mains voltage (fuse-holder, on/off switch and both transformers) should be protected against accidental contact by heat-shrink sleeving or similar means.

Operation

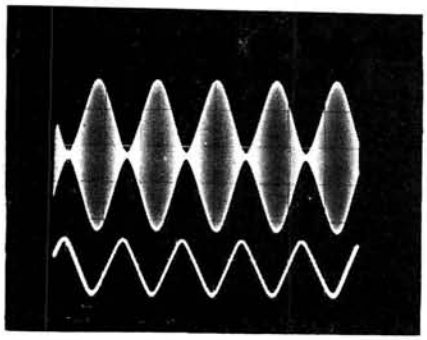
There is not a great deal to say about operating the *PW* Modulated Waveform Generator. Read the advice given in the XR-205 data sheet, connect the generator to an oscilloscope, switch on and play around with it until you find out what it can do. You will come across some really intriguing waveforms, especially when you try modulating a very low frequency carrier, or doing simultaneous a.m. and f.m.

There are just three adjustments to make when you first switch on. One of these is the crystal trimmer in the DFC4, which requires some external source of reference such as another frequency counter or a medium wave receiver. Hints are given in the kit instructions.

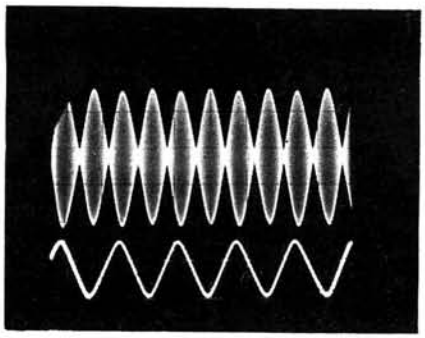
The other adjustments are to R10 and R22 on the waveform generator board, which are adjusted for minimum distortion on sinewave outputs from IC1 and IC2 respectively. The XR-205, like most function generator chips, produces a sinewave by "distorting" the triangle wave output, rather than generating a true sinewave. The presets R10 and R22 control the amount of this "distortion" which is introduced. If you have access to an audio distortion meter then the job is very easy, as you just twiddle the appropriate potentiometer for minimum reading. Otherwise you can adjust by judging how good the sinewave looks on an oscilloscope. You will find that you have to compromise between pointed peaks and flattened peaks, but check that you haven't turned the level control up to the point where the XR-205 buffer amplifier is beginning to limit. Minimum sinewave distortion is typically 2·5 per cent, which is not as good as some of the more recent waveform and function generator i.c.s, but then they don't offer you a built-in balanced modulator.

No connection points are provided on the waveform generator p.c.b. for C20 and C21, and they were not initially fitted. However, when the prototype was first switched on, the modulation oscillator had a positive-going notch in its sinewave output, just before the negative peak. The suggested 22pF for C20 distorted the sinewave to an extent that could not be corrected by adjustment of R10, but it was found by experiment that about 17pF (15pF and 2·2pF in parallel) connected across terminal pins "F" and "H" did the trick.

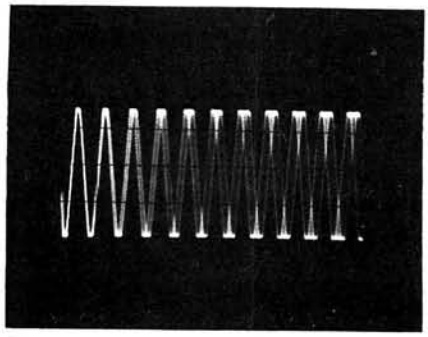
Some examples of the waveforms produced by the prototype generator are shown in the photographs. The XR-205 data sheet shows many more waveforms and describes how they can be achieved. Note that it is not possible to produce the classic over-modulated a.m. waveform with this generator because of the use of a balanced modulator. The amount of frequency modulation or sweep achievable from the internal modulation oscillator is limited, but is a maximum when the CARRIER



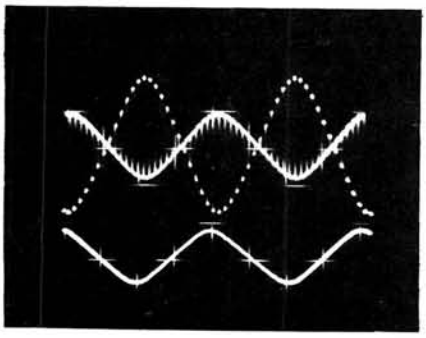
A 90% modulated a.m. waveform (top). Note how the envelope follows the modulating waveform shown on the bottom trace



A d.s.b. suppressed carrier a.m. waveform (top). Note the two envelope peaks per cycle of the modulating waveform



A frequency-modulated carrier. The oscilloscope trace is triggered, and therefore steady at the left-hand end



One of the weird waveforms you can produce. Suppressed-carrier mod of pulses by an a.f. sinewave. Note the polarity reversal of the pulses on each half-cycle

All the waveform photographs in this article were taken from the screen of a Telequipment D43 oscilloscope, using a Shackman 7000 camera and Polaroid 3000ASA film. Exposure was $\frac{1}{4}$s or $\frac{1}{2}$s at f:8.

FREQUENCY control R31 is set fully anti-clockwise. Using an external modulating source, a frequency sweep range of 7:1 or more can be produced.

If a wire-wound potentiometer is used for R31, the output frequency will change in very small but noticeable steps when getting up into the r.f. region. This is of course due to the wiper moving from one turn of the track winding to the next, and is a problem in all *CR* oscillators operating at r.f. If continuous change of frequency is required, a good quality carbon track potentiometer should be used in this position.

Remember that you must turn the CARRIER LEVEL control R6 away from its null point whilst using the frequency counter. ●

EARLY VALVES

▶▶▶*continued from page 24*

in this case the grid connection was brought out through the side of the bulb for short wave oscillator use.

The "LS5B" later became favoured as a frequency doubler for output on 20m (14MHz), they were also used for similar work on 10m (28MHz). In a few cases, uncapped valves were used on this wavelength and the shorter 5m (60MHz) wavelength, but reduced rating was normally applied.

It is of interest to note that at the same period the American experimenters were using a very similar valve for their transmitters, this was the "UX210". It had originated from a demand for a power valve for low frequency amplifiers, to drive the then new Rice-Kellogg moving coil loudspeakers. It was similarly priced to the "LS5", being nine dollars compared with two pounds ten shillings (£2.50).

The first dull emitter valve specially produced for transmitter use was the Marconi-Osram "DET1" (40 watt) quickly followed by an equivalent from Mullard known as "DO40". Both these valves were characteristically better than any of the earlier types, having a slope of around 2mA/V. The "DET1" advertisements of the day quoted: "Owing to the remarkable results obtained with "LS5" valve as a 10W transmitter, this type has been developed".

These valves were fitted with a large low capacity cap and it was claimed that the valve would oscillate down to 5m (60MHz). The "DO40" quoted that it was suitable for short wave transmission, down to 40m (7MHz). Both valves cost five guineas (£5.25) each.

From the foregoing, it will be appreciated that early experimenters were faced with relatively expensive items and the cost was very much greater than nowadays. For example, in the early twenties, when the average weekly wage for a craftsman was around thirty to thirty-five shillings (£1.50 to £1.75), to buy a "R" valve took half a week's money, and an "LS5" required nearly two weeks' pay! ●

Bright Emitters

Company	Type No.	Volts	Amps	M	R	M/R
BTH	R	4	0·65	6·5	25kΩ	0·26
Ediswan	R	4	0·65	8	25kΩ	0·324
Osram	R	4	0·7	9	35kΩ	0·26
Mullard	ORA	4	0·7	8	26kΩ	0·24
Cossor	P1	4	0·72	6·6	18kΩ	0·24
Cossor	P2	4	0·72	12	50kΩ	0·238
Radion	GP	4·25	0·48	9	45kΩ	0·20
Osram	R5V	5	0·65	9	30kΩ	0·30
Osram (RAF)	C	5	0·75	6	19kΩ	0·316
Mullard	HF	4	0·7	7·3	32kΩ	0·225
Mullard	LF	4	0·7	6	23kΩ	0·26
Osram	V24	5	0·45	6	22kΩ	0·27
Osram	Q	5	0·45	50	150kΩ	0·33
Osram	QX	5	0·45	20	100kΩ	0·25

The EUROCOMM Range

27 MHz CB Transceivers to MPT 1320

EUROCOMM 40

A compact 40 channel unit offering high sensitivity, ease of operation and switched Channel 9 selection

Features: Large LED Channel Display
Illuminated Signal/Power Meter
Tx and Rx Status LED's
Hi/Lo Power Switch
CB/PA Selector Switch
Volume and Squelch Controls
Internal Speaker

The Eurocomm 40 is supplied complete with fused power cord, mobile mount, microphone and mounting clip.

PRICE: £69.00 inc. VAT

EUROCOMM DX40

A robust unit ideal for mobile and base use.

Features: Large LED Channel Display
Illuminated Signal/Power Meter
Tx and Rx Status Indicators
Hi/Lo Power Switch
CB/PA Switch
Volume and Squelch Controls
Internal Speaker

The Eurocomm DX40 is supplied complete with a universal mounting bracket, fused power cord, microphone and clip.

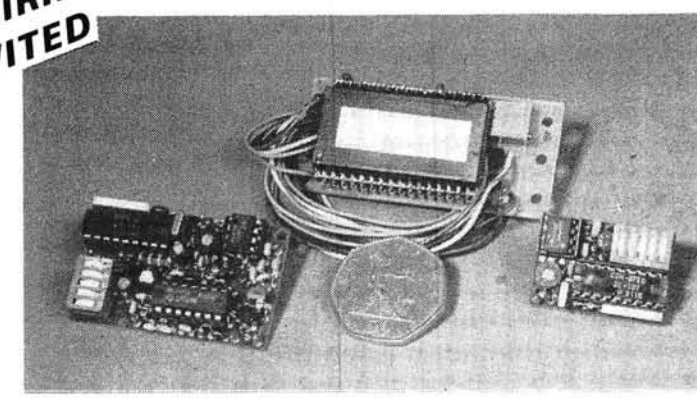
PRICE: £79.00 inc. VAT

TRADE ENQUIRIES INVITED

TONE SIGNALLING PRODUCTS

A range of boards are available to fit the Eurocomm range. When switched in, these enable only breakers with the appropriate tones included in their transmissions to open the squelch. Ideal for users who need to monitor a channel continuously for a call, but find the interference annoying. These small sized modules interface with virtually any type of two way radio equipment, and when switched out allow normal operation of the rig. Units are programmable for multiple calling tones. Details on request.

PRICES:
CTCSS (Tone Mute) — £31.00 to £61.00 inc VAT
5 Tone Selcall — £99.00 inc VAT



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CB RIG CHECK

COMMTRON CB 40F

CB is a mobile short-range telephone system. You require a licence to use it, £10 p.a. from Post Offices.

The CB 40F is Commtron's first rig purpose-built to the UK 27MHz f.m. CB specification MPT 1320. They have some years of experience in producing transceivers for the US market under several well-known brand-names and it certainly shows in the standard of design of this set.

FACILITIES

Full 40 channels with red l.e.d. digital readout. Switch for Channel 9 priority selection. Illuminated power/"S" meter. Hi/Lo power switch. Public Address facility. Socket for 8/16 Ω external loudspeaker. Supplied with microphone; mobile mounting bracket; microphone bracket; 12V d.c. power lead 1·5m long with in-line fuse; instruction manual.

DESIGN

Looks very competent, with clean internal layout. Main board, single-sided and with all components identified, carries all circuitry except channel selector switch and display decoder which are on a small separate board. Extensive r.f. filtering on control and audio leads coming off-board.

A p.l.l. synthesiser is used, with receiver i.f.s of 10·695MHz and 455kHz, both including ceramic filters.

CONSTRUCTION

Generally good, although a few solder balls and wire ends stuck to p.c.b. reveal a need for improved quality control.

HANDBOOK

The 14-page instruction manual supplied covers specifications, brief description, operating controls and features, installation, operation, alignment, main p.c.b. layout, circuit diagram and block diagram. Although (like the rig) the handbook is produced in Korea, it is in good English and sets a standard others might follow.

HOW IT HANDLES

First, the moans: 1. The microphone plug is of the non-latching DIN variety (5-pin). If it is pulled out, the receiver output disappears because the loudspeaker earth return is via the back contact of the p.t.t. switch. 2. The knobs are chrome finish and could cause trouble with reflections when in a car. Worse still, they are very smooth, and the channel selector takes quite a grip to turn it. 3. The receiver audio output comes out of the p.a. loudspeaker when on radio, which would not please neighbours or passers-by!

Now the good points: 1. The audio quality is good on both transmit and receive, with enough clean audio from the loudspeaker for even a noisy car. 2. The transmitter output will withstand short-term accidental short-circuit or open-circuit antenna conditions without disappearing in a puff of smoke, as proved during lab tests.

We tested two rigs mobile, using Avanti Moonraker AV-241M antennas, which are base-loaded, 1·22m long with mag-mount base. One rig was also tested as a home-base, using an AV-241M in the loft with a makeshift ground-plane of two 3m lengths of aluminium strip arranged as an "X". Results were good, with mobile-to-mobile contacts up to about 5 miles in a semi built-up area, despite considerable sideband interference from the Continent during afternoon tests. Monitoring during the evening showed much activity but no problems with interference from strong stations on adjacent channels.

HOW MUCH?

You should find the CB 40F in the shops at around £75.

Our thanks to Des Walsh of Tritel Group, 1043 Leeds Road, Thornbury, Bradford BD3 8ES, telephone 0274-665670, Commtron importers, for his co-operation, and to Stour Valley Communications, 112 Stour Road, Christchurch, Dorset, who lent the review rigs.

IN THE LAB

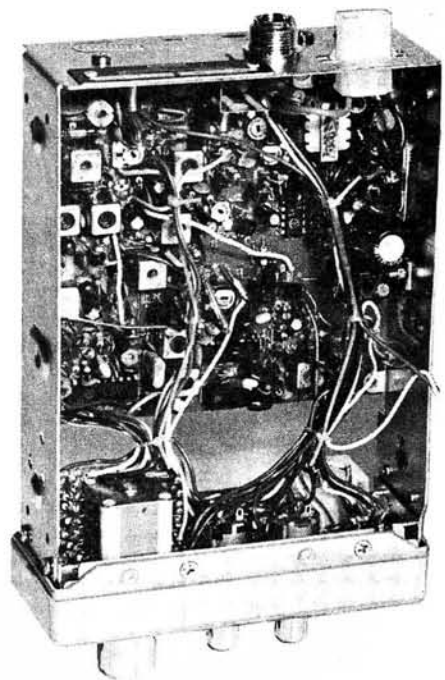
Feature	Spec	On test
Transmitter		
Power out: HI	4W	3·8W
LO	0·4W	0·45W
Spurious:	<0·25µW	—(1)
Adjacent channel:	−60dBc	−80dBc (2)
Frequency error:	<1·5kHz	<100Hz
Receiver		
Sensitivity: (3)	<1µV	1µV
Selectivity: (±10kHz)	−60dB	—
Audio output: (8Ω)	3·5W	—

Feature	Spec	On test
General		
Consumption:		
Standby	250mA	230mA
Transmit	<1·5A	1·1A

Size: 54 x 132 x 194mm (excluding projections).
Weight: 1·4kg approximately.

Notes

1. Test equipment available for these tests would not measure below 0·4µW. All spurious outputs below this level.
2. dBc means dB relative to the carrier power.
3. For 20dB (S+N)/N, with 1kHz tone and 1·5kHz deviation.
4. All tests on 13·8V d.c. supply.



NEWS NEWS NEWS

ZX80/ZX81 Users Club

The Club was founded early in 1980 as the ZX80 Users Club, an independent user group run by enthusiasts of the ZX80 microcomputer. It has now been expanded to cover the ZX81.

The Club caters for all types of user and produces a regular newsletter containing articles on basic computing, educational computing and, of course, ZX80 and ZX81 hardware and software. A special feature of the newsletter is the "Cambridge Hot-Line" with the latest news direct from Sinclair Research Ltd.

As well as technical support, the Club has set up a software bank available to members at minimal cost.

The annual membership fee, which includes the cost of the newsletters and software bank index, is £6 for UK members and £10 for overseas members.

Further information will be supplied in return for an s.a.e. to: *ZX80/ZX81 Users Club, PO Box No. 159, Kingston upon Thames, Surrey KT2 5UQ.*

Cushcraft Antennas

The sole importer of the entire range of Cushcraft Antennas is now: *Communications Products Ltd., PO Box 23, Halifax HX3 6AN.*

Repeater News

70cm repeater GB3NF at QRA location ZK14H, map reference SU428048 which in layman's terms is adjacent to Southampton Water in Hampshire, has become operational on channel RB11. The site is 130 feet above sea level and the antenna, a single 6dB gain colinear, is 80 feet above ground level. Further information is available from G4KCM, QTHR.

2m repeater GB3WH closed-down at its original site on 20 November 1981, and on the same day GB3VA at Brill commenced operation on R4. Approximately two weeks after that date GB3WH will rise, phoenix like, from a new site south of Swindon on R2.

A proposal is under preparation to establish a 70cm repeater on the island of Guernsey, site etc. details are not known at this time, but if the licence is granted, this installation would be the most southerly unit in the UK. In addition to its primary function, the repeater will provide a very useful test facility for u.h.f. propagation over a seaward path.

A great amount of interest has been shown in the re-opening of u.h.f. repeater GB3WS, following the enforced close-down by the R.S.G.B. The Society hope to re-issue the licence to a new controlling group in the near future.

PW Exe

Those readers residing in the Irish Republic who intend building the *PW* Exe microwave transceiver, may be interested to learn of a Dublin supplier of parts for this project.

Two suitable annealed copper parabolic dishes are available, one is 500mm diameter and the other is 490mm diameter with a side lobe shielding cylinder, focal length for both dishes is 130mm. Either dish costs IR£12·00 each and is supplied with a protective polyurethane coating.

Also available are 3mm and 6·5mm acrylic rods for focus mounted doppler modules at £3·00 per 2 metre length (p&p not included).

Further details are available in exchange for an s.a.e. from: *John F. Hitchcock (jnr.), 99 Avondale Park, Raheny, Dublin 5, Ireland.*

Moving On

Hull and District Amateur Radio Society notify me that they have moved. As from 4 December 1981 their new base will be at West Park Recreation Centre, Walton Street, Hull. Further details from: *The Secretary, H. V. Cunliffe G6DUL. Tel: (0482) 447355.*

Golden Anniversary

Scarborough Amateur Radio Society celebrates its 50th anniversary in 1982 and it is planned to issue a certificate to commemorate this occasion.

To qualify for the award contact must be made with the club station, G4BP, and five members of SARS during 1982.

Full details of how to claim the award and a list of SARS members can be obtained by sending an s.a.e. to: *D. E. Mappin G4EDR, 39 Clarence Drive, Filey, N. Yorkshire YO14 0AZ.*

Stolen Equipment

Two local amateurs report that during November 1981 their cars were broken into and the following equipment stolen.

One Kyokuto Digital 2—Model FM144 which has 144·690MHz programmed into the personal channel. Also a unique Jaybeam end-fed window mount antenna. Stolen on 9 November from G2HCG, QTHR.

One Trio TR-9000, serial No. 1041020 minus mobile bracket and will probably have dents in sides, one Cobra 40 channel f.m. mobile CB rig and one Oscar, SMC, 40 channel f.m. mobile CB rig. Stolen on 25 November from G8YBT, QTHR.

If you are offered, or have any information of these items, please contact either the owners or Poole Police, tel: Bournemouth 22099.

Can I Help You!

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

Alan Martin

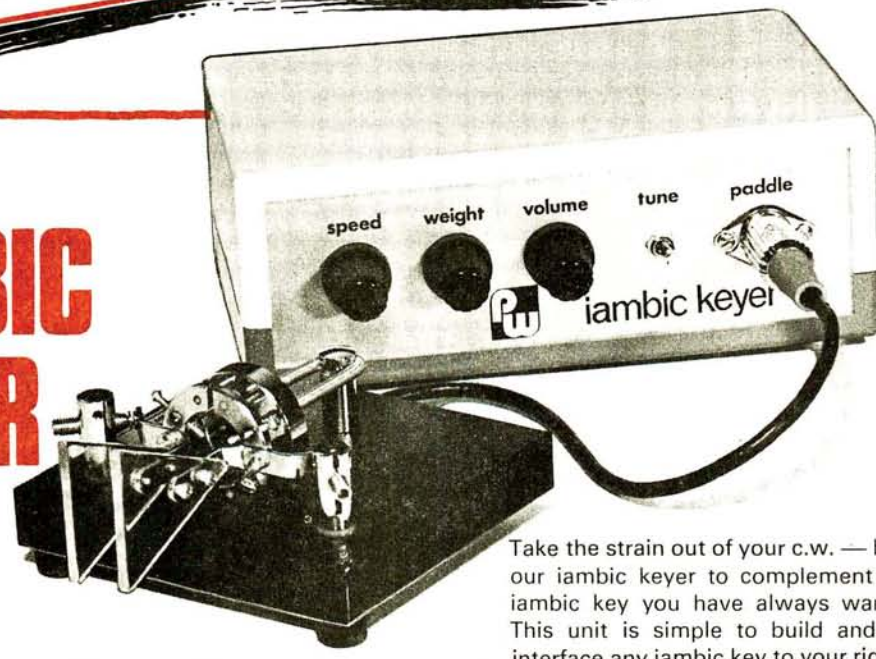
Next month in PW

ON SALE 5 FEB

EXTRA PULL-OUT

World Amateur Prefix List plus Maps of European Prefix areas and QRA Locator Squares

PW IAMBIC KEYER



Take the strain out of your c.w. — build our iambic keyer to complement that iambic key you have always wanted. This unit is simple to build and will interface any iambic key to your rig

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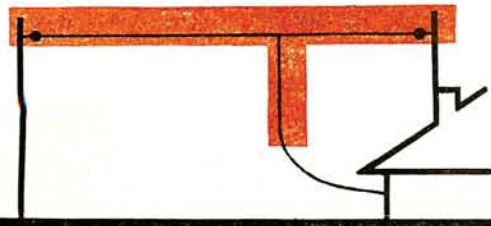
2 SIMPLE HF ANTENNAS



Working h.f. from a restricted site? Then you will find these two compact antennas for the h.f. bands interesting and worth the small effort required to construct them. Your bank balance will not suffer either

IC of the month

Brian DANCE M Sc

National Semiconductor LM10 Op Amp and Voltage Reference

Monolithic operational amplifiers have been employed in a large variety of applications and in many cases a common type such as the 741 is quite adequate. For some applications, however, there are good reasons for using a more expensive type of operational amplifier featuring special parameters that the more common types cannot equal.

One example of a high performance operational amplifier is the fairly new National Semiconductor device type LM10. This will operate from a total supply voltage as low as 1·1V and a supply current of only 270μA. It is thus very suitable for use in portable equipment powered by a battery: indeed, it can be operated from a single dry cell near to the end of its life. The low supply current required by the LM10 ensures that maximum cell life is obtained from the battery.

The internal circuit of the LM10 device is shown in Fig. 1 in block form together with its connections. It can be seen that the device contains not only an operational amplifier, but also a 200mV reference voltage source, together with its own comparator amplifier, which acts as a buffer for the reference voltage source to prevent any current taken from the reference output from interfering with the reference voltage.

The LM10 is available as a series of devices with slightly different type numbers, but all having the same internal circuit. The LM10, LM10B and LM10C versions can be operated from any supply voltage between 1·1V to 45V total, although it is wise to regard the maximum as 40V to allow for a margin of safety. If balanced supplies are employed, the maximum is about +20V lines. The maximum differential input voltage is quoted as ±40V; the input voltage may exceed the supply voltage provided that the voltage from the input to any other terminal of the device does not exceed this maximum differential input voltage. Lower cost versions, LM10BL and LM10CL have a maximum total voltage supply limit of 7V, although it is again wise to regard 6V as the upper limit. The LM10 can be operated with its chip at temperatures as high as 150°C, whereas the more economical LM10B and LM10BL can only be operated at chip temperatures up to 100°C. The LM10C and LM10CL have a maximum chip temperature specified as 85°C.

All LM10 devices incorporate thermal overload protection circuitry. This means that if the temperature rises towards the point at which thermal damage could occur, the output current is automatically reduced by the circuit so that damage is prevented. However, it is unwise to use the device under conditions that are likely to cause the thermal overload circuitry to operate, since such high temperatures will render devices more likely to failure.

Basic Parameters

The input offset voltage of the LM10C and the LM10CL is typically 0·5mV (maximum 5mV) which is better than the corresponding values of 2mV and 6mV respectively quoted for the LM741C. However, when one considers the input currents, the performance is ten to a hundred times better than the 741C. For example, the input offset current of the LM10C and LM10CL is only 3nA maximum, whereas that for the 741 is 300nA. The corresponding values for the LM10 and LM10B are even smaller, the typical offset current being quoted as 0·25nA and the maximum 1·5nA.

A further advantage of the LM10 series of devices over more conventional operational amplifiers is that the output potential from the devices can swing to within 15mV of that of the power supply lines. Thus one can obtain output voltage swings of about 40V using the LM10 series, with the exception of the LM10BL or LM10CL.

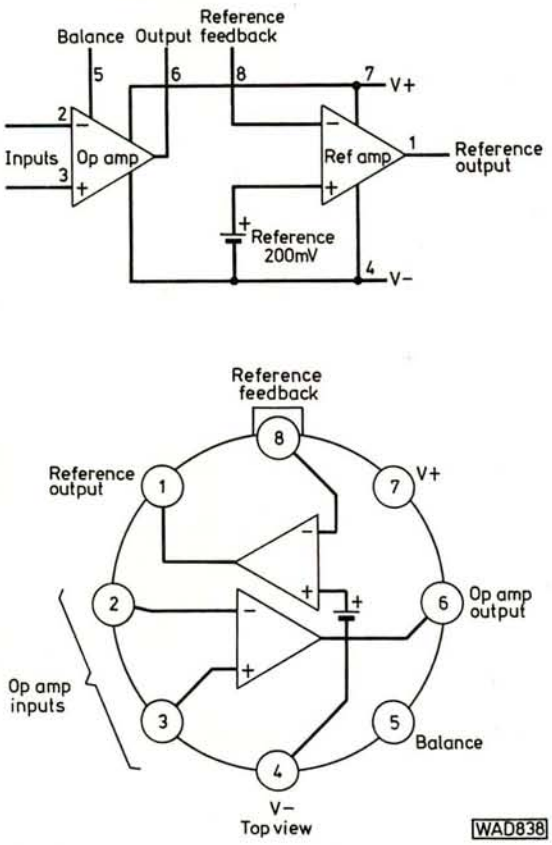


Fig. 1: The LM10 series connections and basic internal circuit

The 200mV internal reference voltage source employs the bandgap of silicon as the voltage standard. Special techniques are employed to compensate for the effect of temperature changes on the reference voltage: typical voltage drift of the reference source being quoted as 0·003%/°C for the LM10CL.

Variations of power supply current required against operating temperature are shown in Fig. 2.

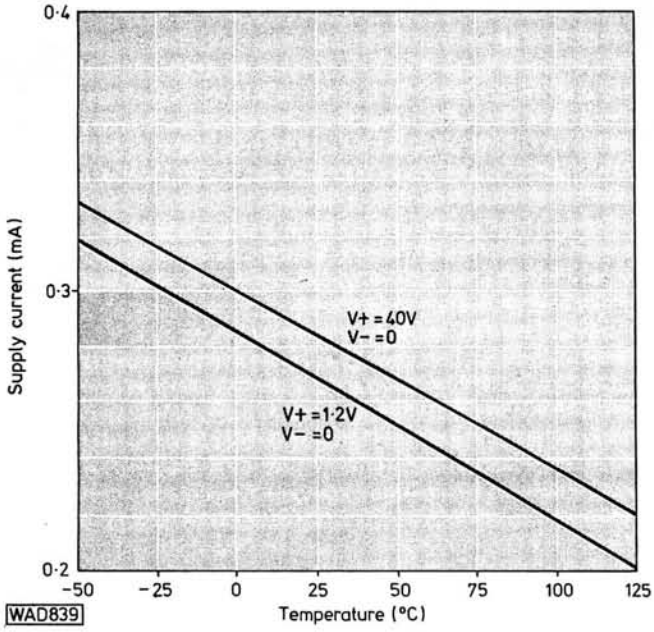


Fig. 2: Variation of supply current with temperature

Circuit Applications

LM10 series of devices have been designed for use in a wide variety of applications, such as voltage and current regulators (from low voltages to some hundreds of volts) providing greater precision than earlier monolithic devices: thyristor control circuits; transmitters for analogue signals, etc. Detailed information is available on the data sheet for the LM10, National Semiconductor Notes AN211 entitled "New Op Amp Ideas" and TP-14 entitled "Low Voltage Techniques." The following examples have been chosen to illustrate the wide variety of possible uses to which the versatile LM10 can be put.

Light Detector

The circuit of Fig. 3 employs the LM10 in a "floating mode" without any ground voltage reference. The photodiode is connected directly between the inverting and non-inverting inputs of the LM10; the output of the device is directly connected to the positive supply line so as to disable one half of the internal output stage. When the non-inverting input at pin 3 is positive with respect to the inverting input, no current flows in the internal output stage. As the potential at pin 3 falls, whilst light falls onto the photodiode, current passes from the positive line to pin 6.

The internal reference circuit provides the bias from pin 1 which determines the switching threshold of the circuit. At the switching point, the voltage across the photodiode equals the offset voltage of the operational amplifier; this is quite small and leakage current in the diode is negligible. A few hundred microvolts across the photodiode will produce the full short circuit current in the LM10.

The circuit of Fig. 3 employs R3 to provide hysteresis. Hysteresis is an effect which, in this case, renders the light level for switching to the conducting state slightly greater than that for switching back to the non-conducting state. The presence of some hysteresis ensures that the circuit does not keep switching between the two states for very small fluctuations in the light level. The values shown provide about 1mV of hysteresis for a 5V output swing,

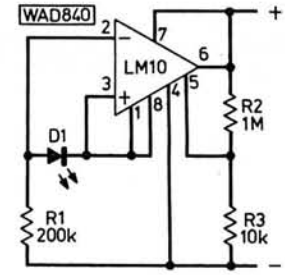


Fig. 3: A light detector using the LM10

although this disappears at frequencies above 10Hz owing to loss of gain. This circuit is not intended for fast operation, as the LM10 is fully frequency compensated. High accuracy should not be expected at switching frequencies exceeding 100Hz.

Logarithmic Light Sensor

The circuit of Fig. 4 also employs a photodiode to sense the presence of light, but the output is linearly related to the logarithm of the current passing through the photodiode and hence to the logarithm of the light level. This enables variations in light level over four decades (10 000 to 1) to be accommodated with good resolution at low light levels. The circuit is balanced at the middle of the range at which point R3 should be chosen so that the current through it is equal to the current through the photodiode, with the light level corresponding to the desired middle of the range. The output current varies from 1mA to 5mA over the working range set by the value of R3.

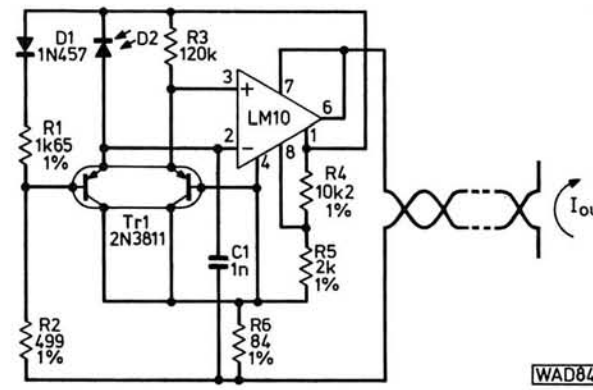


Fig. 4: A logarithmic light sensor circuit. This has a response similar to the human eye as far as variations in intensity are concerned

The logarithmic conversion characteristic of this circuit is temperature compensated by the resistor R6 which should be made of fine copper wire wound on a suitable former. The reference feedback circuit from pin 1 to the comparator input of pin 8 determines the voltage between pins 1 and 4; the latter is equal to the 200 mV reference multiplied by (R4 + R5)/R5 or 1·22V with the values shown. The setting of this reference output from pin 1 to 1·22V provides a current through R2 which is proportional to the absolute temperature, (owing to the presence of the forward biased junction of D1), and this "level-shift" voltage has a temperature coefficient matching that of R6. The capacitor C1 will prevent instability if a photodiode with a high capacitance is employed.

Meter Amplifier

The circuit of Fig. 5 shows how the LM10 can be used to increase the sensitivity of a 0–100μA meter to provide a

full scale deflection of 10mV or 100nA. The total current drain of this circuit from the power cell is less than 500μA; this corresponds to a life of some 3 to 6 months with an "AA" size cell or over a year with a "D" cell. Readers may feel an ON/OFF switch is unnecessary!

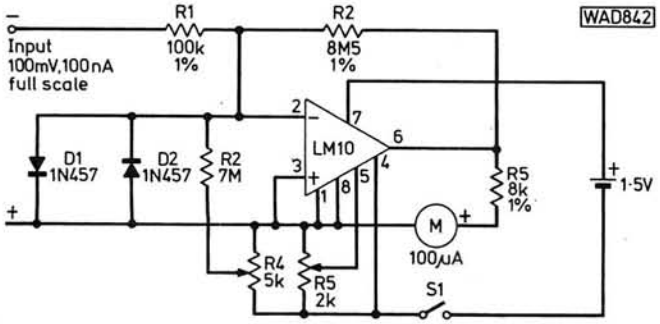


Fig. 5: A 10mV, 100nA meter circuit using the LM10

A particular advantage of this circuit is that its accuracy can be maintained over a temperature range of 15°C to 55°C. Offset voltage errors are nulled by adjusting R5, the zero setting control. The bias current can be balanced out using R4. As these trimming adjusters operate from the reference voltage output from pin 1, the settings are stable against variations of power supply voltage from the cell.

Input clamping diodes D1 and D2 protect the circuit from large overloads. The limited output swing provided by the LM10 provides protection for the meter during overload conditions. If the meter amplifier circuit is used to construct a multi-range meter, the internal reference voltage from pin 1 can also be employed in resistance measurements, eliminating the frequent adjustments required for setting of multi-range meters on resistance ranges as the cell voltage falls.

Electronic Thermometer

An electronic thermometer for the range −55°C to +150°C is shown in Fig. 6. The LM134 sensor develops a current which is proportional to the absolute temperature. The LM10 provides the required amplification and voltage

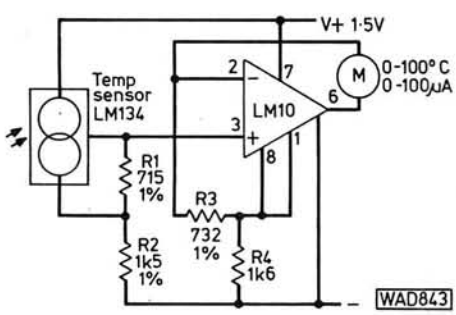


Fig. 6: An electric thermometer

offset so that direct readings in either °C or °F can be obtained. R2 is used to set the zero temperature and R3 sets the width of the temperature range that the circuit can accommodate. Some errors may occur in this circuit if the cell voltage falls below 1·5V, since the LM134 characteristics are unspecified below 1·5V.

Microphone Amplifier

For audio applications the frequency response of the LM10 device is somewhat limited, but it is possible to obtain a gain of about 10 at frequencies up to 10kHz. In order to obtain a higher overall gain, for use as a microphone amplifier, the circuit of Fig. 7 employs the reference voltage amplifier as an audio preamplifier stage with a gain of 100. The output from pin 1 of this preamplifier stage is coupled by R3 and C1 to the inverting input of the operational amplifier. The values of R7 and R3 set the gain of this operational amplifier stage at 10 and at this low gain frequency response is level up to 10kHz.

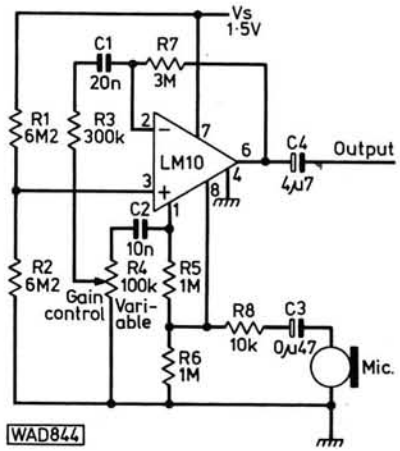


Fig. 7: A microphone amplifier with a gain of 60dB using one i.c.

The overall gain of the circuit is 1000 (60dB) with a 10kHz bandwidth when no load is connected to the output, falling to a 5kHz bandwidth with a 500Ω output load. The input impedance is 10kΩ. The circuit has been designed so that no steady current flows through the gain control, as this reduces noise when the control is operated. However, a slightly simpler circuit could have been designed using R5 as the gain control with a steady bias current (less than 75nA) flowing through it.

Laboratory PSU

A general purpose laboratory type power supply unit using two LM10 devices is shown in Fig. 8. The output is fully adjustable from 0V to 50V, this output voltage being equal to the value of R3 in ohms divided by 10000. A three-stage emitter follower circuit (TR3 to TR5 inclusive) is employed to provide the output current of up to 1A.

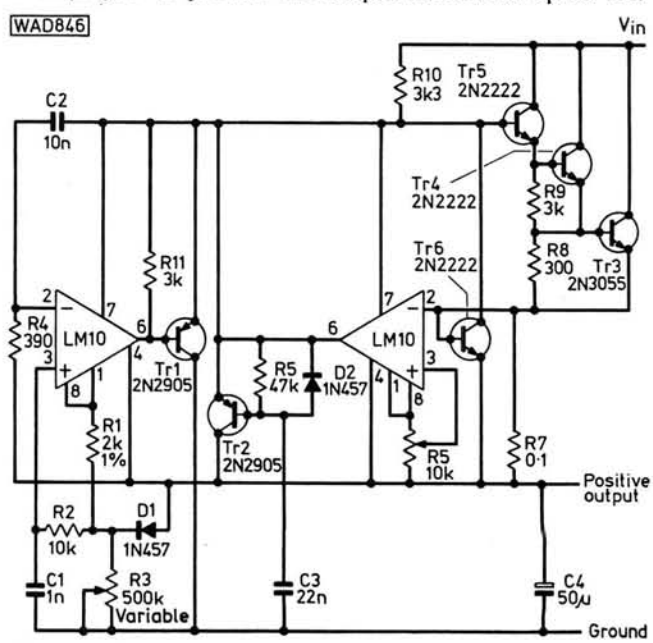


Fig. 8: A laboratory power supply providing 0V to 50V at outputs of up to 1A

continued on page 57▶▶▶

special offer

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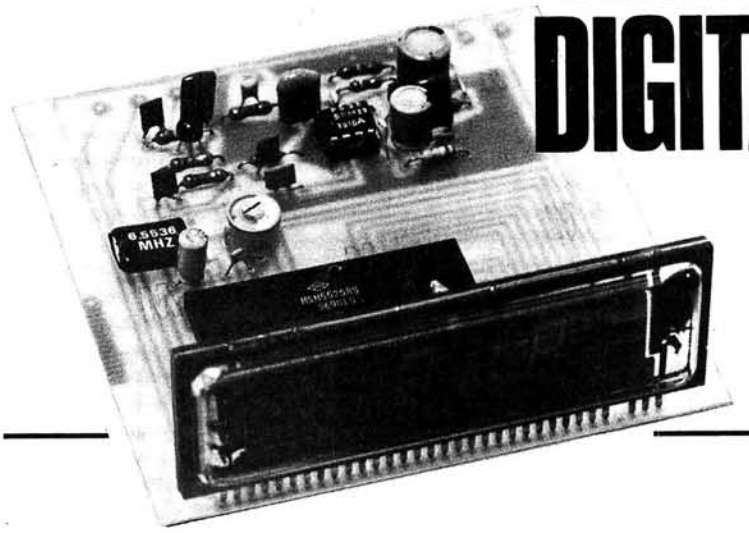

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THE 'WINTON' Stereo Tuner

Part 5

E. A. RULE

This month in Part 5 of the Winton Tuner we will deal with the wiring details. It is very important to follow these instructions carefully in order to avoid introducing unnecessary faults into the project.

Mounting the TV Unit

The TV unit was originally intended to be soldered directly into a p.c.b. of a TV receiver but this is not possible in the *PW* tuner. The method used may seem crude but in practice is very reliable and enables the unit to be removed for any service needed with ease. First, the four fixing screws and solder tags are fitted to the chassis but not tightened. The TV r.f. unit is then placed into its correct position and the solder tags adjusted in their position until each one can be soldered to the TV unit case. Once soldered, the fixing screws can be tightened up. To remove the unit it is only necessary to remove the screws, the tags will stay on the unit in the correct positions for refitting. Once mounted, the TV antenna socket can be soldered to the input pin on the side of the unit. Fig. 16 shows how the unit is mounted.

Wiring

The full wiring details are shown in Table 1. It is important to note that this describes the correct sequence of connections, and the actual route the wires should take. A suitable size wire to use is 7/0·2mm (0·22mm²). Once the wiring is finished it can be tidied up with cable ties (RS type 543–428 are suitable). Where decoupling capacitors are shown between the earth pins and chassis, keep the leads to the capacitors as short as possible. These capacitors are for radio frequency decoupling and should be fitted even though they appear to be decoupling a "short."

Use the minimum amount of solder required to obtain a good joint and let the solder "flow" so that dry joints are avoided. Tracing faults in r.f. circuits is one of the most difficult jobs, without adding any due to intermittent "dry" joints. Extra care taken with the p.c.b. soldering (and for that matter all soldering) will avoid hours of frustration later.

The soldering iron used should have a small bit as this will help in avoiding "solder bridges" between the copper tracks. The use of a strong magnifying glass to look at each and every joint after soldering will be found well worthwhile and is something the author always does.

Ferrite Antenna

The ferrite antenna is mounted in two plastics clips which are in turn mounted onto the rear panel of the chassis. The ferrite rod is fitted into these clips with the m.w. coil L6 (the longest coil) towards the f.m. antenna socket. The wires from the coil connections to the a.m. p.c.b. are passed through the grommet positioned next to the a.m. antenna socket. The most suitable wire for connecting up the ferrite rod coils is 7/0·1mm (0·055mm²) if available, but the 7/0·2mm can be used although not so flexible. The wires should be left as single conductors, i.e., don't twist the groups together as this will increase the capacity between them and may make the antenna trimmers difficult to adjust.

A small amount of slack should be left at the ferrite rod end of the wires so that the coils can be adjusted for optimum position on the rod during final adjustment. The actual connections are shown in Fig. 14. It is important to note that each coil has its own earth lead to the a.m. unit, do not be tempted to use a common lead for this as unwanted signal pick-up could result.

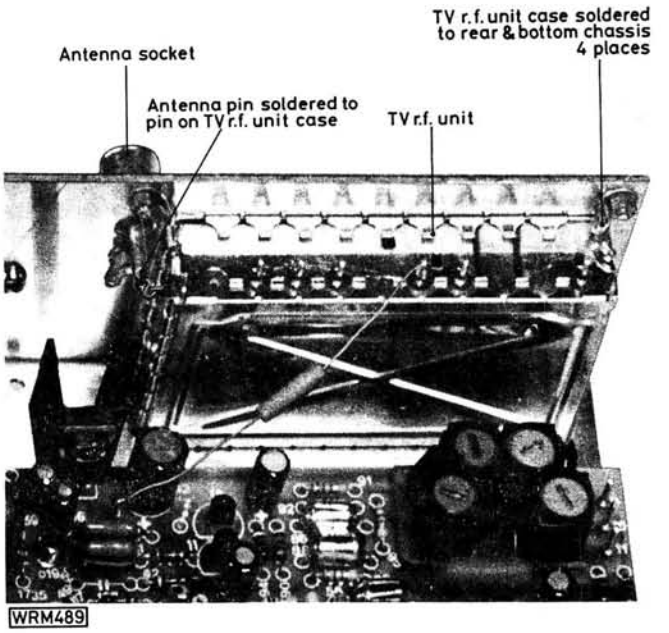


Fig. 16: The mounting of the TV r.f. unit

Fig. 14: The connections for the ferrite rod antenna looking at the tag ends of the coils

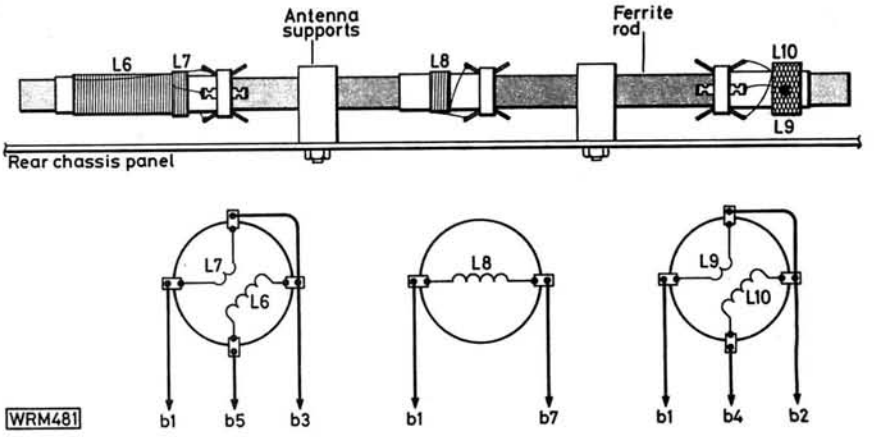
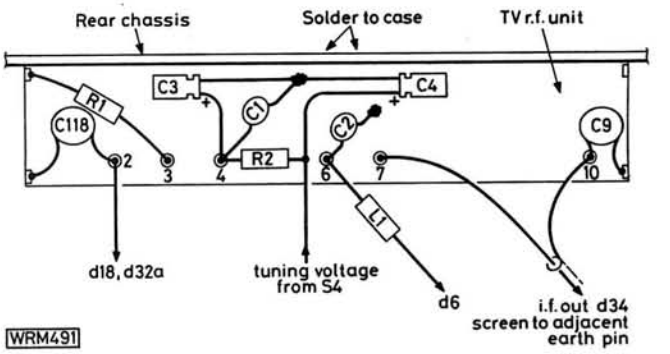


Fig. 15: Connections to the TV r.f. unit ▶



Most of the wiring is gathered up after completion into a "loom" and the route that the wires take is most important. There are four routes.

The front route follows the front of the unit from end to end approximately 40mm behind the front plate.

The rear route runs from end to end along the line of the rear edge of the a.m. board.

The cross (x) route joins the first two routes along the line where the digital board meets the a.m. board.

The direct route simply indicates that a wire goes from one point to another directly and is not gathered into a loom.

Before getting down to wiring, a few oddments should be done. Capacitor C112 (470nF) goes from pin c31 to nearby earth solder tag. Capacitor C10 (100nF ceramic) from pin "to C10" on the i.f. board to earth solder tag. A short green wire should be soldered from the earthed solder tag behind the digital board to the earth pin next to pin 5. On the front panel a wire should go from the solder tag above the four push switches to one side of S16 to 19 and the wiper A of S14.

The three-button switch should have all its bottom pins trimmed off and a spacer fitted at each end with a 6BA screw. It is then fitted to the front flange of the chassis with 6BA screws.

Meters

The meters should only be glued in place when the unit is completely assembled and the front plate fitted; for wiring purposes they should be merely put in their correct place.

Mains Transformer

The mains transformer is fitted to the chassis with three large cable ties, with the buckle behind the small holes. Think carefully about the disposition of wires here as things are quite cramped. The fuseholder and cable clamp fitting are straightforward, but make sure the mains lead earth is long enough to reach an earth solder tag.

Wire	From	To	Via	Route/Notes
Yellow	S14–1	S15 left centre	—	Front
Yellow	S14–3	c14	R107	Front
Yellow	S14–4	c15	R108	Front
Yellow	S14–5	c13	R106	Front
Brown	c8	S16 "B"	—	Front
Brown	c9	S17 "A"	—	Front
Brown	c10	S18 H/S	—	Front
Brown	c11	S19 T/O	—	Front
Green	R56 pin 2	b8	S4 rear	Front x Rear
Blue	d38	d39	connections	Direct
Blue	Point "Z" on AM board	to "Z"	—	Direct
Green	R56 pin 3	d20	—	Front
Blue	R56 pin 1	d19	—	Front
Brown	b32	d13	—	Front
Black	d16	S2 left rear	—	Front
Black	S2 left centre	"to S2" IF board	—	Front
Yellow	d24	S3 left centre	—	Front
Grey	d27	S3 left front	—	Front

Wire	From	To	Via	Route/Notes
White	d21	S3 left rear	—	Plus another 50mm wire on S3 left rear for tuning meter negative. Meter fitted later
Orange	d29	S1 left rear	—	Front
Red	d6	b22	c22	Rear L1 from TV tuner also to d6
Orange	b23	d17	FM Tuner B1 S1 left centre	Rear × Front
Red	d28	l.e.d. K	S1 left front	Front. Wire to l.e.d. 125mm long. K is longer lead. Use heatshrink sleeves on l.e.d.
Blue	d12	l.e.d. A	—	Front
White	c3	c21	—	Direct
White	c12	c20	—	Direct
White	d36	c19	15Ω ½W at C19 end	Rear
White	d32	c16b (1·5kΩ)	—	Direct
Black	C61 –ve	d4	—	Direct
Red	C61 +ve	d3	—	Direct
Red	d3	S16 right top	c1	Rear × Front
Orange	S16 centre right	d5	—	Front × Rear
Yellow	b24	d32a	c9	Rear
Yellow	d32a	d18	TV tuner pin 2	Rear and right end
Grey	c7	junction R2/C4 TV tuner	Right centre	Front and right end
Grey	S4 centre left	junction R3/C7 FM tuner	—	Front × Rear
Purple	d14	a.g.c. pin FM tuner	—	Front × Rear
Blue	d35	b29	—	Rear
Brown	d25	b27	—	Front × Rear
Green	d26	b28	—	Front × Rear
Blue	b14	S16 (standby) top left	c18	Rear × Front
Twin coaxial cable screens	b17	d9	—	Rear
	b21	d11	—	Rear
	b18	d16	—	Rear
Single coaxial	Antenna socket on chassis	Antenna phono plug on tuner	—	Direct. Fit also wire from earth solder tag on socket to black socket below
Twin coaxial cable	b16	pin 4 din o/p	—	Rear
	b20	pin 1	—	Rear
	b18	pin 2	—	Rear
Black	b15	c16a	R110	Rear
White	b13	c17	R111	Rear
Single coaxial screen	FM Tuner IF Out plug	d31	—	Rear
	IF Out plug	pin E	—	Rear
Single coaxial screen	FM Tuner F Out plug	c5	—	Rear
	F Out plug	adjacent earth pin	—	Rear
Single coaxial screen	c3	b26	—	Rear
	c2	NC	—	Rear
Fit meters now. See note headed "meters"				
White (already fitted)	S3 rear	Tuning meter negative	—	—
Orange	d22	Tuning meter +ve	—	Front
Red	b30	Signal strength meter +ve	—	Direct
Black	b31	Signal strength meter –ve	—	Direct
Single coaxial screen	d34	TV tuner pin 7	—	Rear
	adjacent earth	pin 10	—	Rear
Now fit the mains transformer, fuseholder and mains lead. See notes				
Red	d1	transformer	—	These wires are already fitted to the mains transformer
Black	earth above D15	transformer	—	
Red	d37	transformer	—	

Wire	From	To	Via	Route/Notes
Brown	transformer	fuseholder front tag	—	Sleeve joint to prevent shock
Brown	mains lead	fuseholder rear tag	—	Sleeve joint to prevent shock
Green/Yellow	mains lead	earthed solder tag by transformer	—	
Blue	mains lead	transformer	—	Sleeve joint
Fit the ferrite rod in two plastic clips. Coils are referred to as follows: LWC — long wave coil, MWC — medium wave coil, CC — coupling coil. The coupling coil has only two tags. The long and medium coils have their tags numbered by their "clock" position when viewed from the tag end and referenced to the paint mark at "12 o'clock'.				
Green	b1	LWC 4	MWC 2 and CC1	Do not twist the following wires but leave as loose as possible to reduce stray capacitance. If a.m. performance is critical smaller wires may be used.
Red	b3	MWC 8 and 10		
Black	b2	LWC 8 and 10		
Yellow	b4	LWC 2		
White	b5	MWC 4		
Grey	b7	CC2		
Brown	b6	AM antenna socket		

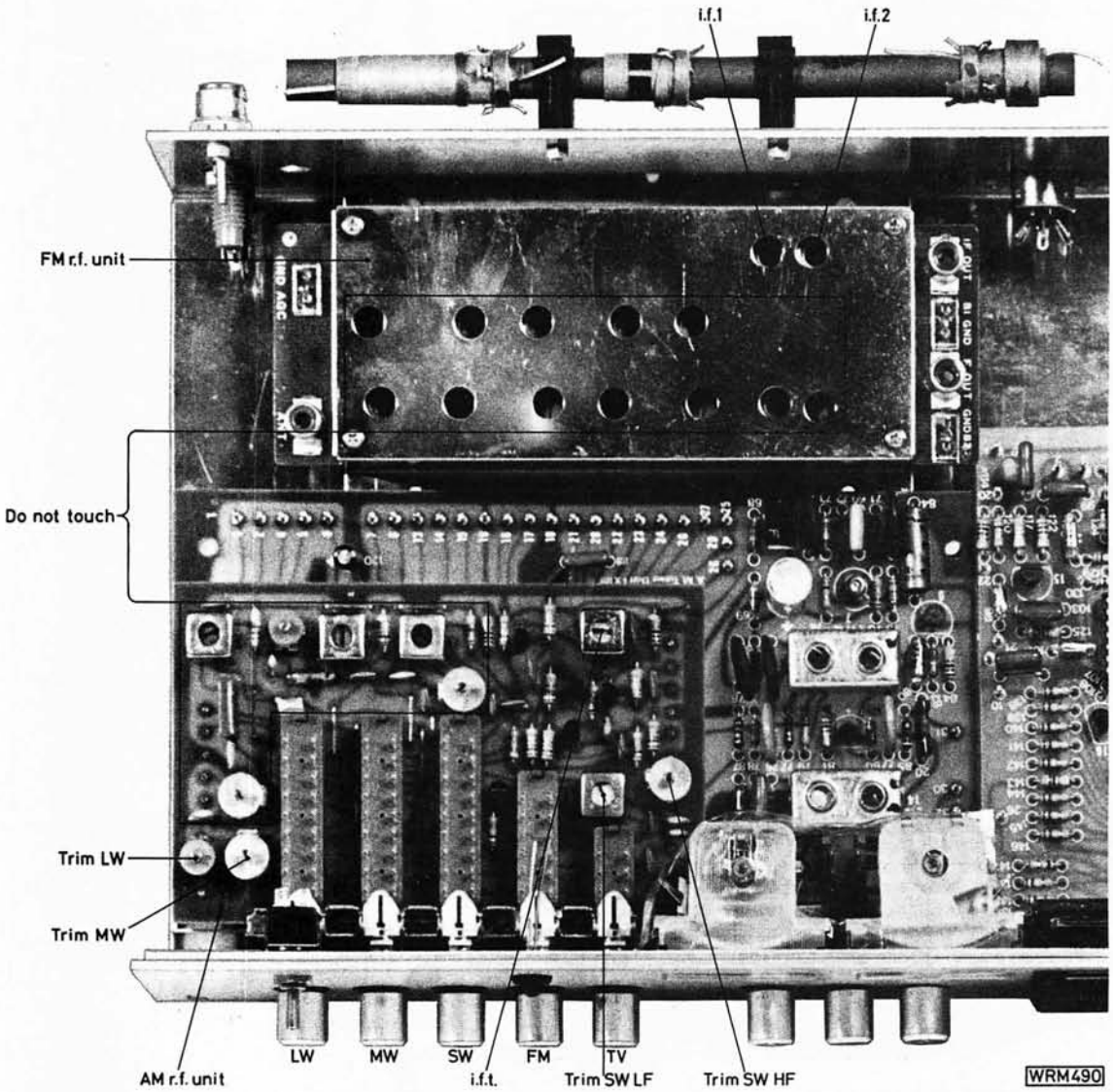
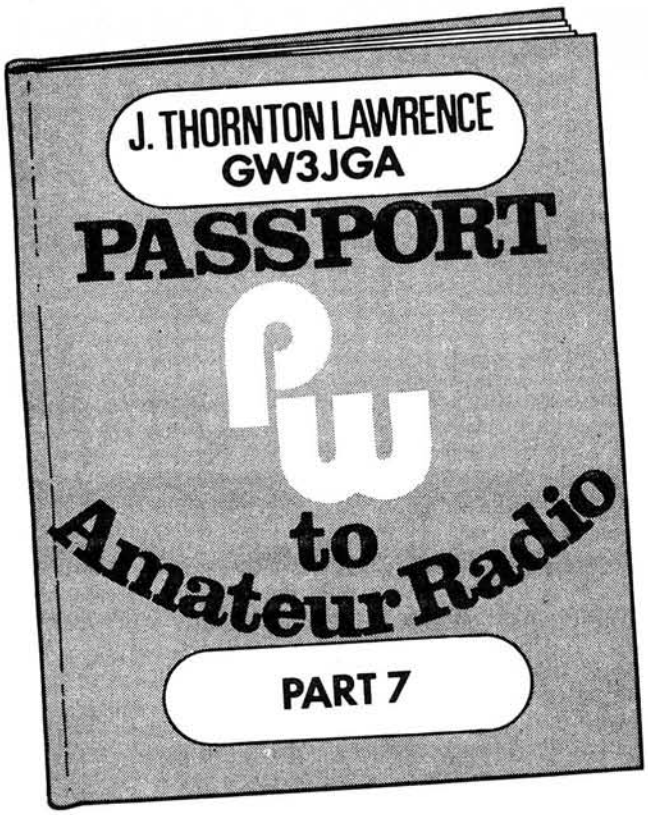


Fig. 17: The f.m. and a.m. r.f. units with their respective tuning adjustments marked

We will deal with the setting up instructions for the tuner next month, as they have had to be held over due to space problems.



In this part of the series we will be looking at transmitters and types of modulation.

Transmitters

To state the obvious, the purpose of the transmitter is to generate a radio frequency signal for transmission to a distant receiving station. In addition, the transmitted signal must conform to the Amateur Sound Licence requirements in terms of power, frequency, accuracy and stability, absence of spurious emissions, etc., particularly when keyed or modulated by the information to be sent. Full details of these requirements are given in the Home Office publication *How to become a radio amateur.*

A block diagram of a simple c.w. transmitter (emission type A1A) for 160m, 1·8–2·0MHz, is shown in Fig. 47. It consists of a variable frequency oscillator followed by a buffer amplifier and a power amplifier.

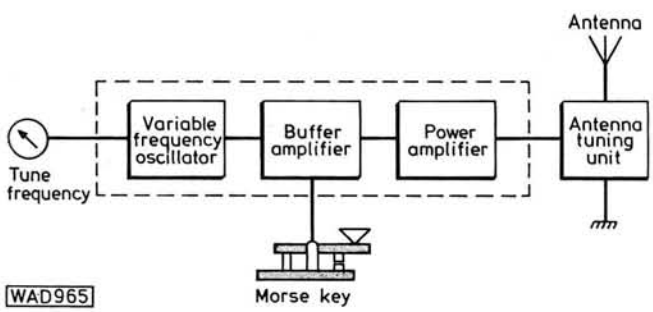


Fig. 47: Block diagram of a c.w. transmitter

It is usual for the oscillator to be operated in Class A or B, the buffer amplifier in Class B and the power amplifier in Class C. The various classes of operation refer to the conditions under which the valve or transistor operates and these are summarised and shown graphically in Fig. 48.

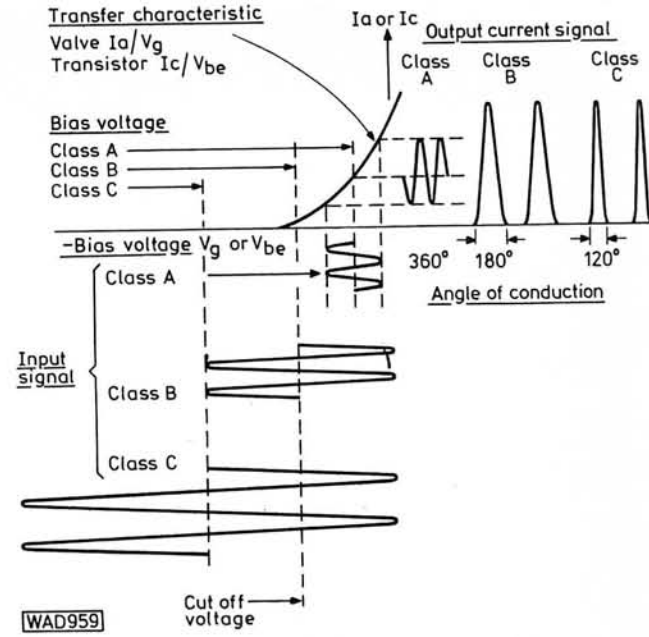


Fig. 48: Operating conditions for Class A, B and C

Classes of Amplifier Operation

In **Class A,** the transistor or valve is biased to near the centre of its linear operating range and the signal amplitude is insufficient to cause operation outside this range. Class A amplifiers have a low efficiency, typically 50 per cent or less (less than half the input power is converted into useful output), but they do not significantly distort the signal or generate harmonics.

In **Class B,** the valve or transistor is biased to the cut-off point and the input signal drives the device into full conduction for half of the cycle of input signal (180°) and beyond cut-off during the other half. The efficiency is higher than Class A, being 60–65 per cent for c.w. (continuous radio frequency wave operation).

A Class B amplifier stage with a single valve or transistor distorts the signal passing through it, producing mainly second harmonic distortion. In a Class B audio frequency amplifier two valves or transistors are required. These operate in push-pull, one handling one half-cycle and its partner the other, so eliminating the distortion.

A single valve or transistor Class B amplifier can be used for r.f. purposes in a transmitter because of the "flywheel" effect of the output tuned circuit. This type of amplifier has a reasonably linear transfer characteristic (the output signal is proportional to the input signal) and therefore an amplitude-modulated r.f. signal can be amplified with little distortion, an important property which is essential in single sideband transmitters, as we shall see later.

In a **Class C** amplifier, the valve or transistor is biased well beyond cut-off and the input signal is required to have a larger amplitude in order to drive the device into conduction. Conduction only occurs for about one-third of a cycle of the input signal (120°) and the efficiency can be in the region of 70 per cent.

The output of the device contains a high proportion of harmonics and the output circuit must be correctly tuned to the fundamental frequency to reduce the possibility of harmonics being radiated. The Class C amplifier has a non-linear transfer characteristic and is therefore unsuitable for amplifying an amplitude-modulated input signal, although we will see later that it can be used to amplitude modulate a carrier wave.

A Class C amplifier can be employed intentionally as a harmonic generator or frequency multiplier by increasing the bias still further so that the device is only conducting for a quarter of a cycle (90°) of the input signal.

In this condition, the output is rich in harmonics and by making the output circuit resonant at the desired harmonic, power can be obtained at this frequency. For example, the input could be at 7MHz and the output tuned to the second harmonic (14MHz), with further amplification for transmitting on the 14MHz band, or the third harmonic selected for transmitting on the 21MHz band. In Fig. 48 the bias conditions are shown for a valve I_a (anode current)/V_g (grid voltage) characteristic and for a transistor I_c (collector current)/V_{be} (base-emitter voltage) characteristic.

Simple CW Transmitter for 160m

The circuit of the transmitter illustrated in the block diagram (Fig. 47) is given in Fig. 49.

The v.f.o. is a series-tuned Colpitts oscillator. The oscillator feedback is obtained from a capacitive tap (the junction of C3 and C4). A simple memory "aid" is "C" is for Colpitts and capacitive tap and "H" is for Hartley and an inductive tap. The frequency stability of the oscillator depends mainly on the coil and the tuning capacitor C13 having good mechanical stability and Tr1 being coupled in such a way that any change in its internal capacitance has little effect on the frequency.

This is done by arranging that C3 and C4 are effectively across Tr1 and are large enough to swamp any small changes that might occur.

The output from Tr1 is fed to the tuned circuit L2 and C5 which has a coupling winding L3 feeding Tr2. The bias for Tr2 is provided by R5 and R6 with decoupling by C6. The output from Tr2 is fed to the tuned circuit L4 and C7 with a coupling winding L5 feeding the base of Tr3. Note that Tr3 is normally cut-off and only conducts when driven with an input signal. The emitter biasing resistor R8 provides extra biasing voltage when the stage is operating giving the correct Class C conditions. The output is fed to a suitable impedance matching point on L6 which, with C14, resonates at the output frequency. Output coupling to the antenna tuning unit is provided by an adjustable coupling coil L7.

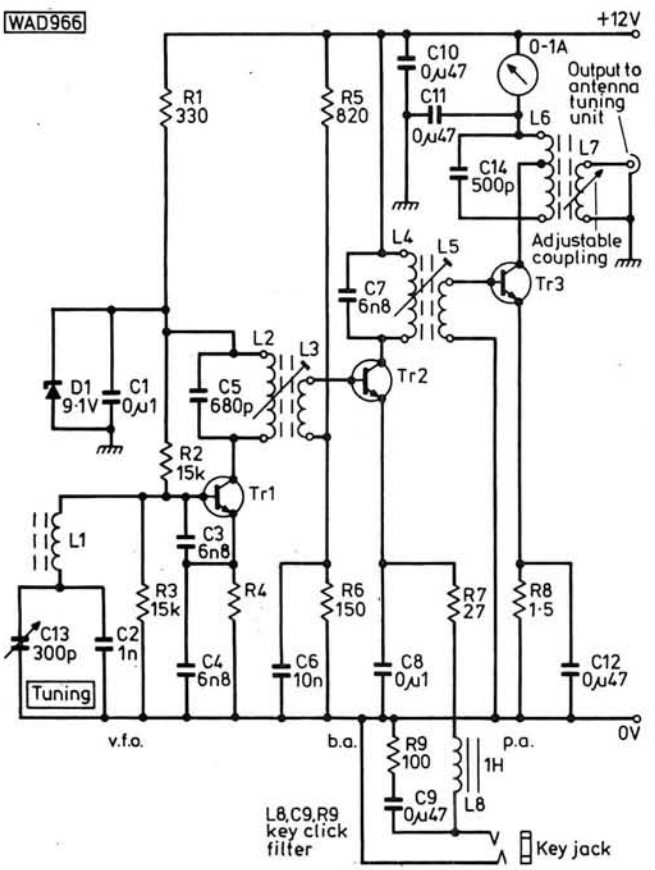


Fig. 49: The circuit diagram of the c.w. transmitter of Fig. 47

Keying and the Keying Filter

The transmitter is keyed on and off by connecting the Morse key in the emitter circuit of Tr2. When the key is "up" no current will flow through Tr2 and there is no output. With the key "down" normal output is obtained.

Keying a transmitter by abruptly starting and stopping the carrier wave results in spurious signals being radiated and these are received as "key clicks" over a wide range of frequencies. To overcome this problem the transmitter must turn on and off less quickly and a key click filter, L8, C9 and R9 is included for this purpose. Inductor L8 restricts the rate of rise of current through Tr2 when the transmitter is keyed on, and C9 the fall of current when keyed off, as shown in Fig. 50. The values of L8, C9 and R9 are often chosen experimentally, but the values given are typical.

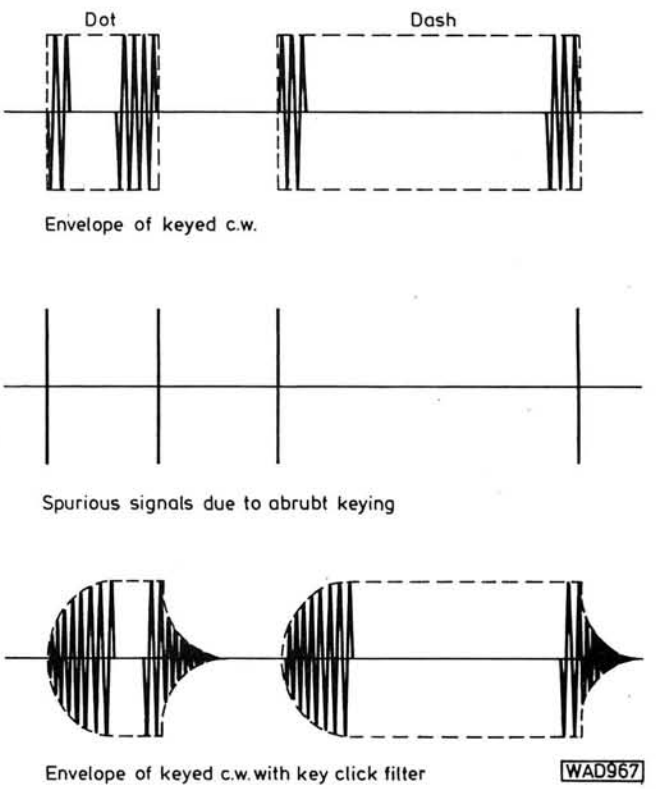


Fig. 50: Signal envelopes with and without key click filter

Modulation

To transmit voice information by radio wave it is necessary for the microphone output signal to vary or modulate the r.f. carrier wave in such a way that will allow the a.f. signal to be extracted at the receiver. The two basic

methods are amplitude modulation (a.m.) and frequency modulation (f.m.), each method having its particular advantages and disadvantages.

Amplitude Modulation

Amplitude modulation is produced by mixing the modulating signal with the carrier wave in a non-linear device or amplifier. Modulation can be carried out at high power levels in the output stage of the transmitter or at low power in an earlier stage providing the subsequent amplifiers are linear (Class A or B).

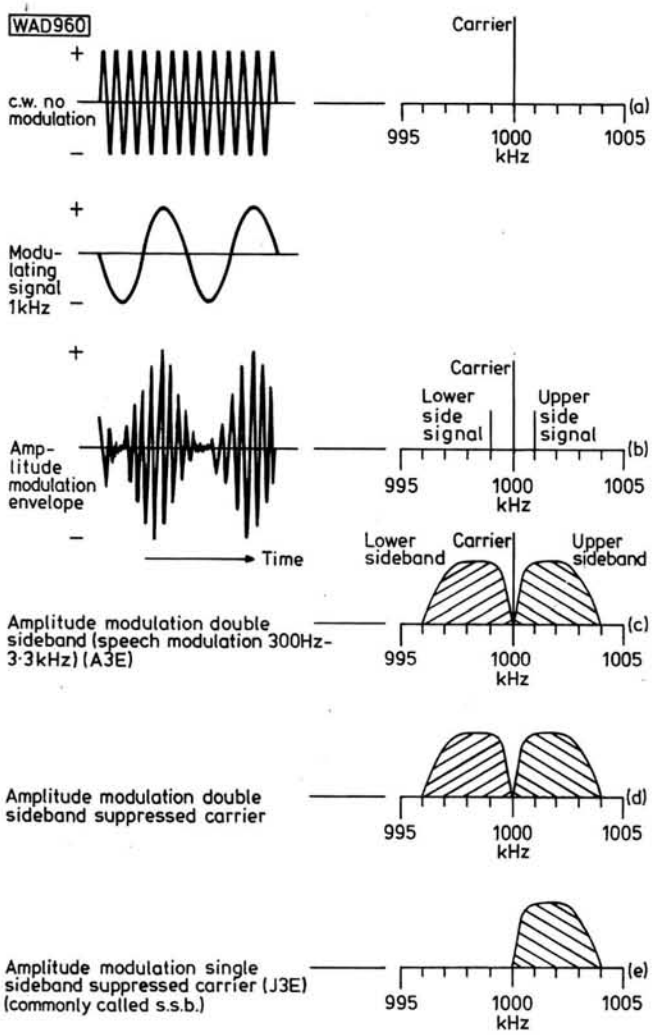


Fig. 51: Examples of a.m. envelopes showing sidebands

Amplitude modulation is shown in two ways in Fig. 51(a), (b) and (c). On the left is a representation of the carrier wave, the modulating signal and the resultant modulation envelope as would be seen on a conventional oscilloscope. The graphs on the right show the same conditions but with the frequency along the base-line. When two frequencies are fed into a non-linear stage, the output will contain a number of signals in addition to the original input signals. The main ones are the "sum" and "difference" frequencies, as shown below.

Input signals f_1 and f_2

Output signals f_1, f_2, $f_1 + f_2$, $f_1 - f_2$.

If the carrier frequency is 1000kHz (f_1) and the modulating frequency is 1kHz (f_2) then two side-frequencies are generated, the higher one at 1001kHz ($f_1 + f_2$) and the lower one at 999kHz ($f_1 - f_2$). It is the sum of the carrier and the two side-frequencies which forms the modulation envelope shown in Fig. 51(b).

The speech signal from the microphone consists of a band of frequencies between about 300Hz and 3·3kHz varying in frequency and amplitude with the voice patterns. Modulation by a speech signal results in two sidebands, the upper sideband and the lower sideband. These sidebands, which carry the a.f. modulation information, are mirror images of each other. The carrier wave remains constant irrespective of whether modulation is present or not and although it carries no information its presence is required at the receiver for the demodulation process.

Since the carrier wave conveys no intelligence it is possible to dispense with it altogether as shown in Fig. 51(d) (thus saving a great deal of transmitter power), provided it is generated again, locally at the receiver for demodulation purposes. Unfortunately this carrier must be in the correct phase relationship with the sidebands or serious distortion will result. A double-sideband suppressed-carrier transmission is very difficult to tune in and requires a sophisticated receiver for satisfactory reception. However, if the carrier and one of the sidebands are removed and the remaining sideband transmitted then this exact phase relationship is no longer essential and the carrier can readily be inserted at the receiver.

As the two sidebands contain identical modulation, removing one of them does not result in loss of information and effects a further saving of transmitting power. This type of transmission shown in Fig. 51(e) is known as single sideband suppressed carrier or emission type J3E (A3J) and commonly abbreviated to just s.s.b.

Single Sideband (J3E)

Single sideband has several advantages for the radio amateur:

1. Saving in transmitter power or the ability to run the equivalent of higher power for the same rating of output amplifier.
2. No carrier radiated so it does not cause the usual heterodyne interference.
3. Requires only half the usual bandwidth.
4. Less affected by transmission path disturbances.

Amplitude Modulated Transmitter

Amplitude modulation A3E (A3) can be performed at high signal levels in the output stage of the transmitter by applying the modulating audio voltage in series with the supply voltage as shown in Fig. 52(b). To achieve adequate amplitude modulation of a transistor transmitter it is

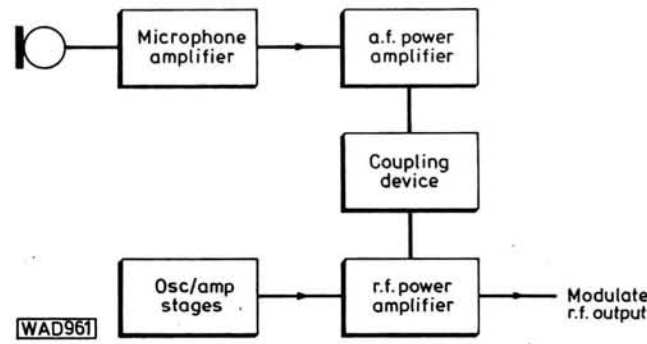


Fig. 52(a): Block diagram of a.m. (A3E) transmitter

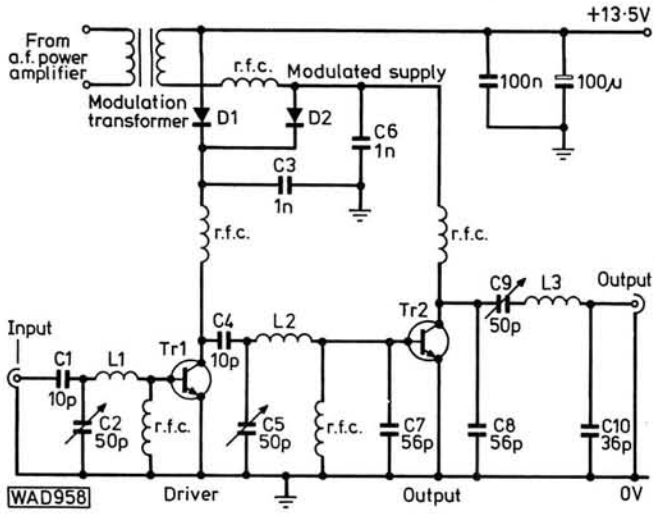


Fig. 52(b): Output stage of 144MHz a.m. transmitter

usually necessary to modulate the supply to the driver stage in addition to the output stage. In the circuit shown, diode D2 conducts and D1 cuts off when the modulating voltage swings positive and so provides extra drive to the output stage on positive modulation peaks.

If the output stage transistor was drawing 30 watts d.c. input power then approximately 15 to 20 watts of audio power would be required for full modulation.

SSB Transmitter (J3E)

The s.s.b. (J3E) signal is usually generated either by a phasing method, shown in Fig. 53(a), or by the use of a balanced modulator and filter shown in Fig. 53(b).

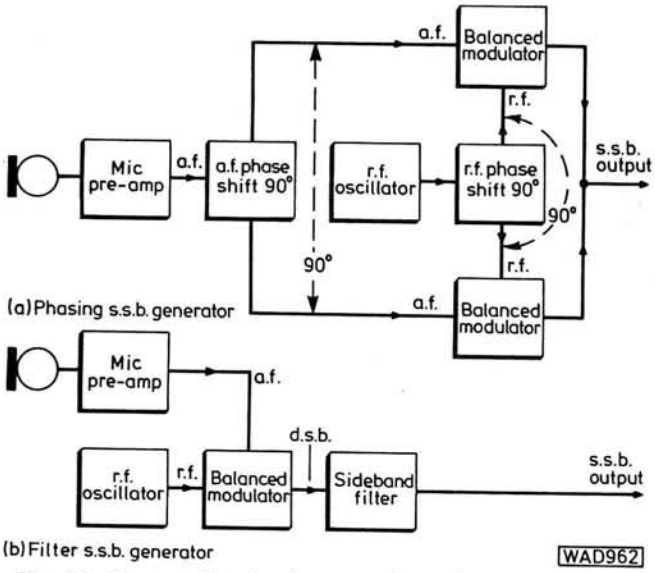


Fig. 53: Two methods of generation of an s.s.b. signal

In the phasing method, the a.f. signal is processed in a phase-shifting circuit which generates two signals having a 90° phase relationship over the audio frequency band, 300Hz to 3·3kHz. The r.f. signal is also phase shifted by 90° and fed with the a.f. signals to two balanced modulators with a common output. The result is that the carrier is removed and one sideband is cancelled out. Upper or lower sideband can be selected by reversing the a.f. or r.f. inputs to the modulators.

In the filter method, the r.f. signal is modulated in a balanced modulator to provide a double-sideband suppressed-carrier signal and then one of the sidebands is selected by a high-grade crystal filter to produce an s.s.b. signal. The filter method is the simpler of the two, but requires an expensive or very carefully home-made crystal filter.

Balanced Modulator or Mixer

The balanced modulator can take many forms but in essence it is a balanced circuit in which the r.f. input signal is cancelled or "nulled" out.

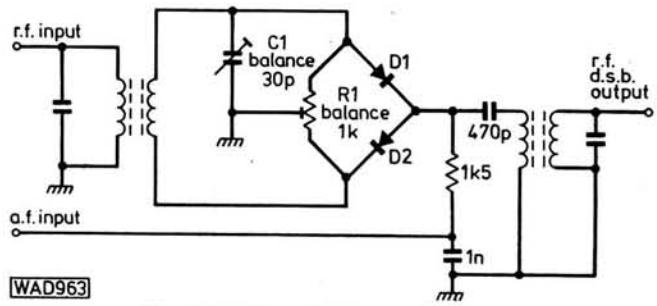


Fig. 54: Diode bridge modulator

The simplest form is a diode bridge arrangement shown in Fig. 54. Here the r.f. input is fed to a bridge circuit where the centre of the diodes is a null point. Resistor R1 and capacitor C1 enable the bridge to be accurately balanced to provide adequate suppression of the carrier. An a.f. signal input causes D1 and D2 to conduct alternately, on each half-cycle, unbalancing the bridge and producing a double-sideband suppressed-carrier signal at the output.

Simple SSB (J3E) Transmitter

The block diagram in Fig. 55 shows a simple s.s.b. transmitter for use on one band 14–14·35MHz. In this transmitter the s.s.b. signal originates from a 9MHz crystal oscillator feeding into a balanced mixer and then to a crystal filter. The 9MHz s.s.b. signal is mixed with a variable frequency oscillator (v.f.o.), tuning

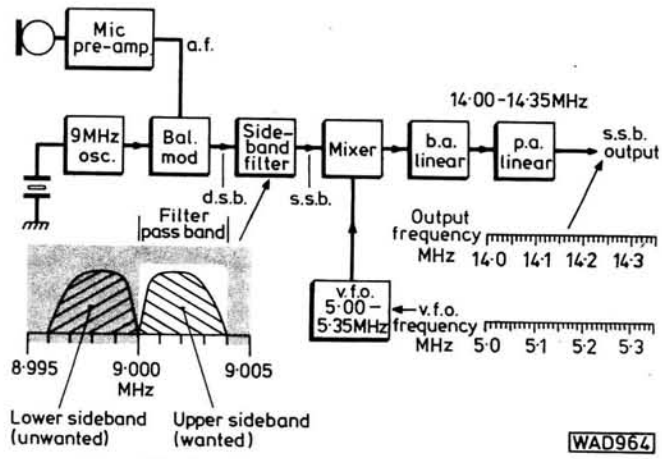


Fig. 55: Block diagram of a single band s.s.b. transmitter

5·0–5·35MHz. The sum of the two frequencies 14–14·35MHz is selected at the output. This signal is amplified in a linear buffer amplifier and then a linear power amplifier to give the required s.s.b. power output. Operation on other bands would be possible by changing the v.f.o. frequency.

It is essential that, once the amplitude modulated s.s.b. signal is generated, subsequent amplification must be linear or severe distortion will result. Class C amplifiers are unsuitable for this purpose.

Linear Power Amplifier

A typical linear power amplifier, for use on one h.f. band, is shown in Fig. 56(a). The valve is biased to operate in Class B for good linearity combined with high efficiency.

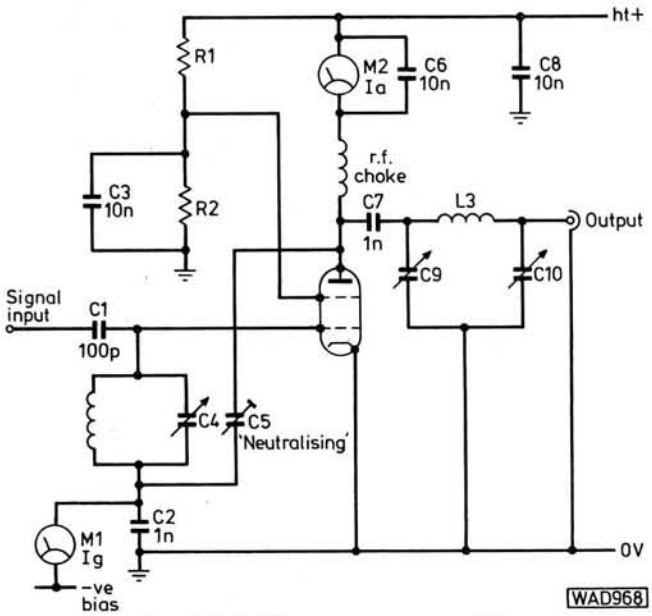


Fig. 56(a): Linear power amplifier

The s.s.b. signal is applied to the input tuned circuit and the control grid. The output signal at the anode is developed across the r.f. choke L2 and fed via C7 to the output tuned circuit L3, C9 and C10. This output circuit is called a "pi" network (similar in shape to the Greek letter pi, π.). In operation, C9 tunes the output circuit to resonance and C10 effectively provides a variable capacitive tapping point on the tuned circuit and enables the output of the transmitter to be correctly matched to the load.

Neutralisation

There is usually some stray capacitance existing between the anode and grid of the valve both in the valve itself and in the wiring. Signal feedback through this capacitance affects the grid and anode tuning and may cause self-oscillation. A neutralising capacitor C5 feeds a small amount of r.f. signal from the anode to the opposite end of the grid tuned circuit and neutralises the effect of the anode-grid capacitance. The circuit is rearranged in Fig. 56(b) to show that the neutralising capacitor forms part of a "bridge" circuit. To set C5, the h.t. is temporarily disconnected, an input signal is applied and C4 adjusted for maximum drive indicated on M1. With C10 at maximum C9 is rotated and any variation on M1 noted. Capacitor C5 is then adjusted for negligible variation of M1, indicationg correct neutralisation.

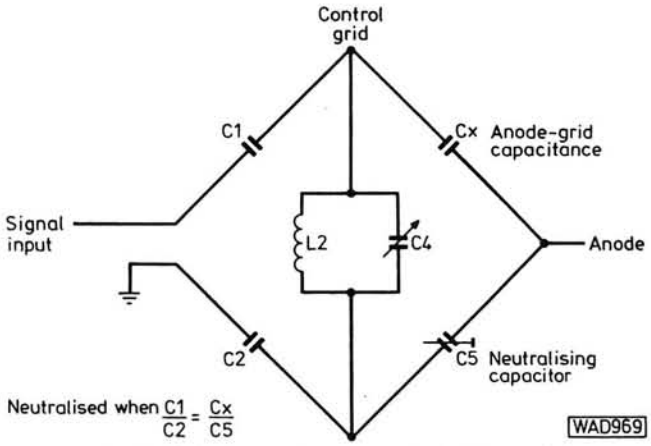


Fig. 56(b): Equivalent circuit of Fig. 56(a)

Upper and Lower Sideband

In the s.s.b. transmitter shown in Fig. 55 the upper sideband was selected by the relative placing of the 9MHz oscillator and the filter passband.

Selection of the lower sideband could be obtained by moving the 9MHz oscillator to the high-frequency side of the filter passband so that the lower sideband would fit within the filter passband.

By convention, amateur transmissions use the lower sideband on the 1·8, 3·5 and 7MHz bands and upper sideband on 14MHz and above.

In practice, two quartz crystals would be employed in the 9MHz oscillator having frequencies differing by about 3kHz correctly placed on each side of the filter passband and switched to give upper or lower sideband operation.

With regard to Class B and Class C r.f. amplifiers, remember that there are no essential physical circuit differences between the two types; the difference is in the operating conditions, namely the bias supply voltage and the amplitude of the r.f. input signal. However, Class B (and Class A) amplifiers are more critical to any stray feedback which may be present in the device or wiring and therefore may need neutralisation, as described, before correct tuning and operation can be obtained.

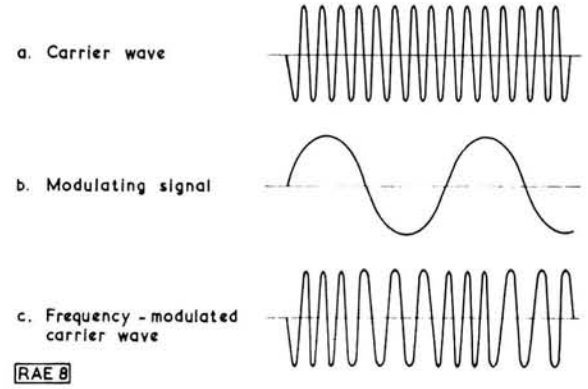


Fig. 57: Frequency modulation of a carrier wave

Frequency Modulation

Frequency modulation is shown graphically in Fig. 57, where (a) represents an unmodulated r.f. carrier wave, (b) an a.f. modulating signal and (c) a frequency modulated carrier wave.

In this diagram it can be seen that the frequency of the carrier wave is increased and decreased in direct relationship with the modulating signal. The amount of frequency change (deviation) depends on the amplitude of the modulating signal, and the number of times per second the frequency changes is equal to the modulating frequency. For example, suppose that an r.f. carrier wave of frequency 1000kHz is frequency modulated by a 1kHz signal, the deviation being 2·5kHz above and below the centre frequency, 1000 times per second (1kHz rate). If the amplitude of the 1kHz modulation signal is reduced to half, then the deviation will be reduced to half, i.e. 1·25kHz above and below the centre frequency, but still 1000 times per second (1kHz rate), as before.

Direct frequency modulation is performed in the oscillator circuit itself, usually by using a variable capacitance diode to modulate the oscillator frequency as shown in Fig. 58.

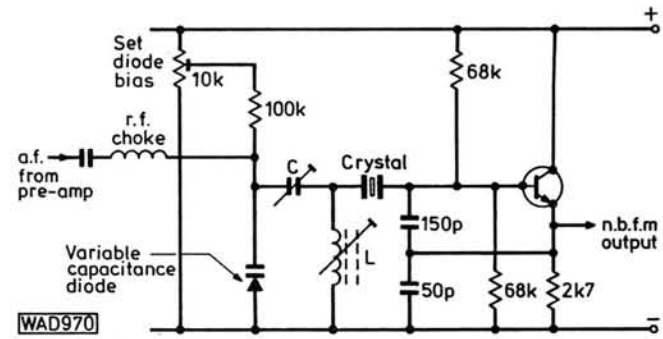


Fig. 58: A typical n.b.f.m. oscillator circuit

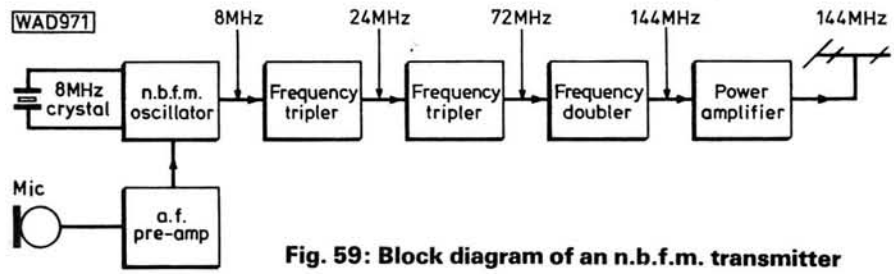


Fig. 59: Block diagram of an n.b.f.m. transmitter

Phase Modulation

Indirect frequency modulation, or phase modulation as it is more popularly known, is performed by modulating the r.f. carrier such that the phase of the carrier is changed corresponding to variations in the amplitude of the modulating signal.

In this method the frequency remains fixed and modulation is applied using a phase-shifting circuit, which can either be in the oscillator stage or following it. The effect is to either add or subtract frequency variations from the fixed carrier.

For amateur radio purposes, particularly on the 2-metre band, narrow band frequency (or phase) modulation (n.b.f.m.) is frequently used. In this mode the deviation is usually restricted to about 2·5kHz. A block diagram of a typical 2-metre n.b.f.m. transmitter is shown in Fig. 59.

In this transmitter the crystal oscillator frequency is nominally 8MHz and the frequency is multiplied 18 times in three frequency multiplier stages (×3, ×3, and ×2) giving a final frequency in the 144–146MHz band. It follows that any frequency deviation at the oscillator will also be multiplied 18 times and for a final deviation of 2·5kHz the oscillator deviation will only need to be 2500/18Hz = 139Hz.

Basically, a crystal oscillator has good frequency stability but, by including in the crystal circuit a reactance which can be varied by the modulating signal, the crystal can be "pulled" off frequency and adequate deviation obtained for n.b.f.m. transmission.

The use of n.b.f.m. has several advantages:

(a) Modulation can be applied at low power, no high power modulator is required.

(b) The transmitter output stage operates at a constant power level which allows the use of lower rated components, e.g. transistors and capacitors.

(c) Any class of amplification can be used and chosen for best efficiency or low spurious emissions, etc.

(d) Interference with television broadcast and audio equipment is significantly reduced as f.m. is not demodulated by the usual rectification methods.

Crystal Oscillators

Quartz crystal oscillators are employed in transmitters, receivers and frequency measuring equipment wherever a stable, accurate oscillator is required.

A plate cut from quartz crystal has the property of generating an alternating voltage between its opposite faces when made to vibrate by mechanical means. Conversely it will vibrate when an alternating voltage is applied across it. The natural mechanical resonant frequency of the quartz plate is determined to a large extent by its dimensions, and when electrically connected in an oscillator it behaves as a series-tuned circuit having a very high *LC* ratio and a very high "Q" (>10 000). See Fig. 61.

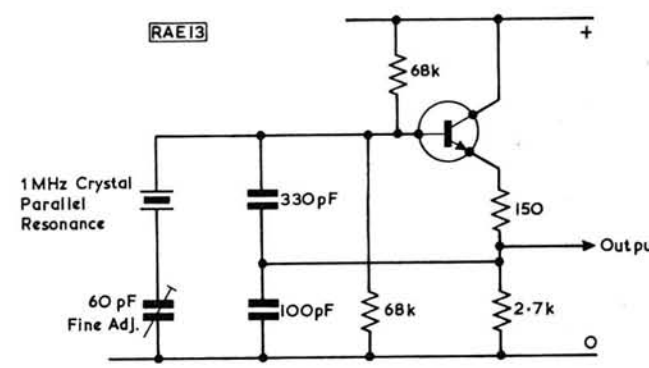


Fig. 60: A basic crystal oscillator circuit

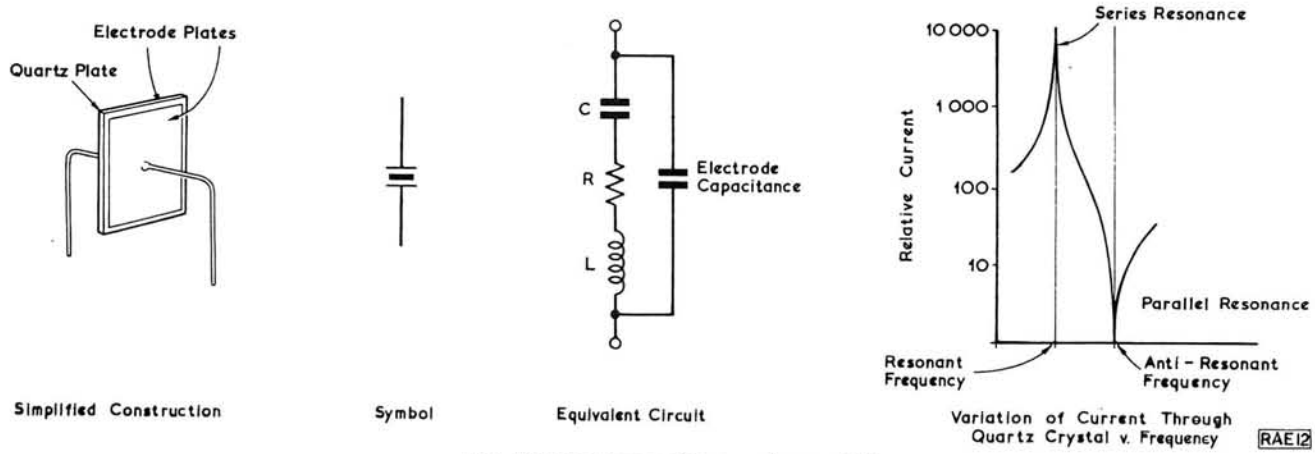


Fig. 61: Features of a quartz crystal

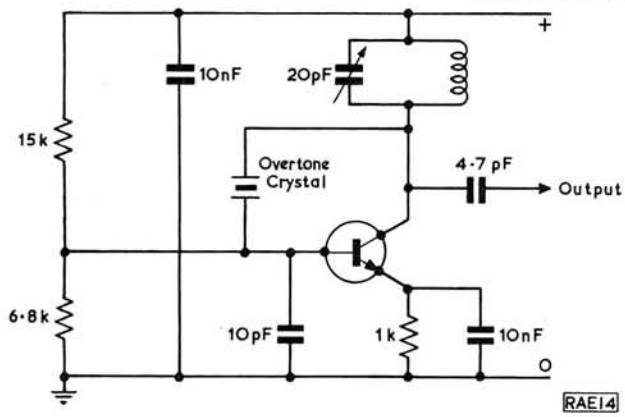


Fig. 62: An overtone crystal oscillator circuit

The crystal exhibits a series resonant frequency and a parallel resonant frequency; these are extremely close together: only a few hundred hertz apart at 10MHz. Crystals are calibrated in frequency for one or the other mode of resonance depending on the circuit requirements. An oscillator circuit for a crystal operating in parallel resonance is shown in Fig. 60.

Under normal room temperature conditions, the frequency of this oscillator would remain constant within a few parts per million (few hertz per megahertz).

Crystals can be manufactured for very high frequencies (100MHz and beyond) using multiple vibration of the crystal; these are known as overtone crystals and are used in series resonance. A typical circuit is shown in Fig. 62.

Next month we will consider transmitter measurements.

MODS No. 13

▶▶▶*continued from page 25*

The new switch will now perform two separate functions depending on when it is operated. Setting it to position "A" before powering-up sets the band edges when the power is applied and in this instance gives us the European band and channel spacing. If you now set the switch to position "B" while the power is being applied to the rear of the set, regardless of whether it is turned on or not, you will alter the channel spacing and not the band edges. In other words, you will now have European band edges coupled with US channel spacing, thus making it usable in Australia. Similarly, setting the switch to "B", then powering-up and then resetting the switch to "A" will give you US band edges and European spacing.

It is important to remember that it is the position of the switch before power is applied that sets the band edges and the position afterwards that sets the channel spacing. If you can obtain a miniature s.p.d.t. switch that has a centre off position, such as RS No. 317-005, then the centre position will give you the option of the Japanese band limits and channel spacing, i.e. neither of the diodes will be in circuit.

Unfortunately there is not enough space this month for me to include the "Wanted" section but please continue to write in if you have any mods that you would like to pass on or if you have a request for a mod. The address is: R. S. Hall, Room 301, Hatfield House, Stamford Street, London SE1.

73's
Sam G8TNT

IC of the Month

▶▶▶*continued from page 44*

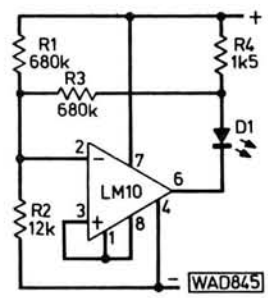


Fig. 9: A battery status indicator

TR3, a 2N3055 transistor, must be fitted to a suitable heat sink. The circuit contains a built-in current regulator for protection.

Battery Indicator

The simple circuit of Fig. 9 can be used to indicate the state of a 9V battery. The l.e.d. D1 begins to dim as the voltage falls below 7V and becomes extinguished at about 6V. If the warning of falling voltage is not required, R3 can be removed and the value of R1 halved so that switching to the extinguished condition occurs suddenly.

Availability

The LM10 is available from **Watford Electronics, 35 Cardiff Road, Watford, Herts.** ●

3-BAND SHORT-WAVE CONVERTER

1·6–6 MHz
4 –15 MHz
7–30 MHz

PART 1

R. F. HAIGH

Short wave listening on the amateur and broadcast bands is a fascinating pastime, but a sensitive and selective receiver, which is easy to adjust and free from spurious responses, is essential.

The converter design presented here precedes the facilities of second conversion, i.f. detector and audio output stages, of an ordinary m.w. portable transistor receiver to provide general coverage of the h.f. bands between 1·6 and 30MHz.

With the i.f. strip within the existing receiver already working, alignment of the converter presents no real problems. Although a little care and patience is required, a signal generator is not necessary. A b.f.o. (beat frequency oscillator) unit is incorporated to enable amateur s.s.b. and c.w. signals to be resolved.

Circuit Description

The complete circuit of the converter is given in Fig. 1. The dual gate MOSFET transistor Tr1 functions as a first mixer stage, with received signals from the r.f. front end coils, L1 and L2, taken to gate 1 and the local oscillator input applied to gate 2.

The mixer stage output is taken from the drain and developed across L3, the primary of the 1·6MHz i.f. transformer. The secondary, L4, couples the converter unit to the m.w. receiver via a short length of coaxial cable.

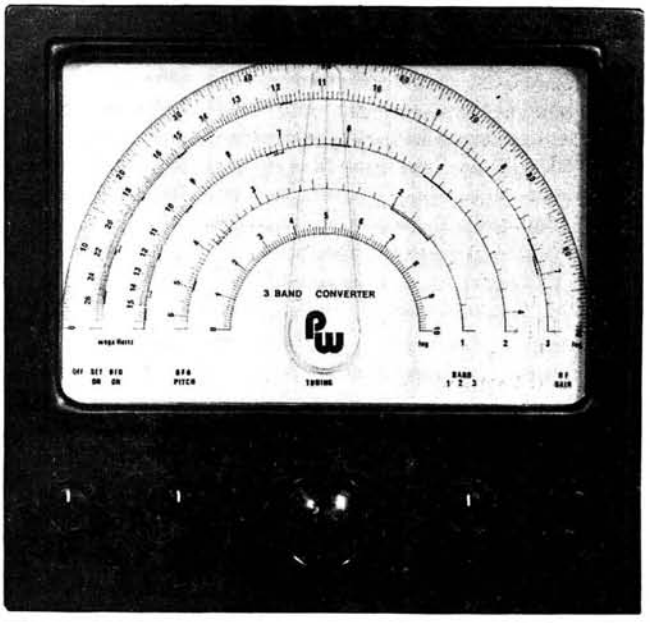
A second field effect transistor, Tr2, acts as the local oscillator, the output from this stage being applied to Tr1 through the 10pF capacitor C9. A padder capacitor is inserted in series with the oscillator coil tuned winding, L6, in order to enable the stage to track at 1·6MHz above the received signal frequency. Coil L5 is the feedback winding which must be connected in the correct sense.

Band selection is effected by S1, a 4-pole, 3-way switch bank. Only one set of r.f. and oscillator coils, together with associated trimmer and padder capacitors, are shown on Fig. 1, in the interests of clarity. (Refer to Table 1 for the values of components marked with an asterisk.) It should be noted, therefore, that individual trimmers C1* are wired across the tuned windings of each of the r.f. coils, and each oscillator coil has a separate padder capacitor C6*. The r.f. and oscillator coils are tuned by ganged variable capacitors C2 and C8.

The 10kΩ potentiometer, R1, functions as a simple form of r.f. gain control. Without this facility, very strong amateur s.s.b. transmissions cannot be resolved.

A beat frequency oscillator, b.f.o., is included, so that c.w. and s.s.b. can be rendered intelligible. The tuned winding of the b.f.o. coil, L8, is connected to the collector of Tr3, and feeds back to the base via L7. The b.f.o. stage has to work in conjunction with the i.f. amplifier in the receiver used with the converter. Accordingly, the 220pF capacitor C16 tunes L8 to within the standard i.f. range of 450 to 470kHz, and the dust iron core is used to set the b.f.o. precisely at the receiver i.f. frequency. Fine adjustment of the b.f.o. is by means of the 15pF variable capacitor C18, and the output is taken from the collector of Tr3 via the 10pF capacitor C17.

Zener diode, D1, and resistor, R9, ensure a stable supply voltage for the b.f.o. unit, as fluctuations have a significant effect on the frequency of oscillation of Tr3. The converter oscillator stage is also supplied from the stabiliser circuit. Pre-set potentiometer R8 is used to optimise the drain voltage of Tr2, and its adjustment is not critical.



Power supply switching is performed by a 4-pole, 3-way rotary switch, S2, giving OFF, CONVERTER ON and CONVERTER AND B.F.O. ON positions.

Components

No difficulty should be encountered in obtaining any of the components, and most of them are available from suppliers advertising in *PW*. A brief note on some of the items may, however, prove helpful.

The ganged tuning capacitors, C2 and C8, must be good quality air spaced components, but the actual type and value are not critical. A large "E" type 500pF

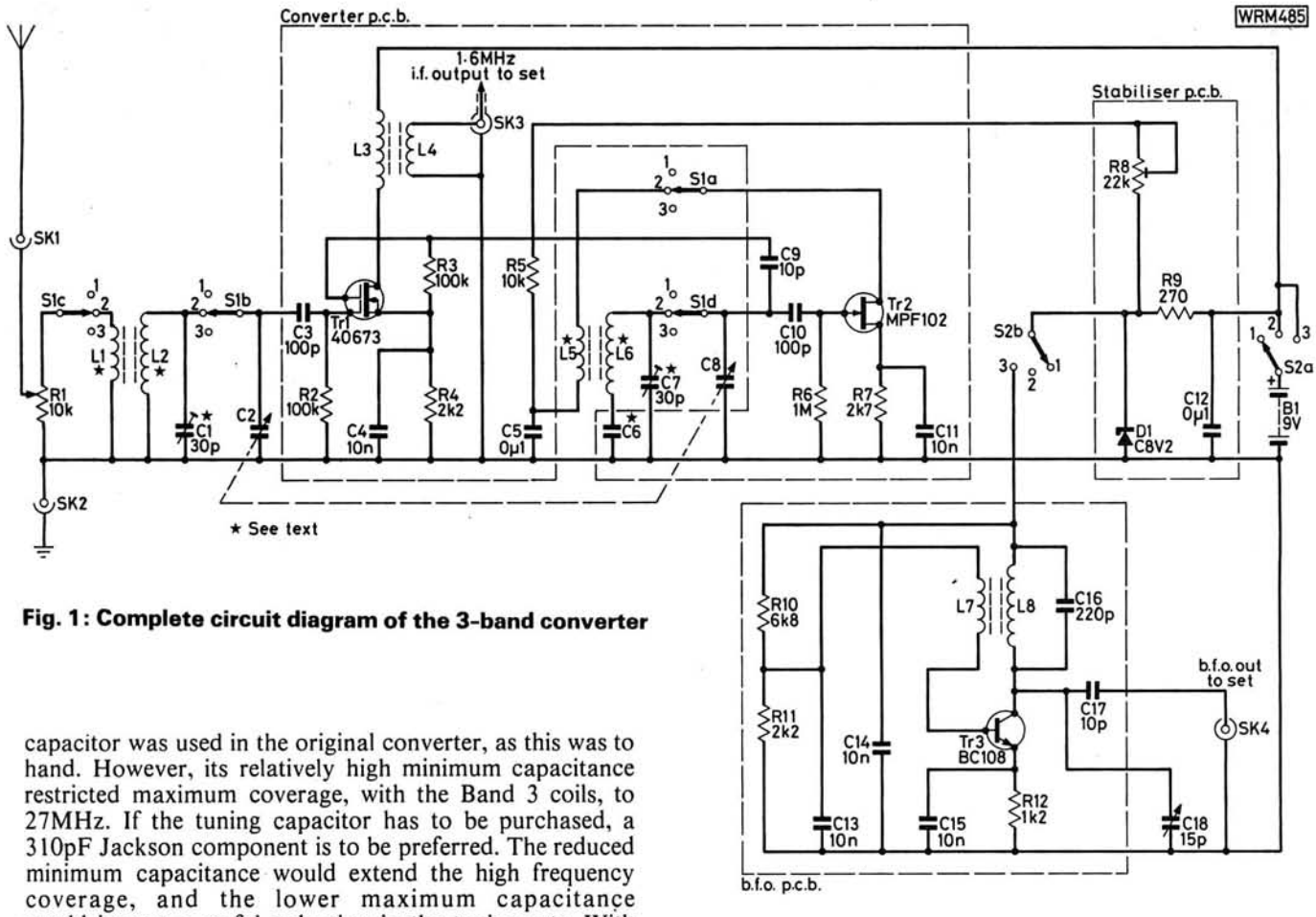


Fig. 1: Complete circuit diagram of the 3-band converter

capacitor was used in the original converter, as this was to hand. However, its relatively high minimum capacitance restricted maximum coverage, with the Band 3 coils, to 27MHz. If the tuning capacitor has to be purchased, a 310pF Jackson component is to be preferred. The reduced minimum capacitance would extend the high frequency coverage, and the lower maximum capacitance would impart a useful reduction in the tuning rate. With the specified coils, there would still be an overlap on all three bands, thus ensuring continuous coverage. If the variable capacitor has integral trimmers, these must be removed. Chassis mounting, rotary, air spaced trimmers were fitted in the original unit, but the type used are no longer readily available. Philips "beehive" trimmers, or the more modern polypropylene dielectric rotary trimmers, would be ideal. The standard 10mm diameter formers with dust iron cores can be obtained from Electrovalue.

All of the fixed capacitors used for r.f. coupling, tuning and padding are 5 per cent tolerance polystyrene components, and two capacitors have to be connected in parallel to give some of the non-standard C6* padder values.

The 6:1 ratio reduction drive, drive drum, spindle couplers and tension spring are all manufactured by Jackson Brothers, and can be obtained from Watford Electronics. If any difficulty is encountered obtaining nylon drive cord, thin nylon curtain cord is an acceptable substitute.

Inductor Construction Details

All coils are home wound on standard 10mm formers with dust iron cores. Full winding details are given in Table 1.

Locate the coils at the base of the former or it will not be possible to completely withdraw the dust iron core and the amount of inductance variation will be curtailed. All turns are wound in the same direction and held in position by a liberal application of Balsa cement.

Anchoring the start and finish of the winding to pegs pushed into the former mounting holes is a good way of keeping the turns in place until the cement hardens. With the exception of L7 and L8, the coils consist of a coupling, or feedback winding, wound over the main tuned winding. The cushioning effect of a thin strip of paper masking tape laid over the main winding will help to secure the turns of the coupling coil until adhesive can be applied to lock them in position.

If about 150mm of wire is left at the start and finish of the windings, it is possible to connect the coils directly into circuit. However, the 38 s.w.g. wire used for some of the coils is really too fine for this, and it is desirable to provide some means of anchoring the leads close to the windings.

CONSTRUCTION RATING Intermediate

BUYING GUIDE

All components required for this project are readily available from advertisers in *PW*. Jackson Bros. tuning capacitors and drives are available from Watford Electronics

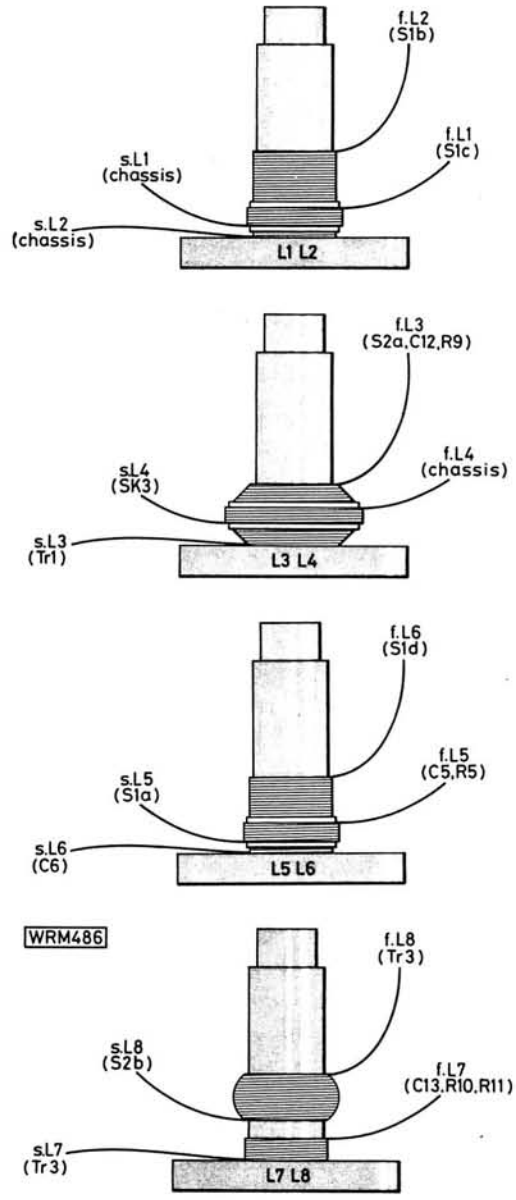
APPROXIMATE COST £35

TABLE 1

RF COILS	No. of turns			Notes
	Antenna	Tuned	Padder	
	L1	L2		
Band 1 1·6–6MHz	7	45		38 s.w.g. close wound
Band 2 4–15MHz	4	18		26 s.w.g. close wound
Band 3 7–30MHz	2	9		26 s.w.g. tuned winding spaced over 7mm

OSC. COILS	Feedback	Tuned		
	L5	L6	C6*	
Band 1	6	27	330pF	38 s.w.g. close wound
Band 2	3	14	970pF	26 s.w.g. close wound
Band 3	3	8	2nF	26 s.w.g. tuned winding spaced over 6mm

IF, BFO COILS	L3	L4		
1·6MHz IF	120	20		38 s.w.g. L3 pile wound. L4 wound over L3
	L7	L8		
450–470kHz BFO	30	150		38 s.w.g. pile wound



S = start of winding, F = finish of winding. All turns are wound in the same direction

Slightly undersize holes are drilled in small squares of 5mm Perspex sheet, and these are reamed out until a tight push fit is obtained on the coil formers. Veropin terminal pins are pressed into holes drilled at the corners of the squares, and the coil leads are soldered to these. Paxolin or plain Veroboard could be substituted for the Perspex.

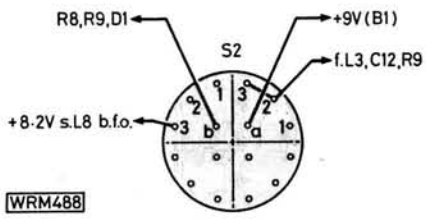


Fig. 2: Connections to ON/OFF switch S2. Position 1 OFF, 2 CONVERTER ON and 3 CONVERTER AND BFO ON

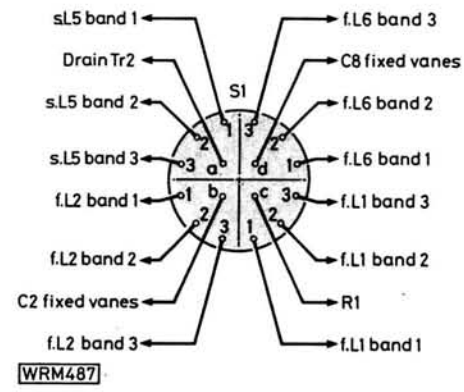
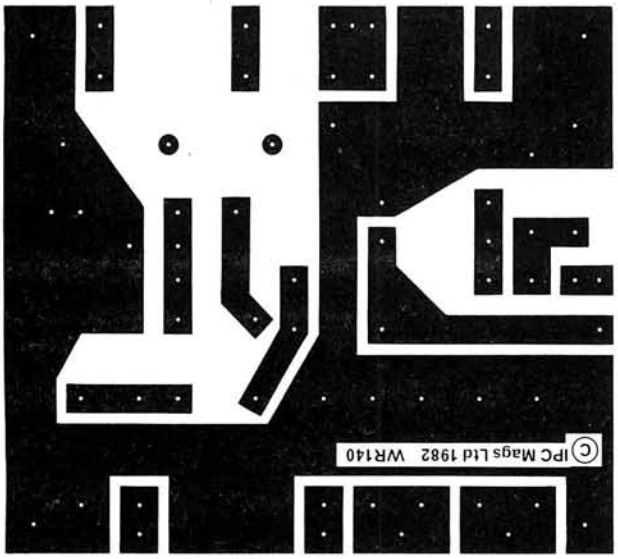
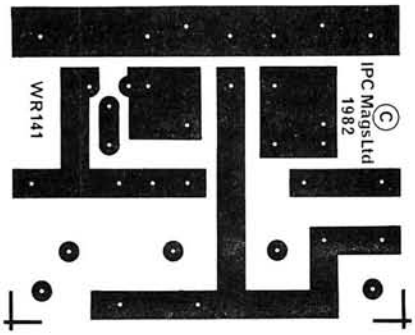
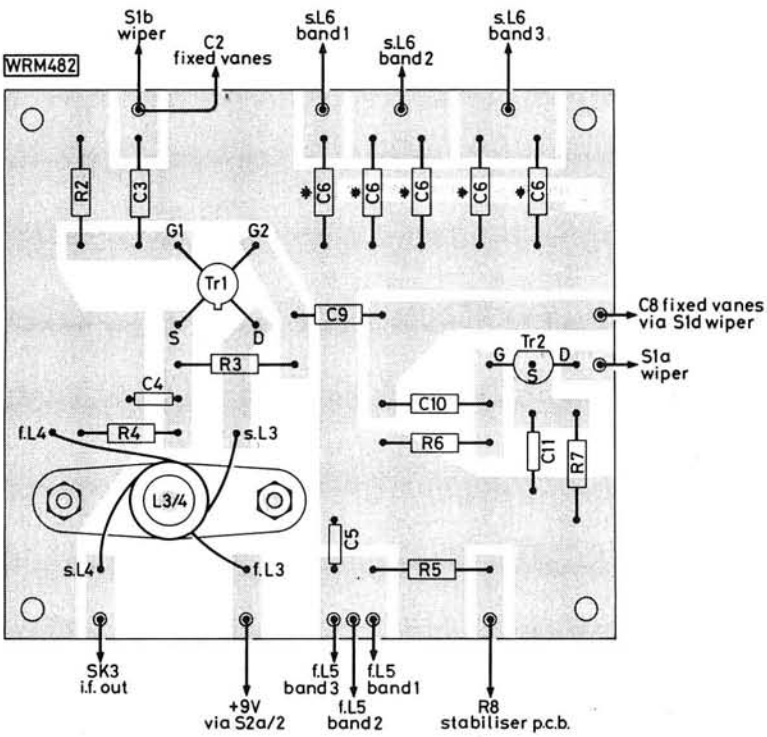
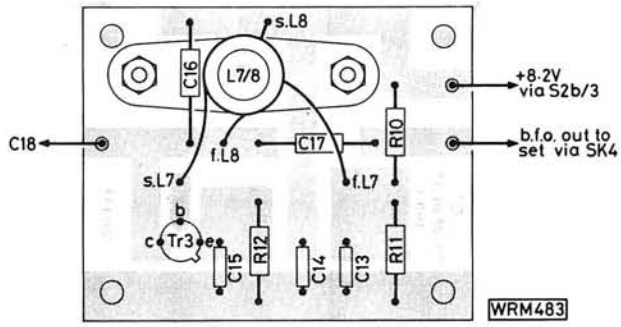


Fig. 3: Connections to band selector switch





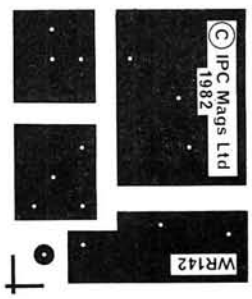


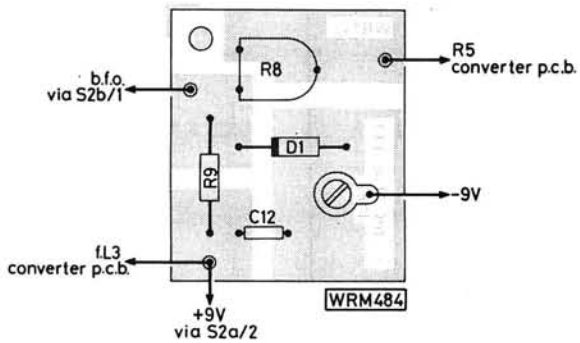


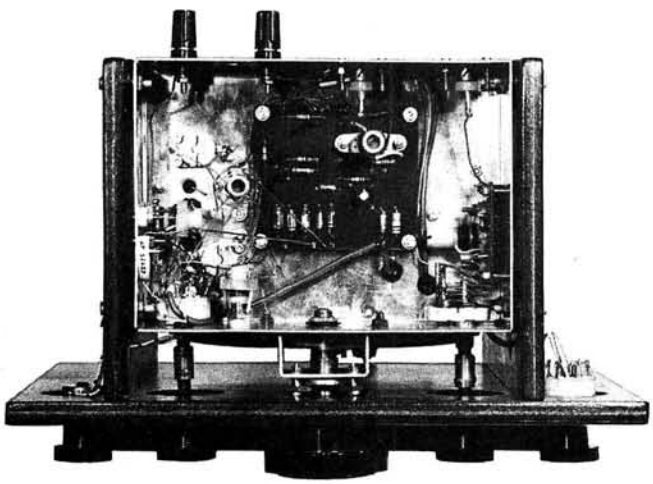
▲ **Fig. 4: Track pattern and component layout of the b.f.o. board**

◀ **Fig. 5: Track pattern and component layout of the converter board shown full size**

▼ **Fig. 6: The voltage stabiliser board track pattern and component layout shown full size**







◀ **An internal view of the author's prototype**

★ components

Resistors

¼W 5% Carbon film

270Ω	1	R9
1·2kΩ	1	R12
2·2kΩ	2	R4, 11
2·7kΩ	1	R7
6·8kΩ	1	R10
10kΩ	1	R5
100kΩ	2	R2, 3
1MΩ	1	R6

Linear potentiometer

10kΩ	1	R1

Pre-set miniature horizontal

22kΩ	1	R8

Capacitors

Disc ceramic

10n	4	C11, 13, 14, 15
0·1µF	1	C12

Polystyrene

10pF	2	C9, 17
100pF	1	C10
220pF	1	C16
See Table 1 —		C6

Air spaced twin gang variable

(See text for value)	1	C2, 8

Trimmers

15pF Jackson C804	1	C18
3–30pF (See text)	6	C1*, 3–7*

Semiconductors

Transistors

40673	1	Tr1
MPF 102	1	Tr2
BC 108	1	Tr3

Diodes

BZY88C8V2	1	D1

Inductors

(Refer to table for details)	8	L1–8

Miscellaneous

Coil formers, 10mm with dust-iron cores (8); 26 and 38 s.w.g. enamelled copper wire; 4-pole 3-way rotary switch, type CK (2); Ball drive 6:1 ratio Jackson 4511 (1); Drive drum 137mm dia. Jackson 5017 (1); Nylon cord, tension spring, 6mm spindle and bush; Belling Lee co-axial plug and socket (2); 4mm insulated terminals (2); 175 × 125 × 63mm standard aluminium box (1); p.c.b. (3); control knobs (5).

Next Month

Part 2 of this article will conclude with the mechanical construction of the 3-band s.w. converter and provide comprehensive setting-up and alignment details.

Full details of the interface with suitable m.w. receivers will be given.

THE CB CODE OF PRACTICE

READ YOUR LICENCE—It tells you what you can and cannot do. The conditions have deliberately been made simple with few restrictions. It is up to you to develop this service as you wish for the benefit of all. This means having consideration for one another and recognising that no-one has preferential rights at any time or place or on any channel. NATCOLCIBAR, the Parliamentary CB Working Party, and representatives of industry have in consultation with the Home Office prepared this simple code of practice. If you work to it, you will help the system to help you.

HOW TO OPERATE

1. LISTEN BEFORE YOU TRANSMIT. Listen with the Squelch control turned fully down (and Tone Squelch turned off if you have Selective Call facilities) for several seconds, to ensure you will not be transmitting on top of an existing conversation.
2. KEEP CONVERSATIONS SHORT when the channels are busy, so that everyone has a fair share.
3. KEEP EACH TRANSMISSION SHORT and listen often for a reply—or you may find the station you were talking to has moved out of range or that reception has changed for other reasons.
4. ALWAYS LEAVE A SHORT PAUSE BEFORE REPLYING so that other stations may join the conversation.
5. CB SLANG ISN'T NECESSARY—plain language is just as effective.
6. BE PATIENT WITH NEWCOMERS AND HELP THEM.

EMERGENCIES AND ASSISTANCE

7. AT ALL TIMES AND ON ALL CHANNELS GIVE PRIORITY TO CALLS FOR HELP.
8. LEAVE CHANNEL 9 CLEAR FOR EMERGENCIES. If you have to use it (for instance to contact a volunteer monitor service) get clear of it as soon as you can.
9. IF THERE IS NO ANSWER ON CHANNEL 9, then call for help on either channel 14 or 19 where you are likely to get an answer.
10. IF YOU HEAR A CALL FOR HELP, WAIT. If no regular volunteer monitor answers, then offer help if you can.
11. THERE IS NO OFFICIAL ORGANISATION FOR MONITORING CB AND NO GUARANTEE THAT YOU WILL ALWAYS BE IN REACH OF A VOLUNTEER MONITOR. CB IS *NOT* A SUBSTITUTE FOR THE 999 SERVICE.

CHOICE OF CHANNEL

12. RESPECT THE FOLLOWING CONVENTIONS:

Channel 9: Only for emergencies and assistance.

Channel 14: The calling channel. Once you have established a contact, move to another channel to hold your conversation.

Channel 19: For conversation among travellers on main roads. (Remember, if you are travelling in the same direction as the station you are talking to, not to hog this channel for a *long* conversation.) Give priority to the use of this channel by long distance drivers to whom it can be an important part of their way of life.

Other: You may find that particular groups in particular areas also have other preferred channels for particular purposes.

SAFETY

13. USE COMMONSENSE WHEN USING CB and do not transmit when it could be risky to do so. For example, don't transmit:

a. When fuel or any other explosive substance is in the open—e.g. at filling stations, when petrol or gas tankers are loading or unloading, on oil rigs, or at quarries.

b. When holding a microphone may interfere with your ability to drive safely.

c. With the antenna less than 6 inches from your face.

INTERFERENCE

14. INTERFERENCE can be caused by any form of radio transmission. Avoid the risks. Put your antenna as far away as possible from others, and remember that you are not allowed to use power amplifiers. In the unlikely event that your CB causes interference, co-operate in seeking a cure using the suggestions from a good CB handbook. Moving the set or antenna a few feet may cure the problem.

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CRYSTAL FILTER 10.7MHz, 12½kHz spacing, ITT 901C **£6.90**

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PL259 UHF plug with reducer **75p;** SO239 UHF socket, panel mtd. **60p; Inline coupler** (2 x sockets) **£1.00; Inline coupler** (2 x plugs) **£1.00.** Any 5+ connectors: less 10%

HT TRANSFORMER multi-tap pri.; 5 secs.: 35v 200mA, 115v 150mA, 50v 500mA, 150v 300mA, 220v 300mA **£5**

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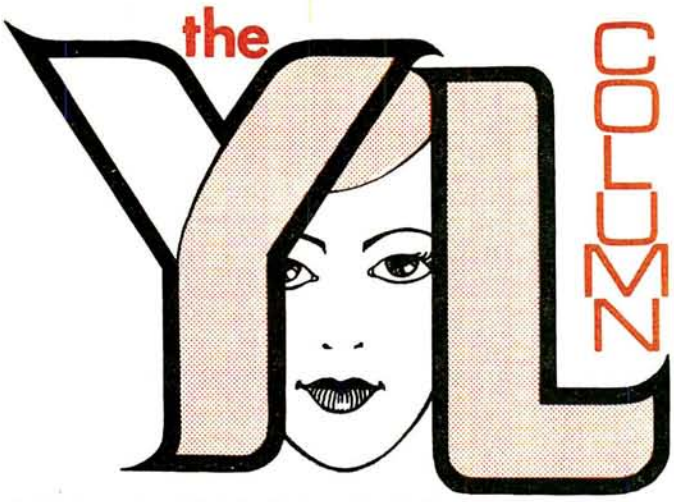


Elaine HOWARD G4LFM

Well here I am again, pen flying over the paper in an attempt to get some coherent thoughts into the magazine this month. So many things that deserve a mention have happened since I last wrote this column that I don't really know where to start.

Most of my news is all tied up with last autumn's Wireless Day at Chalk Pits Museum. Whilst operating mobile on my way there early that Sunday morning I managed to have a QSO with Constance G8LY. Many of you will have heard of Constance as she has been on the bands for many years now and is known to amateurs both old and new. We don't often have the chance to work each other as my home QTH is in what could be called a "radio black hole"! Constance told me one other lady to look out for was Violet G4ESR who would be at the Wireless Day.

Violet Bryan is a "white stick" operator who has two of the most beautiful guide dogs I have ever seen. Not normally being one of this country's dog lovers I was almost persuaded to change my mind after meeting Cindy and Sheba. They were very well behaved all day and didn't even mind being taken round by me whilst Violet and I explored the various stands.

I must say thank-you to those of you who have written to me over the months. If you have been wondering why the YL column doesn't appear every month it's not through lack of material, it's an "occasional" series—but all contributions are always welcome. It is very encouraging to hear from new licensees or not so new, everyone seems to have something to contribute.

Where were all the YL amateurs in the London area during the Breadboard Exhibition November 11–15? In the three days that I was operating the special event station GB8BB I worked 161 stations, and not one YL amongst them! Even reading through the log book for the whole five days not one lady's name appears—perhaps next year.

One QSO I did have that sticks in my memory was with Jonathan G6GJG, his callsign arrived in the post early Saturday morning and about his sixth contact was GB8BB. A new licence holder and just 14 years of age!

I have heard that there were a lot of YL RAE passes from last May's exam, so there should be a lot of G6s on the air. I must admit that I haven't heard many yet, but there's still plenty of time. Many ladies are learning the Morse very quickly, passing the test, then trading in their old callsigns without them ever being printed in the Call Book. Not a bad achievement I think, and YLs on the h.f. bands are even more a rarity than on v.h.f., as some will no doubt have found out by now.

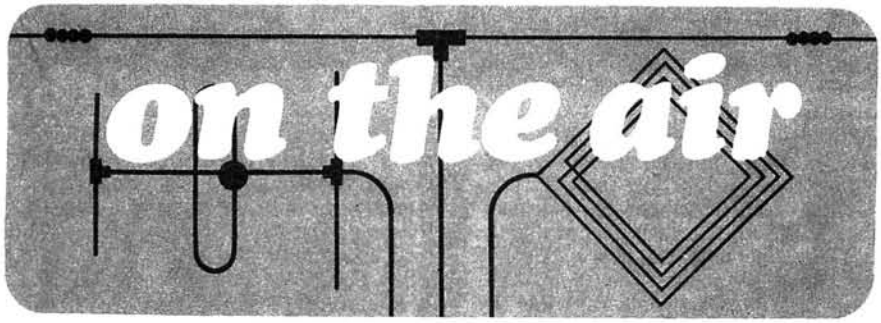
I will finish up with some of the comments that have arrived on my desk in some of the letters, if only to show that I do read them! Sheila G8KPL wrote telling me about the stations she worked during a lift, and right back in last July she had worked 91 QTH squares and was well on the way to the magic 100. Perhaps by now she will have completed that, but she was working EA stations on both sideband and f.m. modes of operation. Anne G4MBA has a good motto, if you can't beat them—join them, her husband is G4EDJ and has been licensed for over six years. Due to working during the day Anne has joined the local "Early Birds" net, from 6.30 to 7.30 in the mornings on 160m a.m.

Jeff Herbert sent me the results of the Colchester Radio Club 2m contest. It was held over three months and the number of stations worked were collected from members at the fortnightly club meetings. Scoring was simple, one point per simplex contact, repeater and mobile contacts were void. The final results were G8OVQ Jack with 251 points, and Jane G8WQY (who now has a G4 call) came second with 244 points. Jeff says that the club has four ladies in their membership, all with G4 callsigns and, who knows, that number may have risen since his letter.

Lastly, but not least, G6AIS wrote just saying what an enjoyment amateur radio is, and that next it is the Morse and a G4 callsign. "Now I press on with the Morse so that once more I can travel the world as I once did in working days, and call to mind the lovely places, islands with coral beaches, great cities full of beautiful architecture, and dusty bazaars with teeming multitudes and most of all blue skies and sunshine, and all this from a comfortable chair in my little Radio Room." What a lovely idea.

73s to you all until it's my turn to write again.

"How high are you, and do you suffer from wind?"
"About 5ft 8in and only when I eat beans!"
. . . heard on 2m by Ms A. C. Allen, G4HRH



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.

Greetings all, and a Very Happy New Year. May all your RAE's be happy ones. I hope that not too many of you were lumbered with CB rigs that you didn't want, considered by many doting relatives to be a "natural" as a Christmas gift for the radio-minded offspring.

As some of you may know the 1·8 to 1·9MHz section of the 160m amateur band has been released to US amateurs by the FCC for c.w., a.m. and s.s.b. modes, with power inputs up to 1kW on an exclusive basis with the exception of certain restrictions to safeguard Loran navigational stations in eastern Canada. The US chain of Loran-A stations has been closed down to the joy of amateurs over there who have suffered incomprehensible restrictions on operation since 1949, with limitations on power varying with the time of day or night and from state to state.

Amateur operation in the segment 1·9 to 2·0MHz remains in some doubt even though the whole band 1·8 to 2·0MHz was earlier expected to be released with full privileges. With the advent of several other countries on to 160m in recent times, the band should become even more interesting with this news from the States. Many multiband h.f. transceivers now include Top Band, with a consequent increase in the amount of s.s.b. operation to be heard. In the past DXing has been inclined to be concentrated on c.w. at the low frequency end of the band.

The main problem on Top Band, especially for the transmitting amateur, is getting a suitable antenna system going, especially when one realises that the quarter wave wire is over 40 metres long. For DX working the antenna should be vertical over an extensive ground plane. In the event the wire is kept vertical as far as possible and then the remaining wire allowed to go off horizontally, or sloping, to the nearest support. In this case the wire is fed at the bottom and can go straight to the receiver usually. For transmitting a balun is advisable.

While a 40 metre-long wire is low impedance at the shack end on 160m it may be a good idea to check with the receiver's manual as to the set's input impedance on this band as, in some cases, it may very well be different from the other h.f. bands. Anyway, as you may be sick of reading in this column, an antenna tuning unit should always be used with such a wire. The wire may be shorter if physically necessary, but resonated by the a.t.u.

An 80m centre-fed antenna with tuned feeders will work well on 160m if the a.t.u. is suitably modified for Top Band. Every effort must be made when transmitting on Top Band to get as good an earth system as possible, to the extent of laying down radial wires under the vertical portion of the antenna. This may take the form of wires a quarter wave long radiating from a central earth rod or even a buried galvanised water tank discarded by a builder. In practice the wires can be any old length to suit the QTH with as many as possible.

The far end of each wire ought to be soldered to a copper earth rod driven into the ground. This is not so impracticable as it sounds as the small-bore copper pipe used for domestic heating systems is quite cheap and offcuts are even cheaper and quite adequate.

To bury the wires I use the plywood end-cheek from an empty cable reel, freely given by almost any electrical dealer! Just run it along the lawn pushing it in for a depth of about three inches, repeating the process to push the wire into the slot. Use any old copper wire, bare, insulated or whatever with old coaxial cable eminently suitable. Don't worry about scars across your favourite lawn as they will disappear in a very short time! All joints must be soldered and then taped against corrosion. A butane hand torch is very useful when working beyond soldering iron range.

Hello Clubs

To those hard-working secs and PROs whose efforts have doubled the clubs' membership in the last year, well done! Rest assured, it will more than double again in the coming year! So let that be a lesson. I note the odd club where debate has centred around whether CBers should be accepted as members. Can there possibly be any argument on this point?

Every club needs a continuous injection of new blood if it is to survive and here it is for the asking. Legal and illegal CBers are far from the idiot, drooling, incomprehensible "breakers" the American films would have us believe. So let them be most welcome, in every club.

Wimbledon & District RS Second and last Friday of every month with the venue at St Johns Ambulance Hall, Kingston Road, Wimbledon, London SW19. Ted Allen G3DRN, boss of the RSGB's QSL bureau, is the new secretary and busy arranging the new season's programme. He can be found at 30 Bodnant Gardens, Wimbledon SW20 0UD.

Crawley ARC Formal meetings normally held at the Ifield Trinity United Reformed Church with informal gatherings at members' QTHs. A code class is being run by Ken Franklin G3JKF who can tell you more on Crawley 28080 with Vernon and Dot Davis the ones to ask about club details, on Crawley 26316.

Cambridge & District ARC Every Friday round about 7.30 in the Visual Aids Room of the Coleridge Community College, Radegund Road, Cambridge, just off Coleridge Road. In the Tower Room will be found the club stations for v.h.f. and h.f., operating under the call G2XV. A very special welcome is on hand for any CBers says David Wilcock G2FKS, 19 Cavendish Avenue, Cambridge CB1 4UP (CB1!) or on 0223 247220.

Bolsover ARS Relatively new group meets every Wed at 8pm at The Angel, Bolsover, with Morse tuition starting half an hour earlier, courtesy G3MOK. Coming events include a talk on meteor scatter techniques plus a visit to the local Radio Hallam. Contact David Brocklehurst G8KIF, 33 Chestnut Drive, Clowne, near Chesterfield S43 4JG or ring 0246 811666.

Milton Keynes & District ARS January gathering will reveal all on receivers and test equipment at the Lovatt Hall, Silver Street, Newport Pagnell at 8pm on the second Monday, which is a regular date every month. Feb's meeting will deal with photo acoustics. It's D. O. White G3ZPA, Rose Cottage, Shenley Brook End, near Bletchley, Bucks MK5 7AF.

Glenrothes & District ARC The Club Room at Provostland, Leslie, Fife, at 7.30 every Wednesday but also, unusually, at the same time on the third Sunday with talks, lectures or a demonstration. Nobody has been inveigled into the sec's job at the moment so Chairman John Halliburton GM4AQO at 72a Ramsay Road, Kirkcaldy, Fife, will help out with club information, which is also 0592 266287.

Exmoor RC New sec reporting in is David Jones G6CHZ, Loughrigg, East Street, South Molton, Devon, with meetings at this QTH every Thursday at 8pm active with club station G8SSS. Near future plans call for RTTY facilities.

Mid-Warwickshire ARS Note new meeting times for the club, 8pm on the first and third Tuesdays at 61 Emescote Road, Warwick, instead of Mondays. So says Mary Palmer G8RZR of 12 Edmondes Close, Woodloes Park, Warwick, club secretary.

Borders ARS In fact covers both sides of the border, meeting on the first and third Fridays, with the new committee about to come up with a programme for

the coming year. Alex McCreadie GM8YPI, 16 Fancove Place, Eyemouth, Borders or Eyemouth 50492 has all the answers.

Cannock Chase ARS Nominated as the member who had done the most for the club in the past year, Larry Arkley G4HMV has been awarded the G3ABG trophy, named after the late John Morris. Meetings every Thursday at the Bridgtown War Memorial Club, Union Street, Bridgtown, Cannock, says PRO J. Gregory, 22 Tower View Road, Great Wynley, S. Staffs WS6 6HE or Cheslyn Hay 416419.

Barry College RS New sec is John Share GW3OKA of 3 Uplands Crescent, Llandough, Penarth, S. Glam or 702455, who, in the 70s did ditto with the Wirral DX Assoc and the Wirral RS. After some blush-making comments on the new-look *PW* John says club considers *PW* as best market place for new members. Needless to say all such will be welcomed with open arms. (See note later.)

Torbay ARS Has club stations G8IUI and G3NJA now all cock-a-hoop after getting top spot on 1·8MHz in NFD and 10th place overall. Meetings Fridays 7.30 at Bath Lane, Torquay, rear of 94 Belgrave Road, are informal but you'll need your tie apparently for the formal do on the last Saturday of every month, same time and place. RAE course runs at the Torquay Tech College says sec Hugh Davies G4DZH.

Cheshunt & District RC An excellent printed guide to the club and its activities awaits prospective members with an invite to attend for up to four weeks before being pestered to join! Full details of club officials and phone numbers all help to put the newcomer at her/his ease. Other clubs please copy! So, it's every Wednesday at 8pm, Church Room, Church Lane, Wormley, Herts, with Jan 6 being devoted to nattering but the 13th is all about radio equipment with the 27th offering video tapes on an Introduction to Amateur Radio and SSB HF Field Day 1981. Why not ring Bob Gray G6CNV on Dane End 203 if you'd like to go along.

Southdown ARS Has club station G3WQK quite active with meetings first Mondays at 7.30 at the Chaseley Home for Disabled Ex-servicemen at Southcliff, Eastbourne, E. Sussex. Excellent club mag adds interesting items on mobile STD in DL-land and those Euro-pips from the paging system in DL and F just below 88MHz on Band II. Drop a line or ring R. E. Holtham G4EKS, 2 Benbow Avenue, Eastbourne or 32777.

Maidstone ARS A steadily growing membership is blamed on the publicity in *PW!* Good lectures are a big factor of course, witness Jan 8 when Rowley Shears G8KW of KW Electronics will be presenting his new range of equipment. On Jan 22 a Mr Gibson will be talking on the RSGB's amateur radio insurance scheme. It's first and third Fridays around 8pm at the YMCA Sportscentre, Melrose Close, Cripple Street, Maidstone, Kent, which includes the beginners' classes with more formal meetings on the other Fridays. On Tuesdays there are informal question and answer sessions, also at 8pm. However, Graham Edy G4AXD is waiting to tell you more at 29 Beech Road, East Malling, Maidstone, Kent which also hides **West** Malling 841021, strange to relate.

Wakefield & District RS Alternate Tuesdays. UGH! but you can work it out from meetings on Jan 12, a talk on crime prevention with the emphasis on vehicle security, and Jan 26 when there is a junk sale. Place is Holmfield House, Denby Dale Road, Wakefield, at 8pm. All visitors are most welcome says sec R. Sterry G4BLT, 1 Wavell Garth, Sandal Magna, Wakefield, or ring Wakefield 255515.

Stevenage & District RS Still meets first and third Thursdays at the staff canteen, British Aerospace Dynamics, Site B, Gunnels Wood Road, at 8pm. Membership has increased by 30 in last couple of months so you'll have to get there early if you're going to get a seat! Contact Steve Clarke G8LXY at 126 Putteridge Road, Luton, for all the gen on meetings etc. Just to keep up your interest there is a computer evening on Jan 7 so take yours along, while on the 21st G3WTV will chat on the QSL bureau, with an early date on Feb 4 when G4HED deals with the Morse code.

Hastings Electronics & Radio Club Club mag *Vital Spark* says club meets third Weds at the West Hill Community Centre, Hastings, for formal gatherings, with Mondays being computer nights and Fridays social nights at the Club Room, 479 Bexhill Road, St Leonards-on-Sea. Jan 20 is down for a talk on meteor scatter techniques but membership sec Paul Brown G8OXD, 7 Scutes Close, Hastings, will fill in the details.

Mid-Sussex ARS Marle Place Further Education Centre, Leylands Road, Burgess Hill, W. Sussex, at 7.30pm with AGM on Jan 28. Magazine *Mid-Sussex Matters* raises very important issue of careless talk on our bands, particularly on v.h.f. and u.h.f. where personal movements are frequently discussed quite openly with other amateurs. After all, amateur band receivers are freely available to one and all, and we don't want to tell others when we will or will not be at home! If you are interested in the club drop a line to Jack Brooker G3JMB, 20 Farnham Avenue, Hassocks or ring him on 4965. Sorry, should have added that meetings are on second and fourth Thursdays of the month.

Conwy Valley ARC With a programme of speakers until June next, at Green Lawns Hotel, Colwyn Bay, second Thursdays at 7.30pm. Highlight will be a visit by members of British Telecoms Radio Interference Branch, but contact sec J. N. Wright GW4KGI, Eleven, Bryn Derwen, Abergele, which also answers to 823674.

Radio Society of Harrow Meets Friday evenings 8pm in the Roxeth Room of the Harrow Arts Centre, High Road, Harrow Weald, Middx., with members enjoying spacious accommodation and ample seating, licensed bar at special prices plus coffee and biscuits. What else could one want? Full v.h.f. and h.f. band facilities through club station G3EFX on informal evenings. On Jan 8 talk and demo on Brit Telecoms radiophone and paging systems with a film show on the 22nd, other Fridays being informal. More from Chris Friel G4AUF who will respond on 01-868 5002.

West Kent ARS Alternate Fridays, again UGH!, at the Adult Education Centre, Monson Road, Tunbridge Wells, Kent, with informal meetings at each following Tuesday at the Drill Hall, Victoria Road, TW. But it looks like Jan 8 when G8CAA talks of System X and beyond (sci-fi or simply telephones?) with a lovely junk sale on the 22nd. Club mag *QLF* tells us how to use an iambic keyer properly, much of which was new and useful to me, so obviously I've been making hard work of it! Why not ring Brian Castle G4DYF on Sevenoaks 56708 for the latest on the club.

Braintree ARS It's the Braintree Community Centre, Victoria Street, Braintree, first and third Mondays and around 7.45pm will do. Editor of club mag *BARSCOM* is Bob Willicombe who, with XYL Norma, is all set to take the RAE 'ere long, spurred on by the success of 15-year-old son David. So, who's turn is it for the rig tonight? Ask Norma for more details at 355 Cressing Road, Braintree, Essex.

Barry College RS Again. Late news is that due to great influx of new members meeting times have been increased and are now first and second Thursdays at the College Annex, Weycock Cross, Barry, with lectures and opportunities to buy and sell equipment. Space has been found for the demonstration of amateur radio and allied interests. One for diary is the Barry Mobile Rally on May 23 at the Barry Memorial Hall.

Ipswich RC Reminder of the East Suffolk Wireless Revival annual event to be held on May 30 this year at same venue, adjacent to the Suffolk Show ground. Club meetings second and last Wednesdays in the Clubroom of the Rose and Crown, 77 Norwich Road, Ipswich. Rooms are detached from the public bars so nothing to stop juniors coming along. Talks and lectures are backed by code classes plus active participation in field events by club stations G4IRC and GB2IRC. Jack Toothill G4IFF, 76 Fircroft Road, Ipswich or 0473 44047 can enlarge on the details. Should mention Jan 27 when Henry Massey G8YXP, lecturer at the Suffolk College, will explain the RAE.

Bournemouth RS Suppose I'd better mention this club since I imagine most of the *PW* staff are members, or ought to be if they are not! New venue since I last heard from them is the Kinson Community Centre, Pelhams, Millhams Road, Kinson, Bournemouth, first and third Fridays at 8pm. Secretary Arthur Bagley G4EKE of 8 Larks Rise, Ferndown, Wimborne, Dorset, awaits the postman with your enquiries about events and membership. Or you can always give him a bell on 0202 877945.

North Bristol ARC Just in time. Fridays 7.30pm at the Self-Help Enterprise Centre, Braemar Crescent, Northville, Bristol 7, where a warm welcome awaits prospective members, says Hon. sec. Ted Bidmead G4EUV, 4 Pine Grove,

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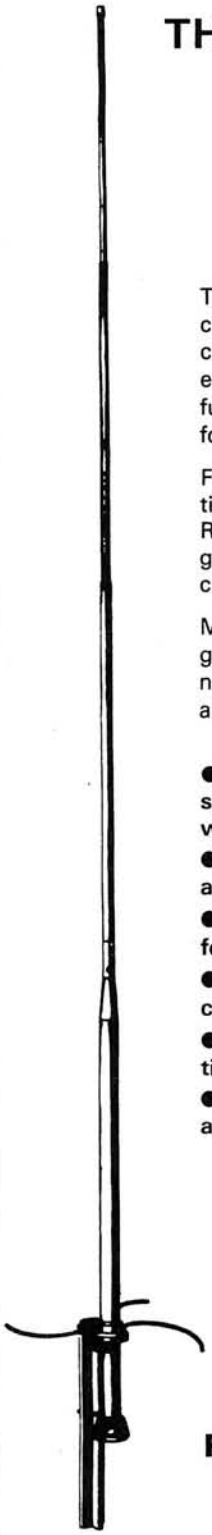

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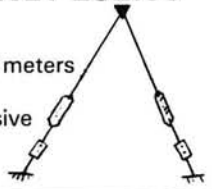

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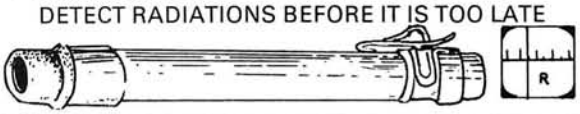

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Northville, Bristol BS7 0SL, bemoaning the continuing absence of Chairman Ernie G2DWI due to a spell in hospital. Get well soon, OM.

DX Time

Jim Dunnett of Prestatyn, Clywd, spends a lot of time with his SRX-30 and Creed 78 page printer on the RTTY frequencies printing out such as Y34YO on 7MHz, EC2XI, N1NBK, UK2BAB, 4N7NS and 4X6CV on 14MHz, and KA9EDK, KB9IS, VE2JR on 21MHz. Many Americans on 28MHz were supplemented by TR8WR and YB2AG. In the c.w. mode Jim found FY7YE, HK0BKX on San Andres, KP4KK/DU2, and M1C on 21, with XE2KF and ZS1XR on 28MHz. 10m band has been good for Jim of late, often finding it chock full of stations.

In Gower, Swansea, the CR100 of **Philip Morris** aided by a 40 metre-long wire and a 40m dipole ranged between 10 and 160m on s.s.b. Working backwards, he found EA8AK and EA9EU plus 4X4NJ and W2HCW on 160m s.s.b. ZL2BT, 4S7MX, FP0GAQ and 6W8HL on the 80m band. Catches of note on 40m were ZD7HH and P41C while 20m produced J28DM and lovely KC4USV, ending with FK8DH, YJ8NMP and 5W1DQ on 15m and FR0FLO on 10m.

From **David Warr** (Weymouth) comes news of the Safari Net around 21·290 MHz starting at 1830Z enabling him to log some fine catches like FP0GAP on St Pierre Is with GAQ at the same QTH, HS1ANN, J3AH, KH6CF, S83H, TR8BJ, G3AAE/VP9 and 7P8BX. On 10m, David found HV3SJ, 5H3TN and 9Q5FL. The 20m band produced VP2KAL, 3X1Z and 8R1RBF with sole VU2NKR of note on 40m. David uses a newly-acquired FR-50B and a ZL-special cut for the 15m band.

John East of Highworth, Wilts, is still breaking records with his remarkable HAC three-transistor t.r.f. receiver acquiring a coil for the 10 and 15m bands finding such as KX4S, VU2RYL, JH8BJG on 15m and JX7FD, ST2FF, VU2UGI and 8P6T on the 10m band with a 9 metre-long wire. The old 20m coil provided CO7AM, FK8CR, KX6QX on the Marshall Is., YI1BGD who wants cards to PO Box 5864 Baghdad, 3X1Z and 8R1RFB, all in spite of a bout of 'flu. Needless to say, John gets clobbered by every passing CBer!

From Wadhurst in E. Sussex comes **Rob Gibson** and his FRG-7 plus fan dipoles for 10, 15 and 20m in the loft. Nevertheless, he managed 5H3TC, 6Y5SH, C6ANU, FP0GAQ, G3MUV/CE0, JD1BAE on very rare Ogasawara Island, P29FV, VK9NYG on the Cocos Is and VP8ADR in the Falklands on 10m. Some good ones on 15m included 4S7VJ/5N21 for a strange one, 5R8AL, 6W8KA, A22DC, HM1KR, TR8DX and VP8ADR. The 20m band gave up AH8A on American Samoa, KH6DQ, VK9NS, VR6TC and YI1BDG.

Jon Kempster of Berkhamsted, Herts, BRS45205, is now safely ensconced in his new school where his studies include computers. His log shows such as SV0BV/SV5 who wants cards to PO Box 564, Athens, VP2NFW, VP2KAA, 8P6MH, and K6HNZ/CT3 for 14MHz. On 21MHz he caught S85H, VP9AD, 5Z4NQ, FR0FLO and HB0BHA with 28MHz showing up with N6KT/HK0, 6W8AR, D4CBC, FG7AR/FS7, SV1IA/8 reputedly on Corfu, and VY1CJ in the Yukon for a strange one.

BRS48544 is **John Hayes** of Edmonton, London N9, who sports an FRG-7700 and FRT-7700 a.t.u. plus Datong FL2 filter and a long wire. He warns that the ST0AT on 10m is a phoney. John says much of his DX was logged using headphones. What else? His long list held such as C5AEG, C31MF, EP2TY, HM0K, J3AH, M1C, P29NAB, SV1DX, TA1AB, V2AS with cards to PO Box 550, St Johns, Antigua, plus V3ME, VK9NYG, VP5WJR, VS6IC, XT2AU, all on 10m s.s.b. On 15m PZ1AN showed up with YA1CP, G4HZI/P/5N21 (whew!), and UM8MAA. Goodies on 20m were AP2SQ, KL7LI, and VP9V. Lower down on 40m, John copped JX7FD, KG4KK, 8P6KK. And C5ACJ came up on 80m.

The Trio R-1000 and 20 metres of wire in the loft have kept **Archie McGrath** (Ramsgate) busy, mainly on 21 and 28MHz copying s.s.b. such as VP2KAC, FP0GAQ (QSL to K8CJK), VP2VD, AA1Q, HV1CN and YB2BJM on 21 and J28DL, ZS6LW, TA1SC plus HP6T working on 28. From Edinburgh, **Anne Edmondson** BRS47285 finds time to drop a line on her activities, which seem to be concentrated on getting ready for the RAE, but gets carried away a bit when digging too deep into the RSGB's *VHF/UHF Manual!* Although expected to be chopped in the current economy drive, a local RAE course has now got under way so Anne is very pleased. She was angry with herself recently, missing CO2OM and KC4ST on the Arabian Net, by falling asleep, but it was 0430! However, in more social hours Anne was able to log AJ1L, FP0GAQ, JY5ZM, V2AU (Antigua), YK1AA, 5N0FCA and 6Y5MJ on her Realistic DX200 and 9 metre-long indoor wire on 20m.

Dave Coggins (Knutsford, Cheshire) and I are both nutters when it comes to wildlife, so we seem to have more to say on that than on amateur radio! He's hoping to send his Labrador up his highest tree with one end of his 40 metre-long wire in her mouth! One way, I suppose. Dave ranges from 10 to 160m on his FRG-7700 and matching a.t.u. plus a 2-element delta beam on 15m and 20/40m W3EDP, finding G3MUV/CE0 on Easter Is., JT1KAI in Mongolia, KH6DX, UK0FAP on Sakhalin Is., and 8R1J on 10m, with amazing goodies like FK8DH, FR0FLO, HK0FBF, KL7U, TI9FAG on Cocos Is., VU2YK, YJ8RG, ZD7HH, ZS6BPL and 5N9ACO/8 all on the 40m band. Much the same on 80m where it was FP0GBG, HC1MD/5, HP3FL (PO Box 76, David, Panama), N6YK/VP2A, OE2VEL/KH6, XE1AE and ZL2BT. Still onwards, or is it downwards, to 160m for EA3VY, OH0BH, and OH0NA on c.w., and a good one in 4X4NJ, an old timer on Top Band, plus many Europeans.

In General

From Crowthorne in Berkshire **Allan Stevens** seems to have got hooked on the 2m racket listening to repeaters and things on his new Wolfsen 1200, but I don't suppose it will last! Foreseeing the rapid exhaustion of the current G6 + 3 calls Allan is wondering what the next series will be and reckons the "M" or 2A to 2Z blocks ought to cause a few pile-ups if they were to be introduced. At least it would make the humble "G" feel wanted, for a change.

An interesting letter from house-bound BRS42979 **Peter Lincoln** of Aldershot, Hants, who thought that my comments on the limited value of reports from SWLs seemed to relegate them to second-class members in the hobby. This is not so, of course, but merely a practical approach to an unfortunate trend in amateur radio. Peter is only 36 but already retired through ill-health. He is not entirely without knowledge of the electronics world and I have perhaps encouraged him to have a go at the RAE, for which he can take the exam at home, as well as the code test if necessary. He may have problems with neighbours when it comes to transmitting, but I'm sure the RAIBC will be able to assist, come the great day.

Adrian Oates G4MOU of Chester may be redundant and not so young but he won't lie down! He remembered amateur radio from his early days so sat and passed the RAE last December and has now overcome his nervousness on the air with c.w. He has also turned to another past achievement, that of printing, and handles QSL cards among other lines. Good luck OM, you deserve it.

D. L. Broadley (Frome, Somerset) read of Bill Rendell's exploits in rejuvenating an old HRO, so dragged out one he had acquired in Aden in 1950, changed every resistor and fixed capacitor and was staggered by the results. He added a digital frequency readout module after cutting a suitable slot in the panel, no mean task! So he is all set to send me the odd log very soon, I hope. It's all your fault, Bill!

From Armagh, N. Ireland, **H. Irwin** GI8ROJ sent me a copy of a letter countersigned by GI4FFL, GI8RLE and GI5MPS, addressed to our esteemed Editor, in which they support my "totally justifed comment" in the September issue of *PW* concerning repeaters on the v.h.f. and u.h.f. bands. Hope the Editor finds time and space to publish it in toto. At least I know now that I'm not alone in my views!

Cheers for now, and don't forget the 15th of the month deadline for any information intended for publication. Once again VERY HAPPY NEW YEAR to each and every one of you, and keep those letters and club reports coming.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

George Boorer (ZL3PN) who lives in Timaru New Zealand has sent me a copy of his article *Listening to the Eclipse of the Sun* which appeared in the September issue of *Break In* of the NZART. The article describes some radio experiments conducted by George during a total eclipse of the sun which occurred on February 5th 1981 and the part that is of interest to us is his monitoring of an aviation beacon. "My FRG-7 was left running on an aviation beacon just above 1600kHz. This beacon is located not too far from Timaru, is very strong at night, but not receivable in daytime during summer," writes George.

Then follows a sequence of events starting at 0830 when the beacon was just detectable, by 0920 it was S9, by 0930 the broadcast band (medium wave) was full of stations "a mini-night on the broadcast band in mid-summer during daylight." By 1000 all the broadcasters had gone. 1015 saw the return to normal sky conditions and by 1030 the beacon was not detectable. "February 5th 1981 had started again. The D layer was back in place."

A striking experiment that demonstrates clearly how much we depend on solar radiation for our radio communications. It will be 1999 before we have an eclipse of the sun in the UK but there is no need to wait that long. As sunset approaches every day the medium wave gradually fills with stations. Why is this and what is the D layer?

Medium Wave Propagation

During the daytime any signals to be heard on the medium wave will have reached the receiver by means of the ground wave. This ground wave follows the curvature of the earth and the distance it will travel depends on the nature of the terrain over which it passes. Signals will travel further (are attenuated less) over water than over land. I had an example of this last summer while holidaying in SW Scotland. My local radio station BBC Radio Merseyside came roaring in on a car radio near Stranraer but was inaudible at Carlisle. One path was over the sea, the other over land.

What about the sky wave? In daylight the lowest layer of the ionosphere that is of interest to us is the D layer. It is a region of rarified gas some 60km to 90km above the earth's surface which is kept in an electrified condition (ionised) by ultra violet light from the sun. The D layer absorbs signals in the medium wave band. As darkness approaches the D layer disappears and signals from medium wave stations now penetrate higher into the ionosphere where they are bent back to arrive at the earth at distances up to 2000km from the transmitter. This is the maximum distance for a single hop for E layer reflection. When the signal comes back to earth it can be reflected back to the ionosphere for a second hop and so on.

In short, it is the D layer that prevents daytime DXing on the medium wave. At night or during an eclipse of the sun, the D layer disappears and then we are in business.

Breakthrough

"All over the lower part of the medium wave broadcast band I am plagued with Morse signals from Radio Scheveningen that are so strong that they even drown the stronger signals such as BBC2" writes **P de Man** (PE1DMN). Our reader lives near Leyden in Holland only a short distance away from the coastal station at Scheveningen.

What seems to be happening is that very strong signals from the coastal transmitters, on frequencies lower than the medium wave, are forcing their way past the selective tuned circuits in the radio receiver. As the receiver is tuned away from the l.f. end of the band it becomes more difficult for this breakthrough, as it is called, to occur, hence the problem is confined to the low frequency part of the medium wave band.

What can be done about it? A directional antenna such as a medium wave loop could be used to null out the offending QRM. Tune the loop to the station you are listening to and rotate it until the QRM disappears. The snag with this cure is that broadcasts in the same direction as the QRM, or its reciprocal, will also be nulled out. In a similar way one can make use of the directional properties of the receiver's internal ferrite rod antenna (if one is fitted). Simply rotate the receiver till the QRM disappears.

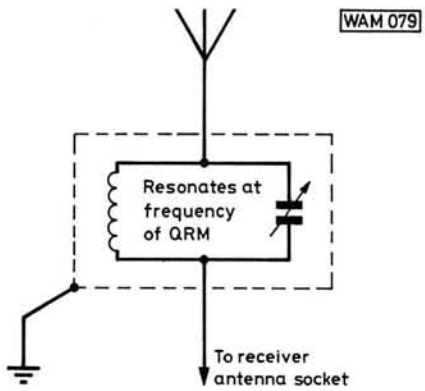

Fig. 1: Wavetrap

Can you use a filter? asks our reader. Yes you can. Provided the receiver does not have an internal antenna of its own you can insert a wavetrap in series with the lead from the external antenna. The wavetrap is just a parallel tuned circuit (Fig. 1) which is adjusted to resonate at the frequency of the QRM. The values of the inductor and variable capacitor will have to be found by trial and error but a long wave antenna tuning inductor and a 470pF variable would be a good starting point. The wavetrap should be placed inside a metal box which is connected to earth. It is easy to adjust the trap. Turn its tuning knob until the QRM is reduced or disappears. Has anyone experience of suppressing breakthrough?

A pennant from Radio Bilbao which is on 990kHz

France Inter Time Signals

My reference to the one second pulses on the two megawatt French long wave station on 164kHz in the October issue prompted an interesting and informative reply from reader **M. A. Kirk** of Geneva. To quote from his letter, "The French time code is transmitted by phase modulation and was demonstrated at the TELECOM-75 exhibition in Geneva in 1975. Since March 1980 France Inter's 2MW 163·84kHz transmitter has been carrying the signal for 24 hours a day except for a few hours for maintenance on the nights of Tuesdays and Wednesdays—the information is phase modulated and a logic 1 is represented by two 25ms pulses at 100ms intervals and a logic 0 by a single 25ms pulse. The code is the same as that used by the DCF77 transmission at Mainflingen."

According to the *World Radio and TV Handbook 1981* page 533, Mainflingen (West Germany) gives "coded transmission of the number of minutes, hour, day, day of week, month and year". So, not only does our 2MW broadcast transmitter radiate second pulses, it also contains coded information giving the date and time as well. If you have not yet heard this transmission then tune to 164kHz (1829m), switch on the b.f.o. and you can't miss it.

Readers' Letters

Regular readers will remember the problem that some m.w. DXers have had with the DX160 communications receiver. It has its own ferrite rod antenna for use on the medium wave and this may be mounted internally or externally at the rear of the receiver. This of course prevents one using a medium wave loop with this receiver nor is it feasible to try the usual dodge of mounting the receiver at the centre of the loop and rotating the loop and receiver together, relying on induction between the two. The set is too bulky and heavy for that. Remembering that the ferrite rod antenna is also directional **Ted Jones** (Woking) bought a four wheel trolley. "With the DX160 on top and placed by the window I can manoeuvre the trolley for nulling out stations on medium wave." An ingenious and practical solution.

Using a Grundig Satellit 1400 with internal antenna **Simon Hamer** of New Radnor managed to pick up Oslo University Radio on 1314kHz after sign-off of NRK Stavanger. The time was 2303 on 7th October. Simon recognised the theme tune of the station as it had been played by *Sweden Calling DXers* the previous day. According to *Sweden Calling DXers* both Oslo and Trondheim universities have been using it and Bergen University Radio has applied to use it during March 1982.

Dial Search

This is the name of a rather useful booklet produced by **George Wilcox** of Eastbourne. It is a listeners' check list of European radio stations and is in three parts. There is a list in frequency order of what can be heard, including the language used, on each channel of the Geneva Plan which covers the medium and long waves. There is a section on v.h.f. and there is a map based on Eastbourne which gives the bearing of a large number of European broadcasters. The map shows the direction to point your radio for the best reception of any of the locations marked on it. Instructions are given that enable the reader, with the aid of a protractor, to change the bearings so that they apply to any other location in Europe.

Dial Search will help listeners to find British and European broadcasters on the long wave, medium wave and v.h.f. It costs £0·80 plus £0·20 postage in the UK or six IRCs abroad and is obtainable from George Wilcox, 9 Thurrock Close, Lower Willington, Eastbourne BN20 9NF.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

The 120 metre tropical band seldom attracts much attention mainly I think because it is so difficult. Few DXers have ever heard anything on 120 metres and a word of warning for those who may be tempted to try comes from reader **M. Jansen** of Hoek in the Netherlands. Stations heard on 120 but not identified could be second harmonics from broadcasters on the medium wave. A second harmonic is a spurious emission from a transmitter on twice the normal frequency and a third harmonic is a spurio on three times the fundamental. Broadcasting stations do their best to suppress harmonics but it is difficult to prevent the radiation of a few watts of harmonics from a high power station. Our reader has found several harmonics on 120 metres while testing a new homebrew receiver which he has built especially for the tropical bands. If you suspect you are listening to a harmonic then search for the fundamental on the medium wave. Second harmonics on 120m would come from stations transmitting between 1150kHz and 1250kHz and third harmonics from stations between 767kHz and 833kHz. Divide the frequency of the suspected harmonic by 2 or 3 to find the fundamental.

Control Points

Our reader in the Netherlands goes on to say that it is possible to DX on the tropical bands during daylight. "Here in Holland many serious DXers receive Indonesian stations on both the 60 and 90 metre bands during the afternoon in wintertime around 1400-1500 hrs GMT." Yes it is the same here in the UK and the reason is that it is only necessary to have darkness on part of the path from transmitter to receiver; the part between the control points. This of course raises the question, what are the control points?

Fig. 1, which is not to scale, shows how a signal travels from a distant transmitter, via the ionosphere, to our receiver. In the case of the frequencies used for the tropical bands it is necessary for the two control points shown to be in darkness otherwise the radio signal will not be returned to earth. The control points shown assume that the signal is reflected. In practice it is refracted and follows the curved dotted line below the control points, but the principle is the same.

Signals coming from the East will fade in before sunset at the receiver and will fade out after sunrise at the transmitter. Signals from the West will fade in before darkness reaches the transmitter and they will fade out after sunrise at the receiver. The effect is more pronounced in midwinter than at other times of the year. The

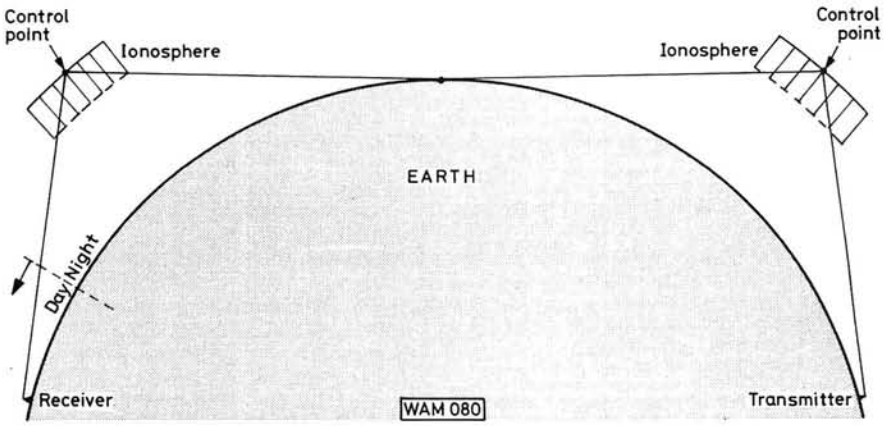

Fig. 1

sun is at a lower altitude, it ascends and descends at a shallower angle, twilight is longer and the period when DX can be heard in daylight is longer.

How far away are the control points? For the E layer (medium wave DX) the maximum distance for single hop reflection is 2000km and the control point obviously is at half this distance which is 1000km. For the F layer single hop reception cannot exceed 4000km and the corresponding control point is 2000km.

It is roughly true to say, when DXing on the medium wave or on the tropical bands, that there must be a path of darkness between TX and RX and it is only in mid-winter that any error becomes apparent. It is on the higher frequencies where the control points have to be in daylight that one really has to take account of them. The path from the UK to South America for example is open on the 19m and 25m bands for several hours after UK sunset because the control points, unlikely as this may seem, are still in daylight.

Radio New Zealand

Broadcasts from Radio New Zealand seem to have a fascination for listeners in the UK. Indeed it is an achievement to pick up RNZ at all as the transmitters are low power, only 7·5kW, and the broadcasts are not beamed to Europe. Local time in NZ is 13 hours ahead of us (they are on summertime at the moment) and since the best time for reception in the UK is around breakfast time one gets the feeling of listening into the future, to events of the day to come.

Pennant from Radio New Zealand

RNZ have sent me a copy of their current schedule of short wave services which covers the period 25 October 1981 to 6 March 1982:

Pacific Service

1700–2030GMT	11·675MHz
2045–0530GMT	17·86MHz
0540–1115GMT	11·945MHz
1700–2005GMT	9·54MHz

Australian and NW Pacific Service

2015–0715GMT	15·485MHz
0730–1115GMT	11·96MHz

RNZ has a DX programme called *New Zealand Calling* which lasts for half an hour and is broadcast on the first and third Monday of each month on the Pacific Service Frequencies and at 0215GMT on the Australian and NW Pacific Service at 0915GMT. "DX reports must be accompanied by four International Reply Coupons if QSL Verification cards are required" writes the station who go on to say that "interesting information about the areas in which we are received and the people who listen, is also appreciated." The station does not operate a general mailing list but requests for frequency and programme details are welcomed.

QSL Card from New Zealand

Colin Brooke's QSL from WWVH

PW reader **Simon Hamer** of New Radnor has become a regular listener. "Thanks to your help, RNZ has been coming in regularly since I first logged it on Sunday 20 September". The receiver is a Grundig Satellit 1400 and 20 metre long wire and the best frequency is 15·485MHz at 0715. "I find RNZ's Book Review Programme aired at 0730 on Sundays very interesting" concludes Simon who thinks the station is a very welcome visitor to New Radnor. From Waltham Cross comes another report of RNZ on 15·485, this time at 0440 with a commentary of a rugby match. The receiver used by **T. W. G. Elsenham** is a vintage CR-100 which he has modified and he uses it with the outdoor TV antenna.

Readers' Letters

Another letter from New Zealand, this time from 16 year old **Martyn Barnes**, who is a student at college. He lives at Lower Hutt which is located NE of Wellington. His receiver is a new Sanyo stereo cassette/radio M7700K. "Its small size however does not seem to diminish its ability to receive stations on its two short wave bands. It tunes through the 120 metre band up to the 13m band". DX heard on the tropical bands includes Radio Colosal in Colombia on 4·945MHz, Solomon Islands on 5·02MHz and Radio Vanuatu at Port Vila (formerly New Hebrides). The frequency of the latter was not mentioned but Radio Vanuatu broadcasts on 3·945MHz and 7·26MHz. Welcome on board Martyn, hope to hear from you again.

Colin Brookes moved from Blackpool to RSA in 1979 and he says it took some months to readjust, as the transmitter directions and times are totally different. Colin gets fair reception from Brasil on 15·28MHz and 17·81MHz, R. Nacional Bogota in Colombia on 11·79MHz but so far HCJB has eluded him. WWVH Hawaii comes in well and he wonders if this might be the station heard by Alan Proctor (September issue).

Broadcasts Heard

A fine log of interesting DX comes from **Jim Edwards** who lives at Bryn near Wigan. With his R-1000, 60 metre-long wire and a.t.u. he pulled in Radio Clube Rondonopolis Brasil with a weak signal at 0100 on 2·48MHz in the 120m-band (quite a catch), ABC Melbourne on 6·15MHz at 2100, Ibadan Nigeria on 6·05MHz at 2205, Gansu China on 6·155 at 2200, Xinjiang China on 6·12 at 2310 and Action Radio Guyana on 5·95 at 0255 in English. **Rich Lewis**, Louth in Lincolnshire, uses the well known FRG-7 with a 19 metre-long wire and he reports hearing Seoul in the Republic of Korea on 6·48MHz at 2003. **Paul Clements** (Seaford) used an Eddystone 730/10 with a 6 metre-long wire outside the window to listen to Radio Internation Brasil on approx 17·86MHz at 2100.

Reader **A. N. Mead** is a newcomer to the short waves. He recently purchased a Realistic DX200 which he uses with a 25 metre-long wire. In the first few days he picked up Radio Nacional Brasil on 16·128MHz at 1945, Israel on 15·415 at 2100, HCJB the Voice of the Andes in Ecuador on 21·48 at 2130, Radio Nigeria on 15·12 at 0630 and All India Radio on 11·155 at 2045.

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	1X011	9 + 9	1.66		
	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		
50 VA 80 x 35mm 0.9 Kg Regulation 13%	2X010	6 + 6	4.16	£5.83 + £1.10 P/P	£4.93 + £1.10 P/P
	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		
	2X026	110	0.45		
	2X029	220	0.22		
	2X030	240	0.20		
80 VA 90 x 30mm 1 Kg Regulation 12%	3X010	6 + 6	6.64	£6.51 + £1.43 P/P	£5.47 + £1.43 P/P
	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		
120 VA 90 x 40mm 1.2 Kg Regulation 11%	4X010	6 + 6	10.00	£7.55 + £1.43 P/P	£6.38 + £1.43 P/P
	4X011	9 + 9	6.66		
	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		
	4X018	35 + 35	1.71		
	4X028	110	1.09		
	4X029	220	0.54		
	4X030	240	0.50		
160 VA 110 x 40mm 1.8 Kg Regulation 8%	5X011	9 + 9	8.89	£9.92 + £1.43 P/P	£8.44 + £1.43 P/P
	5X012	12 + 12	6.66		
	5X013	15 + 15	5.33		
	5X014	18 x 18	4.44		
	5X015	22 + 22	3.63		
	5X016	25 + 25	3.20		
	5X017	30 + 30	2.66		
	5X018	35 + 35	2.28		
	5X026	40 + 40	2.00		
	5X028	110	1.45		
	5X029	220	0.72		
	5X030	240	0.66		

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE inc VAT	PRICE ex VAT
225 VA 110 x 45mm 2.7 Kg Regulation 7%	6X012	12 + 12	9.38	£11.83 + £1.73 P/P	£10.06 + £1.73 P/P
	6X013	15 + 15	7.50		
	6X014	18 + 18	6.25		
	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		
	6X025	45 + 45	2.50		
	6X033	50 + 50	2.25		
	6X028	110	2.04		
	6X029	220	1.02		
	6X030	240	0.93		
300 VA 110 x 50mm 2.6 Kg Regulation 6%	7X013	15 + 15	10.00	£13.67 + £1.73 P/P	£11.66 + £1.73 P/P
	7X014	18 + 18	8.33		
	7X015	22 + 22	6.82		
	7X016	25 + 25	6.00		
	7X017	30 + 30	5.00		
	7X018	35 + 35	4.28		
	7X026	40 + 40	3.75		
	7X025	45 + 45	3.33		
	7X033	50 + 50	3.00		
	7X028	110	2.72		
	7X029	220	1.36		
	7X030	240	1.25		
500 VA 140 x 60mm 4 Kg Regulation 4%	8X016	25 + 25	10.00	£18.17 + £2.05 P/P	£15.53 + £2.05 P/P
	8X017	30 + 30	8.33		
	8X018	35 + 35	7.14		
	8X026	40 + 40	6.25		
	8X025	45 + 45	5.55		
	8X033	50 + 50	5.00		
	8X042	55 + 55	4.54		
	8X028	110	4.54		
	8X029	220	2.27		
	8X030	240	2.08		
625 VA 140 x 75mm 5 Kg Regulation 4%	9X017	30 + 30	10.41	£25.10 + £2.20 P/P	£21.54 + £2.20 P/P
	9X018	35 + 35	8.92		
	9X026	40 + 40	7.81		
	9X025	45 + 45	6.94		
	9X033	50 + 50	6.25		
	9X042	55 + 55	5.68		
	9X028	110	5.68		
	9X029	220	2.84		
	9X030	240	2.60		

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BARCLAYCARD VISA

VHF Bands

by Ron Ham BRS15744

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

I have always believed that all aspects of radio communication are both essential and exciting and looking back over 35 years, at the systems I've seen, I ask myself, where else but in the world of amateur radio could one find a choice of 15 wave-bands to work on, some 6 different modes of operation and at least 4 types of atmospheric disturbance to influence the signals and add the sporting element to working DX.

Solar

Up in Ayrshire, **A. W. Rhead,** a member of the British Astronomical Association and frequent solar observer, has been experimenting with v.l.f. for some years and sending his results to a co-ordinator in the USA who runs a v.l.f. experimenters' news-letter. Like **Comdr Henry Hatfield** in Sevenoaks, Mr Rhead records the signal of MSF on 60kHz and compares his results with solar activity. From Bristol, **Ted Waring** reports that he counted 36 sunspots on October 20, 39 on the 31st and 50 on November 3. Henry also counted large numbers of sunspots and there is little doubt that these were responsible for the solar noise storm which began mildly on the 2nd, reached a high level on days 5, 6, 7, 8, 9 and 10 and gradually faded with a little noise and a few bursts each day until the 14th. In addition to this storm, which Henry and I recorded at 136 and 143MHz respectively, we also received several small bursts of solar noise, almost daily, between October 19 and 31.

The largest individual burst of solar radio noise that we have recorded for some time began at 1305 on the 15th and lasted for 10 minutes. It is surprising how events like these can just suddenly occur.

The 10m Band

I found the 10m band generally good between October 19 and November 15 with strong signals from Japan, in the mornings on 21 days and from Canada and the USA in the afternoons on 23 days. As far as my station is concerned signals from Australia were sparse throughout the period. At 0912 on October 30, I received a strong signal from 14-year-old SM2MTB while he was working a German station and around 0900 on November 5, I heard YU6GAS from the University of Titograd. At 1400 on October 19, **Harold Brodribb,** St Leonards-on-Sea, Sussex, heard the young voice of 15-year-old Ari 4X6BP, working into the USA and when asked about DX conditions in Israel, Ari replied with a list of his QSOs with stations in South and Central America. "This young man must have a great future as a DXer" writes Harold who also noted that utility stations and harmonics from lower frequency broadcast stations were coming in as high as 45 to 50MHz on most days between October 20 and November 3. **Jon Kempster** BRS45205, Berkhamsted, using an FRG-7, an inverted "L" antenna and an a.t.u. has been listening to several American stations and trying to keep up with the c.w. Keep trying Jon, it will add a great deal to the pleasure you already get from your set.

"My new Tandy Patrolman 50 is great for listening on the 30–50MHz band for signals via the "F2" layer" writes **Wenlock Burton** from Victoria, Australia, who, between October 1 and 17, received signals from American and Hawaiian paging systems and Mexican and Russian mobiles between 34 and 40MHz. On several days, especially November 9 and 11, I heard strong echoes on the signals from European stations which of course may have been due to the prevailing solar activity.

10m Beacons

"What with new beacons and seasonal changes there is always something of interest" writes Ted Waring on November 10, who heard the beacons DF0AAB, VS6HK, WD4HES and ZS5VHF for the first time during his daily observations between October 15 and November 9. Between October 4 and 27, **Geoff Haynes** G3CWL, using a Ten-Tec RX10 receiver and a G3WPO 10m converter at his home in Leatherhead, Surrey, consistently heard signals from DL0IGI, 5B4CY, A9XC, VP9BA and YV5AYV. Then although this situation continued when he listened from his QTH in Falmouth, 240 miles west of Leatherhead, between October 29 and November 3, Geoff noticed a marked improvement in the reception of the European beacons DF0AAB, DK0TE, HG2BHA and LA5TEN, because, where he seldom heard these in Leatherhead he received them at good strength, almost daily in Falmouth. A good observation Geoff, you have proved the point that the reception of h.f. beacon signals does vary over relatively short distances. During the 28 day period between October 19 and November 15, I logged signals from the 10m beacon stations in Australia VK2WI on 5 days, Bahrain A9XC on 27 days, Bermuda VP9BA on 26 days, Caracas YV5AYV on 17 days, Cyprus 5B4CY on 26 days, Germany DL0IGI on 27 days, Hong Kong VS6HK on 14 days, Hungary HG2BHA on 9 days and, like Henry Hatfield, a new beacon U2ABJ 28·272MHz on November 5, 6, 9, 12 and 13. The reports from both Henry and Ted Waring show similar results to mine but with the addition of the Canadian and South African beacons VE2TEN and ZS6PW which they both frequently heard. Another similar log came from **Arthur Swatton,** Westcliff-on-Sea, Essex, who also heard the German beacon DF0AAB.

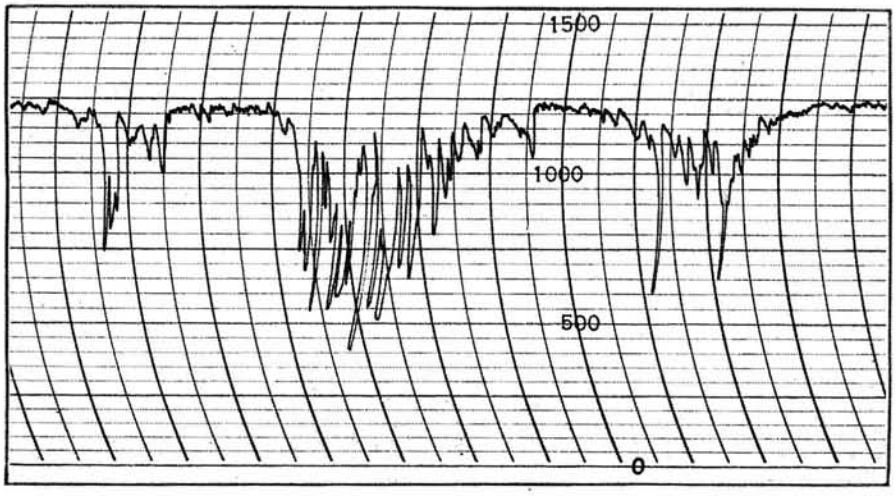

Fig. 1: Ten minute solar burst recorded at 140MHz by the author at 1305 on November 15

The 6m Band

My phone rang at 1430 on November 10 and I was pleased to hear **Barry Ainsworth,** G4GPW, from nearby Lancing say "the 6m band is wide open, I have just worked VE1AST, cross-band between 10 and 6m s.s.b. and heard strong c.w. signals from WS 1, 2 and 3". Around 1400 on the 13th, I received strong s.s.b. signals from KA1MP and WB2CUS on 50MHz while they were working cross-band with 10m stations in England and Germany respectively.

RTTY

Although the majority of my RTTY listening is limited to short periods in the early morning and at midday I logged 200 stations between October 19 and November 15 spread over 28 countries, CN, DJ, EA, F, G, GW, HA, HB9, I, LA, LX, OE, ON, OK, OZ, PA, PY, SM, SV, T1, UA, VE, VK, W, YO, YU, YV and Y3. Among the interesting two-way QSOs I copied on 20m (14·090MHz) were I3FWY and W3AE at 0846 on October 19, DF9NW and EA3CVT at 1401 on the 23rd, I0DAO and OZ7XE at 1612 on the 24th, DJ1IJ and KD4SC, DK2DR and WA1ZEZ and DL7GE and WA1ZEZ around 0830 on the 26th,

DF3HE and DJ5QU at 0837 on the 28th, ON6ZM and OZ1CLE, PA3AXZ and EA6HH and UA3HR at 0934, 1400 and 1928 respectively on the 29th, DF2IC and LA5IV at 1400 on the 30th, F9KP and UA3HR and DF2IC and G3ASM at 0837 and 1334 on the 31st. Then on November 1 EA6HH and WB3HAZ at 0856, G3PFZ and ON4ZU around 0845 on the 2nd, EA3CVT and PA3BJD and I1KMF and I3XCE around 1425 on the 4th, F8DP and I1KMF at 0920 on the 5th, F6DXZ and I0EMV at 1355 on the 10th, GW4LWD in Cardiff and our Breadboard '81 exhibition station GB2PW at 1352 on the 12th and HB9BX and DL6BBJ around 1410 on the 13th. Among the 13 RTTY signals I received on 15m was SV1DU in Athens at 1814 on October 25 and the 6 copied on 10m were mainly in Canada, Italy and the USA. Between November 11 and November 14 the RTTY section of the *Practical Wireless* station at Breadboard '81, using the special event call-sign GB2PW, worked 31 stations in 15 countries. At 1442 on the 11th, I copied F6DXZ telling Geoff, our Editor operating at the time, that he would like to work him again under his own call G3GSR.

New readers with RTTY to TV converters should watch out for a rapid repetition of the letters RYRYRYRY or the figures 46464646 because these often precede a CQ or reply call-signs and offer a good chance to latch on to a QSO.

Microwaves

"The morning was spent making use of test equipment to test both transmitters and receivers in the microwave range" writes **John Tye** G4BYV, Dereham, who attended the Microwave Round Table meeting at Martlesham on October 18. The afternoon session was devoted to two lectures, one by Bill Thorpe on equipment for 29GHz and the other by Mike Walters on 23cm antennas.

On August 7, John, using his home-brew gear worked PA2HJS on 9cm (3·456GHz), a distance of 384km.

What about some microwave reports readers, with all those *PW* dishes sold there must be some new activity about.

Tropospheric

Apart from a few hours on October 23 and 24, the atmospheric pressure, measured on my Short and Mason barograph (have you seen the new Heathkit one) remained below 30·0in (1015mb) from midnight on October 19 to midday on the 31st when it began to rise and by midnight it was 30·15 (1020mb). It continued to rise reaching 30·3 (1026mb) at midnight on November 2 where it remained until 0600 on the 4th when it began to rise still further, reaching 30·5 (1032mb) by midnight on the 5th and apart from a slight drop on the 11th and 12th, it stayed high until the 15th. Although the pressure was high, v.h.f. conditions were not as good as they should have been. On November 2, **Roland Jeffery** G6DSA, using a FT225RD and an 8-element Yagi, belonging to his father G8SIG, worked stations on 2m in Guernsey, France and Spain, EI8AAB on the 5th and EA1TA on the 6th.

Once the pressure went up I could hear signals, almost daily between October 31 and November 15, from the Bristol Channel repeater GB3BC R6 with only a roof-mounted dipole feeding my receiver. At 0500 on November 3, I heard an EA calling on R3 and judging by the strength, I am sure it was through the Brighton repeater GB3SR and on the 14th and 15th there were several repeater signals coming up on each channel.

Band II

Both **Simon Hamer,** Presteigne and **Ian Kelly,** Reading are keen Band II DXers and during the improved conditions between October 31 and November 5, Simon received signals from broadcast stations in Belgium, France, West Germany, BBC Radios London, Manchester, Solent, Sheffield and ILR Chiltern, Capital, LBC and Thames Valley between 88 and 100MHz. Ian also received signals from France and from a Dutch speaking station called "Radio Marina", BBC Radios Medway, Oxford and Solent and ILR Capital and LBC. For Band II DX, Simon uses a Pioneer SX450 and a Grundig Melody Boy and Ian uses a Realistic Modulette 929 music centre and both have wideband pre-amplifiers and a variety of home-brew antennas to meet their needs. "The best days were October 31 and November 2, when 7 and 12 continental stations were heard respectively. The majority of signals were absolutely excellent in mono" writes Ian and during the evening of November 1, Simon counted 8 editions of BBC Radio 3. Ian listened to the Disco Programme *Soiree Club* on most evenings and Simon also enjoyed a variety of music programmes from the abundance of French stations. Like Simon, I noticed a good bit of continental interference between 88-104MHz on November 1.

News Items

"The U.K. Horizontal FM Group has been very active over the past few months and is growing in strength," writes their Secretary, **Arthur Dorsett,** G8YLH, Dogmersfield, Hants. The committee have decided that there will no longer be a net controller on activity nights. The calling frequency is now 144·675MHz and G8YLH will stand by on this channel to help any station in difficulty. Any station wishing for information about the group should call G8UAV on 144·650MHz.

The group also hold a Sunday morning net at 1030 on 145·350MHz to the Dutch novice stations (PD), also to EI on 145·575MHz at 1100. Arthur would like to give a word of thanks to one of my readers, Jon Kempster BRS45205 for the trouble he has taken to provide the group with some really excellent s.w.l. reports.

Congratulations to **Tim Norris,** Barnham, Sussex, who passed the RAE in May and now has the call-sign G6FKY. Tim became interested in radio in 1965, at the age of 12 and through the years listened on a variety of ex-Army and RAF receivers and now has a HC1400 and colinear for 2m and a Trio 1000 and long wire antenna for general use and a loft dipole for 10m. Tim worked an ON via the Kent repeater soon after he was licensed and an EA, he thinks via the Torquay repeater on R2 at 1439 on November 3.

Congratulations to the leading stations in the WAB VHF contest held on September 19 and the following information was kindly sent by the organiser, Del Roberts. Multi-operator section, 1st G4LAB/P and 2nd G6SW/P. Single operator, 1st G4HCQ, 2nd G8YBR and 3rd G8WJO and the mobile section was won by G4FQO/M.

Congratulations to George Grzebieniak on passing the RAE and now sporting the call-sign G6GGE which he received on November 5. George is now QRV on SSTV as well as 2m, 70 and 23cm and is looking forward to working some real DX on all bands.

Anyone interested in an expensive but rather special DX Diary for 1982, published in Finland, should write to Keith Hamer, HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR, for details.

Congratulations to 15-year-old **Roland Jeffery,** in Cheshire, who passed the RAE in May and now has the call-sign G6DSA and along with G8WWY is helping to run a RAE course at Woodford Lodge Comprehensive School. Roland, a member of the Mid-Cheshire Amateur Radio Society, is push-bike mobile with a TR2300 and a home-brew $\frac{1}{4}$ wave ground plane antenna which works well from his bike.

TV

by Ron Ham BRS15744

Reports: as for VHF Bands, but please keep separate.

I am always pleased to hear from overseas readers, because it gives us a chance in the UK to learn more about the type of DX and propagation encountered in other parts of the world as well as an insight into the technical problems which have to be overcome.

Although the amount of sporadic-E is small during the winter months I did see bursts of the RS-KH test card from Czechoslovakia at 1330 on October 20, test cards scribed Budapest from Hungary, CST 01 from Czechoslovakia and the plain one from Poland at 0850 on the 22nd, Grunten and Poland at 1315 on the 23rd. I also saw ORF FS1 and a film

about gliders at 0855 on the 25th. Austria again at 0810 on the 26th and RSKH at 0845 on the 27th. Sometimes bursts of sporadic-E occur while an "F2" disturbance is in progress but it is easy to distinguish between the two. The majority of these signals were on Ch. R1 49·75MHz because such disturbances rarely go above 50MHz at this time of year.

"Not quite sporadic-E time yet, it should start between November 14 and 20, so I am testing my home-made Band I filters" writes Australian reader **Wenlock Burton** on November 2, who adds "There has been quite a bit of trop lately with the good weather". I look forward to hearing more Wenlock.

Tropospheric

When tropospheric conditions are good, Wenlock Burton often receives pictures, Fig. 2, at his home in Melbourne, from one of Australia's privately owned commercial TV stations, BTV6 (Ballarat and Western Victoria TV Ltd) in Ballarat. According to the 1980 edition of the *World Radio TV Handbook* there are some 29 such stations and their call-signs are coded. The first two letters 'BT' are an abbreviation of the name of the licence, the 3rd letter 'V' indicates the state 'Victoria' and the number '6' signifies the channel. In Australia Ch. 6 is 175·25MHz.

Between October 12 and 16, Wenlock also received pictures from stations BCV8 (Victorian Broadcast Network Ltd), MTN9 (Murrumbridge TV Ltd) GTV9 (General TV Corporation Pty. Ltd) and HSV7 (Herald Sun TV Pty Ltd).

At 2120 on October 31, the atmospheric pressure having risen sharply, was steady and during a brief opening I received strong colour pictures from BRT Belgium on Ch. E10. The station was showing an episode of *Tales of the Unexpected,* in English with Belgian sub-titles. This was followed at 2138 with their weather report, 2139 came their NIEUWS (news) and sport mainly VOETBALL (football) followed at 2155 by a list of the following day's programmes and a clock showing 2259, one hour ahead of GMT. Finally a test card scribed BRT VTV.1 appeared accompanied by the time pips for 2300 and the station closed down. I also saw a monochrome film on Ch. E8 but this died out around 2230 GMT. This opening began to ebb and flow with changing weather, but as the pressure remained high, at 30·2in (1022mb), I received a weak signal of a football match at 2204 on November 1 and a weak picture at 1340 on the 2nd from Belgium on Ch. E10. At 0900 on the 3rd, I received strong pictures from the IBA transmitter at Lichfield on Ch. B8, strong colour test cards from BRT VTV.1 and RTBF-1 at 1400 and the *Muppets* with Shirley Bassey, in English with Belgian sub-titles on Ch. E10. Around the same time, **Tim Norris,** Barnham, using a converted Bush TV161, watched the French station TF1 from Caen on Ch. 21. At 2230 on October 31, **George Garden,** Bracknell, received a test card from Belgium on Ch. 28 and put this down to the two huge high pressure systems, which he saw on the weather report, over France and Germany. George has now invested in a JVC CX-610GB colour set and is looking forward to more good DX. In Chippenham, **Brian Renforth** received excellent pictures from France, TDF FR3 on Ch. 42, on October 30, TDF test cards on Chs. 39, 42 and 46 from Rennes on November 5 and several French stations, including Teletext transmissions from FR3 Ch. 42, on the 6th. I again received pictures from Belgium on Ch. E10 for short periods around 1955 on the 6th and 1344 on the 9th.

Amateur Television

"I can now report that the ATV repeater, VK3RTV, has been given its complete control system," writes Wenlock Burton, from Australia, who tells me that the functions are touch-tone commanded and a standard touch-tone keyboard is required. The user v.d.u. (TT1) is accessed by sending 300 baud Kansas City AFSK on the audio uplink frequency, "same as sending RTTY" says Wenlock.

Between 2000 and 2300 on November 7, **Roy Humphreys** G6AIW, from the Worthing Amateur TV group, set up his portable TV gear, home-brew 10W transmitter on 435MHz with 2m talk back and an 18-element parabeam, on the South Downs and successfully transmitted pictures to stations in Oxford and Derby and fellow club member, **Robin Stephens** G8EXU, has been experimenting with inter-carrier sound which he transmitted with his video for a couple of hours to Roy on November 9. The Worthing group gave much pleasure to the residents of the St Giles Home for the Disabled in Lancing when the Worthing Amateur Radio Club put on a special station at the home between 1100 and 1630 on November 7.

"Although I have a full licence (h.f.-v.h.f. etc) I am QRV on the 2m band only, but also on ATV 70cm as the announcer of the station ON6PM/T. We transmit every Saturday between 1500 and 1700 GMT, sound 439·75MHz and vision 434·25MHz and listen on 145·575MHz for reports" writes **Jose Robat** ON7TP, Bressoux, Belgium. Jose sent one of their ATV QSL cards, Fig. 1, which would sure look good on the shack wall and on the reverse side are 6 pictures, graded 0–5, indicating the quality of the report.

F2 TV

"At 1145 GMT today I discovered a smeary Soviet test card on Ch. R1, its image continually disintegrating and then reforming. At times there were multiple images" writes **David Appleyard** from Uppsala, Sweden on November 6. Join the club David, that's "F2" propagation and very well described. Around 1200 on the 7th, David noted a similar jumble of bars and patterns on Ch. E2 48·25MHz and writes "The disturbance persisted and at 1255 Arabic letters were discernible across the bottom half of the screen". David also saw a smeary, un-readable clock just before 1300 and then for about 10 minutes, large Arabic letters on a white centre piece with dark borders top and bottom were shown at intervals of about 2 minutes. David, using his 8in National receiver with its own rod antenna, suggests that this signal was coming from Dubai.

From Chippenham, Brian Renforth has been watching the "F2" signals on Chs. E2 and R1 and noted the typical Russian test card on October 16, Dubai with Arabic caption at 1400 on the 17th and a test card with squares, possibly Ghana, on the 27th. "A good start to my 16th birthday" said Brian as he identified tanks on display with CCCP on them at 0900 and Dubai test card at 1240 on the 28th.

"Today there has been a lot of TSS "F2" on Ch. R1" writes **Keith Hamer,** from Derby on October 31, who also sends 3 pictures, Figs. 3, 4, 5, of typical "F2" signals received by **Garry Smith** and himself between October 15 and 18. These pictures come from as far afield as China and as Keith says "look at the characters" (in Fig. 5).

I have seen that broken Russian test card around 0900 on several days, in fact, I logged multi-image, smeary and mostly un-identifiable signals on Chs. E2 and R1 on October 19 and then, almost every morning from October 26 to November 15. At 0930 on October 27, I saw what I thought was someone teaching in front of a giant chequered board and a multi-image announcer at 0835 on the 28th. Around 1350 on November 2, I saw what looked like an announcer answering the phone and at 1200 on the 6th David Appleyard saw the image of a woman dancing reproduced several times on the screen. "It is interesting that multiple TV reception on Ch. R1 re-appeared on November 1" writes **Harold Brodribb** who nearly resolved a picture on the 1st but did catch a glimpse of a test card on other days. "I couldn't identify it" said Simon Hamer

Fig. 2: Ballarat test card received by Wenlock Burton in Australia

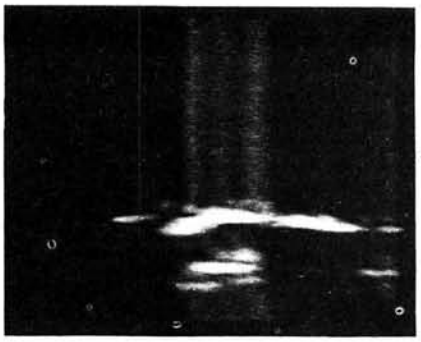

Fig. 3: Arabic TV caption received by Keith Hamer via F2

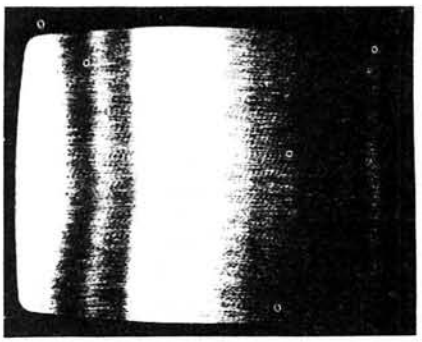

Fig. 4: Typical F2 patterns received by Garry Smith

Fig. 5: F2 signal possibly China received by Keith Hamer

Fig. 6: Gibraltar Band III TV received by Fred Pilkington in Spain

Fig. 7: Gibraltar caption received by Fred Pilkington

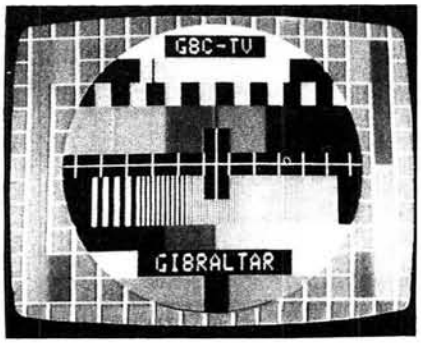

Fig. 8: Gibraltar test card received by Fred Pilkington in Spain

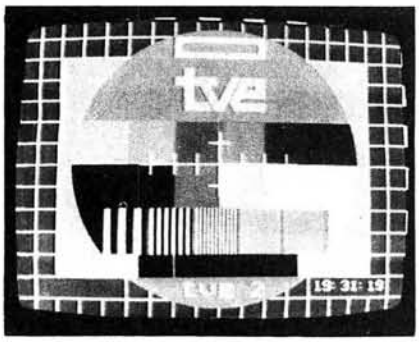

Fig. 9: Spanish TV test card received by Fred Pilkington whilst on holiday

Fig. 10: Spanish TV test card received by Fred Pilkington

who tried to grapple with the mixture on R1. Keep trying everyone, each bit of information helps.

Gibraltar

"I have recently been on vacation in the Malaga area on the Costa del Sol" writes **Fred Pilkington** G3IAG, Newmarket and while there he used a home brew 220MHz beam and did some experimenting with reception of television from Gibraltar, 55 miles away. The excellent results, Figs. 6, 7, 8 came from the translator on top of the Rock, Ch. E11 217·25MHz. While in Spain, Fred kindly took 2 pictures of test cards from the Mijas u.h.f. transmitter, Figs 9, 10 and one from the regional station, Andalucia, Fig. 11.

Equipment

One of our readers since 1952, **W. H. Collier,** Newport, Wales, asks about suitable receivers for DXTV so I suggest you take a look around your shops for small screen portable sets made by JVC, National Panasonic, Plustron, Sanyo and Sony because these usually tune through v.h.f. Bands I and III and u.h.f. Make sure the dials on the set you choose are marked in Chs. 2–4, 5–12 and 21–69. I am always pleased to hear about any make of set which covers these ranges.

The DXTV-RX Group are organising a telephone warning network for openings caused by Aurora, tropospheric or sporadic-E. Several members have joined the network and any reader wishing to take part should contact the secretary, George Grzebieniak, 35 Binns Road, Chiswick, London W4.

Fig. 11: Spanish TV test card received by Fred Pilkington

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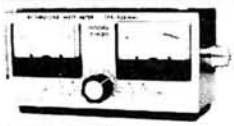

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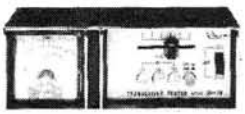

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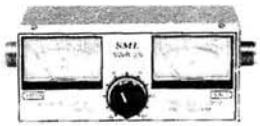

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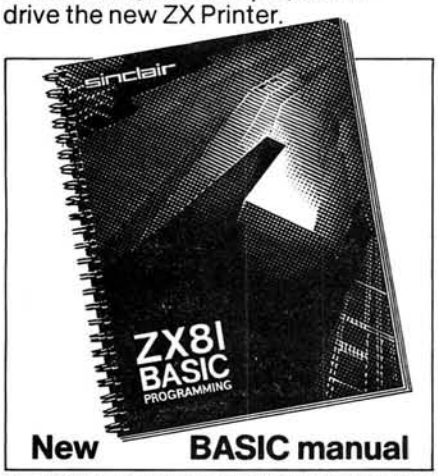

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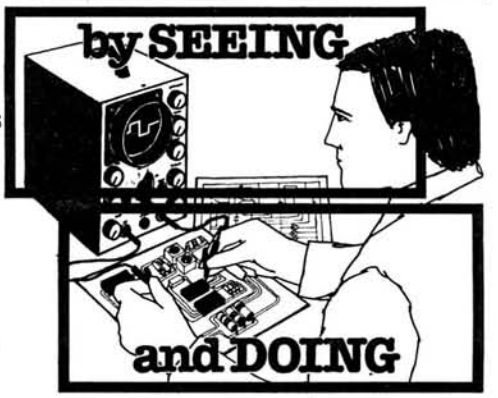

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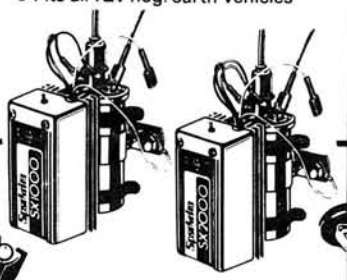

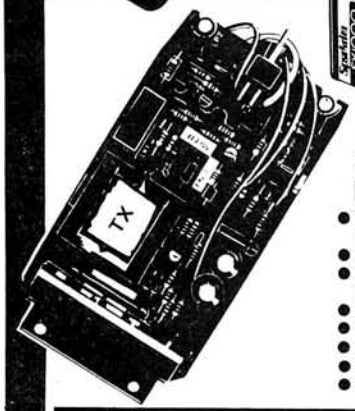

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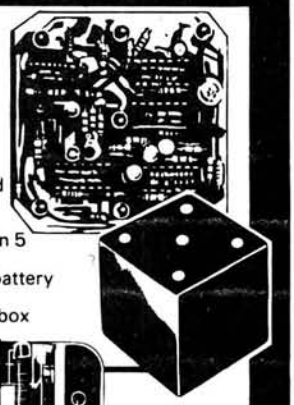

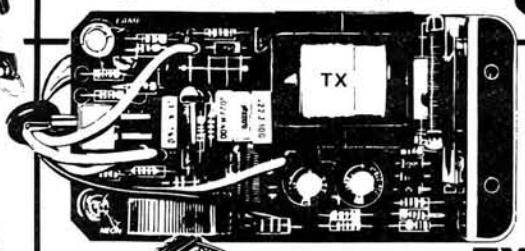

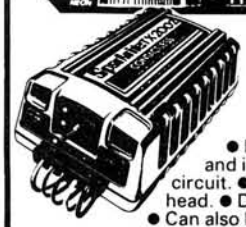

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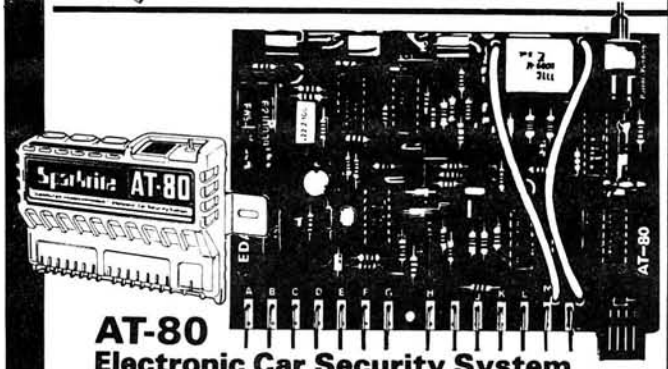

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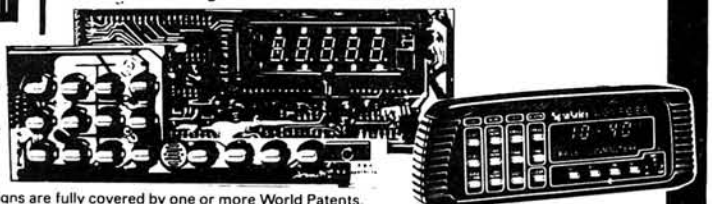

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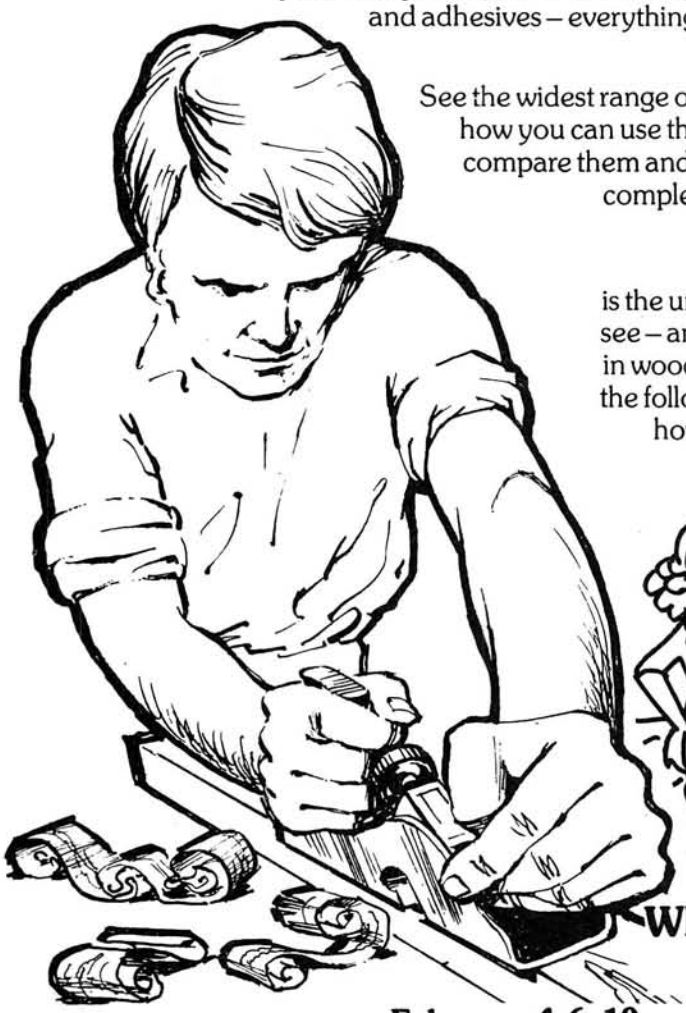

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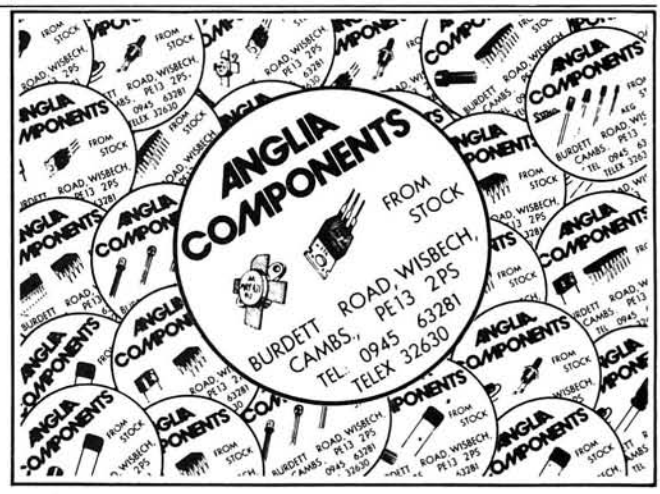

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33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
TEL. WATFORD (0923) 40588. TELEX 8956095

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POLYESTER RADIAL LEAD CAPACITORS: 250V; 10n, 15n, 22n, 27n **6p;** 33n, 47n, 68n, 100n **7p;** 150n, 220n **10p;** 330n, 470n **13p;** 680n **19p;** 1µ **23p;** 1µ5 **40p;** 2µ2 **46p.**

ULTRASONIC TRANSDUCERS **395p** per pair.

ELECTROLYTIC CAPACITORS (Values in µF). **500V:** 10 **52p;** 47 **78p; 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: 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;** 220 **88p; 10V:** 15, 22 **26p;** 33, 47 **35p;** 100 **55p.**

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

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

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	40p

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

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

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.

OPTO ELECTRONICS

LEDs plus clip	
TIL209 Red	13
TIL211 Grn	18
TIL212 Yel	18
·2" Red	14
·2" Green or Yellow	18
Rectangular LED's Red, Green, Yellow with bezel	29
7 Seg. Displays Red	
·3" C Cath	99
·3" C Anod	99
·3" ±1 Red or Grn	150
·5" C̄ Cath	115
·5" C Anod	115
·6" C Cath	180
·8" Orange	275
Burgraph 10 seg.	225
3½ Digit LCD	550
4 Digit LCD	750
OCP71	120
ORP12	86
2N5777	45
(Infra Red Emitter) LD271	46
TIL32	52
Detector SFH205	91
TIL78	60

CRYSTALS

100KHz	270
455KHz	370
1MHz	295
1·008M	295
1·6MHz	395

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**

COPPER CLAD BOARDS

Fibre Glass	Single-sided	Double-sided	SRBP 9·5"×8·5"
6"×6"	90p	110p	95p
6"×12"	150p	200p	

FERRIC CHLORIDE
1 lb **195p** +50p p&p

DALO ETCH RESIST PEN plus Spare Tip **90p**

SOLDERCON PINS
100 pins **60p;**
500 pins **325p**

VERO WIRING PEN + spool **310p**
spare spool **75p;** combs **6p.**

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	28p	80p
36 pin	—	105p
40 pin	30p	99p

EDGE CONNECTORS TEXAS

	·1	·156
2 10 way	—	135p
2 15 way	—	140p
2 18 way	180p	145p
2 22 way	199p	200p
2 25 way	225p	220p
2 30 way	245p	—
2 36 way	295p	—
2 40 way	315p	—
2 43 way	395p	—

DENCO COILS
Dual Purpose 'DP'
VALVE TYPE
Ranges: 1-5 Bl. Yl. Rd. Wht. **122p**
6-7 B, Y, R **110p**
1-5 Green **150p**
'T'-type (Transistor Tuning).
Ranges: 1-5 Bl. Yl. Red, White **150p**

B9A Valve Base	42p
RDT2	145p
RFC 5 chokes	140p
RFC 7 (19mH)	160p
1FT 13/14/15/16 17	120p
1FT 18/1·6	135p
1FT 18/465	152p
TOC1	124p
MW 5FR	122p
MW/LW 5FR	154p

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	220p
500pF	250p
6:1 Ball Drive 4511/DAF	185p
Dial Drive 4103 6:1/36:1	775p
Drum 54mm	59p
0-1-365pF	350p
00-2-365pF	435p
00-2-650pF	650p
0-2-365pF with slow motion Drive	495p
00-2-208/176	435p
,, ,, with slow motion drive	495p
C804: 5pF; 10	278p
25pF	290p
50pF	290p
100;150pF	350p
'L' 3×310pF	725p
00-3×25pF	575p

LINEAR IC's

702	75	LM10	395	RC4136D	69
709C 8 pin	35	LM301A	26	S566B	245
710*	48	LM308T	95	SAB2917	485
733	75	LM311H	70	SAB3209	425
741 8 pin	14	LM318	240	SAB3210	275
747C 14 pin	78	LM324	50	SG3402	295
748C 8 pin	36	LM339	70	SN76013N	250
753 8 pin	185	LM348	90	SN76003N	240
810	159	LM349	115	SN76018	148
9400CJ	350	LM379	415	SN76023N	240
AY-1-0212	675	LM380	75	SN76033N	195
AY-1-1313A	660	LM381N	145	SN76115N	115
AY-1-1320	225	LM382	125	SN76131	125
AY-1-5050	99	LM386	99	SN76227N	95
AY-1-5051	160	LM387	120	SN76477	175
AY-3-1270	840	LM389	99	SN76660	120
AY-3-8500	390	LM733	75	SP8629	299
AY-3-8910	720	LM1458	45	TA7205A	225
AY-5-1224A	235	LM3900	60	TAA621AX1	250
AY-5-1230	450	LM3909N	70	TAA661A	155
AY-5-1317A	639	LM3911	125	TAD100	159
AY-5-8100	735	LM3914	220	TBA120S	70
CA3011	110	LM3915	240	TBA540	220
CA3014	157	LM3916	225	TBA550Q	330
CA3018	68	LM13600	135	TBA641-A12/ BX1 or BX11	275
CA3020	186	LS7220	280	TBA651	190
CA3023	191	M252AA	625	TBA800	80
CA3028A	80	M253AA	1150	TBA810S	95
CA3035	235	MC1303	88	TBA820	70
CA3036	115	MC1304P	260	TBA920Q	260
CA3043	275	MC1310P	150	TCA965	120
CA3045	365	MC1494	694	TDA1004	290
CA3046	71	MC1495	350	TDA1008	310
CA3048	214	MC1496L	92	TDA1022	575
CA3059	195	MC1596	225	TDA1024	105
CA3075	213	MC1710	79	TDA1490	295
CA3080E	65	MC3302	150	TDA2020	320
CA3081	190	MC3340P	120	TL061CP	40
CA3089E	215	MC3360P	120	TL062CP	90
CA3090AQ	375	MC3401	52	TL064CN	98
CA3123	150	MC3403	89	TL071CP	30
CA3130	90	MC3405	150	TL072CP	70
CA3140	48	MFC6040	97	TL074CN	100
CA3189	295	MK50398	635	TL081CP	25
ICL7106	795	MM5303	635	TL082CP	70
ICL7107	975	MM5307	1275	TL083CP	75
ICL8038CC	340	MSM5526	820	TL084CN	95
ICM7205	1150	NE543K	210	UAA170	170
ICM7215	1050	NE544	185	UAA180	170
ICM7216A	1950	NE555	16	UAA1003	895
ICM7216B	1950	NE556DB	55	XR2206	350
ICM7216C	1950	NE560	325	XR2266	320
ICM7217A	790	NE561	398	ZN414	95
ICM7555	80	NE562B	410	ZN424E	130
LA4032	295	NE564	420	ZN425E	415
LC7130	495	NE565A	120	ZN426E	325
LD130	452	NE566	120	ZN427	660
LF355	85	NE567V	150	ZN1034	200
LF356	90	NE570	450		
		NE571	420		

TRANSISTORS

AC125	35	BD140	40	OC170/1	85	2N3771	179
AC126/7	25	BD144/5	198	OC200	85	2N3772	195
AC128	25	BD205	110	TIP29	34	2N3773	270
AC141/2	30	BD214	115	TIP29A	36	2N3819	22
AC176	28	BD245	45	TIP29B	56	2N3820	45
ACY17/18	70	BD378	70	TIP29C	60	2N3822/3	65
ACY19/20	75	BD434	55	TIP30	48	2N3866	90
ACY21/22	75	BD517	75	TIP30C	58	2N3903/4	18
ACY28	75	BD695A	99	TIP31A	45	2N3905/6	15
AD149	79	BD696A	99	TIP31C	55	2N4037	46
AD161/2	42	BDY56	180	TIP32A	48	2N4058	10
AF106	70	BF115	35	TIP32C	60	2N4061/2	10
AF118	95	BF167	29	TIP33A	65	2N4427	80
AF139	40	BF180	38	TIP33C	78	2N4859	78
AF178	75	BF194/5	12	TIP34A	74	2N4871	55
AF239	78	BF196/7	12	TIP34C	88	2N5172	18
BC107	10	BF198/9	16	TIP35A	160	2N5179	45
BC107B	12	BF200	30	TIP35C	185	2N5191	75
BC108	10	BF224	24	TIP36A	170	2N5305	24
BC108B	12	BF244	30	TIP36C	199	2N5457	36
BC108C	12	BF244B	35	TIP41A	55	2N5485	36
BC109	10	BF256	35	TIP41B	68	2N5642	750
BC109B	12	BF257/8	32	TIP42A	60	2N5777	45
BC109C	12	BF259	35	TIP42B	75	2SA715	60
BC140	30	BF274	42	TIP120	90	2SC495	70
BC141/2	30	BF336	40	TIP121	99	2SC496	70
BC143	30	BF451	35	TIP142	120	2SC1096	85
BC147	9	BF594	30	TIP147	120	2SC1173	125
BC147B	10	BF595	39	TIP2955	60	2SC1306	150
BC148	9	BFR39	23	TIP3055	60	2SC1307	220
BC148B	10	BFR40/41	23	TIS43	32	2SC1449	85
BC148C	10	BFR79	23	TIS44/5	45	2SC1678	140
BC149	9	BFR80/1	24	TIS88A	50	2SC1923	50
BC149C	10	BFR98	105	TIS90	30	2SC1945	225
BC153/4	27	BFX29/84	28	TIS91	32	2SC1953	90
BC157/8	10	BFX85/6	28	ZTX107	11	2SC1957	90
BC159	11	BFX87/8	28	ZTX109	12	2SC1969	198
BC160	45	BFY51/2	23	ZTX300	13	2SC2028	85
BC167/8	10	BFY56	32	ZTX301/2	16	2SC2029	180
BC168C	10	BFY64	35	ZTX303	25	2SC2078	155
BC169C	10	BFY81	120	ZTX304	17	2SC2091	85
BC170	15	BRY39	40	ZTX314	25	2SC2314	85
BC172/3	11	BSX20	20	ZTX326	30	2SC2166	165
BC177/8	20	BSY95A	25	ZTX341	30	2SC1679	190
BC179/81	20	BU105	170	ZTX500	14	2N6027	32
BC182/3	10	BU205	190	ZTX501/2	15	3N128	112
BC184	10	BU208	200	ZTX503	18	3N140	112
BC182L	10	E421	250	ZTX504	25	40311	60
BC183L	10	MD8001	250	ZTX531	25	40313	125
BC184L	10	MJ400	150	ZTX550	25	40315	68
BC187	26	MJ491	175	2N697	23	40316	85
BC212	10	MJ2955	90	2N698	40	40361	50
BC212L	10	MJE340	54	2N699	48	40362	50
BC213	10	MJE370	100	2N706A	19	40408	95
BC213L	10	MJE371	100	2N708	19	40411	280
BC214	10	MJE2955	99	2N918	35	40467	95
BC214L	10	MJE3055	70	2N1131/2	24	40468	60
BC236	10	MPF102	66	2N1303	60	40594	90
BC237	14	MPF103/4	36	2N1304/5	65	40595	98
BC307B	15	MPF105	36	2N1671B	160	40603	90
BC308B	16	MPF106	40	2N2219A	28	40673	95
BC327	15	MPSA05	25	2N2220A	26		
BC338	15	MPSA06	25	2N2221A	25		
BC441	34	MPSA12	32	2N2222A	25		
BC461	34	MPSA55	30	2N2369A	17		
BC477	40	MPSA56	30	2N2646	45		
BC516/7	40	MPSA70	25	2N2904/5	28		
BC547/8	14	MPSU06	55	2N2906/7	26		
BC549C	14	OC28	130	2N2926G	10		
BC557/8	15	OC35	125	2N3053	26		
BC559	15	OC36	120	2N3054	58		
BCY70	16	OC41/2	120	2N3055	48		
BCY71/2	20	OC43	55	2N3442	140		
BD131/2	48	OC44	120	2N3663	15		
BD133	60	OC45	40	2N3702/3	10		
BD135	45	OC70/71	40	2N3704/5	10		
BD136/7	40	OC74/76	50	2N3706/7	10		
BD138/9	40	OC81/82	50	2N3708/9	10		
		OC83/4	40	2N3710/11	10		

74LS (TEXAS)

74LS00	12	LS15	15	LS221	60
LS01	13	LS20	15	LS240	96
LS02	14	LS21	15	LS241	96
LS03	14	LS22	15	LS242	85
LS04	15	LS26	18	LS243	85
LS05	15	LS27	15	LS244	80
LS06	15	LS28	20	LS245	118
LS08	15	LS30	18	LS247	40
LS09	15	LS32	15	LS248	65
LS10	15	LS33	16	LS249	68
LS11	15	LS37	16	LS251	40
LS12	15	LS38	16	LS253	40
LS13	30	LS40	16	LS257	48
LS14	48	LS42	35	LS258	40
		LS47	40	LS259	85
		LS48	80	LS261	195
		LS49	60	LS266	25
		LS51	15	LS273	90
		LS54	15	LS275	290
		LS55	30	LS279	88
		LS63	150	LS280	250
		LS73	25	LS283	45
		LS74	25	LS290	57
		LS75	28	LS293	46
		LS76	20	LS295	215
		LS78	24	LS298	130
		LS83	50	LS299	420
		LS85	70	LS300	175
		LS86	38	LS302	175
		LS90	35	LS320	270
		LS91	80	LS323	270
		LS92	36	LS324	200
		LS93	36	LS325	320
		LS95	45	LS326	330
		LS96	120	LS327	315
		LS107	43	LS347	150
		LS109	30	LS348	190
		LS112	30	LS365	37
		LS113	40	LS366	37
		LS114	35	LS367	37
		LS122	44	LS368	90
		LS123	55	LS373	75
		LS124	105	LS374	75
		LS125	30	LS375	48
		LS126	30	LS377	90
		LS132	45	LS378	69
		LS133	35	LS379	65
		LS136	28	LS384	250
		LS138	35	LS390	62
		LS139	38	LS393	60
		LS151	39	LS395	199
		LS153	39	LS398	275
		LS155	39	LS399	220
		LS156	39	LS445	140
		LS157	35	LS447	195
		LS158	36	LS490	245
		LS160	41	LS541	135
		LS161	41	LS668	175
		LS162	41	LS670	175
		LS163	41	LS673	550
		LS164	48	LS674	750
		LS165	145		
		LS166	85		
		LS170	170		
		LS173	72		
		LS174	72		
		LS175	58		
		LS181	130		
		LS183	275		
		LS190	58		
		LS191	58		
		LS192	58		
		LS193	65		
		LS194	40		
		LS195	40		
		LS196	58		
		LS197	85		
		LS200	345		
		LS202	345		

74S

74S00	60
74S132	138
74S138	240
74S158	240
74S188	210
74S189	158
74S194	360
74S201	620
74S241	540
74S262	850
74S287	325
74S288	210

COMPUTER ICs.

2114L 300n	99
2114L 200n	130
2114-450	90
2532 32K	525
2708	200
2716-5V	250
2732 450	750
4027	240
4116-16K	85
4315 CMOS	795
6502	450
6520	310
6522	485
6530	1350
6532	750
6551	785
6800	375
6802	550
6810	175
6821	175
6845	975
6850	175
6852	255
8080A	450
8085A	550
81LS95	115
81LS96	115
81LS97	115
8251	400
8253	799
8T26A	99
8T28A	135
8T95N	135
8T97N	135
AY-3-1015	395
AY-5-1013	350
AY-5-2376	700
MC1488	62
MC1489	62
MC14411	695
MC14412	800
RO-3-2513	600
SFF96364E	800
SFC71301	820
TMS2716	875
TMS6011	365
Z80ACPU 4	550
Z80 DART	725
Z80PIO	380
Z80APIO	440
Z80CTC	400
Z80A CTC	440

TTL 74 (TEXAS)

7400	11	90	28	74181	140
7401	11	91	45	74182	75
7402	11	92	30	74184	99
7403	14	93	30	74185	99
7404	14	94	34	74188	290
7405	18	95	50	74190	70
7406	28	96	45	74191	70
7407	28	97	120	74193	65
7408	16	100	85	74194	75
7409	16	104	54	74195	65
7410	14	105	55	74196	65
7411	20	107	32	74197	65
7412	20	109	35	74198	99
7413	24	110	40	74199	99
7414	32	111	55	74221	80
7416	25	112	170	74246	150
7417	25	116	88	74247	150
7420	16	118	80	74248	150
7421	20	119	90	74249	150
7422	20	120	75	74251	80
7423	22	121	30	74265	65
7425	28	122	45	74273	195
7426	30	123	50	74278	160
7427	27	125	42	74279	90
7428	28	126	40	74298	100
7430	16	128	42	74365	55
7432	26	132	48	74366	55
7433	27	136	35	74367	55
7437	27	141	70	74368	55
7438	27	142	190	74390	99
7440	17	143	250	74393	99
7441	68	144	250	74490	120
7442	38	145	70		
7443	90	147	99		
7444	90	148	75		
7445	65	150	80		
7446	55	151	45		
7447	50	153	45		
7448	50	154	75		
7450	16	155	75		
7451	16	156	75		
7453	16	157	45		
7454	16	159	99		
7460	16	160	60		
7470	35	161	60		
7472	30	162	62		
7473	30	163	64		
7474	25	164	64		
7475	40	165	62		
7476	30	166	65		
7480	48	167	185		
7481	120	170	168		
7482	70	172	290		
7483	50	173	65		
7484	80	174	72		
7485	95	175	72		
7486	26	176	55		
7489	205	177	75		
		178	95		
		180	65		

CMOS*

4000	14	4028	58	4162	99
4001	14	4029	77	4163	99
4002	14	4030	50	4174	99
4006	66	4031	170	4175	105
4007	18	4032	125	4194	105
4008	62	4033	165	4408	790
4009	35	4034	195	4409	790
4010	40	4035	95	4410	725
4011	15	4036	275	4411	695
4012	18	4037	115	4412	800
4013	34	4038	110	4415	480
4014	75	4039	290	4419	280
4015	66	4040	59	4422	770
4016	32	4041	78	4433	770
4017	48	4042	60	4435	850
4018	68	4043	70	4440	999
4019	42	4044	65	4450	350
4020	61	4045	170	4451	350
4021	70	4046	75	4490	350
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4023	20	4048	55	4501	28
4024	45	4049	30	4502	90
4025	19	4050	30	4503	50
4026	130	4051	78	4504	105
4027	38	4052	78	4506	65
		4053	78	4508	265
		4054	125	4510	68
		4055	125	4511	68
		4056	120	4512	75
		4057	1915	4513	199
		4059	480	4514	195
		4060	90	4515	198
		4061	1225	4516	75
		4062	995	4517	415
		4063	99	4518	42
		4066	36	4519	29
		4067	399	4520	78
		4068	22	4521	200
		4069	20	4522	125
		4070	26	4526	95
		4071	20	4527	115
		4072	20	4528	80
		4073	20	4529	150
		4075	20	4530	90
		4076	60	4531	130
		4077	26	4532	110
		4078	26	4534	500
		4081	26	40097	88
		4082	21	40100	215
		4085	65	40101	130
		4086	70	40102	180
		4089	140	40103	175
		4093	43	40104	95
		4094	168	40105	115
		4095	90	40106	75
		4096	90	40107	60
		4097	320	40108	450
		4098	88	40109	100
		4099	95	40110	300
		4160	95	40114	240
		4161	99		

VOLTAGE REGULATORS

1A +ve 5V, 12V, 15, 18, 24V	50p
1A –ve	55p
100mA –ve 5V, 6, 8, 12, 15V	30p
100mA –ve	65p
LM309K	135p
LM317K	350p
LM323K	635p
LM723	38p
78H05	530p
78HG05	650p
79HG	850p
TBA625B	75p

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	55

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

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7475	38p
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74100	85p
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74123	48p
74125	40p
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74136	32p
74141	65p
74145	70p
74147	100p
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74163	60p
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74165	60p
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74170	160p
74172	300p
74174	70p
74175	70p
74190	70p
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74197	60p
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74285	200p
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74366	55p
74367	55p
74368	55p
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4052	80p
4053	60p
4059	500p
4060	90p
4066	35p
4067	400p
4068	18p
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4078	20p
4081	20p
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2N6290	65p
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2SC1306	150p
2SC1307	150p
2SC1957	90p
2SC1969	195p
2SC2028	120p
2SC2029	250p
2SC2078	200p
3N128	120p
3N140	120p
3N141	110p
3N201	110p
3N204	120p
40290	260p
40361/2	75p
40408	90p
40409	100p
40410	100p
40411	300p
40594	120p
40595	120p
40673	75p
40871/2	100p

DIODES

BY127	12p
BYX36 300	20p
OA47	8p
OA90/91	9p
OA95	9p
OA200	9p
OA202	10p
1N914	4p
1N916	7p
1N4148	4p
1N4001/2	5p
1N4003/4	6p
1N4005	6p
1N4006/7	7p
1N5401/3	14p
1N5404/7	19p
IS920	9p

BRIDGE RECTIFIERS

1A 50V	19p
1A 100V	20p
1A 400V	25p
1A 600V	30p
2A 50V	30p
2A 100V	35p
2A 400V	45p
3A 200V	60p
3A 600V	72p
4A 100V	95p
4A 400V	100p
6A 50V	80p
6A 100V	100p
6A 400V	120p
10A 400V	200p
25A 400V	400p

ZENERS

2.7V-33V 400mW	9p
1W	15p

TRIACS PLASTIC

3A 400V	60p
6A 400V	70p
6A 500V	88p
8A 400V	75p
8A 500V	95p
12A 400V	85p
12A 500V	105p
16A 400V	110p
16A 500V	130p
T2800D	130p

THYRISTORS

3A 400V	100p
8A 600V	140p
12A 400V	160p
16A 100V	180p
16A 400V	180p
BT106	110p
C106D	45p
MCR101	36p
TIC44	27p
2N3525	130p
2N4444	140p
2N5060	34p
2N5064	40p

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OCP71	180p
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ORP60	120p
ORP61	120p
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MCT26	100p
MCS2400	190p
ILQ74	240p
TIL111	90p
TIL112	90p
TIL113	90p
TIL116	90p

LEDS

0.125"	
TIL32	55p
TIL209 Red	13p
TIL211 Gr	16p
TIL212 Ye	18p
TIL216 Red	18p
0.2"	
TIL220 Red	15p
TIL222 Gr	15p
TIL228 Yel	22p
Rectangular	
LEDs (R, G, Y)	30p
NSB5881	670p

DISPLAYS

3015F	200p
DL704	140p
DL707 Red	140p
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FND500	90p
FND507	90p
MAN3640	175p
MAN4640	200p
TIL311	600p
TIL312/3	110p
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TIL330	140p
7750/60	200p

DRIVERS

9368	250p
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VOLTAGE REGULATORS
FIXED PLASTIC

1A	+ve		−ve	
5V 1A	7805	50p	7905	55p
12V 1A	7812	50p	7912	55p
15V 1A	7815	55p	7915	60p
18V 1A	7818	55p	7918	60p
24V 1A	7824	55p	7924	60p
5V 100mA	78L05	30p	79L05	65p
12V 100mA	78L12	30p	79L12	70p
15V 100mA	78L15	30p	79L15	70p

OTHER REGULATORS

LM309K 1A 5V	135p	78HGKC	600p
LM317K	325p	78HOSKC	550p
LM317T 1A Adj	200p	78MGT2C	140p
LM337T	225p	78GUIC	200p
LM323K 3A 5V	500p	79GUIC	225p
LM723 150mA Adj	37p	79HGKC	700p
TL494	400p	TL497	300p
78S40	300p	LM305AH	250p

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